UPRIVER SUPPLEMENTATION AND
RECOVERY OPTIONS

Ed Bowles is Principal Fisheries Research Biologist for the Idaho Department of Fish and Game. He received his masters degree from the University of Idaho in 1985. Since then he has worked for the Shoshone/Bannock tribes and has been with Idaho F&G for the past five years. In his agency, our sources tell us, Ed is recognized as the authority on supplementation (hatchery) operations in Idaho and, by extension, the Columbia-Snake system. Ed fishessteelhead and cutthroat on the fly and cheerfully admits steelhead are harder to figure. This is his first contribution to The Osprey and we think readers will find it a significant one.

Using hatcheries to supplement naturally reproducing salmon and steelhead populations is controversial. Expectations of supplementation range from a panacea for solving survival bottlenecks, to a curse which will accelerate declines and seal the fate of our anadromous stocks. This article addresses the theoretical benefits and risks of supplementation for upriver stocks. It is intended to help narrow the chasm of expectations and promote a clearer understanding of supplementation and its potential role in the recovery process.

The plight of anadromous fish in the Columbia River Basin is a well documented tragedy. This plight is particularly tragic for naturally reproducing populations, which rely heavily on upper basin tributaries for spawning and nursery areas (Figure 1). For example, Idaho contains an estimated 40 to 55 percent of the historical natural production potential in the entire Columbia River Basin for spring and summer chinook salmon and summer steelhead. Regrettably, inadequate adult returns currently limit natural production (Continued on page 14.)

Idaho Chinook Salmon
Natural Production Trend

![Graph showing natural production trend of Idaho Chinook salmon](image)

Figure 1. Index redds counts for spring and summer chinook salmon in Idaho (five year average).
SKEENA STEELHEAD: THE END?

(Pete Soverel is National Chairman, FFF Steelhead Committee. Pete has fly fished for steelhead longer than he can remember and, as regular readers have by now noticed, he has an encyclopedic memory and understanding of the river systems, their fish and what’s wrong with them. One of his longtime favorites is British Columbia’s Skeena River system, a collection of such fabled rivers as the Kispiox, Bulkley, Morice, and others.)

The end, extinction, is in sight for the Skeena summer run steelhead fishery. The story is almost too depressing to recount. I recall vividly one glorious day, not many seasons prior, raising 25, and landing 17 Skeena steelhead to a dry fly; another 12-fish morning between a late breakfast and lunch. Ten fish days were not uncommon. Runs which used to produce two, three, four and more fish are now empty. Whole watersheds are empty. I have talked with anglers who have fished the last two years, in storied Class I waters, without a single fish to the fly: not one.

The Skeena once hosted summer steelhead runs in the range of 100,000 annually. But no more. The 1991 spawning escapement was in the order of two to four percent of historic abundance and set off shock waves as well as calls for and promises of effective action.

Despite government promises, the 1992 spawning escapement will be in the neighborhood of 8,000 steelhead—the second consecutive year, the third in the last four, of severely depressed steelhead escapements. The rate of decline among Skeena steelhead populations is similar to the now almost extinct Snake River summer chinook salmon.

The cause of the looming extinction of Skeena steelhead stocks is neither a mystery nor a secret: It is the “incidental” interception by the huge commercial salmon net fishery in the approaches to the Skeena River mouth and the Canadian Federal Government’s unwillingness/ inability to implement the needed sensible conservation steps.

The FFF, the Steelhead Society of British Columbia, Trout Unlimited and other conservation organizations have urged for years the Canadian federal Department of Fisheries and Oceans (DFO) to impose restrictions on the commercial fishery to protect declining steelhead and coho populations from extinction.

Responding to this clamor, amid much fanfare, the current DFO minister, John Crosbie, committed the Canadian government last fall to a program to reduce drastically the steelhead harvest rate by 50 percent and to a maximum of 30 percent of the run within three years.

He promised "innovative harvest techniques," a change from "status quo" management, and to involve citizen user groups in an action plan. One commercial fishing season later, there is precious little to show for all the fanfare.

Gill Net Catch, Tag and Release

The centerpiece of the DFO/Commercial fisherman’s 1992 plan to save Skeena steelhead was a “study” of what happens to steelhead in gill nets. The key to saving steelhead was a Rube Goldberg scheme to tag and release gill net caught steelhead. We know what a steelhead does on the end of a fly line; imagine what this fish does to itself when tangled in a gill net which is ripping off its gill plates, breaking gill rakes and so on.

With this preposterous program in place, DFO and the commercial fishermen stonewalled all conservation suggestions which had any hope of reducing the commercial interception such as linking the commercial effort to actual steelhead in-river escapements. Nowhere were Minister Crosbie’s “innovative harvest techniques,” no restricted commercial fishing zones, no reduced openings, nothing else.

This outlandish "program" did and proposed to do nothing to increase steelhead escapements. And what of citizen involvement?

Who’s In Charge Here?

On July 6, 1992, Minister Crosbie informed the FFF Steelhead Committee that the 1992 commercial exploitation rate on Skeena steelhead was 60 percent. Based upon that statistic, the in-river escapement estimates (by both DFO and B.C.’s Ministry of Environment) of about 7,500 steelhead translates to a commercial catch of 11,250 which corresponds approximately to what sources observed on-scene: eight to 10 thousand “incidental” steelhead. Steelhead were observed to be present in the commercial catch delivered to the fish processors at the usual rate of about one steelhead per commercial fishing boat day, or about 11,000 for 1992.

Incredibly, the commercial fleet, during an 11,000 boat day season, was able to tag only about 400 steelhead through the so-called ambulance program (gill net tagging) and perhaps another 300 to 500 not in that program. So far, very few tags have been recovered up-river. Predictably, most tagged steelhead did not survive the experiment.

Unbelievably, the processors reported only about 2,200 “incidental” steelhead landed during the entire season, about one-fourth the minimum number reliably estimated to have been caught and 19 percent of the estimated catch based upon DFO’s stated exploitation rate. Curiously, the 1992 reported catch from a marginally bigger run is less than half of that reported in 1991. Quite astonishingly, two Rupert area processors did not report a single steelhead landed for the entire season.

Evidently, DFO checkers were not able to see the steelhead that on-scene witnesses saw every day, day after day.

Based upon the foregoing, we are left with four equally troubling conclusions:

1. The 1992 run is marginally better than 1991 which was the worst ever;

2. DFO escapement and incidental catch numbers do not add up and are mutually exclusive. One or all are wrong;

3. Commercial fishermen and processors are simply discarding steelhead or they are lying;

(Continued on page 12.)
EDITORIAL
THE FACES OF DROUGHT

West of the Cascades the vine maples blaze. Indian Paint Brush scarlets the passes. On the east side of the mountains, the desert side, aspen and cottonwoods already yellow, though October is far away.

A drought year. No snow last winter and spring. No rain this summer. The glacial fed streams milk by, grey or brown, heavy with rock meal ground from volcano slopes two miles high. The snow and rain fed streams trickle. Small creeks that harbor winter and spring steelhead—dry.

The drought of 1992, in Washington at least, promises to stress steelhead and salmon stocks to the fullest—at a time when many wild stocks are near extinction.

On the Elwha River of the Olympic Peninsula, poached by two illegal dams more than a half-century old and ignored by government for as long, remnants of the river’s once great Chinook salmon runs beat their snouts against the lower dam and die—from parasites invigorated by the warm water spilling down the raceway.

In the Skagit River steelhead fry turn belly up in Finney Creek, running on some days recently at 74 and 75 F. And why not? Federal, state and private forest managers have scalped that watershed.

Across the mountains, the Wenatchee, nearly sucked dry by irrigators and drought, slicks over rocks glassy with skeins of algae. To the south in its lower reaches the Yakima stinks in the heat, putrid with irrigation returns.

