

# Eddies

*Reflections on Fisheries Conservation*



FISH LADDER TO THE STARS

# Eddies

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Fish Ladder to the Stars  
by featured artist  
Ray Troll.



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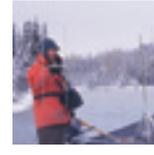
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*The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect and enhance fish, wildlife, plants and their habitats for the continuing benefit of the American people.*



# Headwaters

## *Alaska: A Place that Humbles the Spirit*

By Bryan Arroyo



USFWS

Alaska evokes strong feelings, vivid images, and for me—powerful memories. Growing up in the tiny island of Puerto Rico, I only read and dreamt about this place. All my daydreaming never prepared me to absorb its vastness. It's rugged and wild. Its landscapes and magnificent wildlife all combine to make every excursion a great adventure.

The fisherman in me is jubilant that Alaska still boasts immense self-sustaining fish populations, like no other in the Lower 48. Fish abound in habitats that remain largely unfettered by people. The conservationist in me warns that we must be vigilant so that these populations remain self-sustaining for future daydreamers.

The future, in part, is in the hands of folks like U.S. Fish and Wildlife Service fishery biologist Steven Miller. I say "in part" because true conservation can only be achieved through meaningful partnerships. Miller, a former U.S. Marine with Viet Nam experience, works for the Kenai Fish and Wildlife Field Office, but keeps office at the Yukon Delta National Wildlife Refuge headquarters in tiny Bethel, a place that you can only get to by air or boat. In season, Miller is on the wild waters of the Refuge, and the work he oversees—counting salmon, marking fish movements, collecting data to set harvest regulations—speaks to the essence of what are Alaska's fisheries.

One fish-counting weir that Miller supervises is a 50-mile boat ride from Bethel, up the twisting Kwethluk River that meanders so tight at its lowest reaches that it's about to curl in on itself at every turn. The river courses through the tundra that from a distance looks featureless, like smooth hummocks of green velvet.

"Remote" doesn't even begin to describe the workplace. If Miller and crew forget a hammer or food or fuel or other necessities, it's no short walk back to the pick-up truck. Work here demands a certain confidence and self-sufficiency.

Most people have never been to Alaska, and many may never get the chance to visit. But there is a particular satisfaction that you should receive, knowing that Alaska's fisheries are well managed for the future. From the pages that follow, I want you to come to know more about the successes enjoyed, and the challenges Alaska's fisheries face.

Corinne Smith with The Nature Conservancy writes in her story, "Balancing the Needs of People and Fish," about how development in the Anchorage area confronts the well-being of salmon fisheries. She tells how the Mat-Su Salmon Partnership uses education and on-the-ground habitat protection and restoration to keep fish at self-sustaining levels.

In the story, "Alaska Fisheries on the Frontline of Conservation," biologist Ray Hander writes about the many questions that science needs to answer to manage fisheries in the face of climate change.

Alaska Department of Fish and Game biologist Ed Jones tells us a whole lot about how Arctic grayling make a living in his American Fishes installment. Did you know the fish's scientific name comes from what they smell like? Read the piece, and you'll learn more.

We're pleased to present our annual featured artist in this issue, the work of Alaskan Ray Troll. Troll's work is on the cover and inside the magazine, along with a great biographical sketch by Ben Ikenson.

Our scientific capabilities shine in stories by John Wenburg, Ph.D., and Doug Palmer. Wenburg communicates how leading-edge technology is applied in a practical and meaningful manner. Palmer tells a "moving story" about how radio telemetry reveals the habitats used by two fish species.

The work of folks like Steven Miller is really important. Fish in Alaska are more than objects of affection for the naturalist and angler. Fish feed people. They fuel an economy, and make possible the lifeways that Alaskans enjoy. Alaska's fisheries are yet to succumb to habitat loss and over-exploitation—the things that have hampered fisheries most everywhere else—and largely remain sustainable. I find that fulfilling, and humbling.

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

## May I see your library card?



Emily Smith/USFWS

*The Fishing Rod Loaner Program equipped this Kenai youngster with a fishing pole.*

If you want to connect a kid with nature and to conservation, put a fishing pole in his hand. The Kenai Fish and Wildlife Field Office in Soldotna, Alaska, helps make that happen, and all a kid needs is a library card.

The Fishing Rod Loaner Program runs in conjunction with the Kenai Community Library, where children with parental consent can check out a fishing rod the same way they would check out a book. But you can't get away from a library without something to read—and when a kid checks out a rod, they get reading matter from the U.S. Fish and Wildlife Service—information on knot tying and local fishing hot spots, and a copy of the fishing regulations.

According to librarian Julie Niederhauser, over two summers the rods have been checked out 44 times, and she's delighted. "I think it's incredible—the excitement is tangible in the kids," said Niederhauser. "It's wonderful to get a young person into fishing, and it's great that the library is part of that." Soldotna Trustworthy Hardware Store donated the rods. ♦ Emily Smith

## Necessity spawns video innovation

Necessity is the mother of invention, and she's spawned a very useful innovation in fisheries conservation: underwater video. And the Kenai Fish and Wildlife Field Office is at the fore in its use with fish weirs.

Fish weirs are a common tool used in managing Alaska's fisheries. These weirs are in essence fences that funnel fish through a chute to be counted. In the past, that's meant lots of labor, having fisheries workers on the weirs to literally count fish as they swam upstream, but only during daylight hours. Now, biologists working throughout Alaska remotely monitor salmon and steelhead populations, and invasive northern pike using digital video—and the data are gathered around the clock.

The standard components of an underwater video system include a sealed camera box and pond lights, a fish passage chute, and a digital video recorder equipped with robust motion-detection software to record video images when fish pass the camera. The system is powered by solar and thermoelectric energy. The data—video images—are transmitted via microwaves and can be quickly reviewed miles away, reducing travel and personnel costs. A 24-hour video can be compressed and reviewed in mere minutes.

The imagery is of high quality, too. With video, biologists can do more conservation work in less time, and at less cost to the taxpayer. ♦ Ken Gates



Ken Gates/USFWS

*A weir on Nikolai Creek funnels steelhead and coho salmon past an underwater video system.*

## Salmon in the city



A train passes over Chester Creek, where salmon pass through habitat restored by the Anchorage Fish and Wildlife Field Office.

Chester Creek flows through the heart of urban Anchorage, Alaska, draining into the coastal waters of Cook Inlet. Dena'ina (Athabascan) subsistence fish camps once dotted

the 60-acre estuary at the mouth of the creek. Alterations to the estuary began in the 1930s with construction of a railroad embankment and trestle bridge across the estuary mouth. Years later, Chester Creek was dammed, routed through a concrete weir, and piped under the

railroad, while the estuary became a permanently flooded freshwater lagoon. These things significantly impeded fish passage, and damaged

diverse intertidal and migratory bird habitat. In 2009, biologists with the Anchorage Fish and Wildlife Field Office, and many partners, completed a major restoration of this area. The concrete weir and pipes are gone, and the creek now flows down several hundred feet of constructed pools and riffles, through a box culvert under the railroad—restoring the creek's direct connection to Cook Inlet. That connection now passes migrating wild salmon upstream. It has restored tidal flooding to five acres of the original estuary, and created migratory bird habitat. Interpretive signs that educate people about the site, coupled with public salmon viewing, are a catalyst for future restoration projects along Chester Creek. ♦ David Wigglesworth

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## FEATURED FACILITY

### Lahontan National Fish Hatchery Complex

**Where:** Gardnerville, Nevada

**When:** Established 1956

#### **Then:**

Lahontan National Fish Hatchery was established to raise sport fish.

#### **Now:**

Lahontan National Fish Hatchery Complex oversees recovery implementation of the threatened Lahontan cutthroat trout and the endangered cui-ui, both economically and culturally valuable fisheries in Nevada.

The Complex includes the Nevada Fishery Resource Office, the Marble Bluff Fish Passage Facility, and the Lahontan National Fish Hatchery. Biologists provide technical assistance to state, tribal, and other federal agencies. Challenges in recovery for the Lahontan cutthroat trout include lake trout predation in Lake Tahoe to the degraded water quality in Walker Lake. But biologists meet these



Fishery biologists at Marble Bluff Fish Passage Facility take biological data from a cui-ui to help better manage the fishery.

challenges with innovative, applied research, and reliance on collaborative partnerships with academic researchers. One such example includes the capability of using what is called “hydroacoustics” technology in reintroduction efforts at Fallen Leaf Lake, an alpine lake that flows into Lake Tahoe. The acoustic profile that the technology helps to create is used to locate lake trout spawning sites and, eventually, guide gill net samplings. Further development of this protocol will allow biologists to map lake trout distributions and focus removal methods for Fallen Leaf Lake and Lake Tahoe. ♦ Lisa Heki

## Common sense culverts connect fish habitats



USFWS

*Volunteers restore habitats along a small tributary of the Matanuska River.*

The Matanuska and Susitna rivers north of Anchorage, boast thousands of salmon streams. Some are immense rivers, but most are streams less than 10 feet wide. These small waters provide vital habitat for five salmon species and other aquatic organisms. Many small streams aren't used for spawning, but are essential for rearing salmon.

