NATIVE FISH SOCIETY
READING AND REFERENCE LIST

The Fallacy of Wildlife Conservation
John A. Livingston
McClelland and Stewart Limited, 1981

John A. Livingston, one of Canada's leading naturalists, makes the persuasive argument that unless new approaches are found to our perception of nature and our place within it, it will soon be impossible to reverse the destruction man is inflecting on nature.

The Natural Alien: Humankind and Environment
Neil Evernden
University of Toronto Press, 1985

In this thoughtful and sympathetic evaluation of the international environmental movement Evernden raises grave doubts about its ability even to express adequately its real message, let alone to establish societal acceptance and government support for it. He reviews the assumptions inherent in Western industrial societies that make them so resistant to the basic motivating concerns of those active in the environmental cause.

Return to the River: Restoring Salmon to the Columbia River
Richard N. Williams, Editor
Elsevier Academic Press, 2006

Salmon recovery efforts need to be redirected. After almost a century of application, the engineering solution has failed to halt the decline of salmon in the Columbia River. Instead, salmon need to be reconnected to the Columbia River and the river allowed to express a measure of its natural character, thereby re-establishing habitats and conditions essential to native fish and wildlife. The lessons are that if the magnificent heritage of Columbia River salmon is to continue, we must recognize the fundamental linkages between species and their environments, view change and variation as constructive features of natural systems, and accept our role as participants and stewards of the environment for the present and into the future.

King of Fish: The Thousand-Year Run of Salmon
David R. Montgomery
Westview Press, 2003
ISBN 0-8133-4147-7

Montgomery traces the human impacts on salmon over the last thousand years and examines the implications both for salmon recovery efforts and for the more general problem of human impacts on the natural world. What does it say for the long-term prospects of the world's many endangered species if one of the most prosperous regions of the richest country on earth cannot accommodate its icon species?

Salmon Without Rivers: A History of the Pacific Salmon Crisis
Jim Lichatowich
Island Press, 1999
ISBN 1-55963-360-3

Jim Lichatowich exposes the myths that have guided recent human-salmon interactions and clearly explains the difficult choices facing the citizens of the region. He argues that the dominate worldview of our society-a world view that denies connections between humans and the natural world-has created the conflict and controversy that characterize the history of salmon management and recovery. This is a factual work well researched and documented and it is the effort of a man who has been in the fishery management profession that brings insight and understanding to the reader.

Fishy Business: Salmon, Biology, and the Social Construction of Nature
Rik Scarce
Temple University Press, 2000
ISBN 1-56639-729-4

Rik Scarce, a sociologist, takes a unique and penetrating look at Pacific salmon management, research, restoration and issues. He shows how political, bureaucratic, and economic forces have directed salmon science for their own purposes and how control remains a central feature in salmon biology.

Population Genetics and Fishery Management
Nils Ryman and Fred Utter, Editors
Washington Sea Grant Publication, 1987
Distributed by the University of Washington Press, Seattle
ISBN 0-295-96436-7

This book contains contributions from twenty-four scientists from around the world. Together they provide a valuable reference on the impact and consequences of applied technology to fishery management. Scientific fisheries management is a relatively new branch of the biological sciences, but this field remains largely unincorporated in fisheries management. While stocks of fish have been impacted by human exploitation and enhancement programs for centuries, recent technology and fishery development have contributed to the decline of populations, extinctions and loss of biological diversity, all of which threaten the future of the salmonids and dependent fisheries. This book exposes these problems and offers solutions.

Fish Gene Pools
Nils Ryman, Editor
Ecological Bulletins 34
Swedish Natural Science Research Council, 1981
ISBN 91-546-0299-8

Only very recently has the need for conservation of genetic resources within non-domesticated species become recognized and generally accepted. In particular, the various aspects associated with maintenance of genetic variability on the intraspecific level have been neglected in the management of natural populations. Today, it is clear that a detailed understanding of the amount and distribution of genetic variation in a species is a basic prerequisite of efficient management. Genetic variation within and between natural populations constitutes a natural resource, and there is an immediate need for adequate management programs for that resources. There is agreement on genetic goals and objectives. The challenge is now to incorporate them into management. This book discusses the genetic variation among Atlantic and Pacific salmonids and establishes the basis for protection.

Bush Pilot Angler
Lee Wulff, A Memoir
Down East Books, 2000
ISBN 0-89272-480-3

The Bush Pilot Angler is an unforgettable story of courage, flying, love, fish, and fishermen. And it is a fitting tribute to Lee Wulff, an extraordinary man who fought tirelessly for the conservation of his beloved Atlantic salmon in Newfoundland and throughout the North American continent.

