2006

Salmon oysters and the spotted owl: Environment and economy in coastal Washington 1985-2006

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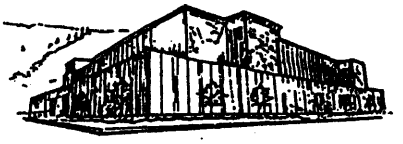

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SALMON, OYSTERS, AND THE SPOTTED OWL:

ENVIRONMENT AND ECONOMY IN COASTAL WASHINGTON, 1985 – 2006

by

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M. Ed. University of Washington, Bothell, 2003

B.A. Washington State University, 1998

Presented in partial fulfillment of the requirements

for the degree of

Master of Arts

The University of Montana

May 2006

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5-26-06

Date

ProQuest LLC.
789 East Eisenhower Parkway
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Bauer, Robert A. M.A. May 2006 History

Salmon, Oysters, and the Spotted Owl: Environment and Economy in Coastal Washington, 1985 – 2006

Chairperson: Dan Flores 

The economy of the Pacific coast region of Washington state, including Grays Harbor and Pacific counties, has traditionally been based on natural resource extraction. These industries include primarily timber, milling, and logging, but also fishing and oyster farming, among others. In the past two decades, environmental challenges have impacted each of these industries in various ways. Each is dealing with difficult issues that affect their long-term success in coastal Washington, as well as the long-term health of the natural environment.

For the timber industry, the primary challenge was the legislation to protect the Northern Spotted Owl under the Endangered Species Act. The year 1989 saw the first limits on timber sales under this Act, and the next few years witnessed a fierce battle between industry and environmentalists over the fate of the spotted owl and local economy. For the oyster farmers in the region, the problem was somewhat different. Ghost shrimp and an invasive species called spartina, or cordgrass, hurt their operations, and their response of using pesticides to deal with the ghost shrimp brought them under fire from environmentalists. Finally, like many areas in the Pacific Northwest, salmon and fishing traditionally were important to the local economy. Trying to save the spawning runs of salmon and other fish comprises the third instance of how the local economy interacts with the local environment.

Though each of these stories has its own complex workings, the three connect in many ways as well. Events in one area often link to the others. Often, these links are forces as elementary as slope and gravity. At other times, they connect closely with human developments, as in the case of the role of technology in each industry. In the end, this thesis is about how recent events in each industry led it to its current situation, and how each industry's response to those recent events affects the economic and environmental future of coastal Washington.

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Introduction

Environment and Economy in Coastal Washington

As a young man, I had the opportunity to spend some time fishing the rivers of Grays Harbor and Pacific counties. Motoring along, my father and I would spend a good part of a weekend day fishing for salmon in a river like the Willapa. Looking back on this experience now, I can see all the elements of my fishing experiences play out in this narrative about the economy and environment of these two counties in coastal Washington. Although I caught a few nice fish, as often as not, I went home empty-handed. Despite being a teenager at the time, and being partially oblivious to my surroundings in the way that teenagers are, nonetheless I managed to take in a few pieces of information.

Even I could tell that there just were not as many fish as their used to be. I had seen the pictures of my father and grandfather proudly holding up a rope with six or eight beautiful salmon hanging from it. Yet, just fifteen years later, my father and I were lucky to catch one or two. Clearly, part of that was due to a lack of talent and fishing experience on my part, but equally clearly, the populations of the salmon had declined. As I considered why, the most obvious answer seemed that people had caught too many fish, so that the salmon could not reproduce sufficiently to match their previous numbers. Although that conclusion was not wrong, there was much, much more to the story than that. Had I been more aware at the time, I might have noticed the signs all around me pointing to other clues for the decline of the salmon.

To be fair to myself, I noticed all the wooden pilings still standing in the rivers, and was even aware of their connection to the timber industry of bygone days. However, I must admit that at the time, I was light-years away from making any kind of connection between logging and salmon. Yet I knew that both existed side by side. When driving into Aberdeen heading west on Highway 8, the first thing one notices is the Weyerhauser mill on the opposite side of the Chehalis River. Despite the legislation to protect the habitat of the

Northern spotted owl and its impact on the local timber economy, there was always something happening in the mill's lumberyard. Continuing through town and south on Highway 105 toward the Pacific County line, one passed through Bay City, where one store advertised itself as the home of the world's largest salmon.

When I took a job as a high school math teacher at Aberdeen's Weatherwax High School for the 2003-04 school year, and lived in the area for a full year, I gradually became aware of the extent to which the local economy related to the local environment. After doing some reading in environmental history (who said that all math teachers have to think in a linear manner?), the connections I had missed completely a decade earlier started to emerge. I knew that the laws to protect the spotted owl had hurt the local economy in a big way in the early 1990s, yet looking around, there were new stores like WalMart and Staples where there had been nothing back in 1990. Granted, in a way I regretted the transition to a strip mall scene that I had moved to Aberdeen largely to escape from in the first place, but clearly, the presence of these national chain stores had meaning. They would not be in Aberdeen in the first place unless they thought the local economy was strong enough for them to make money.

This experience led me to think that the story of spotted owls and timber companies in Grays Harbor might be more complex than it seemed on the surface. As I researched this idea, in the course of my reading I found that other issues in coastal Washington, like watershed health and pesticide use in oyster farming, connected with the economy in ways that I had never fully considered. In large part, that is the focus of this narrative. By attempting to unravel some of the complexities of this relationship, my goal is to contribute to finding solutions to environmental and economic problems, both by presenting a careful

analysis of what has happened in recent decades and by clearing away some of the misconceptions that surround events like the protection of the spotted owl.

One of the difficult yet exciting aspects of conducting this research was dealing with the secondary literature about coastal Washington. To be blunt, there are few books specifically dedicated to the type of questions I have addressed. I believe that is partly because I have chosen to research events of the very recent past. In addition, though, I also believe this is because areas without large cities or significant populations like coastal Washington rarely appear in the news unless something dramatic takes place there. Flooding on the Chehalis River merits at least regional news coverage, but stream sedimentation and hillside erosion does not. How many Americans even know where Willapa Bay is, much less that oyster farmers there harvests up to a quarter of the nation's oysters each year? Do oyster lovers really care if they consume oysters grown with or without the help of pesticides? One point that this research underscores is that society should care about what happens to the oyster farmers of Pacific County. The oyster industry faces two crucial challenges, and its response is instructive for other areas facing similar challenges. First, can a traditional economic activity like harvesting oysters survive without the use of chemical pesticides that can harm the surrounding landscape and the species that live in it? In addition, can the industry overcome the challenge posed by an invasive plant species that is in the process of crowding out flora native to coastal Washington? Seen from this angle, the fate of the oyster growers matters greatly, because so many areas in the United States and the world are facing similar problems.

Despite the relative paucity of secondary material on the environment or economy of coastal Washington, some important works have informed and contributed to this narrative. For a history of the Endangered Species Act of 1973 (ESA), Shannon Petersen's book *Acting*

for Endangered Species: The Statutory Ark contains an exemplary description of how and why the Endangered Species Act became law. It also traces how some of the law's future implications, unforeseen at the time, have stirred great controversy over the ESA. The case of the Northern spotted owl in Grays Harbor is one of the most celebrated of these controversial events. One of the key works that describes what happened in Grays Harbor is William Dietrich's *The Final Forest.* This book not only captures what happened over the course of the spotted owl controversy, but how it impacted various groups and their reactions.

Hard Times in Paradise: Coos Bay, Oregon, 1850-1986, by William Robbins, is a useful resource as well for understanding the timber history of the Pacific Coast. While Robbins focuses on a location in Oregon, rather than Washington, and writes about a much greater historical time frame, his work is instructive because the same forces are at work in both locations. Workers in both coastal Oregon and coastal Washington have lost jobs to increased technology and mechanization, and this fact is key to understanding what took place in Grays Harbor in the late 1980s and early 1990s.

In researching the history and present status of Willapa Bay's oyster industry, a series of locally published books entitled *They Remembered* provide valuable background information. These collections of local histories are full of local knowledge of the area's participation in the oyster industry. Book IV provides the background for some of the history of oystering presented here, and contains the tragic story of the Murakami family in Willapa Bay. Though not cited specifically here, Book I also contributed background information to the narrative.

Due to its importance as a regional symbol, salmon in Washington and Oregon have attracted much more secondary research than oysters. Most of these books, however, focus

on the Columbia and Snake rivers, not the smaller rivers of Grays Harbor and Pacific counties. For good reason, the incredible spawning runs these rivers hosted historically, and their decline, is truly a remarkable story with many important lessons about resource management and the attempt to engineer nature. However, as chapter three points out, most of the problems salmon face on the Columbia and Snake are also present in coastal Washington, although on a smaller scale. This serves to increase the relevance of the commentary from these sources when it comes to salmon in coastal Washington.

Among the most valuable of these secondary sources is Joseph Taylor's *Making Salmon: An Environmental History of the Northwest Fisheries Crisis.* This exceptional book describes the attempts to engineer salmon in the Pacific Northwest. Taylor convincingly contends that saving the salmon runs through technological innovation is the favored response of most groups involved in the attempt to save the salmon, because with this approach, there is no need for limits or restraint, and no one need take responsibility for the decline, because technology will save the day. Yet the inescapable conclusion is that salmon runs continue to decline while the search for a scapegoat rages on. Efforts to polarize the salmon's decline into a question of black or white, right or wrong, has also hurt recovery efforts because the problem is much too complex, and far too many constituencies are involved, for any simple solution save the fish.

Another of the central works on salmon and rivers in Richard White's *The Organic Machine.* While focusing on the Columbia River as a source of energy over the past 200 years, White's book contains a critical insight as to why salmon runs continue to decline. He points out that rivers that once featured conditions favorable for the salmon no longer do, and that society spends millions of dollars yearly to try and save the fish, while at the same time spending hundreds of millions to support a system which kills them.

The construction of this system that kills salmon is the topic of Keith Petersen's 1995 book, *River of Life, Channel of Death: Fish and Dams on the Lower Snake.* Among the many relevant insights Petersen offers is the way in which dams hurt salmon populations. Whether passing through the dam turbines, dropping over spillways, or bursting from nitrogen supersaturation, young salmon incur a catastrophic casualty rate while passing dams heading downstream to the ocean. Petersen, like Taylor, also describes the many contradictory political forces that shape salmon recovery efforts.

This scholarship provides a place to start, but none of it attempts to work on the regional level of this narrative. The regional focus recognizes that Grays Harbor and Pacific counties share many characteristics that other areas of Washington do not share. Both counties experience significant rainfall and feature moderate temperatures. Both are primarily comprised of forested hills, broken by hundreds of rivers and creeks. They share historic economic strategies such as timber harvesting, fishing, and oyster growing. These facts differentiate them as a region from other areas of Washington. Someone in central Washington, living in Wenatchee, for example, can still catch a salmon from the Columbia, just like people living in southern Pacific County can. However, little else is similar about these two places. Central Washington features much less rainfall and much more extreme temperatures. Historically, there was much less forest cover than in coastal Washington, and traditional economic activities include growing fruit and harvesting wheat.

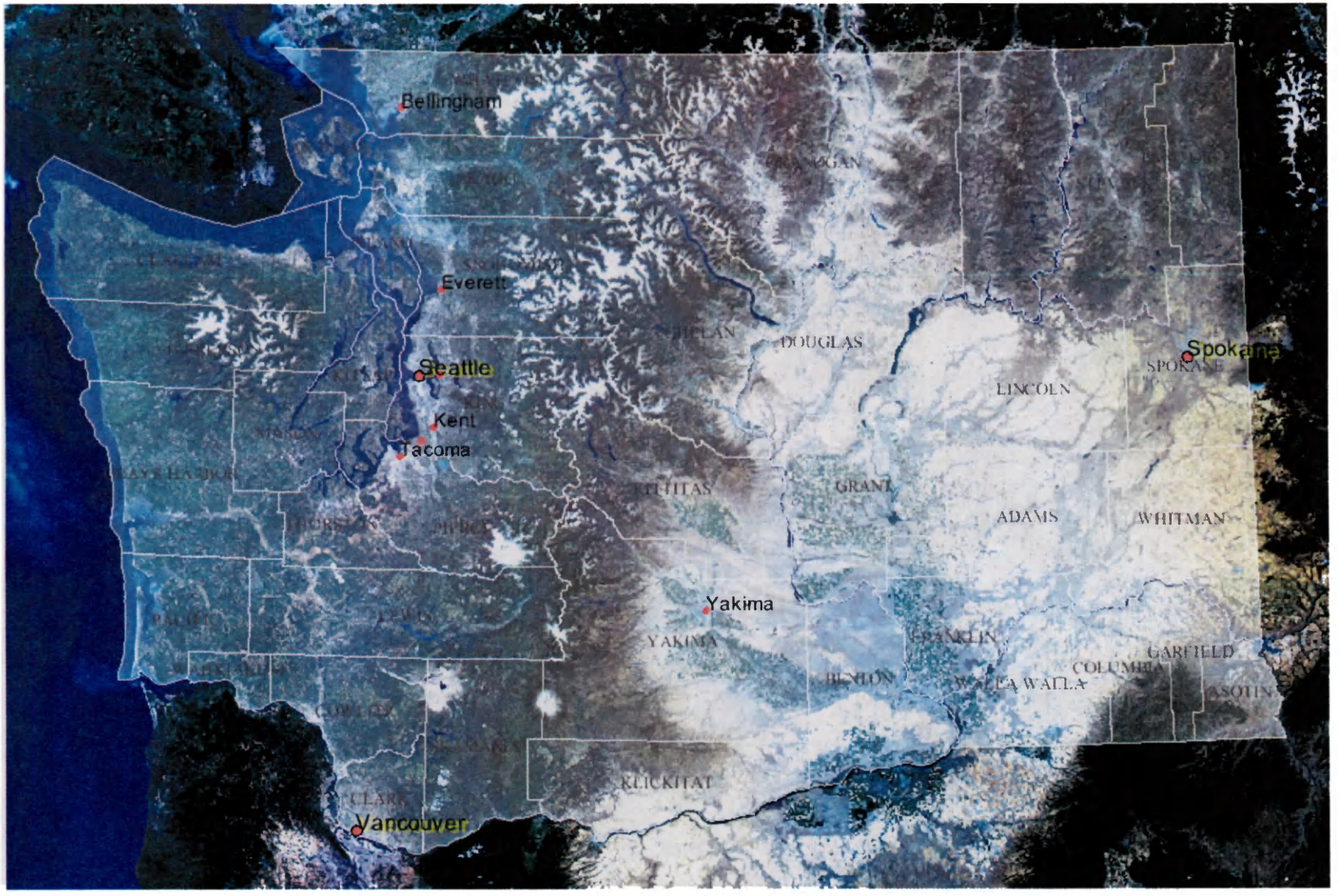
While this approach may appear constraining to some, in reality it provides great flexibility. It allows an examination of the specific local conditions leading to important events in a way that a general economic or environmental history does not. Yet, because local events are similar to those happening elsewhere in the Untied States and the world, understanding how the region has offered protection to an endangered species like the

spotted owl while simultaneously fighting an invasive species like cordgrass offers an instructive example to the larger society. It is my sincere hope that this research contributes something meaningful that does increase our knowledge about connecting the environment and the economy of the region of coastal Washington with the larger debate taking place nationally and internationally.

Chapter One

Making the Cut?

A Case Study of the Economy of Grays Harbor County, Washington a Decade After the Spotted Owl Crisis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CLALLAM
DOUGLAS
LINCOLN
SPOKANE
GRANT
ADAMS
WHITMAN
YAKIMA
FRANKLIN
GARFIELD
COLUMBIA
BENTON
KLICKITAT
CLARK

Map 1[1] (Previous Page) Washington, County Map.

Map 2 (Below) Close Up Map of Grays Harbor County

[1] Map created with the Washington State Department of Fish and Wildlife's Salmonscape interactive mapping program. This program is accessible online at wdfw.wa.gov/mapping/salmonscape/index.html.

How it All Began

On a summer evening in 1968, a young biologist named Eric Forsman sat down on the porch of an isolated ranger station in Oregon's Willamette National Forest. The station, located on the edge of a clearing in Box Canyon, sat amongst a stand of old growth timber. Forsman, a wildlife biology student at Oregon State University, had landed a job with the Forest Service for the summer, watching for forest fires. However, on this particular evening, he found something that, in the long run, proved to have a much greater impact on the Pacific Northwest than any forest fire.[2]

He heard a sound among the trees that initially sounded like a barking dog. Quickly dismissing the idea because of his remote location, he listened again. Soon, Forsman realized that he was hearing the call of a spotted owl. He decided to imitate the call and, to his astonishment, a spotted owl flew down into the clearing and commenced examining Forsman. Looking back now, it is evident that this chance encounter is one of the amazing coincidences that make history so delightfully unpredictable. The spotted owl, a bird so reclusive that only about 25 sightings had been made throughout the entire Pacific Northwest as of 1968, had flown right into the front yard of a wildlife biologist with the education to know exactly what he had seen and exactly what it meant. Over the course of the summer, Forsman had several other opportunities to observe this rare creature and begin to study its virtually unknown habits.[3]

Fast-forward to April 29, 1990. At high noon on a Saturday, 1500 residents of Grays Harbor County, Washington (more than two percent of the county's roughly 65,000

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[2] William Dietrich, The Final Forest. (New York: Simon & Schuster, 1992): 47.
[3] Ibid., 48.

residents),[4] blockaded U.S. Highway 101 where it crosses the Hoquiam River in the lumber town of Hoquiam. Citizens of The Harbor (as locals call it) came out in force to protest the recent release of a proposal to limit timber harvests in order to protect the northern spotted owl. At the rally, yellow ribbons showing solidarity were ubiquitous; some people were seen sporting t-shirts that read "I Love Spotted Owls – Boiled, Barbequed, Fricasseed, Stir Fried." In Hoquiam (a Quinalt Indian name meaning, appropriately, "hungry for wood")[5] many houses displayed bright yellow signs reading "This Family Supported By Timber Dollars", and local leaders wanted to make their side heard in this debate between the timber industry and Washington environmentalists. Their fear was that greater protection for the spotted owl meant less protection for the jobs of working class people in Grays Harbor.

Jim Carlson, owner of a timber-related business in Neilton, in northern Grays Harbor County, took up a bullhorn and denounced the hypocrisy of urban environmentalists, stating "They paved their's (land) over, and we replanted ours."[6] He goes on to announce, "We don't want an economic aid package and counseling, we want our jobs."[7] Joining Carlson was Hoquiam resident Bill Pickell, president of the Washington Contract Loggers Association, who fired up the crowd by shouting, "I don't want my community to be a welfare state. I don't think there's a politician in Washington or Olympia who can carry a logger's lunch bucket."[8] While no environmentally minded congressional representatives found themselves hanged in effigy, the crowd vociferously denounced those

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[4] Grays Harbor Economic Development Council, Grays Harbor County Demographic Profile. (Aberdeen, WA, March 2005): 11.
[5] Brad Knickerbocker, "Headline: Gray's Harbor." Christian Science Monitor. March 10, 1993: 10.
[6] Quoted in Don Duncan, "Families First...and Owls Last." The Seattle Times. April 29, 1990: A1.
[7] Quoted in Ibid.
[8] Quoted in Ibid.

representatives supporting the environmentalists as the archenemy of the working class in Grays Harbor.[9]

Fast-forward once more to the year 2005. The most heated drama over saving the spotted owl is now ten or twelve years in the past. As time has passed and passions cooled, two related questions continue to loom large about the economy of Grays Harbor. How great an impact did legislation to save the spotted owl really have on the economy of Grays Harbor County, and how have communities there responded to the economic challenges in the subsequent years? To find the answers, it is necessary to revisit the factors leading to the convergence of owls and environmentalists as the enemies of Washington's timber industry in the late 1980s and early 1990s.

Creating the Endangered Species Act

How did the timber industry and spotted owls come into conflict in the first place? The roots of the answer lie in the way the Endangered Species Act (ESA) of 1973 evolved over the course of the 1970s and 1980s. Congress passed the ESA in 1973 in response to growing awareness of the number of species in the United States facing extinction. In 1967, the Fish and Wildlife Service (FWS) listed 78 species as endangered. This list would grow to more than 800 species by 1971 and include several large, charismatic animals such as eagles and condors. By the early 1970s, scientists and researches had helped draw attention to the plight of endangered plant species as well, and plants gained listing on the FWS reports in 1971.[10] In 1969, James Martin wrote a book entitled *Wildlife in Danger,* in which he argued

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[9] Ibid.

[10] Shannon Petersen, Acting For Endangered Species: The Statutory Ark. (Lawrence, KS: University of Kansas Press, 2002): 24-6.

that since 1600, one of every 100 mammals and birds had become extinct, while extinction threatened almost half of the remainder.[11] The increased level of public awareness, combined with a measure of genuine concern for protecting endangered plants and animals, led the 93rd Congress to create the Endangered Species Act.

When the original bill creating the Endangered Species Act went before Congress in 1973, it received nearly unanimous support. In fact, the Senate did have a unanimous vote on July 24, 92 to 0, and when the House of Representatives voted on its version of the bill on September 18, it voted 390 to 12 in favor of the ESA. President Richard Nixon supported the legislation as well, and signed the ESA into law December 28, 1973.[12] Some congressional representatives who voted for the bill, however, did so intending to provide protection for large, charismatic American animals, such as bald eagles or grizzly bears. These representatives did not immediately recognize that the ESA applied not only to all animals, but to plants as well.[13] This misunderstanding, combined with the great success of environmental groups in using the provisions of the ESA in legal challenges, led to a great deal of controversy later on; the spotted owl became one of the most celebrated of these cases.

