Chlorpyrifos
Analysis of Risks
to
Endangered and Threatened Salmon and Steelhead

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Summary

Chlorpyrifos is an organophosphorus insecticide, acaricide, and nematicide widely used in agriculture and formerly in residential areas. Primary agricultural uses are on corn and fruit trees. All residential uses and many other non-agricultural uses were cancelled following a June, 2000 Memorandum of Agreement. Chlorpyrifos is toxic to fish, and EPA's screening-level risk assessment noted concerns for direct, lethal effects on fish. The high toxicity to organisms that serve as food for threatened and endangered Pacific salmon and steelhead are also of concern, but effects on food organisms are unlikely at concentrations below EPA's level of concern for direct effects to fish. An endangered species risk assessment is developed for federally listed Pacific salmon and steelhead. This assessment applies the findings of the Office of Pesticide Program's Environmental Risk Assessment developed for non-target fish and wildlife as part of the reregistration process to determine the potential risks to the 26 listed threatened and endangered Evolutionarily Significant Units (ESUs) of Pacific salmon and steelhead, plus one candidate ESU (Central Valley Fall/Late Fall-Run Chinook Salmon). An initial screening-level assessment based on ESU habitat and chlorpyrifos use (or potential use) within each county concluded that the use of chlorpyrifos may affect 17 of these ESUs and is not likely to adversely affect 10 ESUs. A refined assessment using more precise estimates of chlorpyrifos use within ESU boundaries concluded that 5 additional ESUs were not likely to be affected. Further refinement based on monitoring data supported the conclusion that an additional 7 ESUs were

not likely to be affected. Of the 5 remaining ESUs, two are considered to be protected by programmatic activities of the State of California. Based on the refined assessment, it was concluded that chlorpyrifos may affect 3 ESUs: Southern California Steelhead, California Coastal Chinook, and Central California Coast Coho. The effects determinations at each stage of the assessment are summarized in the table below.

Summary of effects determinations for chlorpyrifos risks to endangered and threatened Pacific salmon and steelhead.

ESU	Screening level	Refined use estimates	Monitoring data	Regulatory action
Southern California Steelhead	may affect	may affect	may affect	may affect
South Central California Steelhead	may affect	may affect	not likely to affect	—
Central California Coast Steelhead	not likely to affect	—	—	—
California Central Valley Steelhead	may affect	may affect	may affect	not likely to affect
Northern California Steelhead	not likely to affect	—	—	—
Upper Columbia River Steelhead	may affect	SR: some HUCs may affect; others not likely to affect C: not likely to affect	not likely to affect	—
Snake River Basin Steelhead	may affect	SR: some HUCs may affect; others not likely to affect C: not likely to affect	not likely to affect	—
Upper Willamette River Steelhead	not likely to affect	—	—	—
Lower Columbia River Steelhead	may affect	not likely to affect	—	—
Middle Columbia River Steelhead	may affect	SR: may affect C: not likely to affect	not likely to affect	—
Sacramento River Winter-Run Chinook	may affect	SR: may affect C: not likely to affect	not likely to affect	—

ESU	Screening level	Refined use estimates	Monitoring data	Regulatory action
Snake River Fall-Run Chinook	may affect	SR: HUCs near Columbia River may affect; others not likely to affect C: not likely to affect	not likely to affect	—
Snake River Spring/Summer-Run Chinook	may affect	not likely to affect	—	—
Central Valley Spring-Run Chinook	may affect	SR: may affect C: not likely to affect	not likely to affect	—
Central Valley Fall/Late Fall-Run Chinook[a]	may affect	may affect	may affect	not likely to affect
California Coastal Chinook	may affect	may affect	may affect	may affect
Puget Sound Chinook	not likely to affect	—	—	—
Lower Columbia River Chinook	may affect	not likely to affect	—	—
Upper Willamette River Chinook	not likely to affect	—	—	—
Upper Columbia River Spring-Run Chinook	may affect	not likely to affect	—	—
Central California Coast Coho	may affect	may affect	may affect	may affect
Southern Oregon/Northern California Coast Coho	not likely to affect	—	—	—
Oregon Coast Coho	not likely to affect	—	—	—
Hood Canal Summer-Run Chum	not likely to affect	—	—	—
Columbia River Chum	not likely to affect	—	—	—
Ozette Lake Sockeye	not likely to affect	—	—	—
Snake River Sockeye	may affect	not likely to affect	—	—

[a] The Central Valley Fall/Late Fall-Run Chinook ESU is a candidate for listing.

Introduction

The methods and presentation of this analysis are intended to match those used by the U.S. Environmental Protection Agency (EPA) Office of Pesticides (OPP) for analysis of pesticide risks to threatened and endangered Pacific salmon and steelhead. Many relevant portions of the document are taken verbatim (without specific attribution) from the OPP analysis for another organophosphorus insecticide, diazinon. Part 3, the general aquatic risk assessment, is largely reproduced (again, without specific attribution) from OPP's Registration Eligibility Document Science Chapter for chlorpyrifos ("RED Science Chapter," June 8, 2000) and the Interim Reregistration Eligibility Decision (IRED, September 28, 2001). This material is used with little or no modification so the document can serve as a surrogate for an analysis of chlorpyrifos by OPP itself.

Problem Formulation - The purpose of this analysis is to determine whether the registration of chlorpyrifos as an insecticide for use on various crops may affect threatened and endangered (T&E or listed) Pacific anadromous salmon and steelhead and their designated critical habitat.

Scope - This analysis is specific to listed western salmon and steelhead and the watersheds in which they occur. It is acknowledged that chlorpyrifos is registered for uses that may occur outside this geographic scope and that additional analyses may be required to address other T&E species in the Pacific states as well as across the United States.

Contents

1. Background

Under section 7 of the Endangered Species Act, the Office of Pesticide Programs (OPP) of the U.S. Environmental Protection Agency (EPA) is required to consult on actions that “may affect” Federally listed endangered or threatened species or that may adversely modify designated critical habitat. Situations where a pesticide may affect a fish, such as any of the salmonid species listed by the National Marine Fisheries Service (NMFS), include either direct or indirect effects on the fish. Direct effects result from exposure to a pesticide at levels that may cause harm.

Acute Toxicity - Relevant acute data are derived from standardized toxicity tests with lethality as the primary endpoint. These tests are conducted with what is generally accepted as the most sensitive life stage of fish, i.e., very young fish from 0.5-5 grams in weight, and with species that are usually among the most sensitive. These tests for pesticide registration include analysis of observable sublethal effects as well. The intent of acute tests is to statistically derive a median effect level; typically the effect is lethality in fish (LC50) or immobility in aquatic invertebrates (EC50). Typically, a standard fish acute test will include concentrations that cause no mortality, and often no observable sublethal effects, as well as concentrations that would cause 100% mortality. By looking at the effects at various test concentrations, a dose-response curve can be derived, and one can statistically predict the effects likely to occur at various pesticide concentrations; a well done test can even be extrapolated, with caution, to concentrations below those tested (or above the test concentrations if the highest concentration did not produce 100% mortality).

OPP typically uses qualitative descriptors to describe different levels of acute toxicity, the most likely kind of effect of modern pesticides (Table 1). These are widely used for comparative purposes, but must be associated with exposure before any conclusions can be drawn with respect to risk. Pesticides that are considered highly toxic or very highly toxic are required to have a label statement indicating that level of toxicity. The FIFRA regulations [40CFR158.490(a)] do not require calculating a specific LC50 or EC50 for pesticides that are practically non-toxic; the LC50 or EC50 would simply be expressed as >100 ppm. When no lethal or sublethal effects are observed at 100 ppm, OPP considers the pesticide will have "no effect" on the species.

Table 1. Qualitative descriptors for categories of fish and aquatic invertebrate toxicity (from Zucker, 1985).

LC50 or EC50	Category description
<0.1 ppm	Very highly toxic
0.1-1 ppm	Highly toxic
>1-<10 ppm	Moderately toxic
>10 <100 ppm	Slightly toxic
>100 ppm	Practically non-toxic

Comparative toxicology has demonstrated that various species of scaled fish generally have equivalent sensitivity, within an order of magnitude, to other species of scaled fish tested under the same conditions. Sappington et al. (2001), Beyers et al. (1994), and Dwyer et al. (1999), among others, have shown that endangered and threatened fish tested to date are similarly sensitive, on an acute basis, to a variety of pesticides and other chemicals as their non-endangered counterparts.

Chronic Toxicity - OPP evaluates the potential chronic effects of a pesticide on the basis of several types of tests. These tests are often required for registration, but not always. If a pesticide has essentially no acute toxicity at relevant concentrations, or if it degrades very rapidly in water, or if the nature of the use is such that the pesticide will not reach water, then chronic fish tests may not be required [40CFR158.490]. Chronic fish tests primarily evaluate the potential for reproductive effects and effects on the offspring. Other observed sublethal effects are also required to be reported. An abbreviated chronic test, the fish early-life stage test, is usually the first chronic test conducted and will indicate the likelihood of reproductive or chronic effects at relevant concentrations. If such effects are found, then a full fish life-cycle test will be conducted. If the nature of the chemical is such that reproductive effects are expected, the abbreviated test may be skipped in favor of the full life-cycle test. These chronic tests are designed to determine a No Observable Effect Concentration (NOEC) and a Lowest Observable Effect Concentration (LOEC). A chronic risk requires not only chronic toxicity, but also chronic exposure, which can result from a chemical being persistent and resident in an environment (e.g., a pond) for a chronic period of time or from repeated applications that transport into any environment such that exposure would be considered "chronic."

As with comparative toxicology efforts relative to sensitivity for acute effects, EPA, in conjunction with the U.S. Geological Survey, has a current effort to assess the comparative toxicology for chronic effects also. Preliminary information indicates, as with the acute data, that endangered and threatened fish are again of similar sensitivity to similar non-endangered species.

Metabolites and Degradates - Information must be reported to OPP regarding any pesticide metabolites or degradates that may pose a toxicological risk or that may persist in the environment [40CFR159.179]. Toxicity and/or persistence test data on such compounds may be required if, during the risk assessment, the nature of the metabolite or degradate and the amount that may occur in the environment raises a concern. If actual data or structure-activity analyses are not available, the requirement for testing is based upon best professional judgment.

Inert Ingredients - OPP does take into account the potential effects of what used to be termed “inert” ingredients, but which are beginning to be referred to as “other ingredients.” OPP has classified these ingredients into several categories. A few of these, such as nonylphenol, can no longer be used without including them on the label with a specific statement indicating the potential toxicity. Many others, including such ingredients as clay, soybean oil, many polymers, and chlorophyll, have been evaluated through structure-activity analysis or data and determined to be of minimal or no toxicity. There exist also two additional lists, one for inerts with potential toxicity which are considered a testing priority, and one for inerts unlikely to be toxic, but which cannot yet be said to have negligible toxicity. Any new inert ingredients are required to undergo testing unless it can be demonstrated that testing is unnecessary.

The inerts efforts in OPP are oriented only towards toxicity at the present time, rather than risk. It should be noted, however, that very many of the inerts are in exceedingly small amounts in pesticide products. While some surfactants, solvents, and other ingredients may be present in fairly large amounts in various products, many are present only to a minor extent. These include such things as coloring agents, fragrances, and even the printers ink on water soluble bags of pesticides. Some of these could have moderate toxicity, yet still be of no consequence because of the negligible amounts present in a product. If a product contains inert ingredients in sufficient quantity to be of concern, relative to the toxicity of the active ingredient, OPP attempts to evaluate the potential effects of these inerts through data or structure-activity analysis, where necessary.

For a number of major pesticide products, testing has been conducted on the formulated end-use products that are used by the applicator. The results of fish toxicity tests with formulated products can be compared with the results of tests on the same species with the active ingredient only. A comparison of the results should indicate comparable sensitivity, relative to the percentage of active ingredient in the technical versus formulated product, if there is no extra activity due to the combination of inert ingredients. “Comparable” sensitivity must take into account the natural variation in toxicity tests, which is up to 2-fold for the same species in the same laboratory under the same conditions, and which can be somewhat higher between different laboratories, especially when different stocks of test fish are used.

The comparison of formulated product and technical ingredient test results may not provide specific information on the individual inert ingredients, but rather is like a “black box” which sums up the effects of all ingredients. This approach is more appropriate than testing each individual inert and active ingredient because it incorporates any additivity, antagonism, and synergism effects that may occur and which might not be correctly evaluated from tests on the individual ingredients. Aquatic toxicity data are limited for most formulated products.

Risk - An analysis of toxicity, whether acute or chronic, lethal or sublethal, must be combined with an analysis of how much will be in the water, to determine risks to fish. Risk is a combination of exposure and toxicity. Even a very highly toxic chemical will not pose a risk if there is no exposure, or very minimal exposure relative to the toxicity. OPP uses a variety of chemical fate and transport data to develop "estimated environmental concentrations" ((EECs) from a suite of established models. The development of aquatic EECs is a tiered process.

The first tier screening model for EECs is with the GENEEC program, developed within OPP, which uses a generic site (in Yazoo, MS) to stand for any site in the U.S. The site choice was intended to yield a maximum exposure, or "worst-case," scenario applicable nationwide, particularly with respect to runoff. The model is based on a 10-hectare watershed that surrounds a 1-hectare pond, two meters deep. It is assumed that all of the 10-hectare area is treated with the pesticide and that any runoff would drain into the pond. The model also incorporates spray drift, the amount of which is dependent primarily upon the droplet size of the spray. OPP assumes that if this model indicates no concerns when compared with the appropriate toxicity data, then further analysis is not necessary as there would be no effect on the species.