Salmon Fishing
Hugh Falkus
H.F. and G. Witherby Ltd. 1984
ISBN 1-84188-183-X

This is a well written and informative book on Atlantic salmon fishing and is of value for those who fish steelhead. Falkus is well read in salmon angling literature and scientific information on salmon. He is inventive, observant and a joy to read. He offers a lot of information that can be applied wherever one may fish for salmonids. His other book Sea Trout Fishing is a remarkable treat as well.

Collapse
Jared Diamond
Viking, 2005
ISBN 0-670-03337-5

What caused some of the great civilizations of the past to collapse into ruin, and what can we learn from their fates? Diamond weaves an all encompassing global thesis through a series of fascinating historical-cultural narratives, moving from the prehistoric Polynesian culture of Easter Island to the formerly flourishing Native American civilizations of the Anasazi and the Maya, the doomed medieval Viking colony on Greenland and finally to the modern world. Diamond traces a fundamental pattern of catastrophe, spelling out what happens when we squander our resources, when we ignore the signals our environment gives us, and when we reproduce too fast or cut down too many trees. Environmental damage, climate change, rapid population growth, unstable trade partners, and pressure from enemies were all factors in the demise of the doomed societies, but other societies found solutions to those same problems and persisted.

IMPORTANT STUDIES

The Native Fish Society has an extensive collection of studies relevant to native, wild salmonid conservation. This is a world-wide literature that is difficult for the public to access but we have made it available. Since this scientific literature is paid for with public funds, it should be in the public domain. The studies presented here are key to understanding wild salmonids and their interactions with hatchery fish. Each abstract is provided with a link to the full study available on the NFS web page.

Hendry, Michael **et al. 2002. Genetic and phenotypic variation through the migratory season provide evidence for multiple populations of wild steelhead in the Dean River, British Columbia. Transactions of the American Fisheries Scociety.**

Abstract. – We provide evidence for previously undetected population structure in a wild run of summer steelhead *Oncorhynchus mykiss* within a river that has considerable recreational importance (Dean River, British Columbia). Data were gathered from an existing catch-and-release fishery and examined for phenotypic and genetic variation through the migratory season. Specifically, we compared fish captured in different periods during the migration: early (July 2–30), middle (July 31–September 5), and late (September 6–30). Age (freshwater and saltwater), sex ratio, and body girth did not differ significantly among these groups for females or males. Body length increased through the migratory season for both sexes, perhaps because late-migrating fish had more time to feed in the ocean. Based on genotypes at 10 microsatellite loci, early and late groups showed highly significant genetic differences (*P* , 0.001). Assignment tests were able to classify individuals back to early or late groups with 84% accuracy (122 of 145 tests). These results suggest the presence of at least two populations that migrate at different times in the Dean River system. The magnitude of the genetic difference was small (*F*ST 5 0.007; Nei's unbiased *D* 5 0.0149, Reynolds coancestry coefficient 5 0.007) but comparable to values for other anadromous Pacific salmon species over similar spatial scales. Moreover, the coarse level of our sampling, and possible overlap in migratory timing among populations, suggests that the observed differentiation underestimates the true differentiation. A deficit of heterozygotes in the late group suggests further population substructure within late-migrating groups of fish. Examining temporal variation through a migratory season proved a useful approach for obtaining preliminary evidence of population structure in migrating salmonids within a small river system.

Reisenbichler, R.R. and J.D. McIntyre. 1977. GENETIC DIFFERENCES IN GROWTH AND SURVIVAL OF JUVENILE HATCHERY AND WILD STEELHEAD TROUT. J. Fish. Res. Board Can. 34:123-128.

Abstract- Relative growth and survival of offspring from matings of hatchery and wild Deschutes River (Oregon) summer steelhead trout were measured to determine if hatchery fish differ genetically from wild fish in traits that can affect the stock-recruitment relationship of wild populations. The fish used in this study were indigenous to the Deschutes River and the hatchery fish were two generations removed from the wild parental stock. Sections of four natural

streams and a hatchery pond were each stocked with genetically marked (lactate dehydrogenase genotypes) eyed eggs or unfed swim-up fry from each of three matings: hatchery x hatchery (HH), hatchery x wild (HW), and wild x wild (WW), In streams. WW fish had the highest survival and HW fish the highest growth rates. In the hatchery pond, HH fish had the highest survival and growth rates. The hatchery fish were genetically different from wild fish and when they interbreed with wild fish may reduce the number of smolts produced. The observed differences in survival suggested that the short-term effect of hatchery adults spawning in the wild is the production of fewer smolts and ultimately, fewer returning adults than are produced from the same number of wild steelhead spawners.

