REPRODUCING THE RIVER: HISTORIC CONTEXT AND RESOURCE SURVEY OF OREGON'S STATE FISH HATCHERY SYSTEM

by

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THESIS ABSTRACT

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Title: Reproducing the River: Historic Context and Resource Survey of Oregon's State Fish Hatchery System

Oregon's fish hatchery system developed in the late 1800's in response to salmon fishery losses. Salmon hatcheries consist of a number of built components. 'Growing fish' requires a variety of building types which support the hatchery process as well as constant input of resources. In addition to surveying and inventorying fish hatchery resources, this study will analyze the social, economic, cultural, and environmental conditions under which these fish hatcheries were organized and commissioned. Ultimately, this survey will not only serve as a baseline for future, more intensive-level surveys, but will also provide a foundation for a National Register Multiple Property Submission. The use of hatcheries to sustain native Oregon fish species constitutes a major aspect of Oregon's fishing and environmental conservation efforts. Oregon's heritage hatcheries stand as physical reminders of early conservation activity and while their preservation provides a more complete picture of Oregon's relationship with natural resources.

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CHAPTER I

INTRODUCTION

Inspiration for this project derived through my involvement in a feasibility and market study for a proposed interpretive center along the McKenzie River. The interpretive center is the vision of the Friends of the McKenzie River (Fiends), a group consisting of current and former river guides, area residents, and government liaisons. The site, at the former Leaburg Fish Hatchery, lies about 20 miles east of the Eugene-Springfield Metro Area on Highway 126. During the study, I examined site constraints including the presence of a National Register Historic District nominated around the historic hatchery.

Though the feasibility concluded that the regional market could potentially support such an endeavor and Friends moved forward with concept planning. I was invited to participate in a design charrette which occurred on-site in October, 2016. The other invitees and Friends members were treated to a tour of the historic hatchery. I was struck by the scenic grounds and historic architecture. During the design charrette, participants encouraged incorporating and highlighting the historic hatchery. Should the area of effect intrude on the district, an understanding of the historic district's character defining features would be needed. I investigated the districts nomination form and researched similar project, and found sparse investigations into fish culture sites.

Scope and Purpose

The significance of the project lies in the fact that fish hatcheries have been, and in many ways still are, an important component of Oregon's history regarding its residents' relationship with natural resources. Research for this thesis started with basic questions: What are fish hatcheries? How were they built and used? What is their historical significance? Unfortunately, it is a history that does not get told nearly as often as more common resource extraction and agriculture counterparts such as traditional farmsteads, mining, or timber. Ultimately, historic fish hatchery facilities provide a lens highlighting the significant development of natural resource management in Oregon.

The history of Pacific Northwest fisheries decline and the consequent emergence of mitigation efforts to alleviate losses has been carefully recorded and widely examined by scholars. Specific study of the material structure comprising Oregon's artificial propagation efforts remains isolated at best, largely clouded and wanting. Furthermore, as public resources, the identification, evaluation, and protection of historic fish culture resources is de rigueur. Many fish hatcheries are, or are nearing, fifty years of age, the need for their survey has reached certain imperativeness. Lastly, as the physical sites of propagation, intrinsic hatchery elements convey significance by pulling together often disparate historic narratives. Addressed, these detached scenes display respective design features specific to Oregon's initial and subsequent periods of hatchery development. Taken together, they express insights into the history of aquaculture as well as evolving approaches of our own relationship with natural resources.

The purpose of this study is to survey and establish historical significance of trout and salmon hatchery resources by evaluating their role within relevant, regional history. In attempting to establish and weigh this significance, a survey of state-operated fish hatcheries will help guide historical research by revealing, most importantly, whether intact, historic fabric remains on these sites. Expecting that historic resources still do exist, the survey intends to highlight periods of development and escalated construction. In other words, in regards to historic resources, what remains and what patterns and themes do those remains imply? Conversely, historic context research shall provide an appropriate capacity by which to evaluate hatchery resources—the who, how, why and where. My intent in documenting the history of salmon and trout propagation in Oregon by employing a survey and evaluation of state-operated fish hatcheries is to ultimately yield a more comprehensive portrayal of Oregon's mitigation experience commencing with initial fish culture stations in 1876 through contemporary upsurge instituted in the 1950s.

In addition to surveying and inventorying fish hatchery resources, this study will analyze the social, economic, cultural, and environmental conditions under which these fish hatcheries were organized and commissioned. In other words, the do these historical hatchery sites continue to reflect the historical contexts in which they were constructed? Ultimately, this survey will not only serve as a baseline for future, more intensive surveys, but will also provide a foundation for a National Register Multiple Property Submission covering eligible fish hatcheries throughout the state.

Methodology

The research design for establishing fish hatchery history and surveying sites established through the first-half of the 20th century utilizes methodology outlined through the National Park Service and Oregon State Historic Preservation Office literature on historic resource surveys and evaluation. The historic context statement investigates relevant patterns of historical development pertaining to fish culture development and regional salmon and trout fisheries management as evidenced through archival research and associated literature review.

Literature Review

As implied above, previous research into the history of the salmon industry and environmental degradation through development and resource extraction activities within Oregon is well documented through numerous books, journals and articles. To better understand this history and the role of artificial propagation, literature review included primary and secondary source documents predicated on Pacific Northwest fisheries management. Additionally, to understand the process involved with artificial propagation, literature review also included multiple fish-culture sources including both historic and contemporary manuals.

Archival Research

As this study involves publically owned and operated facilities, an extensive amount of primary source records related to motives and subsequent design, construction, operations, and even retirement of the facilities exists in various repositories. Archival research for this project was limited both temporarily and financially. However, availability of reports through online repositories greatly aided with context and survey research. Key to the history of these facilities is the history provided in Oregon Fish and Game Commission *Biennial Reports* as well as Commission meeting minutes made available through the Oregon State Archives in Salem, Oregon. Furthermore, essential primary documents included an examination of architectural drawings housed at the Oregon Department of Fish and Wildlife Headquarters, also in Salem. Lastly, historical documents from other states' fish and game commissions in addition to federal reports also supplemented research considerably.

Historic Resource Survey

The historic resource survey design aimed to provide a preliminary overview of the age, type, and frequency of historic resources contained within the study's geographic and temporal boundaries. The author endeavored to provide a statewide snapshot which, in turn, contribute to producing the statewide history while yielding future research direction and priorities. To this end, surveying fifteen stations spread over an area of nearly 30,000 square miles in size, within the given timeframe, with significant budge restrictions proved challenging. The project was fortunate to receive supplemental funding from the Oregon Heritage Commission in addition to University of Oregon's School of Planning, Public Policy and Management as well as the university's Historic Preservation Program. The site surveys were conducted between February and June 2017. Surveys lasted approximately three hours per station and included recordation and photography of all primary buildings, structures, ponds, and accessible intake structures. Occasionally, on-site staff provided access to building interiors and restricted areas. Furthermore, on three occasions, staff also provided access to historic records and photographs. However, due to the nature of site visits occurring on weekends, staff were often unavailable. First-hand experience on the hatchery sites aided enormously in understanding the hatching and rearing process, hatchery siting, and past site changes. The historic resource descriptions rely heavily on notes from a 2006 *Maintenance Program Report* located at the Oregon Department of Fish and Wildlife headquarters in Salem, Oregon.

Historic Context Statement

As described in the introduction above, this statewide context focuses on design considerations guiding the construction of important resources related to State-operated fish hatcheries in Oregon. Beginning research of the historical contexts of those design considerations and surveyed resources requires establishing bounds as a point of departure. With this in mind, geographic, thematic, and temporal parameters shape this investigation.

Geographic focus includes the entire state of Oregon. Oregon's fish hatcheries are distributed across most of the state's ocean-flowing watersheds and separated into two regions; the Columbia River Basin and Coastal Region.

Although the first recorded fish culture station in Oregon dates to 1876, the earliest hatchery facility *remaining in operation* dates to 1907. Establishing a late bound is based on periods of hatchery system expansion uncovered through the literature review and early archival research. Furthermore, once the Congress amended appropriation limit on Mitchel Act funding in 1946, it would take four years before that federal aid reached Oregon.[1]

The guiding theme of fish culture development, more broadly categorized as agriculture according to the National Park Service, encompasses related themes often specific to periods of fish culture history. Broadly, hatchery development includes the NPS defined categories of Commerce and Trade, Government, Recreation and Culture, Industry, Landscape, and Transportation. Broken down, subcategories include outdoor recreation, energy facilities, conservation, rail- and road-related transportation, and military mobilization. Within these contexts, discussion highlights prominent trends and actors influencing the relevant course of events.

This study of fish hatchery development in Oregon, from initial establishment through construction commencing after World War II, pays specific attention to facility design and structural components in order to distill the essential qualities of these hatcheries. This examination will rely on the historic context statement to evaluate the extent to which those resources represent enmeshed histories.

[1] Columbia River Inter-Tribal Fish Commission, “The Mitchell Act: An Analysis,” (Portland, 1981), 6.

CHAPTER II

HISTORIC CONTEXT

The destruction of fisheries up through the Civil War provided the impetus for the development of technology to artificially improve fishery conditions. Fishing proved an important component of industrial development in birth of colonial New England.[2] Rapid industrialization diminished fishery stocks nationwide. Instead of restricting catches and improving stream conditions, commercial pressure forced a political response pushing for ways to create more fish— “If you could make more fish, then you did not have to regulate the harvest among competing users.”[3] Through technology, the perception of inexhaustible ocean fisheries could become reality.

Oregon’s fish hatchery system developed in the late 1800’s in response to fishery losses. With improvements in processing and preservation through canning, salmon fisheries’ prominence quickly grew, becoming a considerable component of Oregon’s heritage. Fishing—whether commercial, sport, or tribal—remains an important contribution to the state’s natural resource economy. The newly organized Oregon and Washington Fish Propagation Company built the Columbia River Basin’s first recorded

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[2] Mary Finley, “The Tragedy of Enclosure: Fish, Fisheries Science, and U.S. Foreign Policy, 1920-1960,” (PhD. Dissertation: University of California, San Diego, 2007), 29; citing Raymond McFarland, *A History of the New England Fisheries* (New York: University of Pennsylvania, 1911), 19.

[3] Mary Finley, “The Tragedy of Enclosure: Fish, Fisheries Science, and U.S. Foreign Policy, 1920-1960,” (PhD. Dissertation: University of California, San Diego, 2007), 30.

hatchery in 1876. Ten years later, the three person Oregon State Board of Fish Commissioners formed and allocated a $1,000 budget to enforce fish and game laws and operate a hatchery for two years. Continued increase in hatcheries can be attributed to the growth of industry and development in the state. After 1930, growing support for hydroelectric facilities, a significant threat toward native fish species, necessitated the increase in hatchery activity.[4] In 1975, the Fish and Wildlife Commissioners merged under one agency and operating hatcheries numbered 31.[5] Today, the Oregon Department of Fish and Wildlife (ODFW) operates 33 hatcheries.

The Species of Concern: Salmon and Trout

To appreciate and describe the challenges and design consideration of a hatching and rearing facility, it is important to understand the lifecycle and natural setting related to the target species. Salmon and trout culture involves a series of methods designed to replicate natural settings and artificially produce juvenile fish that will successfully mature in the open ocean.[6] Just before reaching sexual maturity, these species,

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[4] Stephen Beckham, *The Bonneville Hatchery: A Historical Assessment for the Bonneville Navigation Lock Project, Bonneville*, *Oregon*, Eugene: Heritage Research Associates, 1986. Report to Portland District, U.S. Army Corps of Engineers, 6.

[5] "Oregon Department of Fish and Wildlife History, 1792 – 2011," Oregon Department of Fish and Wildlife, last modified June, 2015, accessed December 9, 2016, http://www.dfw.state.or.us/agency/history.asp

[6] Patricia Roppel, *Alaska's Salmon Hatcheries: 1891-1959* (Portland, OR: National Marine Fisheries Service, 1982) 35.

collectively termed *salmonids*, begin a long journey to their home stream in order to reproduce.

The primary salmonid species propagated by Oregon hatcheries include six species of salmon (*Oncorhynchus spp*.) and two of anadromous trout (*Salmo spp*.). Artificial propagation has focused on chinook (*O. tshawytcha*), coho (*O. kisutch*), and steelhead trout (*S. gairdneri*) in addition to chum (*O. keta*), pink (*O. gorbusha*), and sockeye (*O. nerka*) due to their exceptional "economic and recreation importance." Species such as the Chinook salmon and steelhead trout can be further divided by season based on the timing of their spawning return to freshwater.[7] Collectively, however, these principal pacific salmon and trout species are often collectively referred to as *salmon*.[8]

The challenges in propagating these species has been the focus of decades of fisheries biology research and, as such, is difficult to summarized in this brief introduction. Extensive existing literature describes the natural history, life-history patterns, habitats, and ecology of salmon.[9] On the other hand, prevailing general patterns do exist instruct the challenges and subsequent techniques utilized in salmon culture.

[7] Roy Wahle and R.Z. Smith, "A Historical and Descriptive Account of Pacific Coast Anadromous Salmonid Rearing Facilities and a Summary of Their Releases by Region, 1960-76," *NOAA Technical Report* 736 (Washington, D.C.: U.S. Government Printing Office, September 1979).

[8] Thomas Quinn, *The Behavior and Ecology of Pacific Salmon and Trout* (Seattle: University of Washington Press, 2005), ix.

[9] Thomas Quinn, *The Behavior and Ecology of Pacific Salmon and Trout* (Seattle: University of Washington Press, 2005), ix.

Fish culture terminology has remained relatively consistent since its emergence. To provide a brief introduction to the lifecycle and associated terms, fisheries biologist Dr. Thomas Quinn gives and an abstract on the main points:

> The term *egg* refers to the unfertilized ovum, produced by the female. Once fertilized by a sperm cell (mixed with fluids from the male, collectively called *milt*), the egg becomes an embryo, the cell divisions begin, and development proceeds. The embryo is immediately buried by the female in ta gravel nest, termed a red, in a stream or lake beach. The red is composed of several pockets of eggs, deposited and buried by the female in a sequence of spawning events. The embryo develops within the egg membrane for several months and, at an appropriate stage of development, it hatches. The hatchling is termed an *alevin*, with a large, external yolk sac for nourishment. As the alevin grows, the yolk is metabolized until it is fully or largely gone and the young salmon can feed on its own. It then wriggles up through the gravel and emerges into the stream or lake as a fry. Depending on the species, the fry might migrate directly to sea (chum, pink, and some sockeye and chinook), migrate to a lake (sockeye), or remain in the stream (most salmonid species) . . . After some period in freshwater (days, months, or years, depending on species and population), the salmon migrate to sea. . . The fish in this transitional stage are termed *smolts*. Smolts can be found in freshwater readying themselves for migration, migrating in freshwater, and in the nearshore marine environment. . . However, the term is not used to describe salmon that have been feeding for long at sea; salmon at sea are generally just termed immature. . . At some point the salmon at sea begin a complex set of physiological processes that will lead them to migrate back to freshwater, spawn, and die. . . In the case of the "traditional" species of salmon (coho, chinook, chum, pink, and sockeye), all individuals die after spawning. However, in rainbow and cutthroat trout, some individuals survive after spawning and are known as *kelts* during their downstream migration.

One exception that requires some clarification to avoid misunderstanding is terminology describing lifecycle stages.[10] Specifically, the term causing the most confusion concerns the youngest stages of fish development—"fry." According to Alaska fish hatchery

[10] Patricia Roppel, *Alaska's Salmon Hatcheries, 1891-1959* (Portland, OR: National Marine Fisheries Service, 1982), 1.

historian Patricia Roppel, between 1891-1936, “the word FRY referred to what is today’s sac-fry. It is the fish up to the time the yolk sac is absorbed and the fish reach the stage when they swim up or become free swimming and feeding begins.”[11] Borrowing from Roppel, the following terms help provide consistency:

> SAC-FRY: the larval stage of salmon
> FRY: a fish from the end of the sac-fry period until one-year-old
> FINGERLINGS: fish between one inch and the yearling (or one-year-old) stage[12]

Lastly, some mention of terms associated with literature, particularly in regards to fishing must also be explained:

> The salmon run is the total number of adults surviving the natural mortality agents and heading back to freshwater to spawn. Some are caught (the catch) and others that evade the fishing gear and span are called the escapement. Depending on the dynamics of the population and the management regime, the ratio of catch to escapement can vary greatly. Fishery is a term referring to a type of gear operating on one or several species in a particular area. For example, one might speak of the gillnet fisher for sockeye salmon in Bristol Bay, Alaska, and the troll fishery for Coho and chinook salmon off the Oregon coast.

The process of migrating to the sea, maturing, and returning to freshwater to spawn is known as anadromy. The nutrient waters of the North Pacific Ocean allow the salmon to grow rapidly, especially compared to nonanadromous salmonids.[13] Bemusingly, salmon

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[11] Patricia Roppel, *Alaska’s Salmon Hatcheries: 1891-1959* (Portland, OR: National Marine Fisheries Service, 1982), 1.

[12] Patricia Roppel, *Alaska’s Salmon Hatcheries: 1891-1959* (Portland, OR: National Marine Fisheries Service, 1982), 1.

[13] Thomas Quinn, *The Behavior and Ecology of Pacific Salmon and Trout* (Seattle: University of Washington Press, 2005), 5.

display an ability to return to the same site where they spawned, a trait known as homing. Salmon anadromy significantly impacts riparian areas of the upstream watersheds. After completing the spawning process, remaining salmon carcass provide rich fertilizer to the adjacent shorelines. The life-history pattern of death following reproduction in Pacific salmon species is termed semelparity. Observing, understanding, and replicating the necessary conditions and process in an efficient manner, though relatively straightforward, required decades of trial-and-error refinement.

Replicating the life-history pattern includes an understanding of the species' natural environment. Germane to this survey is the environmental conditions specific to Oregon's salmon, however it is worth pointing out that salmon are not unique to the Pacific Northwest. Within the North Pacific Ocean, salmon's native range occurs "from northern Mexico to the Arctic Ocean on one side of the Pacific, and from Taiwan, southern Japan, and Korea to the Arctic Ocean on the other side, though salmon are present only as scattered populations in the Artic."[14] Within Oregon, salmon spawn and rear in a variety of stream types, from mountain rapids, coastal streams, and large rivers.

[14] Thomas Quinn, *The Behavior and Ecology of Pacific Salmon and Trout* (Seattle: University of Washington Press, 2005), 10.

Aquaculture History

The majority of fish culture development occurred simultaneously with the Industrial Revolution. However, the earliest accounts of fish culture date to the fifth century B.C. in China and potentially as early as 4,000 B.C. Egypt. Early Europeans also practiced early forms of aquaculture which developed during the Middle Ages and spawned many of the early practices followed in United States.[15] Much of the early fish culture on either side of the Atlantic during the early-19th Century concerned fish culture for the sake of scientific study and closely tied to public displays of fish in aquariums and gardens.

Fish Culture in the Ancient World

The earliest documented husbandry of aquatic organisms traces back to ancient carp farming in the fifth century B.C. in China and potentially as early as 4,000 B.C. Egypt. Romans constructed most likely the first concrete ponds. In Europe, earthen ponds were used to contain carp primarily for symbolic purposes. The practices were carried and refined throughout Europe and the Mediterranean, expanding to new fish and shellfish species. France became a particular epicenter of fish culture during the 19th century.

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[15] Robert Stickney, "History and Purpose of Fish Culture," in *Fish Hatchery Management*, 2nd ed. Gary Wedemeyer, editor (Bethesda: American Fisheries Society, 2011), 1-30.

European Study

According to a manuscript dated 1420, "Dom Pinchon, a monk in the abbey of Reome, France, conceived the idea of mixing the reproductive elements of the male and female trout… in a vessel of water." However, Dom Pinchon's work went unnoticed save for a brief reappearance in 1854. During the period, work in fish culture remained on hold until 1741 when "Father of Fish Culture", Sephan Ludwig Jacobi rediscovered the field.

Victor Coste, a physician by training, rose to prominence in 1853 through his research and publication of *Instructions praticques sur la pisciculture*. The following year, much of Coste's work was translated and published in *A Complete Treatise of Artificial Fish Breeding* – a compendium of all the major writings of French fish culture.[16] The advancements included within quickly made the passage across the Atlantic and spread through the United States. Much of the early fish culture on either side of the Atlantic during the early-19th Century concerned fish culture for the sake of scientific study and closely tied to public displays of fish in aquariums and gardens.

America's Conservation movement and Early Fish Culture, 1850-1911

Scientific inquiry into aquaculture in the U.S. began in the early nineteenth century—its popularity bolstered by the escalating 'conservation movement'. By 1853,

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[16] Darin Kinsey, "'Seeding the Water as the Earth': The Epicenter and Peripheries of a Wester Aquaculture Revolution,'" *Environmental History* 11 (July 2006): 527-566.

Theodatus Garlick was fertilizing eggs of brook trout, publishing the preliminary manual on propagation in 1857, and thus setting off the development a fish culture in the America. His and others' achievements moved fish culturists to begin exploring the possibility of using artificial propagation to supplement native fisheries, much to the delight of the growing body of recreational anglers.

Amongst anglers and field sports enthusiasts, recognition of declining fish populations, paralleling observations regarding game mammals and bird populations, ultimately influenced a broader trend of natural resource management. In considering how sportsmen cultivated an ethic of conservation and environmentalism, of John Reiger argues, "those who hunted and fished for pleasure rather than commerce or necessity, were the real vanguard of conservation… sportsmen had initiated an environmental movement composed of thousands across the country."[17] Traces of a new 'Conservation Ethic' appear as early as the beginning of the 19th century.

The sportsmen adopted codes of conduct regarding hunting and angling, often adopted from similar guidelines developing in Europe. Regarding the European-connection, Reiger finds that, "both in books and magazine articles, early sportsmen continually pushed for the adoption of an Old World-derived code of conduct in the field. They emphasized that sportsmen should be 'gentlemen,' suggesting that they were members of the upper classes who should have nothing in common with the lower-class

[17] John F. Reiger, *American Sportsmen and the Origins of Conservation, 3rd, Revised and Expanded, Ed.* (Corvallis: Oregon State University Press, 2001) pp. 3.

"market" (commercial), or "pot" (meat), hunter and fisherman." Commercial harvesting of fish and game utilized the most efficient means available and as such were viewed as unethical and wasteful while the sportsmen exercised their own form of "self-restraint." The rules governing bag limits, tools, methods, and seasonal restrictions eventually formed the basis of many of the first fish and game laws in addition to efforts to artificially propagate game species. By extension, the fish-culture movement serves as the "very first environmental crusade to capture the imagination of a significant segment of the American public."[18]

The early "sportsmen-conservationist," was keenly aware of impacts of commercial harvesting. In response, increasingly popular sporting clubs would pool resources to influence protection and initiate early stocking programs strictly limited to sport angling. New England-based, "sportsmen-sponsored" efforts to stock fish ponds and rivers established a fish-culture movement. Reiger points out that "though earlier sportsmen-sponsored efforts to establish state-run fish-culture programs in Connecticut and Massachusetts had failed, largely because of questions over funding and state authority, the fishermen of Vermont were determined to try again." Vermont proceeded by commissioning George Perkins Marsh, a sportsmen-conservationist, to study fish decline and the feasibility of a state-run fish-culture program.[19]

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[18] John F. Reiger, *American Sportsmen and the Origins of Conservation, 3rd, Revised and Expanded, Ed.* (Corvallis: Oregon State University Press, 2001) pp. 22

[19] John F. Reiger, *American Sportsmen and the Origins of Conservation, 3rd, Revised and Expanded, Ed.* (Corvallis: Oregon State University Press, 2001) pp. 22

In addition to the classism associated with field sports and angling, the setting aside of hunting grounds, and codes of conduct regarding the pursuit of wildlife, New England and Federal fish culture supporters adopted from Europe the idea of initiating public fish hatcheries. A facility in Hüningen (Huningue) Alsace, France is thought to be the first publicly owned fish hatchery.[20] In speculating as to the potential of the new hatchery or "piscifactory" under his supervision, M. Coste stated, "there is no branch of industry or husbandry which, with less chance of loss, offers an easier certainty of profit." Unfortunately, the potential rewards proved fruitless and public enthusiasm waned quickly.[21] One of the last, significant developments coming out of Europe was the dry method of fertilizing eggs as developed by V.P. Vrasski in 1856 and published in 1871. Waning public sentiment relegated mid-19th century fish culture work to private hatcheries. Although the next stage of fish culture development and its subsequent growth transferred to North America, the basis of modern methods can be traced to improvements of European fish culturists.[22]

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[20] Frederick F. Fish, "Founders of Fish Culture European Origins," *The Progressive Fish Culturist* I-131, No. 16 (Washington, D.C.: Bureau of Fisheries, U.S. Department of Commerce, March 1936): 10.

[21] Frederick F. Fish, "Founders of Fish Culture European Origins," *The Progressive Fish Culturist* I-131, No. 16 (Washington, D.C.: Bureau of Fisheries, U.S. Department of Commerce, March 1936): 10.

[22] Frederick F. Fish, "Founders of Fish Culture European Origins," *The Progressive Fish Culturist* I-131, No. 16 (Washington, D.C.: Bureau of Fisheries, U.S. Department of Commerce, March 1936): 10.