When there is a concern with the comparison of toxicity with the EECs identified in GENEEC model, a more sophisticated PRZM-EXAMS model is run to refine the EECs if a suitable scenario has been developed and validated. The PRZM-EXAMS model was developed with widespread collaboration and review by chemical fate and transport experts, soil scientists, and agronomists throughout academia, government, and industry, where it is in common use. As with the GENEEC model, the basic model remains as a 10-hectare field surrounding and draining into a 1-hectare pond. Crop scenarios have been developed by OPP for specific sites, and the model uses site-specific data on soils, climate (especially precipitation),and the crop or site. Typically, site-scenarios are developed to provide for a worst-case analysis for a particular crop in a particular geographic region. The development of site scenarios is very time consuming; scenarios have not yet been developed for a number of crops and locations. OPP attempts to match the crop(s) under consideration with the most appropriate scenario.

The overall EEC scenario, i.e., the 10-hectare watershed draining into a 1-hectare farm pond, may not be appropriate for a number of T&E species living in rivers or lakes. This scenario is intended to provide a "worst-case" assessment of EECs, but very many T&E fish do not live in ponds, and very many T&E fish do not have all of the habitat surrounding their environment treated with a pesticide. OPP does believe that the EECs from the farm pond model do represent first order streams, such as those in headwaters areas (Effland et al. 1999). In many agricultural areas, those first order streams may be upstream from pesticide use, but in other areas, or for some non-agricultural uses such as forestry, the first order streams may receive pesticide runoff and drift. However, larger streams and lakes will very likely have lower, often considerably lower, concentrations of pesticides due to more dilution by the receiving waters. In addition, where persistence is a factor, streams will tend to carry pesticides away from where they enter into the streams, and the models do not allow for this. The variables in size of streams, rivers, and lakes, along with flow rates in the lotic waters and seasonal variation, are large enough to preclude the development of applicable models to represent the diversity of T&E species' habitats. We can simply qualitatively note that the farm pond model is expected to overestimate EECs in larger bodies of water.

Indirect Effects – OPP also attempts to protect listed species from indirect effects of pesticides. There is often not a clear distinction between indirect effects on a listed species and adverse modification of critical habitat (discussed below). By considering indirect effects first, we can provide appropriate protection to listed species even where critical habitat has not been designated. In the case of fish, the indirect concerns are routinely assessed for food and cover. The primary indirect effect of concern would be for the food source for listed fish. These are best represented by potential effects on aquatic invertebrates, although aquatic plants or plankton may be relevant food sources for some fish species. However, it is not necessary to protect individual organisms that serve as food for listed fish. Thus, the goal is to ensure that pesticides will not impair populations of these aquatic arthropods. In some cases, listed fish may feed on other fish. Because our criteria for protecting the listed fish species is based upon the most sensitive species of fish tested, then by protecting the listed fish species, we are also protecting the species used as prey.

In general, but with some exceptions, pesticides applied in terrestrial environments will not affect the plant material in the water that provides aquatic cover for listed fish. Application rates for herbicides are intended to be efficacious, but are not intended to be excessive. Because only a portion of the effective application rate of an herbicide applied to land will reach water through runoff or drift, the amount is very likely to be below effect levels for aquatic plants. Some of the applied herbicides will degrade through photolysis, hydrolysis, or other processes. In addition, terrestrial herbicide applications are efficacious, in part, due to the fact that the product will tend to stay in contact with the foliage or the roots and/or germinating plant parts, when soil applied. With aquatic exposures resulting from terrestrial applications, the pesticide is not placed in immediate contact with the aquatic plant, but rather reaches the plant indirectly after entering the water and being diluted. Aquatic exposure is likely to be transient in flowing waters. However, because of the exceptions where terrestrially applied herbicides could have effects on aquatic plants, OPP does evaluate the sensitivity of aquatic macrophytes to these herbicides to determine if populations of aquatic macrophytes that would serve as cover for T&E fish would be affected.

For most pesticides applied to terrestrial environment, the effects in water, even lentic water, will be relatively transient. Therefore, it is only with very persistent pesticides that any effects would be expected to last into the year following their application. As a result, and excepting those very persistent pesticides, we would not expect that pesticidal modification of the food and cover aspects of critical habitat would be adverse beyond the year of application. Therefore, if a listed salmon or steelhead is not present during the year of application, there would be no concern. If the listed fish is present during the year of application, the effects on food and cover are considered as indirect effects on the fish, rather than as adverse modification of critical habitat.

Designated Critical Habitat - OPP is also required to consult if a pesticide may adversely modify designated critical habitat. In addition to the indirect effects on the fish, we consider that the use of pesticides on land could have such an effect on the critical habitat of aquatic species in a few circumstances. For example, use of herbicides in riparian areas could affect riparian vegetation, especially woody riparian vegetation, which possibly could be an indirect effect on a listed fish. However, there are very few pesticides that are registered for use on riparian vegetation, and the specific uses that may be of concern have to be analyzed on a pesticide by pesticide basis. In considering the general effects that could occur and that could be a problem for listed salmonids, the primary concern would be for the destruction of vegetation near the stream, particularly vegetation that provides cover or temperature control, or that contributes woody debris to the aquatic environment. Destruction of low growing herbaceous material would be a concern if that destruction resulted in excessive sediment loads getting into the stream, but such increased sediment loads are insignificant from cultivated fields relative to those resulting from the initial cultivation itself. Increased sediment loads from destruction of vegetation could be a concern in uncultivated areas. Any increased pesticide load as a result of destruction of terrestrial herbaceous vegetation would be considered a direct effect and would be addressed through the modeling of estimated environmental concentrations. Such modeling can and does take into account the presence and nature of riparian vegetation on pesticide transport to a body of water.

Risk Assessment Processes - All OPP risk assessment procedures, toxicity test methods, and EEC models have been peer-reviewed by OPP's Science Advisory Panel. The data from toxicity tests and environmental fate and transport studies undergo a stringent review and validation process in accordance with "Standard Evaluation Procedures" published for each type of test. In addition, all test data on toxicity or environmental fate and transport are conducted in accordance with Good Laboratory Practice (GLP) regulations (40 CFR Part 160) at least since the GLPs were promulgated in 1989.

The risk assessment process is described in "Hazard Evaluation Division – Standard Evaluation Procedure - Ecological Risk Assessment" (termed Ecological Risk Assessment SEP below; Urban and Cook 1986), which has been separately provided to National Marine Fisheries Service staff. Although certain aspects and procedures have been updated throughout the years, the basic process and criteria still apply. The toxicity information for various taxonomic groups of species is quantitatively compared with the potential exposure information from the different uses and application rates and methods. A risk quotient of toxicity divided by exposure is developed and compared with criteria of concern. The criteria of concern presented by Urban and Cook (1986) are presented in Table 2.

Table 2. Risk quotient criteria for fish and aquatic invertebrates.

Test data	Risk quotient	Presumption
Acute LC50	>0.5	Potentially high acute risk
Acute LC50	>0.1	Risk that may be mitigated through restricted use classification
Acute LC50	>0.05	Endangered species may be affected acutely, including sublethal effects
Chronic NOEC	>1	Chronic risk; endangered species may be affected chronically, including reproduction and effects on progeny
Acute invertebrate LC50	>0.5	May be indirect effects on T&E fish through food supply reduction
Aquatic plant acute EC50	>0.5	May be indirect effects on aquatic vegetative cover for T&E fish

The Ecological Risk Assessment SEP (pages 2-6) discusses the quantitative estimates of how the acute toxicity data, in combination with the slope of the dose-response curve, can be used to predict the percentage mortality that would occur at the various risk quotients. The discussion indicates that using a “safety factor” of 10, as applies for restricted use classification, one individual in 30,000,000 exposed to the concentration would be likely to die. Using a “safety factor” of 20, as applies to aquatic T&E species, would exponentially increase the margin of safety. The safety factor (originally part of the 1975 regulations for FIFRA) is based upon slopes of primarily organochlorine pesticides, stated to be 4.5 probits per log cycle at that time. As organochlorine pesticides were phased out, OPP undertook an analysis of more current pesticides based on data reported by Johnson and Finley (1980), and determined that the “typical” slope for aquatic toxicity tests for the “more current” pesticides was 9.95. Because the slopes are based upon logarithmically transformed data, the probability of mortality for a pesticide with a 9.95 slope is exponentially less than for the originally analyzed slope of 4.5.

The above discussion focuses on mortality from acute toxicity. OPP is concerned about other direct effects as well. For chronic and reproductive effects, OPP criteria are intended to ensure that the EEC is below the NOEC, where the “effects” include any observable sublethal effects. Because the EEC values are based upon “worst-case” chemical fate and transport data and a small farm pond scenario, a non-target organism would rarely be exposed to such concentrations over a period of time, especially for fish that live in lakes or in streams. Thus, no additional safety factor is used for the no-observed-effect-concentration, in contrast to the acute data where a safety factor is warranted because the endpoints are a median probability rather than no effect.

Sublethal Effects -With respect to sublethal effects, Tucker and Leitzke (1979) did an extensive review of existing ecotoxicological data on pesticides. Among their findings was that sublethal effects as reported in the literature did not occur at concentrations below one-fourth to one-sixth of the lethal concentrations, when taking into account the same percentages or numbers affected, test system, duration, species, and other factors. This was termed the “6x hypothesis.” Their review included cholinesterase inhibition, but was largely oriented towards externally observable parameters such as growth, food consumption, behavioral signs of intoxication, avoidance and repellency, and similar parameters. Even reproductive parameters fit into the hypothesis when the duration of the test was considered. This hypothesis supported the use of lethality tests for use in assessing ecotoxicological risk, and the lethality tests are well enough established and understood to provide strong statistical confidence, which can not always be achieved with sublethal effects. By providing an appropriate safety factor, the concentrations found in lethality tests can therefore generally be used to protect from sublethal effects.

2. Description of chlorpyrifos

a. Registered uses

Chlorpyrifos is an organophosphate insecticide, acaricide and miticide used to control a variety of insects, first registered in 1965 for control of foliage and soil-borne insect pests on a variety of food and feed crops. Chlorpyrifos is one of the most widely used organophosphate insecticides in the U.S. and, until 2000 when nearly all residential uses were cancelled, was one of the major insecticides used in residential settings. Currently registered uses include food and feed crops, golf courses, greenhouses, non-structural wood treatments such as utility poles and fence posts, and as an adult mosquitocide. Structural treatments for termites are also currently registered, but are being phased out. All use of products for structural termite control will be prohibited after December 31, 2005, unless acceptable data demonstrate that risks from these exposures are not of concern.[1] Remaining indoor non-residential uses include shipholds, railroad boxcars, industrial plants, and manufacturing plants.

(1) Agricultural uses

Chlorpyrifos has a number of uses on crops. Some of these may be cancelled as part of the reregistration process. Those crops currently under consideration for continued use and which are grown in areas with Pacific salmon and steelhead include alfalfa, almonds, apples, asparagus, broccoli, cabbage, carrots (grown for seed only), cauliflower, cherries, citrus, corn, cotton, figs, filberts, grapes, grass seed, nectarines, onions, pears, peaches, pecans, peppermint, plums & prunes, radishes, snap beans (seed treatment), sorghum, spearmint, strawberries, sugarbeets, sunflowers, sweet potatoes, turnips, other vegetables, walnuts, wheat, pulp wood, and Christmas trees (nurseries and plantations).

(2) Non-agricultural uses

Chlorpyrifos was formerly registered for various indoor and outdoor uses in and around residential areas. Nearly all of these were cancelled in a June 2000 Memorandum of Agreement.

[1] Percent of total US treatments, Jan 1993 through June 1996 and annual aquatic incident rate expressed as % of treatments (Giesy et al. 1999):

	Treatments	Incidents
WA	0.08	0.0138
CA	2.87	0.004
OR	0	0
ID	0	0

Termiticide use historically has not been a large contributor of chlorpyrifos inputs into salmonid surface water habitat in the PNW and CA.

The only non-agricultural uses that will remain are residential use of containerized baits, and use in ship holds, railroad boxcars, industrial plants, manufacturing plants, or food processing plants. These uses will not result in entry of chlorpyrifos into surface waters.

b. Chlorpyrifos usage

According to OPP's Quantitative Use Assessment (QUA) and based on available pesticide survey usage information for the years of 1987 through 1998, an annual estimate of chlorpyrifos' total domestic usage is approximately 20,960,000 pounds active ingredient (a.i.) for 8,027,000 acres treated. Most of the acreage is treated with 2.3 pounds a.i. or less per application and 3.9 pounds a.i. or less per year. Chlorpyrifos is an insecticide with its largest agricultural market in terms of total pounds a.i. allocated to corn (26%). No other crop is treated with more than 3% of the total pounds of chlorpyrifos applied. The largest non-agricultural markets in terms of total pounds of a.i. applied are PCOs, termite control (24%) and turf (12%). As a result of the June 7, 2000 Memorandum of Agreement, which eliminated residential uses and phased out the termite uses, approximately 10 million pounds of chlorpyrifos (approximately 50% of the total) have been or will be phased out of the market place. Crops with a high percentage of their total U.S. planted acres treated include brussels sprouts (73%), cranberries (46%), apples (44%), broccoli (41%), and cauliflower (31%).

3. General aquatic risk assessment for endangered and threatened salmon and steelhead

a. Aquatic toxicity of chlorpyrifos

There is a large amount of aquatic toxicity data on chlorpyrifos. The quality of these data is highly variable. OPP has rigorous validation requirements for data used in assessments, and these data (Table 3 through Table 9) are used in preference to other data. Compilations of chlorpyrifos toxicity data are also available in EPA's AQUIRE database, and in the review by Barron and Woodburn (19xx). The following summary is based on the RED science chapter for chlorpyrifos.

