Fisheries

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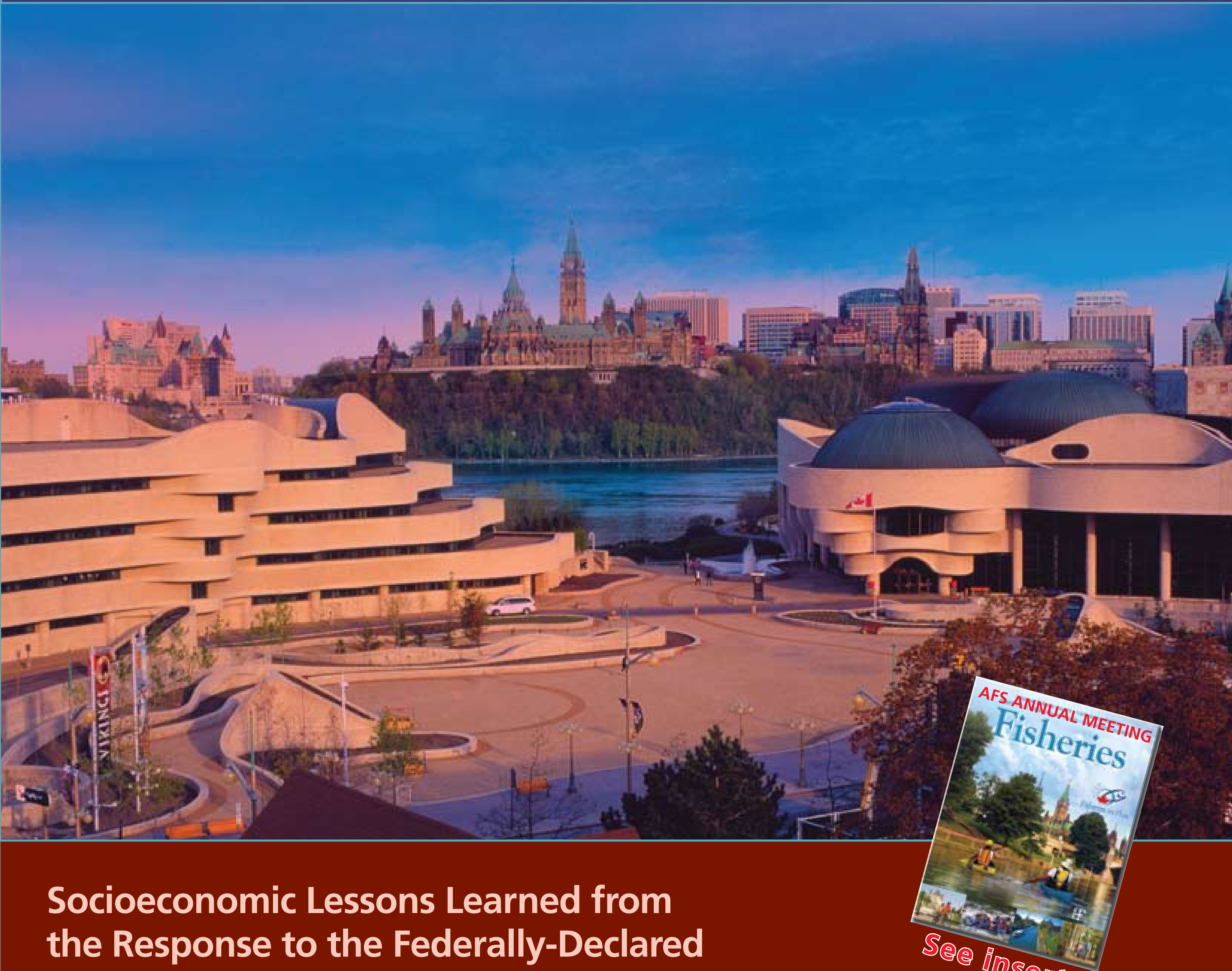

See insert.

Socioeconomic Lessons Learned from the Response to the Federally-Declared West Coast Groundfish Disaster

Misconception, Reality, and Uncertainty about Ecological Interactions and Risks between Hatchery and Wild Salmonids

A Winning Combination

Dr. Brennan releases hatchery snook into Florida's estuarine streams to evaluate the stocking program. The juveniles are tagged with Coded Wire Tags (CWT) that are detected electronically, and with Visible Implant Elastomer (VIE) tags in the caudal fin (below)[2]. Recovery of the CWT will provide detailed information about the release group, while the elastomer tag designates the hatchery origin of the fish. Wild snook were tagged with color coded VIE tags to designate the stream of origin.

Photos courtesy of N. Brennan.

Before tagging, it is critical to evaluate the study objectives, the animals involved, and the methods of recovering or detecting tags. We enjoy helping our customers select the right type of tag for their research, and sometimes, a combination of tags, simultaneously or over time, is the best solution. Research programs tend to be stronger if they don't depend on any one tag type but use the strengths of different tags to address a range of questions.

Dr. Nathan Brennan and fellow researchers at Florida's Mote Marine Lab demonstrated how tags can be effectively combined[1]. Common snook (*Centropomus undecimalis*) are valued as one of the top marine sport fishes in Florida. Despite restrictive fishing regulations, they are considered overfished. Managers are investigating the potential of stock enhancement to help snook recover to sustainable levels. Dr. Brennan's research focuses on evaluating whether releasing juvenile hatchery fish would supplement or displace wild juveniles. After estimating the pre-release abundance of wild juvenile snook, they stocked hatchery juveniles at high and low densities into estuarine creeks.

Dr. Brennan et al. found little movement of stocked or wild snook between streams. They also concluded that the experimental releases of high densities of juvenile hatchery-reared snook did increase total abundance of juveniles without suppressing the density of wild snook. This research is an important step in understanding the dynamics of enhancing Florida's snook populations.

[1]Brennan, N. P., et al. (2008). Rev. Fish. Sci. **16**: 215-227.
[2]Brennan, N. P. et al. (2005). N. Amer. J. Fish. Manage. **25**: 437-445.

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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 2008 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.

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CREDIT: Ottawa Tourism

COLUMN:
PRESIDENT'S HOOK

Lourdes M. Rugge
AFS International Fisheries Section President
Rugge is employed by ECORP Consulting Inc., in Rocklin, California, and was recently recognized by the AFS Mexico and Cal-Neva Chapters for her efforts to promote communication across international borders.

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

Expanding Our Horizons: What is the Role of AFS in the International Arena?

Although fisheries professionals have long recognized that aquatic organisms move across political borders, all too often, the effectiveness of conservation efforts are impeded by real and perceived boundaries such as scientific discipline, organizational affiliation, taxonomic expertise, geography, culture, and politics. If the links across these boundaries can be identified and strengthened, then the success of our efforts will be increased. It is from this basic supposition that scientific professional societies reach out to include an international component in their programmatic objectives and strategies. Initially, such strategies apply a global approach, but not necessarily an international one. The distinction between international and global approaches is an important one: global strategies are those involving universal processes or activities that are not influenced by geopolitical boundaries, whereas international efforts must address the realities and effects of geopolitical boundaries. For example, the transfer of information from one country or organization to another is a global process—books and journals can move across boundaries with relative ease, and the scientific principles therein are the same regardless of where they may be read. International activities of professional societies are more complex. For instance, to promote conservation goals for a species that occurs across political boundaries, effective international strategies must comply with national and jurisdictional norms and should focus on the needs and expectations of individual members. For a professional society, global strategies are perhaps easier to pursue, but international strategies are necessary as well. Expanding our horizons, the American Fisheries Society has implemented a number of global and international initiatives in recent years, and new programs are proposed annually, but we have not yet addressed the question of our role in the international arena. To do this, we first need to examine current activities and programs.

I. INTERNATIONAL AND GLOBAL ACTIVITIES IN AFS

Since the mid-1980s, the AFS International Fisheries Section (IFS) has been instrumental in improving the global visibility of AFS and has championed the building of cooperative relations with fisheries societies and individual scientists outside North America. A scientific book and journal exchange program was initiated with Baltic, African, and Latin American countries in an effort to promote and sustain fisheries science and build educational and research capacity overseas. Realizing the benefit of extensive networks among scientists and fisheries professionals throughout the world, the Society began subsidizing AFS memberships for fisheries professionals in developing countries and providing access to *Fisheries* online. This initiative increased and broadened our international membership, but did not provide opportunity for members around the world to interact meaningfully with one another. To begin to address this, the IFS offers financial support for international professionals to travel to the AFS Annual Meetings. So far, scientists, managers, and students from 25 countries have attended our Annual Meetings and continue to participate in scientific information exchange.

Travel grants can go a long way toward facilitating face-to-face interactions among fisheries practitioners at professional meetings, but such grants are, of course, limited. Promoting the participation of international fisheries professionals at AFS meetings has been a topic of discussion among the AFS leadership: AFS is keen to sponsor scientific meetings that are inclusive of professionals worldwide. One obvious option is to convene an Annual Meeting in a venue outside of North America. Another option is to organize topic-oriented meetings in international locations; we believe that the desirability of meeting participation can be enhanced by focusing the meeting on topics of interest to a global community. A good example of such a meeting is the February 2008 international symposium in Auckland, New Zealand, on fish tagging and marking. This symposium was a collective effort of the AFS, the New Zealand Marine Sciences Society, and the Australian Society for Fish Biology. AFS leadership is exploring the use of this highly successful joint venture as a model for additional topic-oriented meetings to be convened in other countries (see the Guest Director's Line in this issue).

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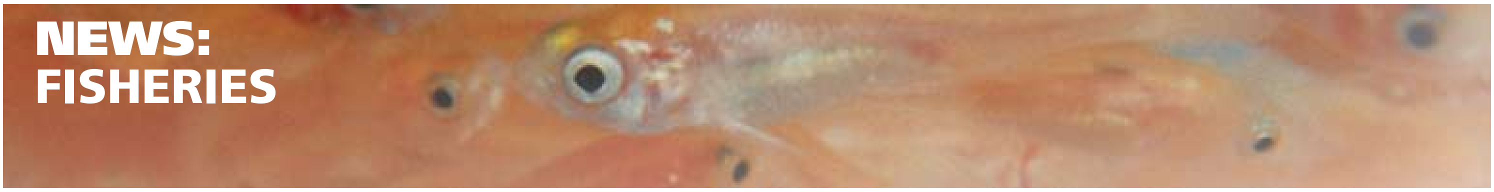


PROPOSED SALTWATER ANGLER REGISTRY

NOAA Fisheries Service is seeking comment on a proposed rule that requires anglers and spearfishers who fish recreationally in federal ocean waters to be registered before fishing in 2009.The rule would also require registration by those who may catch anadromous species anywhere, including striped bass, salmon, and shad.

The proposed rule satisfies National Research Council recommendations to establish a national database of saltwater anglers, and meets requirements under the Magnuson-Stevens Fishery Conservation and Management Act. The proposed rule is a part of a larger initiative of NOAA Fisheries Service to improve the quality and accuracy of data on marine recreational fishing and catches. The registry will also help measure the economic effects of recreational fishing on the national and local economies.

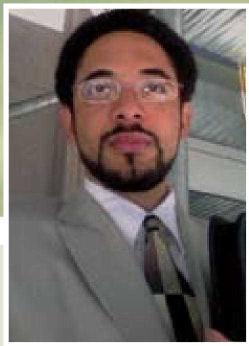
NOAA may exempt anglers from registration if they already have a state-issued saltwater fishing license or registration, and the state provides sufficiently complete information to place in the national registry. In certain instances, anglers in states participating in regional surveys of marine recreational fishing may also be exempted. The new rule allows states to apply for exemptions.

Fishermen would be required to be registered annually and NOAA will not charge a registration fee in the first two years. Beginning in 2011, the annual fee will be an estimated $15 to $25 per angler. Anglers under the age of 16 would be exempt from registering and fees would be waived for indigenous people, such as members of federally-recognized tribes. Anglers who fish only on licensed party, charter, or guide boats would also be exempt, since these vessels are surveyed separately from the angler surveys. Also, persons who hold commercial fishing licenses or permits, and are legally fishing under them, will be exempt from the registration requirement.

To read the proposed rule, go to www.countmyfish.noaa.gov. Comments on the proposed rule will be accepted until 11 August 2008 and should be mailed to: John Boreman, Director, Office of Science and Technology, NOAA Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910, Attn.: Gordon Colvin. Comments may also be submitted electronically at www.regulations.gov.

Elden Hawkes, Jr.

AFS Policy Coordinator Hawkes can be contacted at ehawkes@fisheries.org.



HEARING ON THE MANAGEMENT OF WEST COAST SALMON FISHERIES

On 15 May 2008, the House Subcommittee on Fisheries and Oceans held a hearing entitled "The Management of West Coast Fisheries." The hearing included Rodney McInnis of the National Marine Fisheries Service (NMFS), who stated that strong steps are being taken to strengthen NMFS biological opinions by using the best science available and outside scientists when needed. He also explained that many recommendations from independent reviews have already been implemented, and that finding long-term solutions will require multiple parties working together.

Michael Rode of the California Department of Fish and Game stated that weak Klamath coho and Chinook salmon stocks have constrained West Coast mixed-stock ocean salmon fisheries for more than 20 years, even when other salmon stocks were robust and ocean conditions were favorable. He explained that this strongly indicates that unfavorable in-river environmental conditions have played a major role in suppressing Klamath coho and Chinook salmon numbers. Rode further stated that the mandates of the Magnuson-Stevens Fishery Conservation and Management Act, as amended, have not been met by Bureau of Reclamation or NMFS for coho or Chinook essential fish habitat in the Klamath River and that the 2002 Coho Biological Opinion is not based on the best scientific data available.

Jack Williams of Trout Unlimited stated that long-term survival depends on viable genes and habitat abundance. Williams further elaborated that 295 of all salmon populations are extinct and that salmon are especially susceptible to climate change. He further stated that in order to promote the salmon population, streams must be reconnected to headwaters, and that building alliances with unlikely partners are key.

James Litchfield of Litchfield Consulting stated that hydro performance survival standards are greater than 96% for juvenile salmon migrating downstream through the dams in the spring, and 93% for summer migrants at each dam. Litchfield stated that these are extremely high survival commitments but they can be achieved. He further elaborated that for most of the 13 listed salmon and steelhead populations in the Columbia River, there continues to be concern over the interaction between hatchery practices and the survival of naturally-spawning (wild) fish. The promise of hatcheries compensating for human impacts on salmon habitat, combined with the higher harvest rates that large hatchery production encourages, has put less productive naturally-spawning populations at significant risk of extinction, and the current hatchery-harvest strategy is now inconsistent with the Endangered Species Act's mandate to preserve every unique life history.

CLIMATE SECURITY ACT OF 2007

On 6 June, the U.S. Senate voted on cloture (a vote to move the debate forward and to consider specific amendments) in regards to the Climate Security Act of 2007. The vote fell short of the 60 votes needed to proceed. In all, 54 senators indicated their support, with 48 senators voting to move forward on this legislation and an additional 6 absentee senators entering statements that they would have voted "yes" on the vote.

If passed, the Climate Security Act would provide $137 billion through 2030 for natural resource protection from global warming. This natural resource funding would be beneficial for habitat, wildlife corridors, and climate change adaptation, as well as beneficial to people as natural resources provide clean drinking water, coastal storm protection, forest fire control, and more. An average of $7.2 billion would be provided each year for conservation, of which almost 40% would go to state wildlife agencies through the state wildlife action plans for use in climate change adaptation.

SUBCOMMITTEE RECOMMENDS 4.8% INCREASE IN USGS BUDGET

On 11 June 2008, the House Appropriations Subcommittee on Interior, Environment and Related Agencies approved a bill that would increase funding for the U.S. Geological Survey (USGS) by 4.8% or $48 million to $1.054 billion in FY 2009. The House mark is 8.4% above the President's FY 2009 budget request for the USGS. The President proposed a 3.7% budget cut for the USGS in FY 2009. A full committee markup of the House Interior appropriations bill is scheduled for 18 June.

CONGRESSIONAL SPORTSMAN'S FOUNDATION BRIEFING ON MARINE PROTECTED AREAS

On 4 June 2008, the Congressional Sportsmen's Foundation (CSF) hosted a Capitol Hill briefing, sponsored by the American Sportfishing Association (ASA), where members of Congress, leaders of major fishing organizations, and industry representatives were informed about marine protected areas (MPAs), and their potential impact to recreational fishing. Attendees were welcomed by CSF Co-Chairman Rep. Ron Kind (D-WI), Rep. Bob Latta (R-OH), and former CSF Chairman, Rep. Adam Putnam (R-FL). The representatives reiterated the CSF's commitment to advancing sportsmen's issues in Congress.

Gordon Robertson, vice president of ASA, noted that MPAs are loosely defined as an area of the ocean set aside for special protections based on biological, social, or cultural reasons. Robertson expressed concern that the establishment of MPAs is increasingly leading to the creation of restrictive "no-take" marine reserves. Consequently, recreational anglers are being blocked out of miles of prime fishing areas. He stated that MPAs attempt to manage habitat through preservation and ignore proven existing management techniques and practices. Robertson further stated that the recreational fishing community will work to ensure that MPA's are designated only when based on the best science available after public input is considered, and thereafter monitored and revisited to ensure their effectiveness.

Kameran Onley, Interior Assistant Secretary for Water and Science, reassured the attendees that the Administration would consult the fishing community on the establishment of MPAs and that the Administration is not planning to lock off large sections from recreational fishing. She also pointed out that 85% of MPAs are state-driven actions.

