USGS
science for a changing world

WFRC Research News

(news you can use to thrive and survive)

Editor: Gary A. Wedemeyer *Volume 3(3): November, 2004*

In This Issue…

Lab News You Can Use

by Lyman Thorsteinson

In August, USGS science in the Pacific Northwest was showcased in an Open House at the Seattle Laboratory. One purpose was to increase public awareness of USGS efforts in Puget Sound with emphasis on our coastal research on nearshore bathymetry; eel grass dynamics, juvenile salmon, marine invaders in ballast water, and disease in Pacific herring. The Open House was held in conjunction with a media event and congressional visit. Although we fishheads didn't attract the local crowds of Mt. Saint Helens, we wowed our visitors with field sampling, laboratory tours, equipment demonstrations, and meetings with scientists. USGS participation was great, with scientists from Geology, Water, Geography and the Cooperative Fish and Wildlife Research Unit (University of Washington) displaying their scientific wares. It was a rewarding way to learn about the other disciplines and our shared interests in this area.

I am pleased to officially announce Dr. James Petersen as our new Laboratory Director at the Columbia River Research Laboratory (CRRL). Jim is well known for his large river research on fish bioenergetics and predator prey relationships. He has been a senior fishery research biologist and supervisor at the CRRL since 1988. In the Columbia River Basin his work on non-native fishes and species interactions is pioneering. His bioenergetics and species interactions models have had immediate impact on hydroelectric power operations, juvenile salmon passage, salmon predation, and endangered species management. Dr.

Petersen is an affiliate associate professor at the University of Washington's College of Fisheries and Aquatic Sciences and in this capacity has served on numerous graduate student committees. He is well published in the professional literature, a regular participant at science conferences and professional society meetings and is recognized nationally and internationally as a subject matter expert. Congratulations to Jim in his new position.

Over the course of the last year, I have been working with senior managers in the Center and Western Regional Office to develop a 5-year Workforce Plan. The completed plan was submitted to the Western Region (REx, Biology) in early October. This plan includes strategic science directions of the Center and workforce needs in light of our demographics (i.e., succession planning), existing skills, and a "gap analysis" to identify areas where specialized expertise will be needed. In describing our strategic directions, I considered customer and emerging science needs in several broad science areas: disease ecology, watershed ecology, coastal and marine ecology, threatened and endangered species, aquatic invasive species, and landscape ecology and enterprise technology. In all that we do, these areas are at least conceptually linked in our goal for developing aquatic ecosystem understanding in the West.

A few fun facts from the workforce planning are in order. Not surprisingly, most WFRC staff were hired as Fishery Biologists under the GS-482 series. Regarding staff age, the "grayest panthers" can be found in Seattle (average age = 45.1 yrs), followed by Reno (38.4 yrs), Dixon (37.8 yrs), CRRL (35.4 yrs), and Klamath Falls (31.0 yrs). Age data from Marrowstone Island was pooled with Seattle to keep its average age lower. The average Center employee is 37.6 years old.

On the horizon, Carol Schuler (Director FRESC) and I will be meeting with the USFWS in November to discuss our Centers and learn about that bureau's information needs and priorities. In January, BRD and WRD cost-center managers will be meeting to discuss common skill sets and enhancing research collaboration. On the science side, the WFRC will be assisting others in the planning and organization of national USGS workshops on "next generation tools for water and ecosystem management" and adaptive management in 2005.

Puget Sound Gap Analysis

by David Woodson

Reg Reisenbichler (WFRC Seattle), Jim Hatten (WFRC/CRRL) and I are currently developing a 5-year action plan for the Puget Sound Aquatic GAP project. To gain valuable information about Coastal GAP projects, we visited the USGS Tunison Laboratory in Cortland, NY, during September 21 – 23, 2004.

While we were there, Jim McKenna, a Fishery Biologist at Tunison gave an overview of the first 3 years of the Great Lakes Coastal GAP project. Topics included habitat classification, statistical analyses, and logistical constraints involved in working in such a large area.

Greg Kennedy, a Fishery Biologist with the Great Lakes Science Center, provided an overview of the side-scan sonar and substrate classification work he has been doing. Jim McKenna also discussed fish assemblage sampling and various modeling techniques for predicting species occurrence.

This information provided valuable insight to our WFRC group and will assist in the development of the 5-year Puget Sound Aquatic GAP plan.

Immunology Group Leader Dr. John D. Hansen

by *Gary Wedemeyer*

Please join me in welcoming our new Immunology Group Leader Dr. John D. Hansen, and his research team members Dr. Kerry Laing, a post-doctoral fellow, and Eric Landis, a Ph.D. candidate from the University of Maryland.

John graduated from the University of Wisconsin (Eau Claire) in 1987 with a B.S. in Zoology/Chemistry and then worked at a V.A. hospital for several years as a member of a research group studying the role of the immune response in liver cirrhosis. Feeling the need for more advanced study, he entered graduate school at Oregon State University (OSU) in 1991, working in Steve Kattari's laboratory on a research fellowship. John says his interest in fish immunology actually began during his doctoral training at OSU. His dissertation research focused on defining the primary sites for B-cell development (lymphopoiesis) in rainbow trout, and is now widely considered to be the seminal work on the subject.

John received his doctorate in 1995 and was immediately offered a position at the pestigious Besel Institute of Immunology in Switzerland. While there, he and his wife Brenda lived in a 15th century stone house, did a lot of hiking and rock climbing, and learned a lot of German and French. After about 6 years as a scientific member at Basel exploring processes that govern lymphocyte development and self/non-self discrimination in rainbow trout, John felt it was time to return to the U.S. where fish immunology was considered more in vogue. In 2001, he joined the faculty at the University of Maryland where he continued his research on cellular events during viral infections in elasmobranch and teleost fishes.

On a trip to the West Coast in 1998, John gave an informal seminar here at WFRC while visiting his close friend Eric Anderson, and says he was quite impressed with both the quality of the research going on and the facility itself. When he heard that a position had opened up here (*vice* Pascho), he applied for it and, as they say, the rest is history!

