Intercom

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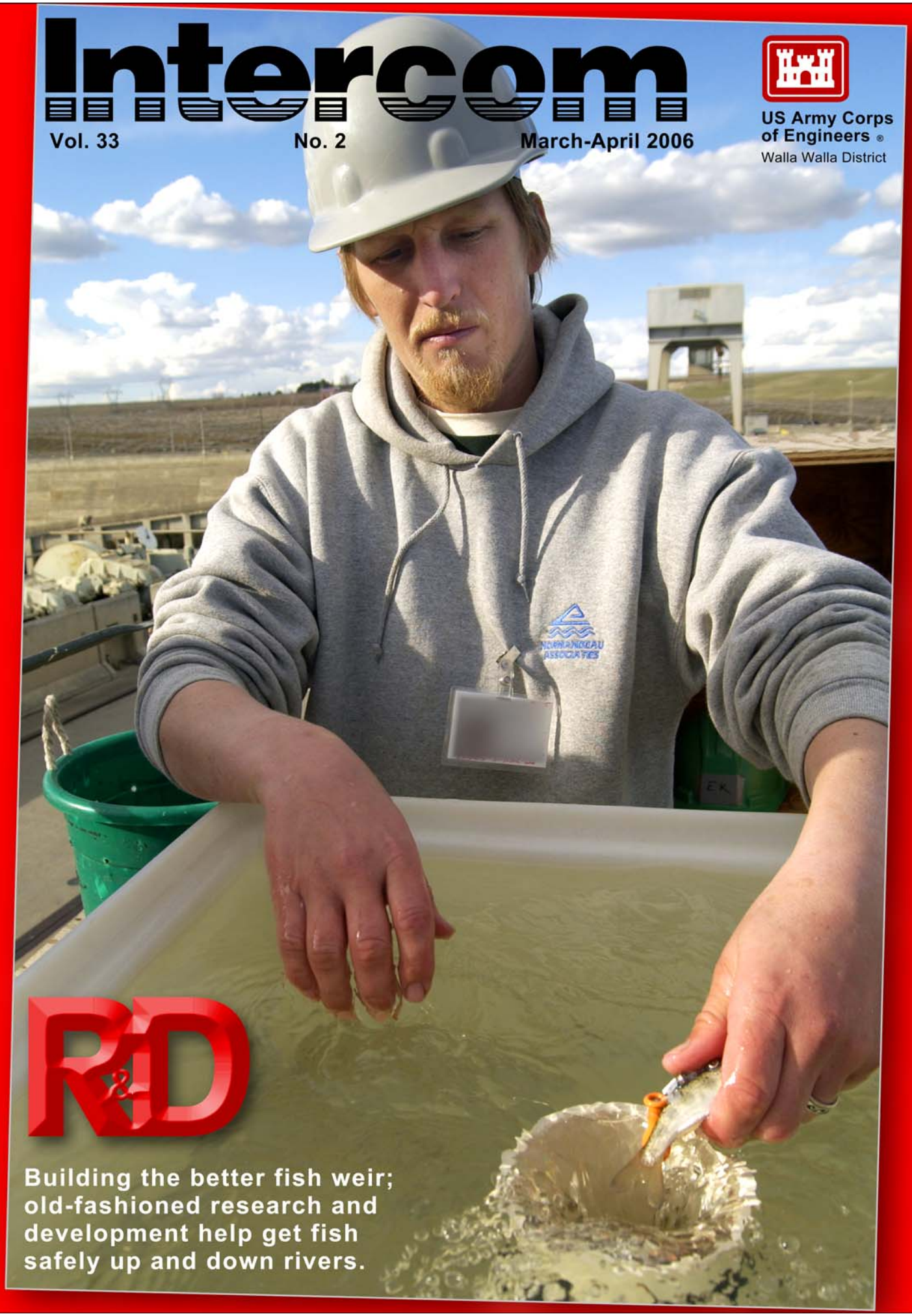
US Army Corps of Engineers ®
Walla Walla District



R&D

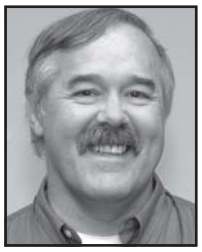
Building the better fish weir; old-fashioned research and development help get fish safely up and down rivers.

From Where I Sit

Biologist hopes for many happy returns in District waterways

by Fred Higginbotham

As a relatively new member of the Anadromous Fish Evaluation Team, as well as fisheries research, I am in a continual learning mode. I have spent most of my multi-agency career in fish and wildlife habitat management, enhancement and mitigation. Before I came to work for the Corps, I knew there was tremendous controversy over how the dams on the Snake and Columbia rivers should be operated for fish passage, including the debate of whether the lower Snake River dams should even be allowed to remain in the river. But I knew just a smattering about the research that has been going on for over 20 years.



Higginbotham

During my five years in Walla Walla District I have had the privilege of working with some of the brightest, most dedicated people I have met in my career. The cooperation within the different disciplines in the Walla Walla District is nothing short of outstanding. The coordination effort that is put forth within the Pacific Northwest region to support the recovery of wild salmon and steelhead is nearly incomprehensible for me. Literally, every federal, state, and county agency, numerous tribal governments, public utility district, private consulting firm, and public interest group that has an interest in the recovery of anadromous fish is involved with research in some way or another. I see the value of most of the current or proposed research in the region

I believe within the next 5 to 10 years we will see juvenile survival and smolt-to-adult return rates that will be nearly as good as the region can achieve on the mainstem Snake and Columbia rivers. The on-going research, along with improvements at the dams in fish guidance, operations, turbine technology and transport, will be key components contributing to higher juvenile survival and adult returns.

As a final note, I believe the Corps should keep up the good work until the region and all of America witnesses our success in recovering salmon and steelhead. The Walla Walla, Portland, and Seattle district Corps employees deserve that. I also believe the Corps should work toward securing authority to assist with habitat enhancement and research in the upper tributaries of the Snake and Columbia. If I had more influence and political clout, I'd do it myself.

And now, for my personal philosophy: "Retire early, sleep late, go fishin".

Higginbotham is a fish biologist in the Planning Section, Walla Walla District.

Comment sought for new wetlands rule

The U.S Environmental Protection Agency (EPA) and U.S Army Corps of Engineers (Corps) are proposing a new rule to ensure more effective wetlands restoration and preservation. The agencies' rule, being published for public comment, proposes improved science and results-oriented standards to increase the quality and effectiveness of wetlands conservation practices under the Clean Water Act (CWA).

The proposed rule responds to recommendations to improve the success of wetland restoration and replacement projects, and it combines accountability and flexibility. Most importantly, the proposal establishes a "level playing field" ensuring that all forms of wetlands conservation satisfy the same high environmental standards.

For more information regarding compensatory mitigation and how to provide comments on the proposed standards see: http://www.epa.gov/wetlandsmitigation. Information about the importance of wetlands is available at: http://www.epa.gov/owow/wetlands/. Additional information about the Corps' regulatory program can be found at: http://www.usace.army.mil/inet/functions/cw/cecwo/reg/.

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On the Cover...

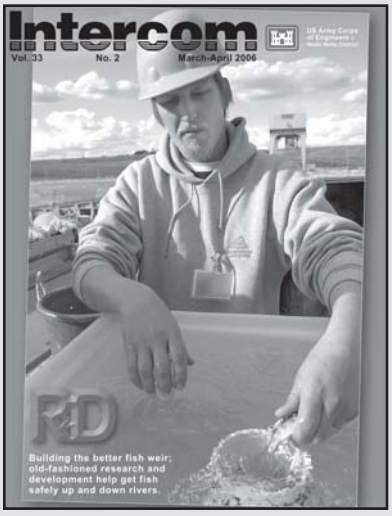


photo by Rick Haverinen

Biologist Eric Rydbach of Normandeau Associates drops a tagged juvenile salmon into a tube leading to a spillway at Ice Harbor Dam as part of a fish injury test March 7. Protecting fish during migration at U.S. Army Corps of Engineers projects requires creativity, close collaboration between biologists and engineers, thorough research, and funding.