JOURNAL HIGHLIGHTS: NORTH AMERICAN JOURNAL OF FISHERIES MANAGEMENT

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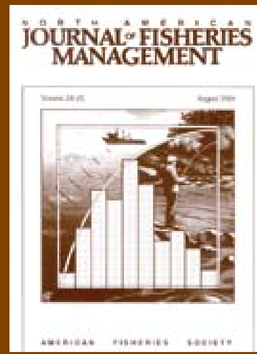

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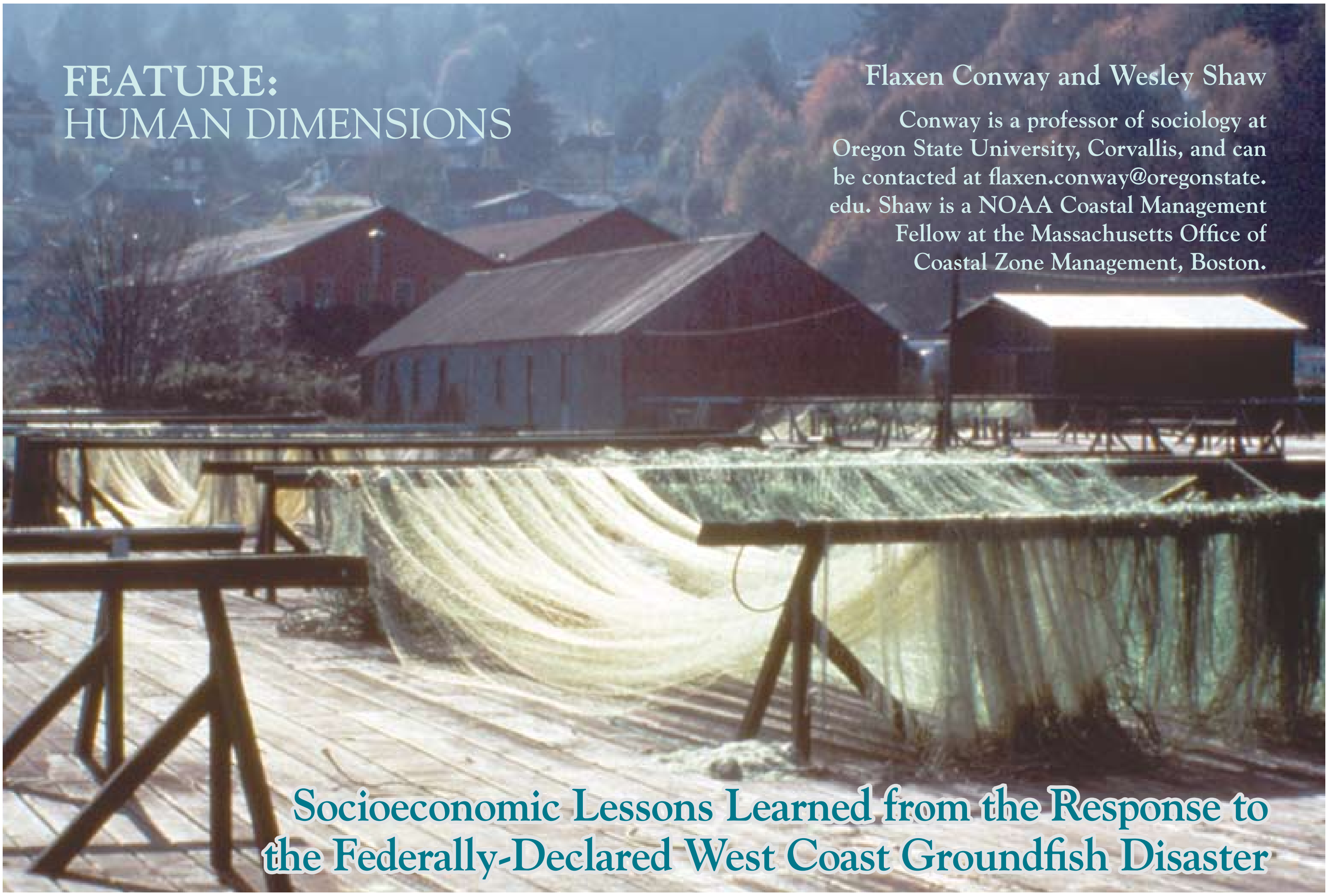


FEATURE:
HUMAN DIMENSIONS

Flaxen Conway and Wesley Shaw

Conway is a professor of sociology at Oregon State University, Corvallis, and can be contacted at flaxen.conway@oregonstate.edu. Shaw is a NOAA Coastal Management Fellow at the Massachusetts Office of Coastal Zone Management, Boston.

Socioeconomic Lessons Learned from the Response to the Federally-Declared West Coast Groundfish Disaster

ABSTRACT: Congress responded to the 2000 West Coast groundfish disaster by allocating $5 million in disaster relief for Oregon, Washington, and California. Each state designed and executed its own disaster response program to help impacted members of the fishing industry and coastal communities to cope with the downturn. While the federal goals for the funding were identical, each state created different relief programs. Oregon focused on helping individual members of the fishing community to access social services. Washington focused on economic development of coastal towns. California focused on payments to impacted individuals and cooperative fisheries research. While federal responses to fisheries disasters cost the government millions of dollars each year, they are rarely researched and poorly understood. The goal of this project was to document responses to the disaster (focusing on Oregon), explore useful comparisons, and extract possible lessons learned. Results indicate that people working in the fishing industry face many obstacles to leaving the fishery, and that aggressive, well-planned outreach programs are necessary for efforts to directly help members of the fishing community through fishery disasters. It is hoped that the lessons learned in this project will help both decision makers and those impacted by future fishery disaster responses.

Lecciones socioeconómicas aprendidas de la respuesta al desastre pesquero de la costa oeste de los Estados Unidos

RESUMEN: En 2000 el Congreso de los Estados Unidos de Norteamérica respondió al desastre pesquero sucedido en la costa oeste aportando, como medida de mitigación, 5 millones de dólares a los estados de Oregón, Washington y California. Cada estado diseñó y ejecutó su propio programa de contingencia para que las comunidades costeras y miembros de la industria pesquera que fueron afectados por el desastre, hicieran frente al siniestro. Si bien los fondos federales fueron iguales en cantidad, cada estado creó distintos programas de ayuda. Oregón se enfocó en ayudar de forma individual a los miembros de la comunidad pesquera para que tuvieran acceso a servicios sociales. Washington canalizó sus esfuerzos al desarrollo económico de los pueblos costeros. California se orientó a pagar directamente a los individuos afectados y a la investigación realizada por las cooperativas pesqueras. A pesar de que la respuesta por parte de la federación a los desastres pesqueros le cuesta al gobierno millones de dólares cada año, éstos son raramente objeto de investigación y no han sido comprendidos adecuadamente. La meta de este proyecto fue documentar las respuestas a estos desastres (específicamente en Oregón) explorar comparaciones que resultaran útiles y derivar las lecciones aprendidas. Los resultados apuntan a que la gente que trabaja en la industria pesquera enfrenta muchos obstáculos para abandonar la actividad, y que los programas extensivos, agresivos y bien definidos son necesarios para auxiliar a los miembros de las comunidades pesqueras en medio de desastres de esta naturaleza. Se espera que las lecciones aprendidas en este proyecto ayuden tanto a los encargados de tomar las decisiones como a todos aquellos que se vean afectados por desastres pesqueros en el futuro.

Figure 1. US West Coast groundfish landings, 1981–2000. Modified from Husing et al. 2002.

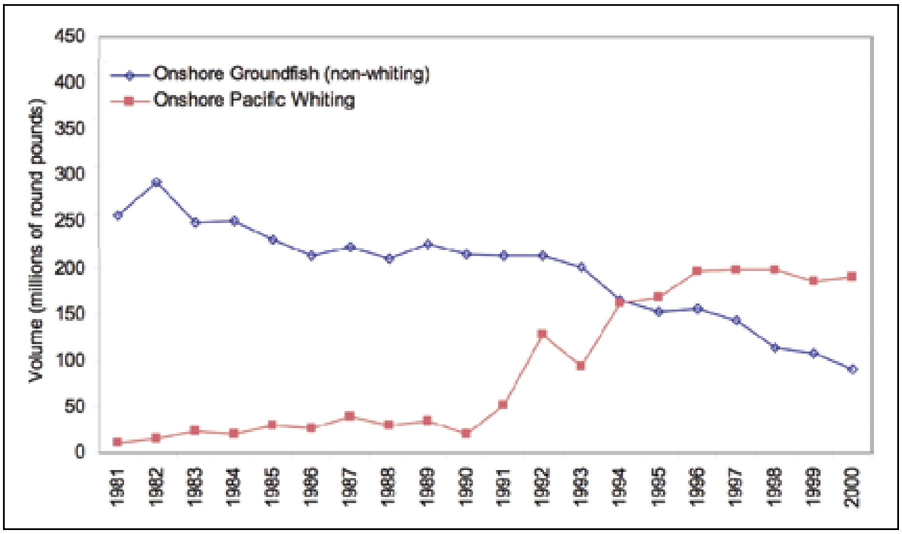
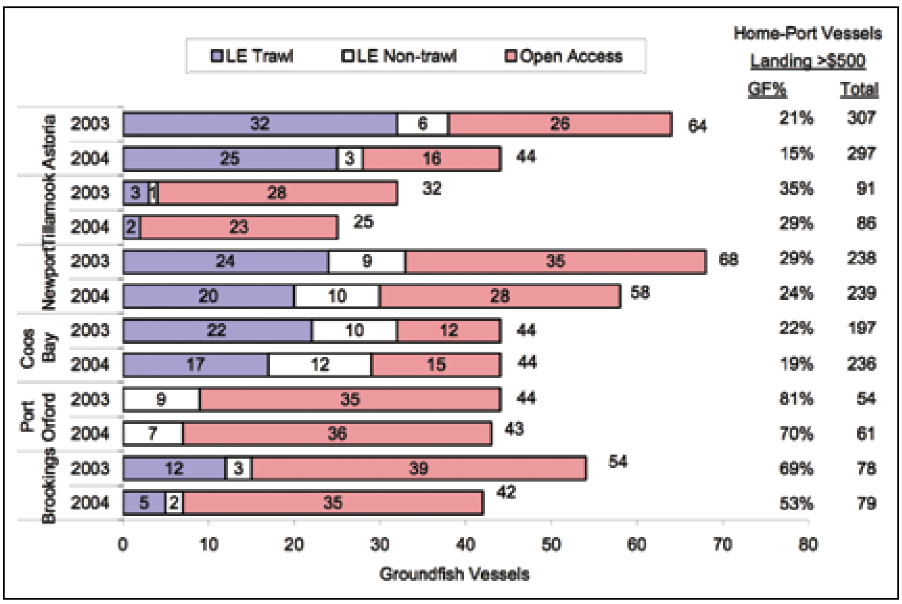


Figure 2. Oregon homeport vessel counts by port group and groundfish LE permit status. From Davis and Radtke 2005.



INTRODUCTION

Commercial fisheries on the U.S. West Coast are undergoing considerable change. Oregon's groundfish industry peaked in the mid-1990s, accounting for about 40% of the state's total fisheries value (Husing et al. 2002). Washington, Oregon, and California had large groundfish fleets; over 11,000 vessels participated between 1987–2000 (Scholz 2003) and revenue from the industry supported hundreds of jobs in coastal communities.

In the late 1990s the groundfish industry began a coastwide constriction, caused by the cumulative effects of poor stock recruitment, decades of heavy fishing, and management mistakes. As stocks declined, the amended Magnuson-Stevens Fishery Conservation and Management Act (MSA) mandated that the Pacific Fisheries Management Council (PFMC) sharply cut back catch levels.

Unfortunately for the commercial fishing community, these decreases in catch left behind thousands of under/unemployed people. Some managed to switch to other fisheries but others faced the difficult task of leaving the industry. Employees of governmental and non-governmental organizations, called the "social service community," assisted displaced members of the commercial fishing community with occupational training and other social services.

The ever-increasing percentage of the commercial fishing community needing assistance strained the social service community's capacity to help. Under local pressure, Oregon, Washington, and California requested federal assistance and on 26 January 2000, the U.S. Secretary of Commerce declared the West Coast groundfish fishery an economic disaster. Shortly thereafter Congress allocated $5 million of disaster relief for the region. The money was split among the states, each of which designed and implemented its own response.

This article summarizes a study investigating three main questions about the West Coast groundfish disaster (WCGD): What was the severity of the WCGD? What was the government's response to the WCGD and how well did it work? And what were some lessons learned that could help communities and decision-makers deal with future disasters?

BACKGROUND AND CONTEXT

The groundfish fishery: history and changes over time

Our study used the PFMC's definition of groundfish (including several species of rockfish, flatfish, roundfish, sharks, skates, and a few unrelated species). Groundfish are harvested using hooks, traps, and trawling. Trawling accounts for approximately 90% of the commercial catch (1997 data, PFMC web site). Gear specialization has effectively split the West Coast groundfish industry into two groups, those who target Pacific whiting (*Merluccius productus*, a high-volume, low-value fish requiring large vessels to be fished efficiently) and those who target the other species (lower volume, higher value).

Management of groundfish has proven to be challenging for the PFMC and fishermen alike (Mansfield 2001; Radtke and Davis 2004). Groundfish (non-whiting) catches peaked in the early 1980s (Hanna 2000) and then began a long-term decline (Figure 1). By 2000, Oregon's catch had dropped from a 20-year average of 74,000 tons to 27,000 tons. In 2002, the PFMC declared nine species of groundfish overfished. Faced with extremely slow growth rates (Love et al. 2002) and a high degree of scientific uncertainty, the PFMC closed the entire continental shelf to bottom trawling. By 2004 the Oregon groundfish fishery had an ex-vessel value of just $16.3 million; 53% below the 10-year average between 1987–1996 (Radtke and Davis 2005).

The Human and Social Impacts of the Decline

The MSA defines community as "a community which is substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs… and includes fishing vessel owners, operators and crew, and the United States fish processors that are based in such a community" (PL94-265). In our study, the commercial fishing community refers to people involved in the groundfish industry—people working on boats or in processing plants, gear manufacturing/repair, shipyards, fueling, mechanics, and fishermen's shore-side business spouse/partners. Members of the commercial fishing community have strong economic linkages with the fishing industry (Jacob et al. 2001) and the diverse and changing coastal communities along the Oregon coast (Gilden et al. 1999). The commercial fishing community is diverse and attitudes of members are famously diverse (Harms and Sylvia 2001).

The social service community is diverse as well. Members may work directly with the commercial fishing community to access occupational training, food stamps, healthcare, and other social services, or they may be only indirectly involved in response program planning.

Disasters and Disaster Response

Social scientists use the term disaster to describe communities that are incurring damages, losses, and/or disruption of their routine functions (Kreps 1989). Economic disasters can be caused by large-scale layoffs/closures, or changes in regulations that, for example in fisheries, force people to stop harvesting. Rural communities, particularly those that are resource-dependant, are particularly susceptible to economic disasters due to market and regulatory forces outside their control (Freudenburg and Frickel 1994; Overdevest and Green 1995).

Disasters of all types can have severe effects on both individuals and the community as a whole (Raphael 1986). Communities impacted by the 1980 eruption of Mt. St. Helens in Washington state saw increased rates of illness, alcohol abuse, family stress, and violent behavior (Adams and Adams 1984). Other common effects of disasters include psychological distress, depression, and anxiety (Miller 2005).

Governments and non-government organizations frequently assist communities impacted by disasters. Relief programs vary in design and scope, depending on the type and cause of the disaster, funding source, and political and economic pressures.

Comparison with Other Disasters

There are similarities between the WCGD and the Pacific Northwest timber crisis where, between 1979 and 1988, mill closures resulted in the loss of over 25,000 jobs (Pissot 1993). These transitioning workers faced similar challenges to those that faced members of the commercial fishing community during the WCGD: workers generally had low-levels of formal education, were accustomed to high incomes, and were reluctant to leave the industry due to a strong sense of identity bound to their professions (Carroll and Lee 1990; Conway et al. 2000).

Similarities can also be found between the WCGD and the West Coast salmon crisis of the mid-1990s, which, unfortunately, shared some of the same participants. In the 1980s and 1990s salmonid stocks declined, and in 1994 the federal government declared a West Coast salmon fishery disaster and allocated more than $24 million to relief programs in Oregon, California, and Washington. The response was designed as a stop-gap mechanism to help people endure some bad years in the fishery until it recovered and they could return to fishing (Gilden and Smith 1996a), not to transition people out of the fishery.

Despite the large amount of money spent, the salmon disaster response program was not well liked (Gilden and Smith 1996a, b). Only fishermen were qualified to receive benefits; there was no aid provided for fisheries support industries. Only a third of troll-permit owners applied for the relief (Gilden and Smith 1996b). Of those who did not apply, a third felt that they were not eligible and a quarter did not know about the program. A few did not apply because they did not approve of what they viewed as "government handouts." Other complaints were that much of the help went to people who did not deserve/need it, eligibility was difficult or impossible to prove, and the rules were too confusing.

METHODS

The objectives of this study were to: (1) document responses to the WCGD, focusing primarily on Oregon, and (2) assess how well the responses worked. For Objective 1, 5 academic journals, 15 popular media (magazines, newspapers), 10 government white papers, 8 academic or non-governmental organizations' white papers, and 1 record of congressional testimony were perused. In addition, we gathered date through e-mails, telephone calls and in-person informal conversations with ten government employees, academics, and members of the commercial fishing and social service communities.

