

5-31-2014

Salmon Hatcheries as fish Factories: Forgetting the Lessons of Leopold

Michael C. Blumm

Follow this and additional works at: <https://digitalcommons.law.seattleu.edu/sjel>

Recommended Citation

Blumm, Michael C. (2014) "Salmon Hatcheries as fish Factories: Forgetting the Lessons of Leopold," *Seattle Journal of Environmental Law*. Vol. 4: Iss. 1, Article 13.

Available at: <https://digitalcommons.law.seattleu.edu/sjel/vol4/iss1/13>

This Article is brought to you for free and open access by the Student Publications and Programs at Seattle University School of Law Digital Commons. It has been accepted for inclusion in Seattle Journal of Environmental Law by an authorized editor of Seattle University School of Law Digital Commons.

Salmon Hatcheries as Fish Factories: Forgetting the Lessons of Leopold

Michael C. Blumm[†]

TABLE OF CONTENTS

| | |
|---|-----|
| I. Introduction | 409 |
| II. Background | 410 |
| III. Lichatowich's Search For Salmon Recovery..... | 411 |
| A. The Adverse Effects of Hatcheries on Wild Salmon..... | 411 |
| B. Bureaucratic Fragmentation..... | 415 |
| C. Proposed Reforms..... | 417 |
| D. Inconsistency with the Ecological Principles of Aldo Leopold.... | 418 |
| IV. Conclusion..... | 419 |

I. INTRODUCTION

Salmon are the iconic natural resource of the Pacific Northwest, a region that Tim Egan once memorably described as “anywhere a salmon can get to.”¹ The Northwest’s salmon runs, which have been at the center of native culture and subsistence for centuries, were the subject of 19th century treaties that facilitated non-native settlement of the region and became a fulcrum in the development of the Northwest’s economy in the last century-and-a-half. Today, they have become widely recognized as a barometer of the health of aquatic ecosystems.² Jim Lichatowich’s new book, *Salmon, People, and Place: A Biologist’s Search for Salmon Recovery*,³ a sequel to his influential 1999 work, *Salmon Without Rivers*,⁴

[†] Jeffrey Bain Faculty Scholar & Professor of Law, Lewis and Clark Law School. An abbreviated, unfootnoted version of this review appeared in volume 115 of the *Oregon Historical Quarterly*.

1. JIM LICHATOWICH, *SALMON, PEOPLE, AND PLACE: A BIOLOGIST’S SEARCH FOR SALMON RECOVERY* 22 (Oregon St. U. Press, 2013) (quoting TIMOTHY EGAN, *THE GOOD RAIN: ACROSS TIME AND TERRAIN IN THE PACIFIC NORTHWEST* (Vintage Books, 1990)).

2. *See generally* MICHAEL C. BLUMM, *SACRIFICING THE SALMON: A LEGAL AND POLICY HISTORY OF THE DECLINE OF COLUMBIA BASIN SALMON* (Vandeplas Publishing, 2013).

3. *See* Lichatowich, *supra* note 1.

claims that the listing of several stocks of Pacific salmon during the last two decades has led to spending billions of dollars on recovery efforts, despite making no discernable effect on the fact that salmon have fully lost 40 percent of their historic range.⁵

This review of Lichatowich's book first discusses the adverse effects of salmon hatcheries on wild stocks of salmon, including various forms of artificial production like ocean ranching, net penning, and supplementation hatcheries. It then assesses Lichatowich's criticism of what he considers to be bureaucratic fragmentation, and suggests that he employs a too-narrow interpretation of the real governmental fragmentation that threatens recovery of wild salmon because his focus is almost exclusively on fishery agencies, especially those on the state level. Third, it asserts that, although Lichatowich's recipe for hatchery reforms seems sound, it somewhat ambivalently endorses supplementation projects without much explanation of their costs and benefits. Finally, the review claims that Lichatowich's criticisms of the "industrial model" of fish production,⁶ while well taken, might have resonated more forcefully had he elaborated on just how inconsistent that model is with the ecological principles championed by the father of modern ecology, Aldo Leopold.

