

Eddies

Reflections on Fisheries Conservation



Eddies

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Jackson National Fish Hatchery has raised wild Snake River cutthroat trout since 1992, Drew Rush photo.



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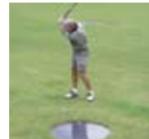
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Craig Springer

Gila trout, found only in the headwaters of the Gila River in the Southwest, were downlisted to threatened in 2006 and opened to fishing for the first time in 50 years. See page 16.

The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect and enhance fish, wildlife, plants and their habitats for the continuing benefit of the American people.



Headwaters

Symmetry and the Future of Fisheries Conservation

By Bryan Arroyo



USFWS

There is a certain symmetry in this special issue of *Eddies*, a pairing and a balance, if you will. You'll find something old and something new. One half of the magazine has the normal features we've delivered in each issue of *Eddies*, and in the other half we give you some quick looks at work done on the ground and in the water over the last five years.

The ancient pallid sturgeon is the topic of our "American Fishes" department in this special issue of *Eddies*, served up by John Bryan. It's been called a "swimming dinosaur," as fossil records show that the fish has existed in its present form since, well, since rocks were made. The pallid sturgeon embodies a story of survival over epochs and then has feebly hung on over the last century of assaults to its habitat. It also embodies the commitment of our National Fish Hatcheries and Fish and Wildlife Conservation Offices through the Mississippi and Missouri River basins, and our partners in conservation share to keep this fish from going extinct, and more, to turn the trend toward a growing population in the wild. Modern science and technology are at work to see that this happens.

It's appropriate that Spencer Fullerton Baird is our "Pioneer" for this issue. His story is deftly told by the U.S. Fish and Wildlife Service historian, Dr. Mark Madison. Baird essentially created the U.S. Fish and Wildlife Service in 1871, urging Congress then to create the U.S. Fish Commission. Baird was a highly regarded scientist in his day, mentioned in the same breath as names more well-known. Having recently read *Wilderness Warrior* by Douglas Brinkley, I

am reminded how Baird's scientific acumen influenced the conservation ethos of a future president. Theodore Roosevelt wrote: "My chief interests were scientific. When I entered college, I was devoted to out-of-doors natural history, and my ambition was to be a scientific man of the Audubon, or Wilson, or Baird, or Coues type — a man like Hart Merriam." Baird continues to influence us in fisheries conservation 138 years later. We named a ship in his honor, the *M/V Spencer Fullerton Baird*, a science vessel that plies the Great Lakes today in service to you.

Professor Baird's story represents the days of the distant past. But the past, no matter how distant, is prologue; our history begets the future. Grounded in science, we in the U.S. Fish and Wildlife Service's Fisheries Program now embark on renewing the next five years of our strategic plan. Along with our partners, the plan will be our guide to conserving fisheries for the American people. We reasoned that *Eddies* would be the most appropriate place to tell in some snap shots what we've accomplished in the last five-year period.

Fisheries conservation in the U.S. Fish and Wildlife Service is guided by not only law and policy, but at the practical level, it is charted by *Conserving America's Fisheries: U.S. Fish and Wildlife Service Fisheries Program Vision for the Future*. Our first five-year plan was built from this vision in 2004 with our partners at our side, convened by the Sport Fishing and Boating Partnership Council. Our strategic plan focuses our work into seven areas, and they are reported here in one half of *Eddies*.

I think that you will see that we have in the Fisheries Program, the unique ability to work in fisheries conservation outside confining boundaries. And we don't go at it alone, but paired in partnership, in symmetry with many — state agencies, Native Americans, industry, and conservation organizations. Reading over what we have done makes me look forward to the next five years.

Bryan Arroyo is the Assistant Director for Fisheries and Habitat Conservation in Washington, DC.

Dammed eels, doomed mussels?



Maryland Fishery Resources Office biologists collect mussels.

Eastern elliptio, perhaps the most common freshwater mussel in the eastern U.S., does not appear to be thriving in the Susquehanna River and its tributaries. U.S. Fish and

Wildlife Service biologists believe that the decline in mussel populations in these waterways is linked to four dams that inhibit movement of American eel. Prior to dam

construction in the lower part of the river, the eel were likely the primary host species for eastern elliptio, according to studies.

To learn more about the relationship between eel, mussel and dam, the Maryland Fishery Resources Office assessed recruitment status of eastern elliptio in the Susquehanna River drainage above and below Conowingo Dam. Biologists conducted surveys of streams in the watershed with the highest density of eastern elliptio; and they conducted fish surveys at several of the high-density eastern elliptio sites above and below the dam. Population estimates for high-density sites in the Susquehanna River were much lower than those in the Delaware River. Furthermore, length analysis shows that mussels below the dam where eels occur are smaller than those at six sites above the dam. Altogether, the results indicate a decline in mussel growing to adulthood in recent years and will prove valuable in informing solutions. ♦ Julie Devers

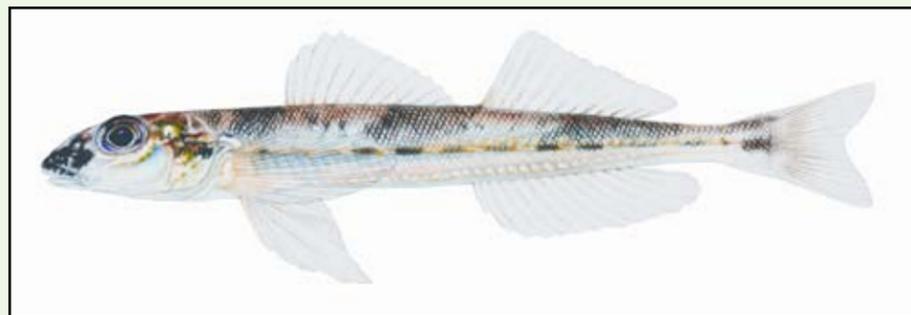
A rare honor for a rare gem of a fish

It's more common for a planet, than a fish, to be named after a person. But Dan Cincotta has earned the unique distinction. A fishery biologist for the West Virginia Division of Natural Resources and adjunct professor of ichthyology for West Virginia University, Cincotta was selected for the honor by Dr. Stuart Welsh of the West Virginia Cooperative Fish and Wildlife Research Unit. "Dan has devoted a 30-year career toward studies of the diversity of West Virginia fishes, including efforts toward conservation of the Elk River," Welsh said.

Cincotta has demonstrated an uncanny knack for finding the elusive diamond darters — now also referred

to as *Crystallaria cincotta* — even though they bury themselves in the sand. They themselves are sand-colored with some black speckling and an overall translucent appearance. "You have to look in the gravel of the sand — in specialized

places," said Cincotta. Very specialized, in fact. Only 12 diamond darters have been found in the Elk River near Charleston, West Virginia. The fish may be considered for future protection under the Endangered Species Act. ♦ Kathy Sholl



A new species of fish, the diamond darter.

Stoking Three Fires back to health

With two other neighboring tribes, the Pottawatomini once formed a loose confederacy called the "Three Fires" for protection against invasion in what is now southwest Iowa. To signal warnings, they built fires atop the highest hills that overlooked the valley now covered by the Lake of Three Fires, a 96-acre constructed reservoir that eventually yielded to the combined effects of sediment-nutrient deposition and unwanted fish such as carp and gizzard shad.

Fortunately, the Lake of Three Fires has become an ideal fishing spot thanks to an intensive collaboration and various funding sources, including Sport Fish Restoration funds. The project helped landowners to reduce sediment reaching the lake and create wetlands to filter nutrients from runoff. The Iowa Department of Natural Resources (IDNR) dredged about 500,000 cubic yards of sediment and increased the lake's average depth by four feet. Carp and gizzard shad disappeared



Lake of Three Fires

after draining the lake, and IDNR restocked it with largemouth bass, bluegill, and channel catfish. IDNR added new fish structures and basins in the watershed, which increased angler opportunities and reduced soil loss. Sediment and nutrients

decreased by 70 percent, thus increasing the longevity of the lake and improving water quality. The collaborative effort earned an award from the American Fisheries Society. ♦ Thomas McCoy

Old hatchery, new presidential name



Angler-president Dwight D. Eisenhower was memorialized in conservation. From left, Henry Bouchard, hatchery manager; Marvin Moriarty, regional director; U.S. Senator Patrick Leahy, Donnaleen Farwell select board chairwoman with fellow members Gary Congdon, Dave Sargent, Robert Bearor, and Vermont governor James Douglas.

