women in NATURAL RESOURCES

Volume 13, Number 4 June 1992

for professionals in forestry, wildlife, range, fisheries, recreation, and related social sciences.

OFFICE COPY PORTIONS REMOVED

Focus on Western Fisheries:

- Managing Texas and Idaho Fisheries
- Science and Fisheries
- Creating a New Intertidal Visitor Center
- Commercial Fisheries
- California's Water Transfers
- Urban Fish Habitat

Guest Editorial

Christine M. Moffitt

This issue, *Women in Natural Resources* focuses on women fisheries professionals who work in the west. As usual, the journal is packed with articles from scientists and administrators who have made their way up difficult rungs in their career ladders. I am pleased to see several of the managers from two states' fisheries programs (Texas and Idaho) contribute articles as a group, and to see some of the graduate students in the fisheries program at the University of Idaho discuss their projects. We need more women like the wide variety represented here doing fisheries work.

The fisheries profession is exceptionally slow in progressing from one dominated by white males to one represented by both genders and people with a diversity of races. The image of the white fisherman in hip boots still prevails. Men are directors and supervisors; women are technicians. In the Pacific northwest, women are used almost exclusively to apply coded wire tags to small salmon because of "their exceptional dexterity," but few women are high level scientists and managers. The National Marine Fisheries Service's Threatened and Endangered Species Recovery Team for sockeye and chinook salmon, for example, is composed of seven white males.

Much of the increase in the percentage of women in fisheries from less than seven percent 10 years ago to 12 percent today comes from women entering fisheries from allied disciplines, such as water quality, fish health, and genetics. Each time that we cross disciplines, we improve those numbers. (At a recent fish health meeting—with students included—nearly 30 percent of the audience was female.) Our approaches to natural resources are becoming more sophisticated, and there are opportunities for people trained in other specialities. We use genetic techniques, developed initially for use on humans, to separate stocks of fish; our need to analyze and monitor fish health demands that we have professionals trained in microbiology, toxicology, and modern immunology.

The academic world that introduces college students to fisheries is still dominated by white males. Full professors, deans, and higher level administrators are nearly all white males. Women fisheries educators are more often in non-tenure track positions, with lower salaries and benefits. One of our graduate students here at the University of Idaho recently lamented the fact that she would complete her Master of Science degree work having had no women instructors.

Women undergraduate students at most universities and colleges maintain a slightly higher average GPA than that of their male counterparts, yet these same women often suffer from insecurity. This lack of self confidence is something we need to address. With few role models in higher level jobs and in higher education, women have almost no one with whom to compare themselves. On the other hand, this could serve at times as an advantage to the individual growth of women, because there is no formula for an individual to apply for success.

This year, women are predicted to be a major force in politics as the desire for outsiders soars due to dissatisfaction with the insiders of the political system. Similarly, women are still outsiders in the fisheries profession, and maybe we can capitalize on this if the desire for honest science and unbiased evaluation continues. Women have not always played the games that many male professionals play. The cost to women has been missed opportunities for research and other networking. And there are other costs. If women continue to be poorly represented in fisheries, society in general, and fisheries science in particular, will miss the fresh approaches and creative solutions that are within the realm of women's contribution to natural resources.

Christine M. Moffitt is a Research Scientist and Adjunct Associate Professor in the Department of Fisheries and Wildlife at the University of Idaho. Her current research focus is antibiotic therapy for salmon to counteract bacterial kidney disease (BKD). Moffitt's Bachelor's is from the University of California-Santa Cruz, her Master's is from Smith College, and her Ph.D. in Fisheries Biology is from the University of Massachusetts-Amherst.

WOMEN IN NATURAL RESOURCES IS A QUARTERLY. RATES: $19 FOR PERSONAL, $15 FOR STUDENT, AND $30 FOR BUSINESS, GOVERNMENT AGENCY, LIBRARY OR UNIVERSITY. WRITE WiNR, BOWERS LAB, UNIVERSITY OF IDAHO, MOSCOW ID 83843 (208-885-6754).

•Power generating companies often look on even a relatively small patch of hydrilla as a threat. Water intake screens must be cleaned frequently as floating hydrilla fragments clog water intakes. Operations can be suspended because of this problem. Often utility companies sense the best course of action is immediate eradication. Their rationale is that they built the reservoir for industrial purposes and that use must be protected regardless of any impacts to recreational fishing.

With so many competing views of the best use of the resource, managing aquatic plants is a complicated task. The line between optimum public use and abuse must be judiciously drawn. Decisions are not always well-received even by those whose resources are being protected.

As the only statewide agency charged with aquatic plant control, it is the Department's responsibility to determine what areas need treatment, what are practical treatment alternatives, how extensive is the problem, and who shares in the financial burden.

Habitat Enhancement Projects

Another aspect of the Aquatic Habitat Enhancement program is developing projects to increase fisheries productivity. During the 1960s and 1970s, reservoir construction was at an all time high in Texas. Management biologists recommended preserving or adding structure to many new impoundments. Hundreds of tire reefs were built in West Texas reservoirs when natural structures, such as trees and brush, were insufficient for good habitat. The Department provided manpower, equipment, and technical expertise in many of these projects.

As reservoir construction has slowed over the past 10 years, the Department's role in enhancement is being modified. From the Department's perspective, the prevailing need now is for staff to monitor and manage the now-aging reservoir fisheries. At the same time, environmental awareness has resulted in the public's willingness to take a much more active role. Volunteers have planted willows, coontail, and other beneficial native plants. They have developed base-line data to assess needs for supporting a trout fishery, and they undertake stream bed/shoreline clean-ups. Several fishing clubs with interests in a particular lake have built reefs with hundreds of discarded Christmas trees.

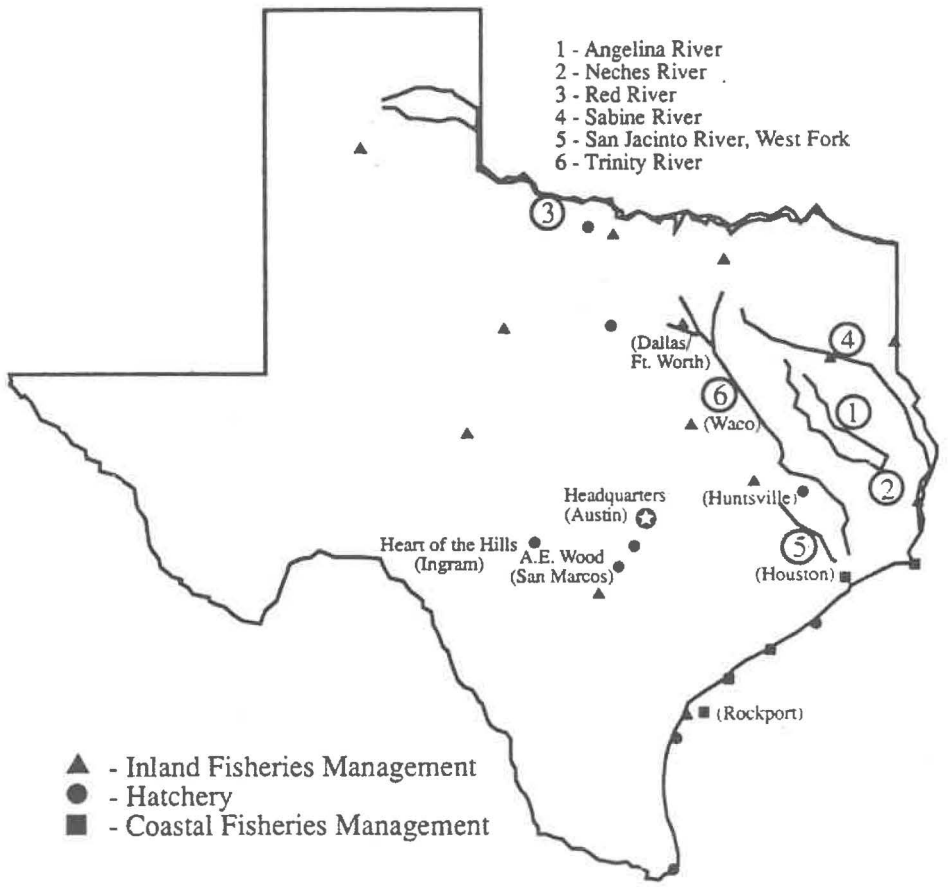
Volunteers with good intentions to improve the fisheries need guidance on what and how to plan projects and where habitat is needed. For instance, artificial reefs provide structure that attracts fish. However, this may pose problems in lakes where sufficient structure exists and overharvest is occurring.

In general, the Department encourages habitat improvement projects, such as planting native vegetation, building tree and brush shelters, improving water quality, or restoring natural habitat, in order to enhance productivity as well as bring fish and fishermen together. Department assistance is available on construction methods, getting permits and assessing impacts to the fisheries at specific lakes. To assist the public in these and other activities, management biologists routinely give talks on enhancement options at bass clubs, civic and environmental organizations, and at schools.

Becoming Director of this particular program was one of my major career goals. Since assuming these duties in March 1989, I have been involved in writing the first program procedures manual, streamlining contract and reimbursement processes, computerizing herbicide use records, and initiating field releases of two new insect species for biological control in the state. The Inland staff is strongly committed to long-range resource management to directly benefit both the public we serve today and preserve the rich diversity of Texas fisheries for future generations to enjoy.

Joyce Johnson is the Aquatic Habitat Enhancement Program Director. For the 12 years prior to being hired by Texas Parks and Wildlife Department, Johnson worked for the Galveston District, Corps of Engineers as an Environmental Specialist, administering the federal Aquatic Plant Control Program in Texas and preparing environmental assessments and recreation development plans. She has a Bachelor's in Environmental Management from the University of Houston.

FISHERIES OFFICES



THE ROUTINES OF FISHERIES BIOLOGISTS INCLUDE A LOT OF INTERACTING WITH THE PUBLIC AS WELL AS INTERACTING WITH THE FISH.

THE BASIC ELEMENTS OF TEXAS FISH MANAGEMENT

CINDY HOBSON

I am a freshwater fisheries biologist with Texas Parks and Wildlife Department (TPWD). I usually work with a field crew that includes the district management supervisor and two technicians. Our office is located in Huntsville, Texas, in the east-central part of the state. Our responsibilities include monitoring and managing sport fish populations in district waters, managing nuisance aquatic vegetation on roughly one-third of Texas' public waters, conducting fisheries management research, and informing and educating the public on fisheries issues.

People may not visualize pine forests when they think of Texas, but eastern Texas is very similar in climate and topography to Louisiana and the rest of the southern forest belt. Most of the large reservoirs and river systems in the state lie here in eastern Texas. All but one of Texas' "lakes" are contructed reservoirs, most of which were impounded in the 1960s and '70s, so our sport fisheries rely partly on introduced species. Our district waters include Lake Livingston, a 90,000-acre reservoir on the turbid Trinity River, and Lake Raven, a 240-acre lake located in a popular state park only an hour from Houston which attracts 500,000 visitors (day-use/overnight) a year.

In our field work we use standard state-wide survey methods: gill netting in the spring to catch pelagic species such as striped bass, white bass, and catfish; electrofishing shorelines in the fall to sample black bass, sunfishes, and shad; and frame netting in the fall to capture cover-seeking species, crappie and sunfish. The usual three crew members rotate the different tasks that are part of our surveys, such as driving the boat, picking fish out of nets, recording data, and weighing and measuring fish. I usually work closely with the data, entering fish measurements in a spreadsheet program which compiles the information, and graphing the results.

These surveys give us a relative estimate of population abundance and size distribution which can be compared with previous years in terms of trends. We also calculate an estimate of physical condition on each fish, which shows how the weight of a fish compares to others in the state of the same length. We remove aging structures such as otoliths and spines at the office and examine them under the microscope to estimate age and growth rates.

We interact most with the public on the year-round angler survey we conduct on Lake Livingston. On random computer-generated dates and sites, a crew member counts fishing boats and anglers and conducts interviews. We ask them how far they travelled to fish at the lake, how long they have been fishing, and what kind of fish they are looking for. If anglers have fish they are going to harvest, we ask them if we can weigh and measure the fish and then return them. The counts and interviews provide information on fishing pressure, harvest, and fishing quality. Sometimes this part of the work is interesting because we get a variety of reactions from people on the water. Most start reaching for their fishing licenses as we approach, thinking we are game wardens. Not a lot of people know what TPWD does in terms of fisheries management or that there are fisheries crews working on the public waters of Texas to improve fishing, so we usually get a chance to explain what we do for a living. It is rare to meet with suspicion or hostility. We ask anglers if they care to participate in our survey when we approach them, and if they do not want to answer questions, we wish them good fishing and continue on to the next party.

As most field workers who work in natural resources know, occasionally the weather presents problems for us. Hot weather in our part of Texas that begins in the spring often persists well into the fall. In the cooler months fog sometimes makes it hazardous to navigate Lake Livingston, which is full of stumps, fallen timber, and shifted shoals. We have even had a few days when the wind blowing across two or three miles of water at the lower end of the reservoir has created choppy conditions, making it difficult to work nets and move around on the lake.

Aside from fisheries management activities, we are one of three fisheries districts in the state (out of 16) responsible for aquatic habitat enhancement. This consists mainly of herbicide application to control nuisance exotic vegetation, especially water hyacinth (*Eicchornia crassipes)* on Lake Livingston. Due to the long growing season in Texas, we may conduct treatments any time from March to November. (Application is usually conducted by the technicians, although I maintain a state herbicide application license.) I coordinate nuisance aquatic vegetation control for lakes in our region, which is roughly one-third of the state. This means surveying water bodies infested with problem vegetation, deciding on treatment options, writing treatment plans based on the type of plant and area affected by the plant, and being responsible for the many safety regulations concerning the storage and use of herbicides. Some of the herbicides we use are expensive, which makes it important to plan an effective treatment which is not wasteful.

Aquatic plant control is a controversial part of fisheries management because of the roles of aquatic plants in providing fisheries habitat and the needs

TPWD REVENUE AND BUDGET INFORMATION

Fiscal year 1992 approved budgets:

Fisheries and Wildlife Division:	
Inland Fisheries	$4,886,652
Coastal Fisheries	$4,129,458
Hatcheries	$3,580,540
Resource Protection Division	$3,554,405

Major sources of revenue for the fisheries budget are hunting and fishing license fees (est. $42 million this fiscal year), federal grants (est. $16 million), and boat registration (est. $8 million). Fiscal year 1992 runs from September 1, 1991 to August 31, 1992.

of anglers and other aquatic recreation users to have access to the water. For example, a canoe event was planned at Huntsville State Park, and the participants wanted to use a strip of the Lake Raven shoreline bordered with hydrilla, a submerged aquatic plant, which fringes the lake. With only about six weeks notice, we had to use a quick-acting herbicide. The disadvantage to the chemical of choice was a three-day moratorium on fishing following herbicide application. Huntsville State Park is a high-use park, but we were able to treat after Labor Day weekend, thus ameliorating the effect of closing fishing for three days and still obtaining the desired effect for the canoe event.

Shortly after our office was set up in the fall of 1990, we were confronted with an organized group of marina owners and other residents of the Lake Livingston area about the fishing quality and the use of herbicides at the lake. TPWD has treated aquatic weeds at Lake Livingston since 1971, and it is the opinion of some around the lake that fishing quality has deteriorated as aquatic vegetation has been controlled. A petition to this effect was circulated by lake area businesses and signed by as many as 3,000 people, culminating in a meeting with Joyce Johnson, who directs aquatic habitat enhancement for the state, our regional fisheries director, my supervisor, and representatives from the lake area. Not everyone at this meeting or in the Texas public at large was convinced of the need for herbicides used by the state in public waters, but at this time there is no other economically feasible way for us to keep certain aquatic weeds under control. With our new agency leadership and growing public concern about the use of pesticides in general, we are looking forward to the introduction of grass carp and insects to control aquatic weeds on private and public waters in Texas in the near future, and a reduction of our dependence on chemical control.

When I have time out from our busy schedule in fisheries and vegetation work, I work on special projects. I am writing a report, for example, on the results of an angler survey conducted on the tailwater fishery below the Lake Livingston dam. Fish tend to concentrate in this area as they swim against the current, so a great deal of fishing takes place there. This report will document the amount of fishing pressure that exists in this area. Since this is also one of the places TPWD obtains its broodstock for striped bass culture, overharvest from this fishery is an area of concern to us.

Another project I have is to gather information on commercial fish harvest from Texas freshwaters. Beginning in September, 1992, markets buying fish from commercial fishermen will be required to report their purchases to TPWD on a monthly basis, and I am helping to revise the current marine products report to include information on freshwater catches. As a team, our crew has participated in fishing clinics to teach children to fish and raise their interest in fishing as recreation. In addition, I am planning to devise programs on fishing that we can bring to local elementary school students or to youth clubs such as 4-H.

Representation of women in the Inland Fisheries branch is poor—I am the only woman currently employed on a management field crew. The paucity of women is especially noticeable at the professional and administrative levels. The Hatcheries and Coastal Fisheries branches of the Fisheries and Wildlife Division, as well as the Resource Protection Division, employ a much higher proportion of women. This situation is not peculiar to Texas—it seems like every issue of *Fisheries*, the American Fisheries Society's monthly magazine, has an article about the implications of poor representation of women and minorities to the future of fisheries science in light of changing demographics in this country. The Society is the major professional organization for fisheries scientists, and has formed an Equal Opportunities Section of the organization to study this problem. Meanwhile, our agency's leadership wants TPWD staff to be representative of the citizens we serve and is actively promoting recruitment of qualified women and minorities into the agency, especially at the professional levels.

This article was written when Cindy Hobson was stationed (beginning in 1990) in Huntsville, Texas as a freshwater fisheries biologist with Texas Parks and Wildlife Department. Since that time, Hobson has changed positions and is now a contaminants biologist (responsible for 46 counties in eastern Texas) with the Resource Protection Division of TPWD. Her Bachelor's is in biology from Baylor University-Waco. She received her Master's in marine biology from the Rosenstiel School of Marine and Atmospheric Science, University of Miami, Florida with a thesis in experimental fish physiology.

ANOTHER IMPERILED FISH, THE PADDLEFISH, IS MOVING TOWARD RECOVERY IN TEXAS.

PRE-HISTORIC FISHES

VERONICA (RONNIE) PITTMAN

Over 300 million years ago, long before the dinosaurs roamed the earth, paddlefish inhabited the rivers and sloughs of the Mississippi Valley. Native to North America only, the paddlefish is one of the oldest surviving species of animal life on our continent. Even with that long history, it was not until 1897 that paddlefish were first reported in Texas. Working for the U. S. Fish Commission, B. W. Evermann trekked across Louisiana and East Texas and found them in the Neches River at Bonner's Ferry; in the Angelina River at Michelli; and in the Sabine River at Logansport. Since 1900, paddlefish also have been reported in the Trinity, Big Cypress Bayou, and Sulphur rivers, and in Texas tributaries to the Red River. The species also existed in the San Jacinto River but has not been found there since the mid-1950's.

Today, however, fisheries biologists are working to assure that this imperiled fish once again becomes plentiful and widely dispersed. Currently, I am the coordinator for the Texas Paddlefish Recovery Program. As such, I am responsible for organizing and administering restoration activities for this state endangered species. I also represent my employer, Texas Parks and Wildlife Department (TPWD), in their paddlefish restoration efforts at the intra-and inter-state levels, and at scientific meetings and national forums. I routinely work with TPWD fishery management and hatchery personnel to assist in implementation of the recovery program, and interact with other state and federal agencies (e.g. the Texas Water Commission, river authorities, Louisiana Department of Wildlife and Fisheries, U. S. Fish and Wildlife Service (USFWS), to work out interjurisdictional concerns and activities associated with paddlefish recovery. Accordingly, I also coordinate with those state universities interested in conducting paddlefish research for the TPWD.

The paddlefish, *Polyodon spathula*, is a unique species. It is a large fish, which can grow to seven feet and 200 pounds. It has a smooth, tough skin except for scales on the upper lobe of the tail. The paddle-like snout develops within a few weeks after hatching and grows to about one-third of the fish's body length. As a young fish, it has fine teeth but these are lost by adulthood. A cartilaginous skeleton (except for the jaw bone) and a notochord (a forerunner of the central nervous system) reflect the creature's primitive nature. The life span of a paddlefish is at least 30 years. Males sexually mature when four to nine years old and females when six to twelve years old. The paddlefish is a freshwater planktivore and prefers slow or quiet waters of large rivers or impoundments for feeding and clean, gravel substrates with high current velocities for spawning.

As it swims with its mouth open, the fish draws water through its mouth cavity and pumps it over long, thin gill rakers which filter out zooplankton and other food. Sometimes the paddlefish feeds on insects, and on rare occasions, small fish.

The paddlefish was placed on Texas' Endangered Species list in 1977 when it became apparent there was a reduction in the species' range and numbers. Harvest of paddlefish is now illegal in Texas. In 1989, the TPWD initiated a 12-year paddlefish recovery program with the hopes of creating self-sustaining populations in targeted river systems.

To enhance recovery activities, I was asked to conduct a thorough literature review of the species and to develop a recovery plan. This work has resulted in three publications: the Synopsis of Paddlefish Biology and Their Utilization and Management in Texas, the History of Paddlefish Occurrence in Texas, and the Texas Paddlefish Recovery Plan.

The Texas Paddlefish Recovery Plan presents specific approaches and schedules for restoration of paddlefish stocks in East Texas river basins. Although the exact approach differs slightly between rivers, key elements addressed in each river basin plan are: stocking locations and rates, habitat enhancement, and regulation. Also included in the recovery plan are criteria for removing paddlefish from the state's Endangered Species List, approaches for informing and educating the public, a list of research needs, and strategies for management of the fishery.

Only remnant paddlefish populations are found now in East Texas, so Texas obtains paddlefish eggs from the State of Missouri and from the USFWS in South Dakota. The fish are spawned at TPWD's A. E. Wood State Fish Hatchery and reared there and at national fish hatcheries throughout the state. During the first three years of the program, approximately 292,000 paddlefish were stocked into target restoration areas in East Texas.

In addition to administering the recovery plan, I am also responsible for the implementation of two 12-year monitoring studies which will assess the overall success of the recovery program. Stocking survival and success will be measured by annual mark-recapture efforts since all fingerling paddlefish are marked with coded wire tags before they leave the hatchery. Paddlefish movement and habitat selectivity are studied by the tracking of radio-tagged fish. While management personnel typically collect the field data, data analyses and report preparation are usually my domain.

Although the majority of my time is spent with the paddlefish recovery program, I am responsible for additional research studies outside the realm of threatened and endangered species. I recently completed a study with Steve Gutreuter of the US Fish and Wildlife Service (LaCrosse, Wisconsin) and the subsequent paper, Initial Stocking Survival of Hatchery-Reared Fishes, evaluated 24-hour post-stocking survival of 10 fish species in the absence of predation. This paper has been submitted for publication and was presented this year at the annual meeting of the American Fisheries Society.

I have been with the Inland Fisheries Branch of the Department for almost seven years. The last five of those years have been spent in Ingram, Texas (northwest of San Antonio) at the Heart of the Hills Research Station (HOH). The HOH staff consists of a research director, a facility manager, seven biologists, eight technicians and a secretary. Together we conduct research that typically has either management or propagation implications for sport fishes, or is associated with the protection or recovery of threatened and endangered fishes.

During this time, I have found a career in fisheries research is not only exciting and challenging, but also rewarding and seldom mundane. These impressions have been fostered by the work environment at HOH, which is harmonious, supportive, and highly productive.

Veronica (Ronnie) Pitman holds a Bachelor's in History from the University of Colorado and a Master's in Wildlife and Fisheries Sciences from Texas A&M University. She currently serves on the Endangered Species Committee of the American Fisheries Society and is active in the Texas Organization for Endangered Species and the Texas Chapter of the American Fisheries Society. Prior to her work with the Inland Fisheries Branch of the Texas Parks and Wildlife Department, Pitman and her husband managed a hunting and fishing club in North Texas.

TEXANS HAVE GREAT CONCERNS ABOUT THE FUTURE OF THE RESOURCES. THIS CONTAMINANTS BIOLOGIST SHARES THOSE WORRIES AND WORKS ON OVERDRIVE TO RESPOND.

JILL OF ALL TRADES

JOAN A. GLASS

Pollution problems affect wildlife and their habitats in Texas. My job with the Texas Parks and Wildlife Department is to evaluate wildlife kills and serious pollution events and determine the source, immediate impact, and any long term effects.

I am employed by the Environmental Quality Branch of the Resource Protection Division. The main focus of my job is to respond to reports of pollution and wildlife kills in a 99 county area of approximately 90,000 square miles. I have the assistance of the Game Warden for each county most often, but there are many times that I investigate alone.

My job is often like a murder mystery with a crime scene, dead bodies, and clues. To complete one investigation requires forensic work on the victims, counts and identification of the dead, field analyses of water, careful collection of samples for laboratory analyses, and documentation of evidence for the potential court case.

I build my wildlife case as carefully as any detective. The victims in my cases cannot defend themselves, even if they survive, but they often "tell their story" and identify the cause of their death. Dead wildlife often indicates a serious threat to the environment which includes the people who live in the area. In an investigation, every bit of knowledge I have is used. To stay current in this field requires constant work due to new techniques, new sample collection methods, new chemicals in use, new laboratory methods, protection and safety of employees. Add to this list knowledge of habitat areas, what is normal water quality, animal behavior at different seasons, how chemicals are metabolized by different species, and the behavior of acute and chronic toxicosis. All this and more becomes critical during an investigation. There will never be a time when I know enough and can quit seeking information and resource persons.

For these reasons, a Conservation Scientist V (my title) for the Texas Parks and Wildlife Department is often a "Jill of all trades." Most of us have a B.S. in fisheries, aquatics, toxicology or a related field and all of the personnel who hold the job have a Masters Degree and toxicology work in their background, but things that sometimes discourage newcomers are:

•1) Maintaining a 4-wheel drive truck, two boats with trailers, a laboratory, an office, various meters and probes, typing and filing reports, letters and memos, ordering all chemicals for the lab and the supplies needed for the office with no secretary nor technician

•2) Driving (sometimes) over 400 miles out to an investigation site

•3) Working effectively from dawn to dark to identify causes when wildlife (and human) health risks are involved

•4) Working in chest waders with summer temperatures that overcome any deodorant while breathing dead fish fumes during counting, measuring and weighing

•5) Walking up and down river banks for several miles with 40 pounds of equipment on your back

•6) Working alone in areas you have never been in before requiring self-confidence, common sense and a desire to meet new friends

•7) Keeping a constant awareness in unfamiliar surroundings and noting affects of the contaminant (thus eliminating dangers to oneself and keeping poison ivy attacks to a minimum)

When it's too dark to work there is the decision: is the nearest motel acceptable or shall I drive another 50 miles to the next town and begin the decision process again. Convincing the desk clerk that you really aren't a street bum is hard especially when you are muddy and smell like a dead fish. Trying to find a place to eat after 9 pm, after a shower, in a town of 500 is another of life's joys. (Fortunately most desk clerks don't mind talking about their town and eating places. Some motel owners I have gotten to know will even feel sorry and feed me if I arrive late. I cannot say that I always enjoy these things but I have made dear friends and often gotten some good laughs.)

I am required to be in my office when not on a field investigation, in the lab or maintaining equipment. When I am in my office, I write the reports for my field investigations and follow-up on smaller events by checking with game wardens. Applications for permits to discharge treated wastewater into streams, rivers and lakes are reviewed to protect critical habitat and keep additional loading from areas already showing effects.

I comment on applications and renewals of permits which need improvement or endanger protected species or federal and state parks. I comment on waste load evaluations done by other state agencies which become the basis for permitting other dischargers into that river system, on proposed state laws, rules, regulations and standards whenever my region and wildlife issues are involved. I review and comment on proposed Department studies and often participate in these studies in my region. Most of my comments are integrated with the other professionals in our headquarters office and combined into a final report or letter which is presented with the executive director's signature.

I attend and testify at hearings, court cases, mitigation and instream flow projects. I try to answer all questions from my employers (the taxpayers of the State of Texas) or refer them to someone who can answer the question. These questions range from identification of a snake in a jar to what do I do when there is oil all over the Brazos River for 30 or more miles. I have never been "caught up" in four years and sometimes the volume of work is overwhelming. But each aspect of the work I am responsible for is important and demands quality assessment and quality control at every stage. The variety is often challenging and a guarantee that it won't get boring.

I also run a laboratory as manager, head chemist, chief dishwasher and janitor. I will admit that my laboratory work is sporadic and I don't make my main living there. However, I can calibrate meters and probes, perform the "wet chemistry" tests of pH, dissolved and suspended solids, chlorides, ortho and total phosphorus, sulfides, ammonia nitrogen, nitrate nitrogen, nitrite nitrogen, rotenone, chlorine, Winkler dissolved oxygen, oil and grease, and others along with

microscopic examinations and identification of aquatic algae, zooplankton and basic bacteria work. I also perform fish autopsies and water analyses for samples which are mailed or delivered to me. For me, working in the laboratory is so enjoyable that I have worked well past quitting time on many occasions.

Meeting the public is my most important and challenging job and also my most satisfying job. I treat people with respect, answer questions truthfully and volunteer to find the specific information or identify the person who can answer other questions. I give presentations to school children in classrooms and in organizations regarding pollution and how each of them can help beginning today and continuing for their whole life.

My greatest joy has been to reaffirm my belief in people who care. I have found so many people who care about the land, the plants, the wildlife, their neighbors and their families. Most people are willing to become partners in preserving a healthy environment for the future generations. Total strangers have become new friends and come to my aid in finding landowners, leading me to areas with dead wildlife, finding access points along rivers and creeks, giving permission to be on their land and providing information and clues in investigations. People who can only afford the land their house is built on have the same regard for quality and concern as those with large farms and ranches which have been owned for generations. There is a deep need for more education about chemicals—but most Texans care.

When I first started my job I was told that there would be resentment and poor attitudes from men who did not want to work with a woman. You have heard of the "good-old-boy mentality?" Well, let me tell you, I have met only the best professionals anyone could wish for. I work with city employees, other state agencies, private industry, game wardens, landowners, and hunters. A professional always shows an on-the-job attitude of common courtesy. I have always tried to acknowledge the efforts of others who contribute to my investigations.

There is the rare occasion where we "agree that we disagree" and still are civil to each other. Even some of the "agree that we disagree" persons have provided days of hard work, laughter, and excellent investigations working side-by-side in hot, smelly conditions.

Joan Glass worked for 18 years in greenhouses, libraries, law and insurance offices, bookstores, biology department offices and labs, tutoring, and doing contract work on contamination and impact projects while finishing her two degrees. Her Bachelor's is in education and biology from Baylor University and her Master's is in Limnology from the same university.

TPWD: THE ORGANIZATION

The fisheries resources of Texas comprise over 16,000 miles of perennial streams, more than 600 public reservoirs impounding two million acres of fresh water, and 300 miles of coastline encompassing four million surface acres of salt water. The Texas Parks and Wildlife Department (TPWD) Fisheries and Wildlife division serves over three million anglers and millions of other recreational users of water resources.

In August, 1990, new executive director Andrew Sansom initiated major reorganizations in the Department. The fisheries and wildlife divisions were united into a single division led by Dr. Rudy Rosen, with over 300 employees.

The fisheries and wildlife division is composed of the Inland Fisheries, Coastal Fisheries, and Hatcheries branches. Personnel in each branch are divided between field locations and agency headquarters in Austin.

•Inland Fisheries management activities are conducted by sixteen district crews divided among three regions, each led by a program director. Each crew is staffed by two biologists and two technicians. Most of the Aquatic Habitat Enhancement (AHE) activities are conducted by three of the fisheries management crews along with their fisheries responsibilities. The AHE program is directed from Austin by Joyce Johnson. Inland Fisheries research is centered around the Heart of the Hills Research Station in Ingram, Texas.

•Coastal Fisheries operates from eight research laboratories and field stations along the coast. Management is organized around two programs: harvest monitoring and resource monitoring. Resource monitoring crews made up of biologists and technicians survey the state waters in the Gulf of México and in the nine major bay systems of the Texas Gulf coast. Harvest monitoring crews conduct intensive site surveys of sport catches and collect and summarize data on commercial harvest. Research on spawning and culture of marine species is conducted at the Perry R. Bass Research Station. The Coastal Fisheries branch interacts with other gulf states and the federal government in the research and management of gulf fisheries.

•The Hatcheries branch operates six freshwater fish hatcheries and two saltwater hatcheries. Freshwater hatcheries rear Florida largemouth bass, smallmouth bass, catfish, sunfish, striped bass, hybrid striped bass, rainbow trout, paddlefish, and crappie. Red drum, spotted seatrout, and snook are reared at the saltwater hatcheries. Hatcheries biologists and technicians focus on production of the best quality fingerlings based on broodstock genetics. Along with refining warmwater culture techniques, they conduct research in fish health, pond fertilization, fish culture, and related topics.

Resource Protection is a division of TPWD whose interests and jurisdiction overlap those of fisheries where water quality is concerned. The division employs 67 people and is divided into three branches.

•The Environmental Assessment branch reviews discharge permits for freshwater and saltwater and establishes mitigation requirements for construction projects, especially along the coast.

•The Endangered Resources branch conducts research on rare plants and animals to determine if they should be listed as threatened or endangered, constructs recovery plans for rare species, and seeks to protect native Texas biomes.

•The Environmental Contaminants branch investigates pollution events and fish and wildlife kills and reviews discharge permits.

SAMPLING IS A LARGE PART OF MARINE FISHERIES WORK.

FIFTEEN YEARS ON THE TEXAS COAST

KAREN MEADOR

I consider myself a Marine Fisheries Biologist, but my official title with Texas Parks and Wildlife Department (TPWD) is Conservation Scientist. I am currently responsible for monitoring the finfish and invertebrate populations of two estuarine systems — Aransas and Corpus Christi Bays. I operate out of the Rockport Marine Laboratory, one of seven such labs run by the Department along the coast.

