THE OSPREY

A Newsletter Published by the Steelhead Committee
Federation of Fly Fishers

FEDERATION OF FLY FISHERS
FFF
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Dedicated to the Preservation of Wild Steelhead • Issue No. 45 • MAY 2003

Rising in Defense of California Central Valley Wild Steelhead

by Norm Ploss

— Northern California Council, Federation of Fly Fishers —

This month's cover story describes a serious challenge to the preservation of wild steelhead in the rivers of California's Central Valley. In this instance, a coalition of irrigators has brought a lawsuit against NOAA Fisheries claiming that not only should wild and hatchery steelhead be considered the same, but resident rainbow trout she be lumped in as well; therefore, none should qualifiy for protection under the Endangered Species Act.

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Imagine a web of rivers and tributaries feeding two great rivers: The Sacramento in the north Central Valley and the San Joaquin in the south Central Valley. The two meet in the confluence known as the San Francisco Bay-Delta. From the confluence it is less than a 50-mile swim to the Golden Gate Bridge and the Pacific Ocean.

Great rivers feed both systems. Our interest here is four rivers of the San Joaquin drainage. The western slope of California's Sierra Nevada range sheds snowpack runoff onto national forest, national park and other lands feeding the Merced, Tuolumne, Stanislaus and Calaveras rivers. These rivers generally flow westerly and meet the mainstem of the San Joaquin, which flows northward to the Bay-Delta. The once mighty San Joaquin is so long its headwaters lie on the eastern slope of the Sierras at Devil's Post Pile National Monument, accessible by U.S. Highway 395.

> *The decline of wild steelhead stocks in the Central Valley is horrific. Some 85 percent of the habitat is blocked by dams.*

Ocean going steelhead enter the Golden Gate, then head up the Bay Delta; Those bound for the Merced, Tuolumne, Stanislaus and Calaveras rivers turn right, looking for passage up the San Joaquin to their natal streams. Steelhead likely used to travel far up these streams to the forests — even to the gates of Yosemite National Park. The size of runs in these rivers will never be truly known, but given the miles of streams and tributaries, and the tenacity of the species to survive, our imagination needs little help envisioning clear pools filled with fish.

Today, when the California Department of Fish and Game presents a map of the steelhead's range within the state, it questions their existence in this region. That they still exist is not in doubt to sport fishers. Federation of Fly Fishers (FFF) members have caught and photographed large, aggressive fish, believed to be steelhead, within the

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FROM THE PERCH — EDITOR'S MESSAGE

Fish Justice

by Jim Yuskavitch

In a perfect world, all parties in a dispute would sit down at the table and talk out their differences, see eye to eye, then walk away, problem solved to everyone's satisfaction. Sometimes that consensus approach actually does work, even in the imperfect world of salmon and steelhead conservation. But more often than not, those who don't care whether there is a place on the planet for wild fish play hardball — so we must play their game, too.

That usually means bringing in that special group of attorneys who work to uphold the nation's environmental laws that protect our wildlands, waters, fish and wildlife — even though their labors earn them considerably less income than they would in the corporate world. In spite of the legions of dedicated activists and ordinary citizens volunteering their time and energy to protect all facets of our environment, the natural landscape of the U.S. would much poorer without this group of specialists.

While there are many environmental attorneys fighting the good fight throughout the country, one group especially stands out, particularly for wild fish advocates — Earthjustice Legal Defense Fund.

Founded in 1971 as the Sierra Club Legal Defense Fund (they changed the name to Earthjustice in 1997), it's headquartered in Oakland, California, with satellite offices in Juneau, Alaska, Denver, Colorado, Tallahassee, Florida, Honolulu, Hawaii, Bozeman, Montana, Seattle, Washington and Washington, D.C.

To date, they have offered legal services to more than 600 clients, charging only for administrative costs, ranging from preserving desert ecosystems to protecting old-growth forests, and just about everything else in between.

Here in the steelhead and salmon country of the West, Earthjustice's footprint looms as large as Bigfoot's.

Their legal work for wild fish here includes lawsuits to protect coho salmon from logging, defend the ESA listings and critical habitat for coho and chinook salmon, protect steelhead and salmon from pesticides and to provide adequate amounts of water for fish in the Klamath basin.

The group's most recent legal victory for wild steelhead and salmon came on May 7 when a federal judge ruled that the federal government's plan to recovery Columbia/Snake river system salmon and steelhead was inadequate.

But the battles are far from over, and in these times the attorneys and support staff at Earthjustice seem as important to the survival of our wild fish as water.

To learn more about Earthjustice, their work and how you can help, visit their website at www.earthjustice.org.

Letters to the Editor

Supporting Diversity

Dear Editor:

The Columbia Basin Fly Casters is a Federation of Fly Fishers affiliated organization representing approximately 160 fly fishing enthusiasts in the Columbia Basin. Our membership is comprised of fishers young and old, women and men, beginners and experts and all ranges in between. We are dedicated to the sport of fly fishing and to preserving and enhancing the fish, waters and habitat that make fishing possible.

In our view, it is important that *The Osprey* maintain a balanced approach when reporting on salmon and steelhead issues. This means reporting on good science and avoiding rhetoric that does nothing more than create animosity and hard feelings among parties that are truly working towards solutions from which we all benefit. We hope that you will publish articles and opinions from those entities that we may find threatening our objectives as well as those that support our objectives. Only by understanding the views and needs of others can we work collaboratively to enhance salmon and steelhead populations.

Don Barnes
President
Columbia Basin Fly Casters
Richland, Wash.

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The Osprey is a publication of The Federation of Fly Fishers and is published three times a year.

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The Federation of Fly Fishers is a unique non-profit organization concerned with sport fishing and fisheries

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

RIVERS, WATER, STEELHEAD AND DAMS

by Bill Redman

— Steelhead Committee —

I've been reflecting a lot lately about how water flows, in-river migration, and transportation by barge or truck affect the success of the critical downstream migration of juvenile steelhead and salmon through the Columbia River basin hydro system.

Two sets of events have encouraged this thinking.

Pressures to Reduce Flows

The first is the continuing and seemingly increasing pressures to reduce the amount of water available to assist the juvenile fish in their downstream migrations. These pressures have at least three recent sources.

1. Since last fall, the Northwest Power and Conservation Council (formerly the Northwest Power Planning Council) has been running a proposal through the approval process to provide more of the available water for winter power generation and less for the spring and summer downstream smolt migration. This draft amendment to the river's operations plan seemed headed for approval in the early spring of this year, with most of the Council's members supporting it. It runs counter to the requirements for flow augmentation called for in the NOAA Fisheries (formerly National Marine Fisheries Service) Biological Opinion for the 12 Threatened and Endangered groups of stocks of Columbia and Snake rivers steelhead and salmon, as well as the advice of the Power Council's own Independent Scientific Advisory Board (ISAB) report of February 10, 2003, which indicated reduced survival when flow targets are not met. In the face of the advice of its own scientific advisory body, Council members have argued that the science in support of additional flow is uncertain. But, as the Portland Oregonian wrote on December 12, 2002, "the burden of proof sits not with those arguing that fish need water, but those who insist otherwise."

2. In November 2002, the Washington Department of Ecology (WDOE) issued rights to the cities of Pasco, Kennewick, Richland and West Richland for 178,000 cubic feet per second of Columbia River water. In addition, hundreds of water withdrawal applications await action by WDOE, but there is very little agreement on stream flow requirements for steelhead and salmon. To us the evidence increasingly is that the river is over appropriated. Some offsetting good news is that WDOE recently acquired two large water rights in the Yakima River Basin from PacificCorp and irrigators. Even better news is that the National Research Council of the National Academy of Sciences, at the request of WDOE, has selected 13 scientists to complete a "review of the available science surrounding salmon survival and the impacts of hydropower resources as well as municipal and irrigation water diversion in the Columbia Basin." The study will review knowledge of conditions that impact fish survival rates at critical stages of their lives under a variety of water use scenarios. We look forward to this report, due out in the spring of 2004.

The techno solution will replace the river's natural rhythm. This can not be good for the long term future of steelhead runs.

3. The Bonneville Power Administration — under pressure from utilities, industrial power users, and irrigators — continues to divert as little water as possible from power production and irrigation to flows that benefit juvenile fish in their downstream migrations. These pressures are magnified by BPA's financial problems, which result in part from the residual pricing chaos of 200l. Therefore, BPA has been working with the Power Council to reduce 2003 fish and wildlife expenditures by $40 million. Add to that a forecast of below normal snow pack and resulting Columbia water flow in 2003, and the short term environment for the fish looks very discouraging. Looking farther out, the likely impact of global warming on future snow packs paints a gloomy picture indeed.

In summary, the pressures to divert water away from the needs of the fish are relentless and increasing.

Adult Returns

The other information to consider is the returns of adult steelhead to the Columbia system, especially the Snake, in 2001 and 2002. Beginning in the late 1990s and through 2000, the Columbia/Snake steelhead returns increased dramatically as compared to the dismal returns of the early and mid-1990s, due to a combination of strong river flows to move the migrating juvenile fish downstream and hospitable ocean conditions.

