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Portland State University

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ESR 506

Master of Environmental Management Community Partnership Project

United States Environmental Protection Agency

Compilation of tasks and products related to
research, draft, composition and publication of the

State of the River Report for Toxics

Bradley Carter

Dr. Joseph Maser

Portland State University

February, 2009

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Introduction

The United States Environmental Protection Agency (EPA) strives to prevent pollution, protect water quality and improve ecosystems in order to reduce risks to human health and the environment. As outlined in the Agency's Strategic Plan, the Columbia River Basin was identified as a "National Priority" and designated as one of our nation's seven "Large Aquatic Ecosystems". This designation grants legislative status equal to the Chesapeake Bay, Great Lakes, Gulf of Mexico, South Florida Ecosystem, Long Island Sound and Puget Sound. The Strategic Plan is the Agency's road map of future work efforts, and targets specific goals that are expected to result in a healthier Columbia River Basin. In support of the plan, the Columbia Basin *State of the River Report for Toxics* (SORR) is the culmination of the collaborative efforts of the Toxics Reduction Working Group - a collection of Federal, State, and municipal agencies, Indian Tribes, non-profit groups and private industries - intended to increase public understanding about the impacts of toxics in the Basin and foster new and enhance existing partnerships to reduce toxics. The Report centers on contaminants of concern (COCs), indicators, toxicant trends, and reduction efforts. SORR will be available in print form by February, 2009.

SORR is a public document produced by the U.S. EPA Region 10 (Alaska, Idaho, Washington and Oregon) Office of Environmental Assessment in Seattle, Washington. The effort was divided into four subgroups and received direction from a steering committee composed of members from the U.S. Fish and Wildlife Service, Idaho Department of Ecology, U.S. Geological Survey, National Oceanographic and Atmospheric Administration, Washington Department of Ecology, Oregon Department of Environmental Quality, Northwest Power and Conservation Council, Washington Department of Health, and Confederated Tribes of Yakama Nation. This committee was led by Mike Cox, at EPA Region-10 headquarters in Seattle, Washington. The subgroups were divided into Contaminants, which focused on those substances chosen to represent the greatest threats to the health of the basin; a Sources subgroup that defined origins of the contaminants; an Effects subgroup that focused on the adverse effects caused by these contaminants on humans and wildlife; and a Data subgroup which validated and verified the information used to compose SORR. A complete list of the Steering Committee, subgroups, and other contributors to SORR is in Appendix C.

This MEM Community Partnership Project was designed to focus upon the compilation of the Results of the Subgroups and the composition of the Report, which is a document intended to inform and educate our fellow citizens. It is also a reflection of my immersion into the study of toxicants (“toxics”) and associated trends in the Columbia River Basin. This internship opportunity has afforded lengthy and detailed exposure to the necessary components and processes involved. These included research and detailed analyses of scientific studies to help produce various sections of SORR, as well as conducting interviews, and attending meetings, conferences, and workshops to help assess toxicant trends. We also had regular group summits and individual sessions to share information. Charts, maps and graphs representing toxicant data and associated analyses were performed involving web resources and geographic imaging systems. I received exposure to the administrative and managerial aspects of interagency relations. Also, useful experience was gained as I wrote, organized, and edited text and procured graphics while refining and improving SORR.

This paper is segmented into the individual assigned tasks and subsequent products. These occur as written word, maps, charts and graphs. I have imported some of the actual tools used to compose sections of SORR such as the indicator matrices, parts of various draft editions of SORR, and provide some research strategies that were employed. Following the reference list, an index of appendices provides additional relevant data and information.

Task: Contaminants of Concern (COCs) Research

Thousands of chemicals have been used in this country (EPA, 2008). COCs are the toxicants with which the Toxics Reduction Working Group (TRWG) is most concerned. A Contaminant and Media Subgroup was tasked to identify the toxics of the highest priority for the TRWG based on either an ecological or human health threat. These substances were also determined to be contaminants of particular concern in this region. Criteria used in SORR for identifying these COCs included: if there are fish advisories associated with the contaminant; if there is evidence of this contaminant in fish and wildlife; if it is identified as persistent, bioaccumulative and toxic; if the contaminant is a suspected or known carcinogen; if the contaminant has been identified as a suspected or known endocrine disrupter; or if there are non-cancer effects associated with the contaminant (Walker, et al., 2006).

In order to effectively assess data and glean pertinent information on adverse effects to the environment, it was essential to research these COCs. I needed to become familiar with the sources, fate, and transport vectors to fully understand the implications and adverse impacts of exposure to COCs. It was necessary to focus primarily on the specific COCs associated with the indicator species upon which I conducted my contributory research for this report. These were dichlorodiphenyl trichloroethane and its associated breakdown products (DDTs), elemental mercury (HG) and methyl mercury, polychlorinated biphenyls (PCBs), polybrominated diphenyl ether (PBDEs), polychlorinated dibenzodioxins (dioxins), and polychlorinated dibenzofurans (furans). The following paragraphs provide some of the information on toxics that I used to work on SORR. Trends regarding the first four COCs are discussed at length in the Report.

Dichlorodiphenyl trichloroethane or **DDTs** ($C_{14}H_9Cl_5$) is an organochloride compound first synthesized in the 19th Century. It gained popularity in the 1940s as an extremely effective insecticide, and was used widely to combat malaria, typhus, and louse infestation. It is nearly insoluble in water, but is considerably lipophilic, or fat-soluble. DDT, (and its breakdown products, DDE, and DDD) biomagnifies through the food webs, and apex predators such as raptors gain a higher concentrations of the chemical than other animals sharing the same environment. These compounds are toxic to embryos and disrupt calcium absorption, thereby impairing eggshell quality. This caused dramatic decline in populations of eagles, ospreys, and peregrine falcons. Prior to the U.S. ban of DDT in 1972, nearly 1.5 billion tons were applied. DDT has been marketed under include the trade names Anofex, Cezarex, Chlorophenothane, Clofenotane, Dicophane, Dinocide, Gesarol, Guesapon, Guesarol, Gyron, Ixodex, Neocidol, and Zerdane.

Polybrominated diphenyl ethers or **PBDEs** ($C_{12}H_{10-x}Br_xO$) are organic compounds that are used as a flame retardant. Like other brominated flame retardants, PBDEs have been used in a wide array of products, including building materials, electronics, furnishings, motor vehicles, plastics, polyurethane foams, and textiles. PBDEs are particularly toxic to the developing brains of animals. In April 2007, the legislature of the state of Washington passed a bill banning the use of PBDEs. The suite of PBDE chemicals consists of 209 possible forms, called congeners. Some early toxics studies concentrated on just a few PBDE congeners, but it is now commonplace to measure tissue levels of all 209 congeners.

Polychlorinated biphenyls or PCBs, ($C_{12}H_{10-x}Cl_x$) are a class of organic compounds with 1 to 10 chlorine atoms attached to two benzene rings, each containing six carbon atoms. These compounds were primarily used as coolants, lubricants, and as dielectric fluids in electrical parts and machinery. PCBs are stable compounds which made them highly effective. Like PBDEs, PCBs have low solubility, many congeners, and are lipophilic. Due to their inherent toxicity - such as liver damage and acute systemic poisoning - and tendency for bioaccumulation, PCBs were banned in the 1970's. Unfortunately, their influence is still present in the Basin. Recently, a large cache of PCB tainted equipment was discovered near Bonneville Dam.

Mercury (atomic number: 80) is a naturally occurring metallic element whose symbol (Hg) is derived from Latinized Greek *hydrargyrum* meaning “liquid silver”. It occurs in soils and other substrate in this region and elsewhere. Sources in the Basin include historic and current mining operations, concrete kilns, and the coal ignition for power generation and other uses. A somewhat complicated chain of events leads to the harm caused by Hg. Much Hg is still present in soils from historic mining operations, and current industrial processes like cement kilns and coal-fired power plants pollute the air with mercury. After volatilizing to the atmosphere, it eventually descends to Earth through rainout or as particulate matter. Although elemental Hg is relatively harmless, some microbial processes in anaerobic conditions (e.g., in wetlands) can render an organic, highly toxic methylated form. Uptake by macroinvertebrates initializes the bioaccumulative processes that lead to detriments such as developmental and neurological damage in indicator species. A useful diagram of this process is in Appendix E.

Polychlorinated dibenzodioxins (dioxins) occur as by-products in the manufacture of organochlorides, incineration of chlorine-containing substances, bleaching of paper, and from natural sources such as forest fires and volcanoes. These lipophilic compounds are bioaccumulative and suspected carcinogens.

Polychlorinated dibenzofurans (furans) are similar in structure and properties to dioxins and usually occur simultaneously with them.

Task: Research for the Composition of Piscivorous Mustelid Section for SORR

The goal of this task was to carefully review a selection of scientific studies on piscivorous mustelids, and to help compose a part of the SORR indicators section. Strictly speaking, the presence or absence of a species - reflective of the ecological health of an area or ecosystem - defines the term “indicator species”. Species used to monitor the ecological health of an area or ecosystem system by measuring pollutants in them, for example, are usually referred to as sentinel species. For purposes of simplicity, the steering committee decided that the term “indicator species” was to be used, regardless of the species’ presence, abundance, or listing status.

Incidentally, with regard to SORR, the indicator species selected to help assess the health of the Basin ecosystem are: 1) salmon (juvenile and adult); 2) resident fish, both native and introduced (e.g., sucker, bass, and mountain whitefish); 3) sturgeon; 4) predatory birds (osprey and bald eagles); 5) aquatic mammals (mink and otter); and 6) sediment dwelling shellfish (Asiatic clams). The actual species chosen to represent the indicators in SORR are bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*), juvenile salmonids (*Onchorhynchus spp.*), Asiatic clam (*Corbicula fluminea*), American mink (*Mustela vison*) and river otter (*Lontra canadensis*). Although I developed a familiarity with all of these, most of my research was on the piscivorous mustelids and the predatory birds.

Method: Indicator Matrix for Mustelid Section

The first step involved in the composition of the indicators section of SORR was to read and summarize scientific studies on the effects of COCs on indicator species. In order to effectively assess these studies, a great deal of background information was necessary. First, I composed short summaries of the scientific studies, which are indexed as supporting information in SORR. These summaries were instrumental in the completion of the so-called indicator matrix (a questionnaire designed by the Data Subgroup) and the subsequent narrative sections, from which the SORR sections on these mammals were derived. In order to provide a glimpse of the content of these studies, a brief summary follows each citation. Piscivorous mustelids, in this case American mink and river otter were used as indicators for many reasons, not the least of which is the availability of scientific studies regarding them. Also, these were chosen because they are representative of fauna dependent upon a healthy river ecosystem (EPA,

2008) just as people are dependent on a healthy ecosystem. A copy of these summaries is in Appendix A.

The next step in this task was to complete the indicator matrix with relevant for the SORR mustelid indicator section. The indicator matrix is a table that allows the researcher to answer specific questions regarding the species in question. These tables are a standard form that was used for all indicator species in SORR. It is from these matrices that the narrative sections for the SORR indicator species were derived. Gathering background information and gaining a thorough understanding of the species his was vital to complete to the indicator matrices. The matrices were designed to guide the information toward a narrative discussion of the indicators, which would help “tell a story” about the indicator species with regard to the contaminant of concern. The answers to these generalized questions provide the foundation to the narrative on the indicators.