In order to monitor the marine populations, we utilize independent sampling gear such as monofilament gill nets, beach seines, multifilament bag seines, otter trawls, oyster dredges and longlines. Our coastwide sampling program is large: In 1992 we expect to collect 760 gill net samples, 2,292 bag seine samples, 252 beach seine samples, 1,320 dredge samples, and 3,288 trawl samples. In addition to conducting our routine sampling, we also have special projects: red drum (*Sciaenops ocellatus*) fingerling stocking into the bays, longline sampling for adult red drum in the Gulf of Mexico, collecting extra finfish and shellfish specimens for mitochondrial-DNA and electrophoresis analyses, assessment of major fish kills (one in 1983-84, one in 1986, and two in 1989), and participation in SEAMAP sampling in the Gulf. Samples are collected routinely on a monthly or seasonal basis to provide long term trend information on population abundance and stability.

We are also involved in the Marine Mammal Stranding Network (MMSN) and the Sea Turtle Stranding Network (STSN) which responds to live and dead strandings of dolphins, whales, and sea turtles. State network offices are located in Galveston, Texas--while the national office is in Miami. Recently we were inundated with reports of dead bottlenose dolphins (*Tursiops truncatus)* washing ashore in two coastal counties in our area. We investigated the strandings and filed MMSN reports as soon as possible. For about four or five weeks in the spring of 1992, 90 percent of my time was devoted to responding to these calls, coordinating personnel for initial investigations, informing MMSN crews for subsequent necropsies and filing all appropriate reports. Local officials and media responded to the dolphins washing ashore in highly visible areas. Local, state, and federal managers cooperated and coordinated to find a cause. To date, none has been found. We are awaiting the tissue analyses and other test results.

Another project I am working on is developing a Fisheries Management Plan for black drum (*Pogonias cromis)* for the Gulf of Mexico along with representatives from each of the Gulf states. This endeavor is coordinated and funded through the Gulf States Marine Fisheries Commission based out of Mississippi. We meet about every three months to present our state's perspectives regarding the commercial and recreational black drum fisheries.

Being located in the Rockport Marine Lab means that we are usually the front line to be asked to help with a myriad of fisheries related (and some not related) concerns. We deal with city, state, and county folks, Harbor Masters, and shrimp and oyster industry officials on everything from pollution in our harbors, injured sea gulls, fishing information, disposing of dead marine animals, to officiating at fishing tournaments.

As with most other natural resource scientists, our work can be physically demanding. Samples are collected in all kinds of weather because routine program objectives specify certain time frames, and even if you try to pick and choose the days to be out in the water, Mother Nature sometimes gets the best of us. We are lucky these days because we have state-of-the-art equipment with which to do our sampling. It was not that long ago that we had to brave all kinds of conditions in 16 ft wooden skiffs with 40 hp cranky outboards. I remember many trips with a co-worker in those small, high-sided commercial-looking boats trying to retrieve an overnight gill net while a blue norther was blowing in. One of us would pick up the 600 ft net as fast as possible, fish and all, while the other would be bailing out water as fast as possible. Then came the high point when we found out whether the motor would carry the loaded net, the eight inches of water in the bottom and us back to the boat ramp through the crashing waves against a 30 mph wind.

We now use 21 ft fiberglass boats with 100 hp O/B complete with VHF radios and power winches. We still get caught now and then in not-so-good weather, but we feel a lot safer with a self bailing boat and a much larger motor. We also have 44 ft inboard vessels which we use primarily for sampling offshore

waters and the open bays with otter trawls. I supervise one boat captain and six technicians to insure that project objectives are met. My responsibilities include coordination of workloads between two crews (all male), with other project crews, with other field stations on the coast, and with public assistance requests. As a manager, I find myself spending the majority of time coordinating the activities of others while getting further away from the data analysis and reporting of the findings. This has been the case especially since our hiring freeze in January 1991 when vacancies were not filled—and have not been to date.

I became interested in Marine Biology/Sciences while my father was stationed in the Panama Canal Zone and while I was attending Balboa High School. Living on the Isthmus of Panama, we were surrounded by the sea; there was no escaping it. In our front yard was the Bay of Panama, about a mile away was the Pacific Ocean entrance into the Panama Canal, and across the isthmus some 25 miles was the Atlantic Ocean.

My career with the Department began with a job indexing fisheries federal aid reports (office work) for close to two years. In this position, I was able to keep my ears and eyes open for any field positions advertised, jobs that were more suitable to my training and taste. In this period, employers in general were just starting to hire "token females" in predominantly male positions, so I thought my chances were extremely good to land something. I interviewed for 15 different field positions and was subjected to questions by panels of male biologists and administrators. The last one landed me a job at my present location on the south Texas coast where I have been able to move up and around over the years.

It is interesting to me that today there are still relatively few women in fisheries. It was no surprise, though, back in 1976 when I graduated from college to find that there were only 10 of us out of a group of 150 getting a Bachelor's in Fisheries. In 1984 I became the first woman with the Department to head up a crew in the resource monitoring project.

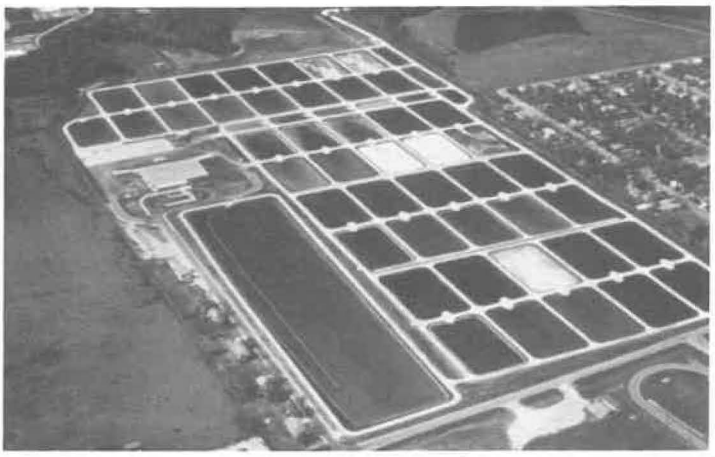
The part of my job that provides the most satisfaction also creates the most conflict in my personal life. Though I don't go to the field as often as I used to, each time I do, it interferes with raising my two young daughters, ages four and one and a half. My boss is pretty understanding most of the time when schedules won't mesh between work and home. I love field work, like to travel, and I thoroughly enjoy the majority of meetings I attend, but things and priorities have a habit of changing once you have children.

Karen Meador has worked for Texas Parks and Wildlife Department for 15 years and is currently a Conservation Scientist III stationed at Rockport Marine Laboratory. She spent nine years of her time with the Department conducting creel surveys of recreational and commercial fishermen and sampling the estuaries with various gears in all kinds of weather. The last four years she has been primarily a manager, insuring that resource sampling is completed. Her Bachelor's is from Texas A & M University in Fisheries.

THIS MANAGER KNOWS THAT HER CAREER CHOICE HAS PROVIDED HER WITH PROFESSIONAL SATISFACTION AND THE KNOWLEDGE THAT HER WORK MAKES A DIFFERENCE FOR THE RESOURCE.

A.E.WOOD FISH HATCHERY

LORRAINE THOMAS FRIES



A. E. Wood Fish Hatchery

I began my career with the Texas Parks and Wildlife Department's Fish Hatchery Branch at an entry level position in 1984. I had gotten married just two weeks prior to the time I was to report to duty. Unfortunately, I had to relocate to accept the position. This created some problems because my husband already had a good job. While my career with Texas Parks and Wildlife did seem promising, I'll never forget my thoughts as I performed one of the "most beloved" jobs at the hatchery—shoveling mud out of the drain ditch: "My husband is going to quit his job so I can shovel muck!" I also had trouble envisioning myself performing such strenuous manual labor for my entire career.

After a year and one-half of hard labor, I had the opportunity to transfer to a different facility. I was delighted with the transfer because my new duty station was the A. E. Wood Fish Hatchery in San Marcos, Texas. At the time, the facility was being renovated into a high-tech, state-of-the-art fish hatchery. Also, the transfer would afford my husband the opportunity to make a career move and attend graduate school at a local university.

The hatchery renovation took longer than expected, and in the three-and-one-half years that followed I developed new skills. I worked under the tutelage of the branch's genetics program leader and learned a variety of biochemical analyses. At that time, these analytical procedures were just becoming powerful tools in fisheries management. One of the applications, electrophoresis, was used to evaluate the presence of Florida bass alleles in reservoir populations to measure the success of hatchery stocking programs.

Another analysis, isoelectric focusing, was occasionally used to confirm the species of fish submitted as water body or state records. This is accomplished by comparing species-specific protein profiles of known fish with those having confusing meristic characteristics.

I also assisted in the organization of a wildlife forensics laboratory. Wildlife forensics is not usually a function of fish hatchery labs, but we had the equipment and expertise to assist law enforcement personnel with species identification of evidentiary materials. We used protein profiles from a library of known samples to identify the species of origin of tissue (e.g., dried blood, fish fillets, etc.) collected in suspected wildlife game violation cases.

The newly renovated A. E. Wood Hatchery was dedicated in January 1989. This renovation was the first of several in a massive rebuilding of Texas' state fish hatcheries. The A. E. Wood facility is possibly one of the most technologically advanced warm water hatcheries in the world. Most hatcheries have earthen ponds but the ponds at A. E. Wood are all lined with an impermeable membrane. The liner eliminates much of the labor associated with pond maintenance.

The hatchery also has indoor raceways and other culture facilities. This allows us to accomplish a large proportion of culture activities protected from the whims of Texas weather. The hatchery is equipped with a modern incubation room housing an assortment of incubators, feeding troughs, and holding tanks. Throughout the facility, fish holding areas are equipped with such features as automatic feeders, low-pressure air, oxygen diffusers, a water re-use system, water level alarms, and temperature and oxygen sensors.

In a typical year, the hatchery and its 17-member staff can produce over 4 million largemouth bass, 1 million smallmouth, 1 million catfish, 3 million striped bass, 6 million hybrid striped bass, 3 million walleye, 100,000 rainbow trout, and 200,000 paddlefish. Once the fish reach target sizes, they are transferred to public waters by pickup truck and a gooseneck trailer fitted with a 600 gallon tank. The work days are long and demanding during production season, and it is not unusual for the staff to accumulate considerable amounts of overtime.

Shortly after the renovation was complete, I received a promotion and became the second female Biologist II in the Fish Hatchery Branch. I supervised two women and two men and, since my former supervisor had moved on, I assumed the responsibility of managing the genetics and wildlife forensics programs. I also was involved in fish culture operations and coordinated activities in the incubation room.

As a woman, I feel handicapped in some aspects of my job. Initially, I believed my lack of physical prowess (compared to the average man) would be an issue, but in reality, physical strength has seldom been a concern. I believe women are actually better suited for handling fish than men because women seldom feel the urge to overload a net simply to demonstrate their physical strength to others. (Overloading nets can be harmful to fish, especially to those at the bottom of the net.) A real handicap, however, has been my general lack of mechanical knowledge. This is one area where I do not feel on an equal footing with my male colleagues, I suppose because males are taught to do more repair and mechanical work routinely while growing up. The facility is operated continuously and has diverse equipment, therefore many maintenance problems can occur. The mechanical room associated with the incubation room has six pumps and over two dozen valves associated with that room alone. Proper operation of the heat pump, which is required to hold incubation water at optimal temperatures, necessitates that each pump and valve is properly adjusted. Water is routed through the machine differently depending on whether the water is to be heated

With staff, checking pit tags in largemouth bass

or cooled. Just turning the heat pump on becomes a daunting undertaking.

Another job aspect that is sometimes uncomfortable is male-female relationships. One of the men I worked with refused to learn my name and referred to me as "that girl". Eventually I proved my worth and I became "our female." I am not exactly sure when it happened, but we are now on a first name basis. I also believe that, on occasion, I have not been taken seriously because of my gender. I have received the brush-off, for example, when I queried about the operation and maintenance of hatchery equipment. One year I was honored as worker of the year, and one of my co-workers grumbled that I was only recognized because I was a female.

On the other hand, I have been most fortunate because my position has evolved to accommodate my abilities. My current position is leader of Fish Health/Genetics and Wildlife Forensics Labs. The Hatchery Branch was recently reorganized and I no longer have fish culture responsibilities, but I report to the Fish Hatchery Manager or the Branch Chief.

I received a promotion and my job now carries a little more prestige than the other hatchery biologists. I supervise a staff of two women and one man. The Fish Health Staff has just been recognized as separate from the hatchery with duties and job descriptions currently in the formative stages. The hatchery genetics program has diversified as the needs of the department change. In the past we had worked to create genetically marked fish which could be identified after stocking; now we are striving to maximize genetic diversity and prevent inbreeding and domestication in our stocks. We continue to monitor the impact of stocked Florida largemouth bass into reservoirs and assist in fish identification. We recently evaluated a potential world record Guadalupe bass which possessed confusing meristics. Isoelectric focusing showed that the fish was actually a hybrid between Guadalupe bass and smallmouth bass.

The wildlife forensics program also changes as the needs of the department dictate. In addition to identifying the species of origin from evidentiary material, we have recently used fatty acid profiles to distinguish legal farm-raised fish from illegal fish. You are what you eat and farm-raised fish are offered a diet different from the diets of wild fish. This project was initiated to enhance enforcement of a Texas regulation that prohibits the sale of red drum except for those produced at a fish farm.

Enumerating paddlefish fries.

On occasion, I have been asked to appear as an expert witness to testify about the lab analyses. I recently testified in what I believe was the first case to admit as evidence fatty acid profiling of fish suspected of being poached from the wild. The evidence included over 10,000 pounds of catfish allegedly illegally taken from Lake Texoma. The prosecution was successful and the jury found all defendants guilty of all the charges against them. Other ongoing projects include refinement of protocols that have been problematic, such as the identification of closely-related deer species in cooked and processed meats. We are also hoping to learn DNA fingerprinting so that we can link evidentiary materials together when they come from individual animals.

I suspect many people working in natural resources, like myself, find it difficult to separate what they do from who they are. My job is more than just a job, it's who I am. When times were tough, I have wondered if I should have done things differently and chosen a somewhat more lucrative field of study. In fact, though, it is difficult to imagine things working out better if they had been planned—and I would still rather be a biologist than anything else. My husband completed a second Master's degree and is currently employed as a Fisheries Biologist at the U. S. Fish and Wildlife Service San Marcos National Fish Hatchery and Technology Center. Because of the limited number of fisheries biologist positions, there are few other places where both of us would be able to find meaningful employment.

The road has not always been smooth, but I am personally fulfilled in my position. My sister-in-law, who at the time was a frustrated physicist in a prestigious national lab, once asked me if I felt my job made a difference. I did not have to ponder very long before I was able to answer, "Yes". My job has directly or indirectly dealt with the culture of an endangered Texas fish species (i.e., paddlefish), re-establishment of a fisheries (i.e., Texas Coast striped bass), and protection of the resource (through wildlife forensics). Not only is my job intellectually satisfying, I am personally gratified to know that my efforts have made a difference in the management of Texas' natural resources.

Loraine Thomas Fries majored in Biology and earned a B.S. (1979) and M.S. (1986) from the University of Texas at El Paso. She has worked with the Texas Parks and Wildlife Department for her entire professional career, beginning at the Lewisville State Fish Hatchery (situated north of Dallas), and is currently stationed at the A. E. Wood Fish Hatchery in San Marcos, Texas. The focus of her work is fisheries genetics and wildlife forensics.

Jessie A. Micales

Research In Progress

Focus on: Research sabbaticals in Japan

Microbial Degradation of Cellulose
Dr. Jody Jellison
University of Maine

I was recently fortunate enough to visit Japan for six months on a fellowship jointly administered by the U.S. National Science Foundation and the Science and Technology Agency of Japan. These fellowships are designed to promote cultural understanding and scientific exchange between Japan and the United States.

My husband, who is also a scientist, our two young sons, and I lived from December 1990 to June 1991 in Tsukuba Science City. Tsukuba is located 60 km northeast of Tokyo. It is a relatively new city conceived approximately 25 years ago as the site for over 50 national and private educational and research institutes. Much of my work was done at the National Forestry and Forest Products Research Institute which houses hundreds of research scientists from many nations. The excellent facilities and gracious hospitality of my scientific hosts made the institute a very pleasant and productive environment in which to work.

While in Japan, I was a guest of the Wood Chemistry section of the Bioconversion Laboratory headed by Dr. M. Ishihara, an expert in cellulase purification and enzymatic saccharification. My research projects in Japan focused on developing a better understanding of how micro-organisms are able to attack and break down cellulose. Cellulose, a major structural component in plant cell walls and hence in wood, is the most abundant organic polymer in the world. A better comprehension of how cellulose can be broken down by micro-organisms would help us to understand how microbes, particularly some of the fungi, are able to invade and colonize plant cell walls. Microbial decomposition of cellulose is involved in many important processes ranging from carbon and nutrient cycling on the forest floor to the use of microbially-modified cellulose in industry as an alternative source of sugars.

My work centered on a group of decay fungi termed "brown-rots." These fungi are able to preferentially attack and utilize the cellulose from wood cell walls leaving behind a crumbly brown lignin-rich matrix. I purified a variety of catalytic compounds produced by these fungi and was able to demonstrate that they can modify and break down the cellulose in cell walls. One of my projects involved the use of x-ray diffraction analysis to examine the effect of low molecular weight iron-chelating compounds and the higher molecular weight fungal cellulases directly on the crystalline structure of the cellulose.

Great emphasis is placed in Japanese laboratories upon both cooperation and technical proficiency. The work day for my work group proceeded in a very orderly fashion with laboratory personnel not only working together but also eating together in the laboratory or institute cafeteria. The institute also included a barbershop, health clinic, tennis courts, and a botanical garden. Local merchants were encouraged to visit so that the resident scientists were able to purchase everything from strawberries to tailored suits without ever leaving the institute grounds.

Whether working in the laboratory or exploring the countryside, we found our stay in Japan both enjoyable and interesting. Japan is a fascinating mixture of the old and new, and we were fortunate to have the opportunity to work in one of their very well equipped national institutes.

Jody Jellison (pictured left) got her B.S. at the University of New Hampshire in 1977 and obtained her M.S. and Ph.D. degrees from the Department of Botany and Plant Pathology at Oregon State University. She completed post-doctoral training in plant molecular biology at Harvard. She has held faculty positions at the University of Maine in the departments of Forest Biology, Microbiology, and Plant Biology and Pathology.

Biology of Pine Rusts
Dr. Pauline Spaine
U.S. Forest Service
Southeastern Experiment Station

I was one of the first Forest Service employees chosen to be a part of the Japanese Science and Technology Award Fellowship Program. This program was offered by the Japanese government through the Japan International Science and Technology Exchange Center (JISTEC). The program was organized in cooperation with the National Science Foundation in Washington, D.C. which helped to coordinate the exchange of scientists from federal agencies, universities, and laboratories of private industry.

I worked for 15 months at the Forestry and Forest Products Research Institute (FFPRI) in Japan. The institute has seven branch experiment stations distributed throughout the four main islands of Japan. The main headquarters is located in Tsukuba (where Jody Jellison was also working). I was first stationed at the Tohoku Research Center, Iwate Prefecture (prefectures are

森林総合研究所

The kanji symbols for the Forestry and Forest Products Research Institute.

analogous to states) in the northern part of Japan. This was a small experiment station that was similar to my own branch experiment station in Georgia. Some 60 to 75 people worked there. After four months, my research colleague and host, Dr. Shigeru Kaneko, was transferred to the main headquarters in Tsukuba, and we were able to work in larger and better equipped laboratories. Unfortunately, however, it was much more crowded at Tsukuba, and our field plots were further away.

Dr. Kaneko is a plant pathologist who is a leading authority in plant rust diseases. Dr. Kaneko had visited our Athens laboratory twice before, so I was familiar with his work. We have similar areas of research interest in host-rust pathogen interactions.

During the fellowship, we were able to concentrate on factors that control the germination and germination type in Cronartium quercuum f. sp. fusiforme, the causal agent of fusiform rust. Fusiform rust is a serious disease of pine in the southern United States.

A similar but less virulent and damaging rust strain found in Japan is Cronartium quercuum. This strain is similar in symptom type to eastern gall rust, another rust of southern pines in the United States. Both rust diseases are heterocious and require two hosts, pine and oak, to complete their life cycles. Most damage occurs to the economic host, which in both cases is pine. The Cronartium quercuum rust fungus forms a very small round gall on the branch or stem of the tree. Fusiform rust forms a spindle-shaped gall that enlarges every year and weakens the branch, often causing infected limbs to snap off in heavy winds.

Dr. Kaneko and I examined biochemical factors and physical parameters that control germination type in the fungus. We also studied the nuclear behavior before and during the germination of basidiospores. It was great to work with someone with such enthusiasm!

My experience of working at FFPRI was a good one. Dr. Kaneko spoke English, and I came to find out that all students in Japan learn English starting in junior high. Dr. Kaneko had been promoted to lab chief or chief forest pathologist. There were three younger men under his supervision and several students who rotated through the laboratory. My colleagues were very helpful and never too busy to answer questions or help me find something.

There were rules of social etiquette for lab groups that were quite different from ours in the U.S. The Japanese mind set is very much for doing things together. Every morning, members of my research group would meet to have tea or coffee together in the laboratory. During this time, they planned the day's activities and let each member know what everyone else was doing. At lunch, our group went to the cafeteria together and ate at the same table. This seemed a bit much to me at the beginning, but it helped make efficient use of the limited cafeteria space. You were not restricted to eating only with your group, but this is usually what happened. Although I often resented the tea/coffee breaks for interrupting my work, I often felt rejuvenated and more relaxed afterwards. Duty to the group was seen as equally important to the work that you were performing.

There were two other women scientists in the Forest Biology Division with me, and there were several female technicians. Women did not hold any supervisory positions, no matter how long their tenure had been at the Institute. Of the 600 employees at the Institute, only a few were women. Most male employees worked and socialized in the building after 5:00 PM, but the women were generally gone to tend to their families.

During the spring and summer months, there were often tennis, volleyball, or baseball tournaments in which the different divisions would play against one another. Women were included in the sports activities as often as they wished to participate.

Tennis was the most popular sport for both men and women. Baseball and volleyball followed in popularity with only a few women participating. Because of my height, I was actually considered a valuable player! I was frequently recruited to play in badminton tournaments. This was not due to my great abilities but because other women would want to play, and in Japanese society it would have been unfair to have a team of women play against a team of men. In the winter, there would be table tennis tournaments. Many employees of both sexes participated, and there would usually be a large potluck dinner after the competition in which everyone would get together.

One problem that I did not anticipate was the climate change. In January, when I left Athens, Georgia, the camellias were in full bloom. When I arrived at the experiment station in Iwate, there was a foot of snow on the ground! My colleagues had already bought me a winter coat for field work, knowing that I would be unprepared for the cold climate.

Ninety percent of Japanese homes do not have central heat. The country imports all of its natural resources, and energy is conserved by using electric and kerosene heaters in homes and businesses. I frequently kept my coat on in my modern apartment for the first 30 minutes when I got home every day. In the experiment station, the heat would come on about 7 AM and be turned off at 5 PM. There would be no heat on weekends, and yet all government workers were required to work a half-day every other Saturday. Monday morning would be the coldest time as we waited for the building to heat up.

As in any new work experience, there were established ways within each organization for achieving results. The Japanese system was very open, and the social system stressed working together and working diligently. I would recommend the FFRPI as a sabbatical experience for anyone interested in Asian-rim forestry.

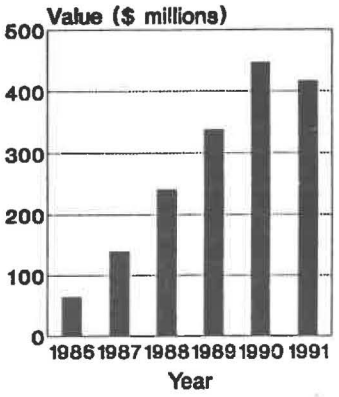
Pauline Spaine is a Research Plant Pathologist with the Forest Service. She has a Bachelor's in Biology from the University of Maryland, a Master's in Plant Pathology from West Virginia University, and a Ph.D. in Botany from North Carolina State University.

A drawing of a Japanese lantern (courtesy of Jody Jellison).

THERE ARE EIGHT REGIONAL FISHERY MANAGEMENT COUNCILS IN THIS COUNTRY WHICH MAKE THE LIFE AND DEATH DECISIONS ABOUT OFFSHORE FISHING. HOW DOES SCIENCE ASSIST IN ANSWERING THE BIOLOGICAL, ECONOMIC, AND SOCIAL QUESTIONS?

SCIENCE AND FISHERIES: ALASKAN WATERS

SANDRA LOWE
REBECCA T. BALDWIN



Ex-Vessel Value of Groundfish Fisheries off Alaska

Introduction

Within the United States, management of many of the natural resources (i.e. fish, timber, water, oil) have traditionally been the responsibility of local, state, and federal government. Decisions made by these regulatory bodies have significant ability to hinder or ease access to these scarce resources among a variety of competing user interest groups.

In the management of our federal fisheries—to help ensure that the decision-making process recognizes the competing interests and allows the resources to be utilized for the best interest of the nation as a whole—there are a series of well-established guidelines and objectives. Fishery science has played a crucial role in providing the best available data, and in applying the proper analytical tools to evaluate proposed management issues. As the number and magnitude of conflicts between potential users increases, the role of science in the allocative process becomes increasingly crucial.

In this paper, we will present the current procedural process for making regulatory decisions and the general role good scientific analysis can play in the process. In addition, we will examine some current management issues that are representative of the type of issues being analyzed in today's national fisheries.

Fisheries Management: The Institutional Setting

The Magnuson Fishery Conservation and Management Act (Act, MFCMA) of 1976, which became effective March 1, 1977, established a fisheries zone from 5.6 to 370 km (3-200 nm) offshore around the coast of the United States. This zone was originally called the Fisheries Conservation Zone (FCZ). In 1983, it was renamed the Exclusive Economic Zone (EEZ). The Act gave the United States exclusive authority over all fish found within the EEZ, all anadromous species of U.S. origin, and continental shelf fishery resources that extend beyond the zone such as coral, crab and lobster, clams and abalone, and sponges.

The Act created eight Regional Fishery Management Councils: the New England, Mid-Atlantic, South Atlantic, Caribbean, Gulf of Mexico, Pacific, North Pacific, and Western Pacific Fishery Management Councils. The North Pacific Fishery Management Council (NPFMC) is unique among the eight councils in that its jurisdiction encompasses fishery resources off the coast of only one state (Alaska).

A major responsibility of the Regional Councils is the development of fishery management plans (FMPs) and amendments to them. These plans serve as the basic reference documents for management of the fisheries in the EEZ. A mandate of the FMPs is that they protect the present and future health of the resource, taking into account social, economic, and biological factors influencing that well-being. Prior to the implementation of a new FMP as well as amendments to existing FMPs, the action must be found to be consistent with the seven National Standards contained in the Act.

The major fishery management plans for the foreseeable future have been developed. Therefore, the main task is now to monitor the fisheries and make changes to the management regime to maintain an orderly fishery and a productive resource. National Standard 2 specifies the use of the best scientific information available. Most Council members are not scientists, and therefore depend on scientific advice, interpretation, and review of the issues before them to make informed management decisions. Two critical types of information are 1) the way that fish populations respond to changes in exploitation rates, as well as biotic and abiotic conditions; and 2) how fishermen respond to changes in fish availability and economic conditions, as well as the associated local and regional impacts (Marasco and Aron, 1991). The NPFMC currently has an organizational structure that, when adhered to, encourages the proper use of scientific data and methodology, and allows for the presentation, discussion, and dissemination of the research into the policy-making process.

Every year the NPFMC must set harvest levels for the fisheries stocks governed under the FMPs. Due to the number of participants in the fisheries and the resultant problems of excessive capacity to harvest and process the resource, the setting of quotas is often overshadowed by the management issues of bycatch—meaning the incidental harvesting of non-targeted species within a directed fishery—and allocation among user groups. In addition, the Councils play an important role in developing solutions to specific habitat problems affecting fishery resources, marine mammals, and endangered marine species. However, regardless of the issue being addressed, the general procedure is the same, and is outlined here for the setting of the harvest levels.

Scientists whose work centers on a particular species or species group, present written reports detailing the status of their assigned species and a recommendation of a catch level—termed the acceptable biological catch (ABC). There is no set formula for setting ABCs for the Alaska fishery resources. Generally the recommendations are conservative and are in response to changes in abundance as indicated by resource surveys conducted by the National Marine Fisheries Service (NMFS). These reports along with their catch recommenda-

tions are then subject to two levels of review. Initially, the reports are submitted to the Plan Teams (PTs) of the North Pacific Fishery Management Council.

There are two plan teams for the NPFMC as there are two FMPs. One covers the Bering Sea and Aleutian Islands fisheries and the other the Gulf of Alaska fisheries. The PTs' members are drawn from the academic community, the International Pacific Halibut Commission, the NMFS, and resource agencies of the states of Alaska, Washington, and Oregon. The setting of annual harvest quotas and limits on bycatch, are provided for in the plans.

The PTs review the fish stock assessments and provide their own recommendations of ABC levels for the groundfish species managed by the fishery management plans. Generally, the teams concur with the authors of the various stock assessments in setting ABC levels. When they differ, the teams must document their differences and provide an ABC recommendation.

The MFCMA specifies that each Regional Management Council shall appoint a Scientific and Statistical Committee (SSC) for advice on scientific and other technical matters relating to Council functions. The NPFMC has a 12-member SSC composed of scientists from the fields of biology, statistics, economics, and sociology. The Act also permits the formation of other advisory bodies considered necessary by the Councils. The NPFMC appointed a 21-member Advisory Panel whose members represent major segments of the fishing industry; catching, processing, subsistence fishermen, and sport fishermen, as well as environmental interests. Both the SSC and Advisory Panel meet immediately before each Council meeting.

Preliminary groundfish harvest quotas for next year's fishery are initially set in September and finalized in December. The fishing year begins January 1 for most fisheries, although there are an increasing number of exceptions due to conflicts involving bycatch and marine mammals. Prior to the Council meetings in September and December, the SSC reviews the written stock assessments, the Plan Team recommendations of ABCs, and various other issues with which the Council is dealing. The SSC, with the Plan Team chairs, makes its own recommendation of ABC levels. Many times they concur with the Plan Teams' proposed numbers, but in cases where they differ, the SSC provides its own recommendation and justifies the modification. The Advisory Panel also reviews both the Plan Teams and SSC recommendations, but their function is one that deals largely with the allocation of the overall fishery quotas among the user groups.

The Council, prior to setting the harvest quotas, receives reports from the Plan Teams, the SSC, and the Advisory Panel at their September and December meetings. After consultation with, and public testimony by scientists and other members of the industry, the Council members set the harvest quota for each species. The quotas must be approved by the Secretary of Commerce before final implementation.

Role of Science in Fisheries Management

The decisions made by the Councils can have significant impacts on the health of the resource, the abilities of the fleet to harvest and process the available quotas of fish stocks, and also can cause major redistributions of catch and revenue among competing user groups. Therefore, it is essential that the Council process incorporates the best available scientific information, both to preserve the long-term viability of the stocks, and to promote the health of the industry which utilizes those stocks.

The role of science in the management process is really three-fold: a) to design studies that gather the necessary basic data that leads to an improvement of our overall understanding of the impact of exploitation on fish stocks and how the fisheries operate, b) to ensure that the correct methodology is used in the analysis of current proposals with the existing data, and c) to assist in interpreting the implications and results of the studies by placing them within the proper context of uncertainty.

The scientific information provided to the Council must be reliable and unbiased. Often the information is imperfect and includes a great deal of variability. These caveats must also be presented with the scientific information. Very often, the effects of exploitation on the resource, or the effects on the industry of proposed management measures cannot be straightforwardly deduced. It then becomes the role of science to provide an analysis of the likely impacts and risks associated with management measures. The scientist must first choose the proper data sets to be analyzed. Then, the proper analytical techniques must be applied. It is important that the major weaknesses of the data sets and the assumptions used in the analyses are clearly pointed out. The manager needs to know the reliability of the data upon which decisions are based. This also allows the analysis to be reviewed. A clear reliable analysis should be subject to review, and should be able to withstand scrutiny.

Thus the role of science is to essentially provide information at many different levels and in many different ways. There is a fundamental need for information on the effects of exploitation. It is important to provide information on the natural variability of the fishery resources, and to determine how exploitation will affect the natural biological processes.

Decisions are not based on the biological impacts alone. An increasingly important part of the scientific process is the associated economic analysis. These fishery stocks will be used; the key questions become at what level and time that use should occur and by whom. Each and every management decision carries with it the cost of regulation and enforcement, in addition to the costs imposed on segments of the industry or society. Benefits gained from an action must offset these costs.

Part of the intent of the MFCMA was to give preferential access to U.S. fishermen over foreign interests in all EEZ fisheries. As the U.S. presence in the prosecution of these fisheries has expanded and the competition for the resource has become internalized to various segments of the domestic industry, the Councils have been forced into making more and more contentious allocation decisions.

The groundfish catch off Alaska has become an important segment of the total U.S. fishing industry with over 40.7 percent (1,808,200 mt) of the catch. This represents 13.1 percent ($447 million) of the total ex-vessel value—meaning the return to the harvesters of the value of the raw fish caught—of the 1990 catch off U.S. shores (Fig. 1) (NMFS 1991). The value of this resource to the U.S. is even larger, once at-sea and shore-based processing of the raw fish is taken into account. These fisheries are a major contributor in terms of generating income, exports, and employment opportunities.

Council decisions that do not appear to have a reasoned and well-documented justification for their acts can lead to the perception of unfairness and could cause lack of faith in the entire fisheries management system. As the race for fish and expansion of effort continues to intensify the competition among user groups, the Councils will find themselves having to make increasingly tough choices with regards to allocations of these very valuable fishery resources.

The following section will describe some of the current issues facing the NPFMC that require scientific input into the process: the setting of ABCs, growing conflicts with marine mammals, the "race for fish" caused by over-capitalization of the fisheries and bycatch concerns.