To understand what follows, the reader needs to understand that the Columbia system is home to two strains of steelhead, "A" run and "B" run fish. The A run adults tend to be smaller than the B runs, mostly four to eight pounds, migrate upstream earlier in the summer/fall than B runs and are present in most of the tributaries of the system with access to the ocean. A runs are primarily "one salt" fish, meaning the smolts that migrate downstream to the ocean in the spring of one year return as adults in the late summer and fall of the following year, spending one year or a little longer in the ocean.

B runs are mostly "two salt" fish from the Clearwater and Salmon rivers

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Central Valley Steelhead, Continued from page 1

last three years. Laboratory analysis of dead fish found in the Calaveras River confirmed they were steelhead. NOAA Fisheries agrees – it listed these wild steelhead runs as Threatened under the Endangered Species Act in 1998.

The decline of wild steelhead stocks suffered in the Central Valley is horrific. Approximately 85 percent of native habitat has been placed out of reach by dams, combined with excessively high temperatures and low flows during critical periods. Of all of California's irrigated acreage, 25 percent is located in the six-county region encompassing Fresno, Kings, Madera, Mariposa, Merced and Tulare counties. This represents a significant portion of the watersheds in question. In perspective, this is two million acres or 3125 square miles of irrigation. Add to that thousands of miles of roads and urbanized areas. As Rob Ferroggiaro, Conservation Vice President of FFF's Northern California Council, noted, "these plaintiffs [irrigators] operate on the very same San Joaquin River system on which there was no need to list Chinook salmon under the ESA...because they were already extinct." Indeed, according to a report released in late February, scientists for the National Oceanic and Atmospheric Administration (formerly the National Marine Fisheries Service, now known as NOAA Fisheries) indicated that they are "highly concerned" that current Central Valley steelhead population trends show a continuation of that historic decline.

The Lawsuit

In December 2002, a group of Central San Joaquin Valley California irrigators filed suit against NOAA Fisheries challenging the listing of the Central Valley California steelhead Evolutionarily Significant Unit (ESU) as Threatened under the Endangered Species Act (ESA). The plaintiffs include the Modesto, Turlock, Merced, Oakdale and South San Joaquin irrigation districts, and the Stockton East Water District. [Editor's Note: Evolutionarily Significant Units have been identified by NOAA Fisheries throughout the range of Pacific salmon and steelhead based on the presence of distinct population segments of fish that generally do not breed with fish from other river basins.]

When NOAA Fisheries did its study of the Central Valley California steelhead and issued its listing in 1998, it included hatchery as well as wild steelhead in the ESU. It also included resident rainbow trout (same species as steelhead) as well as migratory steelhead in the ESU. However, it listed only the wild migratory steelhead as Threatened under the ESA. The plaintiffs claim that, under the ESA, the entire ESU, including hatchery steelhead and resident rainbows, must be listed as threatened if the wild steelhead is so listed. The real motivation behind this action, of course, is to have the judge (and NOAA Fisheries) conclude that, because there are significant numbers of hatchery steelhead and/or resident rainbows in the ESU, the Threatened listing is not justified and the ESU should be de-listed, regardless of how few wild steelhead may be present. The plaintiffs claim that the listing is unjustified and does them harm by limiting their ability to withdraw water for irrigation. The case will hinge on: (1) How the judge rules on NOAA Fisheries' right to list only part of an ESU; and/or (2) Whether the judge thinks that including only wild migratory fish in an ESU fits the ESA definition of a "distinct population segment."

NOAA Fisheries is highly concerned that Central Valley steelhead population trends show continued decline.

In an article published in the Stockton Record newspaper on July 23, 2002, reporter Audrey Cooper wrote: "The steelhead has been a headache for most of the water districts, in part because the fish have been found in the rivers that bring water to the districts. Steelhead protections can change how much water the irrigation districts are allowed to take out of the rivers or even when upstream dams can release water. The special protection also could affect how much water must be released in order to get the river water cold enough to encourage spawning."

Irrigators' Strategy

Cooper's Stockton Record article summarized the irrigators' point succinctly. "The ……. two main reasons why the districts believe steelhead should not be considered a threatened species: only naturally spawning fish are considered threatened, but hatchery-born fish aren't considered; and federal officials only listed so-called anadromous steelhead, which head to the ocean for part of their lives. It didn't list the non-anadromous rainbow trout, although the two fish are the same species.

"'What happens, of course, if they're forced to do that, is that most rainbow trout are too abundant to be listed,' Stockton East Water District attorney Jeanne Zolezzi said."

The Record Article continues: "The water districts' complaint stems from (the) decision from a federal judge in Oregon. In that September 2001 case, U.S. District Judge Michael Hogan ruled it didn't make sense for the government to list wild coho salmon as threatened under the Endangered Species Act while not affording the same protection to hatchery fish."

The Threat to Wild Steelhead if the Irrigators Prevail

So why intervene when NOAA Fisheries is the defendant and should carry out its defense? The sad recent record is that NOAA Fisheries has not been taking a firm line in defense of the fish. In the Oregon coastal coho de-listing case, NOAA Fisheries elected not to appeal Judge Hogan's decision that, if wild and hatchery coho are in the same ESU, the wild cannot be listed without listing the hatchery. That left it to a group of conservation and fishing organizations to appeal.

In another situation, NOAA Fisheries settled out of court with a group of plaintiffs who had challenged

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19 critical habitat designations by removing those designations, at least temporarily.

Also, NOAA Fisheries recently announced in the Federal Register that it would be reviewing the question of whether resident rainbow trout would be a factor in all ten steelhead ESU's listed under the ESA. We simply cannot count on NOAA Fisheries to defend the wild fish competently and aggressively.

In the Central Valley California steelhead case, the wild/hatchery issue is a replay of the Oregon Coastal coho case now on appeal and critically important. In contrast, the migratory/resident issue is a new and serious threat to wild steelhead protection under the ESA, and so this case will be precedent setting and, therefore, even more important for this reason.

Off to Court in Fresno – Fish Advocates Weigh In

A coalition of seven conservation and fishermen's organizations asked a federal judge in Fresno to hear their side of the story in this lawsuit. Those groups are the Northern California Council of the Federation of Fly Fishers (NCCFFF), Federation of Fly Fishers, Delta Fly Fishers, Trout Unlimited, Center for Biological Diversity, Woodbridge River Company and Pacific Rivers Council.

"The irrigation districts are pushing junk science to advance an agenda that spells the elimination of these fish from the Central Valley," said Jeff Miller, with the Center for Biological Diversity. "Their position is unsupported by science, the law, and common sense. The best science shows that hatchery fish are not only different, but that they harm wild steelhead by introducing disease, changing genetics, and competing for scarce resources. Man-made mutant fish shouldn't be counted towards total wild steelhead population numbers, when in fact they are a major threat to the species."

"People need to realize the steelhead are like a canary in a coal mine. When our rivers won't support them any longer there's something terribly wrong," said Kaitlin Lovell of Trout Unlimited. "We're getting into this lawsuit to bring a little common sense and balance back to the table; two things in very short supply, when the pave-and-plough groups are allowed to run roughshod."

The plaintiffs are in the backyard waters of many members of the NCCFFF and FFF. NCCFFF has a history of advocacy for steelhead in these rivers. The Northern California Council was party to a complaint against Stockton East and the Bureau of Reclamation because of a fish kill that resulted from low flow/high temperature events below a dam. NOAA Fisheries consultations required of the Stockton East Water District were due, in part, to this complaint. NCCFFF also submitted a letter of complaint after a fish kill on the Tuolumne River. Stockton East and the other diverters would love to be relieved of their stewardship responsibilities for steelhead.

Why intervene when NOAA Fisheries is the defendant? The sad recent record is that it has not been taking a firm line in defense of the fish.

"As several people have pointed out, this suit is of grave concern because of its potential far-reaching impact. It could have broad implications, not only in California," said Rob Ferroggiaro in one of his many messages on this subject.

The case is the latest in a concerted effort by developers, irrigation and agribusiness interests, and others to strip Endangered Species Act protections from salmon and steelhead stocks up and down the Pacific coast following the controversial Hogan decision. That ruling found that artificially bred hatchery fish should be considered along with their wild cousins when decisions are made regarding ESA protections.

The coalition of conservation and angler groups intends to present arguments on the side of NOAA Fisheries, the defendants in this case, to ensure that needed wild steelhead restoration efforts continue. Based on the pattern of "sue and settle" described above, the groups worry that the Bush Administration will not mount a vigorous defense of wild Central Valley steelhead on its own.

The Science

California Department of Fish and Game has published documents based on limited studies that suggest that rainbows and steelhead could be considered the same species in some California watersheds. In fact, for this reason they have argued that steelhead restoration efforts should be expanded to consider river reaches above dams in some cases. However, the science does not support what the irrigators suggest — that NOAA Fisheries must apply a one-size-fits-all rule that rainbow trout and steelhead are, in every watershed, the same.

Even though the two fish are one species, there are compelling arguments in favor of continued ESA protection. First, study data is limited and by all accounts, may not be conclusive for all streams. Second, even if the science was conclusive, native rainbow populations aren't adequate in many places in California. Finally, the anadromous portion of the population is essential to the long-term viability of the species in light of extreme habitat variability. Historically, the anadromous fish have been essential for survival of natural disasters like drought and fire. In southern California, where steelhead have been hardest hit, rivers with no steelhead also have no rainbow trout.