Three sections of the ESA became the most important over time. Section 4 pertains to the listing of species as either threatened or endangered. This listing relies on the best available scientific evidence, *without regard to economic considerations.* Section 7 has the potential to limit development projects that could impact endangered or threatened species in an adverse way. It forces federal agencies to consult with the Fish and Wildlife Service and the National Marine Fisheries Service (NMFS) before taking any action with potential to affect

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[11] James Fisher, et al, Wildlife in Danger. (New York: Viking Press, 1969): 11, 13.
[12] Petersen, Acting for Endangered Species, 29-30.
[13] Ibid., 33-34.

listed species. Endangered and threatened species also receive strong protection from Section 9. This section of the ESA prohibits anyone from attempting "to harass, harm, pursue, hunt, shoot, wound, trap, kill, capture, or collect, or to attempt to engage in any such conduct."[14] These three sections, taken together with the other sections of the ESA, comprise one of the strictest and most successful pieces of environmental legislation in human history.[15]

Where Loggers and Owls Collide

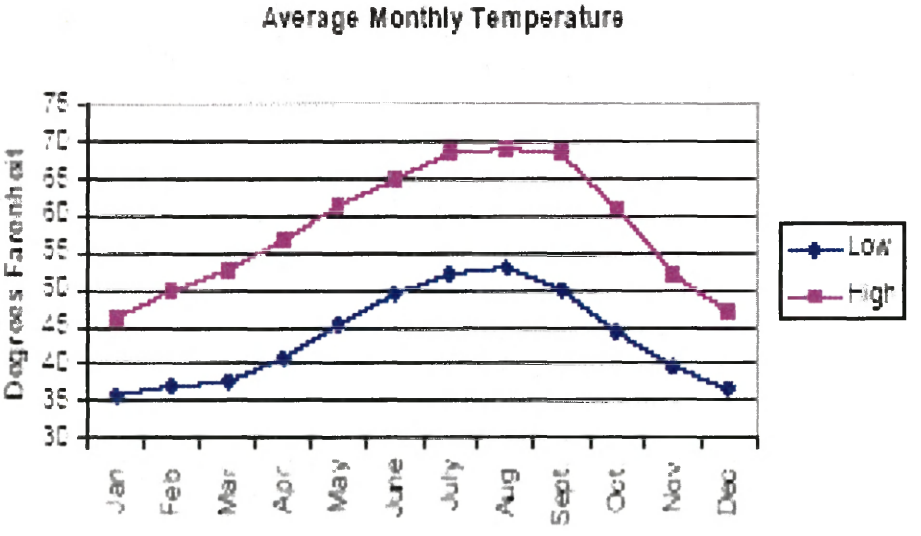
The northern spotted owl's favored habitat is old growth forests (See Map 3 for the current range of all three types of spotted owl). The southwestern coast of Washington state

Map 3 Range of the Spotted Owl

[14] Endangered Species Act of 1973, 16 U.S.C. 1532(19).
[15] Petersen, Acting For Endangered Species. ix-x.

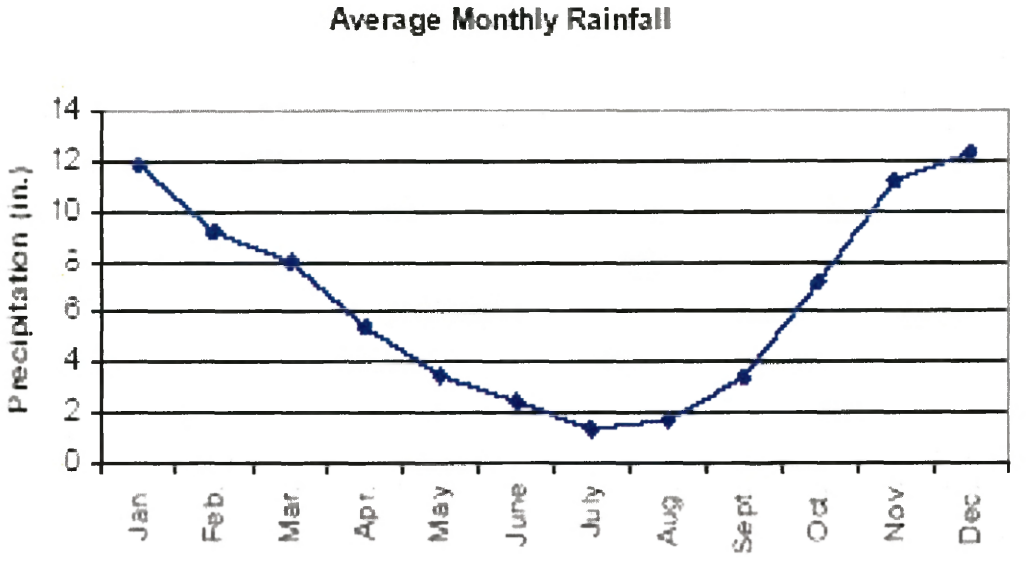
is ideally suited for the rapid growth of trees, and renewable forests constitute approximately 88% of the land area.[16] Temperatures are quite moderate; the average monthly low temperature is above freezing in all months of the year (a low of 35 degrees Fahrenheit in January) and the average monthly high very close to 70 degrees Fahrenheit in July, August, and September. Rainfall is plentiful; all sections of Grays Harbor County receive an average of at least 57 inches of rainfall annually, the western third of the county over 80 inches.[17] Figures 1 and 2 demonstrate this mild climate and abundant rainfall on a month-by-month basis.

Figure 1[18] Average Monthly Temperature in Grays Harbor County



[16] Columbia-Pacific Resource Conservation & Economic Development District, Comprehensive Economic Development Strategy for Columbia-Pacific Resource Conservation & Economic Development District. (Montesano, WA, June 2004): 50.
[17] Grays Harbor County Demographic Profile, 31.
[18] Ibid.

Figure 2[19] Average Monthly Rainfall in Grays Harbor County



Simply put, Grays Harbor County is ideal for growing trees, and some of the old growth timber grows to a prodigious size. One logger tells of cutting down an old growth spruce with a diameter of ten feet. That tree alone produced seven truckloads of logs.[20]

Because of this ideal climate, it is not surprising that the timber industry places such high value on old growth timber harvesting in Washington. Older and taller trees have a larger volume of wood, and a greater volume of wood increases the value of the tree. How many trees did the timber industry cut prior to 1990? In 1968, when Eric Forsman first imitated the spotted owl call from his porch in Box Canyon, private industry cut 5.1 billion board feet of timber in Washington and Oregon. By 1987, just as the spotted owl controversy started its rise to regional and national prominence, the total cut in the two states had increased to 5.6 billion board-feet, most of that being old growth. Between 1968

[19] Ibid.
[20] Sylvia Wieland Nogaki, "Grays Harbor – A County In Limbo." The Seattle Times, August 26, 1990: A1.

and the listing of the spotted owl as an endangered species (effective July 23, 1990)[21] more than one million acres of old growth forest had been cut.[22] The Port of Grays Harbor became the number one exporter of timber in the entire world as a result of the prodigious volume of timber being cut and milled.[23]

Unfortunately for the timber industry, the northern spotted owl also favors old growth forest. However, old growth habitat is important to more than just spotted owls. The owl also serves as an indicator for the health of old growth ecosystems. The presence of spotted owls indicates that prey favored by the owl is also present. This includes rats, several species of mice, small bats, moths, crickets, and large beetles, but the primary prey of northern spotted owls in the Douglas fir forests of Washington's Olympic Peninsula is the northern flying squirrel. The flying squirrel is an important species because it helps to distribute fungal spores that are important to overall forest health. When northern flying squirrel populations are densest, the spotted owl is likely present as well. The amount of habitat needed by the northern spotted owl decreases as the density of the flying squirrel population increases.[24] Old growth forest is superior to second growth forests in terms of support for a greater abundance of animals and greater species diversity. Even if the old growth can only be maintained as a corridor connecting otherwise separated areas, this aids in species diversification and dispersion, and prevents inbreeding among local populations. These corridors are most effective when a riparian element is present.[25]

This is the history leading up to the showdown between the timber industry and the environmentalists acting on behalf of the spotted owl in the late 1980s and early 1990s. The

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[21] Petersen, Acting for Endangered Species, 94.
[22] Dietrich, The Final Forest, 74.
[23] William Miller, "Aberdeen; Reality-Check Time." Industry Week, April 1, 1985: 40.
[24] Andrew Carey, "Sciurids in Pacific Northwest Managed and Old-Growth Forests." Ecological Adaptations, Vol. 5, No. 3 (Aug. 1995): 648, 59.
[25] David Perault and Mark Lomolino, "Corridors and Mammal Community Structure Across a Fragmented, Old Growth Forest Landscape." Ecological Monographs. Vol. 70, No. 3 (Aug 2000): 402.

climate of Grays Harbor, seemingly designed by nature for the rapid growth of stands of huge trees, provided the ideal environment for the timber industry to prosper. It also provided the ideal environment for the northern spotted owl and other species that favor old growth forest habitat. As the plight of the spotted owl (or the timber industry, depending on the individual's point of view) received increasing attention in the late 1980s, the battle over the owl's future changed from a regional to a national political issue.

The Thomas Report, Political Backlash, and the Spotted Owl Recovery Plan

The battle between environmentalists and the timber industry over the future of the spotted owl quickly became bitterly divisive. Environmentalists, backed by the authority of the ESA, argued for preservation of as much old growth habitat as possible, whatever the economic cost. The timber industry, on the other hand, presented their side of the argument in terms of the human cost that owl preservation would have on families. The loss of jobs, and with them the loss of a way of life for many families dependent on the timber industry, formed the bedrock of the timber industry's argument. As the sparks flew and tensions multiplied, the facts often took a back seat to politics and impassioned rhetoric.

In 1989, when the inevitability of the spotted owl being listed as an endangered species became apparent to federal officials, it became necessary to craft a plan to save it. Accordingly, a commission assembled under the auspices of the United States Forest Service for this purpose. Named the Interagency Spotted Owl Committee, and led by Jack Ward Thomas, the Forest Service chief research wildlife biologist, its task was to sift through the growing mass of reports on the spotted owl and determine the amount of habitat the owl

actually required for survival. The Committee finished its final report, known as the Thomas Report, in April of 1990.[26]

The Thomas Report hit the logging industry with the force of an old growth Douglas fir crashing to the hillside. Though the authors of the report endorsed it as a compromise between the timber industry and the environmentalists, the conclusions hit the timber companies like a slap in the face. The 427 page Thomas Report recommended that an astounding 7.7 million acres be set aside for spotted owl habitat. Of the 7.7 million acres, 3.1 million acres comprised land already designated for timber harvests, the rest being land too steep or remote for logging or already included in national parks or wilderness areas.[27]

A political backlash from the administration of George H.W. Bush followed swiftly. Secretary of the Interior Manuel Lujan, and various members of the Congressional delegation from Pacific Northwest states, combined their efforts in an attempt to cast doubt on the necessity of saving the spotted owl and on the science employed by the Thomas Report.[28] However, the government scientists charged by the Bush administration with reviewing the report found practically nothing that they could contest; they found the research rock solid. The reason these initial efforts failed utterly is mainly due to the impressive scholarship of the Thomas Report. Stated in language designed for a high school level audience, yet containing such detailed arguments and thorough scholarship that the science was unquestionable, the Thomas Report stood out as a model of environmental research. In addition, the Report's proposed solution did attempt to compromise between the needs of the spotted owl and the needs of the timber industry. It stated that even with 7.7 million acres of old growth forest set aside for the spotted owl, the population of the

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[26] Petersen, Acting for Endangered Species, 91.
[27] Dietrich, The Final Forest, 224.
[28] Petersen, Acting for Endangered Species, 91-92.

species would still drop 40 to 50 percent (of an estimated population of 3,000 to 6,000 mating pairs)[29] over the ensuing century before stabilizing.[30]

Despite their devastating setback, the timber interests did not throw in the towel. Claiming that state-wide job losses could total as many as 102,000 jobs, the industry attempted to use Congressional pressure and intervention to reverse the setback of the Thomas Report proposals. In May of 1991, the House of Representatives convened a group of four leading environmental scientists consisting of Jerry Franklin, chief plant ecologist of the Forest Service and also a professor at the University of Washington, John Gordon, dean of Yale's School of Forestry and Environmental Studies, Jack Ward Thomas, the Forest Service biologist previously introduced, and K. Norman Johnson, an associate professor of forest management from Oregon State University who had recently helped author a similar report for the state of Oregon, to compose an alternative to the Thomas Report. When this report, based in part on the Thomas Report, did not produce a plan satisfactory to the Bush administration, it convened yet another group, this one to be known as the Spotted Owl Recovery Team. And, despite the fact that the members of this Spotted Owl Recovery Team had been hand-picked by Secretary of the Interior Lujan with the support of President Bush, it also issued a report substantially similar to the Thomas Report. The members of the team refused to give in to political pressure or ignore the scientific evidence concerning the spotted owl.[31]

The political battle over the fate of the spotted owl outlasted the presidency of George H.W. Bush. Almost immediately after taking office, new president Bill Clinton convened a timber summit in Portland, Oregon on April 2, 1993. Vice President Al Gore

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[29] Dietrich, The Final Forest, 80.
[30] Ibid., 224.
[31] Petersen, Acting for Endangered Species, 101-103.

and several other cabinet members attended as well. The summit spent eight hours listening to testimony from all sides of the issue, at which time Clinton directed his cabinet to come up with a plan within 60 days. The final proposal consisted of ten options, and the Clinton administration chose option nine. This option preserved about 10 million acres of old growth forest and limited logging on federal lands to around 1 billion board feet per year. In April of 1994, the Clinton administration formally adopted option nine and renamed it the Pacific Northwest Forest Management Plan. The long legal and political battle over the spotted owl appeared over at last.[32]

But not quite. Predictably, the timber industry filed a lawsuit, and incredibly, despite the fact that the Pacific Northwest Forest Management Plan set aside more acreage than any previous plan up to that point, the environmentalists challenged the Plan in court as well. Despite their different goals, both groups claimed that the Pacific Northwest Forest Management Plan did not meet all requirements of various environmental laws. After hearing both sides the presiding justice, Judge William Dwyer, upheld the Clinton administration's plan, and when the Ninth Circuit Court of Appeals upheld Judge Dwyer's ruling, the curtain fell on the legal and political drama over the northern spotted owl.[33]

It's the End of the World as We Know It

To the timber workers, at least, it must have seemed as if the world was ending. Some important mills in Grays Harbor, including the ITT Rayonier Pulp Mill and the Grays Harbor Paper Company Pulp Mill, had already closed their doors by November of 1992, at a

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[32] Ibid., 110-112.
[33] Ibid., 112.

cost of 626 jobs. By March of 1993, unemployment in the county passed fourteen percent.[34] However, though the large timber corporations active in Grays Harbor (including Weyerhauser, with its mill in Cosmopolis) took a significant hit, most had lands and forests in other states they could turn to. Unfortunately, this option did not exist for most people living in Grays Harbor.

Thus, the families living in Grays Harbor took the heaviest blow from the legislation designed to save the spotted owl. Men and women who had spent their entire lives believing their jobs provided an important service to society, a society that depended on wood for housing, furniture, tables, and the like every day, had that belief shattered. Now society seemed to be saying that their livelihood, and the wood products they produced, had less value than a 22-ounce owl that most of them had never even seen. They had become, in the words of historian Caroline Bird, superfluous people, no longer contributing anything of value to society and cast adrift in a sea of uncertainty.[35] Besides the sheer number of jobs lost as mills closed down, other social strains quickly became evident as well. When the ITT Rayonier and Grays Harbor Paper Company mills closed, the city of Hoquiam lost approximately $2 million worth of tax revenue that helped pay for everything from firefighters to swimming pools. Overall, the city generated 25 percent of its municipal income from business taxes on mills.[36] Grays Harbor also witnessed an increase in family violence and chemical abuse, according to a local counseling center, and local food banks, especially in the county's smaller towns, often ran short of food to distribute to the needy.[37]

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[34] Knickerbocker, "Headline: Grays Harbor."
[35] Caroline Bird, The Invisible Scar. (New York: David McKay Company, 1944): 50.
[36] Knickerbocker, "Headline: Grays Harbor."
[37] Wieland Nagoki, "Grays Harbor – A County In Limbo." A1.

"At some point or another, when the last can of beans goes out the door, the next person gets nothing," said Marscha Irving, food bank coordinator in Oakville.[38]

With old growth timber increasingly off-limits, communities in Grays Harbor had few options. Limits existed on the availability of second growth timber. Up until the 1920s and 1930s, cut and run logging was the rule in Washington. Garish, ugly clear-cuts scarred the hillsides. In the middle decades of the twentieth century, the timber industry increasingly turned to replanting after cuts in order to produce a sustained yield of timber. Unfortunately for the timber industry of Grays Harbor, however, second growth timber takes a minimum of 50 years to grow to a size that makes cutting profitable. While this indicates that there is a future in logging in Grays Harbor, in the late 1980s and early 1990s most of this second growth was not yet ready.[39] Families on The Harbor would pay dearly for the past sins of extractive industry. Job retraining also held limited possibilities because, in the words of local economic development council leader Don Clothier, the lack of jobs in other economic sectors meant that "we don't know what to retrain them to be."[40]

The story of the hardships for families brought on by environmental legislation is important, and many others have written eloquently on the topic. However, amidst the pain caused by economic dislocation, mill closures, and high unemployment levels, certain important questions do not get the attention they deserve. What overall affect has environmental legislation to save the northern spotted owl had on the economy of Grays Harbor? Is this legislation primarily to blame for economic troubles, as the timber industry and many in local communities claimed at the time, or did the spotted owl issue merely serve

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[38] Quoted in Ibid.
[39] Ross Anderson, "Standing Tall for Timber – Gorton Puts Politics on the Line for Loggers." The Seattle Times, June 3, 1990: B1.
[40] Quoted in Nagoki, "Grays Harbor – A County in Limbo." A1.

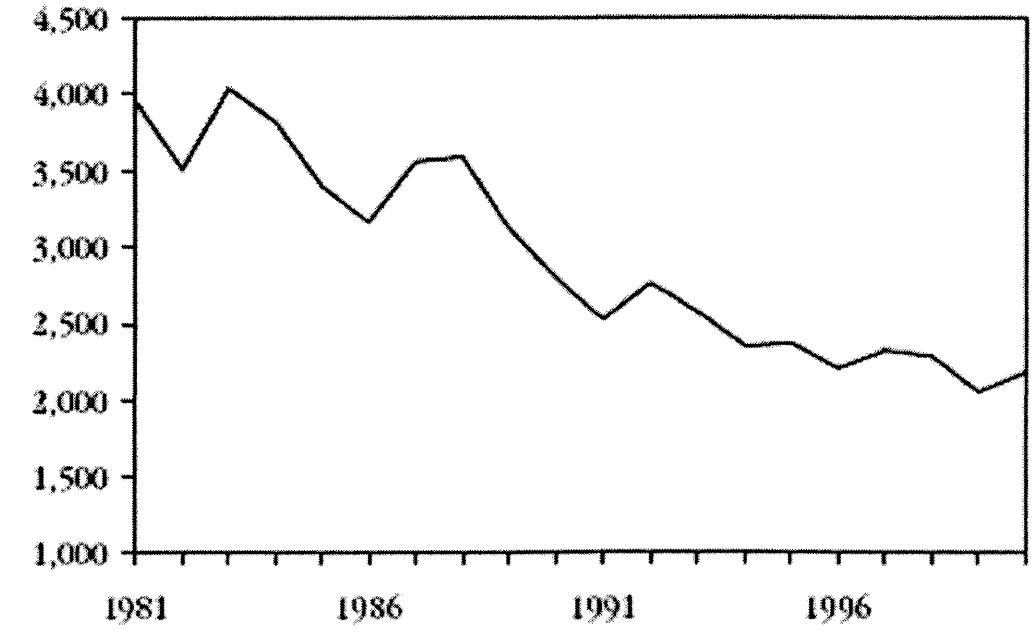
as a scapegoat for larger, structural problems that afflicted the economy of Grays Harbor in the 1980s and 1990s?

Examining the Data

In seeking other explanations for the economic problems in Grays Harbor, it is useful to compare unemployment levels there with unemployment in Washington as a whole. It is also necessary to determine the number of jobs in the timber industry for each year of the comparison. Figures 3, 4, and 5 provide this data.

Figure 3[41]

Timber Industry Employment
Grays Harbor County, 1981-2000
Source: Employment Security Department



[41] Labor Market and Economic Analysis Branch, Employment Security Department, Grays Harbor and Pacific Counties Profile, April 2002. (Olympia, WA, 2002): 25.

Figure 4[42] Unemployment in Grays Harbor County and the State of Washington, 1980 – 2000

Year	Unemployment in Grays Harbor (%)	Unemployment in Washington (%)	Difference (%)
1980	10.7	8.5	2.2
1981	13.9	10.2	3.7
1982	15.7	12.1	3.6
1983	14.9	10.5	4.4
1984	15.0	8.9	6.1
1985	12.7	8.0	4.7
1986	12.6	8.1	4.5
1987	11.4	7.1	4.3
1988	9.5	6.0	3.5
1989	10.3	5.8	4.5
1990	9.3	5.1	4.2
1991	11.6	6.4	5.2
1992	12.3	7.5	4.8
1993	15.2	6.9	8.3
1994	12.3	6.2	6.1
1995	10.8	6.2	4.6
1996	11.8	5.7	6.1
1997	9.3	4.7	4.6
1998	10.0	4.9	5.1
1999	8.3	4.7	3.6
2000	9.9	5.1	4.8
Average	11.8	7.1	4.7
		Standard Deviation (%)	1.2

[42] Grays Harbor unemployment column taken from Ibid., A-1. Unemployment for Washington State column taken from United States Department of Labor, Bureau of Labor Statistics, Local Area Unemployment Statistics. Accessible online at: http://data.bls.gov/PDQ/servlet/SurveyOutputServlet. All other data is my own work.

Figure 5[43] Unemployment Comparison, United States, Washington and Grays Harbor County 1980 - 2000

Taken together, these data sources lead to some interesting conclusions about the condition of the economy in Grays Harbor before and after the spotted owl controversy. As figure 3 clearly shows, between 1981 and 1989 (the year 1989 is a suitable dividing point because in February of that year, nine environmental groups initiated a successful lawsuit to stop timber sales on old growth forest lands pending a decision on whether or not to list the spotted owl as an endangered species),[44] timber industry employment fell by nearly 1,000 jobs, from 3,900 to 3,000, a 23.1 percent decrease. From 1989 to 2000, the rate of decline is nearly identical; the drop is from 3,000 to 2,300, a loss of 23.3 percent. This indicates very little change in the rate of decline of jobs in the timber industry after legislation to protect the spotted owl. Also, from 1980 to 1989, the county lost 900 jobs in ten years, an average loss of 90 per year. From 1989 to 2000, the loss was 700 jobs in 12 years, an average of 58.3.