In the midst of the Civil War, the first North American hatchery was constructed under the supervision of Seth Green at Mumford, New York.[23] Green, borrowing the methods discovered in Europe a century earlier, engaged in commercial fish culture—a burgeoning industry. After the war's end, New York State established its first State Fish commission, appointing Green as one of its commissioners. With his experience, Green was charged with establishing public propagation. His role changed in 1870, when he was appointed superintendent of the first state hatchery at Caledonia, New York. Green also introduced non-native fish species into regional water bodies.

As the Civil War came to a close, an additional publication provides a direct bridge between sport angling and fish culture. In Thaddeus Norris', *The American Angler's Book: Embracing the Natural History of Sporting Fish, and the Art of Taking Them, With Instruction in Fly-Fishing, Fly-Making, and Rod-Making, and Directions for Fish-Breeding*, published in 1864, Norris writes that "all '*true-hearted* anglers'…, who have witnessed the ruthless and indiscriminate destruction of game fish, will take an interest in the plans proposed and the means now happily adopted for their increase."[24] In

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[23] C.G. Atkins, "On the salmon of eastern North America, and its artificial culture," U.S Commission Fish… 1872 and 1873, Part II, Append. B: 226-335 cited in Roy Wahle and R.Z. Smith, "A Historical and Descriptive Account of Pacific Coast Anadromous Salmonid Rearing Facilities and a Summary of Their Releases by Region, 1960-76," *NOAA Technical Report*, National Marine Fisheries Service 736 (Washington, D.C.: U.S. Government Printing Office, September 1979).

[24] John F. Reiger, *American Sportsmen and the Origins of Conservation, 3rd, Revised and Expanded, Ed.* (Corvallis: Oregon State University Press, 2001) 72, footnote 25, referencing Thaddeus Norris, *The American Angler's Book: Embracing the Natural History of Sporting Fish, and the Art of Taking Them: with instructions in fly-fishing, fly-making, and rod-making, and directions for fish-breeding: to which is appended, Dies piscatoriae, describing noted fishing-places and the pleasures of solitary fly-fishing* (Philadelphia: E.H. Butler, 1864) 459.

1864 New Hampshire legislature appointed the pioneer fish commission in the United States and two years later, in 1866, the commission sent Dr. W.W. Fletcher to New Brunswick to obtain salmon eggs for the purpose of propagation in New Hampshire waters. Most likely, Fletcher's was the first attempt at salmon breeding in the United States.[25]

Free from the ravages of the Civil War, groups concerned with fishery declines and environmental degradation were able to join forces and consequently cemented the "environmental movement." Concerns in reaction to perceived environmental ruin, occurring on greater scales as a result of massive industrialization, gave cause to those interested in protecting forests, streams and wildlife. During this period, new technologies and increased industrial protection were changing the political, economic, social, and geographic landscape of the nation emerging from the dark years of conflict. The increase in industrial production and technology intended to provide strategic advantage during the war resulted in new and escalated arms production. Improvements to transportation systems and the ability to render raw materials in expanding factories also heightened the scale of natural resource consumption.[26] Though the seeds may have been planted before the Civil War, the "radical environmental changes that accompanied

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[25] Patricia Roppel, *Alaska's Salmon Hatcheries*, 3.

[26] Miles Powell, Vanishing America, 2016, p36. For more on the Civil War's environmental impact, see: McPherson, *Battle Cry of Freedom*; Mark Fiege, "Gettysburg and the Organic Nature of the American Civil War," in *Natural Enemy, Natural Ally: Toward an Environmental History of Warfare*, ed. Richard Tucker and E. Russell; Dre G. Faust, *This Republic of Suffering: Death and the American Civil War*; Guelzo, *Fateful Lightning*

the Civil War" provided credence to sportsmen's concerns.[27] The common perception of wildlife as a boundless resource to harvest without restraint gradually gave way to growing concern that the forces of progress would forever destroy this significant component of America's heritage. Congress responded, especially regarding the pristine natural lands of the West, and in 1864 granted California the authority to set Yosemite Valley aside for "public use, resort, and recreation . . . for all time." Shortly thereafter, President Grant signed into law America's first national park at the Yellowstone Valley in Wyoming, Idaho, and Montana."[28] Lastly, a shifting attitude towards hunting and fishing also gained following. Originally viewed as an activity to acquire necessary food or for money, the pursuit of game and fish suited, increasingly, an air of gentlemanly prestige and represented direct reaction to rapid industrialization and commercial exploitation of wildlife.[29] A growing number of field sports enthusiasts spurred public contribution to providing a stock of fish and game to pursue.

Regarding angling and commercial fishing, hatcheries offered a new promise of inexhaustible fisheries. The use of fish culture to supplement and even replace stocks of

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[27] Miles Powell, *Vanishing America.*

[28] Miles Powell, *Vanishing America*

[29] John Reiger, American Sportsmen and the Origins of Conservation, 3rd Ed. (Corvallis: University of Oregon, 2001) 42-49. Reiger cities the substantial uptick in journals and books on touting the avails of field sports including *American Sportsman* (1871), *Forest and Stream* (1873), *Field and Stream* (1874), and *American Angler* (1881). *American Sportsman* editorials with titles like "Shooting—Its Pleasures and Benefits" and "The Passion of Sport," "explain how sport hunting and fishing inculcate appreciation of nature and knowledge of "the various habits of animals," improve physical health and mental alertness, and assure righteousness by removing one "from the noise and dirt and moral degradation incident to large towns" (Rieger, 49).

declining or extinct New England fisheries seemed a reality.[30] In his 1868 manual, *American Fish-Culture*, author Thaddeus Norris states that, "artificial propagation of migratory fishes which enter our rivers, is destined to be the principal means by which we are to restock our exhausted streams, and restore those that are rapidly declining, to their former fecundity; as well as in naturalizing valuable species in waters where they have hitherto not been known."[31] In addition to restoring fisheries, Norris' statement also brings to light the prevailing principle that through the identification of desirable species and subsequent taking, rearing, and planting, fish culturists could improve upon those species occurring naturally in a given watershed.

By the 1860's, approximately thirty private hatcheries, in addition to publically established fish commissions, worked to advance fish culture methods. In New England and the Middle Atlantic, nearly every state had a fish commission by 1871.[32] The realization that regional fisheries were not, in fact, a limitless resource provided the impetus for official, public support at the federal-level, including the establishment of public hatcheries as well as federal oversight regarding fish culture:

> That fear of depletion was the main cause for the extensive adoption of fish culture is well shown by the origin and development of what is now the United States Bureau of Fisheries. On February 9, 1871 the House of Representatives adopted a "joint resolution for the protection and

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[30] Robert Stickney, "History and Purpose of Fish Culture," in *Fish Hatchery Management*, 2nd ed. Gary Wedemeyer, editor (Bethesda: American Fisheries Society, 2011), 1-30.

[31] Thaddeus Norris, *American Fish-Culture: Embracing all the Details of Artificial Breeding and Rearing of Trout: The Culture of Salmon, Shad and Other Fishes* (Philadelphia: Coates, 1868) vii.

[32] John Reiger, *American Sportsmen and the Origins of Conservation*, 3rd Ed. (Corvallis: University of Oregon, 2001) 73.

> preservation of the food fishes of the coast of the United States" on the basis that "most valuable food fishes" were "rapidly diminishing in numbers." The course proposed was for the "President to appoint a Commissioner of Fish and Fisheries" and Spencer F. Baird of the Smithsonian Institution was the first appointee. The newly appointed Commissioner instituted a thorough enquiry into the causes of the presumed decrease in abundance of the food fishes and an account of the results formed his first report. On February 7th, 1872, our Society, organized a little more than a year previously as the American Fish Culturists' Association, "suggested that measures be taken to induce the United States to take part in the great undertaking of introducing or multiplying shad, salmon and other valuable food fishes." This suggestion was so well received that articles on the propagation of food fishes formed the great bulk of the second report of the Commissioner. The work of attempting to remedy a presumed depletion of the fisheries by hatching the eggs and planting the young fish developed rapidly and perhaps reached is culmination point about the end of the century. *The Twenty-third Report of the United States Fish Commission*, published in 1898, contained a 340-page "Manual of Fish Culture," which dealt with a great variety of fishes and other aquatic animals." – Archibald G. Huntsman, "Fish Culture—Past and Future," Transactions of the American Fisheries Society, Sixty-Seventh Annual Meeting, 1937.

Promotion of artificial propagation in fisheries recovery paralleled early conservation efforts. Fish culturists often straddled the two worlds—scientific inquiry and public regulation—including Charles Atkins, Spencer Baird, and Livingston Stone.[33] Along with the culturists, "sportsmen-conservationists" also joined in support of protective measures for salmon and trout, often garnering public support through reporting and publishing editorials, journals and texts. The aforementioned Vermont lawyer and field sports enthusiast, George Perkins Marsh. In 1864, Marsh's *Man and*

[33] For more on the efforts of conservationists and fish culturists see D. Montgomery, *King of Fish: The Thousand-Year Run of Salmon*;

Nature, a "cornerstone of the American conservation movement," utilized the plight of Atlantic salmon to convey his alarm regarding man's impact on wildlife:

> Fish are more affected than quadrupeds by slight and even imperceptible differences in their breeding places and feeding grounds. Every river, every brook, every lake stamps a special character upon its salmon, . . . which is at once recognized by those who deal in or consume them. Almost all of the processes of agriculture, and of mechanical chemical industry, are fatally destructive to aquatic animals within reach of their influence.[34]

In order to restock New England's waters with salmon, one solution lied in the abundant supplies of salmon on the Pacific coast. In addition to the founding of the American Fish Culturists' Association (later the American Fisheries Society) in 1872, the U.S. Commission of Fish and Fisheries introduced fish culture into its programmatic mission, this occurring one year after its formation.[35] The U.S. Fish and Fisheries Commission sent Livingston Stone to California to set up a hatchery and egg taking station with the intention of preserving and transporting salmon eggs east. Within a year, Stone established the West's first federal hatchery on the McCloud River, a tributary of the Sacramento River.

> They gathered and mixed eggs from adult chinook salmon, and the fertilized eggs were then packed in sphagnum moss, cooled by ice, and shipped east via stagecoach and railroad. . . Demand was great for Stone's Pacific salmon eggs. Carefully packed crates of eggs were sent to restock rivers in England, continental Europe, and eastern Canada. Eggs were also

[34] David R. Montgomery, *King of Fish: The Thousand-Year Run of Salmon* (Boulder: Westview Press, 2003) 106-107 citing G. Marsh, *Man and Nature*, 1864, 121-22.

[35] For more on the creation of the U.S. Fish Commission, see the dissertation by Dean C. Allard*, Spencer Fullerton Baird and the U.S. Fish Commission* (New York: Arno Press, 1978).

> sent across the equator to try and establish runs in Australia and New Zealand were salmon were desired by English colonists.[36]

Ultimately, the Fish Commission's efforts to introduce salmon to New England failed. On the other hand, Stone did find success in aiding the recovery of salmon runs in the local Sacramento River, cementing the future use of hatcheries to maintain salmon fisheries in spite of a lack of habitat on conservation protection. The U. S. Fish Commission published its first manual of fish culture, based on its members' work in 1897 and quickly followed with a revised version in 1900. The significance of Baird and the Fish Commission in the context of conservation history rests with its early roots:

> In a period better known for political corruption, federal lethargy, and moral blindness, Baird was leading a major federal program in the conservation of natural resources that had most of the characteristics and goals, as well as the problems, of the movement that began in the 1890's. Certainly, federal fish culture in the period was far from being an unvarnished success. But Spencer Bairds's Fish Commission concentrated attention on America's waning natural resources, some progress was made in restoring them, and a basic program was started which could be further developed by Bairds's successors.[37]

The American fish-culture movement, beginning in the New England states, profoundly altered the social landscape in regards to the public's approach to conservation. Fish culture impacted resource management two ways: fishery losses provided evidence of industrialization and over-fishing while the technological advancements afforded by

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[36] David R. Montgomery, *King of Fish: The Thousand-Year Run of Salmon* (Boulder: Westview Press, 2003) 106-107 citing G. Marsh, *Man and Nature*, 1864, 156.

[37] Dean C. Allard, Jr., *Spencer Fullerton Baird and the U. S. Fish Commission* (New York: Arno Press, 1978) 295.

aquaculture promised an improved, limitless fishery which would allow growth to continue unrestricted.

Oregon Salmon Culture History

Although the broad history of fisheries management in Oregon is relatively well researched, the architectural particularities, siting determinants, and the connection between influencing forces and resulting hatchery landscape remain rather uncharted. The depth and wealth of literature clearly demonstrates that fish hatcheries have played a vital and pivotal role in attempts by state and federal agencies to supplement and eventually sustain Oregon's trout and salmon fisheries. The development of the hatchery production was accompanied by a number of advancements in technology and systematic changes. For example, advancements in fish transportation "from pack animals and wagons to trains, trucks, and now airplanes has paralleled the development of the steam engine and subsequently the internal combustion engine."[38] In order to evaluate the historical value, it is necessary to identify the significance of hatcheries within the historical context linked with technological development and changing approaches to resource management.

[38] Nick C. Parker, "Technological Innovations in Aquaculture," *Fisheries* 9, No. 4 (1984): 13-16.

Salmon Industry in Oregon

The salmon industry of the Pacific Northwest contributed significantly to the development of the region. Canned salmon helped feed westward expansion, especially after the introduction of reliable canning technology. Delving deeply into the history of the industry, Clark Spurlock's 1940 thesis finds that, before salmon canning industry was closely bound to the exploitation of the Oregon by the Hudson's Bay Company or by the American pioneers in the Willamette and Columbia River valleys.[39] The reason for the slow gain in popularity of Pacific salmon owes primarily to lack of means for preservation:

> The crude methods of preserving, such as salting, pickling, and smoking which were the resort of those early salmon packers made it difficult to place a satisfactory product on distant markets. . . The strangeness of the product or its bad reputation, and the clumsiness of the containers retarded the industry even through greater potential markets and more adequate transport were then present. . . The industry needed, as it proved, the new method which shortly arrived.[40]

The unassuming tin can transformed the salmon industry and the Pacific Northwest. With continued improvements in canning technology and successful marketing, mass-production intensified. Initial canning of salmon canning occurred along the Sacramento

[39] Clark Spurlock, "A History of Salmon Industry in the Pacific Northwest" (Master's thesis, University of Oregon, 1940) 187.

[40] Clark Spurlock, 184-86.

River in California by the firm of Hapgood, Hume and Company.[41] Over two decades, fueled by marketing and technological improvements, the industry flourished. Production marched north from the Sacramento River in California to the Columbia River, Puget Sound, and on to Alaska; "few industries have undergone such a rapid shift in the center of activity."[42] The industry's propensity for over-production, requiring significant labor and raw material inputs, depleted natural salmon runs and significantly influenced "regional population and labor structures."[43]

Columbia River salmon canners contributed significantly to the salmon industry. Processing techniques, marketing, and the organization and population of laborers determined by the river's canners spread to developing markets in Alaska and Canada. The salmon industry along the Columbia peaked in 1895, with 634,696 cases of salmon produced over twenty-four canneries. Astoria tended to serve as the center of the Columbia River region's salmon industry, with the first cannery built there in 1873.[44] Furthermore, the Columbia River salmon industry developed of most of the basic canning machinery and influenced the growth of the related industries:

> Most of the important inventions are attributable to Mathias Jensen, a Dane who fished on the river for many years. From a successful net-

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[41] Clark Spurlock, "A History of Salmon Industry in the Pacific Northwest" (Master's thesis, University of Oregon, 1940) 116. Difficulties in their first two season moved the company to seek out a new location, settling on a site at Eagle Cliff, Washington. For more on Hapgood, Hume and Company see R. D. Hume, Salmon of the Pacific Coast.

[42] Spurlock, 187.

[43] Spurlock, 187.

[44] Spurlock, 118.

> knitting contrivance he turned to the can filling machine in common use today and thence to the first efficient topping machine. Patents for the two latter were sold to the Alaska Packers Association and, no doubt, contribute considerably to the growth of that organization. Such contrivances, and especially the famous "Iron Chink" first used in 1903, removed the bottle necks from the industry and provided scope for mass production.[45]

At the heart of the Columbia salmon canning industry was faith in the natural patterns of migratory salmon returns. The overwhelming number of salmon appeared never-ending. Often, canners could not keep up with the supply of caught fish. Unfortunately, canneries would quickly become the victims of their own success.

Establishment of the Columbia River salmon canning industry assured serious injury to the river's anadromous river-life. Before the technological achievements of salmon canneries, fisheries were already witnessing declines in the annual salmon runs. Robert Hume, one namesake of the Hapgood, Hume and Company, "feared that the river was being fished out and accordingly he established the first cannery on a minor stream, the Rogue River, and made his first pack there in 1877." The establishment of canneries and the subsequent decline in returning salmon catches on the Columbia River and elsewhere in the Pacific Northwest is well documented. This era of fisheries mismanagement directly motivated the construction and examination of hatcheries as a

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[45] Clark Spurlock, "A History of Salmon Industry in the Pacific Northwest" (Master's thesis, University of Oregon, 1940) 123, citing W. H. Barker, "Reminiscences of the Salmon Industry", *Pacific Fisherman*, 1920 Yearbook, 67-69; "the "Iron Chink" beheads, splits, and cleans the salmon and may be adjusted to all species except chinook. The name is derived from the fact that each unit replaced approximately twelve to twenty Chinese laborers" (footnote by Spurlock).

means to offset the wholesale catching of these fish through the use of fish wheels, river-wide blockages, and other unsustainable means which supplied salmon to the canners.

U.S. Federal Involvement

In 1866, Stone commenced a survey of the Columbia to locate an appropriate site for the future hatchery. With little knowledge of the distinct species of salmon and little regard for settlements upstream, he decided on a site along the Clackamas River near its confluence with the Columbia River. The hatchery began operations in 1877 and after ten years It wasn't until ten years later that the State of Oregon took an active role in the development of salmon hatcheries through the establishment of its own hatcheries through the authorization of the of Board of Fish Commissioners in 1887.

Oregon's Columbia Basin

The expanding and deepening role of hatcheries spread west, first to California and then, in an advisory capacity, to Oregon in 1875. Although Atlantic salmon existed in limited numbers enough to supply New England propagation efforts, abundant west coast salmon, capable of tolerating warmer waters as compared to Atlantic species, offered a promising outlook for success in restocking East Coast rivers.[46] The U.S. Commission of Fish and Fisheries, under direction of the agency's first Commissioner,

[46] Dean C. Allard, Jr., *Spencer Fullerton Baird and the U. S. Fish Commission: A Study in the History of American Science* (New York: Arno Press, 1978) 138.

Spencer Fullerton Baird, sent and tasked fish culturist Livingston Stone with establishing a facility to harvest salmon eggs with the intend to ship those eggs east. Stone established the Commission's first station on the McCloud River in northern California with the Susquehanna River served as the first recipient. The Susquehanna stocking proved unsuccessful, as did later attempts to plant salmon in eastern waters, providing little evidence of success.[47] Back on the West Coast, however, enthusiasm endured for the federal salmon propagation. In addition to taking, spawning and shipping eggs to eastern fish culturists, Stone also explored spawning and releasing salmon fry back into the McCloud and greater Sacramento River system.[48] Stone's success also attracted the interest of Oregon salmon canners:

> In 1874, the salmon canners in this area, alarmed over the rapid decline of the resources on which their industry depended, petitioned Congress for stringent regulatory laws. The appeal was referred to Spencer Baird who submitted a report stressing the difficulties and expense of enforcing restrictive legislation. Certain steps in this direction were obviously necessary, Baird noted; but it would be far better to stress a positive program of artificial culture. Apparently it was with Baird's views in mind that, in the summer of 1975, the canners again petitioned Congress. This time they called for help in establishing both restrictions and a propagation

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[47] Dean C. Allard, Jr., *Spencer Fullerton Baird and the U. S. Fish Commission: A Study in the History of American Science* (New York: Arno Press, 1978) 143 citing U.S. Fish Commission, *Report of the U. S. Fish Commission, 1877*, 18-19; Baird's comments in *Proceedings of the American Fish Culturists' Association* (1876-77), 65; Rhode Island, Commissioners of Internal Fisheries, *Report, 1877* (Providence, R. I.: Angell, Burlingame and Co., 1877) 3-7.

[48] Dean C. Allard, Jr., *Spencer Fullerton Baird and the U. S. Fish Commission: A Study in the History of American Science* (New York: Arno Press, 1978) 143 citing U.S. Fish Commission, *Report, 1877*, 19-20; Stone, *The Artificial Propagation of Salmon on the Pacific Coast*, 219-20.

> program. Once again the problem was forwarded to the Fish Commission.[49]

Spencer Baird opposed using any federal funds, “which he never failed to point out were too slim anyway… to construct a Columbia River hatchery that would benefit only a handful of cannery owners.”[50] Baird did, however, send Livingston Stone to the area in 1875 to inspect the Columbia and access the salmon fishery situation. Stone reported conditions supporting the canners’ concern regarding declining salmon returns. In response, Stone identified potential causes and suggested state-level regulations that should accompany any attempt at artificial propagation. Stone also located potential sites for a hatchery including “an excellent location for such an establishment on the Clackamas River, one of the Columbia’s tributaries.[51]

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[49] Dean C. Allard, Jr., *Spencer Fullerton Baird and the U. S. Fish Commission: A Study in the History of American Science* (New York: Arno Press, 1978) 144, citing U.S., Congress, Senate, Resolution of the Legislature of Oregon (43rd Cong., 2d sess., Senate, Misc. Doc. 33.) (Washington: Government Printing Office, 1875).

[50] Dean C. Allard, Jr., *Spencer Fullerton Baird and the U. S. Fish Commission: A Study in the History of American Science* (New York: Arno Press, 1978) 144.

[51] Dean C. Allard, Jr., *Spencer Fullerton Baird and the U. S. Fish Commission: A Study in the History of American Science* (New York: Arno Press, 1978) 144, citing Stone, The Salmon Fisheries of the Columbia River,” 801-23.

The hatchery was constructed by the Oregon and Washington Fish Propagating Company, under supervision by the federal government through the assistance of Livingston Stone, and backed by Columbia River salmon canners.[52]

> Baird's opposition to spending federal funds for a Columbia River hatchery, together with continued declines in the salon supply, finally led the cannery operators to take action on their own. In the spring of 1877, after forming a corporation with a capital of $30,000, they called on Baird to send Stone once again to their area, this time for the purpose of supervising the erection and initial operation of a private hatchery. This was the type of assistance that Baird was willing to provide. And by the end of the summer Stone was proud to report that the establishment had been built and already had 200,000 impregnated salmon eggs in its hatching troughs. At that point, however, Stone's pride and joy was completely demolished by a flood of unprecedented ferocity. The undaunted Stone, long used to coping with disasters large and small, immediately set to work in restoring the hatchery. By November everything was once again in order. Within a short time, over a million young salmon were expected to be ready for planting in the Columbia River system.[53]

The company operated the hatchery until funding dissipated in 1880. It wasn't until ten years later that the State of Oregon took an active role in the development of salmon hatcheries through the establishment of its own hatcheries through the authorization of the of Board of Fish Commissioners in 1887. The Commission rented out the Oregon and Washington Fish Propagating Company's facility until funding lapsed the next year. A

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[52] Roy Wahle and R.Z. Smith, "A Historical and Descriptive Account of Pacific Coast Anadromous Salmonid Rearing Facilities and a Summary of Their Releases by Region, 1960-76," *NOAA Technical Report*, National Marine Fisheries Service 736 (Washington, D.C.: U.S. Government Printing Office, September 1979).

[53] Dean C. Allard, Jr., *Spencer Fullerton Baird and the U. S. Fish Commission: A Study in the History of American Science* (New York: Arno Press, 1978) 144, citing Stone, "Report of Operations at the Salmon-Hatching Station on the Clackamas River, Oregon, in 1877," in *USFC RPT, 1877*: 783-89.

year later, in 1889, operation of the hatchery transferred to the U.S. Commission of Fish and Fisheries under the condition that eggs and fry remain in Oregon.