At present, aquatic risk assessments are limited to exposure to dissolved concentrations in water. Quantitative methods are unavailable to assess risks for aquatic dietary exposures (i.e., consumption of aquatic organisms by predator fish). For similar reasons, assessing risks of benthic invertebrates and fish to contaminated sediments has not been included in this document. Extensive acute toxicity data are available on technical grade chlorpyrifos for both freshwater and estuarine aquatic organisms. Some acute studies show effects of varying environmental parameters such as different temperatures, pHs, water hardness, and salinity on toxicity. Acute toxicity data are also available for formulated products and the major degradate.

(1) Acute toxicity to freshwater fish

Table 3 presents the acute toxicity data for fish that have been reviewed in OPP's files. Acceptable and supplemental acute 96-hour toxicity tests indicate that technical chlorpyrifos is very highly toxic to both coldwater and warmwater fish species. Acute LC50 values are available for 9 freshwater fish species for technical chlorpyrifos and range from 1.8 ppb for bluegill sunfish to 595 ppb for mosquitofish. A number of studies with technical chlorpyrifos were tested to determine the effect on toxicity of various environmental parameters, such as temperature, pH, water hardness, fish size, and static versus flow-through exposures. In general, acute toxicity of chlorpyrifos was found to increase as test temperature and pH levels increase. Results were not definitive for water hardness, fish size, and static and flow-through tests. Three fish species collected from clean waters appear to be more sensitive to chlorpyrifos than fish collected from a polluted area.

Table 3. Aquatic organisms: acute toxicity of chlorpyrifos to freshwater fish (from RED).

Species	Scientific name	% a.i.	96-hour LC50 (ppb)	Toxicity Category	Guideline[a]
Bluegill sunfish	*Lepomis macrochirus*	Tech.	3.3	very highly toxic	Y
Bluegill sunfish	*Lepomis macrochirus*	97.0%	1.8; 2.4	very highly toxic	Y
Bluegill sunfish	*Lepomis macrochirus*	95.9%	5.8	very highly toxic	Y
Bluegill sunfish	*Lepomis macrochirus*	61.5% Dursban 6	0.8	very highly toxic	Y
Bluegill sunfish	*Lepomis macrochirus*	25% Dursban 25W	9.5	very highly toxic	Y
Bluegill sunfish	*Lepomis macrochirus*	25% Dursban 25W	17.3	very highly toxic	Y
Bluegill sunfish	*Lepomis macrochirus*	26.5% Dursban ME20	768	moderately toxic	S
Bluegill sunfish (18^{o}C)	*Lepomis macrochirus*	97.0%	2.4 (pH 7.1, 44 mg/L hardness) 1.8 (pH 7.4, 272 mg/L hardness)	very highly toxic	S
Bluegill sunfish (pH 7.4, 272 mg/L)	*Lepomis macrochirus*	97.0%	4.2 (13^{o}C) 1.8 (18^{o}C) 2.5 (24^{o}C) 1.7 (29^{o}C)	very highly toxic	S
Channel catfish	*Ictalurus punctatus*	Tech.	13.4	very highly toxic	Y
Channel catfish	*Ictalurus punctatus*	97.0%	280	highly toxic	Y
Cutthroat trout	*Salmo clarki*	97.0%	13.4; 18.4; 26.0	very highly toxic	Y
Cutthroat trout (10^{o}C, 44 mg/L)	*Salmo clarki*	97.0%	18.4 (pH 7.5) 5.4 (pH 9.0)	very highly toxic	S
Cutthroat trout (10^{o}C, pH 7.4-7.5)	*Salmo clarki*	97.0%	18.4 (44 mg/L hardness) 26.0 (162 mg/L hardness)	very highly toxic	S
Fathead minnow	*Pimephales promelas*	99.9%	203	highly toxic	Y
Fathead minnow	*Pimephales promelas*	10% Dursban 10CR	122.2	highly toxic	Y
Fathead minnow	*Pimephales promelas*	Tech.	140	highly toxic	S
Fathead minnow	*Pimephales promelas*	Tech	150; 170	highly toxic	S
Fathead minnow	*Pimephales promelas*	10% Dursban 10CR	122.2 (77-167.4)	highly toxic	S
Fathead minnow	*Pimephales promelas*	10% Dursban 10CR	120	highly toxic	S
Golden shiner	*Notemigonus crysoleucas*	99%	35; 45; 125 (36 h)	very highly toxic	S
Green sunfish	*Lepomis cyanellus*	99%	22.5; 37.5; 125 (36 h)	very highly toxic	S
Lake trout	*Salvelinus namaycush*	97.0%	98	very highly toxic	Y
Lake trout	*Salvelinus namaycush*	97.0%	244	highly toxic	Y
Lake trout	*Salvelinus namaycush*	97.0%	73 (static) 244 (flow)	very highly toxic	S
Lake trout	*Salvelinus namaycush*	97.0%	227 (0.30 g fish) 73 (2.9 g fish)	very highly toxic	S
Lake trout (12^{o}C, 44 mg/L)	*Salvelinus namaycush*	97.0%	140 (pH 6.0) 98 (pH 7.5) 205 (pH 9.0)	very highly toxic	S
Mosquitofish	*Gambusia affinis*	99%	215; 320; 595 (36 h)	highly toxic	S
Rainbow trout	*Oncorhynchus mykiss*	Tech.	3	very highly toxic	Y
Rainbow trout	*Oncorhynchus mykiss*	99.9%	8.0	very highly toxic	Y
Rainbow trout	*Oncorhynchus mykiss*	97.0%	7.1	very highly toxic	Y
Rainbow trout	*Oncorhynchus mykiss*	95.9%	25	very highly toxic	Y

Species	Scientific name	% a.i.	96-hour LC50 (ppb)	Toxicity Category	Guideline[a]
Rainbow trout	*Oncorhynchus mykiss*	61.5% Dursban 6	< 8.3	very highly toxic	Y
Rainbow trout	*Oncorhynchus mykiss*	26.5% Dursban ME20	2,200	moderately toxic	S
Rainbow trout (pH 7.1, 44 mg/L)	*Oncorhynchus mykiss*	97.0%	51 (2°C) 15 (7°C) 7.1 (13°C) <1 (18°C)	very highly toxic	S

[a] Y = fulfills guideline requirements; S = supplemental

(2) Acute toxicity to freshwater invertebrates

Results from acute studies with freshwater invertebrates (Table 4) indicate that technical grade chlorpyrifos is very highly toxic to several freshwater invertebrates including adult life stages. Acute LC50 values are available on 4 freshwater invertebrate species for technical chlorpyrifos and range from 0.1 ppb for *Daphnia magna* to 50 ppb for the stonefly larvae *Pteronacnarys californica*. Adults are usually less sensitive to pesticides than young life stages. *Ceriodaphnia dubia* is used as test species in biomonitoring studies to assess toxicity, because it is very sensitive to chemicals. Some reports suggest that the acute chlorpyrifos toxicity values for *Ceriodaphnia* are about 0.005 to 0.08 ppb which would it the most sensitive freshwater species, but EFED has been unable to locate a definitive test to verify these toxicity data.

Table 4. Aquatic organisms: acute toxicity of chlorpyrifos to freshwater invertebrates (from RED).

Species	Scientific name	% a.i.	96-hour LC50 (ppb)	Toxicity Category	Guideline[a]
Scud	*Gammarus lacustris*	97.0%	0.11	very highly toxic	S
Stonefly	*Classenia sabulosa*	97.0%	8.2	very highly toxic	S
Stonefly	*Pteronarcys californica*	97.0%	10	very highly toxic	S
Water flea	*Daphnia magna*	97.7%	1.7 (48 h)	very highly toxic	Y
Water flea	*Daphnia magna*	95.9%	0.10 (48 h)	very highly toxic	Y
Water flea	*Daphnia magna*	25.6% Dursban ME20	115 (48 h)	highly toxic	S

[a] Y = fulfills guideline requirements; S = supplemental

(3) Chronic toxicity to freshwater fish and invertebrates

The chronic toxicity data cited in OPP's ecological risk assessment for chlorpyrifos are summarized in Table 5. For fathead minnows, effects on growth of both the parental generation and offspring were noted at the lowest tested concentration, 0.12 ppb. Survival of both generations was affected at 1.09 ppb in a full life-cycle study. Reduced fathead minnow growth and survival, and increased occurrence of spinal deformity, were observed in early life stages at concentrations from 2.1 to 4.8 ppb. *Daphnia magna* were more sensitive than fathead minnows, with effects on survival and reproduction reported at 0.08 ppb.

Table 5. Aquatic organisms: chronic toxicity of chlorpyrifos to freshwater fish and invertebrates (from RED; all studies supplemental except *D. magna*).

Species	Scientific name	Duration	% a.i.	Endpoints affected	NOEC (ppb)	LOEC (ppb)
Fathead minnow	*Pimephales promelas*	32 d	98.7%	body wt.	1.6	3.2
Fathead minnow	*Pimephales promelas*	30 d	10% Dursban 10CR	spinal deformity	1.29	2.1
Fathead minnow	*Pimephales promelas*	32 d	10% Dursban 10CR	survival, body wt.	2.2	4.8
Fathead minnow	*Pimephales promelas*	full life-cycle	99.7%	F_0, F_1 survival	0.57	1.09
Fathead minnow	*Pimephales promelas*	full life-cycle	10% Dursban 10CR	F_0 wt., F_1 biomass	<0.12	0.12
Water flea	*Daphnia magna*	21 d	97.1%	F_0 survival, # offspring	0.04	0.08

(4) Acute toxicity to estuarine and marine fish

Acute results indicate that technical grade chlorpyrifos is moderately to very highly toxic to estuarine and marine fish species (Table 6). Acute LC50 values are available for 11 estuarine fish species and range from 0.96 to > 1,000 ppb. Results from flow-through tests with measured test concentrations yielded more toxic values than static, nominal tests. In general, younger life stages are more sensitive than older stages. Several estuarine fish species are more sensitive to chlorpyrifos than bluegill, the most sensitive freshwater species.

Table 6. Aquatic organisms: acute toxicity of chlorpyrifos to estuarine and marine fish (from RED).

Species	Scientific name	% a.i.	96-hour LC50 (ppb)	Toxicity Category	Guideline[a]
Tidewater silverside (1 d old)	*Menidia peninsulae*	92%	0.96 (flow) 4.2 (static)	very highly toxic	S
Tidewater silverside (7 d old)	*Menidia peninsulae*	92%	0.52 (flow) 2.0 (static)	very highly toxic	Y
Tidewater silverside (14 d old)	*Menidia peninsulae*	92%	0.42 (flow) 1.8 (static)	very highly toxic	Y
Tidewater silverside (28 d old)	*Menidia peninsulae*	92%	0.89 (flow) 3.9 (static)	very highly toxic	Y
Tidewater silverside (60 d old)	*Menidia peninsulae*	92%	1.3 (flow)	very highly toxic	Y
Atlantic silverside (1 d old)	*Menidia menida*	92%	0.51 (flow) 4.5 (static)	very highly toxic	S
Atlantic silverside (7 d old)	*Menidia menida*	92%	1.0 (flow) 2.8 (static)	very highly toxic	Y
Atlantic silverside (14 d old)	*Menidia menida*	92%	1.1 (flow) 2.4 (static)	very highly toxic	Y
Atlantic silverside (28 d old)	*Menidia menida*	92%	3.0 (flow) 4.1 (static)	very highly toxic	Y
Atlantic silverside (53 d old)	*Menidia menida*	92%	1.7 (static)	very highly toxic	Y
Atlantic silverside (adult)	*Menidia menida*	92%	1.7 (flow)	very highly toxic	S
California grunion (1 d old)	*Leuresthes tenuis*	92%	1.0 (flow) 5.5 (static)	very highly toxic	S
California grunion (7 d old)	*Leuresthes tenuis*	92%	2.7 (flow) 2.7 (static)	very highly toxic	Y
California grunion (14 d old)	*Leuresthes tenuis*	92%	1.0 (flow) 1.8 (static)	very highly toxic	Y
California grunion (28 d old)	*Leuresthes tenuis*	92%	1.3 (flow) 2.6 (static)	very highly toxic	Y
Inland silverside	*Menidia beryllina*	92%	4.2 (flow)	very highly toxic	Y
Gulf killifish	*Fundulus grandis*	92%	1.8 (flow)	very highly toxic	Y
Longnose killifish	*Fundulus similis*	92%	3.2 (flow)	very highly toxic	Y

Species	Scientific name	% a.i.	96-hour LC50 (ppb)	Toxicity Category	Guideline[a]
Longnose killifish	*Fundulus similis*	92%	4.1 (flow)	very highly toxic	S
Striped mullet	*Mugil cephalus*	92%	5.4 (flow)	very highly toxic	Y
Spot	*Leiostomus xanthurus*	92%	7.0 (flow) (48 h)	very highly toxic	S
Sheepshead minnow	*Cyprinodon variegatus*	92%	270 (flow)	highly toxic	Y
Gulf toadfish	*Opsanus beta*	92%	68 (flow) 520 (static)	very highly toxic	Y
Striped bass	*Morone saxatilis*	99%	0.58	very highly toxic	S

[a] Y = fulfills guideline requirements; S = supplemental

(5) Acute toxicity to estuarine and marine invertebrates

Acute toxicity tests with estuarine and marine invertebrates (Table 7) indicate that technical grade chlorpyrifos is classified as very highly toxic to shrimp and to oysters during shell deposition, and moderately toxic to larval oysters. Acute LC50 values are available for 6 estuarine invertebrate species and range from 0.035 for mysid shrimp to 2,000 ppb for oyster embryo-larvae.

Table 7. Aquatic organisms: acute toxicity of chlorpyrifos to estuarine and marine invertebrates (from RED).