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[43] Grays Harbor Demographic Profile, 16.
[44] Petersen, Acting for Endangered Species. 88-89.

Clearly, Grays Harbor saw a greater number of jobs lost per year before the early court rulings to protect the spotted owl than after, another indication that spotted owl legislation alone did not account for economic troubles in Grays Harbor during this time period.

Figures 4 and 5 also shed light on this issue. Grays Harbor saw higher unemployment than did Washington as a whole in every year between 1980 and 2000, with an average difference of 4.7 percent greater unemployment. To compare this information with that on the decline in timber jobs, we can again break the average up into two periods, 1980 to 1989 and 1989 to 2000. The average difference in unemployment percentage for the first period is 4.2 percent, for the second period 5.2 percent. This indicates that economic conditions in Grays Harbor became slightly, but not substantially, worse after 1989 in terms of the percentage of people unemployed compared to all of Washington.

It is also interesting to note that of the 21 years represented in figure 4, Grays Harbor witnessed unemployment below ten percent in only five of those years. Yet, of those five years, four of them are after 1989, only one before. The average unemployment rate from 1980 to 1989 is 12.7 percent; from 1989 to 2000, it is 10.9 percent. Once again, these facts indicate that the economy did not nosedive after 1989; in fact, conditions improved in absolute terms, even if they became slightly worse in relative terms compared to the rest of Washington. As a result of this 1.8 percent decrease in average unemployment after 1989, the percentage of families living in poverty declined as well from 1990 to 2002, going from 12.9 percent to 11.9 percent.[45]

Before closing the book on this argument, consideration of one additional economic measure is in order. While the statistics on unemployment indicate that the spotted owl is not solely responsible for economic difficulties in Grays Harbor, it is worthwhile to consider

[45] Comprehensive Economic Development Strategy for Columbia-Pacific Resource Conservation & Economic Development District, 18.

the types of jobs that took the place of those lost in the timber industry. In 2002 dollars, the average job in logging and forestry paid $39,369 per year. For wood product manufacturing, the yearly pay averaged $37,852, and a paper manufacturing job paid an average of $56,544.[46] Figure 6 gives data for these three timber-related industries, as well as other leading employment sectors in Grays Harbor.

Figure 6[47]

Key Employment Industries, Grays Harbor County, WA

Title	2002 Share of Local Empl	2002 Employment	1990-2002 Empl Change	2002 Average Annual Wage
Educational services	10.4%	2,393	24.0%	$27,571
Executive, legislative and general government	7.1%	1,632	25.9%	$34,992
Food services and drinking places	6.7%	1,546	-11.4%	$11,318
Wood product manufacturing	5.7%	1,306	-17.4%	$37,852
Accommodation	4.0%	923	-10.3%	$16,524
Food and beverage stores	3.6%	831	7.6%	$20,967
Paper manufacturing	3.1%	726	-35.1%	$56,544
Forestry and logging	3.0%	682	-36.8%	$39,369
Ambulatory health care services	2.8%	648	9.9%	$31,363

As figure 6 illustrates, the wood product manufacturing, paper manufacturing, and forestry and logging sectors of the economy in Grays Harbor County all experienced substantial declines in employment for the period 1990 to 2002. The four sectors of the Grays Harbor economy that experienced employment growth in this period, educational

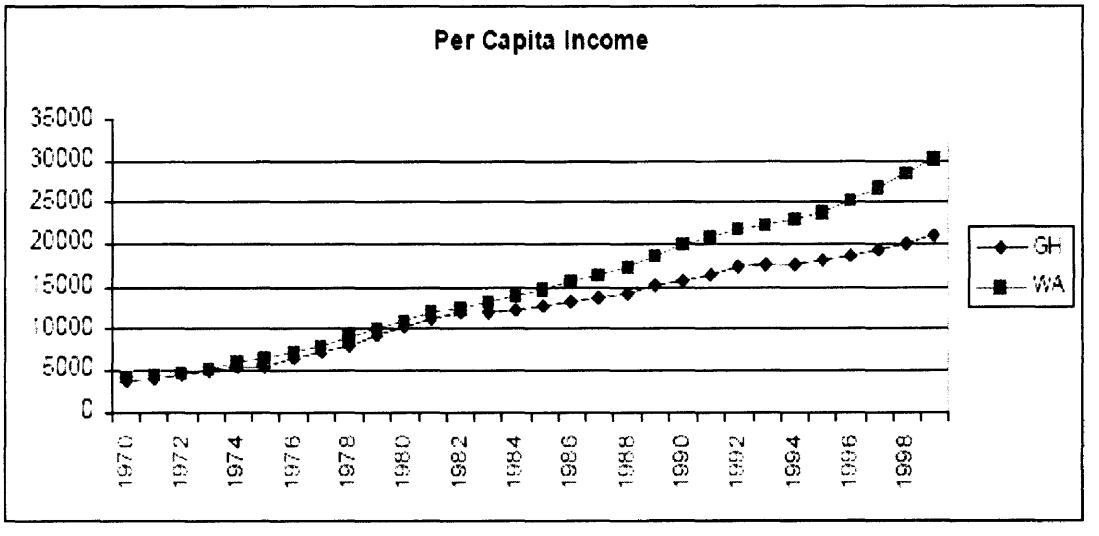
[46] Washington Employment Security Department, Labor Market and Economic Analysis Branch, Labor Market Information for Economic Development: Key Industries in Grays Harbor County, Washington. (Olympia, WA, 2003): 2. Also available online at www.workforceexplorer.com

[47] Ibid.

services, executive, legislative, and general government, food and beverage stores, and ambulatory health care services, all pay an average salary that is inferior to that earned by workers in the wood product manufacturing, forestry, and logging sectors and is substantially below that earned by paper manufacturers. Further substantiating this data from 1990 to 2002, figure 7 compares the per capita income for Grays Harbor to that of Washington from 1970 to 2000. It graphically demonstrates this trend of a decline in the standard of living in Grays Harbor relative to Washington as a whole. Figure 8 shows the same data, but with the income adjusted to show real wages (wages adjusted for inflation).

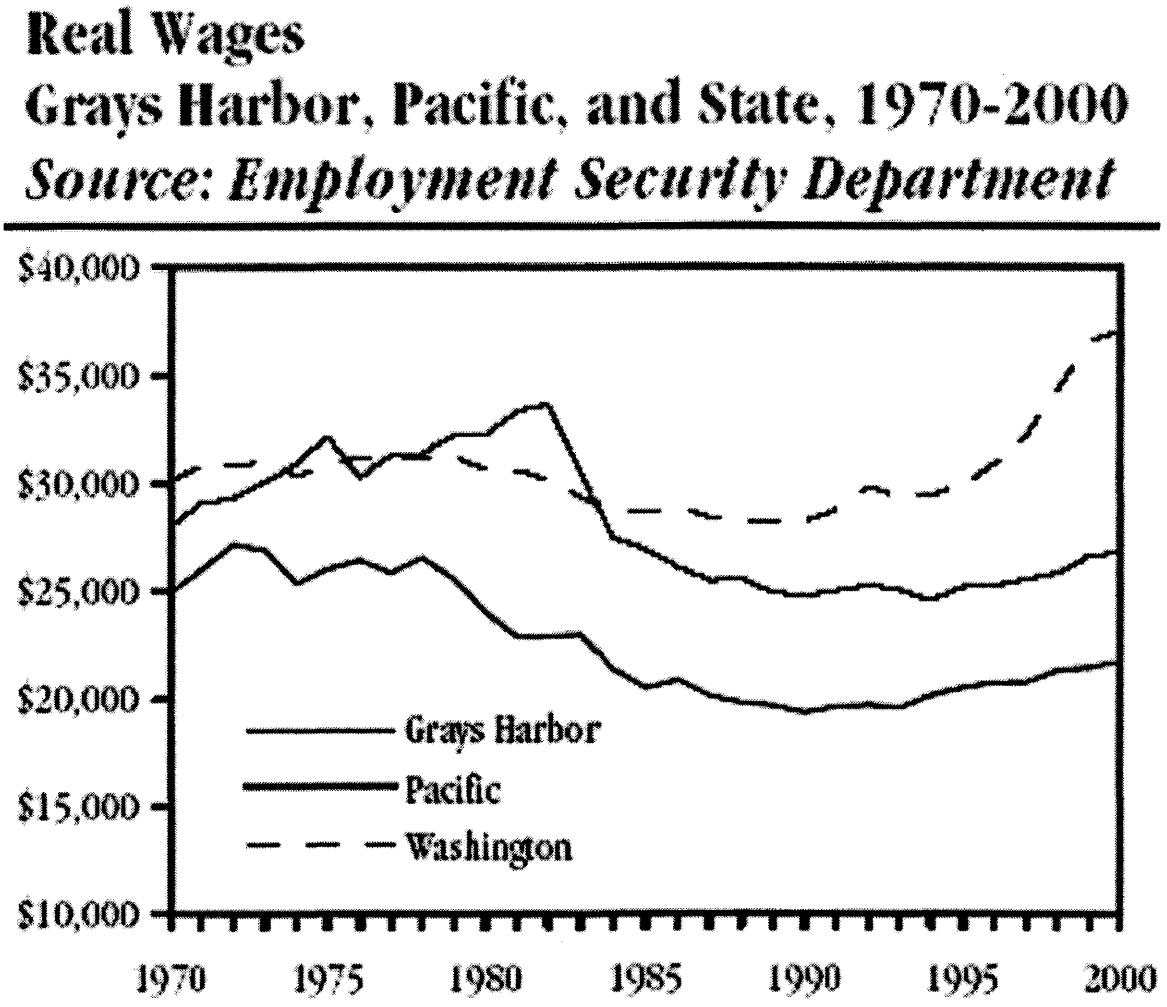
Figure 7[48] Per Capita Income, 1970 - 2000

Per Capita Income (1970-2000):



[48] Grays Harbor Demographic Profile, 18.

Figure 8[49] Real Wages, Grays Harbor, Pacific, and State 1970 – 2000



This data shows that the unemployment figures for Grays Harbor do not tell the entire story of the economic situation. The fact that the unemployment rate generally is lower after initial legislation for the spotted owl in 1989 fails to reveal that the new jobs replacing those lost in the timber industry were not as lucrative as timber industry jobs. Figure 7 shows that from 1970 to 1982, the per capita income for Grays Harbor mirrored that of the state as a whole. A divergence in the per capita income of Grays Harbor compared to Washington became evident by the late 1980s, and it became much more

[49] Grays Harbor and Pacific Counties Profile, April 2002, 20.

pronounced in the ensuing decade. Figure 8 shows that real wages display the same basic pattern of change over time. This is where the economic impact of job loss in timber related industries is most evident. Most former workers in the timber industry did find new jobs to replace those they lost, but the new jobs did not offer pay comparable to positions in logging or wood product manufacturing. In addition, most jobs in the timber industry had been union jobs, while the new positions, more likely in service industries, usually were not.

What is to Blame, if Not Owls?

The most plausible explanation for the long term decline in jobs in the timber industry is not the spotted owl or the Endangered Species Act, but technology. Historian William Robbins, writing in 1988, states the issue succinctly when he writes

> Simply put, the mechanization of the forest products industry was diminishing the size of the workforce. The changes in the south coast economy reflected a general transformation that has affected the North Pacific slope lumber industry, especially during the last twenty-five years. Dramatic technological and capital shifts – increased mechanization in the woods, the introduction of automated mill equipment, and centralized production in fewer plants – have altered both the productive base of the industry and the size of the work force.[50]

Justice William Dwyer offered the same rationale in his May 23, 1991 injunction prohibiting timber sales from national forests until the status of the spotted owl had been determined.

> The main reasons [for job losses] have been modernization of physical plants, changes in product demand, and competition from elsewhere. Job losses in the wood products industry will continue regardless of whether the northern spotted owl is protected. Even if some jobs in the woods products were affected by protecting owl habitat in the short term, any effect on the regional economy would be small. To bypass environmental laws, either briefly or permanently, would not fend off the changes transforming the timber industry. The argument that the mightiest economy on earth cannot afford to preserve old growth forests for a short time,

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[50] William Robbins, Hard Times in Paradise: Coos Bay, Oregon 1850-1986. (Seattle, University of Washington Press, 1988): 153.

> while it reaches an overdue decision on how to manage them, is not convincing today.[51]

In the course of researching plans for spotted owl habitat protection, a government report of 1990 predicted that though timber harvests would rise 55 percent over the next 50 years, sawmill modernization would decrease the labor force necessary by 27 percent.[52] Historians, writers, judges, and government studies all returned the same verdict favoring technology and mechanization as the primary causes of job losses in the timber industry.

The evidence conclusively demonstrates that the technological changes in the timber industry had been taking place for a number of years. It is not as though the situation came out of nowhere to blindside the industry. In the decade preceding the legislation to protect the spotted owl, between 1979 and 1989, timber-related employment in Washington and Oregon together decreased from 160,000 jobs to 130,000, primarily due to increased mechanization.[53] This is a drop of 18.8 percent, about one job out of every five. This important trend does not make the human cost of a lost job any easier to bear, but it does show that the writing was on the wall in Grays Harbor for timber and other natural resource extraction industries.

Increased mechanization in the timber industry was not the only reason for job loss in Grays Harbor, however. Legislation played an important part in the process as well. Not the legislation designed to save owls discussed earlier, but legislation concerning imports and exports. Log export markets have always been important to Grays Harbor. Unemployment rose above sixteen percent in 1985 when the logging export market slumped.[54] In 1990,

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[51] Quoted in Dietrich, The Final Forest, 264.
[52] Sylvia Wieldand Nogaki, "Federal Money at Risk – Timber "Set Asides" too Costly, Officials Say." The Seattle Times, April 17, 1990: F1.
[53] Dietrich, The Final Forest, 131.
[54] Miller, "Aberdeen, Reality-Check Time." 40.

Congress decided to ban the export of 75 percent of unprocessed logs from state-owned lands in Washington.[55] This measure, designed to protect mills in Washington and keep them in business, caused significant hardship to the Port of Grays Harbor, another important employer located in Aberdeen. Twenty-five percent of all timber shipped at the Port of Grays Harbor came from state lands, an unusually high percentage, so it was especially vulnerable to limits on log exports. The Port of Grays Harbor responded quickly to the ban on log exports by diversifying its operations. Non-log cargo increased from 65,354 short tons in 1990 to 303,342 short tons by 1991, an increase of 464% in just one year.[56] Dredging operations for the Port of Grays Harbor, undertaken in 1990 and described in detail later, were also part of this effort. In comparison, the volume of log cargo went from about 26 million board feet in just two months of 1989 to 13 million board feet in the first two months of 1993, a 50% decline.[57] Clearly, greater diversification was an asset to the economy of Grays Harbor. It helped insure that jobs were available at the Port as increased mechanization and more efficient technology diminished the number of jobs in the timber industry.

Grays Harbor County in 2005

The data in figure 4 is a reminder that the annual unemployment rate for Grays Harbor has generally been lower after legislation to save the spotted owl in 1989 than before that legislation. However, the jobs that replaced those lost in the timber industry did not pay

[55] Dietrich, The Final Forest, 229-30.
[56] John Davies, "Grays Harbor Diversification Pays Off as Cargo Volume Soars 30 Percent for Year." Journal of Commerce. Jan. 30, 1992: 1B.
[57] Lorraine Iannello, "Timber Woes Spur Port Diversification." Journal of Commerce. May 10, 1993: 1C.

at the same level as most positions in logging or the woods product industry. The question that remains is what the economy of Grays Harbor looks like in 2005.

Figure 9[58] Major employers of Grays Harbor County

Rank	Employer	Description	Full-Time Employment
1	Port of Grays Harbor	Shipping	1300
2	Weyerhauser Company	Veneer/paper plants	1045
3	Grays Harbor Community Hospital	Medical Facility	590
4	Stafford Creek Prison	Correctional Facility	533
5	Aberdeen School District	School District Employees/Staff	532
6	Westport Shipyard	Manufacturing	477
7	Grays Harbor County	County Administration	463
8	Simpson Door	Manufacturing	446
9	Grays Harbor College	Community College	412
10	Quinault Beach Resort	Hospitality	319
11	WalMart	Retail	319
12	Hoquiam School District	School District Employees/Staff	285
13	Grays Harbor Paper LP	Paper Product Manufacturing	244
14	SafeHarbor Technologies	Telecommunications	195
15	City of Aberdeen	Government	175
16	Grays Harbor PUD	Public Utilities District	167
17	Anchor Bank	Banking	165
18	Coastal Community Action Program	Social Services	165
19	Safeway	Retail	160
20	Swanson Foods	Retail	160
21	Sierra Pacific Industries	Manufacturing	153
22	McDonald's Restaraunts	Retail	152
23	Five Star Auto Dealership	Retail	125
24	Mary's River Lumber	Manufacturing	125
25	Pacific Veneer	Manufacturing	125
26	Hoquiam Plywood	Manufacturing	116
27	Ronglin's	Construction	115
28	Dept. of Social & Human Services	Government	107
29	Bank of the Pacific	Banking	100
30	Washington Crab Products	Food Processing	100

[58] Comprehensive Economic Development Strategy for Columbia-Pacific Resource Conservation & Economic Development District, 20.

Even a cursory glance at a list of the county's top 30 employers in Figure 9 reveals the decline of timber and wood products jobs in Grays Harbor. Though Weyerhauser remains the number one single employer in the county, only five other companies on the list are members of the wood products industry, and a handful of others use wood products indirectly. Though comprised of many entities, Port of Grays Harbor tenants combined employ about 1,300 workers.[59] Employers in the services, government, and education sectors figure prominently on the list, whereas as recently as 1975, timber industry firms supplied two-thirds of the jobs in the county.[60]

To the surprise of many, given that Grays Harbor is nearly an hour from Olympia and the Interstate 5 corridor that connects the sprawling urban and suburban communities of Puget Sound, it has succeeded in attracting new business investment in the past five years. One such company is SafeHarbor Technology. This dot-com company, offering web-based technical support to businesses, stands almost in the shadows of the colossal 480-foot cooling towers of the never-completed Satsop nuclear power plant. This company makes it possible for technologically adept young people to remain in Grays Harbor.[61] Other companies active in the Satsop Development Park include TechTell, a computer network operations company, Boise Building Systems, a division of the Boise Corporation that manufactures wood-plastic composite products, and fifteen smaller firms.[62] Various cities within Grays Harbor County have also undertaken individual and cooperative infrastructure improvement projects within the past year, and numerous others are currently under

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[59] Ibid., 25.
[60] Miller, "Aberdeen; Reality-Check Time." 40.
[61] Monica Soto, "Can Technology Save Satsop?" The Seattle Times, April 9, 2000: D1.
[62] Comprehensive Economic Development Strategy for Columbia-Pacific Resource Conservation & Economic Development District, 24-25.

consideration.[63] Finally, in 2004, the voters of Aberdeen approved construction bonds for a new high school, showing that city's commitment to the youth that comprise its future.

Making Sense of it All

As the beginning of 2005, Grays Harbor had some reasons for optimism. In February of 2004, unemployment stood at 9.5 percent in Grays Harbor, compared to 7.5 percent in Washington generally. One year later, the numbers were 8.6 percent and 6.4 percent, respectively.[64] A quick glance back at figures 4 and 5 shows that not only are these unemployment rates among the lowest of the past 25 years for Grays Harbor, but the gap between it and the state as a whole is narrowing in recent years. This is a result of the diversification of the local economy in response to the challenges of the late 1980s and early 1990s. The creation of a business park at Satsop, the diversification of the Port of Grays Harbor, and the rapid growth of the service, education, and government sectors of the economy (see figure 6) have helped to compensate for the loss of jobs in timber and related industries. The lower average unemployment rates since 1989 also bear out this conclusion. One issue that remains, however, is the increasing gap in per capita income between Grays Harbor and the rest of Washington.

The northern spotted owl turned out to be more of a scapegoat for declining employment in the timber industry than the cause of that decline. Though legislation to protect the owl did cause economic dislocation in the short term, the long term trend toward fewer jobs in the timber industry is clear. The spotted owl crisis might have accelerated the

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[63] See Ibid., pages 26-28 for a complete list and description of projects already underway or completed. See Ibid. pages 76-77 for a complete list of proposals under consideration.
[64] Washington State Employment Security Division, Resident Labor Force and Employment in Washington State and Labor Market Areas. (Olympia, WA, March 2005): 2.

change, but it was not responsible for the change. Based on the trend of recent decades, and considered over that time frame, increased mechanization and greater speed and efficiency from improved technology constituted the root of the problem for timber workers, not owls.

Even with all its struggles, there is light at the end of the tunnel for the timber industry. Unlike other extractive industries such as mining or oil drilling, trees are a renewable resource, albeit a rather slowly renewable one. Part of the reason for the scarcity of timber on private company lands is the cut-and-run policies practiced by big timber companies in the 1920s and 1930s. This practice has since ended, and some of the trees replanted in the middle of the twentieth century will reach harvestable age within the next few decades. This new supply of timber might even lead to a comeback for the timber industry, especially since the spotted owl prefers old growth habitat, not the second growth forest planted in the middle decades of the twentieth century.

Even though the economic situation in Grays Harbor is about more than just owls, in some respects their story continues to impact the larger story. What makes the situation in Grays Harbor hopeful in 2005 is that the same science used by the environmentalists to gain protection for the spotted owl is applicable to timber industry and government efforts to help create solutions that contain both jobs for people and habitat for endangered species. With a more complete understanding of owls and natural ecosystems on the one hand, and of efficient and sustainable forestry techniques on the other, Grays Harbor may yet find a way to have both jobs and habitat. For many years, this county that is currently home to just 66,490 people led the world in log exports. They have since adapted to the economic difficulties of the logging industry through economic diversification. Perhaps they can also adapt to become a leader in coexisting with the natural world.

Chapter Two

Sunk in the Mud?

Challenges to the Willapa Bay Oyster Industry in the 1990s

Map 4 Map of Pacific County, Washington

Why Willapa Matters

Willapa Bay, located in southwestern Washington, does not seem particularly special at first glance. True, the scenery is tremendous for those who value rolling hills (and can look past a few timber clearcuts) or a view of the Pacific Ocean from Highways 101 and 105. In addition, many people would be surprised to know that Willapa Bay is the second largest estuary on the West Coast after San Francisco, and drains over 1,000 streams in a watershed the size of Rhode Island.[65] Because of this high proportion of riparian environments, about 250 species of birds, 53 mammals, and 19 reptiles and amphibians live in the watershed.[66] However, with a population of only about 21,000 people,[67] its importance in the American economy seems marginal at best.