For Objective 2, we conducted a series of 23 ethnographic interviews along the West Coast between September 2005 and

October 2007. Ethnographic interviews reveal complex issues, emergent themes, and broad thematic views held by different communities (Silverman 2001; Robson 2002) and allow informants to help shape the interview and raise topics that might otherwise not be explored (Schwartzman 1993). Interviewees were selected through "snowball sampling" (Berg 2001; Robson 2002); initial contacts were selected from both communities and then interviewees were asked to provide names of other people they felt should be contacted for the study. Those interviewed within the commercial fishing community ranged from people working on boats, in processing plants, in gear shops, and in other support businesses, to fishermen's shoreside business partners. Social service community members interviewed were employees at a variety of governmental and non-governmental organizations. Table 1 lists the geographic distribution and types of members interviewed from each community. Interviewees from both communities represented the diversity found in each community (gender, age), and interviewees from Oregon varied in their location (south, central, and north coast).

Interviews were conducted in person and ranged from 30 minutes to 2 hours. Responses were tape recorded, transcribed, and analyzed via content analysis (Berg 2001; Robson 2002). Unless otherwise noted, quotations are typical of what many interviewees said. To ensure confidentiality, only community identifiers follow quotations—FC for commercial fishing community and SC for social service community.

Table 1. Breakdown of interviewees by geography and community (FC = commercial fishing community and SC = social service community).

Participants by Community		
	FC	13
	SC	10
Participants by State		
Oregon	FC	11
	SC	4
California	FC	2
	SC	3
Washington	FC	0
	SC	1
National/other	SC	2

RESULTS AND DISCUSSION

When the WCFD was declared, Congress allocated disaster relief funds to be used by each state to help individuals and communities impacted. Funds were to be split among the states in proportion to the disaster in each state. Each state, while seeking to help similar groups of people and operating under identical federal guidelines, created very different programs (Table 2). We'll report our findings with a focus on Oregon, indicating notable differences or similarities with California or Washington responses.

Oregon's Response

Several years before the WCGD was federally declared, individuals in Oregon from both the commercial fishing community and the social service community saw signs of a coming disaster. In the late 1990s they formed a coalition of caseworkers from coastal agency One-Stops (multi-agency facilities housing employment department services, workforce services, and adult and family services), the Oregon Economic and Community Development Department, and the Department of Community Colleges and Workforce Development, with members of local fishery groups and Oregon Sea Grant Extension educators. Together they designed the Groundfish Disaster Outreach Program (GDOP), and later served as the Advisory Committee for the program, developing policies and finding solutions to challenges.

The GDOP was designed to help the commercial fishing community access existing resources and transition out of the industry, and to help the social service community find affected members of the commercial fishing community. The GDOP had two main components: outreach peers and groundfish transition income (GTI). Outreach peers were members of the commercial fishing community who were contracted part-time by GDOP to help other members of the commercial fishing community find services in six target areas (Table 3). Outreach peers, who were not government or agency representatives, "greased the skids" in many ways for those trying to leave the fishery. One of their creations was the Occupation Skills Checklists (Table 4), a list of transferable job skills that demonstrated to members of both communities that the commercial fishing community already possessed skills in demand by employers. Five outreach peers and a coastwide coordinator began their work in May of 2000. They worked independently yet met regularly over the life of the program.

The second component of the GDOP was GTI—a source of economic support for people who wanted to leave the fishery but were unable to stop fishing long enough to retrain or look for new work. This was critical in Oregon because of a state bill (HB 3308, 1999) that left Oregon fisher-

Table 2. Breakdown of Interviewees by geography and community. (*Original funding is listed. Note that an additional $2.2 million was received in 2002 [85% of which went to GTI, 15% to peer outreach])

Oregon's Response		
Program*	**Budget**	**Percent of Total Budget**
Peer Outreach	$66,000	4%
Groundfish Transition Income	$1,680,000	96%
Washington's Response		
Program	**Budget**	**Percent of Total Budget**
Diversify Coastal Communities	$1,200,000	80%
Research	$300,000	20%
California 's Response		
Program	**Budget**	**Percent of Total Budget**
Vessel Safety Equipment	$300,000 (actual was approx. $100,000)	13% (actual was approx. 6%)
Collaborative Research	$763,000 (actual was approx. $1,200,000)	33% (actual was approx. 69%)
Program Admin.	$70,000	3%
Groundfish Transition Stipend	$1,200,000 (actual was approx. $400,000)	51% (actual was approx. 22%)

Table 3. Number of people anticipated to be impacted in Oregon by the WCGD.

Regions	Anticipated Number Impacted (%; n = 330)
Astoria	24%
Tillamook	8%
Newport	27%
Coos Bay	20%
Port Orford	12%
Brookings	9%

Table 4. Occupational Skills Checklist for Deckhands.

OCCUPATION SKILLS CHECKLIST: DECKHAND

Vessel operation

- ❑ stands watch
- ❑ takes direction from captain
- ❑ steers vessel
- ❑ loads equipment and supplies by hand or hoist
- ❑ pulls and guides nets and lines
- ❑ signals other workers to move, hoist and position loads
- ❑ removes fish from nets, hooks, pots
- ❑ stows catch/refrigeration or preservation mixture or ice
- ❑ sorts catch
- ❑ has knowledge of radio operation for distress call
- ❑ operates safety and fire equipment
- ❑ has knowledge of refrigeration system
- ❑ may cook for crew

Maintenance

- ❑ vessel repairs
- ❑ switching out pumps-motors hyd/elec
- ❑ scrape vessel for paint
- ❑ equipment maintenance & repair
- ❑ block and tackle
- ❑ hydraulics/heavy equipment
- ❑ rope & cable splicing
- ❑ general maintenance of vessel
- ❑ oil changes
- ❑ climbing in rigging for light replacement, rigging repair
- ❑ battery maintenance
- ❑ wash deck, conveyors, knives or other equipment
- ❑ paint vessel
- ❑ winch operation
- ❑ electrical work
- ❑ net mending
- ❑ winch turning
- ❑ gear repair
- ❑ welding

Business management

- ❑ tax forms
- ❑ record keeping (self-employed/sub-contractor): vessel names, hours worked, wages received, all business related expenses

Personal Skills

- ❑ physical strength
- ❑ can take direction
- ❑ heavy lifting
- ❑ knowledge of fish types
- ❑ good health
- ❑ perseverance
- ❑ good physical coordination
- ❑ patience
- ❑ mechanical aptitude
- ❑ commitment
- ❑ team player
- ❑ work outdoors
- ❑ long hours/intermittent sleep
- ❑ able to recognize and deal with emergency situations
- ❑ good attitude
- ❑ flexibility to assume other's role on vessel

men generally ineligible for federal and state unemployment insurance.

GTI recipients received up to $1,000 a month for single individuals and $1,500 a month for married people, for up to nine months. GTI was available on a first-come, first-served basis to individuals who were:

1. Oregon residents
2. Part of the groundfish industry
3. Negatively impacted by the groundfish disaster (unemployed or underemployed)
4. Actively using or willing to use reemployment assistance
5. Willing to commit to permanently leaving the commercial fishing industry.

When commercial fishing community members signed up for reemployment programs, the determination of GTI eligibility was made by the agency One-Stops. GTI payments were handled by the Oregon Employment Department (OED). Funds were quickly allocated (within weeks), and the first GTI checks were mailed out in June 2001, approximately eight months after federal disaster funds were allocated. Hoping to assist more people in need, Oregon applied for and received an additional $2.2 million in early 2002 (FY 2002 Commerce/Justice State Appropriations Bill; Table 2). These funds were allocated hours after they were made officially available. All GTI funds were allocated by November 2005.

It would be impossible to precisely quantify the number of people helped by the GDOP, as outreach peers only kept estimates of how many people they interacted with. Noting these limitations, cautious estimates suggest that by 2004 the GDOP had reached over 1,500 people. Of those, over 800 directly accessed resources, with over 400 people using agency reemployment programs and 350 using other agencies (food or housing assistance, mental health, etc.). In late 2005, OED reported that approximately 400 individuals had accessed GTI funds. Table 5 shows the breakdown of those who accessed support from the GDOP and the types of occupations they transitioned into.

Washington, on the other hand, spent their portion on coastal communities of place, channeling disaster funds into existing programs (Table 2). The Washington Department of Community, Trade and Economic Development was to get $1.2 million to help communities deal with the coastwide decline of groundfish fisheries through economic diversification. Grants were given to "promote economic diversity away from dependence on the commercial groundfish fishery" and to address locally defined priorities. The remaining $0.3 million was to be administered by the Washington Department of Fish and Wildlife, to help set up arrowtooth flounder (*Atheresthes stomias*) bycatch research. There appeared to be little project management and no centralized coordination. Employees at coastal agency One-Stops were aware that the disaster had been declared but received no guidance or funds to administer new programs.

California's response was similar to Oregon's but had several notable differences. In June 2001 a group of representatives from the California Department of Fish and Game (CDFG) and local agency One-Stops organized meetings in five coastal communities to decide what to do with the California share of the disaster funds. The CDFG, serving as the lead agency in the project, used comments from the meetings, written public comments, and input from an industry advisory group to create the final response plan. The plan included funding for collaborative research, a safety equipment purchasing program, and a groundfish disaster stipend (GDS) program modeled after Oregon's GTI (Table 2). Target audiences were the commercial fishing fleet and the charter fleet.

Challenges Existed

Despite recognition of the overall success of Oregon's GDOP, evidence of cultural conflict emerged as an interview theme. Differences in cultural characteristics and expectations, for example, resulted in stereotyping (Table 6). Some of these stereotypes were offered as explanations for the perceived failure of some fishing

Table 5. Breakdown of members of the commercial fishing community (FC) that accessed the GDOP, and the types of occupations they entered into.

Members of the FC	Who Accessed the GDOP	Types of Occupations Chosen
Boat owners/captains	15%	Occupations varied greatly, spanning from academics to laborers, technicians to social workers
Deckhands	43%	
Shoreside partners	29%	
Processing and other shoreside businesses	13%	
And of these		
Men	60%	
Women	40%	

industry members to transition out of the industry. For example, commercial fishing community members were stereotyped as being "a different breed," having a "fishing addiction," or being accustomed to making more money than they could in other occupations:

> *. . . they're used to making big chunks of money, and they don't make huge chunks of money when they get out into the real occupational world.*—SC

> *. . . guys are used to making a hundred, two hundred thousand dollars a year and all of the sudden you want them to make ten bucks an hour? It doesn't even cover their lifestyle, their bills. Fishing is strange . . . it becomes an addiction, and it's a way of life… not just a job. If it was just a job you'd see more people quitting.*—FC

Other barriers existed as well. Interviewees mentioned that age and feelings of pride prevented many fishermen from accessing aid. Another obstacle was a lack of experience with job search skills such as writing resumes or interviewing. Similar to the lack of education was the lack of experience and the lack of desire (reported by and about members of the commercial fishing community) to work for someone else. This clearly ties with the strong sense of independence of fishermen and other natural resource workers such as farmers. Many who transitioned out of fishing gravitated towards self-employment, but members of the commercial fishing community interviewed reported that they felt that the agency One-Stops discouraged self-employment, reporting that they were told that tracking self-employed people was too "difficult."

While the groundfish fleet decreased in size, every port reported boats still going out. So unlike a mill closure, fishermen up and down the coast continued to try to fish and some who started retraining returned to fishing before or after finishing their training. This situation is true in many fishery disasters. However, this led to two other commonly-voiced themes in interviews—frustration with temporal and geographical inconsistencies between agencies and the importance of looking beyond numbers—and often highlighted cultural conflicts caused by stereotyping (Table 6).

Agencies within One-Stops generally operated with varying degrees of autonomy. Among agency One-Stops along the coast, some agencies operated with little coordination with other agencies and often offered inconsistent benefits. In some cases, a caseworker might take on one member of the commercial fishing community, but not another. This helped to fuel other stereotypes (judgmental, bureaucratic; Table 6). And, like farmers and other members of natural resource communities, fishermen were often cash poor but asset rich:

> *When I started, 'well, there's something out there to help you—let's access it.' I showed them the income that I'd been making, [and] they informed me that they could not pay for the books or the tuition because they needed to be able to get me a job after I graduated paying 75% of the wages that I was making before going into the program, or it would count badly against them. There was no way that they could do that, so they were not going to give me any money.*—FC

> *They could be starving to death, literally, and their kids could be starving to death, yet, on paper their assets looked so great that they didn't qualify for a lot of programs. We live and die by statistics. Its no longer just about getting people trained.*—SC

There was almost universal agreement that the GTI was critical to the success of the program. People have historically transitioned out of the fishery without GTI, but interviewees thought that the program was much more successful due to the inclusion of GTI.

Table 6 Expressed stereotypes of the commercial fishing community and the social service community by members of both communities.

Stereotypes of the Commercial Fishing Community	Stereotypes of the Social Service Community
Proud/Independent/Hardworking	Governmental
FC members are looked down upon	Insensitive
Poor with structure	Bureaucratic
Freeloaders	Helpful
Alcohol and drug users	Rude
Unreliable / not serious about retraining	Mean
A different breed	Judgmental

Without GTI, I don't think they could have successfully made that transition. With it people were abled to at least try and get through the process.—SC

The GTI money was a big draw for people to come into the program, and it was a big draw because it was a nice chunk of change, but it also was a component that was needed for the success of the transition.—FC

Yet GTI also brought challenges. Initially, the IRS indicated that it would tax GTI as income, significantly reducing the aid provided by the program; GDOP leadership worked to change this. In February 2002 the IRS decided that GTI would be tax-free because it was a needs-based payment" and not "income.

In California, the commercial fishing community's response to the program was not as strong as had been expected. The safety equipment program closed in July 2003 with only a third of the moneys budgeted paid out (Table 2). Groundfish disaster stipend (GDS) funds were also not readily used by the commercial fishing community; only 58 people received GDS funds and approximately a third of the $1.2 million remained in the GDS pool when the program closed in June 2004 (money remaining was transferred into the collaborative research program).

Several reasons were given for the commercial fishing community's lack of interest in GDS. Outreach had not worked well; while interviewed members of the California commercial fishing community and social service community had heard about Oregon's program, most had seen no evidence of California money coming to their region. Recruitment for the disaster program was called "ad hoc" at best. By an employee's own confession, CDFG had little to no experience in dealing with economic disasters. While the CDFG mailed out announcements about the programs to all license holders, they had no outreach peers or other mechanisms for contacting crewmembers or people working in processing plants.

They didn't get word unless their boss told them… The only real way to get word out is in person.—SC

In Washington, our research indicated that there was little project management and no centralized coordination. Employees approached at coastal One-Stops were aware that the disaster had been declared, but they received no guidance or funds to administer new programs.

Members of the Washington commercial fishing community were able to access standard state and federal unemployment insurance. According to an agency One-Stop employee, "Fishermen all sign up for unemployment instantly, soon as they come off the boats. It's a pattern," but also commented that the system was too impersonal, and "wasn't working for them as well as it could."

Successes in Oregon

Each interviewee was asked if they felt that the program was a success, an intentionally-broad question allowing respondents to answer in a way that revealed their own definition and experience. Numerous people from both communities noted this was a program specifically designed to help people who were interested in leaving the fishing industry, not to convince people to leave, and ultimately only worked for those willing to help themselves.

Unless the fisherman, or whoever the program is directed at, wants to do it, it isn't going to work.—FC

I think that it was a really good opportunity for those that wanted to make the transition. . . . those that wanted to make that happen, they were the ones that made the program a success.—SC

Nearly everybody interviewed felt that overall the program did well. Some talked about how it was successful in meeting specific goals, others quoted statistics, and some felt that it had simply helped members of the commercial fishing community to deal with the industry downturn.

It worked real well, and our success rate has been real good . . . . I haven't looked at the stats lately, but last time I looked our placement rate was about 90%.—SC*[My job-training] was good. I enjoyed it. It was a little hard being away from home, but I knew it was something that I wanted to do.*—FC

Most people interviewed believed that communication between the commercial fishing community and the social service community had improved, as had awareness in the commercial fishing community of social service community programs. However, there was almost universal sentiment that the individuals involved were critical and that as they left positions in agencies or their communities the bridges would disappear with them.

I think [there were bridges], as long as the outreach peer was there.—FC

I think that a lot of bridges were built . . . [but] nothing lasts forever. There's an awful lot of turnover and burnout in agency work. I don't know that it'll be the same when everybody who experienced this program is gone.—SC

Everybody interviewed expressed reasons for the GDOP's success, and positive communication came up as a theme. While many found meetings frustrating, most agreed they were critical to the success of the program as a whole.

Our first experience with the GDOP was not successful . . . . We ended up having a meeting saying, 'why isn't this working?,' and then it started working. . . . Pretty soon we had a hundred e-mails going back and forth and were communicating with each other and building relationships. And I firmly believe that the relationships are what made this work.—SC

While respondents in Oregon indicated that maintaining clear communication between agencies and regions was a continuous, if often successful, struggle, in California, communication between agencies during the program was often called "virtually nonexistent" and there was a lack of active, adaptive coordination. This is similar to what an independent study on California's response reported to the Monterey County Office for Economic Development (Pomeroy and Dalton 2003). This report posited that the program was less effective than it could have been due to insufficient promotion, unclear rules, and design flaws.

Suggested Improvements to the Oregon Program

Interviewees were asked what changes they would make if they could reorganize the program from the beginning. Interviewees who went through the retraining expressed appreciation for the training they had received and a desire for more. Some were frustrated that they hadn't been able to finish programs that they had started, though they acknowledged they had been aware of the limited duration of the program.

> *My niece, she went for her [Certified Nurse's Assistant certification] and now she's working in the doctor's office. She wanted to be [a Registered Nurse] but the funding ran out and she's got another two years to go . . . . How can you keep doing something when your money runs out?*—FC

The most commonly voiced recommendation was for increased communication, coordination, and standardization between the various organizations involved.

