THE OSPREY

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Federation of Fly Fishers

Dedicated to the Preservation of Wild Steelhead • Issue No. 49 • SEPTEMBER 2004

A Tale of Two Rivers

Assessing the current status of wild steelhead in the John Day and Sol Duc rivers

by Peter Bahls
— David Evans and Associates, Inc. —

These case studies come to us from our friend at the Native Fish Society, Bill Bakke. Written by Peter Bahls, senior fish biologist with David Evans and Associates, Inc., they were commissioned by the Society to help determine the status of wild steelhead in Oregon's John Day and Wilson rivers and the Sol Duc in Washington (space limitations prevent us from publishing the Wilson River assessment).

These articles are abridged versions of the assessments. For more information on the complete report contact the Native Fish Society, P.O. Box 19570, Portland, OR 97280, 503-977-0287, www.nativefishsociety.org.

The Sol Duc, Rain Forest Jewel

The Sol Duc River supports perhaps the healthiest native winter steelhead population in Washington, according to the Washington Department of Fish and Wildlife (WDFW). The river and its tributaries form one of the major river systems within the northwest corner of the Olympic Peninsula of Washington. Rainfall is generally more than 90 inches over the winter and several inches during the summer.

The Sol Duc River flows westward from the Olympic National Park and joins the Bogachiel River to form the Quillayute River close to the Pacific Ocean. The Quillayute Basin includes the Sol Duc and Bogachiel rivers, as well as the Calawah, Sitkum, and Dickey rivers.

The Quileute Tribe has lived in the region for thousands of years and retains treaty reserved rights to fish, shellfish, and other natural resources within their usual and accustomed areas (U&A). Euro-American colonization of the area began in the mid to late 1800s, with the more accessible lowlands along the river railroad logged from the 1920s to 1940s. Logging road development increased dramatically in the 1950s.

While the higher elevations in the Sol Duc watershed are protected as

Continued on Page 4➢

The Free Flowing John Day

The John Day Basin is an area of 8,100 square miles, roughly the size of Massachusetts, located in the high desert of northeastern Oregon. The John Day River supports the largest wild steelhead populations remaining in eastern Oregon, and one of the largest remaining in the Columbia River Basin.

The Middle Fork John Day (MFJD) watershed is approximately 806 square miles, or 10 percent of the entire John Day Basin area. It supports about 30 percent of the steelhead in the entire John Day system.

The MFJD watershed has highly varied terrain, with elevations ranging from about 2,200 feet near the mouth to over 8,100 feet in the headwater areas. The climate is semi-arid, with an average annual precipitation of about ten inches.

The entire basin is within the Usual and Accustomed Area (U&A) of the Confederated Tribes of the Umatilla and

Continued on Page 8➢

IN THIS ISSUE:

FROM THE PERCH — EDITOR'S MESSAGE

The Minority Report

by Jim Yuskavitch

Global warming has been in the news lately. Every time I read another article about melting glaciers or robins in the Arctic, I think about fish — specifically wild and hatchery salmonids. The reason global warming conjures up images of wild steelhead, salmon and trout in my mind is not because climate change will impact them, for it surely will. Rather, the climate change debate, and how it is conducted in the media and in scientific circles, reminds me of how the debate over wild and hatchery fish is being presented.

Corporations with a vested interest in minimizing efforts to reduce pollutants that contribute to global warming have been brilliant in their efforts to portray climate change as a controversial theory. This, in spite of the fact that a majority of the world's scientists believe that the steady warming of planet Earth is being caused by human activity, based on a plethora of independently gathered data.

So it is with hatchery fish versus wild fish. Over the past few decades, hundreds (if not thousands) of scientific studies have confirmed the overall inferiority of hatchery fish ranging from life history differences to spawning success (See articles on pages 3 and 15); yet a minority of scientists and other opponents of hatchery reform often are able to successfully present those differences as a "controversial" theory.

It's a neat trick that often works. The question is: How do we fight a minority who often pose as a majority? Are fish advocates relying too much on hard science and not enough on PR and spin? Whatever the answer, it is far past time to put an end to the manufactured controversy over whether hatchery fish are the same as wild fish. They simply are not. And that's the majority report.

Salmon and Sea Lice Commentary

Regarding Alexandra Morton's powerful piece (beginning on page 13) in this issue: At a Steelhead Committee meeting earlier this year we speculated about the "sea lice problem" in British Columbia waters, asking ourselves if the lice might be the smoking gun that would explain why Puget Sound steelhead runs have recently crashed while Olympic Peninsula runs are in relatively better shape. Apparently juvenile steelhead from the Peninsula migrate up the western side of Vancouver Island, while the former go up the east side and, therefore, through waters much more likely to be lice-infested.

If Ms. Morton's research is credible and her findings valid (and they certainly would appear so), then someone somewhere should be raising the roof about this. We know that the Washington Department of Fish and Wildlife's very own top steelhead specialist has said that Puget Sound steelhead should be on the ESA's "threatened" list.

As we say nowadays, how about somebody connecting the dots?

John Sager
The Osprey Editorial Committee

Letters to the Editor

Mixing it Up

Dear Editor:

In the lead article ["Sportfishing Paradise No More," *The Osprey*, May 2004] where author Hank Lacey talks about Oregon Rivers and their problems, he appears to have gotten mixed up between the upper, middle and lower Deschutes Rivers. He mistakenly says that "Below the Pelton-Round Butte complex, salmon and steelhead confront very low flows caused by irrigation diversions." He says irrigation diversions in the "Lower River" — meaning lower Deschutes — "diverting more than 1,700 cfs, and reducing the flow of the Deschutes to a trickle at some times during the year." There are no large irrigation diversions from the lower Deschutes River. Flow in the Lower Deschutes has not been less than 3,000 cfs since it was naturally 2,900 cfs during the dust bowl era of the 1930s.

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The Federation of Fly Fishers (FFF) supports conservation of all fish in all waters. FFF has a long standing commitment to solving fisheries problems at the grass roots. By charter and inclination, FFF is organized from the bottom up; each of its 360+ clubs, all over North America and the world, is a unique and self-directed group. The grass roots focus reflects the reality that most fisheries solutions must come at that local level.

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CHAIR'S CORNER

The Rainbow Trout-Steelhead Debate

by Bill Redman
— Steelhead Committee —

I intended to write about water in this issue of *The Osprey*, but the water wars go on indefinitely, so the problems seem more timeless than timely. Meanwhile, we are faced with a challenge requiring immediate response — the NOAA Fisheries draft revised hatchery policy, and the associated Endangered Species Act listing reviews for steelhead and salmon. Water will have to wait.

By now, it is well known that in April 2004, NOAA released its new draft hatchery policy, which in many cases will lump wild and hatchery fish together in the same Evolutionarily Significant Unit (ESU) for ESA listing determinations. This draft policy flies in the face of the intent of the ESA to protect wild populations, and the scientific consensus that hatchery fish do more harm than good for the species. The policy revision states: "Hatchery fish that are no more than moderately divergent from a natural population in the ESU are considered part of the ESU, will be considered in determining whether an ESU should be listed under the ESA, and will be included in any listing of the ESU." If this policy becomes final, it inevitably will lead to years of confusion, petitions, and litigation. In the long term, delistings are likely, and the ESA may be rendered useless as a tool to protect the fish.

The hatchery issues have been well documented in previous issues of *The Osprey* and other press. But in its draft listing reviews released at about the same time as the hatchery policy, NOAA also announced by the stroke of a pen that sea-run steelhead and resident rainbow trout in the same geographic area will be placed in the same ESU. This column focuses on that proposed change.

It is critically important that the ESA be an effective tool to protect and recover steelhead. To be effective, sea-run steelhead and resident rainbow trout must be in separate ESUs and treated separately for ESA listing purposes. If they are treated as the same fish and placed in the same ESU when in the same geographic area, steelhead are likely to be outnumbered substantially by resident rainbows, therefore subjected to delisting actions and loss of habitat protections.

The contention that the sea-run and resident forms are the same fish has already been used as partial basis (along with the claim that hatchery and wild fish are the same) for two law suits seeking delisting of ESA listed steelhead. As covered in the May 2003 issue of *The Osprey* (see update on page 16), Central Valley California irrigators sued for delisting of Central Valley California steelhead. The judge ruled that the threatened listing should stay in place based on the uncertain science regarding the sea-run/resident relationship. A copycat suit seeking delisting of Lower Columbia, Middle Columbia, and Upper Willamette steelhead is in process. But if this policy change is finalized by NOAA and validated as consistent with the ESA, all bets are off on steelhead ESA listings.

Any angler who knows both sea-run and resident forms of O. mykiss is aware of their dramatically different life histories.

Any angler who knows both the sea-run and resident forms of *Oncorhynchus mykiss* is acutely aware of their dramatically different life histories. However, more than angler knowledge of life histories will be required to convince NOAA to keep them separate. Authoritative science will be required, and the science of the sea-run/resident relationships is both complex and still emerging. There is evidence that seagoing and resident rainbows carry out limited spawning interactions occasionally and that both the seagoing and resident forms can be critical to the long term health of the stocks in some watersheds. They can back each other up.

So what are the scientific and legal arguments for keeping steelhead and rainbows in the same geographic area separate under the ESA? While they are the same species and the genetics can in some cases be similar, I believe there is a strong case to be made that the sea-run and resident life histories are "distinct populations segments," a valid classification under the ESA, although not very precisely defined.

Scientific support is provided by answering the question raised by Dr. Robert Behnke in his column in the Summer 2002 issue of *Trout*: "In rivers where steelhead and rainbow trout exist together occasional hybridization is likely to occur unless the fish are completely isolated from one another by time or place of spawning. Where a slight amount of genetic interchange occurs, genetic analysis will not show clear cut distinction between rainbow trout and steelhead. This could lead to the wrong conclusion that there is no hereditary basis for anadromous and resident life histories. In such instances, the question that cannot be answered by genetic analysis is: Does like give rise to like? Do steelhead give rise to steelhead and do rainbow trout give rise to rainbow trout, at least in the overwhelming majority of cases?"