In at least one way, however, such an assumption is misleading, because Willapa Bay is home to one of the key oyster industries in the United States. Like Grays Harbor County immediately to the north, which led the world in log exports at various points in the twentieth century despite a countywide population under 70,000, the modest population of Pacific County masks economic activities of national significance. Each year, in the mud flats scattered around the bay's periphery, this county harvests between 15% and 25% of the oysters sold throughout the US. This means a total weight of about 40 million pounds of oysters.[68] Developments affecting the oyster industry here impact not only the local businesses that farm the oysters, but seafood consumption all across America.

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[65] William Allen, "Region Seeks to Protect What Provides its Living: Bay Residents Want Development 'Without Fouling Up Our Nest.'" St. Louis Post-Dispatch, May 12, 1992: A1.
[66] Bill Dietrich, "True Mud – Combine Economic Pragmatism with a Passion for the Planet, and Blend Until Smooth." The Seattle Times, April 19, 1992: Pacific, pg. 5.
[67] Labor Market and Economic Analysis Branch, Employment Security Department, Grays Harbor and Pacific Counties Profile, April 2002. (Olympia, WA, 2002): 7.
[68] Hal Bernton, "Insecticide's Use on Tidelands Raises Worries; Carbaryl, Sprayed to Kill Shrimp Strangling Oysters in Willapa Bay, Persists at Levels that may be too High, Studies Suggest." The Oregonian, August 4, 1999: A1.

Besides the national culinary impact of events effecting oyster growers, other issues combine to make the brown, sticky mud of Willapa Bay more significant than it seems. Oyster growing in Willapa Bay is not simply about putting delectable seafood in restaurants and supermarkets across the country. It is also a story of sustainable resource use and the preservation of the environment that sustains the industry in the face of multiple challenges. Like the case of the Northern spotted owl to the north in Grays Harbor, the story of oysters in Willapa Bay is one of environmentalism seeking to rein in the ecologically damaging practices of local industry while at the same time working with local industries to find a sustainable resource use strategy. The economic livelihood and way of life of many local people hangs in the balance.

Setting the Stage

Oysters have been a significant economic activity in Willapa Bay almost from the time that James Swan first sailed into the bay in 1852. By the 1870s, growers exported the native Olympia oysters to San Francisco, among other destinations, in such quantities that local growers witnessed a significant decline in the native stocks of Willapa Bay.[69] This classic nineteenth century case of resource depletion might have caused the oysters in Willapa Bay to go the way of the bison or the passenger pigeon, but various circumstances intervened. The first of these was the attempt to import and establish an East Coast (locally know as just "Easterns") species of oyster between the 1890s and 1910s. While this attempt met with modest success, this oyster never really gained a strong hold, not in the same way that the Pacific oyster, a new species native to Japan, did in the 1920s. Pacific oysters are

[69] Ibid.

typically gray or white, up to twelve inches in length, with an irregular fluted outer surface. They enjoy various advantages over the Olympic and Eastern oysters, such as greater tolerance of cold. Their greatest advantage, however, is their larger size. This larger size makes them a more viable commodity in economic terms. This is the most important reason why Pacific oysters came to dominate oyster growing in Willapa Bay at the expense of the native and eastern import species. Some native Olympia oysters remain in Willapa Bay, but their smaller size insures that efforts to harvest them remain limited.[70]

This glimpse back at history is significant for two reasons. First, the introduction and proliferation of Pacific oysters allowed an industry on questionable footing to revive and set it on the path to where it stands today, producing $11 million a year for growers in Pacific County. However, during the prior attempt to introduce the Eastern oysters, there was an unfortunate side affect, little noted at the time. The usual story is that, between 1894 and 1912, oyster growers imported Easterns in an attempt to replace the native stocks decimated by previous harvesting. Unfortunately, the oysters arriving came packed in a spiny sea grass called spartina or cordgrass. Dumped onto the beach when the oysters arrived in Willapa Bay, the transplanted cordgrass grass did not succeed in expanding immediately. Over time, however, the grass seeded successfully and spread, to the point where as of 2000, it covers roughly 15,000 acres of intertidal land in Willapa Bay, out of 47,000 total acres of intertidal land.[71] As spartina multiplies, so does the threat it poses to coastal habitat. The expanding fields of this grass convert the landscape to spartina meadows, pushing out not just oysters, but crabs, fish, and birds as well.[72]

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[70] Charlotte Davis, They Remembered, Book IV. Joan Mann, ed. (Midway Printery: Long Beach, WA 1994): 14.
[71] Erin Middlewood, "Bugs Turned Loose on Invasive Grass: Thus far, Nothing has Worked to Slow Spartina, Which Threatens Willapa Bay's Ecosystem." The Oregonian, August 11, 2000: C4.
[72] Jack Broom, "'A Cancer on the Bay' – Invading Sea Grass Threatens Willapa Estuary." The Seattle Times, December 17, 1990: A1.

An Area Overrun with Cordgrass.

The above paragraph reflects the usual story of spartina's establishment in Willapa Bay. However, though widely disseminated, the part about the introduction of cordgrass to Willapa Bay appears unfounded in fact. According to Bruce Weilepp, Director of the Pacific County Historical Society in South Bend, oystermen had nothing to do with the introduction of spartina to Willapa Bay. Though they did attempt to import East Coast oysters for transplant, they oysters did not arrive in ships, and they were not packed in spartina. In fact, they arrived in refrigerated railroad cars, a technology available since the 1870s. Weilepp also mentioned that the grass was supposed to keep the oysters wet, but oysters transported over

a long period of time must be kept dry. If this is true, then where did the spartina actually come from? According to Weilepp, in the 1930s a local sportsmen's club worked to establish a wildlife refuge (now the Willapa National Wildlife Refuge, managed by the United States Fish and Wildlife Service), and in their effort to create suitable habitat for wild fowl, they requested the importation of spartina towards that end. The brochure of the Wild Life Nurseries and Game Farm of Oshkosh, Wisconsin, advertises spartina as an ideal duck blind as well as good cover for hunters in marshy meadows.[73] This is the actual cause for the current amount of spartina-infested acreage in Willapa Bay, according to Weilepp.[74]

Though not necessarily harmful in its typical habitat (in fact, it is useful for stabilizing sediment and providing an ideal habitat for some fish and invertebrates) cordgrass produces various insidious effects when set free in an environment with no natural checks on its growth. The grass produces an extremely dense system of rhizomes, creating tussocks of cordgrass that completely squeeze out other grasses. In the case of Willapa Bay, eelgrass is the primary victim. In the process, cordgrass traps sediment, leading to accumulations that affect the elevation of estuaries. Given time and freedom from predation, it can colonize whole zones within tidal estuaries.[75] The consequences in Willapa Bay include changing ecologically productive mudflats that support thousands of shorebirds into unproductive salt marshes. By eliminating native grasses such as eelgrass, native insects and crustaceans that frequent coastal mudflats lose their favored habitat. This in turn deprives both local and

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[73] Brochure is on file at the Pacific County Historical Society, South Bend, WA.
[74] Interview with Bruce Weilepp, South Bend, WA, December 30, 2005. This paragraph also contains information from three conversations we had via email between Nov. 29 and Dec 2, 2005.
[75] A.L. Denton and J.W. Stiller, "One Hundred Years of *Spartina alterniflora* in Willapa Bay, Washington: Random Amplified Polymorphic DNA Analysis of an Invasive Population." Molecular Ecology, 1995, vol. 4: 355.

migratory birds of an important food source. This is but one example of how an invasive species such as cordgrass can disrupt the food web in an area.[76]

Regardless of how the spartina got to Willapa, oyster growers with long memories can recall many interesting episodes in the history of the industry. An especially difficult episode concerns the people who introduced Pacific oysters into Willapa Bay, the Japanese. While never a large group, the first Japanese arrived in the early 1900s to try their luck with the Eastern oysters grown in the bay at that time. Their importance grew in 1928 when the first batch of Pacific oysters arrived in Washington from Japan, initiating production on a commercial basis.[77] Considering that these immigrants helped to revive the oyster industry of Willapa Bay by providing a prolific and more valuable new species of oyster to replace the native stock, in decline due partly to excessive harvesting, it seems logical that local growers might hold them in some esteem. Apparently, some did. However, following the Japanese attack on Pearl Harbor on December 7, 1941, local Japanese shared the fate of so many Japanese on the West Coast: forced sales of their property and relocation to detention camps. When they returned, most of their pre-war holdings were lost to them, and only a few families regained any of their pre-war property.[78]

At this point, it appears that the oyster growers of Willapa Bay enjoy their current modest level of economic success in spite of the fact that their story contains a fair dose of many of the negative themes of American history. The early years of the industry featured unsustainable exploitation of the oysters for commercial purposes, much like the salmon fishing going on at the same time in the Pacific Northwest. Following the decline of the native species of oyster, growers in Willapa attempted to import a non-native oyster species

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[76] Middlewood, "Bugs Turned Loose on Invasive Grass." The Oregonian, August 11, 2000: C4.
[77] They Remembered, 93-4.
[78] Patty Stanton, "Oyster Port Showcases History on the Half Shell." The Seattle Times, January 6, 1991: J2. The same story also appears in They Remembered, 94-5.

to solve their problems. Paying scant attention to the habitat needs of this new species, and how those needs fit (or did not fit) local conditions, the oyster growers had only modest success and for the most part the experiment failed. After the transplant of the Pacific oyster succeeded, ethnic prejudice inflamed by wartime tensions turned on the Japanese who had helped save the industry. While this was taking place, local sportsmen took the fateful step of introducing spartina into the local environment, heedless of the future environmental consequences, in their quest to achieve a more pleasurable sports hunting experience.

Finding Ghosts

If cordgrass constituted the only threat to oysters in Willapa Bay, it alone would not make for much of a unique story. Willapa Bay is hardly the only place facing invasive plants species, and is far from the worst example of an environment effected by exotic plants. However, in addition to this exotic species of grass, a particular native species threatens oyster farming as well. The ghost shrimp has plagued local oyster growers since the 1950s by burrowing in the mud where oysters live. Their burrowing activities cause subsidence in the mud, causing the oysters (which grow sitting on top of the mudflats) to sink in the mud, smother, and die. Not only oysters, but also small crabs and other species found in tidal areas fall victim to these small, economically worthless creatures. Their only productive use seems to be as bait and as prey for birds, certain fish (such as salmon and sturgeon), and other animals.[79] The proliferation of this native shrimp species poses a difficult problem for oyster growers seeking to protect their livelihood against this subterranean opponent.

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[79] Richard Hill, "Parasite Threatens Coastal Life." The Oregonian, August 18, 2005: B01.

If the shrimp are native to Willapa Bay, and have been there longer than the Pacific oyster industry, why the sudden increase in their activity since the 1950s? There is no definitive answer to this important question as of 2006. However, speculation points to a few likely culprits, or a combination of culprits. Some predators of the ghost shrimp, salmon and sturgeon in particular, are in decline throughout most of coastal Washington. It is also possible that the damming of the Columbia River, a bit more than 50 miles to the south of the entrance to Willapa Bay, plays a role. One purpose of these dams on the Columbia is flood control and historically, during times of flood, the Columbia disgorged large volumes of fresh water into the Pacific Ocean. Tides then carried this freshwater north to Willapa Bay, possibly serving to limit populations of the saltwater ghost shrimp.[80] Another explanation for the shrimp population explosion is logging in Pacific County, primarily done by Weyerhauser. Timber clearcuts allow for a greater amount of soil erosion, which eventually ends up in the streams that run into the bay. The resulting siltation provides more of the mud where the ghost shrimp thrive. A final possible explanation is that changing ocean conditions during El Nino years might favor the shrimp.[81]

Whatever the exact reason for the proliferation of ghost shrimp, the method for raising oysters makes them vulnerable to its activities. Because growth typically takes up to four years, Pacific oysters must survive the hazards presented by burrowing ghost shrimp multiple times before harvesting. There are two hatcheries breeding oyster larvae in the Pacific Northwest. After about twenty days at the hatcheries, the growers buy the larvae and place them in "seed beds" for two to three years in order to grow. The larvae attach to pre-

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[80] Bernton, "Insecticides Use on Tidelands Raises Worries."
[81] Ben Romano, "Oyster Farmers' Pesticide Battles: One Grower Seeks a Ban that Others Say Will Destroy the Industry." The Seattle Times, October 1, 2000: B1.

existing oyster shells after about 24 hours in heated water.[82] Finally, growers plant these young oysters in new beds for a final period of growth lasting up to two years, until they reach an economically viable size. The prime location for these final beds is near the mouth of Willapa Bay, where the young oysters can take advantage of the nutrient-rich inflows of water.[83] At each step in this process, the oysters run the risk of sinking in mud and smothering, undermined by the sapping abilities of the ghost shrimp.

While most growers prefer the above method, alternate methods exist, less vulnerable to subsidence in the mud. A small number of Willapa growers use polyvinyl chloride (PVC) pipes despite the higher labor costs of growing in this manner. The oysters attach themselves to the smooth plastic pipes; by suspending the oysters above the mud to protect against subsidence, this method offers protection against the shrimp unless the pipes themselves sink in the mud.[84]

Exorcising Ghosts

After the emergence of the ghost shrimp as a problem in the 1950s and 1960s, the response of the oystermen was the predictable one of 1960s America: a technological solution featuring chemical pesticides. Carbaryl was the particular pesticide the oystermen of Willapa chose, and spraying commenced in 1963. For the purposes of killing unwanted ghost shrimp, this was a wise choice. Using helicopters, each year growers spray about 600 acres of oyster beds with around two tons of carbaryl, and the ghost shrimp expire en masse as the tide carries the chemical into their underground tunnels. Unfortunately, carbaryl's

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[82] Siobhan Loughran, "An Oyster Man on Willapa Bay." The Oregonian, September 19, 2000: FD01.
[83] Bernton, "Insectisides Use on Tidelands Raises Worries."
[84] Romano, "Oyster Farmers' Pesticide Battles."

effects are not limited to just the ghost shrimp. Other shrimp, sea worms, and small fish such as stickleback, gunnel, and sculpin share the grisly fate of the ghost shrimp. The economically important Dungeness crabs also take a hit from the spraying of carbaryl, as do juvenile salmon. (The only creatures that seem to benefit from the spraying, other than the oysters, are birds that feast on the dead carcasses left on the mudflats after spraying. The birds are able to metabolize the food quickly, and apparently, the presence of carbaryl does not hurt them.[85]) The sheer level of carnage for all marine life in the areas sprayed gradually served to bring the practice of spraying with carbaryl under fire, making oyster growers look to some like indiscriminate killers and poisoners of the environment.

Before the reader gets the wrong impression about the oyster growers, it would be incorrect to see them as environmental Neanderthals who refuse to change their ways out of ignorance, habit, or some mystical belief that technology will cure all their ills. In fact, they realize better than most the need for a clean environment. Oysters absolutely require clean water to live and grow. In turn, the oysters help keep the water clean and clear by filtering it through their gills, sucking up phytoplankton, silt, and other suspended particles in the process.[86] In order to preserve water quality, oyster growers have opposed pulp mills, resorts, and other development projects in the past.[87] They are all too aware that oysters in particular, and shellfish in general, are strictly monitored by the Food and Drug Administration's National Shellfish Sanitation Program. If the water is not clean enough, the NSSP does not permit the sale of the oysters, and the growers have no business. This strict level of monitoring is why 1939 was the last year that an oyster grown in San Francisco Bay

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[85] Bernton, "Insecticide's Use on Tideland Raises Worries."
[86] Paul Rauber "The Oyster is Our World." Sierra, vol. 80, issue 5, September 1, 1995.
[87] Bernton, "Insecticide's Use on Tideland Raises Worries."

went on the market.[88] These strict health regulations provide oyster farmers with all the incentive they need to fight for clean water in Willapa.

Recent history provides several examples of what happens to the oyster industry when clean water is not available. Oyster growers to the north in Grays Harbor County had to cancel their annual Clean Water Oyster Feed in 1997 because effluents discharged from the Weyerhauser pulp mill in Cosmopolis contained unacceptably high levels of fecal coliform (harmful to both humans and aquatic life.) Dumped into the Chehalis River, where it in turn drained into Grays Harbor, the presence of this pollutant shut down oyster harvesting for a week. This was not the only time that the Weyerhauser mill had been guilty of such health violations. A similar event took place in May of 1996,[89] and in May 1999, the Washington Department of Ecology fined the pulp mill twice for wastewater discharge violations, those fines totaling $13,000.[90] Two further violations that year brought the company's tab for 1999 up to $27,000. Once again, in 2000, the state Department of Ecology hit Weyerhauser with another $20,000 fine for three separate incidents of excessive fecal coliform discharge, some of which again shut down the oyster growers.[91]

Given this undeniable need for clean water, why, then, have growers come to rely so heavily on carbaryl to kill ghost shrimp? The short answer is that nothing else to date has proven as effective at killing them or otherwise ameliorating their effects. Carbaryl kills shrimp and other marine organisms by disrupting their nerve transitions, resulting in respiratory muscle paralysis, convulsions, and hyperactivity, as well as increased metabolic activity and oxygen demand. These symptoms combine to cause death for many of the

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[88] Rauber, "The Oyster is Our World."
[89] Doug Barker, "Oysters and Clean Water." The Aberdeen Daily World, October 4, 1997.
[90] "Quarterly Enforcement Summary." Washington State Department of Ecology. Olympia, WA, August 12, 1999. Full Enforcement Summary also available at www.ecy.wa.gov/news/1999news/99-159.html.
[91] "Cosmopolis Mill Fined Another $20,000 for Repeated Discharges." Washington State Department of Ecology. Olympia, WA, July 17, 2000. Further information available at www.ecy.wa.gov/.

hapless marine creatures exposed to the pesticide.[92] One spraying of the pesticide eliminates the shrimp for a period of about three years.

Marshalling the Evidence

When Marvin Gaye sang "Poison is the wind that blows, from the north and south and east" in his 1971 song "Mercy, Mercy Me", it is unlikely he had Willapa Bay in mind specifically. However, if you change the words "wind that blows" to "tide that flows" you get an accurate description of how some observers felt about the spraying of carbaryl by the early 1990s. The known collateral affects on other marine species certainly bothered those who studied the issue in detail. In May of 1999, the Washington State Department of Ecology released a study indicating that the pesticide remained in sediment for weeks after the actual spraying, at levels greatly exceeding the National Academy of Sciences guidelines. Sixty days after spraying in that year, the level of carbaryl (varying between 0.57 and 1.15 parts per billion) was between nine and nineteen times higher that the Academy of Science's recommendations for the health of marine organisms.[93]

An additional danger in spraying a pesticide on water is that the tides are outside of human control, and the drifting water transports the pesticides outside of the original area sprayed. This has created opposition from small, local oyster growers who do not taint their operations by using pesticides. The Shoalwater Indians, who live on a small reservation at the north end of Willapa Bay, have also voiced concerns over spraying because of fear that

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[92] Brett Dumbauls, Kenneth Brooks, and Martin Posey, "Response of an Estuarine Benthic Community to Application of the Pesticide Carbaryl and Cultivation of Pacific Oysters (*Crassostrea Gigas*) in Willapa Bay, Washington." Marine Pollution Bulletin, October 2001, vol. 42, no. 10: 827.
[93] Bernton, "Insecticide's Use on Tideland Raises Worries."

drifting chemicals will disturb the shoreline adjacent to their reservation.[94] These groups, and others, cite research indicating the carcinogenic traits of carbaryl can affect humans. The chemical has also been linked to reproductive problems in fish, including both salmon and trout, species with both economic and symbolic value in Washington. For these reasons, the states of Alaska, Oregon, and California prohibit the use of carbaryl.[95]

Willapa's oyster farmers have countered this argument with some scientific research backing their own views about carbaryl. One example is a 2001 study in the *Marine Pollution Bulletin* that tested the effects of carbaryl on various marine species over the period 1992-94, and their study produced some interesting results. To no one's surprise, the pesticide hit shrimp species hardest. Interestingly, though, while crustaceans also suffered significantly during the initial spraying, their populations rebounded within about 3 months, and a year later, their populations were typically as dense, or denser, than before spraying took place. Testing on mollusk and polychaetes (worm) populations produced mixed results, with some species demonstrating negative effects on their populations, others positive effects, and some no statistically significant effects at all. The overall conclusions of the study stated that the primary effect of carbaryl on marine life generally was short-term. The authors concluded by recommending that future research focus on "examining the support function of, in interplay between shrimp dominated communities and those influenced by oyster culture operations."[96] Oyster growers point to studies such as this to defend their practices of spraying.

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[94] Ibid.
[95] Romano, "Oyster Farmers' Pesticide Battles."
[96] Dumbauld, Brooks, and Posey, "Response of an Estuarine Benthic Community." 842.

A Happy Ending?

In 2003, the Willapa Bay/Grays Harbor Oyster Growers Association signed an agreement with the Washington Toxics Coalition and the Ad Hoc Coalition for Willapa Bay calling for a gradual phase-out of carbaryl over the ten-year period 2003-12. The plan calls for the gradual reduction of carbaryl use, in ten percent increments each year for the duration of the ten-year period. In addition to decreasing their reliance on carbaryl, the Growers Association agreed to spend $10,000 over three years to work with environmental groups to find sustainable strategies for growing oysters without the use of chemicals.[97] In exchange, the Toxics Coalition and the Ad Hoc Coalition agreed to drop their lawsuit against the oyster growers. The lawsuit charged the oyster growers with violation of the Clean Water Act, claiming that carbaryl required the growers to obtain a water pollution permit.[98]

Reaction to the agreement, and predictions for the future of oysters in Willapa Bay without carbaryl, are predictably mixed. Dick Wilson, a grower who does spray with carbaryl, stated bluntly "If we don't use it, we don't farm."[99] "It'll be a slow demise of the oyster growing industry in Willapa Bay - that's a fact," echoed Growers Association President Dick Sheldon in 2000.[100] However, even within the industry, not everyone agrees. Speaking about a preliminary agreement on reducing carbaryl use signed by the Growers Association in early 2001, one member, Bill Dewey, said, "Carbaryl has been the most effective, but using a pesticide is controversial and not a permanent solution." He went on

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[97] Jessica Chesbro, "Success After Years of Work: An Insecticide Out of Willapa Bay." Journal of Pesticide Reform, Summer 2003, vol. 23, no. 2: 4.
[98] "Washington Oystermen Agree to Phase Out Carbaryl Use." Pesticide and Toxic Chemical News, May 5, 2003, vol. 31, no 28: 16.
[99] Quoted in Romano, "Oyster Farmers' Pesticide Battles."
[100] Quoted in Ibid.

to add, "We're going to do our best to use every tool in the toolshed to control shrimp and wean off the chemical."[101]

Among the oyster growers of Willapa Bay, Larry Warnberg is the strongest advocate for a future without chemical pesticides. Much of the uproar surrounding carbaryl use is the result of his attempts to fight carbaryl spraying, and as the co-founder of the Ad Hoc Coalition for Willapa Bay, the 2003 agreement was the culmination of his efforts towards that end. Though he is not solely responsible for waging the fight against chemical spraying, he remains public enemy number one among his fellow growers due to his continual battle to stop pesticide use for the better part of a decade. Having grown oysters without pesticides for almost twenty years, he is Willapa Bay's most vocal advocate for protecting marine life through alternate methods of raising oysters.