CONCLUSION

Fishery disaster response programs cost governments millions of dollars, yet little research has been put into assessing them; they are poorly understood and documented. This study strove to gain some understanding of fisheries disasters programs by investigating the WCGD. Although specifically evaluating the relative effectiveness of each state's program was impossible due to the wide range of approaches, comparisons between states revealed similarities and differences in the programs potentially useful in future program design.

While accessing social services is never an easy or pleasant task, the process is particularly difficult for members of the commercial fishing community. People trying to leave the industry face unique obstacles including a lack of job search skills and an unpredictable work schedule that makes adhering to traditional retraining programs difficult.

An aggressive, well-planned outreach program is necessary for any effort that aims to directly include people from the fishing industry. Traditional routes of advertising help but the best success rates were found in areas where peers actively recruited members of the fishing industry.

When planning for future disaster responses, it's important to look at the lessons learned from the WCGD and other disaster responses. Oregon's response to the WCGD specifically targeted a broader audience than the salmon disaster program by attempting to include not only fishermen but their onshore business partners, processor employees, and others who were directly reliant on the groundfish industry. This inclusiveness was the result of including commercial fishing community representatives in the design of the GDOP, and the successes of the GDOP may have been related to the continual inclusion of the outreach peers throughout the life of the program. Furthermore, while the salmon commercial fishing community expressed frustrations with eligibility red tape and general disappointment with the program (Gilden and Smith 1996a,b), neither of these complaints emerged in our study, possibly because the GDOP was specifically designed to avoid some of the salmon disaster response problems.

Our study, although small and not perfect by any means, allowed us to gather some lessons learned that could be incorporated into the design of future disaster response programs. Some common broad points and keys to success that were consistently relayed to us:

- **It's about People and Perceptions:** The majority of the complaints were about individual people or groups and how they treated each other; many of the positive comments concerned the benefits of building relationships.
- **Nobody Enjoys Accessing Social Services:** No evidence indicated that the system was biased against the commercial fishing community; people access social services as a last resort and most find the experience humiliating.
- **The Commercial Fishing Community Faces Unique Challenges in Transitioning:** The most pronounced obstacles include high-incomes that are difficult to replicate in most coastal communities, work schedules that make it difficult to adhere to most retraining plans, and the preference for fishing as "a way of life."
- **Successful Transitions out of the Fishing Industry Are Possible:** Despite obstacles, there are many examples of members of the commercial fishing community who left the industry and transitioned into other work.
- **Successful Fishery Disaster Relief Programs Are Possible:** While no program was loved by all people interviewed, each had its advocates and the programs in Oregon and California reported successfully helping commercial fishing community members. People in Oregon felt that the GDOP—despite some problems—was generally an overall success. Keys to this success include:
    - o Use of a neutral, respected convening entity to bring partners together.
    - o Proactive planning; planning and implementation done in partnership with the impacted community.
    - o Carefully designed and aggressive peer outreach.
    - o Attention to inter- and intra-agency communication.
    - o Recognition that economic support during transition is critical.

If members of both the commercial fishing and social service communities, as well as fisheries managers and other decision makers, were to consider these lessons learned, they might have a better understanding of how decisions made may impact communities and what support communities might need to deal with those impacts in the best possible way when the next fishery disaster occurs. ♋

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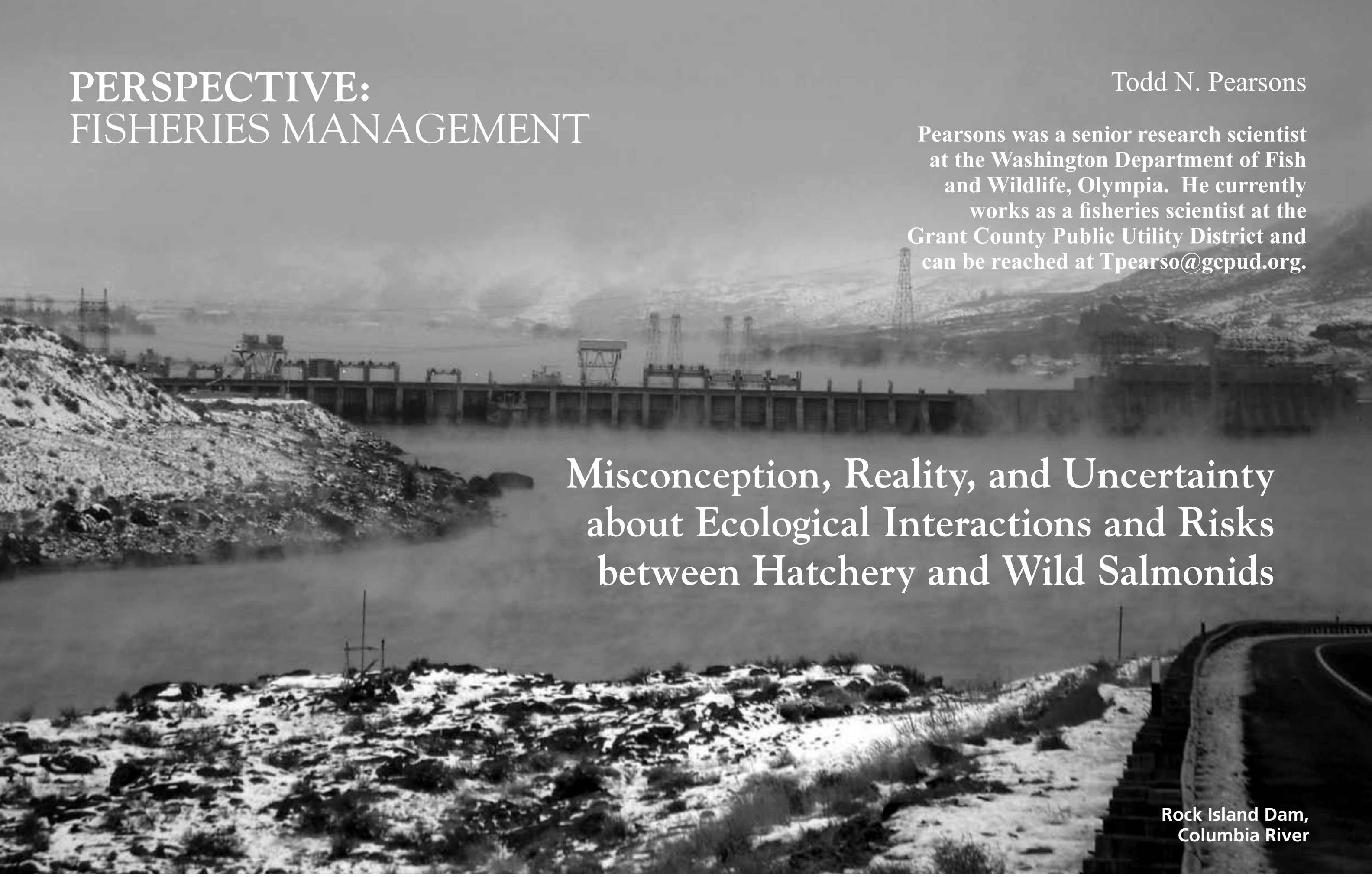

PERSPECTIVE:
FISHERIES MANAGEMENT

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Misconception, Reality, and Uncertainty about Ecological Interactions and Risks between Hatchery and Wild Salmonids

Rock Island Dam, Columbia River

ABSTRACT: Hatchery and wild fish advocates often engage in lively debates about the ecological interactions between hatchery and wild fish. Many arguments about ecological interactions between hatchery and wild fish have been fueled by a variety of misconceptions, scientific uncertainties, and differences of unstated objectives. In order to reduce the frequency of unfruitful discussions, it is important to expose a variety of misconceptions and scientific uncertainties about ecological interactions and risk. In addition, it is necessary to synthesize what is currently known about ecological interactions. Seven misconceptions, three realities, and four of the most important scientific uncertainties are described. I conclude that ecological interactions between hatchery and wild fish will occur but whether those interactions are biologically significant, socially acceptable, and whether any impacts are statistically detectable are probably dependant upon the characteristics of the hatchery program, naturally-produced fish, natural environment where hatchery fish are released, and how interactions are evaluated. Large-scale experiments will be necessary to resolve existing scientific uncertainty, but in the mean time, risk assessments, weight-of-evidence and precautionary approaches, and separating technical and policy discussions can be used to improve evaluation and management of ecological interactions between hatchery and wild fish.

Errores, realidad e incertidumbre de las interacciones ecológicas y riesgo entre salmones cultivados y silvestres

RESUMEN. El tema de las interacciones entre peces cultivados y silvestres es foco de intensa controversia. Muchos de los argumentos acerca de las interacciones ecológicas entre ambos tipos de organismos han sido impulsados por una variedad de errores, incertidumbres científicas y diferencia de objetivos. Con el fin de evitar discusiones infructíferas es importante exponer las diferentes equivocaciones e incertidumbres científicas acerca del riesgo e interacciones biológicas. Adicionalmente es necesario recapitular lo que se sabe acerca de estas interacciones. En este trabajo se describen siete errores, tres realidades y cuatro de las incertidumbres científicas más importantes. Se concluye que las interacciones biológicas entre peces cultivados y silvestres sí ocurrirán pero el hecho de que éstas sean biológicamente significativas, socialmente aceptables y con efectos estadísticamente detectables probablemente dependa de las características de los programas de cultivo, de los peces producidos de manera natural, de las condiciones naturales de los lugares donde los peces cultivados son liberados y de cómo se evalúen dichas interacciones. Se requerirán experimentos de gran escala para resolver las incertidumbres científicas, pero mientras éstos se llevan a la práctica, el análisis de riesgo, el peso de la evidencia, los enfoques precautorios y la diferenciación entre discusiones políticas y técnicas pueden utilizarse para mejorar la evaluación y manejo de las interacciones ecológicas entre peces cultivados y silvestres.

My goal is to provide evidence to question the veracity of a misconception so that the burden of proof for acceptance of a misconception is shifted to the proponent of the misconception.

Hatchery and wild fish advocates often engage in lively debates about the ecological interactions between hatchery and wild fish (Meffe 1992; Hilborn 1992; White et al. 1995; Brannon et al. 2004). Some communications can even degrade into passionate pseudo-scientific arguments that have the flavor of scientific credibility, as described generally by Lackey (2004, 2006, 2007), but do not advance the true evaluation of costs and benefits of hatchery operations (Waples 1999). There have been pleas for improved civility among fisheries professionals (Martin et al. 1992; Stickney 1994), but improvements are still needed. One way to improve civility and increase objectivity of discussions is to conduct formal risk assessments. Disciplined risk assessment procedures have been developed to improve predictions of ecological costs and benefits associated with hatcheries (Pearsons and Hopley 1999; Ham and Pearsons 2001; Busack et al. 2005). However, even with disciplined procedures, biased information, viewpoints, and interpretation can taint the assessment of costs and benefits (Lackey 2006, 2007). This bias in outlook is one of the main subjects of this article.

What is "known" about ecological interactions is often wrong, and what is "not known" about ecological interactions is often unrecognized. It is critically important to productive future dialog to clarify in general terms what is known about ecological interactions involving hatcheries. This would complement the work of Waples (1999), who addressed misconceptions about hatchery programs primarily from a genetic perspective, but intentionally avoided ecological issues. This avoidance was not because "ecological considerations are unimportant; rather, the topic is too complex and my expertise in that area is too limited to do it justice."

During the many years that I have engaged in assessing ecological risks of hatchery operations, I have encountered many partial truths and falsehoods that are uncritically accepted as truth. Some of these "misconceptions" may not be found in citable documents, but are part of the "scientific" dialogue that may influence local decisions, and part of the way that the scientific literature is interpreted and applied. In some cases they may be found in environmental impact statements, hatchery master plans, or in hatchery and genetic management plans. One of my purposes in writing this article is to expose a subset of these misconceptions so that ecological risk assessments will be conducted and the quality of assessments improved. In many cases there are insufficient empirical data to conclusively falsify a misconception. However, the converse is also true—there are also insufficient empirical data to support acceptance of a misconception. My goal is to provide evidence to question the veracity of a misconception so that the burden of proof for acceptance of a misconception is shifted to the proponent of the misconception. In some cases, a misconception may not be presented as bluntly as I have portrayed, but the essence of a variety of versions is contained within my portrayal of the misconception.

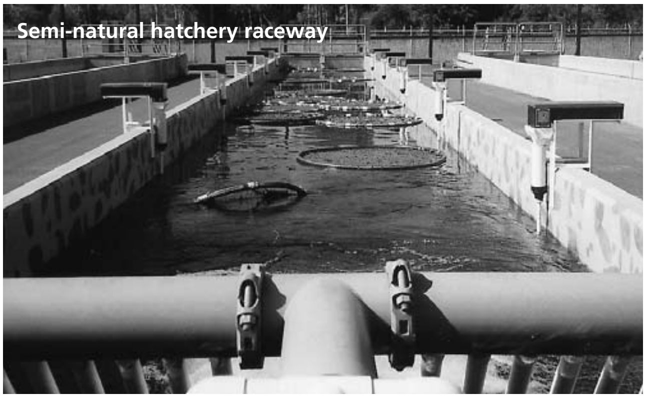
Besides exposing misconceptions, improvements in our understanding and application of ecological interactions will be made by synthesizing the most important aspects of what is known and unknown. The reality of what is known should be applied to current risk assessments, whereas the most important uncertainties should be prioritized for future funding and resolution. The most important realities and uncertainties about ecological interactions are presented in the remainder of this article.

The list of misconceptions, realities, and uncertainties should not be considered exhaustive, but illustrative of the important issues that confront risk assessors and managers. The misconceptions that I have chosen to present are among the most prevalent and potentially influential that I have encountered. For ease of communication, I will refer to hatchery fish as fish that are released from a hatchery and wild fish as natural-origin con-specifics and other species that aren't the target of enhancement. However, I acknowledge that this convenience of communication is an oversimplification of the differences between hatchery fish, wild fish, and the gradients between the two (e.g., see Goodman 2005). Furthermore, hatcheries have different goals, such as harvest augmentation or conservation (Mobrand et al. 2005), which can result in differences in the qualities of the fish and ecological interactions with wild fish. As such, some of the presentation will be more appropriate to some types of hatcheries than to others.

MISCONCEPTIONS

Misconception #1: *Release of hatchery fish downstream of species of concern means impact will be negligible.*

It is appealing to assume that impacts will not occur if hatchery fish are released downstream of species of concern. However, hatchery fish may swim far upstream of their release site and overlap with species of concern (Hume and Parkinson 1987; McMichael and Pearsons 2001). Hatchery fish may also leave a shadow of reduced food abundance that may impact later migrating, later emerging, or resident salmonids. However, I am not aware of a study that has demonstrated this hypothetical shadow effect (although see Ruggles 1959). Wild fish may also swim downstream into areas containing



Semi-natural hatchery raceway

hatchery fish, and mixing of anadromous hatchery and wild fish will occur in estuaries and marine waters. Evidence suggests that intra- and interspecific competition in estuaries and marine waters can reduce the survival and growth rates of juvenile salmonids (Ruggerone and Nielsen 2004), and that competitive effects increase when prey abundance declines (Ruggerone and Goetz 2004). Exploitative competition may be particularly important in areas such as estuaries and near-shore marine environments that experience large numbers of fish at different times or in freshwater environments when fish densities are low (Grant and Imre 2005; Williams 2006).

***Misconception #2:** The published literature is a representative sample of ecological interactions between hatchery and wild fish.*

When insufficient evidence of ecological impacts in the scientific literature occurs, then this lack of evidence is sometimes used to support the conclusion that impacts do not occur. Statements such as "we could find no evidence that disease impacts wild fish" can be interpreted that disease will not impact wild fish. However, the lack of literature simply may be because studies have not been conducted or that they have been conducted but haven't been published in journals (Don Chapman Consultants Inc. 1989; Moller and Jennions 2001). For example, significant interactions may occur between hatchery steelhead (*Oncorhynchus mykiss*) and sand roller (*Percopsis transmontana*), but I am not aware of any studies that have been published about this topic, presumably because studies haven't been conducted. The scientific literature is likely to be biased in a number of ways. First, many journals are uninterested in publishing results that fail to reject the null hypothesis (Moller and Jennions 2001). In other words, studies that do not demonstrate a statistically significant interaction or impact are less likely to be published. This results in a bias towards publishing studies that have demonstrated an impact. Second, those studies that are successful in publishing statistically insignificant (alpha > 0.05) data may be committing a type II statistical error because of a lack of statistical power. When studies do not detect a statistically significant impact, they are usually used to support a conclusion that impacts did not occur (McMichael and Pearsons 1998; Riley et al. 2004; Pearsons and Temple 2007). Detection of a statistically significant impact may not be found because of a lack of impact or because of inadequate statistical power (Peterman and Bradford 1987; Ham and Pearsons 2000). In many cases, detection of impacts to population abundance of less than 20% is highly unlikely using current methods (Ham and Pearsons 2000). This illustrates the difficulty of detecting impacts to population abundance in all but very large impacts and therefore the likelihood of falsely accepting the interpretation of no impacts. The implication of the biases that were described is that the literature cannot be viewed as a representative sample in syntheses or risk assessments.

***Misconception #3:** Interactions from hatchery fish are always negative.*

Discussions about ecological interactions between hatchery and wild fish usually center on negative interactions to the exclusion of positive ones. Negative interactions such as predation, competition, and disease are usually highlighted, while positive interactions such as nutrient addition and predator swamping are usually overlooked (Marnell 1986; White et al. 1995). For hatcheries that return more adults to the spawning grounds than would have occurred without hatchery intervention, additional nutrients may contribute to enhanced freshwater productivity (Bilby et al. 1998, 2001; Stockner 2003). Large numbers of hatchery fish may confuse or satiate predators, which may result in increased survival of wild fish (Peterman and Gatto 1978; Wood 1987 a, b; Fritts and Pearsons in press). An unbiased assessment of risk can only be completed after both positive and negative interactions are considered (Pearsons and Hopley 1999).