John's focus at WFRC will include his on-going research to define the basic mechanisms of fish immune systems and the application of this knowledge to solving infectious disease problems limiting the success of both state and federal conservation hatcheries and the commercial aquaculture industry. To this end, he is particularly looking forward to working with the WFRC fish virology group on the basic mechanisms of DNA vaccines. Again, this will include their application to conservation hatchery problems as well as basic research on the mechanisms involved.

Assisting John as members of his research team are Dr. Kerry Laing, a post-doctoral fellow, Eric Landis, a Ph.D. candidate from the University of Maryland, and the charming Dorothy Chase of WFRC. Currently they are utilizing a functional genomic approach funded largely through the USDA to define the MHC haplotypic architecture within clonal lines of trout. In addition, they are actively involved in the design and usage of microarray technology that can be used for the identification of molecular pathways and candidate genes that are relevant to fish health and the production of effective vaccine technologies. Viral (IHNV, VHSV, IPNV) and bacterial (*R. salmoninarum, S. iniae*) pathogens cause devastating mortalities among hatchery and

aquaculture reared salmon, some of which are already threatened by over fishing and habitat loss. Therefore it is critical to learn more about the factors that protect fish from the detrimental effects of these infections. John's research team is also funded through the National Science Foundation to look at the processes governing T-cell development and function in trout.

On his rare days off from research, John enjoys snowboarding, hiking and other outdoor activities with his wife Brenda and two young children Keagan and Mina. He and Brenda are also amateur beekeepers and intend to have active hives set up in the near future.

Visiting Scientist: Michelle Penaranda

by Ma. Michelle Demogina Peñaranda

Mabuhay!
If you've seen an Asian girl wandering through the corridor… appearing lost…that's probably ME! Yes, I am the newest girl in the building. I am, and will be, working in Gael Kurath's lab for 5 years or so while pursuing a doctorate degree in Pathobiology at the University of Washington.

I have lived the whole 25 years of my existence in a tropical country called the Philippines. I grew up in Aklan, a small province known for Boracay (an island with fine white sand and crystal clear water) and Ati-Atihan Festival (our version of Mardi Gras). Prior to this 'great American adventure', playing with piscine nodavirus was my main hobby – which is not to say, of course, that I don't have a life. I also go clubbing, dancing, occasionally shopping, and nature-tripping for fun.

I must say that although many Filipinos are already assimilated with the American culture, the Philippines is different from the U.S. in the sense that hiking/trekking, fishing (as a hobby), rowing, and all other nature-related activities are mainly for the financially-stable, while 'malling' (going to malls) and shopping (window-shopping, that is) are for those with relatively lower incomes. But I digress.

My fascination with science started at an early age. I initially thought of becoming a medical doctor, that being the most popular profession for science enthusiasts in our place. But thanks to Hollywood movies and American shows – exaggerated and unrealistic as these may be at times – I got to realize that there is a whole lot of other vocations available in the scientific field.

I first developed my interest in DNA and scientific research when I saw Jurassic Park. Then I watched Outbreak and became enthralled with the 'powers' of viruses. Inspired by the researchers who cloned the dinosaurs from DNA preserved in dinosaur-biting prehistoric insects, I took Molecular Biology and Biotechnology as an undergraduate degree. At some point, I got hooked on X-Files and Discovery Channel's Medical Detectives and considered pursuing a career in forensics (I even did volunteer work collecting tissue samples from exhumed bodies of fire victims). Until it dawned on me that forensic work can be very frustrating in a country with inadequate crime lab facilities (we didn't have any of C.S.I.'s hi-tech gadgets at that time). But I still resolved to work in a laboratory setting though.

And work in a lab I did. I got a job in SEAFDEC-AQD, an international institution (with 10 member countries) that specializes in aquaculture research. There, I conducted experiments related to

Philippine fish viruses, particularly the nodavirus VNN, which is the most prevalent virus in our archipelago. At the same time, I pursued a Master's degree in Biology (major in Microbiology).

The bulk of my work at the Fish Health Section was mostly diagnostic though, and being the innately curious person that I am, I aspired to do more in-depth studies on these fish viruses. Hence, I decided to apply for a Ph.D. program in the U.S. under the Fulbright scholarship. I started searching the web for possible mentors, and guess whose name popped out – Gael Kurath's!

After months of preparation and anticipation, I finally arrived in Seattle (in one-piece, if I may add). And thus begins another chapter of my life story.

-- *Michelle*

NBII's Vivian Hutchison

by Vivian Hutchison

Sometimes in life we are handed opportunities that we can't pass up. Other times we have to arrange them. My latest experience in moving to the Seattle USGS Western Fisheries Research Center fell into the latter category. My name is Vivian Hutchison, and I work for the National Biological Information Infrastructure (NBII), a program sponsored by the USGS.

Here's the official description: The NBII <www.nbii.gov> is a broad, collaborative program whose mission is to provide increased access to data and information on the nation's biological resources. Coordinated by the USGS, the NBII links diverse, high-quality biological databases, information products, and analytical tools maintained by NBII partners and other contributors in government agencies, academic institutions, non-government organizations, and private industry.

My background is in Library and Information Science, and so it was only natural that I become the Metadata Coordinator for NBII when I started the job in June 2002. At the time, I was working in Reston, VA in the USGS headquarters building, and really had only a vague concept of the nature of "metadata."

That changed quickly after a training workshop, and pretty soon I had the lingo down. By the way, if you want to be in the know, metadata literally means, "data about data". When you go into a library and look up a book on the computer or in the card catalog (if those exist anymore), you are actually reading metadata about that book: title, author, description, publisher, date, etc. Similarly, if you read the label on a food container, you are reading metadata – calories, ingredients, carbs, etc. If they didn't tell you what was in the can, you might not want to eat its contents, right? (You still might not!) But, see? Metadata is all familiar stuff – it's just that there was a fancy term thought up to describe it.