Resident rainbows and migratory steelhead are distinctly different in life histories and other characteristics. For those of us who fish for and study steelhead, hatchery and wild fish are also very distinct in many ways, especially in ability to cope and spawn successfully in the wild.

The science is clear. The future of steelhead is dependent on the wild anadromous stocks. To lose on this case will remove a legal cornerstone of ESA protection for these marvelous and beleaguered fish.

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The End of the Beginning (and Next Steps)

On Monday, March 31 the seven groups filed their motion to intervene in this case. The government does not oppose the intervention, but the irrigation districts have opposed our entry into the case. After a short oral argument by Earthjustice attorneys on May 5, the groups were granted intervenor status. In a related development, NOAA Fisheries has also moved to dismiss the irrigators' case or to call a "time out" in briefing the case until after the agency finishes its recently announced review of West Coast steelhead listings.

What concerns fish advocates is that NOAA Fisheries may try and reach a settlement, including suspension of the ESA listing.

A steelheader casts his fly in the waters of the Yuba River in California's Central Valley. Photo by Nathan Joyner

Perhaps what worries the groups the most, however, is that NOAA Fisheries may try to reach a settlement. (This may depend somewhat on what transpires with the current review of steelhead listings.) The settlement could include anything, including suspension of the listing. If there is an attempt at a settlement, the groups should have standing in the case to insure NOAA Fisheries knows the public is concerned and to formally object to a settlement that is not in the best interests of the fish.

The conservation and fishing groups are conscious of the possible precedent if there is an adverse ruling. In this case, however, others are initiating the action. The suit will proceed to trial or settlement whether or not the groups intervened. Rob Ferroggiaro observed: "If we intervene, we have options in front of us. If we don't, then we will have to be silent."

Earthjustice represents the groups in the suit. "We've seen this same legal claim by other interests that want to ignore the problems facing these runs and turn back the clock on protection for these fish," said Steve Mashuda of Earthjustice. "Instead what we need, and what the law requires, are sustainable populations of wild steelhead in these rivers. That's the side of the story that we'll be making sure the court hears from us."

The lion's share of water in the West is used by agriculture. Photo by Jim Yuskavitch

Dispelling Some Myths About Hatcheries

by Robin S. Waples
— NOAA Fisheries —

That fish hatcheries are controversial is certainly not news to the readers of these pages. One of the reasons that makes these "fish factories" so polarizing among anglers, fishery managers, biologists and conservationists are the many myths and misconceptions that color peoples' views of what hatcheries are and what they are capable and not capable of doing.

In this article, Robin Waples, Director of NOAA Fisheries Conservation Biology Division, outlines some of the widely-held myths about hatcheries and suggests solutions for making the hatchery debate more productive. This article has been condensed from a longer paper first published in the February 1999 issue of Fisheries.

An error is the more dangerous the more truth it contains.

Henri-Frédéric Amiel, Journal Intime 1883

Misconceptions or myths about hatcheries impede productive dialogue among those with differing views about hatcheries. As is generally the case, most of these myths include a measure of truth — in some cases, quite a bit of truth. This makes it all the more difficult to recognize the elements that aren't true, and this factor has contributed to the present state of affairs, in which opposing sides are strongly entrenched in their own views of hatchery reality. The myths can be phrased in a variety of ways, but each has been expressed more or less as stated here by some biologists, fish culturists, fisheries managers, journalists, or other interested parties.

Myth 1: Hatcheries are inherently bad (or inherently good).

Neither of these positions leads to productive dialogue, nor is either supported by a thoughtful consideration of the issue. Fish hatcheries are tools managers can use to accomplish certain goals, and the value of a hatchery program can only be determined in the context of these objectives. A program that is well suited to achieve one type of goal (for example, harvest augmentation) might fail to achieve another (sustainability of natural populations). Unless goals are clearly articulated and agreed on by the various parties involved, there is little hope that arguments about the program's merits will be constructive. In my experience, both lack of clarity about goals and lack of agreement regarding goals are common to hatchery programs.

> *We are unaware of rigorous research designed to detect genetic impacts of hatchery fish that has failed to find them.*

A related issue is the concept of identifying "appropriate" uses for artificial propagation, with appropriateness evaluated with respect to the goals of the program. This is fine as far as it goes; the danger is that, once an appropriate goal is identified, scrutiny of the program often relaxes. This is an example of the misconception that "If a program has a worthy goal, it must be beneficial." Clear goals are essential to adaptive management, but they are not enough; hatchery programs must be evaluated rigorously as part of an ongoing process to determine whether they are, in fact, achieving their goals and not compromising other worthy goals.

Myth 2: Risks posed by hatcheries can be avoided with better management.

This myth contains a good deal of truth. Considerable improvements have been (and continue to be) made in both fish culture and fisheries management, including better broodstock collection and mating protocols, more-natural rearing conditions, wild-fish-friendly release strategies, and more focus on local broodstocks (Kapuscinski and Miller 1993; Maynard et al. 1995). There is no question that these changes can help reduce opportunities for direct and indirect effects on natural fish populations; the myth is that these changes will make the problems disappear altogether. This is an illusion for two reasons: (1) genetic changes in cultured populations cannot be avoided entirely; and (2) many risks are negatively correlated, so efforts to reduce one risk simultaneously increase another.

Genetic Changes

Genetic changes in hatchery populations are associated with the terms domestication and domestication selection. Domestication thus describes a state or condition of a population and can be contrasted with the term domestication selection, which refers to a process that leads to domestication.

Campton (1995) identified three factors that lead to genetic change in cultured populations: (1) intentional or "artificial" selection for a desired trait (such as growth rate or adult body size); (2) selection resulting from nonrandom sampling of broodstock; and (3) unintentional or "natural" selection that occurs in the hatchery environment. Campton used the term "artificial selection" (selection due primarily to humans) to distinguish factors (1) and (2) from factor (3), which is the only one he considered to represent domestication selection.

I would go further and identify a fourth component of domestication selection: (4) temporary relaxation during the culture phase of selection that otherwise would occur in the wild. Temporary relaxation of selection may not lead to genetic change within the hatchery population, but it does lead to genetic change compared with the natural population, which typically will experience high mortality (some ran-

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dom deaths, but others selectively mediated) in the early life history phases.

Although it may be possible to eliminate intentional selection from hatchery programs, it generally will not be possible to eliminate factors 2-4 entirely, because of two inescapable facts: (1) the hatchery environment differs in many ways from the natural environment, and (2) a successful hatchery program profoundly changes the mortality profile of the population and results in more fish surviving than would have survived in the wild. Because of these factors, Busack and Currens (1995) concluded that some level of domestication selection is inevitable in a captive population. Although many factors can help reduce the nature and extent of the resulting genetic changes, they cannot be avoided entirely.

There are several corollaries to the myth regarding domestication.

Corollary 1. Domestication selection can be avoided if there is no mortality in culture.

This is a misconception because it fails to recognize that the genetic effects of fish culture can transcend the culture period. Even if all progeny survive in a hatchery until time of release, they will exhibit a range of values for traits such as size, morphology, aggressiveness, swimming speed, metabolic rate, etc., and these characteristics can have a profound effect on post-release survival and reproductive success. For example, some fish will be larger than others at the time of release because they hatch earlier, grow faster, or are better able to compete for food in the hatchery. In turn, fish that are larger at release may survive to adulthood at a higher rate than smaller fish (for example, because they are better at avoiding predation). This process will select for genotypes that produce large juvenile fish under hatchery conditions, even if all fish survive until time of release

The myths that surround hatcheries often complicate and confuse the debate over their value and role in fisheries management. Photo by Jim Yuskavitch

Corollary 2. Domestication selection can be avoided if family size is equalized.

Equalizing family size in cultured populations can help reduce domestication selection (Allendorf 1993), but there are limits to the effectiveness of this strategy. [Editor's Note: Family size refers to the offspring of a pair of adults or single adult. Uneven family sizes, due to lower survival rates or fecundity, results in fewer fish passing on most of the genetic traits to the next generation.] Although in some cases it may be possible to equalize family size during the captive phase, the key to reducing domestication selection is equalizing reproductive output into the next generation, and that is much more difficult. In a typical salmon hatchery, for example, 90% or more of the mortality occurs after release of the juveniles, so efforts to equalize family size in captivity can easily be nullified by events that occur later in the life cycle (e.g., Geiger et al. 1997).

Corollary 3: Any effects of domestication will be reversed by natural selection that occurs after the fish are released.

Few doubt that most hatchery trout populations are domesticated. However, many question whether domestication really occurs in Pacific salmon hatcheries, which typically culture fish for only 2-18 months of a life cycle that lasts several years. When comparing salmon to domesticated animals using broodstock that spends its entire life in captivity, it seems reasonable to ask, "How can hatchery salmon be domesticated when, after release into the wild, they migrate thousands of miles to the sea and back every generation?"

