Comparisons of Steelhead Abundance in Alaska's Situk River with Washington's Skagit River

By Bill McMillan

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These changes, often taking centuries, alter human perception of what is natural or desirable. Fishery scientists of each generation accept the natural state of fisheries as being the stock levels when their careers started and neglect the fact that stocks may have declined before they started working. This has been termed the "shifting baseline syndrome" and Pauly (1995) has argued that this leads fishery managers to progressively accept degraded systems as the target they would like to achieve, because they have no understanding of the real natural condition that may have existed decades or centuries before" (Hilborn et al. 2004).

Abundance provides more useful lessons than depletion. To observe and to study only depletion is to perpetuate depletion. When the understanding of natural resources is based on false assumptions skewed toward depletion rather than abundance, the potential to restore those resources becomes difficult and perhaps entirely impossible due to the faulty vision used as a restoration target.

Having primarily experienced the anadromous fish rivers of Oregon, Washington, Idaho, and southern British Columbia, my personal visions have often been skewed by the perpetual view of fish resource depletion rather than abundance. My own life history began in late 1944 with the memory of outdoor experiences limited to the mid 1950s onward. I was born a century too late to have a vision of the Pacific Northwest that was other than resource depletion.

But there have been times in my life when personal experience was expanded by travel to landscapes where resource depletion has not as thoroughly occurred. While these experiences have been of limited duration, they have been the equivalent to lighting a torch while exploring a cave, and there on the ceiling is the equivalent to the Sistine Chapel in Paleolithic paintings: "Ah, this ..."

The most recent of these experiences was to Southeast Alaska's Situk (pronounced See-tuck) River in early May of 2003. The Situk is a place of ravens, eagles, moose, bears, salmon, steelhead, and a landscape more than half-circled by mountains to 19,000 feet. I was invited by three friends to join their planned steelhead fishing trip there. It was to be my first experience of seeing steelhead abundance rivaling that of Pacific salmon such as chum. But the fact is, I have since found that it was but a reduced level of depletion. Nevertheless, the experience is one that has suggested how far off the target we may be in setting goals for steelhead restoration in the Pacific Northwest of the Lower 48.

Of particular interest, beyond the sheer numbers of steelhead in the Situk, was the nature of the river itself. It did not look like a steelhead river as limited by my previous perceptions of preferred habitat for rearing juvenile steelhead, that being extensive sections of shallow to deep riffles with a large cobble and boulder substrate. Nor did it look like an important chinook stream due to its small size. It looked like my concept of an ideal coho stream – small size, low gradient, all gravel, and dominated by long pools with continuous accumulations of large wood.

Situk River Description:

The Situk River in southeast Alaska is a small stream whose low gradient and lack of riffles seldom provides habitat typically identified as preferable for juvenile steelhead rearing. However, despite a drainage area of only 124 sq. miles, in 1952 20,000-26,000 adult steelhead kelts were passed downstream through the Situk weir.

The Situk River is located about 10 miles southeast of the village of Yakutat (population 680). It has periodically been the outflow for Hubbard Glacier's entry into what is presently Russell Fiord. At this point in time, that is not the case and the Situk River is a small, stable, low gradient stream running 22 miles from Mountain Lake, then to Situk Lake, and then to the Situk/Ahrnklin Lagoon where it outlets into the Gulf of Alaska. The Situk also has two main tributaries, both relatively small: The Old Situk Channel and the West Fork Situk which comes out of Lake Redfield.

The Situk watershed's landscape is characterized by a patchwork of spruce forest, muskeg, and willow and grass meadows. The U.S.D.A Forest Service indicates the area has an annual rainfall of 151" and annual snowfall of 202". The entire length of the Situk is very low gradient dominated by long, slow pools. The stream substrate is almost entirely gravel. The channel is frequently blocked by debris jams of spruce that have been windthrown (although all of these blockages have been notched with 8’-15’ gaps to accommodate boat passage).

Situk River Relationship to Hubbard Glacier:

In the geologically recent past, the Situk was a much larger river of glacial origin with a primary outflow down the Old Situk Channel. The Situk is a watershed in dynamic processes that occur with somewhat greater magnitude and frequency than is common to other rivers due to its proximity to 76 mile long Hubbard Glacier.

Hubbard Glacier, unlike most over the past 100 years, has been advancing rather than retreating. In 1986 and again in 2002, it briefly sealed Russell Fiord off from Yakutat Bay creating a rising lake that threatened to breech again into the Old Situk Channel and potentially elsewhere depending on the eventual height of the ice dam. Each time those blockages proved temporary. In the 2002 event, the lake level rose 61 feet before it reopened with a rush of water larger than the entire Mississippi River drainage.

The National Oceanic and Atmospheric Administration (NOAA) has reported these are but reprieves to the inevitable. Within the next decade Russell Lake is predicted to become more permanent with Hubbard’s blockage of Russell Fiord. Between 970 AD and 1290 AD, Yakutat Bay was completely ice covered during the last advance of Hubbard Glacier. It may become so again. Predictably, there has been a human outcry from the Yakutat area to somehow use technology to deter Hubbard’s advance. Even drilling and emplacement of a nuclear device has been suggested (English Word, 2002). However, the massiveness of this glacier, and its integral part of the landscape, is not unlike suggesting removal of Mt. McKinley. Yes, it can probably be technologically done, but at what costs, to what end, and with what unseen consequences?