These finger-length fish swim miles up and down streams through the year seeking the best places to live. Unfortunately, these same small streams are particularly vulnerable to habitat fragmentation from roads that come with development.

Current development in the Mat-Su basin includes an expanding road

network with hundreds of stream culvert crossings. Biologists from the Anchorage Fish and Wildlife Field Office (AFWFO) assessed these culverts and found that more than half impede or block young salmon and other fishes from moving about. Access to many miles of prime stream habitat is thus lost due to culvert barriers. The AFWFO promotes culvert designs that incorporate a constructed streambed similar to the natural stream conditions. This allows fish to pass through the culvert as easily as they navigate the natural stream.

Habitat restoration staff with the AFWFO provide design and funding assistance for "stream simulation" culverts. Together with many partners, the AFWFO opened up entire streams by removing multiple barriers. Much work remains to be done, but since 2000, 56 culverts in the Mat-Su basin have been replaced, repaired, or removed, benefitting fish and people. ♦ Mary Price

## Salmon swim to clear-water side-channels

Knowing where fish spawn is a crucial step toward protecting spawning habitat and conserving fish populations. Biologists from the Anchorage Fish and Wildlife Field Office have learned just that about the fishes in the Matanuska River, near Anchorage. While close to the major population centers in Alaska, little is known about the salmon runs into this major river. Biologists used a fishwheel to capture returning salmon, and outfitted them with radio tags to track them to their spawning locations. River current spins the wheel, and captured fish slide from the basket, down the chute, and into the live box where waiting biologists attend to the fish.

During 2008 and 2009, biologists caught 2,200 salmon by fishwheel. Six hundred of them were radio-tagged. The data collected by following their signals revealed that stable clear-water side-channels within the mainstem Matanuska River were the predominant spawning habitat for sockeye, chum, and coho salmon.

The data revealed more. Biologists were able to estimate the spawning distribution over space, and the time at which these fishes swam upstream, and the composition of the fishes by age, sex, and length. This project was conducted as part of the Mat-Su Salmon Partnership under



Craig Springer/USFWS

*Radio tags placed inside salmon reveal data about their movement and habitat selection.*

the auspices of the National Fish Habitat Action Plan. ♦ Doug McBride

## Telemetry reveals sheefish habitat

Sheefish, inconnu, or “Tarpon of the North”—no matter the name, a radio telemetry study of this decidedly northern fish shows some habitat preferences, and that will help fishery biologists manage fish habitat.

Alaska Department of Fish and Game biologists in conjunction with the U.S. Fish and Wildlife Service’s Sport Fish Restoration Program and the Office of Subsistence Management, currently follow radioed sheefish to learn more about where they spawn and how and when they move around, associated with spawning. They do this in Alaska’s Kobuk River.

From July to August 2008, Alaska Department of Fish and Game biologists captured 150 mature sheefish, and implanted radios in

them. They conducted five aerial tracking surveys in September 2008 to locate sheefish in their spawning area, located between Mauneluk River and Beaver Creek. They learned so far that sheefish are meticulous when it comes to choosing a place to spawn. They prefer coldwater between four to eight feet deep, over different sizes of gravel, and fast-flowing current.

Alaska Department of Fish and Game biologists will continue to track radioed sheefish. An additional 150 sheefish will get radio tags through the fall of 2011. This study will help

biologists calculate sheefish spawning patterns in the Kobuk River, to inform future management decisions of this tarpon look-alike. ♦ Thomas McCoy



*A sheefish gets a radio transmitter.*

Alaska Department of Fish and Game

## FROM THE ATTIC Notes from D.C. Booth Historic National Fish Hatchery and Archives

“Do Not Remove Under Penalty of Law.” You see it on couch cushions where it’s more a nuisance rather than a hindrance. We find the phrase in our museum collection at D.C. Booth—on circular disks of brass. They’re survey markers, plain, yet ornate in their simplicity and utility. The dates are revealing. The discs were laboriously installed in permanent locations in federal fisheries facilities to mark property boundaries. The discs were attached to twisted brass rods, and embedded in concrete when placed in the ground. They offered something of a permanent marker and were easier to relocate than something like a tree or large rock, often mentioned in early surveys to define a location.

Markers in the museum were used by the U.S. Bureau of Fisheries (1903-39), and the Bureau of Sport Fish and Wildlife (post-1939). Missing from the collection are survey markers from the U.S. Fish Commission (1871-1903). Transits, tripods, and hand levels are also in the collection. ♦ Randi Sue Smith



*This booklet and survey marker are among the many artifacts found in the D.C. Booth Archives.*

Randi Sue Smith/USFWS

By Lee Allen

## Robert G. Piper



Robert "Bob" G. Piper.

Fisheries Biologist. Hatchery Manager. Educator. Motivator. Author. Consultant. Good Friend.

Bob Piper has been all of these things and more in his lengthy career in fisheries management—culminating with having a building named after him in honor of his professional accomplishments. “Having an edifice named after you is, wow, the ultimate accolade,” he says. “The best thing is it wasn’t called the R.G. Piper *MEMORIAL* Building and I got to be around to enjoy the honor.”

“He’s honest and sincere and has a high level of professionalism,” says Charlie Smith, a friend of 45 years who worked with, and for, Piper (and later replaced him) in their days at the Bozeman Fish Technology Center (associated with the Bozeman National Fish Hatchery) in Montana. “He was a good boss and I learned a lot from him on how to manage both programs and people.”

Piper, now 79 and retired from a 29-year U.S. Fish and Wildlife Service affiliation, began that journey in New York with a BS in biology from Cornell University in the early 1950s. “I took a two-credit course on fish culture that involved a lecture and a lab session where we learned how to mix fish food and handle small trout fingerlings at an experimental hatchery—and before I knew it, a career in fish culture was born,” he says.

Upon graduation, Piper headed to Pennsylvania to manage a commercial trout hatchery before joining U.S. Fish and Wildlife Service employ in 1956 as a biologist in the Eastern Fish Disease laboratory in Leetown, West Virginia where he diagnosed infections and parasitic diseases

of samples from federal, state, and commercial hatcheries throughout the East.

More fish disease diagnostics work was in order at his next station in La Crosse, Wisconsin, before packing up again and heading to the Fish Genetics Laboratory in Beulah, Wyoming, where he helped set up facilities for genetic investigation and spent four years conducting selective trout breeding studies. During this time, Piper pioneered the concept of a flow and density index to determine the carrying capacities of hatcheries, methods that today are widely accepted and used by hatcheries throughout North America.

Piper moved to Bozeman, Montana as assistant director of the Fish Tech Center, then became director there for 12 years until his retirement. “We did applied research on fish quality and healthy hatchery operations and were involved in developing greenback cutthroat trout broodstock,” says Smith. “It was a great way to make a living and while Bob had a lot of responsibilities as director, he was still a hands-on guy and always got involved in all our projects.”

His reputation lingers in many ways. Bob Piper’s advice and counsel can be found in the young men and women who learned from him as undergraduates and then moved on, out, and up the ladder. His knowledge of fish culture still provides a teaching tool in the form of the 517-page *Fish Hatchery Management* book published in 1982 (with five additional printings via the American Fishery Society) and still used by fish culturists throughout the world as well as a text at many universities.

As a Certified Fishery Scientist with the American Fisheries Society, Piper was instrumental in developing the Fish Culture Section, serving as its President, and later receiving their Hall of Fame Award. And as the crowning kudo, there is now a 16,500-square-foot Robert G. Piper Building at the Fish Technology Center. The laboratory and administrative building contains 14 offices, 2 conference rooms, and 7 state-of-the-art labs with a range of applications from organic and inorganic chemistry needed in fish nutrition and contaminants studies to fish physiology and necropsy necessary for reproduction and fish culture research.

“This building will prove invaluable to fisheries, both national and local,” said former Fish Tech Center director Bill Krise. “We’d like to see the Piper Building and Center grounds evolve into a place for tourists and local community groups to learn about the U.S. Fish and Wildlife Services’ fisheries program.”