Of course, when we're talking about metadata for scientists, we're definitely talking about something more complicated than food labels. The standard that biologists follow to create metadata is a bit more in depth. In fact, it's in depth enough to have training sessions that can last 1-2 days, with special software, and major Clearinghouses. But it's easier to create than it sounds. That's where I come in. The majority of my job focuses on arranging training sessions, making presentations at conferences to let more people know about how fun metadata is (!), and working with all kinds of

partners (federal, state, non-profit) to get their metadata into the NBII Clearinghouse. There's a lot more to it, of course, but that's another article. If you're curious about metadata now, visit www.nbii.gov/datainfo/metadata to learn more.

Let's get back to the opportunities in life, though. After attending the Claremont Colleges in California, I moved up to Seattle because I had heard it was gorgeous and had lots of high mountains for me to climb. I lived here for years and never thought I'd leave – the hiking, backpacking, skiing, and year-round, never rained-out co-rec soccer games was too big of a draw – but then one of those life opportunities came along. This was one I couldn't pass up (the first kind I mentioned) – move to the Washington DC area, be near my family for a couple years, and attend grad school at the University of Maryland. I had a great time, learned a lot, and in the midst of it all, started working for NBII at USGS in Reston.

For all of the great aspects of the East Coast, I was never without a nagging feeling that I needed to get back to the Pacific Northwest. So one day I approached the NBII management with the idea of relocating to a USGS Seattle office. (the second kind of life opportunity) They agreed provided I spent another year in Reston to make sure I would remember what metadata really was when I got to Seattle. When the year was up, they remembered their promise. The management at the Western Fisheries Research Center was kind enough to carve out some office space for me, and I certainly appreciate the opportunity to be here. I am looking forward to meeting everyone at WFRC, and discussing ways in which WFRC and NBII may collaborate in future projects.

My office here at the Seattle lab is room A121. Please stop in and say Hi!.

Invasive Species Research

by Rusty Rodriguez

Non-native marine species have been and continue to be introduced into Puget Sound via several vectors including ship ballast water. Some non-native species become invasive and negatively impact native species or near shore habitats. Others do not. Factors thought to be responsible for invasiveness include absence of predators or parasites, short generation times, and generalist diets. Unfortunately, reliable predictive capabilities to determine if a non-native species will become invasive are lacking. Our past research has led us to develop the hypothesis that the invasiveness of plants is due to symbiotic associations with microscopic fungi that live within plant tissues. Until the mechanisms responsible for invasiveness are understood, it will be difficult or impossible to develop effective and inexpensive control methods.

We are also using state-of-the-art technology to develop DNA-based diagnostic tools to rapidly detect the presence of native and non-native species in complex samples such as soil, wood, plants, and ship ballast water samples. Integrating microarray technology and novel nucleic acid chemistry, this diagnostic system will have the capacity to identify up to 18,000 different species per sample. It involves the generation of protein-nucleic acid probe (PNA) microarrays. PNA probes are spotted onto glass slides (one slide can hold up to 18,000 probes) and the arrays incubated with either PCR amplified DNA from water sources, or total DNA extracted from water samples, depending on the level of sensitivity required. One of the benefits of this strategy is that universal PCR primers can be used to amplify specific genomic sequences in all of the organisms present in a sample. The amplified products are then incubated with the PNA probes that bind to complimentary sequences in a species-specific manner. This is a very fast technique and allows all the species per sample to be analyzed at

the same time. Although the initial equipment costs are substantial, the costs of individual analyses will be low.

The PNA-microarray strategy will enable the development of diagnostic systems for species known to be of concern. However, it is not yet possible to predict the potential invasiveness of any species because mechanisms of invasiveness are unknown. Therefore, we are developing "geographic signature" microarrays to monitor the transportation and establishment of species, that are not yet identified as potential invasive species, from specific locations. Although this approach has several technical challenges, the potential outcome will provide a new level of resolution for testing ballast water.

For example, perhaps a known invasive from Eurasia is not detected in ballast water but if the signature arrays indicate that a number of other Eurasian species are present, corrective measures should still be taken. The approach for this will require isolating nucleic acids from native biota in water samples from specific geographic regions around the world. Since many ocean ports are currently contaminated with non-indigenous species, nucleic acids from both native and non-native species will be need to be isolated. Using a combination of nucleic acid cloning, subtractive hybridization, automation and microarray techniques, it should be possible to isolate and array nucleic acids from indigenous species. It will be difficult to identify the species contributing signature nucleic acids because most of the species of interest are undoubtedly not yet represented in DNA databases. Regardless, the signature arrays will allow the question “are there non-indigenous species ballast water samples and what is the origin of those species?” to be answered.

Elwha Dam Removal – An Unprecedented Research Opportunity

by Jeff Duda

The Olympic National Park, as the name implies, is truly a majestic place. A unique gem of the Pacific Northwest, its minimal roads and a rugged interior make accessibility challenging. What is left to the motivated hikers and backpackers, though, is a park of nearly complete wilderness. This wilderness is a vast wonderland of huge trees, unique fungi, and delicate mosses. The park is incredibly intact and supports an impressive biodiversity, earning Olympic a designation as an International Biosphere Reserve and a World Heritage Site. As impressive as the natural credentials are, though, much attention has been paid recently to two uniquely human components of the ecosystem — the Elwha Dam and the Glines Canyon Dam. Purchased by the National Park Service and slated for removal in 2008, these two dams on the Elwha River will be the largest ever removed in the United States. The USGS is right in the thick of things, with scientists from at least 8 different laboratories contributing to the research and monitoring of both the short and the long-term effects of the dam removals.

Built over 90 years ago and located 4.9 and 13 miles from the river mouth, the Elwha River dams were originally intended to produce electricity for Port Angeles, Sequim, and Bremerton, although after 1920 the power was mostly used to supply a pulp and paper mill in Port Angeles. Because the dams lacked any fish passage provisions, the upper river and nearly 70 miles of spawning habitat, were effectively blocked to migrating salmon. The Elwha supported 10 runs of anadromous fish — pink, chum, coho, sockeye, spring and fall Chinook salmon, winter and summer steelhead, bull trout, and sea-run cutthroat. These fish numbered in the hundreds of thousands and the spring Chinook were

legendary. There are historic reports of fish weighing in as large as 100 lbs.