Some of the More Pressing Issues From the NPFMC

A. Biological Issues

1. Recommendations of Acceptable Biological Catch

The recommendations of ABCs are the basis for the setting of harvest levels. This is an annual process in which scientific input is critical. It is important to provide information on the natural variability of the fishery re-

sources, and to determine how exploitation will affect the natural biological processes. Fisheries managers need to know what levels of exploitation can be sustained, and at what expense. They need to know if there will be sufficient spawners to ensure future generations. In addition, the potential number of new fish that will be available to the fishery for harvesting (recruits) is of vital interest to the industry and is an important component of setting the annual quota levels. The current status of a fish stock is important to know as well as the potential trend in abundance given exploitation and other management measures. The increasingly large number of participants in the fisheries, each hoping for an adequate share of the resource, places a great deal of pressure and scrutiny on the recommendations of ABCs.

2. Marine Mammal Interactions

Marine mammal interactions with commercial fisheries have become important considerations in fisheries management in the North Pacific. These interactions can occur directly through harassment near breeding and feeding areas or entanglement in fishing gear, or indirectly through competition for food resources. In November 1990, the northern sea lion (Eumetopias jubatus), whose population has declined significantly in the North Pacific over the last 30 years, was listed as threatened under the Endangered Species Act (ESA). Numbers of harbor seals (Phoca vitulina richardsi) have also dropped precipitously since the mid-1970s (Pitcher 1990), and the status of this species with respect to listing under the ESA is currently under review.

A major portion of the diet of northern sea lions and harbor seals is comprised of walleye pollock (Theragra chalcogramma) (Pitcher 1980; Calkins and Goodwin 1988), which also supports large commercial fisheries in the eastern Bering Sea (EBS) and Gulf of Alaska (GOA). Although a causal relationship between direct and indirect effects of commercial fisheries and the sea lion decline has not been conclusively established, NMFS and the NPFMC have implemented measures to reduce the likelihood of significant interactions.

These measures spatially and temporally disperse trawl fishing effort for walleye pollock in the Gulf, prohibit trawling within 10 nm of all Steller sea lion rookeries yearround and within 20 nm of five rookeries in the eastern Aleutian Islands from January through April 15. Pollock quotas in the EBS and GOA are also set conservatively to reduce the potential competition for this food source. Studies are currently underway to determine seasonal and spatial differences in the sea lion diet, locations of their principal foraging areas and variability in their prey resource base so that other steps, if necessary, to foster the recovery of the sea lion population can be taken. Causes of the decline are most likely many-fold.

B. Economic and Social Issues

As the participants of the fisheries have changed so have the critical management issues. We are now faced with more than sufficient capacity to harvest and process the existing levels of the fishery resources off Alaska. The competition for the resource is no longer between foreign and U.S. interests, but has become internalized to various segments of the domestic industry. Given the dynamic nature of the fisheries and their immense value, the setting of annual catch quotas and their allocation among various segments of the industry can be highly contentious.

1. Bycatch Issues

For a variety of reasons, certain species, such as crab and halibut, are not permitted to be retained when harvested incidentally in trawl and fixed gear operations for groundfish species. Only fishermen in the directed crab and halibut fisheries are able to retain and deliver these species for processing.

Crab and halibut fishermen are concerned about the impact of the mortality of the discarded crabs removed by the groundfish fleet, and have sought over the years to find ways to limit or reduce the incidental taking of these species by groundfish operations. In general, this concern has resulted in the imposition of annual prohibited species caps (PSCs) or overall limits on the groundfish fleets. Once the cap is reached, groundfish operations must stop fishing in order to avoid the further taking of the prohibited species, even if there is still remaining quotas for various groundfish species.

Groundfish fishermen have had to forgo considerable revenue when they have been unable to prosecute the groundfish harvest to its full level, and have sought to use the Council process to modify the impact of the PSCs. The Council has responded by dividing the overall PSC for halibut and for crab among the different target groundfish groups, so that fisheries that have lower rates of bycatch would not be closed out by those who had a higher incidental catch of the prohibited species. In addition, partial closures of fishing grounds occurred in areas that have traditionally had higher bycatch rates.

While this approach has reduced some of the negative impacts of the overall caps on

Magnuson Act Language

According to Section 301 of the Magnuson Fishery Conservation and Management Act, in general, any fishery management plan, pursuant to this title shall be consistent with the following national standards for fishery conservation and management:

1) Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry. (2) Conservation and management measures shall be based upon the best scientific information available. (3) To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination. (4) Conservation and management measures shall not discriminate between residents of different States. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges. (5) Conservation and management measures shall, where practicable, promote efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose. (6) Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches. (7) Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

the groundfish fisheries, it also requires an increasing amount of information in order for the fishery manager to correctly apportion the caps among the various groundfish fleets. In addition to ascertaining the impact of the incidental removals on the health of the halibut and crab stocks, the Council must now also be aware of the difference in bycatch rates, relative costs and values of the different groundfish stocks, and the anticipated amount of groundfish foregone within a directed groundfish fishery once its share of the cap is reached.

If the Council gives "too much" of the cap to a given groundfish fleet, such as the midwater pollock fishery that has a relatively low bycatch rate of halibut and crab, then it can prosecute the full amount of its groundfish and have surplus PSC remaining at the end of the year, while another groundfish fishery would be shut down for not having sufficient PSC to utilize while harvesting its groundfish species. Also, within each directed fishery, individual fishermen have little or no incentive to modify their fishing patterns to avoid bycatch species if it would also slow their rate of groundfish harvest. Other vessels within the fleet who do not likewise modify their operations could take the PSC limit thereby closing the entire fishery. Thus, this system may actually intensify the "race for fish" among fishermen before they are all closed out by the PSCs.

In recent years, other fishermen, such as those who target on salmon and herring, have sought to gain the same protection for their stocks as have crab and halibut fishermen. If this trend continues, the Council will be forced to spend more and more time attempting to determine the annual levels of these caps and the appropriate division of that cap among groundfish fleets.

A variety of bycatch solutions are being proposed, but the Council appears to be moving toward a long-term solution that would incorporate more individual vessel incentives, and would allow for appropriate trade-offs among the marginal values of harvesting the different stocks in response to changes in prices. A market-based solution would increase the efficiency of the overall fishery and would reduce the costs of harvesting the combined resources.

Further biological research on the interactions and relationships of the various stocks is crucial in order to be able to address the impacts of these removals, as is economic analysis of the various firm structures and the implications of moving from a less centrally planned solution. If this approach does work for the traditional bycatch concerns, it could potentially be applied to the incidental taking of marine mammals by these same fleets. As these animals are highly valued by society in general, fisheries management needs to find a way to protect their populations with the lowest cost of that protection being imposed on commercial groundfish operations.

2. Social Issues

As noted previously, an increasing number of the Council's decisions deal with the allocation of the commercial fishery resources among competing user groups. From an efficiency viewpoint, in order to best benefit society or the nation as a whole, the fisheries should be managed in order to harvest the quotas at the lowest cost (where costs include impacts on other fisheries and stocks).

However, although the benefits of these resources can accrue to consumers throughout the nation, indeed the world, the costs are often imposed on a much smaller segment of the population. At times, there may be concern with the impacts of the management decision on a local community or region. This is especially true for the fisheries managed by the NPFMC. Even though the area managed is federal waters, all the waters are off the coast of one state, Alaska, and many of the local communities there are highly dependent on fishing resources.

Given the natural variability of fish populations, many managers are concerned with ways to maintain a relatively stable economic health for these small fishing communities. Science can be of some assistance to the fishery planner with these concerns as well, by attempting to determine and predict changes in population levels that could reduce these communities' access. In addition, they can also provide estimates of efficiency loss and other trade-offs the Council might make in its attempt to preserve these local communities.

The fisheries stocks and the waters in which they reside provide many benefits to the nation, beside their commercial use. These values from recreational fishing, from contributing to the health of marine mammal stocks, from maintaining or creating jobs and income for individuals, or from preserving the less tangible benefits of a certain lifestyle must be accounted for in order to provide an accurate measure of the implications of a proposed management measure.

Conclusion

At the heart of fishery management is the idea of conservation, which carries with it an implicit awareness of the value of preserving the resource for future generations in making the decision on how to best use the scarce resources. Fishery management seeks to utilize the fisheries to garner as much benefit for existing users, conditional on preserving the stocks as viable entities into the future. All of this is done within the context of natural biological variability, uncertainty, and with imperfect information.

To ensure that the decisions made are the best for both resource and society, all or the most relevant alternative actions must be considered and the consequences of each be determined and evaluated. Only when the decision is based on the merits of the analysis can society be assured that the social, political, and economic values that are achieved or sacrificed during the policy process have been appropriately incorporated.

References

Calkins, D. G. and E. Goodwin. 1988. Investigation of the declining sea lion population in the Gulf of Alaska. Unpubl. Rept., Alaska Dept. of Fish Game, 76 p.

Marasco, R. and W. Aron. 1991. Explosive evolution-The changing Alaska groundfish fishery. Reviews in Aquatic Sciences, 4(4)-313 (1991).

National Marine Fisheries Service. 1991. Economic status of the groundfish fisheries off Alaska, 1991. Socioeconomic Task, Resource Ecology and Fisheries Management Division, Alaska Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration.

Pitcher, K. 1980. Food of the harbor seal, Phoca vitulina richardsi, in the Gulf of Alaska. Fishery Bulletin 78: 544-549.

Pitcher, K. 1980. Major decline in number of harbor seals, Phoca vitulina richardsi, on Tugidak Island, Gulf of Alaska. Marine Mammal Science 6:121-134.

Sandra Lowe (seated, below) has been a fisheries biologist with the Alaska Fisheries Science Center (AFSC) in Seattle, Washington since 1983. She is currently the chair of the NPFMC Gulf of Alaska Plan Team and is responsible for providing annual stock assessments and catch recommendations for various fish stocks. Her current areas of research focus on determining life history parameters and mathematical modelling of population dynamics of fish stocks. She received a Bachelor's in Marine Biology at California State University, Long Beach in 1983, and a Master's in Fisheries at the University of Washington in 1990.

Rebecca Baldwin (standing) is currently an economist with AFSC and a member of the NPFMC Bering Sea Plan Team. Her current research areas include market-based solutions to the fisheries bycatch problems. She received her Master's in Economics at the University of Washington in 1987 and is in the process of completing her Ph.D. in Forest Economics at the same university.

AS A TESTAMENT TO THE SPLENDOR OF THIS GENUS, E.K. BALON NOTED THAT "THE ARCTIC PEOPLE, THE INUIT, BELIEVE THAT CHARRS CAME FROM THE SKIES ON A RAINBOW AND HAVE REMAINED COLORFUL EVER SINCE."

BULL TROUT: BIG FISH IN A LITTLE STREAM

SUSAN ADAMS

Do you ever hear a story and wonder if you should believe it or just write it off as another exaggerated fish tale? For example, a friend returns from fishing a very small mountain stream in Idaho and tells you that she caught a 55 cm (21.6 inch) fish from that little stream, but it was so beautiful she let it go. Or someone tells you that in certain mountain streams of the Pacific Northwest resides a fish species that eats not only insects and other fish, but also snakes, frogs, ducklings and small rodents. They add that this same fish is such a voracious predator that it was once considered a menace and had bounties on it, but is now prized as a sport fish by many anglers who desire to save its dwindling populations.

Do these stories seem believable? Well, they could all describe bull trout (*Salvelinus confluentus*), a long-neglected, but fascinating fish native to northwestern North America (figure 1). These fish can reach up to 102 cm (40.2 inches) and 14.5 kg (32 pounds) while feeding on fish in lakes (Goetz 1990). They then spend several late-summer months migrating up small mountain streams to reach their fall spawning areas. It is awe-inspiring to see such large fish in a several-meter-wide stream where the water barely covers their dorsal fin. Some individuals repeat the spawning migration many times since they can live to be 20 years old (Goetz 1990). The average bull trout lifespan varies between locations, but ages of mature adults range from 5 to 20 years.

Bull trout from Coal Creek, Montana, held by Nick Hetrick (1983).

Bull trout are easy to see and to catch with lures or bait while in headwater streams. Once hooked, they put up a vigorous fight. This, in addition to the delectable dinner they provide, makes them a popular sport fish. They are the only native, non-anadromous (do not go to the ocean) fish that reach very large sizes in relatively sterile, mountain rivers of the Northwest. Anglers will travel great distances to certain sites—such as Montana's Flathead River—specifically to fish for bull trout. Thus, they are a valuable economic resource for recreation and tourism.

The historical range of bull trout extended from northern California to the Yukon and from the Cascade Range of Oregon and Washington to western Montana (figure 2). They are now extinct in California and in many Oregon rivers. Most remaining populations are shrinking in numbers (Goetz 1990). In February, 1992, the Oregon Chapter of the American Fisheries Society voted to petition the U.S. Fish and Wildlife Service for a status review to determine if bull trout warrant protection under the Endangered Species Act.

The name bull trout arose from the fish's broad head and aggressive feeding habits. They are not, however, actually trout. They belong to the same family as trout but are members of the genus *Salvelinus*, commonly known as char. Close relatives of bull trout include arctic char (*S. alpinus*), Dolly Varden (*S. malma*) and eastern brook trout (*S. fontinalis*). Bull trout and Dolly Varden were considered one species until 1978 when Cavender showed that they are actually distinct. They are difficult to distinguish visually, except that Dolly Varden do not reach the large size of some bull trout. They occur together only in a few areas of northeast Washington and southwest British Columbia. Most Dolly Varden are anadromous, whereas almost all bull trout are not.

Figure 3. Study location: Weiser River drainage, Idaho.

Resident bull trout, those that spend their entire lives in streams, may only reach 18-25 cm in length (Meehan and Bjornn 1991), while those that migrate down to major rivers or lakes after one to three years may grow to the large sizes prized by anglers. This is due to a change in diet from primarily insects in the streams to predominantly a variety of fish in the large rivers and lakes. Large bull trout in Flathead Lake, Montana, eat fish 43 percent of their own size, on the average (Shepard et al. 1984).

Over the past several decades, some anglers and fisheries managers gave bull trout a bad reputation because of their predation on juvenile chinook salmon (*Onchorhynchus tschawytchsa*) and cutthroat trout (*Salmo clarki*). Limits were seldom placed on how many bull trout could be kept, and over harvesting occurred in many areas (Simpson and Wallace 1982). Bull trout usually take four to six years to reach maturity, which makes their populations more susceptible than fast-maturing species to over harvest.

Factors besides over fishing that may be causing the decline of bull trout include destruction of their habitat by road building, mining, logging, and obstruction of migratory routes by culverts and dams (Fraley et al. 1989). Competition with the introduced eastern brook trout also appears to be a problem, since bull trout are declining in all areas where the two species co-occur (Goetz 1990). Few scientific studies have addressed the effects of human activities on bull trout, be-

cause most researchers have focused on aquiring basic information about the fish. In Idaho, biologists still lack complete distribution data on the fish. Without such information, it is difficult to manage effectively bull trout populations.

The northwest regions of the U.S. Forest Service classify bull trout as a Sensitive Species, which means that their population viability is of concern due to decreases in population numbers or density or in available habitat for the species. In order to learn more about the distribution and habitat requirements of these fish, the Payette National Forest is funding a Master's degree research project for me to study bull trout in west-central Idaho's Weiser River Drainage (figure 3). The study will focus on temperature and summer habitat requirements of juveniles.

The Weiser River drains approximately 4,100 square kilometers in a primarily basalt geologic area. Elevations within the drainage range from 2,477 meters to 895 meters at the confluence with the Snake River. The bull trout we have located inhabit the headwaters, above 1,525 meters, of several eastern tributaries.

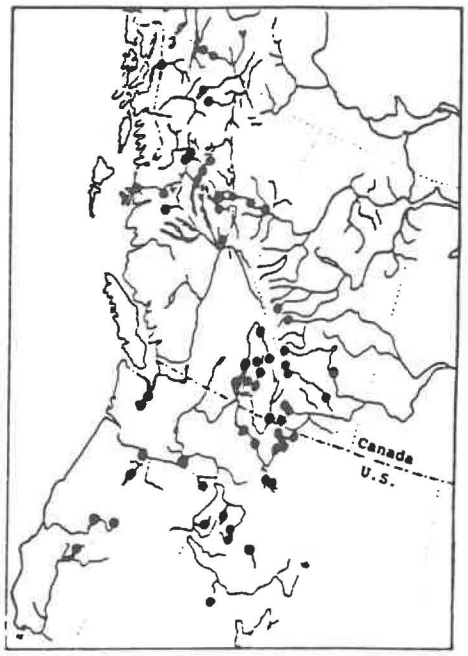


Figure 2. Minimum historical distribution of bull trout in North America (Adapted from Cavender, 1978).

We suspect that the existing populations of bull trout in the drainage are composed of resident fish and represent only a small fraction of the historical population size. Anecdotal information from people who fished in this area three or more decades ago indicates that bull trout were then plentiful in some of the tributaries of the Weiser River. Recent surveys by the U.S. Forest Service and conversations with local anglers suggest that few, if any, bull trout remain in most of these streams.

Most of the watersheds have been roaded, logged, heavily grazed by cattle, and water diversions are numerous in the lower reaches. These activities often reduce stream cover and increase sediment in streams causing stream water temperatures to vary beyond their normal range. Extreme temperature variation may be detrimental to bull trout which are usually found in streams whose mean monthly temperature does not exceed 12 to 15 degrees Centigrade.

Stocking of eastern brook trout and overfishing may also have contributed to the decline of the bull trout in the research project area. Finally, the Weiser River is near the edge of the species' natural range, which may cause this population to be particularly vulnerable to changes in habitat.

My study will provide distribution information as well as insight into the habitat conditions that juvenile bull trout require to survive here. Knowledge gained from the study will provide the Forest Service with a foundation for developing a bull trout conservation plan. The information will also be used to identify further research needs and may allow us to locate areas where the land uses can be modified to improve habitat for this interesting fish.

References

Balon, E.K., editor. 1980. Charrs, salmonid fishes of the genus *Salvelinus*. Dr. W. Junk Publishers, The Hague.

Cavender, T.M. 1978. Taxonomy and distribution of the bull trout, *Salvelinus confluentus* (Suckley), from the American Northwest. California Fish and Game 64(3):139-174.

Fraley, J.J., T. Weaver, and J. Vashro. 1989. Cumulative effects of human activities on bull trout *(Salvelinus confluentus)* in the Upper Flathead Drainage, Montana. Pages 111-120 *in* W.W. Woessner and D.F. Potts, editors. Proceedings of the symposium on headwaters hydrology. American Water Resources Association, Bethesda, Maryland.

Goetz, F. 1989. Biology of the bull trout, a literature review. U.S.D.A. Forest Service, Willamette National Forest, Eugene, Oregon.

Meehan, W.R., and T.C. Bjornn. 1991. Salmonid distributions and life histories. Pages 47-82 *in* W.R. Meehan, editor. Influences of forest and rangeland management on salmonid fishes and their environment. American Fisheries Society Special Publication 19, Bethesda, Maryland.

Shepard, B.B., K.L. Pratt, and P.J. Graham. 1984. Life histories of westslope cutthroat and bull trout in the upper Flathead River Basin, Montana. Montana Department of Fish, Wildlife and Parks, Kalispell, Montana.

Simpson, J., and R. Wallace. 1982. Fishes of Idaho. University Press of Idaho, Moscow, Idaho.

Susan Adams received a Bachelor's degree in biology from Carleton College in 1986. She worked seasonally for the U.S. Forest Service for the next six years in various jobs including volunteer backcountry ranger, helitack firefighter, and most recently, fisheries research assistant. Adams is currently working on her M.S. degree in fisheries resources at the University of Idaho. Adams is shown below sorting chinook salmon for spawning on the South Fork of the Salmon River, Idaho (1989).

THIS RESEARCHER STUDIES RIVERS AND SMALL STREAMS INSIDE THE SPREAD-OUT INDIANAPOLIS METROPOLITAN AREA. SHE REVIEWS HERE SOME OF THE RESEARCH FOCUSED ON THIS SOMETIMES HOSTILE SETTING FOR FISH.

CONSERVATION OF FISHERIES IN THE URBAN CONTEXT

GWEN WHITE

Introduction

Historians have long believed that our social landscape is shaped by watercourses because humans tended to settle inland in large groups beside rivers. The earliest known Western civilization for example, sprang up between the banks of the Tigris and Euphrates Rivers (Eckardt, 1979). Over the past 6,000 years, the Nile River has been managed as a common resource—perhaps longer than any other natural resource in history (Hammerton, 1972). And over time, watercourses subsidized the growth of pioneering cities by providing water, a means of travel, power generation, and waste products removal. Because of such uses, rapid industrialization depleted aquatic life in many large rivers such as the Thames of England and the Illinois River in the United States.

Like many growing American cities, Indianapolis, the focus of my study, was located on a large, presumably navigable river in the early 1800s (Logan, et al., 1922). Observers of the early life of the city note that the population grew steadily with little development of the steep banks along the mainstem of the White River; settlers were warned to stay away from lowlands because of regular flash flooding (Mahoney, 1990).

After World War II, repeated flooding caused by riverbank development in many cities resulted in the passage of the Federal Floodplain Protection Act of 1945. This Act initiated a permitting process for any proposed construction located within a floodway. Since then, over 1000 permits have been issued along the 288 miles of natural waterways in the 400 square mile city/county region of Indianapolis. Projections based on a consistent logarithmic increase in permitting activity indicate that more construction will take place during the present decade than in all 47 years since the beginning of the program.

Urbanization at the Watershed Level

The spatial pattern of floodplain construction in Indianapolis is changing over time. Initially, development took place in the central region of the city at the confluence of a large tributary and the White River mainstem. As urban sprawl set in during the next few decades, the zone of construction spread outward from downtown in an increasingly larger ring. The growing ring was superimposed upon a naturally branching network of streams, so that construction proceeded up the main river and outward into smaller and smaller tributaries.

As residents and businesses continued to leave the inner city for suburban fringes, negative effects on headwater streams were exacerbated. In Indianapolis, large reservoirs that were built for city water supplies attracted an influx of suburbanites. Nodes selected for these outer suburban centers created hotspots of localized, intense, and rapid construction around the few remaining wetlands, and small, previously undeveloped streams. Water quality and fish populations declined precipitously during initial stages of infrastructure layout.

In general, the longest streams historically saw the most activities. However, streams with subbasins of 20 to 50 square miles underwent an unusually large number of changes for their smaller size. Projections indicate that future activity in headwater streams and wetland sources will eventually surpass that in receiving streams. The dendritic design of river systems results in three to five times as many small streams as large streams in a given watershed. Therefore, the combined effects of the natural organization of rivers and the pattern of urban growth suggest that most development impacts will occur in small streams.

Fish Response to Watershed Development

What effect does this pattern of urban watershed development have on fish communities? Although studies have not *directly* addressed this issue, ecological theories and life history data can be applied in a predictive manner for streams. Accelerated disruption in increasingly smaller streams hypothetically could affect fish communities in at least two basic ways, one direct and one indirect.

•First, habitat diversity, protective cover from predation, spawning and rearing, and sources for recolonization will be directly disturbed or eliminated in tributaries.

Many fish species depend upon streams for spawning and rearing habitat. Smaller species and young fish of larger species live in shallower streams which sustain abundant, diverse food sources and are devoid of larger predators. In particular, mid-sized streams present a mixture of habitat types, support a fish assemblage consisting of both large and small river species, and generally demonstrate relatively high growth rates for young fish. These streams are found in the Indianapolis study area.

These tributaries also provide critical refuge sites in areas that are affected by human intervention. Researchers have noted that fish escape chemical and physical habitat disturbances in larger river sites by fleeing upstream into smaller tributaries (Gore, et al., 1990). These upstream locations then become significant sources of colonizing individuals after the perturbation is over (Binns, 1967).

The reverse situation also happens. Disturbed tributaries have been known to recover due to recolonization from downstream sites (review in Niemi, et al., 1990), but may be limited by physiological and life history traits of species. Unfortunately, if tributaries are becoming debilitated by construction, populations in downstream areas have probably already declined and do not survive in numbers necessary to encourage emigration and recolonization of recovering sites. Large river populations could be improved by maintaining refugia in backwater areas on the mainstem, but downtown construction near or on the larger river has often reduced the type of habitat needed to sustain those populations essentially eliminating this option.

•Second, other studies indicate that fish disturbed by instream construction may be crowded into upstream areas, effectively forming "island habitats" in reaches between work sites. Consequently, species may be lost inadvertently (or indirectly) from the community over time in a predictable manner,

according to island biogeography theory (MacArthur and Wilson, 1967; Gore and Milner, 1990). Habitat volume is one of the strongest predictors of species richness for fish in temperate and tropical streams (Angermeier and Schlosser, 1989). As humans encroach on the tributary, the stream is essentially shortened, reducing the amount of space available for populations of different species. Depending upon the duration and extent of projects, instream construction may interfere with migration, alter competitive relationships between species, or reduce vital habitat. These aspects will control the order in which species are eliminated.

Site Specific Habitat Change

The majority of the permits for construction in Indianapolis along a waterway were issued for development of urban infrastructure (e.g., bridge, general, utility crossing, outfall). All infrastructure activities and seawall construction took place predominantly on small streams and headwaters. Far fewer activities were associated with flood control (e.g., seawall, residence, levee, excavation, dam). The last four flood control activities occurred most often on larger streams and rivers. How do these actions affect fish habitat? Does the effect change depending upon the size of the stream?

Drawing again upon the work of earlier researchers, we note that their studies indicate a prevalent and serious effect of infrastructure development is increased sedimentation. Water quality may be altered on a short- or long-term basis. Equipment stirs up silt, which blankets gravel and sand substrates. Islands form downstream of bridges on larger tributaries, creating a braided, widened, shallow, and turbid channel. As channels fill in with sediment, the danger of flooding increases. At this point, city managers may call for clearing a channel. Channelization reduces habitat patchiness that may maintain competitively inferior species (Pringle, et al., 1988). Several studies demonstrated that over half a century was required for some fish communities to recover from channelization (review in Yount and Niemi, 1990). Dredging to remove silt has been cited as the single most debilitating impact on aquatic and riparian ecosystems (Coles, et al., 1989). Sedimention and dredging interfere with species that require clean, stable streambeds for spawning and feeding. And finally, in Illinois, siltation has been responsible for eliminating or greatly reducing more species than *any* other single environmental factor (INHS, 1971).

Site Specific Fish Response

In Indianapolis, county managers readjust the streambed by annually dredging an average of 3,000 tons of debris from watercourses. The only tributary site in Indianapolis with an extremely poor fish community had been dredged within a year of the survey done by Kingsley (1983). Even industrialized locations receiving most of the treated wastewater for the city were not as severely damaged. Other studies indicate placement of bridges and pipelines across streams reduced abundance and diversity of aquatic insect prey for several years. Nearly a decade after highway construction along streams, fish communities had not recovered to their previous composition (reviewed in Yount and Nemi 1990).

Darters and redhorse suckers have disappeared from much of the county in highly developed, industrialized downstream areas in Indianapolis. These pollution sensitive species feed on aquatic insects and prefer gravel or sand substrates for spawning. Habitat quality and corresponding populations of these species actually showed improvement along the mainstem as the river flowed into the transitional area from agricultural to suburban zones. Unlike mainstem areas above or below these sites, streams on the suburban fringe supported relatively complete forested banks, instream boulder cover, deep pools, clean sand and gravel beds, and no aquatic plant growth.

Removal of streambank vegetation—which is included in some "general" permits as well as miscellaneous activities such as channelization and removal of instream debris—causes an increase in water temperature and aquatic vegetation. These effects may be multiplied in urban streams. In cities, air temperatures are often already 5 to 10 degrees warmer than the surrounding countryside. Unnaturally high quantities of nutrients leach into streams from many sources, providing additional support for aquatic plant growth. Fish adapted to cool, clear streams will likely be most severely influenced.

Debris which has fallen across streams enhances flooding and thus economic losses in urban areas. Obstructions are regularly removed during stream maintenance. These structures play an important role in fish communities by retaining nutrient-rich organic matter, housing diverse prey, providing cover against predation, and altering flow. Some researchers have warned that these functions increase in relative importance for smaller streams (Bilby and Likens, 1980). As urbanization encroaches on smaller streams, maintenance and clearing activities may seriously interrupt ecosystem dynamics which support fish communities.

Research Needs

Rivers are the antithesis of an isolated ecosystem; they are so intimately connected to the landscape that they offer a portrait of surrounding land use conditions and reflect the health of a community. Many scientists believe that aquatic organisms, including fish, provide an economical, effective, and efficient means of detecting ecologically unsound development (Fausch, et al., 1990). It follows that fisheries management should become an integral part of urban development planning. And techniques do exist for assessing land use effects based on characteristic differences between fish communities in various sizes of streams.

Presently, most data on aquatic organisms are collected for specific *regulatory* purposes in urban areas. An abundance of information on sites located near sewage treatment and power generating plants on the main river was available for this study. However, very few collections were conducted on smaller streams. Without this baseline data, it is impossible to monitor the effects of land use in outlying areas or the importance of tributaries to mainstem fish communities.

In addition, few studies on fish have addressed the cumulative impacts of urban development. Again as a result of regulation, sites which have been altered during particularly large development projects have been examined for environmental stress. Stream ecologists agree, however, that river systems are intertwined. Changes in one location will reverberate within the system. Some scientists suggest two types of cumulative impacts should be monitored in the urban environment: 1) complex, nonincremental response to repeated actions at a site, along a channel, or within a watershed; and 2) secondary development resulting from an initial change in land use (Contant and Wiggins, 1991).

Stream organization is radically altered by engineering of flood control systems. Storm sewers, for example, change flow regimes within streams by transferring water between regions. Subsequent changes in the hydrology of urban areas in Indianapolis should be considered because of the importance of flow requirements for fish and their prey. Effects of industrial outfalls and releases of water from large dams has been addressed, but, unfortunately, not the design of stormwater diversions. Furthermore, genetic fitness of locally adapted fish populations may be altered by movement of individuals through artificial channels and is something that needs to be researched in urban settings.

Carefully designed disturbance-related experiments conducted in the urban-rural gradient could examine: 1) response to and recovery from disturbance; 2) influence of abiotic factors on fish populations; 3) effects of exotic species introductions; 4) stability of altered communities; and 5) population dynamics, especially with reference to life history, mobility, energy flux, physiological response to stress, and maintenance of genetic diversity. Understanding these pat-

terns would facilitate a planning process that preserves future options by conserving fish diversity and ecosystem health.

Urban Management Strategies

In conclusion, without additional attention focused on fisheries in urban areas, national goals of "fishable, swimmable" waters may be impossible to find for a growing majority of U.S. residents who now live in cities. (Nearly one third of all Indiana residents live in three cities along the White River, including the state capitol city.) Outside the cities, fragmentation of oversight responsibilities and overlapping agency jurisdictions have often been cited as a reason for poor management of natural resources. In contrast, the majority of actions taking place within a city's boundaries along urban streams (infrastructure development and flood control, for example) are directed by local government through one or two agencies usually called planning and zoning. Given adequate information, these agencies can adjust development patterns and improve fisheries resources in areas with a high public profile.

Land use in metropolitan regions varies greatly, from central industrialized areas to suburban fringes laced with agriculture. Scientists recognize that this gradient of land use poses a large unplanned experiment that is being repeated in cities around the world (McDonnell and Pickett, 1990). Chemical point source pollution in cities and nonpoint agricultural impacts on streams have been studied and controlled successfully in many areas. However, little research has been conducted on the response of fish communities to habitat changes caused by urban development. The question remains: Is it possible to identify patterns of urbanization along streams and adjust these actions so that healthy fish communities are protected?

Literature Cited

Angermeier, P.L., and I.J. Schlosser. 1989. Species-area relationships for stream fishes. Ecol. 70(5):1450-1462.

Bilby, R.E., and G.E. Likens. 1980. Importance of organic debris dams in the structure and function of the stream ecosystem. Ecol. 61(5):1107-1113.

Binns, N.A. 1967. Effects of rotenone treatment on the fauna of the Green River, Wyoming. Fisheries Research Bulletin No. 1. Cheyenne: Wyoming Game and Fish Commission.

Coles, T.F., J.M. Southey, I. Forbes, and T. Clough. 1989. River wildlife databases and their value for sensitive environmental management. Regulated Rivers 4:179-189.

Contant, C.K., and L.L. Wiggins. 1991. Defining and analyzing cumulative environmental impacts. Env. Impact Assessment Rev. 11(4):297-310.

Dargitz, R.E. 1990. Sport versus subsistence: The role of health advisories in supporting and sustaining an urban fishery. Paper presented to Popular Culture Assoc., March 7-10, Toronto, Canada.

Eckardt, W.V. 1979. Reclaiming our waterfronts. In: L. Taylor (ed.). Urban Open Spaces. New York: Rizzoli.

Fausch, K.D., J. Lyons, J.R. Karr, and P.L. Angermeier. 1990. Fish communities as indicators of environmental degradation. Am. Fish. Soc. Symp. 8:123-144.

Fox, R. 1987. Population Images. United Nations Fund for Population Activities.

Gore, J.A., and A.M. Milner. 1990. Island biogeographical theory: Can it be used to predict lotic recovery rates? Env. Mgt. 14(5):737-753.

Gore, J.A., J.R. Kelly, and J.D. Yount. 1990. Application of ecological theory to determining recovery potential of disturbed lotic ecosystems: Research needs and priorities. Env. Mgt. 14(5):755-762.

Hammerton, D. 1972. The Nile River - A Case History, pp. 171-214. In River Ecology and Man. R. T. Oglesby, C. A. Carlson, and J. A. McCann (eds.). New York: Academic Press.

Haub, C., and M.M. Kent. 1989. 1989 World Population Data Sheet. Washington, D.C.: Population Reference Bureau.

INHS. 1971. Illinois streams: A classification based on their fishes and an analysis of factors responsible for disappearance of natural species. Biological Note No. 76. Urbana: Illinois Natural History Survey.

