

Human Numbers — The Alpha Factor Affecting the Future of Wild Salmon

BY GORDON F. HARTMAN, THOMAS G. NORTHCOTE, AND C. JEFF CEDERHOLM

[Editor's note: This is a highly abridged version of the original article which appeared in *Salmon 2100: The Future of Wild Pacific Salmon*, R.T. Lackey, D.H. Lach, and S.L. Duncan (eds.), American Fisheries Society, Bethesda, Maryland, 2006, pp. 261-292.]

Original introductory note by the *Salmon 2100* editors: Taking the four core drivers of salmon decline into account removes us from the seemingly safe world of scientific analysis and known management practices and places us uncomfortably in the arena of projections about future scenarios and conflicting world views. Designating human population growth as the alpha factor driving wild salmon decline rec-

Gordon Hartman obtained his Ph.D. from the University of British Columbia in 1964, in behavior and ecology of juvenile salmonids. Originally out of the logging camps and sawmills of central British Columbia, he has 53 years of experience in and across several fields of biological work. These include research in salmonid biology, administration as Fish and Wildlife Regional Director (Kootenays), later as Director of Wildlife (Yukon), and university teaching at Guelph in the Netherlands, Addis Ababa in Ethiopia, and Malaspina, British Columbia. **Tom Northcote** grew up on a farm in the lower Fraser River Valley and early became interested in pursuing a career in freshwater fishes and limnology. His professional degrees are from the University of British Columbia, Vancouver, along with postgraduate work at Cambridge focused on environmental and genetic controls in the behavior of salmonid movements and migrations. He was in charge of the British Columbia Fisheries Research Division at UBC from 1957 to 1972, and started fisheries-forestry courses in the Forest Sciences Department in 1972. **Carl Jeff Cederholm** has a 33-year career working on behalf of wild salmon. He completed thesis research on the effects of channelization on salmon in Big Beef Creek. From 1972 to 1981 he worked for the University of Washington's Fisheries Research Institute, on the effects of logging on salmon in the Olympic Peninsula.

ognizes the need for this shift in perspective. Doing something about it, on the other hand, requires a great deal more moral stamina than we have yet shown in the Pacific Northwest and California.

Introduction

The Salmon 2100 project asks a crucial question: what does society have to do, specifically, in order to have sustainable runs of wild salmon at the end of the century? The question assumes people want to act on this challenge. The project asks us to examine four major elements in the way our society functions and then to identify policy options that would respond to these basic aspects of society and consequently sustain and/or restore salmon populations.

In addressing the challenge we first lay out various contextual issues, then present a detailed example from the Okanagan basin of how fish populations and habitat are lost. In this illustrative example, we consider the history of land use, human number expansion, and all levels of governmental behavior... [W]e see rapidly increasing human numbers as a primary societal driver affecting the future of salmon, hence the term alpha factor...

The core drivers [of salmon decline] are beyond the domain of fisheries managers and thus are much less amenable to fisheries policy influence. They are deeply rooted in human behavior in our society and in other societies; indeed, they are influenced by the global community. We stress the difficulty in grappling with these factors because they take us from matters of established scientific method and management principles on the one hand to matters that involve scenarios of future conditions and our world views on the other...

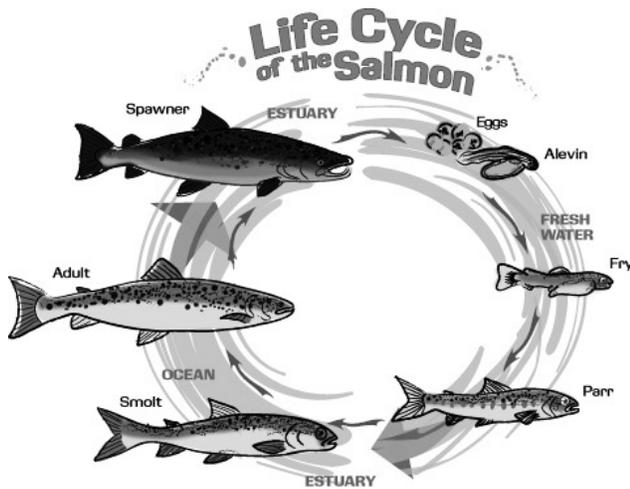
Societal elements driving salmon decline

In Chapter 2, Lackey et al. (2006) have identified four basic elements in society (core policy drivers) that indirectly influence the future of salmon:

1. The rules of commerce,
2. The demand for critical natural resources,
3. The numbers of humans in the region, and
4. Individual and collective material preferences.