***Misconception #4:** Historical coexistence translates into present coexistence.*

Many species that are the focus of artificial propagation are released into places that they historically occurred. Some suggest that historical coexistence of species means that wild (conspecifics and non-target species) and hatchery fish will not negatively impact each other in the present. This assumes that environmental conditions and species assemblages of the past are functionally similar to the present. This assumption is likely to be false in many if not most areas where hatchery programs exist. If environmental conditions, such as habitat complexity, flow, or water temperature has changed over time then we cannot assume that the interactions will be the same. Studies have shown that outcomes of interactions can change when environmental conditions such as temperature and flow patterns change (Reeves et al. 1987; Li et al. 1994; Tait et al. 1994; Reese and Harvey 2002). In addition, establishment of nonnative species may also change the functional relationships among species or races (Li et al. 1987; Fritts and Pearsons 2004, 2006). Furthermore, reintroduction or enhancement of species in areas where other non-target species have been released from competition are likely to result in a reduction in abundance of non-target species (Pearsons 2002).

***Misconception #5:** Acceptable impacts to wild fish should not be any less than what is statistically detectable.*

Some have argued that acceptable impacts to wild fish should be determined based on what is scientifically detectable rather than what is desired by policy makers (e.g., containment objectives). Containment objectives are the levels of impacts to non-target taxa that are acceptable in order to achieve the predicted benefits of a hatchery program and are derived based on the perceived values of different species in the ecosystem (Pearsons and Hopley 1999; Ham and Pearsons 2001). They are the management targets that scientists assess risks against and attempt to detect with a monitoring plan. For example, a containment objective for a particular species might be to keep impacts below a 5% reduction in abundance, size, and distribution. Monitoring plans vary in their ability to detect different levels of impacts (Ham and Pearsons 2000). Variation in impact detection can be driven by non-biological factors such as funding or scientific factors such as study design, study implementation, or interpretation of results. Containment objectives should be compared to predicted impact detection to determine the level of risk containment that is possible (Ham and Pearsons 2001). However, the value-based containment objectives should not be adjusted by the level of impact that is scientifically detectable. If this were the case, then a species that has low societal value and low level of detectable impacts would have a lower containment objective than a federally-listed species that has a high level of detectable impact. It is important for managers to know whether a monitoring plan can or can't detect and contain risks at the desired level. This information could have implications about the potential benefits and costs of a hatchery (Pearsons and Hopley 1999).

Misconception #6: *Management can contain risks associated with ecological interactions within acceptable levels.*

Due to the desire to stock hatchery fish and the high uncertainties associated with ecological risk assessments, many propose to implement hatchery programs with the hope that monitoring programs will be able to detect impacts and that managers will be able to stop or mitigate impacts (e.g., Bonneville Power Administration 1996). Risk containment management may not be able to contain risks adequately because of inability to detect impacts before containment objectives are exceeded, or because actions to contain risks are not available (Ham and Pearsons 2000, 2001). The magnitude of impact and the time that it takes to detect an impact are typically larger, more expensive, and longer than would be desireable by managers (Ham and Pearsons 2000). This is particularly true in cases where hatchery fish share resources with wild fish that are listed as threatened or endangered. For example, managers may not want to have more than a 5% impact to a listed species abundance and want to be alerted no later than a year after the impact has occurred. Neither of these conditions is currently achievable.

Misconception #7: *Ecosystems are so complicated that we can't predict what interactions will occur.*

While it is true that ecosystems are very complicated and no one has ever really studied all of the interactions within an ecosystem, we know enough about interactions to make fewer management mistakes than if we acted as if we knew nothing (e.g, Dambacher et al. 1999; Dambacher 2001). Walters and Martell (2004) confronted the same misconception when applied to setting fish harvest. We know enough about the potential interactions that could occur and some of the factors that will influence the strength of these interactions, that we

Luke Pearsons snorkeling to observe fish.

can make reasonable and logical predictions. For instance, most people would agree that higher spatial-temporal overlap of hatchery and wild fish and higher number of hatchery fish increases interaction risk (McMichael et al. 1999a; Weber and Fausch 2005). Furthermore, releasing large-sized piscivorous species into areas containing small fish pose higher predation risks than releasing these fish into areas containing fish that are too large to consume (Pearsons and Fritts 1999). Competition strength is likely to be higher among species with similar ecological requirements than those with different ones (McMichael et al. 1997). In addition, releasing fish with contagious pathogens poses more risk to wild fish that those that are free of pathogens (Goede 1986).

REALITIES

While it is true that there are many misconceptions about ecological interactions and risks, there are also a number of realities. Realities can come from a variety of sources such as empirical studies, ecological theory, or experience. These realities could be used in support of conducting risk assessments and identifying critical knowledge gaps. Although many other realities besides the ones that I present are possible, I attempt to focus on ones that provide the most heuristic value.

Reality #1: *Ecological interactions between hatchery and wild fish will occur.*

Releasing thousands or millions of fish into natural watersheds will result in direct or indirect interactions with wild fish. Fish released from a hatchery will eat a variety of prey, occupy space, be eaten by predators, influence the flow of nutrients through their carcasses, and potentially serve as amplifiers of pathogens (Steward and Bjornn 1990; Groot and Margolis 1991; Willson and Halupka 1995; Fresh 1997). Furthermore, many other con-specifics and non-target species of wild fish share similar food sources, space, predators, and susceptibility to pathogens as hatchery fish (Steward and Bjornn 1990; Beamish and Neville 1995; McMichael et al. 1999b; Pearsons et al. 2007a). Ecological communities are too interdependent for hatchery fish to live within an ecological vacuum. In addition, theoretical support for ecological interactions between hatchery and wild fish is strong. The following are examples of theoretical support for the occurrence of ecological interactions:

- Ecological resources (e.g., food and space) are finite and many populations, including fishes, have been demonstrated to be regulated through density-dependent mechanisms (Chapman 1966; Grant and Kramer 1990; Achord et al. 2003). Adding additional juvenile fish to the natural environment has the potential to limit the resources to wild fish.
- Hatchery fish that are large enough, have a tendency towards piscivory, and are in sympatry with abundant prey fish will eat other fish (Sholes and Hallock 1979; Pearsons and Fritts 1999; Hawkins and Tipping 1999). Adding piscivores into waters containing prey-sized fish has the potential to increase mortality of wild fish.
- Susceptibility to disease is theorized to be an interaction between the environment, host, and the pathogen (Snieszko 1974; Goede 1986; Bucke 1993). The presence of hatchery fish may increase stress levels to wild fish and increase susceptibility of wild fish to disease. An increase in fish density has been shown to increase stress and susceptibility of disease to rainbow trout (Peters et al. 1988, 1991). Cases of disease transfer between fishes in the natural environment have been reported (Mitchum and Sherman 1981; Goede 1986; McVicar 1997).
- Salmon carcasses can have a dramatic influence on food web productivity (Gende et al. 2002; Schindler et al. 2003; Stockner 2003). Addition of hatchery coho salmon carcasses increased growth of natural origin salmonids (Bilby et al. 1998) and fish that have access to salmon carcasses generally grow faster than fishes without this material (Eastman 1996; Wipfli et al. 2003). Addition or reduction in carcasses caused by hatchery operations can increase or decrease the food available to fish.
- Many fish and birds species have been shown to consume salmonids (Wood 1987 b; Fritts and Pearsons 2004). Animals will move to areas of high prey abundance (e.g., release of hatchery fish; Collis et al. 1995; Shively et al. 1996 a,b; Major et al. 2005) and will often switch their diet to prey of high abundance. This has the potential to increase or decrease impacts to wild fish (Peterman and Gatto 1978; Steward and Bjornn 1990; Nickelson 2003).
- Animals have a limit to what they can eat and it is possible that hatchery fish could swamp predators and reduce impact on wild fish (Peterman and Gatto 1978; Wood 1987a,b).
- Reducing spatial and temporal overlap decreases most interactions and therefore it is likely to reduce ecological impacts (McMichael et al 1999a).

In addition to the theoretical support of ecological interactions described above, many mechanisms of ecological impacts have been observed in the lab and the field. Many review papers have been published about the various interactions mechanisms that could occur between hatchery and wild fish (Marnell 1986; Steward and Bjornn 1990; Fresh 1997; Weber and Fausch 2003). It has been conclusively demonstrated that hatchery fish do eat wild fish in some situations (Sholes and Hallock 1979; Hawkins and Tipping 1999; Pearsons et al. 2007**a**; Sharpe et al. in press) and will use agonistic interactions against wild fish in competitive contests (Rhodes and Quinn 1998; McMichael et al. 1997; 1999b; Weber and Fausch 2003, 2005). Other mechanisms such as disease, indirect predation, behavioral anomalies, and nutrient dynamics are less well studied but theoretically possible (Hillman and Mullan 1989; Steward and Bjornn 1990; Pearsons and Hopley 1999; Nickelson 2003).

Reality #2: *Ecological interactions are context specific.*

Outcomes of ecological interactions can vary depending upon the ecological conditions of the environment (Southwood 1977; Li et al. 1987; Schlosser 1987; Fresh 1997) and the characteristics of hatchery and wild fish (Rhodes and Quinn 1998; Fritts et al. 2007; Pearsons et al. 2007b). No two river systems or hatcheries are exactly the same. For example, changes in ecological conditions such as water temperature has been shown to change outcomes of ecological interactions (Reeves et al. 1987; Tait et al. 1994; Reese and Harvey 2002). The presence of dams can influence predation rates (Ruggerone 1986; Major et al. 2005) and possibly exacerbate disease problems (Li et al. 1987). Differences in nutrient retention, light attenuation, or harvest rates can influence the contribution of salmon carcasses to freshwater productivity (Finney et al. 2000; Wilzbach et al. 2005). Stressors such as pollution, crowding, and abnormal temperatures can influence susceptibility to disease (Snieszko 1974; Goede 1986). Furthermore, differences in size at release, time of release, and degree of domestication could influence competitive dominance (Berejikian et al. 1996; Metcalfe et al. 2003; Pearsons et al. 2007b). Hatchery operations vary in a variety of important characteristics such as the species cultured, number of fish released, release strategy (e.g., volitional vs. direct stream releases), time and location of release, size at release, and disease history. Natural streams also vary in a number of important characteristics such as discharge, habitat complexity, water temperature, carrying capacity, productivity, and species composition. Wild fish populations vary by species, abundance, size, distribution, productivity, ecology, and life history. The wide variety of hatcheries, wild fish populations, and stream environments suggests that outcomes of ecological interactions can vary dramatically, ranging from positive to negative impacts (Figure 1 top).

Reality #3: *Many disagreements result from differences in values rather than science.*

The most difficult exercise of conducting a risk assessment or applying the results of risk assessments is the valuing of different benefits and costs associated with a hatchery (Pearsons and Hopley 1999). A negligible or unimportant impact to one stakeholder may be excessive and important to another stakeholder (Lackey 2006). Many stakeholders think that they are arguing about differing scientific interpretations when in actuality they are arguing about what constitutes a significant impact (Lackey 2004). Others mask personal policy preferences with science to increase credibility of an argument (Lackey 2006, 2007). A significant impact is determined based on stakeholder values as opposed to science. Said in another way, stakeholders will differ in weighting how much impact they are willing to endure in order to get the predicted benefits of a hatchery program. For example, wild steelhead advocates might be unwilling to accept any impacts to get the benefits of a hatchery coho salmon (*O. kisutch*) program, but hatchery coho salmon advocates may be willing to accept a rather large impact in order to get the benefits of a hatchery program. Valuation of species becomes very difficult when supplementation is used to enhance an endangered species that has the potential to impact another endangered species. This scenario exists in the upper Columbia River and Snake River and is becoming more prevalent in the Pacific Northwest. It is important to acknowledge that some species, and the people that champion them, will be winners and others will be losers (Lackey 2006).

KEY UNCERTAINTIES

The misconceptions and realities about ecological interactions illustrate the high level of uncertainty associated with hatchery impacts. The fact is that ecological interactions are often complicated and the most relevant information difficult to obtain (Fresh 1997; Ham and Pearsons 2001; Pearsons 2002). However, some uncertainties are bigger and potentially have more management implications than others. I have attempted to identify the most important uncertainties relative to the lack of information and the importance of the information at the highest geographic scale. However, in particular locations (e.g., watersheds) a different prioritization could easily be supported. These uncertainties could be used to guide or prioritize evaluation programs of ecological interactions, particularly at the state and federal levels.

Uncertainty #1: *Unstudied interaction mechanisms and locations of interaction.*

Most literature about ecological interactions has focused on competition and predation in the freshwater environment (Marnell 1986; Steward and Bjornn 1990; Fresh 1997; Weber and Fausch 2003), while other interaction mechanisms and the interactions that occur in other locations have rarely been studied. Interaction mechanisms such as disease and indirect predation have rarely been investigated, but have the potential to be very important (Goede 1986; Marnell 1986; Li et al. 1987; Nickelson 2003). It is currently unclear how much hatcheries amplify native pathogens through hatchery effluent waters, release of diseased fish, or distribution of spawned-out carcasses for nutrient enhancement. Furthermore, the degree to which hatcheries change the incidence of disease in wild fish is nearly unstudied. We do not have empirical results about the survival of wild fish influenced by predators that are influenced by hatchery fish; although many mechanisms have been demonstrated (Peterman and Gatto 1978; Collis et al. 1995; Shiveley et al. 1996a,b). In addition, interactions in certain locations, such as the migration corridor, estuary, and ocean are also very underrepresented in the literature (Steward and Bjornn 1990; Fresh 1997; Zimmerman and Nielsen 2004). This uncertainty is significant because ecological interactions from hatchery smolt stocking is likely to be greatest in these environments because they spend the most time in them and is where they grow the most.

Uncertainty #2: *Community and population level impacts of single hatcheries throughout the duration of all hatchery stages.*

Although many ecological mechanisms of impact have been demonstrated (e.g., hatchery fish eating wild fish), few studies have been published that evaluate the impacts of a production scale hatchery in natural environments (e.g., percent of population consumed, or decrease

Grand Coulee Dam, Columbia River

in abundance; Marnell 1986; Levin and Williams 2002; Weber and Fausch 2003). Only a handful of studies have attempted to measure impacts and most of these have focused on impacts to naturally-produced conspecifics (Nickelson et al. 1986; Chilcote 2003; Nickelson 2003) and/or stocking salmon before the smolt stage (Bjornn 1978; Tripp and McCart 1983; Nickelson et al. 1986). Pearsons and Temple (2007) evaluated smolt release impacts to three trout species during the early stages of salmon supplementation and reintroduction programs. However, they did not evaluate the long-term effects of later stages of hatchery programs. I am not aware of any study that has conclusively evaluated the impacts of a hatchery smolt program on valued non-target taxa in natural environments.

Population-level impacts from hatchery programs are difficult to detect because of the high natural variability in abundance (Ham and Pearsons 2000). This variability may be further enhanced by variation in impacts associated with different stages of supplementation (Pearsons 2002). The implications of these challenges are that monitoring programs will likely be long in duration and therefore expensive. Furthermore, some rivers are very difficult to sample because of access issues, hydrology, temperature, or turbidity. Finally, absence of adequate control streams can also preclude the ability to produce conclusive results.

Abundance monitoring will rarely be sensitive and timely enough to detect small impacts that are important to managers. Detecting impacts of less than 20% to population abundance may be desirable from a management perspective, but it is likely that the probability to do this is low (Ham and Pearsons 2001). For example, managers may be interested in containing the impacts of a hatchery program to a species protected by the Endangered Species Act. However, impacts between 5% and 20% to a species abundance may be socially unacceptable but also scientifically undetectable. Furthermore, impacts are unlikely to be detectable within the time that a manager may want to contain further impacts (e.g., 5 years). As such, risk containment measures cannot be triggered in the event that unacceptable impacts occur (Ham and Pearsons 2001). This may mean that more risk averse strategies or monitoring more powerful variables (e.g., size structure, interactions mechanisms) will be necessary to contain risks within acceptable levels.

Uncertainty #3: *Cumulative impacts of multiple hatchery programs.*

Many wild fish have the potential to interact with fish from multiple hatchery programs, but most studies are conducted on interactions that occur from a single hatchery or within a single watershed (Pearsons and Temple 2007). For example, wild steelhead originating in the Yakima Basin may interact with hatchery coho, fall Chinook (*O. tshawytscha*), and spring Chinook salmon that are released into the Yakima basin, the many other hatchery fish from other locations in the Columbia basin (e.g., in the migration corridor and estuary), and hatchery fish from outside of the Columbia basin (e.g., in the ocean). Cumulative impacts are most likely to occur in areas where many hatchery stocks overlap those of wild fish such as in main stem migration corridors, estuaries, and oceans. Unfortunately, these locations are the least studied locations with respect to ecological interactions between hatchery and wild fish (Zimmerman and Nielsen 2004). There is mounting evidence that ocean carrying capacity is limited for anadromous salmonids and that density-dependent impacts may occur from the large number of hatchery fish that are released from multiple locations (Beamish et al. 1997; Bisbal and McConnaha 1998; Wertheimer et al. 2004; Ruggerone and Nielsen 2004). Impacts could be particularly important in areas such as the Far East of Russia where large numbers of fish are released, but where hatchery impact evaluations are relatively scarce (Zaporozhets and Zaporozhets 2004). It is possible that impacts to a wild population from a single hatchery may not be detectable, but impacts of multiple programs may be detectable and ecologically significant.