Stairway installed to big catch

photo by Dan Forge

Dworshak Dam and Reservoir has installed a series of fishing platforms near the base of the dam reached via a set of steps. Judging from the steelhead snagged by this lucky angler on opening day, March 6, the new installation works. Those seeking sport fish in the area will no longer have to negotiate rocks to net their catches.

District journalists score at USACE and Army competitions

Writer-photographers from Walla Walla District earned top honors during the annual public affairs journalism competitions held in February at U.S. Army Corps of Engineers and the Department of the Army.

The program recognizes Military and Civilian journalists for achievements in furthering the objectives of the DOD's internal information program.

Walla Walla District dominated the Feb. 10 Corps-level Herbert A. Kassner competition winning six out of 39 awards given throughout the Corps. Winning entries included: **The Intercom, second place, Magazines; Joe Saxon, first place, Feature Articles; Deb Norton, first place, Stringer-Article; Craig Rockwell, second place, Stringer-Article; Frank Scopa, third place, Stringer-Article; Tony Sijohn, first place, Stringer-Photographer.**

First-place Kassner entries advanced to the next level of the contest, the Department of the Army's Maj. Gen. Keith L. Ware journalism competition.

At the Army contest held Feb. 22-23, Norton earned a second place award for Stringer-Article and Sijohn placed third in the Stringer-Photographer category.

Leaders groomed in District

Walla Walla District completed training in April for positional leaders in the Leadership Development Program.

Completing the eight-month program were Kevin Crum, Charlene Duncan, Yvonne Gibbons, Paul Pence, Cary Rahn, Don Redman, Scott Ross, Dale Walters, Dwayne Weston, and Greg Parker.

The next cycle for the program is for emerging leaders and nomination deadline is May 17.

For information call Debbie Mallard, (509) 527-7024.

Corps assists Idaho flood-fight planners

The Walla Walla District, U.S. Army Corps of Engineers, is assisting Idaho flood planners throughout the Snake River Basin.

The Corps sent an emergency management team to Blaine, Idaho on April 22 to prepare for possible flood-fighting efforts on the Big Wood and Little Wood rivers. Corps staff is also helping emergency planners in Lincoln and Gooding counties, Idaho, and they addressed flood concerns with the Eagle mayor and city council at an April 25 public meeting.

"We are providing technical assistance to help counties do their contingency planning so that in the event of flooding they'll have some options available for execution," said Jeff Stidham, a District emergency operations specialist.

The Corps' team in Blaine is coordinating with county officials, Stidham said and they've had "a calming effect," by focusing the community on actions to deal with flood issues.

Record snow packs across the District combined with recent precipitation have resulted in high flows and minor flooding along rivers throughout southern Idaho and southeastern Oregon. Corps officials advise the current flows could continue for several weeks, depending on weather patterns.

"We don't see a need to be concerned in the near future since the rivers are below bankfull," Stidham said. "But we are concerned about future run-off, and we'll continue closely coordinating and supporting the county and cities in planning their response measures."

When there is an imminent threat of flooding or when flooding has already occurred, the Corps of Engineers has authority to provide state or local governments with technical assistance, supplies and materials, equipment, or contracts for emergency construction work. The Corps has stockpiled 25,000 sandbags at Lucky Peak Dam and have 50,000 more in storage at McNary Dam.

"We want to prevent loss of life and limit any property damage, due to flooding, so we are prepared to step up our activities if the local communities become overwhelmed," Stidham said.

District operates multifaceted

by Joe Saxon

Small fish are big business, but everything you need to know about the Walla Walla District's fish program can be summed up by the numbers.

The U.S. Army Corps of Engineers' multi-faceted, $60 million annual fish program is designed to ensure juvenile fish, primarily salmon, get downstream to the ocean, and return safely to their spawning grounds as adults 2-5 years later.

There is one basin, the Columbia River Basin, that includes two primary river systems – the Columbia and the Snake rivers, into which, many other rivers and tributaries flow.

Three internal organizations handle the bulk of the U.S. Army Corps of Engineers Walla Walla District's fish work: Planning's Environmental Analysis and Compliance sections, Engineering Division's Hydraulic Section, and Operations Division's Technical Support Branch.

Four federal agencies have primary responsibility for fish operations. They include three agencies that manage the systems of dams within the Columbia River Basin: the Corps, the Bureau of Reclamation (BOR) and the Bonneville Power Administration (BPA). Meanwhile, the National Oceanic and Atmospheric Administration Marine Fisheries Service (NOAA Fisheries) outlines how the Corps, BOR and BPA operate those dams to protect fish.

Five missions impact upon fish operations: hydropower, irrigation, navigation, flood damage reduction and recreation. The agencies are responsible for balancing each of these interests for the public's benefit.

There are eight threatened and three endangered species of fish that the Corps is working hard to protect.

And finally, the variables, of which, "there are literally thousands that impact a fish's life, and we only control a few of them," said Greg Graham, chief of Planning Programs and Project Management Division.

Fish season begins

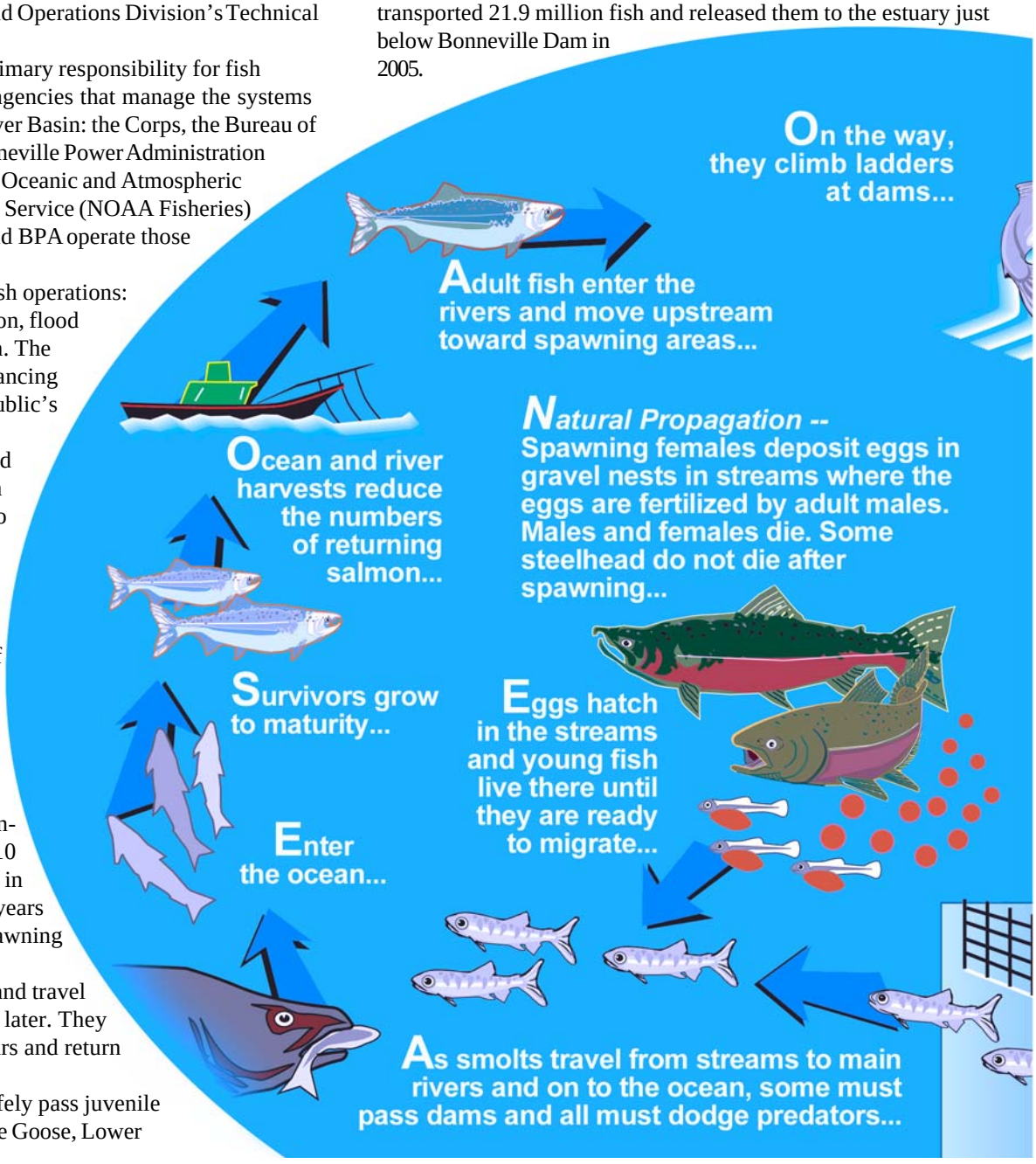
Spring chinook spawn in fall and hatch in spring. They stay in-river in the spawning area for 9-10 months before going down river in early spring. They return in 2-5 years in the spring to their original spawning grounds.

