Willamette River Fish Contamination

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It is evident through even minimal research and environmental testing that the fish of the Willamette River, as well as subsequent consumers, are at risk for chemical contamination. Some of the damage has already been done, but most of the potential health effects have just started. Decades ago, toxic substances including polychlorinated biphenyls (PCBs), DDT, mercury, pesticides, and dioxins, were dumped into the river without initial treatment. Tragically, due to the persistent nature of these pollutants, negligent actions from the past are currently affecting the health of fish and anglers alike. Despite efforts to purify the Willamette, its history of pollution still haunts the biota that reside within the waters. Consequently, humans that live or recreate in close proximity to the river are susceptible to health effects via bioaccumulation.

It is crucial therefore that the public be warned and educated that fish contamination is an existing problem. Awareness of this issue is not only important for avoiding potential health-related risks associated with consumption, but also to ensure a healthy future for the various species of Willamette River fish.

The history of this adverse condition dates as far back as the mid 1940s, when the Willamette couldn't boast of impressive levels of water quality. With the development of the chemical pesticide DDT, along with an increased use of other industrial and commercial

organic compounds, contamination of the river was approaching dangerous levels. Years later, the state of the Willamette, specifically in the Portland area, was in poor shape. Various Chemical plants and other industries dumped harmful chemicals directly into the river. The water was also exposed to these pollutants in less conspicuous, non-point ways. Runoff from agricultural fields, oil spills, burning garbage, pesticides, antiseptics, and degradation of old electrical equipment all contributed to the introduction of such substances in the Willamette. On December 31, 1972, the Environmental Protection Agency issued a ban on the usage of DDT, ending nearly three decades of its application (EPA, 1972).

Through point and non-point sources, the accumulating chemicals consisted of herbicides, pesticides, ingredients of Agent Orange (TCDD- a dioxin), mercury, and diverse PCBs. In order to understand the current health problems associated with these substances, it is necessary to first assess their uses and compositions. Metals, including mercury, are stable, inorganic compounds that have a very long half life, meaning that it requires years for the compound to degrade to half its strength. Mercury was passed into the Willamette primarily through mining activity in the basin.

DDT, its two breakdown products DDE and DDD, TCDD, and PCBs, are carbon based and are equally persistent within the environment (Monroe, Hunsberger, 2000). DDT was used for nearly three decades to control insect pests on crop and forest lands, around homes and gardens, and for industrial and commercial purposes (EPA, 1972). DDT was developed as the first of the modern insecticides early in World War II. It was initially used with great effect to combat malaria, typhus, and the other insect-borne human diseases among both military and civilian populations. A persistent, broad-spectrum compound often termed the "miracle" pesticide, DDT came into wide agricultural and commercial use in America in

the late 1940s. During the past 30 years, approximately 675,000 tons have been applied domestically. The peak year for use in the United States was 1959 when nearly 80 million pounds were made (EPA, 1972).

TCDD, a second important organic pollutant within the Willamette, was an unwanted byproduct in the production of the herbicide 2,4,5-T, which was included in Agent Orange used during the Vietnam War. Many tons of the herbicide were once produced in Oregon not far from the Willamette River. PCBs, highly toxic chemicals, were once used to cool electrical transformers. Like DDT, the chemical was banned in the 1970s, but still persists in the environment and can be consumed by humans, domestic animals, and wildlife as part of the food chain through the process of bioaccumulation.

An example of industrial irresponsibility that occurred too often, and hence led to the current high chemical concentration within fish tissues, is depicted through the actions of plants in downtown Portland that made tons of now-banned chemicals during the late 1960s. For years, northwest industrial plants dumped their waste tars and sludges along or directly into the river. Ditches around one plant ran red with chemicals. Disposal trenches hugging the riverbank turned pink, and fishermen complained that salmon caught in the river nearby tasted like chemicals (Hunsberger, Dec. 19, 2000).

Around the early 1990s, this maltreatment of the river raised concern about the safety of eating fish from especially the middle and lower sections of the Willamette (DEQ, Dec. 4, 2000). In 1997, the Oregon Legislature provided funding to the Oregon Department of Environmental Quality (DEQ) to analyze fish tissues. The DEQ, along with other agencies and organizations, ran research tests to determine what specific chemicals were found within

the fish, the relative concentrations of such chemicals, which fish species were of most concern, and finally, the potential human health effects resulting from consumption.

The results, which hold true for the current state of the situation today, don't provide good news for subsistence anglers. The DEQ study found that high levels of several chemical contaminants, particularly mercury and PCBs, were found in tissue samples of the tested fish, and further, that humans could store the pollutants within their bodies as well (DEQ, 2000). The fish species that embodied the highest concentrations of pollutants were carp, large-scale sucker, northern pikeminnow, and smallmouth bass. The specific area of the river that was being evaluated was the middle, and consisted of a 45 mile stretch from the Willamette Falls near Oregon City, south to Wheatland Ferry, north of Salem (DEQ, 2000).

These results correlate more or less with other studies that have been performed on Willamette River fish. A similar test done by the Oregonian and Oregon State University reveals that the Portland Harbor Superfund Site fish are also storing up dangerous concentrations of organic and inorganic compounds. Since the water runs through a more industrial area, the levels of such toxins in the fish are even higher than in the Middle Willamette River. Carp, black crappie, and smallmouth bass caught between Northwest Portland and Oregon City contained average PCB concentrations 10 times higher than the Oregon Health Division's screening level and three times the level set by the EPA (Monroe, Hunsberger, 2000).