Uncertainty #4: *Valuation of different species that share resources.*

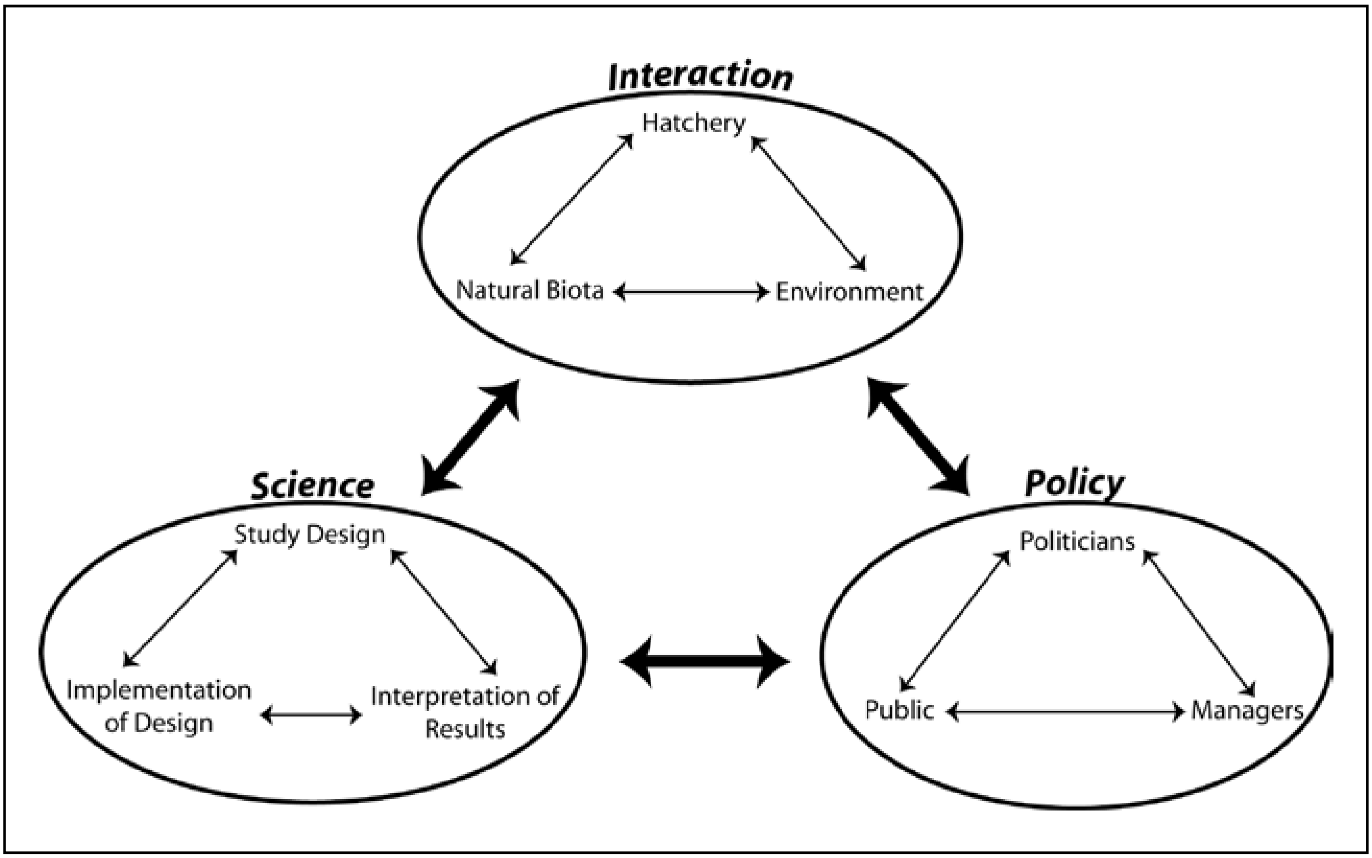
Different cultures, organizations, and generations assign different and potentially conflicting values to different fish species (Hunn 1990; Pearsons and Hopley 1999; Pearsons and Temple 2007; Figure 1 right). One group may prize Chinook salmon above all other species; another group values native trout, and still another values nonnative smallmouth bass (*Micropterus dolomieu*). The species that are the target of hatchery programs are highly valued, but many other species that are not the focus of hatchery propagation are highly valued too. In order to evaluate whether the potential benefits of a hatchery exceed the costs, acceptable impacts to non-target taxa should be quantified by policy makers (Pearsons and Hopley 1999; Ham and Pearsons 2001). Policy makers rarely have made these difficult species valuations (although see Pearsons and Hopley 1999; Pearsons and Temple 2007) and often manage by subconscious valuations or lean on scientists to provide the answer (Lackey 2007). Other times, scientists step outside of their domain and advocate particular preferences in the guise of science (Lackey 2004, 2006, 2007).

CONCLUSIONS AND RECOMMENDATIONS

Ecological interactions between hatchery and wild fish will occur but whether those interactions are biologically significant, socially acceptable, and whether any impacts are statistically detectable are probably dependent upon the characteristics of the hatchery program, wild populations, and natural environment where hatchery fish are released, and how interactions are evaluated. This complex set of spheres of interactions can be conceptualized as an interaction between ecological interaction, science, and social values (Figure 1). Within each one of these spheres, various factors determine the nature of the sphere.

There are many things that we know and don't know about ecological interactions between hatchery and wild fish. It is important to distinguish between misconception, reality, and uncertainty so that expected benefits and costs of interactions can be accurately compared and evaluated. One of the reasons that we have so many misconceptions and substantial uncertainties associated with ecological interactions is because investments have not been spent on resolving uncertainties that will allow for broad application of results to existing hatchery practices. Furthermore, the work is expensive, difficult to implement and

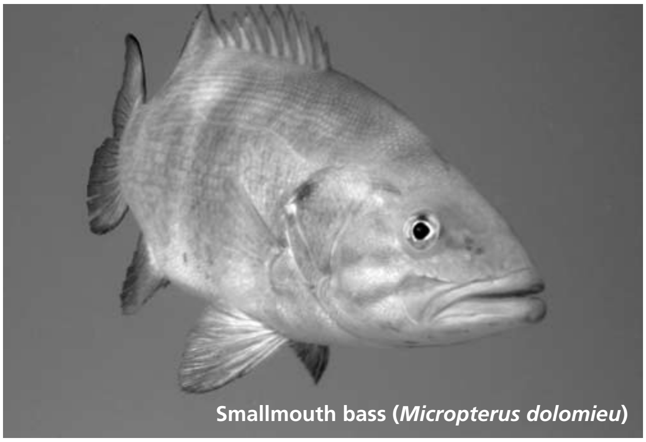
Figure 1. Conceptual model of relationships between ecological interactions, science, and policy and the factors that influence whether ecological interactions are biologically significant (top), scientifically detectable (left), and socially acceptable (right).



coordinate, and insensitive to all but large impacts. This is particularly true of populations that are severely depressed, often the ones that we are most concerned about. In order to improve our ability to assess ecological risks we will need to build upon our current tools and conduct large-scale experiments addressing the most critical uncertainties.

Experiments that will be most effective at resolving critical uncertainties will have the following characteristics: encompass the range of hatchery practices (e.g., diversity of species cultured, various life-stages and sizes of fish released, integrated and segregated programs), encompass the diversity of wild populations (e.g., species, abundance, size, distribution), broad geographic distribution and range of ecological conditions, long-term (e.g., 10-30 years), and large numbers of spatial and temporal controls (Stewart-Oaten and Bence 2001). The most important response variables to measure would be percent impact to abundance, survival, biomass, or productivity of key non-target or target taxa relative to controls, but it would also be beneficial to identify the factors that are most influential in causing impacts. The advantage of evaluating impacts to the population of interest is that it incorporates all of the potential mechanisms of impacts. The disadvantage is not knowing what mechanism(s) caused an impact. Experimental designs might benefit by testing predictions of ecological risk assessments (e.g., Busack et al. 2005) across a range of outputs. Furthermore, it is important to quantify the magnitude of the impact, not just whether impacts were statistically significant. If impacts are detected, then more detailed studies might be conducted to determine the specific mechanisms causing impacts.

It is unlikely that any single funding organization will fund such an undertaking. Furthermore, it is unlikely that any single agency will be able to conduct the work. Implementation of an experiment that has the characteristics described above will likely have to be a coordinated effort among multiple funding organizations, agencies, and research organizations. Due to the large scale and management implications of such a large undertaking, this experiment would face some of the same challenges inherent in other adaptive management projects (Lee 1993, 1999). Standardization of field protocols would also be important so that data collected in different locations could be directly compared (Johnson et al. 2007).


Smallmouth bass (*Micropterus dolomieu*)

There will continue to be uncertainties associated with ecological interactions for some time, even if an ambitious study that had the characteristics outlined above was started immediately. How then should ecological impacts be incorporated into making decisions? There are at least four recommendations that will be useful.

First, risk assessments should be performed to identify the risks and the scientific uncertainties (Pearsons and Hopley 1999; Busack et al. 2005). There will be some locations that will not be amenable to sampling because of physical constraints such as remoteness and many locations where money will not be available to adequately monitor and evaluate effects of interactions. In these cases, risk assessment models or approaches may be the best that can be done to provide the best balance of benefits and costs. There are currently tools available to assess risks, but improvement and expansion of these tools would be beneficial. An expert-based approach for risk assessment has been developed and has been used in a variety of programs to assess risks (Pearsons and Hopley 1999). In addition, an individual-based model called PCD Risk 1 is available to assess predation, competition, and disease risks of smolt programs to freshwater salmonids (Busack et al. 2005). Similar models that include unstudied mechanisms and locations of interactions should be developed. Furthermore, other models that incorporate direct and indirect interactions that occur throughout a community can be applied to risk assessment (Dambacher et al. 1999; Dambacher 2001). Although the use of risk assessment tools may represent the best available science, there will be considerable uncertainty in predicting actual outcomes.

The second of the four recommendations is to use weight of evidence approaches to assess impacts when sample sizes and statistical limitations prevent detectable impacts of importance and experimental designs don't allow for causation to be demonstrated (Conquest 2000; Murtaugh 2002). Third, use precautionary approaches when risks or uncertainties are high, and don't expect that monitoring and responsive management will be able to contain risks below acceptable levels unless adequately powered detection plans and containment management plans have been developed and peer-reviewed (Ham and Pearsons 2001). Fourth, make concerted efforts to clearly identify policy and technical arguments and separate them where appropriate (Lackey 2004, 2006, 2007). If these recommendations are followed, then management of ecological interactions associated with hatcheries will produce improved ecosystem benefits. ♋

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COLUMN:
GUEST DIRECTOR'S LINE

AFS Topic Oriented Meetings: A New Opportunity for Information Exchange

AFS Meetings Oversight Comittee:
Co-chair Ira R. Adelman
Co-chair Phil Moy
Maureen Walsh,
Colleen Caldwell,
Bart Durham,
Jeff Isely,
Don Jackson, and
Al Zale.

Adelman may be contacted at ira@umn.edu.

Would you or your colleagues benefit from attending a meeting that brings together regional, national, and international experts to explore, or renew, a focused area of research? Does your work relate to a specific theme or emerging problem that would benefit from a dedicated conference? AFS has recently taken steps to help members organize such a meeting by approving sponsorship of topic-oriented meetings (TOMs). Topic-oriented meetings are specialized meetings that focus on a particular topic of professional interest. Through careful planning and coordination with AFS, TOMs can effectively promote information transfer, outreach, and aquatic stewardship while enhancing membership services. The recent symposium "Advances in Fish Tagging and Marking Technology," held in Auckland, New Zealand, is an excellent example of how a specialized meeting accomplished most of these goals (Rassam 2008). Although somewhat similar in nature to the larger, multi-day symposiums held in conjunction with the AFS Annual Meeting or AFS Division meetings, TOMs are intended to be free-standing meetings held separately from the AFS Annual Meeting. So if you are considering proposing a multi-day symposium at an upcoming AFS Annual Meeting, please consider submitting a proposal for a TOM—the new format may suit your purposes much better!

The benefits of TOMs will be interactive information exchange in smaller, issue-focused settings without the distractions associated with the larger AFS Annual Meeting. Emphasis is placed on providing significant time for discussion among participants. Thus, the duration of TOMs will be shorter. The regional nature of important issues in fisheries suggests that TOMs may be more geographically convenient to potential attendees, particularly students. The costs associated with travel to an AFS Annual Meeting can be prohibitive. TOMs will likely allow greater participation by members (and non-members) who may not be able to attend larger AFS meetings based on time and budget constraints. Additionally, the wide range of topics appropriate for TOMs will likely increase the visibility of AFS and attract individuals in disciplines not already directly involved in AFS. As a result of the focus on specific issues, TOMs may more readily foster interdisciplinary and international exchange and collaboration with other scientific organizations. Publication of proceedings from TOMs will be an option, increasing the opportunity to disseminate information to a larger audience.

The *AFS Procedure Manual* was recently updated to include full details on how to propose and conduct a TOM (www.fisheries.org/afs/aboutus.html—click on Procedure Manual, pp. 50, 89). Briefly, a TOM may be organized by any AFS Unit or AFS member. Proposals can come to AFS headquarters or directly to the AFS Meetings Oversight Committee (MOC). Proposals should include details such as topic, timing, venue, preliminary budget including suggested registration fees, and potential attendance (number and type). The MOC will act as a reviewer of the scientific validity of the proposal and also of the potential "market" for such a meeting in a process similar to that of the review process used by the Book Advisory Board.

The TOM will be an AFS (parent Society) activity but may be open to co-sponsorship by Units of AFS or other organizations and groups. After approval by the MOC, the TOM proposal will be forwarded to the AFS executive director for final approval. AFS staff will negotiate hotel/convention center contracts, provide registration and abstract submission software, and offer seed money for the meeting organizers. AFS will assume all risk for the meeting and will keep all proceeds from the meeting, unless the meeting is co-sponsored, in which case the split of the proceeds will be negotiated by AFS with the parties involved. In all cases, AFS will have the exclusive right of publishing the proceedings as books or special sections/issues of AFS journals.

For conferences held outside the United States but within North America, AFS encourages cooperation with local fisheries organizations to encourage information exchange and broaden the perspective of fisheries conservation. This sponsorship may be provided as in-kind as well as financial assistance. When a conference is held outside North America, AFS recognizes the host organization will oversee conference logistics and therefore have control of the finances. In such cases, the host organization is generally asked to accept financial responsibility for the conference, relieving AFS of this responsibility.

So are you ready to submit a proposal for a TOM? Are you working on a hot new topic, or struggling to deal with an emerging fisheries issue? Have you recently completed new research that you would like to share with colleagues in the focused setting of a TOM? The benefits include increased visibility, enhanced collaboration, and professional development, not to mention an excellent forum for the exchange of scientific and technical information. AFS and the Meetings Oversight Committee are anxious to hear your ideas and see your proposals. We anticipate at least a year lead time will be necessary for organizing a TOM, so submit your proposal now to be the inaugural AFS TOM in 2009!

REFERENCE

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COLUMN: STUDENT'S ANGLE

Rebecca Deehr and Kenneth Riley
Deehr is a Ph.D. student in the Coastal Resources Management Program and Riley is a Ph.D. student in the Interdisciplinary Doctoral Program in Biological Sciences at East Carolina University. Deehr served as president, webmaster, and historian and Riley served as treasurer of the ECU-AFS.

Essential Elements for Student Subunit Success: The East Carolina University Student Subunit of AFS

Note: This article is the second in a series highlighting AFS Student Subunits of Excellence. The Student Subsection hopes that by highlighting such Subunits that other student-run organizations in AFS will strive to reach this level of achievement and become even better stewards of natural resources and the parent Society. The East Carolina University Student Subunit was chosen based on their award-winning record. The subunit has only been in existence for 10 years, but has twice been named the Southern Division Student Subunit of the Year, the AFS Student Subunit of the Year, and the Organization of the Year at ECU.

—Melissa Wuellner, Student Subsection President

Outstanding Student Subunit 2006

Campus life is not complete without the thrills, stimulation, and fun that are offered by the many student clubs and organizations. At East Carolina University, the Student Subunit of the American Fisheries Society (ECU-AFS) has found success and excitement in educating students interested in fisheries sciences through research, community service projects and network interactions with fisheries scientists, professionals, and fellow students. While considered highly active, ECU-AFS is a relatively small organization, with 30 members representing undergraduate and graduate students, staff, faculty, and alumni of East Carolina University (ECU). The organization provides a forum for students to interact with practicing fisheries scientists through monthly guest lectures, meeting, and activities. Furthermore, ECU-AFS strongly promotes the involvement of students within the American Fisheries Society (AFS) at the Chapter (Tidewater), Division (Southern), and Society levels. In recent years ECU-AFS has been recognized for its contributions and commitment to excellence and has twice been named the AFS Student Subunit of the Year (2006, 2007), Southern Division Student Subunit of the Year (2006, 2007), and the ECU Organization of the Year (2005-06, 2006-07).

A student organization such as ECU-AFS is dynamic with ever-changing goals and membership. To ensure continued success from year to year, our members have identified several essential elements that support the growth and long-term sustainability of a student organization. These elements include: (1) leadership and mentorship,

Joint Tidewater -Southern Division Meeting, Virginia Beach, 2005.

Ninth Annual Banquet, 2007.

(2) image, (3) communication, (4) campus and community service, and (5) consistency. The combination of these elements helps us overcome challenges such as high membership turnover rates and recruitment and retention of undergraduate students.

