



Conservation Report

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By Bill Bakke, Director

A successful day of Atlantic salmon fishing on the Penobscot River in 1926.



Atlantic salmon were abundant in Maine's Penobscot River and the fishery lasted until 1999 when it was closed the save the few salmon left.

For the first time since 1999, seven years ago, the Penobscot River opened for a 30 day catch and release salmon fishery this September. A few salmon had returned and reconnecting people with the salmon was an important reason for allowing a fishery on the depleted run.

Atlantic salmon are an indicator for what could happen to steelhead. The causes for the depletion of Atlantic salmon are now working on steelhead, and it is unreasonable to believe the fate of steelhead will be different.

In his essay on wild steelhead in Dec Hogan's book *A Passion For Steelhead*, Pete Soverel speaks plainly about what we have done to steelhead. Our own impact on the landscape and because the "...agencies responsible for managing these fish have consistently denied the biological and ecological needs of the fish...wild steelhead are but a faint shadow of their former abundance – hundreds of stocks are extinct, most of those that remain are at elevated risk of

extinction. “ Soverel laments repeatedly a single incredulity, “Anglers and the public have accepted this unbroken record of disaster without effective complaint.”

“Perhaps most distressing of all – none of this sneaked up on us unawares. It is not that we did not know what we were doing or were uncertain as to the probably consequences,” says Soverel. He notes that “we had the sad history of Atlantic salmon as a guide.” What we have done to wild steelhead we did knowingly and we are “still doing it,” said Soverel.

BEHAVIOR AND SURVIVAL OF WINTER STEELHEAD IN A LIVE RELEASE FISHERY:

The following information is taken from a 2005 study of catch and release steelhead fishery on the Vedder-Chilliwack River in British Columbia. I think you will find this study interesting and insightful. The abstract is taken from the study and I have gleaned quotes from the text, however, I encourage you to read the study on the NFS web page.

ABSTRACT:

“Mandatory catch and release of wild fish and supplementation with hatchery-reared fish are commonly used to sustain sport fisheries on low-abundance populations of wild steelhead. However, their effectiveness in limiting angling mortality on wild fish is uncertain. We radio-tagged 226 (125 wild, 101 hatchery) angled adult steelhead near the mouth of the Vedder-Chilliwack River, British Columbia, in 1999 and 2000 and monitored their subsequent movements to determine survival to spawning and overlap in the distributions of inferred holding sites, spawning sites, and spawning times. The distributions of prespawning holding sites did not differ between wild and hatchery fish in either year, but spawning locations differed. Holding and spawning sites used by hatchery fish were restricted to the lower two-thirds of the river, downstream of the hatchery where they were reared but will upstream of their smolt release site. Wild fish spawned throughout the watershed. Spawning times did not differ between wild and hatchery fish, but varied with run timing. The maximum mortality from the initial catch and release and radio-tagged fish were recaptured and released in the sport fishery up to three times without any mortality before spawning. Hatchery fish were recaptured at twice the rate of wild fish. At least 92% of unharvested fish spawned, and 75% of successful spawners survived to emigrate from the watershed. The incidence of postspawning death did not vary with the frequency of capture and release. Catch-and-release angling imposed small costs in terms of survival, however, behavioral differences existed between adult wild fish and the adult F1 progeny of wild fish reared to smolt stage in a hatchery.”

FINDINGS AND CONCLUSIONS:

Results of Catch-and-Release Angling on Steelhead Survival

Catch-and-release angling for winter steelhead in the Vedder-Chilliwack River in 1999 and 2000 resulted in an average mortality of 3.6% before spawning. There was no difference in the survival to spawning of fish captured and released multiple times or in the subsequent survival from spawning to emigration from the river as kelts. The authors believe the mortality from catch-and-release angling was “considerably lower than the 3.6% estimated for this study” because of radio tag loss.

Although small in magnitude, mortality from catch-and-release angling may nevertheless contribute to the decline of populations with greatly depressed productivity (e.g. by the reductions in smolt-to-adult survival associated with variations in marine productivity). Because steelhead

can spawn more than once, increases in adult mortality may cause a disproportionate decrease in juvenile production from repeat spawners which are more fecund and more successful in spawning.

Although hooking mortality rates for anadromous salmonids vary widely, our mortality estimate is in the lower portion of the reported ranges. It is, however similar to mortality rates (2.6% - 3.6%) reported by Hooton (1987) for winter steelhead caught on baited, barbless hooks. Mortality rates vary with factors such as hook type, and hooking location which determine the extent of wounding; mortality rates also vary with temperature, air exposure, and a fish's physiological state. Several factors may reduce physiological stress and mortality for angled steelhead in our study. First, water temperatures were low (39 to 44.6 degrees F.); mortality is most commonly associated with water temperatures above 64.4 degrees F. Second, because catch-and-release regulations for wild steelhead have been in force in the Chilliwack River since 1985, most successful anglers are familiar with proper handling and releasing of angled fish; mortality may be higher in areas with less experienced anglers.