These predictions of woe echo the situation surrounding the Northern spotted owl legislation in Grays Harbor County in several ways. However, it is important to note a crucial difference between the spotted owl legislation and the carbaryl agreement. The fact that the oystermen signed an agreement calling for the *gradual* reduction and elimination of pesticide use may prove important as the story plays out. It remains too early to know what will eventually transpire in the oyster industry of Willapa Bay without carbaryl. Only three years into the agreement, it is too soon to tell if the economic doomsday predictions will come true, or if a sustainable strategy for growing oysters exists. Whatever the final outcome, however, the gradual implementation of this agreement should help to prevent a replay of the massive economic dislocations that rocked Grays Harbor County in the immediate aftermath of the spotted owl legislation. Although chapter one described how the long-term predictions of economic disaster have not necessarily come to pass in Grays

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[101] Quoted in Erin Middlewood, "Oyster Farmers Sign Pact on Pesticide." The Oregonian, February 1, 2001: D2.

Harbor, the short-term problems were severe, and hopefully Willapa Bay will avoid a similar fate.

The Story Intertwines

As pesticide use is phased out by oyster growers seeking to combat the ghost shrimp, there is a question of whether the Washington Department of Natural Resources, in charge of controlling spartina, will take their place as pesticide users, or if that agency can find an alternative way to deal with this exotic plant. In their effort to preserve important habitat for oysters, salmon, and birds, Washington Department of Natural Resources officials had small success combating the spread of spartina through the year 2003, with better results the past two. It is possible to uproot and tear out young stands of the plant, but this is not effective against the older, established meadows of spartina. In 1999, the Willapa Bay National Wildlife Refuge bought a specialized lawnmower (at a price tag of $180,000) in an effort to cut down the grass before it could seed. The Wildlife Refuge, primarily located at the southern end of Willapa Bay, contains the oldest stands of spartina around Long Island (see map, page 3).[102]

Unfortunately, mowing the grass has not succeeded in stopping its continued spread, which is aided both by the warmer weather of recent decades and by the tides that disperse its seed. The battle against spartina is becoming a substantial drain to the taxpayers of Washington as well; the cost of combating its spread is currently about $2,000 per acre according to the Columbia Pacific Resources Center.[103] With control costs running high, some want to turn to the same solution that oyster growers have employed against the ghost

[102] Middlewood, "Bugs Turned Loose on Invasive Grass."
[103] Ibid.

shrimp: control and eradication using pesticides. In this case, the primary chemical agent of choice is not carbaryl but glyphosate, the active ingredient in the herbicide Rodeo, an aquatic version of the commercial weed killer Roundup.

The decision of whether or not to employ Rodeo is a difficult one for the same reason that carbaryl spraying on oyster beds was controversial. On the positive side, Rodeo has produced some success. However, the potential drawbacks of widespread pesticide use on the 15,000 acres infested with spartina raises serious questions about the health risks to local plants and animals, humans included. This is because as the pesticide breaks down, the active component, aminomethyl-phosphonic acid, absorbs into the sediment underlying the spartina grass.[104] A study of Rodeo use against spartina published in 2003, considering the question of just how much aminomethyl-phosphonic acid affects the surrounding plants, arrived at some intriguing conclusions. It found that while the active ingredient itself did not pose a great threat to plant and animal organisms, certain surfactants (a detergent-like substance that helps otherwise incompatible components of a mixture to mix) did pose a great threat when used to spray Rodeo. The study concluded that the focus of concern with this herbicide should be on the surfactant used in the spray, and not the active ingredient.[105]

Opponents of pesticide use continue to consider other means of halting and reversing the advance of spartina. One such strategy calls for the use of an aphid-sized insect called prokelisia that proved to kill spartina in a greenhouse setting at the Washington State University Cranberry Research Station in Long Beach, WA. (Though, interestingly, the bug is ineffective against other types of spartina. Scientists speculate that the reason for this is that the local spartina plants lost resistance to the prokelisia in its 100-year isolation from

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[104] W. Major, C. Grue, S. Gardner, and J. Grassley, "Concentrations of Glyphosate and AMPA in Sediment Following Operational Applications of Rodeo to Control Smooth Cordgrass in Willapa Bay, Washington, USA." Bulletin of Environmental Contamination and Toxicology, 2003, 71:912.
[105] Ibid., 917.

the insect.)[106] Adding to the appeal of this biological solution is the fact that prokelisia appears to eat only spartina. Without the plant as a source of food, the insects refuse to eat and die, according to Dr. Donald Strong of the University of California-Davis. To a large extent, this relieves worries that by introducing prokelisia, scientists will merely be replacing one invasive species with another.[107] As with the oystermen's agreement on carbaryl, it is too soon to determine the ultimate effectiveness of this tactic, but it holds out some hope of fighting spartina without an over-dependence on chemicals.

Looking Ahead

The two stories of spartina containment and carbaryl use in Willapa Bay are meaningful on several levels. The first is the obvious economic level. Oyster farming remains one of the key economic activities in Pacific County. The proliferation of ghost shrimp threatens the economic livelihood of many residents of Willapa Bay, as does the potential of spartina to swarm over the tidal lands where the oyster beds are located. The economic burden on Washington's taxpayers of fighting spartina is growing as well. Protecting the standard of living for Pacific County residents is important, because as figure 8 shows (page 35), the county has not shared in the increasing general prosperity of Washington state over the last decade.

Figure 8 illustrates some notable things. With real wages only slightly more than half that of the rest of Washington, and that have actually declined over the past thirty years, the people of Pacific County cannot afford the blow to their local economy that would result if

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[106] "Washington Researchers Hope to Control a Fast-Spreading Weed in Willapa Bay Mudflats with a Beneficial Insect." Pesticide and Toxic Chemical News. August 17, 2000, vol. 28, issue 43: 15.
[107] "State May Employ a Hungry Bug to Control a Willapa Bay Weed." Control a Willapa Bay Weed." The Seattle Times, February 27, 1998: B2.

spartina were allowed to crowd out productive oyster beds. This recent decline in overall prosperity makes it imperative that state agencies and local people do something to preserve the local oyster industry and stop the spread of spartina.

That leaves the question of what, exactly, needs to happen regarding ghost shrimp and spartina. The strategy of using carbaryl against the ghost shrimp is out of favor for now, at least through the year 2012. If the non-chemical solutions to the ghost shrimp problem do not succeed, however, will we see calls for a return to carbaryl or some similar chemical agent? What about spartina? Mowing it is a stopgap measure at best. It may prevent the seeding of the plant, and thus its spread, but it does nothing about the root system and therefore nothing about removing the problem. It is possible that the insect prokelisia will help destroy some of the grass, but even scientists who advocate its use concede that it may not eradicate spartina altogether. If this biological solution does not succeed, will the WDNR turn back to chemical pesticides as the only effective measure? A chemical solution would force the WDNR to choose between the lesser of two evils. It forces an evaluation of which risk is greater, the risk of spartina's continued spread or the risk to the environment of heavy use of chemicals against the plant.

Washington's response to this question is an integrated one. The most recent efforts from 2003 to 2005 combine many of the approaches discussed already. Ongoing efforts to educate landowners have helped in small ways. Many people will pull out or dig up young plants before the thick root systems become established. The monstrous lawnmower is now more of a rototiller, used to uproot spartina and till it under the ground. Tilling cordgrass to uproot it achieves two useful results. It kills some, though not all, of the plant. Tilling also buries the plant in the mud, and thereby increases the surface area of tidal mudflats that migratory bird populations depend on. Efforts to introduce more of the prokelisia insect are

ongoing. Finally, the use of pesticides continues in combination with these other methods.[108]

The results of this integrated approach are promising. In 2003, the Willapa National Wildlife Refuge combined with the state Department of Agriculture and local oyster growers to treat 5,000 acres of cordgrass. The integrated approach killed ten times as much cordgrass as any previous year and, for the first time, diminished the area colonized by spartina. Future follow-up efforts will include the continued treatment of some areas to achieve eradication, as well as treatment of new areas.[109] The prokelisia appear to be making some progress as well. After five years, groups of the insects have established themselves, and studies continue to find the most effective type of prokelisia for the environmental conditions present in Willapa Bay.[110]

The eventual outcome of events in Pacific County is clearly important to the local residents, their economic prospects, and their way of life. In truth, though, the implications are much larger. The intertwined problems of spartina eradication and ghost shrimp control for oyster farming have the potential to serve as important examples in the greater debate over whether the environment and economic prosperity can co-exist. The story of the spotted owl and the timber industry of Grays Harbor provides one example of how communities can have jobs and preserve critical habitat at the same time. Though the issue in Pacific County is about limiting or getting rid of unwanted and invasive species, instead of preserving an endangered one, the outcome there will inform this important debate in much the same way.

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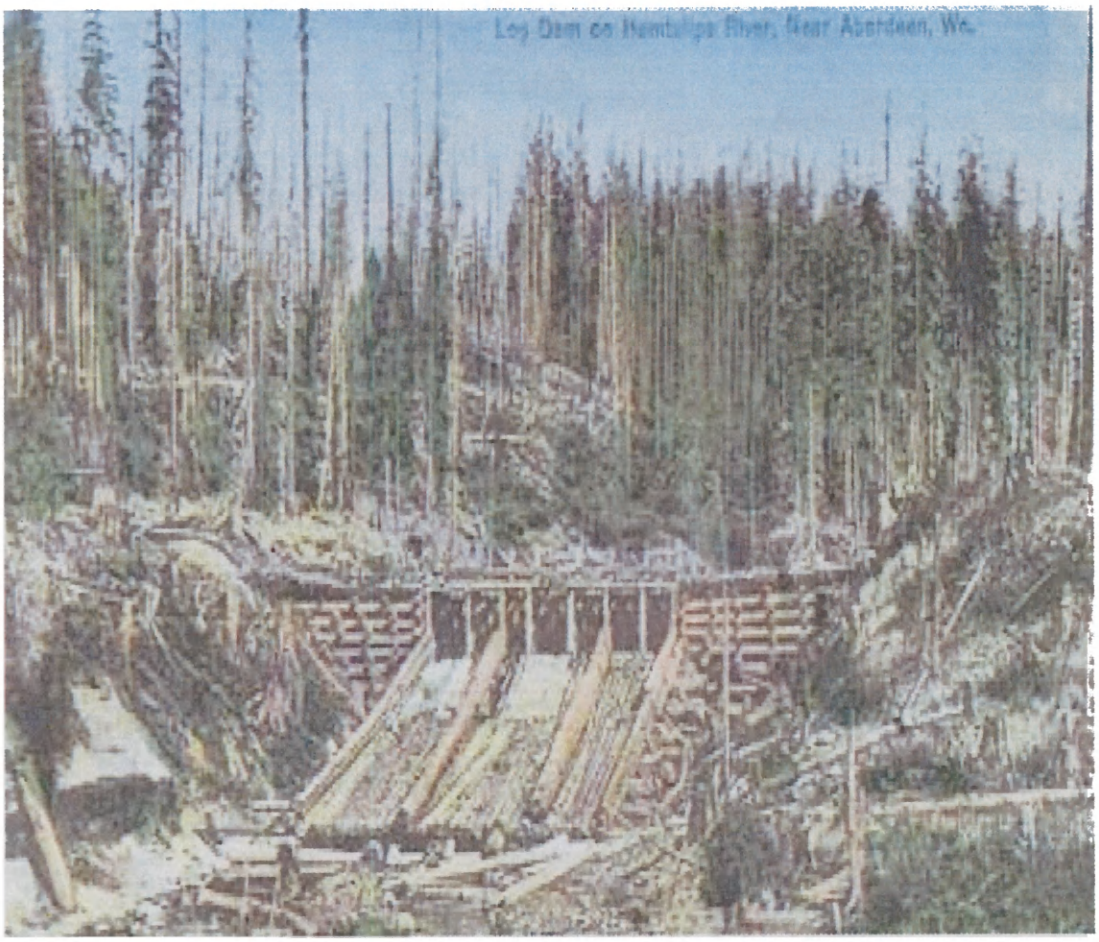
[108] This information is from the website of the Willapa National Wildlife Refuge, found at http://www.willapabay.org/~fwnwr/spartina.html.
[109] Eric Apelategui, "Lonely, Beautiful, and Threatened: Willapa Bay's Advocates Fend Off Invasions." Washington State University Magazine Online, Spring 2004. Available online at http://washington-state-magazine.wsu.edu/stories/04-spring/willapa-1.html.
[110] Fritzi Grevstad, "Update: Bio-Control Project." Spartina Control News, Issue 26, June 2005, 2.

It is easy to root for the oyster growers to succeed in their efforts to raise oysters without resorting to pesticides, while at the same time rolling back and eradicating cordgrass. Many have a history in Willapa Bay going back several generations, and for those families, oysters are a way of life. No matter which side of the environment versus economy debate one stands on, the outcome in Willapa Bay affects his or her life. After all, the selection in the seafood department of grocery stores all across the nation could depend on it.

Chapter Three

Down to the River



Watershed Health and Salmon in Grays Harbor and Pacific Counties

Driving along Highway 105 in Grays Harbor County, Washington, near the border with Pacific County, a motorist emerges from a series of rolling hills and passes over the bridge spanning the Elk River tidal estuary. To the west are the waters of Grays Harbor, to the east the Elk River and its estuary. The view depends on the time of day and the tide level. At low tide, mud flats are in evidence, and viewers can clearly see the various streams and pools that join with the river here. As the tide comes in and the water rises, however, the individuality of each stream merges into a blue-green flatness of shallow water. On a sunny day, the openness and brightness of the scene cannot fail to impress even the most jaded viewer with the natural beauty of this location.

Remarkable as this particular scene is, the Elk seems an otherwise unremarkable river. It is not particularly long, and many state maps do not even depict it at all. No centers of population or industry depend on it for survival. Yet the river and its estuary provide a valuable lesson in land use and its impact, both for the local people of Grays Harbor County and to the larger society as well. It is particularly worthwhile to contrast the history and present condition of this river with some of the other larger and well-known rivers in Grays Harbor, especially the Chehalis and its tributaries. In turn, a comparison of the Chehalis river system with even larger systems such as the Columbia or Snake River demonstrates that salmon and other fish in the Chehalis River face all the same problems as fish on these larger systems. Though the scale of the problems is smaller in coastal Washington, each river system shares many of the same obstacles for fish, and despite the individual history of each body of water, the decline of native fish runs is due to similar circumstances.

Spend even a small amount of time fishing the rivers and creeks of Grays Harbor or Willapa Bay, and one thing that will stand out are all the pilings still in place. Often, now, mosses or weeds coat these wooden stakes, but they remain in place decades after last being

used, silent memorials of the logging history in the region. As intriguing and colorful as that past was, its environmental downside has received increasing attention in recent years as the need to understand the links between logging, dams, and fish runs becomes increasingly important to preserving salmon runs in Washington, many of which are in danger. Understanding these links is important to the continuing efforts to preserve the salmon, such an important natural and cultural symbol throughout coastal Washington and the entire Northwest.

Biologists understand the stages in the life cycle of the salmon, even if the particular reasons for the fish's behavior remain elusive. There are several species of salmon in Washington, most notably the king, silver, sockeye, and chum. These various types of wild salmon hatch in the gravel of shallow streambeds. (There are many salmon hatcheries in Washington as well, all of which attempt to raise salmon in a controlled environment free of natural predators and release them at the right age for their downstream migration. The successes and failures of the hatchery system make for an important story, but they play a limited part here.) Upon reaching a certain size, the fish head downstream towards the ocean. As an anadromous fish, the physiology of their bodies changes from that of a freshwater fish to a saltwater fish during the journey downstream. Once they reach the ocean, the salmon will spend most of their lives there, before returning upstream to spawn just before death. Amazingly, the fish will return to the exact place where it spawned, often within just a few feet, in order to deposit a new group of eggs to perpetuate the species.

In order to complete its journey successfully, the salmon requires several conditions. For spawning purposes, it requires a gravelly streambed where the water is clear and cool. After the female salmon lays her eggs, 3,000 - 5,000 of them, and the male salmon fertilizes them, she will bury them in pebbles. After about 50 days of lying buried in the streambed,

they hatch (amazingly, as many as 99% of the eggs do), and begin feeding on small insects and drifting organic matter. Salmon spend up to eighteen months in this stage after spawning. After they have grown to a sufficient size to begin the journey downstream to the ocean, they require an unobstructed, swift-flowing stream in order to insure that they reach the ocean at the right time for their bodies to undergo the physiological changes from a freshwater to a saltwater fish. The stream needs to be free flowing because the young salmon generally float downstream instead of swimming. After reaching the ocean, they typically spend one to five years feeding, growing, and dodging predators before returning to spawn.[111]

For the return trip, the mature fish is capable of overcoming significant obstacles to reach its final destination. They are able to jump over falls and other natural obstructions up to ten feet tall that block their path in order to find their original spawning grounds. (When Julius Caesar's legions saw the Atlantic salmon perform such feats, they named it *salmo*, the leaper, giving the fish its name.) The fact that 90 percent of salmon return to within a few feet of their birthplace before they spawn and die is well known, but that should not diminish our appreciation of this miraculous and, so far, poorly understood ability. Though the system is not quite perfect, a few salmon lose their way on the journey to spawn and lay their eggs in unfamiliar places. Salmon biologists believe, however, that this deviation by a few fish is a natural strategy to create genetic variability.[112]

Though the salmon is a tenacious and powerful fish, capable of overcoming nearly all of the roadblocks nature may place in its path, humans have modified the salmon's environment in ways that the salmon cannot always overcome. The most obvious (and most

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[111] Keith Petersen, River of Life, Channel of Death: Fish and Dams on the Lower Snake. (Lewiston, ID: Confluence Press, 1995): 106-7.
[112] Ibid, 107-8.

threatening to the salmon) is the construction of dams in the path of salmon migrations. It is undeniable that these dams serve many useful purposes, including hydroelectric power generation, flood control, inland navigation, diverting water for irrigation, and recreation on the reservoirs that dams create. From the point of view of the salmon, however, they are a disaster, for multiple reasons.

First of all, the fish need to be able to get by the dams going both upstream and downstream. Those salmon heading downstream to the ocean sustain a frightening mortality rate when attempting to bypass dams, estimated at 15 percent per dam for the major structures on the Columbia and Snake Rivers.[113] Several factors combine to cause this level of mortality. The turbines inside the dams kill some of the fish that pass through them; even for the survivors, passing through the turbines often leaves them disoriented, making them easy prey for the squawfish and other predators that congregate at the base of the dams.[114]

The phenomenon of nitrogen supersaturation also plays a large role in killing fish attempting to bypass dams. Air is 78 percent nitrogen, and when water contains too much of it nitrogen supersaturation occurs. Dams create this situation when water passes over the spillways. The pool below traps the air and its nitrogen. In a free flowing river, the nitrogen supersaturation dissipates in the form of gas bubbles, but for rivers dammed multiple times, or containing a great deal of slackwater in storage reservoirs, the excess nitrogen does not dissipate from the reservoirs. The resulting supersaturation kills the salmon by blocking their blood vessels with gas bubbles, the same phenomenon that humans call the bends.[115]

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[113] These effects are cumulative. For example, if 100 salmon had to bypass five dams to reach the Pacific, 15 percent would perish when passing over the first dam, leaving 85 fish. Fifteen percent of those survivors would die at the second dam, leaving 72 fish (rounded off) to challenge the third dam. After passing all five dams, on average, only 44 fish (rounded off) will still be alive.

[114] Petersen, River of Life, Channel of Death, 110.

[115] Ibid, 138-9.

The third obstacle posed to salmon by dams is the slackwater reservoirs that build up behind the dams. As mentioned earlier, young salmon moving downstream typically float instead of swimming, and the timing of the entire operation is critical. Slackwater eliminates or greatly diminishes the current; too much slackwater and the young salmon will not make it to the ocean soon enough. Their bodies will change before they reach they ocean and, unable to live in freshwater any longer, they will die.

The final piece of the mortality puzzle surrounding dams concerns the adult fish heading upstream to spawn. Not only do they have to survive between one and five years in the ocean, overcoming both commercial fishing operations and predation from other marine creatures during that time, they also have to swim upstream against the river current to reach their birthplace. When the salmon encounter a dam, after overcoming possible nitrogen supersaturation, they must locate whatever fish passage facility the dam offers if they are to proceed any further. Typically, this means finding a fish ladder to bypass the dam. Then and only then are they able to complete their epic journey to their home stream and spawn. Unless, that is, their home stream is blocked by a dam with no fish passage system in place, such as Grand Coulee on the Columbia. When completed in 1942, this massive concrete monolith had no fish passage facilities for spawning salmon. From that time on, salmon runs on the upper Columbia were no more.

In addition to dams, other factors affect the salmon's survival chances, and there is plenty of blame to go around. Agriculture has hurt salmon habitat by polluting streams with wastes, pesticides, and herbicides. Diverting water for irrigation dries up other habitat areas by lowering water levels, exposing the gravel beds where salmon spawn. Pollution from industry and cities reduces water quality. Mining operations play a role as well. Dredge mining in streambeds destroys habitat in the area of the dredging and sends sediment

downstream to bury other spawning grounds. Placer mining, on the other hand, diverts water from streams using temporary dams, often with no fish passage facilities.[116] Add to this the threat posed to salmon by natural predators, and human predation in the form of sport and commercial fishing, and the continuing decline of salmon runs should surprise no one.