No doubt natural selection will operate on the post-release population to help eliminate individuals that are not well suited to survive in the wild, and this can help offset the effects of domestication selection. However, the traits exposed to selection in the post-release juvenile-to-adult phase will generally not be the same as the early-life-history traits for which selection was relaxed during the period in culture. A successful hatchery program — one that produces more fish than would have been produced in the wild — will always result in some genetic change to the hatchery population..

Corollary 4. Domestication selection can be avoided if fish are propagated for only a single generation.

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This belief appears to be surprisingly widespread among hatchery managers and fisheries managers, but I can find no theoretical or empirical support for it. Genetic change can occur at many points within a single generation as well as between generations. There is no mechanism that automatically erases genetic changes that occur within a single generation. Theory and empirical studies agree that, in general, cumulative genetic changes will increase with the length of domestication, but the changes will not be zero for a single generation of culture.

It may be that alternating hatchery and natural generations is the best way to minimize effects of domestication selection. However, there does not appear to be any scientific reason to believe that this strategy will eliminate domestication entirely.

Corollary 5. Divergence of the hatchery population can be avoided if random sampling of broodstock is practiced.

Regarding this myth, it is important to recognize that even a random sample is just that--a sample. Taking a random sample will, on average, avoid directional bias, but in any particular case there is no guarantee that the sampled individuals will be representative of the population as a whole (Hard et al. 1992). By chance, some types will generally be overrepresented while others are underrepresented. The effect can be pronounced in small samples and diminishes as the sample size increases. Therefore, it should be recognized that broodstock sampling will result in a captive population whose genetic composition differs from that of the natural population for one or more traits of interest. At best, one can hope to minimize the extent of these genetic differences.

Risk Tradeoffs

Inescapable risk tradeoffs associated with alternative management strategies also make it impossible to avoid all undesirable effects of fish hatcheries. For example, although opportunities for genetic change in the hatchery are reduced if fish are released early in their life cycle (e.g., as fry or parr rather than as smolts), doing so increases opportunities for competition with natural fish, and it also reduces the survival benefit provided by the hatchery. Similarly, taking a large fraction of the population for broodstock minimizes founder effect in the hatchery population but exposes a larger proportion of the population to the risks of fish culture and could affect the remaining natural population demographically or genetically. [Editor's Note: Founder effect refers to random genetic changes that may occur when a few "founders" start a new population. This can result in offspring with substantial genetic and adaptive differences from its parents. Hatcheries that begin their programs with a small number of broodstock are susceptible to this effect.]

Artificial propagation can cause substantial harm long before there is any reasonable expectation of being able to detect it.

These inherent tradeoffs in risk are a major reason why it is difficult to develop comprehensive guidelines for broodstock collection, fish culture, and release strategies. There are no simple, universal answers to questions such as "Is it better to mark all hatchery fish in a supplementation program to facilitate monitoring and enhance managers' ability to meet program guidelines (such as controlling hatchery-wild spawning ratios), or is it better to minimize marking to reduce harm to the fish?" In this and many other cases, no strategies exist that will simultaneously minimize every type of risk.

Myth 3: Hatcheries will always have unintended and deleterious effects on natural populations.

Whether genetic change in cultured populations will affect natural populations will depend on the nature of the program. In supplementation programs, which involve the intentional integration of natural and hatchery production, some genetic change to the natural population is also inevitable. The net value of a supplementation program, therefore, must be determined by weighing these genetic changes (and potential ecological effects such as competition, predation, etc.) against benefits (such as alleviating severe demographic and genetic risks of small populations) that a successful program may be able to provide to natural populations.

In contrast, harvest augmentation hatchery programs can (at least in theory) avoid deleterious effects on natural populations if strong enough isolation of hatchery and natural fish can be maintained. Whether such isolation is feasible will vary widely from program to program and species to species. Straying is an incidental risk to natural fish populations posed by hatcheries that can occur, but has sometimes been overstated in the popular press. This is an example of a blurring of fact and speculation about the effects of hatcheries mentioned by Campton (1995).

That hatchery fish stray more than wild fish is an assertion that is not necessarily true. What is known about straying in salmon can be summarized as follows (see Quinn 1993, 1997 for reviews and discussion):

(1) The proportion of cultured fish that return to sites other than the hatchery or release site varies greatly among programs; some hatcheries consistently produce a relatively high proportion of strays, while others produce very few.

(2) Whether, on average, hatchery fish stray more frequently than natural fish is an open question. Studies of straying in natural populations have been too limited to resolve this issue.

(3) Homing and straying are complex phenomena that are imperfectly understood. Fish culture can be a factor in the level of straying, but stock transfers and choice of release site also can have a strong influence.

(4) Effects on natural populations are a function of the proportion of natural spawners that are hatchery fish, not the fraction of the hatchery population that strays (Grant 1997). Therefore, a hatchery program with a relatively low stray rate can still substantially affect natur-

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al populations, particularly if the hatchery is large and/or the natural populations are depressed. Conversely, a relatively high stray rate from a small hatchery might not have a substantial impact on a large natural population.

Myth 4: Objections to hatcheries are purely theoretical and have no empirical basis.

This has been a theme of some recent pieces complaining about critics of hatcheries (e.g., Incerpi 1996; Rensel 1997). I don't believe this view is supported by a review of the evidence. It's true that our understanding of the genetic and ecological effects of hatcheries on natural populations is far from perfect. Substantial uncertainties remain about virtually every major issue, and periodically it is important, as Campton (1995) has done, to take stock of the situation and summarize the empirical data to help refocus the debate. Nevertheless, I believe a review of this body of information shows that, in spite of the many uncertainties, every major concern raised about hatcheries has some empirical basis. Extensive literature exists on this topic (e.g., see Waples 1991; Hindar et al. 1991; Campton 1995 and other papers in the same volume).

Reisenbichler (1997) has compiled available information regarding the effects of hatchery culture on fitness of anadromous Pacific salmonids in the wild. These data — all from controlled experimental studies — are imperfect; they apply to a single species (steelhead) and in some cases confound the effects of fish culture and stock transfers. Nevertheless, they are the best available data on this issue, and they demonstrate that fitness of hatchery-reared fish in the wild can be substantially reduced compared with natural fish. Furthermore, the reductions in fitness occur across all life stages and increase with the number of generations of fish culture.

A point made by Busack and Currens (1995: 77) regarding effects of hatchery fish on natural populations is: "We are unaware of rigorous research designed to detect genetic impacts that has failed to find them."

Myth 5: It is not a hatchery problem, it is a fisheries management problem.

Campton (1995) and others (e.g., Rensel 1997) have argued that critics of hatcheries often confound biological factors intrinsic to hatcheries with effects of fisheries management (stock transfers, selective breeding, extensive harvest rates in mixed-stock fisheries). As a result, many hatchery managers believe they have "become scapegoats for virtually every perceived negative biological effect associated with the artificial propagation, release, and management of anadromous salmonid fish." (Campton 1995: 338) This argument has some merit. Adaptive management is most effective when the consequences of individual actions can be evaluated and modified as appropriate. To the extent that distinguishing between biological and management factors facilitates this process, it can be useful and productive.

Many hatchery managers believe that they have become scapegoats for every perceived negative biological effect.

However, we should be careful not to exaggerate the dichotomy between biology and management. No fish hatchery exists in a vacuum isolated from fisheries management concerns; rather, every hatchery program is designed to meet one or more management objectives (e.g., harvest enhancement, mitigation, conservation). Some factors identified by Campton, such as stock transfers and mixed-stock fisheries, are primarily a function of fisheries management rather than fish culture, but many others involve both. For example, selective breeding, when it occurs, is carried out by fish culturists to achieve a fisheries management objective. The effects on natural populations from an action such as selective breeding are the same whether one chooses to allocate this action to fish culture or fisheries management. In this case, the only meaningful unit to consider is the overall hatchery program, which encompasses both fish culture and fisheries management. Put another way, "Fish culture is as much a part of management as management is of fish culture." (Incerpi 1996)

Myth 6: Everything will be OK if we have a good monitoring program.

Although no one doubts the importance of monitoring and evaluation (M&E) for adaptive management, there is a very real danger in relying too heavily on M&E as a substitute for meaningful and comprehensive risk management. The danger arises from three factors.

First, M&E for hatchery programs has limitations with respect to both reliability and timeliness. Statistical power to detect genetic effects of hatcheries can be relatively high for selectively neutral molecular markers, which can provide key information on gene flow between hatchery and natural populations, individual reproductive success, and effective population size (e.g. Waples et al. 1993). However, the most serious concerns regarding fish hatcheries involve fitness effects on phenotypic, behavioral, and life history traits in natural populations. As discussed by Hard (1995; see also Peterman 1990), the power of even the most ambitious M&E program to statistically detect a fish culture effect on traits such as these is likely to be very low because the natural variability in the same traits is typically very high. Furthermore, even if such an effect is detected it will generally occur only after several (fish) generations of monitoring. This means that artificial propagation could cause substantial harm to natural populations long before there is any reasonable expectation of being able to detect it. Of course, this does not mean that deleterious effects will always occur; however, it should give pause to those willing to embark on a high-risk program in the expectation that they will be able to quickly and surgically intervene at the first sign of an undesirable outcome. In most cases, unfortunately, that is a myth.