Species	Scientific name	% a.i.	96-hour LC50 (ppb)	Toxicity Category	Guideline[a]
Mysid shrimp	*Americamysis bahia*	92%	0.035 (flow) 0.056 (static)	very highly toxic	Y
Mysid shrimp	*Americamysis bahia*	95%	0.045	very highly toxic	Y
Mysid shrimp	*Americamysis bahia*	92%	0.04	very highly toxic	S
Brown shrimp	*Penaeus aztecus*	92%	0.20 (48 h)	very highly toxic	S
Grass shrimp	*Palaemonetes pugio*	92%	1.5 (48 h)	very highly toxic	S
Pink shrimp	*Penaeus duorarum*	92%	2.4 (48 h)	very highly toxic	S
Eastern oyster (embryo-larvae)	*Crassostrea virginica*	92%	2000	moderately toxic	Y
Eastern oyster (shell deposition)	*Crassostrea virginica*	92%	34 (13^{o}C) 270 (28^{o}C)	very highly toxic	Y
Eastern oyster	*Crassostrea virginica*	95%	84	very highly toxic	S
Blue crab	*Callinectes sapidus*	92%	5.2 (48 h)	very highly toxic	S

[a] Y = fulfills guideline requirements; S = supplemental

(6) Chronic toxicity to estuarine and marine fish and invertebrates

Results of chronic toxicity tests with estuarine and marine fish are presented in Table 8. The toxicity results of the three fish early life studies on the three *Menidia* spp. are very similar. The NOAECs for the three tests range from 0.28 to 0.75 ppb. The adverse effects were statistically ($P < 0.05$) significant reductions in survival and/or body weight. In the tidewater silverside ELS test, a reduction in fish survival of 42 percent at 0.38 ppb was not statistically ($P < 0.05$) significant. Results from the mysid shrimp life cycle study indicate chronic toxicity to chlorpyrifos at 0.0046 ppb (the lowest test level).

Table 8. Aquatic organisms: chronic toxicity of chlorpyrifos to estuarine and marine fish and invertebrates (from RED; all studies supplemental).

Species	Scientific name	Duration	% a.i.	Endpoints affected	NOEC (ppb)	LOEC (ppb)
Tidewater silverside	*Menidia peninsulae*	28 d	Tech.	survival	0.38	0.78
Atlantic silverside	*Menidia menidia*	28 d	Tech.	survival, body weight	0.28	0.48
Inland silverside	*Menidia beryllina*	28 d	Tech.	survival, body weight	0.75	1.8
Mysid shrimp	*Americamysis bahia*	full life-cycle	99.7%	number of young	<0.0046	0.0046

(7) Toxicity to aquatic plants and algae
There are very few data on aquatic plants or algae (Table 9). As an insecticide without known phytotoxicity, aquatic plant data are not considered necessary. Toxicity studies on three estuarine algal species yielded LC50 values ranging from 140 to 300 ppb. Direct applications of chlorpyrifos up to 240 ppb reduced the growth of several algal species which took from 9 to 17 days to recover. At direct application rates up to 1 lb ai/A in ponds 10 to 13 inches deep, an algal bloom of a blue-green algae (*Anabaen*a) was observed. The authors assumed that dramatic reductions in herbivorous invertebrates caused the algal bloom.

Table 9. Aquatic organisms: acute toxicity of chlorpyrifos to algae (from RED).

Species	Scientific name	% a.i.	7-d EC50 (ppb)	Guideline[a]
Golden-brown alga	*Isochrysis galbana*	92%	140	S
Diatom	*Thalassiosira pseudonana*	92%	150 (120-180)	S
Diatom	*Skeletonema costatum*	92%	300 (270-340)	Y

[a] Y = fulfills guideline requirements; S = supplemental

(8) Microcosm and field enclosure studies
Outdoor pond microcosm and littoral enclosure studies with chlorpyrifos applied directly to water show effects on sensitive aquatic invertebrate populations after a single application as low as 0.3 ppb (Giddings 1993). The results for treatments of 0.5 ppb and higher suggest adverse effects on young fish growth and possibly recruitment (Giddings 1993; Siefert et al. 1989). In the RED science chapter, EFED cited a study by Shannon et al. (1989) as evidence for effects on invertebrates at 0.19 ppb, but this study was conducted in a highly artificial test system (laboratory flasks); the results cannot be considered indicative of responses of natural invertebrate populations or communities. Other microcosm and mesocosm studies with chlorpyrifos were reviewed by Giesy et al. (1999).

(9) Toxicity of degradates
The major degradate of chlorpyrifos, 3,5,6-trichloro-2-pyridinol (TCP), is moderately to slightly toxic to freshwater fish and invertebrate species. The degradate is considerably less toxic to fish and invertebrates than is chlorpyrifos and can be excluded from the problem formulation for risk assessment.

(10) Toxicity of inerts
Attachment 2 lists the composition of Lorsban[2] 4E, 15G, and 75 WG formulations and acute toxicity information for each component, where available from tests or QSAR estimates.

Four of the components of Lorsban 4E are more toxic to algae than is chlorpyrifos, but considering the low percent composition (0.006 to 1.5% w/w) this toxicity level is not considered relevant at expected environmental concentrations. Two of these components are also toxic to daphnids and three are toxic to fish, but less toxic than chlorpyrifos is. Although QSAR was not possible for the antifoaming agent mixture, it is not expected to be toxic because the molecular weight of its principal component is >> 1000. It also is present at a low percent composition (0.05% w/w).

No toxicity data are available for the Lorsban 15G carrier. However, this clay is a natural constituent of many mineral soils. The stabilizer in Lorsban 15G is much less toxic than the active ingredient.

Lorsban 75WG has three components without data and for which QSAR is not possible. However, based on chemical class these ingredients are not expected to be toxic. The second emulsifier and antimicrobial ingredient are much less toxic to fish than is chlorpyrifos.

(11) Review of literature on sublethal and endocrine effects

There are no reports of chlorpyrifos effects on the olfactory system of salmonids. Such effects have been reported for other OP insecticides in laboratory studies, but the ecological relevance of such endpoints is doubtful. For a complete review of this concern, see Attachment 3.

Endocrine effects have been attributed to many existing pesticides found in surface water systems. However, in our review of the literature (Attachment 4) there is no evidence suggesting endocrine disruption occurs in salmonids or other aquatic organisms following exposure to acetylcholinesterase-inhibiting compounds such as OP insecticides.

b. Environmental fate and transport

The environmental fate of chlorpyrifos is summarized in the RED ERA. Chlorpyrifos is moderately to highly persistent in the environment and binds to soil. Chlorpyrifos can contaminate surface water at application via spray drift and can be transported offsite on sediment borne by runoff. It has been shown that chlorpyrifos will leave corn watersheds in Illinois and can be transported to ponds a short distance from the fields; quantities of chlorpyrifos transported are generally less than 1% of the amount applied, but the quantities transported of its major degradate (TCP) may be greater. Substantial fractions of applied chlorpyrifos could be available for runoff for several weeks to months post-application (aerobic soil metabolism half-lives of 11-180 days for 8 soils; terrestrial field dissipation half-lives of 33-56 days). The intermediate to high soil/water partitioning of chlorpyrifos (K_{oc}s of 3680-31,000; SCS/ARS database K_{oc} of 6070; K_ds of 50-260) indicate that most of chlorpyrifos runoff is

[2] Trademark of Dow AgroSciences LLC

generally via adsorption to eroding soil rather than by dissolution in runoff water. However, in some cases within the lower ranges of adsorption and when runoff volume greatly exceeds sediment yield, dissolution in runoff water may also contribute significantly to runoff.

The relatively low to moderate susceptibility of chlorpyrifos to hydrolysis (half-lives of 72 days at pHs 5 and 7 and 16 days at pH 9), direct aqueous photolysis (half-life of 30 days in sunlight), low volatilization (intermediate Henry's Law constant = 4.2 X 10^{-6} atm*m^3 /mol), and degradation under aerobic conditions indicate that chlorpyrifos will be somewhat persistent in the water columns of some aqueous systems that have relatively long hydrological residence times. However, volatilization and/or adsorption to sediment may substantially reduce the persistence of dissolved chlorpyrifos in shallow waters and in waters receiving influxes of uncontaminated sediment, respectively. In his comprehensive literature review, Racke (1993) attributed short dissipation half-lives in the water column (sometimes < 1 day) to volatilization and/or adsorption to sediment. The relatively low to moderate susceptibility of chlorpyrifos to degradation under anaerobic conditions indicates that it will also be somewhat persistent in anaerobic bottom sediment.

The intermediate to high soil/water partitioning of chlorpyrifos indicates that its concentration in sediment will be much greater than its concentration in water. BCFs greater than 1000X in the rainbow trout exposed to 0.30 ppb in a 28-day flow-through study (1280X for edible tissues, 2727X for whole fish, and 3903X for viscera) and in eastern oysters (2500X for edible tissues, 3900X for viscera, and 1900X for whole body) indicate some potential for bioaccumulation. Although the observed rapid depuration rates should somewhat modify its bioaccumulation potential, chlorpyrifos has been detected at several ppb in the tissues of many fish collected from many different surface waters.

As part of the National Study of Chemical Residues in Fish (US EPA 1992), fish were collected from 362 sites nationwide and analyzed for chlorpyrifos. Approximately 23% of the samples collected had chlorpyrifos residues above the detection limit of approximately 0.05 µg/kg. The maximum value was 344 µg/kg in carp tissue collected from the Alamo River in CA. Concentrations between 60 and 70 µg/kg were detected in fish collected from GA, TX, WI, and CA. The 90th percentile value was slightly greater than 10 µg/kg. Since chlorpyrifos was found to rapidly depurate in the fish BCF test, the presence of chlorpyrifos residues in fish would suggest existing or recent exposures.

The major degradate of chlorpyrifos in the environment under most conditions is 3,5,6-trichloro-2- pyridinol (TCP). TCP appears to be more persistent than chlorpyrifos (substantial amounts remain 365 days post-application) and it exhibits much lower soil/water partitioning (K_ds of 0.53-1.95) than chlorpyrifos. Consequently, substantial amounts of TCP are probably available for runoff for longer periods than chlorpyrifos and TCP is probably more persistent in water/sediment systems than chlorpyrifos. The relatively low soil/water partitioning of TCP indicates that its concentrations in sediment and water are probably comparable and that runoff occurs primarily by dissolution in runoff water rather than by adsorption to eroding soil. The low soil/water partitioning of TCP suggests that its bioaccumulation potential is probably low.

c. Incidents

A number of fish kills have been reported for chlorpyrifos. Most incidents are related to perimeter applications around residences, which were eliminated as a result of the June 2000 agreement..

On June 25, 1975, about 500 bream in a Georgia pond were killed when a swimming pool backwashed into the pond. Analysis of a water sample found 1.5 ppm of chlorpyrifos, which was determined as the cause of the kill. Dursban M had been ground sprayed around the residence.

In April 1977, a series of fish kills occurred in a watershed of the Saline River. The fish kills followed years of use of chlorpyrifos and carbofuran by a contractor for the Weyerhauser Corporation to treat pine seedlings in the watershed area. One kill including crappie, bass, bullhead, catfish, and redhorse was reported by Arkansas State Pollution Control and Ecology Department in a river at the mouth of a lake. Although there had not been recent applications, chlorpyrifos was found in an unidentified sample. Approximately 200 dead fish were found in another kill along the Saline River and Brushy Creek above Dierks Reservoir in Arkansas. About 70 percent were bullhead catfish and 28 percent were redhorse and spotted suckers. One dead flathead catfish and a green sunfish were also found. Several days later similar fish deaths were reported from Camp Creek between Camp Creek Falls and Dierks Reservoir. The incidents occurred after heavy rains 3-4 weeks before and after April 17-20, 1977. Dursban was found in analyses of fish liver and blood (341 µg/kg), bottom sediments (7.15 µg/kg), 0.46 µg/l (ppb) in water collected at the mouth of the Saline River above Dierks Reservoir, and > 0.46 µg/l (ppb) in water from Saline River at Highway 4 bridge. Samples were also checked for carbofuran, but none was found.

In July 1992, a fish kill of about 2,000 small bluegill was reported in Abbott Lake at Peaks of Otter, Virginia. Two rooms in a motel had been treated for termites with Dursban TC by a commercial certified applicator. It was concluded that the Dursban was unknowingly injected into an underground water supply, which discharged into the lake.

d. Estimated and actual concentrations of chlorpyrifos in water

(1) EECs from models

In the RED ecological risk assessment (ERA), estimated environmental concentrations of chlorpyrifos in aquatic systems were modeled using GENEEC and PRZM-EXAMS to reflect use on corn, citrus, peanuts, cotton and tobacco. Use patterns for these sites reflect the range of application rates, frequency of application, maximum seasonal limits and application methods for chlorpyrifos. Estimated concentrations derived from the models were used to assess acute and chronic risks to freshwater and estuarine organisms in ponds and estuarine areas, respectively. Acute risks were assessed using peak EECs. Chronic risk quotients were calculated using an exposure period ranging from 96 hours to 21 days.

A number of scenarios were modeled in the ERA (pages 20-25). Selected results are presented in Table 10. However, these are quite unrealistic for use with Pacific salmon and steelhead. The primary difficulty is that all were modeled for areas that will have far more runoff than will occur in the Pacific states, even including the more mesic parts of western Oregon and Washington because the precipitation there, while substantial, does not typically occur in large runoff events. In addition, the model is based upon the upper 10th percentile of runoff events. This would not be unrealistic if the precipitation scenarios were based upon the Western areas being addressed in this analysis. But the upper 10th percentile values further exaggerate the high rainfall events that occur occasionally (e.g., associated with hurricanes, tornadoes, etc) in the areas used for the models. The chronic EECs are based upon the farm pond model and would not relate to flowing water situations.

Table 10. Estimated environmental concentrations (PRZM-EXAMS) and risk quotients (freshwater fish) for chlorpyrifos and selected crops, from the revised Environmental Risk Assessment (2000).