Fall chinook hatch in spring and travel downstream about three months later. They stay out in the ocean for 2-5 years and return in the fall (from July-Nov).

The Corps' challenge is to safely pass juvenile fish through Lower Granite, Little Goose, Lower Monumental, Ice Harbor and McNary dams, and then through John Day, The Dalles, and finally Bonneville at the mouth of the Columbia River near Portland, Ore.

Juvenile salmon, or smolts, pass over or through dams in one of three routes: over a spillway, through a turbine or in a bypass system. "Spillways are being equipped with weirs to allow safe and efficient passage with less water, and improvements to turbines are being planned to increase survival," Graham said. "By-pass systems incorporating huge screens that guide fish away from turbines are being designed to increase survival," he added.

By-pass systems incorporate huge screens that guide fish away from turbines into channels carrying fish around dams. These by-pass fish can be collected and placed into specially designed barges or trucks and transported around dams. District personnel transported 21.9 million fish and released them to the estuary just below Bonneville Dam in 2005.



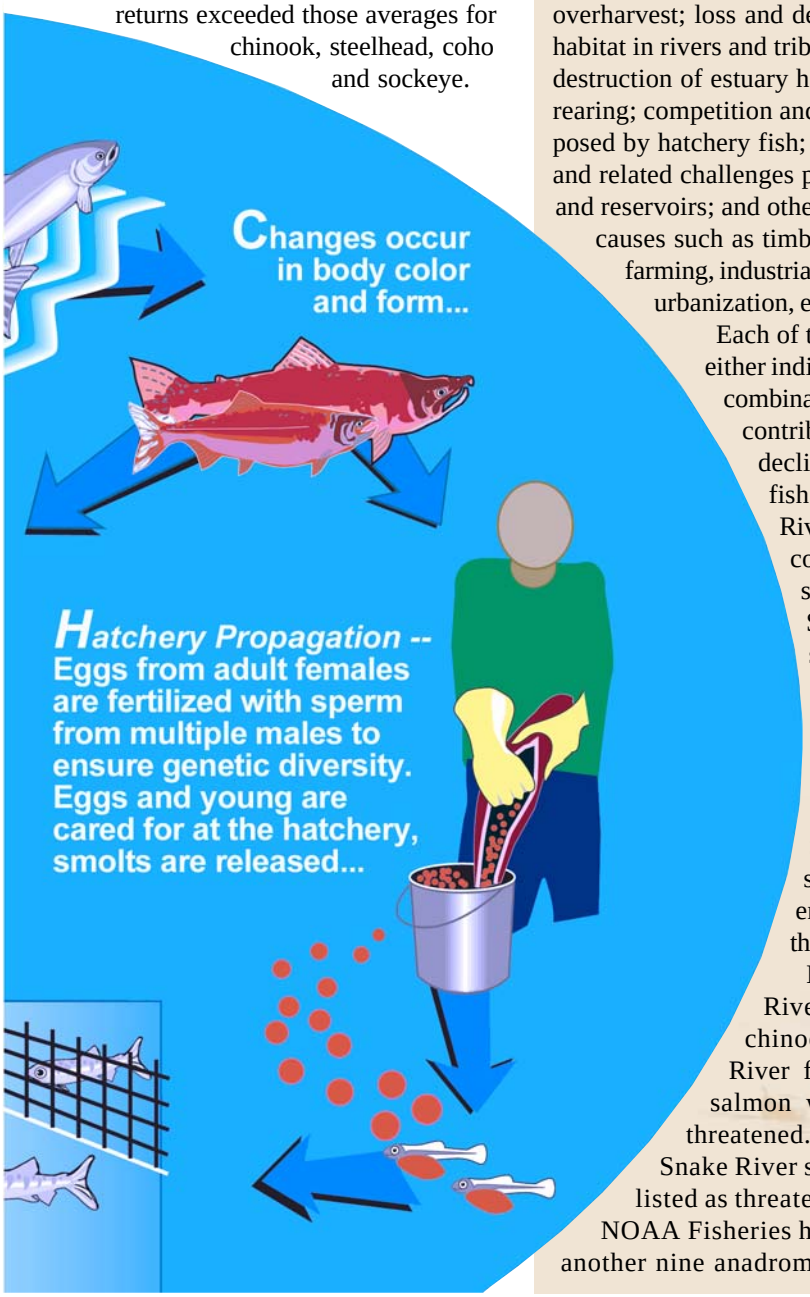
fish program by the numbers

Although fish passage through each dam hovers around 98 percent, every dam takes a toll upon juveniles headed downstream, as do other fish, birds and sea lions.

Adult fish returns

After fish have been in the ocean for 2-5 years, they return in the spring and fall. The Corps dams help these adults get to their spawning grounds by incorporating fish ladders that help fish traverse upstream around the dams.

The 10-year average for adult returns is 528,000 chinook, 312,000 steelhead, 81,000 coho and 54,000 sockeye. In 2005, adult fish returns exceeded those averages for chinook, steelhead, coho and sockeye.



Lower Snake River Juvenile Salmon Migration Feasibility Study

The decline of salmon and steelhead in Pacific Northwest rivers is a complex problem without one specific cause. The problem stems from a variety of interrelated sources that regional scientists are working hard to evaluate and understand.

Factors contributing to the decline of salmon and steelhead runs in the Columbia-Snake River Basin are: overharvest; loss and degradation of habitat in rivers and tributaries; destruction of estuary habitat used for rearing; competition and other dangers posed by hatchery fish; altered habitat and related challenges posed by dams and reservoirs; and other human-related causes such as timber harvest, farming, industrial facilities, urbanization, etc.

Each of the above factors either individually or in combination may be major contributors to the decline of anadromous fish runs in the Snake River. Due to the continued decline of some Columbia-Snake River Basin salmon and steelhead populations, the National Marine Fisheries Service (NMFS) listed the Snake River sockeye salmon as endangered under the ESA in 1991.

In 1992, Snake River spring/summer chinook and Snake River fall chinook salmon were listed as threatened. In 1997, lower Snake River steelhead were listed as threatened. By 1999, NOAA Fisheries had placed another nine anadromous fish species throughout the Columbia-Snake river basin on the Endangered Species List.

