

## CONSERVATION AND SCIENCE REPORT

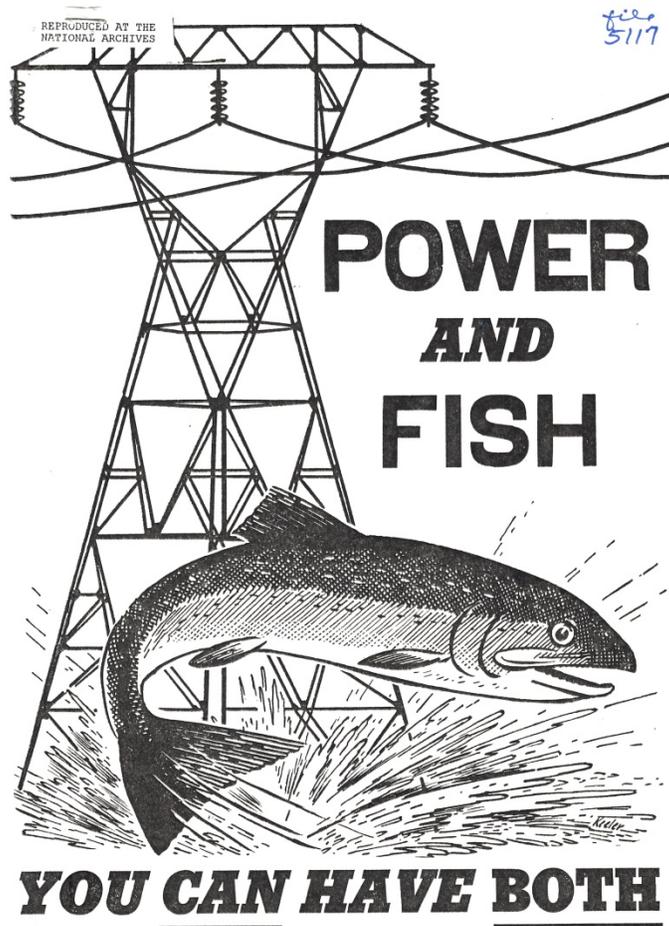
Issue 11, 2016

By Bill Bakke

Conservation and Science Director

& Founder

Native Fish Society



### The Environmental Impact Statement for the Columbia River System It's Time to Dispel the Myths

The Environmental Impact Statement for the Columbia River System

It's Time to Dispel the Myths

In the 1950s, when the building of large dams in the Columbia Basin was ramping up, the proponents of hydroelectric development recognized the inherent conflict between dams and salmon. Dams were a real threat to the salmon and the fishing communities dependent on them. Advocates for hydropower got around this obstacle by the use of a slogan - "Power and Fish You Can Have Both". The source of this optimistic promise

was the salmon hatchery. At the time hatcheries had shown little success in producing adult salmon returns to the Columbia River, but slogans need not reflect reality.

Contrast this optimistic view of hatcheries with the approach taken by the Canadians, who were considering a proposal to build a large main stem dam on the Fraser River. The International Pacific Salmon Fisheries Commission—the body that managed Fraser River salmon—undertook a scientific review of the use of hatcheries to mitigate the effects of dams on salmon. The resulting report (released in 1960) concluded that mitigation using hatcheries would not maintain the salmon runs in the Fraser. So unlike the United States, the Canadians were told they had a choice: salmon or dams. The main stem dam was not built.

There are three key lessons from this: 1) The Canadians relied on a scientific review to determine if hatcheries could mitigate the effects of dams and the U. S. did not. 2) Even though the record of hatcheries gave little reason for optimism, the responsible U.S. government agencies bet our wild salmon on the assumption that hatcheries would compensate for the effects of the dams. 3) Once we made that decision and assumed without evidence the slogan was true, it became an unexamined belief or myth that has persisted to this day. Many years later biologists did undertake scientific reviews of the hatchery programs in the basin but the recommendations coming from those reviews were not implemented. By that time there was too much invested in the myth to face reality.

In addition to those scientific reviews, fisheries science has for at least the past 35 years shown that hatcheries are a problem for the conservation of wild salmon. The accumulated record of this science is impressive. Since 1993, the Independent Science Group later named the Independent Scientific Advisory Board has been recommending that the Northwest Power and Conservation Council (Council) adopt a more ecological approach to its salmon recovery program. But the Council chose to invest in the myth and spent millions of dollars on new hatchery programs. After 34 years, the Council's salmon recovery program has failed to achieve its modest goal of five million salmon returning to the river. The historical run size was 15 million salmon or more.

The U.S. Army Corps of Engineers, Bonneville Power Administration and Bureau of Reclamation have agreed to prepare an Environmental Impact Statement (EIS) covering the Columbia River System operations in the basin. It only took five court rejections of biological opinions and an order from Judge Michael Simon to stimulate the agencies to begin work on the EIS. One of the topics that will be covered is fish and wildlife. We are asking the three federal agencies to thoroughly review the origins and consequences of the assumption that hatcheries could mitigate the effects of the dams. The joint agency EIS is an opportunity to dispel the myths and put the Columbia River Salmon on the path to recovery. We recommend you voice your opinion by going to <http://www.crsso.info> to submit your comments or look up the schedule for scoping meetings and attend one near you.