Kingsley, D.W. 1983. Fisheries Survey of the West Fork of White River and Tributaries in Marion County, Indianapolis, Indiana. Ind. Dept. Natural Resources.

Leedy, D.L., R.M. Maestro, and T.M. Franklin. 1978. Planning for Wildlife in Cities and Suburbs. Pomona, N.J.: Urban Wildlife Research Center.

Logan, W.N., E.R. Cummings, C.A. Malott, S.S. Visher, W.M. Tucker, and J.R. Reeves. 1922. Handbook of Indiana Geology. Indianapolis: Indiana Dept. of Conservation.

MacArthur, R.H., and E.O. Wilson. 1967. The Theory of Island Biogeography. Princeton, N.J.: Princeton Univ. Press.

Mahoney, T.R. 1990. River Towns in the Great West: The Structure of Provincial Urbanization in the American Midwest, 1820-1870. Cambridge, Mass.: Cambridge Univ. Press.

McDonnell, M.J. and S.T.A. Pickett. 1990. Ecosystem Structure and Function along Urban-rural Gradients: An Unexploited Opportunity for Ecology. Ecology 71(4)1232-1237.

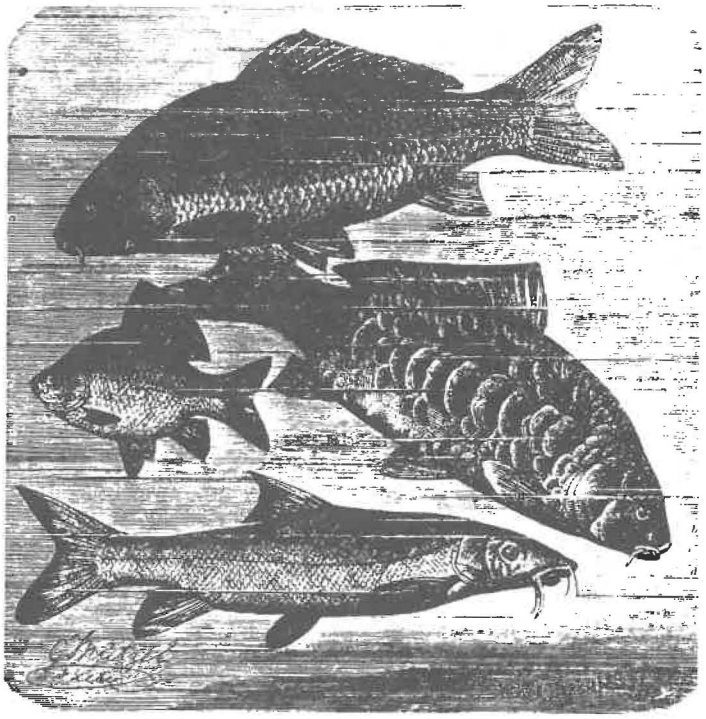
Niemi, G.J., P. DeVore, N. Deterbeck, D. Taylor, A. Lima, J. Pastor, J.D. Yount, and R.J. Naiman. 1990. Overview of case studies on recovery of aquatic systems from disturbance. Env. Mgt. 14(5):571-587.

Pringle, C.M., R.J. Naiman, G. Bretschko, J.R. Karr, M.W. Oswood, J.R. Webster, R.L. Welcomme, and M.J. Winterbourn. 1988. Patch dynamics in lotic systems: The stream as a mosaic. J. N. Am. Benthological Soc. 7(4):503-524.

WRI. 1992. The 1992 Information Please Environmental Almanac. Boston: Houghton Mifflin Co.

Yount, J.D. and G.J. Niemi. 1990. Recovery of Lotic Communities and Ecosystems from Disturbance—A Narrative Review of Case Studies. Env. Mgt. 14(5)547-569.

Gwen White is currently a graduate student in Conservation Biology at the University of Minnesota. Prior to entering the program, she received an M.S. degree in Zoology from the University of Maryland while studying the behavior of coral reef shrimp. White worked in the U.S. Peace Corps fisheries program in Honduras, and later worked with marine mammals at the Indianapolis Zoo.



FOR MOST OF US, THE LURE OF THE FISHING TRIP HAS LITTLE TO DO WITH HOW MANY FISH END UP ON THE STRINGER AND MUCH TO DO WITH JUST BEING THERE.

GONE FISHING

TERESA CATLIN

I always thought of fishing as a boring way to give yourself permission to sit by the creek. The thought of fishing always conjured up the stereotypical images of potbellied men in T-shirts sitting out in their lawn chairs by the side of a lake, ice chests full of beer by their sides, poles stuck in the sand, and, best of all, wives at home. Good old boy camaraderie, sort of an aging fraternity party.

Then, 11 years ago, I happened to be spending a great deal of time with an otherwise fairly normal man who, come spring and the beginning of trout season, ate, slept, talked, breathed fishing. Priding myself on my open-mindedness— and not wanting to pass up an opportunity to go back packing— the dog and I tagged along on a fishing expedition to the North Fork of the American River one fine weekend in late May.

We hiked three steep miles deep into the wilds of the American River canyon on a trail that alternately switched back on itself over slides of shale and bare rock, and wound through stands of sun-flickered pine and madrones. We could hear the river below us for a good half hour before we finally worked our way down to the boulder-strewn banks. The river was still fairly high, splashing and dancing its way under and around a half-submerged log, and cascading across a wide, shallow stretch of gravel before pouring into the pool at our feet.

"See the way that riffle there sort of makes a waterfall and runs into a deep pool? That's perfect for trout—lots of oxygen from the water falling through the air and splashing into the pool, and lots of food being washed down from the warm, shallow riffles above."

Assuming that I would, of course, be an enthusiastic convert, Kris had brought along an extra spinning rod and reel for me and plenty of extra tackle suitable for the beginner. Since the dog couldn't bait a hook, he was left to his own devices. Kris was already setting up the rod, putting together the sections he had taken apart to fit into his backpack, and attaching an artificial lure to the end of the line. This he handed to me, the beginner, and set up his own fly rod.

The purist approaches trout fishing as a game of wits and skill in which the fisherman attempts to beat the fish on the fish's terms, in the fish's world. With utmost respect for the trout's cunning perceptiveness, the fisherman attempts to fool the fish into biting into an artificial fly that closely resembles what the fish is feeding on at the time. He sneers at such gaucheries as the spinning lure and has no words contemptuous enough to fully express his disgust for the "inartistic and greed-riddled bait-using cretin", as Paul O'Neil so objectively puts it. Kris is not a purist, and has even been known to throw a few worm-baited hooks out when everything else failed, but spinning being easier for the novice, he took the fly rod for himself.

As we set out upriver, the dog trotting alongside attentively, Kris explained that the secret of catching trout was being able to "think like a fish."

"If you can think like a fish, you know where the fish are likely to be. If you were a trout, you'd want water with plenty of oxygen dissolved in it, like in the pools just beneath waterfalls. There's one back there. Deep pools provide hiding places for trout, and cooler water in the summer, which they like. Usually the trout will be at one end of the pool when they're feeding, or alongside rocks in the middle. The water behind large rocks makes a calm spot to rest in, and the water eddies around and concentrates food in one spot. See the more shallow, warmer riffles above the pool? They're just right to grow algae, so plenty of insects feed there and get washed down into the pool by the current. Insects are what you'll usually find in a trout's stomach when you clean him."

We paused at the head of a small pool and I tried casting my spinner downstream to a point just past a large boulder on the left-hand side of the river. The object in casting a spinner is to throw out enough line to place the lure in a spot just below the area you suspect has trout lurking in it (without tangling your line in the trees overhead or the bushes on the opposite bank), and then retrieve the lure by reeling up your line onto the reel attached to the handle of your rod. The action of drawing the lure through the water against the current causes it to spin and, you hope, draw a fish's attention. If the fish is hungry or even just feeling territorial, he may go for the lure and grab it in his mouth. Fish will take almost anything into their mouth, but are pretty discriminating about what they actually swallow. The key is to set the hook into the fish's mouth when you feel him hit the lure.

If, like me, you become so enthralled in watching your line float out across the water and settle at a point miraculously near where you had intended it to go that you forget to start reeling in, then your line and lure continue downstream until they become hooked in the rocks, or caught on a submerged branch or other snag. Without water flowing past the lure, it ceases spinning and becomes useless. It also becomes stuck.

Most of the time this calls for aggressive action. Off come the boots and pants and into the water you wade, reeling yourself in to the point where your lure seems to be caught. Most lures can be saved this way, but it may not be worth it. By now, any fish who may have been in the area will be well hidden and not easily coaxed out again for awhile. I was lucky though. After a little tugging, I pulled my lure free (minus one of the three hooks).

Further upriver, the water rushed over a hundred yards of gravel between wide banks undercut several feet by the current's action. Lined with over-hanging willows and alders, water plants trailed out over the water which crashed into the first of a series of three pools feeding into each other. Several casts into each pool with a small, gold spinner elicited no response from the trout who were almost certainly residents of the pools. I noticed quite a few small, black beetles crawling about on the bank foliage, many dropping into the water. The good angler must be part entomologist in order to present the fish with a lure or fly that is likely to look like fish food. I tried to think like a fish to decide whether these little beetles were tasty or not. If so, maybe the fish would go for a black, eighth ounce Panther Martin spinner. I snapped one onto the swivel at the end of my line and tried a few more casts. No luck.

Meanwhile, Kris had been turning over rocks at the edge of the river and found a few caddis fly larvae cases. We could see quite a few of the adult flies flitting about over the pools and banks. Kris decided that a fly resembling a caddis might be what the fish wanted.

Fly fishing requires more skill and finesse in casting than does spinning. In some cases the angler may want to cast the fly out to a particular spot and lightly set it

down to float or drift with the current. Other times he may want the fly to skitter and twitch on the water in imitation of a mayfly nymph shedding its skin. Most of the fly line is a thick, almost cord-like line to which is attached nine to fifteen feet of very light, thin, monofilament line called a leader. The fly is then fastened to the leader which is almost invisible when floating on the water.

Kris cast out a few times, flicking the line back and forth above his head and gently setting the fly down on the water, but apparently the fish were not hungry—or were just not fooled. Reluctantly (and with some persuasion), Kris decided we should call it quits for the night and go about the business of finding a campsite and setting up camp. The dog reminded us gently, but persistently, that he'd like dinner please, and we were inclined that way ourselves by then. Macaroni and cheese, backpacking style, was no match for fresh pan-fried trout, but we had high hopes for breakfast.

Early morning, clear and cold, the sun not yet up over the high canyon walls, we rousted ourselves out of warm sleeping bags and shivered around the camp stove making coffee. One cup later we're off, downriver this time, stalking breakfast. A squirrel scolded us from the top of a pine tree and a doe silently stepped back into the trees and vanished. It's great to be up and alive and out here—not another person around for miles. It doesn't take long to feel that you belong here and are a part of this place—these trees, this water, and this community of creatures. Neither of us spoke, not wanting or needing to disturb the muted sound of the woods and river folk waking to the day.

Around a bend we arrived at a long, shallow pool that was just catching the first rays of sun on its smooth, glassy surface. As we rigged our poles, Kris pointed out the occasional ripple and boil on the pool caused by a trout tail just breaking the surface of the water. It appeared that they are feeding on something on the bottom or just below the surface of the pool. As the sun climbs, and the air temperature begins to warm a little, we noticed one or two small insects rise to the surface and undergo an amazing transformation. In a matter of minutes, they wriggled out of their skins and became flies, awkward at first, bumbling around on the surface until finally they were airborne on their newly-dried wings. Kris said that these are mayfly nymphs shedding their larval "shucks" and metamorphosing into the next stage of their life cycle, the dun. Gradually, the pool seemed to fill with the nymphs, and trout begin to rise in response to the hatch, sometimes with a splash of tail and a leap out of the water.

At this point, Kris employed one of the fly fisherman's most effective tactics: "matching the hatch." He picked out an artificial fly that resembled the newly-hatched dun, a grey Quill Gordon, and attached it to his leader. Fifteen feet upriver and close to our side of the pool, a trout rose several times in the same small area. Kris cast the line up and back, and then out to a point just in front of the area the trout had been feeding in. He did this several times, twitching the fly slightly in imitation of the real fly's struggles. Suddenly, the trout struck and Kris jerked up on his rod to set the hook well into the fish's jaw. A flash of silver and the fish jumped two feet out of the water and ran straight downstream, taking a good 150 feet of line with him.

Kris followed down the bank, tripping on roots and vines, pulling in line with his left hand and reeling it onto the reel with his right in order to keep pace with the fish. Finally beginning to tire, the trout stopped and Kris began to turn him and get him coming the way he wanted him. Keeping his rod pointed up at a 45 degree angle, Kris pulled line in, pulling upward with his rod, then pointing it forward to reel the resulting slack onto the reel. The fish jumped again, this time running for the opposite bank, and Kris let him take all the line he wanted before he stops. The fight continues in this fashion for almost five minutes before Kris finally pulled the silvery, green-speckled fish onto the shore. The dog inspected him carefully, jumping back each time the fish flopped.

The fish measured about sixteen inches from mouth to tail. Kris said it may be a steelhead. It is generally accepted that a steelhead is an ocean-going variety of rainbow trout. Because a steelhead migrates to the ocean and spends several years there, where its growth rate is quite rapid, a steelhead rainbow is larger than its resident cousin of the same age. Both are *Oncorhynchus mykiss*, members of the family Salmonidae, which includes the salmon and whitefishes.

Because steelhead run upstream to spawn in either fall or very early spring, and this was late May, Kris decided that his fish is probably a large resident rainbow rather than a steelhead. He passed the end of the nylon stringer through the fish's gills and out his mouth, then through the metal ring at the other end, securing the fish on the stringer, and puts the fish back in the water. It brought tears to my eyes to see that strong and beautiful creature tethered to a cord, helplessly swimming back and forth in the water of the pool he used to own, and I asked Kris to kill him instead of humiliating him further. Fishermen usually try to keep their catch alive as long as possible to keep it fresh, but to this day I think of that trout, and I kill the fish I plan to keep as soon as I bring them in.

Kris caught another, smaller fish out of the same pool before we moved on downriver. The fish were all hungry that morning, and I caught my first one, a decent-sized rainbow, on a plain silver spinning lure. I did everything wrong when I felt that fish hit my lure—too excited to remember to reel in my line, I jerked my rod straight back, miraculously hooking the fish in the upper lip, and practically in one motion, flopped him out onto the rock I was standing on. Kris was incapacitated with laughter, the dog was impressed and I was ecstatic! I nearly lost everything several times (rod, reel, fish, dignity) trying to pick the fish up as he squirted through my hands and I fell off the rock. Finally Kris stopped laughing long enough to come to my assistance and we killed the fish and put him securely on the stringer. I was hooked, so to speak, on fishing, and at that point would have sold everything, quit my job, and spent the rest of my life fishing, despite the fact that I fished for two more hours that morning and did not catch another.

After the world's best breakfast—pan-fried trout rolled in cornmeal and lemon pepper—I settled down with a book and Kris and the dog went off to fish again. I watched him for a long time, a solitary figure slowly fishing his way up the river from pool to pool, dog faithfully at his side. A quiet, soft-spoken man, he is never more at peace with himself and his world than he was right then: alone, complete, content, sure that the best fish was probably around the next bend, up only one more pool, just one more cast away.

He returned several hours later, enough fish for dinner on his stringer, with a play-by-play description of the battle his last trout had put up. "Was that this big one on the end?" I asked. He grinned, embarrassed at being caught in his sentimentality. "No," he said, "I called it a draw and let him go."

We hiked out the next morning, leaving the rush and tumble of the river for the cool stillness of the forest above. At the top a few hours and a couple of thousand feet in elevation later, we thankfully released ourselves from our packs and loaded the dog and gear into the pickup for the trip back down to civilization.

As the forest gradually faded into grass-covered foothills, I pondered the appeal of carrying 40 pound packs six miles over a rocky trail in order to sleep on the dirt and spend several hours capturing supper. I think we humans have a need to reconnect with Mother Earth—her seasons, the interconnectedness of her community of creatures, the illusion of simplicity the natural world presents. We have a deep need to step back from life lived only in the frontal lobes of our brains and reconnect with our spiritual, animal, instinctual selves. The ritual of fishing, engaging all our senses and instincts as well as our powers of reason, allows us the feeling of belonging in the natural scheme of things.

Teresa Catlin is employed by the US Forest Service on the Colville National Forest as a forester trainee. She earned her Bachelor's in Animal Sciences from the University of California at Davis and is currently working on a Master's in Forest Resources at the University of Idaho.

CALIFORNIA'S HUGE RESERVOIR AND WATER PUMPING SYSTEM SERVES TWO-THIRDS OF ITS CITIZENS WITH WATER, BUT IMPACTS FISH ADVERSELY.

SACRAMENTO-SAN JOAQUIN DELTA AND ESTUARY CHINOOK SALMON

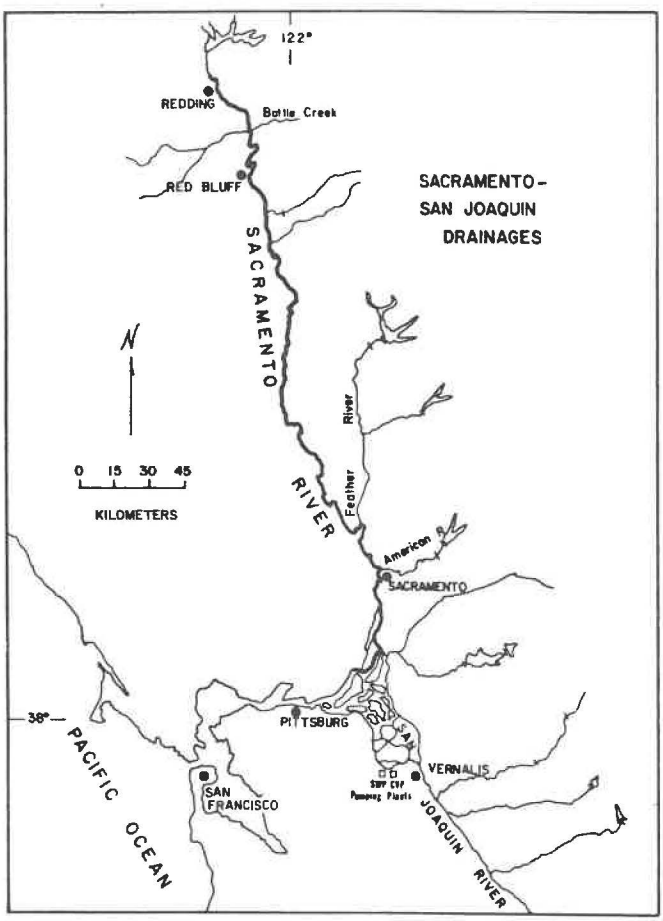
PATRICIA LITTLE BRANDES

The areas of greatest water demand in California occur in the southern part of the state and includes the San Joaquin Valley and Los Angles basin. California's hydrology is such, however, that the majority of precipitation occurs in the north. In order to transfer water from areas of high supply to those areas of high demand in Southern California, the state has created an extensive reservoir storage, pumping plant, and canal system. These water development projects have been constructed primarily to supply water for agriculture, domestic, and industrial use.

Many Northern California reservoirs and dams are designed to store water in the winter and spring months to be used throughout the year (see map). Once the water is released from the reservoirs, it flows down the natural rivers to the Delta where it is then pumped from the southern Delta via the State Water Project (SWP) and Federal Central Valley Project (CVP) pumping plants. (The Delta is defined as the triangular area between Sacramento, Pittsburg and Vernalis and is the critical point in transferring water from the Northern part of the state to Southern California.)

In this way, approximately six million acre-feet of water is annually being diverted through the Delta channels to the South Delta pumping plants. This system provides water for two-thirds of the state's population and irrigates roughly 4.5 million acres of farmland.

An important question fisheries biologists are addressing is: How has this diversion of water from the Delta affected fish? Although the Delta pumping plants have louver screen facilities that are designed to salvage fish, high direct and indirect mortality is associated with these diversions *before* the fish actually reach the screening facilities. Such mortality is caused by the salmon being diverted off their main migration path into areas of the Delta near the pumping plants. These waters have increased temperatures, predation, and river flows that *flow upstream* to the pumping plants. This is in addition to the direct losses of those fish that aren't adequately screened and are killed by the pumps.



Clearly there is not adequate protection for the fish in the Central Valley Rivers, San Francisco Bay / Delta and Estuary resulting in a great loss of all anadromous fish and many resident populations. Specifically, naturally produced chinook salmon in the Central Valley streams have declined by over 50 percent since 1950, when the Federal water exports began and is attributable to both habitat degradation in upstream and delta waterways.

The office I am a member of is the Sacramento-San Joaquin Estuary Fishery Resource Office (FRO) of the U.S. Fish and Wildlife Service. We are specifically responsible for evaluating the impacts of water development on chinook salmon in the Delta and Estuary.

Juvenile salmon use the Delta and Estuary for rearing and as a migration corridor to the Pacific Ocean, where they will spend two to five years. The salmon will again migrate through the Delta on their way to the upper rivers in both the Sacramento and San Joaquin basins where they will ultimately spawn and die.

The Upper Sacramento River is unique as it has four separate races of chinook salmon in its drainage. One of them, the winter run chinook salmon was placed on the Federal endangered species list by National Marine Fisheries Service in 1988.

The Sacramento-San Joaquin Estuary FRO has been in operation since 1978 and is a participant in the Interagency Ecological Study Program which includes five federal and three state agencies. The Interagency program is designed to evaluate impacts of water project operations on the fish communities within the Delta and San Francisco Bay and to recommend means to improve protection for these valuable resources. The Service is primarily responsible for conducting such studies on the salmonid resources in the Delta.

Field elements of our salmon project employ common fisheries sampling techniques and include beach seining, fyke and hoop netting, towing a midwater trawl net with a research vessel, and the use of mark and recapture experiments to estimate juvenile survival under different water project conditions.

To date our work has identified water temperature, diversion off the main channels, State and Federal water exports, and river flow as factors that influence the abundance, distribution and survival of juvenile salmon in the Sacramento-San Joaquin Delta and Estuary. Additional studies are being conducted to refine our knowledge and to monitor when the juveniles enter the Delta and when they are at greatest risk to the pumping plants.

This information is being used to develop recommendations to water users and the California State Water Resources Control Board on how impacts on the salmon resource from the present operation of the Delta can be lessened. Operational and structural measures are presently being evaluated to determine which measures will be the most successful and least costly to increase the abundance of salmon populations in the Central Valley of California.

Patricia Little Brandes is a Senior Staff Biologist with the U.S. Fish and Wildlife Service in Stockton, California. Her Bachelor's in Fisheries Biology is from Michigan State University. Since 1982 she has worked for the U.S. Fish and Wildlife Service and came to the Stockton office in 1983. Brandes is specifically responsible for directing the varied field and lab programs in addition to conducting data analyses and writing pertinent reports. She has also been an expert witness for the U.S. Fish and Wildlife Service during the ongoing Bay-Delta Water Quality/ Water Rights hearings.

Book Review of

Cold Tracks

by Lee Wallingford

(Walker & Company, New York, 1991)

Reviewed by Mary Stuever

I was dragging my kids through the public library the other day, arms full of children's literature. "Aren't you going to get an 'adult' book for you, Mom?" my four-year-old asked as we headed for the check-out counter. Wanting to acknowledge such a thoughtful gesture, I quickly scanned the new arrival rack, and this book nearly jumped into my hands.

Cold Tracks, A Walker Mystery the title read.

The cover pictured a stand of trees on a cliff. A quick glance at the comments on the back mentioned the Forest Service setting for the story. "Okay," I told my son, "I'll get this one." On to the the check-out counter.

I was so pleasantly surprised and entertained by this book, I'm even inspired to recommend it to all my kindred WiNR readers. The book features a female heroine, a Forest Service employee, written by a female author, Lee Wallingford, who, according to the jacket cover, also worked for the Forest Service.

This who-dun-it mystery is staged in the Oregon Coast Range amidst Christmas Tree farms, prescribed burns, timber sales, and project wildfires (off in California, of course). As a forester, I appreciated characters who were fire management officers, silviculturists, dispatchers, and tree farm managers.

The character development throughout the story is interesting, but I think Wallingford's women have the most appeal. I found I could relate to the real life challenges of rearing a family in the midst of fire season, forging a career in a male-dominated atmosphere, and quelling sexual harassment in the work place. Hopefully, throughout my career, I'll only encounter dead bodies and questionable characters in the form of entertaining fiction.

The main character, Ginny Trask, is a fire dispatcher, single mother of a creative nine-year old daughter, and who is well integrated into her community. She teams up with a newly hired Forest Service law enforcement agent who brings along a past from the Seattle Police Department.

I'm not one for revealing too many secrets when I recommend a book, but there is one tidbit I'd like to share. Again, with the jacket cover as my source, I'm glad to say that we can look forward to more Ginny Trask and Frank Carver adventures. As I do for other women in natural resources, I'm pulling to see Ginny advance to higher levels of responsibility and gain the respect she deserves from her peers.

Reviewer Mary Stuever is a forester and co-owner of Seldom Seen Expeditions, Inc., a natural resources and environmental education consulting firm based at Placitas, New Mexico. She worked for four years for the New Mexico Forestry and Resources Conservation Division, for Project Learning Tree and Project Wild, and as program director for the New Mexico Forestry Camp—a camp for teenagers. Her Bachelor's is from Oklahoma State University.

THE AMERICAN FISHERIES SOCIETY IS BEGINNING TO COMPILE THE DATA AND DO THE NEEDED PLANNING TO ENSURE THAT THERE WILL BE WOMEN AND MINORITIES TO FILL FISHERIES POSITIONS AS THE WHITE MALE POOL SHRINKS IN COLLEGES AND THE WORKFORCE.

EQUAL OPPORTUNITIES IN FISHERIES SCIENCES

JULIE E. CLAUSSEN
MARY C. FABRIZIO

Recently, there has been a growing concern about the predicted shortage of scientists. Much of the discussion revolves around the need to fill these gaps by recruiting women and minorities, groups that are currently underrepresented in science.

The scientific and engineering workforce is predicted to decline rapidly due to a projected shortfall of white males entering college, a group that has traditionally formed the pool from which scientists are drawn (Congressional Task Force 1989). The numbers of *all* college-age Americans are dropping and this group is expected to continue decreasing until the year 2000. At the same time, the Bureau of Labor Statistics predicts that the number of jobs in scientific fields will *increase* 27 percent by the year 2000. Blacks, Hispanics, Asians, and Native Americans, however, make up an increasing proportion of the U.S. population, and their proportional growth is fastest among school and college-age groups. Despite the predictions and the alarm generated by the statistics, little has been done to increase participation by the grossly underrepresented populations of women and minorities in scientific careers.

Effective strategies for reversing the trend in the decreasing number of students in the sciences must focus on making all topics in the sciences more accessible. Progress can be made by ensuring that underrepresented groups become knowledgeable about careers in science and by encouraging those individuals with a genuine interest in the sciences to remain in the field. It will be especially important to target women and minorities, groups that will comprise 85 percent of new entrants in the workforce by the year 2000.

Participation of women in AFS

In light of these predictions, many scientific professional societies are taking a closer look at the composition of their memberships and are beginning to establish programs to address issues confronting women and minorities. In North America, fisheries biologists are represented primarily by the American Fisheries Society (AFS). The AFS was formed in 1870 and has expanded to include about 9,000 members from many nations.

AFS has had some past successes in attracting women into leadership roles. As early as 1927, the AFS elected a woman, Emmeline Moore, to serve as its president. (Although statistics are lacking, it is unlikely that women constituted more than a few percentage points of the membership at that time.)

One prominent fisheries scientist, Dr. J. Frances Allen, pioneered the way for women in fisheries in several ways. Dr. Allen joined the society in 1949 and served as Chair of the Resolutions Committee, the Professional Standards Committee, and the Finance Committee. Her outstanding contributions to science were recognized by her appointment as a fellow of the American Association for the Advancement of Science (AAAS). Dr. Allen also served as the AFS representative on the AAAS council for many years. In honor of her research, teaching, and mentorship, AFS established a scholarship in her name. The annual scholarship is conferred to a woman Ph.D. student in fisheries science.

Two other women also should be noted for their roles in AFS: Janice Hughes and Johanna Reinhart, who served as Presidents of the society in 1983 and 1985. Today, a number of women are highly visible in the society, chairing committees and serving as elected officials of various sections, chapters, and divisions. Yet, there are few women who serve on the AFS Executive Committee, one of the driving forces of the society.

Although there has been a growing interest among society members to increase membership diversity, there was no way to reliably assess the number of women and minority members already in AFS. In 1989, the Equal Opportunities Committee initiated a "check-off" on AFS membership forms for ethnic and gender delineation. Thus, this optional "check-off" has allowed AFS, for the first time, to estimate the composition of its membership.

Of the 6239 membership forms received (by the end of September, 1991), 88.2 percent respondents were male. Of those males that responded to requests for ethnic delineation (78.5 percent), the largest male minority membership was Asian, with 2.2 percent. Hispanics and Native Americans comprised 1.0 and 0.7 percent of our male members, and only 0.3 percent of male members were black.

Total female membership in AFS was 11.8 percent in 1991. Of these respondents, 81.2 percent provided ethnic information. The largest female minority membership was also Asian (3.5 percent), followed by Hispanics (2.0 percent) and Native Americans (1.2 percent). Of all women respondents, only 0.5 percent were black.

Disregarding gender, members of minority groups represented 4.6 percent of AFS members responding to the optional "check-off". Most of these minority individuals (80.4 percent) were male. The ethnic composition among minority groups in AFS appears to be consistent with the general pattern reported for employed Ph.D. environmental scientists (Table 1). That is, Asians are the largest minority group, followed by Hispanics, then blacks. Note that percentages of these groups in fisheries are lower than those for environmental scientists in general.

With respect to statistics on gender, we can compare the composition of AFS to that of several other professional societies. Blockstein (1990) reported that women constitute about 15 percent of members of seven societies of the American Institute of Biological Science, although individual statistics ranged from 7 percent (American Society of Agronomy) to 40 percent (American Bryological and

Lichenological Society). The percentage of women in professional societies, such as AFS and ESA, is generally lower than in the life sciences as a whole; for example, the AFS is comprised of 11.8 percent women and the Ecological Society of America (ESA) is 19 percent women (Langenheim 1988). In 1988, women constituted 30 percent of all employed biologists and 25 percent of agricultural scientists (NSF report, 1990).

The statistics we present for the American Fisheries Society include only those members who responded to the "check-off:" however, they do offer some insight into the composition of AFS. We hope that in the future, more accurate information will be available to assess the diversity among AFS members. Also, other questions might be addressed, such as, what is the total participation of women and minorities in aquatic sciences in general and what proportion are currently members of AFS? Is AFS successfully attracting membership from a diversity of ethnic groups? Of those women and minorities in AFS, how many hold faculty positions, supervisory/administrative positions, technical positions? How do pay scales among groups compare? As these data are collected and analyzed, we can compare them to other surveys, such as the one being conducted by *Women in Natural Resources.*

We are also interested in determining the factors that motivate women and minorities to become fisheries professionals. Two sociologists from the University of Colorado at Boulder, Nancy M. Hewitt and Elaine Seymour, are studying the reasons why so many young women *drop out* of science careers. Eighty-eight percent of those students indicated that one of the major factors for dropping out was because of poor teaching. Furthermore, of the students who stayed in a science career, 51 percent complained of poor advising and an inability to find help with academic problems. If we know these critical factors, we can improve our efforts to reach young students at a time when career decisions are made. For example, an ESA survey of 200 women ecologists indicated that about 44 percent were initially motivated to pursue a career in ecology after participating in an undergraduate college course, especially one associated with a field station (Langenheim 1988). Knowing similar types of statistics for fisheries scientists, we can develop programs to foster greater interest by women and minorities in natural resources.

Activities of the AFS Equal Opportunities Section

As the leading professional fisheries society, the AFS needs to address the critical issue of future shortfalls in the number of aquatic scientists. Other organizations, such as the American Association for the Advancement of Science, and the Ecological Society of America, have been and continue to be active in sounding the alarm and urging new programs. Journals such as *Women in Natural Resources* are also very helpful in this regard. However, we cannot rely entirely upon efforts by others to increase the number of women and minority fisheries scientists. Science is broad—represented by interests as diverse as medicine, physics, and biology. The major emphasis of other societies is not in aquatic sciences, so an effort must be made to expose underrepresented groups to fisheries science specifically, as well as to encourage their continued career development in fisheries.

The AFS Equal Opportunities Section is aware of these challenges and is currently exploring mechanisms to stimulate interest in fisheries science and increase participation by women and minorities. Some of our goals and objectives include scholarships and travel grants for attending AFS meetings, support networks, mentorship programs for students and new employees, special symposia and workshops at AFS meetings, and regional committees to work on local concerns. In addition, the Equal Opportunities Section can provide AFS members with information on natural resources recruitment programs for women and minorities, opportunities for fisheries science coursework at various field stations (such as the undergraduate Program for Minorities in Marine Science at Shannon Point Marine Center, Western Washington University), sponsors of scholarships, grants, and financial aid (such as the list compiled by the Association for Women in Science), job networks, and the availability of cooperative education programs through various federal and state agencies.

Table 1. Composition of the membership of AFS compared to the number of employed Ph.D. environmental scientists.

		%					
	TOTAL NUMBER	WHITE	WOMEN	ASIAN	HISPANIC	NATIVE AMERICAN	BLACK
AFS	4,917[a]	95.4	11.8[b]	2.4	1.1	0.7	0.3
ENVIRONMENTAL SCIENCE[c]	19,787	91.8	8.4	5.8	1.6	NA	1.2

[a]Number of respondents providing information on ethnic origin
[b] Percentage based on 6239 respondents
[c] Statistics reported in Science *252:1113, 24 May, 1991, and based on an NSF survey of employed Ph.D. scientists*
NA = information not available

References

Blockstein, D.E. (1990). Women and minorities-how are the AIBS societies doing? Bioscience Vol. 40: 607-609.