Product: Mink and Otter Indicator Matrix Questions

What story do we want to tell for this species? The North American River Otter has been prized for its thick, lustrous fur, the durability of which all others are compared. These members of the weasel family are top predators that feed primarily on fish and crayfish. Mink are important furbearers, but to trappers their pelts are about 1/6 as valuable as an otter’s. Mink are opportunistic feeders, and their diet contains more rodents and birds, as well as fish. River Otter can be found in aquatic, river or estuarine habitat and Mink are found in wooded areas near water throughout the Columbia River Basin (CRB). Both can be widely distributed but at low densities, though neither is listed threatened or endangered in the States of Oregon, Washington, Idaho, Montana, or British Columbia. Current populations of both animals are stable, but may experience cyclical fluctuations. There are probably far fewer otter and mink now than in the days of epic Columbia River salmon runs, but smaller salmon runs, loss of habitat, and unregulated trapping weren’t the only reasons for their decline. Because these two mammals are fish eaters, they tend to be susceptible to the adverse effects of contaminants. Both are vulnerable to toxics, which can bio-accumulate in aquatic food webs. Specimens provided by trappers were sent to the Great Lakes Institute for Environmental Research (GLIER) in Windsor, Ontario, Canada. Physical evaluations, and tissue and organ analyses for toxics were performed. As described below, river otters and mink in Columbia River Basin have PCBs, furans, dioxins, and heavy metals in their tissues.

What measure will be evaluated? Researchers measured amounts of contaminants in tissues, and a field evaluation made note of physical anomalies, and performed statistical analyses on laboratory data.

Do we have data that shows effects from COCs on these species? Yes. The studies conducted (Henny, et al., 1996), (Harding, et al., 1998), (Elliot, et al., 1998) contain information relevant to COCs. Residues of petroleum products, mercury and other heavy metals, organochlorine compounds, polychlorinated biphenyls, and other toxic compounds are found in river otter tissues (Kimber and Kollias, 2000). Bioaccumulation of polychlorinated biphenyls was considered the likely cause of river otter declines in Oregon (Henny, et al., 1981), (Grove and Henny, 2005). Also, there was a significant negative correlation between total PCB concentrations (as Aroclor 1260) and baculum length in juvenile mink ($r = 0.707$; $p = 0.033$; $n = 8$). The association of juvenile baculum length with eventual reproductive success is unknown, but further characterization of reproductive organ morphology and relationship to contaminants should be undertaken in a larger subset of these populations.

What is the range of these species? Historically, river otters and mink occurred throughout most of North America, and are usually found in aquatic, river, or estuarine habitats throughout the CRB.

How is the overall health of the populations? Opinions on the health of these populations vary. “Population declines of both mink and otters resulting from PCB contamination may have occurred, and still may be occurring, along the Lower Columbia River.” (Henny, et al., 1978). Population considered to be stable in Oregon, Washington, Montana, Idaho, and British Columbia but listed as endangered, threatened, or of special concern in 12 states. Mink populations in areas adjacent to the Columbia River in Oregon have decreased more rapidly than populations in areas farther from the river. Insight may be gleaned from the fur market. Supply, demand and price are all interdependent. An increase in price may spawn an increased harvest, legal or otherwise, and a decline in harvest may increase the demand, and subsequently the market price. The following “Harvest Data” provides a brief overview of harvest information. Harvest declined from 363 (100 trappers) in 2002 to 256 (76 trappers) in 2003, while total trap-nights increased from 17,481 to 21,970. Pelts prices remain steady at \$7.00 each.

Table 1: Harvest Data

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
# Mink Taken	370	322	673	607	310	311	367	299	363	256
# Otter Taken	486	378	522	446	388	377	445	466	627	549
# Reporting No Harvest	n/a	n/a	n/a	n/a	n/a	n/a	38	47	46	44
% Reporting	n/a	n/a	n/a	n/a	n/a	n/a	7	9	7	6

Mink appear virtually absent from the main stem of the Columbia River downstream from Portland. Otters, however, seem fairly abundant. Mink absence is possibly tied to fluctuations in rodent populations. Harvest of river otter harvest declined slightly during 2003 with 166 fur takers harvesting 549 otters, compared to 144 fur takers taking 627 in 2002. Pelt price remained stable at \$94.00 as of 2003.

Do we have a conceptual model to link COCs to the species? Mercury bioaccumulates in prey species sourced from airborne deposition and historic mining operations (Harding, et al., 1998). PCBs entered the air, water, and soil during their manufacture, use, and disposal; from accidental spills and leaks during their transport; and from leaks or fires in products containing PCBs. PCBs can still be released to the environment from hazardous waste sites; illegal or improper disposal of industrial wastes and consumer products; leaks from old electrical transformers containing PCBs; and burning of some wastes in incinerators. PCBs do not readily break down in the environment and thus may remain there for very long periods of time. PCBs can travel long distances in the air and be deposited in areas far away from where they were released. In water, a small amount of PCBs may remain dissolved or bind to organic particles and bottom sediments. Most, volatilizes back into the atmosphere. As PCBs bind to soil, they are taken up by small organisms and fish in water. They are subsequently taken up by other animals that eat these aquatic animals as food. PCBs accumulate in fish and marine mammals, reaching levels that may be many thousands of times higher than in water. Organochlorine pesticides have a long history of widespread use in the United States and around the world. These compounds are typically very persistent in the environment, and are known for accumulating in sediments, plants and animals.

How will the decision-makers use this information? Many organochlorines have been banned in the U.S. and other countries because of concerns about environmental impacts and human health effects. In addition to DDT, the United States has banned aldrin, dieldrin, arochlor, chlordane, heptachlor, mirex, hexachlorobenzene, oxychlordane, toxaphene and others. However, several organochlorines are still registered for use, including lindane, endosulfan, methoxychlor, dicofol and pentachlorophenol. Some organochlorines (OCs) have been targeted for global elimination under the recently signed Stockholm Convention on Persistent Organic Pollutants. The treaty is an international effort to phase out harmful chemicals that persist in the environment and can be transported around the world. Many organochlorines fall into this category. A list of twelve chemicals targeted by the treaty includes nine OC pesticides, all of which have been banned in the U.S.

What questions could be addressed by this indicator species? Some pertinent questions could be raised. For example: Are effective measures in place to reduce or abate the bioavailability of these toxicants? Will pronounced reduction in numbers of this species result in an overall detriment to the CRB ecosystem? Are humans at risk to the same toxicant-related health issues occurring in mink and otter populations?

What data do we have on the indicator species in the CRB? The “short summaries” in Appendix A provide an ample overview of this data.

How is the data reported? The data are reported in scientific journal, web sites, and in various other publications.

What comparisons can be made for this indicator with other ecosystems outside the CRB? Mink collected for study from a reference area (Malheur NWR, OR) in the recent past showed low PCB, dioxin, and OC insecticide residues in their livers. (Henny, et al., 1996).

What are the data gaps that need to be filled? There definitely are important data gaps that need to be filled. For example, too little information on populations of these two mammals exists, especially the mink in the Lower Columbia, where their absence renders studies of their populations almost impossible.

What are the future research needs? More information on actual populations of mink and otter in the CRB, and the presence of bioaccumulative toxins in them is needed; establish a correlation between fluctuations in rodent population and abundance in mink; also some research needs mentioned in “Data on Indicator” listed previously.

What are your recommendations for moving ahead? I would recommend that more studies to assess bioaccumulative in humans with a high-fish diet. I believe that more public outreach to involve trappers will gain valuable information on population trends because continued studies of trapped carcasses will be of great assistance in establishing population trend data.

The information used to answer these questions regarding piscivorous mustelids is the foundation for the narrative on Mink and River Otter. Through a series of edits and comments by team members the actual section for the SORR is produced.

Method: Narrative of Mustelid Indicator Section

The next step in this task was the composition of the narrative section on piscivorous mustelids. The narrative is the final product appearing in SORR. It is a culmination of the summaries and matrix, reflective of the information contained in the scientific studies. It provides an outline of how indicators are affected by particular toxics in an interesting and consumer-level format. The section was subject to the scrutiny of the team, and numerous rounds of edits and alterations. After the indicator matrix was composed, a short summary was written, which is a condensed version of the relevant scientific studies. Finally, a narrative version of findings was composed. This narrative serves as the written section on the particular indicator in SORR. Also, a short essay which briefly summarizes the publications including bibliography, and a summary of trends in the contaminants of concern with regard to this particular indicator was written. In addition, a small section of supporting information on each indicator appears in the SORR index. The finished product is quite different than the original draft. The editing method used by SORR group members is an effective writing tool that employs the various skills and backgrounds of those participating.

Background

Mink and river otter are found in suitable habitat throughout the Columbia River Basin, but there are probably far fewer now than in the days of the epic Columbia River salmon runs. Reasons for their decline include less salmon, habitat loss, and unregulated trapping. Another reason for their decline may be persistent, bioaccumulative contaminants such as polychlorinated biphenyls (PCBs).

While the presence of fish-eating birds such as osprey and bald eagles are a good indicator of an ecosystem's health, non-migrating predators such as river otter and mink may tell us more. These large members of the weasel family can be especially vulnerable to persistent bioaccumulative contaminants, and their habit of often eating slow-moving resident fish like suckers may increase their exposure. Mink - and to a lesser degree river otter - are particularly sensitive to (PCBs).

Status and Trends

Studies in the late 1970's found PCB residues in the livers of CRB mink and river otters. Some animals in the Lower Columbia River had levels as high as those reported in female mink that experienced total reproductive failure after eating a PCB-contaminated diet (Henny, et al 1979).

Several follow-up studies have been conducted over the past two decades. Henny, (1996) found the level of several bioaccumulative chemicals like PCBs were significantly higher in river otters from the CRB than in reference areas. The study also found that the youngest otters had a greater incidence of reproductive system abnormalities, and that mink numbers were too low to draw any conclusions.

Another study from the Columbia and Frasier River Basins (Elliot, 1998) showed that PCB contamination in the lower Columbia River had decreased since the late 1970's, but populations of toxic-sensitive mink appear depressed in the Lower Columbia River. Based on tissue samples, river otters demonstrated a tolerance to PCB levels associated with the reproductive effects in captive mink mentioned above. The authors also suggested that the continued presence of PCBs was likely a contributing factor to the absence of mink in the Lower Columbia.

A subsequent study in the Columbia and Frasier River Basins (Harding, 1999) found that the body burdens of PCBs in mink and river otter had in fact declined 10-fold since the late 1970's. The scientists

observed no adverse effects from toxics on river otters but mink showed similar reproductive system abnormalities as those found in river otters studied (Henny 1996). The authors cautioned that the observed associations were based on a small sample size, but together with the findings from Henny, et al (1996) the need for further investigation of possible effects of PCBs on reproductive development in both otters and mink is suggested.

Future Needs

The levels of bioaccumulative contaminants such as PCBs in mink and otter in the Columbia River Basin have declined over the past several decades. However, there is still a need to conduct additional research on the reproductive system abnormalities possibly caused by PCBs that were observed in both mink and river otter. In addition, more research is needed to document population trends in mink and otter throughout the Columbia River Basin including an evaluation of the factors (e.g., habitat, toxics) contributing to their increase or decline.

Product: SORR Indicator Section on Mink and River Otter

Aquatic mammals—mink and river otter

Mink and river otter are members of the weasel family. They are excellent swimmers and are active predators that feed on fish, frogs, crayfish, occasionally small mammals and waterfowl. The average lifespan of mink in the wild is three to six years, whereas river otter average over eight years. Both are found throughout the Basin in appropriate habitat; however, mink populations have not recovered from a decline in the 1950s and 1960s, even though suitable habitat is available for them in the Lower Columbia River.

Mink and otter are useful indicators of ecosystem health in the Basin because they: (1) prey on other aquatic species; (2) are particularly sensitive to environmental contaminants which accumulate and can impact their reproduction; (3) have smaller home ranges compared to osprey and bald eagles; and (4) occur throughout the Basin.