Following his retirement, Piper served as a private consultant in fish hatchery design criteria and for a decade, functioned as Editor of *The Progressive Fish-Culturist*, a quarterly scientific journal published by the American Fisheries Society. He’s slowed down a bit, but recently functioned as a task force member for a hatchery scientific review group in the state of Washington. Currently he works for the state of Montana as a monitor in an Aquatic Animal Drug Approval Partnership.

“I’m taking more time now to sit back and smell the roses,” he says. When asked if he’d have done some things differently during his career, the pause is lengthy but the response is

an enthusiastic, ‘No!’ “I think I’ve had a fantastic career. Throughout the different location and job changes, I made a lot of acquaintances with a lot of fisheries colleagues along the route and they’ve become my friends. If I had to sum everything up, the broad sweep of the vocational paintbrush painted a pretty picture for me as these colleagues became chums.”

His ‘best chum,’ hunting and fishing buddy Smith allows that “we’ve had a lot of good times over the years,” and he’s looking for more Piper-Smith days in the field—whether saddling up horses or rowing a boat in search of ducks or deer or just another good day in the outdoors. ♦



Ardis Piper

*Robert Piper at the wheel of a U.S. Fish and Wildlife Service truck, on assignment at the former Manchester National Fish Hatchery, Iowa, in 1959.*



David Klingler/USFWS

*The book, Fish Hatchery Management, was a major text in fisheries conservation—and a major undertaking. These men were among the several that Robert Piper worked with to see the book to print. Pictured here (l-r) are Robert Kendall, Joe McCraren, Robert Piper, and John Leonard.*

## Arctic Grayling

By Ed Jones

Arctic grayling (*Thymallus arcticus*) epitomize the northland. The genus *Thymallus* refers to the scent of these fish that supposedly resemble that of the herb thyme. These beautiful fish flourish in clear, cold freshwater systems that drain into the Hudson Bay and the North Pacific and Arctic Oceans from both North America and Asia. In the Lower 48 states Arctic grayling were most likely deposited in northern Michigan and the upper Missouri River system by Pleistocene glacial meltwater.

Relict populations still persist in the Upper Big Hole River in Montana, yet the populations of the Great Lakes basin are now extinct. In fact, the city of Grayling, Michigan is named after the Arctic grayling that at one time abounded in the Au Sable River, a major tributary to Lake Huron.

On August 22, 1805, Lewis and Clark were near the present-day site of Clark Canyon Reservoir, and Lewis noted, "late in the evening I made the men form a brush drag, and with it in about 2 hours they caught 528 very good fish, most of them large trout, among them I know for the first time saw ten or a dozen of a white species of trout..."

Then in 1823, the Scottish naval surgeon, naturalist, and arctic explorer Sir John Richardson caught a fish at Winter Lake, near Fort Enterprise, in the Northwest Territories that he named signifer, or "standard-bearer," in reference to its large, waving flag-like dorsal fin. In his *Fauna Boreali-Americana*, 1836, there is a beautiful colored plate of this specimen under the name *Thymallus signifier*.

Arctic grayling are members of the salmon family having iridescent purplish-gray bodies with varying numbers of black spots scattered along their sides. Elegant in appearance, their flag-like dorsal fin is bluish-gray in color and covered with large spots often edged in rose. Arctic grayling are relatively small. Adults typically range 12 to 15 inches in length. Larger specimens can exceed 20 inches. The world's record Arctic grayling weighed 5 lb. 15 oz. and was caught in 1967 at the Katseyedie River, Northwest Territories, Canada.

Arctic grayling have diverse behaviors adopting a way of living to cope with their often callous and tenuous environments. These fish can spend their entire lives in a small section of water or they may be highly migratory using different streams and lakes as necessary for survival. Arctic grayling can survive low levels of dissolved oxygen, an adaptation necessary for surviving long winters in habitats otherwise not suitable to fish.

Each spring when the ice begins to melt and the smaller streams and creeks begin to flow, Arctic grayling congregate to spawn. Generally speaking, males are the first to arrive on the spawning grounds, and the last to leave. Typically fish spawn for the first time when they are four years old. The spawning season lasts around three weeks. During courtship, males occupy small territories in search of females. When females are disinterested or other males interfere, the dorsal fin is erected as a show of aggression. Not erecting the dorsal fin by the female is a sign that she is ready to spawn.

Unlike salmon, Arctic grayling do not bury their eggs in gravel nests but the females scatter between four and seven thousand eggs over the gravel. Eggs hatch about two to three weeks and juveniles tend to rear nearby in calm waters. After spawning, adults spread out into their summer feeding areas and then migrate to overwinter habitats in late fall.

Although Arctic grayling prefer to dine on insects, they are opportunistic when it comes to food, eating other fish, their eggs, and even small mammals, like mice and voles. This aggressive feeding behavior is perhaps what makes the Arctic grayling such a well-liked sport fish. Their willingness to rise to the water's surface and take a dry fly makes them very popular among fly fishermen.

In general, Arctic grayling populations continue to thrive in their pristine and often remote locations. Throughout most of the northern North American continent, Arctic grayling are a common fish, even dominant. However, where overfishing, degradation of habitat through poor land-use practices, and competition with exotic fish has occurred, these fish have been severely impacted.

The sole remaining population in the Lower 48 is making its last stand on a small section of Montana's Upper Big Hole River, in roughly four percent of its former habitat. Communities, ranchers, agencies, and non-governmental organizations have united to restore the health of the Upper Big Hole River and hopefully these and future actions will help this population gain back some of the gravel lost this past century.



Scott Raborn

*Glenda Raborn caught and released this Arctic grayling in the Togiak River basin near Bristol Bay, Alaska.*

Without a doubt, the Arctic grayling is one of our most beautiful and exciting sport fish. Once seen, it is never forgotten. Reason perhaps for why over the past century these fish have been stocked in many Lower 48 states resulting in numerous viable sport fisheries.

The aggressive nature of the Arctic grayling is a major reason why these fish are so fun to catch. They are the epitome of the northland. ♦

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Ed Jones is a Salmon Stock Assessment biologist with Alaska Department of Fish and Game, Sport Fish Division. He lives in Juneau, AK.

# Alaska Fisheries on the Frontline of Climate Change

Alaska's 55 million acres of inland lakes and rivers began forming about 300 million years ago, and a variety of fish have evolved to thrive among its diverse and ecologically unique habitats. These habitats range from the freshwater streams of the southwest, the coastal rainforest streams of southern Alaska, to the glacial Yukon River of the interior. Tundra and foothill streams course toward the Arctic.

Now, climate change stands to transform Alaska's fisheries. Throughout much of Alaska, permafrost and glaciers are thawing, exerting an influence on the hydrological cycle. Its fisheries are vulnerable, potentially challenging the persistence of fish populations.

Warming at about twice the rate of the global average, several regions of Alaska are already seeing profound changes to their fisheries. Higher air temperatures, changing precipitation patterns, and longer growing seasons are causing water temperatures and evaporation to increase. These increases affect habitats, and will ultimately change fish populations.

Documenting these changes to the Alaska landscape is the easy part. Predicting their impacts is more difficult. The questions are many. Which fish populations will adapt as their habitats change? Will juvenile salmon migrate to sea earlier in the spring, and face unfavorable feeding conditions in nearshore marine waters? Do increased sediment loads from melting permafrost affect sheefish spawning success on the Selawik River? Are Dolly Varden in the Hulahula River affected by channel alterations from more

glacial melt-water? Will rainbow trout adapt to higher stream temperatures in the Kenai Peninsula? Will Pacific salmon colonize Arctic systems as water temperatures go up?

Much of Alaska's fisheries remain to be studied. Describing the effects of climate change requires the combined efforts of many scientists from many disciplines. Under the framework of Strategic Habitat Conservation, the U.S. Fish and Wildlife Service's Fisheries Program is building upon traditional partnerships with state and federal agencies to include new partnerships with universities, non-governmental organizations, and communities. These partnerships will help prioritize our work through Landscape Conservation Cooperatives, or LCCs.

Here is one such recent effort. The Fisheries Program convened the "Wildlife Response to Environmental Arctic Change (WildREACH)" workshop. A broad array of stakeholders participated in a forum among specialists to establish effective partnerships. Since the WildREACH workshop, the Fisheries Program has promoted an LCC that houses the technical expertise from multiple partners who can collectively better address the science needs of overarching Landscape Conservation Regions.