Locals old enough to remember recall President Eisenhower's fondness for fishing the waters of the West Slope of Vermont's Green Mountains. In fact, a retired fish hatchery manager enjoyed the honor of fly fishing for rainbow trout with the President in 1955. A few months later, the President was responsible for securing funds to rebuild the facility that was, until recently, known as the Pittsford National Fish Hatchery. In August, the facility was officially renamed the Dwight D. Eisenhower National Fish Hatchery. At the renaming ceremony, Senator Patrick Leahy, who was responsible for the language in the Omnibus bill that changed the hatchery's name, highlighted the facility's contribution to fisheries resources of Vermont and its economic impact. ♦ Henry Bouchard

Hopes for Colorado pikeminnow

In 2006, with assistance from Arizona's Bubbling Ponds State Fish Hatchery, the New Mexico Fish and Wildlife Conservation Office stocked more than 1,500 five-year-old Colorado pikeminnow. Fish were recaptured later that year and in 2007. Based on the lack of recaptures in 2008, biologists concluded that fish survival was low. Hopes were renewed, however, in April 2009, when a 22-inch fish was recaptured four miles upstream of the stocking site, suggesting that more stocked fish survived and may be contributing to recovery efforts for this species. Recovery of federally protected Colorado pikeminnow in the San Juan River Basin is a primary goal for the San Juan River Basin Recovery Implementation Program ♦ Jason Davis

By Dr. Mark Madison

Spencer Fullerton Baird



Smithsonian Institution Archives

Spencer Baird U.S. Fish Commissioner 1871-1887

In the history of American conservation, fish were first to enjoy federal protection. The person most responsible for this was Spencer Baird. More charismatic species like bison, eagles, and wolves have largely relegated fisheries conservation to a footnote, while more charismatic conservationists like John Muir, Gifford Pinchot, and Rachel Carson have likewise sidelined the forgotten Commissioner Baird. This is unfortunate as the work of Baird and the U.S. Commission of Fish and Fisheries laid the groundwork for the ongoing fisheries work of the U.S. Fish and Wildlife Service. Fish came first in conservation and laid the foundation for all future federal conservation labors.

Baird's early career is a synopsis of the origins of the American conservation movement. Born in 1823 in Reading, Pennsylvania, he attended Dickinson College, an experience that enlivened a long-standing interest in natural history. After graduating in 1840, Baird began to correspond and visit John James Audubon, who gave him part of his collection of birds. Audubon taught him how to draw birds and mentored this budding ornithologist. Baird's other correspondents and colleagues included Ralph Waldo Emerson, Henry David Thoreau, George Perkins Marsh, and Louis Agassiz. After working as a professor of Natural History at Dickinson College for a number of years, in 1850 he was appointed the first Assistant Secretary of the recently created Smithsonian Institution. In this role, Baird supported the growth of the Smithsonian's natural history collections and coordinated

the dissemination of all scientific information — a role he expanded when he became its Secretary. So, with experience in the field, in the world of science, and in institution building, Baird was immensely qualified to lead the U.S. Fish Commission.

Now for most people, helping create and fill what would become the National Museum of Natural History would have been work enough, but Baird looked beyond the terrestrial collections which had heretofore dominated his work. In 1870, Baird drew up a proposal for a commission to investigate the decline of the nation's fisheries. Congress resolved on February 9, 1871 to create the United States Commission of Fish and Fisheries, the first federal agency created exclusively for natural resource conservation.

Commission was probably too grand a term for what was initially Baird in an unsalaried position working alone out of his home office. And in fact, Congress set out very modest goals for the new Commission charging it — that is, Baird — to “determine whether a diminution of the number of food-fishes...has taken place... and, if so, to what causes the same is due.” But Baird had a good track record in building new institutions and he set out to create a real Fish Commission focused on his interests of research, scientific collaboration, and restoration. Baird immediately began collecting information on declining fisheries and possible remedies. These studies were dutifully published in the first Fish Commission report, which, perhaps uniquely in the history of government reports, was replete with useful

information thoughtfully compiled by the best scientific minds of the day.

But Baird had grander plans to expand the Commission's role and institutional base. Congress's interest in “food-fishes” led to an appropriation of \$15,000 in 1872 for fish propagation, a subject that perfectly fit Baird's research interests in the science of aquaculture and the practical field biology of replenishing the nation's streams and coasts. In keeping with Baird's vision, the first fish hatchery was no small-scale operation but a grand expedition with international repercussions.

Baird sent Livingston Stone, a renowned fish culturist, to California to establish a hatchery to propagate salmon eggs. Stone established what became the Baird Hatchery on California's McCloud River. That first year, 30,000 Chinook salmon eggs shipped to the East Coast. Only 7,000 eggs survived the journey and the 300 eventual fingerlings salmon did not survive their transplant into the Susquehanna River.

Baird did not give up and later was far more successful, shipping eggs and fingerlings around the continent and, eventually, the world. Shad and striped bass were transplanted from the Atlantic to the Pacific Ocean. Rainbow trout, brown trout, and other game and food fishes were introduced to numerous waterway, greatly expanding their range.

While fish culture was being mastered in a growing number of hatcheries, the vagaries of human culture were more problematic. In 1873, an “aquarium car” carrying catfish, eels, bullheads, perch, bass, trout, and lobsters crashed through a railway

bridge sending aquatic and human passengers into Nebraska's Elkhorn River where Livingston Stone swam to safety — the lobsters being not so fortunate.

One of Baird's pet projects was the introduction of common carp to the U.S. Carp ponds were prominently placed at the base of the Washington Monument and Baird delighted in giving Congressmen personalized tours of the ponds and free carp fry to send to their constituents. Carp were raised in many lakes and rivers and Baird was certain Americans would take to this “food-fish” as had Europeans. Baird misjudged the American appetite — literally — and no Fish Commission cookbook could convince Americans to eat this fish. Yet such is the way with pioneers, in charting a new path, successes are enjoined with periodic wrong turns.

Although the National Fish Hatchery System was the most visible and popular part of the Fish Commission, scientific research was Baird's passion. Baird envisioned the Fish Commission becoming a Smithsonian of the seas — an institutional home for the best fisheries science. To this end Baird began a series of research programs in 1871, which are still ongoing to chart the changes in America's fishery stocks. He also began a series of summer research stations along the East Coast that culminated in the making of the Woods Hole Marine Laboratory. In 1882, Baird purchased

a large ocean-going research vessel, the *Albatross*, to study both coasts and revolutionize American oceanography.

Baird succeeded through astute scientific and political instincts in creating an institutional base for American fisheries conservation, one that persists 138 years later in research, scientific collaboration, and propagation in the U.S. Fish and Wildlife Service's Division of Fisheries and Aquatic Resources Conservation.

Those who carry on his conservation work are in a very real sense his heirs. ♦

Mark Madison, Ph.D., is the Historian for the U.S. Fish and Wildlife Service, stationed at the National Conservation Training Center in Shepherdstown, WV. He contributed the POSTCARDS to *Eddies*. Madison would like to fish every day with his three young children in honor of Baird.



NOAA

Spencer Baird (right) directs fish sampling.



NCTC Archives/Museum

The first National Fish Hatchery, Baird Station, CA in 1875.



NCTC Archives/Museum

Spencer Baird (left) at Woods Hole, MA.

Pallid Sturgeon

By John Bryan



Corey Lee/USFWS

An extremely rare fish with a bright future.

On Memorial Day weekend, 1994, Steve Krentz hooked a freight train on the Yellowstone River near where it joins the Missouri. “When it surfaced I said, ‘Oops, I got a pallid.’”

Pallid sturgeon is known to science as, *Scaphirhynchus albus*. It means “spade snout” and “white” derived from Greek and Latin. It is among the rarest of North America’s nine species of sturgeon. Pallids were here 100 million years ago with dinosaurs, marine reptiles, bees, and flowering plants. Then a catastrophic event killed 75 percent of the earth’s species. Marine omnivores that fed on detritus were apparently suited for survival — and the pallid sturgeon did.