Second, even if adverse effects are

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found, there is no guarantee that effective remedial action will be taken. To be effective, an adaptive management program should include a framework describing the range of possible outcomes along with management actions that would be triggered by each outcome. Too frequently, this has proven difficult to accomplish for hatchery programs. Once begun, hatchery programs have considerable momentum and may be difficult to terminate or substantially change, even in the face of clear evidence that they are not accomplishing their goals.

Third, fishery biologists often find themselves in an M&E Catch-22 with respect to hatcheries: If they find no evidence of deleterious effects, it is difficult to argue for restrictive measures; if they do find adverse effects, some will argue that restrictive measures are unnecessary because there is no pure, natural population to worry about any more.

Where Do We Go from Here?

A key step in resolving some of the controversies regarding fish hatcheries will be moving toward agreement on a common version of the realities about hatcheries. In my view, actions are needed in four major areas: Identifying goals, conducting overall cost-benefit analysis to guide policy decisions, improving the information base, and dealing with uncertainty.

Goals

To begin with, we must not only achieve greater clarity in articulating the goals of hatchery programs, but also ensure that the programs are developed to address fisheries management needs. A given program may have a single major goal (e.g., to replace production lost through habitat blockage; to supplement an at-risk natural population), or it may have multiple goals (increase the abundance of naturally spawning fish while augmenting harvest opportunities).

Secondly, it is important that these goals are inclusive enough to achieve other fisheries management or societal goals and should be expanded to reflect these other considerations if necessary.

Third, fisheries managers, fish culturists, fishery biologists, and conservation biologists should review the goals and, if possible, agree on general principles that will guide future management decisions.

Comprehensive Cost-Benefit Analysis

To determine the most suitable type of hatchery program for a particular situation, it is necessary to do a comprehensive cost-benefit analysis. Conducting such an analysis is exceedingly challenging. In the simplest scenario (use of artificial propagation to alleviate short-term extinction risk to natural populations), the primary costs and benefits are in a common currency, both being evaluated with respect to the natural population.

Hatchery programs have considerable momentum and may be difficult to terminate or change if they are not meeting their goals.

The analysis becomes much more complex if the goals of the program include benefits to society as a whole rather than (or in addition to) benefits to natural populations. Societal benefits might include benefits derived directly from the hatchery program (more fish to harvest; more jobs for fishers, fish culturists, and fishery biologists; and meeting legal or tribal treaty obligations) as well as benefits that accrue indirectly from activities (hydropower, logging, agriculture) that are permitted because they are compensated for by the hatchery program. An analysis of this type requires comparing at least three types of currencies: fiscal expenditures to operate the program (measured in dollars); benefits to society (only some of which can easily be measured in dollars); and costs and benefits to natural populations and the environment.

Research

Major gaps in our understanding occur for most of the key processes associated with fish culture. Some critical issues are regularly identified by scientific workshops and panels as high-priority research topics; however, such research is seldom funded because the necessary experiments are expensive, time consuming (often requiring several fish generations), and logistically difficult.

Major new funding initiatives are unlikely in the current political climate. However, one approach is readily available and could make a significant impact: Devote more hatchery facilities to research. This could involve either setting aside portions of a number of hatcheries or devoting one or more facilities entirely to research.

Uncertainty

More and better research is necessary but is not by itself sufficient. Because new research will not resolve all uncertainties, and because in any event some critical information is not likely to be available for many years, it also is essential that we develop workable methods for dealing with uncertainty. For production hatcheries, the most critical questions are "Given the inevitable uncertainty, where should the burden of proof reside? Should hatcheries be presumed harmless unless proven otherwise (thus risking irreversible losses to biotic integrity if deleterious effects do occur), or should hatcheries be used only very cautiously (thus risking major sacrifices of societal benefits that may turn out to be unnecessary)?"

A considerable amount has been written on how to deal with uncertainty in the fields of decision analysis and ecological risk assessment (e.g., Raiffa 1968; Lackey 1997), but it has not been used effectively with hatchery issues (see discussion of this issue in Currens and Busack 1995). A key question to ask is "If we find that a mistake was made, can we reverse the consequences of the error, and if so, at what cost?"

Columbia River Tangle Net Fishery

by Mark McCollister

— *Oregon Trout* —

With its mix of salmon and steelhead, including both hatchery fish and ESA-listed wild fish, the lower Columbia River commercial fishery is a real challenge for fishery managers. How do you protect wild steelhead and salmon listed under the Endangered Species Act while allowing for a commercial harvest of hatchery fish that is so important to the economy of coastal communities? One relatively recent approach is the use of tangle nets which, theoretically, allows for the safe release of wild steelhead and salmon while retaining hatchery-bred fish for market.

In the following article, Mark McCollister, Oregon Trout's Fish Refuge Program Manager, explains how this "technological fix" works and if it is accomplishing its mission.

Oregon Trout is headquartered in Portland, Oregon. Its mission is to protect and restore native wild fish and the ecosystems that sustain them. McCollister may be reached at mark@ortrout.org.

In the spring of 2003, fish biologists charged with monitoring Columbia River salmon returns predicted that 271,000 spring chinook would return with just over 26,000 available for commercial harvest. This was welcome news for commercial fishermen buoyed by last year's commercial fishery, the first full-fleet fishery targeting both upriver and lower river run spring chinook since 1977. Highly sought after, with a single fish netting upwards of $100, these fish allow hope for the persistence of the once vibrant Columbia River commercial fishery. Caught up in this bright forecast are the Columbia's wild fish stocks — uniquely adapted to the Northwest's diverse landscapes, and the cornerstone for recovery.

Tangle net fishermen haul in their catch of wild fish and hatchery-bred fish. Photo by Oregon Department of Fish and Wildlife

The Fishermen's Quarry

Targeting early returning hatchery spring chinook headed for the Willamette River this past February, commercial fishermen were stunned by their catch. After just two days of fishing they had burned through over half of the allowed impact to wild upriver spring chinook at a time when few of these fish were expected to be in the river at all. Prevented from a return to fishing by the unusual early mix of upriver and lower river fish, fishermen were forced to wait for over a month to resume fishing, and after one brief opening, consumed the last of their allotted take of upriver fish. Little more than 3,000 fish were harvested.

The Columbia River is home to six species of anadromous salmon and trout: chinook, coho, sockeye, and chum salmon, and steelhead and sea-run cutthroat trout. Of these, winter steelhead and spring chinook enter the Columbia River at the same time, returning in the late winter and early spring, and are susceptible to capture in lower Columbia River commercial fisheries. Spring chinook and winter steelhead populations are boosted by substantial hatchery programs in the Columbia system, and targeting these hatchery spring chinook is the goal of fishery managers.

Commercial harvest of upriver spring chinook has been closed since 1977 due to poor returns, and commercial harvest of steelhead by non-Indians has been prohibited since 1975. The targeting of lower river spring chinook has been on-again-off-again during this period, with limited harvest also occurring during the winter gillnet season targeting white sturgeon. Endangered Species Act (ESA) listings in the 1990s increased the oversight and scrutiny of these fisheries, requiring specific action or, in the case of commercial fishing, inaction to protect listed stocks from extirpation.

The Columbia River steelhead and chinook returning late winter and early spring are grouped into eight discrete stocks or Evolutionary Significant Units (ESU), groupings based on shared or similar geographic areas, life history characteristics, and lineage. Seven of these eight stocks are listed as threatened or endangered under the federal ESA. Hatchery fish, though included within ESU's, are not listed under the

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ESA and are available for harvest by commercial fishermen.

Spring chinook enter the Columbia River beginning in late winter. These fish are split into two groups named for the geographic area to which they home, differentiating into lower river and upriver spring chinook. This nomenclature roughly correlates to differences in run timing and age of fish. Age 5 chinook, destined for lower river tributaries, return early with peak abundance in late March. Age 4 fish, also destined to lower river tributaries, return later. Predominantly age 4, upriver spring chinook peak in abundance in mid-April. Run times are variable but generally predictable, and allow fishery managers to differentially target these two groups. Recent past harvest for spring chinook has targeted the age 5 early returning lower river chinook in a gill net season from February to mid-March.

Early returning, lower river spring chinook comprise two ESU's. Chinook destined for lower Columbia River tributaries — the Cowlitz, Kalama, Lewis, and Sandy rivers — make up the Lower Columbia River Spring/Fall ESU and were listed as threatened on March 24, 1999. Willamette and Clackamas river fish also enter the Columbia River at this time in substantial numbers, though the peak of this run is typically mid-March to mid-April, and make up the Upper Willamette Spring ESU. This group was listed as threatened on March 24, 1999. Age 5 Willamette chinook make up the majority of the commercial chinook catch.

The second group, upriver spring chinook, begin entering the Columbia River in late February and early March with peak abundance in April and May, passing upstream of Bonneville Dam from March through May. Fish destined to the Columbia River above the Snake River make up the Upper Columbia Spring ESU, listed as endangered on March 24, 1999. Fish headed to the Snake system make up the Snake River Spring/Summer ESU, listed as threatened on April 22, 1992. Fish headed to Columbia river tributaries, the Deschutes, Klickitat, John Day and Yakima rivers make up the Mid-Columbia River Spring Run ESU and are not listed.