Not pleasant to contemplate, fisheries on the edge in good times, over the edge in bad.

Nor is it pleasant to contemplate the politics enveloping some fisheries.

On the Columbia-Snake system, hummed by U.S. Sen. Slade Gorton of Washington, sung by his partisan imitators, the word is out: Gut the Endangered Species Act, forget the Snake River sockeye and chinook runs declared endangered, save the water for the farmers and barge operators. Suddenly, to be for or against saving fish is a 1992 campaign issue.

The administration declares that existing Snake and Columbia dams pose no threat to the progeny of this year’s spawning run of a half dozen sockeye. Environmentalists sue. The Steelhead Committee of the Federation of Fly Fishers has joined in.

Where court injunctions have stilled the chain saws until the U.S. Forest Service can bring itself to write forest-management plans that satisfy the Forest Management Act and the Endangered Species Act, the administration has declared political war against the Northern Spotted Owl—the indicator species for the well being of the creatures that depend on mixed-stand forests that include old growth trees.

Among those creatures are wild steelhead and salmon.

Economics must come first, declares the president, who is scheduling a campaign trip to inveigh against the owl and the court injunctions by a judge who in his decision points out that he will lift his directives as soon as the laws are met.

The environmental president cares not. Damn the owl and its protectors. Clear-cut the forests as before, willy-nilly. Let the landsides flood the streams and smother the spawning beds. Pretend that hatcheries will make up for the destruction. Let the timber companies profit. Let the public bear the costs.

A drought from nature. A drought of the mind. A drought of the soul.

A bad year, 1992, sere and political—and, worst of all, cynical, willing, for an election, to sacrifice spotted owls, Snake River sockeye and chinook and other threatened wild stocks in the forest water-sheds—all for another four years.

Unless anglers raise their voices and cry out, "Basta! Enough!"

Maybe we can’t do much about the weather. We can do a hell of a lot to the politicians. Basta!

THE CHAIRMAN’S MEND

Another bad news/good news report.

This issue of The Osprey, like most before it, reports some pretty bleak stuff. I am especially dismayed by the rapidly dwindling Skeena steelhead stocks and Ottawa’s intellectual response. And, adversity brings surprises.

As FFF, the Steelhead Society of British Columbia, Trout Unlimited and others turned up the heat on the Canadian federal government, many readers of The Osprey received brochures from a prominent Skeena region steelhead outfitter. Astonishingly, and to the consternation of many of us, these missives took up the commercial fishermen’s discredited position: Blame for Skeena steelhead troubles lies not with the massive commercial salmon fishing effort but on unnamed “incompetent bureaucrats” in the B.C. Ministry of Environment Fisheries Branch. There are no declines on his Bulkley River, he asserts, and no evidence of excessive commercial exploitation of Skeena steelhead. This outfitter assures all is well up north—skip the mountains of reliable, independent scientific data substantiating the precipitous decline of Skeena steelhead. This outfitter urges clients and potential clients not to be fooled, come on up, the steelhead crisis is a mythical paper crisis, never mind the science.

(Continued on page 4.)
THE CHAIRMAN'S MEND
(Continued from page 3.)

This well known outfitter is, of course, entitled to his opinion. What should concern us is his timing and his disregard for the factual evidence. Along come these unsubstantiated and unfounded claims. And he throws rocks at the very Fisheries Branch officers who have worked so hard and tirelessly for Skeena steelhead, without their efforts there could be no effective campaign to save Skeena steelhead. The North American plight of Skeena steelhead is now energizing anglers and non-anglers alike, throughout North America. The B.C. Steelhead Society's Wild Steelhead Campaign is gaining momentum. Local businesses are lining up behind steelhead conservation. Steelheaders everywhere are joining the fray to prevent the destruction of Skeena summer steelhead.

We can be certain the commercial fishing industry will point to these false claims as "proof" that all is well and that steelhead conservation measures are not needed.

But the scientific data is unequivocal: Skeena steelhead are in deep trouble. Even if the escapement estimates for 1992 are off by 300%, Skeena steelhead will not meet the minimum spawning escapement goal.

Let's all pull together to do whatever it takes to save the last great runs of wild steelhead left on the planet.

The Good News

All the news is not bleak. Under the able and dedicated leadership of Jack de Yonge and John Sager, The Osprey has emerged as North America's authoritative source on steelhead. The newsletter now receives unsolicited manuscripts, telephone calls and faxes from resource biologists and managers on matters relating to steelhead, state and provincial resource agencies asked to be added to the mailing list. At the 1992 FFF Conclave in Calgary, praise of The Osprey was free flowing.

With the newsletter's increasing credibility comes added influence and opporunities to "do good" for steelhead. Hats off to Jack and John!

Also at the Calgary Conclave, the FFF approved a comprehensive steelhead policy, published on page 9 in this issue. And over the past 18 months, the Steelhead Committee has held a series of in-depth discussions with the Northwest Salmon and Steelhead Chapter of Trout Unlimited which have produced cordial working relationships and a very broad area of agreement on steelhead management. These discussions have produced a joint FFF Steelhead Committee-NWSSC TU statement on steelhead management principles, essentially similar to the FFF's own.

I anticipate that as the Federation and TU work more closely on steelhead management, we will be more effective in securing regulations which provide proper protection for wild steelhead and which broaden catch and release and wild steelhead release regulations. This will expand recreational opportunity for steelhead fishers in Washington state, good news indeed.

The Washington Wildlife Department has adopted far-reaching management principles and is developing a Steelhead Management Plan which places the highest management priority on native and wild steelhead. The new Assistant Director for Fisheries Management, Bruce Crawford, has been supportive of and sympathetic to our concerns about wild steelhead.

I am encouraged by the early drafts which have been shared with the Fisheries Management Policy Task Force, on which I serve. The steelhead management plan will bring consistency and clarity to steelhead management and hatchery operations, including policy for the various cooperative hatchery/wild brood stock imprinting pond operations which have been areas of concern for the Steelhead Committee. I understand that the department is moving towards a state-wide environmental impact statement of its hatchery programs and that all new hatchery programs will be subject to impartial scientific review.

Next year, Washington state's steelhead punch card will provide for recording release of wild and hatchery steelhead. The Steelhead Committee has urged this practice for years; it will help provide data to document the popularity and recreational value of catch and release steelhead fishing among the angling public. Also, the next fishing regulation pamphlet will reinstate the section on catch and release.

The FFF Steelhead Committee recently has joined with other conservation and environmental groups to:

- Petition the Federal Energy Regulatory Commission (FERC) for "standing" in the FERC proceedings considering Tacoma Light's requests for re-licensing its facilities on the Skokomish and Nisqually Rivers.

- Urge the Army Corps of Engineers to conduct a full EIS on the proposed Wynoochee mitigation hatchery.

- Be represented in several law suits and petitions by the Oregon Natural Resources Council, Sierra Club Legal Defense Fund and American Rivers. These are all organizations worthy of our financial support. Why not send them a check?

A few weeks ago I went out on a resource check to determine if it is all still worth it. It is.

I was fishing a stream I knew hosted at least a few wild summer runs—not many but enough to fish for with some hope. The tailout of the camp water is ideal for summer runs—huge rocks with broken, streamy water to move the fly. I worked my way down the run without moving anything to a dark caddis dry fly except plucks from rambunctious parr. The little hen's take, as soft and quiet as another parr, came right where you would expect it—in the streamy water. A few minutes later, I admired her. She was a wild three-four pound fish, probably a one salt, perfect in every detail—the crown jewel of our coastal fishery. Like me, she was home from the sea. As I set her free, I hoped she would, unlike me, return to the sea.

It is hard to imagine my life without steelhead.