Crop	Application	Peak EEC (ppb)	Acute Risk Quotient	60-d Chronic EEC (ppb)	Chronic Risk Quotient
Corn, IA	ground spray, 3 lb a.i./A, incorp. 2”, 1 appl.	2.75	1.5	0.81	2.2 - 3.8
Corn, GA	aerial, foliar, 1 lb a.i./A, 11 appl.	33.8	19	16.3	42 - 49
Corn, IA	granular, 1.1 lb a.i./A, incorp 4”, 1 appl.	0.98	0.54	0.22	0.77 – 1.4
Corn, MS	granular, 1.1 lb a.i./A, incorp 4”, 1 appl.	2.71	1.5	0.69	2.3 – 3.9
Citrus, FL	airblast, 3.5 lb a.i./A, 2 appl.	37.3	21	12.9	33 - 54
Peanuts, GA	ground spray, 2 lb a.i./A, 2 appl.	9.38	5.2	2.58	7.5 - 13
Cotton, MS	aerial, foliar, 1 lb a.i./A, 6 appl.	27.2	15	9.71	30 - 40
Tobacco, NC	ground spray, 5 lb a.i./A, 1 appl.	30.6	17	6.85	21 - 42

(2) Measured residues in the environment

In the IRED ecological risk assessment, concentrations of chlorpyrifos reported in NAWQA and California monitoring data were used to assess risks for some typical flowing waters. Much of this information was reviewed by Giesy et al. (1999). These authors concluded that overall, the existing data monitoring data do not suggest ecologically significant risks, except in a few locations. They further concluded that in most stream and river systems chlorpyrifos exposure is episodic and would not elicit chronic effects in nontarget aquatic organisms. Therefore, the rare risks were attributed to acute effects on sensitive freshwater invertebrates. A more recent intensive monitoring study conducted in an agriculturally dominated tributary of the San Joaquin River demonstrated a similar exposure pattern and low probability of ecologically significant risks (Poletika et al. 2002).

e. Recent changes in chlorpyrifos registrations

Most of the changes in the registration of chlorpyrifos are presented elsewhere, as pertinent. For example, registered use sites are indicated in section 2. Details on changes are described on pages 102 to 118 of the IRED.

Mitigation measures have been incorporated on the labels for Lorsban-4E, Lorsban 15G, and Lorsban 50W. These changes, adopted in 2003 for use beginning in 2004, have the objective of reducing exposure to non-target plants and animals. Setback distances and Best Management Practices have been specified for spray applications, as described in Section 3.f below. Other significant changes applicable to major uses in California, Oregon, and Washington include:

<u>Lorsban-4E</u>
Alfalfa: Added precautionary statement to wait 24 hours after application before flood irrigating; limited use to 4 applications per year; added 10-day retreatment interval.
Almond, Pecan and Walnut Orchard Floors (Ant Control): Added precautionary statement to wait 24 hours after application before flood irrigating; reduced maximum application rate to 4 lb ai/acre; limited maximum seasonal applications to 2 for orchard floors; added 10-day retreatment interval for chlorpyrifos to orchard (both foliar and orchard floor treatments).
Citrus Fruits: Eliminated aerial application.
Citrus Orchard Floors: Limited maximum seasonal application rate to 1.5 lb ai/ acre; limited maximum seasonal applications to 3 per year; added 10-day retreatment interval.
Cotton: Limited maximum seasonal rate to 3 lb ai/ acre; limited maximum number of seasonal applications to 3; added 10-day retreatment interval.
Sugar Beets: Limited maximum seasonal rate to 3 lb ai/acre; limited maximum seasonal applications to 3; added 10-day retreatment interval.
Tree Fruits and Nuts (Dormant/Delayed Dormant Sprays); Tree Fruits and Nuts (Foliar Sprays); Tree Fruits and Nuts (Trunk Spray, or Preplant Dip) and Orchard Floors (Ant Control in Almond, Pecan and Walnut Orchard Floors): Added precautionary statement to wait 24 hours after application before flood irrigating; added 10-day retreatment interval where appropriate; added limitations on number of applications and maximum use rate per application and per crop season.
Vegetables: Added 10-day retreatment interval.

<u>Lorsban 15G</u>
Citrus Grove Floors: reduced maximum season application rate to 3 lb ai/acre; reduced maximum number of applications to 3; added a 10-day minimal interval for retreatment.

Sugar Beets: limited maximum seasonal application rate to 3 pounds ai/acre; limited number of applications to 3 per season; specified 10-day retreatment interval.

Lorsban 50W
Apples: added applicable limitations from Lorsban-4E, including minimum retreatment interval.
Citrus Crops: added minimum retreatment interval.
Tree Nuts: added minimum retreatment interval.
Sour Cherries: added minimum retreatment interval.

Dow AgroSciences has calculated the reduction in EECs that would result from some of these mitigation measures, using the GEneric Estimated Exposure Concentration (GENEEC) model (Havens and Poletika 2003). Overall, the mitigation measures reduced the EEC by an average of 46%. Results for major uses in California, Oregon, and Washington are summarized in Table 11.

Table 11. Reduction in aquatic exposure to chlorpyrifos (GENEEC simulations) resulting from label changes for major uses in California, Oregon, and Washington.

Use pattern	Formulation	Mitigation[a]	Aquatic exposure change, old to new
Alfalfa granular, 4" incorporation	Lorsban 15G	use withdrawn	-100.0%
Alfalfa maximum foliar, aerial broadcast	Lorsban 4E /Lock-On	setback	-36.9%
Alfalfa typical foliar, aerial broadcast spray	Lorsban 4E /Lock-On	setback	-40.8%
Mint, foliar ground spray	Lorsban 4E	setback	-3.8%
Cotton maximum foliar aerial spray	Lorsban 4E	reduced number of applications, increased retreat interval, setback	-70.5%
Vegetables, ground spray	Lorsban 4E /Lorsban 50W	setback	-3.8%
Vegetables, aerial spray	Lorsban 4E /Lorsban 50W	reduced number of applications, increased retreatment interval, setback, brussel sprouts only	-78.2%
Citrus foliar airblast	Lorsban 4E	setback	-4.8%
Citrus grove floor, granular broadcast	Lorsban 15G	reduced number of applications	-65.8%
Citrus grove floor, ground spray	Lorsban 4E	reduced number of applications, increased retreatment interval, setback	-68.3%

Use pattern	Formulation	Mitigation[a]	Aquatic exposure change, old to new
Oranges typical air blast	Lorsban 4E	setback	-5.1%
Dormant tree airblast	Lorsban 4E	reduced application rate, setback	-36.7%
Nut & tree fruits, aerial spray	Lorsban 4E	reduced number of applications, increased retreatment interval, setback	-59.6%
Apples & sour cherries, foliar, aerial spray	Lorsban 4E	reduced number of applications, increased retreatment interval, setback, reduced application rate, non-dormant apples removed	-78.4%
Grapes foliar, aerial spray	Lorsban 4E	setback; 24(c) labeling for OR only; CA, CO, WA ground spray	-40.8%
Almond, walnut, pecan orchard floor, ground broadcast spray	Lorsban 4E	reduced application rate, increased retreatment interval, setback	-52.2%

[a] Mitigation represented in the GENEEC model. Other mitigation measures have been specified for some use patterns and formulations.

A new formulation, Lorsban 75WG, was approved for sale in December, 2002. This formulation is intended to be a safer replacement (for humans) for other formulation technologies. High value crops, especially those grown near residential areas, are expected to migrate to Lorsban 75WG. Specifically, pecans are expected to migrate as they are sprayed in the summer and are often near residential areas. The leafy, cole vegetables and mint are also expected to migrate. No row crops are expected to migrate. There will be no new uses. The mitigation options and precautionary statements that have been added for Lorsban-4E and Lorsban 50W are included on the label for Lorsban 75WG. The introduction of Lorsban 75WG is unlikely to affect the risk of chlorpyrifos use to threatened and endangered Pacific salmonids.

f. Existing protections

Nationally, there are no specific protective measures for endangered and threatened species beyond the generic statements on the current chlorpyrifos labels. However, agricultural uses of chlorpyrifos are classified as restricted use, which means it can only be applied by certified applicators. As stated on all pesticide labels, it is a violation of Federal law to use this product in a manner inconsistent with its labeling. There are a variety of measures on chlorpyrifos labels for the protection of agricultural workers and other humans, which are not discussed here, but which may be seen on the attached labels. The Environmental Hazards section for a typical chlorpyrifos agricultural use label states:

"This pesticide is toxic to birds and wildlife, and extremely toxic to fish and aquatic organisms. Do not apply directly to water, to areas where surface water is present, or to intertidal areas below the mean high water mark. Drift and runoff from treated areas may be hazardous to aquatic organisms in adjacent aquatic sites. Cover or incorporate spills. Do not contaminate water when disposing of equipment washwaters or rinsate. This product is highly toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area. Protective information may be obtained from your cooperative agricultural extension service."

The label for Lorsban-4E has specific setback requirements to reduce spray drift exposure to aquatic habitats, as well as Best Management Practices (BMPs) for aerial, ground boom, and orchard airblast applications. The following text and table appear on the label:

Observe the following precautions when spraying Lorsban-4E adjacent to permanent bodies of water such as rivers, natural ponds, lakes, streams, reservoirs, marshes, estuaries, and commercial fish ponds.

The following treatment setbacks or buffer zones must be utilized for all up-wind applications from the above listed aquatic areas with the following application equipment:

Application Method	**Required Setback (Buffer Zone)**
Ground Boom	25 feet
Chemigation	25 feet
Orchard Airblast	50 feet
Aerial (fixed wing or helicopter)	150 feet

Similar setback requirements have been set for Lock-On formulation.

Some section 24(c), Special Local Needs, labels contain additional protective labeling for endangered species. An example is the Special Local Needs label for chlorpyrifos use on strawberries in Washington, which states:

"This pesticide is extremely toxic to fish and aquatic organisms. Lorsban-4E should not be used under this SLN label where impact on listed threatened or endangered species is likely. You may contact the Washington Department of Fish & Wildlife, National Marine Fisheries Service or US Fish and Wildlife Service for information on listed threatened or endangered species (e.g., Bull trout, Chinook salmon). Consult the Federal label for additional restrictions and precautions to protect aquatic organisms."

OPP's endangered species program has developed a series of county bulletins which provide information to pesticide users on steps that would be appropriate for protecting endangered or threatened species. Chlorpyrifos is included in these county bulletins in California. Bulletin development is an ongoing process, and there are no bulletins yet developed that would address fish in the Pacific Northwest. OPP is preparing such bulletins.

In California, the Department of Pesticide Regulation (DPR)in the California Environmental Protection Agency creates county bulletins consistent with those developed by OPP. However, California also has a system of County Agricultural Commissioners responsible for pesticide regulation, and all commercial applicators must get a permit for the use of any restricted use pesticide and must report all pesticide use, restricted or not. The California bulletins for protecting endangered species have been in use for about 5 years. Although they are "voluntary " in nature, the Agricultural Commissioners strongly promote their use by pesticide applicators. Chlorpyrifos is currently included in these bulletins for protection of terrestrial and aquatic animals. Agricultural and other commercial applicators are well sensitized to the need for protecting endangered and threatened species. DPR believes that the vast majority of agricultural applicators in California are following the limitations in these bulletins (Richard Marovich, Endangered Species Project, DPR, telephone communication, July 19, 2002).

g. Discussion and general risk conclusions for chlorpyrifos

(1) Fish

The lowest fish LC50 used by EFED is 1.8 ppb for bluegill sunfish. OPP's level of concern for endangered species is 0.05 times the LC50. Thus OPP would consider endangered fish to be at risk when chlorpyrifos concentrations exceed 0.09 ppb. However, the 96-h LC50 for three salmonid species ranged from 3 ppb to 244 ppb in toxicity studies that, in OPP's judgment, met guideline standards (Table 3). The most sensitive salmonid tested was rainbow trout, the same species (*Oncorhynchus mykiss*) as steelhead. The geometric mean of the four acceptable 96-h LC50 values for rainbow trout was 8.1 ppb. Applying OPP's 0.05 multiplier to the rainbow trout mean LC50 gives a concentration of 0.4 ppb that, if not exceeded, would not be expected to put salmonids at risk.

(2) Invertebrates

OPP's assessment used a *Daphnia magna* LC50 of 0.1 ppb as the most sensitive species in validated tests. According to OPP's criteria, an EEC greater than 0.5 times the LC50 could have an effect on populations of aquatic invertebrates that may serve as a food source for listed fish. On this basis, concerns for indirect effects on fish (including threatened and endangered salmonids) would occur at concentrations greater than 0.05 ppb. However, even if the most sensitive invertebrate species were affected, other less sensitive species would still remain as a food source at higher chlorpyrifos concentrations.

Giddings (1993) studied the invertebrate communities in outdoor pond microcosms after spray applications that resulted in initial chlorpyrifos concentrations ranging from 0.03 to 3.0 ppb. Concentrations of 0.03 and 0.1 ppb caused few significant ecological effects. A 0.3 ppb spray treatment caused temporary reductions in many groups of invertebrates, but fish (bluegill sunfish) were unaffected. In another set of microcosms, three biweekly applications of clay slurry producing chlorpyrifos concentrations of 0.3 ppb caused persistent reductions in the populations of many invertebrates. In limnocorrals at the EPA Duluth Environmental Research

Laboratory, spray treatment of 0.5 ppb caused significant reductions in the abundance of some species of macroinvertebrates, insects, amphipods, and bluegills, and reductions in growth of larval fathead minnow and green sunfish (Siefert et al. 1989). From these studies, we conclude that ecologically significant effects on overall invertebrate communities are unlikely at 0.1 ppb, possible at 0.3 ppb, and likely at 0.5 ppb.