In northern Alaska, the Fisheries Program is partnering with the University of Alaska-Fairbanks, the Marine Biological Laboratory-Woods Hole, and the Alaska Department of Fish and Game to combine expertise in climatology, hydrology, and biology. This partnership will describe how Arctic grayling in the Kuparuk River

may be affected by climate-induced habitat loss. Scientists project for Alaska's North Slope that an overall drying effect will occur with drought conditions present during late summer. Combining these projections with current hydrological information leads researchers to think that several areas within the stream will likely go dry. We already know that Arctic grayling feed in one area of the drainage during summer, but overwinter elsewhere. Late-summer drought could strand fish, keeping them from winter habitat. The model to be built from the partnership will increase our understanding of what Arctic grayling need to persist.

On the Kenai Peninsula's Anchor River, the Fisheries Program is applying a predictive model that will allow scientists to estimate the distribution and quantity of salmon and trout habitats throughout the basin. They will also be able to project the potential effects of habitat changes on Anchor River salmon populations—answering those questions about elevated stream temperatures, changes in nutrients, the altered flows, and the sediments flowing into streams.

The U.S. Fish and Wildlife Service uses a deliberate and focused process to address climate change, and its effects on fish. Sharing information, testing hypotheses, and prioritizing actions should lessen the effects of habitat loss. The models will add greatly to the Fisheries Program's ability to conserve fish populations, benefiting the fisheries and the array of people and wildlife that depend on fish for their food and livelihood. ♦



Mitch Osborne/USFWS

*Erosion occurs with the decreasing ice pack in the Arctic Ocean on Alaska's North Slope.*



USFWS

*Alaska's vast water ways are habitat for a multitude of coldwater fish species. Changes in flow patterns from accelerated ice melt could stress fish populations.*



Ben Crosby/Idaho State University

*The melting permafrost of the Selawik River thaw slump has deposited sediment on sheefish spawning grounds and caused the river to become turbid for over 100 miles downstream.*

By Corinne Smith

# Balancing the Needs of Fish and People

## *The Mat-Su Salmon Partnership at Work*



Craig Springer/USFWS

*Chum salmon spawn in a Matanuska River channel downslope from a new home near Anchorage, Alaska.*

In Alaska's Matanuska-Susitna River Basin (Mat-Su), the pace of growth is a familiar topic of conversation. A recent observation by Pauline Hooten is all too typical. "I drove Farm Loop Road the other day and was surprised at how many housing developments have sprung up. It used to be all farms when I first moved to the Mat-Su in the 1980s."

Like many people, Hooten understands the desire to live away from Anchorage, but within commuting distance, and, like many, she doesn't want that population growth to harm the landscape, the

wildlife, the free-flowing streams that make this area feel like an Alaskan home. That conviction—that people and fish and wildlife can not only co-exist but thrive in the Mat-Su Basin—was the impetus for the creation of the Mat-Su Basin Salmon Habitat Partnership.

In the Mat-Su Basin, roughly the size of West Virginia, the magnitude of the landscape is matched only by the riches of its salmon streams. Each summer, millions of salmon—Chinook, coho, sockeye, pink and chum—return to the impressive Matanuska and Susitna rivers

and their vast web of lakes and tributaries. It is an incredibly diverse landscape. Beyond the shopping centers and neighborhoods lie the forests of birch and spruce and expanses of tundra that ultimately rise up to the snowy elevations of Denali, the tallest peak in North America. In the Susitna River drainage, 200,000 Chinook salmon return each year, making it Alaska's fourth-largest Chinook salmon fishery—among the largest in the world.

It's difficult to imagine life here without salmon. Nature runs on salmon—and the economy does, too. Subsistence fishing

is a vital tradition, while commercial fishing and sportfishing anchor the local economy.

The Matanuska-Susitna Borough (analogous to a county), whose boundaries track the basin, is the fastest growing region in Alaska. Its growth has been spurred by the need for housing and the desire for larger, more rural lots within driving distance of Anchorage, where half the population of Alaska lives. The borough has an average population increase of four percent per year, compared to one percent for the

state overall. The population of the borough as a whole has more than doubled in the last 20 years and is expected to continue to increase to a population of 100,000 by 2010. The borough's "core area" between the cities of Palmer and Wasilla is expected to double in population by 2025.

History has shown that loss of habitat is a major contributing factor to loss of salmon populations in the rest of the world. Alaskans like to think that they can do things differently. Protecting salmon as a subsistence and economic resource and as an icon of Alaskan life is a priority that brings people together. That's why the collaborative, locally driven, and non-regulatory approach outlined by the National Fish Habitat Action Plan works so well to guide the efforts of the Mat-Su Salmon Partnership. Since its formation in 2005, the partnership has brought together local communities, non-profit organizations, state and federal agencies, and residents to prevent the negative impacts that development could have on salmon habitat.

The Mat-Su Salmon Partnership developed a strategic action plan to guide its work in the next few years and to set goals for protection and restoration of salmon habitat. The plan identifies common consequences

of development—expansion of impervious surfaces, loss of vegetation around streams and lakes, filling of wetlands, and blocked fish passage on the road network—as the greatest stressors on salmon habitats.

Partners are taking a proactive approach to avoid these problems through education on salmon and their use of these habitats, and setting priorities for protection. The Wasilla Soil and Water Conservation District fosters stewardship in school children by taking them out to local creeks to learn about stream health and the salmon life cycle and to assist with streambank revegetation. The U.S. Fish and Wildlife Service and Alaska Department of Fish and Game hold workshops for developers, engineers and permittees on how to build roads and culverts that allow free passage of juvenile and adult salmon. The partnership's Science Working Group, composed of biologists and hydrologists from many organizations, has characterized watersheds by their biological value to salmon and their vulnerability to human activities. This group guides where habitat protection and restoration should occur. In the fall, the Mat-Su Salmon Science and Conservation Symposium provides a forum to share information on conservation and research related to Mat-Su salmon, and to promote an exchange of ideas on salmon conservation.

The partnership is also at work on the ground to restore habitat by rebuilding poorly designed road crossings and replacing culverts. In 2005 the Mat-Su Borough received a Celebrating Habitat award from U.S. Fish and Wildlife Service for replacing inadequate culverts on older borough roads. The borough is at the core of a collaborative effort of several partners—U.S. Fish and Wildlife Service, The Nature Conservancy, Chickaloon Native Village, Aquatic Restoration and Research Institute, and Wasilla Soil and Water Conservation District—to

## Cooperative Conservation Award

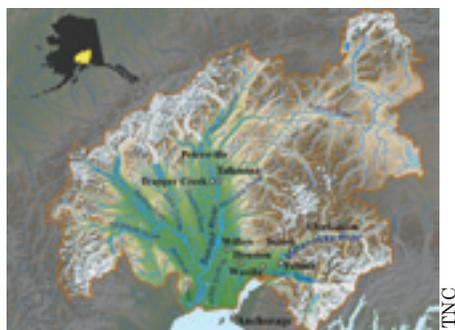
The Alaska Department of Fish and Game, Matanuska-Susitna Borough, National Marine Fisheries Service, The Nature Conservancy, and the U.S. Fish and Wildlife Service initially formed the Mat-Su Basin Salmon Habitat Partnership in 2005. Its work on behalf of Mat-Su Basin salmon earned it the Cooperative Conservation Award from U.S. Interior Secretary Dirk Kempthorne in 2008. The award recognized the partnership's work to champion salmon habitat as the effects of development in the Mat-Su Basin continue to rise.

restore salmon migration on entire streams and to use these sites as a way to learn more about salmon movements in Mat-Su streams and to promote stewardship among the community.

The partnership is determined to help salmon thrive in the Mat-Su Basin. Salmon haven't always fared well where development pressures have increased, and so the Mat-Su Basin faces a sizable challenge. But it's not too late for Alaska to learn from past errors elsewhere.

By committing to thoughtful growth in the Mat-Su Basin, the partnership helps ensure that salmon have safe passage in healthy habitats. In a place where growing communities bump up against Alaska wilderness, a rural lifestyle, and wild salmon, people have a rare opportunity to live with salmon. ♦

Corinne Smith works for The Nature Conservancy as the Matanuska-Susitna Basin Project Manager. She lives in Anchorage, Alaska.



The Mat-Su River basin.

Alaska's Population in 2007	677,000
Alaska	284,000
Municipality of Anchorage	80,065
Mat-Su Borough	100,000
<b>Projected for 2010</b>	<b>100,000</b>

By Ben Ikenson

# Master of Fin Art: Ray Troll

*“Through the  
miasma of creatures,  
how did we come to  
be?” Troll ponders.  
“Whether it was  
destiny or pure  
accident, it was by no  
means a direct path.”*



*Game Fish.*



Ray Troll

Chimaeras, also known as ratfish, dwell in very deep waters; most species live hundreds of feet below the water's surface. And they've been doing so for more than 300 million years.