Congressional Task Force on Women, Minorities, and the Handicapped in Science and Technology (1989). *Changing America: the new face of science and engineering.* Final Report. Washington, D.C.

Langenheim, J.H. (1988). The path and progress of women ecologists. ESA Bulletin 69: 184-197.

National Science Foundation. (1990). Women and minorities in science and engineering. NSF 90-310. Washington, D.C.

Julie E. Claussen, pictured right below, works for the Illinois Natural History Survey at the Center for Aquatic Ecology as an assistant research biologist. She is currently involved in research linking the concepts of conservation biology and population genetics to fisheries management. Her Bachelor's is from the University of Northern Iowa and her Master's is from the University of Toronto.

Mary C. Fabrizio, pictured left below, is a fisheries research biologist with the US Fish and Wildlife Service in Ann Arbor, Michigan. She serves as a specialist for the Fish Community Dynamics project of the National Fisheries Research Center-Great Lakes. Her Bachelor's is from Fordham University and her Ph.D. is from the Graduate School of Oceanography, University of Rhode Island. Her interests have focused specifically on fish population dynamics of both freshwater and marine species.

Large portions of this article are reprinted with permission from one which appeared in *Fisheries.* 1992. Vol. 17, No. 2.

QUERY

Josie Ross asks:

What did you do to prepare yourself to work for the Soil Conservation Service?

A California perspective.

Jennifer Martens
Ag Engineer
Gilroy Field Office

My interest in natural resources began at an early age learning about conservation from my father, whose career included working for the Civilian Conservation Corps and the Soil Conservation Service. After I decided to pursue a degree in Agricultural Engineering, I was discouraged by the Dean of the College of Engineering at the University of Illinois, who told me that I would never make it in the engineering curriculum. From that point on, of course, I was determined to get my degree in Engineering.

My college days were the first introduction I had to the very male dominated field of Agriculture and Engineering. There were three other women in our curriculum–out of 120 students. I learned that it took a while to be accepted by male students, but once we broke that initial barrier, things went well. Unfortunately there were no female professors in the department to serve as role models for the males to respect–or for us to emulate. This is something I wished the department had had.

My career with the SCS began in the summer of 1983 as a student trainee in a field office in central Illinois. I enjoyed surveying and learning about conservation first hand. That summer experience convinced me to stay in Ag Engineering, however tough.

After graduation, I worked full time as an Ag Engineer in an office in the midwest. It was great to finally use some of the tools I learned in college. I became exposed to a variety of subtle forms of sexual harassment, though. For a while the male co-workers in my office harassed me about another male co-worker I worked with out in the field. They described him as "a real animal with the ladies" and warned me not to be alone with him. Because I was young and single, I seemed to be an easy target for their harassment. My co-workers thought the comments were funny, but I was really offended and embarrassed. I did not tell the harassers how much the comments bothered me mostly because I didn't want to make the situation any worse. Luckily it stopped, but I have since learned to deal right away with harassment issues–and directly–with the other person.

In 1987 my husband and I moved to southern California. (The U.S. Navy gave us this opportunity!) For the last year and a half, I have been in an SCS Leadership Development Program, as well as serving as an Equal Opportunity Committee member. This has given me a chance to pursue training in management and also has gotten me involved with civil rights activities on a statewide basis.

I recently transferred with the SCS to northern California. I went from being the only engineer with my own office to one of two engineers sharing one office. At the old job, I did all of the engineering and had earned a lot of credibility over the three years I worked there. In my new position, I share engineering tasks, but also I am doing soil conservationist and management tasks—areas I want to pursue in the future. It did take a while to rebuild credibility with new coworkers, conservation districts, and landowners, But I've learned that when you move, there is always a trial period in which you are becoming adjusted. As I move, the variety of job experiences received from each office has made me a stronger person.

Malia Oliver
Soil Conservationist
Merced Field Office

I was 17 years old, a senior in high school and I needed a job. I didn't want the traditional burger-joint job, so I went to the high school work experience office to inquire about a possible secretarial position. It just happened that the field office District Conservationist also was there looking for a part-time clerk through the stay-in-school program. I was interested, so they sent me to interview at the local SCS office, and I was hired. I had no idea what the Soil Conservation Service was or what they did, but getting that GS-1 Clerk Typist position changed my life forever.

My mother had not finished high school; my sister dropped out her junior year; I was the only one in the family who would probably graduate from high school. I didn't know what I wanted to do. I just knew that I probably wouldn't be able to go to college because my mother (a single parent) surely couldn't afford to send me. So I had taken all the various secretarial classes to get a decent job that didn't involve working in a factory.

After I began working with SCS, I discovered that the agency's beliefs regarding conservation of natural resources and helping people were something I really bought into. I was learning so much, and I liked the idea of getting to work in the field. My supervisor, John Beyer, must have noticed my interest because near the end of my appointment, John asked if I would be interested in applying for a Junior Fellowship Co-op Program that would help me pay my way through school, plus give me on-the-job training for a technical position in the SCS. I applied and was turned down because I didn't meet all of the criteria (I was not an Ag major in high school and I was not in the top 10 percent of my class). But John believed in me and thought that I would make a good employee, so he wrote a letter of support and resubmitted my application. This time I was accepted. That is how it all began.

The Junior Fellowship Program was set up basically to hire technicians. My plans at that time were to attend Fresno City College, take my general education classes, then transfer to California State University, Fresno. After I got on the program, I worked for the SCS for three months, then I began school in the spring semester. This program worked wonderfully for me. I stayed at Fresno City College for five semesters, which really helped me financially. I took not only my general education classes, but as many science courses as I could fit in. I worked for the SCS during the summers, gaining experience and earning money to help me go to school.

After graduating with an Associate of Arts degree, I trans-

ferred over to the regular Student Co-op Program and worked a six month period before transferring to California State University, Fresno. There I majored in Agronomy, worked as a student aid to an Agronomy professor and in the Plant Science Department as a computer assistant. All the while I worked summers with SCS. I learned how the agency works: how to process ACP applications, Long Term Agreements, write conservation plans on both farmland and rangeland, and perform irrigation evaluations. I even had a hand in designing an outdoor classroom.

I graduated in 1986 with a degree in Plant Science (emphasis in Agronomy) and came on full time. Co-workers in my office later told me that they were hesitant about my appointment to replace a well-liked, productive Soil Conservationist. In a short-handed office, they were not looking forward to spending time training a new employee. My co-workers were pleasantly surprised that I was able to pick up where the previous Soil Conservationist left off because I was familiar with all of the programs. That was one of the great things about the Student Co-op Program. Another incentive was to get good grades. I was able to start as a GS-7 instead of the normal GS-5 because I kept my grade point average above 3.0.

If not for the program, I could not have paid for school. The co-op program certainly worked for me, as well as, I believe, the Soil Conservation Service. And I really owe a lot to John, who saw potential in me and didn't give up.

Polly Ann Huggins
Soil Conservationist
Fall River Mills Field Office

During my first years as a Soil Conservation Technician, I worked extensively with a Soil Conservationist who pushed me to excell and gave me hands-on experience with many projects. These covered a wide spectrum such as range planning, grass clipping, fisheries management, pipeline designs, critical erosion projects, and wildlife management. I also worked with staff from California Department of Forestry and received practical experience in burn and brush management. Those first years were fun and exciting and I learned to work hard physically.

Someone asked me during this time if I encountered problems because I was female. My answer back then was no. I was oblivious to the problems females face on the job, and I never took things too personally. The one incident I can remember was an older dairy farmer who always insisted on working with one of the "boys." But it did not bother me. My supervisor even asked me if I wanted him to talk to the farmer, but I said no and things were left at that.

After taking several job transfers to gain experience in new areas, I landed in the Madera Field Office, which is located in central California, working on the Food Security Act AD-1026 determinations. The AD-1026's are "highly erodible land and wetland conservation determinations." Any producer receiving financial assistance through USDA agencies must have this determination made before receiving payments. This was mandated by the 1985 Farm Bill's Food Security Act and this work takes up much of SCS field staff's attention. After spending a career working out in the field with natural resources, it was not easy for me to sit in an office and fill out this trail of paperwork.

During this time, SCS flew an Upward Mobility Position to convert a Soil Conservation Technician to a professional Soil Conservationist. I jumped at the prospect and got it. The Upward Mobility Program offers special opportunity for on-the-job training and formal study to promote employees at lower grade levels so that they can advance to higher grade levels. Under this program, I was allowed to attend college full time and work 20 hours per week while receiving my full salary.

It sounds great. Here I was, a single parent raising a nine-month-old daughter, working *and* getting my bachelors degree.

It wasn't all great, though. Some of the office staff I worked with were jealous of my Upward Mobility position. They resented the fact that I was going to college and it caused many hard feelings among everyone in the office. I really believe that most of the problems were due to jealousy and a general lack of communication about the program. Comments from other field staff were deliberately wounding: "The only reason you got the position is because you are a woman," or "You will never complete the program," were just the under-currents of how people were feeling. After talking to other people who have finished the Upward Mobility Position, I have found that my experiences were not unique. Even the male employees in the program experienced the same resentment and jealousy from their fellow employees.

Most of my problems came to a halt when, after my second year in the program, the administration told the field office that my job was to go to school and the negative comments were not to be tolerated. During this time, we also got a new supervisor who strongly supported the Upward Mobility Position and my going to school. His very vocal support of my position gave me the encouragement I needed to finish the program.

I graduated when my daughter was three and a half years old; I had a Bachelor of Science in Agricultural Communications and became a professional Soil Conservationist. I now think that all the hard times and adversity I faced under the Upward Mobility Program were worth it. I grew in two ways: from the classes I attended, and from learning to be tough while watching my back.

After receiving my degree, I transferred to the Fall River Mills Field Office in northern California. This area was not accustomed to single females with children who were career persons. In their experience, single parents were on some sort of government aid. But my supervisor has taught me that these social views can be countered by being very professional. So I speak to local groups and associations, work with ranchers and farmers in the field, and work extensively with the Resource Conservation Districts on special projects. At the moment, I am satisfied with this level of acceptance.

My next career goals are to become active in several professional organizations I belong to, to become a Certified Erosion and Sediment Control Professional, and to become a District Conservationist in a small rural community.

Kelly A. Gin
Soil Conservationist
Napa Field Office
Napa, California

The clients I assist are usually male farmers and ranchers who own and/or lease land. Sometimes these landowners hire a consultant or manager depending upon whether or not they have interests in a large amount of acreage. In addition, there are various engineer and geotechnical companies for hire.

SCS is often asked by the consultant or manager to review their project's proposal and/or provide erosion control advice. Through the Agriculture Conservation Program, sometimes the SCS can render federal cost share money for the project's construction. The manager then implements the project and becomes the spokesperson for the landowner. (A consultant's primary function is advisory.)

Rarely are there female clients, but when there are, she usually is the wife of the landowner or she might have a partnership with her husband in a land management company. A land management company does all the day to day work and/or farm management for the landowner using their own personnel. Often the landowners don't even live on the property because they have other financial interests besides farming.

The largest group of female clients of SCS is in the wine industry. In Napa County, they include presidents, executive managers, and winery owners.

As I interact with individuals in the local, state and federal agencies, the cultural diversity becomes wider and the number of females increase. I am, however, often the lone female among my colleagues in SCS, but this has never hindered me.

Gene's Market Monitor

Retirement Planning: Financial Advice by Gene Bammel

Planning for early retirement is something most workers should do. For one thing, it creates some financial goals and enables you to put some numbers on things. It also helps put your career in perspective: are you working because you love the work and want to do it till you drop, or are you working to earn the money that enables you to do the things you really want to do?

But *planning* for early retirement and actually retiring early, are two different things. I talk to many people who had planned to retire early, were financially able to do so, but have worked on into their 60s and 70s. I have also talked to many people who thought they would be financially secure when they reached their target retirement age, but decided that financial security was a chimera, an illusion, and have determined that they must work longer. Some lucky employees work for companies or organizations that have excellent pension plans—or create early retirement incentives—that make retirement very attractive. But the pension plans of the future, and the politics of social security, make early retirement impractical for more and more people.

The demon of inflation is temporarily at bay, but even at three percent, purchasing power is cut in half in 24 years. For those who want to retire at 50, by the time they are 74, they would need twice the amount of their initial retirement living income. Some pension plans will adjust for inflation, but the majority will not.

Health care costs rose about 12 percent last year. Some companies make very happy health care arrangements for their employees, but as health care costs rise, fewer and fewer companies will be able to afford accommodating the needs of their retirees. Medicare kicks in at 62. Retiring much before that could put your finances in jeopardy. (The costs of health insurance will be regulated by Congress within the next few years—but regulation creates two new problems for every one it solves.) When you run the figures for your retirement planning, estimate that your costs of health care will increase five percent per year for the years of your life expectancy. That means a doubling every 15 years. If you expect to live 30 years in retirement, and your projected health care costs are $3,000 your first year of retirement, in the last year of your good health they will be $12,000.

It requires a very large pool of savings to replace your monthly paychecks. Someone who spends $50,000 a year would need a nest egg of more than $1,000,000 to generate the dollars they will need to keep up that level of spending over 30 years of retirement. Investing for growth is quite a different matter from aggregating sources of dividend and interest income targeted to keeping spending at the level of salaried employees.

The upshot is, many people who plan on early retirement, might be well-advised to spend more money while they are young and can enjoy it, and then expect to work until they are 62 or 65—perhaps older. There are, of course, no guarantees about longevity. Think this way: hope to retire early, allocate savings so that retirement might be possible, but have a good time along the way, because circumstances may dictate that you be a productive member of the workforce until your sixties.

Because the SCS technical expertise costs very little, we are asked for help repeatedly by the same people. But I have only encountered one landowner who requested numerous site visits and recommendations and then totally disregarded advice—and failed to comply.

Whatever the situation, my attitude is to remain humble and do my best. Staying in contact with several advisors or co-workers also alleviates stress.

Sometimes maintaining composure is hard, though. I remember one situation when the owner of a land management company asked me whether I would have children soon and leave my job like the former soil conservationist. I replied that she does have children and still maintains a full-time position with the SCS and likewise I would too. But when I reflect back, I do think he was out of line for asking.

Fewer than 100 women in California are in a professional job series in SCS. Mobility, adequate child care facilities in remote areas, and recognition are issues we are concerned about. Only 15 years ago, an SCS employee was required to relocate (or be mobile) every few years. Today, mobility is not mandatory. Unless an employee has signed a mobility statement, they can remain in the same location to reach their current job series potential.

Female employees are also worried about the inadequacy of child care centers, especially in rural areas. Some centers close before a full-time employee finishes their workday.

Maxiflex was recently incorporated statewide and helps in many ways. An employee is given the flexibility to work during nonscheduled office hours and still achieve an 80 hour pay period.

The Federal Women's Program Managers are also interested in childcare, and one of them proposed a center in Yreka. A year ago, the Klamath National Forest and the Soil Conservation Service jointly sponsored a center's opening, so there are some successes.

SCS recognizes the need for more creative problem solving when it comes to the workforce. We held a nationwide conference "Toward Workforce 2000" in Sparks, Nevada in 1988. The committee reports and the conference proceedings have been distributed nationwide. A follow-up conference was held to consider action and to address other issues.

Just recently the conservationist and district conservationist grade series was raised which will be helpful to employees. And only a year ago, an adjusted pay increase began for those employed in high-cost living areas. For these reasons, women in California SCS are optimistic.

THERE ARE NO BLUEPRINTS AVAILABLE FOR CONSTRUCTING NEW TIDAL POOLS. BLM'S SALEM DISTRICT LOOKS TO SCIENCE FOR INFORMATION.

BLM CONSTRUCTS A NEW INTERTIDAL AREA ACCESSIBLE TO THOSE WITH DISABILITIES

TRICIA HOGERVORST-RUKKE
JACK DELAINI

In the early 1980s, an abandoned rock quarry at Yaquina Head, a mile-long headland on the central Oregon Coast near Newport, was transferred to the Bureau of Land Management. BLMs Salem District constructed a paved road to the Yaquina Head Lighthouse (circa 1871), added parking, interpretive signing, and provided interpreters at the site year-round. In 1991, 365,000 people came to see the lighthouse, nesting marine birds, whales off-shore in the Pacific ocean, and to explore the abundant tide pools.

Today, BLM is following this success with many additional developments to be completed in the next three to four years. Yaquina Head's lower quarry, which is about 10 feet above sea level, is being excavated to sea level. By September 1992, the contractor will have lowered the three- to four-acre quarry, built a paved road into the area, and added parking to what will become an intertidal area accessible to people with disabilities. A 20,000 square foot interpretive center is also planned for completion elsewhere on the headland by 1995.

BLMs concept of *constructing* a tide pool is a first-of-a-kind effort. Oceanographers are wrestling with questions such as "Exactly how much of the ocean do we let in and where's the best place to do it?" "Should the tide come in via a 'surge channel,' or should it be spread out?" "How can we 'armour' the base of the quarry walls against the erosive action of waves?" "Can we create a 'splash zone' which is safe for visitors but yet promotes the growth of barnacles and mussels which should inhabit it?" "Is there anything we can do to protect this area against storm waves and/or drift logs?"

Oregon State University zoologist Sylvia Yamada is serving as biological consultant. She and her students have been inventorying the marine life found at the mouth of the planned intertidal area. Based on their findings, she is predicting how and when the area will be colonized by marine life and how the tide pools need to be sculpted to accommodate as many types of intertidal animals as possible.

"We want to sculpt the area in such a way as to create a diversity of habitat such as shelves, benches, cracks, caves and tide pools. Sponges prefer caves, porcelain crabs need holes, sea urchins live in depressions in the rocks, and sculpins live in tide pools," noted Yamada. "Sea mussel beds take 30 or more years to establish naturally. To create beds, we will remove a patch of mussels from another bed, put a cage over them to protect them, and give them time to fuse to the rocks. Once established, they will perpetuate. Species such as barnacles and ephemeral algae colonize on their own quite easily and will probably move in within a year. Grazing snails will probably follow a year or two later," said Yamada.

Yamada is counseling retention of the existing basalt surfaces as much as possible to make the entire area resemble a natural tide pool.

Tides will fluctuate about 13 feet within the tidal zone so the planning team will have to determine where, how many and what levels the rock outcrops, deep and shallow pools, and other physical features ought to be.

Another question Yamada is pondering is: what will happen to the freshwater marsh now occupying less than five percent of the quarry. The marsh is a recent and spontaneous phenomenon BLM wants to preserve when the new zone is opened to the sea. And finally, the whole design has to conform to the parameters which the oceanographers determine must be met in order to have the area "behave" like a natural tidal zone.

Compounding these difficult design problems is BLMs firm commitment that persons with disabilities will have safe and relatively "easy" access to these tidal areas: safe pathways, gentle slopes which will attract intertidal organisms, traversable by those with mobility impairments even after having been underwater most of the day.

The designers will have to determine what experiences visitors will have when the area is completely or partially under tidewater (which is where it will be more often than not). Yamada believes that "it might be nice to have a large tide pool at a slightly higher elevation for when the tides are high. This would extend the time period when people could observe marine organisms beyond the best viewing time—at low tides.

During the spring low tides, Yaquina Head's natural tide pools have been a very popular destination for school field trips. In recent years, however, the number of school children from all over Oregon visiting Yaquina's tide pools has increased to between 7,000 and 9,000 per year.

Graduate students Deborah Brosnan (Oregon State University Department of Zoology) and Lana L. Crumrine (University of Oregon, Department of Biology) addressed this issue in their recently published study on the human impact on the Yaquina Head tide pools. They found one of the pools, the popular south cove tide pool area, to be heavily trampled, causing decreases in many of the popular intertidal marine life found there.

The proposed conversion of the quarry to a barrier-free area will help disperse the heavy use of this south cove area and open a new area for viewing the fascinating marine life.

Tricia Hogervorst-Rukke is the Public Affairs Officer for the Bureau of Land Management's Salem District in Salem, Oregon.

Jack Delaini is an Interpretive Specialist on BLMs Salem District. Prior to coming to the Bureau in 1991, he worked for the Oregon Department of Fish and Wildlife and the Washington Park Zoo in Portland, Oregon (1978-89). Delaini's Ph.D. is in museum education from the Claremont (California) Graduate School.

Photos this page of Silvia Yamada (with transect and camera) and Yamada's students taking transects at the mouth of the future intertidal zone. Debra Brosnan, graduate student Oregon State University, (in striped shirt) examines marine life.

PUBLICATIONS

Sea Wind: Bulletin of Ocean Voice International is a quarterly, non-profit journal edited by Dr. Don E. McAllister. Ocean Voice International of Ottawa, Ontario's goals are to conserve the diversity of marine life, to protect and restore marine environments, to enhance the quality of life and income of those who harvest marine resources, to promote the sustainable harvest of marine resources, to encourage the participation of harvesters in environmental decision making and management, and mutual cooperation. The organization is interested in education, training, research, and publishing work which will help to bring harmony between humans, marine life, and the environment. The journal reviews publications, has calls to action, carries news and notes about environmental concerns, and publishes short articles--about half of which are written by women. In a recent *Sea Wind* issue there were articles about amphipods, coelacanths, a review of wastewater and sewage treatment in North America, and Arctic Ocean icepack shrinkage and warming. There are several membership categories (and the organization accepts donations for their work). For information about memberships and publications, write to Ocean Voice International, Inc., 2883 Otterson Drive, Ottawa, Ontario K1V 7B2 CANADA (613-990-8819).

In Mary L. Sprouse's book *Sprouse's Two-Earner Money Book* (Viking Penguin) she admonishes families to consider the two incomes as a business. This means spending lots of time managing the money wisely and keeping the lines of communication open about how to handle it. Start by saving 5-20 percent of the income without fail every month. Next, set up a dedicated space in the home to get organized using filing cabinets for investment publications and bookkeeping. Use in and out baskets and tickler files to keep ahead of deadlines, to maintain good tax records, and keep up with the work. Open a single joint bank account to reduce fees and transfer any excess funds to a joint money-market account with a higher interest rate. Use no or few credit cards. Buy one of the bookkeeping software packages like Quicken (Intuit) or WealthBuilder (Reality Technologies) to help with taxes and investing. Batch related activities and dedicate a time to do them. Rotate the responsibilities so that both are familiar with all aspects of finances and taxes.

June Stephenson wrote *Men Are Not Cost Effective* (Diemer, Smith Publishing Co.) because murder, rape, burglary, and pollution are usually male pastimes. Males should be taxed at a higher rate to defray the cost to society of prosecuting and incarcerating them. To those who charge her with male bashing, she says that so then are the FBI and the Department of Justice male-bashers because most of their targets are male.

Although many men and women say that they would prefer not to work for a woman, studies show that women make good supervisors and employees are more satisfied with them than with male supervisors. Alice H. Eagly, professor of psychological sciences at Purdue University (Indiana) analyzed 368 studies of leadership which examined leadership styles of men and women. She concluded that both are equally effective as leaders, but women encourage subordinates to participate in decision-making and interpersonal relationships—thus women female supervisors got higher marks from both men and women.

Opportunities for Research and Study 1991 describes fellowships, grants, internships and other student funding sponsored by member centers of the National Council for Research on Women. Send $10 to NCRW, 47-49 E 65 St, New York NY 10021.

Bernice Sandler, Editor of *About Women on Campus* (Spring 1992), selected several books she recommends for unraveling the mysteries of male-female conversation and relationships. Deborah Tannen's bestseller *You Just Don't Understand* (Ballantine) looks at the huge gaps between men's and women's cultures. Regina Barreca wrote *They Used to Call Me Snow White But I Drifted* (Viking) which is about the differences in senses of humor and how that impacts relationships. *Moving the Mountain: The Women's Movement Since 1960* (Simon and Schuster) by Flora Davis is a series of interviews of activists, known and not-so-well-known, who were key players at the national and at the grass-roots levels of the women's movement.

Nancy Austin, columnist and a co-author with Tom Peters of *A Passion for Excellence* has a short list of recommended books for new managers to read. At the top of the list is Robert K. Greenleaf's 1977 classic, *Servant Leadership* which focuses on the well-being of employees and how they creatively respond to their superior. *The Female Advantage* by Sally Helgesen is another of her favorites because it addresses the myriad ways women have the edge in leadership. *The Grace of Great Things* by Robert Grudin is about sparking creativity and innovation.

BEACH FLEAS, SKELETON SHRIMPS, SCUDS, AND WHALE LICE: THE UBIQUITOUS AMPHIPODS.

ESSENTIAL TO THE AQUATIC FOOD WEB

KATHLEEN E. CONLON

Amphipods are those little comma-shaped shrimps that hop about when you overturn beach wrack at the side of the ocean or that sidle into crevices when you dislodge rocks at the lakeside. They go by the none too endearing name of beach flea, skeleton shrimp, well shrimp, scud, or whale louse, depending upon what they look like and where they are found. Amphipods are essential food items to many fish, seabirds, and whales—and they are important beach cleaners and food recyclers.

Related to shrimps, crabs, and lobsters, amphipods have probably been around for about 200 million years. They evolved in the ocean, but have since colonized fresh water, underground streams, caves, and moist tropical terrestrial habitats. Although little known, they are abundant and diverse. They occur in all oceans of the world from the high Arctic to the Antarctic, from the highest beaches to the deepest ocean trenches, and in estuaries, glacial melt pools, and most permanent bodies of freshwater.

The name amphipod comes from the greek for amphi, meaning "both kinds," and podos, meaning "foot." Amphipods are so named because of the way that their feet are directed: half forwards and half rearwards. The front-most legs are used for feeding, grooming, fighting, mating, and signalling. The middle ones are used for walking and making webs. The hind legs are used for walking and grasping. Behind the legs are three powerful pairs of swimmerets for swimming and aerating the gills and eggs, followed by a spiny tail fan for steering and digging. Amphipods are therefore capable of adopting a variety of modes of living.

Amphipods have evolved into four major lineages: the gammarids, caprelids, hyperids, and ingolfiellids. Gammarids are the most numerous and diverse, and are the most likely of the four to be seen. Caprellids are skeleton-like and usually found crawling like miniature loopers on filamentous algae and hydroids under floating docks and marina ramps. Hyperiids are free swimmers in the open ocean, or attach themselves to jelly fish and salps. Infolfiellids are worm-like and rare, living among sand grains. Nearly 6,000 species of amphipods have been described so far, classified into 97 families. More species are being discovered each year. There are probably more species of amphipods than birds.

Amphipods are not familiar to most, because they tend to hide and because they are small. Most are between 2 and 25 mm full grown, although some species that live in the deep ocean can reach 340 mm, nearly 4 inches. Some anphipods are fast movers, flitting amongst algae, swimming high above the bottom chasing plankton, or deftly burrowing into the shifting sands of wave-washed beaches. The more sedentary amphipods nestle under stones or amongst detritus, burrow into tunicates, sponges, coral, and sea anemones, or build their homes out of algae, sand, or detritus cemented with home-made "amphipod silk." Many are suspension feeders, capturing plankton and floating detritus with hairy antennae, or are algae cleaners, algae eaters, sand lickers, detritus eaters, predators, or scavengers. Some parasitize fish and whales; others bore into kelp and wood pilings. Amphipods can be pests to lobsters and crab fishers, attacking the bait and catches, or chewing the nets. Some amphipods attack scuba divers, leaving exposed skin sore and bloodied.

Many amphipods mimic the colours of their background and have banding or spotting patterns to enhance camouflage. Some mimic snails and sea slugs to avoid being eaten by fish. Others bear long spines to deter predators. The white band on *Chromatopleustes oculatus* causes this amphipod to look like a small air bubble as it wanders over kelp, cleaning small plants and animals from the fronds. Some amphipods live on stinging anemones and jellyfish which their fish predators avoid. *Hyperiella dilatata* captures a small mollusk called a sea butterfly and carries it about on its back for days. The sea butterfly is armed with a chemical defense against fish predators, and imparts immunity to the amphipod as well. Some algae eaters concentrate the toxins in their food to make themselves distasteful to fish. Many amphipods incorporate red pigments into their cuticle. Since red wavelengths are rapidly absorbed by water, red amphipods become invisible in deep water.

Amphipods are important elements of aquatic food webs. They rapidly convert dead material to usable organics. They keep beaches clean of cast-up seaweed, attack organic waste dumps, and clean algae of encrusting growths. They are the staple food of many whales, seabirds, and fish. Gray whales depend on bottom dwelling amphipods for sustenance. Other baleen whales eat pelagic amphipods. The tube dwelling *Corophium volutator*, which populates Bay of Fundy mudflats in eastern Canada, supports 50 to 75 percent of the world's three million sandpipers, supplying them with sufficient nourishment to complete their fall migration from the Arctic to South America. Other species of *Corophium* are essential to salmon fingerlings in North Pacific estuaries, where the salmon smolts fatten up and acclimate to salt water before progressing oceanwards.

(Continued on page 43.)

IF YOU FEEL RESPONSIBLE FOR THE RESOURCE, IF YOU LIKE AN OUTDOOR LIFESTYLE, IF YOU HAVE THE WILLINGNESS TO GO TO SCHOOL TO LEARN THE LATEST, AND IF YOU HAVE A HEAD FOR SOLVING PROBLEMS, THEN "BIRTHING" FISH MAY BE FOR YOU.

SMALL HATCHERY, GREAT JOB

KATHY CLEMENS

I worked in a fish hatchery when I was going to school. This particular hatchery was Coleman National Fish Hatchery located "out of" Anderson, California. It was a summer and weekend job, good money, but not necessarily what I wanted to do with my life. My interest, I thought, was in wildlife. Well, I graduated in and was immediately hired on at the fish hatchery. Of course I started at the bottom. A Bachelor's only got me a GS-4. This was also a time when women were few and far between in positions other than clerical. And if you've heard before that women had to work twice as hard as men just to be accepted, it was certainly true in my case. I can't tell you how long I fed fish and cleaned ponds before I was "allowed" to do other jobs.

I am now managing a small Spring Chinook Salmon Hatchery in the mid-Columbia River Basin. It is Entiat National Fish Hatchery, located out of Entiat, Washington. (Very few hatcheries are located "in" anywhere.) It is part of the Leavenworth Complex, situated at the eastern base of the Cascade Range. I think it is beautiful here: we have sage brush and orchards on one side, and forest on the other. I have three horses and am very fortunate to be able to keep them here on the hatchery grounds. For the outdoor lifestyle that I like, it is almost perfect.

To get here, I worked at several other hatcheries, worked as a disease biologist, and had extensive training at the Leetown, West Virginia "long course" run by the Fish and Wildlife Service. Among the courses offered is the one I took—the Fish Health and Disease Diagnosis Long Course. Ours was five months in duration; previous courses had been seven to nine months. But it is five days a week, eight hours a day, taught by professional educators or other top professionals in their fields. Every aspect of fish health was covered, from specific diseases to stress and physiology. It was pretty intense at times, but definitely worth the work. There were 15 students in my class (eight women, a first) from all over the country. There were federal people, as well as state, tribal, and private sector folks. (Previous classes even had foreign students.) The course is held every four years or whenever there is enough need for trained fish health professionals, so there is limited space and lots of competition to get in.

The production goal at this station used to be 800,000 smolts—18 month-old fish. It is now 400,000 smolts and 400,000 zero age (six-month-old) fish. This change was brought about for fish health considerations. At one time the Entiat River used to be the main source of water for the hatchery. There are free-ranging fish above the hatchery intake, so consequently, there are *many* disease problems associated with using Entiat River water. There are also new data showing that reduced densities definitely affect positively the survival of Spring Chinook Salmon. So, now all of the fish are reared on well/spring water and our limiting factor due to reduced density is that we have only enough water to raise 400,000 smolts.

In order to maximize what water we do have, we had to reorganize production. Our zero age fish are released in May. Their size is larger than their siblings who are kept as yearlings because of even lighter densities and increased feeding rates. Zeros do not survive as well, but until we get more water (which means more funding) that is what we are capable of doing. Most station production goals are set by the capacity of the individual stations. That is true here, although other agencies, the tribes, and the state of Washington sometimes get involved, making things more complicated.

There are a couple of things that I am proud of that I've been able to accomplish here. Up until last year, the adult pre-spawning mortality was 30 to 50 percent. Last year, we managed a 5.4 percent rate. Also, for the first time (in who knows how long) Entiat did not have any BKD (Bacterial Kidney Disease) in their yearling fish. Normally, loss would start in October and continue to April, averaging three percent per month. Reduced densities and clean water plus a lot of hard work by the crew made the difference.

I do enjoy my job. It is a challenge to try and meet production goals with old facilities, old ideas, little money, and the unforseen. Just when you get everything planned out, something always seems to go wrong—or just different. Granted, hatchery work isn't as exciting as habitat work or stream surveying, but it is a necessary part of our role as stewards of the resource.

In an ideal world, it would be great to have all wild fish. But until there is no habitat degradation, no more dams, no more harvest on the fishery, hatcheries play an important role. The wild populations cannot stand the continued insults that befall them. I feel my job as a hatchery manager is to put out the healthiest and best product that I can.

Kathy Clemens is Supervisary Fishery Biologist and Assistant Hatchery Manager at the US Fish and Wildlife Entiat National Fish Hatchery, Leavenworth National Fish Hatchery Complex. She has worked for the USF&WS in various capacities and in five stations (beginning as a temporary) since 1975. Prior to that she spent four years in the Air Force as a medical laboratory technician. Her Bachelor's degree is in Biological Sciences from California State University-Chico.

Photo at left shows staff injecting adult salmon with Erythromycin.

DOES FISH FARMING POLLUTE?

KEYA COLLINS

The water quality degradation of the mid-Snake River has been exacerbated by over five years of drought conditions. The drought has diminished flows which have reduced the flushing capacity and dilution of nutrients in the river. Extensive shallows have appeared supporting abundant growths of aquatic plants and algae in the nutrient rich waters. These aquatic flora can then reduce oxygen levels significantly during periods of respiration and place faunal biota in jeopardy.