The chlorpyrifos concentration found unlikely to cause effects on invertebrate communities, 0.1 ppb, is similar to the concentration considered by EPA to present no risk to endangered fish species, 0.09 ppb. Therefore potential indirect effects on salmon and steelhead due to reductions in their invertebrate supply were not considered in this analysis.

(3) Criteria
The Office of Water's Water Quality Criteria for chlorpyrifos are 0.083 ppb (1-h average) and 0.041 ppb (4-d average) for freshwater, and 0.011 ppb (1-h average) and 0.0056 ppb (4-d average) for saltwater (EPA 1986).

(4) Conclusions
Making "typical" risk conclusions regarding the aquatic risk of chlorpyrifos to threatened and endangered Pacific salmon and steelhead is confounded by a number of factors. On a lethal basis, chlorpyrifos is not extremely toxic to fish, but can have sublethal effects. Invertebrate food supply may be affected if these fish feed on the most sensitive aquatic invertebrates, which are indeed very sensitive. But there are many less sensitive invertebrate species, and overall macroinvertebrate communities do not seem to be markedly affected at levels below 0.3 ppb (Giddings 1993). In addition, the usage of chlorpyrifos is expected to be quite different in the future, especially as relates to urban and suburban areas after the home uses are phased out. Finally, the disparity between the modeled EECs, which were based largely on non-salmon areas, and the extensive monitoring data showing generally much lower values even after dormant orchard sprays and runoff events, makes comparisons with toxicity data very difficult.

It is our best professional judgment that chlorpyrifos concentrations above 0.4 ppb may cause acute effects on listed Pacific salmon and steelhead. Lower concentrations might cause chronic effects, but chronic exposure is unlikely in the case of chlorpyrifos (Giesy et al. 1999). Lower concentrations might also cause temporary effects on some portions of the invertebrate community, but alternative food sources for fish would remain.

Risk is a function of both toxicity and exposure. While there may be some questions regarding toxicity levels, there is high uncertainty with respect to exposure levels. As the recent changes in chlorpyrifos registrations are phased in, the concentrations of chlorpyrifos in aquatic environments would be expected to decrease.

4. Listed salmon and steelhead ESUs and comparison with chlorpyrifos use areas

The sources of data available on chlorpyrifos use are considerably different for California than for other states. California has full pesticide use reporting by all applicators except homeowners. Oregon has initiated a process for full use reporting, but it is not in place yet. Washington and Idaho do not have such a mechanism to our knowledge.

The latest information for California pesticide use is for the year 2001 [URL: http://www.cdpr.ca.gov/docs/pur/purmain.htm]. The reported information to the County Agricultural Commissioners includes pounds used, acres treated, and the specific location treated. The pounds and acres are reported to the state, but the specific location information is retained at the county level and is not readily available. Table 12 presents chlorpyrifos usage over the past nine years in California. Table 13 presents all of the chlorpyrifos uses in California for 2001. The tables further below for each ESU include all of the uses where more than 100 pounds was reported to California's Department of Pesticide Regulation (DPR).

Table 12. Reported use of chlorpyrifos in California, 1993-2001, in pounds of active ingredient.

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001
Use	2,246,121	2,887,838	3,385,416	2,687,809	3,152,564	2,355,626	2,257,936	2,093,382	1,673,183

Table 13. Reported use of chlorpyrifos, by crop, for 2001 in California. Only crops with 100 or more pounds of chlorpyrifos included.

crop or site	lb a.i. used	acres treated
alfalfa	231,550	453,129
almond	162,846	94,748
apple	12,468	7,934
asparagus	7,242	7,229
avocado	365	400
bean, dried	996	2,879 tons
bok choy	1,087	960
broccoli	58,984	48,543
brussel sprout	6,609	7,350
cabbage	6,075	5,870
cauliflower	17,453	18.657
cherry	991	635
chinese cabbage	2,683	2,507
chinese greens	301	156
citrus	1,716	593
corn	9,546	29,356
cotton	271,882	291,412
cucumber	149	238,830
fig	4,871	2,455
grape	63,375	36,527

crop or site	lb a.i. used	acres treated
grapefruit	3,727	2,544
grass, seed	705	231
herb, spice	163	108
kale	816	907
landscape maintenance	9,087	148
lemon	66,648	20,000
mint	585	442
flowers and transplants	11,132	
nectarine	23,104	12,967
onion, dry	1,645	1,684
orange	148,604	70,290
peach	29,058	14,986
pear	8,612	5,220
plum	20,434	10,735
prune	4,042	2,483
public health	106	
radish	704	523
rappini	253	131
rights-of-way	2,424	
sorghum/milo	514	717
strawberry	5,194	5,724
structural pest control	251,069	
sugarbeet	48,350	77,494
sunflower	427	543
sweet potato	5,539	2,781
tangelo	1,365	618
tangerine	3,106	1,544
turf/sod	411	406
walnut	141,558	79,623
wheat	691	1,298

Information in the tables below for Oregon, Washington, and Idaho are for the acreage of the specific crops on which chlorpyrifos could be used under the 2000 Memorandum of Agreement. The data were taken from the 1997 USDA agricultural census. The amount of chlorpyrifos used on each crop in each county is not known. Data on the percentage of crop area treated with chlorpyrifos are available for some crops for Washington (Doane Market Research; WSDA 2002), and national percentages for many crops are reported in OPP's Quantitative Usage Analysis. The crops with the greatest potential chlorpyrifos use in Washington, Oregon, and Idaho, based on percentage of crop acres treated in Washington, are the following:

sugarbeets (72% of crop acres in WA treated, 1998)
apples (91% of crop acres in WA treated, 1997)

pears (44% of crop acres in WA treated, 1998)
cherries (51% of stone fruit acres in WA treated, 1998)
dry onions (30% of crop acres in WA treated, 2000).

Crops with high acreage (> 25,000 acres total) in WA, OR, ID counties containing salmonid ESUs, but for which little chlorpyrifos use is likely, are the following:

wheat (4,000,000 acres; 1% of crop acres treated nationwide)
alfalfa (745,818 acres; 3% of crop acres treated nationwide; 1% in WA, 1998)
grass, seed (541,001 acres; assume low percentage treated, like wheat and alfalfa)
corn (83,018 acres; 7% of crop acres treated nationwide; 6% in WA, 2000)
grapes (48,566 acres; <1% of crop acres treated nationwide; 7% in WA, 2000)
filberts (32,588 acres; 6% of crop acres treated nationwide)
snap beans (25,619 acres; chlorpyrifos used for seed treatment only).

Mint also has high acreage in these counties (73,865 acres). The percentage of acres treated with chlorpyrifos is unknown and presumed to be high.

Based on this information, chlorpyrifos use in Idaho counties with salmonid ESUs is estimated to be low. This is consistent with USGS data (Attachment 1). The counties and crops in Washington and Oregon with the greatest potential for chlorpyrifos use are the following (acres in parentheses):

Adams, WA: mint (7,328), apples (3,457), sugarbeets (1,570)
Benton, WA: apples (18,425), pears (472), cherries (3,219), sugarbeets (4,284), dry onions (3,398)
Chelan, WA: apples (17,096), pears (8,298), cherries (3,704)
Douglas, WA: apples (14,383), pears (1,104), cherries (1,842)
Franklin, WA: apples (9,000)
Grant, WA: apples (33,615), pears (998), cherries (3,470), sugarbeets (10,792), dry onions (6,214), mint (15,610)
Okanogan, WA: apples (24,164), pears (3,280), cherries (1,003),
Walla Walla, WA: apples (5,222), cherries (280), dry onions (2,172)
Whitman, WA: mint (12,577)
Yakima, WA: apples (75,264), pears (10,190), cherries (6,129)
Crook, OR: sugarbeets (1,510), mint (5,501)
Hood River, OR: apples (2,592), pears (11,788), cherries (1,081)
Jackson, OR: pears (9,387)
Lane, OR: mint (5,350)
Union, OR: sugarbeets (1,035), mint (9,226)
Wasco, OR: cherries (7,352)

In the tables below for each ESU, data are not included for chlorpyrifos uses being cancelled. We have also presented the acreage only for crops with more than 10 acres listed in the agricultural census.

Information on the distribution of the ESUs was taken almost entirely from Federal Register Notices relating to listing, critical habitat, or status reviews. Initially, descriptions of ESU occurrence were taken directly from OPP's analysis of diazinon risks to endangered and threatened salmon and steelhead, which relied upon existing ESU maps available from NMFS. Due to altered descriptions of the ESU critical habitat published in the Federal Register in recent years, many of these maps are out of date. Some error was therefore likely in determining the counties containing agricultural land and falling within ESU boundaries. To correct this deficiency Dow AgroSciences redrew the ESU boundaries, taking into account the most current published descriptions. Attachment 5 gives the details of the process by which ESUs were delineated using the new critical habitat descriptions. Also provided is an analysis of county contribution to potential chlorpyrifos loading in critical habitat based on factors such as elevation analysis and location of various categories of federal land where chlorpyrifos use does not occur.

Any counties that were added or removed from OPP's analysis as a result of redrawing the ESU boundaries are reflected in the analysis and risk conclusions for specific ESUs discussed in the following sections. Portions of the narrative and tables for each ESU that reflect the revised ESU boundary delineation are shown in red. Counties removed from the analysis are lined out in the narrative and tables (e.g., Lake County, CA in Table 18).

(a) Steelhead

Steelhead, *Oncorhynchus mykiss*, exhibit one of the most complex suites of life history traits of any salmonid species. Steelhead may exhibit anadromy or freshwater residency. Resident forms are usually referred to as "rainbow" or "redband" trout, while anadromous life forms are termed "steelhead." The relationship between these two life forms is poorly understood; however, the scientific name was recently changed to represent that both forms are a single species.

Steelhead typically migrate to marine waters after spending 2 years in fresh water. They then reside in marine waters for typically 2 or 3 years prior to returning to their natal stream to spawn as 4-or 5-year-olds. Unlike Pacific salmon, they are capable of spawning more than once before they die. However, it is rare for steelhead to spawn more than twice before dying; most that do so are females. Steelhead adults typically spawn between December and June.

Depending on water temperature, steelhead eggs may incubate in redds (spawning beds) for 1.5 to 4 months before hatching as alevins. Following yolk sac absorption, alevins emerge as fry and begin actively feeding. Juveniles rear in fresh water from 1 to 4 years, then migrate to the ocean as "smolts."

Biologically, steelhead can be divided into two reproductive ecotypes. "Stream maturing" or "summer steelhead" enter fresh water in a sexually immature condition and require several months to mature and spawn. "Ocean maturing" or "winter steelhead" enter fresh water with well-developed gonads and spawn shortly after river entry. There are also two major genetic groups, applying to both anadromous and nonanadromous forms: a coastal group and an inland group, separated approximately by the Cascade crest in Oregon and Washington. California is thought to have only coastal steelhead while Idaho has only inland steelhead.

Historically, steelhead were distributed throughout the North Pacific Ocean from the Kamchatka Peninsula in Asia to the northern Baja Peninsula, but they are now known only as far south as the Santa Margarita River in San Diego County. Many populations have been extirpated.

(1) Southern California Steelhead ESU

The Southern California steelhead ESU was proposed for listing as endangered on August 9, 1996 (61FR41541-41561) and the listing was made final a year later (62FR43937-43954, August 18, 1997). Critical Habitat was proposed February 5, 1999 (64FR5740-5754) and designated on February 16, 2000 (65FR7764-7787). This ESU ranges from the Santa Maria River in San Luis Obispo County south to San Mateo Creek in San Diego County. Steelhead from this ESU may also occur in Santa Barbara, Ventura and Los Angeles counties, but this ESU apparently is no longer considered to be extant in Orange County (65FR79328-79336, December 19, 2000). The San Mateo Creek watershed also includes a small portion of the southwest corner of Riverside County, but the area is in the Cleveland National Forest so Riverside County was excluded from the analysis. Hydrologic units in this ESU are Cuyama (upstream barrier - Vaquero Dam), Santa Maria, San Antonio, Santa Ynez (upstream barrier - Bradbury Dam), Santa Barbara Coastal, Ventura (upstream barriers - Casitas Dam, Robles Dam, Matilja Dam, Vern Freeman Diversion Dam), Santa Clara (upstream barrier - Santa Felicia Dam), Calleguas, and Santa Monica Bay (upstream barrier - Rindge Dam). Counties comprising this ESU show a very high percentage of declining and extinct populations.

River entry ranges from early November through June, with peaks in January and February. Spawning primarily begins in January and continues through early June, with peak spawning in February and March.

Within San Diego County, the San Mateo Creek runs through Camp Pendleton Marine Base and into the Cleveland National Forest. While there are agricultural uses of pesticides in other parts of California within the range of this ESU, it would appear that there are no such uses in the vicinity of San Mateo Creek. Within Los Angeles County, this steelhead occurs in Malibu Creek and possibly Topanga Creek. Neither of these creeks drain agricultural areas.

Reportable usage of chlorpyrifos in counties where this ESU occurs are presented in Table 14.

Table 14. Use of chlorpyrifos in counties with the Southern California steelhead ESU.

County	Crop	Usage (pounds)	Acres treated
San Diego	avocado	365	400
	grapefruit	278	284
	lemon	612	551
	orange	634	888
	strawberry	283	285
Los Angeles	alfalfa	626	1,490
Ventura	broccoli	1,948	2,433
	cabbage	1,070	1,108
	corn	711	720
	cucumber	149	238,830

County	Crop	Usage (pounds)	Acres treated
	lemon	49,430	14,716
	orange	1,817	1,581
	strawberry	3,434	3,859
San Luis Obispo	alfalfa	110	150
	apple	180	90
	bok choy	542	479
	broccoli	3,764	2,818
	cabbage	145	137
	cauliflower	980	1,228
	chinese cabbage	1,853	1,640
	grape	2,199	1,107
	lemon	1,386	826
	orange	373	164
Santa Barbara	apple	343	201
	broccoli	14,707	12,521
	cabbage	1,096	1,121
	cauliflower	4,783	5,589
	chinese cabbage	310	321
	corn	163	179
	grape	1,550	1,773
	lime	119	222
	strawberry	314	322
	walnut	479	467

Chlorpyrifos use within the Southern California steelhead ESU is moderate. The greatest use is on lemons in Ventura County and broccoli and cauliflower in Santa Barbara County. Depending on the location of these crops relative to the habitat of the fish, the use of chlorpyrifos in these counties may affect this ESU. However, use on citrus is not allowed during December, January, and February, which coincide with the peak river run and spawning of this ESU. This factor mitigates, but does not eliminate, the risk from exposure to chlorpyrifos.