LEADERSHIP AND MENTORSHIP

> *Don't tell people how to do things, tell them what to do and let them surprise you with their results.*
>
> *—George S. Patton*

ECU-AFS Advisors Don Holbert and Roger Rulifson

Leadership is extremely important in student organizations, and an executive committee (i.e., president, vice-president, secretary, etc.; hereafter referred to as EXCOM) provides the core leadership of ECU-AFS. The characteristics and qualities of the individuals serving on the EXCOM are as diverse as our student body. However, our strength lies in the ability to work cooperatively, regardless of inevitable differences. Each year the EXCOM is charged with setting goals and developing a unified vision to achieve the organization's goals. In contrast to most organizations governed by a top-down leadership strategy, ECU-AFS leaders have found great success in a leadership strategy with bottom-up controls and democratic nature. This leadership strategy encourages members to become engaged and personally vested in the organization. Members are equally challenged to be creative and innovative and to contribute their expertise. The EXCOM members provide guidance, but members routinely organize events, plan activities, and chair committees. The result is an exciting organization with a true sense of community. The ECU-AFS EXCOM and Subunit members are committed to actively working together to move the organization forward.

Mentors play an important role in the education and training of students and future fisheries scientists. Mentors are role models who must respect the position they hold and realize their position to impact others. The ECU-AFS advisors—Roger Rulifson, Don Holbert, and Anthony Overton—provide supervision and instruction for student leaders and members of our organization. Our advisors help to recruit new students to ECU-AFS through their work in classrooms and lecture halls. They motivate students to take an active role in their education. They encourage students to become engaged in extracurricular activities and instill the value of teamwork and cooperation. Furthermore, they encourage students to take risks and be accountable for their actions. The student members of ECU-AFS appreciate the active participation of our mentors and advisors, and we are grateful for their suggestions and guidance over the years.

IMAGE

The American Fisheries Society is the oldest and largest not-for-profit professional society for scientists associated with conservation and management of fishery resources in North America. ECU-AFS members recognize the prestige, honor, and historical importance of being associated with the parent Society, and we make every effort to preserve the image of AFS. Furthermore, we instill in our members the value of membership in the parent Society, Divisions, Chapters, and Sections. To support this goal, ECU-AFS has an annual membership campaign to reimburse students for joining the parent Society. Thus, ECU-AFS members become members of a prestigious international organization and an award-winning student organization.

We are proud of our affiliations with both ECU and AFS. Our reputation as a successful student organization draws attention to us, but it also provides recognition to our university and the parent Society. Thus, the image ECU-AFS portrays enables us to attract new members to ECU-AFS, ECU, and AFS, and it presents us with opportunities to fulfill our mission.

ECU-AFS has an active outreach campaign to educate new students and the public about the mission of the American Fisheries Society and our organization's contributions to the local community. An example of our outreach includes participating in the annual Shad Festival in Grifton, North Carolina. Each year we set up a booth display and we host a "children's fishing tournament" at this two-day event. Parents and children attending the event learn about our current fisheries research while children compete for prizes by fishing in our ephemeral pools. For many of our student members, these experiences represent their first attempt at public education and outreach. For our organization, the public becomes knowledgeable of our work.

COMMUNICATION

ECU-AFS uses several tools for communicating within and beyond our Student Subunit. The website (www.ecu.edu/org/afs) is the most widely available source of information about our organization. It is updated regularly, and it has been maintained by Past President Chad Smith since 2004. This year, we established a listserv that is moderated by one of our members and provides up-to-the-minute news and events. All of our members belong to the listserv, and non-members are invited to join. In addition to the listserv, we maintain e-mail distribution lists to contact friends of ECU-AFS that include alumni, past invited speakers, members of the Tidewater Chapter or Southern Division, and other fisheries professionals.

ECU-AFS members regularly contribute to newsletters and campus publications. We prepare summaries of activities for the Tidewater Chapter quarterly newsletter, the Southern Division semi-annual newsletter, and the ECU Biology Department annual newsletter. This allows us to maintain regular communication with AFS, and it provides another medium for the dissemination of information about ECU-AFS and our activities.

Communication on campus is maximized through various activities hosted by the university. We participate in a survey called "Pirate Connection," which is given to incoming freshmen during their summer orientation. The survey provides us with e-mail addresses of students

Continue your education in Ottawa:

Great variety of workshops to be offered at the AFS Annual Meeting in Ottawa, August 16th and 17th… From technical skill building to leadership training and GIS principles and application: all adding up to expanding your career horizons and at a reasonable cost to you.

See a list of course offering in the supplement to this issue— and remember to sign up for Continuing Education courses when you register for the meeting.

Please note:
1. Number of students per workshop is limited.
2. AFS reserves the right to cancel any undersubscribed workshop.
3. Registration Deadline is July 25th.

who have expressed interest in joining an organization such as ours. In addition, we can interact with incoming freshmen during summer orientation fairs, where we set up an informational table to attract potential new members. In the fall, we participate in the annual "Get a Clue" organization fair, where we provide information about ECU-AFS and recruit new members through our fliers, tri-fold display, and personal interactions. Similarly, in the spring we host a recruitment event during one of our regular business meetings, featuring free food and a special guest lecture. Our final opportunity to advertise ECU-AFS comes during the annual spring celebration "Barefoot on the Mall," which is a fundraising and recruiting opportunity for all student organizations on campus.

Student organizations are an essential component of the college campus community. The bodies that govern student organizations (e.g., Student Government Association or Graduate Student Council) frequently provide administrative support, leadership training, educational opportunities, and fiscal oversight. By actively participating with the Graduate Student Council at ECU, we benefit from leadership and financial planning workshops, as well as competitive funding to support conference travel, supplies, recruitment of members, and honorary guest speakers. This year, ECU-AFS was able to support 20 graduate and undergraduate students who attended and/or presented research at seven conferences across the country. Student attendance at a wide range of conferences helps promote our research programs, our organization, and our university, thus potentially attracting graduate students to East Carolina University.

Off-campus, ECU-AFS is active in the community. We participate annually in "Big Sweep," a state-wide program to clean up North Carolina waterways and beaches. ECU-AFS serves as the lead campus organization to facilitate volunteers who help to remove trash from the creeks and rivers that run through our town. In 2007, we sponsored our first "Take a Kid Fishing Day," where local children joined us at a park for an afternoon of fishing and fun. We are currently planning the 2008 Take a Kid Fishing Day, which will be a city-wide event! In a non-fisheries related activity, ECU-AFS members volunteer at the local Food Bank, which serves 34 counties in eastern and central North Carolina. Volunteering with the local Food Bank helps members recognize important social issues affecting our local community. While not directly related to fisheries, most of our members regularly volunteer at the Food Bank and assist with other community service organizations.

The Big Sweep

CONSISTENCY

Our experiences over the years have helped us recognize activities and events that work well for our organization. We recognize that our student members are busy with classes, teaching, and research, and they have limited time for extracurricular activities. We host monthly business meetings to ensure consistency, quality, and continuity of programs and services. For each meeting, we invite a guest speaker to address the membership, and follow up the presentation with a social at a local establishment. In addition to our regular monthly meetings, we hold an annual winter banquet. Our banquet is a great way to showcase student research, enjoy a nice meal, listen to invited speakers, and network with professors, professionals, and students from throughout the state.

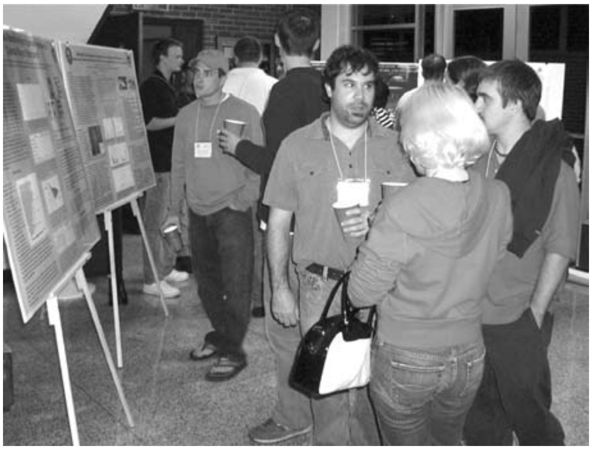
Our calendar of events is always full. Along with the monthly business meeting, we strive to participate in a campus event, community service project, or social event each month. We have students traveling to conferences and meetings throughout the year. When we are not traveling, ECU-AFS members know that there is always an exciting program to get involved in just around the corner.

Take a Kid Fishing Day

CHALLENGES

ECU-AFS is not without its obstacles. The previously mentioned elements that support our success also help us evaluate and clear hurdles as they come along. Institutionally, ECU-AFS does not reside in a natural resources program, fisheries department, or wildlife management program, and we have minimally equipped marine labs, field stations, or aquaculture facilities. Instead, we operate out of several research labs within the Biology Department which are split among multiple buildings. The lack of a central physical facility does not deter us; we created ECU-AFS as our own "fish ladder" to facilitate communication and interaction among students in fisheries and environmental sciences.

We also face a high turnover rate of undergraduate and graduate students in our organization. Most members of ECU-AFS are students pursuing their masters degree and their residency at ECU is generally less than three years. Luckily, many of our graduate students have undergraduates assisting with field research or laboratory



Student Colloquium, 2005.

experiments for their thesis projects. Active involvement of undergraduates in fisheries research helps in recruiting undergraduates to our organization.

The recruitment and retention of undergraduate students is particularly challenging. It is uncommon for an undergraduate to intrinsically recognize the value of belonging to an organization like AFS, particularly if the student is unfamiliar with AFS or the science behind their love of the outdoors or fishing. Aside from specific recruitment events, we have come to rely on our advisors and fisheries professors to help attract undergraduate students to ECU-AFS, because their knowledge and experiences pique the interest of so many students. ECU-AFS provides a vehicle for further exploration of fish, fisheries, aquaculture, resource management, and many other related subjects. Our current undergraduate members report they value the camaraderie, personal and professional relationships with students, advisors and professionals. Further, they value the knowledge, skills, and experiences needed to land a job upon graduation. We recognize that "word-of-mouth" advertising is our greatest tool to recruit new members and friends to ECU-AFS.

CONCLUSION

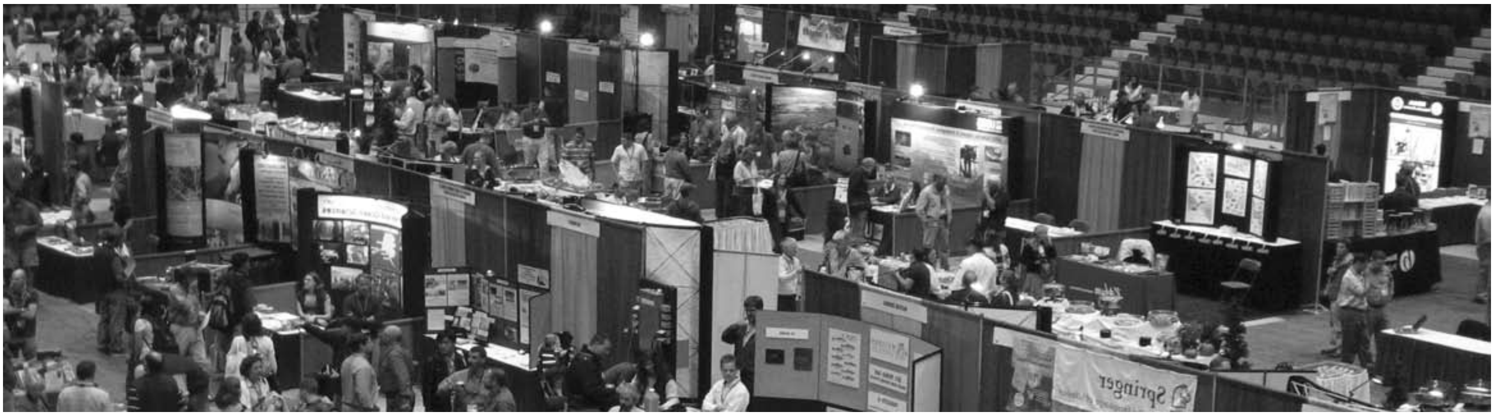
As we enter our 10th year as a Student Subunit of AFS, we believe that our successful past will positively influence our future. We know that we can depend on ECU, the parent Society, the ECU-AFS leadership, and our mentors to provide continued support and guidance. Together with a shared vision and the cooperative spirit of our members, ECU-AFS looks forward to continued excellence for many years to come. ♋

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.)

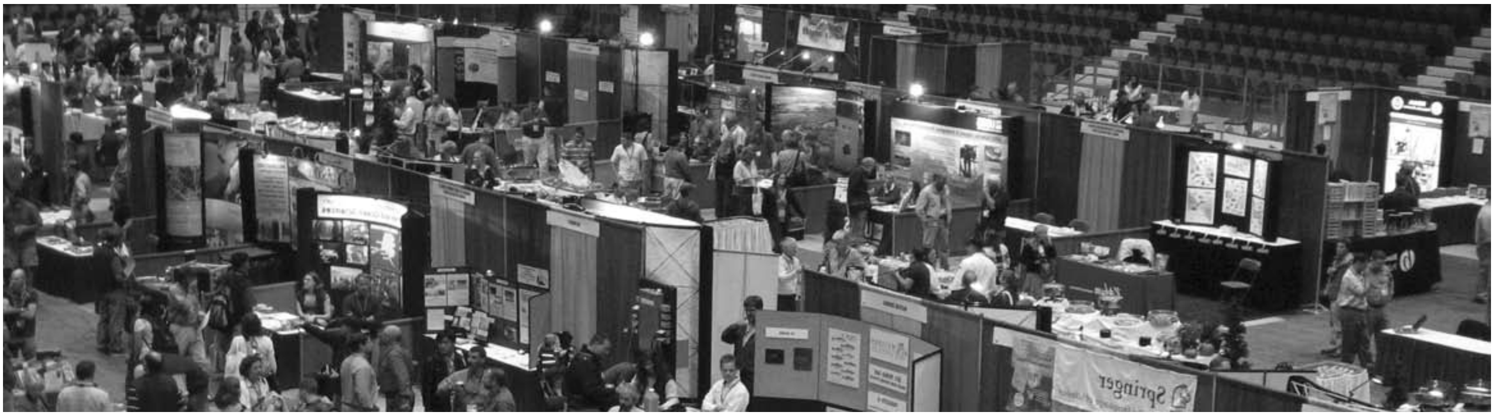
To see more event listings go to www.fisheries.org and click Calendar of Events.

DATE	EVENT NAME CITY, STATE	FOR MORE INFORMATION
Jul 14-18	**HydroVision 2008** Sacramento, California	www.hcipub.com/hydrovision/abstracts.asp, techpapers@hcipub.com
Jul 20-25	**Eighth International Wetland Conference,** Cuiaba, Brazil,	www.cppantanal.org.br/intecol
Jul 21-25	**Fisheries Society of the British Isles Annual International Symposium** Cardiff, United Kingdom	www.Fsbi.org.uk/2008
Jul 22-25	**Asian Wetland Symposium 2008** Hanoi, Viet Nam	www.aws2008.net
Jul 23-28	**American Society of Ichthyologists and Herpetologists Conference** Montreal, Canada	www.asih.org/annualmeetings
Jul 25-27	**Seventh International Conference on Recirculating Aquaculture** Roanoke, Virginia	www.cpe.vt.edu/aquaculture/ Terry Rakestraw, aqua@vt.edu/aquaculture/, 540/231-6805
Jul 28-Aug 1	**Eighth International Congress on the Biology of Fish** Portland, Oregon	http://fishbiologycongress8.usgs.gov/



Aug 17-21	AFS	**American Fisheries Society 138th Annual Meeting** Ottawa, Ontario, Canada	www.fisheries.org
Aug 25-29		**Fourth International Symposium on FISH-GIS/Spatial Analysis** Rio de Janeiro, Brazil	www.esl.co.jp/Sympo/4th/index.htm
Sep 15-18		**2008 Conference: Australian Society for Fish Biology: Assessing Recreational Fisheries: Current and Future Challenges** Bondi Beach, Sydney, Australia	www.asfb.org.au
Sep 15-18		**Aquaculture Europe 2008** Krakow, Poland	www.easonline.org
Sep 22-24		**Oceania Chrondrichthyan Society** Sydney, NSW, Australia	www.oceaniansharks.org.au
Sep 22-26		**ICES 2008 Annual Science Conference** Halifax, Nova Scotia, Canada	www.ices.dk/iceswork/asc/2008/index.asp
Sep 28-Oct 2		**Pathways to Success 2008 Conference: Integrating Human Dimensions into Fisheries and Wildlife Management Increasing Human Capacity for Global Human-Wildlife Coexistence** Estes Park, Colorado	www.warnercnr.colostate.edu/nrt/hdfw/partners.html eduke@warnercnr.colostate.edu

Date	Event	Location	Contact
Oct 11-15	**Fourth National Conference on Coastal and Estuarine Habitat Restoration**	Providence, Rhode Island	www.estuaries.org/?id=4
Oct 12-15	AFS **62nd Annual Southeastern Association of Fish and Wildlife Agencies Conference**	Corpus Christi, Texas	http://seafwa2008.org
Oct 19-22	**Women Evolving Biological Sciences**	Seattle, Washington	www.webs.washington.edu
Oct 19-24	**International Aquarium Congress 2008**	Shanghai, China	www.iac2008.cn
Oct 20-24	AFS **Fifth World Fisheries Congress 2008**	Pacifico Yokohama, Japan	www.5thwfc2008.com, wfc2008@ics-inc.co.jp, +81-3-3219-3541
Oct 28-29	**Coastal Research Symposium**	Biloxi, Mississippi,	http://masgc.orgbaysandbayous
Nov 9-13	**Integrating Biogeochemistry and Ecosystems in a Changing Ocean: Ecological and Biogeochemical Interactions in End to End Food Webs Workshop**	Miami, Florida	www.confmanager.com/main
Nov 10-13	**Fifth World Recreational Fishing Conference**	Dania Beach, Florida	www.igfa.org, 954/927-2628.