Water quality of the mid-Snake River in Idaho is an important issue for the aquacultural community and area residents. Nearly five million pounds of trout are raised in southern Idaho, or approximately 65 percent of the commercial trout production in the entire U.S. Small farm pond rearing units of <100,000 pounds annual production contribute substantially to the trout production. There are over 60 permitted small farm ponds, managed by local farmers producing under contract or selling privately to privately owned processing firms in the valley.

Community concern over the mid-Snake River water quality and its present listing by Idaho Division of Environmental Quality as a water quality limited segment prompted the Idaho Aquaculture Association to address the quantity and composition of fish farm effluents. The Aquaculture Institute at the University of Idaho offered to undertake a one year water quality study for characterization of fish farm effluents and calculations of mass flows of nutrients contributed by the small farm pond owners. Deep Creek, in Twin Falls County, Idaho was chosen as the representative tributary. I was chosen by the Aqauculture Program to manage the sampling program which includes sampling, calibration of field equipment, sample analysis, monthly and final reports, and, of course, washing sample bottles.

The mid-Snake River plateau, where the study takes place, is about 3000 feet above sea level, the climate is relatively dry, receiving an average of 9.29 inches per year. Winters are mild with a mean temperature of 29.4° F in January, and there are warm summers with 72.7° F mean for July. The famous Thousand Springs, other minor springs, creeks, irrigation return flows and seeps provide water for the farms. The Snake River ultimately receives the outflows. The flow rates from farms ponds vary between 3 and 30 cfs. These rates are a function of irrigation, weather patterns, season, number of fish, and water supply.

Sample locations included: the creek above the fish farms; water sources including irrigation canals, seep tunnels and creek water; presettling of rearing waters; the outflows for six farms and a point near the confluences of Deep Creek and the Snake River. The sampling program was initiated in May 1991 and included sampling twice per month for one year and several 24 hour surveys.

Parameters under study

Water temperature is an important parameter relating to fish metabolism. Temperature controls fish feeding rates, metabolism, and growth—thereby affecting nutrient loading. Water temperature also affects dissolved oxygen; as the temperature increases the quantity of dissolved oxygen at saturation decreases. pH is a widely used water quality parameter which characterizes the acidic or basic nature of a solution. The water's capacity to conduct an electrical current and a measure of dissolved material is the specific conductance. An indicator of water clarity is turbidity, which includes the suspended and dissolved materials in the water column. In highly turbid waters fish are unable to see food, and the suspended materials irritate gills, which causes bacterial gill disease. Suspended solids, or filterable solids, are the weight of dried matter collected by filtration from a specified quantity of water. The settleable solids are the quantity of solids which collect at the bottom of a one liter graduated cone (Imhoff cone) in one hour.

Ammonia-nitrogen is naturally excreted by fish through the gills. This byproduct of fish metabolism is readily found in the outflow from rearing ponds. The organic nitrogen can be estimated by subtracting ammonia nitrogen from Kjeldahl nitrogen. Organic

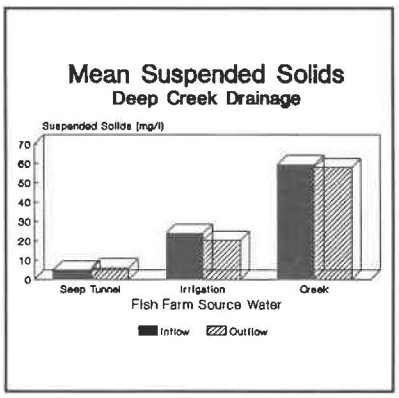


Figure 1. A comparison of mean suspended solids from water supplies and fish farms.

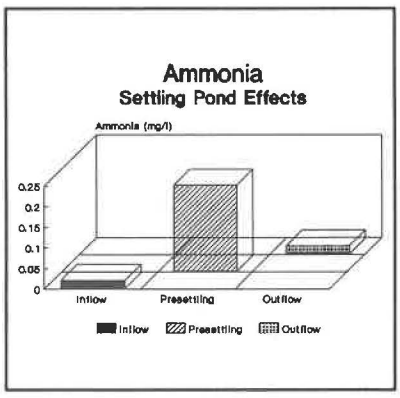


Figure 2. The effects of settling ponds on reducing the ammonia nitrogen prior to outflow.

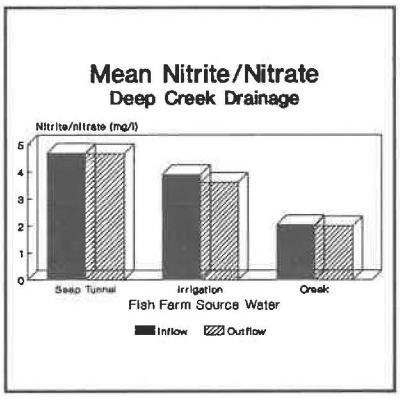


Figure 3. Nitrite/nitrate nitrogen concentrations from water supplies and farm loadings.

nitrogen is often a limiting factor for plant growth, and added to the system from fish food and waste products.

Nitrite and nitrate nitrogen are analyzed as one; nitrite forms nitrate when oxidized. Ten mg/l is an imposed limit on drinking water by EPA. Greater concentrations are toxic to fish and humans, particularly babies where nitrate is broken down in the stomach to form nitrite and reduces the blood's ability to carry oxygen ("blue baby disease"). Nitrate occurs naturally in some ground water or is increased by fertilizers.

Bacterial breakdown of the various phosphorus species allows for ready assimilation by rooted plants and algae. Orthophosphate, similiar to reactive or dissolved phosphorus, is readily assimilated by plants and often is the limiting nutrient for plant growth. Total phosphorus measures the particulate and dissolved species of phosphorus found within the sample.

Chloride is often measured in agricultural areas and is a major inorganic anion in water and waste water. Finally, the flow and feeding rates are monitored. These will be used to calculate the mass loadings of nutrients leaving the farm for the quantity of feed fed.

Preliminary results

Water temperature rarely fluctuates by more than two degrees Celsius from fish farm inflow to outflow, with greater seasonal temperature variations of the creek water supply. Water temperature affects water quality through feeding rates, metabolic activity and the saturation of dissolved oxygen. Dissolved oxygen usually decreases between 2 and 4 mg/l as it passes through a rearing pond. The decrease in oxygen is a function of fish respiration and is dependent upon water temperature, size of fish, number of fish and feeding rates. Also, BOD (biochemical oxygen demand) and aquatic plants and algal respiration can reduce the dissolved oxygen. A significant decrease in oxygen is critical to fish: dissolved oxygen below 7 mg/l results in lower growth in rainbow trout and salmon. To aid in reaeration a drop or cascade is built between ponds.

Minimal pH changes have been observed from inflow to outflow, with daily fluctuations resulting from fish metabolism, plant respiration and photosynthesis. The conductivity is lower from irrigation supplies than from the other sources. The Snake River, upstream from Twin Falls, Idaho is the major water source for irrigation. The seep tunnels, irrigation and creek waters during the non-irrigation season range from 500-700 ohms (measure of electrical resistance), while creek and irrigation waters range from 350-500 ohms during irrigation.

The daily fish farm operations have a minor affect on turbidity, suspended solids and settleable solids except for short durations of cleaning operations and weed removal from the dirt ponds. Turbidity is consistently low from seep sources (the water appears crystal clear to the eye) as opposed to creek water with a high turbidity—impossible to see your hand at depths greater than eight inches.

The preliminary results indicate a total net decrease in suspended solids after passing through the sampled fish farms (Figure 1). Irrigation water can carry high loads of sediments; upon entering rearing ponds the water velocity decreases and sediments are dropped. This accounts for the net loss and frequent removal of accumulated sediments from ponds receiving irrigation return supplies. The estimated annual contribution of suspended solids from Deep Creek to the Snake River is 16,850 tons, but water passing through fish farms has a net loss of 66 tons annually.

By their nature, fish farms contribute ammonia to receiving waters; this quantity can be reduced when settling ponds are used (Figure 2). Weeds within a settling pond are naturally coated with (epiphytic) algae and bacteria which contribute to the break down of ammonia and other nutrients. (This is similar to the process used by sewage treatment plants, except the beneficial micro-organisms are ususally coating gravels or media.) Ammonia has been below detectable levels at the sampling site eight miles past the last sampled farm.

Nitrite/nitrate-nitrogen are dependent upon the source waters. These nutrients are found at moderate levels (~5 mg/l) in seeps and in the creek during the non-irrigation season. The irrigation season levels are reduced by dilution from water taken upstream on the Snake River. The levels of nitrite/nitrate are also reduced as water is passes through the fish farm (Figure 3).

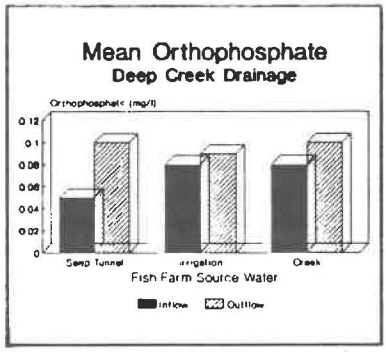


Figure 4. Orthophosphate concentrations from water supplies and farm loadings.

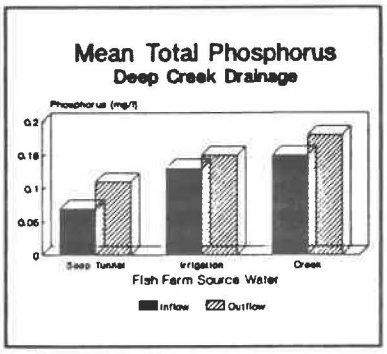


Figure 5. Total phosphorus concentrations from water supplies and farm loadings.

Total phosphorus and orthophosphate vary with water sources and fish farm inputs (Figure 4 and 5). Phosphorus is often a limiting nutrient to plant growth in freshwaters, therefore, loadings are critical to receiving waters. The EPA "Gold Book" recommends levels below 0.1 mg/l to prevent nuisance plant growth. The farm ponds rarely exceed a loading of 0.1 mg/l but when added to the rather high level found in the source waters total phosphorus may exceed 0.1 mg/l.

The chloride levels have remained between 35 and 50 mg/l throughout the sampling period, with the higher values from seep tunnel sources. Fish farming appears to have little affect upon chloride, though the concentrations increase as one moves downstream. The flow rates are variable and often a function of irrigation, weather patterns, and season. Typically, water flows through the farm and into a Deep Creek tributary or directly into the creek and eventually into the mid-Snake River.

Preliminary conclusions

The initial results from the survey demonstrate that the fish farmers have minimal affect on the water quality. There may be a need for a general reduction of phosphorus in all water sources and possibly further reduction of solids and ammonia-nitrogen. Fish food manufacturers are researching methods to reduce both solids and phosphorus in feeds with some limited success, but good husbandry practices are still the most effective means for maintaining quality water.

Upon completion of the sampling program, a formula for mass loadings based upon feed rates and flow shall be developed. The fish farmer can then calculate nutrient flows from the rearing ponds without having to undertake an expensive water quality survey. (The twice monthly sampling for the chemical analysis alone will cost about $25,000. Other costs include solids analyses, transportation to and from sample locations, equipment for on site monitoring, labor, etc.) The Aquaculture Institute is presently examining wetlands and weed ponds for removal of nutrients and more effective settling ponds for reduction of solids for wastes.

Keya Collins is a Master's student in the Department of Fisheries Resources at the University of Idaho-Moscow. She is in the midst of changing careers after eight years as an exploration geophysicist with Phillips Petroleum Company. This position included six years as an expatriate in London and Norway where she developed an interest in aquaculture. Collins attended a nine-month fish farming course in Scotland prior to her return to the US. Her degrees are a Bachelor's in Biology from Skidmore College, Saratoga Springs, New York and a Master's in Geology from Rensselaer Polytechnic Institute, Troy, New York.

HER JOB IS TO MAKE SURE THAT ANADROMOUS FISH, AS WELL AS RESIDENT FISH, HAVE SUITABLE SPAWNING AND REARING HABITAT WITHIN NATIONAL FOREST WATERSHEDS.

STRIVING FOR BALANCE

RON BONAR

As the Wallowa-Whitman National Forest's Zone Fish Biologist for the Wallowa Valley, Eagle Cap and Hells Canyon National Recreation Area Ranger Districts (over 2,000 square miles), Gretchen Sausen manages a complex fisheries program. With 11 employees inventorying over 200 miles of stream during the summer of 1991, three technicians enhancing fish habitat, three technicians surveying perennial and intermittent (non-fish bearing) streams, and two assistant fish biologists and two hydrologists involved with coordination and input to timber sales, range allotments, recreation projects and other activities related to fisheries program management, her program certainly meets the definition of "complex."

In the summer of 1992 her crews plan to survey at least 176 miles of fish-bearing streams, which will provide her with a considerable amount of data on fish distribution, fish habitat, streamside vegetation, pool/riffle/glide ratios (fish habitat quality indexes), stream substrate and other habitat parameters. It will then be up to her to enter the world of biological evaluations and environmental analyses. There she represents the world of fishes among other Forest Service disciplines, such as wildlife biology, recreation, engineering, archeology, range, and timber management. She represents that same constituency with other federal agencies, tribal representatives and the Oregon Department of Fish and Wildlife (ODF&W).

As a partner on the cutting edge of what's happening in today's biological world, she and Duane Kloes, fish habitat enhancement specialist for the Wallowa Valley Ranger District, work on the Elk Creek Demonstration Project, which the Wallowa-Whitman National Forest has selected as an example of New Perspectives in action. Although the Elk Creek watershed has been previously logged, roaded, and grazed, Elk Creek provides very important steelhead spawning habitat.

With assistance from the Bonneville Power Administration—which funds the planning, installation and monitoring of habitat improvements—and the local cattle permittees, who agree not to graze the exclosures and to graze in the fall rather than the summer, she and the rest of her "fish gang" will continue to improve the existing fish habitat so that steelhead trout will again return in large numbers to their spawning and rearing habitat. Sausen strives for "balance." She works with these cooperators so that cattle grazing is "as compatible with the management of riparian areas as it realistically can be."

Gretchen Sausen is a 1987 graduate of Humboldt State University with a BS in zoology and a BA in marine biology, with an emphasis in fisheries. She now works about 900 miles (as the salmon swims) from the ocean, on the Imnaha, Joseph, Grande Ronde, and Snake River watersheds in northeast Oregon. After graduating from high school, spending a year in Hong Kong, and a year and a half attending Evergreen State College in Olympia, Washington, she signed on the crew of a gill net fishing boat. The following year, she put in a stint on a salmon troller working the Inland Passage between Sitka and Juneau, Alaska. "Commercial fishing changed me," she said. "I felt uncomfortable killing fish, so I decided to help them." Enrolling in the University of Alaska in Juneau's program at Auke Bay, she began her college career in fisheries biology. Her work-study time at the National Marine Fisheries Service's nearby lab, "maintained my interest in the future of fisheries," but Alaska's cost of living precipitated her transfer to Humboldt State University in Arcata, California.

"Salmon have always interested me. Their incredible journey from freshwater spawning beds to the ocean and back to their spawning grounds is something that I respect." Gretchen also believes in sharing this professional expertise. One of her projects is an educational outreach to the county's fourth graders. She hopes to teach them this life cycle by having them monitor salmon eggs in a classroom tank, then follow up with a trip to the local ODF&W fish hatchery to view artificial spawning. The students finish with a theatrical skit on the life cycle of an Imnaha spring chinook. With eight hydroelectric dams to migrate through in both directions, that's quite an exciting swim on their journey from and back to Wallowa County!

It is now proposed that video professionals film the work her crews have accomplished to be shown at the new Wallowa Mountains Visitor Center in Enterprise, Oregon. She anticipates that people who view this video will better appreciate how Forest Service management practices "achieve a balance." For example, whole trees placed in creeks mimic nature more closely than the old style log weirs, thus better improving spawning and rearing habitat. They also allow fish better escape routes from predators. Planted willows, cottonwood, and other streamside vegetation provide shade to cool water temperatures, help stabilize streambanks and provide a food base for aquatic organisms, including fish and aquatic insects.

Besides her work with anadromous fish such as spring chinook and summer steelhead, Sausen also works with bull trout, rainbow trout, and redband trout—the resident fish. She is very interested in the outcome of her recent cooperative efforts with ODF&W within the Hells Canyon Wilderness. Utilizing electro-fishing equipment in McGraw Creek, she collected redband trout and sent this subsample of the population to a laboratory at Oregon State University for a determination of their genetic make-up. "Although these fish are related to other redband trout," she said, "their ancestors

are different. They're more closely related to the redband trout of the Klamath Basin of southwest Oregon, and are the most genetically distinct group of fish sampled on the Wallowa-Whitman National Forest. They are even genetically different from the redband trout on the south end of the Forest." Redband trout are on the Regional Forester's [Pacific Northwest Region] sensitive list, and must be monitored to assess whether grazing or natural occurrences such as wildfires adversely affect this isolated population.

Spring/summer chinook salmon, steelhead trout and bull trout are also on the Regional Forester's sensitive species list. Spring/summer chinook and fall chinook have been proposed as threatened by the National Marine Fisheries Service, which has until June 1992 to make a final determination of their status.

Anticipating that the spring chinook will be listed as threatened, Sausen wants to make sure that all local Forest Service projects that might affect this species have proper mitigation measures proposed prior to consulting with the National Marine Fisheries Service. These include such practices as the leaving of riparian buffers to maintain streamside shade, restricting road densities, maintaining open roads to minimize sedimentation of streams, and adjusting the cattle grazing seasons to help maintain streambank stability.

Gretchen looks forward to the listing of the spring chinook, which, however, "will add another layer of office work and result in less time in the field. This extra time in the office is tolerable, if it ultimately means restoring these magnificent fish to stable population levels."

Viewing the entire fisheries program from a more regional perspective, Gretchen hopes that preserving forest health—the most pressing Forest Service issue at this time in the Inland Pacific Northwest where defoliators and bark beetles are predetermining the location of an ever-increasing number of timber sales—also means striking a balance. She believes, "We not only need healthy trees, but we need healthy streams too. We, as employees of National Forests, must not only maintain the health of the trees in the Forest, but also need to be a major factor in protecting the fish species that course through the veins and arteries of the Forest."

Ron Bonar is the Reforestation and Animal Damage Control Forester on the Wallowa-Whitman National Forest, USDA Forest Service. Prior to this assignment, he was Assistant Area Ranger on the Hells Canyon National Recreation Area. His Bachelor's is from State University of New York's College of Environmental Science and Forestry at Syracuse.

Amphipods

(Continued from page 38.)

Like other arthropods, amphipods have a tough outer skeleton which must be split and shed in order to grow. This creates a problem for males, because they can only mate with females that have recently molted, and whose cuticle is flexible enough to let the eggs pass out to the external brood pouch. Many males spend their adult life searching for and guarding females, either by carrying their prospective mate around with them or by defending them against intrusions by other males. One amphipod which walks around in a self-made tube of sand and shell, glues female tubes to his own and defends his harem from other males. This ensures that he will always be on hand when one of his females molts and becomes receptive to mating. Not all females are so docile. Females in the genus *Jassa* will treat males as competitors for their homes unless the males present an appropriate signal to signify mating intent. This signal is a thumb that develops on the front claws only near the end of life. Although thumbless males are capable of mating, they are rejected by females, and lose in battles with thumbed males. Small-bodied thumbed males have extra adornments on their thumb, which perhaps allow them to sneak in with the females when the large males are out defending their territory.

Some males develop sound producing organs for snapping or stridulating, presumably to establish territories and to attract and guard females. Males that do not mate-guard develop abundant chemosensors for female pheromones ("signalling perfumes"), rapidly locating and mounting receptive females before other males can establish a grip. Many scavenging and predatory amphipods are similarly well endowed with chemosensors and vibration sensors, to locate prey and carcasses. This is particularly important in the deep ocean, where food falls may be infrequent. Inuit and museum preparators have made use of these scavengers at times to clean skins and skeletons.

Most amphipods are sensitive to environmental change. Scientists value amphipods as indicators of acid rain effects and pollution by sewage, heavy metals, hydrocarbons, pesticides, and industrial chemicals. The amphipod's reproductive sensitivity to temperature may well prove to be an important indicator of climatic change.

Additional reading

Barnard, J.L. and Barnard, C.M. 1983. Freshwater Amphipoda of the world. Hayfield Associates, Mt. Vernon, Virginia. 830 pp.

Barnard, J.L. and Karaman, S. 1991. The families and genera of marine gammaridean Amphipoda (except marine gammaroids). Records of the Australian Museum, Supplement (13): 1-866.

Bousfield, E.L. and Conlan, K.E. 1990. Malacostracans. pp. 854-859. In: *The new Encyclopedia Britannica.* Volume 16, Macropaedia. Encyclopedia Britannica, Inc., Chicago.

Kathleen E. Conlan is a Research Scientist in the Research Division of the Canadian Museum of Nature, Ottawa, Ontario. Her research focus is on the consequences of disturbance by ice scour for diversity and stability of benthic invertebrate communities in the High Arctic; effects of hydrocarbon polluted sediment on survival, behavior, and reproduction of amphipod crustaceans in Antarctic; life history strategies of benthic crustaceans in Antarctica; and the mating behavior, ecology, systematics and biogeography of amphipod crustaceans.

Her degrees are a Bachelor's from Queen's University, Kingston, Ontario, the Master's from University of Victoria, Victoria British Columbia, and the Ph.D. from Carleton University, Ottawa.

This article is reprinted with permission from *Sea Wind:* Bulletin of Ocean Voice International, Ottawa (October-December 1991).

LESSONS LEARNED FROM THE EXXON VALDEZ

BRENDA L. NORCROSS

Responding to the Exxon Valdez

In an ideal situation, a study would be designed prior to an oil spill and be ready for implementation. In reality, when an oil spill occurs scientists are expected to respond immediately. To illustrate this I present examples from my experience with the Exxon Valdez oil spill.

The spill occurred when the oil tanker hit Bligh Reef on 24 March 1989 and discharged 10.6 million gallons of Prudhoe Bay crude oil into Prince William Sound, Alaska. Though the spill was unfortunate, I naively thought it would not have an impact on me. However, the Institute of Marine Science of the University of Alaska Fairbanks (UAF) was expected to perform an initial assessment of oil spill damage.

My "normal" approach to larval fish research is to investigate the background of a system, formulate hypotheses regarding fish in the system, and design a study to test those hypotheses. An accidental oil spill does not allow for a "normal" approach. In the Prince William Sound (PWS) spill, there was no time to develop a thorough sampling regime prior to sampling and there was not a preplanned response. On 6 April 1989, 12 days after the spill, UAF's ship R/V Alpha Helix sailed from Seward, Alaska with 14 scientists and technicians. Having just moved to Alaska was a disadvantage as I had no program, no technicians, no equipment and little knowledge of the area and species. However, I had one big advantage over everyone else—as a new faculty member, I had no other commitments. University, federal and State of Alaska workers were pulled off other projects and personnel shortages rebounded in all programs and lasted for months.

With borrowed gear, I collected larval fish samples on the first cruise. My unfamiliarity with the area limited my initial contribution to the integrated study plan. The resulting data are incomplete and difficult to interpret.

I did not generate my hypothesis; the oil spill did. The null hypothesis was that the oil did not change species composition, abundance, and condition. The alternative hypothesis was that it did change them. My objectives evolved daily. They were formulated after the first cruise in April, refined after the second cruise in early May 1989, and continually reanalyzed throughout the summer of 1989.

My first objective was to determine the spatial and temporal presence of species of larval fish in PWS. This distributional information could be compared to similar pre-spill data to investigate possible changes caused by the spill. However, though OCSEAP (Outer Continental Shelf Environmental Assessment Program) baseline studies were conducted in proposed oil lease areas offshore, there were no baseline data for Prince William Sound (with the exception of Valdez Arm) for comparison. Therefore, my first objective became to provide a foundation for the rest of my project.

My second objective was to determine the distribution of larval fish in relation to distributions of hydrocarbons. I was relying on hydrocarbon distribution in the water column being supplied to me by the chemical component of the state's oil spill assessment study. However, in such a large study it is difficult to coordinate all component projects. At a very late date I learned that it was unwise to assume that samples were being collected and analyzed on a scale I could use. I did not directly measure hydrocarbons in my larval fish samples as it was not a technique with which I was familiar or to which I had ready access. After the first cruise, I learned that hydrocarbon analysis required fresh frozen (non-preserved) samples. Separating fish larvae from zooplankton during a spring bloom in Alaska on a rolling ship did not appear feasible. Later I learned feasibility was not an issue, defensability was. Empirical relationships between distribution of fish larvae and oil spilled may be good science but they are not going to be accepted as evidence in court. I suggest finding a way to directly measure hydrocarbons.

My third objective was to determine potential for loss of larval fish as a result of the oil spill, based on occurrences of physical abnormalities, breaks in growth stanzas, and published literature documenting the toxicity of oil to the same or related species. Laboratory toxicity tests had been conducted for some of the species found in PWS and the findings could be applied to my data. Additional laboratory bioassays on the other species would require spawning fish in the lab to produce larvae and thus were time and cost prohibitive (i.e., such a project would not be funded). My empirical approach of comparing my data to laboratory tests conducted by someone else were not considered acceptable (i.e., defensible in court) as proof of impact caused by the oil spill.

As spring 1989 progressed, all oil spill studies came under control of the Alaska Department of Fish and Game which was also rapidly responding. Project plans were being developed as we were simultaneously sampling in the field. Proposals for studies were submitted while studies were in progress. Funding for a study that was being conducted but was not yet approved caused budgetary nightmares.

My sampling plan was refined over the course of the summer. I conducted a one-week cruise each month April through October 1989. I sampled strata which were representative of characteristic hydrological, geological, and ecological areas within the sound. Each stratum included oiled and non-oiled areas, and covered as much horizontal space as possible during a one week cruise.

As the summer progressed and my cruises changed from multi- to sole-investigator, I had much more time to sample (wire time) and was able to increase the density of the stations within the strata sampled. The final refinement came when the MOCNESS (Multiple Opening and Closing Net Environmental Sensing System), ordered in April, arrived in time for the October cruise. Incremental vertical sampling was increased. Thus on the sixth and final cruise, the final study plan was implemented—six months following initial sampling.

That is a reasonable amount of time to design a study, test gear and conduct preliminary sampling under normal conditions. However, in this case, the six months were not lead time, but critical to the study. One can debate trade-offs between immediate,

inadequate sampling versus delayed, more complete sampling. I did both. Initially it was a no-win situation because what was needed was an immediate complete plan, which of course did not exist. I was very pleased with the final study plan and knew it could answer the questions I was asking. Unfortunately, it was fully implemented six months after I needed a really good measure of the effects of the oil spill. The frustration at not being able to go backwards in time and use all that newly acquired knowledge sooner was great.

Oil Spill Sample Design

Ideally there would be sufficient time to design a study to assess the impact of an oil spill on fisheries in any specific area. Baseline data should be known, including: species presence, abundance, and distribution; species development and age structure; water current regimes and transport rates; seasonal temperature regimes and their effects on species distribution, metabolic rates, and susceptibility to oil; laboratory analysis of effects of different source oils on each species of concern; and natural causes of interannual variability which can be differentiated from oil-induced mortality. In summary, ideally, for each species one needs prior knowledge about time and space sensitivities to a specific oil.

Some of this may be known, but all or most of it will not be known. Some aspects will not even be initially considered, and therefore not accounted for in the sample plan. Therefore, first, collect too much data. You can always not analyze the data or not work up the samples, but you cannot go back in time and collect more data. Second, if you have any routine survey stations, i.e., "before" data, sample those locations again. Add more station locations if the existing ones do not cover all habitats in oiled and non-oiled areas. (In Alaska there were good baseline data near salmon hatcheries within Prince William Sound but not for any other species or location.)

Third, cover as much area and as many different habitats as possible, both horizontally and vertically. Use your basic knowledge of the area to assess "strata", i.e., habitat type, and randomly assign station locations within those strata. This plan is statistically defensible. If the objective is to cover space distribution as needed for oil spill assessment, it is better statistically to sample more stations than to take replicates at one station (S. Thompson, Professor, Mathmatical Sciences, UAF, personal communication). Replicate sampling is used to put confidence limits on abundance estimates at each station. Multiple samples within a stratum can be used to calculate confidence limits within that stratum as opposed to at each station. If there is not enough time to take more than one sample within all strata, skip any replicate sampling in favor of expanding horizontal and vertical coverage.

Brenda L. Norcross (standing) and technician Brenda A. Holladay

There are major problems with designing an oil spill study. The first is the inherent non-repeatability (Smith 1978). There is only one experimental unit and you did not choose it. Experimental designs rest on the foundation of random assignment of treatment and controls. In an oil spill there is only one treated area and there may or may not be one or more controls (Eberhardt 1976). Replicate samples are often unattainable because of lack of availability, time and money. Therefore some analyses may fall short of significance because of natural variation and small sample size (Eberhardt 1976). The problem of a single site with no true replication can be circumvented by employing a pseudodesign (Eberhardt 1976). In the pseudodesign, pre-impact data on the single site and a control area are compared to post-impact data on both areas. One must start with the assumption that two areas in close proximity to each other are subject to the same climatic factors, have populations of the same genetic make-up, and that the populations will follow the same trends over time. Therefore the best that can be done with a single-site situation is that there should be multiple control sites, and that a baseline period (i.e., pre-spill) can be used to establish the ratio of population density in the impacted site to that of the control sites (Eberhardt 1976).

This points to the second major problem in designing an oil spill study - - the unavailability of baseline data (Smith 1978). What can not be obtained from the past could be obtained in the future. That is, the sampling could continue into the future until the affected area has returned to its natural state as compared to the control areas. However a totally unaffected, natural, stable state is ambiguous and probably unattainable. One would have to assume that the affected area should be quite similar to the control areas while allowing for the natural variation expected in the region. The impact of the oil spill then could be compared across space (site vs. control) and time (seasons and years). As many changes from year to year are associated with natural population variations, any design based solely on population studies may succeed in demonstrating statistically significant changes while failing to show that the changes were due to the environmental impact (Eberhardt 1976). Because populations often follow pronounced seasonal and interannual cycles of abundance, sampling over a period of several years should be conducted to filter these natural changes from those caused by the oil spill. The result would be to produce a measure of interannual reproductive success as well as seasonal fluctuations in population size. Multi-year sampling would provide insight into the nature of the effect of the oil spill, i.e., on reproductive success or or individual survival (Eberhardt 1976).

The necessity of repeated sampling across sites, seasons and years leads to a third major stumbling block in designing an oil spill study— the total cost of the sampling effort is not known at the start and may never be known (Smith 1978). Proposals to answer the question "Was there an impact caused by the oil spill" are going to evolve and expand. One of the most difficult aspects in designing a study is knowing when "enough" possible effects are being addressed. As one gets involved, it is easy to think of more and more possible areas of

study that should be incorporated. There are too many possibilities to include them all. Gray (1981) suggests getting away from simplistic biological investigations which cost large sums of money and replacing that approach with properly formulated hypotheses which can be tested. This is an excellent suggestion and should be used whenever enough information is available with which to develop a hypothesis. However, often there is too much baseline science lacking that must be investigated in order to adequately answer the original question about the impact of the oil spill. Not everything can be done. Reality sets in as funding availability becomes the limiting factor.

Conducting the Study

Be aware that the major constraints to an oil spill response are time, people, gear, and baseline data. No one will have excess time built into their schedule to undertake a project of this magnitude. If you work for a state or federal agency, you may be taken off projects to which you are vital. You may be required to work on both projects for a time. But it is not possible for one to perform well at two full time jobs for an extended period of time.

If you work for a university, you most likely are committed to other grant and contract-funded research projects which have time constraints that cannot be ignored. Your technicians and students also are committed to ongoing projects. Therefore, you will not have enough people to continue with current projects and to begin new oil-related projects. It will be necessary to reassign, hire, and train people. New facilities will have to be acquired to accommodate additional people for oil spill work. All of these activities require time, but time is not a commodity you have.

Gear will be another limit. It must be available and accessible. There will not be time to order gear before your response is needed in the field. Most programs do not have a plethora of gear. You may have to borrow gear from another project initially, after carefully weighing the effect on that project, of course.

The gear used initially should be expendable if it gets covered with oil. A good rule to follow is if the water is thickly covered with oil, do not even put your nets in the water. They will not filter effectively and they will be contaminated, which may influence your results at other locations. Following this rule causes you to lose some valuable information in key areas and must be weighed based on the objectives of your study and multiplicity of gear. If there is just a sheen or patches of mousse on the water, use the ship's fire hose to clean the surface of the water before deploying and recovering your nets.

As noted earlier, baseline date are vital to your assessment. If the oil spill occurs in a location that has been sampled for years, then you have a distinct advantage as you can base your sampling plan on your own knowledge of the system. If the spill occurs in an unfamiliar location, do a literature search to locate all available information, no matter how irrelevant it first appears.

Designing a Contingency Plan

The more seriously depleted fisheries resources are in an area, the more conscientious the government seems to be about protecting them by being prepared prior to a disaster. Alaska is still in the developmental stage and has lots of natural resources which are not as seriously over-exploited as those in other areas. There was not a contingency plan in place for fisheries scientists to respond to an oil spill in Alaska, but other states can learn from that error.

Norway has yearly drills which include oil companies, clean-up crews, government agencies, and university scientists (L. Foyn, Institute of Marine Research, Bergen, personal communication). To respond to a spill, the coast of Norway is divided among six spill response teams. Each team has collection, diving, and other equipment packed. Military helicopters are used for transportation. A series of fixed sites along the coast are established within 50 km of the projected trajectory of the oil. Thus, pre-spill photographs and samples can be collected. After the spill hits, the shore sites are revisited and counts of mortalities are made directly instead of estimated (Gray 1981).

If your position may require you to respond in event of an oil spill, I suggest having a generic sampling plan in place. Details of the plan can be adapted to specific spill areas as needed. The generalities are the same within your geographic area, i.e., gear, depth strata, habitat types, and species. A statewide plan should include a division of labor between state, university, and federal entities so that efforts are neither duplicated nor ignored. Identify individual and agency areas of strength and weakness ahead of time. Have gear and personnel in place; of course, they will normally be employed in other projects, but be ready. Your immediate response to an oil spill is possible but it will require preparation and planning. The response can be implemented from institutional through state and national levels.