The ecological effects of the dams on the Elwha ecosystem have been large and cumulative. Aside from the obvious impacts of changing the fish community and starving the upper river of marine-derived nutrients, there were also cross-boundary effects in the riparian and upland areas. It is believed that many species of birds and mammals that once feasted upon salmon carcasses suffered population declines. The reservoirs created by the dams (Lakes Mills and Aldwell) have acted as sediment traps, storing 13.8 and 4.0 million cubic yards of fine grained sediments. This has starved the lower river, the delta at the river mouth, and the near shore and beach areas of material that would have naturally accumulated and receded. Instead, there has been considerable erosion, resulting in the near shore habitat becoming a cobble dominated system. This, in turn, has affected the benthic biological community with probable reverberations throughout the nearshore food chain.

Because of these impacts, the fact that most of the upper river lies within the Olympic National Park, and other issues such as relicensing, Congress enacted the Elwha River Ecosystem and Fisheries Restoration Act of 1992 (PL102-495). The stated goal of this legislation is, "...the full restoration of the Elwha River ecosystem and native anadromous fisheries." Considerable effort has been undertaken by the National Park Service to make this happen through removal of the Elwha dams – currently slated to begin in 2008.

The dams will be deconstructed following a process that will basically resemble a reversing of the way in which they were put it. "Notching" of the upper levels of the dam face will drain down a portion of the reservoir, exposing a section of the dam to be removed. Successive notching will take place, systematically removing the two massive structures. The Elwha (lower) dam is 107 ft. high and 405 ft. wide along its top; the Glines Canyon dam is 205 ft. high and 270 ft. wide. Because the Elwha supplies the surrounding community with drinking water, a new water treatment facility must be built. The Elwha Tribe will also receive a new fish hatchery.

Because the removal date is rapidly approaching, there has been heightened activity by various government and state agencies, the Elwha Tribe, and universities to seize this unique opportunity to study the effects of dam removal and track the restoration of the fishery and ecosystem. Unfortunately, little funding exists within the 182 million dollar appropriation to accommodate all of the research and monitoring priorities that scientists have identified as vital to fully understand the impacts of dam removal. Undaunted, the USGS, NPS, NOAA Fisheries, Elwha Tribe, WDFW, and university partners have forged ahead, convening 3 workshops and numerous planning meetings regarding science issues in the Elwha. Many foundations have been contacted, at least 3 NSF grants are currently under review, and some research projects are already underway, one of which was initiated by the Western Fisheries Research Center (Jeff Duda, Pat Connolly, Reg Reisenbichler, and Jim Petersen).

Working in close coordination with many of the partners listed above, we are primarily concerned with documenting baseline levels of three vitally important components of the river expected to change once salmon return to their ancestral breeding grounds. The fish communities above, between, and below the dammed river segments are expected to change, obviously, but the dynamics of recolonization are complex and few predictions about the status of the fish community 5, 10, and 50 years post removal currently exist. Pat Connolly, Ian Jezoreck, Brady Allen, Jodi Charrier, Scott Sebring, and Steve Rubin did extensive field work on the Elwha this past summer, using various

techniques to enumerate fish, including electroshocking and snorkeling. We found rainbow trout and bull trout between and above the river within index reaches that will be sampled again next year and into the future.

A crew of Student Conservation Association interns (Jeremy Steinbacher, Cat Chambers, and Christie Galitsky) and I had the enviable task of working above the dams to document existing stream invertebrate and periphyton communities and collect fish DNA. With most of the sites in the backcountry, we embarked on 4 backpacking trips ranging from 11 to 25 miles and lasting a week or more. We also collected additional samples of bugs, algae, and fish to analyze for stable isotope levels of carbon and nitrogen. These heavy isotopes have been used since the early 1990's to determine the relative contribution of salmon carcass energy to the aquatic ecosystem. The idea is straightforward: born in rivers and streams, salmon rear in freshwater for a species-specific time and then migrate to the ocean with bodies that are relatively small. Once in the ocean, they mature and grow into adulthood, gaining a considerable amount of biomass in the productive marine environment. After a few years, they return to their natal streams to reproduce. After spawning (which is another pathway for nutrients to enter the food chain via egg deposition), they die in the stream and their carcasses represent an important flux of "marine-derived" nutrients. Because the mountains of the Pacific Rim are relatively young, most of the freshwater streams are nutrient poor. The salmon represent, energetically, an important source of nutrient enrichment for the ecosystem, especially fish, bugs, bears, and eagles.

The Elwha River, starved of an important source of nutrients for over 90 years by the dams blocking salmon migration, was shown in a previous USGS Water Resources Division survey (by Mark Munn and Bob Black) to be in a moderate to highly oligotrophic state. My colleagues and I have set out to establish a baseline level of marine derived nutrients at various trophic levels, which can be monitored for years to come as the salmon populations recover and once again deposit their nutrients into the system. Much of the existing marine derived nutrient research in this arena has been conducted in Alaska and provides a useful template for the Pacific Northwest. Next year, tissues from plants in the riparian and upland areas will also be collected, so that the relative contribution of the marine subsidy provided by salmon carcasses can be better understood.

Because rainbow trout are resident in the system in the upper river and tributaries, there is considerable interest in documenting their genetic status so that natural levels of recolonization by steelhead can be better understood. It is hypothesized that some of the resident trout will, once the dams are removed, become steelhead. With good genetic characterization of the Elwha stock, future studies can compare the returning steelhead genes with the information collected prior to dam removal.

Pat Shafroth, a plant ecologist with the Fort Collins Science Center will also be examining the ecological effects of dam removal. His studies over the past few years have established cross-valley vegetation transects to document the dynamics of riparian plant communities adjacent to the river. These communities above, between, and below the dams are all expected to change once the dams are removed and Shafroth expects the transects to become long-term monitoring stations. Also, the effect of returning salmon on upriver terrestrial communities will be looked at from a bear's perspective, as Kurt Jenkins, USGS ecologist with the Forest and Rangeland Ecosystem Science Center's Olympic Field Station studies the resident bear populations.