I hope you feel the same.
A VICTORY FOR STEELHEAD  

Bill Barnett, semi-retired grocer and real estate man from the Wenatchee Valley of central Washington, is that region's living legend among steelhead flyfishers. Bill founded the Wenatchee Valley Flyfishers and presently serves on the Washington Wildlife Department's Fisheries Management Policy Task Force. Bill literally lives on the river (The Wenatchee) and from his lovely bank-side home keeps a close eye on the dwindling numbers of steelhead moving up each fall. Bill is a member of the Steelhead Committee and we appreciate this first contribution to the newsletter.

A century ago, the great plains of America were densely covered with American buffalo. In 1850, about 20 million thundered over the western plains. Forty years later, only 550 were alive. In like manner, wild steelhead populations are approximately 15 percent of what they were 100 years ago.

Will the wild steelhead of the cold swift rivers of the Northwest be allowed to survive as a species? One wonders. I'm doubtful. Mother Nature equipped the wild steelhead to cope with most of nature's stern tests. But it did little to protect it from the devastation brought on by over-fishing, water pollution, dams, habitat destruction, urban development.

- In Idaho, some biologists say only a small semblance remains of the once plentiful runs of steelhead that return to the Snake River to spawn in the Clearwater and Salmon rivers. I can personally testify to the last two years' depressed runs on the Clearwater.

- On British Columbia's Vancouver Island, all steelhead rivers are now managed as catch-and-release on wild fish because the wild stocks have shrunk up like smoked bison jerky. On British Columbia's mainland, even the world famous Kispiox River, which produced the world's record fly-caught steelhead, is now under catch-and-release regulations.

- In Washington, where the Skagit River 20 years ago yielded more than 10,000 fish annually, it's down two-thirds or more. The steelhead sport catch (both wild and hatchery) last winter in Washington was estimated at 33,400, the lowest since record keeping began in 1947. In fact, according to Washington Department of Wildlife figures, the statewide steelhead sport catch has melted by over two-thirds since the winter of 1964-65 (big run year).

But we can't give up on our fight to preserve, and yes, increase our wild steelhead runs.

Here is an example of what can be done if we plan, cooperate and, yes, fight together.

A little more than two years ago Washington's Wildlife Department and Wildlife Commission agreed that a citizens' volunteer Fisheries Management Policy Task Force should address issues facing anadromous fish runs. This group of interested and informed lay people was to meet on a timely basis and provide guidance to the department toward better management of our anadromous fish.

My particular interest is in the world of wild steelhead. Over time I had discovered that our Wenatchee River smolts were being badly treated in the Tumwater Canyon stretch of the river. I gathered facts and figures and brought the tragic story before the Task Force.

After two years of discussion and strong support from most Task Force members, Wenatchee River steelhead now appear to have won a victory. This is their story.

The best steelhead smolt habitat in the Wenatchee River is in the Tumwater canyon, some miles upstream of Wenatchee. But for 25 years a put-and-take fishery took place in the canyon as a "mitigation" program by the Chelan County Public Utility District, operator of nearby Columbia River dams.

Every year the PUD dumped 25,000 legal trout right on top of naturally-spawned steelhead juveniles, in an easy access area. Thousands of anglers then routinely caught limits of eight- to 10-inch fish.

But a three-year scientific study of the fishery, begun in the mid-1980s, rang alarm bells.

Conducted by Boise, Idaho's Don Chapman Consultants, Inc., and funded by the PUD, the 301-page study was titled "Summer and Winter Ecology of Juvenile Chinook Salmon and Steelhead Trout in the Wenatchee River, Washington" and released in June 1989.

Steve Hays, fish biologist for the PUD, explained that the steelhead work was part of a comprehensive study of steelhead and salmon habitat use, population density and species interaction.

The study's third season, July to June 1988-89, focussed on larger juvenile steelhead, six to eight inches, during their last year of fresh-water living before going to sea.

Alarmingly, the study found fishing pressure to be the major killer of wild steelhead juveniles. Anglers caught... 61 to 87 percent of the wild steelhead smolts longer than five inches and killed up to 28 percent of the wild steelhead larger than four inches (by mishandling) through hook-and-release. Anglers harvested 72 to 91 percent of the hatchery trout soon after they were planted."

Hays believes steelhead over six inches, and especially those over seven or eight inches, are the "cream of the crop" because they have survived the hardest part of the natural rearing cycle and normally have much lower natural mortality than do the six-inch smolts.

Further, the report showed 90 to 98 percent of those steelhead smolts disappeared in the summer, mostly from hooking mortality and from being six inches long ("legal"). Many went home in the creels of Tumwater anglers.

Interestingly, the underwater researchers (sonarists) found wild steelhead smolts were more susceptible to angling than hatchery trout, because "...steelhead reacted faster to lures and baits." 

(Continued on page 10.)
THE ELWHA RIVER: COMEBACK OR DISASTER? 

Dick Goin has lived on the Olympic Peninsula since 1937, close by the lower Elwha River near Port Angeles. He has fished and watched the Peninsula’s streams for as long as he can remember, having gear-hooked his first steelhead in 1941. He was on to fly by 1945 and still prefers them. The steelhead, Dick says, is the grandest fish of them all. Dick is in the thick of the fight to remove the river’s two dams, Gline Canyon at river mile 12 and Elwha Canyon at river mile 5. If the dams are removed the event will set a very important precedent in Northwest river management. At end-August a bill in the U.S. Senate was still under consideration which would allow the federal government to take action leading to the removal. If the bill fails before the November general election, Dick says, “it’s a whole new ballgame.” This is Dick’s first contribution to The Osprey and we welcome this up-close view of one of North America’s most unique, yet troubled steelhead rivers.

There are many things about the Elwha that made it a unique river. First, it is the only major river of the Olympic Peninsula which flows north and, as such, is not as subject to the floods that scour the west-flowing streams such as the Hoh, Queets and the Quillayute system.

Weather systems, coming in from the west, lose most of their moisture over these large western peninsula rivers and yet provide plenty of snow in the Olympic Mountains to ensure good flows in the Elwha.

In addition, glacial turbidity affects the Elwha much less frequently than other peninsula streams. When the Elwha clouds it is from the glacial flour banks of the upper and middle river, once an ancient lake.

Historically these and other factors, such as gradient and nutrient base, resulted in a wider variety of species in the Elwha than any of the large west-flowing rivers: chinook, coho, chum and pink salmon, sea-run cutthroat trout, dolly varden, and, of course, steelhead.

In most cases each species was numerous, and in the case of the Elwha Chinook it was probably the largest fish on the peninsula. The run sizes of some species, such as pinks, were truly amazing and in the better years reached upwards of a quarter million; this, even 30 years after the Elwha was dammed.

There is little doubt that these great runs of pinks, and the others, contributed greatly to the extremely rich nutrient base of the Elwha through the deposition of vast numbers of carcasses.

There are several good reasons why (Continued on page 11.)
Editor, The Osprey

Congratulations on your recent Osprey publication. Your article on steelhead politics in Washington was well received by this reader.

Best Regards,
Jim Hubbard
Washington Capital Management, Inc.,
Seattle

Editor, The Osprey

Kudos for another fine issue. I have appreciated your recent inclusion of material by Lucky Al Pratt. It is good counterpoint to technical data pointing to the disappearance of our sport and my own recent article which was not only pessimistic in nature, but bordered on the morose.

Saltwater fishing with the fly here in the Northwest is my second choice to steelheading the rivers. In fact, Lucky Al led me to being blooded on fly-caught coho several years ago. We know that diving birds, rises and concentrations of fishers have been used as fish indicators, but, out there on some lonely beach, snifing one's way to the source of Lucky Al's cigar smoke may be the best way to know where to start casting.