Task: Research for the Predatory Birds Indicator Section for SORR

The indicator section on predatory I helped produce for SORR employed the same methods as were used while producing the section on the piscivorous mustelids. It was originally planned to have separate indicator sections for bald eagle and osprey, but these two were combined into a single indicator section

in the final draft of SORR. The information used in the studies came primarily from eggs and tissues of nestlings, and some of the tests were conducted at the Great Lakes Institute for Environmental Research (GLIER) at University of Windsor, Ontario, Canada. To begin my data collection, I carefully scrutinized the scientific studies written on ospreys and bald eagles in the region and wrote short summaries, which are listed in Appendix A. Next, I filled out an indicator matrix, but just for osprey, which of course provided my contribution for the narrative section on this indicator. The narrative section – just as was done with the piscivorous mustelid narrative section – underwent numerous rounds of edits and alterations. Eventually, as was it was previously decided, the osprey and eagle sections were combined before being placed into the final draft of SORR.

Method: Indicator Matrix for Predatory Birds Section

The next step in this task was to insert information into the indicator matrix for the SORR predatory birds indicator section. As mentioned previously, the indicator matrix is a table that allows the researcher to answer specific information regarding the species in question, and is a standard form that was used for all of the indicator species in SORR. It is from these matrices that the narrative sections for the SORR indicator species were derived. Gathering background information and gaining a thorough understanding of the species his was vital to complete to the indicator matrices. The matrices were designed to guide the information toward a narrative discussion of the indicators, which would help “tell a story” about the indicator species with regard to the contaminant of concern. The answers to these generalized questions provide the foundation to the narrative on the indicators.

Product: Osprey Matrix Questions

What story do we want to tell for this species? The osprey (*Pandion haliaetus*) is a large fish-eating bird that has a particular sensitivity to the adverse effects of organochlorine pesticides like DDT. These raptors have shown a noted recovery in numbers since the 1972 ban on DDT. However, studies show ospreys are accumulating other harmful contaminants. Polychlorinated biphenyls (PCBs) were used as coolants, lubricants, and insulators in electrical equipment but have not been manufactured in the U.S. since 1977. This lipophilic and bioaccumulative group of compounds, as well as mercury, has been found in the eggs of osprey and other piscivorous birds and is the focus of numerous scientific studies.

What measure will be evaluated? The studies researched focused on levels of PCBs and Mercury in osprey populations. The data is primarily from eggs, and nestling tissues.

Do we have data that shows effects from COCs on these species? The effects of PCBs and mercury on ospreys are probably subtler than the eggshell thinning of effects of DDT exposure. Dieldrin, DDE, and PCBs are 3 environmental pollutants that have most likely been important factors in the greatly reduced reproductive success and rapid population decline of Connecticut ospreys (Wiemeyer, et. al, 1987).

What question could be addressed by this indicator species? Are the mercury and PCB levels found in osprey samples truly reflective of current environmental conditions? Are mercury levels increasing in CRB, or can osprey data be correlated with water quality studies?

What is the range of these species? Ospreys are found on every continent but Antarctica, and breed in all but approximately 15 states. They occur in suitable habitat (open water and nesting areas) throughout the CRB.

How is the overall health of the populations? Numbers have been increasing steadily since the 1970s, and reintroduction efforts have been successful in many locations as well. Along the Willamette River, there were 13 nesting pairs in 1976 and 234 nesting pairs in 2001 (Henny an Grove, 2003). Population estimates are approximately 450,000 for the lower 48 states.

Do we have a conceptual model to link COCs to the species? If not, can we develop one? Yes. The basis upon which Henny conducted most of his research appears feasible. Contaminant concentrations from fish have a tendency to bioaccumulate in tissues and eggs.

How will the decision-makers use this information? It is possible that decision-makers will monitor disposal of PCBs more closely and pinpoint sources and causes of mercury deposition in the Columbia Basin.

What data do we have on the indicator species in the CRB? (Henny, et al., 2002, 2004, 2007)

examined distribution, abundance, reproductive success and contaminant burdens, and evaluated eggs for residue concentrations of OC pesticides, PCBs, dioxins, furans and mercury, and biomagnification factors from fish to osprey for toxics; (Elliott, et al. 1999, 2000) assessed effects of chlorinated hydrocarbons in osprey chicks, and contaminants in ospreys of the Pacific Northwest.

Has the data been peer-reviewed? Yes, in numerous publications including: *Environmental Monitoring and Assessment* 84; *Arch. Environ. Contam. Toxicol.* 38; *Envir. Toxicology and Chemistry* 20, etc.

How is the data reported? Usual methods, such as journal articles, web publications, and as in poster presentation forms well.

What data do we have on the measurement endpoint proposed for this species? According to one publication, the minimum critical levels of the main contaminants in the eggs of birds of prey (above which adverse reproductive effects are frequently observed) are approximately:
4.0 ppm for DDE, 1.0 ppm for dieldrin, 50.0 ppm for PCBs, and 0.5 ppm for Hg (Henny, 2006).
Other mercury data : 0.8 ppm threshold (Heinz, 1979).

What comparisons can be made for this indicator with other ecosystems outside the CRB? Some researchers selected a reference area that was believed have suffered less environmental degradation. For example, Henny (2002) says: "...eggs from the Willamette River had significantly elevated PCBs and PCDDs compared to reference eggs collected nearby in the Cascade Mts."

What are the data gaps that need to be filled? Although Henny (2006) concluded that "Hg concentrations in eggs increased significantly but below established adverse effect levels..." he was unable to provide reasons for this increase or if it poses a current or eventual negative effect of human health.

What are the future research needs? Henny (2007) "The significant increase in mercury justifies the need for future monitoring"

Elliott (1999) “A study of mercury accumulation in ospreys breeding on hydroelectric reservoirs in the PNW is probably warranted.”

Henny (2007) “A combination of techniques and species are required to fully understand the many contaminants and their effects on a diverse system such as the Columbia River.

What are future reporting needs? It would be very useful if it could be demonstrated that upward population trends are not compromised by current levels PCBs and mercury.

What are your recommendations for moving ahead? Although not nearly as feasible as is the study of ospreys, I believe more effort should be applied to raptors experiencing slower recovery (eagle, peregrine, e.g.).

Product: Osprey Narrative

Background

Osprey are large piscivorous birds whose numbers were in severe decline prior to the U.S. ban on the pesticide dichlorodiphenyltrichloroethane (DDT), but populations in the Columbia River Basin are increasing. The osprey is an excellent sentinel species because they are common, long-lived, and tolerant of nest intrusion. By collecting single eggs from nests scientists can determine the toxics to which the birds have been exposed with virtually no effect on the overall health of the population. Recent studies show that levels of mercury found in eggs have been increasing. Fish retain the metal in tissues principally as methyl mercury, although most of the environmental mercury to which they are exposed is inorganic.

Theories differ as to the source of the Mercury. Atmospheric deposition to land is estimated to be the largest (587 kg yr^{-1}) single contributor, with approximately one half of this deposited mercury returned to the atmosphere via volatilization. Combined local anthropogenic (360 kg yr^{-1}) and global emissions (390 kg yr^{-1}) substantially overshadow all other anthropogenic point-source inputs. The largest source of Hg to surface water ($\sim 70\%$) is runoff from native soils (particulate and dissolved phases) and contributions from anthropogenic air emissions deposited on land and then transported as runoff were approximately 17%. Other identifiable point sources account for approximately 5% of the input (Krotz, 2006).

Status and Trends

The overall health of the Osprey population in the Columbia River Basin is on the upswing. A recent study (Henny and Grove 2007) notes an approximately 14% annual increase in number of occupied nests on Lower Columbia 1997-2004 and significantly lower egg concentrations of most OCs, PCBs, dioxins and furans compared to previous studies. However, DDE apparently was still affecting the reproductive success of some portions of the population. Furthermore, the Mercury concentration in osprey eggs had increased significantly compared to previous studies yet considered still to be at levels below those known to cause adverse effects.

Reduction efforts

State and federal agencies are taking steps to reduce mercury in the CRB. The Association of Clean Water Agencies (ACWA) and the Oregon Dental Association are working together to promote to promote discharge-reduction practices. Both the Oregon Department of Environmental Quality (ODEQ) and the EPA are committed to actions with similar goals in mind. These include limiting mercury releases into the environment, reducing the amount of mercury already present, improving monitoring practices, identify where fish tissue concentrations pose a risk to public health, and improve overall public awareness of mercury issues.

Task: Secondary Research on Bald Eagle Studies

Although others were assigned to compose the indicator section on bald eagles for SORR, I was charged with compiling a list of short summaries on the studies used to write this section of the Report, which indexes them. To write these summaries, I employed the same methods I used previously on mustelids and osprey. This consisted of gathering as much background information as was feasible, conducting a great deal of web-based research, and carefully scrutinizing the studies to capture the main points in an abbreviated form. These summaries are listed in Appendix A.

Product: SORR Indicator Section on Piscivorous Birds

Predatory birds—osprey and bald eagle in the Lower Columbia River

Osprey and bald eagle are large birds of prey that live in much of the Basin, but they are concentrated in the Lower Columbia River. While the bald eagle is found exclusively in North America, the osprey has

a nearly worldwide distribution. Bald eagles feed primarily on live or scavenged fish and aquatic birds, while the osprey has a diet almost exclusively of live fish captured near the nest.

Osprey and bald eagles are useful indicators for evaluating the health of an aquatic ecosystem for several reasons: (1) they are widely distributed; (2) they are long-lived (bald eagles, for instance, can live up to 28 years in the wild); (3) they primarily prey on fish and other aquatic predators, usually near their nests; and (4) they are at the top of the food web and are therefore exposed to high amounts of contaminants through their diet.

Task: Pacific Lamprey Research

Ms Rueda was delegated to compose a short entry on the Pacific Lamprey. I was allowed to submit changes, many of which were subsequently accepted. I wanted to learn as much information as possible regarding this animal. First, I conducted a great deal documental and web-based research its life history. This provided a firm basis and understanding of this unusual anadromite.

Next, Ms. Soscia asked me to represent EPA at the Columbia Inter-Tribal Fish Commission Tribal Columbia River Basin Pacific Lamprey Summit II on 15 May 2008. The conference began with tribal elders such as Elmer Crow and Fidelia Andy emphasizing the importance of “eels” as a cultural and nutritional resource, and how noticeably scarce they have become. Keynote speakers included biologists, state and federal decision-makers, and tribal members. An overview of restoration goals and objectives was outlined, and a workshop between smaller groups allowed individuals to provide input and voice concerns. The conference ended with representatives of the various entities speaking briefly before the entire group. When asked to address the group, I tried to assure the tribal elders that EPA would continue to take steps to restore this important resource. A record of the meeting I submitted to Mr. Cox can be found in Appendix C.

Method: Pacific Lamprey Narrative Edits

The following paragraphs illustrate my contribution to the SORR section on lampreys. The next to paragraphs are Ms. Rueda’s original write-up on lampreys. I made changes (which follow) and my submission was accepted for the SORR with few alterations. The “SORR Indicator Section on Pacific Lampreys” is how it appears in the final draft.

Ms. Rueda's Narrative

Pacific lampreys are boneless fish that spawn and spend the first five to seven years of their lives in freshwater streams. In this juvenile phase the lamprey is a filter feeder. Adult lampreys migrate to the ocean, where they feed parasitically on other fish for up to three years before returning to freshwater streams to spawn. Lamprey numbers have declined in the past twenty years, and they are no longer found in many streams of their range.