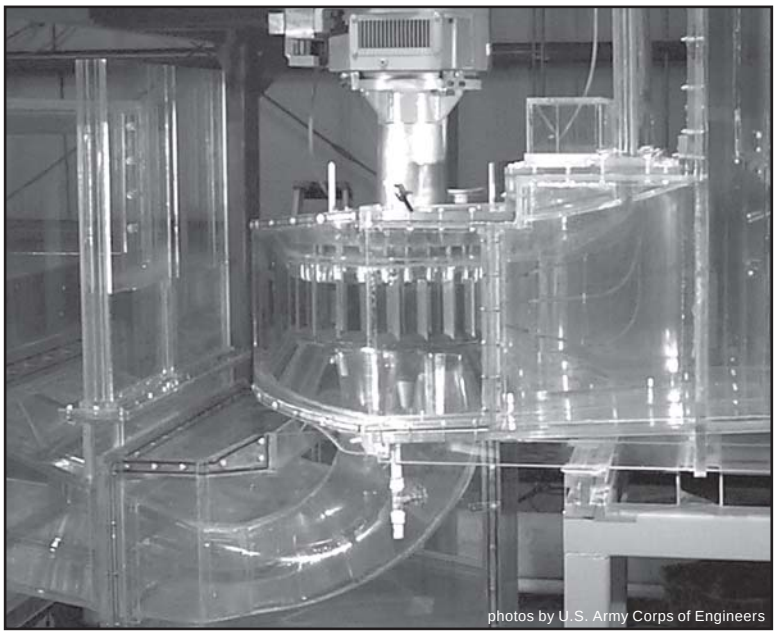
The U.S. Army Corps of Engineers, in response to the National Marine Fisheries Service 1995 Biological Opinion, launched a comprehensive study on structural alternatives to improve the migration of juvenile salmon through the Lower Snake River Project. By the time it was completed in 2000, thousands of people coast to coast had attended public hearings and over 230,000 comment documents, some several inches thick, had been received.

The study examined four proposed alternatives: 1) maintain the existing condition; 2) maximizing transport of juvenile salmon; 3) incorporating system improvements that could be accomplished without a drawdown; and 4) dam breaching.

The selected alternative called “adaptive migration” called for flexibility to switch between in-river migration and barge or truck transportation as conditions required. It also included incorporating spillway deflectors to reduce total dissolved gas concentrations, developing spillway weirs and other surface passage systems to improve fish passage.

The study included engineering evaluations; biological investigations (i.e., effects to salmon and steelhead, resident fish, and wildlife); effects on recreation, cultural resources, Tribal impacts, and water quality; and socioeconomic effects, including implementation costs, navigation, irrigation, and power.

Gentler turbines can be more efficient



A test model of a turbine installation at Ice Harbor Dam shows at center the wicket gates and staves. This model is among a collection of different Corps project mock-ups at the Engineering Research Development Center at Vicksburg, Miss.

A turbine that produces electrical power more efficiently may be another bonus from the search for one that is gentler on fish.

"I believe that with the modifications we're looking at, we'll gain efficiency," said Martin Ahmann, a hydraulic engineer at the Walla Walla District, U.S. Army Corps of Engineers.

Ahmann has teamed up with Dan Feil, a District biologist, to find the design answer to a problem related to juvenile salmon migrating downriver and around Columbia and Snake river dams operated by the Walla Walla and Portland Districts – fish passing through rotating turbine blades can be injured.

Dan Feil

"It's been understood that turbines at most of the projects can be harmful to fish," said Feil. "That's typically our passage route with the lowest survival compared to other passage routes such as spill or screened bypass. Generally that's the case, but not true at every project. We have relatively high fish survival through turbines at Bonneville Dam."

The Corps studies every route taken by fish traversing dams in order to improve survival and reduce passage time. Searching for a better turbine design is one of many efforts to protect this vital natural resource.

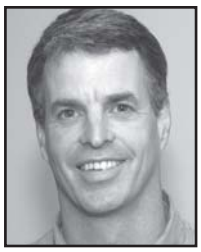
"The challenge for the engineer is to make turbine design feasible for both power production and fish passage," Ahmann said.

Ahmann said the Corps generally operates turbines for best efficiency for electrical power production.

"What we're finding is fish survival may correlate to the geometry and the flow through the unit," Ahmann said. "If we open up the water passageway by streamlining the stay vanes and wicket gates and having the blades operating at a steeper angle, we're putting more flow through the unit, and that provides better geometry for fish passage."

Ahmann said a redesign of the shape of the turbine blade, or "runner," may reduce the potential danger of striking fish.

"We're investigating pressure drops that occur as fish pass beneath the runner blades that could cause injury to fish," Ahmann said. "We're also looking at blade shapes to minimize gaps between the hub and the periphery of the discharge ring. If we can reduce the number of blades, then it's reasonable to assume we may minimize the potential for strike. If we want to minimize the pressure drop under the blades, we may be looking for larger and longer runner blades. A fixed-bladed runner has a smaller hub so that gives us a larger blade as well."



Martin Ahmann

Feil said that a newer turbine runner design installed at Bonneville Dam has shown some improvement for fish passage. "Our hope is to identify specific elements that make the Bonneville turbines safer and incorporate those elements into designs for other projects."

"In addition, we're looking at the effect of turbine operating point on fish survival," Feil said. "There are obvious differences that we've seen in our physical models at Vicksburg in the quality of water flow through the turbine based on how much discharge you put through the unit. You can really reduce the amount of turbulence and sheer present within the unit if you optimize the unit's operation by maximizing the quality of flow throughout the passageway. Those are some of the things we're looking at. We haven't yet identified one exact variable to say, 'We can make turbines safe for fish.' We're looking at all these components and trying to determine how they fit together to come up with a safe design. We're developing this process by using scaled physical models at the Engineer Research and Development Center in Vicksburg, Mississippi and biological field and laboratory tests to come up with a process to develop designs that will be safer for fish."

The view from below of a test fish-friendly turbine design shows the close spacing between the blades and the discharge ring.

"I think we can make a better turbine," Ahmann said. "I think that we are isolating zones and conditions that may be detrimental to fish. We can improve turbine passage through operational adjustments as well as structural or runner modifications. So we're optimistic."

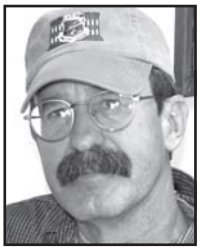
Acting project fish biologist Ken Fone, at corner of fish separator, shows schoolkids around the juvenile fish facility at Lower Monumental Lock and Dam April 12.

photo by Sue Walton

Protect fish, don't drop anything

by Joyce McDonald

The mission statement reads, "Move fish past hydroelectric dams as quickly and safely as possible."



Brad Eby

It's the first responsibility of the project fish biologists at U.S. Army Corps of Engineers dams in the Pacific Northwest. How do they accomplish that task? More times than not, it's all about being a very talented juggler. Much of the project biologists' day consists of coordinating research work, monitoring fish facilities and passage routes, ordering materials, dealing with leaky pipes and tripped breakers, giving tours, and attending management meetings. Most of this multi-tasking could not be accomplished without project support.

Mike Halter

Brad Eby, project fish biologist at McNary Lock and Dam said that a typical day is hard to describe because so many are a blur of activity. This is especially true at this time when so much fisheries research is taking place.

"We are constantly needing more power, more water, or more space to get everything accomplished (for the researcher)," Eby said.

While one part of the project's mission is to support fish passage, another part is the day-to-day operation of the powerhouse. Priorities can change with little or no warning. Entrance weirs to the fish ladders or fish pumps can malfunction, guidance screens for juvenile fish may need repair, turbines may be put out of service for unscheduled maintenance, funding for a research project may fall through, and the list goes on and on.

Greg Moody

Mike Halter, project fish biologist at Lower Granite Dam said the job can be a real balancing act.