Bob McLaughlin, Edmonds, WA

Editor, The Osprey

I'm one of those who reads every word; in so doing, I always learn a great deal. The interesting (as always) May issue clearly shows why steelheaders on either side of the border can never risk becoming complacent. I thank you and The Osprey for focusing on essential themes.

Attentive readers doubtless recognize that some fisheries managers are allies, and some aren't. Fisheries managers who take refuge behind "policy" or "popular opinion" are particularly dangerous. Integrity will never go out of fashion.

And that's why British Columbians are fortunate to have the likes of Bob Hooton, and Washingtonians are fortunate to have the likes of Jeff Cederholm.

In his piece on catch-and-release, Hooton quietly sounded yet another warning that no matter how dangerous and expensive hatchery steelhead are, some fisheries managers will likely consider hatchery production for some time to come.

FLY FISHING MAGAZINES

An anonymous longtime FFF lifer wants to help the Steelhead Committee's treasury by auctioning off his considerable collection of flyfishing magazines, in three sets: Rod and Reel, now Fly Rod and Reel, 1985 to present; American Angler and Fly Tyer, 1985 to present; Fly Fisherman, 1979 to present. Only a few issues are missing from each set. Those interested should send an offer (no money yet) to The Osprey, specifying which sets are of interest and a per-set price bid. Offers for individual issues will be considered only if the offered price is worth the extra work involved in breaking up the sets. We'll do the rest and the proceeds will go for support of the Committee's work.

River reclassifications?
A surrender of fisheries managers?
More techno-fixes?

Nor are remote rivers automatically safe from hatcheries. As Hooton says, a "common feature of a large majority of British Columbia's steelhead streams is their low productivity." Will low productivity be an excuse for stocking hatchery fish?

Cederholm's "Who Speaks for the Salmon" reveals an important link between the hatchery-and-harvest mentality and the universities. It's nothing short of pathetic that biologists-in-training are assured "fishery biologists are created to 'give the public all the salmon they want.'"

One doesn't have to be a biologist or rocket scientist to know how inadequate that kind of education really is, or how contradictory it is to feed the "insatiable appetite of commercial and sport fisherman, while looking out for the salmon's welfare."

Greed cannot be appeased.

The Osprey is correct. If wild steelhead races are to survive, steelhead anglers must do several things: escalate their battle to protect steelhead habitat; constantly remind the uninformed that infusions of hatchery fish improve neither the catch rate nor the quality of fishing (only the number of participants, the level of competition, and the number of disputes with riverbank property owners increase); convince more anglers that the maximum-harvest mentality is no longer viable.

Above all, they must do their utmost to curb human population growth.

Osprey readers can find the issue neatly summarized in one of your own sentences "Unless we wish to see our fish and our sport disappear, we must devote less time to talking about the fish and how to catch them and more time—and money—into turning ourselves into conservation (Continued on page 13.)
Anglers who value wild steelhead trout should be alarmed at findings listed in The International North Pacific Fisheries Commission’s 1992 report: “Distribution and Origins of Steelhead Trout (Oncorhynchus mykiss) in Offshore waters of the North Pacific Ocean.”

(This is Bulletin 21, produced by members of the American Fisheries Society, working out of the office of The International North Pacific Fisheries Commission, 6640 Northwest Marine Drive, Vancouver, B.C., Canada, V6T 1X2.)

Briefly, the report states that most of the 85 populations of naturally produced (wild) steelhead along the Pacific coast of North America are declining.

Conversely, the number of (cultured) steelhead smolts released annually from enhancement facilities increased from approximately 2,800,000 in 1960 to 30,000,000 in 1987. At that time there were 84 hatcheries and at least 23 rearing, imprinting or acclimatization ponds producing steelhead along the Pacific coast.

States and provinces contributed cultured stocks as follows: Idaho 41.9 per cent, Washington 27.6 per cent, Oregon 18.4 per cent, California 9.4 per cent, British Columbia 2.5 per cent and Alaska 0.2 per cent.

British Columbia was producing the most wild steelhead, 225,000, and coastal Washington, including Puget Sound, the fewest, at 64,000.

Total abundance of all North American stocks of steelhead was estimated at 1,600,000. The proportion of cultured (hatchery and pond) stocks was estimated at 50 per cent overall, with 36.5 per cent overall produced in the Columbia River basin.

The foregoing highlights recently were selected and circulated by behavioral ecologist Craig Orr, PhD., president of the Steelhead Society of British Columbia (SSBC). The Osprey invited the Society to augment Dr. Orr’s piece, so former SSBC president Lee Straight, a retired journalist, has provided the following supplementary text. Eds.

Steelhead in North America spawn in the Aleutian Islands, as far west Russell and Trout Creeks of Cold Bay, and the creeks of the north coast of Unimak Island. The reported northern limit of spawning is in the Copper River system, vicinity of Anchorage and Prince William Sound, mainland Alaska.

The reported southern limit of steelhead in North America is in Malibu Creek, Santa Monica Bay, southwest outskirts of Los Angeles County.

Asian populations of wild rainbow trout are abundant on southeastern Siberia’s Kamchatka Peninsula. Scattered populations are found in mainland coastal streams of the Sea of Okhotsk and of the Greater Shantar and Commander Islands, all just west of Kamchatka.

Steelhead kelts are predominantly female (or hens). Hens outnumbered males (cocks) by over four to one among repeat spawners in wild-fish samples from 14 Vancouver Island streams. In contrast, among the steelhead of Alaskan streams, hens comprised 65-80 per cent of repeat spawners. Frequency of repeat spawners varies greatly among populations—very few in the Columbia River basin, but well over 30 per cent in one creek in Alaska.

Summer-run fish from the Clearwater River, Idaho, and the Thompson and Skeena rivers in British Columbia achieve great size. In general, fish size correlates with the number of years spent at sea.

In one study of salmonid homing behavior, coho (O. kisutch) stayed much more than did steelhead. Fish reared at one site, then released as smolts after an additional rearing period at another site, tend to return to the release site. In Oregon, however, significant straying was reported.

The holding areas chosen by steelhead on their upriver migrations often contain deep pools with abundant cover. In spring, they typically move from those holding waters to the spawning areas.

Stream residence of juvenile (parr and then smolt) steelhead lasts one to five or more years, the majority two or three, before emigration to sea as smolts.

The freshwater age of the maturing fish, river-by-river, generally increases along the coast from south to north. Among “wild” fish, few emigrate after only one year, yet in the Rogue and many other California rivers, nine to 29 percent of the wild smolts do so. In colder or less productive rivers, such as those of British Columbia and Alaska, many linger in rivers for four and, occasionally, five years.

Fry emerging late in the year grow slowly and are only about 50 mm (two inches) long by the following spring. Hatchery fry, however, usually are three times that long in their first year, large enough to be released into the river the spring following their hatching. It takes most wild fingerlings until the end of their second winter to surpass that six-inch (150 mm) length, upon which they leave the system as smolts. Size, far more than age, then, is the critical determinant in maturing sufficiently to be smolt emigrants (for “out-migration”).

The size (tip of nose to tail-fork) of most wild smolts is consistently around 160 mm (six-plus inches), ranging from five to 8-3/4 inches (125-225 mm). Larger smolts appear to produce adults that return sooner to spawn. The migratory period is mid-March to mid-July, peaking mid-April to mid-May. Smolts from the Alaska “panhandle”, from Asia, and from the headwater tributaries of the Fraser and Columbia rivers, migrate in June.

Upon entry into the sea, steelhead smolts move more directly offshore than do salmon smolts, and the former are consistently found further offshore. There is little evidence that young steelhead remain inshore. The initial large size at entry into the sea, and rapid growth probably are factors in the generally more extensive ocean migration of steelhead trout. By July 1 of their second (Continued on page 10.)
NEW FFF NATIONAL STEELHEAD POLICY

(The following policy statement was approved by FFF national directors at the Federation's annual conclave in Calgary, Alberta, July 1992.)