The Tlingits say their ancestors crossed the ice of Yakutat Bay 1,000 years ago in native settlement of the area (English Word, 2002). It is part of the oral history of a people that experienced the previous growth of the glacier, its retreat between 1300 to the late 1800s, and its most recent 100 year advance. The very presence of the Tlingits whose original ancestors crossed the Bering Land Bridge exemplifies life’s (human or otherwise) necessary adaptability to climate and geology.

NOAA predicts that the Situk, once Russell Lake breeches into it, will alter from the small, clear, ground water fed river it now is to a large, unstable, glacial river. The Situk would be predicted to change from a river with a flow of 220 meters per second to one of 1,400 meters per second and the channel would widen from its present 25 meters to 2,500 meters with multiple channels. In the short term the Situk River substrate will alter to a scoured bottom with diminished spawning habitat. It will become more turbid, colder, and would remain unstable for a number of years. Sockeye salmon might be entirely lost. However, NOAA also indicates the long term impacts are more difficult to assess once the quality and quantity of habitat stabilizes. Apparently fish numbers might also increase as one possible long term result.

Presumably, the Situk's fish resource future will depend on how many places the glacial lake breeches over into the drainage, and how much of present habitat might remain unaltered. When Mt. St. Helens erupted in 1980, the mainstem Toutle River and forks and tributaries with mountain origins took a massive fish habitat hit. However, within five years of the eruption, wild steelhead were exceeding past escapement goals when other rivers in the region unimpacted by the eruption were not. What had been forgotten is that most of the Toutle River's smaller tributaries did not have mountain origins and still provided excellent steelhead spawning and rearing habitat.

Situk Hydrology, Drainage Area and Flow Compared to Washington Rivers:

The lake sources the Situk originates from cover 992 acres and provide considerable hydrologic stability. The other sources are all ground water and snow/rain run off. The United States Geological Survey (USGS) gauging station on the Situk River is 14 miles upstream of the mouth. It records the flow from a drainage area upstream of 36 sq. miles. (The Alaska Department of Fish and Wildlife website for the Yakutat Region indicates the area of the entire Situk River drainage is 124 sq. miles.) The upper Situk's average low flow occurs in July at 152 cfs and the average high flow occurs in October at 553 cfs. The highest streamflow recorded between 1988-2000 was 3,800 cfs in 1989. On August 10, 2003, the day of this writing, the Situk gauge is reading 70 cfs. This was also the flow when I visited in early May after over 4 weeks of drought.

For a comparison, the Hoko River on Washington's Olympic Peninsula has a drainage area above its USGS gauge of 51.2 sq. miles with the lowest average flow being in August at 45 cfs and the highest average flow occurring in January at 896 cfs. A stream somewhat similar to the Situk is the Dickey River, also on the Olympic Peninsula but for which there is no USGS gauge of comparison. The North Fork Tolt River's drainage area at 39.9 sq. miles is nearly identical to the upper Situk's 36 sq. miles as are its minimum (115 cfs in August) and maximum (533 cfs in December) average flows. The Tolt River system as a whole is probably of similar drainage size to the entire Situk system, although the Tolt River's higher gradient and canyon dominated stream channel is very different. Unlike the Tolt, the Situk has no waterfalls or gradient changes that isolate large portions of habitat from anadromous salmonid entry, and of course, no dams. But size wise, these three Washington river systems provide reference points from which to compare the Situk in water volume, drainage area, and quantity of available salmonid rearing habitat.

Current Alaskan and Situk River Steelhead Information:

Despite its small size, the Situk River has the largest known steelhead population in Alaska. Downstream kelt passage has ranged between 1,211-9,204 steelhead annually since 1988 as counted through the Situk Weir by Alaska Department of Fish and Game (ADF&G Situk Weir counts, 1988-2003). The Karluk River, further north and west on Kodiak Island also has a weir. Between 1976-1995, downstream Karluk kelt counts ranged between 210-7,014 annually which makes it the second most productive steelhead stream in Alaska (Begich 1997).

There have also been comparative snorkel and boat counting surveys on the Situk River. For instance, the high boat count for 1994 was made on May 21st with a total of 4,702 steelhead observed. That compares with the total weir count of 7,854 steelhead kelts that went out in 1994. So 60% of that total count was observable at one time in the Situk on May 21st of that year (Johnson 1996). This may have been the approximate number of steelhead we saw in the river in early May of 2003.

Although the Situk's steelhead were once decimated due to a bounty on them, it is now Alaska's most prolific steelhead stream with 6,113-9,204 outmigrating kelts counted annually over the past decade. Note the dark line of clustered steelhead in the center of the lower-right quadrant highlighted by the dashed oval. This one pool had an estimated total of at least 500 adults in early May 2003.

The Situk has both spring and fall runs of steelhead. The fall run overwinters in the headwater lakes until spring spawning dispersal downstream (Johnson, 1991). It also has resident rainbow. There are no apparent spatial or temporal barriers to prevent spawning interactions. It is presently not known if there are separate populations or if the Situk system has but one steelhead/rainbow population (per. com. Bob Johnson, ADF&G, 2003).