To illuminate, Behnke cites two parentage studies using otolith (inner ear bone) analysis. "When this technique was applied to rainbow trout and steelhead from the Deschutes River, Ore., it was found that all of 20 steelhead tested came from steelhead mothers and all of the 38 resident rainbow trout had rainbow trout mothers. In the Babine River of British Columbia, one of 24 steelhead trout had a rainbow trout mother and two of nine rainbow

Continued on page 19 ➢

Sol Duc River,
Continued from page 1

National Park (31.9 percent of the watershed area), extensive timber harvest has occurred at lower elevations on Forest Service ownership (32.1 percent), State of Washington lands (13.4 percent), and large private industrial timberland holdings (22.5 percent). Rural residential development is scattered along the main river valley.

Winter Steelhead Life History

The Sol Duc winter steelhead is considered a distinct stock due to the geographic isolation of the spawning population in the Sol Duc River and tributaries, according to Washington's Salmon and Steelhead Stock Inventory (SASSI). SASSI categorizes the stock as wild and maintained by natural production. The stock is part of the North Coast Genetic Diversity Unit established by WDFW. Genetic analysis of fish from this Genetic Diversity Unit formed two clusters. Cluster B fish, which include the Sol Duc River winter steelhead, have a high similarity to the Chambers Creek hatchery strain.

The Chambers Creek hatchery strain was planted in the Sol Duc on an irregular basis in the 1950s and 1960s and continues to be planted in other rivers of the Quillayute Basin. The Sol Duc genetic analysis was based on a sample of 52 juvenile winter steelhead collected in 1994 from the Sol Duc River; a sample which may not adequately represent the wild population. The Sol Duc winter steelhead stock is also included in the Olympic Peninsula Evolutionarily Significant Unit (ESU). NOAA Fisheries considers the Olympic Peninsula steelhead genetically distinct from other steelhead ESUs.

Sol Duc winter steelhead first enter the river in late November and are still entering freshwater in April and May. Recreational catch records indicate that the majority of the population is composed of late-spawners, entering the river from February through April. However, this may be an artifact of the early portion of the wild run having been severely depressed by hatchery influence and the over-harvest that began in the 1950s

The English translation for the Quileute term for the month of January is "the beginning of the spawning of steelhead salmon," and February was the "regular or strong spawning time of salmon," indicating that steelhead were prominent in the rivers at this time. The natural genetic strain of the wild Sol Duc winter steelhead is unusually large, averaging ten to 12 pounds, with many in the 20- to 25-pound range.

Previous assessments have consistently rated the Sol Duc winter steelhead stock as healthy.

Sol Duc winter steelhead spawn in the mainstem and tributaries. Eggs incubate in the gravels for several months, and fry emerge in the spring or summer to rear in freshwater. Information on juvenile life history in the Sol Duc watershed is limited. For the Quillayute River as a whole, most of the juveniles rear in freshwater for two years, with an estimated 10 percent of the juveniles rearing for three years before migrating to sea.

Stock Status

Previous stock assessments have consistently rated the Sol Duc winter steelhead stock as healthy. In their 1996 status review under the federal Endangered Species Act, NOAA Fisheries determined that population trends within the Olympic Peninsula ESU were generally upward, with some stocks declining. The trend in total escapement between 1978 and 1994 for the Sol Duc stock was considered to be generally stable.

Since 1994, the spawning escapement has increased dramatically, far exceeding the escapement goal set by WDFW of 2,910 fish. Escapement estimates for Sol Duc steelhead are based on extensive spawning surveys, with some of the most complete coverage in Washington. Surveyors walk stream reaches, totaling 31 miles of the Sol Duc River and its tributaries, every seven to 14 days during the spawning season and count and mark redds. The mainstem

Although much of the higher elevation areas of the Sol Duc River drainage are protected within the boundaries of Olympic National Park, its lower reaches have seen extensive logging over the years. Photograph by Jim Yuskavitch

Continued on next page ➢

Continued from previous page

Sol Duc River is surveyed from a helicopter six times per season. Most of the Sol Duc River spawning grounds are surveyed. The observed escapement is expanded to account for unsurveyed areas, which probably contribute less than 10 percent to the total escapement estimate

The early timed portion of the Sol Duc spawning population (November-December-January) may be severely depressed. This early portion of the run may constitute a genetically distinct sub-stock. An analysis of historical and recent harvest patterns showed a significant decline in the December sports harvest for the Sol Duc and Bogachiel/Quillayute portions of the watershed that appears to have started in the 1960s.

In some of the limited data available, a marked hatchery return timing experiment found that 186 of 397 (47 percent) of the wild steelhead that returned from December through April of the 1954-1955 season returned in December and January. The December and January component of the run historically appears to have provided over 30 percent of the total harvest of wild steelhead. In recent years, this has been reduced to about 16 percent.

Hatcheries

Hatchery influence on the Sol Duc winter steelhead stock began with early stocking of Chambers Creek hatchery fish in 1953, 1956, and between 1967 and 1970. The program was ended in 1970 because of pressure from local anglers on the Washington Department of Game. The anglers were concerned with the declining sports catch of native stock, believed to have been caused by excessive sport and commercial fishing pressure on the early portion of the wild run when the Chambers Creek hatchery fish also returned. To boost the wild run, the Sol Duc Native Steelhead brood stock program was begun by local anglers in 1976, who then curtailed the brood stock collection in 1983 to prevent creating another hatchery situation.

However, the program restarted in 1986 as the Snyder Creek project of the Olympic Peninsula Guides Association, and stocking levels in recent years were two to three times as large as the annual plantings of Chambers Creek fish in the 1950s and 1960s.

Limited monitoring data indicate that Snyder Creek hatchery fish contributed only about two percent of the sport caught fish from 1994-95 and 1995-96. In addition to the Snyder Creek stocking in the Sol Duc River itself, a permanent rearing facility was developed in the 1950s on the Bogachiel River that has outplanted an increasing number of Chambers Creek stock, mainly in the Bogachiel and Calawah Rivers. Since 1990, a total of about 150,000 Chambers Creek stock hatchery smolts, and 40,000 Snyder Creek brood stock smolts were planted annually in the Quillayute Basin.

Hatchery influence on the Sol Duc winter steelhead stock began with early stocking of Chambers Creek hatchery fish.

During the 1997-98 season, the Bogachiel River hatchery return crashed to the extent that the recreational fishery was closed to harvest. A total of about 5,240 hatchery fish returned. During the same year, the wild winter steelhead return was strong, with over 12,352 wild fish, suggesting that the resilience of hatchery fish under fluctuating ocean conditions may be substantially lower than that of wild fish. Steelhead return rates for hatchery steelhead range between 0.015 and 0.14. No data are available on wild return rates.

Impacts of hatchery strays pose a threat to wild steelhead in the Sol Duc River, where the early part of the run is mostly hatchery fish. Between 1994-95 and 1998-99 season, the average sports harvest of winter steelhead in November was nearly 100 percent hatchery fish, harvest in December was about 50 percent hatchery fish, and by January had dropped to about 30 percent hatchery fish. Because the Snyder Creek brood stock program was found to contribute less than two percent of the total sports catch in limited monitoring conducted during 1994-95 and 1995-96 seasons, most of these hatchery fish are probably hatchery strays from the Bogachiel facility. However, there hasn't been an analysis of the Snyder Creek project's contribution in recent years and it could be higher than in the past.

Harvest

Commercial and recreational harvest is negotiated between the Quileute Tribe and Washington State, based upon pre-agreed spawning escapement goals established in a long-term harvest management plan and annual harvest agreements. The Tribe and WDFW agreed upon a Sol Duc River spawner escapement of 2,910, 49 percent of the total escapement goal of 5,900 for the Quillayute Basin system.

Spawning escapements for watersheds of the Quillayute Basin were determined by estimating the potential steelhead that could be produced based on the river's surface. A portion of the total production is allocated to escapement based on the observed relationship between numbers of spawners and recruits produced and formulas for maximum sustained yield. This escapement estimate has been repeatedly called into question as extremely low by long-time anglers. The method assumes that the parr densities actually surveyed to derive the escapement estimate for a river were the result of an escapement yielding maximum recruitment. It seems highly unlikely that parr densities during surveys of the Sol Duc River in the late 1970s were at "carrying capacity," especially considering the significantly larger escapements in recent years. In addition, parr densities surveyed in the Sol Duc were very low in relation to other rivers surveyed.

Unfortunately, actual historical data on spawning escapements prior to the 1950s are not available to help resolve the debate over sufficient spawning escapement levels upon which to base harvest management plans.

The total exploitation rate (recreational and tribal) for Sol Duc winter steelhead can only be approximated based on overall rates for the Quillayute River, since tribal and recreational fish-

Continued on next page ➢

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eries harvest an unknown number of Sol Duc stock fish downstream of the Sol Duc River in the mainstem Quillayute. Between the 1978-79 season and the 1998-99 season, annual catch of Quillayute Basin wild fish fluctuated between 10 and 55 percent of the total wild fish returning to spawn that year.

Hatchery fish had a much higher estimated exploitation rate, up to 90 percent. Since the early 1990s, the exploitation rates have dropped substantially due to decreases in both sport and tribal harvest rate. The drop in sport catch may be partly due to recreational fishing regulations adopted in 1996 that allow harvest of one wild fish per day and a total of five for the season. The decreased catch is probably not due to fewer fishermen, as anglers and managers have observed dramatic increases in non-tribal fishing pressure on West End rivers in recent decades.