Jim Lichatowich, Biologist and author  
 Rick Williams, Fishery Biologist and Author  
 Bill Bakke, Wild Fish Advocate and Founder of NFS  
 Kurt Beardslee, Executive Director of Wild Fish Conservancy  
 Jim Myron, Native Wild Fish Advocate





Conrad Gowell photo

Wild Fish Conservancy Experimental Pound Net Fishery on the lower Columbia River. The purpose is to test selective fishery for salmonids where wild fish are released with little to no handling and hatchery fish can be retained. Pound nets or fish traps were first used in 1879 in the lower river. By 1889, 156 traps were operating at Baker Bay near the mouth of the river (Craig and Hacker 1940)



## **Multiple Male Mating with Female Chinook May Improve Reproductive Success**

**Lewis, J. E. and T. E. Pitcher. 2016. Tactic-specific benefits of polyandry in Chinook salmon *Oncorhynchus tshawytscha*. *Journal of Fish Biology*.**

The present study does show that female chinook benefit from polyandrous mating and this benefit is most likely an indirect genetic benefit. (Polyandrous: mating with two males)

The present study also revealed tactic-specific effects of monandry and polyandry on offspring hatching success of *O. tshawytscha*. Overall, it was found that there seems to be a benefit to females when jacks are present in spawning events, as crosses involving a jack produced offspring with higher hatching success. Within the monandrous crosses of the present study, there was approximately an 8% difference in offspring hatching success between a single jack and a single hooknose (72.3 and 66.6%, respectively).

In the wild, a female often mates with a single hooknose, multiple hooknoses, or one or more hooknoses with one or more sneaking jacks. In the present experiment, these spawning events represent H, H + H and H + J respectively, whereas spawning events with one (J) or two jacks and no hooknoses (J+J) are unlikely to occur in nature. Of these ecologically relevant crosses, the present data show there is an increase in hatching success (6–8%) when comparing only hooknose crosses (both monandrous and polyandrous; H and H + H) to the cross involving both a jack and a hooknose (H + J).

Jacks mature precociously at 2 years old, while hooknoses and females mature at ages 4+ years, so during a spawning season, the jacks present are from an entirely different year class than the hooknoses and females (Flannery et al., 2013). Therefore, the H + J cross presents a female with the broadest genetic continuum compared with other crosses and reduces the risk of a female only mating with closely related individuals, as no jack present would be closely related to the female as they are from a completely different year class.

Evidence suggests that females of many species may bias paternity in favour of males with specific genotypes (Palumbi, 1999; Yeates et al., 2009; Butts et al., 2012; Løvlie et al., 2013). In fishes, polymorphic genes involved in the immune response are often a target for female mate choice (Yeates et al., 2009) and in the present study population, there are interesting patterns between the females, jacks and hooknoses in terms of their major histocompatibility (MH) genes (S. J. Lehnert, I. A. E. Butts, E. Flannery, K. Peters, D. D. Heath & T. E. Pitcher, unpubl. data). These genes are involved in the immune response, where females may select mates with more divergent genotypes relative to their own, therefore providing offspring with more diverse MH genes, which may increase fitness through better defense against a wider range of pathogens (Aeschlimann et al., 2003; Consuegra & de Leaniz, 2008; Neff et al., 2008).

Therefore, females could be employing post-spawning mechanisms (cryptic female choice), via ovarian fluid (Rosengrave et al., 2008) or egg-sperm recognition (Yeates et al., 2009), to bias paternity in favour of a genetically superior, or compatible male to increase embryo viability (Neff & Pitcher, 2005).

For example, Pitcher & Neff (2006) found (in the same wild population of *O. tshawytscha*) that MH class IIB alleles contribute to both additive (good genes) and non-additive (compatible genes) genetic effects on viability, including hatching success and early juvenile survivorship (Wedekind et al., 2004; Pitcher & Neff, 2007).

The benefits observed in this study are also tactic-specific, with the precocious jack males providing a greater benefit generally, but the presence of both jack and hooknose males provide the female with the greatest benefit. This study not only has obvious implications to the evolution of polyandry and mating systems, but can have important implications to fish conservation breeding programmes as protocols that adopt multiple males and jacks could improve such programmes.

Thanks to Brian Morrison, Ganaraska Region Conservation Authority, Ontario, Canada, for this study.



## **Salmon Management Frameworks**

### **How the Salmon Game is Played:**

Management Frameworks or conceptual foundations are the principles and assumptions that give direction to management and research activities, including fishery restoration programs. It determines what problems (e.g.,

limitations on fish production) are identified, what information is collected and how it is interpreted, and as a result, establishes the range of appropriate solutions. Because it influences the interpretation of information, the conceptual foundation is a powerful scientific element of management and restoration plans and it can determine the success or failure of those plans.<sup>i</sup> Natural resource management carried out with the best intentions and methodological expertise can have disastrous consequences if based on incorrect assumptions (conceptual foundation).