Lampreys have great cultural importance to the Columbia River Tribes. Although very little data has been collected on toxic contaminants in lamprey in the Columbia Basin, because they have a high fat content and spend a significant developmental period in the Basin's streams, there are concerns that toxic contaminants may be a contributing factor in their declining numbers. Lamprey is not discussed as an indicator in this report because so little data has been collected on them to date. Their unique life cycle with its potential for exposure to basin contaminants during a prolonged developmental period, distinguishes them as potential indicators of ecosystem health.

Edits Submitted

Pacific lampreys (*Lamperta tridentata*) are scaleless, boneless fish that are of great cultural importance to the Columbia River Tribes. Their numbers have declined drastically in the past twenty years, and are no longer found in many streams in their range. Pacific lampreys spawn in freshwater streams. Juvenile lampreys, called ammocoetes, spend the first five to seven years of their lives in the sediment as filter feeders. Adult lampreys migrate to the ocean, where they feed parasitically on other fish for up to three years before returning to freshwater streams to spawn. Because lampreys have a high fat content and spend a significant developmental period in the Basin's streams, there are concerns that toxic contaminants may be a contributing factor in their declining numbers. The unique life cycle of the lamprey with its potential for exposure to basin contaminants during a prolonged developmental period distinguishes them as potential indicators of ecosystem health, although very little data has been collected on toxic contaminants in lamprey in the Columbia Basin. As a result, Lampreys are not discussed as an indicator in this report.

Product: SORR Indicator Section on Pacific Lamprey

Pacific lampreys are scaleless, boneless fish that are culturally important to the Columbia River tribes. Lampreys have declined drastically in the past 20 years and are no longer found in many streams in their traditional range. Pacific lampreys spawn in freshwater streams. Juvenile lamprey (ammocoetes) spend their first 5 to 7 years in the sediment as filter feeders. Adult lampreys migrate to the ocean, where they feed parasitically on other fish for up to 3 years before returning to freshwater streams to spawn.

Because lampreys spend their developing years in the Basin's streams, there are concerns that toxic contaminants may be a contributing factor in their declining numbers. Studies in locations outside the Columbia Basin have documented the sensitivity of juvenile lamprey to toxic chemicals in their environment. The unique life cycle of the lamprey with its potential for exposure to Basin contaminants distinguishes it as a potential indicator of ecosystem health. However, very little data have been collected on toxic contaminants in lamprey in the Columbia Basin. Because of this lack of data, lampreys are not discussed as an indicator in this report. Given the cultural importance of lamprey to the Columbia River tribes, however, we will evaluate whether lamprey should be added as an indicator species after additional data on toxics in lamprey are collected and evaluated.

Task: Research for the Asiatic Clam Distribution Map

The information we had on Asiatic Clam (*Corbicula fluminea*) distribution in the Pacific Northwest was inaccurate not suited for our purposes. Therefore I took the initiative to compose a new map that would effectively depict *Corbicula* distribution in the Basin with a map suitable for SORR.

Through a thorough search of available data, I was able to obtain *Corbicula* distribution shape files from Amy Benson of USGS in Gainesville, Florida. The older information, she said, came from a paper by Counts (1991) and the newer information was borrowed from the work of Portland State University's Mark Sytsma and Robyn Drahiem. The files were in the WGS84 projection. I was unable to produce a useable map with Arc GIS, and with the assistance of Matt Gubitosa - GIS Scientist at the Region-10 Office of Environmental Assessment in Seattle, Washington - we re-defined the projection to NAD83. This proved effective. I obtained raster data and water body shape files from the Regional website, and imported all of these into the GIS and subsequently produced a workable map. After a few suggestions from various group members, the final product emerged and was inserted into SORR.

Initial *Corbicula* Distribution Map

Distribution of Asiatic Clam in Columbia River Basin (USGS).

Product: Revised *Corbicula* Distribution Map

Task: Research for the Columbia Basin Dioxin Trends Chart

This task involved the revision of a chart representing dioxin concentration trends in animal tissue from various locations in the Columbia River Basin. The initial chart made by Ms Rueda required specific refinements to suit our purposes. The goal was to depict the individual species' concentration trends over time, as opposed to concentration trends by year for each species. My suggestion to represent human health consumption guidelines on the chart was accepted, but the version that appears in SORR (Appendix E) conveys less information than those that were submitted.

Original Dioxin Trends Chart

2,3,7,8 TCDD in Columbia River Fish and Osprey

Product: Revised Dioxin Trends Flex Chart

Dioxin Trends, Columbia Basin 1987-2005

Product: Flex Chart (alternate version)

Dioxin Trends in Columbia Basin, 1987-2005

Task: GIS Research of DDT Trends

I was asked to create a series of maps using Arc GIS to provide a visual aide in assessing the trend of DDT concentrations in the Basin. These maps were not placed directly into SORR, but were used by Ms. Rueda to help complete her contribution to the COCs section of the Report. Specific instructions were e-mailed by Ms. Rueda that requested 2 separate maps, depicting measurements taken prior to 1995 and those taken afterward. We needed to import the data from an Excel spreadsheet, and add it to a map of the Columbia Basin.

Product: DDT Trends in the Columbia Basin:

Task: Strategic Targets Research

This task involved the composition of a map depicting so-called strategic targets for toxics in the Columbia River Basin, to be used by Ms. Soscia in various presentations. In order to justify the toxics reduction efforts of the Working Group, 5 specific sites within the Columbia River Basin were chosen are “Strategic Targets” intended to serve as benchmarks of progress. These are representative of harmful contaminants measured in various habitats and locations. It is at these strategic target areas where progress in toxics reduction efforts will be measured.

The target locations and COCs are as follows:

Columbia Mainstem near Abernathy Point (RM54), PCBs & DDT

Columbia Mainstem at Multnomah Channel (RM 86), PCBs & DDT

Walla Walla River (RM 14), DDT

Little Walla Walla River (west prong), Azinphos methyl & Chlorpyrifos

Yakima River above Horn Rapids Dam, DDT

Methods:

Ms. Soscia provided descriptive locations of the strategic target locations (e.g., river mile). In order to compose a map, geocoding was necessary. Prior to doing so, I referenced a USGS map with river mile (RM) locations that I could input into a program in order to obtain latitudinal and longitudinal coordinates. At GPSvisualizer.com, I entered the strategic target locations, and geographic coordinates were subsequently returned. Next I entered these coordinates into a Microsoft Excel spread sheet, which I imported into Arc GIS. In the GIS I composed a map using agency database shape files and raster data for water bodies and topographic information. I used callouts and various Arc GIS symbols to represent the strategic targets, and added a key, legend, and direction arrow. Then, after a series of small adjustments, a final map was produced and submitted.

Product: CRB Strategic Targets for Toxics Reduction

Columbia River : Baseline for Pesticides / Toxics Strategic Targets

This U.S. Environmental Protection Agency (EPA) has compiled this computer representation from data or information sources that may not have been verified by the EPA. This data is intended for use as a general representation only, and is not to be used without verification by an independent professional geospatial data or information. The EPA does not guarantee the accuracy, completeness, or timeliness of the information shown, and shall not be liable for any loss or injury resulting from reliance upon the information shown.

Task: Editing and Revising SORR

Another important task I performed was assisting with the editing of the SORR. By giving team members access to the documents, the final product reflects the benefits of the collaborative efforts of the group. The amount of modifications varied on reviewer's workload, interest, and area of expertise. At times, questions were posed to the team during conference calls, and our input was always welcome.

Methods: This was done either by utilizing the "track changes" feature in the Microsoft Word program or by simply copying particular portions of the document and submitting my proposed changes to the group. The narratives were subject to rounds of track change edits by the group as a 'living document' that was distributed among the group's members. I employed the latter method on various occasion. An example of second-draft edits submitted to Mr. Cox is in Appendix D.

Product: Refined SORR Sections

Although it isn't feasible to list each and every refinement that was made to SORR through various rounds of editing, it is nonetheless a noteworthy undertaking and worthy of mention. Through a closely-knit collaborative effort, this team created a continuously improved product culminating in a polished report on toxicant trends in the Columbia River Basin. The actual document is planned for release to the public by February, 2009.

Tasks Performed Not Directly Related to SORR

A large agency such as EPA is often involved in many areas such as restoration projects, assessment, monitoring, remediation, funding management, community outreach and others. It is my good fortune that my experience as a graduate research assistant at EPA went beyond the composition of SORR. In addition to my work on SORR, I participated in assisting other staff members to gain experience and insight of other projects and endeavors with which EPA is involved. These included updating and improving the Region 10 website, reviewing environmental assessment document, and assisting with inspection reports.

Website Improvement and Support

In order to effectively provide the public with information regarding what EPA does, where these efforts occur, why they are done and whom they affect, a publicly-accessed website is in place. Ongoing efforts often require updated information, and improvements in technology also may require website changes.

Ms. Soscia and I concentrated our website improvement efforts on the Columbia Basin section of the Agency's Region 10 website. Here, we identified areas of improvement or those with erroneous or outdated information. Through various means such as phone calls, electronic mail, and use of computer software programs, we were able to make many important and necessary changes and improvements to the Region 10 website. These included updates of ongoing efforts in the Basin, improved mapping or graphics created with Microsoft Office or Arc GIS programs, and occasionally, format issues. The people we contacted were from government agencies, non-profit groups, and private industry.

This task required some knowledge or use web-writing languages. Usually the information was obtained and placed it in a format useable to the Region 10 web team. Text was usually placed in a Word document and maps were composed in Arc GIS, saved as a converted file (usually PNG) and submitted to the web team via electronic mail.

Product: LCREP Updates

A Portland based non-profit group called the Lower Columbia River Estuary Partnership conducts restoration and education projects in the area. Progress of their efforts can be found on the Region 10 website, and requires occasional updates. Usually I would phone or email the LCREP media coordinator and she would provide the information needed. Over a period of time, we were able to thoroughly update the information regarding LCREP's work and eventually submitted our changes to the web team. A copy of the updates that were submitted is in Appendix B.

Product: Portland Harbor Superfund Site Updates

Ms. Soscia and I also recognized the need to update information with regard to the ongoing efforts to remediate the Portland Harbor Superfund Site. Through a series of emails, phone calls and interviews with EPA's Mr. Humphrey, Mr. Bleschke and others, we procured an adequate amount of worthwhile

information to submit to the regional web team. A copy of the updates that were submitted is in Appendix B.

Product: Columbia River Basin Thumbnail Map

The maps on the Region 10 website needed improvements. We concluded that the front page should contain a much simpler map to serve as a thumbnail that would link the user to other more detailed maps of the region. I composed this using the usual methods with Arc GIS, saved it in a portable format, and submitted it to the web team. In a related issue, we also suggested using one of Ms. Rueda's maps from SORR on the Region 10 website.

Columbia River Basin

Task: PUD Budget Review

Another task I was given by Mr. Salter was to attend a budget review meeting and compose a summary of it for his budget report. I would also gain an understanding of the processes involved when a municipality applies for federal funding. This opportunity provided a great deal of insight into finance and budget objectives strategy, and a good overview of the intricacies public utilities district (PUD) administration. Some of the information to which I was exposed is confidential in nature, and many details have been omitted. A summary of the meeting follows.

Product: Meeting Summary

Project: Hwy 409 Water Main Replacement & Electric Conduit Installation Project

Participants: Wahkiakum PUD and United States EPA

Location: Wahkiakum PUD, Cathlamet, Washington

Attendees: David Trambly, Erin Wilson, Joel Salter, Bradley Carter

The purpose of this meeting was to review the application process in order to allow Wahkiakum PUD to secure Congressional Earmark funds for water quality improvement under the State & Tribal Assistance Grant (STAG) program. Independent public engineering estimated total project cost to be approximately \$900k. Requested STAG funds are expected to cover approximately 16% of these costs.