The recreational fishing regulations for Sol Duc River winter steelhead have generated political controversy in recent years. In most rivers in Washington, wild steelhead must be released unharmed. Some guides and anglers were not pleased that WDFW allowed killing wild winter steelhead in the Sol Duc River, one of the few healthy populations of steelhead remaining in the Pacific Northwest. Anglers killed about 1,000 wild Sol Duc winter steelhead per year between 1953-54 and 1998-99.

During the 1997-98 season, early hatchery and early wild returns were so poor that managers closed the Quillayute Basin to sports harvest early; only 77 fish were harvested that year in the Sol Duc River. After political pressure from guides and anglers in 1996, the Washington Fish and Wildlife Commission passed new rules that restricted the catch on the Sol Duc River to one fish per day with a five fish annual limit. Only catch and release was allowed upstream of the salmon hatchery at River Mile 30.

Controversy erupted a second time when WDFW proposed, in their 2000 rule package, to raise the limit to a harvest of two fish per day and 30 fish per season on the Quillayute system, based on the perceived healthy status of the winter steelhead stocks. After protest by guides and anglers concerned about over-harvest, the proposed rules were modified.

For the Sol Duc, the catch was increased beginning in the 1999-2000 season from five to ten fish per year, instead of 30 fish, and the one fish per day limit was not changed to two fish per day.

In many of Washington's coastal river systems, fishery managers have attempted to reduce the risk of hatchery-wild interbreeding by encouraging heavy (80 percent to 90 percent) harvest of early spawning hatchery fish and allowing sizeable escapements of late-spawning wild steelhead. In the Quillayute Basin, the State-Tribal annual fishery management agreements have generally focused tribal fishing effort on the early part of the run, with up to five days a week open to the gillnet fishery, as opposed to fewer days later in the season.

Due to the geographic isolation of the spawning population, Sol Duc River winter steelhead are considered to be a distinct stock. Photograph by Jim Yuskavitch

However, the inverse result of this management strategy was to potentially establish a mixed stock fishery situation of hatchery and wild fish, with excessive harvest rates on the early timed portion of the wild winter steelhead population. Such harvest can have profound effects on the genetic characteristics and health of the population as a whole.

In the Sol Duc River, the initiation of stocking in the 1950s with Chambers Creek stock, which return early, may have increased overall fishing pressure at this time of year and resulted in excessive harvest on the early timed component of the wild run. Tribal and recreational harvest has continued to be high on the early portion of the wild run in the Sol Duc River. The harvest rate on early (December-January) hatchery and wild steelhead in the Sol Duc and Bogachiel/Quillayute portions of the Quillayute Basin averaged 67 percent during five seasons from 1990-91 to 1994-95. This is substantially higher than the 43 percent that occurred for the wild steelhead as a whole for the same time period. Because these harvest patterns began in the 1960s and 1970s, WDFW Commission (1996) concluded that "recent management plans that focus higher harvest rates on the early-timed portion of the winter steelhead run are not responsible for the shift [in population abundance], though they may be preventing the rebuilding of the wild early-timed component."

Hydropower

No hydro-electric dams or other hydropower facilities were built in the Sol Duc River watershed.

Habitat

West-end rivers are generally in better condition than many watersheds on the Olympic Peninsula due to protection provided by Olympic National Park and the wetter climate. Two watershed-level habitat assessments have been conducted for the Sol Duc River watershed. The U.S. Forest Service completed the Sol Duc Pilot Watershed Analysis in 1995. The Washington State Conservation Commission (WSCC) completed a habitat limiting factors analysis for Watershed Resource Inventory Area 20 (the Sol Duc and Hoh watersheds).

Continued on next page ➢

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The following excerpt from the Executive Summary of the WSCC report provides a concise summary of the state of the knowledge regarding habitat limiting factors in the Sol Duc watershed:

"The Soleduck sub-basin lies partly within the Olympic National Park (upper reaches) and partly in timber-managed, agricultural and residential development. The contrast between the pristine habitat conditions within the park is sharp compared to conditions further downstream. Outside of the park boundaries, numerous major habitat problems exist.

Excessive sedimentation is a problem and stems mostly from landslides. High road densities are associated with the sedimentation problems. High levels of fine sediments are found in many Soleduck tributaries which degrade the quality of spawning habitat. Areas of "poor" large woody debris and riparian conditions are other problems. The Soleduck drainage is naturally limited in wetland habitat, yet continued loss of wetlands and off-channel habitat occurs. Warm water temperatures are a problem in the summer, potentially impacting adult migration and spawning of summer chinook and a unique summer coho run. A large potential habitat problem is the over-allocation of water from the river. Contributing to summer low flows and warm water temperatures is the "poor" hydrologic maturity (loss of fog drip, change in hydrology) outside of the Park boundaries. Blockages are a known major problem within Gunderson and Tassel Creeks."

Summary

The spawning returns of Sol Duc winter steelhead have far exceeded the escapement goal in most years since intensive monitoring began in the late 1970s. The population as a whole appears to be stable or increasing. However, the escapement goal, based on limited data and questionable assumptions, may be too low to provide an accurate gauge of true historic or potential production. Also, the early portion of the run (December-February) has been significantly depressed from historic levels, probably by continued mixed stock fishing pressure on wild and hatchery fish.

Hatchery strays, probably originating from the hatchery facility downstream on the Bogachiel River, jeopardize the health of the wild steelhead run, particularly the early portion of the run.

In recent years, hatchery fish comprised an average of 50 percent of the steelhead caught in the Sol Duc River in December. Due to the depressed status of the early portion of the run and questionable size of the current population in relation to historic abundance, the stock as a whole is not considered healthy.

Restoring the early run along with higher escapements may offer more fish for harvest than provided by hatchery supplementation at lower risk to wild populations.

Monitoring Recommendations

Life History

❑ Conduct research on juvenile life history. Very little information is available on juvenile use of freshwater and estuarine rearing habitats. A high priority is to conduct parr surveys during summer low flow in tributaries and the mainstem of the Sol Duc River to update the parr density data that was used to set the escapement goal.

Hatcheries

❑ Evaluate the hatchery straying rate into the Sol Duc River. Hatchery strays from the Bogachiel hatchery facility appear to be a threat to maintaining the genetic integrity of the early timed portion of the wild winter run.

❑ Cease operation of the Snyder Creek brood stock facility. It does not seem to be making a significant contribution to the catch and is taking wild spawners off the spawning grounds with unknown genetic risks to the wild population.

Harvest

❑ Evaluate the strategy of 100 percent wild production versus continued hatchery supplementation for long term sustainability and production of winter steelhead in the Quillayute River system. The major concerns in the Sol Duc River revolve around the impacts of hatchery production facilities in the Quillayute, in terms of mixed stock fishery in depressing the early timed portion of the wild run and potential genetic impacts from straying of hatchery fish. Restoration of the early timed run to the Sol Duc River along with higher escapements in the basin, may provide more fish for harvest than currently provided with hatchery supplementation and at much lower risk to the survival of the wild populations.

Habitat

❑ Conduct comprehensive instream flow monitoring to assess existing flows, water rights, and impact of existing surface water diversions.

❑ Conduct a detailed sediment and road survey for the watershed to identify all sediment sources and evaluate the relation to instream habitat conditions.

❑ Increase monitoring of riparian condition and evaluate the relation of riparian condition to other habitat parameters and winter steelhead survival. Poor riparian conditions in some areas were identified as a major problem for aquatic habitats in the Sol Duc.

❑ Detailed mapping of riparian habitats is needed, as is intensive research aimed at documenting the complex relationships between riparian condition, other habitat parameters, and steelhead survival and production in their freshwater rearing habitats.

❑ Conduct a comprehensive fish passage barrier survey in the Sol Duc watershed. A comprehensive assessment is needed to identify all barriers and prioritize them for restoration based on upstream habitat gain.

John Day River, Continued from page 1

Warm Springs reservations. The Tribes retain fishing, hunting and gathering rights within their U&A under treaty with the United States.

Nearly three-quarters of the land in the watershed, and nearly all of the headwaters, is owned by the U.S. Forest Service. About 75 percent of the Forest Service land is grazed. Most of the private lands are pasturelands located along the river valleys. Some widely dispersed parcels along the lower and middle reaches of the Middle Fork and Long Creek are owned by the Bureau of Land Management.

Historically, the MFJD River is generally considered to have had some of the best fish habitat in the John Day system due to its relatively low gradient and unconfined valleys. However, the river has also suffered some of the worst habitat impacts of any John Day tributary. Current and historic impacts of mining, gold dredging, grazing, and timber harvest have severely reduced habitat for cold water fishes in the MFJD river.

Natural History

The summer steelhead populations of the John Day River are part of a broad inland group located east of the Cascades that are genetically distinct from those populations to the west of the Cascades. NOAA Fisheries has classified the John Day River populations into a Middle Columbia Evolutionarily Significant Unit (ESU), based on genetic evidence that separates this ESU from the Snake River populations to the east and the lower Columbia populations west of the Klickitat Basin in Washington and Fifteenmile Creek in Oregon.

Within the John Day River, the Oregon Department of Fish and Wildlife (ODFW) has identified five distinct populations based on geographic isolation: the Lower Mainstem, Upper Mainstem, North Fork, Middle Fork, and South Fork.

Adults are considered part of the "A" run for fishery management purposes under both timing and size definitions. Steelhead less than 78 centimeters (30.7 inches) in total length are considered "A" run, and larger fish are considered "B" run.

Fish begin migrating up the John Day River in September when water temperatures cool and flow increases. The steelhead over-winter in the river and spawning begins in the lower tributaries of the John Day River in mid-March and continues through mid-June in the upper tributaries. Fry emerge in early July. Peak downstream movement of smolts generally occurs from April through May. Age one-plus juveniles periodically migrate to new rearing habitats, especially in the late summer and fall, corresponding with increased flows.