The minimum survival of unharvested fish from initial capture to spawning was greater than 92% for both wild and hatchery steelhead in both years. Actual survival may be slightly higher because radio tags were removed from some recaptured fish and the fate of these fish could not be tracked.

There was no evidence for delayed mortality; fish that died usually did so within a few days of release. Thus, the hooking mortality rates determined from the many shorter-term studies in the literature probably provide accurate measures of the effects of catch-and-release angling.

There was no evidence that the physiological stresses associated with multiple recaptures of a fish by anglers reduced postspawning survival to kelting. The survival estimates also imply that prespawning natural mortality was less than about 4% in the Chilliwack River.

Our survival data indicate that catch-and-release angling imposes relatively small costs in terms of survival to spawning and kelting in this population of winter steelhead and that the sport fishery may select against specific timing groups (early run) within the population.

Behavioral Differences of Wild and Hatchery Steelhead

The in-river behavior of hatchery and wild steelhead differed despite the hatchery fish's being the F1 progeny of native, wild parents collected throughout the watershed. The spatial distributions of hatchery and wild fish during the prespawning period were similar, and thus, their interactions with the fishery might be expected to be similar. However, hatchery fish were reported recaptured at twice the rate of wild fish.

Other studies have also found that hatchery-origin salmonids have a higher susceptibility to angling than wild fish, but the hatchery fish in these studies were nonnative or domesticated stocks whose behavior might be expected to differ from that of the native stock. In contrast, we expected hatchery-reared steelhead in our study to be similar to wild fish because the broodstock was drawn annually from the wild, native population. *(This data is in contrast to ODFW findings for Deschutes River hatchery steelhead contribution to the fishery from 1986 to 2004. Wild steelhead contributed more to the angler catch than hatchery fish. The ratio of wild catch has ranged from .52 to 4.08 to 1 for an average of 1.64 to 1. This is based on the number of wild and hatchery steelhead caught per 100 hours of angling effort. Similar anecdotal information from Columbia River anglers indicates a higher catch rate for wild steelhead than for hatchery*

steelhead. This higher catch rate persists even though the wild steelhead run size is smaller than that of the hatchery steelhead run size.)

The presumed genetic similarity of hatchery and wild fish in our study and the fact that both wild and hatchery fish would experience similar environmental conditions from smolting onward suggest that the response of adult steelhead to angling was influenced by their different early rearing environment. Inadvertent selection during broodstock collection or rearing was possible. It is tempting to speculate that the collection of hatchery broodstock by angling might select for aggressive behavior in adults. Higher levels of aggression have been noted in hatchery-reared salmonids but the basis of the behavior is uncertain.

Hatchery programs with a goal of providing harvestable fish while minimizing adverse effects on native steelhead often attempt to segregate wild and hatchery fish in time and space. The overlap in the spatial distributions of hatchery and wild adults seen here during the prespawning holding period will reduce the ability of fishery managers to direct angling mortality away from wild fish, despite their lower catchability. However, the observed difference in spawning distributions between hatchery and wild steelhead - half the wild fish spawning upstream of the hatchery fish - will maintain a partial reproductive isolation between the two stock components, despite temporal overlap in spawning.

The spawning distribution of hatchery fish, near the hatchery site at which they were incubated and reared to smolt stage, rather than near the downstream smolt release site, was consistent with other studies that found that the proportion of adults returning to their rearing site increased as the separation between rearing and release sites decreased. Dittman and Quinn (1996) suggested that "salmon may initially return to their site of release, but if they can detect the odors of their rearing site they will continue on to this site."

The location of the hatchery in the middle portion of the watershed and the close proximity of smolt release sites to the hatchery will limit the ability of managers to restrict the spatial distribution of hatchery spawners to areas little-used by wild fish and, thus, to limit interbreeding.

Early-run fish were exposed to the sport fishery for much longer periods than late-run fish and in 2000 at least were recaptured and killed by the fishery in much higher proportions than late-run fish. Run timing is heritable in salmonids and may be correlated with spawning location. Thus, the sport fishery may be selecting against specific subcomponents of the population.

Our data have important implications for both types of hatchery programs (segregated and integrated). Our spatial distribution data suggest that (1) habitat conditions (e.g. the spatial distribution of potential holding sites) may result in a common fishery, even where management intent is to segregate hatchery and wild fish., (2) phenotypic effects of rearing environments may be important modifiers of spawning distributions, even when hatchery fish (presumably) share a high degree of genetic similarity with wild fish, and (3) supplementation programs, which are intended to augment the natural breeding population by allowing interbreeding between closely related hatchery and wild fish, may not necessarily result in substantial interbreeding.