Nov 11-14	**North American Lake Management Society Symposium**	
	Lake Louise, Alberta, Canada	www.nalms.org
Nov 14-16	**Third International Bonefish and Tarpon Symposium: Research and Conservation for the Future**	
	Dania Beach and Islamorada, Florida	aadams@mote.org
Nov 23-25	**International Symposium on the Bearing-Aleutian Salmon International Surveys: Climate Change, Production Trends, and Carrying Capacity of Pacific Salmon in the Bering Sea and Adjacent Waters**	
	Seattle, Washington	www.napafc.org
Dec 3-4	**11th Flatfish Biology Conference**	
	Westbrook, Connecticut,	http://mi.nefsc.noaa.gov/flatfishbiologyworkshop, rmercald@clam.mi.nmfs.gov, 203/882-6549

2009

Jan 13-14	**Lake Mead Science Symposium**	
	Las Vegas, Nevada	www.lakemeadsymposium.org
Jan 15-18 AFS	**Spring Meeting of the Southern Division and Louisiana Chapter of the AFS**	
	New Orleans, Louisiana	www.sdafs.org/meetings
May 25-29	**Australian Society for Fish Biology 8th Indo-Pacific Fish Conference**	
	Freemantle, Western Australia	www.asfb.org.au/events/

OBITUARY: CLARK HUBBS

1921–2008
Ichthyologist

Noted ichthyologist Clark Hubbs, 86, died on 3 February 2008 at his home in Austin, Texas. The son of Carl and Laura Hubbs, he carried on a family tradition by becoming an ichthyologist and professor. Hubbs received his AB degree in 1942 from the University of Michigan. From 1942 to 1946 he served in the U.S. Army's 96th Infantry in the South Pacific campaign, and then entered Stanford University. It was at Stanford where he met and married Cathy Symons; they were married for over 58 years. While still working on his Ph.D., in 1949 Hubbs took a job as instructor at the University of Texas (UT) Austin. Receiving his Ph.D. from Stanford in 1951, he then became assistant professor (1952), served as chairman of the Division of Biological Sciences (1974–1976), chairman of the Department of Zoology (1978–1986), regents professor (1988–1991), and finally regents professor emeritus (1991 until his death). He published more than 300 articles and was still collecting field data as recently as January 2008.

Hubbs was an active member of the American Fisheries Society. For many years he was especially active in the Texas Chapter and was awarded an honorary AFS membership in 1997. For more than a decade he served as editor of *Copeia* (journal of the American Society of Ichthyologists and Herpetologists), and was president of the American Society of Ichthyologists and Herpetologists (1987), American Institute of Fisheries Research Biologists (1995–1997), Southwestern Association of Naturalists (1966–1967), Texas Organization for Endangered Species (1978–1979), and the Texas Academy of Sciences (1972–1973). He was chair emeritus of the Research Committee at Hubbs-Sea World Research Institute (1989 until his death). He was a tireless supporter of Texas natural resources and defender of endangered species and habitats.

Hubbs was a talented and energetic teacher who encouraged his students to think about the subject rather than simply memorize. When he found a student who appeared gifted, he encouraged them to consider the rewards of biology, ichthyology, and fisheries biology. He didn't always convince them but he kept trying. His influence greatly benefited the 46 masters students, Ph.D. candidates, and postdoctoral fellows that he supervised. One measure of the admiration and respect his students had for him was the tribute of the Clark Hubbs Symposium held in 1993 at the annual meeting of the American Society of Ichthyologists and Herpetologists in Austin. A t-shirt designed especially for the symposium held a special place for Hubbs, who had it signed by not only his former students, but also by a wide variety of more than 1,000 scientists, resource specialists, university presidents, and even some politicians!

Hubbs did not do things by half-measures; he brought enthusiasm, energy, and tenacity to everything he did. This included his defense of endangered species and endangered habitats, his membership and work with 21 professional societies, his parenting of three children, and his teaching. Colleagues were constantly amazed at the vitality that he injected into his pursuits and how he somehow always had a little more energy in reserve, especially if there was a small child to play with or a student asking questions.

During 60+ years, Hubbs sampled more streams and springs in Texas, and deposited more fish specimens from the state in fish collections (primarily the Texas Natural History Collection that he founded), than has, or likely ever will, anybody else. In tribute to him and that legacy, his colleagues and former students formed the Hubbs Ichthyological Society to carry on monitoring of Texas fish habitats so that what he started can be maintained and enhanced. The H.I.S. website www.utexas.edu/tmm/tnhc/fish/hubbs/HIS/ includes links to more information on ClarkHubbs, his life, and his legacy.

—F. Douglas Martin, Robert J. Edwards, Dean A. Hendrickson, and Gary P. Garrett

Continued from page 264

In recent years, AFS launched a program to support and empower fisheries professionals in Latin American countries to expand their own international outreach programs and objectives. As a result of this and many other efforts, the Mexico Chapter was formed in 2005. In celebration of this organizational feat, the AFS executive director, president elect, and other AFS leaders attended the 1st Biannual Meeting of the Mexico Chapter in La Paz, Baja California, in 2007. Activities at the La Paz conference included meetings with influential Mexican fishery leaders, such as Miguel Angel Cisneros, chief of the Instituto Nacional de Pesca, to promote sound stewardship of Mexican fishery resources. The lively exchange between North American and Mexican scientists is also supported by the Cal-Neva Chapter: each year, the Chapter offers up to $5,000 to Mexican students and professionals for travel support to Cal-Neva Chapter meetings and for development of continuing education courses for fisheries colleagues in Mexico. Such international efforts are directed at meeting the needs of fisheries professionals in Mexico.

In addition to these programs, AFS participates in a leadership exchange agreement with the Fisheries Society of the British Isles (FSBI) and the Japanese Society of Fisheries Science (JSFS), whereby the AFS president is hosted at the annual meeting of the FSBI and JSFS and activities that promote fisheries science are developed and discussed (such as joint conferences, student exchange programs, etc.). In turn, AFS hosts the participation of the FSBI and JSFS leadership at our Annual Meetings. Through these exchanges, society leaders share strategies and promote understanding. One of the outcomes of the leadership exchange program has been the development and support of the World Council of Fisheries Societies (WCFS)—an organization of professional societies that seeks to foster international collaboration and exchange of scientific information. The primary activity of the WCFS has been to sponsor the World Fisheries Congress, a conference to explore global fisheries issues and to encourage scientific collaborations among scientists throughout the world. The congress is held every 3 to 5 years in locations around the world where fisheries are a major enterprise.

AFS has promoted a number of global and international activities and seeks to provide additional opportunities for the professional growth of individual researchers, scientists, and managers, regardless of where they may practice their profession. However, opportunities to promote fisheries science in the global arena must be recognized, understood, and acted on with skill, resolve, perseverance, and adequate resources. Selecting effective opportunities and developing the necessary response will require a clear statement of purpose and desired outcome.

II. PROMOTING AN INTERNATIONAL PERSPECTIVE ON FISHERIES ISSUES: GLOBAL PROBLEMS DEMAND GLOBAL AWARENESS

Global issues such as population growth, limited biological resources, and energy crises affect aquatic systems and the organisms they support, and our ability to manage or mitigate these effects is constantly being challenged. Many conservation priorities and programs were established during a time of lower population pressures and different climatic and land-use patterns than those observed today. In light of these global changes, we need to ask if there is a need to consider changing the major paradigms of fisheries management and conservation. Can management actions be directed toward the consequences of large-scale, global processes without excluding the needs of local ecological and human communities?

Global issues such as these can be addressed only from a global "world-centric" awareness that allows cultural differences to be recognized and cherished. Such a view would allow us to fully see, and effectively respond to, the complex dimensions of the world of fisheries. Therefore, for AFS to play a significant role in the international arena of fisheries, we must cultivate leaders who can effectively lead international ventures. An important point here is that we must first understand what makes leaders effective across cultures. Our culture shapes how we think about successful leadership, and the characteristics of an effective leader vary from one culture to another. In fact, effective leadership behavior in one culture may be completely ineffective in others. Clearly, a one-type-of-leader-development approach will not succeed when nurturing international leaders. Although true leaders can envision what they want to achieve, know how to meet the challenges, and take steps to make that vision a reality, their success will be measured not so much by these actions, but how well they interact with people along the way. Thus, leaders with cultural sensitivity will be more effective than those lacking this awareness. A worthy goal for AFS may be to prepare new generations of critical thinkers for effective international leadership, ready to act as global citizens in addressing international and national fisheries resource issues across cultures. Promoting leadership across cultures is challenging. However, it is a vision worthy of pursuit, if we are serious about expanding our role in international fisheries.

Member involvement and participation in AFS business matters are crucial. Coupling our roles as students, teachers, researchers, managers, and advocates with our personal lives makes it difficult to add new responsibilities. Yet our ability to make personal contributions in the service of fisheries conservation is dramatically magnified by the existence of a diverse and vibrant professional society like the AFS. We believe that, in the long run, multiple minds, hands, and cultures will make for a stronger Society. Having dedicated and involved people serving as global leaders and ambassadors is essential to the achievement of the international goals of AFS.

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.

M.S. Research Assistantship in Stream Ecology, Department of Natural Resources and Environmental Sciences, University of Illinois.

Responsibilities: Evaluate the spatial variability of stream mussel assemblages.

Qualifications: Interests in stream ecology, be highly motivated self-organized, and able to work independently. Experience in mussel identifications and biostatistics will be assets. Minimum academic qualifications include a B.S. in ecology, zoology, or closely related field, 1100 on the GREs combined verbal and quantitative, and a 3.0 GPA. Additional graduate program information can be found at: www.nres.uiuc.edu.

Salary: $1,500 per month for 11-month plus tuition waiver and benefit.

Closing date: 30 July 2008.

Contact: Send a cover letter, resume, copies of transcripts, GRE scores, and the contact information of three references to Yong Cao, Illinois Natural History Survey 217/244-6847, yongcao@uiuc.edu.

Assistant Program Director—Upper Mississippi River, The Nature Conservancy, Minnesota.

Responsibilities: Serve as liaison to all public and private partners regarding the design, targeting, and successful implementation of the authorized ecosystem restoration program on the Upper Mississippi River. Help to develop and oversee budgets, reviews marketing materials, and support the creation of fundraising proposals. Supervise administrative and project staff, and interns or volunteers in remote locations.

Qualifications: Seasoned, committed, detail-oriented professional with at least 7 years successful experience in conservation practice. Superb communication, project management and relationship skills along with scheduling flexibility are a must.

Salary: Commensurate with and depending upon qualifications and experience.

Closing date: 31 July 2008. /

Contact: To view the full job description and to apply using online application system, see www.nature.org/careers. EOE.

JIMAR PIFSC Fishery Scientist: ID#28115—RCUH Non-Civil Service, School of Ocean and Earth Science and Technology, Joint Institute for Marine and Atmospheric Research, National Marine Fisheries Service, Pacific Islands Fisheries Science Center, Honolulu, Hawaii.

Responsibilities: Analyze fishery statistics, data collected from biological and oceanographic surveys, and other information. Construct mathematical and statistical models, including computer simulation models of fish populations and fisheries to study dynamics and effects of natural and anthropogenic factors on fishery yields and other characteristics. Assist in establishing overfishing guidelines and reference points for determination of stock status is in compliance. Evaluate alternative fishery management strategies and policies with respect to their yield characteristics and impact on fish stocks. Issue scientific reports and advisories to National Marine Fisheries Service managers and constituents. Publish research findings and present results at scientific conferences and public meetings.

Qualifications: M.S. in biology, zoology, oceanography, fisheries, or related field. 1–3 years experience in fisheries stock assessment research, population monitoring, and population modeling. Broad knowledge of fish population dynamics and stock assessment theory and methods. Working knowledge and experience in application of statistical methods to problems in fisheries, ecology, and wildlife science. Ability and experience in the development and application of computer simulation models. Ability to communicate effectively with scientists, managers, and the public. Must meet security requirements for working in a U.S. federal facility. Must be able to withstand uncomfortable living conditions at sea for up to 30 days at a time. Continuation of employment is dependent upon program and operational needs, satisfactory work performance, and availability of funds.
Salary: $3,620 per month, minimum.
Closing date: 31 July 2008.
Contact: Apply at www.rcuh.com For more information contact Nicole Wakazuru 808/956-9465.

Marine Fisheries Observers, Marine Fisheries Observers AIS, Inc., out of ports from Maine to North Carolina.
Responsibilities: Work at sea collecting/recording data and biological samples for the National Marine Fisheries Service aboard commercial fishing vessels. Observers work on vessels ranging from 40–100 on trips ranging from 1–14 days collecting data on fish catch and discard.
Qualifications: B.S. in marine biology or biology. Able to commit to the program for at least a year. Other requirements include: a vehicle, U.S. or Canadian citizenship, CPR/First Aid certification and passport.
Salary: $200 per sea day, $12 per hour land time with benefits.
Closing date: 18 August 2008.
Start date: Next three-week training session begins 8 September 2008 in Woods Hole, Massachusetts.
Contact: E-mail resume, references, list of biology courses and cover letter detailing sea and fish experience to 17478@aisobservers.hrmdirect.com. See www.aisobservers.com.

John P. Laborde Endowed Chair for Sea Grant Research and Technology Transfer and Visiting Professor, Office of Sea Grant Development, Lousiana State University.
Responsibilities: Perform work that directly supplements or complements activities being conducted by the program or other sponsored research, technology transfer, or education projects administered by OSGD. Scholarly work in either research or teaching would also be encouraged within appropriate discipline-based academic departments. See www.laseagrant.org/laborde/guidelines.htm. An offer of employment is contingent on a satisfactory pre-employment background check.
Qualifications: Nationally/internationally recognized in some area of marine/coastal research, technology transfer, education, or business development. Academic candidates must hold the rank of full professor or its equivalent and will maintain similar rank during the appointment. Appointment duration can vary from a few months to one year. We particularly encourage nominations of individuals eligible for either one-half or full year sabbatical from their institutions.
Salary: Salary is commensurate with rank and qualifications.
Closing date: 29 August 2008 or until filled.
Contact: Those interested in applying or nominating an individual confirm a nominee's interest should submit a nomination letter with the candidate's curriculum vitae including e-mail address , summary of expertise/interests, proposed activity, preferred appointment dates, and salary requirements to Charles A. Chuck Wilson, Executive Director Office of Sea Grant Development 239 Sea Grant Building Louisiana State University Ref: 020577 Baton Rouge, Lousiana 70803. EO/EAE.

Data Analyst, Normandeau Associates, Inc., New Hampshire.
Responsibilities: Work closely with project scientists to analyze data and prepare tables and charts.
Qualifications: M.S. in applied statistics, biostatistics, or closely related field. Minimum of 3 years experience, including environmental data analysis and SAS programming. Knowledge of GIS, MATLAB, and R programming language a plus.
Salary: Depends on experience.
Closing date: 31 August 2008.
Contact: Send cover letter and resume to: Normandeau Associates, Inc., Attn: Robyn Chadwick, 25 Nashua Road, Bedford, New Hampshire 03110; rchadwick@normandeau.com; fax 603/471-0874

North Pacific Groundfish Observer, Alaskan Observers, Inc., Seattle, Washington.
Responsibilities: Gather management data for the government. Live and work aboard U.S.-flagged commercial

fishing vessels operating in the Bering Sea and North Pacific Oceans. Training in Anchorage, Alaska. Make 2 deployments of approximately 2 1/2 to 3 months each within 7 months of completion of training.

Qualifications: B.S. in fisheries biology, marine biology, general biology, zoology, or a related natural science.

Salary: $3,900–6,006 per month, depending on experience, plus room, board, and travel to and from job site. Subsequent deployment opportunities and salary advances available.

Closing date: 17 September 2008. Positions available year-round.

Contact: David Edick, Alaskan Observers, Inc., 130 Nickerson, Suite 206, Seattle, Washington 98109; 800/483-7310; aoistaff@alaskanobservers.com; www.alaskanobservers.com.

Natural Resources Biologist I, Maryland Department of Natural Resources, Fisheries Service, Annapolis.

Responsibilities: Provides technical and administrative support to Maryland's striped bass harvest monitoring program. Assist the current biologist in net inspections and certifications, tag distribution, and data management. Assist with the distribution and collection of harvest permit cards and declarations of intent.

Qualifications: B.S. from an accredited college or university in biology, natural science, natural resources management, botany, marine biology, fisheries management, zoology, or a natural resources management related field of study. Preference to candidates with up to one year experience working with Microsoft Access.

Salary: $31,461–40,441, contractual, no benefits.

Closing date: 26 October 2008.

Contact: www.dnr.state.md.us/hr/jobs.asp.

Fisheries Biologist I, Arkansas Game and Fish Commission, Fisheries Division, Mammoth Spring.

Responsibilities: Assist with all duties associated with a coldwater intensive culture trout hatchery including: spawning fish, monitoring development of eggs and fry, developing and implementing feeding schedules, administering chemical treatments for disease, monitoring water quality, maintaining hatchery production records, collecting and entering data and preparing reports on hatchery operations, assisting in the supervision of the hatchery staff, training workers in fish husbandry techniques, and assisting other personnel as needed with sampling and habitat improvement work.

Qualifications: B.S. in biology, zoology, botany, or a related field, or equivalent.

Salary: Grade 18, $26,415 per year. Salary above $26,415 requires exceptional qualifications as determined by the Office of Personnel Management.

Closing date: 26 October 2007.

Contact: See www.agfc.com/employment/. For additional information contact Melissa Jones, 877/625-7521.

2008 Membership Application

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Life (*Fisheries* only, 2 installments, payable over 1 year)	$1,000	$1,000

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North American Journal of Fisheries Management	$43	$25	$48	$25
North American Journal of Aquaculture	$38	$25	$41	$25
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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.

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