Steelhead abundance in the John Day basin has fluctuated greatly since the first spawner surveys were conducted in the 1950s.

The larger tributaries and mainstem may be particularly important habitats during these latter stages of juvenile rearing prior to migration out of the John Day system the following spring. In a study of juvenile rearing in the MFJD and two other tributaries in the basin, researchers found that steelhead select microhabitats by age class. These microhabitats could be distinguished by such characteristics as the water depth and velocity at the fish's focal point and total depth and velocity of the habitat.

Scale analysis indicates that about 62 percent of the steelhead smolt at two years and the remainder smolt at three years. About 51 percent of the adults spend one year at sea, with most of the remainder spending two years at sea. However, rearing time in freshwater may be much longer for a small proportion of juveniles.

Stock Status

Although the Columbia River once was among the most productive river basins for anadromous salmonids on the West Coast of North America, its current runs are less than 10 percent of historical levels. Within the John Day Basin, steelhead abundance has fluctuated greatly since the first spawner surveys were conducted in the 1950s. Redd counts reached a low point in the 1970s, peaked in the late 1980s, and recently have exhibited lows similar to the 1970s. These fluctuations may at least partly reflect larger patterns of climate and ocean productivity.

NOAA Fisheries status review of West Coast steelhead concluded that the majority of stocks within the Middle Columbia ESU were declining, including those in the John Day River, which is the largest producer of wild steelhead. Steelhead within this ESU were listed as a federally threatened species on March 25, 1999. A 1998 status review of steelhead in Oregon conducted by ODFW rated the Middle Columbia ESU populations as "sensitive" (at some degree of risk of extinction), particularly in the John Day Basin.

The ODFW status report indicated that the steelhead population of the MFJD River was generally depressed in the 1990s, but with a spike in abundance for the 1992 spawner year. This stock assessment was updated in November 2000. The data indicates continued declines for all John Day populations, including the MFJD.

The MFJD River data is based on spawning surveys conducted in only two tributaries, Lick Creek and Camp Creek, totaling 8.8 miles of total stream length that were surveyed fairly consistently between 1971 and 1999. The spawning redds per mile data were converted to fish per mile (based on the number of females per redd), and then converted to pre-harvest fish per mile (using a constant harvest rate of 12 percent for the John Day River and variable rate estimate for the Columbia River). The population trend data indicate a potentially serious 1990s decline in the MFJD population and other John Day Basin populations. Steelhead abundance estimates have been based on a relatively solid long-term database of redd counts for the John Day Basin.

The redd counts, usually conducted just after the estimated peak of spawning, in some years covered more than 100 miles of stream reaches and date back to the 1950s, among the longest term spawning data records in the state.

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However, data from limited spawning surveys conducted in the MFJD River is probably not sufficient to provide a good estimate of trends in abundance for this watershed. Furthermore, because Columbia River fish runs had already declined substantially by the late 1890s, the spawning data does not indicate the magnitude of historical production prior to Euro-American colonization of the region.

The John Day Basin is managed under Oregon's Wild Fish Management Policy Option A, Management Exclusively for Wild Fish. The intent of Option A is to ensure that the life history characteristics and productivity of the locally adapted wild stock are not altered by man's activities.

Non-indigenous summer and winter steelhead were released into the subbasin in 1966, 1967 and 1969. Few fish likely survived due to the use of improper stocks and hauling mortality. With the exception of these releases, subbasin production has been entirely from native stock, and potentially from hatchery or wild fish strays from out of the basin.

Hatchery fish are widespread and escaping to spawn throughout the Middle Columbia ESU, with potential impacts to John Day populations. NOAA Fisheries considers that the major threat to genetic integrity for steelhead in this ESU comes from past and present hatchery practices. A primary trouble spot identified in ODFW's 1998 steelhead status review of the Middle Columbia ESU was the Deschutes steelhead.

Over the previous four years, the population has been in almost complete reproductive failure. Stray hatchery fish dominated the spawning populations (greater than 75 percent) and were likely causing severe genetic impact to the innate productivity of the wild stock. Information on hatchery strays in the John Day River is weak and based on relatively few angler reports with varying estimates from various sources. Hatchery strays accounted for 15 percent and 4 percent of the fish sampled during the 1982-83 and 1983-84 sport fishing seasons, and they were found in upriver locations. According to a more recent stock assessment, strays were believed to account for four percent to eight percent of the run.

ODFW notes the possible increase in hatchery strays in recent years, but assumes that without better information, they constitute less than five percent of the naturally spawning population.

The John Day River is among the last of America's free-flowing, undammed streams. Photograph by Jim Yuskavitch

Harvest

The John Day Basin supported a popular sports fishery with harvest of wild steelhead allowed until 1996. ODFW has used the count of wild A-run steelhead over Bonneville as a trigger mechanism to enact emergency regulations. When the count was less than 40,000, emergency rules were proposed to the Oregon Fish and Wildlife Commission and were enacted for the 1990, 1993, 1994 and 1995 run years. These regulations allowed retention of only two wild fish per year. For the 1996 run year, the Commission enacted regulations requiring catch-and-release of all wild steelhead for the John Day River because of concern for continued low returns of wild steelhead over Bonneville dam. There is still no sport harvest of wild steelhead allowed in the Columbia River or its tributaries.

Run year specific estimates of sports harvest averaged about 2,000 fish and ranged from 305 to 9,675 fish from 1958 through 1991 for the John Day River.

Sport harvest data on the MFJD indicate an average annual catch of about 71 fish, ranging from zero to 250 fish from 1975 through 1987.

The Umatilla and Warm Springs Confederated Tribes have reserved Usual and Accustomed fishing sites in the John Day River subbasin. Tribal harvest has been a minimal subsistence harvest only, and the commercial fishery has been closed since 1978 to restore runs to harvestable levels. Both the Tribal and sport fisheries in the Columbia River catch an unknown number of MFJD River steelhead in a mixed stock fishery situation. Ocean fisheries do not appear to be a significant form of harvest. Since 1977, less than one percent of the upriver summer steelhead accounted for by coded wire tag recoveries of harvested hatchery fish came from the ocean.

The Columbia River Fishery Management Plan (CRFMP) goal for production of wild summer steelhead was 62,200 group "A" fish passing Bonneville Dam. The sub-basin plans, under the Northwest Power Planning Council (NWPPC), have a goal of a 45,000 summer steelhead return to the mouth of the John Day River, with 33,750 for escapement and 11,250 for tribal and sports harvest. The CRFMP goal was met twice between 1985 and 1994, and runs continued to decline. Estimates of total escapement to the John Day River are considered unreliable since they are based on extrapolation to the whole basin from a relatively small length of spawning surveys

Hydropower

The John Day River is the largest tributary without major dams in the Columbia River Basin, a system that is otherwise full of dams. However, seasonal pushup dams and small impoundments for irrigation and livestock

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watering are still used. Three major dams occur on the mainstem Columbia River downstream of the John Day River. These dams and their reservoirs are major sources of mortality for juvenile steelhead and other salmon species that migrate downstream and get caught in the turbines. Losses of smolts were estimated at 10 percent to 20 percent of the total population at each dam, with an estimated 51 percent to 73 percent survival through all three dams to the Pacific Ocean.

In a study of wild spring chinook salmon in the John Day River, researchers attributed spring chinook declines since the 1970s primarily to mortality at dams. Nevertheless, the relatively few dams that John Day River summer steelhead need to pass is considered a major reason for the relatively healthy status of John Day populations.

Habitat

Steelhead habitat in the Middle Fork John Day River has been highly degraded by over 150 years of resource exploitation, including activities such as widespread beaver trapping, mining, dredging, surface water withdrawals for agriculture, channelization and flood plain clearing for agriculture and pasture land, and timber harvest and road building.

Two watershed analyses have been conducted in the MFJD watershed by the U.S. Forest Service. For the Galena Watershed, a subwatershed encompassing about 25 percent of the upper Middle Fork John Day, the U.S. Forest Service (USFS) documented high road densities, forest roads in floodplains of creeks, impacts of mine tailings and livestock grazing, and high stream temperatures. The loss of beaver and their dams were considered a major loss to hydrologic function and habitat.

The MFJD River is composed of two types of riparian habitat: wide valley floodplains that have mostly been converted to pastureland, and narrow forested ravines. The most productive habitats for fish were the areas that have been altered the most — the wide floodplains that historically contained multiple channels and extensive shrub and tree riparian vegetation. These floodplains were cleared for pastureland and now consist of a single shallow channel in most locations, with few pools and little riparian cover.

Extensive research has documented the significant impacts of cattle grazing on riparian habitats, channels, and water temperature. Likewise, research has documented the rapid restoration of floodplains, riparian vegetation, wildlife species, and even stream flow following fencing of riparian zones in semi-arid inland watersheds.

Using temperature as an indicator, researchers found that fish assemblages could be clearly related to longitudinal temperature profiles. As stream temperatures increased in a downstream direction, coldwater salmonid communities were replaced by warmwater fish communities. Greater than 70 percent of the mainstem MFJD River reached temperatures higher than 25 degrees Centigrade (77 F), the incipient lethal temperature for salmonids.

More than 20 percent of the mainstem John Day was between 19 degrees C and 24 degrees C. A noticeable lack of salmonid use was found in areas where stream temperatures exceed 22 degrees C for more than six hours at a time. Juvenile steelhead have been documented to select seeps and other cold water refugia to survive otherwise extremely high water temperatures. However, it is clear that the high water temperatures limit the distribution and potential production of steelhead and other salmonids in the basin. Warmwater species dominate the majority of the MFJD River, and few salmonids have been observed in snorkel surveys downstream of Galena.