Localizing the Plight of the Salmon

Salmon spawning in the watersheds of Grays Harbor and Willapa Bay face many of the problems pertaining to salmon in general, though on a lesser scale than the salmon on a major river system such as the Columbia. However, just as dams on the Columbia are problematic for salmon survival, the same is true of human constructions in Grays Harbor and Pacific counties. Though there is nothing on the scale of Bonneville or Grand Coulee Dam, as of 2006 Pacific County contains nine dams. Of the nine, the Washington Department of Fish and Wildlife (WDFW) classifies three as total obstructions to fish passage, three as partial obstructions, two as non-obstructions, and one as having an unknown impact.[117]

As an example of the impact of these dams, consider the two largest rivers systems in Pacific County, the Naselle and the Willapa. The Willapa system features only one dam, located on its upper reaches and rated as partially obstructing by the WDFW. The WDFW classifies both its runs of fall chinook (king) salmon and coho (silver) salmon on the Willapa

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[116] Ibid, 167.

[117] Washington Department of Fish and Wildlife, "Salmonscape" Interactive Mapping Program. Found online at http://wdfw.wa.gov/mapping/salmonscape/. This mapping program is an outstanding source of information for those interested in the topography, river systems, salmon runs, stream attributes, or other information related to salmon and fishing in Washington.

as healthy. The Naselle River, on the other hand, has two dams, both located in its middle section and rated partially obstructing. Its runs of fall chinook and coho, both rated as depressed by the WDFW, are not as healthy as those of the Willapa River system. A third river system in the county, the Chinook River system, is home to two of the dams rated as total obstructions. Not surprisingly, there are no substantial runs of either chinook or coho there, an unfortunate irony considering the river's name.[118]

The situation with dams in Grays Harbor County is much the same, but on a somewhat larger scale. There are currently eleven of them, seven rated as total obstructions, three as partial obstructions, and one unknown. There are several river systems of modest size in Grays Harbor, the largest of which is the Chehalis. Its river system is the third largest in Washington, after the Columbia and Snake. Though subjected to several modifications near its mouth by the city of Aberdeen and the United States Army Corps of Engineers (discussed later) its main course contains just one dam, and it hosts generally healthy fish runs according to the WDFW. Other rivers systems with dams in Grays Harbor County, such as the North, Wynoochee, and Quinalt, have more mixed records in terms of supporting healthy salmon populations, based on WDFW data.

The timber history of the area adds several other circumstances that are deleterious to the existence of the salmon. Historic logging practices hurt the fish in a type of chain reaction, with one event inexorably leading to the next and the effects compounding on the salmon. Recall that salmon need spawning grounds featuring clear, cool water with gravel beds where the female salmon bury their eggs. Logging, especially logging using the clearcut technique, affects all three of these spawning ground requirements. General deforestation, such as clearcutting produces, allows for greater soil erosion. Because water flows downhill,

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[118] Ibid.

much of the extra soil carried in runoff eventually finds its way into the local rivers, causing increased siltation. Not only does this cloud the water, the silt covers the gravel of potential spawning grounds. Cutting down the trees directly bordering the watercourse eliminates shade, and this increases the water temperature, further reducing the suitability of the stream for spawning salmon.[119] The elimination of riparian vegetation even influences the distribution of insects along the watercourse, some of which serve as food for the young salmon.

Timber cutting practices themselves are not the only historic force that harmed the salmon runs. Techniques to harvest the timber played a role as well. Timber harvesting traditionally was heaviest in riparian areas, because local rivers were the easiest way to transport the logs for milling or export. Pushing one Douglas fir after another into a river eroded the banks of the river. Sometimes the logs would jam, creating rafts almost a quarter mile in length blocking the flow of water and the ability of salmon to move up or down streams.[120] Then there were the splash dams, such as the one pictured on the title page of this chapter. Not only did these edifices typically contain ineffective fish passage facilities or no facilities at all, they would often block stream flow entirely to insure the transport of logs downstream at regular intervals. The sudden release of the dammed waters damaged spawning beds and sometimes even rechanneled riverbeds entirely.[121]

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[119] Joseph Taylor, Making Salmon: An Environmental History of the Northwest Fisheries Crisis. Seattle: University of Washington Press, 1999, 55-7.
[120] "Chehalis River Basin Action Plan." Chehalis River Council. Centralia, WA, April 2000. Located online at www.crcwater.org/tours.html
[121] Taylor, "Making Salmon." 55-7.

Identifying the Present Situation

The troubled environmental past of logging in Grays Harbor and Pacific counties bequeathed many problems to current residents concerned with the health of local river systems and their natural inhabitants. Local residents are surely not alone in having to deal with these unwanted legacies of extractive industry, but their response to the present conditions may hold some clues for other regions facing similar issues.

As already mentioned, the Chehalis is the most prominent river system in Grays Harbor County. In addition to its salmon runs, it is the home of several other species of fish. These other species include the bull trout and Dolly Varden trout, both natives to the Chehalis, and the brook trout, a non-native. Three types of lamprey inhabit the Chehalis watershed, including one that is anadromous like the salmon. White and green sturgeon (the largest North American fish, it can grow to 20 feet long, weight 1,800 pounds, and live to be 100) are found near the river's mouth, while the Olympic mudminnow, rarely found outside the Chehalis watershed and Olympic Peninsula, lives in backwater areas. The regular minnow family is represented by the infamous Northern squawfish (the squawfish is infamous because it is a known predator of juvenile salmon. Various locales in Washington have held squawfish derbies in an effort to reduce their populations.), the redside shiner, speckled dace, longnosed dace, and the peamouth. There are also smelts, suckers, sticklebacks, sculpins, flounders, and whitefishes. The roster of exotic species includes American shad, carp, sunfish, various bass, yellow perch, and catfish. Some of these species,

such as bass and perch, have value as food while others do not; however, all are subject to the effects of human actions.[122]

Close consideration of a few of the rivers feeding the Chehalis are instructive as to how historic economic practices and fish are interrelated. The Satsop River is an important tributary of the Chehalis, providing about 30 percent of its volume by the time the Chehalis empties into Grays Harbor. Though some of the areas on the Satsop's upper reaches in the Olympic Mountains remain old growth timber, 70 percent of the timber stands throughout the drainage are under 35 years old, not surprising considering that corporate entities own 117,010 acres (62.8 percent) of the land in the watershed. Logging in these areas, the construction of logging roads, and a lack of streamside vegetation, combined with an annual rainfall of 70-175 inches per year and the steep hillsides common to much of the Satsop's drainage, has produced serious erosion and sedimentation problems, harming the significant runs of chinook, coho, and chum salmon that spawn in the Satsop. A study conducted by the Washington State Department of Ecology (WSDE) has identified hundreds of places in the watershed in need of erosion control. This excessive sedimentation is especially harmful to the summer fish runs, when warmer air temperatures combined with reduced streamflow create a situation that is inhospitable to the incubation of salmon eggs because the water is slow moving, too warm, and too cloudy.[123]

The Wynoochee River, the Satsop's immediate neighbor to the west, is also a tributary of the Chehalis. Though smaller than the Satsop, humans have modified this river to a significant extent by any standards. Like the Satsop, steep mountain slopes, logging, logging roads, and tremendous rain and snowfall (over 187 inches per year in the upper

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[122] Mike Kelley, "The 'Other Fishes' of the Chehalis River." Drops of Water, Issue 14, November-December 1997. Electronic version can be referenced at www.crcwater.org/newsltr/news9712.html#60.
[123] "Chehalis River Basin Action Plan." Chehalis River Council.

stretches of the Wynoochee) have created difficult problems with slope erosion and sedimentation. Its gravelly bed, historically a boon for spawning salmon, became a bane for the fish as well in the twentieth century when gravel miners scoured the riverbed and gravel bars for their contents as late as the 1970s. Other historic environmental modifications exacerbated the effects of gravel mining on salmon; activities such as the blocking and draining of side channels turned the Wynoochee into a meandering river with less of the gravel favored by salmon for spawning. Besides the impact on salmon runs, the mining, land, and river modifications also lowered the riverbed, thereby lowering the water table. This practice has hurt riparian vegetation and caused bank erosion not only on the Wynoochee, but also on other rivers that historically experienced gravel mining, such as the Satsop and Humptulips.[124]

The Wynoochee Dam, built by the Army Corps of Engineers, is located 51.8 miles above the Wynoochee's confluence with the Chehalis. This edifice serves several useful purposes, including flood control, recreation, and water supply for the city of Aberdeen. However, a concrete barrier 2.2 miles downstream from Wynoochee Dam blocks all fish passage upstream, and it is necessary to attract, collect, and sort all fish heading upstream at this point. Truck drivers then transport the various fish around the dam and put them back into the river on the other side of the dam to continue their upstream journey. Needless to say, mortalities occur during this process of taking fish from the stream and transporting them overland to avoid the dam, and the collection rate is somewhat below 100 percent. In fact, the effectiveness of this tactic, pioneered by the Army Corps of Engineers on the Columbia and Snake rivers in the late 1960s, remains open to question. However, the practice "continues not because science has proved that it works but because it helps

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[124] Ibid.

politicians ameliorate disputes between the river's many users."[125] In addition to the storage reservoir at Wynoochee Dam, pulp and paper mills in Aberdeen also utilize water from the Wynoochee, providing an example of the industrial importance of this river.[126]

Moving westward once more, the Wishkah River is the next tributary of the Chehalis due for consideration. Emptying into the Chehalis in its tidewater portion at the city of Aberdeen, its drainage features clayey soils poorly suited for agriculture but ideally suited for the growing and harvesting of sitka spruce. This river's history amply illustrates the adverse affects of splash dams on salmon. Several of these constructions blocked the Wishkah historically; they were among the more than 100 splash dams in operation between 1880 and 1920 in the Chehalis watershed. Almost all the dams on the Wishkah were large enough to block the passage of fish, and this resulted in the extinction or near extinction of several salmon runs. In addition to blocking the runs, the splash dams destroyed spawning beds when the operators released the pent-up water to float logs downstream. This cut channels in the riverbed and left fish attempting to go upstream high and dry when operators blocked up these temporary water flows. More recently, industrial and municipal pollution from the city of Aberdeen is harming the remaining juvenile salmon attempting to take advantage of the prime habitat offered by the Wishkah and its tributary streams.

The Hoquiam River is a near neighbor of the Wishkah, and shares some of the same characteristics in terms of possessing clayish soils of low quality for farming but gently rolling hills ideally suited to the growth of western hemlock, sitka spruce, and western red cedar. In fact, ecologists classify the Hoquiam River drainage as one of the greatest biomass production zones in the entire world. Historically, logging companies operated extensively in this watershed, with the mixed stands of original trees now replaced by managed forests

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[125] Taylor, Making Salmon, 245.
[126] Chehalis River Basin Action Plan." Chehalis River Council.

of mainly Douglas fir, but also sitka spruce, red cedar, and western hemlock. The siltation from these activities affects the coho and fall chinook salmon that spawn in the Hoquiam, in addition to the steelhead trout and sea run cutthroat. The siltation is so extensive that the city of Hoquiam must extract the silt from their water storage reservoirs on the Hoquiam every other year. This proved particularly disastrous in 1987, when the operation resulted in low levels of dissolved oxygen (causing the nitrogen supersaturation described earlier) that killed about 28,000 fish and resulted in a fine from the WSDE.[127]

Though it flows into the north side of Grays Harbor and not the Chehalis itself, ecologists consider the Humptulips River a part of the Chehalis watershed because it flows into Grays Harbor instead of directly into the Pacific Ocean like the Quinalt. Geologic conditions combine with weather to make this watershed especially vulnerable to erosion because the soils derive from highly erodible marine basalt. The headwaters of the Humptulips are in the southwestern Olympic Mountains. Weather systems rolling in off the Pacific Ocean subject the steep natural slopes where the Humptulips heads to roughly 220 inches of rain per year, including many significant storms. The natural susceptibility to erosion of the soil combines with steep slopes and prodigious rainfall to make the watershed extremely vulnerable to soil erosion without any human assistance. However, there has been plenty of that as well. The Quinalt Ridge and other ridges in the upper drainage experienced significant logging activity historically, and serious erosion episodes resulted, producing almost 85 percent of the siltation and sediment in the river. This historic logging also contributed to erosion of the banks of the Humptulips, a phenomenon that claims close to nine acres of land per year in the watershed. Logging clearcuts not only left the hillsides

[127] Ibid.

vulnerable to erosion, but also left too few trees bordering the river itself to preserve the structural integrity of the banks.[128]

Splash dams are another historic blight on the sizeable salmon populations of the Humptulips. At one time or another, almost 30 of these constructions operated on this river, which is less than 150 miles long. Even in their heyday, observers of these splash dams recognized the disastrous effect of the dams on salmon, and one dam builder, the Humptulips Driving Company, had to build four salmon hatcheries on the river in an effort to mitigate the effects of the dams. Unfortunately, these hatcheries have a rather mixed record and the splash dams, in conjunction with the effects of gravel mining, have had an egregious effect on salmon in the Humptulips. One small ray of hope for the fish in this watershed is related to the fate of the Northern spotted owl described in chapter one. Legislation designed to protect the owl has almost eliminated logging in the Olympic National Forest, sparing the upper reaches of the Humptulips many of the negative environmental impacts of industrial logging for the time being.[129]

The following maps demonstrate the current status of various salmon runs in Grays Harbor County and Pacific County. The first map displays the health status of Fall chinook salmon on each of the rivers discussed in this section. Left to right, they are the Humptulips (flowing into the northern bulge of Grays Harbor), the Hoquiam, the Wishkah, the Wynoochee, and the Satsop. The next map shows the distribution of Fall chinook salmon in the same set of rivers. Map three demonstrates the health of Fall chinook salmon for rivers and creeks in Pacific County, and map four shows the distribution of Fall chinook in Pacific County, along with the locations of the dams discussed earlier.

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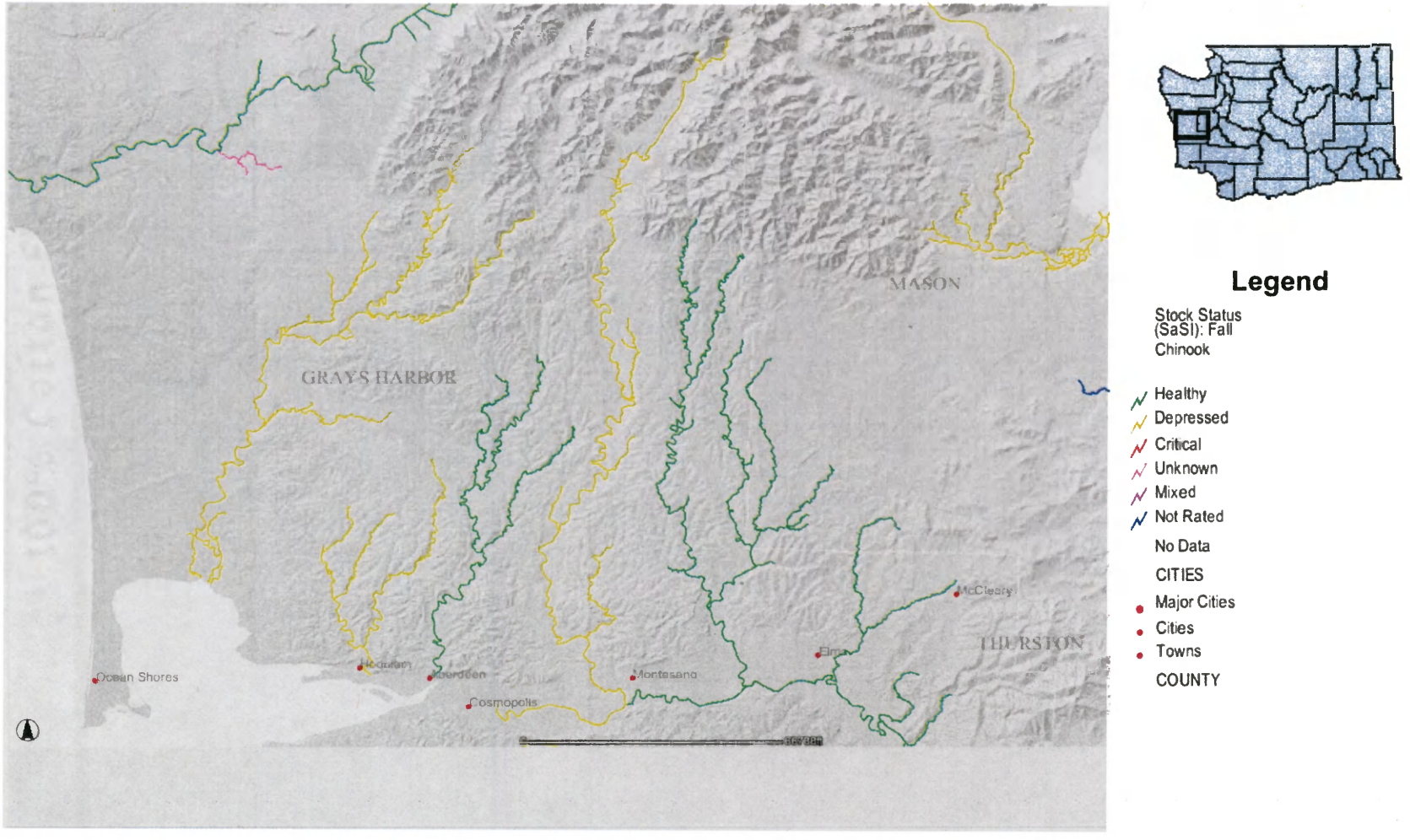
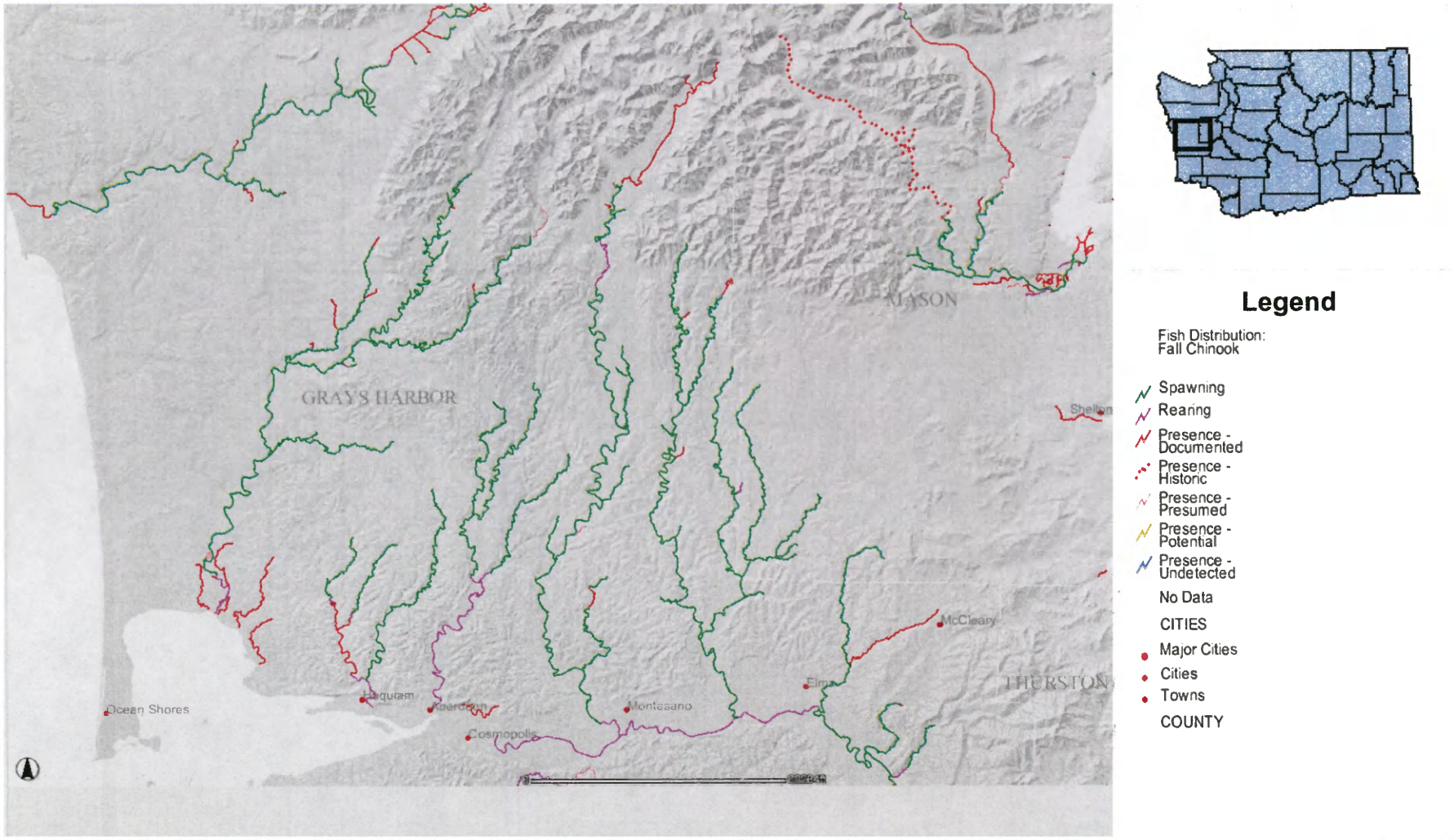
[128] Ibid.
[129] Ibid.