II. BACKGROUND

The Lichatowich book suggests that the vast amount of money devoted to salmon recovery has been, at least in some substantial part, poorly spent. Lichatowich mounts a sustained attack against what he calls "fish factories," otherwise known as salmon hatcheries, and their effects on salmon management.⁷ A highly respected salmon biologist, Lichatowich co-authored a seminal 1991 article, *Pacific Salmon at the Crossroads*,⁸ which signaled the advent of the Endangered Species Act (ESA) era for Pacific salmon.⁹ In his new book, Lichatowich indicts salmon hatcheries for being the center of a flawed conceptual foundation

4. See generally, JIM LICHATOWICH, *SALMON WITHOUT RIVERS* (Island Press, 2001) (criticizing various salmon recovery plans).

5. See Lichatowich, *supra* note 1, at 30, 51.

6. See *id.* at 115.

7. See, e.g., Lichatowich, *supra* note 1, *passim*. According to Lichatowich, these fish factories make hatchery salmon "ecologically placeless." *Id.* at 23.

8. Willa Nehlsen, Jack Williams & Jim Lichatowich, *Pacific Salmon at the Crossroads: Stocks at Risk from California, Oregon, Idaho, and Washington*, 16 *FISHERIES* 4, 4 (1991) (describing the imperiled state of wild salmon runs throughout the West Coast).

9. See generally Michael C. Blumm & Greg D. Corbin, *Salmon and the Endangered Species Act: Lessons From the Columbia Basin*, 74 *WASH. L. REV.* 519 (1999).

for salmon management, which has sacrificed salmon habitat for what he calls a “simplified industrial production system.”¹⁰ That system has traded away habitat for hatcheries, countenanced widespread overharvesting, largely ignored adverse effects on wild salmon, and lost sight of the salmon’s essential attachment to place.¹¹

Lichatowich’s powerful brief against contemporary salmon management is captured in his recounting of a phone conversation with a Puget Sound salmon manager—occurring around the time of the publication of his *Crossroads* article. The manager objected to the fact that a draft of the article placed some coho salmon populations on a list of those in danger of extinction. He objected, not because the populations were healthy, but because protecting them would interfere with harvests of abundant hatchery-produced fish that intermingled with the depleted wild stocks in the ocean. The manager wanted to avoid the “waste” of hatchery-fish harvests that he feared the *Crossroads* article—and the consequent ESA listings—might produce.¹² This revelation led to an epiphany for Lichatowich concerning the Faustian bargain salmon managers have historically made with fish factories. This bargain has deflected attention from the immense habitat damage inflicted by federal and federally licensed dams¹³ (although Lichatowich is not quite as clear as he could have been about the habitat damage due to dams).

III. LICHATOWICH’S SEARCH FOR SALMON RECOVERY

This review discusses (1) Lichatowich’s views on the adverse effects on hatcheries on wild stocks of salmon; (2) his criticism of what he calls bureaucratic fragmentation; (3) his proposed reforms; and (4) the inconsistency of widespread reliance on salmon hatcheries with the ecological principles of Aldo Leopold.

A. The Adverse Effects of Hatcheries on Wild Salmon

Lichatowich criticizes “simplified industrial production” as the root cause of traditional hatcheries, ocean ranching, net penning of salmon, and “supplementation” projects. Ocean ranching, which is the process of harvesting eggs from indigenous salmon to be fertilized and cultured in a hatchery, rose in the 1970s only to die a couple of decades later, due to a flawed assumption that the limiting factor in salmon production was a

10. See Lichatowich, *supra* note 1, at 67.

11. See *id.* at 23-30, 56-60.

12. See *id.* at 57-58.

13. See *id.* at 40.

vacant ocean habitat. Net penning of salmon, which Lichatowich calls “feedlot aquaculture,” is still going strong in British Columbia and Washington, with some thirty operations in existence in 2003. Finally, “supplementation” projects ostensibly attempt to increase salmon runs in the future.¹⁴