Harding and Brookover (2003) report that 331 streams have steelhead populations in Alaska. Most of these consist of 200 steelhead or less, and most are in the Southeast. The Naha, Karta, and Thorne are exceptions with populations likely in excess of 1,000. The known range of steelhead in Alaska is from Dixon Entrance in the Southeast to the Cold Bay area on the Alaska Peninsula. They indicated there are typically two runs: spring, mostly limited to rivers from Yakutat south, and fall, mostly north and west of Yakutat.

Repeat spawning for Alaska steelhead has reportedly ranged from 11%-38% with an average between 25%-33% (Brookover and Harding 2003). However, on the Situk River in 1994, of 907 steelhead captured and sampled for age and length, 51% were found to be repeat spawners (Johnson 1996). Evidently respawner rates can be highly variable on an annual basis. First time spawners are typically equally divided between males and females, while repeat spawners are 80% females as found in the Situk (Jones 1983; and Johnson 1996). This would suggest the overall steelhead return is female dominated.

Situk Salmon Information:

The Situk is a remarkably productive salmon stream. Although adult coho counts are not available for the Situk, the estimated coho harvest it provides for commercial, recreational, and subsistence fisheries is 10,000-100,000 annually. Juvenile coho production is better known. A total of 1,197,298 coho smolts emigrated in 1992. In 1993 this helped provide a harvest of 49,800 adult coho in the varied fisheries (Ericksen and McPherson 1997).

The total annual run sizes (harvest and escapement combined) are estimated as follows:

Chinook 1,000-18,000
Sockeye 67,000-302,000

And on odd years:

Pink 30,000-500,000

There was no readily available chum salmon information.

It has been estimated that an average of 500,000 salmon return to the Situk annually (Johnson, per. com. 2003). As of August 8, 2003, when the weir was removed for the year, 89,720 sockeye, 2,615 large chinook, 344 medium chinook, 349 small chinook, and 375,333 pink salmon had passed through the Situk. It was too early for coho or chum to have been counted when the weir was removed. Its primary purpose is to count sockeye and chinook.

Situk River Past Steelhead History:

The most fascinating Situk steelhead information is not provided by the present counts. Bob Johnson, with ADF&G in the Yakutat Region, provided an historic report of the Situk River's steelhead history (per. com. 2003):

Johnson indicates the steelhead trout has been one of the least understood and most maligned species in the Situk. Uncontrolled sockeye and coho commercial net fisheries commenced in 1902 in the Situk Lagoon with a rapid decline that was apparent by 1923. This was followed by gear and fishing time regulations in 1927, but the sockeye and coho numbers continued to decline. The plentiful steelhead and Dolly Varden were blamed for this decline, and in the early 1930s a bounty was paid for killing them in the Situk. A total of 142,547 trout (steelhead) and Dolly Varden were destroyed in 1934 in the Situk at a cost of $672.81 (USFWS, 1934). Fish traps, seines, fyke nets, and explosives were all used. However, after 1939 the bounty fund supplied by the fish cannery dried up and interest in the eradication effort waned.

The Situk steelhead population gradually recovered after 1939. The peak occurred in 1952 when 20,000-26,000 steelhead kelts were counted through the U.S. Fish and Wildlife Service (USFWS) weir. Over 6,000 steelhead were counted in just one night (Knapp 1952). But after that the steelhead population crashed and has remained at a reduced level ever since (Johnson 1990).

Johnson provides a discussion of possible reasons for this crash: the record dry years of 1950 and 1951 in the Yakutat region may have affected juvenile steelhead survival, although he is quick to point out that it was likely a combination of several factors. He indicates that thousands of dead rainbow fry were found in the West Fork of the Situk during the drought that occurred in the summer of 1987. There was also concern in the years after 1952 that the operation of the weir itself may have impacted the kelts on their way out with a subsequent high rate of mortality in repeat spawners. And he briefly discusses ocean cycles as possible contributors as well.

The sport fishing history on the Situk did not begin until the construction of the airfield near Yakutat in 1942. It resulted in 10,000 servicemen stationed there during World War II. A 1945 U.S.F.W.S. report noted that many trout were taken out of the Situk in the war years by the armed forces, but it indicated an abundance of rainbows and Dolly Varden of all sizes remained. In 1948 it was said the Situk was one of the best sportsman streams in Alaska.

For whatever reasons, the end of Situk steelhead abundance was sudden. The 1953 Federal Report stated: "Steelhead trout were almost non-existent this season." In 1954 it reported much the same. After the military left Yakutat there was a decline in sport fishing pressure on the Situk with low usage through the 1950s and 1960s. Intermittent counts by ADF&G from 1960-1980 indicated a minimum escapement of 1,100-1,500 steelhead (Johnson 1990).

In the 1970s angling pressure steadily increased due to better access provided by a new road system. In the late 1980s there was a sudden increase which may have been related to televised sportfishing programs and promotions at outdoor expositions in the Lower 48.

Situk River Steelhead Sport Fishing Changes:

In 1988 the most recent Situk weir counts began. That first year the number of downstream kelts counted was 1,211, the lowest modern count. But in 1989 it was up to 5,991 which was followed by declines to 3,652 in 1990, 2,526 in 1991, and 2,976 in 1992 (Situk weir cumulative data, 2003).