Damage Assessment versus Scientific Research

The damage assessment process is a scientific, economic and legal exercise (Brown 1988). As a scientist I had a different perspective of the problem than did the economic and legal components. I found it hard to comprehend that what I was being asked to do was called "impact assessment" and not considered "research". Impact assessment requires all the components of research --knowledge, planning, implementation, and analysis. Any study, research, or impact assessment, should contribute new knowledge to the understanding of a component of the ecosystem of the region. The goal of environmental research is to reduce uncertainty about the environmental consequences of some activity in order to support and inform environmental management (Shaw 1982). Impact assessment tries to identify the legally defensible effects of the environmental insult. I think the results of that assessment should be used to reduce the uncertainty about what similar effects to expect under analogous conditions in the future.

The term "impact assessment" assumes there has been an effect which needs to be measured. Approaching an oil spill from a research perspective should be unbiased as defined by the null hypothesis that no change has occurred. If adequate assessment studies can be conducted that show certain grades of oil or certain windows in time are not harmful, we should accept those results and stop worrying. Time and effort will not have to be expended addressing these types of spills in the future. There are so many permutations of types of oil, time frames, and species to consider that eliminating one combination is progress. However, to date most studies are approached as adversarial impact assessment and adequate studies which provide new knowledge about interactions in the ecosystem are not a goal.

After the initial, scientifically-driven response and study planning, the assessment process in Alaska was not directed as much by scientific, as by what would be defensible in court. Quantifiable estimates of damage were required. To determine an abundance estimate after an event occurs requires knowledge of the abundance before the event, including population and environmental factors affecting fluctuations. Beware of the kinds of numbers you promise to produce. Non-scientists do not understand that asking you to provide an exact number of fish killed (or that will not be produced in the future) is an impossible task.

Because the studies were conducted with the goal of a confrontation in court, the results of the research from the Exxon Valdez oil spill were kept secret. (As of the beginning of May, 1992, the results can be made public and published.) Ramifications of this secrecy go beyond the inconvenience of chain-of-evidence, i.e., knowing where your samples are at every minute, who has access to them, and always keeping them locked up. For an academician who lives in a publish-or-perish environment, conducting secret research which cannot be published can destroy a career. No graduate students

Elizabeth Estill, formerly Deputy Chief of the National Forest System, has been named Regional Forester of the Rocky Mountain Region, succeeding **Gary Cargill.** She is the first woman so named. Prior to this post, she was Director of Recreation, Cultural Resources, and Wilderness Management. Estill joined the Forest Service in September 1988 as an Assistant Director of Recreation coming from the position of Director of Land Between the Lakes, a national recreation demonstration area in western Kentucky and Tennessee. Her tenure with TVA lasted 14 years. Her Bachelor's and Master's are both from the University of Tennessee in Ecology, and she served at Harvard University as a Loeb Fellow in Advanced Environmental Studies, teaching in Harvard's Graduate School of Design.

Diane Hienton is one of the new members of the National Public Lands Advisory Council. The 21-member council advises the Secretary of the Interior and the Director of the Bureau of Land Management on national-level policies and programs. Hienton is the Chief Counsel of the Land and Natural Resources Section of the Arizona Attorney General's Office. She joins **Susan Bray** of California as one of two women serving three years.

Nancy G. Tilghman has been appointed Assistant Station Director for Continuing Research at four research labs in Florida and Georgia for the USDA Forest Service, Southeastern Forest Experiment Station (Asheville, North Carolina). She comes to that position from the Forest Environment Research Staff of the Washington Office where she was a staff specialist in the Wildlife, Range, and Fish Habitat Research section. Her focus was rangeland ecology and threatened, endangered, and sensitive species. Tilghman's Bachelor's is from Eckerd College, her Master's from the University of Wisconsin, and her Ph.D. in wildlife management from the University of Massachusetts. Tilghman's predecessor was **Ann Bartuska** who is now a wetlands specialist in the Washington Office.

When she was appointed chair of the women's studies program at the University of Arizona in 1990, **Karen Anderson** was able to negotiate the formation of six new faculty lines to be filled over a five-year period. The lines are joint appointments split equally between women's studies and other departments on campus. The first two faculty—**Janet Jakobsen and Judy Nolte Lensink**—will teach courses beginning Fall 1992.

Donna Haraway is a Rockefeller Foundation Humanist-in-Residence who will visit the University of Arizona for one week in the Fall of 1992. Haraway is the author of *Primate Visions: Gender, Race, and Nature in the World of Modern Science*, and *Simians, Cyborgs, and Women: the Reinvention of Nature*. She is Professor of the History of Consciousness at the University of California-Santa Cruz.

PEOPLE

Yvonne Weber is one of four new managers who will supervise one of the Forest Service's Pacific Northwest Research Station's Research, Development, and Application (RD&A) Programs. Before joining PNW, Weber was a senior environmental protection specialist with the Office of the National Environment Policy Act (NEPA) Oversight in Washington DC. Prior to that, she was a Washington Office hydropower policy specialist for the US Fish and Wildlife Service, and before that a terrestrial ecologist for the National Ecology Laboratory for USF&WS. Her Bachelor's is from Marylhurst College, and her Master's is from Portland State University, both in Portland, Oregon. She will be based in Seattle.

The Sierra National Forest (California) announced that Minarets District Ranger **Christine Nota** had been named the 1992 Ranger of the Year by the National Forest Recreation Association. Nota was chair for the North Fork Chamber of Commerce Town Restoration Committee which received funds to begin preparing a community action plan; she helped form the Sierra Vista National Scenic Byway; and she wrote a rural diversification grant on behalf of the Mono

(Continued on page 51)

could use the oil spill studies for their research, because their theses could not be published. For the scientific community, the lack of access to these data is incomprehensible. Knowledge is gained to be shared.

Did we gain any new knowledge? We do not know; it's a secret. Is impact assessment scientifically successful? No, not in my opinion. Good science and good scientists are constrained by the adversarial judicial system. Scientific insight was clearly not the goal of the damage assessment studies once the process was no longer controlled by the scientists.

Professional and Personal Aspects

There was a duty, as a state employee, to respond to the Exxon Valdez oil spill. I did not have a choice at the time; I responded. I spent the next 11 months working full time on oil spill research, to the exclusion of writing proposals, beginning other research, and teaching.

I received a quick introduction to life as a fisheries oceanographer in Alaska. I met many state and federal fisheries scientists. I learned a lot about Alaskan fish species, Prince William Sound, and sampling in a deep (to 700 m) fjord environment. I had the opportunity to participate in or be chief scientist on several cruises. I hired technicians, acquired gear, and set up a laboratory.

In retrospect, I consider myself lucky to have had my project cut after the first year, because, while these were all very valuable experiences, one year was enough. I no longer have to contend with the legal bureaucracy that constrains the science. Another year or two of collecting data that I may never be able to publish would make it impossible for me to get tenure. Yes, it was big money that was easier to get than most, but I do not want to do secret research. Given the choice now to respond to an oil spill, I would politely decline.

However, someone has to respond. You may not have a choice. If you work for a state agency, as opposed to a university, the results of the constraints may not be as devastating. You can design your study to produce some scientifically gratifying results. The best advice I can give you is to be prepared. There will be an oil spill somewhere of some size and of some grade. Don't be afraid to ask for help. You will need it.

References

Brown, J. D. 1989. Successful natural resource damage claim for a coastal oil spill. Proceedings 1989 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), pp. 292-296.

Eberhardt, L. L. 1976. Quantitative ecology and impact assessment. Journal of Environmental Management 4:27-70.

Gray, J.S. 1981. On experimental oil spill - a reply. Spill Technology Newsletter, March-April:44-45.

Shaw. D. G. 1982. Why do environmental research? Marine Pollution Bulletin 13:338-339.

Smith, W. 1978. Envionmental survey design: a time series approach. Estuarine and Coastal Marine Science 6:217-224.

Brenda L. Norcross is an Assistant Professor of Fisheries Oceanography at the Institute of Marine Science, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, a position she has held since January 1989. Her Ph.D. is in Marine Science from Virginia Institute of Marine Science, College of William and Mary, where, subsequent to her graduation, she was a non-tenure track assistant professor for four years prior to moving to Alaska.

BEING AN OBSERVER FOR THE NATIONAL MARINE FISHERIES SERVICE AND THE HALIBUT COMMISSION WAS A TREMENDOUS EXPERIENCE.

10 MONTHS AT SEA

LAURA GARMANN

I came to the Pacific Northwest from a small town in Illinois to become a marine biologist. After four years and a B.A. in Biology from the University of Puget Sound, I then tried to work my way into a job with a marine-type of setting. I wanted to get into the field of marine mammals, but I somehow ended up in fisheries. My first position was as a National Marine Fisheries Service (NMFS) biological observer.

I heard about the observer program through a friend. Heresay from other past observers told me that being an observer was hard work. One must deal with isolation (being out to sea for three months at a time), sea sickness, increased danger during the winter months due to high seas and storms. There is a fair amount of physical labor as you sample the fish. Not many women become observers because of these conditions. It sounded like an adventure to me!

To be an observer, one must have a degree in Fisheries, Zoology, Ecology, Biology or some other related field. Previous experience is not necessary.

The National Marine Fisheries Service provides a three-week training course in which they instruct perspective observers on how to identify species of fish, crab, and marine mammals of the Bering Sea and Gulf of Alaska areas. NMFS focuses on identifying the prohibited species, meaning the species whose fishery isn't open at that particular time—such as salmon, halibut, King crab, Tanner crab, and herring. These species are closely monitored and documented because it is possible that the incidental catch of these species will result in the closing of a different fishery such as Pacific cod or pollock. NMFS also trains observers how to estimate catch rates from different fishing gear types—bottom trawlers, longliners, and others A brief overview of fisheries regulations and regulatory areas is also a focus of the training.

By the time the training is over, an observer is sent out to sea knowing how to collect, report, and record data on catch rates, incidental catches, species composition, age from age structures (otoliths and scales). We were also trained to collect stomach contents to determine the diet of the fish, to report the occurrence of marine mammals, how to implement different sampling techniques, and how to stay alive in a survival suit if the boat goes down.

When I first arrived on the boat that I was about to spend the next three months on, isolated out at sea, I felt as if I needed to assert myself. I was an observer for NMFS, I was considered federal government, so people were suspicious about my job and my intentions. Being a women on a boat also adds to their curiosity—they wonder if you can handle the job.

The boat I was assigned to was called the New West, a 185 foot long floating processor. We were stationed a tenth of a mile off the coast near a town called Sand Point located on Popof Island in the Gulf of Alaska. There were approximately 75 people employed on the New West to run the processing lines 24 hours a day if necessary. A floating processor doesn't fish itself, but processes the fish from smaller fishing boats that make seaside deliveries. There were four main boats that delivered to the New West and their average size was 75 ft. Sea sickness wasn't going to be a problem because my boat didn't move—it stayed anchored in the same spot for most of the time.

The New West was processing Pacific cod, some rockfish, and a small amount of pollock. I was assigned to collect length frequencies, age structures, sex distribution, and total catch of P. cod. I didn't have to monitor for prohibited species because the catches were already sorted by the fishermen before they arrived on the line on my boat. (The delivery boats have observer coverage only thirty percent of the time due to their smaller size.)

An average work night for me started at 10 p.m. when the first boat would deliver after fishing on the grounds for one or two days. An average load of fish delivered was 30-40,0000 lbs. If a boat was deck-loaded, it could hold approximately 120,000 lbs. When the fish started on the processing line, I put on all my raingear and headed out to the processing room.

The engineers on the New West built a sampling station for me so I could sample the fish first as they came onto the line, but designed the station so I was out of the way of the factory processors. I would randomly collect totes of cod and take the necessary data. I could usually collect enough required data within two to three hours and then the next boat in line would be ready to deliver. So on went the night. I would usually get done around 8 a.m. and then I tried to fill out all of the corresponding data forms before I showered and headed off to my bunk.

In addition to all the work, I was fortunate enough to have a population of resident sea lions that would visit the New West. I kept a record of their activities, which the marine mammal lab at National Oceanic and Atmospheric Administra-

tion (NOAA) utilized to keep track of the sea lion populations of that area.

During my three month stay on the New West I was successful in keeping my sanity and I even made a few friends. There were times when I wanted to skiff into town and take the next plane out (one attempted to fly in and out every day) and there were times when I didn't think I could stand it anymore. Some of the problems that I did encounter were sexual harassment (briefly, it was quickly taken care of), pressure to interpret Alaska Department of Fish and Game (ADF & G) and NMFS fisheries regulations (which is not advised, you should refer the inquiring party to the proper agency), and the stress in trying to get along with people in the fishing industry when they sometimes interpret you as the enemy.

As an observer, you do not have the authority to enforce the regulations. You are, however, required to report what you find from each boat that delivers to you. I had an encounter where the reporting of my data caused one boat to have its entire catch seized by the government because it had retained too much pollock as an incidental catch species. Pollock fishing was closed because the limit had been caught, but a catch of less than 25 percent pollock of the total catch was allowable. When a catch is "seized" the fishermen lose the money from that delivery. Even after this particular incident, my relationship with the boats was still above average. In fact, I was fortunate to have had such a positive and even *fun* experience; but I realize—and others should realize—that the size of my boat and the people that I had the opportunity to work with definitely had an affect on the outcome of my first trip to sea. Not everyone has been as fortunate.

The next position I took was with the International Pacific Halibut Commission. I was hired as a temporary to collect biological data from the halibut openings and other surveys that the Halibut Commission was conducting at that time. I first spent a week in Seward, Alaska at the May 7, 1991 halibut opening. I helped other biologists with the collection of otoliths and sex frequencies, and also collected all catch data from the fishermen.

Next, the Halibut Commission sent me to the Queen Charlotte Islands in Hectate Straight, British Columbia. Another biologist and I were sent on a 48 ft. wooden schooner that had been built sometime around 1910. (So much for running water, a private room, a toilet.) But the beauty and the scenery of the Queen Charlottes made up for any inconvenience from the boat. We were studying and videotaping halibut and dogfish interactions to baited circle hooks. I was in charge of controlling the underwater video camera and recording any activity at the bait from the monitor. This was a truly exciting experience. The Pacific Halibut is a beautiful species and is very popular with the fishermen. I was lucky enough to be in a position to appreciate the halibut in its natural state and as a graceful swimmer.

My next trip was by far the best. NOAA conducts a survey on the Aleutian Chain Islands once every three years. The main purpose of this survey was stock assessment and the determination of species composition. Many hours are logged by the biologists at NOAA before they even go out to sea to determine the areas to be sampled and what data is to be collected from which species. The Halibut Commission sends a representative to monitor the abundance of halibut in these areas. The NOAA chartered boat was the Ocean Hope I, a bottom trawler. Four biologists from different departments of NOAA—Resource Assessment and Conservation Engineering, Resource, Ecology and Fisheries Management, and NMFS—and I from the Halibut Commission boarded the boat in Dutch

Harbor. By the end of 15 weeks, we had traveled all the way to Attu which is the last island of the chain, and back to Dutch Harbor.

A day consisted of five to six short (30 minutes or less) tows in predetermined, but random areas within a transect. When the net came aboard, the team worked together to record species composition and abundance, collected age structures, length frequencies and sex distribution. I helped them with their data collection, but I also collected age structures, pituitary glands, data on length frequencies and sex distribution for halibut. I also collected specimens for parasite analysis.

This trip was exciting because we were sampling specific areas, not specific species, so the composition was vast and interesting. Spotting Killer whales was commonplace as well as Dahl's porpoises. There were several times when we were able to anchor near an island for the night. If the seas and time allowed, we would skiff onto the island for an evening of exploration since the sun didn't set until 11 p.m.. The Aleutian Chain Islands played an important role in World War II, and some of the evidence of the war can still be found, especially on Kiska Island. I returned from the Aleutian Chain Island survey with a new appreciation for Alaska and a broad knowledge of the fish that inhabit those areas.

Laura Garmann received a Bachelor of Arts in Biology at the University of Puget Sound. Her first project was benthic invertebrate sorting on the Prince William Sound Oil spill for an environmental consulting firm. She became a National Marine Fisheries Service observer and then worked for the International Pacific Halibut Commission, both described above. Garmann is currently working with Dr. Christine Moffitt in the Co-operative Fish and Wildlife Research Unit at the University of Idaho. This summer (1992) Garmann will be working for the Halibut Commission in Excursion Inlet Alaska, leading all sampling exclusively. She will be starting a graduate program in Fisheries Resources/ Management this year.

Photos these pages are of Garmann while on the Aleutian Chain Island Survey: a Sleeper Shark and an Alaska King Crab are pictured.

AS THE VERY PUBLIC "LISTING" PROCESS GOES ON FOR SALMON AND STEELHEAD, THE PROFESSIONALS DOING THE PLANNING FOR THOSE STOCKS WORK WITH AN EYE ON ALL THE OTHER COOPERATIVE AGREEMENTS DESIGNED TO MITIGATE.

FISHERIES MANAGEMENT PLANNING FOR IDAHO

SHARON W. KIEFER

I was hired in 1987 by the Idaho Department of Fish and Game (IDFG) as a Fishery Research Biologist in the anadromous fish management section. Various state and federal contracts provide my funding and most of them are related to mitigation for the devastating effect of hydroelectric development in the Snake and Columbia rivers on Idaho's salmon and steelhead

My first task was to represent the department in a regional planning process called Subbasin Planning for these Columbia Basin fish. The focus of the work was to provide guides for mitigation efforts of the Northwest Power Planning Council (Council) over the next several years. This multistate compact (Oregon, Washington, Idaho, and Montana) was mandated by the Northwest Power Act of 1980 to conduct regional electrical power planning in a public forum. Their other mandate was to give equal attention to the tolls that nearly half a century of hydroelectric development had taken on the basin's fish and wildlife.

Essentially, the Council wanted to know how many fish could be produced in each subbasin, and by what means. They wanted plans that described the physical characteristics of each drainage, the biological characteristics of the stocks, and the management constraints and opportunities. The focus of the plans, however, was objectives and potential strategies for fish production.

The Idaho Department of Fish and Game is pretty small compared to our sister agencies to the west who also manage salmon and steelhead. I work

in our headquarters office located in Boise where there are 17 people on the fisheries staff, including clerical positions. Five of us are anadromous fish management folks, the largest group. I am supervised by the Chief of Fisheries, so there is a short chain of command. Anadromous fish management means coordinating closely with four of our eight regional offices, our research staff, two other states, two federal agencies, land management agencies, two Idaho Indian tribes, and assorted harvest and mitigation councils. And this was before species of Idaho salmon were listed under the Endangered Species Act—so there will be others.

I began my task by compiling about 10 years of IDFG data for salmon and steelhead in the Salmon, Clearwater, and Snake river subbasins. This information was important to describe Idaho's anadromous resources. I also collaborated with other biologists to develop input parameters for a life cycle model, a planning tool. Then for the next three years, I wrote a lot. I was the leadwriter for the Salmon River subbasin plan and a cowriter for the Clearwater and the Snake plans. My other cowriters were biologists from the Shoshone-Bannock and Nez Perce Indian Tribes. I also chaired the group responsible for developing the System Plan. This plan integrated the 31 subbasin plans into one package. The Council ended up with 31 Subbasin Plans and one System Plan. They are presently grappling with how to amend these volumes of material into their mitigation program. The entire region is studying how to bring the numerous plans and strategies forward into implementation in a coherent manner.

Planning never really ends, but the subbasin planning *funding* ended in the spring of 1991. My original 18 month contract easily stretched into three years, the magic time period at which I became a permanent employee of IDFG. My job title changed to Anadromous Fishery Subbasin Analyst because my duties did not fit that of a Fishery Research Biologist. One planning effort led to another as I was assigned to draft a five-year IDFG anadromous fish management plan. Species management planning is a function of the IDFG and the previous plan had expired in 1990.

With the help of our anadromous managers and researchers, I wrote the plan against a backdrop of petitions to list Snake River sockeye and chinook under the Endangered Species Act (ESA). It took us two years to complete the management plan, and during that period a number of biological, social, and political events occurred. Snake River sockeye were listed by the National Marine Fisheries Service as "endangered" in November, 1991. The IDFG Anadromous Fish Management plan, 1992-1996 was approved by the IDFG Commission in January, 1992. Snake River chinook

were listed as "threatened" in April 1992 while the IDFG plan was in press.

The IDFG Anadromous Fish Management Plan revolves around five long-term goals for salmon and steelhead. The mitigation and recovery strategies that IDFG supports reflects these goals as well. All of our goals are interconnected which means multiple achievements if we are successful in attaining any one of them. We want to maintain genetic resources and productivity of our wild and hatchery populations. We want to increase juvenile and adult survival through the federal hydrosystem on the Snake and Columbia Rivers. We want to rebuild our salmon and steelhead populations so that our miles of wilderness once again produce lots of salmon and steelhead and so that fisheries for tribal and non-tribal fishers are restored. We want to implement a combination of production and survival improvements to achieve the mitigation promises made to Idaho when the Snake and Columbia hydroelectric dams were built.

We have estimated that Idaho has the habitat capability to support almost 58,000 spring and summer chinook adult spawners, and almost as many steelhead. Idaho used to support thousands of sockeye and fall chinook and could again. In order to meet our long-term goals and our spawner goals, we need chinook smolt to adult survival of about 0.8 percent to 1.0 percent. Predam survival was probably three percent to five percent. Right now, especially with Idaho's sustained drought, chinook smolt to adult survival is on the order of 0.2 percent. At this survival rate, the Endangered Species listings will be with us a long time.

Data that I have helped to compile indicates that substantial gains in survival can be made by decreasing the amount of time juvenile salmon take to migrate to the ocean (travel time). This is why much of our recovery focus has been and will continue to be on the eight hydroelectric dams and reservoirs blocking the migration corridor of Idaho salmon: the Snake and Columbia Rivers.

I am currently working on an update of the Idaho portion of a 1985 report which summarizes biological information about Columbia Basin salmon and steelhead stocks. There is a renewed focus on characterizing our anadromous resources because of the listings. The information compiled over the last few years' planning will be invaluable.

Salmon and steelhead management is truly analogous to a gigantic jigsaw puzzle. The anadromous fish management section in IDFG headquarters is sort of like the glue that sticks the statewide and Pacific Northwest management issues together. We take the Idaho parts, such as our research findings or hatchery information, and piece them together with information such as ocean harvest or Snake River migration conditions to try and get the "big picture."

Where will all of these planning efforts end up? Although a federally-designated recovery plan will supersede other management plans for Snake River sockeye and chinook, I believe the subbasin/system plan and especially the 1992-1996 IDFG Anadromous Fish Management Plan will play an important role. Our management plan has defined our policies and goals. It is flexible enough to incorporate recovery actions, yet it defines our sideboards for managing salmon and steelhead resources for the public of Idaho.

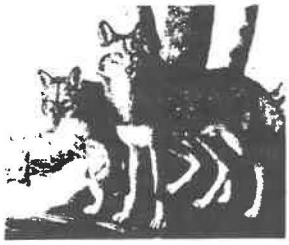
Sharon Kiefer is a Fishery Subbasin Analyst with the Idaho Fish and Game Department. Her Bachelor's is from Stephen F. Austin University in Nacogdoches, Texas, and her Master's (in Biology with a minor in Aquatic Biology) is from Southwest Texas State University-San Marcos. She worked for the Texas Parks and Wildlife Department at a coastal red drum hatchery, then with the Texas Water Commission as a field investigator before moving to Idaho in 1986.

People (continued from page 47).

Indian tribe. She has two Bachelor's—in Sociology from UC Santa Barbara and one in Natural Resource Management from CSU Humboldt.

Molly Stock, professor of forest resources and computer science will serve as chair of the Faculty Council at the University of Idaho for the 1992-93 academic year. She was one of the co-editors of *Women in Natural Resources* in its early years when it was called *Women in Forestry,* and is the founder and editor of the journal *Artificial Intelligence.* Stock as been at the University of Idaho since 1974.

Wildlife artist **Janet Allen Walker** will contribute one-half of the purchase price of limited edition prints of her acrylic painting Return to the Wild—Red Wolves to assist in red wolf recovery. The release of eight adults in 1987 into the Alligator River National Wildlife Refuge in North Carolina marked the beginning of the first project in conservation history designed to restore a carnivore that was extinct in the wild.



Walker has 750 signed and numbered prints (at $85 each). Information about Walker and the prints can be had by phoning 919-473-1131.

The Society of American Foresters (Bethesda, Maryland) announced several reorganized departments. Among the new managers is **Rebecca Staebler,** the new editorial director. She will oversee five publications. Prior to joining SAF Staebler was managing editor of *Caring* magazine. **Paula Tarnapol** was named communications director in the new communications department, and **Sarah Zollman,** formerly public affairs assistant, was promoted to public relations coordinator.

Women in Natural Resources **plans a focus issue on natural resource professionals who work for the Soil Conservation Service. If you have an idea for an article or wish to discuss one already in progress, call the editor at 208-885-6754, or FAX a draft to 208-885-5878.**

WORKING AS A TECHNICIAN HAS THE UPSIDES AND THE DOWNSIDES. IT PAYS TO BE TOUGH TO STAY IN THE BUSINESS.

RELEASE AND RECOVERY

JUNE JOHNSON

I work as a fishery technician in charge of the release and recovery information for the state of Idaho for all anadromous species. I chose to do my degree work in college in fisheries and wildlife because I love animals. I wanted to work with wildlife and learn about different species. I am not just interested in how they can benefit people, but also how different species benefit the environment. I find it fascinating to study different behaviors.

The lab personnel, Connie Stevens, Vicki Feucht, and I, researched and put together a list of all anadromous fish released from Idaho hatcheries for 1976-1990. Getting the correct numbers of fish released was no small task since every place you looked, you found a different number reported. Previously, few people even cared about unrepresentative groups— the groups of fish released that do not contain or are not represented by a coded-wire tag. It took the three of us four months to complete the project. My next task was putting it into a specific format for the Pacific States Marine Fisheries Commission, making it available for all agencies' and states' biologists and statisticians to use and analyze. We are now working on the recovery database, which was tabulated from all coded-wire tags removed from the snouts of salmon and steelhead that have returned from the ocean to Idaho, via the Columbia River. (The database contains only 29,000 recoveries!) I oversee the lab that removes the coded wire tags from the snouts and completes the data entry for the various databases.

We also collect, press, and analyze steelhead scales. Scales are collected from returning adults at Lower Granite Dam on the Snake River in the state of Washington. In 1991 I attended a training session in Clackamus, Oregon, to learn to take and analyze steelhead scales. This spring, using that training, I analyzed several hundred scales as to hatchery or wild origin and their freshwater and saltwater age for a report submitted to the anadromous fisheries manager.

As for the particular joys or sorrows I feel as a woman working in natural resources, my sorrow is the same as that of many working women: not being able to stay home with the children. Another problem for working couples is the lack of continuity, of roots. People in natural resource fields spend a lot of time moving around. My husband has to locate new jobs, has no retirement, limited benefits and vacation, from my moving around. My son has to have new babysitters. Good babysitters are hard to find and you always worry about what's going on when you're not there. Our nearest family is 1000 miles away (most are 1400 miles away). Holidays are rarely spent with loved ones and weekend retreats with my husband are non-existent for financial reasons. (Who can afford to pay a babysitter by the hour for a whole weekend?) And aside from babysitting, it would be nice for our son to grow up having a lot of contact with his grandparents.

Major frustrations have come also in trying to find a uniform. While there are now shirts, jackets, and vests available for women, we did not have a reliable source for pants. (I cannot fit into men's jeans, and don't feel I should have to.) One individual suggested, "Just buy some men's jeans that are close in size and have them altered." I think, however, that women should have equal opportunities to everything so I located an excellent source for jeans, but approval for the rest of the women in fish and game was slow to take place. Other frustration results in the lack of physical strength I have compared to men. OK, so I can't carry 150 pounds for three miles. I'll do as much as I am physically able to do.

I've worked hard to get where I am and I enjoy my job. After three and a half years doing temporary work without a good, permanent job in which I could use my education, I was about to give up. I had that silly notion when I graduated from college that if I tried really hard I'd get a job, but I sent over 100 resumes to private, state, and federal agencies without success.

If you aren't tough enough to stick it out for several years of temporary work I wouldn't recommend this field. My advice for other women in that regard would to be to go straight for graduate school and obtain a master's degree. Your chances for employment will be greatly enhanced. Even so, you have to be tough and love the natural resources field enough to stick it out. Perseverance wins!

June Johnson is a Fishery Technician with IDF&G. Her Bachelor's is in Fisheries and Wildlife Biology (1987), from Iowa State University. In addition to the work described above, she has worked for one and a half years at a rainbow trout hatchery and four months working for a fishery research biologist while in Iowa. She spent nine months gathering water rights and streamflow information for anadromous/resident fish and water users on the Sawtooth National Forest, Idaho, for the Forest Service, and four seasons working sage grouse and big game check stations for Idaho Department of Fish and Game.

THE LARGEST OF NORTH AMERICA'S FRESHWATER FISH RECEIVES ATTENTION FROM A WIDE RANGE OF COOPERATORS.

KOOTENAI STURGEON: HEALTH AND SURVIVABILITY

KIM APPERSON

A career in fisheries biology hadn't entered my mind until I landed a seasonal job with California Fish and Game working for the fisheries branch. After recently earning a B.A. in biology, my career goals were in an early formative stage. It was 1981, and I was in the right place at the right time: a woman in an affirmative action state that was on a quest for more hydropower. As my fishery skills developed, the technician jobs came easily.

Now, another degree later, I work as a Senior Fishery Research Biologist for the Idaho Department of Fish and Game. I lead a white sturgeon research project on the Kootenai River. We are evaluating why this population is failing to sustain itself. Funding comes from Bonneville Power Administration to both study the wild sturgeon population and to construct an experimental facility for culturing white sturgeon. The facility was opened in the spring of 1991 on the Kootenai Indian Reservation near Bonners Ferry, Idaho and the Canadian border. One tribal member is employed as a fish culturist, and another works as a technician helping with hatchery and field work. A hatchery manager employed by the Idaho Department of Fish and Game is supervising hatchery operations until tribal members gain enough expertise to operate the facility on their own.

Spawning operations conducted in 1991 will provide about 1,000 yearling sturgeon to be stocked in the river in 1992. The hatchery is serving as a tool to evaluate the health and survivability of Kootenai sturgeon during early life stages, and is producing juvenile fish for study in the wild.

Near the Kootenai's confluence with the Columbia River, Bonnington Falls serves as a natural barrier that has kept these sturgeon from entering the Columbia and the lower basin for some 10,000 years. Kootenai Falls near Troy, Montana, prevents upriver migration. Recent genetic analysis of enzymes from muscle tissue shows that the Kootenai sturgeon population can be distinguished from populations in the lower basin. Though functionally the same species, Kootenai white sturgeon display a lowered genetic variability—an expected finding from a relatively small, isolated population.

To what extent natural selection has molded this population to specially adapt to life in the Kootenai, we don't know. Because of their genetic differences from other sturgeon and the danger of disease transmission, only native Kootenai River fish are being cultured for supplemental stocking.

Evolving 200 to 400 million years ago, the group of fish we know as sturgeon and paddlefish, Family *Acipenseridae*, has not changed appreciably over the millenia. The white sturgeon ranges along the Pacific coast from central California to Alaska, and throughout the larger river systems that flow to the Pacific. Only one other family member, the green sturgeon, is found in the Pacific drainage, and its range is limited to coastal areas. The white sturgeon, however, can be anadromous (migrate from the ocean into rivers to spawn) or live strictly in freshwater.

A cartilaginous skeleton (no bones) supports the body of this largest freshwater fish in North America. (The biggest white sturgeon on record was caught in the Fraser River of British Columbia in 1912; it was 20 feet long and weighed 1,800 pounds.) Sturgeon have no true scales, but are armored with five lateral rows of sharp scutes that make them undesirable prey once they reach a foot or so in length. The white sturgeon's large, sucker-type mouth creates a powerful vacuum, which makes it an efficient bottom feeder. Sturgeon will consume the smallest of insect larvae as well as crayfish, mollusks, and dead or injured fish. Four barbels and a long, very sensitive snout smell out food as the fish cruises along the bottom of the river.

White sturgeon may live to be 100 years old. Biologists consider sturgeon mature at about four feet in length and age 10 to 25. Males probably mature earlier than females, and growth rates vary among populations. Female sturgeon do not spawn every year, since it takes at least two years for eggs to develop to maturity. From 200,000 to more than four million eggs may be produced by a single female, depending upon the size and health of the fish. Male sturgeon may spawn annually or in alternate years.

Eggs and sperm are broadcast into the water, ideally over a large gravel or cobble bottom where fertilized eggs can fall into small crevices for the two-week incubation. Another two or three weeks after hatching, the larval fish begin feeding on microscopic organisms. No parental care is given to the eggs or young, who are easy prey during their early life. On the average, it is assumed that fewer than 0.1 percent of wild sturgeon survive past their first year.

My study area crosses state and international boundaries and we have people from several organizations that sit on an advisory committee. My skills in coordination and communication have certainly been challenged. Work in the natural resources field is no longer for shy people.

Kim Appersion is a Senior Fishery Research Biologist with IDFG and has been full time since 1987. Her Bachelor's is from California State University-Fresno in Environmental Biology with a minor in Geology. Her Master's is from the University of Idaho. Portions of this article appeared in *Idaho Wildlife*, Winter 1992.

AN EFFICIENT LIBRARIAN CAN SAVE A NATURAL RESOURCE AGENCY TIME AND MONEY.