"It is an underappreciated and primitive, vertebrate survivor. It's a living fossil that pre-dates about practically every fish in the sea," Ray Troll muses on his favorite fish. "And, the word 'ratfish' itself is so close to the word 'raffish,' which means to have fun in a kind of bad way."

The ratfish makes for a fitting talisman for the Alaska-based artist,

who bears a tattoo of a ratfish on his arm and for whom a ratfish species—*Hydrolagus trolli*—is named. Like the ratfish, Troll's art goes deep and attests to prehistoric times. Also like the fish, the art at times links the distant past with an unlikely contemporary descendant. For the artist, past is not only prelude, it is an ironic reference point for citing pop culture and the American way of life or presenting original inhabitants of a landscape no longer submerged beneath Paleozoic waters: extinct fish swim circles around television sets; ancient marine arthropods cohort with Elvis Presley; plesiosaurs—those gargantuan sea reptiles from



dinosaur times—sail through skies above the wheat-covered fields of Kansas.

“Through the miasma of creatures, how did we come to be?” Troll ponders. “Whether it was destiny or pure accident, it was by no means a direct path.”

The dichotomous nature of Troll’s work exists even when the evident social commentary does not. A comical spirit imbues serious content; accurately rendered organisms inhabit fantastical compositions. This is no doubt why Troll’s art has been described as “scientific surrealism.” While Troll goes to great pains to capture details, the artist does not present the same thing that a purely scientific illustrator would. Frequently in his vision, a profound evolutionary connection links humans to the primordial waters from which we have emerged.

“I take the fish-centric world view,” says Troll. “I’m always saying that we humans are actually modified fish. We’re dry land fish, as we’re all descendant of those fish that left the ocean all those years ago. We are all fish.”

If not for the imaginative evolutionist, Troll’s art certainly features a wealth of fodder for the eager psychoanalyst. Often it’s as if the images have been rendered directly from dreams and the ether of the subconscious. One blurb on the back of a book of Troll’s art puts it best: “Ray is a man who not only is in touch with his unconscious; he has made friends with it and appears to periodically take it out for a burger, chocolate malt and large fries. And his unconscious has a lot to say to all of us.”

Indeed, Troll has been dredging the weird waters of his subconscious for decades. What he’s uncovered has been featured on the Discovery Channel, has graced the walls of



HOOK, LINE AND THINKER



THE SALMON FAMILY TREE

natural history museums and art galleries, and has adorned the pages of numerous books and magazines.

Still, in order for Troll to keep channeling his inner artistic ratfish,

## WALK SOFTLY



## AND CARRY A BIG FISH

he knows he must sometimes rise to the shallower waters where art and commerce blend. As one of his influences, Pieter Bruegel the Elder sold woodcuts throughout 16th century Europe to promote his work, Troll trades in t-shirts, tote bags and baseball caps. Yes, a realist lurks beneath the surrealist. “You kind of have to have that shameless self-promotion gene,” he says.

Troll’s proven he is in full possession of that gene, offering his iconic fish-focused art on wildly popular t-shirts with slogans like “Bass Ackwards,” “Spawn Till You Die,” and this year’s bestseller “Fish and Chips,” which depicts a gathering of poker-playing fish. Troll takes it all in stride, noting that the merchandising side of his life helps sharpen a strain of humor similar to that of *The Far Side* creator Gary Larson, who coincidentally attended his alma mater of Washington State University.

As with all artists, Troll’s biography has much to do with the evolution of his work. In the 1970s, after growing up and attending college in landlocked and conservative Kansas, Troll headed for Seattle, absorbing in equal measure the thriving art scene and the awe-inspiring scenery of the Pacific Northwest. Later, after he earned a Master of Fine Arts at Washington State, a summer job led him fatefully to southeastern Alaska and the small town of Ketchikan, the “salmon capital of the world.” Here, he has made a home ever since—and nurtured a body of work that celebrates pretty much all things fish.

“I was a fish-monger with a Master of Fine Arts degree,” he says. “And I started really looking at the fish I was selling, and the next thing they were showing up in the work.”

Throughout his long and storied career, Troll has depicted thousands



Artist Ray Troll peers out from pickled ratfish in his Alaskan studio.

Clark Mishler



of species, most often fish. And, with a new book soon to be released and more projects in planning, it doesn't appear he'll be calling it quits anytime soon. In that respect too, the artist bears resemblance to that most formidable of muses, the deep-dwelling and remarkably persistent ratfish. ♦



Ben Ikenson wrote "Nomenclature" in Eddies, summer 2008. He lives in Albuquerque, New Mexico.



By John Wenburg, Ph.D.

# Conservation in the Last Frontier *Or* the Last Frontier of Conservation



*Alaska's Yukon River drainage covers an immense area, stretching comparably from Colorado to West Virginia. Leading-edge technology allows geneticists to predict where migrating salmon are headed months before they arrive.*

The Yukon River is massive. It drains more than 330,000 square miles and flows nearly 2,000 miles through Canada and Alaska. Let's put that into perspective. The drainage is nearly the size of the entire state of Texas. Conservation of any species on this scale is a daunting challenge and chum salmon that swim throughout the Yukon are no exception.

But conservation genetics gets it done. Conservation genetics involves

the application of genetics research to conservation issues. One prime example of conservation genetics in action is found at the top of the world along the Yukon River.

Chum salmon spawn throughout the Yukon drainage and are extremely important for subsistence fisheries in the U.S. and Canada, accounting for 70 percent of the salmon harvested in subsistence fisheries. Returns of Yukon chum have fluctuated widely in the last decade and low returns have

resulted in subsistence shortfalls because of closures and restrictions. This is especially hard on residents along the Yukon River where the subsistence lifestyle is a cultural and economic necessity.

Yukon River chum salmon are managed under Pacific Salmon Treaty mandates to conserve and equitably share the fishery between the U.S. and Canada. Of primary management concern to the U.S. Fish and Wildlife Service is the distinction between harvested chum salmon originating in the U.S. and Canada. Knowing where harvested chum salmon come from is essential for effective management. This task is extremely difficult because of the large size and remoteness of the drainage and the fact that most of the harvest takes place weeks or months, and hundreds or thousands of miles before the chum salmon separate into distinct spawning groups throughout the massive Yukon basin.

Tagging studies had little success in identifying discrete stocks of Yukon River chum. That's where conservation genetics were applied. The U.S. Fish and Wildlife Service's conservation genetics laboratory in Alaska used a mixed-stock analysis to estimate the numbers of specific Yukon River chum salmon stocks in harvest mixtures. The data greatly assisted fisheries managers.

Over the course of many years, in collaboration with the Department of Fisheries and Oceans Canada and the Alaska Department of Fish and Game, the U.S. Fish and Wildlife Service's conservation genetics laboratory developed a baseline of genetic data from over 5,000 fish representing 29 distinct chum salmon stocks from the Yukon River—no

small feat over such a large and remote area.

Here's how it was done. The baseline genetic data are derived by clipping small pieces of fins from fish. It's non-lethal. Geneticists use high-tech genetic analysis to assay the fin clips—the same way forensic scientists examine human genetic material. The assays effectively provide a “fingerprint” of each fish. Then, based on genetic relatedness of the individual fingerprints, they are pooled into groups, creating fingerprints through the entire Yukon drainage at the population or stock level.

The final piece of the puzzle for the chum salmon work comes from fin clip samples taken at the Pilot Station sonar site located low in the river, about 120 miles from the mouth. Gill nets catch the fish passing by the sonar counting facility. This allows scientists to estimate the size of the migration for each salmon species. However, with sonar data alone, it is impossible to tell how many of the fish are headed to any specific area in the river basin—the various stocks appear physically identical. At this point, a critical question remains: which country, region or even tributary in the remaining 1,880 miles of the Yukon River are the fish migrating to? The fish will not make it to their spawning grounds for weeks or months, so the answer lies in applying conservation genetics, allowing for effective in-season harvest management throughout the chum salmon run.

When the chum salmon come in, fin clips are expedited to the conservation genetics laboratory in Anchorage via Yukon Delta National Wildlife Refuge airplanes. Geneticists

quickly assay a number of fin clips proportional to sonar passage data. With these data, using the genetic baseline as a reference, the lab provides accurate estimates of the proportion of each chum stock in the sample within 48 hours. Combining this estimate with the sonar abundance data allows managers to determine the number of fish headed to each part of this massive drainage well before they separate into spawning groups.