The project will replace 7100 feet of aging asbestos water main with modern 8" diameter pipe. During this process Wahkiakum PUD determined it appropriate to also install 5000 feet of 4" electrical conduit.

Items on the agenda included a review of necessary forms, sample application, an overview of project progress and various particulars such as preexisting costs, demographic information, NEPA wetlands delineation documents, budget issues, consumer rates, sewage and water supply regimes.

Additionally, the team conducted a site visit and physical inspection of project area on Puget Island. This primarily rural, six-mile long group of islands in the lower Columbia River between Cathlamet, Washington, and Westport, Oregon (RM 38-RM 45) was settled by Norwegian dairy farmers and fishermen in the early 1900s. No issues with regard to compliance or regulation were observed.

Task: Environmental Assessment Research for LNG Project

Another task I performed unrelated to SORR was to assist Ms. Kubo in a review of an environmental assessment document for the controversial liquefied natural gas pipeline project in Northwestern Oregon. I was given the opportunity to review the document and to mention any issues regarding adverse impacts that I felt were not addressed. After carefully scrutinizing the report, I listed important points that Ms. Kubo might have not noticed. I submitted my findings via e-mail shortly thereafter. A copy of my suggestions to ms. Kubo is in Appendix D.

Task: Record Keeping at Working Group Meeting

This task involved taking minutes as to provide a summary of the February meeting of the Toxics Reduction Working Group, delegated to me by Mr. Cox. At this conference, various speakers gave presentations on findings and progress in toxics reduction efforts in the Basin working. These meetings help reinforce the goals of the group and provide insight to the efforts of other members' work. My summary provided a record of the gathering and justification of our presence and role in Columbia Basin toxics reduction. This record was distributed by Mr. Cox to serve as a reference. A copy of the meeting notes can be found in Appendix C.

Task: Assistance with Compliance Inspection Reports

Another facet of my MEM project experience involved working with EPA hydrologist Mr. Salter on water quality projects. I used this opportunity to explore funding procedures, perform site visits and inspections, and help compose inspection reports, photo logs, and related documents. To oversee progress on EPA funded endeavors, I participated in site visits to the City of Salem POTW, a Wilsonville residential storm water abatement project, and a funding conference at the Wahkiakum PUD. Additionally, I compiled comments, suggestions and edits from various sources on a Memorandum of Agreement between EPA and the State of Oregon.

Task: Canyonville Project

Mr. Salter was reviewing a grant proposal for a water quality improvement project in Canyonville, Oregon. He need a visual depiction of the project site and asked if I could compose a map of the area that labeled important features relating to the project. I concluded that we should obtain an aerial photo and then label it in a Microsoft PowerPoint presentation. I found that Windows does not allow one to

easily copy such photos off of the Internet, but I was able to easily procure the needed photos using a Macintosh computer. Next, I imported the photos into the presentation and labeled them with Windows graphics tools. I then saved the labeled photos as Portable Network Graphics (PNG) files and sent them to Mr. Salter via email. The photos were eventually inserted in his funding inspection report and submitted for review by his superiors. A labeled but less-detailed photo of the Canyonville project follows.

Product: Example of Canyonville Aerial Photo Maps

Task: Assistance with Cunningham Ranch Inspection Report

Another project with which Mr. Salter was involved was a feedlot inspection at the Cunningham Sheep and Cattle Ranch in Eastern Washington. I was asked to label some aerial photos that were to be part of an inspection report. The actual photos were already on file in EPA's database. I converted them to PNG files, imported them into a PowerPoint presentation, and added the desired labels. I then saved the images and sent them to Mr. Salter and he inserted them into his inspection report. A sample photo from the report follows.

Product: Cunningham Ranch Aerial Photo Map

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Appendix A

SORR Information

a) Summaries of Piscivorous Mustelid Studies

Henny, C.J., L.J. Blus, S.V. Gregory, and C.J. Stafford (1981) “PCBs and organochlorine pesticides in wild mink and river otters from Oregon” *Proceedings of the Worldwide Furbearer Conference* 3:1763-1780.

- speculation that apparent declines in Mink and River Otter are due PCB contamination
- carcasses were analyzed for organochlorine pesticide and PCB residues
- levels in some otter much higher than those in similar study in Alabama (Hill and Lovett 1975)
- PCB in mink livers as high as those experiencing complete reproductive failure with experimental diet
- Lower Columbia mustelids most contaminated & conclude mink more sensitive to PCBs than otter
- suggest need for laboratory studies on otter to determine sensitivity to PCBs

Henny, C.J., Grove, R. A., and O.P. Hedsrom (1996) “Field Evaluation of Mink and River Otter on the Lower Columbia River and the Influence of Environmental Contaminants” USGS FRESC Corvallis Research Group, Project #12.

- evaluated PCBs, dioxins, furans, heavy metals and physical condition
- all contaminants higher in Lower Columbia River juveniles (age class 0) than in reference area
- reduced baculum length and other reproductive anomalies in juvenile males
- PCB concentrations in river otter show increase with age
- 3 of 4 river otter from RM 119.5 had “gross abnormalities in addition to highest PCB concentrations”
- conclude river otter to be less sensitive to PCBs than mink
- propose additional studies on live-trapped otter

Harding, L.E., Harris, M.L., Stephen, C.R., and J.E. Elliott (1999) “Reproductive and Morphological Condition of Wild Mink (*Mustela vison*) and River Otters (*Lontra canadensis*) in Relation to Chlorinated Hydrocarbon Contamination” *Environmental Health Perspectives* 107, #2: 141-147.

- analyzed livers in carcasses for residues of organochlorine pesticides, dioxins, furans and evaluated various biological parameters
- contaminant levels 'relatively low' compared to other NA populations
- chlorinated hydrocarbon TEQ values and PCB concentrations below those considered to cause adverse reproductive effects
- found similar correlation in baculum length vs. PCB concentration in juvenile mink as Henny (1996) did in river otter
- suggests mink possibly more sensitive than otters to PCBs
- dioxin and furan concentrations higher in Lower Fraser valley probably due to biocide use in forest industry
- some reproductive system abnormalities found in males, though low concentrations of chlorinated hydrocarbons suggest genetic defects
 - suggests need for further studies on possible effects of PCBs on male mustelid reproductive systems

Elliott, J.E. and C.J. Henny (1998) "Chlorinated hydrocarbons in livers of American mink (*Mustela vison*) and river otter (*Lontra canadensis*) from the Columbia and Fraser River Basins, 1990-1992" *Environmental Monitoring and Assessment* 57: 229-252.

- evaluated tissues in mustelid carcasses for dioxins, furans and PCBs
- concentrations in mink liver of dioxins and some furans higher than those in Quebec study
- with a few exceptions, species not heavily contaminated
- indicative of 'several regional contaminant sources' (hot spots)
- concur mink have 'extreme sensitivity' to PCBs
- suggests 'difficulty in trapping' of mink reflects 'depressed' populations and speculates PCBs are contributing
- conclude dioxins and furans found in both species originated from use of wood preservatives

Harding, L.E., M.L. Harris, and J.E. Elliott (1998) "Heavy and Trace Metals in Wild Mink (*Mustela vison*) and River Otter (*Lontra canadensis*) on Rivers Receiving metals Discharges" *Bulletin of Environmental Contaminant Toxicology* 61: 600-607, Nov 98.

- examined concentrations of heavy metals in liver and kidney tissues of mustelids from trappers

- found metals concentrations in mink and otter tissues 'generally low'
- some individual otters showed elevated Pb concentrations, higher than similar studies in Ontario (Wren 1988), Illinois (Halbrook 1996) and Virginia (Anderson-Bledsoe 1983)
- mercury concentrations in Kootenay mink kidney tissues high compared to Illinois (Halbrook 1996) and Lower Fraser and intermediate to contaminated basins in Manitoba (Kucera 1983) and Ontario (Wren 1986)
- concludes that 'no species difference in liver concentrations of the heavy metals' were detected
 - “...mustelids from the Fraser and Columbia River systems ...are not at risk from discharges of metals”

b) Summaries of Osprey Studies

Henny, C.J. and R. A. Grove (2007) “Osprey Distribution, Abundance, Reproductive Success and Contaminant Burdens Along the Lower Columbia River, 1997/1998 versus 2004” *Archives of Environmental Contaminant Toxicology* 2007.

- ~14% annual increase in number of occupied nests on lower Columbia '97-'04
- significantly lower egg conc. of most OCs, PCBs, dioxins, and furans
- DDE still affecting reproductive success of a portion of the population in '97-'98
- Hg conc. in eggs increased significantly but below established adverse effect levels

Henny, C.J. and R.A. Grove (2004) “An Evaluation of Osprey Eggs to Determine Spatial Residue Patterns and Effects of Contaminants along the Lower Columbia River, USA” *Raptors Worldwide* 2004.

- ‘sample eggs’ from 29 nests analyzed for OCs, PCBs, dioxins, furans, and Hg
- high PCBs immediately below Bonneville Dam
- mean nest productivity (1.64 young/nest) considered very good
- total PCBs 1435 ug/kg (ppb) / 42 congeners = 34.2 (average); TEQs
- Hg below known effect concentrations: Geo mean. 29 ppm for all reaches
- only 1 samples (rm137) @.94 ppm exceeded known effect conc of 0.8 ppm (Heinz, 1979; Newton & Haas, 1988)

Henny, C.J. (2006) “PBDE and HBCD Flame Retardants in Eggs of Osprey and Double-crested Cormorants from Washington and Oregon, 2002-2004.” *Poster, 2006 Annual SETAC Meeting.*

- measured levels of PBDE & HBCD in 79 osprey & 12 cormorant eggs (just Everett)
- compared data among PNW locations, other locations, and between the 2 species
- found PBDE-47 to be the dominant congener (55-75% of total)
- totals highest in Lower reaches
- Yakima River had highest PBDE-99 concentrations in the PNW
- Everett Harbor Osprey eggs had higher total PBDE concentrations especially congeners 28 & 47 than cormorants (speculation: larger prey)

Henny, C. J. and R.A. Grove (2003) “Biomagnification Factors (Fish to Osprey Eggs From Willamette River, Oregon, USA) For PCDDs, PCDFs, PCBs, and OC Pesticides” *Environmental Monitoring and Assessment* 84, 2003.

- examined 10 Osprey eggs & 25 composite samples of fish for Ochs, PCBs, dioxins, furans, and Hg (fish only)
- Geometric means found to be low: DDE 2.3 uGu/g (pap)
- total PCBs .69ug/g (ppm); dioxins 2.3 ng/kg (ppt), well below known threshold for adverse effects; values were highest in from eggs immediately downstream from paper mills
- Hg data: “higher conc. throughout study area” in N. pikeminnow (piscivore) than Largescale Sucker (omnivore) 1.12 v.29 ug/g (ppm); above RM 146 (all 3 sp) Hg (geom.. mean) N. pikeminnow 1.2 ug/g, Lgscl sucker 0.23, Mt w.fish .10; osprey population increasing in Willamette Valley

Elliott, J.E., Wilson, L.K. and Henny, C.J. (2000) “Assessment of Biological Effects of Chlorinated Hydrocarbons in Osprey Chicks” *Environmental Toxicology and Chemistry* 20:866-879, 2001.