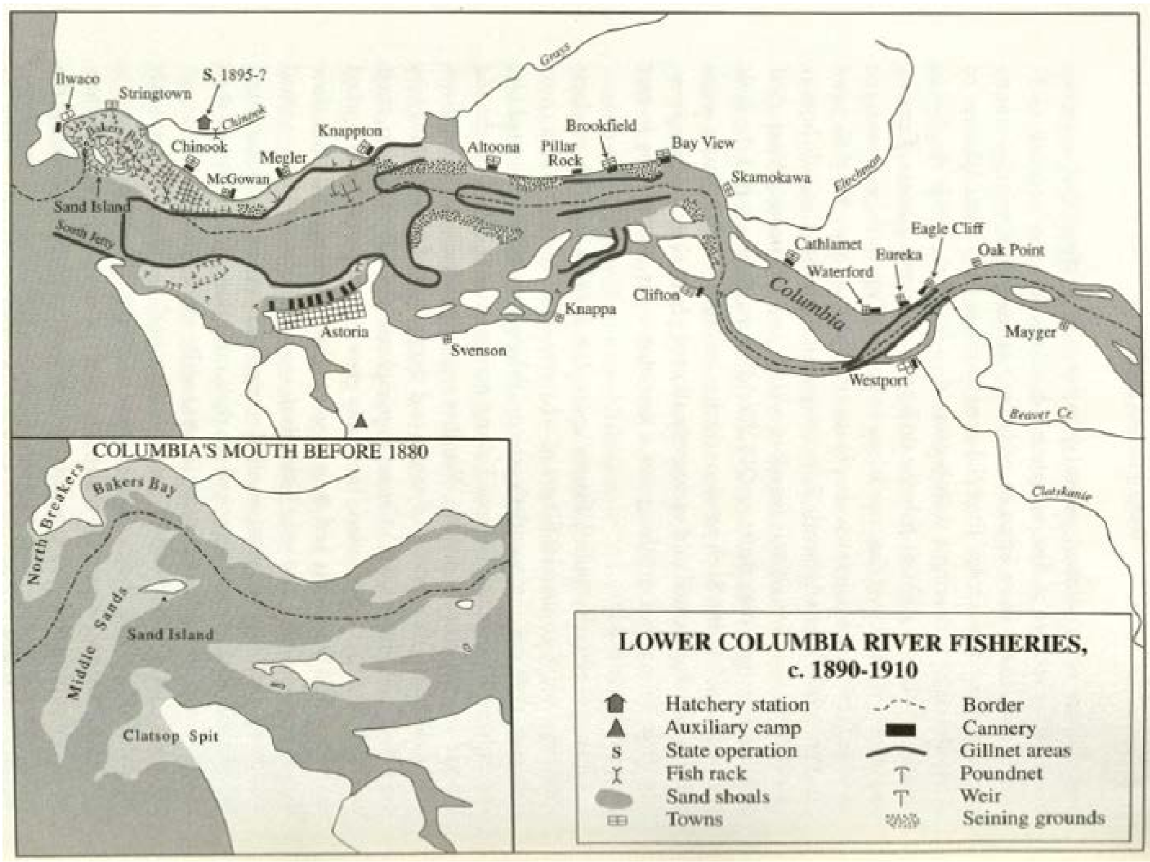

Figure 2.1. Location of hatcheries in relation to Oregon's salmon industry activity. Courtesy of Joseph Taylor, *Making Salmon: An Environmental History of the Northwest Fisheries Crisis* (Seattle: University of Washington Press, 1999), 143.

Over a decade later, in 1897, propagation of steelhead trout commenced through the federal government. Temporary egg taking stations established on the Salmon River in Clackamas County as well as at Willamette Fall by Oregon City provided early success. At the same time, state-level experimentations with steelhead trout occurred on the upper Columbia River and nearby tributaries (specific citation and more needed).[54]

One of Oregon's most prominent facilities, Bonneville Hatchery, was constructed by the State in 1909 with the intention of servicing at the central hatching station, receiving eggs from other taking stations and hatcheries in the watershed. The hatchery's 60 million-egg capacity represented, at the time, the largest on the Pacific Coast.[55]

In 1911, the State's interest in natural resource management expanded by forming a combined State Board of Game and Fish Commissioners. In addition to game birds and animals, this new board also introduced the idea of trout hatcheries which, up until this point, had been pushed aside in favor of efforts solely focused on salmon.

Oregon legislature divided the Fish and Game Commission into two agencies with separate responsibilities for fish propagation. Under the new division, the Fish Commission administered salmon production while the Game Commission took over

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[54] Roy Wahle and R.Z. Smith, "A Historical and Descriptive Account of Pacific Coast Anadromous Salmonid Rearing Facilities and a Summary of Their Releases by Region, 1960-76," *NOAA Technical Report,* National Marine Fisheries Service 736 (Washington, D.C.: U.S. Government Printing Office, September 1979).

[55] Roy Wahle and R.Z. Smith, "A Historical and Descriptive Account of Pacific Coast Anadromous Salmonid Rearing Facilities and a Summary of Their Releases by Region, 1960-76," *NOAA Technical Report,* National Marine Fisheries Service 736 (Washington, D.C.: U.S. Government Printing Office, September 1979).

steelhead and sea-run cutthroat trout production. Existing hatcheries realigned under either commission based on its production emphasis.[56]

By 1929, there were 10 State hatcheries and 1 Federal hatchery in operation. According to a National Marine Fisheries report, “the total accumulated production through 1929 was almost 650 million fish with most coming from State facilities. Emphasis was placed on fall chinook and coho salmon with accounted for 56% and 31% of these released, respectively” (Wahle, 1979).

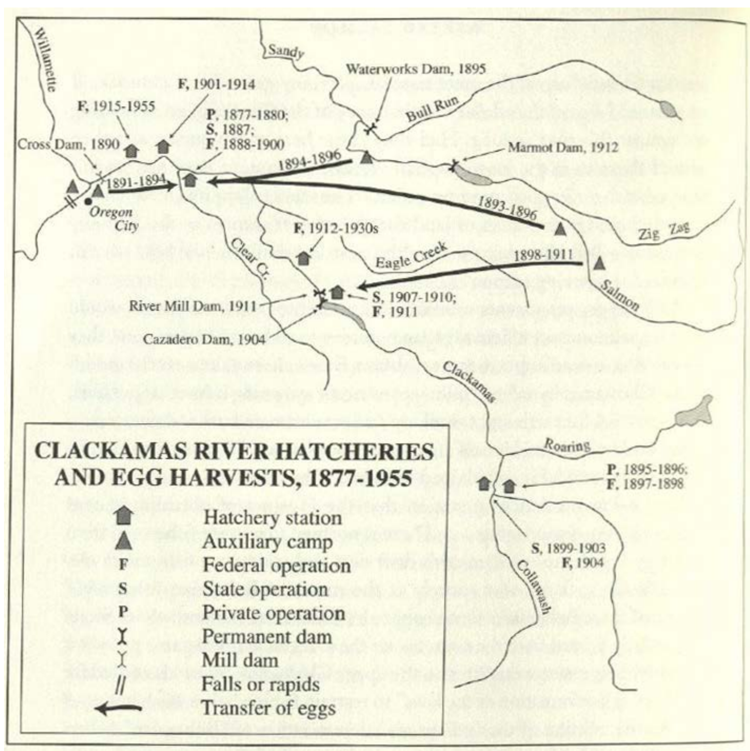

Figure 2.2. "The Clackamas River hatchery began as a private venture, but fiscal and political problems shifted control to state and then federal agencies. Fish culturists began to exploit other streams following the installation of Cross Dam in 1890. Dams and biological transfers increasingly concentrated reproduction in the lower Clackamas and Sandy Rivers." Taylor 1999, 143.

[56] Roy Wahle and R.Z. Smith, “A Historical and Descriptive Account of Pacific Coast Anadromous Salmonid Rearing Facilities and a Summary of Their Releases by Region, 1960-76,” *NOAA Technical Report,* National Marine Fisheries Service 736 (Washington, D.C.: U.S. Government Printing Office, September 1979).

Oregon Coast

The first hatchery along the Oregon Coast was constructed by R. D. Hume in 1877 on the Rogue River. Hume, whose commercial efforts included the entire production cycle from rearing to canning, was able to gain public support for his private endeavors. Oregon Legislature supported Hume's hatchery through public appropriations to use for enlargement, operation and maintenance.[57]

Hume's vertically integrated system included early attempts at hatchery development in addition to harvesting and canning operations. Hume experimented with egg collection at various sites along the Rouge River in addition to various hatchery methods and rearing locations. Eventually Hume partnered with the State and the sites of his early exploits served as State-run hatcheries in later years.

Historians credit Hume with originating the concept of adult holding ponds. Adult holding ponds allowed Hume to hold returning adults until they "ripened"—reaching sexual maturity—and egg or milk taking could occur.[58] Adult holding areas have gained prominence in contemporary hatcheries.

Another example of Hume's unconventionality: while most hatchery operators were eager to release fry shortly after absorbing their yolk sac, Hume practiced rearing fish for longer periods and releasing more mature fingerlings.

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[57] Roy Wahle and R.Z. Smith, 1979.

[58] Roy Wahle and R.Z. Smith, 1979.

Outside of Hume's hatcheries, the State directed construction of hatcheries and egg taking stations on most of Oregon's coastal rivers. In addition to the challenges of early fish culture methods, these coastal hatcheries continually struggled against commercial anglers whose nets cutoff returning salmon from the upstream hatchery locations.

State Involvement, 1911-1929

In 1911, the State's interest in natural resource management expanded by forming a combined State Board of Game and Fish Commissioners. In addition to game birds and animals, this new board also introduced the idea of trout hatcheries that, up until this point, had been pushed aside in favor of efforts solely focused on salmon. This move represented the increasing pressure by sport anglers on the State.

Replicating early prerogatives of federal agencies like the Bureau of Biological survey and the National Park Service or game commissions of other states, "the Oregon Fish and Game Commission's objective was not to protect natural ecosystems or to encourage 'wildness' but rather to sustain and grow some species at the expense of others".[59] Game wardens proceeded with efforts to wipe out undesirable fish species and predators while also stocking previously uninhabited waterbodies. Anticipating tourism

[59] Lawrence M. Lipin, Workers and the Wild: Conservation, Consumerism, and Labor in Oregon, 1910-30 (Urbana and Chicago: University of Illinois Press, 2007) 56.

into the backcountry, particularly by elite sportsmen, stocking included remote mountain lakes:

> In the summers of 1913 and 1914, wardens stocked the previously fishless mountain lakes around the volcanic peaks known as the Three Sisters with trout. This was no small endeavor, for without roads the wardens had to take the trails established by the U.S. Forest Service, and the published account of one such trip led by Finley makes clear just how remote some of these lakes were. The first shipment of ten thousand eastern brook trout from the main hatchery at Bonneville arrived by railcar at Detroit, nestled below Mount Jefferson. From there, the trout were packed into large milk cans and were carried by horseback. The jostling caused by the gait of the horses aerated the cans; on the trail breaks were limited to about an hour to keep the fish healthy, and in camp the cans needed to be periodically stirred. Moreover, to keep the fish at a comfortable temperature of fifty-six degrees, new supplies of fresh water were regularly put into the cans.[60]

The ability of rod and gun clubs as well as organized commercial fishermen to pressure state-level authorities to better meet their individual and often conflicting expectations included the example of the Clackamas County Fishermen's Union and the Multnomah Angler's Club. In representing the sportsmen of the Angler's Club, state senator and club officer John Gill prevailed in 1917 in persuading state legislature in closing the Willamette River near the Willamette Falls to commercial fishing.[61]

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[60] Lipin, 56.

[61] Lawrence M. Lipin, *Workers and the Wild: Conservation, Consumerism, and Labor in Oregon, 1910-30* (Urbana and Chicago: University of Illinois Press, 2007) 56; ultimately the bill was turned down two years later as a result of efforts by the Clackamas County Fishermen's Union.

War Era Mitigation, 1920-1949

As the Oregon Fish and Game Commission matured and propagation techniques improved the survivability of stocked fish, hatchery development entered a new era of growth. In 1920 alone, six new hatchery facilities were constructed. The automobile, technological leaps, and post-World War I economic growth pushed the hatcheries to the brink in order to meet demand. World War II also brought its own unique challenges and opportunities, creating lasting impacts on the built fabric within Oregon's hatchery system.

The Automobile and Outdoor Leisure: 1920-1930

Despite national prosperity, economic gain was limited in Oregon. That Oregon did not experience the level of economic growth that benefited other parts of the U.S. may be attributed to the fact that the state lacked sufficient transportation, particularly with regard to its road system.

> A spectacular exception was the just completed Columbia River Highway, which provided both inspiration and impetus to push modern road building forward on a statewide basis. After passing the nation's first gas tax to pay for roads in 1919, Oregon moved at full speed to construct a network of modern paved and concrete roads. The campaign to "Get Oregon Out of the Mud" began to pay dividends as highway projects such as the Pacific Highway and later the Oregon Coast Highway captured the imaginations of wandering Oregonians and Americans. Meanwhile, great efforts went into enhancing a network of farm to market roads linking agricultural communities with railroads and other shipping resources.[62]

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[62] "Oregon and the Roaring Twenties," Oregon Secretary of State, http://sos.oregon.gov/archives/exhibits/ww1/Pages/oregon-roaring-twenties.aspx

Initially, Oregon's immense size and challenging topography provided significant barriers to developing highways and rural road networks. An influx of new residents and resources in the 1920's provided the means to new rural connections and offered an alternative to rail transportation.

By 1920, the U.S. Forest Service had become increasingly aware of the growing demand to use the recently developed reserves for recreation. As automobile-driving hunters and anglers grew in numbers, they made it increasingly difficult for the hatchery managers and wardens of the Fish and Game Commissions to propagate and protect sufficient numbers to satisfy both sportsmen and commercial fishermen, and their official correspondence and publications reveal the impact that the mass-produced automobile had on their work. In 1920, while the growth in numbers was first becoming evident, the new state game warden, A. E. Burghduff, placed the motoring public as only on of a series of threats posed to game supplies*:*

> The inroads of the automobile, aided by a statewide road construction program, together with agricultural and industrial activities throughout the state, are proving so serious a menace to the wild life of the state that it is necessary to enact measures for its further protection and provide funds for additional propagation purposes, if we are to preserve a semblance of outdoor life for the benefit and enjoyment of coming generations. The entire flow of water from some of the most famous fish streams in the state is now diverted during the summer months for irrigation purposes.[63]

[63] Lawrence Lipin, *Workers and the Wild,* 106

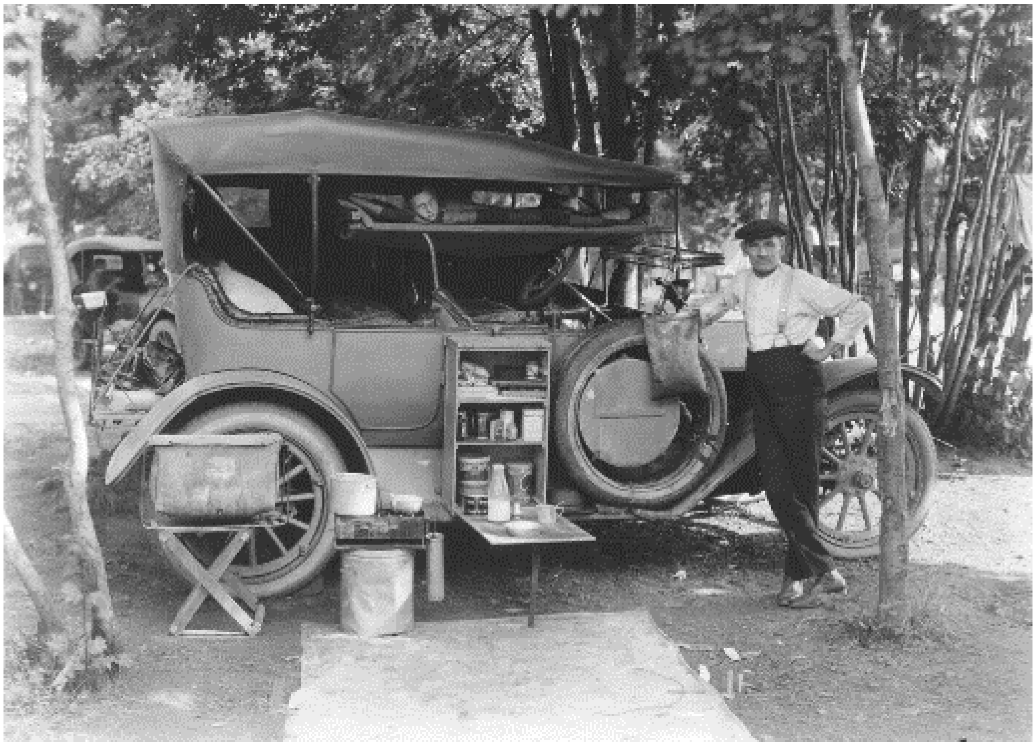

Figure 2.3: A child and man pose with an automobile equipped with camping equipment, c. 1925. Courtesy of Angelus Studio photographs, 1880s-1940s, University of Oregon, Special Collections and University Archives, Eugene, Oregon.

In 1921, when Oregon legislation separated the single commission into separate Fish and State Game Commissions. The 1920s proved difficult for the newly formed Game Commission. In their 1925 annual report, the Commission expressed concern about water supplies, increasing demand for more fish, more game, more patrol, and more game protection. The Commissioner attributed much of the increased demand to new feature of the American landscape—the automobile.

The automobile significantly altered the trajectory of field sports participation, opening geographic as well as socio-economic access to hunting grounds. In his work regarding the role of labor and class issues on the development of the Conservation

Movement in Oregon, Lawrence Lipin prudently addresses the profound impact of the newfound mobility:

> Wealthy Oregonians were the first to enjoy the transforming qualities of automobile ownership, and it provided them further incentive to try to use state agencies to fashion leisure rather than products from the natural world. Prominent men from both the metropolis and the rural hinterland urged the state to take greater responsibility for the supply of game and fish for the sportsman on the one hand and to engage in a program to build scenic highways on the other. In doing so, men such as wildlife advocate William Finley and timber tycoon Simon Benson, who advocated strongly for the building of the Columbia River Highway, joined others of their social class, who perceived the ennobling and spiritually redeeming qualities that a prolonged engagement with natural splendor might provide as well as the lucrative prospects that an expanded tourist economy might bring. In pushing for such a brake on the commercial exploitation of nature, they ran right up against the assumptions and objections of people who worked with their hands. As a result, the Fish and Game Commission and its crew of wardens engaged in the second and third decades of the century in a dangerous battle with rural people who thought that the state bureaucracy was too responsive to the needs of wealthy men from the Willamette Valley and too little concerned with the way that fish and game animals served as part of rural subsistence strategies.[64]

Workers took to the highways in search of leisure, and many became avid sport fishermen and hunters as the purpose or spirit of plebeian engagement in those activities was transformed from subsistence to recreation.[65] For Oregon's fish and game commissioners, the growing numbers of motorized anglers and hunters created an enforcement nightmare. Moreover, these new sportsmen increased the demand for game,

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[64] Lawrence Lipin, *Workers and the Wild.*

[65] Cindy Aron, *Working at Play: A History of Vacations in the United State*; Rothman, *Devil's Bargains* as cited in Lawrence Lipin, *Workers and the Wild*.

requiring greater efforts by state managers. Unfortunately, things would get worse before they got better, as they say, for the Commission's efforts in Oregon.

The combined Boards lasted a decade and in 1921, when the single body was split into separate commissions for Fish and Game. The Game Commission received five hatcheries for their trout propagation. Oakridge as added to the Game Commissions hatchery efforts the following year.

Scientific Discipline

As hatchery activity expanded in response to new pressures for their yield, culturists experimented with new programs and methods for increasing hatchery output. Coinciding with this expansion, "many scientific disciplines that underpin aquaculture began to mature."[66] Fish culturists became increasingly interested in regulating the environmental conditions of the ponds as hatcheries reared both trout and salmon for longer periods and to larger size before releasing the fry. Chemists and biologists conducted studies to understand and refine water quality control and disease prevention. During this period educational programs also gained in support and popularity. Oregon State established its Department of Fish, Game, and Fur Animal Management in 1935

[66] Robert R. Stickney, Aquaculture in the United States: A Historical Survey (New York: John Wiley & Sons, 1996), 121.

and at the same time legislation established the Oregon Cooperative Wildlife Research Unit.[67]

A significant leap forward in standardizing and communicating improved culture techniques arrived in the form of a new, professional journal. In 1934, “recognizing the need for placing before hatchery men in a simple understandable form recent advances in the art and science of aquaculture,” the US Bureau of Fisheries began publishing *The Progressive Fish Culturist*. The publication provided concise summaries and views regarding pressing issues facing fish culturists with special consideration for fish disease, feeding, record keeping, and best practices. Much of the need for developments stemmed from the practice of holding and rearing fish to more mature, larger life stages thus exposing trout and salmon to greater instances of affliction and fish loss.[68]

> When the fish culturist set about his difficult task of beating Nature by holding and feeding his fish, new and unexpected forms of trouble arose to plague him. Even today, with somewhat more extensive knowledge concerning the cause and control of fish diseases, they still furnish the greatest single problem for the fish culturist to face.”[69]

Overcoming disease required improved approaches to feeding the fish. For example, using raw meet as a feed source could easily lead to contamination in the rearing ponds.

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[67] “About Us,” Oregon State University, College of Agricultural Sciences, Department of Fisheries and Wildlife (oregonstate.edu/fisheries-and-wildlife, accessed Jan, 2018).

[68] Elmer Higgins, “Prospectus,” *The Progressive Fish Culturist* I-131, no. 1 (Washington, D. C.: Bureau of Fisheries, December 1935): 1.

[69] Frederic Fish, Ph. D., Associate Aquatic Biologist, US Bureau of Fisheries, “The Microscope in the Hatchery,” *The Progressive Fish Culturist* I-131, no. 3 (Washington, D. C.: Bureau of Fisheries, February 1935): 2.

The design of the rearing ponds themselves were also investigated as a vehicle by which disease could be prevented. Changing holding pond designs will be investigated later in this text.

Hydroelectric Dams Mitigation

Despite initial success in producing surviving trout and salmon, artificial propagation failed to allay the concerns of State officials and sportsmen. Among others, the reliability of hatcheries to produce large-scale returns remained unproved. In 1936, regarding losses on the Klamath, for example, investigations indicated that artificial propagation was insufficient and that greater restrictions on the fishing season provided the only improvement in seasonal runs of salmon and steelhead.[70]

In the mid-1930s, however, the Columbia River Basin, and the Pacific Northwest by extension, entered a new era of industrialization. In 1937, the Army Corps of Engineers completed construction of the Bonneville Dam and Congress created the Bonneville Power Administration to coordinate and supervise regional, wholesale electric distribution.[71] A New Deal project of the Roosevelt administration, the dam's completion

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[70] California Conservationist in "News Notes and News," *The Progressive Fish Culturist* I-131, no. 18 (Washington, D. C.: Bureau of Fisheries, May 1936): 14.

[71] Sarah T. Phillips, This Land, This Nation: Conservation, Rural America, and the New Deal (Cambridge: Cambridge University Press, 2007), 235.

represented a significant first step towards a new hydroelectric power policy for the Pacific Northwest—the Columbia Basin Project.[72]

The Columbia Basin Project intended to bring development and growth to an overwhelmingly rural area of the country. In many ways, Congress viewed the program as an opportunity to encourage a new region, lush with agrarian communities and dotted with industrial activity, a "Promised Land" in America's last frontier.[73] Despite the completion of the Bonneville and Grand Coulee Dams, World War II delayed the Columbia Basin Project until 1946. Ultimately, while the New Deal, Columbia Basin Project did bring industrial and economic growth to the region, it significantly altered the watershed and those species who relied on its free-flowing rivers.

The New Deal represented a new approach to growth, "a critical juncture in which intellectuals and policymakers attempted to embrace both progress and restraint."[74] New Dealers emphasized social and environmental justice, and they recognized the need to offset undoubtable losses to Columbia River fisheries—hatcheries provided a straightforward solution.

The mitigation for losses to native fisheries caused by hydropower, flood control, and irrigation benefits of dams increased hatchery supplementation. Hatcheries gained

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[72] Philip Funigiello, *Toward a National Power Policy: The New Deal and the Electric Industry, 1933-1941* (Pittsburgh: University of Pittsburg Press, 1973), 174.

[73] Sarah T. Phillips, *This Land, This Nation: Conservation, Rural America, and the New Deal* (Cambridge: Cambridge University Press, 2007), 235.

[74] Sarah T. Phillips, *This Land,* 235.

new significance.[75] Dam builders could employ hatcheries to offset any suggestion of harm to native fish runs. When, in 1937 Congress enacted the Bonneville Project Act, the Commissioner of Fisheries suggested the use of "adaptive management" approach, federal influence renewed the call for investment to fish-culture. Congress responded, enacting the Mitchell Act in 1938. The Mitchell Act authorized funding for salmon recuperation through hatcheries fish ladders, irrigation screens, habitat restoration, and scientific studies. However, with a limit of $500,000, action was limited to watershed surveys.[76]

Author and biologist Douglas Dompier, who spent twenty-six years (1979-2005) developing and overseeing hatchery programs and fisheries management for indigenous tribes within Washington State, points out a significant turning point in the role played by hatcheries up to 1938, "prior to passage of the Mitchell Act in 1938, previously constructed hatcheries offered a false sense of security to commercial fishers who harvested too many salmon after the late 1800s. [77]

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[75] Michael Blumm, *Sacrificing the Salmon: A Legal and Policy History of the Decline of Columba Basin Salmon* (Lake Mary: Vandeplas, 2002),111-112. Another excellent resource on the history of Columbia River development is Richard White's, The Organic Machine: The Remaking of the Columbia River (New York: Hill and Wang, 1995).

[76] Blumm, 112.

[77] Douglas Dompier, The Fight of the Salmon People: Blending Tribal Tradition with Modern Scince to Save Sacred Fish (2005), 41 with biographic highlights from David Gordon and Shepard Krech, Eds., *Indigenous Knowledge and the Environment in Africa and North America* (Athens: Ohio University Press, 2012) 189.