However, stream temperature is only one problem resulting from impacts to channels, floodplains, and riparian areas.

The loss of riparian forests not only decreased stream shade, but diminished the capacity of the stream to restore itself. The effects of humans have reduced interactions of the stream with its floodplain. Streams have been channelized, rivetments gird the banks, and much of the exploited streams will not be able to adjust their gradient, sinuosity or structure without human intervention. Grazing has removed vegetation and compacted riparian soils.

The combination of compaction and loss of organic mulch caused increased soil density, diminished soil porosity and subsequently reduced water infil-

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Livestock grazing has had a significant impact on riparian habitat conditions within the John Day River basin. Photograph by Jim Yuskavitch

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tration. This increases runoff to the stream, decreases recharging of the floodplain aquifer, increases silt deposits on riffles and pools and results in higher rates of bank erosion because of the absence of tensile strength provided by plant roots.

Riparian restoration appears to be the priority for habitat improvement in the MFJD River. The Oregon Water Resources Department (OWRD) prepared a plan for a stream restoration program for the MFJD River based on their comprehensive assessment. The Confederated Tribes of the Umatilla Indian Reservation also prepared a restoration plan that identified 143.7 miles of stream in need of improvement in the MFJD watershed (fencing, large wood, rip rap). The Bureau of Land Management (BLM) has proposed a new plan for managing federally designated Wild and Scenic River sections of the John Day River, but has proposed only minor improvements to the current grazing system.

Much riparian and floodplain restoration has occurred in the MFJD River in recent years. The Nature Conservancy purchased a 1,220-acre ranch in the floodplain of the MFJD River and has conducted much of the historical research necessary to plan restoration. The Bonneville Power Administration (BPA) has spent 10 to 15 million dollars on habitat improvements in the John Day Basin since 1980. Annual reports of John Day River fish enhancement efforts funded by the BPA document an impressive amount of riparian fencing that has been completed.

Summary

Limited spawning surveys indicate an overall steep decline of summer steelhead of the MFJD River since the late 1980s. NOAA Fisheries concluded that the majority of stocks within the Middle Columbia ESU, including the John Day River, were declining. Steelhead within this ESU were listed as a federally threatened species in 1999. Since 1996, the MFJD River summer steelhead have continued to decline, probably due to a combination of highly degraded watershed conditions and high mortality of smolts during downstream migration through the dams. Initial assessment of healthy stocks, which relied upon expert judgements of area biologists, appears to have been overly optimistic for John Day Basin stocks.

Monitoring Recommendations

Life History

❑ Conduct detailed monitoring of juvenile steelhead migrations and habitat use in relation to habitat variables. Very little is known about steelhead use of various habitats at various stages in their life history.

Limited spawning surveys indicate a steep decline of summer steelhead in the Middle Fork John Day since the late 1980s.

Stock Status

❑ Conduct random stratified spawning surveys, similar to ODFW's efforts for coastal coho, to develop accurate extrapolations of total escapement to the John Day River Basin and to the MFJD River and other rivers, based on the limited spawning surveys conducted. Currently, spawning counts are not considered accurate enough to use for overall escapement estimates.

Hatcheries

❑ Determine the extent of hatchery straying within the MFJD watershed. High straying rates have been documented for the Deschutes River, and increasing straying rates for the John Day Basin may pose a major threat to the survival and genetic integrity of the wild populations.

Harvest

❑ Investigate methods to improve the catch estimates for John Day fish harvested in mixed stock fisheries of the mainstem Columbia River.

Hydropower

❑ Adopt a rigorous program of evaluation, monitoring, and research to test the conceptual foundation of salmonid restoration as recommended by the Independent Scientific Group. [The Independent Scientific Group (1999) of the Northwest Power Planning Council reviewed regional salmon management actions of the Columbia River Basin Fish and Wildlife Program and concluded that the current program is unlikely to recover declining steelhead and salmon stocks. The Independent Scientific Group recommended major changes to move away from technological fixes and toward restoring normative river processes and functions, including mainstem passage conditions.] Successful salmon restoration is not occurring in the Columbia River Basin partly because monitoring has been insufficient to identify problems and conduct adaptive management.

Habitat

❑ Conduct surveys to understand the relationships between juvenile steelhead distribution and stream temperatures.

❑ Conduct detailed monitoring of juvenile steelhead use in relation to restoration of riparian and floodplain habitat. Despite large amounts of funding devoted to riparian fencing, there is little research to document the results in terms of steelhead response.

❑ Establish the John Day Basin as a salmon reserve, or refuge, with an increased emphasis on protection, restoration, and monitoring of wild steelhead and salmon and their habitat that would provide the basis for testing the normative river concept advocated by the Independent Scientific Group.

Days Past on the Stilly

by Scott Hagen

— Steelhead Committee —

In the following short essay, Steelhead Committee member Scott Hagen shares with us some of his early experiences fishing for steelhead on Washington's Stillagaumish River system.

Although I was born and raised in Bellingham, Washington, I learned to fly fish on Rapid Creek, a little stream near Rapid City, South Dakota. The trout there were a mix of browns and rainbows, with 10 inches being a good fish and a 12-incher being a trophy. They weren't very sophisticated, but then neither was I.

I finished my stint as a migratory missile worker in very early 1968 and moved to Stanwood, Washington. Naturally, the fly fishing only North Fork of the Stillagaumish attracted my attention. The first few times I explored and fished the Stilly, I caught lots of six to seven inch trout, but nothing bigger. Some time in late July, I was swinging a #10 Royal Coachman Bucktail past a log jam near Hazel, and this hook jawed, slab sided torpedo almost three feet long charged out from the log jam and ate my fly. I was so stunned I did exactly the right thing — nothing. When I did raise the rod a few seconds later, the water exploded, the fish went tearing down river, and we soon parted company. So began a long relationship with the Stilly and its steelhead.

Over the next couple of years, I read books, bought better equipment and asked lots of questions about fly fishing for steelhead. I did not land any of the first nine steelhead I hooked on a fly, through combinations of ignorance, bad technique and just plain bad luck.

One of those fish will stay in my memory forever. I was swinging a wet fly through a boulder filled run a half mile or so above Hazel. About mid-swing, half way down the run, the line tightened and the reel started screaming. This was another slab-sided "B" fish, charging the fly and continuing up river. I watched in amazement, rod held high, as he ripped off about twenty feet of line, jumped, ripped off another twenty feet, jumped again, made another longer run, jumped a third time and broke me off. Shaken, I sat on the bank and reviewed the last few seconds, coming to the conclusion that some times the fish is in charge and the angler is merely a spectator.

Eventually, of course, through improved equipment, hard earned knowledge, and dogged persistence, the jinx lifted and some of those wonderful fish were landed. The early seventies were my best years on the Stilly, fishing the North Fork and the mainstem for winter run and summer run steelhead, and sea run cutthroat in the fall.

I hooked one leg on an underwater snag, and fell headlong into the icy December water. Righting myself, I found the fish still on.

There was an unforgettable early December afternoon after work, fishing below Arlington, when a friend and I hooked five steelhead and landed three. About a year later, fishing that same special spot, I hooked a nice bright hatchery hen. After a very pretty jump, she swam straight at me, way faster than I could strip. She swam right between my legs in mid-thigh-deep water and headed up the river. Knowing it was all over if I didn't fix this, I lifted one leg as high as possible and passed the rod under, untangling myself. Instantly, she reversed course and swam between my legs again. Attempting to duplicate the pass through trick again, I hooked one leg on an underwater snag, tore a foot long rip in my waders, and fell headlong in the river. Righting myself in the icy December water, watching my cap floating down stream, I found the fish still on! I then noticed this infernal racket, and across the river in a drift boat were two guys howling with laughter. I landed the fish, which by this time it was pretty well played out, and decided that I had earned some dry clothes and a nice steelhead dinner.

Like most other steelhead fishermen, I was angry and frustrated by the Boldt decision of 1975. After spending many fishless days that fall and winter, and hearing stories of nets strung from bank to bank, I decided to give up steelheading and wait until everyone came to their senses. In so doing, of course, I taught Judge Boldt, the tribes, and the world in general a lesson they never even noticed, and I will never forget. I also deprived myself of several years of steelhead fishing.

The North Fork of the Stilly was paradise for summer run steelhead fly fishermen in the forties, fifties, sixties and early seventies. In 1941, through the efforts led by Enos Bradner of the Washington Fly Fishing Club, along with Ken McLeod, the North Fork of the Stillagaumish River was designated fly fishing only during the regular fishing season. This was a first for Washington State.

Sadly, the North Fork of the Stilly has fallen on hard times. Severe habitat damage brought about by ill advised logging and road building, increased development, and changes in the weather have decimated the summer run steelhead of the North Fork. Between low flows, high water temperatures and the mud slides, the fishery is a shadow of what it once was.

I still fish the Stilly, and still catch an occasional summer run fish there, but not as often as I used to. When I have the time and want to have good fishing for summer steelhead, I now travel to British Columbia, Oregon, Idaho or southwest Washington.