The Federation of Flyfishers notes that West Coast wild steelhead stocks are declining rapidly and are at high risk. Scores of stocks are already extinct, many additional stocks have been identified as at elevated risk of extinction, most wild stocks are substantially below historic levels of abundance and the wide range of genetic diversity and variability of native stocks has been and continues to be compromised by habitat alteration, excessive harvest and ill-advised hatchery practices.

Federation steelhead goals are to preserve wild steelhead genetic diversity and variability and restore wild West Coast steelhead stocks to levels approximating historic abundance through habitat restoration, sharp restrictions of sports harvest until wild populations recover, phased elimination of mixed stock commercial fisheries, modification of hatchery practices and, in some instances, discontinuation of hatchery supplementation.

The Federation supports steelhead management which emphasizes self-sustaining wild populations. The Federation recognizes explicitly the value and integrity of stream/tributary specific steelhead stocks which require careful, conservative management of these irreplaceable resources giving due weight to their special habitat and escapement requirements. As we move from a management philosophy based upon harvest of hatchery products to one emphasizing self-sustaining wild populations, catch and release regulations provide an excellent management tool to protect recovering wild populations.

WILD STEELHEAD MANAGEMENT

Wild steelhead are at the heart of any steelhead management scheme. The Federation urges steelhead management agencies to accord the highest management priority to wild, stream born steelhead. All steelhead management decisions must proceed from a careful analysis of the consequences for wild steelhead. The Federation urges an in-depth review of all steelhead supplementation programs to determine their impact on wild populations with the objective of discontinuing counter-productive hatchery practices.

The Federation urges diverting the fiscal savings from discontinued/scaled down hatcheries to habitat restoration/acquisition.

HABITAT

Without sound habitat, steelhead are doomed. To ensure increasing, self-sustaining wild steelhead populations, the Federation urges management agencies to concentrate their best human and technical resources to habitat protection, restoration and enhancement. Artificial propagation should not replace or assist natural propagation of steelhead in watersheds where individual rivers are still capable of supporting viable wild steelhead.

In those instances where habitat degradation has reduced the wild production capacity, management agencies should allocate, as a top priority, human and fiscal resources to restore habitat as key components of a "no net loss of steelhead habitat" policy.

HATCHERIES

The Federation views steelhead hatchery supplementation as an admission of management failure to provide for wild steelhead. Hatchery supplementation should be taken only as a step of last resort, hopefully in the context of a wild steelhead recovery plan. Before commencing or continuing any Artificial steelhead supplementation in any stream, agencies shall conduct a thorough stream survey to establish existing wild population status, stream capacity and suitability for habitat restoration.

Should a short term artificial supplementation program appear advisable, management agencies shall develop a river specific supplementation program which includes safeguards for existent and recovering wild steelhead stocks. Should an artificial enhancement program actually be instituted, all hatchery stocks must be native/wild to the river being enhanced unless no wild stocks exist in the watershed.

In those watersheds where habitat has been damaged beyond where restoration could be expected to provide habitat suitable for wild stock recovery, supplementation should mimic, as closely as possible, wild stocks paying special attention to protection of any remaining wild stocks.

The Federation urges the utmost caution in any steelhead supplementation program. The Federation notes that biologists and sportmen alike tend to underestimate the ability of wild populations to adapt to their environment, sustain and expand their numbers and provide a healthy fishery while, at the same time, over-estimating the promised, but rarely fulfilled, beneficial consequences of hatchery supplementation.

HARVEST

Excessive sports harvest of wild steelhead, often co-anglered with hatchery products, has contributed directly to depressed wild populations. Given the depressed status of wild steelhead stocks, the Federation supports sharp limits on angler harvest until those stocks have recovered to levels which permit harvest of specific numbers of wild steelhead in each particular watershed. While stocks are recovering, the Federation supports catch and release and wild steelhead release regulations which permit recreational opportunity without harm to the recovering resource.

The Federation urges the phased elimination of non-selective mixed stock commercial fishing methods and conversion to terminal, selective fisheries. Escapement requirements shall be the first consideration in all harvest management regimes. The Federation supports state and federal compensation programs, funded by sportmen and consumers, to facilitate the conversion to terminal fisheries.
STEELHEAD VICTORY
(Continued from page 5.)

Given that the Wildlife Department is committed "to manage a healthy and abundant game fish population for recreation and to avoid actions that might hurt native fish populations," the report signaled that something had to be done.

Several proposals were presented to the public, each considering where to move the put-and-take trout fishery. Fish Lake and Lake Wenatchee were two candidates. Fish Lake won. The Tumwater canyon plants have ceased.

So now the young migrating steelhead, living in Tumwater Canyon and then heading hundreds of miles to the Pacific, are much safer. It is a real victory.

INTERNATIONAL REPORT CARD
(Continued from page 8.)

summer at sea, steelhead average considerably larger than sockeye, chinook, or chinook, and about the same as coho salmon.

Virtually all steelhead caught by anglers are taken in non-tidal waters. The small fraction of tidal catch is taken incidentally during salmon angling.

In British Columbia, over 80 percent of the steelhead catch is released alive. This suggests that the value of the recreational fishery should be based on the total fish landed, rather than simply on those caught and killed. For that reason, the recreational catch figures used in the INPFC report (and not included in this excerpt) likely represent an underestimate of the true fishery value.

The only inshore commercial steelhead fisheries are conducted by aboriginals, and statistics on them are widely variable. The report says that catch varied from 91,000 to 275,000 per season between 1980-81 and 1987-88.

The report is not explicit about the incidental catch ("by-catch") of steelhead in the commercial salmon netting industry every year. It is difficult to discern if those figures are included in this report's estimated total annual "unenhanced" catch of steelhead by the aboriginals and the entire commercial net fleet, rather than just the aboriginal commercial net fleet. "Inshore" means close along the coast, at sea. The aboriginal (tribal) and inshore commercial catch totals are given as 331,000 to 703,000 per annum.

Reported catches of steelhead by the Japanese land-based commercial drift net fishery ranged from 29,000 in 1983 to only 3,000 in 1989. Within the now notorious squid drift net fishery, Japan's 1989 northward shift of the northern boundary for that legal fishery in July and August increased the probability of incidental interception of steelhead trout. Data are, however, insufficient to quantify the effect.

(The term "legal" is used here as there is acknowledged also to be a huge squid fishery not practised by international treaty, therefore termed "illegal" in North America. Only wild guestimates of that catch are available.)

In their examination of escapements from 85 populations of naturally-produced steelhead along the Pacific Coast of North America, two scientists concluded in 1987 that most escapements are declining.

The future demand for steelhead as game fish will increase, rather than diminish.

Unless habitat enhancement or other measures result in increased wild production, the reliance on hatchery-produced steelhead to enhance that wild production will similarly increase, according to a statement from the Northwest Power Planning Council of Washington and Oregon.

A MEMORIAL

Hamilton Gray Wadman, M.D., a well-known Vancouver, B.C. steelhead flyfisher, was remembered at his recent funeral by his daughter, Meredith. "Ham" lost to cancer but pursued his dream right to the end, obviously with loving support.

I tend to think, as his doctor said, that some fun would be the best thing of all for my father. As far as I know, Father has most of his fun two weeks per year: the week he goes steelheading with the guys from his fishing club, and the week before that, when he's like a kid on Christmas morning, poring over his "wet" and "dry" lines, arranging his flies like precious gems in their boxes, checking and rechecking his tears and rods, practicing his casting in the back yard, reminding Mother to cook the chili in time for the Saturday morning departure. Saturday comes, his buddies honk at 6 a.m.; he's off, and Mother collapses.