"It's up to the project fish biologist to coordinate schedules so a balance between individual mission needs can be met, but our focus is clearly fish passage," said Greg Moody, project fish biologist at Little Goose Lock and Dam.

Mark Plummer

Ken Fone, acting project fish biologist of Lower Monumental Lock and Dam, said it's important to establish a give and take relationship with the project so there's an understanding of the multiple needs of the mission.

"Ultimately it's the criteria within the Fish Passage Plan (FPP) that the biologist and the project are required to follow," Fone said.

The FPP sets year-round guidelines for how the projects operate regarding fish protection and passage at the dams, and in many instances the FPP specifies what takes highest priority. The FPP was developed by the U.S. Army Corp of Engineers in coordination with the Native American tribes, Bonneville Power Administration, regional fish agencies, and other participants through the Corps' Fish Passage Operations and Maintenance Coordination Team. The project fish biologist is responsible that the plan is followed.

Mark Plummer, project fish biologist at Ice Harbor Lock and Dam, said he and his counterparts are team players supporting the overall missions of their projects.

"We must not forget that it is the project fish biologist's role on that team to always advocate for the fish," Plummer said.

Project fish biologists are entrusted to be frontline stewards for overseeing the safe passage of endangered or threatened fish species under the Endangered Species Act. They juggle whatever is thrown at them to make sure that their mission is successful.

McDonald

Joyce McDonald is a fisheries biological science technician at Ice Harbor Lock and Dam.

Getting answers to b takes repetition. Gett

Scientist Paul Heisey injects water into the balloon of a tagged juvenile salmon at Ice Harbor Lock and Dam. At right is biologist Eric Rydbach. Normandeau Associates had a 12-person crew at the project in March to test for fish injuries during spill.

Testing for fish injuries during spill

The hydroelectric dams installed along rivers in the Pacific Northwest mark intersections of extremely complex mechanical and biological systems. The U.S. Army Corps of Engineers determined years ago that changing a detail in one system can cause unexpected changes in another.

Jim Cain

One previous deliberate mechanical change the Walla Walla District is scrutinizing is the installation of deflectors at the bottoms of the end of the spillway.

"The deflectors were constructed to reduce dissolved gas levels," said Jim Cain, a Walla Walla District hydraulic engineer. "As water goes through the spillway, it entrains air bubbles, and if you didn't have the deflectors, those air bubbles would go with the flow deep into the spilling basin. That puts the gas into solution."

Nitrogen is the major component of air. Dissolved in water, nitrogen can harm fish in the river in much the same way nitrogen saturation can harm human divers with the "bends." As the water quickly descends the spillways, the deflectors make the water skim across the surface of the tailrace, and less gas from the air gets dissolved.

Corps biologists and engineers are scrutinizing whether spillway deflectors and hydraulic forces due to various tailwater levels at Ice Harbor Dam might be contributing to fish injuries.

Mark Smith

"We're trying to make passing the dams as safe as possible for fish," said Mark Smith, a biologist.

Figuring out how to get migrating juvenile fish downstream or adult fish upstream at Corps projects is often a process of sequential adjustments made over years. Because the scale of the dams is huge, physical adjustments to systems are predictably on very large scale. Determining the effectiveness of fish passage improvements takes careful investigation. This study used repeated experiments with live and electronic "sensor" fish and employed control groups. The groups of fish in any single trial were released at locations close to either the removable spillway weir (RSW) or spillway gates, and they were recovered for later study by crews in motorboats.

Smith said last year's installation of an RSW at Ice Harbor now allows the project to spill water from a greater depth from the forebay via opened spillway gates; or from the surface through the RSW. Observations that juvenile fish migrate downstream at shallow levels led to the development of the RSW.

"The water washes over the top, which we believe is a more natural fish passage situation," Smith said, "and a much higher percentage of fish pass it versus regular spill."

Steven Ada Associates March 7 at I

If less water is spilled through the RSW, then more water is available for power generation. The March biological testing at Ice Harbor looked at spill through both systems.

"Both spill routes are causing some injury," Smith said, "but we don't know if the same problem occurs at all dams."

Some of the variables built into the trials conducted over a 12-day period looked at three conditions of

biological questions

tailwater turbulence in the spill basin. Control groups of fish were released in the tailrace. The actual testing work was done by a 12-member team from

n Adams, a fishery biologist at Normandeau ciates, tags a juvenile salmon for testing n 7 at Ice Harbor Lock and Dam.

contractor Normandeau Associates, headquartered in New Hampshire.

Smith said the results of the testing could lead to physical improvements at the dam or to better operation.

"The Corps has a heavy commitment to getting this right," Smith said. "There is a lot of attention focused on our work, and the fish in general. It's endangered species that we're working with. They're critical. The government is commited. There's no question about it."

"Research is a methodical process of evaluation and elimination. Doing years of research with consistent results will ultimately lead to success."

Rebecca Kalamasz

Research as a lens on the big picture

The big picture of biological research work involves doing the same thing over and over many times until you start to get a view of what's happening within the frame.

"The Corps has a comprehensive research program (know as the Anadromous Fish Evaluation Program) that's designed to get biological information to answer questions related to engineering design, construction and operation of the hydro projects in an effort to help improve the passage and survival of juvenile and adult salmon, and other species that use the river system," said Rebecca Kalamasz, supervisory environmental scientist at Walla Walla District.

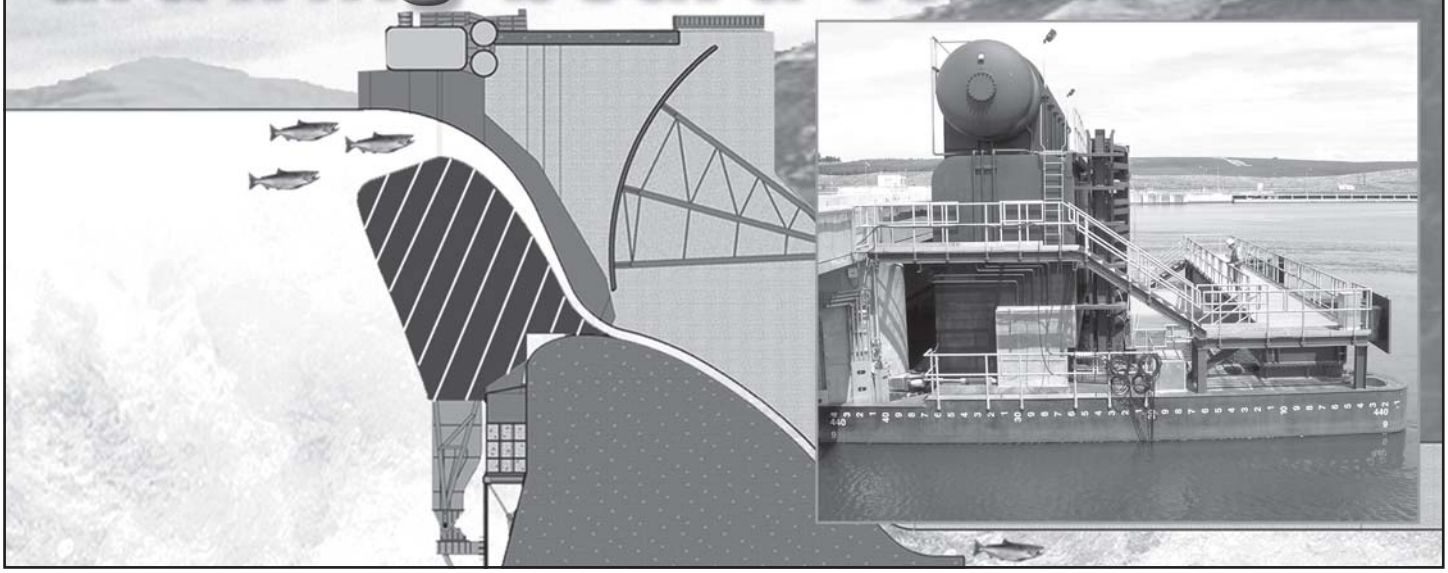
"This program originally started back in the 50's, when the region was concerned about the consequences of building Ice Harbor Dam on the fish and aquatic environment," Kalamasz said. "At that time our research efforts started out small, first studying adult fish passage and fish ladder design, followed by the development of the transport program, turbine diversion screens and dissolved gas. After the ESA listing of some Snake River salmon species in the early 90's, research efforts have grown to reflect the information needs of the Corps. Now the Corps conducts research on all routes of passage, including bypass facilities, guidance systems to keep fish away from turbines, turbine designs for fish, and the spillway environment, as well as continued improvements to the fish transportation program. The breadth of the research program has also expanded from passage and survival studies to those that consider cumulative impacts or relationship of project operations with environmental variability and natural cycles, be it temperature, water quality, growth of birds colonies that feed on juvenile salmon, productivity cycles, stress and the health of the fish; each of these factors affect the long-term survival of the fish."