Ever since 1977, steelhead sport harvest on the Situk had been increasing until a peak in 1986 when harvest began to fall. Beginning in 1991, the Situk was closed to steelhead retention along with bait restrictions. In 1997 the regulations were changed again: no bait, one steelhead could be retained per day, two steelhead could be retained annually, and steelhead retained had to be over 36" (Brookover and Harding 2003).

Beginning in 1994, steelhead numbers jumped up to stabilized counts of 6,113-9,204 kelts counted annually since. Catch estimates, including both retained fish and those caught and released, have also risen. The combined catch record begins in 1991 with 2,793 steelhead caught. The highest catch was in 2000 when 16,189 steelhead were mostly released (Situk weir cumulative data, 2003).

Bob Johnson indicates angling pressure and friction between differing modes of angling transportation on the Situk have resulted in the U.S.D.A. Forest Service (responsible for people management on the river) initiating a use management plan soliciting public comments. This is particularly aimed at managing boat traffic. Among the options are restrictions in boat numbers during the peak season, restrict motorized traffic to downstream use only, and the hotly debated use of jet outboard motors on the river (per. com. 2003). (Certainly my own experience of the Situk indicated present boat use is out of all balance with the size of the river and that allowing outboards with jet pumps, or any other motor, is preposterous ... yet there they were on a daily basis.)

Situk Habitat Assessment:

I was wrong in my visual assessment of the Situk River. It may not have looked like my perception of a productive steelhead stream, but it is. It may not have looked like a productive chinook stream, but it is. And while it did look like a productive coho stream, and is, it is a remarkably productive system for steelhead, sockeye, chinook, pink and Dolly Varden as well. It probably has a substantial chum run too, although I could find no records. It also has rainbow trout and at least a few cutthroat.

My error in assessing the Situk as less than ideal steelhead habitat was based on snorkel surveys I'd make in Washington rivers over the past 20 years in which age 1+ steelhead were typically found in greatest densities in higher gradient river sections typified by deeper riffles and pocket water in substrates of large cobble and boulders. Situk River steelhead rear even longer in fresh water, 2-5 years with an average of 3 (Jones, 1983), than do Washington steelhead that most typically rear 1-3 years with an average of 2 (Meigs and Pautzke, 1941;Gudjonsson, 1946; Larson and Ward, 1955). Therefore it seemed to make sense that even more reaches of cobble/boulder riffles would be required in Alaska to rear 1+ steelhead an extra 1-2 years.

However, the Situk River habitat is dominated by pools, not riffles. And what riffles exist are typically short with gravel to small cobble substrate – virtually no large cobble or boulders. It is possible that a steeper gradient section with such habitat occurs in the six miles of upper river habitat I did not see, but that is doubtful. At least three miles of that upstream habitat is considered the most heavily used for steelhead spawning, indicating a continuing low gradient with a gravel substrate.

I had also been of the opinion that rearing habitat necessary to sustain juvenile steelhead for 2-5 years fish would be a greater constraint on Alaskan steelhead productivity than available spawning gravel. However, it appeared that the single greatest habitat advantage for Situk steelhead was maximized spawning gravel combined with long, long sections of water with optimal spawning depth and current speed.

Johnson has indicated (per. com. 2003), "The secret of the Situk's productivity is in the layout of the system; it begins in a cold, clear mountain lake, tumbles down to a shallow basin lake that acts as a temperature buffer, and then meanders for twenty miles through some of the most insect rich muskeg and timbered country in the state." In a stream system this far north, any opportunity to warm the flow would be a likely advantage for earlier juvenile emergence from the gravel, and to provide better growth throughout juvenile steelhead freshwater life history.

However, Situk steelhead productivity may be more complex than Johnson's description of the layout. Perhaps even more important was the evidence of salmon bones still remaining throughout the shoreline gravel from the half million salmon that spawn in the Situk each summer/fall.

It was found by Bilby et al. (2001) that nitrogen from salmon carcasses could be identified in coho parr (as well as plants and animals) in western Washington streams in late winter. The nitrogen isotope ratio in the coho parr was related to the abundance of salmon spawning at the site the previous autumn with subsequent higher growth rates at locations where carcasses were available. The amount of carcass-derived nitrogen increased with the increasing abundance of carcass tissue in the streambed area up to 0.15 kg of carcass/sq. meter of streambed area.

The salmon carcass/juvenile coho relationship may be even more important for steelhead. It has been demonstrated that steelhead may be a primary benefactor of salmon carcass nutrients combined with juveniles actual following the salmon movements to take advantage of eggs and decomposing carcass flesh (Bilby et al. 1998).

Meka et al. (2003) used radiotelemetry to determine population structure in adult rainbow trout in the Alagnak River drainage of southwest Alaska. They found unique seasonal movements documenting the existence of multiple migratory and nonmigratory groups of rainbow trout that have apparently evolved to optimize winter thermal refugia and summer food availability of salmon eggs and carcasses.

It is likely due to these seasonal movements and salmon abundance that has allowed the Alagnak drainage to support a remarkable rainbow trout sport fishery. Jaenicke (1998) documented a rainbow trout catch of 6,057-30,665 per year in the 1990s (less than 800 of those fish harvested per year since 1981).

Although the Alagnak drainage does not have steelhead, it does have lake migrating rainbow that very much resemble steelhead, and because juvenile steelhead and juvenile rainbow have identical freshwater life histories, they would have similar population abundance constraints.