Three federally listed steelhead ESU's enter the Columbia River with run times overlapping those of returning spring chinook. Winter steelhead destined for the Willamette River upstream of Willamette Falls enter the Columbia River in March and April and make up the Upper Willamette River ESU, listed as threatened March 25, 1999. Winter steelhead migrating up the Columbia in late winter to spawn in the Klickatat River and Fifteen mile Creek, compose the only populations of inland winter steelhead in the United States. These fish were listed as threatened on March 25, 1999 and comprise part of the Middle Columbia River ESU. Lower Columbia winter steelhead also return to spawn in late winter and early spring, spawning in tributaries of the Columbia between the Cowlitz and Wind Rivers in Washington, and the Willamette up to the Willamette Falls and Hood rivers in Oregon. These fish comprise the Lower Columbia River ESU and were listed as threatened on March 19, 1998.

Though successful in allowing the release of larger, wild chinook, the nets functioned as gill nets for the smaller steelhead.

ATTEMPTING TO LESSEN IMPACTS

The federal Endangered Species Act specifically protects listed species from take, defined as to "...harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect..." To legally take listed winter steelhead and spring chinook requires a take permit by NOAA Fisheries, the federal entity with jurisdiction over anadromous fish. Take numbers are biologically determined to be the maximum level of impact that these stocks can sustain without jeopardizing their persistence.

Following listing as threatened under the ESA, federal and state managers agreed to limit impacts to wild Willamette spring chinook at 20 percent for 2001 and 15 percent for 2002 and beyond, and required that only hatchery origin, adipose fin clipped fish, could be retained. Upriver impacts on listed Columbia River spring chinook, negotiated by the parties to United States vs. Oregon, were set at 15 percent, of which 2 percent was allocated to non-Indian fisheries, and also required the release of wild fish. The non-Indian allocation was further split between sport and commercial fishermen allowing a 0.68 percent impact rate for commercial fishermen. Non-Indian fishery impacts were set at 2 percent for wild steelhead ESU's, as well.

The Columbia Compact, consisting of delegates of the Oregon and Washington fish and wildlife agency directors, adopts seasons and rules for Columbia River commercial fisheries. Challenged to allow exploitation of the strong returns of hatchery born chinook while protecting wild spring chinook salmon and winter steelhead, Columbia River managers began exploring the use of live capture gear in 2001. Whereas individual fish are highly adept at sorting themselves into discrete stocks, commercial fishing techniques are not. Live capture became the fundamental requirement in allowing a commercial fishery targeting hatchery spring chinook on the Columbia River. Otherwise, wild fish mortality was too high.

THE TANGLE NET SOLUTION?

In 2001 the Compact authorized the use of tangle nets to determine if their use was feasible in lower Columbia River fisheries targeting spring chinook. The experimental tangle-net fishery was limited to 20 participants chosen from a field of interested commercial fishermen. Net mesh sizes were varied to calculate fishing success and mortality relative to size of mesh. During a very limited fishery 3.5, 4.5, and 5- to 6-inch mesh nets were tested. Generally pleased with the outcome of this experimental fishery, managers expanded the fishery to include the full fleet in 2002.

The goal of the spring chinook tangle net fishery is to target and harvest

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hatchery chinook without harming wild spring chinook and steelhead. A tangle net, in theory, traps the fish in a non-lethal manner and allows managers the opportunity to target specific fish within a mixed stock fishery. The net is basically a gill net with small mesh. Fish swimming into the net become entangled in their mouths and head, but the small mesh prevents capture further back near their sensitive gills and body.

The physical nature of capture (tangled, clamped, gilled or wedged) and the removal of fish from gear determine the likelihood that a fish will survive. Fish tangled in their teeth or maxillary are released more readily and with relatively minor injuries. Capture further up the body causes gill clamping and suffocation, and entanglement in the gills causes suffocation and significant physical damage. Clamped or gilled fish must be removed forcibly and are usually held by the gills. Wedging entraps the body and leads to loss of protective scales and slime layer. Wedged fish are often pulled through the mesh by the gills or popped out by rapidly jerking the net, falling to the bottom of the boat. Mesh size relative to the size of the fish determines the nature of capture, and influences the probability of mortality.

Long term mortality estimates are difficult to accurately quantify. Generally, there is a decrease in mortality with a decrease in mesh size, resulting from differences in the nature of capture. Due to differences in body size, mortality estimates are calculated differently for steelhead and chinook when mesh size is large, and as mesh size decreases, the disparity in how fish are trapped lessens, and mortality rates become similar.

The first full fleet, live capture commercial chinook fishery requiring the live release of unmarked spring chinook occurred in 2002. Guidelines in place to facilitate the survival of wild fish included a maximum mesh size of 5.5 inches, a maximum net length of 150 fathoms, maximum soak time of 45 minutes, and the use of a recovery box on all lethargic or bleeding fish. Recovery boxes are tanks, required on-board, that hold non-target fish. Circulating water brings oxygen to lethargic fish, reviving them prior to release. Net length and soak time determine, in part, how long fish remain trapped in nets. The less time they are trapped, the less likely they are to be injured. Soak time is measured from the first net panel in the water to the last net panel out of the water, and net length was reduced from traditional length of 250 fathoms to 150 fathoms. A fathom is 1.8 meters or 6 feet.

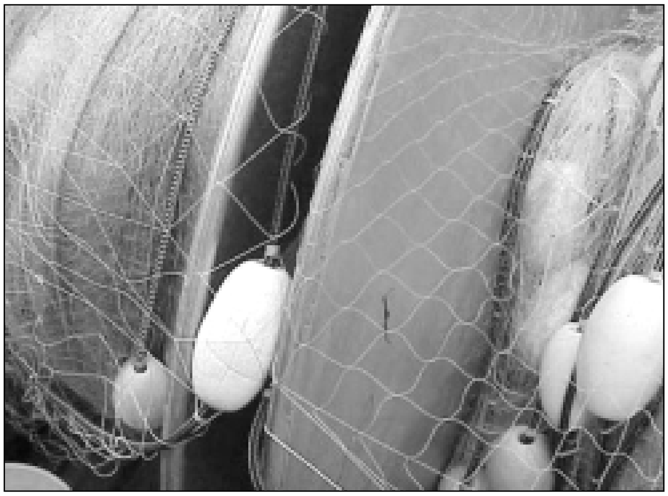
Though aware of the risks that the larger 5.5 inch mesh tangle nets posed to listed wild steelhead, fish managers adopted the commercial season and its rules too close to the start of the upcoming season, thus precluding the option of requiring the use of smaller mesh nets. Not widely available, new nets would take months to be delivered.

The Verdict

The commercial fishing season ran from February 25 through March 27 and consisted of 15 fishing periods, each 14 to 72 hours in duration. Peak fishing days saw 150 boats on the Columbia River in zones between the Willamette River and the Pacific Ocean. Immediate reactions to the fishery were decidedly upbeat, especially among commercial fishermen. Fishermen harvested 14,238 hatchery spring chinook and released 14,489 wild chinook in what was the largest commercial spring chinook harvest since the 1970s. The harvest included 5,242 Willamette fish, 8,237 upriver fish, and 473 lower Columbia River fish. Landings of hatchery spring chinook were valued at 1.5 to 2 million dollars to commercial fishermen alone.

Mortality to listed upriver spring chinook was 0.70 percent, just beyond their limit of 0.68 percent, and impacts to Willamette river chinook were 0.60 percent, well below the impact guideline of five percent.

Though successful in tangling and allowing the subsequent release of the larger, wild chinook encountered, the 5.5 inch tangle nets functioned essentially as gill nets for the smaller steel-



The smaller net size of the tangle net (top photo, right) is designed to catch fish by their less easily damaged mouth parts — at least in theory. It doesn't always work that way (bottom photo). Top photo by Oregon Department of Fish and Wildlife. Bottom photo by Washington Department of Fish and Wildlife.

head, significantly injuring and killing fish before they could be released. Furthermore, in-season monitoring inexcusably failed to detect that impact limits to steelhead had been reached, in part because specific estimates of steelhead mortality were not available until early 2003.

Results from the 2002 fishery show that the tangle net fishery intercepted more steelhead than the targeted hatchery-origin spring chinook. Of the 20,900 steelhead caught in this fishery 12,400 were wild fish. Estimates of mortality,

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both immediate and post-release, are between 2,400 and 6,100 threatened wild winter steelhead, representing between five and 15 percent of the entire run.

Impacts to listed steelhead in 2002 dramatically increased the scrutiny of managers setting the season and fishing rules for the 2003 commercial spring chinook fishery. NOAA Fisheries instructed Oregon and Washington managers that prior to the onset of the 2003 commercial fishery, they must develop and report plans to minimize steelhead encounters, determine specific limits on steelhead encounters and track in-season encounters to keep harvest mortality below the two percent limit.

Managers set impact guidelines and agreed to close the fishery before take limits were reached. Additionally, managers required that all boats have two recovery boxes onboard and reduced the mesh size for tangle nets from 5.5 to 4.25 inches, decreasing mortality rates for ensnared steelhead. Similar to 2002 regulations, soak times and gear length were limited.