Of Sea Lice and Salmon

by Alexandra Morton

— Raincoast Research Society —

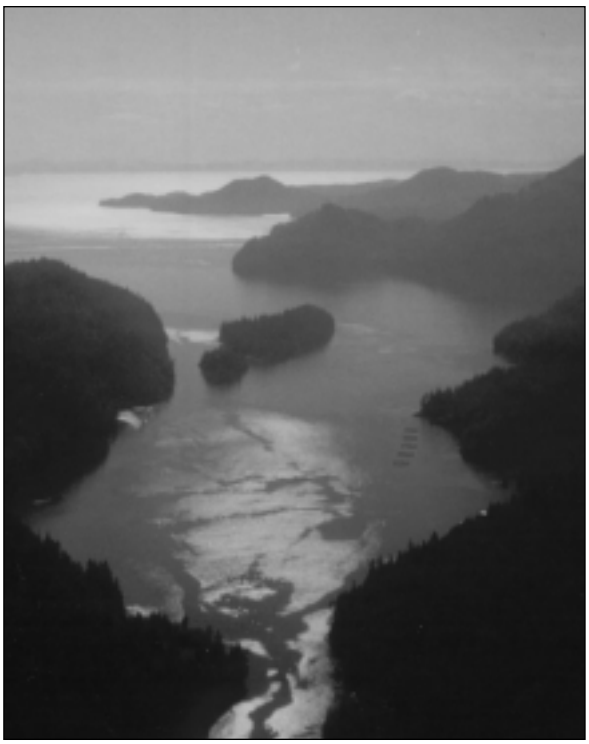
Alexandra Morton, author of "Listening to Whales" (Ballentine Books), was born in Connecticut. Her interest in killer whales drew her to settle in a remote archipelago in British Columbia, off the northeast coast of Vancouver Island. Researcher Morton is senior author on scientific papers on whales, dolphins, invasion of Atlantic salmon into the Pacific and impacts of sea lice from salmon farms on wild salmon. She is working to protect the great wild salmon runs of western Canada. She is with the Raincoast Research Society, www.raincoastresearch.org.

Twenty-one years ago I moved my family into a remote archipelago on the West Coast of Canada called the Broughton. It was the perfect place for the long-term killer whale study I had in mind. Nestled between Kingcome and Knight Inlets, seven major rivers produced millions of salmon, particularly pink, coho, chinook and chum salmon. The whales were drawn to the area to attend each run of salmon and I published my findings with the International Whaling Commission and elsewhere.

In 1987, the first salmon farm appeared; a small steel structure in tow behind a brightly painted tugboat. My first thought was good idea. I thought this farm would take pressure off the wild stocks and bring employment to the micro-community of Echo Bay, where I was raising my son.

The first indication of the problems to come was where the farms were sited. The government came to the local fishermen and asked: "Where don't you want salmon farms?" Most fishermen were reluctant to reveal the best grounds for salmon, prawns, rock cod and other commercially valuable species — but in the end they did. The resulting map depicted red-zones around the most productive areas, but within a year the salmon farming industry had placed many farms inside these red zones. This was a fatal mistake.

In 1991, the coho arriving at a small enhancement hatchery deep in the archipelago swam past three salmon farms that were losing fish to furunculosis [*Editor's Note: Furunculosis is a fish pathogen that causes swelling, ulcers and lesions. It has been documented on a wide variety of salmonid and non-salmonid fish species.*] That year, after a ten-year average mortality rate of three percent annually, the hatchery lost 28 percent of its broodstock to this disease. Antibiotics stemmed the losses. In 1993, a company called Scanmar stocked Broughton farms with Atlantic salmon smolts infected with a strain triple antibiotic resistant furunculosis and it spread in days to infect the nearby B.C. Packer farms. Once again, the coho came home with the disease, and no antibiotics worked this time. When I tried to compare the hatchery and farm strains, I was told they were "different," but no data was released to confirm this.



Broughton Archipelago with an Atlantic salmon farm visible in the middle right. Photograph by Alexandra Morton

In 2000, I decided to count how many Atlantic salmon are caught in my area (Pacific Management Area 12). In six weeks I had records of 10,826 Atlantic salmon, most intercepted by gillnet fishermen. An escape from a farm in the Broughton area that summer provided near experimental conditions. The immediate area of the escape was fished on day one, day seven and day 21 after the escape. Initially, the escaped Atlantics had no wild food in them, but by day 21, 24.4 percent had successfully found and caught wild food including salmon, herring and shrimp. Finding and consuming wild food is the most crucial test for an invading species and these had passed it easily. Non-native salmonids are the greatest cause of freshwater fish extinctions attributed to invasive species, and yet this scenario is being replayed on a catastrophic scale in western Canada.

The government-conducted Salmon Aquaculture Review of 1995 set the stage for the relentless expansion of salmon farming on this coast. While an exhaustive process, the devil was in the terms of reference. No findings from outside Canada would be considered. This meant we were not allowed to learn from the European experience with salmon farming, even though most of these companies were from Europe. No anecdotal information would be considered either. This meant the observations pouring in from fisher folk were ignored. And finally, virtually no research was funded to look for signs that the problems with salmon farming in Europe were repeating themselves here. And that is how the sea lice got out of control.

In 2001, a fisherman brought me one chum fry and one pink salmon fry each with 10 to 15 sea lice attached. Some guests at his lodge were now fishing in British Columbia because sea lice had destroyed once productive runs of sea trout in Scotland. The evidence that

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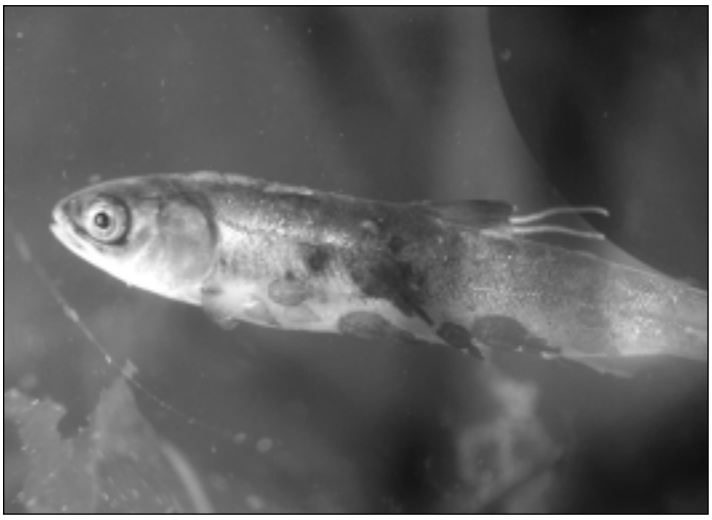
this plague had spread terrified the lodge owner. As a biologist living in the area, I was able to initiate a study immediately without funds. This burgeoned into an ongoing four-year project, including colleagues Williams and Routledge.



Look closely at this pink salmon (above) and you will see the sea lice with which it is infested. These escaped Atlantic salmon (below) were caught in the Wakeman River, Broughton Archipelago near Kingcome Inlet. Photographs by Alexandra Morton

We found ample evidence that every time a stock of pink salmon was infected by sea lice as juveniles, that run crashed. We found there were only sea lice on juvenile pink salmon in areas near salmon farms. We found if the farm salmon were removed, the lice vanished. We found it took very few lice to kill the three- to four-centimeter (1.18 - 1.57 inches) pink and chum salmon sampled adjacent to the farms. Our findings were identical to those in Norwegian and other parts of Europe — whenever salmon farms are placed in long narrow seaways, 98 percent of their wild salmonids are lost.

In addition to all this, the farms displaced the very killer whales I had come to study, by use of high amplitude acoustic harassment devices to discourage salmon predators.

Salmon farming is a flawed concept. Farming a carnivore can only result in net loss of world protein. However, if it must continue, it does not have to impact the naturally produced fish stocks. The crux of the problems outlined here is the use of nets to contain the farm fish. While these nets allow the farmers to use the ocean's ability to flush waste, they also allow the free flow of pathogens between the highly concentrated, stationary farm and transitory wild stocks. For this reason, salmon farms have been dubbed "pathogen culturing facilities" in the scientific literature. The farms themselves are harmed by the consequences of this dynamic, suffering the impact of the deadly algae blooms (Heterosigma) and relentless rounds of the virus of IHN (Infectious haematopoietic necrosis, an often fatal viral infection) carried by wild sockeye that have wiped out many farms in British Columbia.

All that is required to end this cycle of destruction is a better barrier between the wild and farmed stocks. Since the ocean has a reputation for crumpling all structures made by humans, this would mean placing the farms on land. This would protect the farm salmon from disease, predators, low oxygen cycles, algae blooms and environmentalists, while allowing the wild salmon to continue to thrive.

For years I have struggled with the question why? Why would any government risk a resource as desirable and renewable as wild salmon, for an industry which can only be a flash in the pan? It takes three to four pounds of wild fish to make one pound of farm salmon — a losing equation in our over-fished oceans. At this moment in human history no scientist can afford to simply do her science and sit back. If our work stands as evidence of loss of life on earth, we must walk it through the halls of government to make the case for the connectivity of all life — a dynamic process of which we are part.

Wild salmon are a political nightmare, forcing politicians to say no to all the most powerful lobbies in their court. They have to refuse the loggers eyeing the last great stands of forest along the salmon rivers, trees made huge on nitrogen from the sea carried inland by the fish. They have to say no to the miners wishing to dump tailings, and to those who would build dams, and divert and sell freshwater. They have to say no to the oilmen eyeing British Columbia waters. I think the politicians identified salmon in pens as safe haven. They could have their salmon and exploit wild salmon habitat too.

This is a "solution" with ramifications that will sever the bloodstream of this coast. Wild salmon collect the production of ocean-wide photosynthesis, then carry it up the sides of mountains. The phosphorous from pink salmon has been found in mountain goats. From the moment the salmon egg leaves its mother's body, salmon feed their surrounds. They are a river of life benefiting all blessed with their presence. While I study salmon and sea lice and understand the science, I feel salmon are sacred. We owe future generations this remarkable fish. Today I work for the salmon.