The anglers fly far north to Bella Coola, from there to the river. They pack their gear a half-mile across its flood plain to the tent camp on the raised, gravelly bank. A week later, Dad reappears, happy, filthy, stubble-bearded, rosy-checked and a bit dozy if the bush planes have flown too high.

Father says the river is his church, that up there—he can't explain why—all his problems are forgotten. He also says the steelhead trout is the Cadillac of fish, and that once you've been on the river, it's hard to go back to lakes . . .

(From Some Day We Will Understand, by Meredith Wadman, reprinted with permission from Totem Topics, vol 95, summer 1992.)
THE ELWHA RIVER
(Continued from Page 6.)
this once-great river cannot be restored with the dams in place.

1. Two of the most numerous species, pink and chum, cannot propagate above impoundments. The fry, upon leaving the gravel, immediately head for the sea and cannot find their way through lakes quickly enough to survive.

2. Such fish-handling facilities proposed by the James River Company (the dam operators) as trap and haul have proved to harm upriver stocks, which incur heavy mortalities.

3. Downstream passage strategies proposed by dam operators are inadequate for some stocks at the Gline Canyon dam, for some other stocks at the Elwha Canyon dam, and at both dams will kill kelts (spawned-out adults) of dolly varden and bull trout, searun cutthroat, steelhead and sturgeon.

4. The dams stop the orderly, natural movement of gravel down the Elwha.

In the peninsula's high gradient, short run rivers, most of the species spawn and rear, partially or totally, in the middle and lower portions of the rivers.

In the Elwha, before the dams, probably 60 to 75 percent of rearing fish were confined to the lower 16 miles of the river, from its mouth to the upper end of the present Gline Canyon impoundment.

This portion of the river is now in the late stages of losing the last of the gravel that serves as a spawning medium for fish and as a rearing area for the insect life that young salmonids feed on.

Instead of naturally spreading, the gravels are all trapped as deltas where the river flows into the two impoundments.

There is no effective way to restore fisheries in the river until dam removal allows gravels to again migrate naturally down the river.

Short of this, only small numbers of steelhead, chinook and coho can use the undammed upper river and the lower and middle Elwha will continue to decline and become but a sterile passageway.

Loss of gravel also causes loss of the mouth's estuary, loss of beach east of the mouth and loss of replenishments of the spit protecting Port Angeles.

Hatchery Effects

All stocks of hatchery fish on the Elwha are in decline or no gain: parasites and disease abound even with increasing numbers of plants.

The 1993 Chinook return will be very poor because 5,000,000 Elwha eggs were destroyed at a hatchery after exposure to disease.

(In late August 1992, Goon reports, parasitic disease appeared even worse than anticipated, probably because of drought-related higher water temperatures; prospects for the remaining Chinook salmon are very poor. Eds.)

Hatchery losses of adults and smolts have been quite large in the 1980s. Costs of feed, wages, power, etc., have increased dramatically. But wild fish are free!

The great wild stocks that have held on for these past 80 years have greatly weakened. Some, such as the summer coho, have been extinct at least 25 years; they will be seen no more. The pink salmon, once numbered in the hundreds of thousands, are down to 25 fish; that stock will soon be extinct.

Wild summer and winter steelhead, grand as they once were, hold on against the onslaught of over-fishing encouraged by available hatchery fish.

The large Elwha chinook, down to fewer than 100 fish in 1974, have been brought back to a few thousand each year through hatchery enhancement—but at the cost of disease in the stock, a weakened genetic line and the loss of the earliest and latest components of the run.

The status of wild coho, after infusions of all sorts of mongrel coho stocks, is unknown.

The remaining chum salmon are now found mostly in a few seepage streams and a small braid on the west side of the lower river.

The dolly varden, searun cutthroat and the large resident rainbow and rainbow-cutthroat hybrid, that live in the lower river, are all very weak and have suffered greatly, like the pink, from the loss of the small gravels that they all need.

Despite all the problems, and except for the dams, the watershed has remained basically pristine. And there is every reason to believe that with cooperative management the Elwha could soon start to produce far greater numbers of fish than the hatchery-assisted runs we now have.

But the river must recapture its nutrient base to approach its former glory.

The dams must go. When they do go, gravel movement will renew and free movement for fish will see adults moving up and outmigrants down. Short of this, these once-great stocks will soon pass into oblivion.

Time is short; there are no options.

(Eds. note: Readers interested in helping may write to Friends of the Elwha, P.O. Box 1521, Port Angeles, WA 98362 or phone (206) 452-4072.)
SKEENA: THE END?
(Continued from page 2.)

4. DFO officials responsible for oversight of the commercial catch, and steelhead counting are not enforcing the steelhead reporting requirements.

What is going on here and who is in charge: the government or the commercial fishermen?

Agreed Minimum Spawning Escapement

DFO and others, including commercial fishing representatives, committed to a "minimum steelhead spawning escapement goal" of 23,000 for the Skeena; on the surface, a good start. In practice, the minimum spawning escapement goal became a sick joke. First, readers will note that DFO settled on the word "goal" rather than "requirement," with all that the difference implies.

The DFO plan is a program to reduce the exploitation rate. It is not a firm, binding, commitment to ensure that an irreducible minimum spawning escapement is met. Without a minimum spawning requirement, written by a commitment from the Canadian government and backed by DFO's determination to impose appropriate restrictions on the commercial fishing industry, the entire process is an exercise in futility and deception.

Readers should further note that the entire 1992 predicted steelhead run was less than the "agreed minimum spawning escapement." In these circumstances, we can reasonably ask how DFO could have responsibly made any commercial or aboriginal allocation much less conduct business as usual in the Skeena commercial fishery.

Because of the alarmingly low predicted run, many sports and conservation organizations asked DFO to commit to reductions in the weekly commercial effort if steelhead escapements were below goal as the season progressed. DFO rejected these suggestions. Sadly, DFO was not and apparently never has been prepared to commit to any restrictions on commercial fishing to achieve steelhead escapement goals. Throughout 1992, DFO and Skeena commercial fishermen persistently blocked all proposals to help meet escapement goals if they involved any changes to their ways of commercial fishing.

Over the course of the 1992 season, as in-river steelhead escapements traced at only 30 to 40 percent of the weekly escapement goals, sportmen and conservationists called for restrictions on the commercial effort to ensure the agreed minimum escapement below goal.

Throughout the summer, First Nation aboriginal fishermen employed in-river drift and gill nets seven days a week in many areas, fished the Skeena approaches on closed fishing days and engaged in an active commercial fishery contrary to court rulings and existing DFO promises. DFO did absolutely nothing. The "net" result is almost certainly a spawning escapement well below 10,000, perhaps 8,000 or about 8 percent of historic abundance and less than 35 percent of an already inadequate goal. Is this a plan to save Skeena steelhead?

It is strange indeed that DFO should allocate to the commercial fleet and tribal fishermen (one or two thousand individuals) a minimum of 8 to 10 thousand steelhead in a year where the predicted total run was less than the "agreed minimum spawning escapement goal"—by any standards an extremely poor year—while the sports anglers numbering in the scores of thousands are denied any harvest at all. Sportsmen should have the opportunity to "harvest" (meaning to catch, most are released) at least as many steelhead as other users of the resource—say 7,000. Thus, the minimum in-river escapement past the commercial fleet should have been on the order of 40,000, a figure DFO and the commercial fishermen simply reject out of hand.

The Solution

The solution on the Skeena is simple: adopt live capture, species specific techniques such as weirs, fish wheels, traps and so on. This technology is available, inexpensive and effective. Abundant stocks may be harvested at sensible rates while species from depressed stocks, such as Skeena steelhead, coho, and chum, can be released alive and unharmed.