Might this mean that ideal juvenile steelhead rearing habitat without salmon egg deposition and without salmon carcasses would produce fewer juvenile steelhead than secondary steelhead habitat with a great abundance of salmon spawning and dying – literally tons of food source? With salmon in great abundance, might not the greatest limiting factor be enough steelhead spawning habitat to provide enough juveniles to take advantage of a remarkably abundant food supply provided by salmon?

However, the Situk provides more than just a 22 mile spawning channel (although the upper 8 miles of the river might be validly described so, in particular). In examining the habitat literature, it became apparent that the high proportion of Situk habitat being pools is probably one reason for its multi-species salmonid abundance.

Although it has been pointed out that different salmon species in Pacific Northwest streams prefer different habitat types (Bisson et al. 1982), and Gorman and Karr (1978) suggest that fish community structure in small streams depends on habitat complexity and temporal stability, there is also evidence that pools alone can be disproportionately important to salmonid rearing. The hypothesis that territory size limits the maximum population density of salmonids in streams held true in shallow habitats such as riffles in a regression test of older available literature by Grant and Kramer (1990). But it did not hold in the same way for pools. In an examination of Mason's artificial stream channel information (Mason and Chapman 1965; Mason 1969), they found that more fish than predicted by the maximum-density regression can occupy sites if the fish are distributed in three dimensions such as provided by pools. They indicated that if the same pattern occurs in natural streams, then they would predict high standing crops of salmonids in pool habitats (Grant and Kramer 1990). The Situk River provides that natural example.

Hartman (1965) found that in spring and summer conditions when competition is high between them, juvenile steelhead occupy riffles and coho occupy pools. But in winter conditions when competition is reduced, both species inhabit the pools. It seems possible that the Grant and Kramer (1990) findings regarding the three dimensional aspects of pools might explain how the Situk River produces large numbers of both species. It would appear that both species, juvenile steelhead and coho, may actually prefer pools, but that the competition for limited pools may push steelhead into riffle habitats as a summer alternative. If there is minimal limitation in the amount of pool habitat available, both species may occupy them year around with pool rearing benefits that maximize the numbers of both species.

The Situk's lake sources also provide benefits in ways beyond warming the water (important in Alaska) and flow stabilization. Mundie (1974) indicates that in general, lake outflows are among the examples where the greatest aquatic insect densities occur. It is where black flies and filter-feeding caddisflies collect suspended living material from wave-washed gravel shores of the littoral zone of rich lakes.

By at least the late 1970s, it became apparent that large woody debris (LWD) provides stream structure and salmonid rearing benefits (Swanson and Leinkaemper 1978; Marzolf 1978; Keller and Swanson 1979; Keller and Tally 1979). The Situk River has frequent and often large accumulations of spruce trees windthrown into the channel from the banks.

It has been documented on the Skagit River that fish abundance within the different wood cover types is not uniform. Fish abundance was found to be greater in rootwad cover than single logs, and it was consistent for all species and life stages examined, with the exception of sub-yearling chum (Beamer and Henderson 1998). The Situk LWD was characterized by whole spruce trees with rootwads. Also, due to the Situk's small size and relatively stable flows, the LWD stays for long periods of time in the system without being transported out.

At the same time, it has been found on the Skagit River that habitat types largely missing on the Situk can also provide important salmonid habitat. Boulders, cobble, and even artificial rock riprap all provided cover types that were well used by chinook, coho, and steelhead in varying fish abundance depending on age, species, and time of year, whether winter or summer (Beamer and Henderson 1998). This suggests that streams with habitat types other than domination by pools might also be productive for multiple species of salmonids, providing there are other positive spawning and rearing attributes plus the vital addition of high levels of salmon nutrients.

One habitat aspect that was not assessed in the literature found was the creation of stream structure and rearing habitat by the abundance of abandoned chinook salmon redds. They can remain in a stable streamflow system throughout the winter and into the next spring. On the Situk, chinook redds create small pools, gravel islands, and miniature riffles on either side of them. Juvenile salmonids were observed using the redd depressions as mini pools for resting and feeding in extensive stream sections that otherwise had little to provide beyond spawning gravel for egg incubation. The lower portion of the Old Situk Channel was a complex maze of habitat created entirely by long abandoned chinook spawning redds. The importance of chinook spawning redds in the provision of habitat was also noticed in my visit to Kamchatka Peninsula rivers in Russia. Even adult steelhead used chinook redds for resting lies in long river stretches that otherwise had no structure there.

The Relevance of the Situk to a Skagit River Example:

SKAGIT RIVER STEELHEAD PRESENT AND PAST

The Skagit River is second only to the Columbia River in Washington in its average flow of

water. It has 1,200-1,400 sq. miles accessible to steelhead with long sections of riffles well suited for juvenile steelhead rearing. One of its three major tributaries, the Sauk River, has two of its own tributaries that are larger than Alaska's Situk River. In the winter of 1953-54, an estimated 16,000 wild steelhead were caught in the Skagit and a similar number likely escaped to spawn ~32,000 total.

I presently live on Washington's Skagit River. Beginning in 1984-85, the Skagit River escapement goal was set at 10,300 wild steelhead (Cooper and Johnson 1992). However, after two straight years of wild escapement of 4,000-5,000 steelhead, in 2001 the Washington Dept. of Fish and Wildlife (WDFW) and the co-managing western Washington Treaty Tribes, lowered the escapement goal to 6,000 steelhead as presented by WDFW at a wild steelhead conference held in Seattle in September of 2001.