Hatchery vs. Wild Fish — What the Research Says

Here's a sampling of what the researchers conclude about differences between hatchery and wild salmonid reproductive success*:

"Hatchery steelhead spawning in the wild had markedly lower reproductive success than native wild steelhead. Wild females that spawned in 1996 produced 9 times as many adult offspring per capita as did hatchery females that spawned in the wild. Wild females that spawned in 1997 produced 42 times as many adult offspring as hatchery females. The wild steelhead population more than met replacement requirements (approximately 3.7-6.7 adult offspring were produced per female), but the hatchery steelhead were far below replacement requirements (<0.5 adults per female)."

McLean, Jennifer E., Paul Bentzen, and Thomas P. Quinn. 2003. Differential reproductive success of sympatric, naturally spawning hatchery and wild steelhead trout through the adult stage. Can. J. Aquat. Sci. 60: 433-440.

"In the 2 years of our study, summer steelhead (introduced non-native steelhead), mostly hatchery fish, made up 60% to 80% of the natural spawners in the river. Genetic results provided evidence that interbreeding between hatchery summer and wild winter steelhead was likely minor. Hatchery summer steelhead reproductive success was relatively poor. We estimated that they produced only about one-third the number of smolts per parent that wild winter steelhead produced. However, the proportions of summer natural smolts were large (33%-53% of the total naturally produced smolts in the basin) because hatchery adults predominated on the spawning grounds during our study. Very few natural origin summer steelhead adults were observed, suggesting high mortality of the naturally produced smolts following emigration. Our data support a conclusion that hatchery summer steelhead adults and their offspring contribute to wild steelhead population declines through competition for spawning and rearing habitats."

Kostow, Kathryn E., Anne R. Marshall, and Stevan R. Phelps. 2003. Naturally spawning hatchery steelhead contribute to smolt production but experience low reproductive success. Trans. Am. Fish. Soc. 132: 780-790.

"To aid in the recovery of depressed wild salmon populations, the operation of hatcheries must be changed to reduce interactions of juvenile hatchery fish with wild fish. Evidence suggests that productivity of wild populations can be reduced by the presence of large numbers of hatchery smolts in lower rivers and estuaries that attract predators. …productivity…in 12 Oregon coastal basins and two lake basins was negatively correlated with the average number of hatchery coho salmon smolts released in each basin. Alterations to hatchery programs that could encourage recovery of wild populations include (I) avoiding release of large numbers of smolts in areas with high concentrations of wild fish, (ii) decreasing the number of smolts released, and (iii) using volitional release strategy or a strategy that employs smaller release groups spread temporally."

Nickelson, Thomas. 2003. The influence of hatchery coho salmon on the productivity of wild coho salmon populations in Oregon coastal basins. Can. J. Fish. Aquat. Sci. 60: 1050-1056.

"… a spawning population comprised of equal numbers of hatchery and wild fish would produce 63% fewer recruits per spawner than one comprised entirely of wild fish. For natural populations, removal rather than addition of hatchery fish may be the most effective strategy to improve productivity and resilience."

Chilcote, Mark. 2003. Relationship between natural productivity and the frequency of wild fish in mixed spawning populations of wild and hatchery steelhead. Can. J. Fish. Aquat.. Sci. 60: 1057-1067.

"We find…that the brains of hatchery reared fish are relatively smaller in several critical measures than their wild counterparts. Our work may suggest a mechanistic basis for the observed vulnerability of hatchery fish to predation and their general low survival upon release into the wild. Our results are the first to highlight the effects of hatchery rearing on changes in brain development in fishes."

Marchetti, Michael, P. and Gabrielle A. Nevitt. 2003. Effects of hatchery rearing on brain structure of rainbow trout. Environmental Biology of Fishes 66: 9-14.

** Compiled by Bill Bakke, Native Fish Society*

California Wild Steelhead Victory (For Now)

by Steve Mashuda and Norm Ploss

— Earthjustice & Federation of Fly Fishers —

In the May 2003 issue of The Osprey, *Norm Ploss, of the Northern California Council of the Federation of Fly Fishers, described an ongoing lawsuit brought by a coalition of Central Valley, California irrigators against NOAA Fisheries arguing that resident rainbow trout and steelhead are the same, and therefore need no protection under the Endangered Species Act.*

Since that time, the court has ruled in favor of the fish, although future threats have not been entirely vanquished. In the following article Ploss, along with Eartjustice attorney Steve Mashuda, update us on the situation.

This case, previously reported in *The Osprey*, arose out of the National Marine Fisheries Service's (NMFS) listing of Central Valley California Steelhead as a Threatened species under the Endangered Species Act (ESA). The listing included all wild steelhead that move up the Sacramento River to the Merced, Tuolumne, Stanislaus, Mokelumne, Feather, Calaveras and San Joaquin rivers that flow from the Sierra high country through California's Central Valley.

The plaintiffs, Modesto Irrigation District and several other irrigation districts, filed a complaint in United States District Court for the Eastern District of California [Fresno, California] alleging a violation of the ESA. Their argument: NMFS was wrong to list only naturally spawning (i.e.. "wild") anadromous steelhead populations while excluding hatchery steelhead and resident rainbow trout.

Earthjustice represented seven groups as intervenors on behalf of wild steelhead protection, including Northern California Council of the Federation of Fly Fishers, Federation of Fly Fishers, Delta Fly Fishers, Trout Unlimited, Center for Biological Diversity, Woodbridge Rivers Company, and Pacific Rivers Council.

In March of 1998 NMFS issued a rule protecting wild Central Valley steelhead as an Evolutionarily Significant Unit ("ESU") under the ESA. NMFS made two sets of decisions when listing this ESU. First, the agency asked whether any hatchery steelhead might be useful for conservation of wild runs in the future. It answered this question in the affirmative for steelhead produced at hatcheries in the Coleman and Feather Rivers and included these fish in the Central Valley steelhead ESU. Because these fish were not immediately essential for recovery, however, NMFS excluded them from the population it listed. Next, NMFS asked whether resident rainbow trout in the Central Valley were similar enough to their sea-going cousins to include within the ESU. NMFS lacked any specific information about rainbow trout populations in the Central Valley and, on that basis, excluded them from the listing.

Modesto Irrigation District had two primary claims in this case. First, Modesto argued that NMFS violated the ESA when it included hatchery steelhead in the ESU, but failed to include them in the listing. This claim was based on the Alsea Valley decision (See *The Osprey*, May 2004), which found that NMFS violated the law by including hatchery coho salmon in the ESU, but failed to consider them in the listing. Since the Alsea Valley ruling, NMFS has issued a draft hatchery policy and new proposed listing rules to address the problem.

In a slight variation on this theme, Modesto's second claim in this case was that resident rainbow trout and steelhead are always the same and must either be listed together, or not at all. Modesto claimed that once NMFS found that resident rainbow trout and steelhead could, in some cases, in some streams, be part of the same ESU, they must be lumped into the ESU and be considered for listing together. Modesto's argument rested on its belief that if the agency "counted" resident rainbow trout, it would find them numerous enough to justify stripping protections from wild steelhead.

Irrigation interests brought the lawsuit against NOAA Fisheries. Photograph by Jim Yuskavitch

Oral Argument and the Judge's Final Order

U.S. District Judge Oliver W. Wanger held oral arguments in the case on Monday, April 12, 2004. The Judge began the argument by noting that both the government and Modesto agreed that NMFS was wrong not to consider those hatchery fish that it included in the ESU when it listed Central Valley steelhead. Although the fishing and conservation groups argued that NMFS' decision not to list hatchery fish was defensible and that Alsea Valley was wrongly decided, the Court focused instead on whether the listing should stay in place during the period that the existing ruling would be remanded to NMFS.

Earthjustice received excellent airtime with the judge and argued that

Continued on next page ➢

Continued from previous page

NMFS acted properly in excluding hatchery fish from the listing because hatchery fish pose a threat to wild fish (by competing for food and space, spreading disease and interbreeding) and because the ESA is intended to conserve and recover self-sustaining populations of listed species in their native ecosystems. For the rainbow/steelhead claim, Earthjustice argued the agency actually never made a finding that rainbow trout and steelhead in the Central Valley were "the same" and should be listed together. The agency did find that while this can be true under some circumstances, they did not have enough site-specific information to determine whether it had happened here. Finally, our attorney argued that, even if the Court ruled for Modesto, the listing should stay in place during a remand to the agency to prevent harm to wild steelhead.

Although Modesto's attorneys attempted to argue their claim that resident rainbow trout should have been counted in the listing, the Court noted that they did not include any scientific evidence with their court papers and noted that NMFS had stressed the importance of the anadromous life history for steelhead survival. The judge ended the discussion by telling Modesto that if they had evidence showing that rainbow trout in the Central Valley were identical to steelhead, they should submit it to NMFS during its status review and the agency would be required either to accept it, or explain why it disagreed in its new listing rule.

Federal Court Keeps Protections in Place for Wild Steelhead Pending NMFS Review

On May 12, 2004, U.S. District Court Judge Wanger issued a ruling that rejected Modesto's attempts to strip protected status from wild Central Valley steelhead trout. While deferring to NMFS' on-going review of the fish's status, the Court ruled that wild steelhead would remain federally protected during the time it takes to complete that process. The Court found that "the scientific evidence … indicates that the fish faces serious and irreparable harm if removed from the list and that, given its numbers, its listing is likely to be preserved after the review and update."

(1) First, the bad news. The Court ruled that NMFS was wrong to put hatchery fish in the Central Valley steelhead ESU, but then list only the wild fish (the same legal result as the Alsea Valley ruling). The Court's reasoning was based largely on the fact that NMFS admitted that it committed the same error in the Central Valley steelhead listing and was addressing that error in its status review.

The Court noted that NMFS stressed the importance of the anadromous life history for steelhead survival.

(2) The Court rejected Modesto's claims that NMFS made the same Alsea-style mistake in its treatment of resident rainbow trout and anadromous steelhead. The Judge agreed with our argument that in this listing NMFS did not find that rainbow and steelhead trout are always part of the same ESU, but that such determinations must be made on a case-by-case basis. NMFS did not have enough information to make that determination for the Central Valley.