The Federation recognizes such a change represents a major realignment of the commercial salmon fishing effort in Canada and the United States. A less satisfactory and reliable alternative is to slash commercial fishing days by 30 to 75 percent. Whichever option DFO might choose, the Federation supports strongly the purchase of existing commercial fishing (Continued on page 13.)
LETTERS
(Continued from page 7.)

activists working with like-minded conservation groups to rectify and reverse the causes bringing on the crash of wild stocks."

Though the battle will not be easily won, steelheaders on both sides of the border are fortunate to have talented generals. John Sager, for one, has clearly seen that the Washington Wildlife Commission—like similar agencies on the Canadian side of the border—often puts politics ahead of biology.

Attentive readers will recognize that the commission’s decision against the Skagit/Sauk catch-and-release wild steelhead fishery was "ultra-conservative" in political not biological terms and that a maximum-harvest mentality is a far cry from a maximum-recreation outlook. The commission’s decision seems to be driven by either ignorance or cowardice—neither of which is a good omen.

There are, it seems, two notable differences between Washington and British Columbia steelhead politics. Whereas Washington steelheaders seem "less inclined than anglers of other species to voluntarily practice Catch and Release," steelheaders are at the forefront of B.C.’s catch-and-release movement.

WSTA ACTION PLAN

Wild salmon and trout stocks in Washington are collapsing because people are destroying their habitats and are damaging stocks through overharvesting and overlays of hatchery fish. The Wild Salmon and Trout Action Plan, prepared by the Wild Salmon and Trout Alliance (WSTA) is now available and is a useful guide outlining the problems associated with this crisis and offering suggestions for specific actions to be taken by individuals and grassroots organizations.

WSTA sponsored an informational and working forum on February 29, 1992 (The Osprey, Issue No. 14, p. 17). Prior to the forum, WSTA distributed a draft action plan for study. Attendees, in caucus groups, discussed habitat, harvest and hatcheries as a platform for finalizing the plan. The participating individuals reflected a broad and diverse concern for wild salmonids.

WSTA is a citizen coalition of conservationists, sport and commercial fishers, Native Americans, scientists and others working to protect and recover wild salmon and trout stocks. If you wish to receive a copy of the Action Plan, send $5.00 to Wild Salmon and Trout Alliance, P.O. Box 1755, Olympia, WA 98507. Phone (206) 428-0644.

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And, judging from Sager’s “Steelhead Politics,” provincial politicians who do get involved in steelhead issues seem far less ignorant than do state representatives.

As for the catch-and-release haymen, the mindlessness of the Washington version matches but does not exceed the mindlessness of the B.C. variety. Hatchery-and-harvest proponents are clearly bottom-feeders. They are the same people who deny there is a population problem in the state or province, nation, or world, and the ones who think that technology can set everything right.

The biggest barrier between Washington and B.C. steelheaders is the border. Steelheaders on both sides of the forty-ninth suffer at the hands of fisheries managers who do little to protect wild stocks, who fail to inform the public about how wild stocks can best be protected, who "continue to equate ‘recreation’ with killing fish," and who suffer from a paucity of ideas.

An idea whose time has come is that the steelheader should pay for what he "consumes." Stated another way, it’s time to distinguish between “users” and “consumers,” and to charge an appropriate fee for the privilege of killing steelhead (and other game fish?).

(Continued on last page.)
UPRIVER SUPPLEMENTATION
(Continued from page 1.)

in Idaho to only 15 percent of its capacity for spring and summer chinook salmon. These declines resulted in listing several upriver stocks for protection under the Endangered Species Act; others are likely to follow.

IMPORTANCE OF DIVERSITY

Any attempt to rebuild anadromous runs must recognize the importance of naturally reproducing populations to sustainable recovery. These populations represent a "bank" of genetic diversity that provides the foundation for adaptation and persistence in an ever-changing environment. Recovery approaches are short sighted if they do not maintain or enhance this natural diversity of proven performance characteristics.

Successful recovery is thus dependent on two key elements: 1) Recovery must enhance the number of naturally reproducing fish and 2) this enhancement must not reduce natural productivity and genetic diversity, which are crucial for long term sustainability.

The genetic diversity of a species represents the spectrum of performance capabilities found within and among populations (a group of interbreeding individuals). This diversity represents an important hierarchy that begins at the individual population level that has evolved through adaptation to its local environment (Figure 2).

The diversity within this group is important for continued adaptation and resiliency to environmental fluctuations and change. Part of this diversity is provided by natural gene flow (straying and inbreeding) with other adjacent populations.

Those populations that maintain an appreciable level of gene flow combine to form a stock, whose sustainability and resiliency is a direct function of the natural diversity with and among its populations. Although additional levels in the hierarchy may be appropriate, a grouping of stocks is considered to represent the species unit. Thus the species unit is only as strong as its stock diversity and productivity which are only as strong as their population diversity and productivity—thus the hierarchy.

The importance of maintaining this natural diversity cannot be emphasized enough for sustainable recovery. Current extinction theory demonstrates that as the number of distinct populations within a stock decline, the probability of extinction for that stock increases dramatically. This concept is important because recovery options that are selective (i.e., do not benefit all natural diversity characteristics) will not promote sustainable recovery. This is true even if numbers have increased as a result of the management action but general diversity has declined.

Applying these concepts to fisheries management does not present the quandary that might be expected. Obviously, it is unrealistic to consider managing all anadromous fish at the individual population level, with every diversity unit within that population identified, quantified and monitored.

What it does mean is that no matter how large we draw our management circles, we need to recognize that the management unit contains a spectrum of performance capabilities whose natural diversity is critical to the health of the management unit as a whole.

RECOVERY OPTIONS

Management options for recovery of decimated or extirpated naturally reproducing populations can be grouped into four main categories:

- Improve survival during migrations;
- Reduce harvest impacts;
- Improve spawning and rearing habitat;
- Supplement natural production through artificial propagation.

To be consistent with sustainability goals, these recovery options must be (Continued on page 15.)
UPRIVER SUPPLEMENTATION
(Continued from page 14)

assessed from the perspective of conserving natural genetic diversity and productivity as well as increasing numbers of naturally reproducing fish.

MAINSTEM SURVIVAL

Obviously, our best hope for short and long term recovery lies in improvement of mainstem migrational conditions. Other options pale in comparison to this overriding factor.

It is well documented that most of the decline and continued depression of upriver anadromous stocks results predominately from poor survival (flows and passage problems) associated with the lower Snake and Columbia River dams and reservoirs.

In addition to being the best option for increasing fish numbers, mainstem survival improvements are also the best and perhaps only way to meet sustainability goals. This is the only recovery option that can ensure minimal selection toward particular populations or stocks, thus preserving and enhancing genetic diversity as fish numbers increase. For example, an optimistic benefit from supplementation or degraded habitat improvement may enhance natural production of a target population by 50 percent after one generation.

In contrast, flow and passage improvements that add only 0.3 percent to smolt-to-adult survival would accomplish the same effect for that target population, as well as for all other upriver anadromous stocks.

In spite of these benefits, there is obvious reluctance to pursue this option rigorously. This is primarily because of perceived sacrifices required in the "standard operating procedures" of the Northwest. Thus, the desire to find alternatives.

HARVEST

One of these alternatives is to reduce harvest. In upriver areas, harvest opportunity on natural fish is already severely constrained. With respect to downriver harvest, recovery through other measures will be hampered without stringent harvest restrictions on mixed stock fisheries in the mainstem Columbia and Snake rivers. But these harvest restrictions alone will not recover upriver natural production.

HABITAT

Measures to improve spawning and freshwater rearing habitat have a relatively minor but important role in the initial recovery of upriver salmon and steelhead populations. Much of Idaho's available spawning and rearing habitat is in good condition but inadequate adult returns currently limit utilization of this habitat to less than 35 percent of its potential. With much of Idaho's quality habitat under utilized, it is obvious that habitat improvement will have limited benefit without concurrent improvement in adult escapement.