Krentz, now supervisory fish biologist for the Missouri River Fish and Wildlife Conservation Office, ND, landed the fish and weighed it: 40 pounds — large enough to have been alive in the late 1980s when he and colleagues first asked this question, “What’s going on with pallids?” Casual concerns about pallid populations had emerged among paddlefish researchers. Far outnumbered by the smaller shovelnose sturgeon, the pallid sturgeon had never been common. But still, something was wrong.

“What’s going on with pallids” spawned research that confirmed a depleted population. And on September 6, 1990, the pallid

sturgeon became the first fish in the Mississippi River system to be listed as endangered.

Initial research has blossomed into a massively funded restoration project — “on par with the Everglades, San Francisco Bay, and the Chesapeake Bay,” says Tracy Hill, supervisor of the Columbia Fish and Wildlife Conservation Office, MO. Since 2005, tens of millions of dollars annually have been appropriated for the Missouri River Recovery Program.

“This is one of the highest priorities,” confirms Greg Conover, coordinator of MICRA — Mississippi Interstate Cooperative Resource Association. In the mid-1990s, Conover collected

and tagged pallids over a 200-mile stretch of river between St. Louis and the confluence of the Ohio and Mississippi. Today there are collection and tagging and hatchery operations across 13 states from Louisiana to Montana.

And one of those had — six weeks earlier — tagged the Memorial Day fish that Steve Krentz caught on rod and reel.

Krentz recognized his fish as a pallid, but all sturgeon have similar characteristics: cartilage rather than bones, and five rows of bony plates called scutes extending the lengths of their bodies. A toothless mouth is positioned back from the snout and telescopes outward to suck bottom food such as small fish and crustaceans. Pallids can reach 90 pounds and 90 years, reach sexual maturity between 5 and 15 years, spawn in the late spring, and produce more than 100,000 eggs.

Two questions: Why are pallids disappearing? And why care?

“We built dams, armored the banks, and put in dikes, levies and other structures to prevent flooding and to aid navigation,” explains Tracy Hill. This has caused “loss of habitat and loss of connectivity to the floodplain” — connectivity that provides vital nutrients.

Pallids traditionally swam hundreds of miles upstream to spawn. Larvae would drift downstream and find slower waterways in which to mature. Montana’s 1937 Fort Peck Dam was the first barrier. Now 51 percent of the pallid’s 3,500-mile range has been channelized, 28 percent impounded, and almost all significantly impacted. Every aspect of the pallid sturgeon’s life cycle has been disrupted.

Why save the pallid sturgeon? “I can answer that in two ways,” says Jan Dean, assistant manager of the Natchitoches National Fish Hatchery, LA, and a member of the Pallid Sturgeon Recovery Team. “We never know the full value of a species and how it affects the ecosystem.” Dean’s research territory includes the Louisiana Hydropower outflow channel which, along with a group of discharge gates for the Mississippi, Red, and Black rivers has the world’s highest known concentration of pallids. “We should leave for future generations what we have,” continues Dean. “We shouldn’t be responsible for the demise of another species.”

Jeff Finley, fish biologist with the Columbia Fish and Wildlife Conservation Office, says, “Pallids are long-lived and slow to grow and are an indicator of environmental health.” In 2000, Finley captured the first documented juvenile in the 400 river miles between St. Louis and Kansas City, thereby verifying something encouraging — successful spawning.

Steve Krentz’s Memorial Day fish was one of somewhere between 6,000 and 21,000 pallids according to a 1996 study. Subsequent taggings and recaptures have provided estimates for specific areas. For example, data from 600 captures and recaptures since 1991 in the Old River Control Complex in Louisiana has determined that between 179 and 401 adult pallids live there — Jan Dean’s research territory. “Some of us feel that pallids should be divided into different populations rather than [viewed] as one big population,” says Dean. Some areas may be “in pretty good shape.”

Krentz’s 40-pounder was just one of what are now hundreds of pallids that wear tags. Collection methods have resulted from experimentation and

innovation. For example, the non-success of floating gill nets caused Krentz and his colleagues to invent the “neutrally buoyant” gill net that drifts along the bottom in deep water.

Collections have confirmed that populations differ. In the uppermost range, the population consists almost totally of older adults — up to 80 pounds. But in Louisiana the pallids are much smaller (15 pounds is huge) and research suggests stable populations of adults and juveniles.

Pallid sturgeon recovery efforts are still young, and Krentz offers two priorities. One is the restoration, enhancement, and conservation of the aquatic habitats. “You’re talking about a lot of tributaries and landscape — a complex suite of features.” The other is studying gaps in life history. “We have very little information on the juveniles. Understanding the first year is critical.”

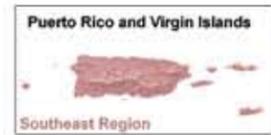
What’s the forecast? “It will take several generations of pallids to know they’ve recovered,” says Greg Conover. “Hopefully the next cohort of biologists will see it happen.”

“Success is when the species can make it on their own,” offers Jan Dean, “and put us out of business” so that future Memorial Day weekends can provide more leaping freight trains on the ends of anglers’ lines. ♦

John Bryan has written for *Gray’s Sporting Journal*, *Sports Illustrated*, and *Field & Stream*. He lives in Richmond, VA.



Fisheries Program Facilities



Conserving America's fish and other aquatic resources cannot succeed without the partnership of Native Americans. They manage or influence some of the most important fish and wildlife habitats — both on and off reservations. Through treaty provisions, Executive Orders, and statutory mandates, the U.S. Fish and Wildlife Service Fisheries Program provides technical support to Indian tribes as they exercise their sovereignty in the management of their fish and wildlife resources on more than 55 million acres of federal Indian trust land and in treaty-reserved areas.



Steve Miller/USFWS

The endangered cui-ui, a species of sucker, lives nowhere else but Pyramid Lake on waters owned by the Pyramid Lake Paiute Indian Tribe. These rare fish swim up the Truckee River to spawn. The Truckee River Operating Agreement brokered by the Nevada Fish and Wildlife Office gives the tribe the lead in managing Truckee River flow in cooperation with the Bureau of Reclamation, the U.S. Fish and Wildlife Service, and the Bureau of Indian Affairs. Flows since 1995 mimic natural conditions and promote the growth of cottonwoods and willows. A water management plan was developed by Lahontan National Fish Hatchery Complex included high spring flows followed by slowly declining water levels, with variability across years. It is working. Many new age classes of cottonwoods grow along the Truckee River. Stable streamside vegetation creates fish habitat, cooling the water, stabilizing the banks.

Cooperation with Native Americans

Native American culture and fish culture at Natchitoches National Fish Hatchery, LA, weave together like the cordage of a net. When the hatchery was built in 1931, construction workers discovered over 100 Caddo Indian burials. Research verified that the hatchery was built on part of the Natchitoches Indian village described by Henri de Tonti. The officer chronicled his experience with LaSalle in his storied 1690 journey through present-day Louisiana. The native Caddo people relied on fish for food. The importance of fishing and land stewardship are knotted together to this day. The U.S. Fish and Wildlife Service honors the hatchery grounds as an important Caddo site, and seeks to honor their cultural heritage through environmental, cultural, and heritage education. We dedicated the Caddo Indian Memorial Plaza on hatchery grounds in March 2007. So whether it is the actual culturing of fish for conservation, or the use of fish as part of their cultural heritage, the Natchitoches National Fish Hatchery and the desires of the Caddo people are braided — to conserve and protect the land and its fisheries.

Craig Springer/USFWS



Karen Kilpatrick/USFWS

The La Crosse Fish and Wildlife Conservation Office, Genoa National Fish Hatchery and the Wisconsin Department of Natural Resources worked with the Menominee Indian Tribe to restore lake sturgeon to waters of the Menominee Reservation. Since 1993, small numbers of the ancient fish have once again been part of tribal sturgeon celebrations that date to well beyond memory.

Five trucks, 300 trips, and 43,000 miles driven — that's what it took to deliver 1,155,082 rainbow trout, brook trout, Apache trout, and brown trout into the waters on 15 Indian Reservations in Arizona and New Mexico. The trout, raised at Alchesay-Williams Creek National Fish Hatchery Complex, went in 63 bodies of water to support angling. Fees to fish tribal land pay for conservation work done by tribal biologists on tribal lands, including initiatives for imperiled species, wildlife law enforcement, nongame management, and watershed restoration.