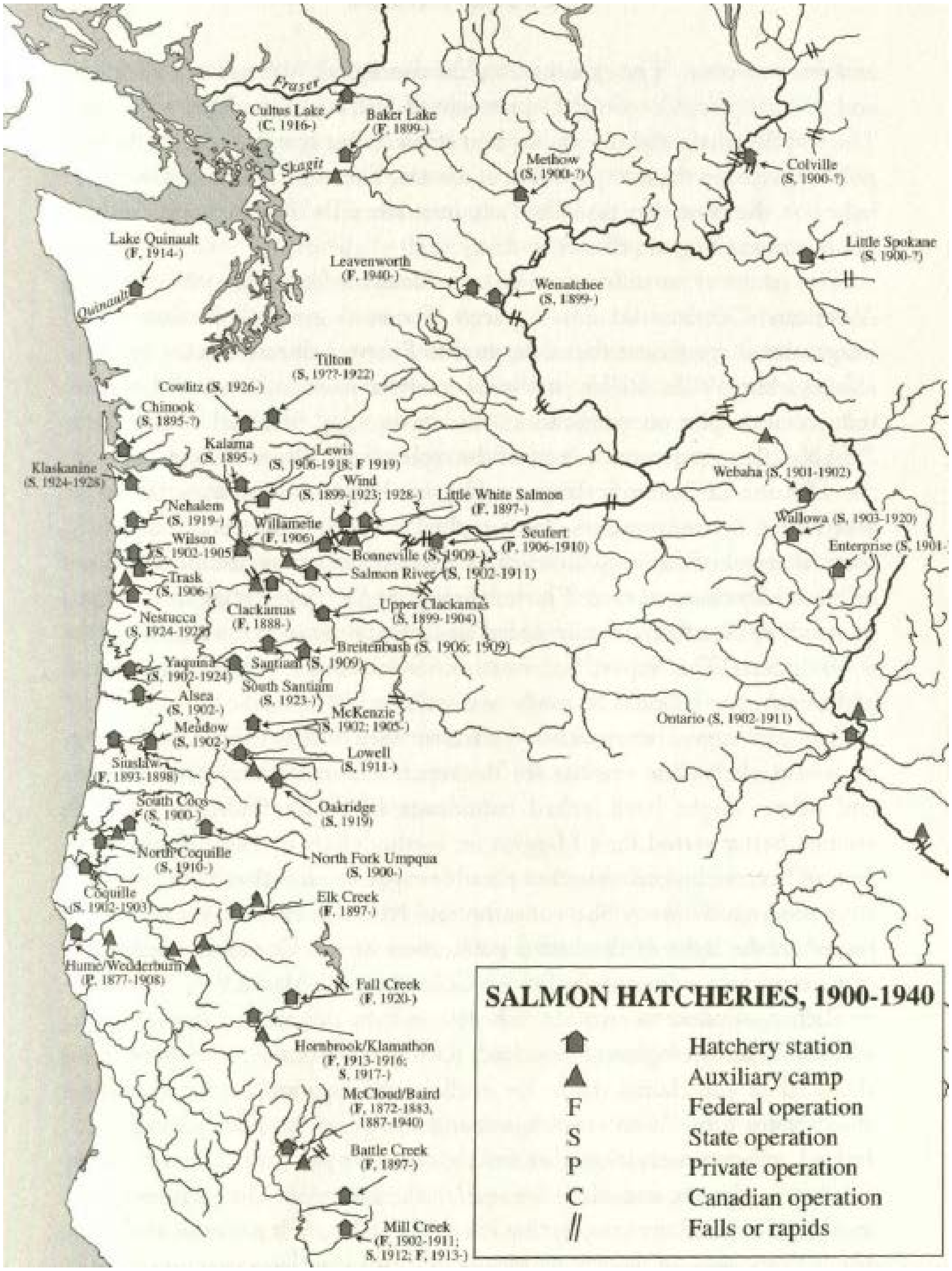

Figure 2.4. Map of early-20th century salmon hatcheries in Oregon and Washington. Courtesy of Joseph Taylor, *Making Salmon* (Seattle: University of Washington Press, 1999), 223.

Contemporary Development, 1949-2018

At the conclusion of World War II, the U.S. entered into period of postwar economic growth and prosperity. Congress followed up the construction of Bonneville and Grand Coulee dams with the Rivers and Harbors Act of 1945 authorizing new dams in the Columbia River Basin, particularly around the Lower Snake River. Dam construction transformed the Columbia River into a series of impoundments. The inundation of spawning habitat immediately restricted natural salmon production, particularly for fall chinook and summer steelhead while all species have been severely impacted by juvenile mortality and loss of returning adults due to the dams.[78]

The next year, in 1946, Congress amended the Mitchel Act of 1938. This action removed the $500,000 authorization cap and setting off bold plans for hatchery construction in order to mitigate losses from the newly authorized dam projects.[79]

In 1948, the U.S. Fish and Wildlife Service's Bureau of Commercial Fisheries, in cooperation with Idaho, Oregon, and Washington and the Bureau of Sport Fisheries and Wildlife, began the Columbia River Fishery Development Program to offset losses of salmon and steelhead trout resulting from Federal water development projects. Between 1948 and 1962, twenty-one hatcheries were either constructed or remodeled within the Columbia River Basin. By 1970, reviews of the program by Bureau of Commercial

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[78] Washington Department of Fishereis and ODFW, *Columbia River Subbasin: Salmon and Steelhead Production Plan* (Northwest Power Planning Council and Columbia Basin Fish and Wildlife Authority, September 1989) 11.

[79] Blumm, 113-115.

Fisheries found favorable recoveries of salmon and large improvements in catches.[80] In addition to citing larger yields from hatchery production, the report referenced the new Oregon moist pellet, developed by the Oregon Fish Commission and Oregon State University, which helped prevent diseases tied to unpasteurized food. The future outlook touted greater potential yields through new, larger hatcheries. The larger hatchery, research suggested, could exponentially lower the cost per pound of fish produced through controlled environments permitting year-round, full use of hatchery ponds.[81]

Earl Leitritz, author and California Department of Fish and Game staff, noted that since the early underpinnings of modern fish culture's development in 18th century Europe, advancement in methods and techniques developed slowly until just before World War II.[82] After World War II, applied science, it is safe to assume, quickly advanced fish hatchery operations. Such advances include the use of new chemicals in preventing disease, improvements in spawning, and introductions of "labor-saving devices such as fish loaders, self-graders, incubators," as well as progress in dry feed.[83] Regarding the evolution of fish culture after the second world war, the *Textbook of Fish Culture* (1970) calls out two compelling developments which apply to the changing form

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[80] Fred Cleaver, *Recent Advances in Artificial Culture of Salmon and Steelhead Trout of the Columbia River*, Fishery Leaflet 623 (Washington, D.C: U.S Fish and Wildlife Service, March 1969): 2-5.

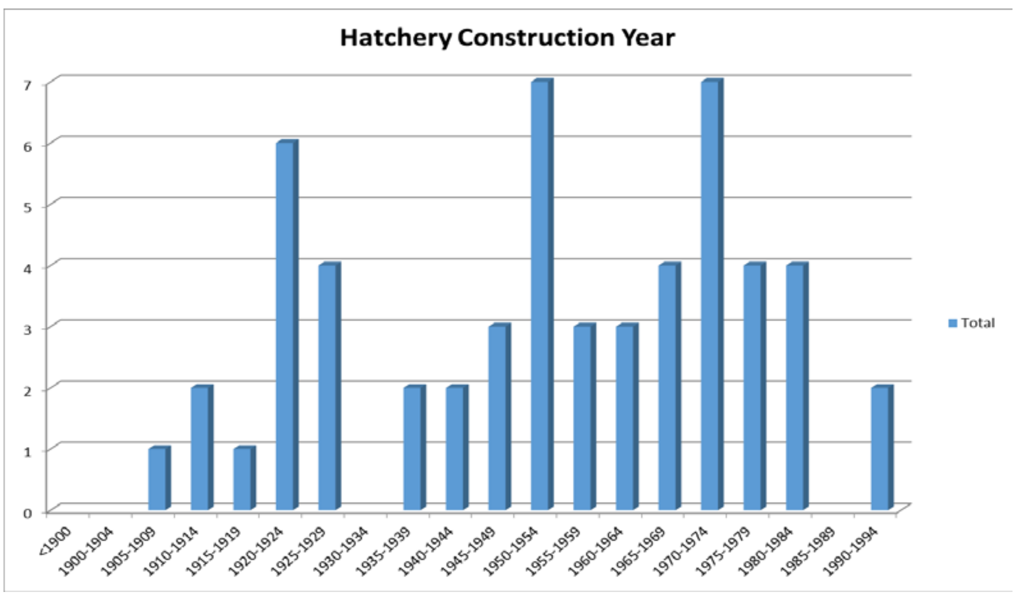
[81] Fred Cleaver, Recent Advances in Artificial Culture of Salmon and Steelhead Trout of the Columbia River, Fishery Leaflet 623 (Washington, D.C: U.S Fish and Wildlife Service, March 1969): 5 citing Burrows and Combs (1968).

[82] Earl Leitritz, *Trout and Salmon Culture (Hatchery Methods)*, Fish Bulletin No. 107, State of California Dept. of Fish and Game, 1959, 7.

[83] Earl Leitritz, 7.

Oregon's salmon and trout culture: modern forms of transportation for fish and developments in the use of artificial food based on concentrates.[84] The ability to more easily transport fish in various life stages—from fertilized egg to full grown—resulted in expanded stocking as well as inter-hatchery systemization. Pelleted food eliminated the need for cold storage and onsite food processing while also allowing for greater control of fish health and growth. Overall, changes after 1950 resulted in even more standardization and consolidation within Oregon's hatchery system.

Table 2.1. Total number of hatcheries constructed by 5-year increments.



[84] Marcel Huet, *Textbook of Fish Culture: Breeding and Cultivation of Fish* (Surrey, England: Fishing News, Ltd., 1972), 3.

The Role of the Fish Hatchery

According to the American Fisheries Society, "fish culture consists of a group of methods intended to fulfill the life cycle requirements of the fish in order to produce the species, number and size desired." Of the requirements, water is of upmost importance.[85]

As mentioned previously, during the beginning of widespread fish culture in the U.S., the release, or "planting," of fry into public waters occurred just after the fry absorbed their yolk sack and started relying on food from their surroundings. Early culturists, such as Hume, began experimenting with holding and rearing fry to greater maturity. By the late 19th century, the practice of holding fry for extended periods gained international attention through the work of Charles Atkins. In his 1893 survey of American fish culture, Nordquist observed the experimental practice and concluded:

> I, for my part, believe that as fish-culture becomes more and more developed the fry will be kept in the ponds until it has reached the age of six months or even a year. It is with the greatest interest that I have followed Mr. Atkins's experiments in feeding salmon fry until it has attained the age of one year, which required a great deal of care and attention. The results attained by this clever experimenter in breeding large quantities of salmon fry in a limited space have been very successful.

Regarding Atkins' experiments, Nordquist is likely referencing the U.S. Fish Commission fish culture station at Craig Brook, "founded in 1889, on the same site

[85] J. T. Bowen, "A History of Fish Culture as Related to the Development of fishery Programs," in *A Century of Fisheries in North America*, Edited by Norman Benson (Washington, D.C.: American Fisheries Society, 1970) 74-76.

where, in 1871, the first attempt at the artificial spawning of salmon in the United States was made."

Hatchery Components

Broadly, fish culture activity and facility construction alludes to the "culture system design": open, semi-closed, and closed systems.[86] The three system designs correspond to the level of exposure of the cultured species to natural systems. Open culture systems function completely in "natural" settings, such as the open ocean. Closed systems, on the other hand, involve closely controlled environmental parameters as water is continuously recycled. With a view to those species of concern to Oregon state hatcheries, namely Pacific salmon and game trout, necessary conditions for reproducing and rearing approximate those of unspoiled regional watersheds—chiefly cool, clean, moving water.

Hatcheries consist of a number of built components. Similar to a traditional farmstead, 'growing fish' requires a variety of building types which support the hatchery process, housing for crew members, as well as access to a constant input of resources which mean proximity to transportation in addition to appropriate natural resources. Individual structures are difficult to separate from the larger complex as their relationships' are so intertwined.

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[86] Fredrick W. Wheaton, Aquacultural Engineering (New York: Wiley and Sons, 1977), 211.

Egg Taking

Egg collection generally occurred at remote locations which met the particular criteria favored by spawning salmon while also facilitating the workers' ability to catch the spawning fish. Usually areas near the confluence of two streams with pools and shallow riffles.

"The act of obtaining eggs from female fish and sperm from male fish is referred to a spawning, egg taking, or stripping."[87] Much of the early literature on hatcheries and related activities focuses on "egg taking." Collecting, fertilizing, and, when necessary, moving eggs required years of trial and error to develop. By 1950, the process of collection and, more importantly, artificial fertilization of nearly 100 percent had been attained.[88]

The construction of "spawn-taking" facilities developed more recently in regards to hatchery design with fish being "herded into the spawning enclosure without being taken from the water."[89] Regardless of whether the spawning house was constructed over enclosed ponds or not, the structure would include furnishings for sorting, stripping, and artificially fertilizing the eggs.

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[87] Earl Leitritz, *Trout and Salmon Culture: Hatchery Methods* (Fish Bulletin No. 107), State of California, Department of Fish and Game, June 1959, pp 24.

[88] Earl Leitritz, *Trout and Salmon Culture: Hatchery Methods* (Fish Bulletin No. 107), State of California, Department of Fish and Game, June 1959, pp 24.

[89] Earl Leitritz, *Trout and Salmon Culture: Hatchery Methods* (Fish Bulletin No. 107), State of California, Department of Fish and Game, June 1959, pp 24.

Hatchery Site Selection

According to the American Fisheries Society, “fish culture consists of a group of methods intended to fulfill the life cycle requirements of the fish in order to produce the species, number and size desired.” Of the requirements, water is of upmost importance, “it is indeed to a hatchery what coal is to a steam-engine, all hatching apparatus of whatever kind being merely mechanical devices for extracting and transferring from it the greatest amount of energy to the ova.”[90]

Figure 2.5. Hatchery site including a 'rack' for collecting salmon, the hatchery building with troughs, and a train bridge in the background. The only identifying information locates this scene in Wallowa County c. 1910. Courtesy Oregon Historical Society Research Library, OrHi 3499, Lot 790, Box 19, Folder 14.

[90] James G. Maitland, “The Culture of Salmonidae and the Acclimatization of Freshwater Fish,” *The Fisheries Exhibition Literature*, Vol 6, International Fisheries Exhibition, London, 1883 (London: William Clowes and Sons, 1884): 33-68; J. T. Bowen, “A History of Fish Culture as Related to the Development of Fishery Programs,” in *A Century of Fisheries in North America*, Edited by Norman Benson (Washington, D.C.: American Fisheries Society, 1970) 74-76.

Early hatcheries generally relied on streams for water while later designs, recognizing the susceptibility of streams to disease and other forms of contamination, located near natural springs and wells.[91] The 1959 California Department of Fish and Game summarizes desirable siting characteristics for considering in selecting and installing a satisfactory water supply:

> (1) moderate rainfall, (2) moderate gradient, (3) good cover, such as trees, grass, and brush, (4) adequate limestone and other mineral deposits, (5) uniform and moderate temperature, (6) freedom from grazing, logging, mining, and similar activities on the watershed above the hatchery supply, (7) a submerged intake, (8) a covered pipeline to minimize temperature changes, (9) a moderate gradient from intake to hatchery, (10) adequate aeration, and (11) enclosure and covering of the water supply to prevent surface contamination.[92]

In addition to water supply, proximity of raceways, generally long, rectangular ponds used to further grow fish before release, are believed to benefit young fish through "conditioning" through access to natural food and replication of stream-like settings, "bridging the gap between the hatchery and the stream."[93]

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[91] Earl Leitritz, *Trout and Salmon Culture: Hatchery Methods* (Fish Bulletin No. 107), State of California, Department of Fish and Game, June 1959, pp 11.

[92] Earl Leitritz, *Trout and Salmon Culture: Hatchery Methods* (Fish Bulletin No. 107), State of California, Department of Fish and Game, June 1959, pp 13.

[93] Walter Allen, "Question Department," *The Progressive Fish Culturist* I-131, no. 16 (Washington, D. C.: Bureau of Fisheries, March 1936) 16.

Hatchery Apparatus

One of the most important advancements in fish culture was the development of efficient and affective egg fertilization. Early hatchery efforts struggled with fertilizing and hatching fish eggs. Often, hatchery personnel would devise means to collect naturally fertilized eggs from river bottoms.[94] The earliest form of an egg hatching equipment which remains relatively unimproved was the egg tray, invented by Marcellus Holton in Rochester, New York. These egg trays required a constant flow of fresh water. Early hatcheries were also challenged with preventing bacteria and fungus growth which was exasperated within the wooden troughs which were difficult to keep clean.

The 1893 observations of Oscar Nordquist, Inspector of Fisheries of Finland, made during a four-month tour of American fish culture facilities, provides a unique perspective of methods and equipment, particularly in handling eggs:

> The manner of hatchery heavy eggs in America in wooden troughs on wire trays, in which the eggs are laid in the troughs, either in single rows, or arranged one above the other, where they are washed by the water in the trough horizontally (Atkins), or where the mater runs clown from above (Clark), or is forced up from below (Williamson), seems to give as good results as call be desired, and the more complicated troughs with their many partitions do not appear to do the work anymore satisfactorily. The simpler method, therefore, is much more in use. One apparatus, which I only saw at the U. S. Fish Commission's excellent exhibition, but never anywhere in use, is Livingston Stone's apparatus, which consists of a Williamson trough in which Mr. Stone, instead of a row of trays, had placed a basket made of wire cloth, and then laid the roe in in many layers one above the other. I have specially mentioned this apparatus because

[94] J. T. Bowen, "A History of Fish Culture as Related to the Development of fishery Programs," in *A Century of Fisheries in North America*, Edited by Norman Benson (Washington, D.C.: American Fisheries Society, 1970) 74-76.

> many modifications of it have been introduced and are largely used in Europe under the name of the Californian apparatus. [95]

Hatchery Building

Incubation, hatching, and preliminary rearing—the decisive affair of the entire operation—resides in the hatchery building, also referred to as the hatch house or incubation building. To accommodate the work of incubating and rearing small fingerlings, hatchery building design needed to provide large, open labor and storage spaces for work-related clothing and equipment. The tenement of young fish also requires significant space. Hatchery building design should generally display considerations such as large floor area, numerous and open fenestration, large double doors, and siting within the larger hatchery operation:

> The hatchery itself should be substantially built on sound foundations, brick and concrete being probably the best materials to use; ventilation, light, and protection from frost are the principal objects in construction; and above all things the drains must be sufficient and rat-proof. Keeping these points in view, the situation of the Hatchery should be governed by the water supply. The house also should be as large as possible, as very much better work can be done in a few central establishments than in many small ones.[96]

Seth Green, the pioneering fish culturist and superintendent of New York State's first public hatchery, oversaw the construction of an upgraded hatching house—the second on

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[95] Oscar Nordquist, "Some Notes About American Fish-Culture," U.S. Fish Commission, *Bulletin*, 13: 197-200.

[96] James G. Maitland, "The Culture of Salmonidae and the Acclimatization of Freshwater Fish," *The Fisheries Exhibition Literature*, Vol 6, International Fisheries Exhibition, London, 1883 (London: William Clowes and Sons, 1884): 33-68.

the site—in 1882. The gambrel-roofed buildings was “the pride of the Commissioners.”[97] Care in constructing the hatchery building, a theme repeated in Oregon hatchery sites, signifies the early prominence of the hatchery building over other hatchery resources.

The earliest hatchery buildings in Oregon did not share the permanence and dignity of New England buildings. Hatchery buildings were often open air structures with gable roof, built for seasonal use (Figure XX).

As hatching operations moved to include longer periods of rearing, year-round care for the young fish necessitated permanent structures. Hatchery buildings included areas for gear storage, a large room for troughs, and usually an area for record keeping, such as an office.

Figure 2.6. Unidentified salmon hatchery building and wood flume c. 1910. Courtesy Oregon Historical Society Research Library, OrHi 3499, Lot 790, Box 19, Folder 14.

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[97] Emile Moore, “Seth Green—A Historical Note on a Pioneer in Fish Culture,” *The Progressive Fish Culturist* I-131, no. 18 (Washington, D. C.: Bureau of Fisheries, May 1936) 11.

Water Intake Structures

Hatcheries rely on water intake structures to either divert water from adjacent waterways or to collect and direct spring water on or near grade. The intake structures consist of three main elements:

1) a diversion structure, to control the water level in the stream and to ensure it is sufficient to supply the intake but not to overcome the structure;
2) inlet control, inside the structure itself, to control water supply, usually connected to the water transport structure;
3) and entrance protection, such as coarse bars or screens to protect the intake from debris.[98]

Depending on the stream size and amount of water flow, the intake structure may include the construction of low head dam to both raise the elevation of the water as well as to divert the maximum water flow available. Citing of the main intake structure depends on topography, layout of water transport structures and rearing ponds, and stream channel formation.[99] Ability to locate in proximity to an appropriate water intake, but outside of frequently flooded areas and on relatively level site contributes to hatchery site selection.

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[98] Food and Agriculture Organization of the United State, *Simple Methods for Aquaculture—Pond Construction for Freshwater Fish Culture: Pond-farm structures and layouts* 20/2, by A.G Coche, (Rome, FAO, 1992) 4.

[99] Food and Agriculture Organization of the United State, *Simple Methods for Aquaculture—Pond Construction for Freshwater Fish Culture: Pond-farm structures and layouts* 20/2, by A.G Coche, (Rome, FAO, 1992) 5-9.

Water Transport Structures

Reliably transporting water from intake areas to the hatchery buildings, ponds, and off-site requires the use of water transport structures. Hatcheries exhibit a myriad of design and material trends over periods of development. The various combinations coalesce into four major groups: open canals, aqueducts, pipelines, and siphons.[100] Most commonly encountered, however, are open water canals and pipelines, both of which generally rely on gravity to move the water as opposed to pumps or siphons. Design of canals or pipelines considers carrying capacity, shape, gradient, and surface roughness. Furthermore, designs often incorporate a canal lining such as stone, brick, concrete, or even wood.

Ponds

After artificially fertilizing, incubating, and hatching salmon, the principle activity of the hatchery involves rearing young fish to appropriate maturity. "Growing" fish is most often practiced in ponds—the enclosure of water provides the critical environment for fish to mature and grow in size. Broadly speaking, ponds are simply small bodies of water. Throughout the history of aquaculture development, ponds have remained relatively unchanged and simple in their general design. As culturalists' comprehension concerning the specific needs and optimum growing conditions developed, so too did the

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[100] Food and Agriculture Organization of the United State, *Simple Methods for Aquaculture—Pond Construction for Freshwater Fish Culture: Pond-farm structures and layouts* 20/2, by A.G Coche, (Rome, FAO, 1992) 35-36.

variety of structures used to hold the cultured species. A general examination of culture containers reveals universal typology. Container classification includes embanked and excavated ponds; tanks and troughs (discussed above); raceways; and even nets. Ponds can be further classified according to their water supply: spring water ponds, ponds supplied with rain or runoff water, and ponds supplied by a water course.[101] Applying basic design and typology of containment structures provides clues when endeavoring to determine a hatchery's age, target species, and operational aim.

Recalling the inclination of salmon and trout hatchery design towards a semi-closed form, pond choice should regard highly the efficient movement of water through the system. By extension, pond designs which allow for constant water flow should overshadow large ponds with low rate of water cycling. Consequently, in providing leeway for developing fish, provincial hatcherymen employed slender ponds and raceways in providing leeway to developing fish.

Rearing ponds serve to take the place of small streams where, in their natural lifecycle, juvenile fish would have matured to the point where they could migrate downstream and eventually to the ocean. The physical and physiological environments provided by rearing ponds significantly affect survival rates and, as such, the success of fish culture operations.[102] Years of trial and error research in addition to the variable

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[101] Marcel Huet, *Textbook of Fish Culture: Breeding and Cultivation of Fish* (Surrey, England: Fishing News, Ltd., 1972), 6.

[102] Roger Burrows and H. Chenoweth, "The Rectangular Circulating Rearing Pond," *The Progressive Fish Culturist* 32, no. 2 (April, 1970): 67.

conditions of hatchery sites and specific needs of individual species resulted in an abundance of pond designs.

Figure 2.7. Wood-lined, earthen rearing ponds at Millcreek Hatchery, Salt Lake County, Utah c. 1890. Courtesy George M. Ottinger photograph collection, P0123, Special Collections and Archives, University of Utah, J. Willard Marriott Library, Salt Lake City, Utah.

Rearing ponds generally fall into two broad design categories—circular or raceways ponds. The design decision depends largely on environmental setting of the hatchery—largely water source variables. Species type and rearing strategies also influence pond design. Ultimately, ponds should provide space for fish to grow, the constant water flow allowing for the recycling of fresh water while flushing detritus, and ease in grading and capturing fish for transporting. By 1959, understanding of pond design led to the understanding that:

> In large, deep, still pools, fish rest most of the time and food conversion is normally better than in narrow, swift ponds, where a good portion of a fish's energy is used in maintaining its position in the pond. The ideal pond is one that can be operated rather deep and with little current most of the time, but can be readily converted to a shallow, swift pond when necessary. Deep, still pools have the disadvantage of not lending themselves to flush or prophylactic treatments, whereas long, shallow, raceway type ponds are ideal for the purpose.[103]

The first publication discussing circular ponds included examples of crude circular tanks constructed from hogshead barrels from the U.S. Fisheries Station at Craig Brook, Maine and a circular, central outlet type pond designed and built by L.E. Mayhall of Washington State.[104] Trials with aquatic vegetation, rim heights, and bottom linings resulted in partially-subterraneous pools with diameters averaging around 15 feet. The ponds were constructed by excavation to appropriate depth, installing piping, and pouring concrete into forms. Outlets could be placed at the center of the pond or along the side. The central-drain design, however, provided obvious advantage in its ability to maintain the circular action principal to the design.[105]

Circular ponds offer advantages such as less water and beneficial, evenly distributed water circulation. The circulation prevents buildup of waste in corners,

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[103] Earl Leitritz, *Trout and Salmon Culture: Hatchery Methods* (Fish Bulletin No. 107), State of California, Department of Fish and Game, June 1959: 68-69.