Concerning “supplementation” projects, a strategy embraced by the Northwest Power and Conservation Council (Council) and several Columbia Basin tribes,¹⁵ Lichatowich appears somewhat ambivalent. He suggests the supplementation projects’ good intention to integrate artificial production with ecosystem sensitivity cannot succeed without considerable changes in harvest and habitat management, including dam operations.¹⁶ However, he does not indict supplementation projects to the extent he does the “industrial production” hatcheries, a distinction that may well be justified, but the reasons for which are not expressly contained in the book.

According to Lichatowich, the basic problem of modern salmon management is the lack of a sound conceptual foundation, a criticism that echoes the critique levied by the Council’s *Return to the River: Restoring Salmon to the Columbia River*.¹⁷ This shortcoming is due largely to a failure of salmon managers to observe a sense of place,¹⁸ which is ironic because salmon’s chief characteristic—and what makes the resource an iconic one—is fidelity to place, which is a characteristic that has captured the public’s imagination.

The Council’s now 30-year old effort to restore the Columbia Basin runs has been a large-scale disappointment, whose effect has been largely eclipsed by a court-supervised biological opinion under the ESA.¹⁹ Lichatowich does not focus specifically on the Council’s

14. See Lichatowich, *supra* note 1, at 104-11.

15. Compare Mathew Johnson, *What Would the Salmon Say? An Argument for Supplementation to Help Rebuild Naturally Reproducing Salmon Populations in the Columbia Basin*, 24 PUB. LAND & RES. L. REV. 45 (2004) (endorsing supplementation), and Lichatowich, *supra* note 1, at 63-65 (explaining the Council’s approach), and *id.* at 68-70 (explaining the tribes’ approach), with Jack K. Sterne, Jr., *Supplementation of Wild Salmon Stocks: A Cure for the Hatchery Problem or More Problem Hatcheries?*, 23 COASTAL MANAGEMENT 123, 140 (1995) (suggesting that supplementation proceed “only under carefully controlled conditions at non-permanent facilities in an experimental, adaptive management framework”).

16. See Lichatowich, *supra* note 1, at 110-111.

17. RICHARD WILLIAMS, *RETURN TO THE RIVER: RESTORING SALMON TO THE COLUMBIA RIVER* (Elsevier Academic Press, 2006) (advocating place-based management), discussed in Lichatowich, *supra* note 1, at 147.

18. See Lichatowich, *supra* note 1, at 24.

19. See Michael C. Blumm & Andy Simrin, *The Unraveling of the Parity Promise: Hydropower, Salmon, and Endangered Species in the Columbia Basin*, 21 ENVTL. L. 657 (1991) (recounting the shortcomings of the Council’s program, particularly with respect to changing

program, although he does criticize its goal of doubling Columbia River run sizes for failing to focus on wild fish and their habitats.²⁰ Moreover, doubling run sizes would appear as a far less impressive goal if the public recognized it would achieve only a 30-50 percent restoration of historic runs.²¹ Lichatowich also does not carefully examine the effect of the ESA's supplanting of the Council's program as the chief restoration effort, although he refers to the "flimsy" nature of ESA protection.²² He notes that the ESA listings resulted in a great deal of funding for salmon restoration,²³ but the inference is that money has been mostly wasted on hatcheries and other artificial production efforts, which are harmful to wild stocks.

Lichatowich claims that reliance on hatcheries to sustain harvest levels, which he refers to as the Walmart/Costco approach to salmon reproduction,²⁴ has allowed salmon managers to substitute the promise of artificial propagation for salmon spawning.²⁵ The result is public financing of hatcheries at the expense of wild stocks, causing both habitat and genetic loss for the stocks. Further, Lichatowich explains how managers habitually establish high harvest rates to avoid "waste" of salmon when too many hatchery fish return to the hatchery.²⁶ When this happens, mixed stock fisheries are overharvested in an effort to ensure that hatchery fish are not overharvested. As a result, the increased use of mixed stock fisheries has depleted wild stocks.