Habitat measures must remain an important component of any recovery package. Habitat has been severely degraded in several critical natural production areas and should be enhanced to support recovery. But these improvements alone will not provide this recovery.

SUPPLEMENTATION

Supplementation proposes to use hatchery production to increase natural production while minimizing genetic and ecological impacts. Supplementation is considered a desirable option because it is not perceived to disrupt business-as-usual in the Northwest. But can supplementation solve our problems? How do we implement it? What are the risks?

Despite over 100 years of hatchery and outplanting programs in the Northwest, existing knowledge on supplementation is very limited. We know little about supplementation mainly because "true" supplementation programs have rarely been implemented. Outplanting programs in the past were directed by conventional hatchery guidelines without the benefit of current natural production and genetic conservation theories. Performance of hatchery fish in natural habitats and the effects on existing natural populations were not major concerns.

The few programs that were monitored and evaluated adequately indicated that supplementation was rarely successful in increasing natural production and often significant risks were incurred.

Resource managers should neither fully embrace nor dismiss supplementation as a recovery tool, but reassess its role within this new context. Our challenge is to develop strategies to maximize benefits and minimize risks, and to test these strategies conservatively in low risk areas prior to large scale implementation. Although knowledge on supplementation is limited, we can already begin this assessment by defining boundaries for its potential utility in the recovery process.

HABITAT RESTRAINTS

Supplementation can potentially benefit only those populations where natural smolt production is limited by adult escapement, not by spawning or rearing habitat. If spawning or rearing habitat is a key factor (i.e., population is at carrying capacity) then this constraint will have to be resolved before or concurrently with supplementation actions.

SURVIVAL

Supplementation can potentially increase natural production (i.e., number of progeny produced from naturally spawning adults) but not natural productivity (i.e., survival of these naturally produced progeny), except in possible cases of severe inbreeding depression. Thus an optimal scenario would be to increase natural production without reducing natural productivity.

To increase natural production, artificial propagation must provide a net survival benefit for the target stock as compared to the purely natural component. In areas with existing natural populations, the combined hatchery and natural productivity (survival) must exceed

(Continued on page 16.)
UPRIVER SUPPLEMENTATION
(Continued from page 15.)

the natural productivity occurring without supplementation (Figure 3). This increase in net productivity must not come at the expense of the natural productivity component if sustainable recovery is desired.

Consider a best case scenario where supplementation increases natural production without reducing natural productivity (Figure 4, Page 17). Two common expectations for supplementation are to rebuild populations to near full seeding, and to provide self-sustaining natural production at these enhanced levels. For upriver stocks, realization of these goals is highly unlikely. In the above scenario, assume the hatchery increases smolt production to provide enough adult returns to fully seed the habitat and produce the maximum possible number of natural smolts (at carrying capacity). But in turn, these natural smolts cannot produce enough adult returns to fully seed the habitat because of excessive smolt-to-adult mortality. Thus supplementation can never provide for recovery to historical levels of naturally produced adults.

In addition, as the number of natural adults is increased through supplementation, the survival of their progeny declines due to density dependent natural rearing constraints. This increased level of natural production can be artificially maintained, but as soon as supplementation is stopped, the population will decline to pre-supplementation levels, assuming natural productivity has not been impaired by the hatchery program. Thus even under a best case scenario, supplementation is unable to provide self-sustaining natural production at this increased level without reductions in downriver mortality.

DIVERSITY

Supplementation has limited potential to maintain or enhance natural genetic diversity throughout the Basin. As discussed previously, a species comprised of a diversity of stocks, which are comprised of a diversity of populations, each of which contains a diversity of locally adapted performance traits.

A major risk of supplementation is the potential loss of this among-population and within-population variability. Variability among populations can be reduced if diversity is not recognized or managed. For example, if a donor broodstock is taken from a relatively productive natural population and used to supplement other weak populations within that stock, genetic diversity of the entire stock may decline from loss of among-population variability. The genetic identity of the weak components is compromised by the excessive gene flow from the donor stock. This is one reason why many scientific forums prescribe supplementation using local populations for broodstock whenever possible.

Even using the local stock is not without risks to genetic diversity. Variability within the population can be lost if supplementation is genetically selective. For example, if adult collection, spawning, rearing or release practices are selective for particular traits (e.g., size, run timing) or families within the population, natural genetic diversity may decline.

Supplementation can potentially enhance only targeted populations. Obviously, independent supplementation of every population within all stocks is unrealistic. Thus supplementation can benefit only a portion of the population diversity necessary for sustainability.

Managers cannot circumvent this dilemma by pooling populations so supplementation of the entire stock becomes manageable. This misdirected approach could greatly reduce the sustainability of the stock by diluting among-population diversity, even if actual production increases. In contrast, improvements to mainstem migration conditions would benefit all upriver populations and promote sustainability with the recovery.

(Continued on page 17.)
UPRIVER SUPPLEMENTATION
(Continued from page 16.)

On a positive note, supplementation may play an important interim role for populations that are on the verge of extinction. Supplementation may allow these populations to persist until adequate survival conditions are ensured. This assumes, of course, we can provide a hatchery survival advantage without adversely affecting performance in the natural environment. This is an unproven assumption that requires rigorous investigation and innovative approaches. Supplementation may also be important as a restoration tool in areas where local populations have been extirpated, assuming problems causing the declines are being fixed.

IMPLEMENTATION

Supplementation cannot be considered an alternative to other options for recovery of upriver stocks. Recovery must be approached as a package, with obvious emphasis placed on improving mainstem migrational conditions.

Contrary to some approaches advocating potential benefits of supplementation relative to risks and uncertainties do not warrant full implementation of this tool for upriver anadromous stocks. The potential benefits from supplementation must be kept in perspective with the overriding mainstem conditions that greatly constrain these benefits. I believe supplementation can contribute to sustainable recovery, but high potential risks and large uncertainties require conservative implementation.

This is the approach taken by Idaho Supplementation Studies, which was recently implemented as a cooperative effort among Idaho’s resource management agencies and tribes. The purpose of this BPA-funded program is to help determine the utility of supplementation as a potential recovery tool for decimated stocks of spring and summer chinook salmon in Idaho.

Our goals are to assess the use of hatchery chinook to restore or augment natural populations, and to evaluate the effects of supplementation on the survival and fitness of existing natural populations.

Nat Production ↑, Nat Productivity =

Figure 4. Hypothetical productivity (upper figure) and production (lower figure) curves illustrating potential benefits and risks if supplementation increases natural production (numbers) and does not impair natural productivity (survival). The diagonal line in the upper figure is the replacement curve.

Nat Production ↑, Nat Productivity ↓

Figure 5. Hypothetical productivity (upper) and production (lower) curves illustrate potential benefits and risks if supplementation increases natural production (numbers) but reduces natural productivity (survival). The diagonal line in the upper figure is the replacement curve.
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In addition to raising revenue that could be used for other resource-saving purposes, a "kill" fee would eliminate accusations that the kill-fishery is subsidized by the catch-and-release fishery.

Since costs of producing adult hatchery steelhead vary from one fishery to another, it would have to be decided whether river-specific, season-specific, or averaged levies should be imposed.

The "average" adult hatchery steelhead would probably cost no more than $100.

It's likely that a cost-recovery season or two would contribute toward what Pete Soverel calls an "about face" of steelhead management—a movement "away from hatchery supplementation toward an orientation which emphasizes naturally spawning, wild steelhead populations."

"It would explicitly recognize values and protect the genetic diversity and variability, river/tributary specific nature of wild steelhead stocks..."

Let's hope. Get back to me if you think the idea has merit. Meanwhile, keep doin' what you're doin'.

Aye,

Pete Broomhall, Vancouver, B.C.