[104] Eugene W. Surber, "Circular Rearing Pools for Trout and Bass," *The Progressive Fish Culturist* I-131, no. 21 (Washington, D.C.: Bureau of Fisheries, August 1936): 1.

[105] Eugene W. Surber, "Circular Rearing Pools for Trout and Bass," *The Progressive Fish Culturist* I-131, no. 21 (Washington, D.C.: Bureau of Fisheries, August 1936): 2-13.

in effect providing a self-cleaning design. The disadvantages include the requirement of substantial water pressure, generally created through a significant drop in elevation between the pond and its source, known as “head”, in order to maintain the circular water motion. Furthermore, circular ponds present difficulties in flush treatments, mechanical fish-loading, and self-grading devices.[106] Culturists have found that circular ponds are particularly suited for newly hatched fry.

Raceways ponds are generally composed of multiple sections intended to house fish of particular maturation stages. Individual sections are arranged in either a series or line referred to as a tier. Early raceways often consisted of earthen channels or simply streams fitted with containment equipment such as screening and weirs. This preliminary design often features sloped sides and earth fill construction. Early earthen raceways relied on gravity flow of water. Earthen raceways gave way to more standardized, usually poured concrete units. Further illustrating the practice of earthen designs was the California Department of Fish and Game’s widely used, standard raceway continued to utilized earthen

[106] Grading of fish is the process by which fish are separated based on their size in order to reduce cannibalism and prevent competition between fish of smaller size. Fish-grading devices include the Murray-Hume Automatic Grader—a rack composed of parallel bars—and the Morton Adjustable Grader—consisting of a table with containing a number of round metal tubes placed in rack. For more on grading and grading devices, see Earl Leitritz, *Trout and Salmon Culture: Hatchery Methods* (Fish Bulletin No. 107), State of California, Department of Fish and Game, June 1959: 100-103.

construction with concrete cross dams, with proportions of "100 feet long, 4 feet deep, 10 feet wide at the bottom and 30 feet wide at the top, and sides slope."[107]

The rectangular design, utilized up to as late as the 1960's, allowed for flushing for cleaning while sloping sides offered improved management flexibility. The concrete dams between ponds provided more or less automatic size grading through the use of screens and grading racks. Lastly, the earth fill simulated natural stream conditions, providing passive cleaning process which reduced nontoxic, inorganic material through decomposition by cellular organisms in invertebrates.

Debate over the use of concrete versus dirt ponds focused on factors such as lower cost and more natural conditions offered by earth ponds against the greater ease of cleaning, improved circulation, and overall greater ability and ease to controlling for conditions made possible by concrete ponds.[108] In an attempt to hedge their bets, workers at the Twin Springs Trout Hatchery practiced transferring fingerlings between one concrete pond and one gravel pond every week or two. Despite no apparent difference in growth rates, the gravel ponds required significantly more care and time to clean between use.[109] To further complicate matters, turn-of-the-century rearing stations also used

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[107] Earl Leitritz, *Trout and Salmon Culture: Hatchery Methods* (Fish Bulletin No. 107), State of California, Department of Fish and Game, June 1959: 69-70.

[108] A. H. Dinsmore, "Concrete Ponds Versus Dirt Ponds: A Symposium of Opinion," *The Progressive Fish Culturist*, no 22 (Sept, 1936) 11-13

[109] W. A. Lewis, "Twin Springs Trout Hatchery, Eden Wis," in "Question Department," *The Progressive Fish Culturist* I-131, no. 16 (Washington, D. C.: Bureau of Fisheries, March 1936) 15.

gravel as a covering in the bottoms of raceways. A 1934 report raised doubt over the effectiveness of the "natural condition" offered by the gravel.[110] Concerns over disease, cleaning procedures, and toxic water conditions caused by the gravel-lined raceways supported unnatural, sterile, smooth-bottomed troughs and raceways.

The arrangement of raceways generally directs water to a settling pond used for pollution and detrital material abatement. Water enters raceways over a drop in order to help oxygenate the water.

Outbuildings

Fish hatchery stations will often include an assortment of various outbuildings. As with most outbuildings, each "purpose-built structure" is designed for a single task.[111] For example, single uses might include automobile repair, feed storage, spawning, or housing water-pumping apparatus.

As suggested by the history of outbuildings in colonial backyards, whereas technology and transportation ended their necessity, more recently constructed or renovated hatcheries should display hatchery-related activities consolidated within one central building set apart by walls or hallways.

Hatchery operations require the use of large equipment to move significant

[110] James Savage, "Report on the Effect of Gravel in Raceways," *Transactions of the American Fisheries Society* (Washington, D.C., 1937)

[111] Michael Olmert, *Kitchens, Smokehouses, and Privies* (Ithaca: Cornell, 2009), 3.

numbers of juvenile fish between the hatchery buildings and the rearing ponds and from the ponds to the release sites. To house trucks and tractors, a common feature on hatcheries in a vehicle garage. Furthermore, large equipment such as boats, as well as storage of fish-corralling screens, debris screens, and troughs may also necessitate primitive shelter from the elements. The pole-bar, generally enclosed on three sides and open along one length, covered with a shed-roof construction, is also a common sight on the Oregon fish hatchery.

Storing and preparing food presented a serious hurdle to early hatcheries. Identifying timing, amount of feeds, and type of constituted a significant portion of hatchery research work. Breakthroughs generally resulted from trial and error as no standard existed during the 19th and early 20th centuries. Access to quality food supplies further complicated feeding of fry.[112] Feeding fish at the hatchery composed a significant portion of the hatchery budget, and as such, securing low-cost, stable food supplies proved a serious concern.

> Condemned liver was considered one of the best foods, but was never cheap nor easy to transport without spoiling. It was generally cooked and ground, particularly after 1915 when two scientists at Reed College in Oregon published a paper which showed by their experiments fish fed cooked liver gained weight faster than those fed raw liver. . . Any food had to be prepared small enough to be utilized by the fish. At first hand

[112] Patricia Roppel, *Alaska's Salmon Hatcheries: 1891-1959* (Portland, OR: National Marine Fisheries Service, 1982) 53-55.

grinders were used. Later grinders were connected to the power system.[113]

A 1935 survey of hatchery foods and feeding practices conducted by the U.S. Bureau of Fisheries provides insight into the attitude of fish culturists during the initial period of hatchery expansion in response to federal dam projects. The impetus for the study, nationwide rising costs of "packing-house products," was "brought forcibly to the attention of the State and Federal fish hatchery operators."[114] The survey of State, Federal, and private hatcheries found that in 1934, hatcheries consumed 11,455,000 pounds of food consisting of meat, fish, diary, and plant products.[115] Food sources were usually combined to influence the greatest growth of the hatchery fish. Suppliers shipped the feed in fresh, frozen, dehydrated or canned forms.

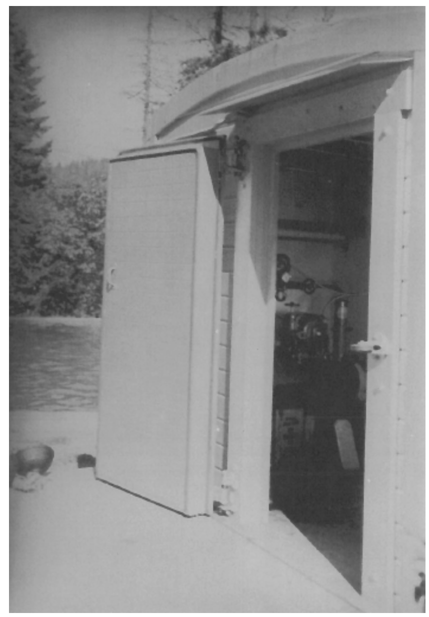

Figure 2.8. Cold storage building with insulated door c. 1935. Courtesy Oregon Historical Society Research Library, OrHi 3499, Lot 790, Box 19, Folder 5.

[113] Patricia Roppel, *Alaska's Salmon Hatcheries: 1891-1959* (Portland, OR: National Marine Fisheries Service, 1982) 54 citing H.B. Torrey and D.E. Lancefield, "Feeding of Raw vs Cooked Beef Liver," *Transactions of the American Fisheries Society*, Vol. XLIV, No. 2 (New York: American Fisheries Society, 1915) 150-153.

[114] R.H. Fiedler and V.J. Samson, "Survey of Fish Hatchery Foods and Feeding Practices," *Transactions of the American Fisheries Society*, (Washington, D. C., 1935): 377-398.

[115] R.H. Fiedler and V.J. Samson, "Survey of Fish Hatchery Foods and Feeding Practices," *Transactions of the American Fisheries Society*, (Washington, D. C., 1935): 377-398.

Figure 2.9. Meat grinder used in preparing feed for juvenile salmon, Oakridge Salmon Hatchery (Willamette Hatchery) c. 1955. Courtesy Oregon Historical Society Research Library, OrHi 3499, Lot 790, Box 14, Folder 17.

Feeding practices manifest in the physical design of hatcheries and in their administration and systematic organization. For instance, the 1935 survey report found that hatchery operators rarely stored significant quantities of feed, instead opting to purchase feed as needed. The lack of large, on-site storage or central cold storage necessitated reliable access and transportation. Furthermore, the lack of coordination decreased the collective bargaining and the potential for lower costs tied to economies of scale.

Residences

Hatchery operation require around-the-clock supervision to ensure a quick response should a blockage to the water supply or any number of other emergencies occur. Furthermore, the fish require daily feeding, frequent check-ups and testing, as well as maintenance of machinery and the facility in general. To accommodate this need for on-site staff, hatchery design generally includes residential units. The earliest hatcheries were either located in close enough proximity to developed areas as to not require housing. Otherwise, canvas tents and easily transportable housing were used. The need for on-site staff also reflects the evolving approach to rearing trout for longer periods, thus requiring the need for intermittent feeding as opposed to releasing fry upon absorption of their yolk-sac.

CHAPTER III

HISTORIC RESOURCE SURVEY

Alsea Hatchery

Alsea Hatchery was established in 1936. Located near the small town of Alsea, Oregon, Alsea appears to be without any rail access, consistent with its post-1920 establishment. Primary research suggests a two-story structure existed at the hatchery at one point (Figure 3), possibly a mixed-use hatchery and residential structure. No obvious evidence of this early structure remains in 2017.

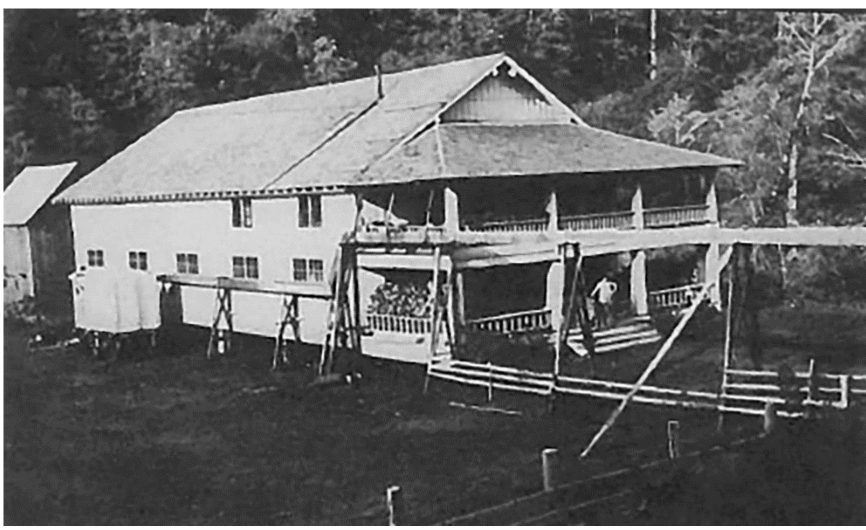

Figure 3.1. Alsea Hatchery, 1916. Courtesy Oregon Historical Society Research Library, OrHi 3499, OrgLot 790.

Design

Consisting of 25 acres, the hatchery is supplied water from the North Fork Alsea River, upstream from the hatchery, via a large dam and intake structure. The water is gravity fed into the site. For the most part, the intake area was updated in the mid-1970s. The site drawings show a specific boundary line around the main portion of the hatchery totaling approximately 12.5 acres in total area. There are two settling ponds. The operational components of the site are laid out with heavy geometric emphasis while five residences are disbursed around three sides while the fourth side fronts the small Alsea River. The oldest raceways are set parallel to each other and arranged in a stepped, diagonal pattern. Areas between holding ponds are grass-covered with a few small trees. The residential grounds contain more numerous and mature trees.

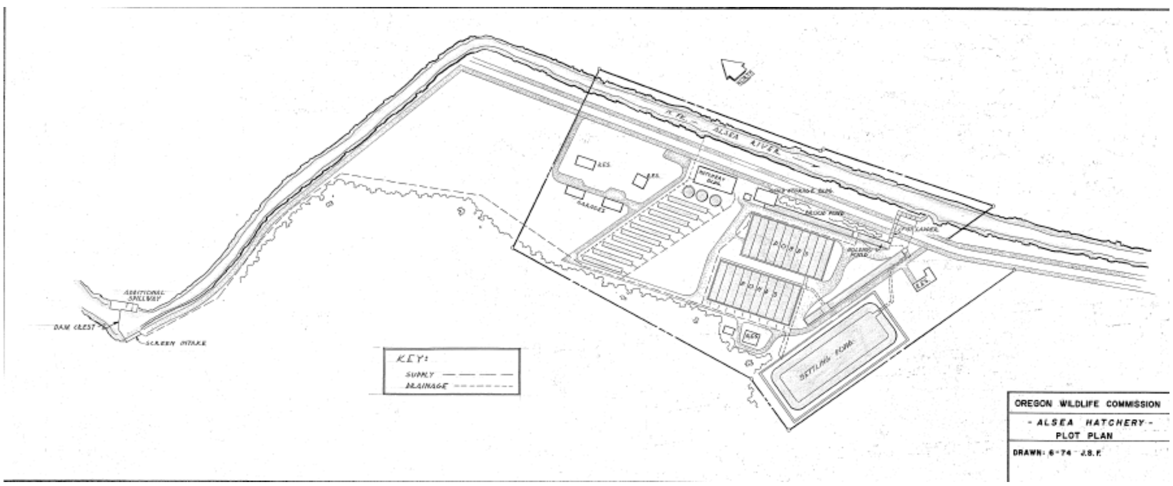

Figure 3.2. Alsea River Hatchery Plot Plan. Courtesy ODFW Archives, Salem, Oregon.

Resource Descriptions

Residence 1 (02001), was built in 1948 and has a crawl space, wood framed walls, and wood siding. The residence has an asphalt-shingled roof and although both the roof and exterior roof gutters were replaced in 1980. All of the windows are original to

1948. Concrete stairs. The front porch is also original to1948. All of the interior doors are original.

Residence 2 (02002) was built in 1934 and has a crawl space, wood framed walls and wood siding. The building has an asphalt-shingled roof and both the roof and the exterior roof drainage components were replaced in 1997. All of the windows and wood doors are original.

Residence 3 (02003), was built in 1934 and has a crawl space, wood framed walls and wood siding. the wood siding was replaced in 1987. The plan includes two front, gable-roof wings (Figure 6). The building has an asphalt shingled roof and exterior roof drainage components that were replaced in 2003. All of the windows and wood doors are original to 1934. Originally this was a two-family housed that was converted into a single-family house.

Figure 3.3. "Foreman's Residence, Alsea Trout Hatchery" c. 1941. Courtesy Oregon Historical Society Research Library, OrHi 3499, Lot 790, Box 11, Folder 1.

Residence 4 (02004), was built in 1962 and has a crawl space, wood framed walls, and wood siding. The windows were replaced in 1993. Interior casework and doors are original to 1962.

The Garage and Tank Storage building (02011/02018) were listed as separate structures with separate numbers, but in reality it is one building with two separate interior spaces.], one tank space, and one storage space. The building was built in 1934 and is a slab on grade, wood framed and wood sided structure. The roof and exterior roof drainage components are listed as original to 1934, but that is uncertain. The windows and wood doors are all original to 1934 and need to be refinished, if not replaced. The vehicle doors are also original. Unfinished interior original to 1934.

The Hatchery Building (02013) was built in 1934 and is a slab on grade, wood framed and cladded building envelope. the metal roof has been replaced within the last ten years along with the exterior roof drainage components. Window are original. Interior spaces vary in age and condition. In the main hatchery room and shop space, there is an original tongue and groove wood finish that is in good condition. Concrete floors.

Hatchery Building Office (02015), was built in 1934 and is only 306 sq. ft. It is a slabs on grade, wood framed and cladded building envelope. Metal roof and exterior roof drainage components were replaced at the same time as Hatchery Building, approximately 1996.

The Cold Storage/Grinder Room building (02016) was built in 1934 and is a slab on grade, wood framed and cladded building envelope with wood siding and trim. Metal roof and exterior roof drainage components were replaced at the same time as Hatchery and Office Buildings. Windows are original. doors are also original. Vehicular door is original. Building consists of three interior spaces, one for equipment storage, one for fish food storage, and the other is attic storage. For the most part, the finishes are exposed concrete.

The Spawning Shed (02017) was built in 1971 and is basically a shed type building that is open to the elements It is a slab on grade and slab below grade structure and has about 50% foundation walls and 50% wood framed and wood cladded walls. Metal roof and exterior roof drainage components are original to 1971. Windows, doors and cladding are also all original. The interior space is open to the elements and is completely unfinished.

The Storage building (02019) is a slab on grade metal storage shed erected in 1996.

Evaluation

The Alsea River Hatchery retains much of its integrity in location, setting, design, feeling, and association. Alterations include improvements to fish ladder infrastructure as well as material replacement including windows, doors, and roof material. However, the site does retain unaltered, early rearing pond construction (Figure 7). The case for individual significance will be difficult due to the level of alterations. However, the site displays likely significance as contributing to multiple property document form.

Figure 3.4. "Rearing Ponds -- Alsea Hatchery." Courtesy Oregon Historical Society Research Library, OrHi 3499, Lot 790, Box 11, Folder 1.

Bandon Hatchery

Bandon Hatchery is located just one mile east of the City of Bandon. obtains its water supply from Ferry Creek and Geiger Creek. The water from both sources is distributed to the site by gravity flow systems. The first hatchery-related construction occurred in 1925 with various renovations since construction.

Figure 3.5. Bandon Hatchery aerial, 1997. Courtesy ODFW, "Bandon Hatchery Program Management Plan, 2017, www.dfw.state.or.us

Design

The hatchery plan consists of two primary areas: the core hatchery operations located in a depression and a primarily residential area located above the hatchery operations. One main asphalt road leads to the parking on the site. This asphalt was installed in 1985. Gravel roads lead to the residences as well as the intake. A small amount of asphalt sidewalks, installed in 1985, exist on the site.

The two water supply creeks feed into the site through manmade reservoirs. There are seven rearing ponds on the site and one holding pond, which has been used as an abatement pond. The hatchery building, related outbuildings, and rearing ponds sit at the confluence of the two Geiger and Ferry Creeks. The layout of the ponds and buildings relates to the topography and natural flow of the creeks.

Resource Descriptions

Residence 1 (06065), built in 1929, consists of wood siding exterior walls on a slab on grade foundation. The rectangular plan original included an inset corner porch and open, full width porch on one gable end (Figure 9). The roof is clipped on the west elevation. According to maintenance reports, the siding was replaced in 1985; the roof, replaced in 1992, is asphalt shingles; windows were replaced in 2004, and the exterior metal doors in 2000; the garage door was replaced in 1990; a wood deck was built onto the back of the house in 1988; a storage shed was also built for the house in 2005.

Figure 3.6. Residence 06065 c. 1953, note the inset corner porch now filled with newer construction. Courtesy Oregon Historical Society Research Library, OrHi 3499, Lot 790, Box 11, Folder 3.

Residence 4 (06068), built in 1955, consists of wood siding exterior walls on a 4ft. crawl space foundation. a couple of the studs on the north wall of the house were found to have some minor rotting. the roof was replaced in 1992 and is in good condition. The windows were replaced in 1985. A deck was built in 1988 and a storage shed in 2003. The heat for the house is generated via electric furnace, installed in 1985. One other house on the site has the same floor plan.

Residence 2 (06066), was built in 1937. The construction is failing and the house was unoccupied during the 2017 survey. Construction resembles Residence 1, with a rectilinear plan and ground floor garage with below-grade entrance.

The Spawning Shed (06070), built in 1983, consists of wood siding exterior walls on a slab on grade foundation. The metal roof and siding are original to the building.

The Rearing Tank Building (06071), also known as the "E Building", was built in 1991. The building consists of wood siding exterior walls on a slab on grade foundation. The asphalt shingle roof and siding are original to the building. There are three skylights on the building.

The Cold Storage Building (06072), built in 1953, consists of wood siding exterior walls on a slab on grade foundation. The siding is original to the building. The asphalt shingle roof was replaced in 1999 and is also in good condition. The exterior wood doors are original. The building is no longer used to store moist food and instead is used as general storage.

The Hatchery Building (06075), built in 1934, consists of wood exterior walls on a slab on grade foundation. The wood siding was replaced in 1995. Other items replaced in 1995 include the gutters, windows, and wood exterior doors. The exterior wood stairs leading to the hatchery office were a safety hazard due to deterioration and replaced in 2005. The interior is mostly unfinished. Historic photos show that Geiger Creek flowed within inches of the hatchery building (Figure 10). The creek was rerouted as part of the canal installation in the 1950s.

The Shop Building (06077), built in 1978, consists of wood exterior walls on a slab on grade foundation.

The Storage Building (06079), built in 1998, consists of metal exterior walls on a slab on grade foundation.

Figure 3.7. Bandon Hatchery Building c. 1950. Courtesy Oregon Historical Society Research Library, OrHi 3499, Lot 790, Box 11, Folder 3.

Figure3.8. Circa 1953 construction and fill between Pond No. 1 and No. 2 with Residence 06065 in background. Courtesy Oregon Historical Society Research Library, OrHi 3499, Lot 790, Box 11, Folder 3.

Evaluation

Bandon Hatchery display minimal integrity in materials and design, especially in regards to its initial construction and period of significance related to hatchery development in the 1920's and 1930's. The building resources have been heavily altered. Furthermore, water intakes, ponds, and water feeding structures have all been modified or removed during mid-1950's reconstruction. The site would most likely be eligible under a multiple property document related to 1950's through contemporary hatchery improvements in Oregon, and is therefore outside the scope of this survey's period of significance.

Big Creek

Big Creek Hatchery is approximately 3 miles upstream from where Big Creek converges with the Columbia River, which is 16 miles east of Astoria, and 2 miles south of Knappa of Hwy 30. The hatchery was established in 1941 and was refurbished in 1957. The facility is used for adult collection, egg incubation, and rearing of winter steelhead, fall Chinook, and coho.

Figure 3.9. Big Creek Hatchery aerial, 1997. Courtesy ODFW, "Big Creek Hatchery, Program Management Plan," 2017, www.dfw.state.or.us

Design

The 19-acre site consists of two levels: the residences are located on the upper level of the site, and the hatchery functions are located on the lower level. The surroundings of the hatchery consist of a mix forested landscape. Entering the hatchery, one passes the residential area, with residences aligned along the entrance road. Big Creek hatchery has four gravity intakes that are original to the hatchery from four water sources—Big Creek, Mill Creek and two springs. The primary intake, on Big creek, about one-half mile above the hatchery. The hatchery is also served by two spring intakes. The intake on Mill Creek is behind the Hatchery Building (04129). The rearing ponds abut Big Creek with the hatchery building looking over the ponds and with its back to the hill rising to the south.

Resource Descriptions

The Residences (04028 through 04031) display the same pattern and are of the Minimal Traditional Style.

The Public Restroom Building (04114) is slab on grade, CMU building with asphalt single roof built in 1952. The construction is a small, simple rectangle.

The hatchery buildings range in age from 1952 to 1995. The Hatchery Building (04129) has a Visitor Center (04118) that was added on. The primary Hatchery Building consists of concrete block construction with metal gable roof and gable wing projection. The vertical ribbon windows and horizontal four-by-four windows are original with metal sashes (Figure 13).

The Office (04146) and new Shop/storage (04144) buildings are recent additions to the hatchery.

Figure 3.10. Hatchery Building facing southwest. Photo by researcher, May, 2017.

Evaluation

Overall, Big Creek Hatchery maintains little of its 1941 original construction. In 2017, the majority of the buildings date to after 1950. The only resource surveyed that dates to 1941 are the rearing pond located in the central grouping (see fig. XX). These concrete rearing ponds with curved ends are most likely the only above-ground resource that relates to this survey's period of significance. As such, Rearing Ponds Battery #2 (04102) would be potentially eligible as part of a pre-1950 Multiple Property Document. In regards to a Multiple Property Document concerned with post-1950 salmon hatchery expansion, Big Creek contains numerous potentially-eligible resources.