From USGS information, the Skagit River drainage area is 3,093 sq. miles. However, 1,175 sq. miles of the Skagit drainage upstream of Newhalem and 297 sq. miles of the Baker River drainage are no longer accessible to steelhead due to dams. That leaves 1,621 sq. miles of the Skagit drainage as potentially accessible to steelhead, although in reality some of upper drainages are blocked by waterfalls and/or high gradients. This would reduce the available area. Perhaps somewhere between 1,200-1,400 sq. miles of the drainage are now steelhead accessible. That represents 12-14 times the drainage area likely accessible to Situk River steelhead at about 100 sq. miles.

The Skagit River average flows have annually ranged from a low in 1944 of 10,930 cfs to a high of 22,310 cfs with an annual mean likely around 17,000 cfs. This would represent an average flow that is more than 20 times greater than the Situk.

714 sq. miles of the Skagit's overall drainage area is in the Sauk River, its largest tributary. Perhaps 500 sq. miles of that area is accessible to steelhead. The Sauk has 5 times the available drainage area for steelhead as the Situk River. The Sauk's average annual flow is about 4,500 cfs, or nearly 6 times the average annual flow of the Situk.

In the winter of 1953-54, 16,170 steelhead were caught from the Skagit River as documented by Washington Department of Game (WDG), as it was called at the time (Frear 1956). The Sauk River 1953-54 steelhead catch was not included in that for the Skagit. Evidently it did not make the top 20 steelhead streams in that reference list. It would likely have added at least another 1,000 steelhead to the Skagit catch for 1953-54.

Its catch from the 1964-65 WDG records was 1,416 winter steelhead (the earliest data for the Sauk I had access to).

Also, the 1953-54 Skagit catch data do not include the summer run steelhead catch of 1953 that would have spawned in 1954. The Skagit River tributaries listed as among 34 summer run streams in Washington were Day Creek and Finney Creek (Frear 1956), although the Fishing Guide to the Northwest (McLeod 1944) also lists Bacon Creek and several other tributaries as having summer steelhead runs in the Skagit system. It is also known today that the upper Sauk and the Suiattle Rivers have small wild summer runs of steelhead. Summer steelhead catch figures were not kept by WDG prior to 1962 (Royal 1972), and while the Skagit may not have had a particularly substantial summer run after the damming of the Baker and the upper mainstem Skagit, in 1953 about 200 hundred summer steelhead could likely have been added to the steelhead catch total. The summer steelhead catch on the Skagit River in 1965 was 156, Finney Creek 31, Sauk River 18, and Suiattle River 3 (WDG catch tables, 1965).

The 1953 date of the Skagit catch record is significant because it was prior to 1962 when steelhead hatchery numbers suddenly jumped in Washington. This was due to a complete changeover from a wet to pellet diet in hatchery rearing in 1959 with increased survival of the larger smolts produced (Royal 1972). The Skagit River 1953-54 harvest would have been primarily wild steelhead. This is further suggested by a tagging program in 1953-54 on the Satsop River where it was found that 7% of the winter run of steelhead was of hatchery origin and 93% was wild (Royal 1972). The Skagit River hatchery return percentage may have been even lower due to its large population of wild fish in those early years as compared to the Satsop's smaller wild population. The 1953-54 harvest from the Satsop was 2,750 steelhead (Frear 1956). That Satsop catch would have been 93% wild.

Adding the Sauk winter catch and the summer catches in 1953-54 (about 1,200 more wild steelhead), and subtracting the 7% hatchery component of the catch (1,132 hatchery steelhead), would mean that the total wild steelhead catch for the Skagit River in 1953-54 would have been at least 16,000 fish. The Skagit River drainage area available to steelhead at the time was about the same as it is today. If steelhead were not being significantly overharvested, one might assume that at least an equal number of steelhead escaped to spawn in the spring of 1954 as were caught in the winter of 1953-54. This would suggest a total run size of 32,000 steelhead.

Since that time, the wild steelhead of the Skagit system have been in steady decline. And it is possible the 1953-54 catch was already well into decline. There are no catch records earlier than 1947 when the punchcard system was initiated in Washington (Royal 1972).

Mikhail Skopets with a bright 20 pound-plus wild steelhead caught in January of 2003 on the Sauk River. It was, one of three wild steelhead he landed in his 2-day visit in a time period when Washington steelhead managers have only recently provided wild steelhead protection from harvest due to a sudden collapse in Puget Sound's wild steelhead .

The past four winters (1999/2000-2002/2003), Skagit steelhead escapement has been 4,000-6,000 fish. The decision to drop the steelhead escapement goal after the second year of the Skagit crash (2001) is particularly curious in light of the available Skagit steelhead history. Given the evidence of Alaska's Situk River, it raises questions regarding a management decision to lower the escapement goal to 6,000 steelhead. Was that number chosen simply because it could be more easily achieved? In another 10 years will the escapement goal be lowered again to accommodate the continuing escapement trend? Was historic steelhead evidence ignored? And was the basic biological necessity of quantifying and assessing available habitat even used for determining the reduced steelhead escapement goal for the largest river system in the state of Washington other than the Columbia?