The ecological consequences of dam removal will echo for many years to come, but there will also be

immediate changes to the river and estuary downstream, where other USGS researchers are focusing their efforts. Chris Konrad, a Water Resources Division hydrologist in Tacoma, is setting up stations to monitor sediment transport in the river. Working with USGS colleagues currently monitoring the Colorado River, Chris is using the latest in technology to measure river stage, water temperature, and turbidity and this information will be transmitted via satellite and available in "real time." He will also be able to command stations remotely, again via satellite, to more closely monitor the river during high flow events. Using these data and advanced modeling techniques, the USGS hopes to link the fluvial dynamics of sediment transport with deposition in the near shore. That's where the work of Guy Gelfenbaum and Jon Warrick, oceanographers with USGS Coastal and Marine Geology program in Menlo Park will come into play. Using various advanced mapping techniques to get precise bathymetric profiles of the river delta and near shore, they are working to develop high-resolution maps before, during, and after the dam removals. Using this information as a template, they are also working toward incorporating physical processes, such as current, tides, and sediment size distribution into models that will estimate sediment dispersal pathways. Ultimately, these data will allow mapping of habitat at a finer scale than currently available, providing scientists and managers with the necessary information to better understand the recovery of the near shore ecosystem.

The Elwha River dam removals represent an unrivaled research opportunity. Realizing the uniqueness of the situation and feeling the pressure to get started on the collection of "before" data, all of the scientists on the ground in the Elwha have taken great pains to coordinate their efforts and work together. The USGS is working with partners to develop a long-term living laboratory, where the coupled physical, chemical, and biological processes of a dynamic system interact with a large-scale restoration effort.

It is quite possible that the story of the Elwha River dam removals will be told for generations to come as an example of a dramatic step taken to restore salmon, a cultural and socio-political icon of the Pacific Northwest. It will also be a story of how salmon populations provide a vital life force to the entire ecosystem.

Back by Popular Demand !

Microscopic Anatomy of Salmonids: An Atlas
Yasutake, Wm. T., and J. Wales

First published in 1983, this book by WFRC's own Tosh Yasutake (now Senior Scientist Emeritus) became a bestseller virtually overnight. Demand for this timeless reference has remained strong over the years even though it has long been available only in the used book market. Fortunately, the US Fish and Wildlife Service recently decided to reprint Dr. Yasutake's classic text for use in fisheries resources training conducted by the FWS National Conservation Training Center (NCTC), Shepherdstown, West Virginia. The Atlas is now *in press* and should be available very soon.

Although most copies will be reserved for employee training courses, a limited number will be made available to biologists in academia and other fisheries agencies. The book will go for $25. A bargain, to say the least.

Anyone interested in obtaining the Atlas contact:

Christopher Horsch, Chief
Branch of Aquatic Resources Training
U.S. Fish and Wildlife Service
National Conservation Training Center
Route 1, Box 166
Shepherdstown, WV 25443

Alumni News

Bill Nelson's Excellent Adventure
by Himself

In my last missive to you, my dear former colleagues, I concluded by telling you that my brand new ice-fishing shack had blown over and how much work it took to right it.

Some time had elapsed since I had tipped it right-side up and, thinking all was now well, I went out to do a little ice fishing. Unfortunately, it was not to be, as I was met by a truly awful sight. Considerable snow had fallen recently, and the weight of the snow pressing down on the ice had forced lake water up through the fishing holes… flooding the shack. The water had then refrozen. To my chagrin, I found that my ice-fishing shack was now embedded in a solid block of ice about eight inches thick. The shack was totally unuseable!

I called a neighbor for HELP and we loaded up our sleds with tools and headed down the lake for what turned into about 6 hours of back- breaking labor. After endless chiseling and prying, we finally got one corner of the shack to wiggle a little. In desperation I hooked my snowmobile to the eyebolts I use to tow the shack around. The first run accomplished nothing more than tearing one bolt out and bending the other into a pretzel. The second run broke the rope. Finally, on the third try, the shack broke free with much creaking and groaning and we were able to tow it to the new location I had decided to try.

A few days later, I figured I had earned some peaceful ice-fishing time. It was a cold evening, so I lit the propane stove. The shack soon warmed up so I turned the stove down a little. After a while it started to make a funny fluttering noise. It didn't stop so I opened the stove door to see what was going on. The next thing I knew I was sitting in a snow bank outside! The #$%&* stove had exploded and blown my sorry self right through the door. Miraculously, I was physically unhurt, although my boot laces were charred. The blast melted the nylon line on all four of my fishing rods, blew my twelve volt battery off the shelf, blew out one window, and, with superb accuracy, blew my dipper down one of the ice holes into the lake. When my body went through the door one of the hinges was torn out and the screws holding the other hinge were sheared off.

It took a very stiff jolt of brandy to calm my nerves.

In a later inspection we found that, either when the shack blew over, or when we broke it free after it froze in, a gas line fitting had worked loose near the stove and gas was leaking into the shack. However, I still don't know if the explosion was caused by my opening the stove door letting in more air, or if the stoggie in my mouth had ignited a build up of gas. Either way, my battered and bruised shack now looks like it has been around since the turn of the century rather than for only about six weeks.

In spite of some initial apprehension, the kids did do quite a bit of ice fishing when they were here later in the winter. They caught the typical tons of perch, a couple of walleyes, and one big eelpout. The weather was downright balmy, usually in the 20's, so they also put a couple of hundred miles on the snowmobile. Sarah and I got a real kick out of them all saying that they no longer think we have lost our mind retiring to upper Minnesota and have now concluded it's more fun up here in the winter than in the summer.

Come up for a visit sometime. I'll take you ice fishing!