Lichatowich discusses the relationship between hatchery production and its pernicious effects on harvest managers,²⁷ but this is hardly a novel observation.²⁸ He questions why managers persist in maintaining high harvest levels despite predictable adverse effects on wild stocks.²⁹ But in actuality, the results are quite predictable under Public Choice political

mainstream dam hydropower operations); Michael C. Blumm & Aurora Paulsen, *The Role of the Judge in ESA Implementation: District Judge James Redden and the Columbia Basin Saga*, 32 STAN. ENVTL. L.J. 97 (2013) (discussing the district judge's refusal to accept the federal government's biological opinion under the ESA and his ordering of spills at dams to facilitate juvenile salmon passage over the government's objections).

20. See Lichatowich, *supra* note 1, at 78, 193.

21. See *id.* at 112.

22. See *id.* at 190.

23. See *id.* at 192.

24. See *id.* at 34.

25. See *id.* at 29.

26. See *id.* at 57-58, 201.

27. See *id.* at 59-60.

28. See, e.g., INDEPENDENT MULTIDISCIPLINARY SCIENTIFIC TEAM, SALMON ABUNDANCES AND EFFECTS OF HARVEST: IMPLICATIONS FOR REBUILDING WILD STOCKS OF COHO SALMON IN OREGON (2000).

29. See Lichatowich, *supra* note 1, at 146.

theory. According to this theory, well-organized interest groups with both short term economic agendas and economies that are linked to commercial and recreational salmon harvest – such as coastal communities and recreational sport fishers – are repeat players heavily invested in salmon harvest management and consistently prevail over unorganized majorities.³⁰ When these heavily invested repeat players prevail, wild stocks suffer the consequences.

A particular source of the book's concern is the fate of Oregon's wild fish policy, which was promulgated in 1978. According to Lichatowich, the policy was flawed from the outset³¹ because it included directives to both protect and "propagate" salmon, which Lichatowich considers an oxymoron—the propagation of hatchery fish is inimical to the protection of wild fish.³² Interestingly, in early 2014, the Oregon Department of Fish and Wildlife designated certain coastal streams for exclusive wild production, restricting hatchery releases to other streams, which would become havens for hatchery fish.³³

Lichatowich briefly mentions the *Alsea Valley Alliance* case, which for a brief time threatened to undermine ESA salmon listings by enjoining the National Marine Fisheries Service's (NMFS's) approach to listing only wild salmon stocks, excluding hatchery fish.³⁴ However, this case was not as significant as Lichatowich claims. Lichatowich considers the lawsuit to be an effort "to prevent change in the salmon story," and he blames an initial NMFS response to the case on the George W. Bush Administration's attempt to undermine salmon science.³⁵ But the eventual response to the decision was not as dire as many feared. The revised policy reinforced the ESA's preference for wild fish protection,

30. See DANIEL A. FARBER & PHILIP P. FRICKEY, *LAW AND PUBLIC CHOICE: A CRITICAL INTRODUCTION* (Univ. Chicago Press, 1991).

31. See Lichatowich, *supra* note 1, at 88.

32. See *id.* at 118.

33. See Bill Monroe, *Salmon and steelhead plants will shift on the Oregon coast, ending on some streams, starting or increasing on others*, OR. LIVE (Jan. 10, 2014), http://www.oregonlive.com/sports/oregonian/bill_monroe/index.ssf/2014/01/post_104.html. Lichatowich discusses this sort of zoning of wild and hatchery fish under the rubric of "select area fisheries management," which he considers to be a response to the competition between sport and commercial fishers without responding to the underlying root cause of the decline of salmon runs. See Lichatowich, *supra* note 1, at 111-15.