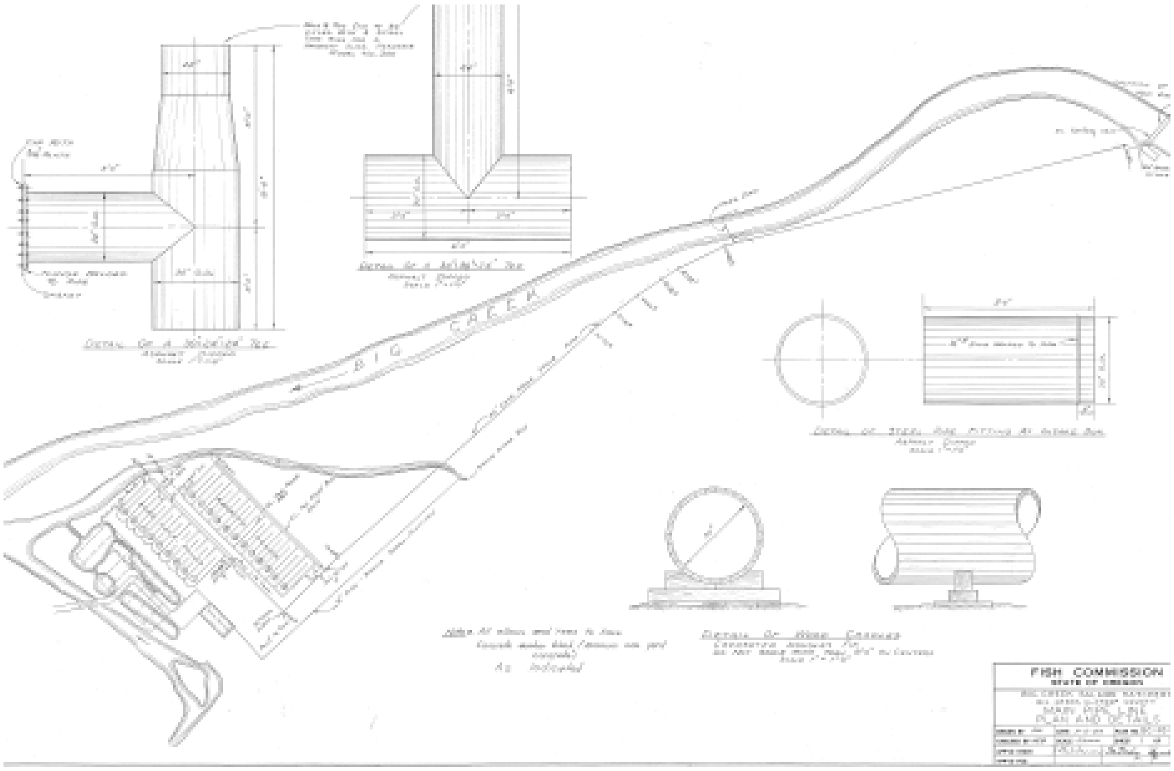

Figure 3.11. 1950 Big Creek Hatchery Plan showing existing ponds and infrastructure. Courtesy ODFW Archives, Salem, Oregon.

Cedar Creek

The hatchery is located 1.5 miles east of Hebo, Oregon. Water for the hatchery is supplied by Three Rivers and Cedar Creek. Cedar Creek Hatchery was established in 1924 and renovations have occurred, most recently as part of the Restoration and Enhancement Program.[116]

[116] Oregon Fish and Wildlife Department, “Cedar Creek Hatchery, Program Management Plan, 2018,” http://www.dfw.state.or.us.

Design

Cedar Creek is comprised of three areas. In addition to the main hatchery area, there is the Three River Fish Trap, which is across Highway 22 from the hatchery, and a satellite facility at Rhodes pond, approximately three miles south on Highway 22. Rhodes pond is not currently operated by ODFW.

Resource Descriptions

Cedar Creek Hatchery has three intakes at the main hatchery – two at the hatchery and one across 22 at the Three Rivers fish trap (29221). The upper and lower intakes are gravity feed systems, on Cedar creek, and are original to the hatchery.

The Spawning Building (29221) at Three Rivers was built in1970

The Cold Storage/Office Building (29249), Pump House (29223), and Pole Barn (29233) are newer buildings. The offices in the Cold Storage Building were remodeled in 2001.

Residence 3 (29275) was relocated to the site around 1947. Reportedly, the building originally had a flat roof. The structural support for an added gable roof is visible outside the building. It is not clear how or if this roof foundation is attached to the original foundation walls. Residence 3 (29275) was enlarged in 2001.

In addition to the residences, older site buildings include the Hatchery Building (29239) and a Gas Shed (29237).

Evaluation

Taken as a whole, the hatchery does not represent on specific period of development. Individual resources do show integrity on their own, and are potentially eligible as part of a statewide multiple property document form.

Fall River

Fall River Hatchery is located south of Bend and just north of the junction of Highway 58, a major east-west route to Eugene, Interstate 97, a major north-south connector. Original construction on the hatchery wrapped up in 1929. However, many renovations were made, particularly in 1952, when additional raceways were added.

Design

The design of the hatchery features a now repurposed, man-made canal which wraps around the hatchery grounds and supplies water to an unused holding pond. The hatchery does not display the rigidity found on other hatcheries of the time period. Builds appear more scattered and the hatchery building is removed from the raceway ponds. Overall, the grounds include a number of coniferous trees, maintained turf, and gravel roads.

Resource Descriptions

Specific building and renovation dates, foundation material descriptions, and condition report information were not located in this research. Overall, the buildings display replacement roof material, usually red, corrugated metal. The hatchery building has original windows and replacement doors.

Evaluation

Renovations have significantly altered most of the hatchery's resources. The residences are all especially altered with replacement windows, doors, roofs, and structural additions. The canal, hatchery building, and associated intake structures display potential for eligibility within the scope of this survey, however.

Klamath

Klamath Hatchery is located 8 miles west of Chiloquin just off Highway 62. The hatchery was established in 1929, however many improvements have been made since then. the hatchery produces legal sized rainbow trout and brown trout and provides fingerling rainbow trout, brown trout and cutthroat trout for air stocking programs and for release throughout the Klamath Basin and southeast part of the state.

Design

Klamath Hatchery sits at the bottom of a significant ridgeline, where the foothills of that ridge meet the flat valley floor. There are twenty-two rearing ponds on the site, which were built on average around 1970.

Resource Descriptions

The North Pond Shed (18032) and South Pond Shed (18029), built in 1955 and 1972, respectively. Both sheds consist of open wall structures on the lower portion of the buildings, with steel siding near the roofline. The roofs are also metal. The buildings do not have slab foundations, and are covering ponds.

The Garage/Shop Building (18032) was built in 1937 and consists of wood exterior walls on slab on grade foundation. The metal roof and doors were replaced in 1985 and are in good condition. The storage shed is missing a door, glass in the windows.

The Restroom Building (18033), built in 1997, consists of wood siding exterior walls on a slab on grade foundation. The metal roof is original.

Feed/Cold Storage Building (18037), built in 1983, consists of wood and concrete exterior walls on a slab on grade foundation. The metal roof was installed in 1990 and is in good condition. The building is no longer used as a cold storage facility, and has been transitioned into an overflow storage space.

Residence 1 (18149), built in 1947, consists of wood siding walls on a 4' foundation wall. the exterior walls and metal roof are original. The exterior is original as well as much of the interior.

Residence 2 (18150), built in 1970, consists of wood exterior walls on a slab on grade foundation. The exterior walls and metal roof are original to the building.

Residence 3 (18151), built in 1937, consists of wood exterior walls on a 4' crawl space foundation. The exterior siding was replaced in 1980.

Residence 4 (18152), built in 1959, consists of wood exterior walls on a 4' crawl space foundation. The metal roof was installed in 1985 and a storage shed was added in 1970. The windows are original.

The Hatchery Building (18153), built in 1937, consists of wood exterior walls on a slab on grade foundation. The metal roof and wood siding were replaced in 1990. The metal roof was installed on top of the previous wood shake roof. The metal doors were replaced in 1970. Other replacements include a new rollup vehicular doors in 1985, exterior stairs in 2000, and a new deck in 1995. The interiors range in age.

The Pole Barn (18154), built in 1998, consists of wood siding on a gravel floor. The metal roof is original to the building and is in good condition. The Pole Barn (18154) is used to house the fish transport truck.

Evaluation

The Klamath Hatchery includes numerous resources dating to the pre-World War II period of hatchery development in Oregon. As such, this hatchery should be resurveyed to better address those resources based on primary and secondary resources uncovered after the site's survey. Resources from the hatchery's establishment likely maintain high integrity and would contribute individually to a statewide multiple property document.

Klaskanine

Klaskanine Hatchery is located southeast of Astoria, Oregon, along the North Fork Klaskanine River. The hatchery commenced operations in 1911 and was enlarged in 1959 under the Columbia River Fisheries Development Program (Mitchell Act).

Figure 3.12. Klaskanine Hatchery aerial photo, 1997. Courtesy ODFW, Klaskanine Hatchery, Program Management Plan," 2018, www.dfw.state.or.us

Design

The landscape surrounding the hatchery consists of primarily forested area with occasional pasture openings. The topography is rolling, including within the hatchery boundaries. Klaskanine Hatchery consists of two levels; the residences are located on the upper level, at the site entry, and the hatchery buildings are located at the lower level. The hatchery has three intakes; all are gravity fed from perimeter streams and date from approximately 1953. The North Fork Klaskanine River flows through the center of the hatchery site, dividing the hatchery building and rearing ponds from the residences and lower abatement ponds (04423 & 04424). The hatchery building overlooks the raceway ponds, while the residences are positioned around an open, shared front yard.

Resource Descriptions

Residences (04047/04048/04049/04050) are all built on the same plan, however, research suggests that they were built in pairs, with the first in the early 1950’s and the second pair in the 1960’s.

The Hatchery Building (04426) was built in 1953 and houses most of the hatchery services as opposed to utilizing multiple outbuildings. Construction consists on concrete block and the plan is of irregular shape with gable roof and projecting front wing slightly off-centered from the side gable (Figure 18).

Figure 3.13. "North Elevation of Entrance," Klaskanine Hatchery Building. Courtesy ODFW Archives, Salem, Oregon.

The Garage/Utility Building (04443) sits as the only substantial, detached utility building on the site. Replicating design elements of the hatchery building, the garage consists of concrete-block construction and a side-gable roof. The Garage was constructed in 1953.

Evaluation

Although Klaskanine Hatchery represents and potentially eligible resource both as part of a post-1950, hatchery expansion multiple property document, within the pre-1950 scope of this survey, the hatchery is not eligible.

Oak Springs

The Oak Springs Fish Hatchery is located just south of Tygh Valley, on the Deschutes river.

Design

The hatchery is situated on a very steep site, as it is in a canyon. The site comprises approximately 120 acres, however most of the site is condensed into a significantly smaller area. Topography instructs the arranging of buildings and ponds. Water is supplied via gravity flow from several different springs near the Deschutes River. There are five different intakes that serve different areas of the site. The intake system for the lower ponds is the oldest, since those ponds are the original ponds of the hatchery.

Resource Descriptions

The hatchery consists of the raceways, the Office Building (33319), Incubation Building (33313), Feed Building (33314), Cold Storage Building (33334), Spawning Shed (33336), Well house (33315), and seven residences. there is a gravel road that connects the entire site. There is a small area of concrete between the Office Building and the U-ponds. The L-ponds are the oldest.

Residence (33305) is a wood framed building that has a basement and an 8' foundation and a metal roof. The house has been lived in continuously and has had recent improvements.

Residence (33306) is a wood framed building that has a crawl space and 4' foundation and a metal roof.

Residence (33307) is a wood framed building that has a crawl space and 4' foundation and a metal roof. The house has been vacant for some years.

Residence (33309) is a wood framed building with a crawl space and 4' foundation. There is a concrete slab where the garage used to be and the building has a metal roof.

Residence (33310) is a wood framed building with a crawl space and 4' foundation wall. All of the windows are original.

Residence (33311) is a wood framed building with a basement and an 8' foundation.

Residence (33312) is a manufactured home.

The Incubation Building (33313) consists of CMU block exterior walls on a concrete slab. The pitched roof is wood framed with metal exterior and siding on the gable portion of the walls.

The Feed Building (33314) was built in 1992.

The Well-House (33315) was built in 1993 to house the new domestic water supply storage and pressure tanks. The building is wood framed with wood siding and metal roof, and sits on concrete slab that is on grade.

The Office Building (33319) is wood framed with a metal roof and wood siding. there is a basement and a concrete slab that is on grade at the roll-up door to the shop, but extends back into the hillside.

The Cold Storage Building (33334), was built in 1934 at the time the facility was established. It is a wood framed building with wood siding and a shingle roof. The building sits on a concrete slab that is supported by piers.

The Spawning Shed (33336) is a converted raceway space at the end of the brood ponds. Two sets of stair have been added that go down into the concrete foundation The space was framed in with wood and enclosed with corrugated galvanized steel panels on the walls and roof. The steel panels had been used prior to being installed on the spawning shed as indicated by nail holes.

Evaluation

Oak Springs has been heavily modified over its history. The residences and cold storage building display the most potential for eligibility, likely only through a statewide multiple property document.

Oxbow

Oxbow Hatchery is located one mile outside of Cascade Locks, just off of Interstate 84. According to the hatchery's management plan:

> Oxbow Hatchery was originally constructed in 1913 to provide additional rearing facilities for Bonneville Hatchery. It was relocated to its present site in 1937 following the construction of Bonneville Dam. Oxbow operated as a state-funded hatchery until 1952 when it was remodeled and expanded as part of the Columbia River Fisheries Development Program (Mitchell Act).

The hatchery obtains its water supply from Oxbow Springs. Two springs are used to fill the reservoir at the west end of the rearing ponds. A springbox is set up at each spring, and the water is diverted down the hill into the reservoir.

Design

The site is 34 acres in size and is divided into three separate, detached areas. This survey focused on two areas containing substantial hatchery-related resources. The core hatchery area sits at the foot of significant ridge which forms the southern wall of the Columbia Gorge. The site is arranged along an east-west axis with nearly every building aligned in a singular-row formation.

Resource Descriptions

The Utility Building (10420) is constructed entirely of CMU with a shingled roof that was competed in 2000.

The Storage Building (14017) was constructed in 1942 and is constructed of wood exterior walls with a shingled roof. the roof was installed in 2000

The Refrigeration Building (14021) envelope, which is constructed of wood and CMU walls. The roof was replaced in the early 1990's.

The Hatchery Building (14022) which is constructed of wood and CMU walls. The interior consists of various spaces: attic, storage, restroom, incubation room, maintenance room, mechanical room, and office.

The Restroom Building (14041) is located next to the Hatchery building and parking lot and was built in 1995.

Residence (14101) was built in 1936 and is constructed of wood exterior walls with an asphalt shingle roof. The house has a basement, a 1.5 car garage, and 200 sq. ft. deck.

Residence (14102/14103) are similar in size and condition; both were acquired in 1987 and built within five years of each other. the exterior finish consists of wood walls.

Residence (14104) was constructed in c. 1950 and consists of wood exterior walls and an asphalt single roof.

Evaluation

Extant resources at Oxbow Hatchery, for the most part, represent the later, post-1950 period of hatchery construction in Oregon. One exception is Residence 14041, constructed when operations were moved to the current site in 1936. However, due to the heavily altered setting, the resource is not eligible.

Roaring River

Roaring River Hatchery is located about eleven miles southeast of Scio, Oregon. The hatchery was originally constructed in 1924 with various improvements through the years.

Figure 3.14. Roaring River Hatchery aerial photograph, 1997. Courtesy ODFW, "Roaring River Hatchery, Program Management Plan," 2018, www.dfw.state.or.us

Design

The property is approximately 40.5 acres of which about half has been developed. The surrounding landscape consists of agricultural areas and woody riparian zones. No railroad remains suggest the rural, agricultural history of the area. Adjacent properties include single-family dwellings.

The hatchery has 25 raceways, 3 circular ponds, and 2 brood ponds used for production of both rainbow trout and steelhead. There are also 11 buildings on the site, ranging in age from 1932 to 2003. Fourteen of the raceways were constructed in 1996 along with new asphalt vehicle surfaces around the raceways.

The site has a gravity feed intake that draws water from Roaring River, upstream from the hatchery, and pipes it down through the raceways. The date of the original intake construction is unknown. Estimates date the construction as occurring in the 1930's and then upgraded in early 1970's.

Resource Descriptions

The Hatchery Building (22127) was built in 1968 with a slab on grade foundation, metal walls, steel frame, and metal roof. The building has the main office, employee restroom, breakroom, storage, and hatchery.

The hatchery includes four residences of widely varying plans and dates. The Foreman's House (22231) and most likely what is the Assistant Foreman's House (22232) appear to be the oldest residences on the site. Residences 22233 and 22234 World War II-era, Minimal Traditional Style suggests a building date coinciding with post-1950 hatchery expansion.

The Storage Building (22131) is a three sided, slab on grade, wood frame building that was built in 1976 and has held up very well. The metal roof was replaced in 1989, and there is an exterior covered area attached to the backside of the building that was built in 1986.

The Cold Storage Building (22133) has concrete walls that extend up approximately three feet from the slab on grade foundation.

The Restroom Building (22134) was built in 1974 and is the only building accessible to the public. It is slab on grade, wood frame building with wood siding and metal roof.

The Trout Spawning Shed (22137) is at the end of raceways 16 and 17. It is a slab on grade foundation, wood framed building that has a corrugated fiberglass roof. One side has three roll up doors that open up to the raceways, allowing the fish to be corralled into the concrete troughs for spawning.

The bulk of the sites rearing ponds date to post-1950 reconstruction. Unused raceway ponds 22103 and circular ponds 22109 most likely represent the earliest extant

Figure 3.15. "Roaring River Fish Hatchery." Courtesy Oregon Historical Society Research Library, OrHi 3499, Lot 790, Box 4, Folder 1.

pond construction with construction dates of 1949 and 1955 respectively. Archival research suggest that original ponds consisted of earth pond construction (Figure 16).

Evaluation

Multiple upgrades and renovations have significantly altered Roaring River Hatchery. As such, the hatchery is not eligible within the scope of this survey's period-of-significance due to alterations and lacking distinction.

Rock Creek Hatchery

Located east of Roseburg, Oregon, along the North Umpqua River, Rock Creek Hatchery was constructed in 1925. Low stream flows forced the hatchery to close in 1975 until 1979 after completion of an extensive reconstruction project.[117]

Design

The hatchery is essentially located on a hillside that slopes toward the North Umpqua River. Moving downhill, the upper area feature residences which gives way to an open, flatter area that includes a mix of hatchery buildings, rearing ponds, and two additional residences. The surroundings consist of thick, coniferous forests which rise steeply.

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[117] Oregon Department of Fish and Wildlife, "Rock Creek Hatchery, Program Management Plan, 2017," http://www.dfw.state.or.us.

Resource Descriptions

The Holding Pond (10116), constructed of concrete, dates to 1944 as well as Raceways (unnumbered).

The Hatchery Building (10140) was constructed in 1948 and features original windows and siding. The site-gable roof was replaced in 1980. The only other part of the exterior that has been replaced since 1948 is the rollup vehicular door, installed in 1999. Interiors are mostly original.

Residence 1 (1005), constructed in 1925 displays original windows and siding.

Residence 10091 was constructed around 1957 and has been significantly modified outside of the siding which is original.

Residence 10092 is situated among hatchery operations. Constructed c. 1949, the structure on rectangular plan consisting of poured concrete displays limited alterations.

Residence (10093), built in 1937, consists of wood siding walls on an 8 ft. foundation (basement). The siding is original to the house. The roof, replaced in 1992, is asphalt shingle. Gutters were replaced at same time as the roof. Storm doors replaced in 1992, and a porch was added to the house in 2000.

Residence 10094, built in 1948, was unoccupied at the time of this survey and all indications suggest it has been unoccupied for some time. The residence has replacement windows, doors, and roof but is otherwise intact. Siding is original.

Evaluation

Many of the potentially eligible resources date to just inside the period of significance set at the outset of this survey. The hatchery building and two residences lack high integrity. On-site reevaluation would confirm their eligibility for inclusion of a statewide multiple property document.

Trask

Trask Hatchery was established in 1916. According to the hatchery's management plan:

> Trask hatchery was constructed in 1916 to replace an earlier hatchery that was located three miles upstream from the present site. Many improvements have been made to the hatchery since original construction including a new alarm system, early rearing building and a 40' x 60' pole building.[118]

Design

The approximately nineteen-acre site consists of two levels separated by approximately 300 yards of an asphalt/gravel road. For the most part, the main hatchery buildings and residences are located on the lower level at the site entry. The intake, spawning shed, freezer and ponds are located at the upper level. Trask Hatchery has two gravity intakes originally constructed in 1927. One is located on Gold Creek and the other on Mary's Creek.

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[118] Oregon Fish and Wildlife Department, "Trask Creek Hatchery, Program Management Plan, 2018," http://www.dfw.state.or.us.

Figure 3.16. Trask Hatchery from entrance road, 1954. Courtesy Oregon Historical Society Research Library, OrHi 3499, Lot 790, Box 14, Folder 10.

Resource Descriptions

Recent additions to the facility include Freezer Building (29324) and the Spawning Shed (29330) that date from mid-1980's.

Residence (29282), which was abandoned after 2005 for radon gas and demolished through a controlled-burn by local fire department.

Residence (29283), of Minimal Traditional Style, features mult-level, side gable design and dates to c. 1945.

Residence (29284), recent construction replacing demolished residence.

Hatchery Building (29290), constructed c. 1970, side gable structure with poured concrete foundation and built-in drainage. The building contains hatching troughs and separate office space.

Evaluation

Trask Hatchery has been the site of major flooding and as such, significant structural changes were completed in response. Very little on the site resembles the historic appearance of the site in 1916. Trask resources would not be eligible individually nor as part of a pre-1950 multiple document form.

Figure 3.17. Circa 1970 Residence replaced Residence (29282), viewable in Figure 3.16. Photograph by R. Bohner, May, 2017

Wallowa

Wallowa Hatchery is located just outside of Enterprise, Oregon. The hatchery commenced operations in 1920 as part of the then Oregon Game Commission's trout propagation program. The hatchery was significantly renovated as part of the Lower Snake River Compensation Program in 1985.[119]

Design

The site is relatively small, only eleven acres, as compared to the other sites within this study. A public road divides a small portion of the hatchery, while the Joseph Branch railroad borders the entire north property boundary. The 1985 construction added significantly to the property acreage. The hatchery building is centrally located with ponds, outbuildings, and residences radiating from its center point. The grounds are primarily gravel, turf grass, and some small trees.

[119] Oregon Department of Fish and Wildlife, "Wallowa Hatchery, Program Management Plan, 2018," http://www.dfw.state.or.us.

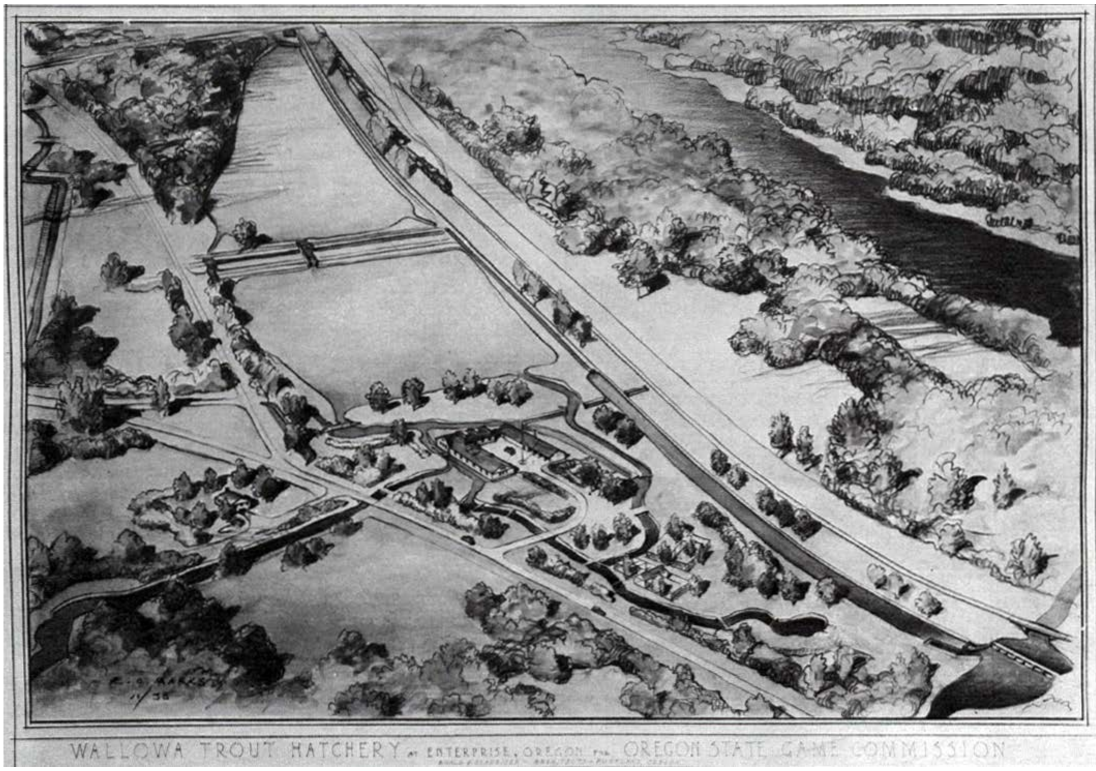

Figure 3.18. Artist's depiction of plan for Wallowa Hatchery c. 1955. Courtesy Oregon Historical Society Research Library, OrHi 3499, Lot 790.