USFWS

A pioneer agreement reached in 2009, between the U.S. Fish and Wildlife Service, the Colville Confederated Tribes, and the Yakama Nation will improve the harvest monitoring of Leavenworth National Fish Hatchery spring-run Chinook salmon returning to Icicle Creek. U.S. Fish and Wildlife Service funding enables both tribes to increase the scope of their fishery monitoring to generate valuable information about harvest rates and the interception of any non-target species listed under the Endangered Species Act. Monitoring data is critical to fisheries conservation.

In Alaska, the U.S. Fish and Wildlife Service initiated the Partners for Fisheries Monitoring Program in 2003 to strengthen Alaska Native and rural involvement in subsistence fisheries management and research. The Partners Program provides approximately \$750,000 annually to Alaska Native and rural organizations to hire fishery biologists, anthropologists, natural resource specialists, educators, and student interns. Positions are strategically placed in rural Alaska to deliver on-the-ground conservation. The program has created over 100 new partnerships to monitor fish populations and harvests, manage subsistence fisheries, build community support, strengthen local involvement, and train future fisheries professionals to become tomorrow's leaders.

Habitat is essential for self-sustaining populations of fish and wildlife. Loss of aquatic habitats is the principal factor in the decline of fisheries and aquatic biodiversity, and represents the most pressing challenges facing fisheries conservation in the U.S. today. The Fisheries Program seeks with partners to conserve streams, lakes, estuaries, and wetlands so that they are functional ecosystems that support self-sustaining communities of fish and other aquatic plants and animals.



Brent Golladay

Aquatic Habitat Conservation and Management



Vernon Orange

The U.S. Fish and Wildlife Service and Project SHARE assessed 83 road crossings that passed over Maine's Old Stream in 2007. Together, we examined the fish habitat on all 83 sites. From those assessments, nine of those barriers have been replaced with open-arch culverts that span the entire width of the natural channel. This design allows fish habitat to be restored under the road, ensuring that habitat is continuous and endangered Atlantic salmon and endemic brook trout pass upstream. Old Stream flows into the Machias River; the Atlantic Salmon Commission ranked Old Stream as the highest priority waters to be restored for Atlantic salmon — partly because scientists with the Maine Department of Inland Fisheries and Wildlife reasoned that its brook trout are endemic to its waters.

The user-friendly, map-based habitat reference system called AQUABASE is a GIS database that links freshwater fish and hydrological information that fishery managers need. It's presently used in Alaska's eastern North Slope within the Arctic National Wildlife Refuge. AQUABASE has data from freshwater lakes, rivers, and springs with attending life history information on the fishes that swim there, like lake trout and Dolly Varden. It contains full references and easy access to relevant scientific publications.



Sean Connolly/USFWS

The National Fish Habitat Action Plan is a science-based, partnership-driven business model for aquatic resource conservation in the 21st Century. Under the leadership of the Fisheries Program, NFHAP was implemented with others at national, regional, and local levels, organizing Fish Habitat Partnerships that target priority habitats like the Southeastern Aquatic Resources Partnership, the Eastern Brook Trout Joint Venture, and the Mat-Su Basin Salmon Conservation Partnership. Of \$9 million invested to implement NFHAP through 2008, \$5.8 million went to on-the-ground projects with more than \$15 million matched from partners.



NATIONAL
FISH HABITAT
ACTION PLAN



USFWS

Nearly the entire population of the endangered Okaloosa darter swims in waters flowing through Florida's Eglin Air Force Base. One stream, Mill Creek, flows almost entirely on Elgin's manicured golf course. To make things better for the Okaloosa darter, the U.S. Fish and Wildlife Service's Panama City Fishery Resources Office redesigned Mill Creek, taking out six barriers and two ponds that kept darters from moving upstream. The re-design included a 200-foot-long fish passage culvert underneath a fairway, replete with glass skylights to encourage fish to swim through. The National Fish Passage Program and Partners for Fish & Wildlife dollars were matched almost 5:1 with Elgin Air Force Base and the Florida Fish and Wildlife Conservation Commission, Loyola University helping out, all with the aim of getting the darter off the endangered species list.

When the 22-foot-high Hemlock Dam on the Wind River, Washington, went down, it opened 15 river miles and more than 20,000 acres of wetlands to threatened steelhead in the lower Columbia River basin. For more than 70 years the dam blocked passage to this native sea-running fish and warmed the water, ruining habitat for coldwater species — like steelhead. Hemlock Dam was the number-one limiting factor to steelhead recovery in the Wind River.

A 64-foot bridge replaced two undersized culverts on Montana's Governor Creek, restoring the stream's natural hydrologic function, and the ability of westslope cutthroat trout and fluvial Arctic grayling to migrate to and from the Big Hole River, to which it flows. Partially paid for by the National Fish Passage Program, the bridge supports the Candidate Conservation Agreement with Assurances for Arctic grayling. It involves local, state and federal fish and wildlife agencies, non-profit organizations — and over 40 voluntary private landowners who own more than 250,000 acres of property with grayling habitat.

A fish passage project on the Texas coast creates more habitats for red drum. The North Triple Culvert Replacement Project created a six-fold increase in flow at the estuary site, stabilizing flow to over 70 acres of highly productive feeding and nursery habitat important to red drum and dozens of other fishes and birds. The new culverts allow the hydraulic flow pattern of the marsh to return to a more natural state.



USFWS



Through the years of 2006 and 2008, fish biologists in the U.S. Fish and Wildlife Service's Pacific Region re-opened 521 miles and 653 acres to fish passage. A 762-acre estuary restoration still underway at the Nisqually National Wildlife Refuge started in 2009 with the removal of the outer dike. National Fish Passage Program dollars coupled with money from Ducks Unlimited, the National Wildlife Refuge System, and many federal, tribal, state, and local partners pays to reconnect fragmented habitat. Habitats whole again in the Puget Sound and the Nisqually River benefit imperiled Puget Sound Chinook salmon, ducks and people who fish and hunt.

The Fisheries Program strives to conserve and manage fish and other aquatic species. We strive for self-sustaining populations of native fish and other aquatic resources that maintain species diversity, while also providing recreational opportunities for the American people. Conserving living resources that move across political boundaries is a fundamental challenge for interjurisdictional fisheries managers. We strive also to reduce risks of aquatic invasive species, and minimize their economic, ecological, and human health impacts. The Fisheries Program has purview over 138 species of fish, 25 amphibians, 70 mussels, and 22 crustaceans listed as threatened or endangered. Many unlisted species are also at risk. The Fisheries Program has an important role in restoration of listed and unlisted species, as well as restoration of their ecosystems and keeping self-sustaining populations healthy.



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Aquatic Species Conservation and Management



Craig Springer

The endangered pallid sturgeon benefits from conservation work over the Missouri River basin. During the last six years, pallid sturgeon recovery has been a major focus in the U.S. Fish and Wildlife Service's Mountain-Prairie Region and its Midwest Region. Fish and Wildlife Conservation Offices in IL, MO, MT, ND, and SD use radio telemetry and other methods to characterize pallid sturgeon populations, determine mortality rates, identify their habitat needs and restore habitats. Wild fish have been captured and spawned and their offspring raised in captivity and released into the wild. Facilities in the National Fish Hatchery System at Garrison Dam, ND, Gavins Point, SD, Bozeman, MT, and Neosho, MO, have created broodstock for future seeding in restored habitat, while our Fish Health Centers in MT and WI check on the health of fish in the wild and in captivity. Our fish culturists have reared, tagged, and released hundreds of thousands of pallid sturgeon every year into the Missouri River, toward providing for their long-term population security. Our Bozeman Fish Technology Center has developed diets, modified tagging methods, and developed new rearing techniques applicable to the National Fish Hatchery System and culturists in partnering state fish hatcheries. Without the work of our National Fish Hatchery System and the Fish and Wildlife Conservation Offices, the pallid sturgeon in the upper and middle Missouri River would be extinct.