- incubated 54 osprey eggs from the Fraser and Columbia River systems
- analyzed yolk sacks for OCs, dioxins, and furans
- all 3 COCs higher in samples collected downstream of pulp mills and industrial centers

Elliott, J.E., M.M. Machmer, L.K.Wilson and C.J. Henny (1998) “Contaminants in Ospreys from the Pacific Northwest: I. Trends and Patterns in Polychlorinated Dibenzo-*p*-Dioxins and - Dibenzofurans in Eggs and Plasma” *Archives of Environmental Contaminant Toxicology* 35, 1998.

- 121 eggs collected, and blood samples of nestlings tested for dioxins, furans, upstream/downstream from paper mills in Fraser & Columbia Rivers in BC, Canada
- downstream concentrations higher than upstream (of pulp mills) both river systems
- significant decrease in mean conc. in eggs of dioxins & furans (downstream) between 1991 and 1997

Elliott, J.E., M.M. Machmer, L.K. Wilson and C.J. Henny (1999) “Contaminants in Ospreys from the Pacific Northwest: II. Organochlorine Pesticides, Polychlorinated Biphenyls, and Mercury, 1991-1997” *Archives of Environmental Contaminant Toxicology* 38, 2000.

- eggs collected “significantly greater concentrations of PCBs were founding eggs from the CRB compared to the Fraser”
- LCR: Arochlor-1242 PCBs higher concentrations than in other regions
- Upper Reaches: Arochlor 1254, 1260 higher in concentration
- Mercury: uniform & comparable to similar sites in other literature, though not reflective of local accumulation
- no indication Hg higher downstream than upstream
- suggest need to study Hg accumulation in ospreys breeding on hydro reservoirs

c) Summaries of Bald Eagle Studies

Buck, J.A., R.G. Anthony, and F.B. Isaacs (1999) “Changes in productivity and environmental contaminants in bald eagles nesting along the Lower Columbia River,” *USFWS and Oregon Cooperative Wildlife Research Study ID # 13420-1130-1F16*.

- nest productivity similar to statewide values, yet possible link between disturbance & productivity (only 1 territory produced young after this study)
- collected partially incubated eggs at 19 of 43 occupied territories along LCR 1994-95 to help determine cause of low productivity
- measured nest productivity (Postupalsky method), eggshell thickness, levels of OCs, PCBs, Hg, dioxins, furans
- all LCR eggs had measurable levels of PCBs & OCs (DDE most common)

- eggshell thickness unchanged from earlier study (Anthony, et al., 1985-87) but well below pre-DDT ban average
- total PCBs & DDE concentrations declined and Hg unchanged from Anthony, et al..
- dioxins & furans in all egg samples, though data not comparable to Anthony study
- mean PCBs still above NOAEC of 4.0 ug/g Hg below adverse-effect concentration
- increased productivity linked to new nesting pairs
- age related productivity data lacking
- no relationship between individual contaminant concentration & productivity
- multiple chemical interaction / human disturbance may contribute to poor success

Buck, J.A., R.G. Anthony, C.A. Schuler, F.B. Isaacs, and D.E. Tillitt (2005) “Changes in productivity and contaminants in bald eagles nesting along the Lower Columbia River, USA,” *Environmental Toxicology and Chemistry* 24: 1779-1792.

- hypotheses of study were to determine if:
 - OC contaminants exceeded no-effect threshold concentrations
 - contaminant concentrations were related to productivity
 - contaminant concentrations & productivity values change over time
 - contaminant concentrations were related to nest location as river mile
- objectives were to:
 - quantify OCs, dioxins, furans, planar PCBs & Hg in the eggs of eagles
 - compare current productivity & egg contaminant concentrations to earlier river studies
 - determine relationships among productivity, eggshell parameters, contaminant concentrations & river mile of nest location
 - measured productivity based on young per occupied territory; used ground surveys & helicopter overflights to determine site occupancy (April), nesting status (May), then lastly final productivity (July)
 - fresh and addled eggs collected at 19 of 43 occupied territories & tested for Hg, DDE, PCBs, dioxins, furans; shell thickness
 - all eggs contained OCs, PCBs, & mercury; PDBEs detected in all eggs collected in ‘95
 - tree climbing to obtain fresh eggs could have adversely affected nest productivity: mean productivity was reduced by 22% (‘94) & 16% (‘95)
 - total PCBs & DDE declined from earlier study (Anthony et al., 1993)

- mean 5-year productivity found not related to nest location as river mile
- all but one of eggs collected exhibited eggshell thinning
- thickness not statistically correlated to DDE or mean 5-year productivity
- dioxins & furans found in all samples, highest in 2 older territories near mouth of CRE
- planar PCBs accumulated in all eggs, most elevated 77 & 126; 118 & 105
- concluded DDE declined 34% & PCBs 49% in eagle eggs since mid-1980s
- however, PCBs still higher than threshold values of NOAEL
- DDE nearly double value associated w/reduced productivity
- TEQs, furans & PCB 169 were statistically correlated to nest location as river mile, with higher values found near mouth of river
- speculates dioxin & furan contamination

Garrett, M.G., J.W. Watson and R.W. Anthony (1993) “Bald eagle home range and habitat” *Journal of Wildlife Management* 57: 19-27.

- seasonal habitat use and home range studied in CRE 1984-86 via aerial & boat survey
- defined territories as areas defended by pairs for nesting and foraging
- all nest trees < 1.6km from river; 94 % in living trees
- trees species used: Sitka spruce – 17, Douglas fir – 14, W. hemlock – 2, cottonwood – 2
- visibility & proximity to food critical to perch selection
- tidal flats principal foraging habitat
- cites Anthony and Isaacs (1989) mean productivity “lower at sites altered by logging”

Anthony, R.G., M.G. Garrett and C.A. Schuler (1993) “Environmental contaminants in bald eagles in the Columbia River estuary” *Journal of Wildlife Management* 57: 10-19.

- bald eagle eggs, tissue and fish collected, breeding success monitored in CRE 1980-87
- tested for OCs, PCBs, dioxins, furans
- statistical association shown between eggshell thinning and DDE, PCBs
- detected DDE in all nestling blood samples
- evidence eagles are accumulating dioxins, probable source contaminated prey

-concluded role of dioxins unclear, but levels in eggs similar to those in studies causing adverse effects
DDT, PCBs, & dioxins in the CRE; more controls on PCB disposition; more dioxin studies on eagles;
effects of dredging activities / re-suspension hazards

-future needs cited include more information on levels of DDT, PCBs & dioxins in CR estuary

d) Edits Submitted to Mr. Cox

B Carter's Edits Fall 2008

P 9, Fig 3.2 "5000x increase in Toxics Contaminants Concentration"

Should be "...Toxic Contaminants Concentration" or "...Toxic Contaminant Concentration" or
"...Toxics Contaminant Concentrations"

p. 14: "I think it should say "Which Indicator Species are Used in this Report?"

and I question the use of some of those capital letters;

Also, some of these are technically Sentinel Species

p 15; paragraph 1:" Their bodies float downstream and decompose, releasing nutrients into the water for
other species of animals and plants"

might read better as:

"Their remains decompose, releasing nutrients for plants and other animals"

P 16 paragraph 1, line 2: I don't believe 'Northern' is capitalized

P 17

Paragraph 1: omit "up to" and replace:

should read: "Sturgeon can live 100 years..."

Paragraph 2: omit "...the Canadian portion of the river..." replace with "...Canada's portion of the
River..."

Note: we capitalize Basin, should not we capitalize River?

P 24:

paragraph 2: "... a cement plant in Durkee, Oregon, emits more than 2,500 pounds of mercury per year. [2] Although just over 140 pounds of this amount are deposited in the sub-basin in which this plant is located, that deposition contributes an estimated 62 percent of the load in that area".

I really think we should mention this fact:

"However, technological advances have been implemented to reduce the plant's mercury emissions by 85% within two years".

reference:

<<http://209.85.173.104/search?q=cache:KuhPXr6GjL4J:yosemite.epa.gov/R10/airpage.nsf/Air%2BToxics/summit%2Bregion%2Bx/%24FILE/Day1-Mercury-issues-Ash-Grove-Cement-Durkee.pdf+ash+grove+carbon+injection&hl=en&ct=clnk&cd=1&gl=us>>

P.24 paragraph 5: "Although not all of the mercury that lands on the surface from the air gets transported to water bodies..."

Should read "Although not all of the mercury which descends from the air gets transported to water bodies..."

P 27: paragraph 1:" DDT and its breakdown products, dichlorophenyldichloroethylene (DDE) and dichlorophenyldichloroethane (DDD), have been linked to neurological and developmental disorders in birds and other animals."

Should encase in "dash" (-) :

"DDT and its breakdown products - dichlorophenyldichloroethylene (DDE) and dichlorophenyldichloroethane (DDD) - have been linked to neurological and developmental disorders in birds and other animals."

P33, paragraph3: "PCBs are very water insoluble and tend to adhere to organic matter and sediment particles. Therefore, PCBs have a high potential to be transported when sediment is transported, such as during storms and floods, and then accumulate in pools or reservoirs."

2 things that really stick out:

"...are very water insoluble..." can't be correct

AND, according to (Chow, et al., 1993)

The dominant mechanism by which PCB's the Great Lakes and most other bodies of water is by atmospheric deposition. PCB's have a tendency not to stay dissolved in water and therefore volatilize back into the atmosphere. Because of this, large quantities of PCB's volatilize out of lakes as well as being deposited into them from the large reservoir of synthesized organic compounds moving in regional and global air masses.

SO, I don't think sediment transport is a valid explanation

I suggest 'borrowing' this statement for this paragraph or quoting Chow directly:

"PCBs entering rivers and streams from storm water runoff and discharge are a growing regional concern. PCBs tend not to stay dissolved in water and volatilize back into the atmosphere moving in regional and global air masses."

P 34 paragraph 2: I don't believe we capitalize "Chinook"

Although: back on p 14, final paragraph, "Chinook" is capitalized (is acceptable, per rules – begins two or more sentences following a colon)

p38: paragraph 3, line 3 : suggest omitting the word "readily" (redundant)

p 41 table 5.2: I don't think "trend" in "Concentration Trends over Time" is pluralized

p43 paragraph 4: reads "The recommended fish consumption rate of 175 grams per day represents approximately the 90th to 95th percentile of Oregon's fish-consuming populations, as indicated by studies of Tribes, Asians, and Pacific Islanders in Oregon and Washington."

If we're approximating, we should pick just one value or the average. I say go with "...approximately the 95th percentile..."

P46, paragraph 1: reads “The area’s many mines were once a primary source of the country’s zinc, copper, lead, and precious metals.”

I suggest changing “...the country’s zinc...” to “...our country’s zinc...” or “...our nation’s...”

AND should add:

“National Environmental Protection Act” to list of ‘all available regulatory tools’

P51, paragraph 1, line 8: I really think “the” should precede phrase

“disposal of pesticides”

P53, paragraph 1: “For several years, Idaho has conducted probabilistic sampling and monitoring efforts for a number of toxics”

–I think it needs to be defined

I suggest, “For several years, Idaho has conducted probabilistic, or random sampling and monitoring techniques, on a number of toxics.”

Appendix B - Web Updates

a) Lower Columbia River Estuary Partnership Website Updates

Dear Web Team,

Please make the following changes to our web page, which are highlighted in red. These include bullet changes/additions and a few other minor changes. Thank you for all of your hard work.

Sincerely,

Bradley Carter
PSU Graduate Intern
United States EPA
OR Ops Off
503.326.3250

The page link:

<http://yosemite.epa.gov/r10/ECOCOMM.NSF/Columbia/Lower+Columbia>

The Lower Columbia River Estuary Partnership EXIT Disclaimer is one of 28 collaborations that make up EPA's National Estuary Program, which is designed to protect America's nationally significant estuaries for their natural, economic and aesthetic values. The estuary programs create and implement Comprehensive Conservation and Management Plans (CCMPs), which address all aspects of environmental protection for an estuary, including issues such as water quality, habitat, living resources and land use.