Source:

Nelson, T.C., M.L. Rosenau, N.T. Johnston. 2005. Behavior and survival of wild and hatchery-origin winter steelhead spawners caught and released in a recreational fishery. *North American Journal of Fisheries Management* 25: 931-943.

References:

Dittman, A.H., and T.P. Quinn. 1996. Homing in Pacific salmon: mechanisms and ecological basis. *Journal of Experimental Biology* 199:83-91.

Hooton, R.S. 1987. Catch and release as a management strategy for steelhead in British Columbia. Pages 143-156 *in* R.A. Barnhart and T.D. Roelofs, editors. *Catch and release fishing: a decade of experience*. California Cooperative Fishery Research Unit, Arcata.

STUDY COMPARES HOMING RATES FOR IN-RIVER, BARGED FISH

A new study indicates that Snake River **spring/summer chinook salmon and steelhead transported downstream in barges as juveniles have more trouble than in-river migrants in finding their natal streams and passing dams when they return as adults to spawn.**

The technical report, "Effects of Transport during Juvenile Migration on behavior and Fate of Returning Adult Chinook Salmon and Steelhead in the Columbia-Snake Hydrosystem, 2000-2003," was prepared for the U.S. Army Corps of Engineers. The Corps manages the dams and fish transportation program.

The study results show that on average juvenile chinook and steelhead that were **barged as juveniles** had "homing" rates to Lower Granite Dam as returning adults that **were 10 percent lower than fish that migrated downstream in-river**. And **barged salmon were 1.9 times more likely to fall back at dams as they make their spawning journey, and barged steelhead 1.3 times more likely, than in-river fish**. A large share of the barged fish that did fall back through spill gates or other routes did so multiple times.

"The results were consistent between species and years, strongly suggesting that juvenile transport impaired adult orientation of both hatchery and wild fish during return migration," according to the report abstract. In-river migrants make their way down river through spill gates, turbines and mechanical bypass systems.

"Overall, the results suggest that the benefits of barging juveniles may be reduced due to negative effects on returning adults," the report says.

The **reduced homing and straying into other streams means fewer of the barged fish return to their natal stream, or hatchery of origin, to spawn than non-barged fish**. That could undermine production for salmon and steelhead in those streams. Some of the stocks are listed under the Endangered Species Act. And it could affect genetics and fitness of stocks in streams where they stray.

"Proliferation of out-of-basin hatchery salmon and steelhead in lower Columbia tributaries could undermine recovery of listed wild fish (Levin et al. 2001), reduce natural productivity (Chilcote 2003), or have other poorly understood ecological consequences (Weber and Fausch 2003)," according to the report.

Assuming four million juvenile spring/summer chinook are transported, adult return rates of 0.5 to 2 percent, a 3.3 percent straying rate, and 11 percent harvest rate for transported chinook,

"approximately 600 to 2,300 barged Snake River salmon may stray into other Columbia River tributaries annually, of which at least 400 to 1,400 (60 percent) would likely be hatchery fish," according to a calculation that the authors admitted was "imprecise." And from 2,000 to 8,000 transported hatchery steelhead might be expected to stray each year.

Adult fallback at dams can bias fishway counts used for escapement estimates and to set harvest quotas. And repeated trips up and over the same dam slows migration and "can be associated with high energetic costs, pre-spawn mortality, and prolonged exposure to fisheries," the report says.

The researchers used radio-telemetry to examine the effects of juvenile transportation on adult "fate" and migration behaviors of 1,184 Snake River spring–summer chinook salmon and steelhead. All study fish were collected and tagged with passive integrated transponder (PIT) tags as juveniles at Lower Granite Dam on the Snake River from 1998-2002 and returned as adults during 2000-2003. About 60 percent of the adults radio-tagged in this study were transported in barges as juveniles from Snake River dams to release sites downstream from Bonneville Dam on the Columbia River.

The study was authored by Matt Keefer, Chris Caudill, Christopher Peer, and Steve Lee, all affiliated with the Fish Ecology Research Laboratory at the University of Idaho, and by B.J. Burke and M.L. Moser of NOAA Fisheries' Northwest Fisheries Science Center.

The study can be found at:
<http://www.cnr.uidaho.edu/uifer/>

The Native Fish Society brought the transported stray issue to the attention of the National Marine Fisheries Service based on research by that agency published in 1982. I remember the researcher, Emil Slatick, saying that transported fish strayed and ended up in non-natal tributaries such as the Deschutes. NMFS responded in a letter of October 6, 1997, "We are not aware of any direct evidence that transported fish wander into rivers at higher rates than occurs naturally." The study reported above shows that this is not the case, however, what remains important is that large numbers of stray steelhead enter the Deschutes and other rivers and it is estimated that 50% of them spawn with wild, native steelhead in the Deschutes, causing ecological and genetic harm to the wild run and making recovery of the wild run more difficult. To this date, the NMFS has not effectively addressed this problem, but then it was only brought to their attention 25 years ago by their own research.