Salmon management biologists must interpret a steady stream of information from research and monitoring programs and a host of journal articles and reports. Those bits of information are the pieces of the salmon management puzzle. If the assumptions about nature that make up the conceptual foundation give a false picture of the salmon's ecosystem and its processes, a lot of relevant pieces to the salmon management and recovery puzzle, will be misinterpreted or ignored.<sup>ii</sup> It will lead some, for example, to ignore the evidence that hatcheries failed to achieve their goals and that they contributed to the decline of wild salmon. Conceptual foundations should not be static, but should be revised continually as new science emerges and new empirical information becomes available.

1886 to 1888

Management Framework Laissez-faire access to natural resources and a belief that man must control and dominate nature were the prevailing world view. Theory and practice of salmon management conformed to that view. Managers believed that artificial propagation would give humans complete control over salmon production, and provide an unlimited supply of fish.

1889 to 1920

Management Framework Justification for a strong reliance on artificial propagation shifted from the religious-based mandate that man should control nature to the Progressive vision of conservation: Natural resources should be managed for maximum economic efficiency by technical experts. Hatcheries easily made the transition to this new set of values. The basic assumption that humans can and should simplify and control salmon production was retained.

1921 to 1958

Management Framework The massive development of the basin's water resources for power production, irrigation, flood control and transportation was enhanced by the post World War II science of systems engineering. The same approach was also popular in ecology. Engineers and many ecologists assumed the machine was a reasonable model of the systems they sought to analyze, improve or manage. Artificial propagation easily made the transition to the new framework because, like the previous frameworks, control and simplification of salmon production were important elements. The artificial production system achieved a higher level of simplification by circumventing most of the salmon's freshwater life history through the release of smolts.

1959 to 1990

Management Framework In spite of a long history of persistent decline, failures to reverse those declines in chinook salmon production and scientific evidence questioning the management framework, the basic assumption that control and a simplification of the production system could restore salmon production remained intact.

1991 to 2016

**Management Framework** Following the winter chinook salmon in the Sacramento River, Snake River sockeye and chinook salmon become the first species protected by the Endangered Species Act (1992) in the Columbia River followed by steelhead (1998), coho (2005), chum (1999). State Fish managers lose direct management authority to the National Marine Fisheries Service federal permit system.

Operating assumptions that control and simplify salmonid production and ecosystems continue through development of watersheds that consume salmonid habitats, hatcheries are assumed to mitigate for wild salmonid production and serve as the primary means to recover wild, native stocks, and harvest is not regulated to achieve spawner abundance objectives by spawning areas in the mainstem or tributaries. State and federal fish managers continue to ignore the best available science in constructing management policy.

### **1999 Alternative Management Framework Recommended by the Scientific Review Group**

“Management of the Columbia River and its salmonid populations has been based on the belief that natural ecological processes comprising a healthy salmonid ecosystem can, to a large degree, be replaced, circumvented, simplified, and controlled by humans while production is maintained or even enhanced. The reliance on large scale hatchery technology to rebuild depleted salmon runs continues.

“In view of the continuing decline in salmon, the FWP's conceptual foundation and implementation of measures derived from it have failed to reverse the decline of salmon in the basin.

The alternative conceptual foundation is based on three fundamental principles or assumptions:

*I. Restoration of Columbia River salmonids must address the entire natural-cultural ecosystem, which encompasses the continuum of freshwater, estuarine, and ocean habitats where salmonid fishes complete their life histories.*

*II. A productive salmonid system requires a network of complex and interconnected habitats that are created, altered, and maintained by natural physical processes in freshwater, estuary, and ocean environments. These diverse and high-quality habitats, many of which have been extensively altered by human activities, are crucial for salmonid spawning, rearing, migration, maintenance of food webs, and predator avoidance. Ocean conditions, always variable, are important in determining the overall patterns of productivity of salmonid populations.*

*III. Life history diversity, genetic diversity, and metapopulation organization are ways salmonids adapt to their complex, interconnected, and variable habitats. Diverse adaptations contribute to the ability of salmonids to cope with environmental variation typical of freshwater and marine environments.*

<sup>1</sup> Lichatowich, J., L. Mobrand and T. Vogel. 1996. A history of frameworks used in the management of Columbia River Chinook salmon. Bonneville Power Administration. Portland, Oregon.

<sup>1</sup> Lichatowich and 4 others. 2006. The Existing Conceptual Foundation and the Columbia Basin Fish and Wildlife Program. In Williams, R. Ed. *Return to the River: Restoring Salmon to the Columbia River*. 29 -49. Burlington, MA: Elsevier Academic Press.

ISG. 1999. Scientific Issues in the Restoration of Salmonid Fishes in the Columbia River. American Fisheries Society. *Fisheries* Vol. 24, No. 3.



---