Kalamasz said it is through a multidisciplinary team of biologist and engineers that the Corps identifies problems, develops the logical process to evaluate the problem, conceptualizes and tests solutions and then incorporates successes at the Dams.

"This is how we developed the fish passage systems we currently have in place," Kalamasz said. "The most well-known improvements being made at the dams right now are the spillway weirs but we are currently investigating improvements in many other areas. Over the next ten years expect to see design improvements to improve the tailrace and turbine environments and changes in the technologies used to monitor and track fish."

An anesthetized juvenile salmon is fitted with tags to participate in spillway injury tests at Ice Harbor Lock and Dam. Two balloon tags provide a backup in case of inflation failure; a transmitter emits radio waves that can be tracked with a directional receiving antenna; and a unique tiny numerical tag is placed just beneath the skin behind the eye.

How the RSW got from the drawing board to the dam



by Rick Haverinen

Like humans, the life cycle of salmon is marked by the adults doing all the climbing while the kids get to slide.

The sliding part has become a bit more literal since the U.S. Army Corps of Engineers has installed removable spillway weirs (RSWs) at two dams on the Snake River in Washington State to help juvenile salmon survive their long journey to the ocean.

The prototype RSW at Lower Granite Dam was tested in 2003 and it was determined that approximately 98 percent of juvenile fish survived the passage through the device.

"The prototypes have worked for fish passage," said Kevin Crum, RSW project manager, "and reduced flows can result in a side benefit for power generation. Depending on local operations, payback can be quick on a $12 million investment."

Lynn Reese

The Walla Walla District is pioneering research in surface passage, including the removable spillway weir.

Kevin Crum

"I think just the breadth of experience and lots of years have got us to where we're at," said Lynn Reese, regional fish passage specialist in hydraulics at the Corps' Walla Walla District.

Many organizations contributed to the development of the RSW and at Walla Walla, the disciplines of biology and engineering collaborated and negotiated until the prototype was installed at Lower Granite. It worked as hoped for, and it got a lot of attention in both fields that developed it.

Reese said the Walla Walla District's RSW design and installation concepts came from brainstorming by many public and private sector agencies devoted to solving the problem of fish mortality, including NOAA Fisheries and the Corps' Seattle and Portland Districts in the Columbia River Basin.

"It was talked about for a long time," Crum said. "I think in the early 1990s people were discussing how to modify a spillway. And one of the problems was you can't permanently place a structure in a spillway because it has to pass a flood. We actually had worked in the mid-90s with an engineering firm and they suggested, 'Why don't you make it removable?' And it was the idea that nobody really thought was possible."

As might be expected, many ideas were entertained and discarded before the prototype design was cast in steel.

"One of the design variations had to do with the current RSW shape where it has the nice rounded crest on the upstream face and a gradually inclined approach face," said Reese. "One of the earlier designs had a duck-billed type flavor where it had the shaped crest, but the approach face came back down and wrapped more vertically. There was a debate whether fish were going to get into that zone and maybe there would be predators hanging out or fish would be delayed. That led to a back and forth discussion that finally they came up with that incline shape."

Scott Ross

"Some of the early concepts had structural members that spanned across the opening," said Scott Ross, supervisory mechanical engineer, "and in terms of an engineered structure that was the preference. But there were big problems. Those cross members could snag debris and were an obstacle to fish, so they were very undesirable."

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"We had to put a structure on the dam that will support the RSW, and seal the RSW against the face of the dam once in operation," said Dale Walters, supervisor of contract administration for the Construction Division. "That involved us going underwater often at great depths, and boring deep holes into the dam, which we set in epoxy grout anchors. That involves a lot of our quality assurance people and a lot of our site inspectors, who have dive training, to supervise the work."

Dale Walters

The Corps river projects cause some hybridization in headquarters buildings as staff members with engineering degrees find themselves considering fish behavior and folks who graduated with biology degrees start wondering about increased loading caused by a fish ladder modification.

"This field is really bioengineering," Reese said. "We work with biologists to develop criteria. 'What's good for fish? What's good for structures?' In my case, I've become half biologist, half hydraulic engineer. And I think the biologists learn a lot about the hydraulics of the situation."

"In some ways once you get into a project, sometimes it doesn't seem to matter whether you're an engineer or a biologist," said Tim Wik, a fishery biologist. "The communication and collaboration skills that you have can become more important than technical skills, because a lot of the stuff that I work on is not really biology."

Tim Wik

"We're not anything like the biologists," Ross said. "You definitely learn to appreciate what it takes. Developing any of these apparatus for fish, you have to pay very close attention because the details truly matter. Fish are easily injured. You have to have smooth surfaces. You can't have fasteners sticking out. You have to pay very close attention to the materials you use because some can affect water quality. You have to watch out for what effect your features have on hydraulics. Fish don't like changes in velocity and acceleration."

The District has awarded the contract to build their third RSW to be installed at Lower Monumental Dam. Outside engineering architectural firms were contracted to design the first two RSWs, but number three will be an in-house engineering staff design. Number two had design enhancements over number one, and number three will be another rung up the evolutionary ladder.

"We had a tremendous learning curve with the first one," Walters said. "The engineering staff and the project manager all learned a lot, and I think the second one went much smoother. But with the third one, we have a different contractor, a different fabricator, and we're doing in-house engineering. So there will be a learning curve again, as we all coordinate our efforts a little more intensely. Now, I think our learning curve in engineering will be less, because we deal with them daily, and the fact that we have engineering upstairs is very convenient. If you have a question, we walk upstairs and we deal with the person who designed it. I think there's plenty of opportunity to find new ways of making this better, faster and cheaper."

A human measure of success for the fish-friendly RSW was achieved in 2003 when the American Council of Engineering Companies (ACEC) chose the Jacobs Civil Inc. engineering company for the "Grand Conceptor Award" for its design for the device.

Engineers and biologists are presently scrutinizing plans for an adjustable spillway weir (ASW) which would use removable elements to vary the depth from which juvenile fish would find the entrance to their downhill slide. The newer evolution of the device would likely be less costly to build as the removable chute sections mean it would not have to submerge for a flood event.

As for now, the question is whether to give the newer adjustable technology a try or focus production on the present device which has proven success.

Lower Monumental to get removable spillway weir

photo by Rick Haverinen

Biologists and engineers visit Lower Monumantal Lock and Dam April 12 to view spill tests in preparation to installing a removable spillway weir. Left to right are Tim Wik, fishery biologist; Ken Hansen, hydraulic engineer; and John Bailey and Ann Setter, fishery biologists. Advanced American Construction Inc. of Oregon City, Ore., has been awarded a $15 million contract to build the surface-bypass structure for LOMO, officials at Walla Walla District headquarters, announced April 14. The winning contractor was selected from among two companies submitting proposals to build the district's third removable spillway weir (RSW). The new weir is slated for operation in 2007.