The Estuary Partnership is responsible for implementing the Lower Columbia River's Comprehensive Conservation and Management Plan. The plan consists of 43 distinct actions that address three overarching goals:

- ☐ On-the-ground improvements for habitat and land use
- ☐ Heightened education and information and government coordination
- ☐ Reduction of toxic and conventional pollutants

Highlights of the Lower Columbia River Estuary Partnership include:

☐☐ Over 100 habitat restoration projects (28 of them directly funded by the Estuary Partnership) are realizing over 10,000 acres of restoration.

□□ Since January 2001, the Estuary Partnership has reached 80,680 students through science programs in the classroom and in the field.

□□ Citizens planted 5,200 trees and shrubs in 2007. Since 2000, citizens have planted more than 21,900 native plants and removed more than 100 truckloads of invasive plants at 18 habitat restoration sites.

□□ The Estuary Partnership coordinates the Lower Columbia River Water Trail, which covers the lower 146-mile stretch of the lower Columbia River.
<http://www.columbiawatertrail.org/>

□□ A long-term water quality monitoring program has been instituted that will allow the Partnership to assess its progress and the impacts of pollutants on public health.

□□ Focused awareness on personal care products and other emerging contaminants that adversely **affect** water quality and aquatic life in the Lower Columbia River.

□ The Estuary Partnership released "Lower Columbia River and Estuary Ecosystem Monitoring: Water Quality and Salmon Sampling Report". This details the results of the Partnership's juvenile salmon and water quality monitoring efforts and compares the two datasets to help determine which toxics are contributing to declines in salmon populations and how juvenile salmon exposure to those contaminants can be reduced. <http://www.lcrep.org/pdfs/WaterSalmonReport.pdf>

□ The Estuary Partnership convened a workshop to identify bathymetry data gaps in the lower Columbia River.

□ The Estuary Partnership and USGS sponsored the Columbia River Summit on Toxic Contaminant Reduction in January 2008 to focus on reducing the level of toxic contaminants entering the Columbia River system. Over 100 business leaders and public sector officials attended the Summit and discussed next steps for toxic reduction and monitoring of the lower Columbia River and estuary.

b) Portland Harbor Superfund Site Website Updates

Dear Web Team,

Please make the following changes to our web page, which are highlighted in red. These include bullet changes/additions and a few other minor changes.

Thank you

Bradley Carter
PSU Graduate Intern
United States EPA
OR Ops Off

The page link:

<http://yosemite.epa.gov/r10/ECOCOMM.NSF/Columbia/Superfund>

Continue to support and coordinate ongoing priority activities:

- Decommission PCB-laden electric transformers,
- Study contaminated sediment and risk above the Grand Coulee Dam,
- Oversee clean-up at the Hanford site,
- Develop state water clean-up plans (Total Maximum Daily Loads (TMDLs)) for water bodies in the Basin,
- Restore habitat in the lower Columbia River estuary,
- Support salmon recovery in the Basin.

Develop and issue a Columbia River State of the River Report on Toxic Contamination that shall:

- Identify the toxic contaminants of concern,
 - Identify key sources of those toxic contaminants,
- Develop indicators to track changes in the availability of those toxic contaminants,
- Compile available historic data on each toxic contaminant throughout the Columbia River System,
- Determine future toxic contaminant reduction actions.

- Who else is working in this area?

To engage others, EPA is working with partners to develop and implement priority actions with federal, tribal, state, and local governments and other stakeholders. EPA is providing leadership for common goals, roles and responsibilities for work efforts including monitoring, assessment and toxic reduction action.

Appendix C

a) Notes from Lamprey Summit

What: Columbia River Basin Pacific Lamprey Summit II

When: 15 May 2008

Where: Native American Student Community Center

710 SW Jackson St

Portland, OR

Keynote Speaker - Rebecca Miles (Nez Perce)

Elders Panel – Fidelia Andy (Yakama); Viola Kalama (Warm Springs); Jay Minthorn (Umatilla); Elmer Crow, Jr (Nez Perce)

Facilitator - Elaine Hallmark

Speakers

Rebecca Miles: Provided introduction and overview

Fidelia Andy: Led the invocation (approximately 4 minutes); gave brief overview of ancestry; mentioned “missing lamprey from our tables”; importance of being truthful; importance of having an ‘Indian name’ with regard to the Creator; recalled cooking and preservation techniques, dietary importance, did not eat the white man’s food until she was 12 years old; “we will never survive if we must depend on the white man for our food”; couldn’t recall last time she ate eel

Viola Kalama: recalled how her grandmother was rescued (orphaned) during an epidemic and raised ‘across the river’; worked as a housekeeper; never spoke in English to her grandchildren; recalled eating eel while growing up; that the tail was tied to a baby’s wrist and was used as a pacifier; recalled the eels in all the streams and rivers, especially near The Dalles; her village was named after the eel, and an ‘eel-shaped’ tunnel where they played as children; recalled preparing eels with her grandchildren and yearns to do so again; also mentioned the scarcity of ‘wild celery’ these days as well.

Jay Minthorn “White Badger”: (also Father’s name, once); recalled having to take a ladder down the falls, very windy and dangerous; rivers were “black with eels”; the “unforgettable flooding” of Celilo

falls; recalled the names of islands in the river – Papoose, Chinook, Rock, Standing, Whiskey, etc.; recalled how his elders mentioned that the resources must be protected “for seven generations”; stressed need for support and how there were now no lamprey for ceremonies

Elmer Crow, Jr: mentioned “plight of the eel”; recalled the ‘joy’ of having an eel stuck to one’s arm; wished that today’s children had the opportunity to provide food for the table like he did; noted low numbers in Snake River and how “we should be ashamed to let this reach a crisis situation” and that we must “re-educate ourselves to eels and their worth”; insisted that ACOE and BIA haven’t helped and that agencies must give the eel more recognition; asked: “How are we going to fix this problem?”

Patrick Luke, biologist, Yakama Tribe: overview of eels’ life history, management issues (e.g., flow, physical barriers, ecological benefits, cultural value; 10-year plan to monitor status, identify biological aspects and limiting factors, continue research

Biaca Streif, USFW: lamprey ‘high priority’, on petition for ESA listing by 14 groups; stressed need to facilitate the coordination of restorative efforts, increase awareness, and how much can be done without regulation, and how the lamprey issue should be addressed “range-wide”; formation of steering committee (need action); identify threats, research needs; “must work together”

Bob Rose, Yakama nation: in reference to draft of restoration project, vision and overview; immediate need to halt decline of lamprey; welcomes comments of the draft

Bob Heinith, CRITFC: discussed lamprey passage and mainstem habitat and need to improve conditions, the “striking reduction in numbers”, the schedule for federal dam improvements and stressed focus on the Walla Walla River

Jen Graham, biologist CTWS: discussed background; also a tributary action plan which includes the Deschutes, Hood, 15-Mile Creek and others; also discussed status, life history of lamprey, limiting factors, restoration, education

Gary James, CTUIR, “Efforts in the Umatilla Basin”: mentioned a ‘comprehensive restoration strategy’
- Umatilla would be a ‘good choice’ based on history, etc. Discussed limiting factors, problems (especially water rights)

Dave Statler, Nez Perce: stressed need for action, only ~ 40 adults per year at Lower Granite Dam; recommends continued translocation of adults; “crisis situation”

Brief salutations and words of encouragement from attendees representing stakeholders

Adjournment of meeting

b) Meeting Notes from TRWG Meeting

What: COLUMBIA RIVER: TOXICS REDUCTION WORKING GROUP

When: THURSDAY FEBRUARY 7, 2008

Where: Native American Student Community Center

710 SW Jackson St

503-7259695

Portland, OR

Greg Fuhrer – introduction

Mike Cox – overview of group formation

Purpose: share information collaborate on toxics in the Columbia River

Overview: State of the River Report

Agenda Overview- introductions/updates/announcements

Personal Introductions

Everyone present introduced himself or herself: name, affiliation

Announcements

“Rachael” - Columbia River Keepers: have obtained toxic monitoring funding; would welcome such ideas regarding McNary Dam to Willamette reach

“John” - Oregon Dept of Energy: encourage participation in scoping of EIS for Black Rock Water Storage Reservoir located up gradient from Hanford site; notes potential effects to groundwater in Hanford Reservation

Mary Lou Soscia - EPA Portland: distributed handout “Request for Recommendations to Amend the Northwest Power and Conservation Council’s *Columbia River Basin Fish and Wildlife Program* (Council Doc. # 2007-17); expressed need for suggestions with more emphasis on water quality and for more input during amendment process; deadline extended to April 04 2008

Presentations

Mike Cox - EPA Seattle:

Brief overview of October State of River Report meeting; mention of Columbia River ConHab Project

Lorraine Edmond - EPA Seattle: emphasize the need to build on LCR studies and need for continued monitoring there; discussed pros/cons of such; mentioned need for assessment of tributary loading, toxics in water column, fish tissue and it’s relation to human health

-mentioned 2008-09 probability survey to assess toxics in fish tissue, especially on Oregon portion from Bonneville Dam to Grand Coulee Dam; noted that for human health studies fillet samples are studied whereas ecological studies use whole-fish samples; also mention of water chemistry study with emphasis on Mercury; also mention of \$384k Regional Environmental Monitoring Assessment Program (REMAP) grant to ODEQ from the EPA and \$50k RARE funding for laboratory analysis
-review of sampling site – where, what, why; no samples of sediments to be take

Question: Concern rose about bottom-dwelling sturgeon and lamprey in light of no sediment sampling
Mary Lou Soscia responded by saying those issued will be addressed in the State of River Report

Question: “will other data sets (e.g. Lake Roosevelt) be incorporated?”

Mr. Cox responds by saying that’s possibly a CERCLA issue and therefore may serve a different purpose

Lorraine E. responds that they will aggregate with LCR data

Question: “Are more funds available?” – John, USGS

Lorraine E responds that there are none beyond RARE and REMAP

“Larry” – clarified that sampling site won’t be restricted to Oregon side exclusively

Agnes Lut mentions that the EPA will provide the shock-sampling boat

Agnes Lut -ODEQ Columbia River Coordinator

-overview of REMAP protocols and indicators; analyses of 23 sites between McNary and Bonneville Dams

-will study primarily water-quality parameters; include a GIS-based habitat assessment; fish tissue analyses (mention that PAHs would have to be studied through stomach contents; overview of the study protocol and procedures

Question: “where are you looking for Mercury?” –John, ODOE

Ms Lut responds “In deposition areas”

Questions: Are you targeting a relative control site?” & will there be a repeat of sampling?

Ms Lut responds: “No” to both questions

Jennifer Morace – USGS

-overview of fish and bird study

-mentions USGS has funds to join its various disciplines in a common area

-expressed need to focus on, LCR especially from Glen Jackson Bridge to the Beaver Army Terminal

-mentioned past studies focused on wastewater and food web

-this year’s study will include 10 sites and test for PBDEs, yeast, estrogen screening, sediment samples, macroinvertebrates, salmon and largescale sucker tissue studies

-also mentioned that Chuck H will study osprey eggs at 4 sites

-brief overview of study procedures

Question: Asked if direct-affect relationships will be studied, Ms. Morace replied, “Yes, we’ll try to narrow it down”.

Question: asked to what spatial extent would be the study, Ms. Morace said, “we’ll stay out of the estuary”.