The Mora Fish Technology Center and the New Mexico Fish and Wildlife Conservation Office, working in concert with the New Mexico Department of Game and Fish and the Gila National Forest, expanded the range of the Gila trout, facilitating the fish's down-listing from endangered to threatened. That in turn allowed for limited fishing for this yellow-colored trout, starting in 2007, for the first time in half a century. The Fish Technology Center rigorously adhered to a science-based genetic broodstock management plan, required under the fish's recovery plan. The broodstock management plan keeps the integrity of four recognized genetic lineages that exist in the wild.



Kootenai Tribe

Burbot have declined in Idaho's Kootenai River due to a loss of habitat. Toward reversing that, the Idaho Fishery Resource Office has developed extensive pond-rearing methods for this fish in accord with the University of Idaho, the Kootenai Tribe, and the Idaho Department of Fish and Game.

Biologists at the Saratoga National Fish Hatchery, WY, have bred and reared the endangered Wyoming toad, an animal found only in the area of Cheyenne. They carefully isolate the animals in the captive habitats where they reside so as to not spread the insidious Chytrid fungus. Chytrid-free tadpoles, 9,441 of them, and 78 toadlets have been released into safe harbor release sites within their historic range toward meeting the objectives of the toad's recovery plan.



Lee Bender/USFWS

The Lower Great Lakes Fish and Wildlife Conservation Office keeps a vigorous watch on invasive species in the New York State Canal System. Canals convey commerce, but they can carry unwanted organisms, too, like round goby, zebra mussel and Asian clam. The system of canals connects the Hudson and Mohawk rivers to the Finger Lakes and lakes Ontario and Erie, all of which are habitat for important commercial, recreational, and imperiled fishes. The unwanted invasive species are introduced by people, or by their natural way of expanding or drifting. Our biologists monitor canal waters for new introductions of invasive species or their range expansion, keeping tabs on rare species like lake sturgeon and longear sunfish.

Ninety juvenile alligator snapping turtles reared at Tishomingo National Fish Hatchery have been released into the Caney River basin in northeastern Oklahoma. Extensive surveys over a three-year period indicated that alligator snapping turtles no longer lived in this drainage. The turtles will be monitored via radio telemetry through the next several years. Biologists at our Oklahoma Fish and Wildlife Conservation Office will learn how well the turtles survive, grow, and move.



Brian Fillmore/USFWS

Biologists at our Fish and Wildlife Conservation Offices in IL, MO, SD, ND, and WI monitor the range expansion and changes in the abundance of Asian carp in the Missouri and Mississippi rivers. We created a long-term management plan and have advised graduate students conducting academic research.



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Partnerships and Accountability promotes open communication between the Fisheries Program and our partners and those we serve. By setting targets, measuring performance, and reporting results, we set a record of accountability that integrates program performance and budget. Partnerships are the foundation of the Fisheries Program. They leverage funding and expertise and create a work environment essential to conservation.



112. "U. S. Fish Hatchery," Spearfish, Black Hills, S. D.

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Partnerships and Accountability

It is through partnerships with the community of Spearfish, and the Booth Society, and host of volunteers that we continue to preserve a National Historic Site and the cultural treasures archived at the D.C. Booth Historic National Fish Hatchery, SD. The one-of-a-kind facility with a professional archivist on staff preserves a historic fisheries station, and interprets the rich history of fisheries management. Over 150,000 people visit this historic site each year. We implemented new standards and procedures for the preservation of 20th-century era collection materials. An ADA-accessible push button door was installed on the Collection Management Facility. Our volunteers labor about 14,000 hours a year.

Craig Springer/USFWS



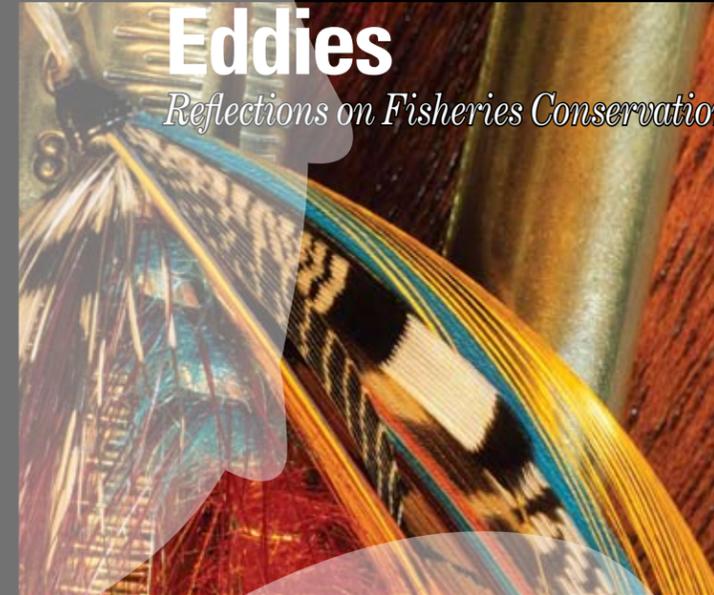
New roads to new homes and new industries slice Alaska's fast-growing Kenai Peninsula. Moreover, more people fish its waters. Both can affect fish habitat. The Kenai Fish and Wildlife Field Office has prevented or reversed such effects by partnering with landowners and the Alaska Fish and Game Department. Biologists at the Kenai office have in the last three years removed eight barriers blocking salmon, steelhead, and whitefish from moving upstream, opening 20 miles of habitat, and surveyed over 400 more barriers that need to come out. They have restored 3,500 feet of stream banks and protected 14,000 feet of streamside vegetation.



USFWS

Eddies

Reflections on Fisheries Conservation



USFWS

Partnerships facilitate strategic habitat conservation in the St. Marys River. Once plentiful, St. Marys River fisheries have declined over time. The St. Marys River Fisheries Restoration Committee (SMFRC) is a partnership that involves collaboration among governments, organizations, private landowners, and political constituencies, to conserve St. Marys River fisheries. The U.S. Fish and Wildlife Service, along with Georgia Department of Natural Resources, Florida Fish and Wildlife Conservation Commission, NOAA-Fisheries, St. Johns River Water Management District, and St. Marys River Management Committee, along with others, established the SMFRC, and are seeking status under the Southeast Aquatic Resources Partnership, which is one of nine designated Fish Habitat Partnerships under the National Fish Habitat Action Plan. The SMFRC considers fishes like striped bass, American shad, and Atlantic sturgeon in need of restoration. The SMFRC views the Atlantic sturgeon as the target indicator species.

The U.S. Fish and Wildlife Service's Red Bluff Fish and Wildlife Office and the Bureau of Reclamation partnered to found the Lower Clear Creek Restoration Team. Clear Creek is a tributary to the Sacramento River in Shasta County, California. Threatened spring-run Chinook salmon and steelhead trout, as well as fall-run and late fall-run Chinook salmon swim its waters. Gold and aggregate mining over the last 150 years damaged fish habitat and the two agencies are restoring it, by increasing in-stream flows to maintain suitable water temperatures for salmon and steelhead. The fish responded, the higher flows produced a swift increase in the fall-run Chinook salmon population. The two partnering agencies also restored fish habitat to a two-mile stretch of creek by rebuilding the stream channel to provide spawning and rearing habitat for fish, eliminating gravel pits and restoring a functional floodplain so that fewer juvenile fish were stranded. Another 11 miles of fish habitat became available when the McCormick-Saeltzer Dam was removed. With the dam gone, more than 100,000 tons of spawning gravel became available to the fish.



Habitat Attitude
PROTECT OUR ENVIRONMENT
DO NOT RELEASE FISH AND AQUATIC PLANTS



STOP AQUATIC HITCHHIKERS!

Prevent the transport of nuisance species.
Clean all recreational equipment.
www.ProtectYourBoat.com

The U.S. Fish and Wildlife Service is responsive to changes in our natural resources. Two national campaigns — Stop Aquatic Hitchhikers!® and Habitattitude® — were created to make the aquatic invasive species issue relevant to targeted citizens. The campaigns empower people to adopt prevention behaviors to limit the introduction and spread of harmful, nonnative species. In seven years, these campaigns have attracted over 1,000 partner organizations including citizen groups, businesses, and government agencies to communicate the two targeted prevention messages. These partnerships have enabled us to leverage \$12 from outside the government for every \$1 we spend on these campaigns.