SKAGIT RIVER SALMON:

Remembering that the Skagit River has 12-14 times more drainage area available to steelhead and salmon than the Situk, and more than 20 times the average flow, it is interesting to examine the salmon escapement goals by species for the Skagit River taken from the Sport Fish Investigations in Washington State, Westside Volume (Leland and Hisata 2000):

Species:	Escapement Goal	1998-99 Escapement
Chinook (summer/fall)	14,900	14,609
Chinook (spring)	3,000	1,086
Coho (wild)	60,000	69,800
Chum	116,500	120,875
Pink	330,000	(only odd years)
(Sockeye*)		

Winter Steelhead (wild)**	10,300***	7,870

* Sockeye were not listed, although they still return and are transported to the upper Baker River.
** A wild summer steelhead escapement goal has never been established for the tributaries where they have historically occurred (Sauk, Suiattle, Bacon Ck., Finney Ck., and Day Ck. being among those historically known to have summer runs.)
*** The winter steelhead escapement goal was reduced to 6,000 for the 2001/2002 return year.

Despite the Skagit having 12-14 times more drainage area available than the Situk, the steelhead escapement goal is only 6,000 steelhead – 1,000 less than the average annual escapement on the Situk the past decade. Low escapement goals can only encourage continuing declines for Skagit River salmon and steelhead as indicated by the photo of chum salmon redds dewatered on a Skagit bar when the Baker River flow was reduced from 4,000 cfs to less than 100 cfs by Puget Sound Energy's hydroelectric operation. The past four years, Skagit wild steelhead escapement has been estimated at only 3,000-6,000 spawners per year.

It would appear from this data, that the salmon and steelhead returns to the Skagit River in 1998 (coho and steelhead overlapping into 1999) met, or came reasonably close to meeting the escapement goals set for them. This makes the fishery management of the Skagit River appear to have accomplished its job.

However, is this apparent success merely a manipulation of escapement goal numbers to accommodate whatever levels are most easily accomplished politically, economically, and socially rather than based on historical evidence, available habitat, and the biology necessary for real restoration to occur?

In the case of steelhead, reasons other than those provided by science appear to have motivated the reduction in the Skagit steelhead escapement goal by over 40% in 2001. The fact is, history suggests the escapement goal, once 10,300 steelhead, should have been increased considering the 1953-54 sport catch of 16,000 wild steelhead. This is further suggested by the evidence from the Situk River, where 1/12th-1/14th of the available drainage area of the Skagit provided a depleted escapement of between 5,786-9,204 outmigrating steelhead kelts each year over the past decade, and with an historic count of 20,000-26,000 outmigrating kelts after earlier restoration occurred. The Situk River information suggests something has gone very wrong with wild steelhead production, steelhead management, salmon management, and habitat protection and restoration efforts made since the winter of 1953-54 on the Skagit River.

That the Skagit is lacking sufficient numbers and distribution of salmon appears to be part of the problem. For instance, Connor and Pflug (2003) have demonstrated a shift of wild chinook production increasingly into the Upper Skagit River. Between 1974-1984 the percentage of the overall wild chinook that spawned above Rockport was 62%, between 1985-1993 it was 73%, and between 1994-2001 it was 78%. Since 1984, the percentage of change in mean chinook escapement was +3% for the upper river, -41% for the lower river, and –51% for the Skagit's main wild chinook spawning tributary, the Lower Sauk River.

Similar trends have occurred in the same span of time for pink and chum salmon on the Skagit River (Pflug, per. com. 2001, 2002, 2003).

There are an estimated 500,000 salmon escaping into the Situk annually. The Situk drainage area available to salmon is about 100 sq. miles. That would mean 5,000 salmon and their carcasses per sq. mile. On the Skagit River, if chinook, coho, chum, and pinks (in odd years) meet their escapement goals, they would provide 524,400 salmon carcasses annually (almost the same as the Situk). However, there is about 1,200-1,400 sq. miles of drainage area on the Skagit available to salmon and steelhead. That means there would be only 375-437 salmon carcasses per sq. mile. That is less than 10% of the salmon eggs, carcasses, and nutrients per sq. mile than in the Situk drainage.

In January of 2003, Mikhail Skopets, Russian fish biologist from Magadan in Siberia, visited me for steelhead fishing on the Skagit River. I told him that in 2001 the Skagit had the best pink salmon return in recent history. It was estimated at 1.5 million fish, the largest return in WDFW record keeping according to news accounts (Skagit Valley Herald, 2001). Nevertheless, I expressed my concerns that this seemingly high number may remain less than what should be returning to the Skagit during the best of the odd years.

Mikhail's answer was the example of a photograph he gave me. The Bolshaya River in Siberia, he explained, has pink runs of 10-11 million during the best years of their return. He indicated the Bolshaya was of similar size to the Skagit. The photograph he gave me was of stacked carcasses along the shoreline with hundreds of sea birds feeding on them. This suggests Skagit River pink salmon escapement goals have been established in a way that will predetermine depletion, not abundance. We need larger visions to accommodate restoration of salmon to the abundance levels both they and steelhead depend upon.