CLIENT SATISFACTION IS A HIGH PRIORITY

INEZ HOPKINS

Supervising and operating a Special Library like ours at the Idaho Department of Fish and Game requires both a college education and a constantly continuing education. Contrary to what seems to be popular belief, you cannot take an individual off the street and turn them into a fish and wildlife librarian. Librarians need to know a little about everything: enforcement, fisheries, forestry, wildlife, range management and hydrology. Most librarians in fish and wildlife libraries have their Master's in Library Science and at least a Bachelor's degree in biology, zoology or fish and wildlife management.

Due to the nature of my duties as the Librarian, it is necessary for me to have continual education in both library science and also in the natural resources fields. If I did not keep up with current techniques in the fields of natural resources, a majority of the time savings my position provides would be eliminated if the patron had to explain the techniques or the request to me each time. To keep all these accessory skills current, I try to participate regularly in creel surveys, electrofishing, check stations, wildlife trapping for transport, winter feeding and other duties. Participation in these activities increases my knowledge of the field work and allows me to explain the techniques and logic behind them to patrons. In addition, it provides opportunities to meet department staff and become better aware of their needs.

Any librarian, but especially a fish and game librarian, provides cost savings to their department and to their patrons in several ways. The first is in time, making use of library training and our specialized in-house retrieval systems to locate publications quickly. A non-librarian could spend hours traveling to a big research library, searching the catalogue and still return home empty-handed and frustrated. Time savings equates to cost savings, both to the agency and the patron. With a centralized library, we avoid duplication of purchases by individual researchers while allowing access to all publications.

This job includes an enormous amount of public contact with hunters and fishermen (trying to find the big buck or trout), craftspeople looking for models, and school students doing reports ("What kind of sharks are there in Idaho?"). Having me on staff to answer these and similiar questions eliminates the potential drain on biologists' time handling such questions.

There is reason to believe that there will be further time-savings and better service soon. With the support of this Department, I was instrumental in organizing the International Association of Fish and Wildlife Librarians in 1991. Since this association came into existence I have compiled a survey—distributed internationally—showing the library retrieval capabilities of each of the state and provincial agencies. Until then, very few of my fellow Fish and Wildlife librarians, myself included, realized that others existed. From a group totally unknown to each other a year ago, we are now organized and are establishing a Group Access to better network between libraries.

One of the difficulties librarians have in this business is that there is a persisting history among fish and wildlife agencies to not justify library positions as professional. In agencies dominated by men, almost 85 percent of the fish and wildlife librarians are women. This can lead to several problems. Female librarians are constantly expected to fill in for clerical office staff, to provide a full service library while on half- to three-quarter-time appointments or while also filling another position such as switchboard, editor, or central filing. They are also expected or pressured to accept a lower pay scale than male-held positions requiring a similiar amount of education.

The rewards, however, definitely outweigh the disadvantages. In general, the individuals in this field, which is ever-expanding and changing, are outgoing and motivated. We have the advantage of working with outdoor professionals in some of the most beautiful areas in the country.

Inez Hopkins started with the Idaho Department of Fish and Game in 1980. Prior to that she worked at the St. Alphonsis Hospital Library in Boise. Her Bachelor's is from Boise State University.

ONCE HOOKED ON SPORT FISHING, IT IS EASY TO INSPIRE INTEREST IN ECOLOGY, CONSERVATION AND ETHICS.

ENVIRONMENTAL EDUCATION AND PARENTING GO TOGETHER FOR THIS MANAGER

JULIE A. SCANLIN

Growing up on a North Idaho farm, in a hunting and fishing family, I received early lessons in conservation, ecology and outdoor ethics; they are, in fact, my roots. My fondest memories are of times spent out-of-doors with my family, exploring, camping, hunting and fishing.

I began my career in natural resources at a later stage than most. I received my B.S. in Education (physical education) from the University of Idaho in 1973, but my initial career as a teacher was not totally satisfying as I was becoming more aware of the need for environmental education, for adults as well as youth. So on my own, with three children, in 1986 I took the plunge and headed back to the University of Idaho to begin working toward a Master's degree in Wildland Recreation. Being 13 years post Bachelor's degree it was, needless to say, challenging. At the time, my children were 8, 6, and 4. That alone should have been challenge enough, yet, ironically, it was thinking of their future and the future of countless others that helped keep me energized.

My first job opportunity was a part-time position with a local soil conservation district working as the information specialist on a state water quality project. Not long after that, in 1988, I was offered another part-time position, as a bio-aide for the Idaho Department of Fish and Game (IDFG).

In February, 1990, I was named to fill the brand new position of Aquatic Education Coordinator for the IDFG, doing exactly what I set out to do: working daily with people of all ages and backgrounds to help them develop a better understanding of Idaho's resources, in particular, the aquatic ones. Aquatic Education is federally funded through the Wallop-Breaux expansion of the Dingell-Johnson Act, which taxes fishing equipment and boating fuel. Thanks to Wallop-Breaux, similar programs exist throughout the nation.

Many of the efforts are directed at youth, through statewide fishing clinics at local ponds, outdoor resource programs, and the new Lifetime Sports progam we bring into classrooms. Once "hooked" on the sport, it's easy to inspire interest in ecology, conservation and ethics—concepts they will need as adults in order to make responsible decisions in a variety of arenas. The immediate rewards come when I see kids' eyes light up as they catch their first fish, or as they begin to explore a new world of ideas.

My job also includes adult outreach. We are developing printed materials to help Idaho anglers get more out of their sport; we are building interpretive areas—such as two salmon viewing sites—that focus on particular conservation or resource issues; and we are advising groups that want to sponsor fishing clinics.

My greatest challenge is to adequately balance the requirements of my job and my responsibilities as a single parent. With three very active pre-teens, my daily schedule is usually out of control. Whenever possible, I also have them share in my job. My son has helped with tours at the Nature Center in Boise, and he and my daughters have worked and participated in countless fishing clinics. They have traveled with me on the road whenever possible and have developed a sense of ownership in the job as well.

Like everyone's children, mine are very proud of the job I do. Even more, they have developed their own commitment to the outdoor world and feel that what I do is not just a job, but is something important for the future of our resources. They know they have paid the dues right along with me and are proud of what we have achieved together.

Julie Scanlin graduated from the University of Idaho in 1973 with her Bachelor's in physical education. She worked as a teacher for several years before returning to graduate school in Wildland Recreation. Her Master's program is still in progress.

AFTER BECOMING MORE AWARE OF THE POLITICAL AND BUREAUCRATIC PROCESSES THAT CONTROL WHAT HAPPENS TO THE ENVIRONMENT, IT IS APPARENT THAT MUCH CAN BE ACCOMPLISHED BY PEOPLE OF CONSCIENCE WORKING INSIDE THE INFRASTRUCTURE.

DUMB LUCK

DIANE RONAYNE

When I proudly received my B.A. in Communications (magazine and newspaper writing and editing) from Stanford University in 1968, the last thing I ever expected to do was work for a Fish and Game agency in Idaho. The next day, I entered the glitzy world of Madison Avenue via a job at Batten, Barton, Durstine & Osborn in San Francisco, the world's third largest advertising agency at the time. I was going to learn what made people tick, write advertising copy and shape their buying habits. After two years in a clerical position in the Media Department (one floor and a universe away from my goal, the Creative Department), I realized the man in charge of Creative would never hire a woman and that I wasn't cut out for the dog-eat-dog world of corporate business, anyway.

Following a year spent blissfully unemployed, exploring out-of-the-way nooks of northern California (my love affair with dirt roads began then) and living on my savings, my husband and I decided to get away from the crowds, weirdos and daily fear of earthquakes and move to Idaho, where a friend had gotten a job after law school. Packing all our belongings in a '63 VW bug, we set out in the middle of winter, lucked out, and made it to our new home, Twin Falls, between blizzards.

Eight and a half years later, after a checkered professional and volunteer career as a legal secretary, court clerk, ad copy writer (at last!), League of Women Voters president, city planning and zoning commissioner, and editor of a New Age community magazine, I found myself in Boise starting life anew as a single woman of thirty-something.

So how did I end up at Idaho Fish and Game? Dumb luck, mostly, and my ever-present sense of curiosity. I'd worked a couple of years at Boise's *Idaho Statesman* newspaper but felt the hectic pace of a daily wasn't really for me. When I heard about the IDFG magazine editor opening, it sounded intriguing—I'd always wanted to edit a slick, color magazine, and there were precious few of them in Idaho. However, I had just accepted a promotion to assistant Features editor at the Statesman. The choice I faced was between a known, safe job dealing with "female" subject matter and working basically with women, and an unknown, probationary job editing "male" subject matter and working almost exclusively with men.

As it happened, the moment when I had to say yes or no to the IDFG job came while I was in Sun Valley attending "The Women's West," a conference dealing with various historical and contemporary aspects of women's lives and how they were shaped by the Western environment. Perhaps being immersed in stories of frontier women who had struck out on their own into the unknown empowered me to say yes. It certainly wasn't because I understood what I was getting into.

For my first three years at Fish and Game, I worked literally night and day: every person I met, every place I went, every word I read, was examined for story ideas. I was constantly on the alert for potential writers, photographers, artists. (In those days, Department employees weren't required to fulfill *Idaho Wildlife* story assignments, and workloads being what they are, very few volunteered.) The learning curve was extreme: I'd never worked for a state bureaucracy, never hunted and only occasionally fished, knew nothing about wildlife management or who its practitioners and "cult figures" were. I also had lots to discover about the technical end of color printing and production. Although I always felt like an unguided missile—never really in control—I loved every minute of it.

People who loved me, however, saw I was on my way to a burnout if I didn't stop once in awhile to catch my breath. I tried to ignore their warnings, but when the Department, in its less subtle way, told me the same thing by shuffling my workload so I was supervising others instead of doing most of the work myself, I had to listen and do it, even though I felt frustration and regret for the job I knew I *could* be doing if only I didn't have to eat, sleep, spend time with friends and my significant other, and in general function like a member of the human race instead of a deadline-driven editor.

Early on I realized I'd need a support group of women. As it happened, by 1984 I knew or had met a handful of women outside the Department whose vocations or avocations centered around natural resources. We began meeting regularly for lunch. Over the years, we've been information sources, reality checks, sounding boards, hand-holders and advice-givers to each other. Without their help, I would have thrown in the towel long ago. One of them just began working for the Department; it's interesting to see how her frustration with the bureaucracy mirrors mine, but I don't think she feels the out-and-out loneliness I sometimes experienced when totally surrounded by alien mindsets that didn't know quite what to make of me, either.

More than sexism, I have had to deal with subtler "isms": not being a biologist and coming from the (scary and untrustworthy, to a biologist) world of the media. By not belonging to the mostly fraternal order of B.S.-ers, I have little opportunity for upward mobility in the agency. I'm considered an anomoly in an off-beat bureau: a journalist first, a bureaucrat second, an environmentalist third.

Yes, an environmentalist. Years ago, in Twin Falls, I had joined the Idaho Conservation League. There was a chapter in Twin for a few years, and through it I had met Carl Nellis and Stu Murrell—my first contact with the Department, in fact. Both had impressed me favorably, in different ways. After moving to Boise, I kept up my connection with ICL through a relationship with my now-husband, Gary Richardson, who had been ICL's first field rep in 1977, and had continued active membership ever since. Long mistrusted by the fish-and-wildlife establishment, environmentalists have gained a small degree of currency with the Department in the past few years, in part due to "cross-overs" like me. Because so many environmental leaders in Idaho are women, I've found it easy to work with them and have helped build bridges where I can.

Wearing these three hats — journalist, bureaucrat, environmentalist —is fine with me, for the moment. I'm still learning something new every day, meeting fascinating people who are doing important work, getting to take photographs (my passion) of everything from endangered sockeye salmon to Mariel Hemingway, and helping grease the wheels of natural resources communication upon which, in my humble opinion, the world's future depends.

I've buckled down to the traces. I've done well by the department and the department has done well by me. *Idaho Wildlife*, the magazine I produce, has won numerous awards and has been read, reprinted and quoted by thousands of men, women and children around the world. The days when I was one of only two women at In-Service Training (a biannual gathering of the troops for a week of classes and socializing) are gone, thank God. (It's awful when everyone in the room—400 or so men—knows your name and you don't know theirs.) Once-numerous occasions when I wondered "Why do their minds work so differently than mine?" about male biologists have been replaced by fears that I'm getting to be so much like them that I won't be able to ask (or even recognize) the questions real-world lay people (IW's readers) want to know.

After 10 years of thinking someday I'd go back to California, where I could do something "important," I gave my heart to Idaho and vowed to keep her from becoming what my native state Colorado had become. (I first learned to love pine groves and mountains when growing up in Colorado, and cried when I saw smog first smudge Denver's clear blue skies in 1964. "Progress," my parents called it, but I knew better.) As I became more aware of the political and bureaucratic processes that control what happens to the environment, I saw that much can be accomplished by people of conscience working inside the infrastructure. As a woman and a journalist, I view that infrastructure from a different perspective than most of its inhabitants, and when it seems appropriate, I share my observations with others. From time to time, that puts me at odds with my supervisors and peers, but for the most part, we work together well because our focus is on getting the job done, not on who gets the credit for it.

As for tomorrow, who knows? It would be hard to let go of that feeling of being in touch with the pulse of what's happening in and to Idaho's environment, even though wearing the agency's velvet muzzle is frustrating at times. On the whole, though, I've truly enjoyed the people in this field—they like their work, are open and honest (compared to Madison Avenue types) and are committed to "protecting and perpetuating" the fish and wildlife resource. It also has been heartening to see our agency (and federal land management agencies) begin to welcome women professionals, treat them with respect and credibility and reward them with the promotions they deserve.

It's not a perfect world, and we have a long way to go. But the new cohort of wildlifers of both sexes who know how to network (a "female" trait) *and* strategize (a "male" trait) is likely to bring a new, enlightened kind of leadership to the field as they rise in the ranks. I'm glad to see it happening and to encourage androgyny: breaking away from traditional male and female roles so we each can apply *all* our abilities to the problem at hand, whether it's building a fish observatory, artificially inseminating a sturgeon, arresting a poacher, anesthetizing a moose or adroitly conducting a meeting to create a win-win situation. Men *and* women are capable of doing all these and more. We simply have to believe that and act on it and we'll accomplish great things together.

Diane Ronayne is the Editor of Idaho Wildlife, *the magazine published by the Idaho Department of Fish and Game, and has held the position since 1983. Under her leadership the magazine has won numerous awards. Among them: Idaho Press club awards for best magazine, best magazine writing, best public relations and public information writing; Idaho Advertising Federation for best printed material, gold and silver awards; and from the American Library Association, notable document (only 20 nationwide). Ronayne's Bachelor's is from Stanford in Communications.*

OVER 900 VOLUNTEERS HAVE SIGNED ON TO WORK ON VARIOUS PROJECTS. SOMETIMES A COOKIE IS THE ONLY PAYMENT BESIDES THE SATISFACTION.

VOLUNTEER COORDINATOR

MARY DUDLEY

"Would you organize some volunteers to plant shrubs to restore winter range that burned on Squaw Butte?" That question changed my life. Stacy Gebhards, Idaho Department of Fish and Game Region 3 supervisor, and Roger Rosentreter, BLM state botanist, posed it to me in October 1986. In August that year, wildfires had burned more than 218,000 acres in the Squaw Butte watershed north of Emmett, Idaho, destroying 85 percent of the critical winter range for more than 6,000 mule deer. Because of extreme conditions (intense heat, high winds and rugged terrain), the fires had devastated the native shrub community, destroying the seed source for mountain big sagebrush and antelope bitterbrush. The IDFG described the fire as one of Idaho's biggest wildlife disasters.

As a seasonal BLM fire lookout, I had witnessed this disaster. One of the lightning-caused fires had burned within 1.5 miles of the home my husband and I had built in a remote area north of the Butte. We knew the importance of the winter range because every spring and fall we watched from our windows as deer and elk migrated to and from the area.

I said yes and then I spent the next two and a half years recruiting and coordinating volunteers—ultimately, more than 900. The "Friends of Squaw Butte" planted thousands of native shrubs in key areas throughout the burn. Public support was incredible: people throughout southwestern Idaho, from all walks of life, were eager to sweat and toil, working together for a common cause. On a given afternoon, you might find Boise Cascade officeworkers, church parishoners, civic boosters, sportsman or conservation group members, and BLM and Fish and Game employees rubbing elbows on the same planting crew. School kids and scouts pitched in by the busload.

None of these folks asked for or expected payment, but I showed my gratitude by passing out dozens and dozens of "Squaw Butte Cookies"—my answer to Mrs. Fields—and a sure-fire, healthy energizer for weary workers.

The project was so successful that in 1987 I received a national Take Pride in America award and was named IDFG Idaho Conservationist of the Year. In 1988, the BLM gave me a national award for exemplary service. By that time I had been hired as a temporary by the BLM to organize and direct the workforce (but my volunteer days didn't end here).

The value of the Squaw Butte project cannot be measured simply in terms of awards, plants put in the ground or hours of donated labor. It taught me how important it is for wildlife if humans get involved in on-the-ground habitat projects, and how easy it is to turn people on to wildlife in this way. And it gave me the opportunity to educate people about wildlife and habitat and to foster an appreciation for natural resources that many of our volunteers had never had.

I was luckier. Growing up in Idaho with two older brothers, I'd had outdoor experiences in the woods and wilds since I was a kid. From my tomboy years on, I had wanted to be in places where wildlife was, to experience the neat things that happen when you're sitting by a stream, on a mountaintop, or walking through woods. As a seasonal for 15 years with the Forest Service and BLM, I had planted trees and worked on controlled burns, fire crews, and lookouts in some of the country's most remote places. The Squaw Butte project brought an abrupt end to my isolation from people, but it wasn't an unpleasant change.

I had been coordinating with Fish and Game people all along, so when they asked if I would initiate a statewide volunteer program for the Department in 1990, I was excited to have the opportunity to reach more people and, with their help, get a lot of important habitat projects done. Although I'm not a professional biologist, I know who to consult, so I've made sure that what we do on the ground is done right.

With my background, working with men is perfectly natural to me. Although I've come across a few males who feel threatened by a strong-willed woman in a supervisory position, I've been able to smooth the bumps and go on to get the job done. Which is what being a volunteer *and* a volunteer coordinator is all about, right?!

Mary Dudley is the Volunteer Coordinator for IDF&G. Volunteers projects vary from improving and restoring habitat, building interpretive areas and fishing access, constructions of all types, riparian cleanup, research assistance, office work, hosting, and teaching hunter education classes.

MARY DUDLEY'S SQUAW BUTTE COOKIES

1 c. butter, 1 c. margarine, 1 1/2 c. brown sugar, 1/2 c. honey
2 t. vanilla, 4 eggs, 3 c. whole wheat flour, 1 c. wheat germ
1/4 c. soy flour, 1/3 c. oat bran, 2 t. baking soda, 2 c. chocolate chips, 2 c. coconut (unsweetened), 2 c. rolled oats, 1 c. nuts (any kind will do, but unsalted roasted peanuts are pretty good), 1 c. raisins or currants.

Cream first five ingredients. Add eggs and stir well. Combine next five ingredients and stir them into creamed ingredients. Stir in remaining ingredients. Drop by rounded teaspoonfuls onto a greased cookie sheet. Bake in a 375-degree oven for 10-12 minutes. Cool. Store in tightly closed tin or freeze in tins or ziploc bags. Yields about 60 cookies.

NEWS & NOTES

Energy level sinking slowly? Simple remedies to the rescue

Here are a number of books (and a snippet from each) that have to do with maintaining positive energy and attitude while working hard and long.

Peter M. Miller, author of *The Hilton Head Executive Stamina Program* thinks taking sporadic relaxation and oxygen breaks—breathing deeply—is the way to go. Nutritionist Liz Applegate, author of *Power Foods,* says drink water: the brain is approximately 75 percent water and dehydration affects its efficiency quickly. If you feel thirsty, you are already partially dehydrated so stay with a set amount, like eight glasses a day. As perfume lovers know, the right fragrance can energize you. Judith Jackson, an aroma therapist and author of *The Scentual Touch* advises pooped patrons of her book to add peppermint or lemon oil or other scents to your bath or shower or use as a rub on the shoulders and neck.

Almost any exercise elevates the brain chemicals that improve mood says Keith Johnsgard, author of *The Exercise Prescription for Depression and Anxiety.* The psychic lift may last 24 hours, but do it regularly. Marily Schwartz said drinking lots of ice tea is the key in *A Southern Belle Primer.* Anne McIntyre, author of *Herbs for Common Ailments* believes in herbal teas or tinctures of ginseng, wild oats, skullcap or vervain. Ann McGee-Cooper wrote *You Don't Have to Go Home From Work Exhausted* and David C. Gardner and Grace Joely Beatty, who are psychotherapists, wrote *Never Be Tired Again.* They believe fatigue is the result of an energy-draining lifestyle. So read their books and fix it.

Clair McIntosh, *McCalls*, June 1992

Running shoes winners

Consumer reports rated women's shoes best for running. For average or "neutral" runners with no-problem-feet they are Saucony Jazz 3000 at $68 (best buy), and New Balance W997 $100. For others, before you shop, find out whether you have motion control problems like overpronation (the feet roll inward more than usual) or supination (the feet don't roll inward enough). The extra wear on your old running shoes shows to the inside on the first, to the outside on the latter. These require a board-lasted shoe for overpronation and a slip-lasted shoe for supinators.

Consumer Reports, May 1992

A modern day muck-raker

Carol Browner, a lawyer, is a former environmental policy director to U.S. Senators Lawton Chiles and Al Gore. She was picked by now Florida Governor Chiles in 1991 to head the Florida Department of Environmental Regulation (DER). Under the previous secretary, civil engineer Dale Twachtmann, DER was demoralized and debilitated. Staff was cut, the mission was defined in terms of developers and engineers, and Twachtmann often fought more stringent regulation or law. For Browner, the first order of business was to try to restore the department's credibility. She sought the advice of environmental groups, freed up her own staff biologists to render professional opinions, asked the governor to appoint new members to the rule-making Environmental Regulation Commission, and began taking on all comers.

In the Everglades, DER, Browner, and general counsel Dan Thompson admitted the park is being contaminated and accepted state blame, getting the state out of a costly lawsuit.

They next took on the powerful sugar industry in trying to find a solution. In her first legislative session, Browner fought the oil industry on a bill that bailed out gas station owners who allowed tanks to leak into the ground water. In federal wetlands policy, she protested adoption of a weakened national standard; the proposed Bush regulations, she said, would have exempted even part of the Florida Everglades. In agency enforcement, she turned up the heat on developers and polluters, increasing enforcement cases by 15 percent and doubled the total amount of penalties awarded to the state. General counsel Thompson, who has worked for three secretaries, says Browner "has been prepared to take on some very powerful interests" and calls her manner "inspirational." Another staff member says: "We know with Carol we simply follow the science and follow our conscience."

Jon East, *St. Petersburg Times,* February 23, 1992.

Committee transit

If the people around here had as many buses as they have committees studying how to get buses, we could all get rid of our cars. In fact, if we could ride on committees, we wouldn't need buses. We are paying them to study buses. We should simply ask them to stop that and start driving buses instead. The money we save on office equipment and supplies now used to study ways to buy gas for the buses can be used

to buy gas for the buses can be used to buy gas for the buses. We already have the buses—dozens of them, all over the region. We have senior citizen buses and nursing home buses and Department of Transportation vans already purchased. Most of all, we have school buses—each one driven about four hours a day and used the rest of the time to provide homes for spiders. So what is this business about committees and studies and meeting to find the money to provide this region with a public transit system?

....Bill Hall, *Lewiston Morning Tribune*, May 4, 1992.

GOTCHA!

Hunters traveling on Interstate 25, a "funnel" highway running through Raton Pass, New Mexico, got quite a surprise on October 15, 1991. For 77 hours, 120 state and Federal law enforcement officers stopped every vehicle (11,535 in all) traveling south from Colorado to New Mexico, questioned occupants, and escorted any of suspicious nature (6,700 of them) to a wildlife station. Often the contents of a vehicle had to be completely unloaded. All in all, some 414 wildlife violations were found and the operation netted $71,900 in fines and bonds. Two and a half tons of meat were confiscated and later donated to welfare agencies.

....Jack Hallowell, Region 6, *Fish and Wildlife News*, Winter 1992.

Earth Summit in Rio: sanctifying rights that nations will have a hard time denying

Most of the gloomy commentary on the primary Rio agreement, the global-warming treaty, has focused on negligible questions like what standard will be used for statistical measurements. Missed in the rush to express on-camera despair is this: the treaty incorporates into international law the notion that nations must consider the global environmental consequences of internal economic decisions. This "has the potential of forcing governments to change domestic policies to a greater degree than any international agreement I can think of," says Jessica Tuchman Mathews, vice president of the World Resources Institute. Legal precedents often start small but grow to instruments of great power. The human-rights premise was that universal freedoms have standing regardless of what a country's internal legal system says. Soviet officials resisted that notion for decades; once it was on the books, the logic of reform became impossible to stop. In ecology, governments and economists have long resisted the notion that nature has a standing independent of national law. Now George Bush, John Major, Helmut Kohl and the other capitalist leaders will sanctify that idea, creating a new logic of "green rights" they will find increasingly difficult to oppose.

Rio is also proclaimed a failure because conventions on biodiversity and forest protection may falter. But these treaties are worth doing today, they will be worth doing in the months to come. Throughout the 80's Washington and Moscow held a series of failed summits on nuclear-arms reductions. After each, wise observers declared that hope for arms control was irrevocably lost. Yet eventually the treaty not only happened but was more sweeping than expected.

....Gregg Easterbrook, *Newsweek*, June 15, 1992

University of Wisconsin-Madison Chancellor Donna Shalala speaks up for college kids

I'm not worried about this generation of young people. I like their values. I like the kinds of things they care about. I don't find them overbearing. They're not a greedy generation. When they care, they're really passionate about it. And when we need them on the great issues of our times, they'll be there.

...Frances Lear, *Lear's*, May 1992

Harassment survey conducted by *Working Woman*

Many *Working Woman* readers insist that filing a complaint still amounts to "career suicide." What's more, they are angry enough about the spectacle of the Clarence Thomas hearing to vote their minds in a year when it matters. Several messages came through:

•Women do know what harassment is by legal definition or intuition.

•The higher a woman is in the hierarchy, the more likely she is to be harassed.

•Women are not at fault.

•Anita Hill changed the picture.

As to why men do it, responders said:

• It is not flirtatiousness, hormones, or sexual desire. The desire to bully and humiliate women is behind most harassment, according to half of the responders.

•Forty-seven percent of the readers said they had been harassed by a "chronic harasser," men who bully one woman after another at work.

•Intimidation is part of it. Workplaces with high rates of sexual harassment also have high rates of racial harassment, discrimination, etc.

What are the odds of getting even when fighting back:

•Only 21 percent agree that complaints are dealt with justly.

•Sixty percent say charges are ignored or offenders are given token reprimands.

•Fifty-five percent of those who reported it said nothing happened.

What does work? Dismissal.

...Ronni Sandroff, *Working Woman*, June 1992.

KIOSK

There are several opportunities to receive information about enhancing fisheries careers. Anyone interested in joining or receiving information about the American Fisheries Society and/or the Equal Opportunities Section of AFS may contact Secretary/Treasurer Dr. Mary Fabrizio, USFWS/NFRC-Great Lakes, 1451 Green Rd., Ann Arbor Michigan, 48105 (313-994-3331). There are also two networks: Women's Fisheries Network, National Headquarters, 2442 NW Market St. #243, Seattle, Washington 98104 and the Women's Aquatic Network, P. O. Box 4993, Washington DC 20008 (this group charges $25 for membership).

A forum proceedings called Green Spaces/Safer Places is available from the Safe City Committee for a cost of $5 Canadian. The topics include subjects such as safer parks for women, new open space policies, downtown parks (specifically New York City, Toronto, Montreal), citizen participation, and others. To get a photocopy, write the committee assistant, Lorin MacDonald at Planning & Development Dept., 20th Floor, East Tower, City Hall, Toronto, Ontario CANADA M5H2N2 (416-392-0415).

A Congressional hearing relating to the reassignment of Lorraine Mintzmyer—National Park Service's only female Regional Line Manager—(see WiNR Vol 13 No. 1) was held on April 29, 1992. Members of the House were in attendance as were US Department of Interior witnesses. The hearing was held because the USDI was believed to have not cooperated with the subcommittee's investigation into alleged improprieties surrounding Mintzmyer's reassignment. One committee member, Constance Morella (R-MD), expressed concern about the allegations that political pressure and discrimination against minorities and women exist in the Park Service and in the Department of Interior. She hoped an open hearing would be held soon, but members voted 3 to 2 to close it. Copies of the witness list and the members' statements are on file in Washington DC at Legislative Affairs, South Agriculture Building, Room 3031—or from Stana Federighi (202-205-1470).

A recent study of 13 large international companies commissioned by Xerox found that half are testing alternatives to transferring employees who are attempting to climb the promotion ladder. They are trying commuting, temporary assignments, flying managers around or to work on company planes, and clustering jobs in regional hubs. Transfers, which started to fall off noticeably in 1990 dropped six percent in 1991 according to the Employee Relocation Council in Washington DC. It's no longer detrimental to refuse a transfer, ERC spokeswoman Anita Brienza believes. In 1990, women made up 18 percent of all transferred employees, up from 11 percent in 1986.

The Love to Commute catalog (call 408-281-7265) has such goodies as a writing desk that fits onto the seatbelt, a portable oven, a refrigerator/food warmer, heated ice scraper and other stuff that plugs into the cigarette lighter. "Do you smell something burning?" could take on new meaning if you are a commuter with these gadgets.

The Women of the West Museum has received its first foundation grant to conduct a financial feasibility study for planning the museum's future. Ideas for exhibits include chronological continuity of women in the West, the tension between the West as home and as destination, women as creators, women and popular culture, and biographies of women leaders. For more information contact them at 250 Bristlecone Way, Boulder, Colorado 80304 (303-443-2946).

The first National Urban Forestry School Session will be held September 20-25, and the second September 27-October 2, 1992—both in Lincoln Nebraska at the Arbor Day Institute. Contact them at PO Box 1415, Lincoln, Nebraska 68501 (402-474-5655).

FORS 9th Computer Conference and Trade Show will be held August 25 to 26, 1992 at Michigan State University, East Lansing. The theme is: Managing and Communicating Information. For information contact David Gilluly, FORS, 122 Helton Ct., Florence, Alabama 35630 (205-767-0250.

TreeKeeper jr is a low-cost, high-ability inventory software program developed to help small communities with 5,000 or fewer trees. User friendly, it can add, edit, and delete trees recorded by building addresses or by city block; store a full range of information about each tree, compute tree values, keep a care diary. For information about cost contact the Arbor Day Institute, PO Box 81415, Lincoln Nebraska 68501-1415 (402-474-5655).

The Pacific Graduate Conference on Social Sciences in Natural Resource Management is sponsored by the graduate students of the University of Washington, College of Forest Resources and will be held November 12-13, 1992. The purpose of the conference is to provide an opportunity for graduate students to exchange ideas about current research, both international and domestic. Topic areas will include women in natural resource use and management, conflict resolution, public and community participation, sustainable development, and rural appraisal. The meeting will be held at the Pack Forest Conference Center near Seattle. For information on presenting papers, contact Kristin Warren, College of Forest Resources, University of Washington, AR-10, Seattle WA 98195 or call Linda Kruger 206-553-7817.

WiNR
Women in Natural Resources

Information for Contributors

Women in Natural Resources provides information and ideas for, from, and about women who work in natural resources. Topics covered in the journal are those of forestry, wildlife, range, fisheries, recreation, arboriculture, ecology, and the social sciences as they relate to natural resources. We address issues of administration and personnel, gender related topics, educational resources, and support mechanisms. Technical articles suitable for reading by professionals in varied natural resource fields are also featured. Our contributors effectively integrate the factual, the personal, and the philosophical aspects of the working professional.

To Submit Full Length Manuscripts: Because of the variety of professions represented, the journal solicits full length manuscripts in the style dictated by the leading journal in your own profession, or the *Chicago Manual of Style*. Clarification of style is the prerogative of the editors. Manuscripts should be sent on disk formatted in Microsoft Word, (unless arrangements have been made with the editor), but should include hard copies as well. All graphs should be camera-ready. Average manuscript length is 5 to 15 pages (space and a half). Include non-returnable black and white photos (action shots, please), and a short biographical sketch similar to those included in this issue.

Women in Natural Resources will provide letters confirming refereeing as needed.

To Submit Short Department Items: Copies or originals with author, source, date, and submittee are all that is required.

For more information: Call 208-885-6754/FAX 208-885-5878.

Information for Advertisers

Camera-ready black and white, or copy suitable for our graphics department, is priced as follows:

Inside: Full page	$600
Half page	$300
One-third page	$200
One-sixth page	$100

WiNR sends out twice-monthly jobs announcements fliers. The cost for space is the same as in the journal. FAX or mail your ad and after the ad appears, WiNR will invoice. **There are no deadlines for ads.**

Quarterly Deadlines

Quarterly deadlines for finalizing manuscripts are as follows:

Copy Due	Issue Mailed
January 15	March
April 15	June
July 15	September
October 15	December

Information for Subscribers

Personal subscriptions are $19. Subscriptions for government agencies, libraries, universities, and corporations are $30. Subscriptions mailed outside the U.S. are $35. Subscriptions for students are $15.

Make checks payable to **WiNR** and send to:

WiNR, Bowers Lab
University of Idaho
Moscow, Idaho 83843 U.S.A.
208- 885-6754
FAX 208-885-5878

The journal is mailed quarterly in June, September, December and March, from the editorial offices in Moscow, Idaho, ID# 82–6000945. Renewal billings are sent after the fourth issue is mailed. For changes of address, send them six weeks before the issue is mailed. Include, if possible, your mailing label.

University of Idaho 152-Y225
WOMEN IN NATURAL RESOURCES
Bowers Laboratory
Moscow, Idaho 83843

FORWARDING AND
RETURN POSTAGE GUARANTEED,
ADDRESS CORRECTION REQUESTED

Office Copy
Portions
removed

Non-profit Organization
U.S. Postage
PAID
Moscow, Idaho 83843
Permit No. 120