34. *Alsea Valley Alliance v. Evans*, 161 F.Supp.2d 1154 (D. Or. 2001) (deciding that NMFS lacked authority under the ESA to distinguish between hatchery and wild fish once it had included both within a "distinction population segment" (an "evolutionarily significant unit" in NMFS parlance)), discussed in Michael C. Blumm & Hallison T. Putnam, *Imposing Judicial Restraints on the 'Art of Deception': The Courts Cast a Skeptical Eye on Columbia Basin Salmon Restoration Efforts*, 38 ENVTL. L. 47, 70-74 (2008).

35. See Lichatowich, *supra* note 1, at 51-52.

but allowed the NMFS to protect hatchery fish, where necessary, to conserve natural self-sustaining salmon populations, after taking into account abundance, productivity, genetic diversity, and spatial distribution.³⁶ The decision also survived judicial review.³⁷

As Lichatowich explains, adverse effects of fish factories on wild salmon include genetic drift, overharvesting due to so-called mixed stock fisheries,³⁸ and a willingness of fish managers to trade loss of habitat for additional hatchery production. Lichatowich confesses that while he once thought of hatcheries as “neutral tools” of salmon recovery, he now understands that their costs far exceed their benefits.³⁹ Given this realization, some of his prescriptions seem a bit tepid.⁴⁰

B. Bureaucratic Fragmentation

One other shortcoming of the book concerns its repeated allegation that salmon management suffers from bureaucratic fragmentation.⁴¹ Lichatowich focuses his criticism on fragmentation among and within fish agencies, but in truth the fragmentation is much more pernicious and widespread. There is no doubt that immense migration of salmon provides the ultimate challenge to regulatory jurisdiction. For example, the Northwest Power Planning and Conservation Council, an interstate compact agency with four Columbia Basin member states, has no control over ocean harvests (or, for that matter, in-state harvests), no control over habitat-damaging dam operations, and no direct control over hatchery operations.⁴² Therefore, regulatory fragmentation is endemic to the salmon management problem.

A key contributor to the fragmentation that bedevils salmon management in the Columbia Basin is that fish managers lack any control over the habitat-damaging activities of the Bonneville Power Administration (BPA). The BPA is a federal agency that effectively

36. 70 C.F.R. § 37.204 (2005).

37. *See* Trout Unlimited v. Lohn, 559 F.3d 946 (9th Cir. 2009) (affirming NMFS’s decision to change the listing of Upper Columbia steelhead from endangered to threatened and allow the harvesting of hatchery steelhead with clipped fins).

38. *See, e.g.*, Lichatowich, *supra* note 1, *passim* (defining stock fisheries as those in which both hatchery and wild fish are harvested).

39. *See* Lichatowich, *supra* note 1, at 100.

40. *See supra* text accompanying note 19, *infra* notes 48, 69-70.

41. *See* Lichatowich, *supra* note 1, at 77, 82, 86, 119.

42. *See, e.g.*, Blumm, *supra* note 2, at 132-34 (discussing limitations on the Council’s authority, including a congressional admonition that it not become a “super” fish and wildlife agency).

controls river flows through its hydropower sales,⁴³ a fact the book barely acknowledges. The book does contain a brief discussion of augmented Columbia River flows, claiming that the increased flows of recent years are one of the concessions of the so-called “Lords of Yesterday,”⁴⁴ but noting only that the flows “caused a political backlash and attempts to eliminate the entire program.”⁴⁵ However, at least in the Columbia Basin, the ESA has not produced substantially increased flows, and environmentalists have been unable to convince the reviewing court to order them.⁴⁶

What Lichatowich most likely meant was that that spills of water from mainstream dams have been quite controversial because they are expensive, reducing the value of federal hydropower sales.⁴⁷ However, they have proved to be quite effective in lowering juvenile salmon mortality at dam sites, and spills have occurred only due to federal district judge James Redden’s interpretation of the ESA—and his persistence in enforcing orders against BPA and allied federal agencies.⁴⁸ This essential role of the federal court escaped the attention of the book.