Map 5[130] Stock Status of Fall Chinook Salmon in Primary Tributaries of the Chehalis River



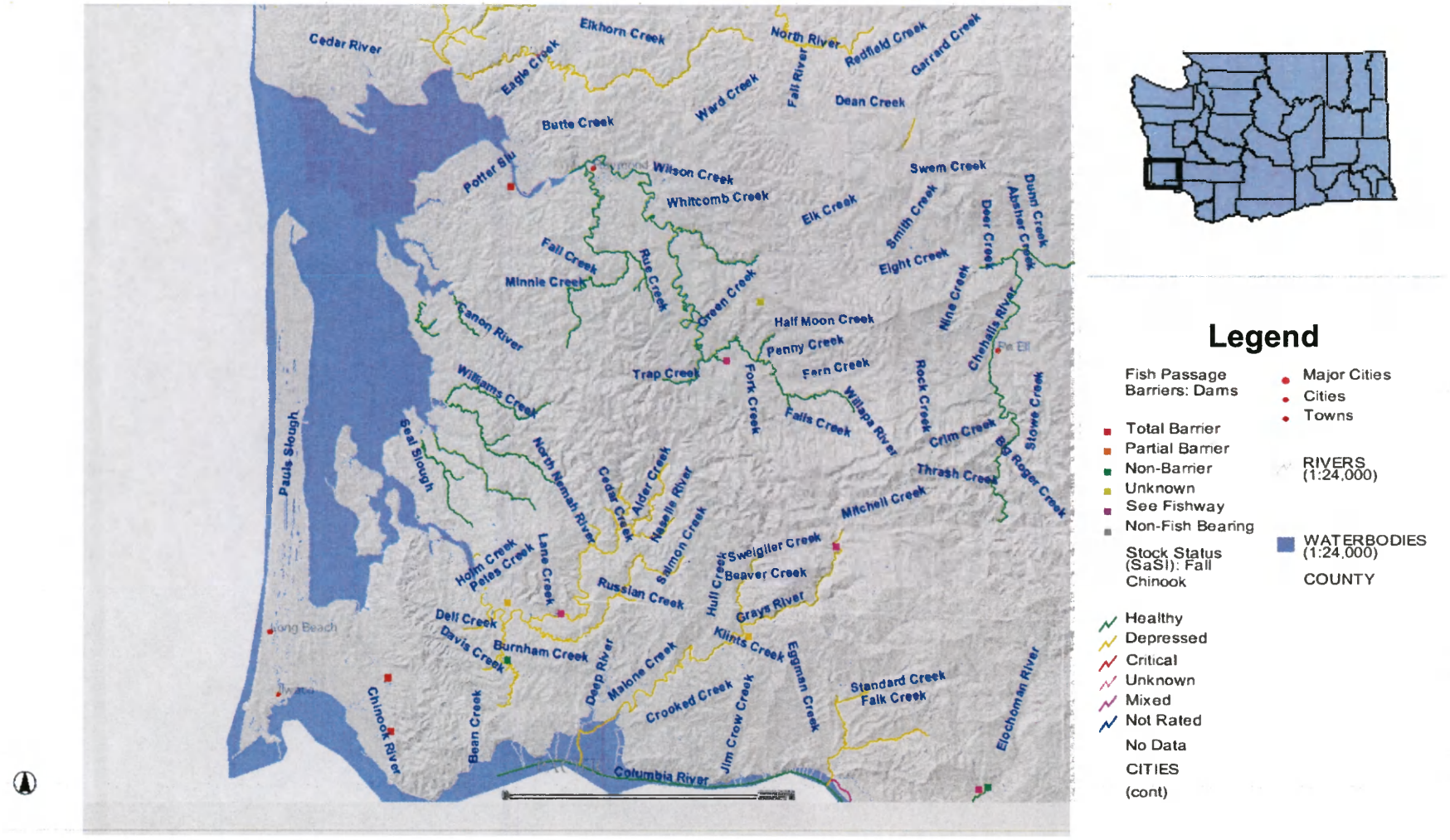
[130] Map created with the Washington State Department of Fish and Wildlife's Salmonscape interactive mapping program. This program is accessible online at wdfw.wa.gov/mapping/salmonscape/index.html.

Map 6[131] Distribution of Fall Chinook Salmon in the Primary Tributaries of the Chehalis River



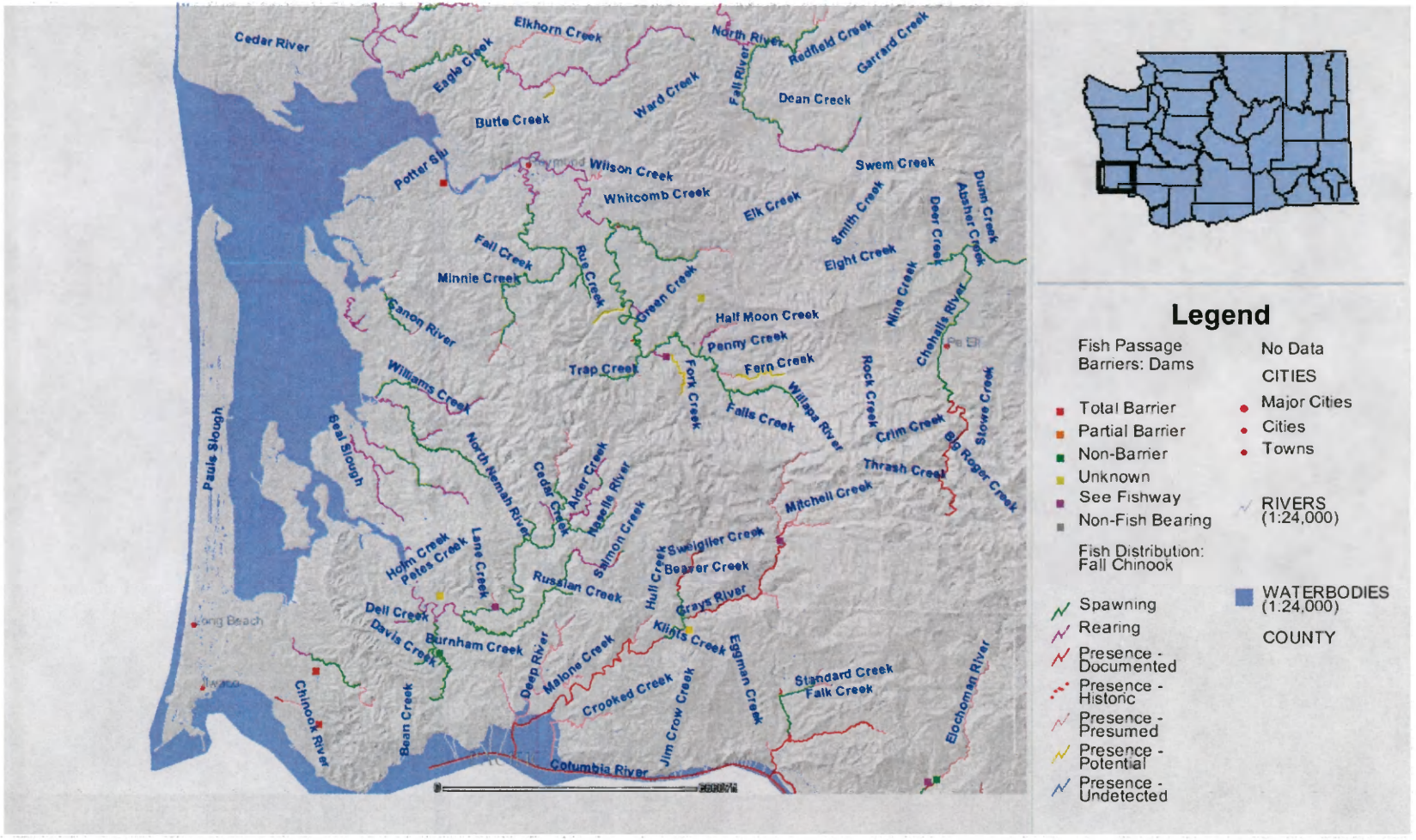
[131] Ibid.

Map 7[132] Stock status of Fall Chinook Salmon in Pacific County, Including Location of Pacific County Dams



[132] Ibid.

Map 8[133] Stock Status of Chinook Salmon in Pacific County



[133] Ibid.

Coming to Terms with History

The history of salmon in the Chehalis basin presents a rather grim picture from the point of view of the fish. In addition, none of the previous accounts even mentions fishing levels (some would say overfishing levels) by commercial and recreational fishers, another obviously crucial factor in the decline of the salmon. Despite the individual characteristics of each watershed, when taken as a whole the reader discovers that salmon in the Chehalis basin face the same major problems as those in larger river systems such as the Columbia or Snake. Despite its smaller scale, the Chehalis river system has historically challenged salmon with obstacles such as permanent dams and splash dams, soil erosion and sedimentation of spawning grounds, lack of dissolved oxygen in storage reservoirs, industrial pollution, residential sewage pollution, and mining of the streambed, and water diversion lowering river volumes.

The debate surrounding the necessity of using the Chehalis River for industrial purposes impacting the environment continues. In 1990, the United States Army Corps of Engineers initiated a project to deepen the channel of the Chehalis over a twenty-mile stretch that encompassed the Port of Grays Harbor. The deepening of the river channel was part of a $70 million plan to help the port diversify its operations from primarily raw log shipments, about 85% percent of cargo operations in 1990, to a more diverse range of products.[134] The plan called for the dredging of 11 million cubic yards of gravel, sand, and mud in an effort to deepen the channel from 30 to 36 feet. Eleven million cubic yards is roughly the same volume of material used to build the three Great Pyramids at Giza.[135]

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[134] David Schaefer, "Unsoeld Backs Project Environmentalists Oppose." The Seattle Times, April 1, 1990: B8.
[135] John Davies, "Massive Dredging Project gets OK, will Deepen Port in Washington." Journal of Commerce, February 23, 1990: 1B.

Though the Port of Grays Harbor had advocated this project for years, the immediate need was connected to the legislation to protect the Northern spotted owl described in chapter one. Because this legislation halted many timber sales, the volume of raw logs moving through the port decreased, forcing it to consider other sources of cargo. Unfortunately, with the channel depth at 30 feet, many of the largest cargo ships refused to call at the port. Others could only do so during certain times of the year, or at high tide, or when shipping only a partial load. By dredging an extra six feet, larger ships would be able to make routine calls at the port, and the port could in turn ship a wider variety of cargo including finished lumber, aluminum, grain, and ores.[136]

Environmental concern with the project centered on two issues. First, the area proposed for dredging would affect the habitat of the indigenous dungeness crab, an economically valuable species. Secondly, environmentalists had significant concerns about the eventual fate of the 11 million cubic yards of material dredged from the river channel. Where would the Corps of Engineers put all that sand, mud, and gravel? Environmental advocates feared that the Corps would use the material to fill in local wetlands, key stopping points for migratory birds as described in chapter two. Eventually, about 90 percent of the fill material ended up in ocean disposal sites,[137] the project went forward, and the Corps of Engineers finished their work in 1991.[138]

Other issues besetting the Chehalis watershed continue to link the environment and history. This narrative already noted several instances of excessive waste discharge by the Weyerhauser mill at Cosmopolis in chapter two. The effect on downstream water users such as oyster growers is well established. One effort is currently underway that seeks to

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[136] Ibid.
[137] Ibid.
[138] William DiBenedetto, "Port of Grays Harbor, Washington, Urges Delay in Upstream Dredging Project." The Journal of Commerce, January 29, 1996: 3B.

ameliorate some of the historic impact of logging in riparian areas on the Chehalis. After realizing that a lack of streamside vegetation and shade creates water temperatures much too high for cold-water fish such as salmon, steelhead, and trout, the WDOE initiated a plan in 2001 to restore streamside vegetation. The impetus for the project was a study in 1991-92 that found that stretches of the Chehalis reached temperatures as high as 75 degrees Fahrenheit during summer months when warm air heated a smaller volume of water. The federal standard for a river such as the Chehalis is 64 degrees. The report also noted a deficiency of shade for virtually all of the lower 100 miles of the Chehalis. As a result the WDOE tightened regulations on timber harvesting by private landowners within a 75-foot buffer on either side of the river, and implemented stronger temperature restrictions on municipal and industrial waste discharge into the river.[139] It will be several years before the exact results of this project become apparent, due to the slow growth of trees, but any improvement will be welcome by the salmon.

Another recent controversy surrounds land use at the former Satsop Nuclear Power Plant. This industrial zone, the site of a colossal waste of $3.8 billion in taxpayer funds by the Washington Public Power Supply System, (WPPSS, also known as Whoops) contains areas that were set aside as wildlife habitat during construction of the nuclear plant in the late 1970s in an attempt to mitigate the environmental impact on the surrounding lands. These habitat areas include 22 distinct types of wildlife habitat and are home to over 200 types of wildlife.[140] The Grays Harbor County Commissioners and the Grays Harbor Public Development Authority wanted to rezone 900 acres of the 1,600 acre park as industrial, a move that local environmental groups, including the Grays Harbor Audubon Society and

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[139] Brian Mittge, "DOE Seeks to Cool Chehalis in Summer." The Chehalis Chronicle, February 17, 2001.
[140] Ryan Beckwith, "Environmentalists Worried About Wildlife Areas at Satsop. The Aberdeen Daily World, March 26, 1999.

Wildlife Forever, opposed. Afraid that the proposed rezoning enabled new industrial development that would exceed the 470 acres currently developed on the site, these two groups brought separate legal actions against the organizations seeking to rezone greater amounts of land.[141]

The industrial zone in question eventually became the Satsop Development Park already mentioned in chapter one. The story demonstrates the continuing effort in Grays Harbor to strike a balance between economics and the environment. The two environmental groups involved did not seek any additional protection for wildlife, only to preserve the already existing level of protection. Both recognized the need for economic diversification in Grays Harbor, while also preserving the health of the Satsop River watershed. As local residents and agencies continue to struggle over how best to preserve the local environment without stunting economic development, it is instructive to take a moment to consider one example of how the situation might look in a more ideal situation.

An Alternate Scenario

Drive twenty minutes south of Aberdeen along Highway 105, and one passes over the Elk River and its estuary shortly before reaching the Pacific County line. Besides its considerable natural beauty, the estuary is notable as one of the largest remaining undeveloped saltwater estuaries on the West Coast. It is ironic, however, that while considered "undeveloped" the estuary is very much a man made creation. In the 1910s, engineers constructed earthen dikes at the mouth of the Elk River estuary, and for 70 years, the area was a combination of freshwater marsh dominated by reed canary grass, soft rush,

[141] Ryan Beckwith, "Wildlife Habitat Focus of Satsop Site Lawsuit." The Aberdeen Daily World, April 8, 1999.

and grassland for cattle grazing. A few crabapple and spruce trees had also colonized the area, but the cattle grazing kept their numbers in check.[142]

This situation persisted until 1987, when the state of Washington agreed to breach the saltwater dike at one location in order to inundate 56.8 acres of land and restore a saltwater marsh to the estuary. The Seattle division of the United States Army Corps of Engineers executed the breaching of the dike, at a spot where a natural channel allowed tidewater to flood the estuary. The state agreed to this course as mitigation for 39.5 acres of wetland lost with the construction of an airport at Ocean Shores on the western side of Grays Harbor.[143] While the cause of the breach was a straightforward situation of creating one saltwater marsh to compensate for the loss of another, the results of this action contain valuable insights to guide future efforts at restoring coastal wetlands. The presence of many such areas around Grays Harbor and Willapa Bay, where dikes built to create pastureland abound, is one more instance where these two counties have an example to offer the state and the nation of the importance of past and present land use patterns.

Ecologically, the results of the marsh restoration provide valuable information on the process and time frame that full restoration might take in other areas. The replacement of freshwater plant species by saltwater species was most rapid in the second, third, and fourth years after the breach, but continued to take place at a slower rate for more than a decade afterwards. The most prominent new species included Lyngby sedge, tufted hairgrass, seashore salt grass, pickleweed, and seaside arrowgrass. Several notable and positive ecological events occurred in the aftermath of the dike breaching in 1987. The conversion from pastureland to tidal marshland increased the habitat available to migratory bird species.

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[142] Ronald Thom, Robert Zeigler, and Amy Borde, "Floristic Development Patterns in a Restored Elk River Estuarine Marsh, Grays Harbor, Washington." Restoration Ecology, vol. 10, no. 3, September 2002: 488.
[143] Ibid.

In addition, the overall diversity of plant species in the area increased, from the initial eight present in 1987 to eighteen in 1998. An added bonus to this diversification of species was the decline and, after three years, elimination, of reed canary grass, considered a noxious weed.[144]

This seeming success story does raise one notable red flag. Among the conclusions offered by the authors of the study on the Elk River estuary is that now, almost two decades after the restoration effort began, the restoration remains incomplete. Seventy years of protection from tidal inundation allow the pastureland to subside an average of about one meter. Full restoration will not be complete until sediment buildup returns the marsh to its original elevation, a process that could require more than 75 years at current rates of accretion. The authors also state that the elevation of the marshland is a critical determinant of what types of plants establish themselves for the long term.[145] This should sound as a warning to anyone who believes mitigation, restoration, or both can be a simple or quick solution to problems of wetland destruction elsewhere. It indicates that the solution of mitigation, such as that which caused the breaching of the dike at the Elk River in the first place, is no panacea for marsh and wetlands compromised by urban or industrial development.

To the south of the Elk River, in Pacific County, is another example of the benefits of a land use strategy not centered on timber harvesting or urban populations. Flowing into the south end of Willapa Bay is a small body of water known as Ellsworth Creek. The watershed, comprising about 7,300 acres, is home to some of the only remaining lowland temperate rain forest in Washington. Much of this temperate rainforest is concentrated in a 300-acre grove that helps support some of the healthiest salmon runs in all of Washington.

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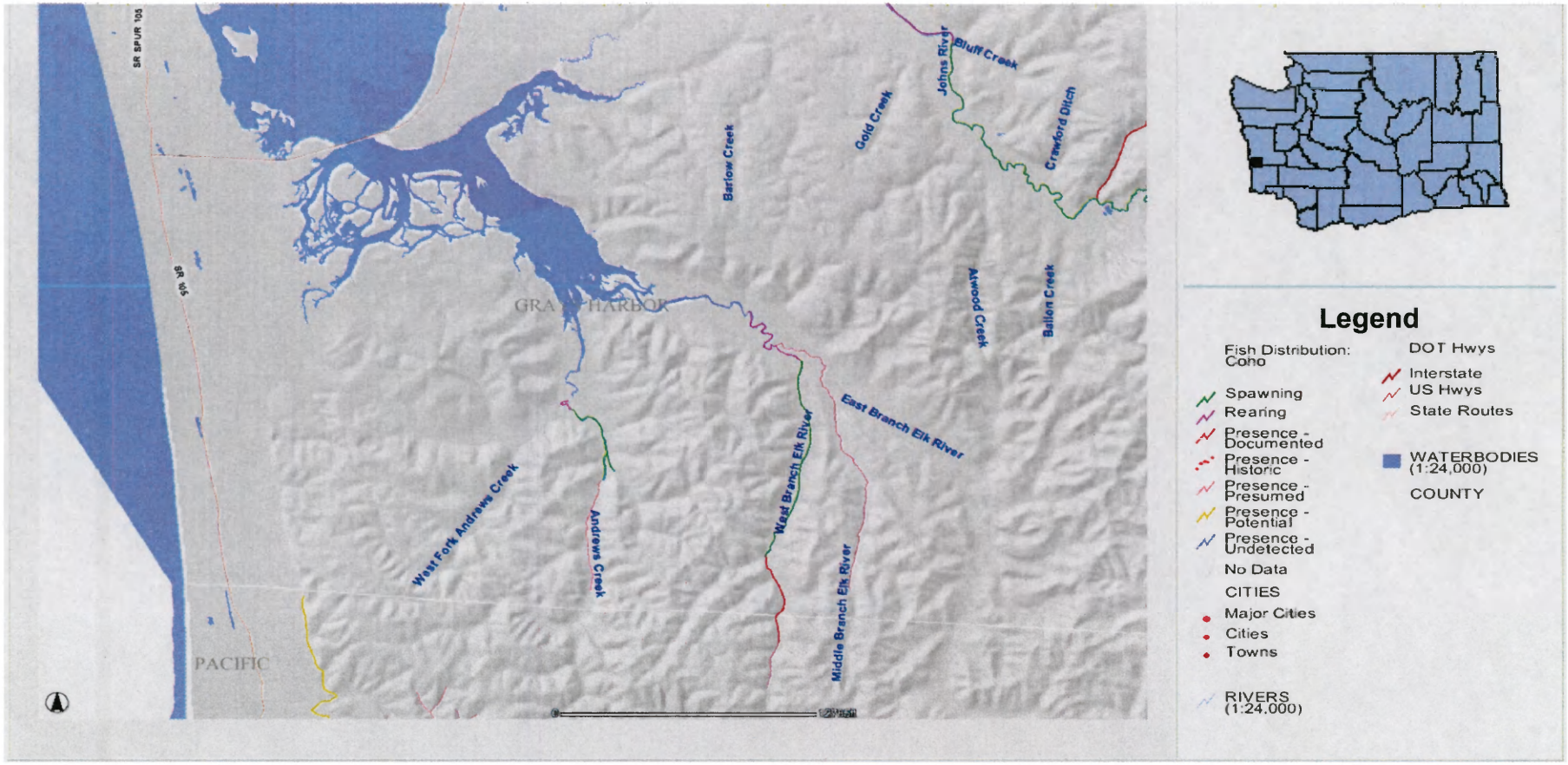
[144] Ibid, 490-2.
[145] Ibid, 493.

Map 9[146] Distribution of Coho Salmon in Elk River Watershed



[146] Map created with the Washington State Department of Fish and Wildlife's Salmonscape interactive mapping program. This program is accessible online at wdfw.wa.gov/mapping/salmonscape/index.html.

In fact, the WDFW uses Ellsworth Creek as a reference for comparing salmon runs on other streams and rivers, in part due to its prodigious runs of coho salmon. In 2003, a group known as The Nature Conservancy bought most of the land in the creek's watershed in order to help preserve the salmon runs, old growth forest, and the habitat of the threatened marbled murrelet along with some rare salamanders and frogs.[147]

Where to go Next

The above examples are not to argue that the people of Grays Harbor would be better off if they dismantled their industrial enterprises or otherwise attempted to turn back the clock to James Swan's arrival in 1852 or some other suitable year in the past. Such a solution is neither practical nor practicable. However, these examples do highlight some of the benefits offered by a more careful and farsighted approach to land use.