The current status of certain Willamette River fish clearly makes them unsafe to eat. With enough doses, the chemicals present within the tissues likewise build in humans. The list of specific health-associated threats is frightening. While questions have been raised regarding the validity of the findings, most health experts argue that the dangers to humans

are real. Within existing scientific literature, it is commonly accepted that PCBs cause slow development, behavior problems, learning problems, and reproductive problems within fetuses, infants, and young children. Among adults, the same carbon based compounds cause heart problems, memory loss, inability to concentrate, immune system problems and failures, infertility, and cancer.

Mercury has been declared to act as a poison to the human nervous system. This health effect has been granted more credibility since there is a population available for testing; mine working yields a large exposure to the metal and those affected show affirmative medical diagnoses of nerve degeneration and decreased activity (Brinkman, 2000). Mercury is often found in the form of methylmercury (MeHg) and is often known to biomagnify in aquatic food webs. The TMDL levels for a recently constructed mercury biomagnification model, which was structured around species of resident Willamette River fish, range from 1.12 to 7.66 parts per million ; this figure is higher than the EPA regulation (Hope, 2525).

Dioxins, such as TCDD, are also contributors to human health problems through consumption of contaminated fish. The DEQ study, in addition to testing fish tissues, researched the increased effects of cancer in humans through bioaccumulation. Three target populations were assessed. The general public was considered to be people who on average ate one meal of Willamette River fish per month. Recreational anglers consumed one meal of fish every 13 days. Subsistence anglers, those who relied on the river fish for much of their food supply, ate 19 meals of fish per month. Researchers accounted for the magnitude, frequency, and duration of exposure to chemical contaminants in assessing human health risks for each population group (DEQ, 2000). The study reported findings that subsistence anglers had cancer risks 19 times that of the general population, while recreational anglers were 2.3

times more likely to get the disease (DEQ, 2000). While statistics such as these should serve as a warning to the population, they should also be viewed with a sense of skepticism. The pollutants in the river are difficult to test for, making definite, quantitative figures and conclusions questionable.

The current regulatory status of this adverse condition isn't comforting. Because of a lack of funding, Oregon is currently one of 15 states in the nation that chooses not to monitor its fish for chemical contaminants (Brinkman, 2000). The alarming result for Oregon citizens, especially anglers, is that there are an untold number of waterways containing fish tainted by undetected toxic chemicals. This is ironic for a state that prides itself in maintaining a healthy environment.

Twenty-three years ago, President Jimmy Carter signed the federal Superfund program into law to clean up toxic waste sites and to ensure that polluters, not taxpayers, paid for the program (Gibbs, Lawrence, 2003). Since the Superfund program began, the EPA has cleaned up six hazardous toxic waste sites in Oregon. The EPA's "polluter pays principle" has been the driving force in making these cleanups happen. Unfortunately, the success of the plan has been dramatically reversed in the last four years. While the Bush administration boasts of the successes of the past, far fewer cleanups have been initiated under his administration. The program is now under-funded and costs are shifting from polluting industries to tax payers. Because President Bush won't reinstate the "polluter pays" contract, which expired in 1995, the fund is bankrupt, and the money to pay for Oregon cleanups is coming from taxpayers' pockets. Local citizens are now paying for the toxic waste sites with their health and their tax dollars (Gibbs, Lawrence, 2003).

Hence, a proposed course of action to remedy the situation of Willamette River fish contamination begins at a political level. Funding absolutely must be provided for research and monitoring of the river's chemical pollutants. In the interest of both the fish species as well as human health, cleanups must be financed. If polluters are monetarily held responsible for their negligent actions, then there will be an added incentive to use more caution and care when disposing of waste products.

A more reliable source to turn to is citizen involvement and volunteering. With assistance at the local level, the state of the situation could gradually improve even through taking baby steps. This requires educating the public, so that further non-point pollution of the water can be avoided. A source of comfort currently resides in the actions of people who do care. Non-government agencies and non-profit organizations are an excellent foundation for improving the condition of fish contamination. For example, the Oregon Center for Environmental Health kicked off a campaign in 2001 to warn of the dangers of eating locally caught fish from the Willamette. Posters were put up along the river and in other nearby public places that detailed the issues (Loving, 2001). Volunteers also handed out brochures in English, Spanish, Russian, and Vietnamese so that all citizens, regardless of the language barrier, could be informed. Help on the local level is crucial right now, since government assistance is minimal.

One additional course of action that could drastically improve the situation is further research and implementation of the process of bioremediation. Many studies and experiments have been completed in this field, and the results appear promising. Using filamentous fungi and other microorganisms, polycyclic aromatic hydrocarbons, which are the chemical compositions of many organic contaminants, have been successfully degraded within both

soil and water. The organisms that have been proven to work the strongest, according to one particular study, are mycelial inoculum, *Coniothyrium* inoculum, and *Fusarium* inoculum (Potin, Rafin, Veignie, 45). Studies in this field suggest that such filamentous fungi could be used in clean-up of long-term contamination of soils by polycyclic aromatic hydrocarbons (Potin, Rafin, Veignie, 45).

Fishing in the Willamette River is an enjoyable activity and pastime for more than 500,000 anglers each year. The health of its biota must be maintained to ensure a healthy ecosystem. For these reasons, it is imperative that the adverse condition of fish contamination be improved. It isn't possible to eliminate the injustices that have been done to the Willamette in the past, but with time and a well-constructed plan of action, recovery is possible. In attempt to monitor and potentially break down the river's chemicals, such as DDT, PCBs, TCDD, and other dioxins, it is necessary to acquire government funding, scientific research in the field of bioremediation, education of citizens, and volunteer help at the local level. The population could hence avoid dangerous health risks through consumption, and the overall health of Willamette River fish could be restored.

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