Despite that important oversight, Lichatowich has written an important book. Among its noteworthy contributions is an indictment of the Northwest Power and Conservation Council’s goal of doubling current run sizes.⁴⁹ As Lichatowich points out, doubling salmon runs without attention to wild stocks is “inane”;⁵⁰ moreover doubling current run sizes assumes current salmon populations is the relevant baseline to measure success. As the book demonstrates, this baseline is hardly

43. See generally Michael C. Blumm, *Hydropower vs. Salmon: The Struggle of the Pacific Northwest’s Anadromous Fish for a Peaceful Coexistence with the Columbia River Power System*, 11 ENVTL. L. 211, 249-56 (1981) (explaining the mechanics of how hydropower demand affects river flows, through agreements between BPA and the U.S. Army Corps of Engineers which operates the federal dams on the Lower Columbia).

44. See Lichatowich, *supra* note 1, at 85-86 (assuming that references to the “Lords of Yesterday” equates to status quo operations). The phrase “Lords of Yesterday” is from Charles Wilkinson’s reference to nineteenth century laws that often control modern public land management; see CHARLES F. WILKINSON, *CROSSING THE NEXT MERIDIAN: LAND, WATER, AND THE FUTURE OF THE WEST* (Island Press, 1992).

45. See Lichatowich, *supra* note 1, at 85-86.

46. See Blumm & Paulsen, *supra* note 19, at 133.

47. Lichatowich, *supra* note 1, at 54 (mentioning that BPA’s proposal to decrease spills to save an alleged \$47 million doesn’t elaborate, suggesting only that the agency offered to use some of the saved money on hatchery improvements, and that the offer was judicially rejected).

48. See Blumm & Paulsen, *supra* note 19, at 115-45.

49. NORTHWEST POWER AND CONSERVATION COUNCIL, *COLUMBIA RIVER BASIN FISH AND WILDLIFE PROGRAM* (2014) available at <http://www.nwcouncil.org/fw/program/2014-03/>.

50. See Lichatowich, *supra* note 1, at 193.

relevant; a better baseline would be historic abundance, so the public would know the historic context of the loss of salmon runs.⁵¹

C. Proposed Reforms

The book calls for changes in the management of salmon hatcheries—indicting the current salmon hatchery system and suggesting a recipe for hatchery reforms, which includes a prohibition on transferring salmon eggs out-of-basin and treating hatcheries as untested experiments.⁵² However, it does not advocate wholesale elimination of the technology that has proved so costly to wild salmon runs. Although he does not quite say so, Lichatowich may endorse a distinction between salmon hatcheries whose goal is to preserve harvests and those aimed at restoring historic runs.

Lichatowich's most arresting recommendation concerns his proposed system of salmon refuges, which would coincidentally restrict their operation through establishment of a series of salmon refuges. These refuges would not only serve to zone out hatcheries, but they would also cause a considerable revamping of harvest management, perhaps redirecting fishing efforts closer to rivers to reduce mixed-stock harvests. Lichatowich provides a glimpse of what the salmon refuge could look like in one of his "side channels."⁵³ This consists of a small commercial fishery, a sports fishery for locals, and a sports fishery for non-locals (controlled by lottery).⁵⁴ This world stands in stark contrast to another "side channel," which depicts a sterile river in which Pacific salmon have been largely excluded to facilitate commercial water sales to southern California and Arizona—river flows no longer reach the ocean, and "everything is in private ownership," largely to foreign corporations.⁵⁵ Nonetheless, it is not quite clear from the book what effect establishing a salmon refuge would have outside the refuges on upstream projects, such as dam operations.

51. *See id.* at 156-157.

52. *See id.* at 168-170.

53. *See id.* The book contains five of these "side-channels:" brief vignettes concerning 1) salmon introduction on the St. Joseph River in Indiana; 2) logged over salmon habitat in the Olympic Peninsula; 3) monitoring of fish migration at The Dalles Dam; 4) a look at what the "industrial production" model of salmon management would look like in 2150; and 5) a look at what a world of salmon refuges would look like in 2150.