In dealing with these core drivers, we (the authors) reflect our world views and broader concerns about society, for we cannot disconnect these things. For example, we believe that there are different weights of impact among the core drivers. Driver 3, human numbers, contributes fundamentally to driver 2. Drivers 1 and 4 reflect outcomes of basic aspects of human behavior, but their effects are exacerbated and modified by population growth.

Put more bluntly, we believe the current pressures on resources such as salmon are caused directly and indirectly by increasing human numbers through many different avenues (Hartman et al. 2000). Key leaders in fisheries in the United States have likewise expressed grave concerns about human population growth and its effects on fishes....



Direct causes of decline

Declines caused directly by habitat degradation and fishing have occurred, in our opinion, because fisheries workers have not been effective in influencing relevant policies in the Pacific Northwest....

The array of direct and indirect causes of decline is wide. Some, such as parasitism, competition, and predation, are related to ecological processes and interactions among species. Others, involving habitat alteration, are related to land-use activities. Some causes for decline spring from narrowly focused human activities (point pollution sources), and others arise from activities that are broadly based across the landscape. Some causes of decline, such as fishing and forestry impacts, may be closely linked to local salmon populations and are, in many ways, related to human population pressures. Other causes of decline, such as hydroelectric power development and climate change effects, may be related to the needs, activities, and growth in numbers of people outside of British Columbia or even North America....

Policy options beyond current reach

Some factors that affect the sustainability of salmon

populations are beyond the control of the primary fisheries agency and indeed even beyond cooperating resource management agencies. Causal agents for climate change originate in many countries and are outside of the control of any Canadian or U.S. fisheries agency....

The types of policies required and relevant to core drivers involve initiatives that fisheries professionals will be criticized for suggesting because they are, in part, outside of the realm of objective science. However, to ensure the sustainability of salmon populations into the future, such policies would need to include those that

- Limit immigration;
- Provide negative incentives for internal population growth;
- Ramp up costs (e.g., permits, services, land, and water) exponentially with increased industrial expansion, area by area, rather than see more expansion;
- Tax users for those things that society normally regards as environmental services that industries tend to get free of charge but which cost the environment and society heavily;
- Prohibit urban and agricultural areas from using more than some predetermined, fixed, fraction of surrounding water resources and charge metered water rates at delivery points;
- Ramp up, progressively, the amount of new habitat that has to be created for replacement of habitat lost to industry, rather than using the current fixed loss-replacement ration as exists in the present no net loss component of the DFO [Department of Fisheries and Oceans] habitat policy;
- Prohibit cities and states, or provinces from bidding against each other, to attract growth, with soft environmental regulations or special incentives; and
- Provide incentives for nongrowth situations.

Some of these policy options are likely beyond reach at present, simply because they go against many things that North American societies stand for. People here will begin to make choices and seek such policy solutions dealing with elements of the core drivers when situations become intolerable or after catastrophes have occurred. Some societies, whose growing populations and activities contribute to climate change and related ocean impacts, may not even be capable of even such limited responses....

Population growth and salmonids

The effects of population growth and environmental change have been forcibly thrust upon one author (TGN) of this chapter for well over half a century. Early experience,

photographs, and information from grandfather and father (keen recreational fishermen) indicate what happened to prime anadromous salmonid habitat, shortly after the turn of the twentieth century, in the lower Fraser valley.