The Lake Champlain Fish and Wildlife Resource Office and Partners for Fish and Wildlife Programs worked collaboratively with over 35 landowners and about 30 other partners to leverage over \$1,400,000 and in-kind services to benefit aquatic, riparian, and upland habitats in the Lake Champlain Basin and eastern Vermont. New England's landscape has been altered. Many activities have degraded fish and wildlife habitat, water quality, and decreased recreational and aesthetic value. To control invasive purple loosestrife, they released 50,000 beetles that selectively eat the plant. Volunteers did "weed-pulls," yanking non-indigenous water chestnut from habitats. All told, the Lake Champlain Fish and Wildlife Resources Office protected 27 miles of riparian habitat, 108 acres of wetlands, and 11 acres of upland habitat in 21 projects in just 2008. In 2009, they planted 13,500 feet of riparian vegetation on two streams tributary to the White River.

The Fisheries Program relies on a broad range of professionals to accomplish its mission: maintenance workers, technicians, scientists. Our workforce is our greatest asset, and we strive to keep them well-trained and equipped with the best appliances of modern technology in their fields. Conservation depends on reliable water supplies and a fully operational physical plant in our National Fish Hatchery System, and state-of-the-art equipment at our Fish and Wildlife Conservation Offices.

Workforce Management



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U.S. Fish & Wildlife Service

An Efficiency Measure for National Fish Hatchery System Rainbow Trout Production

*Hatchery Efficiency Measure/Cost Comparison
Multi-Region Workgroup
September 2005*



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The U.S. Fish and Wildlife Service and the Bureau of Reclamation are sister agencies in the Department of the Interior. Both have a conservation interest in California's Central Valley Project, a water diversion that has had a bad effect on anadromous salmon and steelhead fisheries in the Trinity River. The two agencies re-aligned themselves to create an integrated conservation program, implementing the Trinity River Restoration Program. The combined scientific and engineering expertise benefits the taxpayers and fisheries.



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Biologists from nine Fish and Wildlife Conservation Offices and National Fish Hatcheries traveled to China in October 2008, as part of an employee development Conservation Exchange between the U.S. Fish and Wildlife Service and the People's Republic of China, Ministry of Agriculture. Our biologists learned about conservation measures underway for the Chinese paddlefish, Chinese sucker, and two species of sturgeon. The trip's purpose was to exchange conservation methods and strategies for rare big-river fishes with presentations from the Chinese Academy of Fisheries Science, and Chinese Sturgeon Institute. The Chinese reciprocated and visited U.S. Fish and Wildlife Service fisheries facilities in April 2009.



Craig Springer

Ennis National Fish Hatchery, MT, provided training in all aspects of fish culture, scientific development, and administration for U.S. Fish and Wildlife Service Fisheries Program workforce in the Rocky Mountains.

Workforce planning has become the cornerstone in how we address conservation challenges. Two recent published studies — *A Cost Comparison Analysis for National Fish Hatchery System Rainbow Trout Production* and *An Efficiency Measure for National Fish Hatchery System Rainbow Trout Production* — concluded that the U.S. Fish and Wildlife Service's rainbow trout hatcheries were extremely efficient in producing a quality fish necessary to meet fishery mitigation requirements. Workforce planning within the Fisheries Program is extremely critical, operating at a reduced staffing level due to budget constraints. A subsequent study published by the U.S. Fish and Wildlife Service's Southeast Region in 2007, *Workforce Analysis — National Fish Hatcheries — Trout Mitigation* aligned staff to continue producing high-quality rainbow trout.

An annual hatchery management workshop in the Pacific Region identifies aquatic resource management problems, explores new opportunities, maintains productive working relationships, and shares state-of-the-art science and technology relating to hatchery management. The 80 or so participants address topics common to National Fish Hatcheries, Fish Health Centers, Fisheries Resource Offices, Fish and Wildlife Offices, and Technology Centers. These topics include the use of genetics in hatchery management, producing quality fish by manipulating nutrition, environment, and behavior, and environmental compliance and litigation. This workshop is open others throughout the U.S. Fish and Wildlife Service, state agencies, tribes, and other conservation partners.

The eighth-graders who first attended Career Day at the Aquinas Middle School in LaCrosse, WI, five years ago are now college-bound. And they might be majoring in fisheries science to become part of the U.S. Fish and Wildlife Service workforce. Five years running, the LaCrosse Fish and Wildlife Conservation Office has participated in the event. The youngsters learn about the duties of fisheries professionals and the educational requirements needed for the satisfying career in conserving America's fisheries.



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Training in basic fish health practices helps fisheries professionals identify and control diseases, which is essential to fisheries conservation. The Olympia Fish Health Center, WA, with assistance from Northwest Indian Fisheries Commission and other partners once a year teaches the "Fundamentals of Fish Health." This three-day workshop informs and trains fisheries professionals on the prevention, diagnosis, and control of fish diseases found in the Pacific Northwest.

Biologists at the Bozeman Fish Health Center, MT, completed specialized training to better detect fish diseases. They learned to use advanced genetic-based testing methods, including quantitative DNA assays. The scientists were also trained in aquatic toxicology to detect contaminants and pollution in aquatic animals. Trained biologists apply the diagnostic techniques in hatcheries and in wild fish populations through the National Wild Fish Health Survey (see "Diagnosing Disease," *Eddies* Fall 2008).



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Dams, irrigation diversions, and other development projects constructed and operated by federal agencies have caused lost fishing opportunities. The Fisheries Program mitigates the effect of federal water projects by restoring habitat, providing fish, and lending technical support in fisheries management. We restore native species and stock fish that support commercial and recreational fisheries, and are committed to meeting full mitigation requirements and cost-recovery by the appropriate federal agency.

Public Use



Judy Toppins/USFWS

Recreational fish production fuels a powerful economic engine. Recreational use of hatchery-stocked fish generates significant economic effects. Federal hatcheries in Arkansas, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, and Louisiana annually stock a total 22.3 million fish of 15 game species in 12 states. In 2005, this generated over 3.2 million angler-days of fishing, \$239 million in total economic output, and 3,100 jobs with incomes totaling \$63 million, and \$14.0 million in state and federal taxes. This economic fuel was generated by spending less than \$5 million in budget allocations to produce and stock these fish. This translates to an economic benefit of \$48 for every \$1 of taxpayer money spent on National Fish Hatchery recreational fish production in the Southeast Region.



Craig Springer



Craig Springer

The Biologist-in-Training program (BiT) connects kids and nature. BiT is an innovative, experiential, environmental education program that promotes the National Fish Hatchery System as unique outdoor classrooms. BiT fosters direct interactions with fish and aquatic environments. Students gain a first-hand understanding of aquatic plants and animals and the empowerment to conserve aquatic resources. BiT launched in 2007, and closely follows the goals of the National Fish Hatchery System Volunteer Act of 2006. BiT was created by Fisheries Program staff in the Southeast Region, with substantial contributions from education professionals with varied backgrounds. The NAAEE Guidelines for Excellence for Non-formal Environmental Education and National Science Education Standards steered the creation of BiT. BiT is a creative and unique course that meets the many needs of National Fish Hatcheries and the user groups they serve. BiT has reached more than 18,000 youngsters and has been adopted by 4H, Bass Pro Shops, the Miami MetroZoo, the City of Wichita, Kansas, the Natural Resources Conservation Service, Boy Scouts, Girl Scouts, and home-school networks. BiT is flexible, with an engaging 20-page activity guide. Anywhere there is water, BiT may be taught. Its materials are offered through 21 USFWS field stations and are available at www.fws.gov/southeast/fisheries/BiT.

Twenty-eight million fish a year — that's how many fish get tags in the Pacific Northwest. U.S. Fish and Wildlife Service fisheries field stations mark hatchery-reared Pacific salmon and steelhead en masse to protect imperiled stocks of ESA-listed Chinook and coho salmon, and to promote selective fisheries. Mass marking is critical to maintaining important sport fisheries. The effectiveness of mass marking and mark-selective fisheries are currently being evaluated.