54. *See id.* at 186.

55. *See id.* at 135-37. These two contrasting visions roughly parallel the contrasting vision that Lichatowich paints between the Los Angeles River (roughly paralleling his vision of the future of industrial production in channel 4) and the Carmel River (roughly paralleling his vision in channel 5).

Also included among the book's proposed reforms are setting "ecologically relevant escapement targets,"⁵⁶ which would avoid overharvesting wild stocks. These targets would ensure that there would be sufficient spawning salmon to cure "nutrient deficits"; that is, spawning required to supply the food webs of salmon ecosystems.⁵⁷ Lichatowich advocates for increased monitoring and assessment⁵⁸ because a prerequisite to intelligent reform is an accurate understanding of the status quo. He also welcomes the increasing use of watershed councils as a means to restore a sense of place to salmon management.⁵⁹ However, his endorsement of the consensus-based approach of Oregon Governor John Kitzabher—an avowed salmon advocate—is curious. Lichatowich's frequent criticism is of bureaucratic fragmentation,⁶⁰ and consensus decision-making seems assured to provide many vetoes over any changes to the status quo, which is the very thing Lichatowich strongly criticizes throughout the book. In fact, consensus management, coupled with the salmon's immense migrations, is a chief reason for many of the problems the book justifiably criticizes. One does not have to endorse a salmon expert⁶¹ to recognize that requiring consensus is not a recipe for salmon restoration.

Among the most persuasive of Lichatowich's suggestions is that, given all the failures of salmon restoration measures that date back over a century, salmon managers must learn from history's failures.⁶² Learning from past mistakes would be the first step in finally developing a viable salmon recovery plan. Perhaps the chief lesson for the future is that fish biology majors need to master history courses as well as science courses.

D. Inconsistency with the Ecological Principles of Aldo Leopold

Another lesson that Lichatowich attempts to draw concerns the inconsistency of the industrial production approach to salmon management with the philosophy espoused by the father of modern ecology, Aldo Leopold.⁶³ Leopold espoused his now famous "land

56. Lichatowich, *supra* note 1, at 167 (defining escapement as the number of fish that survive all sources of mortality and successfully spawn).

57. *Id.* at 62 (claiming that "current escapements are carrying only 5 to 7 percent of nutrients of . . . historic [salmon] runs").

58. *See id.* at 155, 156.

59. *See id.* at 87, 139, 166-167.

60. *See id.* at 119, 172.

61. *See* William H. Rodgers, Jr., *What a Salmon Czar Might Hope For*, 74 WASH. L. REV. 511 (1999).

62. *See* Lichatowich, *supra* note 1, at 173-187.

63. *See id.* at 12, 204-205.

ethic,” which argued for an expanded definition of community to include ecological function a half-century before ecology became a byword of the environmental movement. Lichatowich suggests that learning Leopold’s lessons would help the public to understand the idea of natural resources as gifts,⁶⁴ something that was, and is, intrinsic to the native approach to salmon.

Lichatowich’s book should have explained Leopold in greater detail to his audience.⁶⁵ If fishery managers had taken seriously his admonition that land as a community, including dependent animals, is the basic concept of ecology, then salmon might have been less susceptible to the industrial production model. However, the industrial model has dominated salmon management since Leopold’s untimely death in 1948, the year Congress authorized the Lower Columbia Fishery Development Program.⁶⁶ Leopold famously wrote that “[a] thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise.”⁶⁷ If that admonition were taken seriously, salmon hatcheries would have faced a considerable burden of proof that might well have prevented their unfortunate proliferation in the years after Leopold’s posthumous publication of *A Sand County Almanac* in 1949.⁶⁸

IV. CONCLUSION

In the end, some of the criticisms in this review are perhaps aimed at a book that Lichatowich did not write or intend to write. His concern that salmon management needs a new conceptual foundation is well

64. *See id.* at 204-205.