Two major changes occurred as a result of the sharp rise in human numbers. The first was the draining of the large, shallow, and productive Sumas Lake. Brown (2002) estimated that Sumas Lake would have produced between 240,000 and 24,000,000 coho salmon *Oncorhynchus kisutch* smolts. Sumas Lake was drained and the lower Chilliwack River was channelized to provide rich agricultural land to feed the increasing population of the lower Fraser Valley. The second was the multiple damming of the salmonid-rich Stave River to provide humans with more hydroelectric power.

During the 1980s, Northcote and Larkin (1989) documented the case for the Fraser River as one of the great, if not the greatest, salmonid producers of the world. Northcote and Burwash (1991) considered the prospects for it maintaining this position. In conclusion, they made two strong statements:

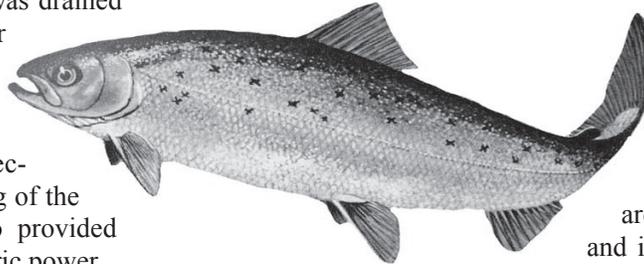
The key feature of change in the Fraser basin and adjoining offshore waters during the last century surely was the large increase in human population with its rush for more and more development, very little of it sustainable even in the short run. To this day, politicians both federally and provincially are doing their utmost to encourage economic growth and development by increasing population, especially by selective immigration from densely populated parts of the world. To many from such backgrounds any attempt to restrict economic growth in the interest of a few components of a fish community must seem ludicrous!

Surely and now slowly, British Columbia will become Canada's California — economically, ecologically, and perhaps even climatically! To those who knew it before, the change will seem life threatening, if not unthinkable. To those who knew far worse, it will seem trivial, if not irrelevant. Whose development do we want to sustain? The choice for a few decades, but not much longer, can still be ours!

In the local context, the Fraser River Valley and its inhabitants would appear still to have choices. In the global context, however, that may not be the case.....

Concluding thoughts

....Our discussion has delved into issues of population growth and its implications, direct and indirect, to the future of salmon in the Pacific Northwest. If human populations in the Pacific Northwest expand to 50, 60, or 100 million (see Lackey et al. 2006b), wild salmon and their habitats and numbers will not persist as we know them today. There is a broader concern with this. Leaders in society, establishing or examining policy options, should not just consider the importance of maintaining wild salmon and their environments alone. They should understand that if we, as a society, are unable to make the choices and implement the actions that permit us to sustain wild salmon into the future, we will by the same token lose many other attributes of wildlife, aesthetics, and the quality of life that we value. ■



References

- Brown, T.G. 2002. Floodplains, flooding, and salmon rearing habitats in British Columbia: a review. Fisheries and Oceans Canada, Canadian Science Advisory Secretariat.
- Hartman, G.F., C. Groot, and T.G. Northcote. 2000. Science and management in sustainable salmonid fisheries: the ball is not in our court. Pages 31-50 in E.E. Knudsen, C.R. Steward, D.D. MacDonald, J.E. Williams, and D.W. Reiser, editors. Sustainable fisheries management: Pacific salmon. Lewis Publishers, Boca Raton, Florida.
- Lackey, R.T., D.H. Lach, and S.L. Duncan. 2006b. Wild salmon in western North America: the historical and policy context. Pages 13-55 in R.T. Lackey, D.H. Lach, and S.L. Duncan, editors. Salmon 2100: the future of wild Pacific salmon. American Fisheries Society, Bethesda, Maryland.
- Northcote, T.G., and M.D. Burwash. 1991. Fish and fish habitats of the Fraser River basin. Pages 117-141 in A.H.J. Dorsey and J.R. Riggs, editors. Water in sustainable development: exploring our common future in the Fraser River basin. Westwater Research Center, University of British Columbia, Vancouver.
- Northcote, T.G., and P.A. Larkin. 1989. The Fraser River: a major salmonine production system. Pages 172-204 in D.P. Dodge, editor. Proceedings of the International Large River Symposium. Canadian Special Publication of Fisheries and Aquatic Sciences 106.