Cheers, Bill

A Little Light Reading: Selected WFRC Publications

The Unexpected Utility of Offshore Marine Structures in Rebuilding an Overfished Species

M. S. Love, D. M. Schroeder, W. Lenarz, A. MacCall, A. S. Bull, and L. Thorsteinson

Canadian Journal of Fisheries and Aquatic Science *(in review)*

Summary. Controversy rages over the disposition of the 4,000+ marine offshore oil and gas platforms and associated structures now in service worldwide. There are 27 such platforms off California and, as in Europe, there is considerable debate over the ultimate fate of these structures once they are uneconomical to operate. Some opponents consider platforms to be marine debris with no benefit to the environment, and in fact possible harm, to fish populations. Others view them in emotional terms and speak of the "catharsis which comes [from] complete removal of the oil platforms." Even if some benefits might accrue to fishes, questions have been raised as to whether these advantages would be manifest on only a local, rather than a regional, scale.

Using a manned research submersible, eight platforms were either wholly or partially surveyed in 2003. Based on these surveys, we estimate that there was a minimum of 433,682 juvenile bocaccio rockfish (Scorpaenidae: *Sebastes paucispinis*) at these structures. Bocaccio are relatively long-lived (over 50 years) and have extremely variable annual juvenile recruitment success. Juvenile bocaccio (less than one year old) settle from the plankton to shallow habitats. Here they dwell for less than one year before migrating into deeper waters. Reduced to about 7.4% of its unfished population, a petition has been filed in the United States to have the bocaccio, federally listed as threatened.

Using the model STATC5, which is the current basis of fishery management under the Pacific Fisheries Management Council, we determined that this number of juvenile bocaccio is about 20% of the average value, and 40% of the median value for the species' entire range. From the same model, we estimated that these fish will eventually contribute slightly less than one percent (0.8%) of the additional amount of fish needed to rebuild the Pacific Coast stock.

By providing nursery habitat to approximately 20% of juveniles produced in an average year, seven offshore oil platforms in California may be critical to rebuilding a severely overfished rockfish species, the bocaccio (Scorpaenidae: *Sebastes paucispinis*). This is unexpected because of the seemingly trivial area this platform habitat occupies comprises 0.02 km compared to the entire geographic range of bocaccio, which is over 4000 km of North American coastline.

There is evidence that platforms retain pelagic bocaccio juveniles destined for inhospitable, offshore waters. Juveniles residing at midwater platform habitats may have fewer predators, more food, or both. Previous research demonstrates that bocaccio that use platforms as nursery grounds either soon emigrate to natural reefs at least as far away as 150 km or survive at these structures and mature into adulthood. Thus, in all likelihood the bocaccio we observed will either emigrate and seed natural reefs throughout a wide area or will reside at the platforms and reproduce. In either instance, these platforms appear to be benefiting the overall bocaccio population.

Our research demonstrates the importance of spatial structure in driving marine population dynamics, where a small amount of nursery habitat, either artificial or natural, may disproportionately impact a widely distributed species.

Reproductive Status of Western Mosquitofish Inhabiting Selenium-Contaminated Waters in the Grassland Water District, Merced County, California

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Archives of Environmental Contamination and Toxicology 47:363-369, 2004

(Editor's Note: more than 20 yrs have passed since selenium contamination was first identified in the Grassland Water District (including Kesterson Reservoir), yet surprisingly little has been done, except for Mike's research, to determine if reproduction of resident fish is adversely affected by exposure to seleniferous agricultural drainwater.)

Abstract. This study was implemented to determine if western mosquitofish (*Gambusia affinis*) populations in the Grassland Water District suffer from impaired reproduction because of seleniferous inflows of agricultural drainwater from the Grassland Bypass Project. During June to July 2001, laboratory trials with pregnant female fish collected from two seleniferous treatment sites exposed to selenium-laden drainwater and two nonseleniferous reference sites yielded fry that averaged 96% survival at birth. In addition, none of the newborn fry exhibited evidence of teratogenesis, a typical consequence of selenium toxicity. Chemical analysis of postpartum female fish and their newborn fry indicated that mosquitofish from seleniferous sites accumulated relatively high body burdens of selenium (3.96 to 17.5 g selenium/g in postpartum female fish and 5.35 to 29.2 g selenium/g in their fry), whereas those from nonseleniferous sites contained lower body burdens (0.40 to 2.72 g selenium/g in postpartum female fish and 0.61 to 4.68 g selenium/g in their fry). Collectively, these results strongly suggest that mosquitofish inhabiting selenium-contaminated waters are not experiencing adverse reproductive effects at current levels of selenium exposure.

Ichthyophoniasis: an Emerging Disease of Chinook Salmon in the Yukon River

Kocan, R., P. Hershberger and J. Winton

Journal of Aquatic Animal Health 16: 58-72, 2004

Abstract: Prior to 1985 Ichthyophonus was unreported among Pacific salmon from the Yukon River, but now infects over 40% of returning adult chinook salmon *Oncorhynchus tshawytscha*. Overall infection prevalence reached ~45% in the Yukon River, and ~30% in the Tanana River between 1999 and 2003. Mean infection prevalence was higher in females in the mainstem Yukon River during each of the five years of the study, but infection prevalence in males increased each year until the difference was no longer significant. Clinical signs of ichthyophoniasis were lowest at the mouth of the Yukon River (~ 10%), but increased to 29% when fish reached the middle Yukon River, and 22% at the upper Tanana River. However, clinical signs at the mouth of the river increased each year of the study. As fish approached the upper reaches of the Yukon River (Canada) and the spawning areas of the Chena and Salcha Rivers (Alaska), infection prevalence dropped significantly to <15% in females on the Yukon River and < 10% for both sexes in the Chena and Salcha Rivers, presumably due to mortality among infected pre-spawn fish. Age was not a factor in infection prevalence, nor was position of fish within the run. The source of infection was not determined, but Ichthyophonus was not found in 400 Pacific herring Clupea pallasi from the Bering Sea, or in 120 outmigrating juvenile chinook salmon from two drainages in Alaska and Canada. Freshwater burbot *Lota lota* from the middle Yukon River were subclinically infected with Ichthyophonus, but its origin and relationship to the chinook isolate is unknown.

Isolation and Characterization of a Rhabdovirus From Starry Flounder (*Platichthys stellatus*) Collected From the Northern Portion of Puget Sound, Washington, USA.

Mork, C., P. Hershberger, R. Kocan, W. Batts and J. Winton.