65. *See* ALDO LEOPOLD, *A SAND COUNTY ALMANAC AND SKETCHES FROM HERE AND THERE* viii (Oxford U. Press, 1949) (stating that “The land ethic simply enlarges the boundaries of the community to include soils, waters, plants, and animals or collectively: the land”).

66. Leopold, a forester, ecologist, and nature writer, was a professor of wildlife management at the University of Wisconsin and helped found the Wilderness Society. He died from a heart attack at the age of 61 after fighting a wildfire. For a recent remembrance, *See* Eric T. Freyfogel, *Leopold’s Last Talk*, 2 WASH. J. ENVTL. & POL’Y. 236 (2012).

67. *Id.* at 262.

68. LEOPOLD, *supra* note 65. Instead of pursuing ecological principles, in 1948 Congress authorized the Lower Columbia River Development Program. Over the next few decades the program funded hatcheries in the lower Columbia, damaging wild fish, and shifting salmon harvests to the lower basin, away from upriver harvests by Indian tribes. *See generally* JOSEPH E. TAYLOR, *MAKING SALMON: AN ENVIRONMENTAL HISTORY OF THE NORTHWEST FISHERIES CRISIS* (U. Washington, 1999). These inherent inequities were partially remedied by the “Boldt Decision,” in 1974, *United States v. Washington*, 384 F.Supp. 312 (W.D. 1974), *aff’d* 443 U.S. 658 (1979) (tribes’ treaty rights entitled them to 50 percent of salmon harvests). But of course the Boldt Decision did nothing to prevent the adverse effects of hatchery fish on wild salmon, and it probably encouraged more hatcheries to satisfy the increased demand that recognition of treaty rights produced.

placed. The fact that he focuses on state fishery managers and the hatcheries and harvest management they control is, given his background, understandable. But even though he emphasizes that an overriding problem with salmon management is fragmented jurisdictional control, his prescriptions—which largely look past the overwhelming influence of hydroelectric project operations⁶⁹—are not sufficient for a truly comprehensive approach to effective salmon restoration.⁷⁰ That unsettling reality confronts those responsible for restoring salmon runs in the 21st century, particularly those in the Columbia Basin.⁷¹

69. See Michael C. Blumm, *The Real Story Behind the Columbia Basin Salmon Debacle: Dam Preservation Under the Endangered Species Act*, 41 ENVTL. L. 1363 (2011).

70. Nonetheless, Lichatowich's criticisms have begun to resonate. The Oregon District Court recently enjoined the continued operation of a state-run, federally-funded hatchery on the Sandy River in Oregon because it failed to properly assess the adverse effects of flooding the river with hatchery fish on wild stock listed on the ESA, violating both the ESA and the National Environmental Policy Act. *Native Fish Society v. Nat'l Marine Fisheries Serv.*, Case No. 3:12-cv-00431-HA (D. Or. Jan. 16, 2014).

71. Epitomizing the challenges ahead is the Obama Administration's proposal to reduce spill in its latest proposed biological opinion, despite the fact that previous opinions have failed to past judicial muster, and the reviewing court's repeated injunctions ordering spill. See *Federal Agencies Squander Chance for Progress on Salmon*, SAVE OUR WILD SALMON (Sept. 9, 2013), <http://www.wildsalmon.org/press-releases/policy-and-government/> (citing a 16-year study showing that spill from mainstream dams is the most effective means of increasing salmon survival in the Columbia River and judicial injunctions since 2006 ordering spill over the objections of the federal government). See also Blumm & Paulsen, *supra* note 19, at 115-45 (discussing the judicial injunctions). Idaho Rivers United claimed that the draft plan "ignores the best science, sidesteps the court's explicit instructions to do more for salmon, curtails the proven benefits of spill, perpetuates uncertainty and fails to address the impacts of climate change." *Currently*, ID. RIVERS UNITED 5 (Dec. 2013), available at http://www.idahorivers.org/images/news/IRU_DEC_2013_final.pdf.