Complicating management of the fishery was a forecasted run of only 15,500 wild, winter steelhead, down from the 2002 run of 33,900 wild, winter steelhead, thus reducing the legally allowed take of steelhead to 250-280 fish. Given the low forecast of wild winter steelhead, managers gambled that five-year-old Willamette chinook would show well before upriver spring chinook, and elected to use traditional eight-inch gill nets for the first two fishing periods. Though lethal to chinook, the bulk of listed upriver fish were not forecast to enter the Columbia until mid-March. By using eight-inch gill nets at the front end of the season, most smaller winter steelhead would pass through the nets unharmed and much of the allotted take on winter steelhead could be preserved until later in the season. As upriver spring chinook entered the river, managers would switch to 4.25-inch tangle nets to keep mortality of wild upriver spring chinook below limits.

Results from the first two openings on February 17 and 19 saw the harvest of 539 spring chinook, and the capture and release of 587 chinook and 174 steelhead, 141 of which were wild.

A spring chinook salmon caught in a tangle net is hauled aboard. No harm done? Photo by Oregon Department of Fish and Wildlife

Upriver spring chinook made up over 80 percent of the chinook catch and, already, over half of the 0.59 percent impact guideline had been consumed. The Compact was forced to rescind upcoming scheduled fishing periods and wait for the ratio of upriver fish to lower river fish to decrease. The internal clock guiding upriver spring chinook was out of synch with the expectations of Columbia River fish managers.

Test fishing periods in March showed continuing high numbers of upriver fish, and no commercial fishing occurred until March 21. In one short day, the impact limits on upriver chinook were surpassed and those set for wild steelhead were nearly reached. The season was over.

SEEKING A BALANCE

The commercial fishery is an enigma. Where wild and hatchery stocks intermingle, it is unclear how to manage a fishery. Societal pressures dictate a place for both a commercial and sport fishery, and wild salmon and steelhead recovery. Commercial fishermen have much at stake in the recovery of wild stocks. In the last two years of this fishery, however, one has come at the expense of the other. As surely as the 2002 fishery was a disaster for wild winter steelhead, the 2003 fishery was unacceptable for Columbia River gillnetters. Lack of adequate safeguards in the 2002 full fleet spring chinook fishery allowed the fishing season to exuberantly continue well past reason, placing three stocks of listed steelhead in further jeopardy of extinction. With proper oversight in place for the 2003 fishery the take of wild fish was kept in-check, but commercial fishermen were stung by a lack of fishing days. Eliminating the commercial fishery may prove a blow to salmon recovery, as few constituencies have more invested in the Columbia's salmon. At the same time, perpetuating a dependency on enormous hatchery production imperils wild salmon as well. Somewhere in the balance there is an approach that allows for the persistence of wild salmon and commercial fisheries, but we have yet to find it.

The Federal Government is Failing Wild Snake River Salmon and Steelhead

by Bert Bowler and Jenna Borovansky
— Idaho Rivers United —

NOAA Fisheries' 2000 Biological Opinion and salmon recovery plan recognized the impact the Snake River dams have on wild steelhead and salmon. The recovery plan embedded in the Biological Opionion tilted towards habitat restoration and various technological fixes. Conservationists have argued that the Biological Opinion did not meet the legal requirements of the Endangered Species Act, and is failing to help the dwindling runs of Snake River wild salmon and steelhead.

In this article, Jenna Borovansky Conservation Director for Idaho Rivers United and Bert Bowler that group's Native Fish Director, explain some of those failings.

"For all the diversity they've given, sun and ocean have managed to bequeath us just one family of creature capable of journeying back and forth between high altitudes and our continent's interior and the green ocean a thousand miles away- the celebrated wild salmon..."

David James Duncan

What a way to describe the magnificence of wild Snake River salmon and steelhead. Their evolutionary legacy follows a strategy of maturing to adulthood in the Pacific Ocean, then returning to freshwater with acute homing fidelity to reproduce. Decaying carcasses contribute vital ocean nutrients to the freshwater streams where they spawn and die, completing their life cycle. These extraordinary creatures have adapted to environmental transformation over geologic time — including mountain building, volcanoes, dramatic changes in climate and glaciations — that has promoted tenacity and perseverance among the species. They are the subjects of legends, history and poetry. Their journey still mystifies scientists.

Snake River salmon are beyond a doubt the 'king of kings.' They migrate inland 900 miles and ascend to 7,000 feet in elevation, a migration achievement found nowhere else in the world. The fat and protein content that allows them to survive this awesome migration also makes their flesh taste superb because of the abundance of stored energy. Columbia River commercial fisherman who caught and sold Snake River salmon in earlier times commanded three times the price compared to their lower river cousins.

The Native Americans venerated the Snake River fish. For more than 10,000 years, the salmon have been economically and spiritually central to the Columbia River basin's indigenous people. Pioneers exploring the Snake River during the Nineteenth Century found a plethora of salmon for the taking. Idaho, Oregon and Washington sport fishermen in the 1940s, 50s and 60s enjoyed ample opportunity to catch the mighty king. This opportunity has disappeared with the decline of the river ecosystem and its salmon and steelhead inhabitants, caused by construction of dams and decline of available high quality habitat throughout the watershed.

> *The government is conducting a dangerous experiment, claiming that underfunded habitat improvements will bring the fish back.*

The Snake River flows out of Wyoming, then through Idaho and along the Idaho-Oregon border before dumping into the Columbia River at Pasco, Washington. Currently, the Snake supports about 70 percent of the remaining spawning and rearing habitat potential found in the entire Columbia River system for spring and summer chinook and summer steelhead. This is extremely noteworthy when considering the legacy of salmon and steelhead in the Columbia River.

Currently, wild populations of Snake River salmon and steelhead are on the endangered species list. One population, the coho, was declared extinct in 1986. Many factors have influenced their demise, including habitat degradation, hatchery fish, harvest impacts and ocean conditions. But the completion of the federal hydropower system in the Snake and Columbia rivers was the final nail in the coffin for the salmon's long-term sustainability. Wild Snake River fish that once numbered in the millions are now reduced to thousands. If allowed to occur, extirpation of wild Snake River salmon and steelhead — an integral component of the Columbia River ecosystem and its genetic resources — would be horrific.

Today, the federal government is conducting a slow, dangerous experiment by claiming that underfunded habitat improvements will bring wild salmon and steelhead back. At stake is nothing less than the continued existence of the most important populations of wild salmon and steelhead in the entire Columbia River drainage, whether predevelopment or present day. Historically, the Snake River produced 55 percent of the summer steelhead found in the Columbia River. Idaho's Salmon River alone nurtured and perpetuated more than 40 percent of the spring and summer chinook salmon grown in the Columbia.

To reach the Idaho border, steelhead and salmon need to pass eight dams — Bonneville, The Dalles, John Day and McNary on the Columbia River and Ice Harbor, Lower Monumental, Little Goose and Lower Granite on the Snake River. The cumulative impacts of passing eight dams during their downstream migration and the same concrete structures during the upstream homeward trip have taken its toll. The U.S. Army Corps of Engineers manages most of the dams on the Columbia and

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Snake rivers. It attempts to mitigate the effects of the hydropower dams on the seaward migrating juveniles — as they try to negotiate the reservoirs and dams — by loading them on barges and trucks and moving them around the dams downstream to the Columbia River estuary. This strategy has been tried for 25 years with no sustained success. When one witnesses a truck full of smolts on the highway, it is hard to imagine this as a healthy component of the ecosystem.

Transporting smolts defies basic ecosystem function relative to the salmon's life cycle. Moving fish through 350 miles of reservoirs on a barge conflicts with the migration strategy of traveling on their own time schedule that is dependent on river flow and temperature and the fishes' physiological readiness to adapt to saltwater. Also, mixing salmon of hatchery origin at elevated densities in the barges promotes stress and increases disease transmission, decreasing wild fish survival.

Independent scientific studies confirm that Snake River salmon and steelhead need a more natural, free flowing river. That can only be achieved by removing the four lower Snake River dams between Lewiston, Idaho and Pasco, Washington. While independent scientists determined dam retirement would provide the necessary survival benefit to recover wild fish over the long-term, partially removing the lower Snake River dams was rejected by the federal government in favor of emphasizing restoration of freshwater habitat. Salmon and steelhead will benefit from improving Snake River stream habitat, but currently the drainage supports areas of high quality habitat that annually go unoccupied. Dam removal offers the most feasible way to rebuild the wild fish populations and prevent extinction. Wild salmon within the Columbia River that have four or fewer dams to negotiate are surviving two to eight times better than their Snake River cousins that are faced with eight dams.

The U.S. Army Corps of Engineers continues to barge salmon and steelhead smolts around Snake and Columbia river dams. Is it a recovery strategy or a boat ride to extinction? Photo by Jim Yuskavitch

The federal government has assembled a 10-year salmon recovery plan tied to the NOAA Fisheries' 2000 Biological Opinion regarding impacts of the dams on salmon. A biological opinion is required when a federal action such as operation of the federal dams jeopardizes the continued existence of a listed species like salmon and steelhead. When NOAA Fisheries determined that the dams do cause jeopardy to the species, they outlined corrective actions to alleviate the risk of extinction of the species and promote recovery.