Every summer since 2004, the conservation genetics laboratory has estimated the composition of Yukon River chum salmon from the Pilot Station sonar site using our genetic baseline. The estimates are accurate, and have been highly correlated with data from other research projects through the Yukon basin. Conservation genetics data provide managers the ability to more effectively regulate fisheries and conserve genetic diversity. It's essential for sustained salmon productivity in this massive and complex river system. ♦

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John Wenburg, Ph.D., is the Director of the U.S. Fish and Wildlife Service's Conservation Genetics Laboratory in Anchorage, Alaska.

By Doug Palmer

# Radio Telemetry Tells a Moving Story

*Chasing Rainbows and Dollies on the Kenai River*



John Tobin/USFWS

*Biologist Doug Palmer listens for radio signals coming from Dolly Varden and rainbow trout during a late-fall telemetry survey on the Kenai River. Following the radio signals over time revealed much about how and where the fish live.*

The Kenai River supports one of the most popular sport fisheries for rainbow trout and Dolly Varden in Alaska. Anglers catch both species throughout the Kenai River, although most are caught near Skilak Lake on the Kenai National Wildlife Refuge. Each year, thousands of anglers chase rainbows and Dollies with flies and lures resembling either aquatic insects, or the eggs and flesh of spawning salmon.

Despite the enormous popularity of these fisheries, very little was known about the wanderings of the two fishes, when biologists from the U.S. Fish and Wildlife Service's Kenai Fish and Wildlife Field Office and Alaska Department of Fish and

Game began targeting rainbows and Dollies. But instead of using a rod and reel, biologists took a couple steps up the technology ladder and tuned into the movements of fish with radio telemetry. Fish implanted with transmitters sent data to biologists who were able to track and describe their movement patterns over years.

Biologists put radio transmitters in about 280 rainbow trout and 400 Dolly Varden during their study.

Each radio provided researchers with up to three years of movement information from the radio-tagged



John Tobin/USFWS

*With much care, a biologist implants a radio transmitter in this Dolly Varden, to follow it in the wild.*

fish, leading to several interesting discoveries.

Movement patterns of rainbow trout were more predictable than those of Dollies. The rainbows displayed a high fidelity to spawning sites, and feeding and overwintering areas. Dolly Varden also displayed a high fidelity to spawning areas, but tended to be more nomadic and to travel longer distances to find feeding and overwintering sites. Skilak and Kenai lakes, two of the largest glacial lakes within the watershed, proved to be key overwintering areas used by both fishes.

Come late April, rainbows began moving from their winter hideouts to spawning areas in mainstem Kenai River and tributaries, such as the Russian River. After spawning, rainbows traveled to feeding areas in the mainstem Kenai River. Some rainbows used the same feeding area all summer, while others selected two or more areas. Over years, some individual rainbow trout were found in the same places. Both rainbow trout and Dolly Varden rely heavily on spawning salmon for food, either their eggs or their flesh, and their movement patterns during summer are highly correlated with the timing and location of salmon runs.

Dolly Varden moved out of their overwintering lakes in the spring, and dispersed to feeding areas in all reaches of the Kenai River, and some tributary streams. Some Dollies routinely followed spawning Chinook salmon up tributaries for food, while others stayed in the main river and fed behind spawning sockeye salmon. Dollies typically spawn during September and October in flowing water, and then immediately

migrate to a lake for the winter. This migration was typically less than 15 miles for most Kenai River Dollies. But one radio-tagged Dolly migrated nearly 120 miles to spend the winter in a neighboring watershed—only to return to the Kenai River the following summer.

Technology illuminated much about the habits of two important sport fishes. These findings from this



*An angler holds a trophy rainbow trout from Alaska's Kenai River.*

John Tobin/USFWS

telemetry study were instrumental in creating more meaningful fishing regulations to protect fish during their spawning periods, yet still provide ample opportunity for anglers. Radio-tagged rainbows and Dollies were unwittingly helping biologists develop management strategies to support one of the most popular sport fisheries in Alaska. ♦

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Doug Palmer is the supervisor of the Kenai Fish and Wildlife Field Office. He lives in Soldotna, Alaska.

*The Kenai River supports one of the most popular sport fisheries for rainbow trout and Dolly Varden in Alaska.*

By Russ Holder

# Marathon Swimmers Rich in Omega-3 Oil

When I first began working on the Yukon River in 1989, processors were paying nearly \$5.00 per pound to commercial fishermen for Yukon River Chinook salmon. Back then, the Japanese market was insatiable for these special fish, which have between 15 to 20 percent oil content when they arrive at the mouth of the river. The marketing slogan which the Yukon River Drainage Fisheries Association adopted reflects this fact – “the longer the river, the richer the fish.” I’ve seen commercial baking sheets covered in 1/2” of oil after baking a pair of filets in the oven. It takes lots of stored energy to power a fish, especially one that stops eating as soon as it enters fresh water, on a journey of between 900 to 1,800 miles to its spawning grounds. In fact, it takes more than a month for one of these big salmon, traveling between 35 and 40 miles per day, to reach its spawning grounds after entering the river.

Times have changed. In the late 1990s, the number of Yukon River Chinook salmon that arrived at the mouth of the river began to decrease, and the commercial harvest followed suit. The loss of a consistent supply of Yukon Chinook, compounded by changes in traditional holiday gift giving, sharply lowered the Japanese market for these fish. Decreased or lost commercial fishing opportunities also impacted other subsistence activities such as berry picking, wood gathering, and hunting. Cash from commercial fishing, you see, has traditionally paid for much of the fuel and other costs involved with living a subsistence lifestyle. With the salmon population in decline and the commercial fishery minimized, managers have struggled to achieve escapement goals, while continuing to provide subsistence harvest opportunities for all the people who live along the river. To those individuals, from the Bering Sea to the Canadian headwaters, the Yukon River Chinook salmon is more than a fish, it is a symbol of the bounty of nature and a testimony to the fundamental ability of a species to survive in an unforgiving land.



*Fort Yukon Fish Wheel from the 2007 Yukon Flats Subsistence Boat Survey.*

USFWS

It has long been recognized that the highest quality fish were those migrating the furthest—which meant those bound for Canada. In general, about 50 percent of the fish harvested by Alaskan fishermen are of Canadian origin. In years past, keeping the Canadian stocks healthy was recognized as important, but it didn’t carry any legal obligation, so the number of fish provided for escapement into Canada was inconsistent. With passage of the Pacific Salmon Treaty in 1985, negotiations began between the U.S. and Canada regarding the number



*Gerald Maschmann holding a Yukon River king salmon at the fish processing plant in Emmonak.*

of fish Canada needed to meet both escapement and harvest needs in the Canadian portion of the Yukon River. After 16 years of negotiations, the U.S. and Canada signed an Agreement in 2002, as an addendum to the Pacific Salmon Treaty, which has not only provided a framework to address Yukon River Chinook salmon conservation but has also vastly improved communications between participants.

Part of the difficulty in providing sufficient fish for upriver escapement and harvest needs is accurately identifying both the timing and abundance of salmon runs from monitoring projects. These projects often provide a false sense of security, since they seem to provide abundance numbers down to “the” fish, when in reality each number has to be interpreted in the context of water level, debris load, turbidity, substrate stability, species abundance, fishing effort, weather, and so forth. It is amazing that a fishery that began in 1903 still depends on test netting, subsistence harvest information, and

sonar passage estimates to guide managers’ decisions.

When Alaska became a state in 1959, management shifted from the federal government to the state. Alaska’s state government and the federal government treat the concept of subsistence use differently. The federal government reentered Alaska subsistence fisheries management in 1999. It has been a difficult transition for the agencies involved, and it has taken real effort to learn how best to work with each other and the public, and having access to new perspectives and resources to address issues has been valuable. Managers from both the Alaska Department of Fish and Game and U.S. Fish and Wildlife Service are grateful that new Genetic Stock Identification techniques have become available to assist with Chinook and fall chum salmon management decisions.

Unfortunately, the management jurisdictional challenges do not end domestically with the two state and federal entities. In recent years the bycatch of Yukon River Chinook

salmon in the Bering Sea Aleutian Islands pollock trawl fishery has become very controversial. The National Marine Fisheries Service (NMFS) manages the pollock fishery, largely based on the recommendations provided by the North Pacific Fishery Management Council. Scale pattern analysis and genetic sampling have both confirmed a high proportion of Chinook salmon, and a lower proportion of chum salmon, caught as bycatch are of Western Alaska origin, and include fish from Yukon River stocks. The combination of low in-river returns since 1998 and high Bering Sea bycatch numbers fueled passionate testimony supporting a low salmon cap in December 2008. The Council’s recommendation to NMFS was not as conservative as many had hoped, and likely will not be codified in Federal regulation until 2011. Unfortunately, even though bycatch mortality contributes to decreased Yukon River returns, elimination of the pollock salmon bycatch would not result in returns of salmon like those of high productivity years. Something else is causing decreased production—likely Bering Sea productivity changes associated with climatic change or cyclic environmental events.