(2) South Central California Steelhead ESU

The South Central California steelhead ESU was proposed for listing as endangered on August 9, 1996 (61FR41541-41561) and the listing was made final, as threatened, a year later (62FR43937-43954, August 18, 1997). Critical Habitat was proposed February 5,1999 (64FR5740-5754) and designated on February 16, 2000 (65FR7764-7787). This coastal steelhead ESU occupies rivers from the Pajaro River, Santa Cruz County, to (but not including) the Santa Maria River, San Luis Obispo County. Most rivers in this ESU drain the Santa Lucia Mountain Range, the southernmost unit of the California Coast Ranges (62FR43937-43954, August 18, 1997). River entry ranges from late November through March, with spawning occurring from January through April.

This ESU includes the hydrologic units of Pajaro (upstream barriers - Chesbro Reservoir, North Fork Pachero Reservoir), Estrella, Salinas (upstream barriers - Nacimiento Reservoir, Salinas Dam, San Antonio Reservoir), Central Coastal (upstream barriers - Lopez Dam, Whale Rock Reservoir), Alisal-Elkhorn Sloughs, and Carmel. Counties of occurrence include Santa Cruz, Santa Clara, San Benito, Monterey, and San Luis Obispo.

There is considerable agricultural use in most counties within this ESU. There is a potential for steelhead waters to drain agricultural areas. Reportable usage of chlorpyrifos in counties where this ESU occurs are presented in Table 15.

Table 15. Use of chlorpyrifos in counties with the South-Central California steelhead ESU.

County	Crop	Usage (pounds)	Acres treated
Santa Cruz	apple	1,255	818
	broccoli	168	130
	brussel sprout	3,224	3,516
	cauliflower	201	198
Santa Clara	apple	24	16
San Benito	alfalfa	209	210
	apple	286	217
	broccoli	577	581
	cabbage	1,078	1,028
	cauliflower	144	161
	grape	277	139
	walnut	1,239	910
Monterey	bok choy	149	119
	broccoli	33,002	24,682
	brussel sprout	1,541	1,550
	cabbage	2,255	1,955
	cauliflower	11,175	11,292
	chinese cabbage	205	149
	corn	114	46
	grape	2,568	1,442
	kale	734	819
	lemon	428	229
	radish	599	259
	rappini	253	131
	walnut	239	120
San Luis Obispo	alfalfa	110	150
	apple	180	90
	bok choy	542	479
	broccoli	3,764	2,818
	cabbage	145	137
	cauliflower	980	1,228
	chinese cabbage	1,853	1,640

County	Crop	Usage (pounds)	Acres treated
	grape	2,199	1,107
	lemon	1,386	826
	orange	373	164

Chlorpyrifos use within the South Central California steelhead ESU is moderate. The greatest uses are on broccoli and cauliflower in Monterey county. Depending on the location of these crops relative to the habitat of the fish, the use of chlorpyrifos may affect this ESU.

(3) Central California Coast Steelhead ESU
The Central California coast steelhead ESU was proposed for listing as endangered on August 9, 1996 (61FR41541-41561) and the listing was made final, as threatened, a year later (62FR43937-43954, August 18, 1997). Critical Habitat was proposed February 5, 1999 (64FR5740-5754) and designated on February 16, 2000 (65FR7764-7787). This coastal steelhead ESU occupies California river basins from the Russian River, Sonoma County, to Aptos Creek, Santa Cruz County, (inclusive), and the drainages of San Francisco and San Pablo Bays eastward to the Napa River (inclusive), Napa County. The Sacramento-San Joaquin River Basin of the Central Valley of California is excluded. Steelhead in most tributary streams in San Francisco and San Pablo Bays appear to have been extirpated, whereas most coastal streams sampled in the central California coast region do contain steelhead.

Only winter steelhead are found in this ESU and those to the south. River entry ranges from October in the larger basins, late November in the smaller coastal basins, and continues through June. Steelhead spawning begins in November in the larger basins, December in the smaller coastal basins, and can continue through April with peak spawning generally in February and March. Hydrologic units in this ESU include Russian (upstream barriers - Coyote Dam, Warm Springs Dam), Bodega Bay, Suisun Bay, San Pablo Bay (upstream barriers – Phoenix Dam, San Pablo Dam), Coyote (upstream barriers - Almaden, Anderson, Calero, Guadelupe, Stevens Creek, and Vasona Reservoirs, Searsville Lake), San Francisco Bay (upstream barriers - Calveras Reservoir, Chabot Dam, Crystal Springs Reservoir, Del Valle Reservoir, San Antonio Reservoir), San Francisco Coastal South (upstream barrier - Pilarcitos Dam), and San Lorenzo-Soquel (upstream barrier - Newell Dam).

Counties of occurrence for this ESU are Santa Cruz, San Mateo, San Francisco, Marin, Sonoma, Mendocino, Napa, Alameda, Contra Costa, Solano, and Santa Clara counties (Table 16).

Table 16. Use of chlorpyrifos in counties with the Central California Coast steelhead ESU.

County	Crop	Usage (pounds)	Acres treated
Santa Cruz	apple	1,255	818
	broccoli	168	130
	brussel sprout	3,224	3,516
	cauliflower	201	198
San Mateo	brussel sprout	1,816	2,257

County	Crop	Usage (pounds)	Acres treated
San Francisco	none > 100 lb		
Marin	none > 100 lb		
Sonoma	apple	1,380	1,408
Mendocino	apple	225	112
	pear	2,195	1,867
Napa	none > 100 lb		
Alameda	none > 100 lb		
Contra Costa	asparagus	133	133
Solano	alfalfa	1,710	2,974
	almond	506	287
	grass, seed	705	231
	sorghum/milo	238	355
	sunflower	172	133
	walnut	2,768	1,514
Santa Clara	apple	24	16

Use of chlorpyrifos in this region is low. Because of the low usage and acres treated, the use of chlorpyrifos is unlikely to affect this ESU.

(4) California Central Valley Steelhead ESU

The California Central Valley steelhead ESU was proposed for listing as endangered on August 9, 1996 (61FR41541-41561) and the listing was made final in 1998 (63FR 13347-13371, March 18, 1998). Critical Habitat was proposed February 5, 1999 (64FR5740-5754) and designated on February 16, 2000 (65FR7764-7787).

This ESU includes populations ranging from Shasta, Trinity, and Whiskeytown areas, along with other Sacramento River tributaries in the North, down the Central Valley along the San Joaquin River to and including the Merced River in the South, and then into San Pablo and San Francisco Bays. Counties at least partly within this area are Alameda, Amador, Butte, Calaveras, Colusa, Contra Costa, Glenn, Marin, Merced, Napa, Nevada, Placer, Sacramento, San Benito, San Francisco, San Joaquin, San Mateo, San Francisco, Santa Clara, Shasta, Solano, Sonoma, Stanislaus, Sutter, Tehama, Tuloumne, Yolo, and Yuba. A large proportion of this area is heavily agricultural, but there are also large amounts of urban and suburban areas. Usage of chlorpyrifos in counties where the California Central Valley steelhead ESU occurs is presented in Table 17. Most agricultural use of chlorpyrifos would likely be as a spray in orchards during the dormant season.

Table 17. Use of chlorpyrifos in counties with the California Central Valley steelhead ESU.

County	Crop	Usage (pounds)	Acres treated
Alameda	none > 100 lb		
Amador	walnut	263	132
Butte	alfalfa	342	645

County	Crop	Usage (pounds)	Acres treated
	almond	3,886	2,529
	orange	113	97
	peach	211	142
	prune	269	205
	walnut	18,536	10,019
Calaveras	walnut	260	155
Colusa	alfalfa	613	1,189
	almond	974	696
	cotton	2,880	3,373
	walnut	1,543	834
Contra Costa	asparagus	133	133
Glenn	alfalfa	1,548	2,796
	almond	3,754	2,327
	cotton	951	1,029
	orange	233	110
	sunflower	146	279
	walnut	6,488	3,771
Marin	none > 100 lb		
Merced	alfalfa	8,022	14,503
	almond	21,396	15,623
	asparagus	223	224
	chinese cabbage	138	132
	corn	2,964	3,020
	cotton	8,916	9,167
	fig	2,684	1,350
	orange	1,044	541
	sweet potato	4,868	2,457
	walnut	4,365	2,481
Napa	none > 100 lb		
Nevada	none > 100 lb		
Placer	none > 100 lb		
Sacramento	alfalfa	1,632	2,325
	apple	326	162
	corn	180	181
	pear	696	348
	walnut	181	119
San Benito	alfalfa	209	210
	apple	286	217
	broccoli	577	581
	cabbage	1,078	1,028
	cauliflower	144	161
	grape	277	139
	walnut	1,239	910
San Joaquin	alfalfa	5,650	11,422

County	Crop	Usage (pounds)	Acres treated
	almond	5,890	3,265
	apple	661	538
	asparagus	2,263	2,311
	corn	3,179	2,348
	pear	146	73
	walnut	18,506	10,482
San Mateo	brussel sprout	1,816	2,257
San Francisco	none > 100 lb		
Santa Clara	apple	24	16
Shasta	mint	249	189
	turf/sod	324	320
	walnut	352	175
Solano	alfalfa	1,710	2,974
	almond	506	287
	grass, seed	705	231
	sorghum/milo	238	355
	sunflower	172	133
	walnut	2,768	1,514
Sonoma	apple	1,380	1,408
Stanislaus	alfalfa	5,199	10,136
	almond	36,984	20,605
	apple	1,528	872
	citrus	741	100
	corn	3,595	3,102
	sweet potato	671	325
	walnut	23,188	12,878
Sutter	alfalfa	547	1,143
	bean, dried	981	2,878 tons
	cabbage	104	133
	peach	610	376
	walnut	16,541	8,806
Tehama	alfalfa	553	863
	almond	2,704	1,422
	prune	107	160
	walnut	7,847	4,514
Tuolumne	none > 100 lb		
Yolo	alfalfa	7,657	14,996
	almond	267	157
	cotton	699	751
	pear	143	96
	sorghum/milo	260	330
	walnut	5,005	2,869
Yuba	peach	160	80
	pear	268	162

County	Crop	Usage (pounds)	Acres treated
	prune	540	285
	walnut	6,022	3,075

There is substantial use of chlorpyrifos on orchards, as well as cotton and alfalfa, within the California Central Valley steelhead ESU. Depending on the location of these crops relative to the habitat of the fish, the use of chlorpyrifos may affect this ESU.

(5) Northern California Steelhead ESU

The Northern California steelhead ESU was proposed for listing as threatened on February 11, 2000 (65FR6960-6975) and the listing was made final on June 7, 2000 (65FR36074-36094). Critical Habitat has not yet been officially established. This Northern California coastal steelhead ESU occupies river basins from Redwood Creek in Humboldt County, CA to the Gualala River, inclusive, in Mendocino County, CA. River entry ranges from August through June and spawning from December through April, with peak spawning in January in the larger basins and in late February and March in the smaller coastal basins. The Northern California ESU has both winter and summer steelhead, including what is presently considered to be the southernmost population of summer steelhead, in the Middle Fork Eel River. Counties included appear to be Humboldt, Mendocino, Trinity, Glenn, Lake, and Sonoma. Glenn and Lake counties are excluded because the hydrologic units in these counties are entirely within the Mendocino National Forest, where there will be no chlorpyrifos usage. Table 18 shows the reported use of chlorpyrifos in these counties.

Table 18. Use of chlorpyrifos in counties with the Northern California steelhead ESU.

County	Crop	Usage (pounds)	Acres treated
Humboldt	none > 100 lb		
Mendocino	apple	225	112
	pear	2,195	1,867
Sonoma	apple	1,380	1,408
Trinity	none > 100 lb		
~~Lake~~	~~pear~~	~~3,985~~	~~1,848~~

Chlorpyrifos use within the Northern California steelhead ESU is limited. Chlorpyrifos use is not likely to adversely affect this ESU.

(6) Upper Columbia River Steelhead ESU

The Upper Columbia River steelhead ESU was proposed for listing as endangered on August 9, 1996 (61FR41541-41561) and the listing was made final a year later (62FR43937-43954, August 18, 1997). Critical Habitat was proposed February 5, 1999 (64FR5740-5754) and designated on February 16, 2000 (65FR7764-7787).

The Upper Columbia River steelhead ESU ranges from several northern rivers close to the Canadian border in central Washington (Okanogan and Chelan counties) to the mouth of the

Columbia River. The primary area for spawning and growth through the smolt stage of this ESU is from the Yakima River in south Central Washington upstream. Hydrologic units within the spawning and rearing habitat of the Upper Columbia River steelhead ESU and their upstream barriers are Chief Joseph (upstream barrier - Chief Joseph Dam), Okanogan, Similkameen, Methow, Upper Columbia-Entiat, Wenatchee, Moses-Coulee, and Upper Columbia-Priest Rapids. Within the spawning and rearing areas, counties are Chelan, Douglas, Okanogan, Grant, Benton, Franklin, Adams, Kittitas, and Yakima, all in Washington.