When it comes to preserving the watershed health of salmon-bearing streams, several lessons from the past are instructive, not just in Grays Harbor or Pacific County, but everywhere. For timber harvesting, instead of harvesting all the trees in riparian areas, allowing most to remain helps to prevent erosion and sedimentation, as well as to provide shade and cooler water, all of which help salmon and other fish. The same holds true for land with a steep slope, especially when exposed to high levels of rainfall. Leaving some of the trees in place will decrease levels of soil erosion, thereby reducing sedimentation levels in streams and helping to preserve spawning habitat for salmon. The example of Ellsworth Creek yields powerful evidence of the potential offered by this strategy. Furthermore, this

[147] Craig Welch, "Coastal Watershed Protected: Conservancy's Purchase in Pacific County Seen as Opportunity to Restore Willapa Bay." The Seattle Times, March 28, 2003: B4.

practice does not preclude logging or other economic activities in all areas, only in the most ecologically sensitive ones.

Unfortunately, this approach will only go so far on rivers that feature dams. Given the enormous mortality rates that such structures cause for juvenile salmon, the future for salmon on these streams appears murky at best. However, while dams are a significant impediment to healthy salmon populations, they do not completely absolve other factors from blame. Many other land and water use strategies such as logging and mining impair the salmon's survival chances. What really complicates efforts to save salmon, however, is that the responsibility for their decline does not fall solely on local resource users. While this narrative focuses on the local history of resource use as the most important impact on the fish, there is a larger circle of responsibility that involves almost everyone.

As an example, consider why logging is necessary in the first place. Much of the timber extracted from Grays Harbor and Pacific counties ultimately ends up as wooden tables and chairs in urban and suburban houses built largely of wood and surrounded by wooden fences. Urban and suburban homeowners admire their wooden houses while sitting on decks made of wood, sipping drinks from glasses they store in wooden cabinets built on top of their wood floors. In this indirect way, urban and suburban homeowners must share some of the responsibility for harming salmon runs with the timber companies that extract the trees, because one group exists in order to feed the demands of the other. This is why it is critical to harvest timber in an ecologically sound manner. Homeowners and other consumers want to take advantage of wood's many uses without harming the environment that surrounds them at the same time.[148]

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[148] Taylor, Making Salmon, 242. While Taylor does not explicitly make this connection concerning salmon and timber at this point in his book, he deserves credit for introducing the idea of viewing the relationship between local, regional, and national use of resources in this way.

Another complicating factor in the attempt to preserve habitat is society's penchant for accepting simple, black or white answers to complex problems. From this mode of thinking springs the contention that society can have healthy rivers, or a healthy economy based on the benefits rivers provide, but not both. In this line of thought, the choice is between healthy fish runs on one hand and the benefits dams bring, such as power, flood control, irrigation, and recreation, on the other. Society has chosen the benefits of dams over the benefits of salmon, and the two cannot coincide. The most hard-line proponents of this school of thought may even want to discontinue efforts to save the salmon, because if the fish are doomed to decline anyway, there is no reason to continue spending money to save them.

In describing the reason why salmon restoration has largely failed to this point, historian Richard White has written, "it was useless to appropriate millions to save the fish while hundreds of millions were appropriated for dams to destroy them. But, essentially, this was what would be done."[149] Though the efforts to save salmon in Grays Harbor and Pacific counties do not operate on the scale of hundreds of millions of dollars, proponents of the fish or dams argument would agree with this statement and conclude that because continuing to spend money on the salmon is useless, it should not continue. This argument rests on the conclusion that while unfortunate for the salmon, the economic benefits of dams outweigh the benefits gained from removing them. More people benefit from cheap power and flood control than benefit from catching fish, and society has made its choice of which economic activity to support.

This argument is substantially similar to the argument that only technology can save the fish. The basic premise is nearly the same; present conditions still doom the salmon to

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[149] Richard White. The Organic Machine. New York: Hill and Wang, 1995, 96-7.

gradual but inevitable decline. However, in this scenario, a brilliant technological innovation still awaiting discovery will save the day. While politically attractive because it requires no sacrifice by anyone, this scenario contains two important flaws. First, it fails to account for the long history of other technological advances that were to have saved the salmon, but did not. The hatchery system is the most prominent of these failures, though far from the only one. Second, and ultimately more important, this absolves present resources users from any responsibility in dealing with the real issues. By throwing money at the problem and expecting scientists and biologists to handle the rest, current resource users acknowledge no limits to their resource consumption while at the same time accepting no responsibility for the consequences of that level of consumption.[150]

Despite the attractions of each of these arguments, they are not airtight. The problems with dependence on technological innovation are clear. The dams or fish argument, while basically correct in the present, leaves something to be desired because it does not account for possibilities in the future. A more optimistic way of thinking about the situation arrives at very different conclusions. This mode of thought considers White's equation of monetary inequality and attempts to reverse or at least equalize it. The best way to do this is to decrease or eliminate the need for the primary economic function of dams, hydropower generation. Possibilities for this exist in technologies such as wind and solar power. Granted, these technologies are not economically viable at the present, but if designers can achieve economic viability through more efficient design and greater storage capacity, exciting new possibilities open up. Among these possibilities is sufficient power to allow for the breaching and removal of some of the dams obstructing salmon in

[150] Taylor, Making Salmon, 254-55.

Washington. At that point, society may decide that the economic and cultural value of healthy salmon runs does outweigh that of the other benefits dams offer.

Complicating this, however, is the fact that society might choose to decrease its reliance on fossil fuels such as oil and coal before scaling back use of hydropower. After all, hydropower is much cleaner than fossil fuels, and there is an infinite supply of it, unless society diverts the water to other uses such as irrigation or municipal uses. In addition, the United States contains many rivers, and is not reliant on any other nation to supply it with hydropower. However, this remains a viable future alternative if society decides it is ready to take responsibility for and promote salmon recovery.

Working from this premise, the future of salmon and watersheds in coastal Washington is not necessarily as bleak as current trends make it appear. Of course, unforeseen events, both good and bad, always complicate any predictions of the future. It does seem safe to say that if the current situation does continue, any significant comeback for salmon is unlikely. This is one area where, given a continuation of recent conditions, the health of the environment manifested in strong salmon runs is not compatible with the economic needs of urban populations depending on dams. Simply put, the mathematics of the present situation do not allow for any other conclusion. Alternate conclusions only become possible through a major change in existing conditions. Without this change, conditions for salmon in Grays Harbor and Pacific counties will continue to bifurcate. Streams without dams can maintain significant fish runs as long as other factors such as overfishing and environmental degradation do not intervene. However, despite society's best efforts, streams with dams and the other environmental stresses described here continue to make long term survival a questionable proposition for the salmon. Washingtonians understand that healthy rivers and healthy salmon runs in those rivers are a

major part of their economic and cultural heritage. Hopefully, the attempt to have both salmon and a strong local economy will allow Grays Harbor and Pacific County residents to look back fifteen years from now in 2020 and see the same success in preserving salmon that they have seen in diversifying their economy of 1991 in response to the legislation for the Northern spotted owl. The future of a noble, symbolic, and altogether remarkable fish is at stake.

Conclusion

Completing the Circle: Owls, Oysters, Salmon, and the Economy of Coastal Washington

The river pilings of Grays Harbor and Pacific counties serve as a reminder of the region's logging past. Part of the foundation that allowed the logging industry to operate, they are one enduring symbol of the nineteenth and twentieth centuries in coastal Washington. In the new millennium, local residents have had a new opportunity to see pilings erected in their counties. This time, however, the pilings are not a symbol of extractive industry, but of education. Voters in Raymond and Aberdeen approved new schools in the last decade in order to enhance the opportunities of young people in their communities. The new Raymond High School, completed in the early 2000s, and Aberdeen High School, scheduled to open for the 2007-08 school year, replaced buildings dating from the 1920s and 1930s, respectively. This new construction is symbolic of the changes and transformations in coastal Washington over the past 25 years. As the economy continues its transition away from traditional extractive industries such as logging, education plays an increasingly important role in preparing young people for success in the workforce, and these new high schools symbolize community recognition of that fact. Along with this recognition comes the realization that their local circumstances tie traditional activities such as logging, oyster farming, and salmon fishing to the fate of the local environment.

One of the most fascinating, and important, reasons for comparing some of the key traditional economic activities of coastal Washington is the way that they connect and interact with each other. Even though logging, salmon, and oysters each rate a separate chapter in this narrative in order to relate the individual circumstances of each story, realistically, events influencing one of these components often influence them all. This fact operates on several levels, the most basic of which is the physics of slope and gravity. Consider the hydrographic relationship between salmon, logging, and oysters. If a timber company wants to operate on the steep hillsides of a tributary of the Chehalis River, they

build a road to the logging location and proceed to extract the timber. If the logging company attempts to realize the greatest possible profit through a maximum sustainable harvest of trees, instead of proceeding with ecological considerations in mind, the high regional rainfall, combined with the slope and the removal of the trees and their root systems, produces high levels of erosion. Due to gravity, water flows downhill and carries the eroded sediments with it. Eventually this sediment ends up in a stream, creek, or riverbed, often burying salmon spawning grounds in the process. Moving downstream, when urban areas, lumber mills, or both discharge pollutants in these already sediment-filled rivers, the life chances of the salmon diminish even further. This pollution discharge also has the potential to disrupt oyster harvesting operations in addition to the general environmental health of Grays Harbor.

Another relationship tying these elements together is the food web. If salmon populations fall for any reason, related to logging or not, there are fewer salmon to prey upon the ghost shrimp that disrupt oyster farming. As long as the oystermen respond to the ghost shrimp menace with carbaryl spraying, they damage the food web even more because carbaryl kills so many other marine organisms in the vicinity, at least in the short run if not the long run as well. After local birds participate in the initial feeding orgy of dead carcasses on the tidal flats, the temporarily depressed numbers of marine organisms such as small fish, other shrimp species, and sea worms hurt the migratory bird populations using Grays Harbor and Willapa Bay as stopping grounds on their yearly migrations.

Yet another factor connecting the components of this story is elevation. The relationship between rainfall, slope, logging, and erosion is clearly established. However, also consider how elevation brings spartina into the equation. Its dense root systems excel at trapping sediment, eventually raising the elevation of spartina meadows as the grass spreads.

High rates of sedimentation from erosion due to logging or any other source only exacerbate this trend. Furthermore, even this slight gain in elevation produced by the spartina meadows reduces or eliminates the natural salt marshes or tidal mudflats it has overrun. In addition to reducing oyster habitat, this eliminates a great deal of biodiversity, both floral and faunal. The cordgrass crowds out native plants, and wildfowl and wading predators shun spartina meadows. Not only does spartina eliminate the marshes housing species these wildfowl and waders prey on, it also can grow to almost four feet in height, meaning that the wildfowl and waders cannot see the predators looking for them.[151]

Fortunately, not all of the relationships between salmon, oysters, and logging are negative. Positive events affecting one species often help the others as well. For example, consider the impact of the legislation to protect the Northern spotted owl. Some of the owl's habitat is in the southern slopes of Washington's Olympic Mountains and the foothills to the south of these mountains. Many of the tributaries of the Chehalis River also head in these mountains or their foothills. By forcibly preventing logging in some of these high-elevation, steep-slope areas, the spotted owl legislation also helps to preserve the ecological integrity of these sensitive landscapes. Less logging means less erosion, thereby preserving the clear water and gravel spawning beds that salmon require for propagation. While this is only relevant if the salmon can reach these spawning beds in the first place, it is a necessary precondition for the revival of salmon runs. This in turn aids the oyster farmers operating downstream. Not only do healthier salmon populations provide more fish to prey on the ghost shrimp, but less sedimentation produces less of the mud where the shrimp thrive as well.

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[151] The information on the impact of spartina and the elevation changes it can produce is accessible from many sources. This particular analysis of its effects is in The Global Invasive Species Database, available online at http://www.issg.org/database/species/ecology.asp?si=76&fr=1&sts=.

Coastal Washington in the Larger Context

The connections formed among these natural processes are one way of envisioning the relationships within the environment of coastal Washington. Some similar connections are evident in the external forces shaping the region, such as science and technology. While the local story has its own particular twists and turns, in terms of the impact of science and technology, the broad outline often conforms to a pattern seen many times in areas across the United States. The plight of salmon in coastal Washington mirrors that of the Pacific Northwest as a whole. Though the scale is smaller than on major rivers such as the Columbia or Snake, the salmon still have to deal with issues such as dams, nitrogen supersaturation, excessive sediment in the water, pollution, and uncomfortably warm water temperatures.

There has been no shortage of attempts to use technology creatively for the benefit of salmon. The most venerable of these attempts is the hatchery system. However, despite reams of research on salmon, and how to breed them successfully in the hatchery system, as the hatchery system enters its second century of operations on the Pacific Coast, the continuing decline of salmon runs in Washington demonstrates that hatcheries cannot save the runs by themselves. More recent innovations, such as barging fish around dams (as at the Wynoochee Dam in Grays Harbor) have been similarly unable to bring back salmon populations. Even catch limits and limits to the fishing season have not availed. Sadly for this incredible fish, all this evidence supports Richard White's conclusion that spending millions to save the fish cannot succeed when hundreds of millions are spent to support a system that kills them.

Science and technology have put the oyster growers of Willapa Bay on a roller coaster. When ghost shrimp populations took off in the 1950s and early 1960s, threatening

their livelihood, the growers jumped on the roller coaster with the decision to use carbaryl. For about three decades, they could enjoy the ride, with all its rises and falls, knowing that while growing oysters would not make them rich, at least their way of life remained secure. By 2003, however, the oyster growers prepared for the big drop off into uncertainty after signing the agreement to phase out carbaryl use. Many growers worry that the industry will be unable to stay on the tracks. Once again, they must trust in science for a solution. Unlike the 1960s, however, this time that science will not come from a chemistry laboratory.

For the timber companies, technology has been an almost unqualified blessing. Increasing mechanization reduces their labor costs and increases labor efficiency, fattening profit margins. For loggers and mill workers, on the other hand, the impact of technology on the industry has not been as providential. As chapter one clearly demonstrates, historians, government reports, and the court system have established that this is the prime culprit for the job losses within the industry.

This also demonstrates the importance of establishing the Northern spotted owl as a scapegoat for the structural changes taking place within the timber industry. By encouraging public opinion that shifted the blame for the job losses within the industry from technological changes to the spotted owl legislation, area timber companies scored a major public relations coup at the time. In fact, they could even join their workers in protesting the legislation, giving the mirage of a united front against a common enemy. In his 1994 book *The War Against the Greens: The "Wise-Use" Movement, the New Right, and Anti-Environmental Violence*, David Helvarg documents similar incidents in other locations where corporate entities encouraged their workers to protest unfavorable environmental legislation, thereby downplaying their own role in cutting employment levels within their industry. One such example comes from Fort Bragg, California, in July of 1990. During the "Redwood

Summer" protest organized by Earth First! to call attention to the cut-and-run logging practices of local timber companies such as Georgia-Pacific, Louisiana Pacific, and Pacific Lumber, a public relations firm hired by Pacific Lumber went so far as to distribute fake Earth First! fliers to advance their own cause. An internal company memo, released as part of a lawsuit against Pacific Lumber, revealed the company was aware of the forgery at the time.[152]

The battle for control of public opinion is crucial in a democratic society. Just as the 1990s and 2000s have seen a concerted effort by energy companies to cast doubt on the nearly unanimous consensus of human responsibility for global climate change, local communities' efforts to blame job losses on the spotted owl must be countered by solid science based on research. The story of the oyster growers in Willapa Bay confirms this necessity. Despite the fact that Alaska, Oregon, and California all ban the use of carbaryl for spraying in tidal areas, Washington continued to allow the practice until public opinion, along with some lawsuits by environmental groups, started to turn against the practice in the 1990s.

If anything, salmon demonstrate the importance of public opinion to an even greater extent. Despite the obvious truth that the economic value of dams dwarfs the economic value of salmon, public opinion continues to support efforts to save the fish regardless of the long history of failure shown by salmon recovery programs. In fact, Joseph Taylor cites a 1997 poll by *The Portland Oregonian* newspaper demonstrating the remarkable extent of public support for salmon. When asked "Should improving salmon be a higher priority on the Columbia and Snake Rivers than commercial uses such as barging or electricity?" sixty percent of Oregon respondents answered in the affirmative, while 40 percent answered

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[152] David Helvarg, "The War Against the Greens: The "Wise-Use" Movement, the New Right, and Anti-Environmental Violence. (San Francisco: Sierra Club Books, 1994): 2-4.

either "no" or "undecided".[153] It is difficult to imagine greater confirmation of the continuing hold of the salmon as a cultural symbol in the Pacific Northwest, despite its diminished economic importance.

Yet, when it comes to taking action that would actually help salmon, society is often reluctant to put their words into action. Part of the reason lies in the differing viewpoints held by urban and rural people. Breaking down the Oregon survey on the relative importance of salmon and dams, Taylor found that 63 percent of Portland residents and 66 percent of Willamette Valley residents favored the salmon, but only 50 percent of people in Eastern Oregon did.[154] In 1994, the Oregon Water Resources Commission (OWRC) voted to breach the Savage Rapids Dam on the Rogue River because it believed that installing irrigation pumps for water users would be cheaper than building fish ladders for the dam. The United States Fish and Wildlife Service eventually cajoled the local water board into accepting the removal plan. The local citizens, worried about their continued ability to irrigate with water from the Rogue, responded by recalling the water board from office. When the new water board also approved the plan, they met the same fate as their predecessors.[155]

Just as science and technology have played a key role in the environmental story of coastal Washington up to 2006, there is no doubt this theme will continue into the future. Their role in the timber industry is not over by any means. As the search for greater efficiency in milling operations continues, it is quite likely that more jobs will become obsolete. In this sense, the timber industry of Grays Harbor is similar to any number of

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[153] Joseph Taylor, "Regional Unifier or Social Catspaw? A Social and Cultural Historical Geography of Salmon Recovery." In Liza Nichols, Elaine Bapis, and Thomas Harvey Imagining the Big Open: Nature, Identity, and Play in the New West. (Salt Lake City: University of Utah Press, 2003): 7.
[154] Ibid.
[155] Taylor, Making Salmon, 244.

extractive industries or industrial occupations throughout the United States. Not that this makes life any easier for the workers remaining in the timber and logging industries, but as long as they understand the real reasons for their situation, it will be much easier for them to arrive at a productive solution. Similarly, science will have something more to say about the Northern spotted owl as well. As more research leads to greater understanding of this reclusive creature's behavior and habitat needs, the chances of insuring its survival and eventual recovery increase accordingly. After all, that is what the entire issue between timber companies and the spotted owl in Grays Harbor is based on in the first place.

For the oyster growers of Willapa Bay, science and technology are finally turning the tide against spartina. The integrated approach of spraying with pesticides, tilling up the roots of the cordgrass, and fighting it via biological means has made progress in the past three years. Dealing with the pesky ghost shrimp, however, may be another matter entirely. Oyster farmers and state agencies will need to call on creative yet scientifically sound solutions to deal with this threat to the industry as they phase out carbaryl use by 2012.

The salmon of coastal Washington face an uphill battle in many ways. The many historical factors militating against them, described in detail in chapter three, demonstrate why their potential recovery is problematic. At the same time, the continued survival of the salmon despite this history testifies to the tenacity and resiliency of the species. While biologists may have a few tricks left up their sleeves to help save the salmon under current conditions, the fish's best hope lies in science and technology that will reduce the importance of the things most responsible for killing them. Public opinion in the Pacific Northwest is on the side of the salmon, but the recovery of salmon populations requires more than just public opinion. Fishers in the Northwest are willing to accept catch limits and seasonal limits to preserve the spawning runs, but whether or not they and the rest of

society are willing to make more difficult economic decisions to save the salmon is the question of the moment.

In the big picture, all three of these stories from coastal Washington remind us that the question of whether or not jobs and environmental health can coincide is never far from the surface whenever an important issue arises that affects both. The history of the Northern spotted owl and Grays Harbor answers that question with a resounding yes. It is true that logging layoffs and mill closures necessitated a transition in the type of jobs available in Grays Harbor. However, as chapter one points out many times, this process started long before any spotted owl legislation and will continue indefinitely. Even the graph in Figure 7, showing the widening gap in per capita income between Grays Harbor and the rest of Washington, indicates that Grays Harbor's per capita income has grown consistently over the past 30 years; it is just that the rest of the state has grown even more quickly.

Other studies confirm this belief that jobs and a healthy environment are not mutually exclusive. In fact, in 2000 the Institute for Southern Studies published a study entitled "Green and Gold 2000" that ranked each state according to 20 indicators of economic and environmental success. It is worth noting that the study, a follow-up to a similar study from 1994, found seven states ranked in the top fifteen in both indexes, while of the bottom fifteen, ten states made both lists. If the situation were truly one of jobs *or* environment, the reader would expect to find states ranking high on one list ranking low on the other, and vice versa, but this is not the case. While some independent historical factors might be responsible for some of the results of the study, this correlation between environmental health and economic health is too strong to be mere coincidence. The results led Institute Director Chris Kromm to state, "What this study finds is that the trade-off myth is untrue. At the state policy level, efforts to promote a healthy environment and a

sound economy go hand-in-hand." Co-author Keith Ernst added "And states that sacrifice their natural resources for quick-fix development aren't improving their long-term economic prospects." To support their conclusions the authors point out that even in the most heavily regulated industries, dealing with environmental legislation represents only two or three percent of operating costs. Kromm concludes with the comment, "States that protect their natural resources also cherish their human resources. And states seeking quick-fix, unsustainable development end up sacrificing both workers and the environment."[156]

Given the many connections between salmon, oysters, and the timber industry, the environmental story in coastal Washington is a complex one. Legislation affecting one of these groups often carries over to impact others, directly or indirectly. This makes understanding each part important in order to look at the ways in which the environment and the economy of this region are closely connected. Hopefully, through an increased understanding of these connections, local residents and state agencies will find solutions to environmental issues that preserve the region's biological diversity and provide for continuing economic growth. By acknowledging the true relationship between the environment and the economy, these local people and state agencies can spend their time, money, and creative energy on productive solutions instead of finding scapegoats. With all that the local people have at stake, they must base decisions for the future on an accurate understanding of the issues of the past. That understanding only comes from acknowledging both the good and the bad of the past. In the end, the story in Grays Harbor and Pacific counties is both a human story and a nature story. If the two continue to find ways to coexist, the story may yet have a happy conclusion.

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[156] Each of the quotations in this paragraph, and all other information about the Green and Gold 2000 study, come from Louis Warren, ed. American Environmental History. (Malden, MA: Blackwell, 2003): 333-5.

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