Examining the Washington steelhead escapement data from the rest of the rivers in the state, it would appear that only the Calawah and the Sol Duc of the Quillayute system regularly provide anything remotely close to biologically reasonable expectations regarding steelhead production per amount of available drainage area. Remembering that both rivers are larger drainages than the Situk, the 22 year average for wild winter steelhead escapement between 1978-1999 was 2,955 for the Calawah and 4,248 for the Sol Duc. A high of 5,558 spawning winter steelhead occurred in the Calawah in 1996. The Sol Duc high was 7,634 spawners in 1998 (Leland and Hisata 2000). While still below Situk River standards the past ten years (remembering the Situk remains in steelhead depletion), the Calawah and Sol Duc are at least approaching the same ballpark as the Situk. The remainder of Washington's steelhead stocks and rivers are not.

Reflections on Abundance, Depletion, Management and Restoration:

On immediate return from the Situk, I felt as though I finally knew what steelhead abundance visually looked like. In the eight days spent there, river viewing conditions (if not fishing conditions) were ideal as provided by over four weeks of drought conditions. The river was remarkably low and clear, and large numbers of steelhead were evident throughout the 16 miles of the Situk River we walked or floated (of the total 22 miles of river).

Trying to fish two miles of river upstream of the 14 mile point, I could not avoid wading on hundreds of steelhead redds. It was frustratingly difficult to try and fish for the few brighter steelhead without foul hooking spawning fish in the process. Steelhead were in splashing, chasing spawning activity in such densities that it reminded me of chum salmon spawning activity as sometimes observed in the side channels of the Skagit River near my home. Yet I was still downstream of the most heavily used spawning section, three miles of which is closed to fishing to provide undisturbed spawning. (It appeared that more of the upper spawning grounds should be similarly protected once spawning activity commences. Legal angling activity that did not snag fish was difficult to achieve with so many steelhead in shallow water.)

However, my perceived experience of steelhead abundance on the Situk, was actually that of depletion as later learned. Although the 2003 downstream count of just under 8,000 steelhead kelts seemed remarkable for a river of 22 miles in length with an average lower mainstem flow of perhaps 600-700 cfs, it was only 30%-40% of the 20,000-26,000 kelts counted in 1952. That 1952 count occurred after a 13 year recovery period from an attempted extermination of steelhead and Dolly Varden ending in 1939.

As an influential manager of the Situk River, it is apparent that ADF&G's Bob Johnson keeps that 1952 count of steelhead very much in mind. The Situk river may still have a long way to go to achieve full recovery. Recent recovery efforts did not begin on the Situk for steelhead until catch and release and bait restrictions were implemented in 1991, so the Situk had gone through 40 years of steelhead depletion. In the 1930s, the Situk only went through ten years of attempted steelhead eradication (heavy harvest provided by a bounty). Even so, it took 13 years for the 1952 evidence of full recovery, three years longer than it took to deplete them.

Although ADF&G has not described the Situk River period of time from 1953 through the early 1990s as “unplanned steelhead eradication without a bounty” due to the long term effects of angling harvest on them, it is a description worth consideration. On the Situk it has been apparent that harvest alone, despite untouched high quality habitat, can significantly deplete fishery resources. This is not limited to Alaska or the Situk River. It has been a common pattern of steelhead and salmon harvest history. Whether through faulty formulas (such as maximum sustained yield), or through targeted eradication efforts, the consequences have often been the same: depletion to threatened levels with the danger of extinction hard on its heels. It may now take 40-50 years of conservative management to bring Situk steelhead back to 1952 levels (and many other North American rivers). It’s possible the longer depletion has occurred, the longer it might take for restoration to occur. At least on the Situk there is a valid target to aim for based on historic information. In the Lower 48 that is not always the case.

Hard Questions:

Basic questions have continually recurred since my experience of, and subsequent research into, the Situk River and its steelhead:

1. How do we presently determine juvenile steelhead rearing capacity for varied available riverine habitats?
2. Do we factor in how increases or reductions in salmon carcasses affect available juvenile steelhead rearing habitats?
3. Do we factor in how land and water use alterations may decrease or increase juvenile steelhead rearing capacity for each habitat type?
4. Do we effectively invest in and implement measures that will eventually maximize juvenile steelhead rearing for each habitat type, or do we primarily implement and invest in mitigating alternatives instead (primarily hatcheries)?
5. And finally, do we use available past histories to guide management decisions, or do we ignore them as something irrelevant to the present?

These are all questions I cannot ultimately answer. Only the managers of our Lower 48 fish and fisheries can, and inevitably must, if we are ever to experience salmon and steelhead recoveries.

Abundance is generally thought of as a relative term. For instance, if the vision of “abundance” is unknowingly based on the remnants of a previous history of long term depletion, then the word has lost historic relevance.

In my old 1963 American College Dictionary, abundance is defined: 1. an overflowing quantity or supply. 2. overflowing fullness. Abundant is defined: 1. present in great quantity; fully sufficient. 2. possessing in great quantity; abounding: a river abundant in salmon. So the defining example for abundant is actually a river with salmon, and integral to the word’s meaning is an overflowing quantity that provides full sufficiency.

In the case of salmon, one might even say self-sufficiency. The very meaning of the words seems to recognize that abundance is integral to, and provides, self-sufficiency.

What is the future of Pacific Rim salmonids without abundance? Yet, the word abundance seldom if ever appears in fisheries science and management. It is considered too relative; too hard to build science around. At the same time, without the word how can we hope to understand and successfully manage for Pacific salmonids and the trout that are largely dependent on them?

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