Journal of General Virology 85:495-505, 2004

Abstract: We report the initial characterization of a rhabdovirus isolated from a single, asymptomatic starry flounder (*Platichthys stellatus*) collected during a viral survey of marine fishes from the northern portion of Puget Sound Washington, USA. Virions were bullet-shaped and approximately 100 nm long and 50 nm wide, contained a lipid envelope, remained stable for at least 14 d at temperatures ranging from -80 to 5 C, and grew optimally at 15 C in cultures of epithelioma papulosum cyprini (EPC) cells. Cytopathic effect on EPC cell monolayers was characterized by raised foci containing rounded masses of cells. Pyknotic and dark-staining nuclei that also showed signs of karyorrhexis were observed following hematoxylin and eosin, May- Grunwald Giemsa, and acridine orange staining. Polyacrylamide gel electrophoresis of the structural proteins and polymerase chain reaction assays using primers specific for other known fish rhabdoviruses, including Infectious hematopoietic necrosis virus, Viral hemorrhagic septicemia virus, Spring viremia of carp virus, and Hirame rhabdovirus, indicated the new virus, tentatively termed starry flounder rhabdovirus (SFRV), was previously undescribed in marine fishes from this region. In addition, sequence analysis of 2678 nucleotides of the amino portion of the viral polymerase gene indicated that SFRV was genetically distinct from other members of the family Rhabdoviridae for which sequence data are available. Detection of this virus during a limited viral survey of wild fishes emphasizes the void of knowledge regarding the diversity of viruses that naturally infect marine fish species in the North Pacific Ocean.

Quantitative Expression Profiling of Immune Response Genes in Rainbow Trout Following Infectious Haematopoietic Necrosis Virus (IHNV) Infection or DNA Vaccination

Purcell, M.K., G. Kurath, K.A. Garver, R.P. Herwig and J.R. Winton

Fish and Shellfish Immunology 17: 447-462, 2004

Abstract: Infectious haematopoietic necrosis virus (IHNV) is a well-studied virus of salmonid fishes. A highly efficacious DNA vaccine has been developed against this virus and studies have demonstrated that this vaccine induces both an early and transient non-specific anti-viral phase as well as long-term specific protection. The mechanisms of the early anti-viral phase are not known, but previous studies noted changes in Mx gene expression, suggesting a role for type I interferon. This study used quantitative real-time reverse transcriptase PCR methodology to compare expression changes over time of a number of cytokine or cytokine-related genes in the spleen of rainbow trout following injection with poly I:C, live IHNV, the IHNV DNA vaccine or a control plasmid encoding the non-antigenic luciferase gene. The target genes included Mx-1, viral haemorrhagic septicaemia virus induced gene 8 (Vig-8), TNF-a1, TNF-a2, IL-1b1, IL-8, TGF-b1 and Hsp70. Poly I:C stimulation induced several genes but the strongest and significant response was observed in the Mx-1 and Vig-8 genes. The live IHN virus induced a significant response in all genes examined except TGF-b1. The control plasmid construct and the IHNV DNA vaccine marginally induced a number of genes, but the main difference between these two groups was a statistically significant induction of the Mx-1 and Vig-8 genes by the IHNV vaccine only. The gene expression profiles elicited by the live virus and the IHNV DNA vaccine differed in a number of aspects but this study confirms the clear role for a type I interferon-like response in early anti-viral defence.

Complete Genome Sequence of Fer-de-Lance Virus Reveals a Novel Gene in Reptilian Paramyxoviruses

Kurath, G., W.N. Batts, W. Ahne and J.R. Winton

Journal of Virology 78:2045-2056, 2004

Abstract: The complete RNA genome sequence of the archetype reptilian paramyxovirus, Fer-de-Lance virus (FDLV), has been determined. The genome is 15,378 nucleotides in length and consists of seven nonoverlapping genes in the order 3 N-U-P-M-F-HN-L 5, coding for the nucleocapsid, unknown, phospho-, matrix, fusion, hemagglutinin-neuraminidase, and large polymerase proteins, respectively. The gene junctions contain highly conserved transcription start and stop signal sequences and tri-nucleotide intergenic regions similar to those of other Paramyxoviridae. The FDLV P gene expression strategy is like that of rubulaviruses, which express the accessory V protein from the primary transcript and edit a portion of the mRNA to encode P and I proteins. There is also an overlapping open reading frame potentially encoding a small basic protein in the P gene. The gene designated U (unknown), encodes a deduced protein of 19.4 kDa that has no counterpart in other paramyxoviruses and has no similarity with sequences in the National Center for Biotechnology information database. Active transcription of the U gene in infected cells was demonstrated by Northern blot analysis, and bicistronic N-U mRNA was also evident. The genomes of two other snake paramyxovirus genotypes were also found to have U genes, with 11 to 16% nucleotide divergence from the FDLV U gene. Pairwise comparisons of amino acid identities and phylogenetic analyses of all deduced FDLV protein sequences with homologous sequences from other Paramyxoviridae indicate that FDLV represents a new genus within the subfamily Paramyxovirinae. We suggest the name Ferlavirus for the new genus, with FDLV as the type species.

The Controversy About Salmon Hatcheries

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C. Smith, A. Talbot, G. Wedemeyer, and H. Westers

Fisheries 29(9): 12-31, 2004

Abstract. The use of hatcheries has been a subject of lengthy debate in the management of salmon and trout resources in the Pacific Northwest. The problem has resulted in part from the wide distribution of hatchery fish in circumstances where natural populations were disadvantaged by management policy involving hatchery fish and the confusion of the effects of management with the effects of artificial propagation. Recently, the controversy has been epitomized by the recommendations to fisheries management agencies that excess hatchery fish should not be allowed to spawn in the wild, and that hatchery fish should be excluded from salmon populations listed under the Endangered Species Act. The authors of the present article disagree with those recommendations and conclude that hatchery fish have an important role in recovery and supplementation of wild stocks. The present article is an attempt to help give balance to the discussion by providing a different perspective on hatchery fish and the literature pertaining to artificial propagation.