Yukon River salmon are facing some tough times with harvest pressure in-river and increasing harvest on the high seas. Unfortunately, the Yukon River fishery is like most limited resources – people will fight very hard to protect what they perceive to be their rightful share, and during times of scarcity emotions run high.

I believe the best advice I’ve heard came from a wise Yupik elder, who said, “Don’t fight over the fish or they will not return.” This advice recognizes that survival is only possible when people work together for the common good of the resource. I hope we all adopt that common sense conservation approach for Yukon River salmon and all our other shared natural resources. ♦

By Polly Wheeler, Ph.D.

# The Rest of the Story: Non-Salmon Fish Research in Alaska

The U.S. Fish and Wildlife Service plays a key role in managing subsistence harvests of fish and wildlife on federal public lands in Alaska, amounting to about 60 percent of the state's total land area. An important aspect of managing harvests involves research on the various species for which it has management authority. In the past, most of the fisheries research

in Alaska has been directed at salmon, largely due to their value to commercial fisheries, a mainstay of the Alaskan economy. But non-salmon species like whitefish, sheefish, northern pike, Arctic grayling, longnose sucker, Alaska burbot, blackfish and Arctic lamprey are important to local subsistence economies, too.



*Whitefish feed rural Alaskans.*

James Magdanz

Harvesting natural resources for subsistence provides a solid foundation for lifeways in rural Alaska as evidenced by the sheer volume of fish and wildlife harvested. Rural Alaskans harvest land and marine mammals, migratory and upland birds, plants, berries, and fish, totaling as much as 44 million pounds a year, 60 percent of which is fish. This subsistence harvest makes up only 2 to 3 percent of the total annual statewide harvest. Comparatively, commercial fish harvests account for about 2 billion pounds—97 percent of the total harvest—with sport hunting and fishing harvests comprising the remaining 1 to 2 percent.

Salmon constitute a significant portion of fish harvest, but non-salmon species are an oft overlooked mainstay of the subsistence economy and diet. Their importance to rural Alaskans is due to their availability. While salmon are only available generally summer into fall, non-salmon species are usually available at every season, and one species can replace another as needed.

While important for subsistence, in many cases little is known about these species from a scientific perspective. Non-salmon are critical to subsistence users, but their value for commercial fisheries is negligible, and they have not garnered much in the way of research dollars or attention. The federal government has worked to change that by directing a portion of its subsistence fisheries management dollars at non-salmon fisheries research.

Some of that research is done through household harvest surveys. The surveys measure the harvest and provide an index of the importance of these species. Researchers also gather local knowledge of abundance, distribution, life history, trends, and population health of the non-salmon species. The researchers typically seek out elderly people to interview,

to tap into a rich body of traditional ecological knowledge (TEK) that has been accumulated through many lifetimes of interaction with the natural world. These data provide valuable context for the harvest information by supplying additional detail on fishing methods, gear types used, preservation techniques, and how harvests are prepared and used. This TEK also provides insights for explaining and identifying the causes of changes in population sizes, short-term and long-term.

Here's an example. A study of the harvest and use and knowledge of non-salmon species was conducted in the Koyukuk River area of interior Alaska in 2002. The study included six communities, with a total of 644 people living in 253 households. Researchers found that a wide variety of species were harvested, including, blackfish, burbot, grayling, northern pike, sheefish, sucker, broad and humpback whitefish. The researchers estimated a one-year harvest of 94,934 pounds of non-salmon fish, far exceeding the harvest of salmon for that year. Whitefish comprised 67 percent of this total harvest. The remainder was comprised of least cisco (10 percent), sheefish (19 percent), northern pike (9 percent), and burbot, sucker, grayling and lake trout each less than 2 percent.

In addition to harvest data, researchers documented a body of TEK for interior Alaska. The researchers built maps from data gathered from household surveys that illustrated several key fishing areas with significant seasonal concentrations of certain fish. Interviews revealed that ingenious and sometimes labor-intensive harvest methods are still employed that rely on very precise knowledge of fish movements, biology, and behavior in order to maximize results. Under-the-ice trapping methods for burbot and Alaska blackfish provide specific examples of harvest methods

that had not been previously well known. These are but a few examples of the wealth of information gathered using this research approach—and it clearly provides key understandings for biologists and managers alike.

This research is important because it provides a baseline understanding of species for which basic biological data are extremely limited. These species are a critical component of subsistence harvests, and are often harvested in large quantities. Understanding harvest levels is vital for managers. These baseline data can also provide a springboard to subsequent biological work. When so little is known about many of these species, this body of locally held information can be invaluable to researchers and managers. Perhaps more importantly, this research provides fisheries managers with an understanding of the role that fish and fishing—for both salmon and non-salmon species—continue to play in the lives and culture of those that rely upon the fish for their subsistence. ♦

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Polly Wheeler, Ph.D., is the U.S. Fish and Wildlife Service's Deputy Assistant Regional Director in the Office of Subsistence Management in Anchorage, Alaska.

# Meanders

By Joshua Conklin, SSGT

## A Wounded Warrior Joins the Fight for Fish

I grew up in rural Missouri, and as a teenager spent every free moment hunting, fishing, or just tramping through the woods. I remember scheming ways to get out of doing my chores around our place, just to sneak out to either a tree stand or one of the small farm ponds. If I wasn't chasing largemouth bass or whitetail deer, I was hoping that the lawn mower didn't have enough gas, so I could be done with chores early. That lucky break only happened once. After that dad always made sure there was an extra five gallons of fuel around.

But like most things in life, roaming the woods of my youth couldn't last forever, and when I was 17 I enlisted in the Army Reserves. The enlistment was enjoyable, and I performed my job, but I wanted to do more. So, in late 2002, I signed on for active duty service in the U.S. Army. During my enlistment, many opportunities have come my way. I've travelled all over our country, and twice to Iraq.

In early 2009, due to an injury I received, I was moved to a unit for soldiers needing prolonged medical treatment. The focus of our mission in this unit is to heal and, it's hoped, be able to rejoin the fight. Unfortunately, this isn't always possible, and in those instances we are provided

with a variety of programs to aid us with the transition to civilian life. One of these is the Warrior Transition Unit (WTU), also known as the Wounded Warriors. While in the WTU we have an abundance of free time. To fill those hours some go to school, some find places to work on Ft. Wainwright, the army base in Fairbanks, Alaska, where we are currently stationed, and some volunteer around the community. When I entered the WTU, I initially thought of it as a chance to get fixed and get back to full duty, but not every road you travel in life takes you where you want to go.