Reisenbichler, R.R. and S.P. Rubin. 1999. GENETIC CHANGES FROM HATCHERY PROPAGATION AFFECT PRODUCTIVITY AND VIABILITY OF WILD POPULATIONS. ICES Journal of Marine Science, 56: 459-466.

Abstract- A number of published studies have shown genetic differences between hatchery and wild anadromous Pacific salmon (*Oncorhynchus spp.*) Nevertheless, none of these studies has provided compelling evidence that artificial propagation poses a genetic threat to conservation of naturally spawning populations. Hence constructive debate and consensus on how to limit deleterious genetic effects from artificial propagation have been limited or ineffectual, often because participants don't agree that a problem exists. When the published studies and three studies in progress are considered collectively, however, they provide strong evidence for a problem - evidence that the fitness for natural spawning and rearing can be rapidly and substantially reduced by artificial propagation. This issue takes on great importance in the Pacific Northwest where supplementation of wild salmon populations with hatchery fish has been identified as an important tool for restoring these populations. Recognition of negative aspects may lead to restricted use of supplementation, and better conservation, better evaluation, and greater benefits when supplementation is used.

Kostow, Kathryn. 2004. Differences in juvenile phenotypes and survival between hatchery stocks and a natural population provide evidence for modified selection due to captive breeding. Can. J. Fish. Aquat. Sci. 61: 577–589

Abstract.- Juvenile phenotypes and fitness as indicated by survival were compared for naturally produced steelhead (*Oncorhynchus mykiss*), a new local hatchery stock, and an old nonlocal hatchery stock on the Hood River, Oregon, U.S.A. Although the new hatchery stock and the naturally produced fish came from the same parent gene pool, they differed significantly at every phenotype measured except saltwater age. The characteristics of the new hatchery stock

were similar to those of the old hatchery stock. Most of the phenotypic differences were probably environmentally caused. Although such character changes would not be inherited, they may influence the relative fitness of the hatchery and natural fish when they are in the same environment, as selection responds to phenotypic distributions. A difference in fitness between the new hatchery stock and naturally produced fish was indicated by significant survival differences. Acclimation of the new hatchery stock in a "seminatural" pond before release was associated with a further decrease in relative smolt-to-adult survival with little increase in phenotypic similarity between the natural and hatchery fish. These results suggest that modified selection begins immediately in the first generation of a new hatchery stock and may provide a mechanism for genetic change.

Knudsen, Curtis, et al, 2006.Comparison of Life History Traits between First-Generation Hatchery and Wild Upper Yakima River Spring Chinook Salmon

Abstract.—Life history traits in hatchery and wild spring Chinook salmon Oncorhynchus tshawytscha from the upper Yakima River were compared to determine whether locally adapted traits had diverged after one generation of state-of-the-art artificial propagation. Sex composition in wild- and hatchery-origin fish differed in three of four brood years (P _ 0.01). The proportion of hatchery males, primarily age 3, increased from 38% to 49% over time. Conversely, the sex composition of wild fish did not exhibit a similar linear trend. Most hatchery- and wild-origin fish reached maturity at age 4 (_76%), followed in magnitude by ages 3 and 5. Wild mean age at maturation demonstrated no significant trend over time, while hatchery mean age at maturation declined (P ¼ 0.05). Mean lengths of 3–5-year-old hatchery fish were shorter than those of wild fish of the same age (differences of 2.7 cm for age 3, 1.7 cm for age 4, and 1.9 cm for age 5). Likewise, body weights of hatchery fish were lower than those of wild fish (differences of 0.3 kg for age 3, 0.3 kg for age 4, and 0.6 kg for age 5), representing a change in body size of between 0.5 and 1.0 standard deviation (SD). Median arrival timing of hatchery and wild fish at a broodstock collection site just downstream of ancestral spawning grounds showed no consistent difference. However, the median arrival date of age-3 fish was 19–20 d later than that for fish of ages 4 and 5 (P , 0.01). Mean spawn timing of hatchery fish was significantly earlier (5.1 d) than that of wild fish in a ''common-garden'' experiment (P , 0.05). We estimate that fitness could be reduced by as much as 1–5% for traits diverging from their optima by 0.5–1.0 SD. The degree of genetic determination of the divergence is unknown, but future monitoring will help clarify this. Perhaps the most important conclusion of our study is that even a hatchery program designed to minimize differences between hatchery and wild fish did not produce fish that were identical to wild fish.