Craig Springer

Garrison Dam National Fish Hatchery, ND, maintains walleye, northern pike, rainbow trout, and brown trout fisheries on National Wildlife Refuges in North Dakota and Montana. Its reach, though, is broader. Chinook salmon, northern pike and walleye, numbering in the millions, also go to South Dakota, Idaho, Iowa, and Wyoming. Jones Hole National Fish Hatchery, UT, recently stocked over 200,000 kokanee salmon and 220,000 rainbow trout in Flaming Gorge Reservoir. Willow Beach stocked 124,000 rainbow trout in Lake Mohave, AZ. Creston National Fish Hatchery, MT, stocks rainbow trout into two lakes, and westslope cutthroat trout into 14 lakes on the Flathead Indian Reservation. Ten National Fish Hatcheries which are part of the Lower Snake River Compensation Plan hatcheries stock 16 million salmon and steelhead to mitigate four federal dams on the lower Snake River.



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Jordan River National Fish Hatchery, MI, pulls visitors from afar for its annual "Hatchery Fest." Attendees learn about fisheries conservation, invasive sea lamprey control, and they brush up on their angling skills. Local business and non-profit groups sponsor the annual event. Across the country at Inks Dam National Fish Hatchery, TX, some 15,000 visitors a year pass through the facility where they are treated to environmental education programs. At Coleman National Fish Hatchery, CA, the annual "Return of the Salmon Festival," celebrated since 1991, provides a great opportunity for visitors to learn about fisheries conservation. They view Chinook salmon returning to Battle Creek and the hatchery, and the visitors observe day-to-day hatchery operations such as spawning, egg incubation, and fish tagging.

Steelhead, sought for sport and food, enter Alaska's Kasilof River in the fall where they overwinter and then move upriver to tributary streams to spawn in the spring. The abundance and run timing of steelhead returning to Crooked and Nikolai creeks have been monitored by the Kenai Fish and Wildlife Conservation Office since 2005. Biologists estimated the number of steelhead spawning in the creeks using a combination of underwater video technology and fish weirs. Eighty fall-run steelhead got internal radio transmitters. Radio signals coming from fish allowed biologists to find their overwintering areas, and where they live over the seasons. Four new spawning groups of steelhead have been found using radio telemetry since 2007. Crooked and Nikolai creeks are the only two streams within the Kasilof River watershed known to support steelhead. Both populations are small — less than 1,000 fish in each spawning population — but represent some of the northernmost stocks of steelhead. Knowing the distribution and abundance of these fish, especially given the small populations size, is essential for conservation. Federal and state fishery managers use the data to ensure the sustainability of Kasilof River steelhead — some of which are harvested by anglers and via personal-use fisheries for subsistence.



Craig Springer



Craig Springer

Science and technology form the foundation of successful fish and aquatic resource conservation and management. Our Fish Technology Centers, Aquatic Animal Drug Approval Partnership, Fish Health Centers, Fish and Wildlife Conservation Offices, and National Fish Hatcheries perform conservation informed by science. We are committed to ensuring that technological advances in fisheries science developed by U.S. Fish and Wildlife Service employees are available to natural resources agencies, regional management councils, and private industry.



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The Kenai Fish and Wildlife Field Office developed video technology that accurately monitors salmon and steelhead returns in Alaska. Several fish weirs on the Kenai Peninsula have the new technology. Underwater video systems have become an important tool allowing resource managers to do more with less. Our success using underwater video has created collaborations with many agencies and private landowners. We partner with the Alaska Department of Fish and Game on three video monitoring projects. Private landowners provide access to strategic locations so that we can operate microwave equipment and video weirs. The Kenai office monitors more fisheries with fewer people at a significant long-term cost savings. Video data are more accurate, and that benefits the fisheries in the end.



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Leadership in Science and Technology



Kaplan Bartlett/USFWS

The Pacific Region conducted a series of National Fish Hatchery program reviews during 2005-2009 to assure that its 24 facilities are part of an integrated, science-based strategy — consistent with broader state, tribal, and federal strategies — for conserving wild stocks and managing fisheries. The review sought to ensure that National Fish Hatchery System facilities operated on the best scientific principles and contribute to sustainable fisheries, and the recovery of naturally spawning populations of salmon and steelhead. Recommendations from the review will produce healthier smolts, increase survival, and modify broodstock composition.



Ken Gates/USFWS

The offspring of modern science — technology — is employed in the U.S. Fish and Wildlife Service's conservation genetics laboratories, most of them nested at one of seven Fish Technology Centers across the country. Using sophisticated cutting-edge equipment, geneticists work with fishery managers to answer questions related to population delineation, landscape genetics, population connectivity, and the management and conservation of genetic diversity. At the Dexter Fish Technology Center, NM, geneticists analyzed the Rio Grande cutthroat trout, threatened Yaqui catfish, and endangered Devils Hole pupfish. They created a genetic-based management and captive propagation plan for the endangered humpback chub and Clear Creek gambusia. At the Warm Springs Fish Technology Center, GA, geneticists determined that alligator gar in the Mississippi River basin should be treated as several distinct populations. Those genetic data spurred fisheries managers to assess potential genetic risks associated with current alligator gar management. Understanding movement of individuals within a species and between populations is an important application of conservation genetics. Warm Springs scientists are presently doing such for populations for three imperiled freshwater mussels — the fat threeridge, purple bank climber, and oval pigtoe. Genetic data will help prioritize mussel populations for conservation and risks associated with hatchery restoration, augmentation, and captive refuge programs. The lab in Alaska has worked on dozens of species — from salmon to sea otters — from Russia to the Lower 48. Genetics research allows fish managers to integrate genetics into their conservation efforts. Geneticists in the U.S. Fish and Wildlife Service frequently publish their research in rigorous journals of science.

It is 95 feet long, 30 feet wide, carries five fish biologists, one engineer, a captain, and releases near four million lake trout a year. The *M/V Spencer F. Baird* is the only ship in the employ of the Fisheries Program. Dedicated in 2006, the *Baird* not only delivers lake trout into the Great Lakes, it's used to evaluate fisheries. It has laboratories inside and net lifting stations on deck, as well as echo sounders for measuring fish populations with sonar. The "auto-trawl" system is high-tech; sensors on the bottom trawling net communicate with winches onboard to automatically adjust the net for efficient operation. Of the 63 science vessels sailing the Great Lakes, the *M/V Spencer F. Baird* is the only hatchery ship on the water.



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Delta smelt are rare, and they were reared at Livingston Stone National Fish Hatchery, CA. Endangered Delta smelt live in the Sacramento River Delta. Smelt collected in the fall of 2007 were spawned in the spring of 2008. Fish culturists at the hatchery succeeded in bringing these fish to the juvenile stage — a first anywhere. In June of 2009, more history was made when these adults were spawned, thus completing the entire life cycle of delta smelt in captivity. Livingston Stone National Fish Hatchery and the U.C. Davis Fish Conservation and Culture Laboratory are the only facilities in the world tasked with raising the delta smelt. These captive fish are a "refuge" population should the fish become extinct in the wild.

Report of the Commissioner: Propagation of the California Salmon

Hon. Schuyler Colfax, President of the U.S. Senate

Hon. J.G. Blaine, Speaker of the House of Representatives

Washington, February 15, 1873

The propriety was strongly urged at the Boston meeting of the American Fish-Culturist Association of sending some experienced fish culturist to the west coast for the purpose of securing a large amount of spawn of the California salmon. This was the more proper, as the resolution introduced into the House by Mr. Roosevelt looked especially to the securing of a supply of eggs by the means of hatching-houses on the Columbia River or elsewhere in the West; and I felt it incumbent to carry out the intention, although the law making the appropriation contained no restriction.

Although considerable diversity of opinion exists with reference to the California salmon, most of those familiar with both species consider it nearly, if not quite, equal to the eastern salmon, and in some respects superior. It possesses the advantages of existing in great abundance in our country, and of thriving in water the temperature of which might not admit of the existence of the eastern species.