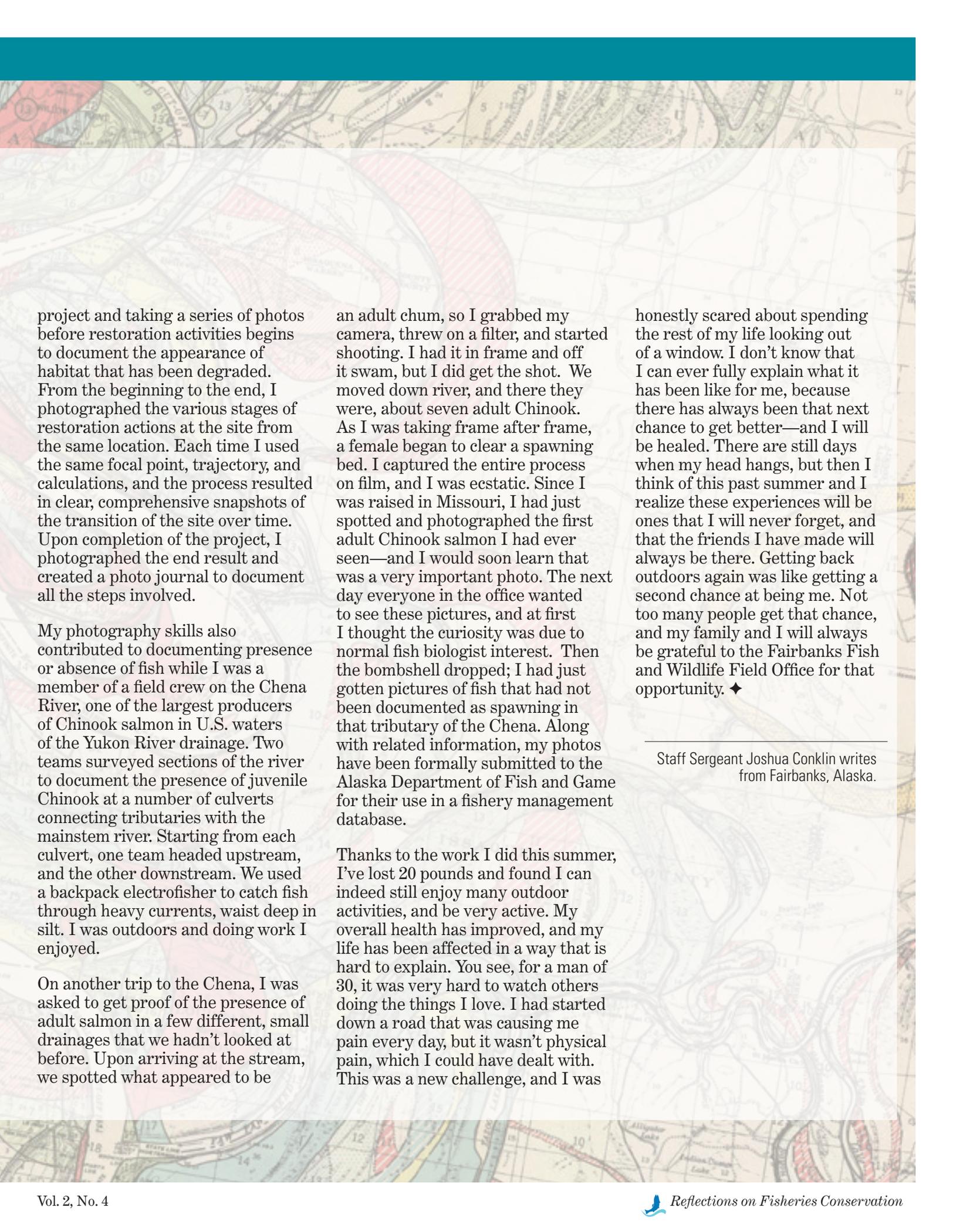
I had a difficult time adjusting to and accepting my new physical limitations, and as a result I gained a lot of weight. I thought my passion and love for the outdoors were doomed to be resigned to my memories and would not play a part in my future. However, in the spring of 2009 one of my fellow WTUs told me of his volunteer experiences with the Fairbanks Fish and Wildlife Field Office. My first thought was that it would be great to get outdoors again, but this excitement was dampened by second thought, which was that I was no longer able to do such things.

Then I met Mitch Osborne from the Fairbanks Fish and Wildlife Field Office. Mitch, a habitat restoration biologist, sought volunteers and after his brief presentation of field projects, I approached him and we discussed what I could do. I let him know that

one of my hobbies was photography, and he quickly said he had a spot for me. Before I knew it, the training had begun, and there was a lot of it: first-aid, CPR, computer security, bear and firearms, and electrofishing, to name a few. Throughout the training, I took photos, and Mitch liked them. My position developed quickly. Not only was I to assist in an on-the-ground project, but I was to document it as it developed with a photo log.

Later that spring, as part of an Army training exercise, a small group of Wounded Warriors were flown by Army Chinook helicopters from Ft. Wainwright over the Arctic Circle to a remote part of Interior Alaska. The objective of the mission was to remove a fish weir on the Black River that was abandoned in the early 1990s. I remember looking at all the equipment and thinking, how in the world are six injured guys going to load all this into a helicopter. Well, I can honestly say we found many interesting ways to get that chopper loaded, and we got the job done in a timely manner. This was the jumpstart I needed to convince myself that I could find ways to enjoy the outdoors once again and find my place in this new life.

The photos I took of the weir removal project were used to show the variety of projects that the WTU could perform. As part of the summer's habitat restoration projects, I provided photo-point monitoring, which involved going to a restoration



project and taking a series of photos before restoration activities begins to document the appearance of habitat that has been degraded. From the beginning to the end, I photographed the various stages of restoration actions at the site from the same location. Each time I used the same focal point, trajectory, and calculations, and the process resulted in clear, comprehensive snapshots of the transition of the site over time. Upon completion of the project, I photographed the end result and created a photo journal to document all the steps involved.

My photography skills also contributed to documenting presence or absence of fish while I was a member of a field crew on the Chena River, one of the largest producers of Chinook salmon in U.S. waters of the Yukon River drainage. Two teams surveyed sections of the river to document the presence of juvenile Chinook at a number of culverts connecting tributaries with the mainstem river. Starting from each culvert, one team headed upstream, and the other downstream. We used a backpack electrofisher to catch fish through heavy currents, waist deep in silt. I was outdoors and doing work I enjoyed.

On another trip to the Chena, I was asked to get proof of the presence of adult salmon in a few different, small drainages that we hadn't looked at before. Upon arriving at the stream, we spotted what appeared to be

an adult chum, so I grabbed my camera, threw on a filter, and started shooting. I had it in frame and off it swam, but I did get the shot. We moved down river, and there they were, about seven adult Chinook. As I was taking frame after frame, a female began to clear a spawning bed. I captured the entire process on film, and I was ecstatic. Since I was raised in Missouri, I had just spotted and photographed the first adult Chinook salmon I had ever seen—and I would soon learn that was a very important photo. The next day everyone in the office wanted to see these pictures, and at first I thought the curiosity was due to normal fish biologist interest. Then the bombshell dropped; I had just gotten pictures of fish that had not been documented as spawning in that tributary of the Chena. Along with related information, my photos have been formally submitted to the Alaska Department of Fish and Game for their use in a fishery management database.

Thanks to the work I did this summer, I've lost 20 pounds and found I can indeed still enjoy many outdoor activities, and be very active. My overall health has improved, and my life has been affected in a way that is hard to explain. You see, for a man of 30, it was very hard to watch others doing the things I love. I had started down a road that was causing me pain every day, but it wasn't physical pain, which I could have dealt with. This was a new challenge, and I was

honestly scared about spending the rest of my life looking out of a window. I don't know that I can ever fully explain what it has been like for me, because there has always been that next chance to get better—and I will be healed. There are still days when my head hangs, but then I think of this past summer and I realize these experiences will be ones that I will never forget, and that the friends I have made will always be there. Getting back outdoors again was like getting a second chance at being me. Not too many people get that chance, and my family and I will always be grateful to the Fairbanks Fish and Wildlife Field Office for that opportunity. ♦

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Staff Sergeant Joshua Conklin writes  
from Fairbanks, Alaska.

# Eddies

*Reflections on Fisheries Conservation*

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Winter 2009/2010



## Evidence of Climate Change In Alaska

Increasing air temperatures, changing rain and snow patterns, decreasing snow, sea-ice and permafrost cover, and glacial retreat indicate that the climate of Alaska is changing.

### Temperatures

Alaska has experienced the greatest warming of any state in the Union. Records from 25 stations across Alaska from 1949 to 1998 documented seasonal mean temperature increases. Increases were highest in winter and spring, lowest in summer. Much of this warming appears to have occurred during a sudden Arctic atmospheric and ocean regime shift around 1977. The most pronounced increases from 1949 to 1998 were found in winter in the Interior region.

Mean annual temperatures in the different climatic regions of Alaska increased by 0.8° to 1.9°C from 1951 to 2001, mostly coincident with the 1977 Arctic atmosphere and ocean regime shift. In northern Southeast Alaska, temperatures increased as much as 1.5 to 3° C in the last 60 years, with largest increases during the winter months. Substantial warming in the Arctic has been documented over the last few decades.

Mean annual surface temperature changes range from 2° to 3°C in Arctic Alaska. Arctic warming trends are most evident in winter and spring, and are twice the global average.

### Water Balance

A 30-percent increase in precipitation has accompanied warming between 1968 and 1990. Total precipitation in the Arctic increased at about one percent per decade over the past century. On the Kenai Peninsula, precipitation records between 1944 and 2002 indicate a nearly 40 percent decrease in the mean annual water balance.

### Projected Trends

Climate projections suggest warming will continue. Changes are expected to be greatest during winter months. Less snow and sea-ice reveals darker surfaces, absorbing more of the sun's heat and causing more warming. Permafrost thawing may accelerate, with as much as the top 30 feet of discontinuous permafrost thawed in 100 years. The accelerated loss of Alaskan glaciers that began by the end of the 1980s is likely to continue.

To learn more, visit <http://alaska.fws.gov/climate>