Question: asked if a study might be conducted to tie bed load to exposure, Ms. Morace replied that sediments, etc. would be analyzed as funding allows.

Question: Nancy Kohn –Battelle, asked if samples would be archived. Ms. Morace replied it was a good idea and that indeed samples would be preserved for later study.

Mary Lou Soscia – U.S. EPA on the status of the State of the River Report

- overview of history of the reports implementation as a collaborative process
- 2006: Columbia River becomes a national priority on equal footing with Great Lakes and Chesapeake Bay
- goals include wetlands restoration and the cleanup of contaminated sediments at numerous sites which will contribute to efforts resulting in a 10% overall reduction in toxics in the Columbia River
- State of River Report will “tell a story” and help identify funding needs in 7 sections including “contaminants of concern”, “ecosystem health” etc.

Tracie Nadeau – U.S. EPA

- discussed her recent Indicators Workshop, which provides information on current / planned toxic reduction effort

Nancy Kohn – Battelle Corporation

- provided a brief update on the status of the draft River Report

Greg Fuhrer - USGS

- expressed the need for comments on “visions” sections of handout-3 main goals
gain funding/increase public outreach
various reduction actions / various research needs identified

Comments:

Ms. Soscia mentioned that “future visions” section is a brainstorming session

- question if session is on activity was addressed by suggestion to read pg 17
- audience member also raise point of the lack of contaminant standards

Ms Soscia urged the need to raise the level of awareness to those “out east”, and ‘piggyback” pharmaceutical association efforts

Goal 2: Increasing Toxic Reduction Action

Why not other states?

- Oregon has more emphasis on legacy toxics and pesticide stewardship programs
- Idaho is ‘data poor’ but effort will be made to honor other states’ interests

Comment: There are approximately 800 registered pesticides yet we’ve only standards for a few. Member emphasized importance of setting effects levels and suggested working with Department of Agriculture to get TMDLs implemented across the region

Mr. Fuhrer on vision #3, Continued Cleanup:

- expressed need to coordinate activities not to re-contaminate sites

On Vision #4

- mentioned ‘partnership fund’ and asked others to submit recommendations
- ‘Ecological Business Program’ (@ecobiz.org) sets criteria for automotive & landscape businesses, and it’s possibly expandable

Question: “Could we include NRCS?” Mr. Fuhrer responded with “Good suggestion”

Question: “where do ‘high water-users’ (e.g. biofuel producers) fit in? Mr. Fuhrer Responded with “we’ll make note”

Comment: “We should add stormwater reduction efforts, non-point sources” Mr. Fuhrer states it’s non-regulatory, and to see Vision 5.

Question: “Is there guidance to examine the suite of contaminants from wastewater treatment?”

Response: “The state can’t /won’t enforce efforts on research area”

Goal3: “What research is necessary?”

Comment: “We should measure trends specifically”

Question: “Shouldn’t we have a section on trend monitoring?”

Comment: “We should put Vision 3 ahead of Vision 1”

Comment: (USDA) Suggests addition of bulletin to encourage the 4 states to collect retail pesticide data.

Comment: “Maybe focus on where pesticide is *used* as opposed to where *purchased*”

Question: (On Vision 4, Develop Database) “Why not put the data into the PNW water Quality Exchange (or another existing database)? Anyone can access it”.

Question: “Is there a place to find existing data?”

Response: “There’ll be resource ‘places’ in the appendix.”

Question: “(on Vision 5) “Who addresses invasive species in the watershed?” “They can affect our health as well.”

Mr. Fuhrer: “We have enough (issues) right now.”

Ms Soscia: “Maybe down the road.”

Question: “Who are the ‘responsible entities’?”

Ms Soscia: those are the one who expressed interest. There are other groups focusing on them.”

Vision # V: Mercury Contaminant Characteristics

-activity: inventory of Hg sources (e.g. Mt Saint Helens)

Comment: “Source characterization should be added for Mercury in the CRB.

Response (“Joe”): “There’s no direction (mentions weight-loss analogy). We Need

Quantification...where do we want to be relative to water-quality standards? We need more than just a direction.”

Ms Soscia: “We have executive-level agreement on quantifiable goals. This report will help.”

Question (Ms Lut): “Aren’t these activities part of the 10 % reduction plan?”

Response: (Ms Soscia): We must think long-term.”

Helen Rueda – U.S. EPA: “Mercury Deposition in Snake River Basin”

-provided background information

-e.g. Snake RB comprises 42% of CRB, Jordan Ck Gold Mining used ~75 lbs of elemental Hg/day/60 years

-overview of fish tissue data and sources of deposition

-study focused primarily on mining operations, sampling by USGS

-background on Hg, volatilization in a Carbon-limited system, etc

-fielded comments and questions

-mentioned possible adoption of Sacramento delta TMDLs

Chuck Henny – USGS “Osprey in the Columbia River Basin”

-worldwide distribution, piscivorous nature, tolerance help make osprey an ideal sentinel species

-provided data on increased nesting sites, young/nest

-contaminant information included increased Hg in eggs, reduction in DDT

-information on new COCs such as PBDE, speculation on sources

Keith Seiders – WADOE “Monitoring Toxic Contaminants in Wash. Freshwater Fish”

-studied contaminant concentrations in game fish species

-study examined fish tissues for Hg, PBDEs, PCBs, OCs

-overview of site selection and permitting process

-noted results include dropping levels of dioxin levels

DDT, PCBs, furans decreased on RM 390–415 between ’97 and ’04

Renee Hackenmiller-Paradis – Or Env. Council “Pollution in People”

-tested 10 prominent Oregonians’ tissues, etc., for classes of 29 contaminants including PCBs, Organophosphates, phthalates, biphenyl-a, mercury, PFCs

-noted how small sample size limited the interpretation of the exposure pathway

-all participants had at least 6 and as many as 16 of the contaminants sought

- all had PCBs, phthalates, mercury, PFCs
- brief discussion of data analyses, possible solutions discussed

Mike Cox, U.S. EPA Meeting Wrap-up

- plans for next meeting possibly in The Dalles, OR
- mentioned desire to share draft of State of River Report for review
- salutations, etc. given

c) Subgroups and contributors to SORR

Steering Committee: Mike Cox (EPA), Lead; Jay Davis (USFWS), Bruce Duncan (EPA), Don Essig (IDEQ), Greg Fuhrer (USGS), Lyndal Johnson (NOAA), Krista Jones (LCREP), Andrew Kolosseus (WADOE), Jill Leary (formerly with LCREP), Agnes Lut (ODEQ), Dave McBride (WADOH), Jim Ruff (NPCC), Mary Lou Soscia (EPA), and James Thomas (The Confederated Tribes and Bands of the Yakama Nation)

Contaminant Subgroup: Jill Leary (formerly with LCREP) and Lorraine Edmond (EPA), Leads; Greg Fuhrer (USGS), Larry Gadbois (EPA), Lyndal Johnson (NOAA), Andrew Kolosseus (WADOE), Agnes Lut (ODEQ), Jennifer Morace (USGS), Elena Nilsen (USGS), Rachael Pecore (Columbia Riverkeeper), and Helen Rueda (EPA)

Sources Subgroup: Lorraine Edmond (EPA), Lead; Linda Bingler (PNNL), Brent Foster (Columbia Riverkeeper), Nancy Kohn (PNNL), Andrew Kolosseus (WADOE), Joanne LaBaw (EPA), Kevin Masterson (ODEQ), Sondra Miller (Boise State), Jennifer Morace (USGS), Elena Nilsen (USGS), and Helen Rueda (EPA)

Effects Subgroup: Tracie Nadeau (EPA), Lead; Liz Carr (WADOH), Jay Davis (USFWS), Lyndal Johnson (NOAA), Dave McBride (WADOH), and Rachael Pecore (Columbia Riverkeeper)

Participants in September 2007 “Indicators Workshop” not listed under other groups: Tracie Nadeau (EPA), Lead; Claudio Bravo (NOAA), Mark Curran (Battelle), Patti Howard (formerly with CRITFC), Sandie O’Neil (WDFW), Jim West (WDFW)

Data Subgroup: Helen Rueda (EPA), Lead; Chad Brown (WADOE), Curtis Cude (formerly with ODEQ), Bruce Duncan (EPA), Lorraine Edmond (EPA), Jay Field (NOAA), Matt Gubitosa (EPA), Jill Leary (formerly with LCREP), Agnes Lut (ODEQ), Jennifer Morace (USGS), Chris Neumiller (WADOE), John Piccininni (BPA), John Sands (DOE), James Thomas (The Confederated Tribes and Bands of the Yakama Nation)

Additional Contributors: Jeremy Buck (USFWS), Brad Carter (EPA), Tracy Collier (NOAA), Don Essig (IDEQ), Marty Fitzpatrick (USGS), Gene Foster (ODEQ), Robert Grove (USGS), Chuck Henny (USGS), Art Johnson (WADOE), Kim Johnson (EPA), Jim Kaiser (USGS), Gretchen Kruse (Free Run Aquatic Research), Lynn McLeod (Battelle), Dale Norton (WADOE), Desiree Padgett (Battelle), Mark Siipola (USACE), Suzanne Skadowski (EPA), Ann Williamson (EPA), and Jennifer Wu (EPA)

Appendix D

a) LNG Project Assessment Review Notes

FERC Procedures, Modified by OR LNG

08 May 08

Ms. Kubo,

I have reviewed this document and made notes of items I find to be questionable. I would appreciate your feedback, if any, and am grateful for the opportunity to contribute to this project.

-Brad

P 3, 1-c: "fuel trucks..."

> Should time of day (e.g. daylight hours) be a concern with regard to refueling?

P 8, 5-e: "Remove equipment bridges...after permanent seeding..."

> Won't the actual bridge location 'footprints' need seeding?

P 12, D-1: "...permanently revegetate..."

> Should they be more specific than 'native species' especially with regard to specific sites?

P 12, D-2: "Do not use herbicides...except as allowed..."

> Shouldn't there be a particular time-frame if used here?

P 17, B-4: "Dewatering the trench..."

> Specifies to not drain heavily silt-laden water flowing into wetland", but not waterbody?

Plus, what if the water is laden with particles not classified as silt (3.9 to 62.5 μm)?

P 17, C-3: "Do not use fertilizer...controlling ...undesirable exotic species..."

> Doesn't specify prohibition of herbicides for control.

P 18, C-4: "...annual ryegrass..."

> Should specifics as to what could or might be planted where standing water exists be listed here?

P 18, C-6: "Remove temporary..."

> Is a more specific barrier-removal plan needed as to not impact amphibians, reptiles, etc?

b) Ms Rueda's Map Instructions

Great work Brad,

I have a mapping project that you can work on when you have time. I am sending you the data set that I have for DDT in fish. I would like you to make two maps of that data in the basin. First divide the data set up into data that is pre-1995 and data that is 1995 on and make each of these two tables into dbf files. (remember to: make sure that the lats and longs and Total DDT values are formatted as numbers with sufficient decimal places then highlight the fields that are data and save as a dbf; then close the file so that you can add it to the map. You will need to give it a projection when you map by xy coordinates, I always use the NAD 1927) If you need help let me know.

So then make one map with the pre-1995 data and one with the post. For symbols go with quantities and use 3 classes of symbol: 0 - 32 ug/kg (green size 4), 32.1 - 500 ug/kg (orange size 11) and the rest (in red size 18). I am trying to get a sense of how much DDT levels have declined and see if that shows up on a map. You can play around with that. So the table I am sending is already a dbf. Sometimes that can make it harder to edit. If you have problems, let me know.

-Helen

Appendix E

a) The Mercury Process

b) SORR Dioxin Trends