Resource Descriptions

The Hatchery Building (32299) was constructed c. 1922 and has two wing additions dating to c. 1940. The building has original siding, windows, and much of the interior is intact.

Residence (32298), built in 1946, has replacement doors, windows, and roof material. The rectangle-plan is constructed on poured concrete.

Residence (32297), constructed in 1949, has replacement windows, doors, and roof. The irregular plan is constructed on poured concrete and the building has a full basement.

Circa 1920 wood flume remains are visible through an area of gravel pavement. The wire wrapping the flume is just visible at grade.

Evaluation

The Wallowa Hatchery Building shows high integrity and is potential as part of a statewide multiple property document. Otherwise, the period raceways and wood-flume remains make up the only other potentially eligible resources.

Willamette Hatchery

Willamette Hatchery is located off of Hwy 58, approximately 50 miles southeast of Eugene. The facility is used for adult holding/spawning, egg incubation and rearing of both salmon and trout. Willamette Trout Hatchery and the adjacent Oakridge Salmon Hatchery were combined in 1983 and operate today as Willamette Hatchery. The trout hatchery was constructed in 1922 and the salmon hatchery in 1911. The U.S. Army Corps of Engineers (USACE) rebuilt the salmon hatchery in 1952 to mitigate for fishery losses caused by Hills Creek, Lookout Point and the Dexter hydroelectric/flood control projects. The trout side was rebuilt between 1950-56.[120]

[120] Oregon Department of Fish and Wildlife, "Willamette Hatchery," *The ODFW Visitor's Guide*, retrieved May 19, 2017, http://www.dfw.state.or.us

Design

The hatchery is divided into two sections, salmon rearing on the north side, and trout rearing on the south side. The hatchery obtains its water supply from Salmon Creek. The water coming through the intake is filtered by both horizontal and vertical screens. The roads and parking throughout the site were redone in 1978 and are primarily asphalt. The concrete on the site was poured in 1952.

Resource Descriptions

The Chemical Building (20052), built in 1978, has wood exterior walls on slab on grade foundation. The metal roof, wood siding, metal doors rollup vehicular door is original to the building.

The Storage Building (20054), built in 1919, is a wood frame building on concrete footers with a gravel floor. Four large wood barn doors on roller were installed in 1994. The roof is metal and was replaced in 1994.

The Pole Building (20064) was built as an addition to the existing Garage (20241). The pole building, built in 1996, has metal exterior walls on a slab on grade foundation.

The Garage (20241) was built in 1992, is 48'x38'. The interior is unfinished.

The Restroom Building (20070), built in 1999, is a preformed concrete structure, built off site, and was dropped into place on the Willamette site. the building envelope is original to 1999.

Residence (20183), built in 1952, has vinyl exterior walls on slab on grade foundation. the vinyl siding was replaced in 1996. The roof, replaced in 1975, is asphalt shingles. The gutters, glass sliding doors, storm door, garage door, exterior wood stairs, and deck were all replaced since 1994. there are 3 other houses on the site that share the same floor plan.

The Hatchery Building (20184), built in 1952, has CMU and wood exterior walls on a slab on grade foundation. The doors, gutters and wood siding have all been replaced since 1990, and the building envelope overall is in good condition. the roof replaced in 1975, is asphalt shingles. the building is heated by electronic radiation units installed in early 1980's. The 1952 Hatchery Building displays advancements in fish culture and construction from the Original Hatchery Building included more prolific use of poured concrete, stucco, and metal frame windows. The substantial 1.5 story purpose-built building is rectangular in plan and features a steeply pitched gable roof with overhanging eaves, frieze board, and clad in composite shingles. The building is oriented along an east-west axis. The gable rood does not extend the entire length of the building however, instead it features a gable roof ringed by a hipped apron. Along the south elevation the roof is punctured by an off-centered, hipped roof dormer with two columns of three-light, metal-framed casement windows in addition to a unique second-story gable dormer allowing for an upper-story loading door. This dormer also displays a pointed 'hay hood' which likely covered an overhead, trolley loading system. The north-facing roof also has two centered hipped-roof dormers with two columns of three-light, mullion-separated, metal-framed casement windows. The west elevation gable-end has a centered window which copies the dormers and is also flanked by a single horizontal ribbon of three-light casements.

The Egg Isolation Station (20189), built in 1993, has a vinyl exterior walls on slab on grade foundation. siding was replaced in 1997 and metal roof was replaced in 2005.

Residence (20191), built in 1950, has vinyl exterior walls on a 4' crawl space foundation. the vinyl siding was replaced in 1996. The metal roof was replaced in 2000.

Residence (20192 and 20193) are identical in floor plan, and both built in 1954. All four residences have vinyl exterior walls on 4' crawl space foundation. The vinyl siding was replaced in 2001. The roof, replaced in 1996, is asphalt shingles.

The Cold Storage Building (20223), built in 1952, has wood exterior wall on slab on grade foundation. The wood siding was replaced in 1996. The roof, original to the building, is metal. The gutter and the rollup vehicular door were replaced since 1996.

The Museum Building (20225), built in 1949, was remodeled in 1996. he building has wood exterior walls on a slab on grade foundation. The wood siding, wall insulation, gutters, and wood doors were replaced as part of the remodeling in 1996.

The Office Building (20226), built in 1954, has vinyl exterior walls on a slab on grade foundation. The vinyl siding was replaced in 2000 and is in good condition. The roof replaced in 1995, is asphalt shingles. the gutters, metal doors, and storm doors have all been replaced since 1995 as well. The interior was renovated in 1984 during conversion of the building from shop into offices.

The Storage Shed (20228), built in 1972, has wood exterior walls on a slab on grade foundation. the metal roof, wood siding, gutters, and rollup vehicular doors are original to the building.

Evaluation

The complex of buildings includes the original incubation building and all remain minimally altered and in their original location, providing a strong representation of Oregon's later stage of hatchery development (1950-present). Due primarily to continued hatchery operations, some alteration and new district intrusions have been added within the nominated area. Alteration include altered siding, primarily of the employee residences. New garage buildings/outbuildings also exist. However, the original incubation building and new, 1956 incubation building remain intact and unaltered. Furthermore, the district retains setting, spatial organization, landscape feature, and overall feeling and is therefore potentially eligible individually as an intact example of post-1950 hatchery construction.

Within the scope of this survey, the building often referred to as the Old Hatchery Building represents a potentially eligible resource as part of a multiple property document. In 1920, the Fish and Game Commission was moving forward with plans for the now adjacent trout hatchery.[121] Little mention is made of the extant rearing ponds

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[121] Eugene Morning Register, "Clanton Tell of Plans for New Fish Hatchery," Jan 30, 1920. Retrieved at newspapers.com

throughout planning correspondence. Often referred to as the original hatchery building, the Old Hatchery Building was most likely constructed in 1934—the first building on the salmon hatchery site.[122] Between 1934 and 1983, the two adjacent hatcheries—Willamette Trout Hatchery and Oakridge Salmon Hatchery—continued to operate independently.

Wizard Falls

Wizard Falls Fish Hatchery is located at 7500 Forest Service Rd. 14, near Camp Sherman along the Metolius River. Sisters, Oregon represents the nearest major population center. The hatchery was established in 1947 and has operated continuously since.

Figure 3.19. Wizard Falls Hatchery aerial photo, 1997. Courtesy ODFW, Wizard Fall Hatchery, Program Management Plan," 2018, www.dfw.state.or.us

[122] Eugene Register Guard, "New Buildings for Hatchery Finished", Aug 8, 1934. Retrieved at newspapers.com

Design

Situated on a fairly level site of about 25 acres, the hatchery is surrounded by a high-desert landscape, consisting primarily of ponderosa pine. The hatchery is bounded on one side by the Metolius River (Figure 19). The hatchery water is obtained from two sets of springs. A cold-water well located on the other side of the river also supplies domestic water. There are gravel roads that wind through the entire sit.

Resource Descriptions

The Office Building (16055O) is wood framed with a metal roof and Hardi-plank on a concrete slab. It is seven years old (2006).

The Restroom Building (16055R) was built in the same period as the Office Building.

The Garage/Shop (16070) was built at the time the hatchery started and features a concrete floor and storage out building.

The Hatchery Building (16071) is a wood framed structure with wood siding and a metal roof on a concrete slab that has been on the site since the hatchery was built. All of the doors and windows on the building are original. Building retains original finishes.

The Cold Storage Building (16072) dates from founding of the hatchery. It is a wood framed building with wood siding and a shingle roof and concrete slab flor.

Residences (16133/16134) are identical in plan and were built in 1947. They are constructed of wood framed exterior with a crawl space and 4 ft. foundation. The have wood siding and metal roofs. The houses were built during WWII to be a temporary office unit in the Midwest.

Residence (16135) is a wood framed building with a crawl space and 4 ft. foundation. the house has wood siding and an asphalt shingle roof. All of the windows in the building are original.

Residence (16136) is site manager's house. It is a wood framed building with a crawl space and 4 ft. foundation. There is also a concrete slab on grade in the garage and covered with a corrugated-metal roof.

Evaluation[123]

Wizard Falls represents the very end of hatcheries associated with War-era construction ending in 1950. Despite is more recent establishment, the hatchery displays a lack of integrity due to alterations, particularly replacement windows and roofs. More significantly, taken collectively, the removal of the oldest rearing ponds has significantly diminished the potential eligibility as its own district. On the other hand, the hatchery building is potentially eligible as a contributing, individual resource to a statewide multiple property document.

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[123] Wizard Falls Hatchery was the subject of an Oregon State Historic Preservation Office Determination of Eligibility and Clearance Form, initiated by ODFW, in response to a proposal to remove the original Burrows Rearing Ponds, see Christopher L. Ruiz and Liz Carter, "Wizard Falls Hatchery Intensive Level Survey and Determination of Eligibility," Report to the Oregon Department of Fish and Wildlife (Eugene: Museum of Natural and Cultural History, 2017), retrieved from Daniel Pettit, ODFW Archaeologist and Tribal Liason.

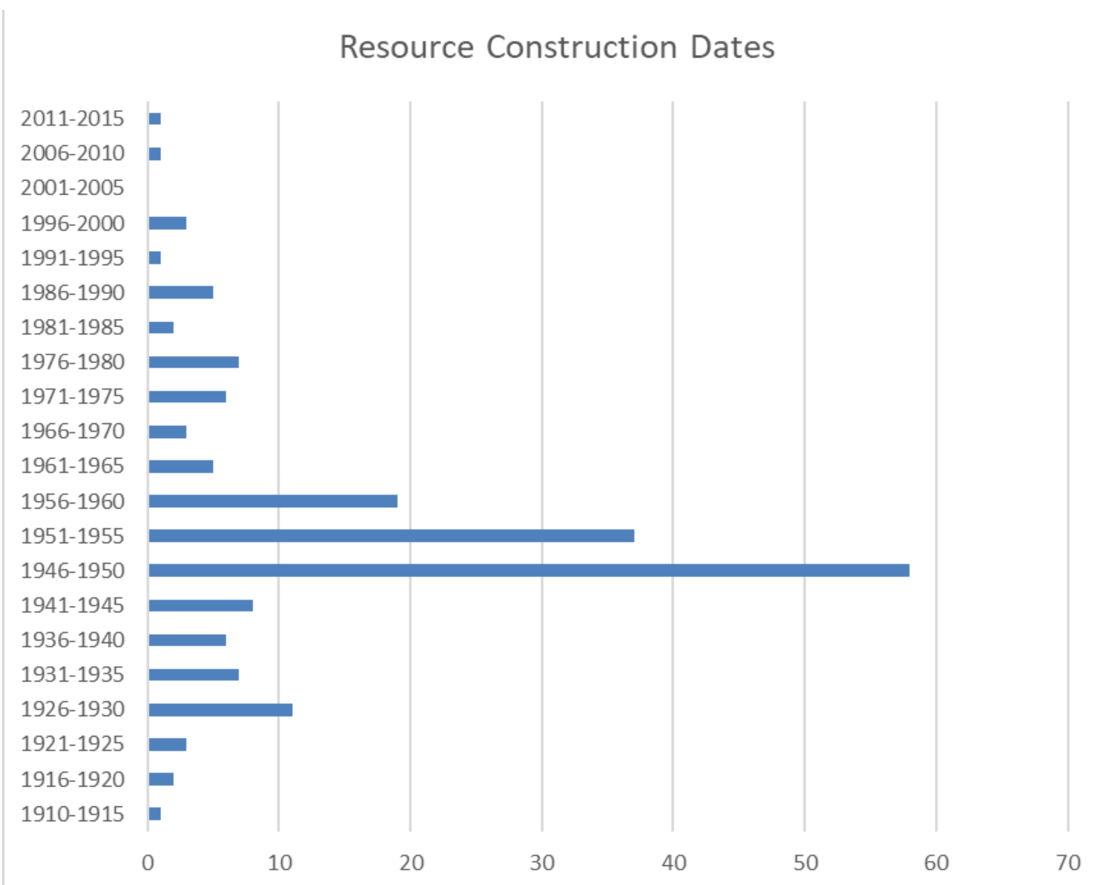
CHAPTER IV

FINDINGS

The entire survey effort resulted in the recordation of one-hundred eighty-two resources. Assuming correct, nearby approximation when actual construction date could not be confirmed though primary or secondary source document—the average year of construction across all surveyed hatcheries is 1952.67 with the earlies construction date recorded in 1911. The survey results suggest that, overwhelmingly and despite initial construction date, today's hatcheries are a product of post-World War II expansion and renovations. Furthermore, the survey highlights the rarity of construction associated with the early era of hatchery construction and propagation activity.

In regards to historic significance, this preliminary survey suggests that the majority of resources, despite later construction compared to the recorded establishment of each station, retain high levels of integrity. One-hundred thirty-two resources were recorded as "Eligible/Contributing" indicting historic significance as part of a larger district or multiple property document. Three resources, two hatchery buildings and one cold storage building, displayed potential significance and integrity as to stand alone and individually listed resources.

Table 3. Total number of resources constructed in surveyed hatcheries by 5-year increments.



Any resource from the initial decades of hatchery development, from the turn of the 19th century through 1919, particularly those associated directly with the propagation process should be considered individually significant due to the rarity and importance within the hatchery system. Pre-World War II resources also share, to a lesser extent, greater potential for individual significance.

Table 4.2. Number of "Potentially Eligible--Contributing," "Potentially Eligible--Individually," and "Non-contributing" resources surveyed.

Significance	Occurrence
Eligible/Contributing	132
Eligible/Significant	3
Non-contributing	47

A comparison of hatchery-by-hatchery survey results provides highlights for future survey efforts. For example, Alsea Hatchery contains the earliest average resource construction date. However, the difference between hatcheries appears minimal. Willamette Hatchery and Oak Springs both display the best probability for individually significant resources—two of which are hatchery buildings and one cold storage building.

Table 6.3 Eligible and Non-Eligible Resources by Hatchery

Alsea	
Eligible/Contributing	13
Non-Contributing	2
Average Construction Date	1944.40
Bandon	
Eligible/Contributing	9
Non-Contributing	4
Average Construction Date	1945.92
Big Creek	
Eligible/Contributing	12
Non-Contributing	2
Average Construction Date	1955.50
Cedar Creek	
Eligible/Contributing	13
Non-Contributing	4
Average Construction Date	1958.76
Fall River	
Eligible/Contributing	5
Non-Contributing	10
Average Construction Date	1944.93
Klamath	
Eligible/Contributing	8
Non-Contributing	2
Average Construction Date	1950.60
Klaskanine	
Eligible/Contributing	11
Non-Contributing	1
Average Construction Date	1956.83

Oak Springs	
Eligible/Significant	1
Eligible/Contributing	5
Non-Contributing	7
Average Construction Date	1957.92
Oxbow	
Eligible/Contributing	9
Non-Contributing	
Average Construction Date	1951.78
Roaring River	
Eligible/Contributing	6
Non-Contributing	2
Average Construction Date	1951.63
Rock Creek	
Eligible/Contributing	11
Non-Contributing	1
Average Construction Date	1962.92
Trask	
Eligible/Contributing	3
Non-Contributing	5
Average Construction Date	1958.25
Willamette	
Eligible/Significant	2
Eligible/Contributing	11
Non-Contributing	1
Average Construction Date	1948.86
Wizard Falls	
Eligible/Contributing	9
Non-Contributing	2
Average Construction Date	1955.27

Discussion

The historic resource surveys expose common narratives which, consequently, highlight themes related to specific periods of construction and larger shifts in broader fishery management. Frequent occurrences of prefabricated construction methods and materials in both new construction and substantial facility renovations supports themes related to government mobilization programs. Secondly, unnatural materials which gained in popularity as a result of the war effort as well as increasingly sterilized facility grounds between rearing ponds, hatchery buildings, and outbuildings also indicates a shifting approach to resource management—an approach that is highly science-based, removed, and reliant on grey infrastructure engineering. Lastly, the wide extent of alterations, particularly to staff housing, ties together both the temporary-construction motif and the distinction afforded to the hatchery building as the core component of the model hatchery station. Ultimately, economic growth and the unleashing of new technologies and expanded infrastructures, primarily road building, hydroelectric power grid, and flood control, ushered in the need for a level of management that parallels and interrelates with the 1940's war effort.

Progression of Salmon Culture

Based on periods of increased construction, historical contexts, and broad aquaculture trends, three periods of salmon culture in Oregon emerge.

Initial Hatchery System Development: 1876-1919

Physical evidence of this initial era of fish culture development appears limited. Construction during this period indicates a temporary nature of fish culture activities. Historic resources present on or near the site associated with the initial construction date display dates reflecting subsequent eras of hatchery system expansion. However, the siting of facilities demonstrates reliance on rail transportation and relative proximity to population centers.

War Era Construction: 1920-1949

With the end of World War I and the advent of the automobile, Oregon's hatcheries received a boost of support resulting in improvements to existing facilities and massive expansion of the State's hatchery system. During the 1930's hatchery operations focused on perfecting hatchery efficiency and effectiveness. A scientific approach to record keeping, promoted nationwide by the growing American Fisheries Society, manifested in hatchery design through militaristic, sterile facility layout and landscape. Hatchery construction experienced a brief lull during America's entrance into World War II after which renewed interest in mitigating losses associated with public works projects injected nearly unlimited federal funding.

Militaristic Construction

Across the hatcheries surveyed, frequent occurrences of building patterns resembling prefabricated military housing and post-World War II construction dates suggests much of the state's fish hatchery construction owes its post-war build out to military techniques and materials. The expeditious renovation and expansion of the fish culture system echoes, albeit at a much smaller scale, the U.S military's need in response to Germany's European invasions. In meeting its need, the state leveraged military architecture: "straightforward, based on simple calculations of cost, efficiency and speed of construction."[124] Through the building program, the U.S. military left an indelible, standardized mark on the nation's architecture.

The influence of military mobilization's building technology is not isolated to Oregon's hatcheries. The State of Washington's post-war salmon and trout hatchery expansion similarly borrowed from the military construction manual. For example, constructed in 1949, the Puyallup Fish Hatchery, historically significant under Criteria A and C, features an incubation building which "takes many of its design cues from public structures built during the late 1930s as part of the Depression era, yet incorporates modern post WWII construction methods and materials."[125]

[124] Diane Wasch, et. Al., *World War II and The U.S. Army Mobilization Program: A History of 700 and 800 Series Cantonment Construction,* Aelene Kriv, Ed. (National Park Service; HABS/HAER, n.d.) 3.

[125] Paula Harmes, "Puyallup Fish Hatchery," National Register of Historic Places Registration Form (January, 2013), retrieved on December 17, 2017 from *Washington Information System for Architectural and Archaeological Records* Data, https://fortress.wa.gov/dahp/wisaardp3/

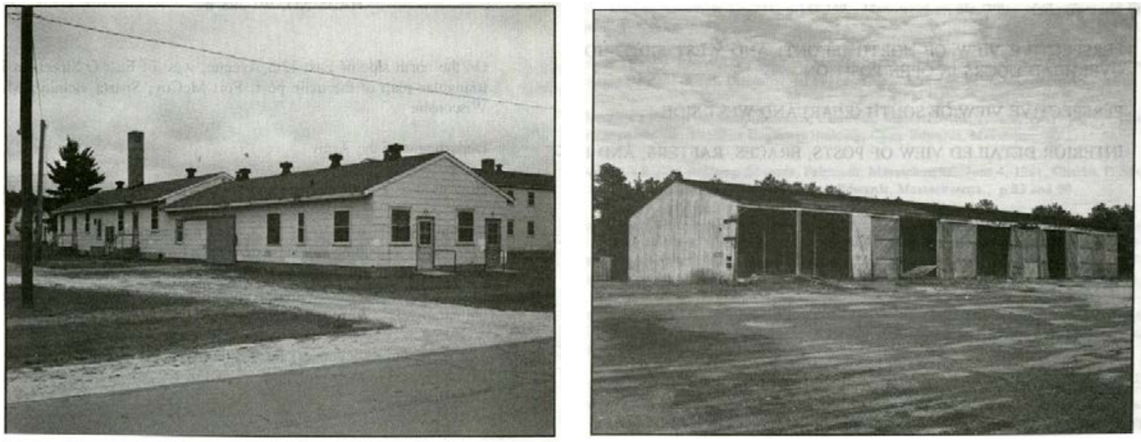


Figure 4.1. Military mobilization construction, Fort McCoy, Wisconsin, c. 1943. Courtesy Kriv, A. R., Wasch, D. Shaw., Historic American Buildings Survey/Historic American Engineering Record, United States. Dept. of Defense, Legacy Resources Management Program, (1992). ***World War II and the U.S. Army mobilization program: a history of 700 and 800 series cantonment construction*****, Washington, D.C.: Legacy Resources Management Program, U.S. Dept. of Defense.**

Contemporary Expansion

The post-war hatchery system build-up mirrored more than military's expansion. Forty years later, climbing maintenance costs called into question the future of 1940s construction— "it became clear to military planners that the army of the 1980s could no longer be housed either comfortably or inexpensively in 1940s army barracks."[126] In response, under authority granted by the U.S. Senate, the military began the massive effort of "disposing" of its World War II buildings. With similar, much slower, resolve, ODFW continues to significantly modify or outright replace its post-war, temporary buildings.

[126] Diane Wasch, et. Al., *World War II and The U.S. Army Mobilization Program: A History of 700 and 800 Series Cantonment Construction*, Aelene Kriv, Ed. (National Park Service; HABS/HAER, n.d.) 3.

CHAPTER V

CONCLUSION

Aquaculture is a chain events aimed at the rational control of fish production. The central occurrence of transformation of energy and raw materials coalesces within the hatchery building and surfaces in the rearing ponds. As such, the critical element of a hatchery are its hatchery units, particularly the hatch house and rearing ponds. Contributing resources of the hatchery include worker housing, outbuildings, and landscape elements.

In his in-depth expose on the history and relationship between salmon and civilization, David Montgomery provides opposing viewpoints on the efforts to protect salmon: "as either a narrow technical challenge or a broad ecological problem."[127] Without delving into the debate over impacts of Oregon's public hatchery system on wild fisheries, most anyone could agree that efforts to utilize a system of artificial propagation relates to the classic narrative of technology and man's attempts to control the natural world.[128] Hatcheries and the technologies utilized therein developed in response to improvements in man's ability to catch and transport salmon at unsustainable levels.

The hatchery is built around a system of water, diverted from its source, into the

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[127] David Montgomery, *King of Fish: The Thousand-Year Run of Salmon* (Boulder: Westview Press, 2003) 150.

[128] David Montgomery, *King of Fish: The Thousand-Year Run of Salmon* (Boulder: Westview Press, 2003) 150.

hatching troughs, through rearing ponds, and eventually, what’s not lost in the process, returns to the watershed. Housing a large portion of this process is the hatchery building. The permanence of the hatchery building confirms its distinction above other hatchery components. Consequently, intakes and water supply systems directly relate to the hatchery building. However, due to their purpose and demanding conditions, intakes appear frequently altered and improved while the hatchery building remains. The prefabricated design and low-cost construction associated with residences and outbuildings further confirms their auxiliary role within the hatchery.

Another important note of distinction worth further consideration is future efforts for historic preservation within working, rural landscapes. With few exceptions, these hatcheries have continued operation since their initial construction. Attempting to either preserve historically significant structures, or even return structures to an earlier period of significance presents conflict with the nature of their operations. A common theme observed through the first two periods of development is the idea of impermanency. From water control and rearing facility construction, the role and exposure of these resources requires frequent rebuilding. Do such modifications and rebuilding negate the historic significance of the hatchery site? This author would argue that a more holistic approach to evaluating hatchery resources for historic significance must adopt a more flexible approach than those taken towards these resources recently.

The history of trout and salmon culture architecture, particularly before standardization and mass expansion after World War II, presents a synthesis of stages building on to the previous stage’s refinement and a case of necessity where materials were pulled from availability. The construction was a specific response to a specific condition but widely-shared patterns are repeated throughout Oregon's hatcheries suggesting a sort of standardization more commonly associated with government officialdom. Almost, despite the incredibly unique landscapes inhabited by each facility is an essential attempt to control regional landscapes.