Mr. Livingston Stone was engaged to undertake this work, and proceeded to California. The experiment was of course

uncertain, in the entire absence of any reliable information bearing upon the natural history of the species. It was not even known at what period they spawned, although Mr. Stone was assured by professed experts that this occurred in late September. Mr. Stone left August 1, and at my request he reported to Mr. Throckmorton and the other fish-commissioners of the State, as well as to the president of the California Fish-Culturists' Association. By all of these gentlemen, he was received with the utmost courtesy and kindness and every assistance was rendered to him. His instructions authorized him to select any point on the Sacramento or the Columbia River that promised to answer best the purposes of his mission. Quartermaster-General Meigs had supplied him with a letter of recommendation to the officers of his department in the West; but to his regret, Mr. Stone found no military post near to render assistance in the present season.

After much fruitless inquiry, Mr. Stone at last learned chiefly through Mr. B.B. Redding, fish-commissioner of California and through the chief engineer of the Central Pacific Railroad that the Indians speared salmon on the McCloud River...320 miles north of San Francisco. Mr. Stone immediately set to work in erecting the hatching-establishment, although, on account of the distance from any settlement and the absence of special facilities, he found the undertaking both difficult and expensive. The efforts of Mr. Stone were prosecuted intermittently day and night and proved the season

had almost entirely passed, and that few spawning fish remained. Many thousands of spawn were secured and placed in hatching-troughs, but the extraordinary heat, rising day after day to 112 degrees in the shade, accomplished the destruction of a greater portion.

The surviving eggs collected by Mr. Stone — 30,000 in number — were packed by him in moss and forwarded by express, addressed to Charlestown, New Hampshire. On receiving a dispatch announcing the shipment, I telegraphed Charlestown directing the packages to be forwarded to Dr. Slack and sent a telegram to Wells Fargo at Albany requesting that if the eggs had not already passed that point, they might be returned at once to New Jersey. This dispatch came too late as the eggs had passed, but the superintendent of Mr. Stone's establishment forthwith sent the eggs to New Jersey, with a skilled assistant to take charge of them. Unfortunately, in consequence of the warmth, and miscalculation of the rapidity with which they accomplished their changes, the eggs were in large part hatched out on the journey so that of the 30,000 all but 7,000 were hatched. The remainder were picked out and placed in the hatching-house by Dr. Slack. The brood proved to be unusually hardy, very few dying, and all manifesting an extraordinary voracity for the food supplied to them.

By the advice of the various State commissioners and fish-culturists at a meeting in New York in October, it was concluded to place this stock of young fish in the Susquehanna; Mr. James Worrall, late commissioner of fisheries

for Pennsylvania, undertaking to do everything possible for their proper care. It had been the intention to transfer them to the river as soon as the yolk-bag had become absorbed and the young fish were able to shift for themselves, but in consequence of the very cold weather, Dr. Slack was requested by Mr. Worrall to keep them until later in the season. They were retained until March 3, when they were taken to Harrisburgh and placed in the Susquehanna, being between five and six thousand in number. Only about 100 perished on the journey and the rest being vigorous and in good condition. It is much to be hoped that some important result may follow this enterprise, especially if it be at all possible to add largely to the number in the course of the next few years. At the time of their introduction, they were from two to two and a half inches long, showing the banded side very distinctly. They were much larger than the young of the *Salmo salar* at the same age, in this respect agreeing with the egg, which, in the Sacramento species, is fully twice the capacity of that of its congener.

The surprise of Mr. Stone at finding the extraordinarily high temperature in the Sacramento Valley was all the greater from the fact that he had been warned against being blockaded with snow during the same period. It is, therefore, probable that, as the season of 1872 was exceptionally warm, this obstacle to success will not continue on a subsequent occasion.

From Mr. Stone's experiences in 1872, he concluded that it will be necessary to commence operations

as early as July 20, and to have the breeding salmon caught and confined as early as August 20. The hatching-water he proposes to take from the McCloud River, which is so even a temperature that notwithstanding the great heat, it does not rise above 54 degrees. He would have used this water for hatching purposes in 1871 but for fear of its rising by sudden freshets so as to destroy the establishment. He found however that the water altered only about two inches during his stay and should operations be continued another season he proposes to employ it for the purpose, continuing operations at the same station. No better place is, indeed, to be had in California than the McCloud, as it is a very clear, cold, swift-running stream, full of salmon, and probably embraces the principal spawning-ground to that fish.

The spawning-beds lower down the river have been almost entirely destroyed by the washings of gravel and sand from the gold-diggings, which have exercised an unfavorable influence upon the supply.

According to Mr. Stone there are no white settlements on the river; but the Indians are numerous. The nearest highway is the Oregon stage-road, four miles from the river. Mr. Stone's party endeavored to enlist the Indians in their service but were unable to communicate intelligibly with them, and were obliged to rely upon their own resources. As it was, their operations were somewhat delayed

by the non-arrival of a salmon-net which had been sent for. Mr. Stone had been assured that there would be no difficulty in securing aid from the Indians, which, however, he found to be entirely impossible.

We do not know enough of the natural history of the *Salmonidae* of the West to decide as to the relationship of the Sacramento salmon to those of the waters farther north, especially of the Columbia and Frazer rivers. Dr. Suckley and others are of the opinion that the same species extends from California to Alaska; but that while there are additional species in the northern waters, only one inhabits the Sacramento. Its flesh is much more highly colored than that of the eastern salmon, being almost of a dark-red, and its flavor is said to be fully equal, if not superior; although about this there is a great diversity of opinion. In its proportions, it differs, being shorter and thicker, so that one of them weighs considerably more than a fish of the same length from the East. Further considerations as to its value and adaptability to eastern waters will be found further on. ♦

Spencer F. Baird, Commissioner of the U.S. Fish Commission, reported to Congress on what became the first National Fish Hatchery. That "hatching-station" now lies under Lake Shasta. Nearby present-day Livingston Stone National Fish Hatchery raises Mr. Stone's Chinook salmon and delta smelt.

Eddies

Reflections on Fisheries Conservation

U.S. Fish and Wildlife Service— Fisheries
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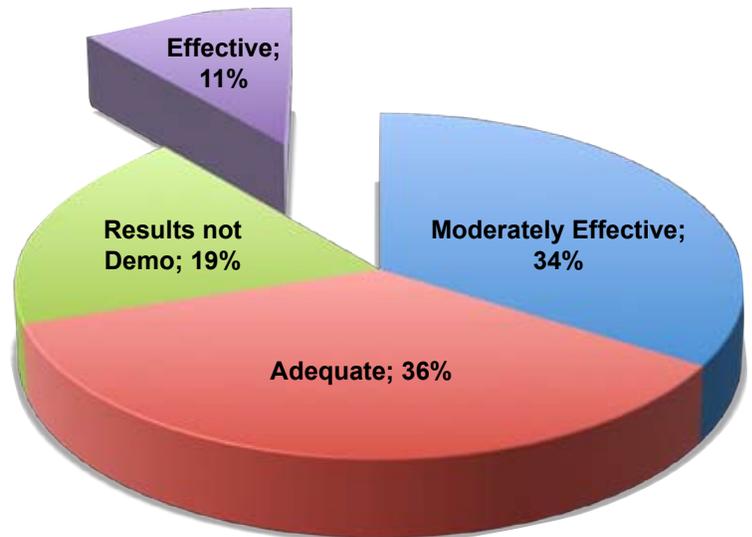


Standing aPART

“Working with partners” does not simply mean standing next to folks while fish are stocked in a creek. It means taking constructive criticism and applying it to improve our work. The U.S. Fish and Wildlife Service’s Fisheries Program did just that, and here’s how; in 2004, the Sport Fishing and Boating Partnership Council, chartered by Congress, assessed how well the Fisheries Program worked in its 12 mission areas. The Council found that the Program was “Effective” in its overall mission, and provided 23 recommendations. We have put many of them into practice, including *Eddies*, to improve communications with partners, and those we serve.

In 2006, the President’s Office of Management and Budget (OMB) put the Fisheries Program through a rigorous review using its Performance Assessment Rating Tool, or PART. OMB scored the Fisheries Program at 85.5 percent and “Effective,” the highest rating possible. The PART score stands as the highest in the U.S. Fish and Wildlife Service — and one of the highest in the Department of the Interior.

Partner input and high ratings position us to meet the challenges of fisheries conservation for future. ♦ Joe Moran



The Fisheries Program was among the 11 percent of Department of the Interior agencies rated “Effective” by OMB in 2006.