(3) The Court left the listing in place until July 11, 2005. If NMFS does not finish a final listing by that date, the agency must show cause for the delay or the judge will set the listing aside at that point. In the meantime, the Court prohibited NMFS from enforcing the listing in a specific Federal Energy Regulatory Committee proceeding involving these irrigators, but for all other purposes the listing remains in full effect.

The Future of Central Valley Wild Steelhead

In June 2004, NMFS issued its proposed rule and request for comments "Endangered and Threatened Species: Proposed Listing Determinations for 27 ESU's of West Coast Salmonids." The rule proposed listing four salmon and steelhead ESU's as Endangered and 23 as Threatened." The Central Valley Steelhead ESU was proposed to remain listed as Threatened.

"We need wild steelhead in the Central Valley's rivers," said Steve Mashuda, an attorney with Earthjustice. "Because the Endangered Species Act was designed to protect habitat for wild fish — not concrete pools for man-made steelhead, we will use every tool we have to ensure that the wild fish will remain protected."

Scientists believe that wild steelhead are special and must be protected. Wild steelhead have higher survival and reproductive success and are more genetically diverse than their hatchery counterparts. Even in those streams that steelhead share with their resident rainbow trout cousins, steelhead constitute a critical part of the evolutionary legacy — and the future survival — of the species, providing a buffer against catastrophic natural and human-caused events and ensuring genetic diversity. In the Central Valley, wild sea-run steelhead are the last survivors of a once-enormous population.

"It's now up to NMFS to follow the science and continue to protect wild steelhead," said Kaitlin Lovell of Trout Unlimited. "Steelhead in the Central Valley have been lost from 95 percent of their historic habitat, and they continue to face threats from unchecked water use, blockage by dams, urban sprawl, and polluted rivers. The bottom line is this: Without adequate ESA protection, steelhead recovery simply won't stand a chance."

NMFS has just extended the comment period for its proposed listing of Central Valley steelhead as a threatened species to October 20, 2004. Interested parties and individuals can e-mail comments to: salmon.nwr@noaa.gov, or mail them to Chief, NMFS, Protected Resources Division, 525 NE Oregon Street, Suite 500, Portland, Oregon, 97232–2737. NMFS asks that commentors identify the comment as regarding the "Proposed Listing Determinations."

Skagit Steelhead Revisited

by Bill McMillan

— Sedro-Woolley, Washington —

This article by Bill McMillan is a response to Washington Department of Fish and Wildlife fish biologist Curt Kraemer to McMillan's paper on the Skagit River published in the September 2003 issue of The Osprey. *With the publication of McMillan's response, the editors intend to let this subject lie for a awhile, then revisit the issue to see what has transpired on the Skagit in the interim.*

Regarding Curt Kraemer's response to my September 2003 article in *The Osprey*, "Skagit River Winter Steelhead, Their Past, Present and Future": Kraemer makes two primary assertions: (1) the post-Boldt punchcard bias factor needs to be applied to reduce the sport catch data of the 1940s and 1950s; and (2) the catch data of the 1940s indicate that early wild steelhead numbers were also very low, and comparable to today.

Regarding (1):

Where is the truth regarding the Skagit? In a recent response to the Draft EIS for the Lower Skagit River Steelhead Acclimation and Rearing Facility, which I drafted for Washington Trout , I found that the most complete 56 year record of steelhead harvest and hatchery smolt releases came from information in the 1994 Grandy Creek Steelhead Hatchery Final EIS Appendices (containing Skagit steelhead data back to 1948), combined with the more recent 2004 DEIS (containing Skagit steelhead data from 1978-2003). This is information intended for the legal obligations of court examination under oath. It is probably as close to "truth" as is possible .

I chose the 1953/54 data for my baseline of what historic steelhead numbers may have been in my 2003 Skagit steelhead article because it was prior to WDG's major commitment of resources to hatchery steelhead programs. The 2004 DEIS defines the "mid-1960s" as the initiation of the Skagit hatchery steelhead program, although the actual hatchery smolt release record begins in 1960 with corresponding adult returns in 1962.

The year 1962 was an important date in Washington steelhead history. In Loyd Royal's 1972 report, An Examination of the Anadromous Trout Program of the Washington State Game Department (page 10): "... for the period 1962-69 the average number of fishermen actually fishing for steelhead increased 63 percent over that for the period 1954-1961." He attributes increases in numbers of fishermen to the hatchery steelhead returns.

Royal also notes that any changes in determining catch from punchcard data would alter the historical statistical value (page 8), "... the consistency of any inherent error depends upon the maintenance of the same system of operation. A modification of the system can upset the relationship of the resulting statistics with those of previous years. It is possible that a new reaction on the part of the public could result in a major error in calculation."

The pre-hatchery era and the post-hatchery era had significant differences in participating steelhead anglers. Also, after the 1974 Boldt Decision a new method of determining catch form punchcard data was used. It would seem erroneous to use post-Boldt catch determinations as statistically relevant to the very different era of the 1940s and 1950s. WDFW apparently agrees with this when it comes down to legally defensible numbers necessary to pass courtroom scrutiny. The 1994 Grandy Creek Hatchery FEIS used exactly the same 1953/54 catch data as I did in the article, not Curt Kraemer's assertion that post-Boldt criteria should have been used. In the 1994 FEIS, all of the years prior to 1960-62 retain the original catch data, while after that point the Boldt period bias factor has been applied.

Regarding (2):

Mr. Kraemer well knows the low catches on the Skagit beginning with the first year of punchcards in 1947/48 through the early 1950s reflected very low angler numbers. Again, the Royal report substantiates this: steelhead fishermen increased 63 percent in the period 1962-69 as compared to 1954-1961. Fishermen were undoubtedly even fewer prior to 1954. Steelhead fishing was not yet popular. Fishermen were more interested in the lure of 50-pound tyees mooched from Puget Sound than in the difficulties of catching 10- to 15-pound steelhead in rivers with the primitive tackle of that era. The steadily building catch from 1947/48 to 1953/54 had nothing to do with lack of steelhead in the Skagit. It was due to the lack of steelhead anglers to harvest them. While steelhead numbers were undoubtedly variable on the Skagit prior to the hatchery program, the data also suggest they were far less variable than what has occurred since the late 1960s.

Regarding an examination of the expanding hatchery steelhead program on the Skagit for the 2004 DEIS comments, a very disturbing pattern became evident which further confirmed the accuracy of the 2003 article in *The Osprey*: The larger the smolt numbers released the fewer the steelhead that returned to the Skagit — not only wild, but hatchery fish as well. Seeing this data stimulated Nate Mantua, Ph.D., from the University of Washington, to create several graphs to illustrate this. In one graph, it is clear that in the 1970s the rising pattern of hatchery smolts crossed with the descending line of steelhead harvested. Another graph plots the strong negative association between numbers of hatchery smolts released and total steelhead runsize. [*Editor's Note: Readers interested in seeing these graphs may request copies by e-mailing The Osprey at jyusk@bendcable.com.*] These were but two of 20 tables, graphs and plots created by Nate Mantua, Steve Conroy and myself as part of the disturbing information included with the Washington Trout comments on the 2004 Lower Skagit DEIS.

Chair's Corner,
Continued from page 3

trout had a steelhead mother (one or both might have been 'residual steelhead')." He concludes: "I'm all for applying the most modern techniques to fisheries problems, but let us not forget history and the past mistakes that created today's problems."

Dr. Behnke restated this line of thinking in many of the same words at the August 2004 meeting of the Federation of Fly Fishers Conservation Committee. He made clear his support for placing the sea-run and resident forms in separate ESUs.

This is one scientific underpinning for the ESA separation of sea-run and resident rainbow trout. Because it is so critical to ESA protection and recovery of steelhead, we hope to bring more scientific focus, including newly emergent studies, to this question in future issues of *The Osprey*.

The use of separate "distinct population segments" under the ESA could find no more perfect fit than in separation of sea-run steelhead from resident rainbow trout in listing determinations. Kathryn Kostow of the Oregon Department of Fish and Wildlife in her report on genetic analysis of the sea-run and resident forms in the Columbia Basin acknowledged the danger of lumping steelhead and resident rainbows together and thereby removing ESA protection from steelhead: "However, it is uncertain that steelhead in these ESUs would persist into the future without the protections provided by the ESA. The loss of the steelhead life history would represent a significant, and possibly irreversible, change in the character of the ESUs. The steelhead phenotype is distinctive from trout and both life histories are an important component of the species."

With a combination of some scientific uncertainty and the clear dangers of delisting steelhead populations from the ESA, NOAA Fisheries ought to be compelled to act with the conservatism required by the ESA. Only time will tell if the agency does.

This discussion leaves untouched for now the government organizational question of whether NOAA Fisheries (currently responsible only for the sea-run life history) can arbitrarily take over responsibility for resident rainbow trout, currently under the purview of the U.S. Fish and Wildlife Service.

Dr. Robert Behnke with an Upper Klamath Lake, Oregon rainbow trout. Is this resident fish identical to its ocean-going form? Scientists and fish advocates say emphatically — no! Photograph by Jim Yuskavitch

The public comment period on the NOAA policy changes is currently scheduled to end on October 20, 2004. Every angler/conservationist who cares about steelhead should support in writing: (1) keeping sea-run steelhead and resident rainbow trout in separate ESUs; and (2) keeping wild and hatchery steelhead in separate ESUs.

Letters should be mailed by October 15, 2004 to:

Donna Darm
Chief
Protected Resources Division
NOAA Fisheries
525 NE Oregon St.
Portland, OR 97232

Or e-mailed to:
salmon.nwr@noaa.gov.

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