Focusing on Transport, spill and

Walla Walla District uses several approaches

by Joe Saxon

"Don't put all your eggs in one basket," describes the fish management strategy for the U.S. Army Corps of Engineers.

That is a smart approach for ensuring the long-term restoration of the fish population, according to Mark Lindgren, chief of hydrology and hydraulics branch in the Walla Walla District.

"The Corps relies on varied approaches including spill, turbine improvements, surface passage, bypass and fish transportation systems to address the impacts on fish populations from hydrosystems (which along with habitat, hatcheries and harvest, are commonly referred to as the four H's), for an effective fish restoration strategy," Lindgren said.

Hydrosystems

The Corps has been concerned with fish restoration efforts since 1888, when it warned Congress of "an enormous reduction in the numbers of spawning fish" in the Columbia River due primarily to harvesters, over-fishing and habitat destruction.

In 1929, regional Corps officials advised that future Corps-built dams provide for "the passage upstream of fish, especially salmon migrating to breeding places." In 1934, the Corps assembled teams of internal and outside experts to design fish passage systems for Bonneville Dam.

The Corps applied the lessons learned and decades of research into constructing the dams on the lower Snake River from 1968 to 1975, Lindgren said.

Spill

Spill is widely recognized as one of the safest means of juvenile fish passage. Water is poured through spillway openings rather than being routed through turbines to generate power or being used for other purposes. Spill has to be carefully managed to avoid gas supersaturation that can be harmful to fish. The Federal agencies responsible for fish restoration recommended using an "adaptive management" approach starting with a spring spill operation that maximizes in-river passage for Snake River spring/summer Chinook until around April 20.

Fish Transport

The District transports between 15-22 million fish each year, depending upon run-off and amount of spill said Dave Hurson, lead biologist in the operations division.

Hurson, who directs the District's fish transportation program, said the Corps began a maximum collection and transport operation using specially-designed trucks and barges to collect Snake River steelhead and late migrating spring/summer Chinook salmon during late spring.

"We began barging as an emergency measure in 1977 in the record drought year as a way to move large amounts of fish," Hurson said. "In 1978 we modified two barges and started the program, in earnest, in 1981. By 1983 we had built two more barges giving us the ability to barge every day out of Lower Granite Dam."

The transport systems "recirculate water, add oxygen and have refrigeration systems that allow us to heat or chill the water" Hurson said. "If the water temperature is 65 degrees at Lower Granite Dam and it's 62 degrees at Bonneville Dam, then over the course of the trip we will slowly drop the temperature to 62 degrees before we release them."

Transporting helps increase fish survivability by putting them on a more natural calendar and helps them bypass potential predators, Hurson said.

"Before the dams were built, fish would migrate through the system in about 7-10 days. Now with the dams in place, it could take 3-5 weeks," he said, and that increases chances for predation from birds like terns and fish such as pike minnows.

Transporting fish gets them back toward their "biological clock for when they should be reaching the ocean" Hurson said, "which enables them to have a better transition to salt water."

Transport is not the total answer to long-term fish population restoration, but "it is one tool in our toolbox," Hurson said. "There is a time and place for transport, and as we incorporate new technologies like the spillway weirs, we're reconfiguring the project to accommodate them. We also are building new juvenile facilities and incorporating flexibility into our systems so we can operate the dams to maximize adult fish returns," he added.

Surface Bypass

The District is pioneering research into surface passage

solutions; bypass systems to ensure salmon restoration

Dave Hurson

Greg Graham

Mark Lindgren

systems that use emerging technologies like spillway weirs to improve fish passage over spillways. Most juvenile salmon tend to stay in the upper 10 to 20 feet of the water column as they migrate downstream to the ocean.

When approaching dams, juvenile fish dive 50-60 feet to find passage routes such as a spillway opening or juvenile bypass channel. At 1.7 million pounds, 10 stories high and 70-feet long, spillway weirs act as giant fish slides, allowing juvenile fish to pass near the water surface under lower accelerations. It uses less water, which benefits hydropower production, and less spill also reduces the dissolved gas levels in water, which can be harmful to fish.

The first spillway weir was installed at Lower Granite Dam in 2001, and a second was placed at Ice Harbor Dam in 2005. The next spillway weir will go into Lower Monumental Dam in 2007.

Juvenile Bypass Systems

Juvenile fish bypass systems, which have operated at the dams for decades, guide fish away from turbines by means of submerged fish screens installed in front of turbines. As the fish migrate downriver, they follow currents and may be attracted by the current created by an operating turbine.

As the fish follow the current towards the turbines, screens guide fish back into bypass channels in the dam. These fish are then either routed back out the river below the dam, or at the four dams with fish transport facilities, they may be loaded into trucks or barges for transport.

Estimates of how many fish are guided into mechanical screen bypass systems at dams vary by location (dam, turbine), time (season, day, time of day), species/run, and method used.

Even so, researchers conclude that extended-length screens appear to guide higher percentages of smolts without increases in descaling and injury rates.

Tagging for Research

Fish research is aided by the use of Passive Integrated Transponder, or PIT tags, that are inserted into juvenile fish and read as they pass detectors at the dams. As the tag is read, data about that particular fish is fed into computers that allows tracking of migrating PIT-tagged fish through the river system. That helps researchers determine, for example, where to release fish from barges. As for adults, in 2004, improvements were made to devices for detecting adults as they pass through fish ladders. These acoustical PIT-tag detectors not only enabled researchers to track the progress of individual juvenile fish migrating through the dams downstream, but also tracked them as adults returning to spawning grounds. Adult PIT-tag detectors are in operation Bonneville, McNary, Ice Harbor and Lower Granite dams.

Predation

Regardless of hydrosystem operations, fish, sea lions and birds, especially Caspian terns and cormorants, take a large toll on juvenile fish. Several federal agencies were involved in redistributing a Caspian tern colony in the Columbia River estuary, downriver to an island nearer the ocean. The terns, which had consumed 15 million salmonids in 1999, consumed about three million salmon and steelhead in 2004.

Also, a relatively small but stable population of Caspian tern (about 1,000 birds) on Crescent Island above McNary Dam consumed an estimated one million smolts in 2004, including about 35 percent of the Snake River steelhead smolts.

In addition, double-crested cormorants, have increased their take of fish. Their numbers grew from 100 birds in the estuary in 1989 to 18,000 in 2004 when they also consumed an estimated 6.4 million salmonids leading Federal agencies to evaluate alternatives to address this situation.

"The Corps has pioneered research for the past 50-years seeking solutions to improve fish survival through the hydrosystem," said Greg Graham, chief of Planning, Programs and Project Management. "This effort integrates the technical expertise of biologists and engineers that lead to novel fish passage operations and structural improvements at the dams."

"While the Corps continues the spread the risk approach to fish operations, we will continue exploring the development of future spillway weirs and other innovative fish passage options, and pioneering research to ensure the long-term restoration of salmon," Graham said.

photo by Gina Baltrusch

Fish ladder improvements at Lower Granite should hasten climb to top

Sean Milligan

"What the biologists do for the engineers is they give us the criteria that they want to see established."
Sean Milligan

photo by John Rosgen, Dix Corp.

story by Rick Haverinen, photos by Gina Baltrusch

A process of pooling talents resulted in modifications to the Lower Granite Dam transition pool that should help adult fish figure out how to get to the top of the structure.

Biologist Marvin Shutters, hydraulic engineer Sean Milligan, and structural engineer Jonathan Lomeland represent a melding of disciplines at the Walla Walla District of the U.S. Army Corps of Engineers that ultimately resulted in producing stronger water current near the bottom of the fish ladder to better clue the fish about which way to go.

Marvin Shutters

About 15 years of research determined fish needed increased water velocity to find the way leading to their spawning grounds.