This Salmon Plan sets out 199 measures that the federal government must undertake to recover salmon and steelhead without partially removing the four lower Snake River dams. The measures include actions to improve water quality, the fishes' ability to survive the dams, spawning and rearing habitat improvements, hatchery and harvest changes, studies and reporting and funding. The Save our Wild Salmon Coalition recently released a report card addressing 150 measures that had some relevance in 2001 and 2002. Unfortunately, the federal government received an 'F' grade by failing to achieve even 30 percent of those actions identified by NOAA Fisheries as necessary to recover listed salmon and steelhead. Some of the areas examined included:

Clean Water Improvements

Clean, cool water is necessary for salmon and steelhead to survive the dams. The dams contribute to elevated dissolved gas levels and increased water temperatures, both of which can be lethal to salmon. In 2002 the federal government completed less than 15 percent of the measures required to provide cleaner water. Temperatures in the Snake River reached as high as 78 degrees Fahrenheit — 10 degrees higher than is safe for salmon.

Surviving the Dams

Snake River salmon smolts must pass through eight dams during their downstream migration, which can result in as much as 15 percent mortality at each project. In 2002, the federal government completed only 31 percent of the measures to increase passage survival at the federal dams.

Spawning and Rearing Habitat Improvements

The cornerstone of the Salmon Plan relies on improving and enhancing upstream spawning and rearing habitat not inundated by the federal dams, rather than partially removing the lower four Snake River dams. In 2002,

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the federal government completed only 25 percent of the habitat measures required in the Plan.

Hatcheries and Harvest

The Salmon Plan describes actions to reform salmon harvest and hatchery practices. Much like in 2001, the federal government's progress was extremely limited, completing only 6 percent of the required measures.

Studies and Reporting

The federal government does its best work planning and designing studies rather than improving actual conditions for salmon and steelhead. In 2002, the federal government completed 40 percent of the studies and reporting measures required in the Salmon Plan.

Funding

A very important category that came up short in 2002 is the funding necessary to implement the early phases of the salmon recovery effort. The Bush Administration failed to even ask for more than about 50 percent of the nearly $900 million per year needed to implement the Plan.

The Plan has three check-in-points, in 2003, 2005 and 2008, to assess progress in Plan implementation and whether it is protecting and restoring salmon. If the Plan is failing, the federal government must opt for stronger measures, including considering partial dam removal in the lower Snake River. The first check-in comes in September 2003 and is specifically designed to answer two questions: (1) Did the federal government ask for and receive the funding and authorizations necessary to implement the Plan's measures; and (2) Did the federal government implement the measures it said it needed to complete by 2003?

The Salmon Plan totally misses the mark, especially for Snake River salmon and steelhead recovery; too much emphasis is placed on repairing freshwater and estuarine habitat rather than returning more natural flows to the Snake by removing the four lower Snake River dams. Snake River salmon habitat is large and in many areas is considered pristine wilderness and roadless country. Currently, much of the premium habitat supports a small percentage of its production potential for wild salmon and steelhead. To assume that habitat restoration alone will recover Snake River stocks counters the prevailing science. This is not to suggest that habitat restoration is not worthwhile. Riparian restoration, protection of intact habitats, water acquisition, conservation easements and land purchases are very important measures in degraded areas. Dam removal, however, was judged the best opportunity to recover Snake River listed stocks. Instead, the federal government chose to adopt more politically acceptable measures, including grand plans for freshwater habitat restoration (without grand implementation efforts), while shelving the option of removing dams in its recovery plan.

A Rube Goldberg network of "chutes and ladders" at Snake River dams is supposed to help migrating smolts avoid deadly turbines. Photo by Jim Yuskavitch.

The Salmon Report Card is evidence of the federal government's lackadaisical implementation of the Salmon Plan and the need for larger efforts if we are to save salmon and steelhead in the Snake River. In order to provide management options if the federal government continues to fail in its recovery efforts, ask your representative to support the Salmon Planning Act in Congress, a bill to authorize scientific and economic studies on partial removal of the dams. The bill also gives the U.S. Army Corps of Engineers the authority to remove the dams if dam removal is deemed necessary to comply with the Endangered Species Act, tribal treaties or the Clean Water Act.

[Editor's Note: As this issue of *The Osprey* went to press, federal judge James A. Redden in Portland, Oregon ruled that NOAA Fisheries' salmon recovery plan was illegal. The ruling said that the plan relied too much on future mitigation actions, mostly involving speculative habitat restoration plans.

Currently, there are 12 Columbia basin stocks of salmon and steelhead listed under the Endangered Species Act.

The lawsuit challenging the salmon recovery plan was brought by Federation of Fly Fishers, National Wildlife Federation, Idaho Wildlife Federation, Washington Wildlife Federation, Sierra Club, Trout Unlimited, Pacific Coast Federation of Fishermen's Associations, Institute for Fisheries Resources, Idaho Rivers United, Northwest Sportfishing Industry Association, Idaho Salmon and Steelhead Unlimited, Friends of the Earth, American Rivers, Salmon For All, NW Energy Coalition and Columbia Riverkeeper.]

For More Information

Idaho Rivers United works to protect and restore the biological integrity of Idaho's rivers. As a founding member of the Save Our Wild Salmon Coalition, IRU works with a broad coalition of conservation organizations, commercial and sport fishing associations, businesses, river groups and taxpayer advocates to promote the removal of the four lower Snake River dams. This will take the Snake River a step closer to natural conditions and provide colder, cleaner and more freely-flowing waters.

To learn more about Idaho Rivers United's work or to view the full report card cited in the story go to www.idahorivers.org or www.wildsalmon.org.

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systems of the Snake River basin. They generally spend two years in the ocean before returning as adults two years after their downstream migration. They regularly exceed 10 pounds and occasionally reach 20 or more. Now to the data.

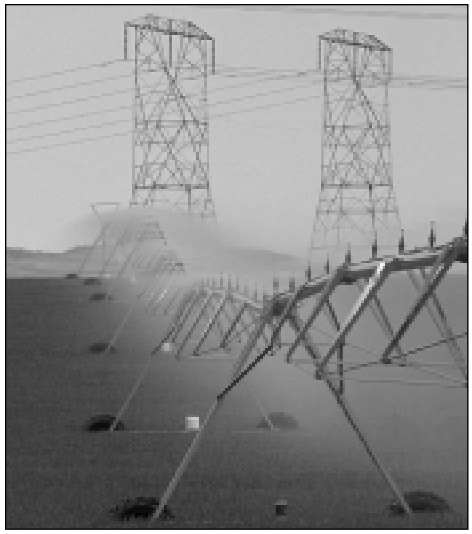
The year 2001 was very good for adult steelhead returns. River flows were excellent for downstream migration in the spring of 1999 (B run smolts) and 2000 (A run smolts), and ocean conditions were very good from 1999 through 2001. The result was the best year for both A and B run adult returns in well over a decade, despite very low flows in the summer and fall of 2001. All of this was predictable and consistent.

The 2002 adult returns, however, showed mixed results. The B runs, helped along by strong spring flows in 2000 and a hospitable ocean from 2000 through 2002, were even better than 2001. The A runs also benefited from good ocean conditions, but the 2001 drought and the unwillingness of BPA to spill water for 2001 downstream migration resulted in the worst downstream migration conditions and the highest instream juvenile migration mortality in many years. Anticipating this, the Corps of Engineers went full throttle on barging, gathering as many migrating smolts as possible at Lower Granite Dam, on the Snake River, and barging them through the hydro system to tidewater. The result was that 2002 A run returns were not as high as 2001; but in truth, they were pretty good, not too far below 2001 and considerably better than other recent years.

So what's going on, and how do we interpret this information?

It is increasingly clear that ocean conditions are a major factor in the robustness of steelhead and salmon runs. When the ocean is hospitable, the fish prosper.

And what about in-river downstream migration versus barging through the hydro system? The recent evidence suggests a couple of conclusions. First, in-river migration is better than barging when spring downstream migration season flows are strong — e.g., 1999 and 2000. Second, a combination of natural drought plus diversion of river water from protecting the fish to



Power generation and irrigation still trump salmon and steelhead recovery in the Columbia River basin. Photo by Jim Yuskavitch

power production and irrigation — e.g., 2001 — can make the river lethal for most in-river juvenile migrants, forcing barging as the necessary default option. So in-river migration with strong flows beats barging, which beats in-river migration in years of dangerously low and weak water flows.

My great fear is that, with the increasing frequency and magnitude of droughts predicted by future climate models and the continuing and increasing political and economic pressures to divert water from fish habitat — in spite of all the nice words in support of steelhead and salmon recovery — there will be more and more years when river flows will not provide anything close to what the ISAB called "normative river" conditions for downstream migration. More and more, the techno solution will replace the river and its natural rhythm. This can not be good for the long term future of steelhead runs.

One more point. None of these alternatives can do what a free flowing lower Snake River can do to restore Snake steelhead and salmon stocks to robust and long term health.

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