Future Research

As research and writing typically do, more questions were raised during this process than answered. Future studies should consider more in-depth histories of individual hatchery stations. Further research could also highlight commonly overlooked characters, most likely associated with local hunting and angling clubs, and their role in the expansion and siting of hatchery stations. Maintaining and preserving historic resources worthy of additional care will also pose a real challenge to the Oregon Department of Fish and Wildlife. Most useful would be a project to gauge feasibility of an updated condition survey, preservation plan, and training regarding preserving historic resources. Along those lines, there is potential that smaller hatchery sites may be closed in the future. A project to investigate past attempts to reuse these sites and challenges and opportunities to preserve decommissioned sites may identify means to preserve historic fish culture resources.

APPENDIX

OREGON STATE HATCHERY SURVEY INVENTORY SHEETS

Alsea Inventory Sheet

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Garage, Tank and Storage (02011/02018)	1934	Eligible/Contributing	Vinyl window replacements
	Hatchery Building (02013)	1934	Eligible/Contributing	Vinyl window replacements
	Hatchery Offices (02015)	1934	Eligible/Contributing	Vinyl window replacements
	Cold Storage (02016)	c. 1948	Eligible/Contributing	Vinyl window and replacement siding
	Residence 1 (02001)	1948	Eligible/Contributing	Vinyl window and composite shingle roof material replacement
	Residence 2 (02002)	1934	Eligible/Contributing	Vinyl window and composite shingle roof material replacement

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Residence 3 (02003)	1943	Eligible/Contributing	Vinyl window and composite shingle roof material replacement
	Residence w/3 Bdrm + Grarage (02004)	1962	Non-contributing	
	Spawn Shed (02017)	1971	Non-contributing	
 	Fish Ladder	c. 1943	Contributing	
	Settling Pond (02136)	c. 1943	Contributing	
	Holding Ponds (02111)	c. 1943	Contributing	

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Holding Ponds (02101 - 02110)	c. 1943	Contributing	
	Starting Ponds (02132)	c. 1943	Contributing	
	Dam (02141)	c. 1943	Contributing	

Bandon Inventory Sheet

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Hatchery Building (06075)	1934	Eligible/Contributing	Vinyl window and composite shingle roof material replacement
	Metal Shop (06077)	c. 1950	Non-contributing	Vinyl window and composite shingle roof material replacement, sky-lights
	Cold Storage Buiding (06072)	1953	Eligible/Contributing	Vinyl window and composite shingle roof material replacement
	Feed Storage (06073)	c. 1948	Eligible/Contributing	
	Garage (06074)	c. 1957	Non-contributing	
	Residence 1 (06065)	1929	Eligible/Contributing	

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Residence 2 (06066)	c. 1929	Eligible/Contributing	
	Residence 3 (06067)	c. 1955	Non-contributing	
	Residence 4 (06068)	c. 1955	Non-contributing	
	Pond (06089)	c. 1929	Eligible/Contributing	
	Pond (06080/06081)	c. 1958	Eligible/Contributing	
	Dam and Pipeline (06093)	c. 1950	Eligible/Contributing	
	Pond (06087/06088)	c. 1950	Eligible/Contributing	

Big Creek Inventory Sheet

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Residence 1 (04028)	1957	Eligible/Contributing	
	Resience 2 (04029)	1957	Eligible/Contributing	
	Residence 3 (04030)	1957	Eligible/Contributing	
	Residence 4 (04031)	c. 1941	Eligible/Contributing	Renovated 1994
	Residence 5 (04032)	1977	Non-contributing	
	Restroom Building (04114)	c. 1940	Eligible/Contributing	

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Utility Building (04119)	1952	Eligible/Contributing	
	Refrigeration Building (04126)	1952	Eligible/Contributing	Vitrually intact; historic windows intact; replacement metal roof
	Hatchery Building (04129)	1952	Eligible/Contributing	Vitrually intact; historic windows intact; replacement metal roof
	Rearing Ponds Battery 1 (04101)	1953	Eligible/Contributing	
	Rearing Ponds Battery 2 (04102)	1953	Eligible/Contributing	
	Rearing Ponds Battery 3 (04103)	1953	Eligible/Contributing	Refloored in 1970

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Holding Ponds (04106)	1963	Eligible/Contributing	
	Pollution Abatement Pond (04105)	c. 1970	Non-contributing	

Cedar Creek Inventory Sheet

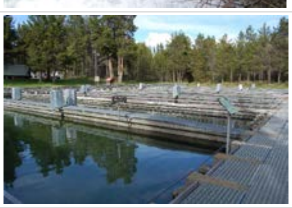
	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Hatchery Building (29239)	c. 1947	Eligible/Contributing	
	Gas Shed (29237)	c. 1947	Eligible/Contributing	
	Cold Storage/Office Building (29249)	c. 1947	Eligible/Contributing	
	Shop (29229)	c. 1947	Eligible/Contributing	
	Settling Box (29223)	1947	Eligible/Contributing	
	Pole Barn (29233)	2006	Non-contributing	

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Residence 1 (29273)	c.1947	Eligible/Contributing	
	Residence 2 (29274)	cc. 1925	Eligible/Contributing	
	Residence 3 (29275)	1947	Eligible/Contributing	
	Shop (29232)	c. 1947	Eligible/Contributing	
	Garage (29251)	c. 1947	Eligible/Contributing	
		2016	Non-contributing	

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
		1989	Non-contributing	
	Pond 6 (29207)	1999	Non-contributing	
	Pond 9 & 10 (29208)	1947	Eligible/Contributing	
	Rearing Pond No. 15 (29215)	1947	Eligible/Contributing	
	Pond No. 13 Outlet Structure (29213	1947	Eligible/Contributing	

Fall River Inventory Sheet

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Hatchery Building (09093)	1929	Eligible/Contributing	
	Storage (09094)	1950	Non-contributing	
	Cold Storage (09095)	1950	Non-contributing	
	Shed (09097)	c. 1980	Non-contributing	
	Residence (09096)	c. 1950	Non-contributing	
	Residence (09081)	1929	Non-contributing	

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Residence (09082)	c. 1950	Non-contributing	
	Residence (09080)	1960	Non-contributing	
	Garage (09088)	1960	Non-contributing	
	Intake	1950	Non-contributing	
	Rearing Ponds (09101 thru 09110)	1950	Non-contributing	
	Canal Output	1929	Eligible/Contributing	

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Canal (09098) (upper)	1929	Eligible/Contributing	
	Canal (09098) (near entrance rd.)	1929	Eligible/Contributing	
	Canal (09098) (lower)	1929	Eligible/Contributing	

Klamath Inventory Sheet

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Feed/Cold Storage Building (18037)	1983	Non-contributing	
	Garage and Shop (18032)	1937	Eligible/Contributing	
	Hatchery Building (18153)	1937	Eligible/Contributing	Addition in 1952
	Residence (18151)	1937	Eligible/Contributing	
	Residence (18149)	1947	Eligible/Contributing	
	Residence (18152)	1959	Eligible/Contributing	

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Residence (18150)	1970	Non-contributing	
	Rearing Ponds (18001 thru 18009)	c. 1950	Eligible/Contributing	
	Dam (18031)	c. 1957	Eligible/Contributing	
	Rearing Pond (18010)	c. 1929	Eligible/Contributing	

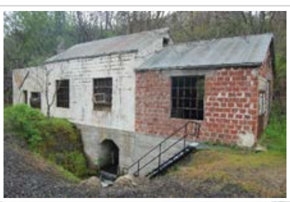
Klaskanine Inventory Sheet

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Hatchery Building (04426)	1953	Eligible/Contributing	
	Residence B (04047)	1960	Eligible/Contributing	
	Residence (04048)	1960	Eligible/Contributing	
	Residence (04049)	c. 1960	Eligible/Contributing	
	Residence (04050)	c. 1960	Eligible/Contributing	
	Restroom Building (04447)	1953	Eligible/Contributing	

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Utility Building (04443)	1953	Eligible/Contributing	
	Utility/Feed/Garage/Shop (04444)	1953	Eligible/Contributing	
	Dam #1 (04037)	1953	Eligible/Contributing	Improvements in 1964
	Rearing Ponds (04401 to 04417)	1951	Eligible/Contributing	
	Rearing Lake (04425)	1951	Eligible/Contributing	
	Abatement and Aeration Ponds (04424/04023)	1975	Non-contributing	

Oak Springs Inventory Sheet

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Cold Storage Building (33334)	1934	Eligible/Significant	
	Incubation Building (33313)	1997	Non-contributing	
	Manager's House (33311)	c. 1953	Eligible/Contributing	
	Office/Shop/Feed Storage (33319)	1956	Non-contributing	
	Seasonal House (33307)	1955	Non-contributing	
	Seasonal House (33310)	1949	Eligible/Contributing	

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Spawning Shed (33336)	1962	Non-contributing	
	Tech 1 Building Lower(33306)	1955	Eligible/Contributing	
	Tech 1 Building Upper (33309)	1957	Eligible/Contributing	
	Tech II Residence + Garage (33305)	c.1955	Eligible/Contributing	
	Abandoned Power House	c. 1920	Non-contributing	
	Cicular Ponds (33340)	1970	Non-contributing	
	Raceways	c. 1990	Non-contributing	

Oxbow Inventory Sheet

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Refrigeration Building (14021)	1953	Eligible/Contributing	
	Residence 1 (14101)	c. 1947	Eligible/Contributing	
	Residence (14102)	1952	Eligible/Contributing	
	Residence (14103)	1952	Eligible/Contributing	
	Residence (14104)	c. 1950	Eligible/Contributing	
	Storage/Wood Shop (14017)	1953	Eligible/Contributing	

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Utility Building (14020)	1953	Eligible/Contributing	
	Rearing Ponds (14001 thru 14012)	1953	Eligible/Contributing	
	Rearing Ponds (14130/14131)	1953	Eligible/Contributing	

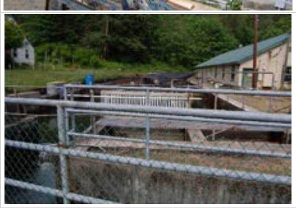
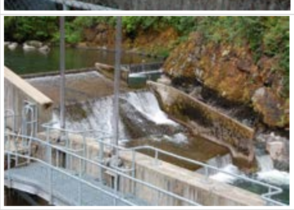
Roaring River Inventory Sheet

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Cold Storage Buildling (22133)	c. 1936	Eligible/Contributing	Renovated 1982
	Garage 3 Car Shop/Storage (22130)	c. 1975	Non-contributing	
	Residence 1 (22231)	1932	Eligible/Contributing	
	Residence 2 (22232)	1936	Eligible/Contributing	
	Residence 3 (22233)	c. 1954	Eligible/Contributing	
	Residence 4 (22234)	1954	Eligible/Contributing	

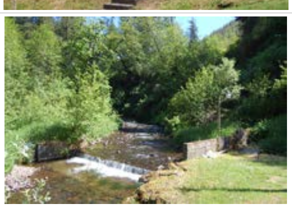
	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Spawning Shed (22137)	1963	Non-contributing	
	Storage Building (22131)	c. 1963	Eligible/Contributing	

Rock Creek Inventory Sheet

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Hatchery Building (10140)	1948	Eligible/Contributing	Replacement vinyl windows with snap-in muntons; replacement metal roof, replacement siding
	Residence 1 (10095)	c. 1925	Eligible/Contributing	
	Residence (10091)	1957	Eligible/Contributing	Replacement windows
	Residence 4 (10092)	1949	Eligible/Contributing	
	Residence 5 (10094)	1948	Eligible/Contributing	
	Shop (10126)	c. 1948	Eligible/Contributing	

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Garage (10128)	1957	Eligible/Contributing	Replacement doors
	Rearing Ponds (10110)	c. 1957	Eligible/Contributing	
	Pollution Abatement Pond (10116)	1979	Eligible/Contributing	
	Rearing Ponds (10101)	2015	Eligible/Contributing	
	Rearing Ponds (n.#)	c. 1957	Eligible/Contributing	
	Spillway/Intake/Dam (10137/10136/10134)	2015	Non-contributing	

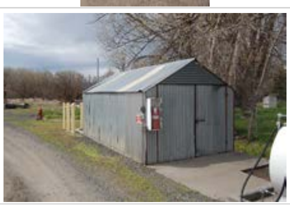
Trask Inventory Sheet

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Freezer Building (29307)	1989	Non-contributing	
	Hatchery Building (29290)	1977	Non-contributing	
	Residence 2 (29283)	1950	Non-contributing	
	Residence 3 (29284)	1950	Non-contributing	
	Storage House @ Upper Hatchry (29306)	1950	Non-contributing	
	Intake (29314)	c. 1950	Eligible/Contributing	

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Pond (29309)	c. 1950	Eligible/Contributing	
	Pond (29308)	c. 1950	Eligible/Contributing	

Wallowa Inventory Sheet

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Hatchery Building (32299)	c. 1922	Eligible/Contributing	Initial construction in 1922 of north-south segment with later wing additions c. 1940
	Hatchery Building (32342)	1985	Non-contributing	
	Residence (32298)	1946	Eligible/Contributing	
	Residence (32297)	1949	Eligible/Contributing	
	Vehicle Storage Shed (32341)	c. 1980	Non-contributing	
	Rearing Pond (32312)	c. 1946	Eligible/Contributing	

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Pond (32311)	c. 1946	Eligible/Contributing	
	Raceway, view east (left) and west (right)	1946	Eligible/Contributing	
	Wood flume remains	c 1920	Eligible/Contributing	
	Oil Storage	c. 1950	Non-contributing	
	Abandoned outhouse	c. 1950	Non-contributing	

Willamette Hatchery Inventory Sheet

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Hatchery Building (20225)	c. 1929	Eligible/Significant	
	Hatchery Building (20184)	1952	Eligible/Contributing	
	Old Hatchery Building (20054)	c. 1911	Eligible/Significant	
	Garage/Utility (20224)	1950	Eligible/Contributing	
	Residence 2 (20191)	1950	Eligible/Contributing	
	Residence 4 (20193)	1954	Eligible/Contributing	

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Storage/Oil/Chemical (20052)	1978	Non-contributing	
	Residence (20182)	1952	Eligible/Contributing	
	Residence (20183)	1952	Eligible/Contributing	
	Ponds (20213 -20216)	c. 1950	Eligible/Contributing	
	Rearing Ponds (20001 - 20040)	1952	Eligible/Contributing	

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Headgate/Trash Rack (20221)	1952	Eligible/Contributing	
	Bridge	1950	Eligible/Contributing	
	Upper Intake & Groin (20056)	1952	Eligible/Contributing	

Wizard Falls Inventory Sheet

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Cold Stage Building (16072)	1948	Eligible/Contributing	
	Garage/Shop (16070)	1947	Eligible/Contributing	
	Hatchery Building (16071)	1947	Eligible/Contributing	
	Office Buildling (16055O)	1998	Non-contributing	
	Residence 1 (16133)	1947	Eligible/Contributing	
	Residence 2 (16134)	1947	Eligible/Contributing	

	Resource Name	Construction Date	Resource Historic Eligibility	Notes
	Residence 3 (16135)	1948	Eligible/Contributing	
	Residence 4 (16136)	1953	Eligible/Contributing	
	Rearing Ponds (16030 thru 16041)	c. 1947	Eligible/Contributing	
	Rearing Ponds (16021 thru 16023)	1979	Non-contributing	
	Bridge (16078)	c. 1947	Eligible/Contributing	

REFERENCES CITED

Allard, Dean C. Spencer Fullerton Baird and the U. S. Fish Commission. New York: Arno Press, 1978.

Allen, Walter. “Question Department.” The Progressive Fish Culturist I-131, no. 16. Washington, D. C.: Bureau of Fisheries, March 1936.

Beckham, Stephen Beckham. The Bonneville Hatchery: A Historical Assessment for the Bonneville Navigation Lock Project, Bonneville, Oregon. Report to Portland District, U.S. Army Corps of Engineers. Eugene: Heritage Research Associates, 1986.

Blumm, Michael Blumm. Sacrificing the Salmon: A Legal and Policy History of the Decline of Columba Basin Salmon. Lake Mary: Vandeplas, 2002.

Bowen, J. T. “A History of Fish Culture as Related to the Development of fishery Programs. A Century of Fisheries in North America, Edited by Norman Benson. Washington, D.C.: American Fisheries Society, 1970.

Burrows, Roger and H. Chenoweth. “The Rectangular Circulating Rearing Pond.” The Progressive Fish Culturist 32, no. 2 (April, 1970).

California Conservationist. “News Notes and News.” The Progressive Fish Culturist I-131, no. 18. Washington, D. C.: Bureau of Fisheries, (May 1936): 14.

Cleaver, Fred. “Recent Advances in Artificial Culture of Salmon and Steelhead Trout of the Columbia River,” Fishery. Leaflet 623. Washington, D.C: U.S Fish and Wildlife Service, March 1969.

Coche, A.G. Simple Methods for Aquaculture—Pond Construction for Freshwater Fish Culture: Pond-farm structures and layouts 20/2. Rome: Food and Agriculture Organization of the United States, 1992

Columbia River Inter-Tribal Fish Commission, The Mitchell Act: An Analysis. Portland, 1981.

Department of Fisheries and Wildlife. “About Us,” Oregon State University, College of Agricultural Sciences. Accessed January, 2018, oregonstate.edu/fisheries-and-wildlife.

Dinsmore, A. H. “Concrete Ponds Versus Dirt Ponds: A Symposium of Opinion.” The Progressive Fish Culturist, no 22 (Sept, 1936).

Dompier, Douglas. The Fight of the Salmon People: Blending Tribal Tradition with Modern Science to Save Sacred Fish. 2005.

Eugene Morning Register, “Clanton Tell of Plans for New Fish Hatchery,” Jan 30, 1920. Retrieved at newspapers.com

Eugene Register Guard, “New Buildings for Hatchery Finished”, Aug 8, 1934. Retrieved at newspapers.com

Fiedler, R.H. and V.J. Samson. “Survey of Fish Hatchery Foods and Feeding Practices.” Transactions of the American Fisheries Society. Washington, D. C.: American Fisheries Society, 1935.

Finley, Mary. “The Tragedy of Enclosure: Fish, Fisheries Science, and U.S. Foreign Policy, 1920-1960” (PhD. Dissertation: University of California, San Diego, 2007).

Fish, Frederic Fish, “The Microscope in the Hatchery.” The Progressive Fish Culturist I-131, no. 3. Washington, D. C.: Bureau of Fisheries, February 1935.

Fish, Frederick F. “Founders of Fish Culture European Origins.” The Progressive Fish Culturist I-131, No. 16. Washington, D.C.: Bureau of Fisheries, U.S. Department of Commerce, March 1936.

Funigiello, Philip. Toward a National Power Policy: The New Deal and the Electric Industry, 1933-1941. Pittsburgh: University of Pittsburg Press, 1973.

Gordon, David and Shepard Krech, Editors. Indigenous Knowledge and the Environment in Africa and North America. Athens: Ohio University Press, 2012.

Harmes, Paula. “Puyallup Fish Hatchery.” National Register of Historic Places Registration Form (January, 2013). Retrieved December 17, 2017 from Washington Information System for Architectural and Archaeological Records Data, https://fortress.wa.gov/dahp/wisaardp3/.

Higgins, Elmer. “Prospectus,” The Progressive Fish Culturist I-131, no. 1 (Washington, D. C.: Bureau of Fisheries, December, 1935.

Huet, Marcel. Textbook of Fish Culture: Breeding and Cultivation of Fish. Surrey, England: Fishing News, Ltd., 1972.

Kinsey, Darin. “’Seeding the Water as the Earth’: The Epicenter and Peripheries of a Wester Aquaculture Revolution.” Environmental History 11 (July 2006): 527-566.

Lancefield, D.E. “Feeding of Raw vs. Cooked Beef Liver.” Transactions of the American Fisheries Society, Vol. XLIV, No. 2. New York: American Fisheries Society, 1915.

Leitritz, Earl. Trout and Salmon Culture: Hatchery Methods (Fish Bulletin No. 107). California: State of California, Department of Fish and Game, June 1959.

Lewis, W. A. “Question Department,” The Progressive Fish Culturist I-131, no. 16. Washington, D. C.: Bureau of Fisheries (March 1936).

Lipin, Lawrence M. Workers and the Wild: Conservation, Consumerism, and Labor in Oregon, 1910-30. Urbana and Chicago: University of Illinois Press, 2007.

Maitland, James G. “The Culture of Salmonidae and the Acclimatization of Freshwater Fish.” The Fisheries Exhibition Literature, Vol 6, International Fisheries Exhibition, London, 1883. London: William Clowes and Sons, 1884.

McFarland, Raymond. A History of the New England Fisheries. New York: University of Pennsylvania, 1911.

Montgomery, David R. King of Fish: The Thousand-Year Run of Salmon. Boulder: Westview Press, 2003.

Moore, Emile. “Seth Green—A Historical Note on a Pioneer in Fish Culture.” The Progressive Fish Culturist I-131, no. 18. Washington, D. C.: Bureau of Fisheries, May 1936.

Nordquiest, Oscar. “Some Notes About American Fish-Culture,” Bulletin. Washington, D.C.: U.S. Fish Commission. 1936.

Norris, Thaddeus. American Fish-Culture: Embracing all the Details of Artificial Breeding and Rearing of Trout: The Culture of Salmon, Shad and Other Fishes. Philadelphia: Coates, 1868.

Olmert, Michael. Kitchens, Smokehouses, and Privies. Ithaca: Cornell, 2009.

Oregon Department of Fish and Wildlife, “Rock Creek Hatchery, Program Management Plan, 2017,” http://www.dfw.state.or.us.

Oregon Department of Fish and Wildlife, “Wallowa Hatchery, Program Management Plan, 2018,” http://www.dfw.state.or.us.

Oregon Department of Fish and Wildlife, “Willamette Hatchery,” The ODFW Visitor’s Guide, retrieved May 19, 2017, http://www.dfw.state.or.us

Oregon Department of Fish and Wildlife. “Oregon Department of Fish and Wildlife

History, 1792 – 2011," (Last modified June, 2015), accessed December 9, 2016, http://www.dfw.state.or.us/agency/history.asp.

Oregon Fish and Wildlife Department, "Cedar Creek Hatchery, Program Management Plan, 2018," http://www.dfw.state.or.us.

Oregon Fish and Wildlife Department, "Trask Creek Hatchery, Program Management Plan, 2018," http://www.dfw.state.or.us.

Oregon Secretary of State. "Oregon and the Roaring Twenties." Retrieved January, 2018, http://sos.oregon.gov/archives/exhibits/ww1/Pages/oregon-roaring-twenties.aspx.

Parker, Nick C. "Technological Innovations in Aquaculture," Fisheries 9, No. 4 (1984).

Phillips, Sarah T. This Land, This Nation: Conservation, Rural America, and the New Deal. Cambridge: Cambridge University Press, 2007.

Powell, Miles Powell. Vanishing America, 2016

Quinn, Thomas. The Behavior and Ecology of Pacific Salmon and Trout. Seattle: University of Washington Press, 2005).

Reiger, John F. American Sportsmen and the Origins of Conservation, 3rd, Revised and Expanded, Edition. Corvallis: Oregon State University Press, 2001.

Roppel, Patricia. Alaska's Salmon Hatcheries: 1891-1959. Portland, OR: National Marine Fisheries Service, 1982.

Savage, James Savage. "Report on the Effect of Gravel in Raceways." Transactions of the American Fisheries Society. New York: American Fisheries Society, 1937.

Spurlock, Clark. "A History of Salmon Industry in the Pacific Northwest" (master's thesis, University of Oregon). 1940.

Stickney, Robert. "History and Purpose of Fish Culture." Fish Hatchery Management, 2nd ed. Gary Wedemeyer, editor. Bethesda: American Fisheries Society, 2011.

Surber, Eugene W. "Circular Rearing Pools for Trout and Bass." The Progressive Fish Culturist I-131, no. 21. Washington, D.C.: Bureau of Fisheries, (August 1936).

Wahle, Roy and R.Z. Smith. "A Historical and Descriptive Account of Pacific Coast Anadromous Salmonid Rearing Facilities and a Summary of Their Releases by Region, 1960-76." NOAA Technical Report 736. Washington, D.C.: U.S.

Government Printing Office, September 1979.

Wasch, Diane, et. Al. World War II and The U.S. Army Mobilization Program: A History of 700 and 800 Series Cantonment Construction. Aelene Kriv, Ed. Washington, D.C.: National Park Service; HABS/HAER, n.d.

Washington Department of Fisheries and ODFW, Columbia River Subbasin: Salmon and Steelhead Production Plan. Northwest Power Planning Council and Columbia Basin Fish and Wildlife Authority. September 1989.

Wheaton, Fredrick W. Aquacultural Engineering. New York: Wiley and Sons, 1977.

White, Richard. The Organic Machine: The Remaking of the Columbia River. New York: Hill and Wang, 1995.

Wire, Frank. “A Brief History of the Oregon State Game Commission, Oregon Department of Fish and Wildlife”. 1938. accessed at www.dfw.state.or.us

Oregon State Archives, Salem, OR

Fish and Wildlife, Department of. Minutes, 1901 – 1977, 4, Mar 1901 – 3 Oct 1905, Vol 1. (RG: F2A-19), Box 1.

Fish and Wildlife, Department of. Hatchery Correspondence, 1913-1915, Box 4-6.

Oregon, State of. Biennial Report of the Department of Fisheries, (Salem: State Printer, 1913).