"The early years of the study were giving some clues that the transition pool was kind of a problem area," said Milligan.

"A portion of the fish get to this area and turn around, and some delay and stay there for a while," Shutters said.

"So then they said, 'Engineers, what can we do to increase velocity,'" Milligan remembered. "Well, the only way you can increase velocity is either to increase the amount of water, or decrease the flow area. So we just kind of sketched it up."

The issues and possible solutions were also discussed with local Native American tribes, and other federal and state agencies concerned about fisheries.

"On this project the issues were discussed for many years," Shutters said, "but some people had their own little napkin drawings. (Finally) we had a design charette, and invited a broad group with as many different points of view and understanding as possible. We got the basic design concept thrashed out in a day, and it changed very little after that."

"What the biologists do for the engineers is they give us the criteria that they want to see established," Milligan said. "So the biologists give a list of conditions they would like to see met, and we figure out how we can achieve that, and then we turn to the structural guys and say can you build something that looks like this and make it stay there?"

"What we need is dimensions," Lomeland said. "We need to know what size the channel is, or where the walls are going. What's the height of the water on those walls and what's providing the load for velocities. The many criteria that we get from the biologists determines what materials we can use on the walls. Then we have to make judgment on what kind of material will last the longest if this is a permanent change, and what's most economical too. There are a lot of different factors to consider to come up with a good end-product."

Jonathan Lomeland

The transition pool changes made at Lower Granite might be helpful at other Corps dams.

"There's a chance for a bigger effect than what we saw with the temporary structure," Shutters said. "I think the extra things we did should have a benefit."

'The final topic for the Dworshak Extreme Explorers is arachnids.'

photos by Rick Haverinen

Kristi Stevens, park manager, far left; and Erin Zemke, park ranger, both from Dworshak State Park in Idaho, present tough naturalist questions, TV gameshow style, to students at Orofino Middle School March 22. Left to right in above right photo are Shay Grimm and Grant Routh, sixth grade junior leaders; and Lizzie Mullins and Marie Spangler, fifth grade. Dworshak Dam and Reservoir park ranger Deb Norton teamed up with the state park rangers and state hatchery employees to provide the students with an after-school session every two weeks about various subjects in nature.

University research leads to Lower Granite modifications

by Rick Haverinen

Research work done by universities under U.S. Army Corps of Engineers contracts has been a springboard toward realizing fish passage improvements around dams in the Pacific Northwest.

One example of the viability of university research work promoting the vitality of migrating fish is now realized in design improvements installed in the first segment of the Lower Granite Lock and Dam fish ladder.

Chris Peery

The source data for the final design was produced by biologists at the Fish Ecology Research Laboratory in the Dept. of Fish and Wildlife Resources, University of Idaho.

"We first started doing telemetry work with salmon for the Corps of Engineers in the early 1990s to assess how fish pass the dams," said Chris Peery, Univ. of Idaho assistant research professor. "The Corps wanted to get a better feeling for what might be affecting fish as they're passing dams."

The original work studying fish behavior as they passed dams was led by professor Ted Bjorn. The project included tagging fish with radio transmitters and installing receiving antennas throughout fishways to gather behavior data as the fish migrated.

"One of the things we found out pretty quickly is that there were some fish that just seemed to do a lot of wandering," Peery said. "They would approach entrances to the fishways multiple times, and they would also go in and out of the fishways quite a bit. We saw one area where fish seemed to get to and then stop, and then they'd turn back downstream. Once they did that, they were likely to exit the fishway and go back out to the tailrace of the dam, and that significantly increased the time it took them to pass the dam."

Peery said the stall area was just beyond the fishway entrance in the transition pool area as the weir steps of the fish ladder begin to lead upward.

"For various reasons which we were guessing at, that seemed to be an area that would cause the fish to hesitate," Peery said. "So the next question is, 'What can we do to alleviate this problem?' And we were guessing, and trying to think like a fish, but it appeared that if there was more directed flow downstream to guide the fish to keep going upstream at that section of ladder, then they'd be more likely to keep going."

Bjorn and Peery compiled their data and worked with biologists and engineers in the Corps' Walla Walla District to evaluate their water flow theory. When Bjorn died in 2001, Peery picked up the leadership for the university's work.

Corps engineers designed a test installation at Lower Granite that allowed biologists to vary water flows with removable weir sections. Additional research suggested that permanently reducing the area of flow to about half would provide enough velocity to attract fish and keep them moving up the ladder. The permanent changes were constructed last winter and are now being evaluated.

"Students are really excited about (the Corps research work) because we have several scientists that have been involved in this project over a number of years," Peery said. "With telemetry, you can look at this data on the screen, and visualize the path that this fish is taking and what it's doing. (There now exists) the largest telemetry data set in the world because of those 15 years of continuous monitoring that the Corps has paid for."

District works to contain nuclear materials

Reaches into Russia in the Global War on Terrorism

"It's an honor and challenge being part of the Global War on Terrorism and knowing that in my lifetime, we will eliminate the last three plutonium-producing nuclear reactors in the Russian Federation."
Rick Grubb

Visitors stroll the plaza at Red Square in Moscow.

photo by Rick Grubb

by Joe Saxon

The Cold War went into the deep freeze in the early 1990s, and Rick Grubb, a Walla Walla District cost engineer, is helping to keep it there.

Since relations thawed between the U.S. and the Russian Federation in the 1990s, the U.S. has aggressively pursued eliminating Russia's weapons grade nuclear material. In 1997, the U.S. and Russia signed the Plutonium Production Reactor Agreement (PPRA) requiring the cessation of weapons-grade plutonium production for use in nuclear weapons.

"Under PPRA, the United States monitors the permanent shutdown of Russia's plutonium production reactors and more than 10 metric tons of plutonium oxide to ensure the reactors and materials are no longer available for use in weapons production," Grubb said.

Grubb led a regional USACE team to Germany last year because three nuclear reactors, designed to produce weapons-grade plutonium, are still operating in Russia. These pre-Cherynobel design reactors also produce energy for nuclear cities in Siberia.

Because the reactors supply critically-needed heat and electricity to the cities of Seversk and Zheleznogorsk, Russia is unable to shut them down and end production of the plutonium until replacement power is available.

Grubb and a USACE team of experts returned to Germany and Russia in February to continue reviewing the Department of Energy's contract with the Russian Federation.

Joining him were LaRhonda McCauley from Walla Walla District, Kevin Birkett, Omaha District; George Sims, Alburqurque District; Gordon Simmons, Savannah District; Bill Thievon, Europe District; and Asya Papanako, a liaison to the Russian Federation.

Rick Grubb

"We are refurbishing a power plant so it can provide energy to replace the nuclear reactors without impacting the people in the region," Grubb said. "If they did not have the power plants they'd freeze during the winter."

The team's work involves reviewing the contractor's processes and evaluating risk management procedures to ensure "their processes are logical, are working, and ensure they'll accomplish their goals," he said.

According to Jerald Paul, Principal Deputy Administrator for the National Nuclear Security Administration (NNSA), "The U.S. is working with more than 70 countries to secure dangerous nuclear and radiological materials, and to dispose of surplus weapons-usable material."

The NNSA is designed to identify and address potential vulnerabilities worldwide regarding the spread of nuclear materials and to limit terrorists' access to deadly weapons and materials.

Paul said, "We are working with Russia to expedite closure of the three plutonium production reactors … and to assist in providing fossil fuel plants to replace energy now provided by the reactors."

According to Paul, "We have made significant progress on this project in the last year. We have already begun construction work at the first site, Severesk, and will start construction at Zhelznogorsk this spring."

For Grubb, "it's an honor and challenge being part of the Global War on Terrorism and knowing that, in my lifetime, we will eliminate the last three plutonium-producing nuclear reactors in the Russian Federation."