Analysis of DNA Vaccinated Fish Reveals Viral Antigen in Muscle, Kidney and Thymus, and Transient Histopathological Changes

Kyle A. Garver, Carla M. Conway, Diane G. Elliott and Gael Kurath

***Virology** (in review)*

Abstract. The safety and high efficacy of a DNA vaccine against infectious hematopoietic necrosis virus (IHNV) were analyzed by investigating tissue distribution, persistence, expression patterns, and histopathological effects of the vaccine. Plasmid pIHNw-G, containing the gene for the viral glycoprotein, was detected immediately after intramuscular injection in all tissues analyzed, including the blood, but at later timepoints was found primarily in the muscle tissue where it persisted to 90 days. Glycoprotein expression was detected in muscle, kidney and thymus tissues with levels peaking at 14 days and becoming undetectable by 28 days. Histological examination of vaccinated fish revealed transient damage that was localized in muscle tissue and was associated with needle injection. At 90 days post vaccination no damage was detected in any tissues indicating the vaccine to be safe and well tolerated. Our results suggest that antigen biodistribution and muscle regeneration may be factors in the exceptionally high efficacy of the IHNV DNA vaccine in fish.

Distribution and Relative Abundance of Fishes in Littoral Areas of Chief Joseph Reservoir, Columbia River

Gadomski, Dena M., D. A. Venditti, T. C. Robinson, J. W. Beeman, and A. G. Maule.

N*orthwest Science 78:48-58, 2004*

Abstract. We surveyed fish assemblages in littoral areas of Chief Joseph Reservoir of the upper Columbia River to aid in understanding this ecosystem. Fish distributions and abundances were examined during April-July 1999 in relation to environmental conditions in the reservoir. We also compared the fish assemblages in Chief Joseph Reservoir in 1999 to a past study conducted during 1974-1975, and to assemblages in other areas of the Columbia River. During 67 hr of electrofishing and 78 beach seine hauls in Chief Joseph Reservoir, 7460 fishes representing 8 families were collected. The majority of the catch was native—northern pikeminnow; redside shiners; longnose, bridgelip, and largescale suckers; and sculpins. The most abundant introduced species was walleye, and one species, rainbow trout, was mostly of net-pen origin. Larger sizes of suckers and northern pikeminnow were most abundant in the upper reservoir, likely due to upstream spawning migrations. The lower reservoir contained greater abundances of smaller fishes, and this area had lower flows, smaller substrates, and more complex shorelines that offered these fishes refugia. Only adult suckers displayed significant differences in abundance related to substrate. The relative abundances of species appeared to have changed since the 1970s, when the dominant fishes were northern pikeminnow, peamouth, largescale suckers, and walleye. Fish assemblage differences between Chief Joseph Reservoir and lower Columbia River reservoirs were also evident due to the morphology of the reservoir, its more northerly location, and the lack of fish passage facilities at Chief Joseph Dam. Our study is one of the few descriptions of fishes in the upper Columbia River.

Homologs of CD83 From Elasmobranch and Teleost Fish.

Ohta Y, Landis E, Boulay T, Phillips R.B., Collet B, Secombes C.J., Flajnik M.F., Hansen J.D.

J. Immunology 173:4553-60, 2004

Abstract. Dendritic cells are one of the most important cell types connecting innate and adaptive immunity, but very little is known about their evolutionary origins. To begin to study dendritic cells from lower vertebrates, we isolated and characterized CD83 from the nurse shark (Ginglymostoma cirratum (Gici)) and rainbow trout (Oncorhynchus mykiss (Onmy)). The open reading frames for Gici-CD83 (194 aa) and Onmy-CD83 (218 aa) display approximately 28-32% identity to mammalian CD83 with the presence of two conserved N-linked glycosylation sites. Identical with mammalian CD83 genes, Gici-CD83 is composed of five exons including conservation of phase for the splice sites. Mammalian CD83 genes contain a split Ig superfamily V domain that represents a unique sequence feature for CD83 genes, a feature conserved in both Gici- and Onmy-CD83. Gici-CD83 and Onmy-CD83 are not linked to the MHC, an attribute shared with mouse but not human CD83. Gici-CD83 is expressed rather ubiquitously with highest levels in the epigonal tissue, a primary site for lymphopoiesis in the nurse shark, whereas Onmy-CD83 mRNA expression largely paralleled that of MHC class II but at lower levels. Finally, Onmy-CD83 gene expression is up-regulated in virus-infected trout, and the promoter is responsive to trout IFN regulatory factor-1. These results suggest that the role of CD83, an adhesion molecule for cell-mediated immunity, has been conserved over 450 million years of vertebrate evolution.

Political Participation as a Function of Internal-External Locus of Control

Robin Salling and Barney Rosen (University of California, Santa Cruz)

Psychological Reports 29:880-882, 1971

(Editors note: few realize that WFRC's computer guru Robin Salling is also a published researcher in his own right. In this reporter's view, Robin's paper explaining voter apathy is a seminal work that is still pertinent today. In the finest WFRC tradition, it ends with a call for still more research on the subject.)

Summary. The aim of this research was to determine whether a person's political participation is a function of their "locus of control." Our hypothesis was that college undergraduates with an internal orientation are more active than externals in political affairs. Subjects completed Rotter's I-E scale, a political activity scale, and a self-rating of political activity. Political participation was positively correlated with internal locus of control. An internal (as opposed to external) locus of control implies: (a) greater alertness to important and useful information in the environment, (b) increased effort to improve the present environment, (c) heightened concern with skill and individual ability, and (d) greater resistance to subtle attempts to be influenced. Political apathy and activity are specific manifestations of more deep-lying and pervasive passive and active orientations. People with low self-esteem are relatively uninterested in public affairs, and involved in few political discussions. An internal orientation implies a person's generalized expectancy that his outcomes are the result of his own efforts, rather than controlled by fate or external forces. Such a view might reasonably be expected to generalize to the political area and lead the internally oriented person to engage in political activity because he believes it will be effective. Alternatively, a person high in internal control may be especially sensitized to the constraints of political reality and participate more actively to extend his range of freedom. Further research, in which attention is given to the nature of the political participation, is needed to decide.