Areas downstream from the Yakima River are used for migration. Additional counties through which the ESU migrates are Walla Walla, Klickitat, Benton, Skamania, ~~Clark, Columbia,~~ Cowlitz, Wahkiakum, and Pacific, Washington; and Gilliam, Morrow, Sherman, Umatilla, Wasco, Hood River, Clackamas, Multnomah, Washington, Columbia, and Clatsop, Oregon. Washington County, Oregon was excluded because only a small mountainous portion of the county intersects the hydrologic unit.

Table 19 shows the cropping information where chlorpyrifos can be used in Washington counties where the Upper Columbia River steelhead ESU is located. Table 20 shows the information for the Oregon and Washington counties where this ESU migrates. In these tables, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 19. Crops on which chlorpyrifos can be used in counties containing spawning and rearing habitat for the Upper Columbia River steelhead ESU.

State	County	Crops and acreage planted	Acres	Total acreage
WA	Adams	corn (5,388), wheat (303,813), sugarbeets (1,570), grass seed (7,487), alfalfa (22,350), asparagus (422), snap beans (102), dry onions (1,453), apples (3,457), cherries, grapes, pears, mint (7,328)	353,370	1,231,999
WA	Benton	corn, wheat (130,981), sugarbeets (4,284), grass seed, alfalfa (13,241), asparagus (1,638), dry onions (3,398), apples (18,425), apricots (174), cherries (3,219), grapes (15,929), nectarines (106), peaches (149), pears (472), plums & prunes (180), walnuts (41), mint	192,237	1,089,993
WA	Chelan	wheat (1,864), alfalfa (1,210), apples (17,096), apricots (81), cherries (3,704), nectarines (22), peaches (21), pears (8,298), plums & prunes (3), walnuts	32,299	1,869,848
WA	Douglas	wheat (200,291), alfalfa (1,763), apples (14,383), apricots (315), cherries (1,842), nectarines (91), peaches (167), pears (1,104)	219,956	1,165,158

State	County	Crops and acreage planted	Acres	Total acreage
WA	Franklin	corn (11,337), wheat (109,627), sunflower (698), sugarbeets, grass seed, alfalfa (70,943), asparagus (8,610), snap beans (236), carrots (3,574), dry onions (4,074), apples (9,000), apricots (68), cherries (2,165), grapes (2,813), nectarines (129), peaches (262), pears (156), plums & prunes (43), walnuts, strawberries (17), mint (1,586)	225,338	794,999
WA	Grant	corn (29,953), wheat (203,498), sugarbeets (10,792), grass seed (6,801), alfalfa (115,509), asparagus (940), snap beans (671), carrots (2,207), dry onions (6,214), apples (33,615), apricots (266), cherries (3,470), grapes (3,132), nectarines (163), peaches (261), pears (998), plums & prunes (5), filberts, walnuts (5), strawberries (2), mint (15,610)	434,112	1,712,881
WA	King	corn (30), alfalfa (358), snap beans, broccoli (8), cabbage (88), carrots (10), cauliflower, dry onions (4), radishes, turnips (2), apples (64), apricots (1), cherries (8), grapes (2), peaches (1), pears (19), plums & prunes (4), filberts (3), walnuts (3), strawberries (42)	647	1,360,705
WA	Kittitas	wheat (5,224), alfalfa (8,571), apples (1,859), cherries, peaches (1), pears (331), plums & prunes (1), filberts (1), mint (409)	16,397	1,469,862
WA	Okanogan	wheat (8,410), alfalfa (21,880), broccoli (1), carrots (1), apples (24,164), apricots (13), cherries (1,003), nectarines (38), peaches (67), pears (3,280), plums & prunes (1), filberts (10), walnuts (29), strawberries	58,897	3,371,698
WA	Skagit	wheat (3,477), grass seed, alfalfa (782), snap beans (4), broccoli, carrots (555), apples (357), cherries, grapes, pears (5), plums & prunes, filberts (12), strawberries (281)	5,473	1,110,583
WA	Snohomish	wheat (428), grass seed, alfalfa (235), snap beans (10), broccoli (4), cabbage, carrots (2), cauliflower, apples (47), cherries (3), grapes (1), peaches (42), pears (27), plums & prunes (2), filberts (11), strawberries (81)	893	1,337,728
WA	Whatcom	corn, wheat (626), alfalfa (708), snap beans (1), broccoli (1), cabbage, apples (174), cherries (4), grapes (10), pears (15), plums & prunes, filberts (206), walnuts (1), strawberries (297)	2,043	1,356,006

State	County	Crops and acreage planted	Acres	Total acreage
WA	Yakima	corn (12,680), wheat (50,430), grass seed (1,070), alfalfa (33,833), asparagus (7,034), snap beans (106), cabbage (144), dry onions, turnips (40), apples (75,264), apricots (285), cherries (6,129), grapes (15,529), nectarines (605), peaches (1,438), pears (10,190), plums & prunes (478), filberts (6), walnuts (11)	215,272	2,749,514

Table 20. Crops on which chlorpyrifos can be used in counties in the migration corridor of the Upper Columbia River steelhead ESU.

State	County	Crops and acreage planted	Acres	Total acreage
OR	Clackamas	corn (14), wheat (1,783), grass seed (9,829), alfalfa (1,072), snap beans (334), broccoli (184), cabbage (72), cauliflower (319), dry onions, radishes (144), turnips, apples (167), cherries (53), grapes (207), peaches (78), pears (37), plums & prunes (37), filberts (3,994), walnuts (51), strawberries (608)	18,983	1,195,712
OR	Clatsop	alfalfa, apples	0	529,482
OR	Columbia	corn (48), wheat, alfalfa (421), apples (39), cherries (7), grapes (6), peaches, pears (12), plums & prunes (2), filberts, walnuts (11), other nuts, strawberries (6)	552	420,332
OR	Gilliam	wheat (95,584), alfalfa (2,450)	98,034	770,664
OR	Hood River	wheat, alfalfa (443), broccoli, apples (2,592), cherries (1,081), grapes (63), peaches (13), pears (11,788)	15,980	334,328
OR	Morrow	corn (9,276), wheat (167,070), sugarbeets, grass seed (1,113), alfalfa (22,180), dry onions (1,284), apples	200,923	1,301,021
OR	Multnomah	wheat (1,688), grass seed, alfalfa (389), broccoli (29), cabbage (459), carrots, cauliflower (55), turnips, apples (51), cherries (8), grapes (28), peaches (36), pears (25), plums & prunes (3), walnuts (2), other nuts, strawberries (171)	2,944	278,570
OR	Sherman	wheat (99,837), alfalfa (230)	100,067	526,911
OR	Umatilla	corn (6,901), wheat (263,624), grass seed (10,064), alfalfa (24,013), asparagus (1,093), snap beans (587), dry onions (3,914), apples (3,927), apricots (14), cherries (349), grapes (163), nectarines, peaches (7), pears (4), plums & prunes (365), strawberries (9), mint	315,034	2,057,809

State	County	Crops and acreage planted	Acres	Total acreage
WA	Clark	grass seed, alfalfa (836), snap beans (2), cabbage, apples (33), cherries, grapes (32), peaches (46), pears (75), plums & prunes (10), filberts (87), walnuts (51), strawberries (162), mint	1,334	401,850
WA	Cowlitz	wheat (293), alfalfa (105), snap beans (1), carrots, apples (14), cherries (2), grapes, pears (3), filberts (1), walnuts (5), strawberries	424	728,781
WA	Klickitat	wheat (40,401), grass seed, alfalfa (28,434), cabbage, apples (516), apricots (18), cherries (457), grapes (419), peaches (199), pears (923), plums & prunes (1), walnuts	71,368	1,198,385
WA	Pacific	alfalfa (110), apples, cherries, grapes	110	623,722
WA	Skamania	alfalfa (164), apples (75), grapes, pears (477), other nuts (4)	720	1,337,179
WA	Wahkiakum	alfalfa	0	169,125
WA	Walla Walla	corn (6,539), wheat (232,419), grass seed (8,233), alfalfa (11,787), asparagus (1,414), snap beans (250), cabbage (6), carrots, dry onions (2,172), radishes, apples (5,222), cherries (280), grapes, plums & prunes (22)	268,344	813,108

There is a considerable amount of acreage, especially orchard crops, where chlorpyrifos may be used within the reproductive area of this ESU. In these counties there are 164,000 acres of apples, 24,000 acres of pears, and 18,000 acres of cherries, as well as 24,000 acres of mint, sugarbeets, and dry onions. Much less acreage is likely to be treated with chlorpyrifos in the migration corridor. Depending on the location of orchards and other crops relative to the reproductive habitat of the fish, the use of chlorpyrifos may affect this ESU.

(7) Snake River Basin Steelhead ESU

The Snake River Basin steelhead ESU was proposed for listing as endangered on August 9, 1996 (61FR41541-41561) and the listing was made final a year later (62FR43937-43954, August 18, 1997). Critical Habitat was proposed February 5, 1999 (64FR5740-5754) and designated on February 16, 2000 (65FR7764-7787).

Spawning and early growth areas of this ESU consist of all areas upstream from the confluence of the Snake River and the Columbia River as far as fish passage is possible. Hells Canyon Dam on the Snake River and Dworshak Dam on the Clearwater River, along with Napias Creek Falls near Salmon, Idaho, are named as impassable barriers. These areas include the counties of Wallowa, Baker, Union, and Umatilla (northeastern part) in Oregon; Asotin, Garfield, Columbia, Whitman, Franklin, Walla Walla, Adams, Lincoln, and Spokane in Washington; and Adams, Idaho, Nez Perce, Blaine, Custer, Lemhi, Boise, Valley, Lewis, Clearwater, and Latah in Idaho.

We have excluded Baker County, Oregon, which has a tiny fragment of the Imnaha River. While a small part of Rock Creek extends into Baker County, this occurs at 7200 feet in the mountains (partly in a wilderness area) and is of no significance with respect to chlorpyrifos use in agricultural areas. We have similarly excluded the Upper Grande Ronde watershed tributaries (e.g., Looking Glass and Cabin Creeks) that are barely into higher elevation forested areas of Umatilla County. In Idaho, Blaine and Boise counties technically have waters that are part of the steelhead ESU, but again, these are tiny areas which occur in the Sawtooth National Recreation Area and/or National Forest lands. These areas are not relevant to use of chlorpyrifos. The agricultural areas of Valley County, Idaho, appear to be primarily associated with the Payette River watershed, but there is enough of the Salmon River watershed in this county it was included.

Critical Habitat also includes the migratory corridors of the Columbia River from the confluence of the Snake River to the Pacific Ocean. Additional counties in the migratory corridors are Umatilla, Gilliam, Morrow, Sherman, Wasco, Hood River, Multnomah, Clackamas, Columbia, Clatsop, and Washington in Oregon; and Walla Walla, Benton, Yakima, Klickitat, Skamania, Clark, Cowlitz, Wahkiakum, and Pacific in Washington. Washington County, Oregon was excluded because only a small mountainous portion of the county intersects the hydrologic unit.

Table 21 and Table 22 show the cropping information for the Pacific Northwest counties where the Snake River Basin steelhead ESU is located and for the Oregon and Washington counties where this ESU migrates. In these tables, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 21. Crops on which chlorpyrifos can be used in counties containing spawning and rearing habitat for the Snake River Basin steelhead ESU.

State	County	Crops and acreage planted	Acres	Total acreage
ID	Adams	corn (104), wheat (200), alfalfa (9,223), apples	9,527	873,399
ID	Clearwater	wheat (9,106), grass seed (839), alfalfa (2,640)	12,585	1,575,396
ID	Custer	wheat (645), alfalfa (24,467)	25,112	3,152,382
ID	Idaho	wheat (62,283), grass seed, alfalfa (20,266), apples (6), cherries (2), grapes (1), peaches, pears (2), plums & prunes (2), filberts	82,562	5,430,522
ID	Latah	wheat (90,706), grass seed (3,161), alfalfa (7,202), apples (3), cherries (19), pears	101,091	689,089
ID	Lemhi	alfalfa (28,143), apples (6), apricots, cherries (9), peaches (3), pears (2)	28,163	2,921,172
ID	Lewis	wheat (64,367), grass seed, alfalfa (3,885)	68,252	306,601
ID	Valley	wheat (652), alfalfa (1,599), carrots	2,251	2,354,043
OR	Union	wheat (36,394), sugarbeets (1,035), grass seed (7,236), alfalfa (25,818), carrots, apples (39), apricots, cherries (596), peaches (12), pears, plums & prunes, mint (9,226)	80,356	1,303,476

State	County	Crops and acreage planted	Acres	Total acreage
OR	Wallowa	wheat (14,502), grass seed (189), alfalfa (18,253), apples (8), peaches	32,952	2,013,071
WA	Adams	corn (5,388), wheat (303,813), sugarbeets (1,570), grass seed (7,487), alfalfa (22,350), asparagus (422), snap beans (102), dry onions (1,453), apples (3,457), cherries, grapes, pears, mint (7,328)	353,370	1,231,999
WA	Asotin	wheat (21,110), grass seed (1,136), alfalfa (1,648), apples (24), apricots (5), cherries (17), peaches (18), pears (6)	23,964	406,983
WA	Benton	corn, wheat (130,981), sugarbeets (4,284), grass seed, alfalfa (13,241), asparagus (1,638), dry onions (3,398), apples (18,425), apricots (174), cherries (3,219), grapes (15,929), nectarines (106), peaches (149), pears (472), plums & prunes (180), walnuts (41), mint	192,237	1,089,993
WA	Columbia	corn (51), wheat (77,511), grass seed (253), alfalfa (1,780), apples	79,595	556,034
WA	Franklin	corn (11,337), wheat (109,627), sunflower (698), sugarbeets, grass seed, alfalfa (70,943), asparagus (8,610), snap beans (236), carrots (3,574), dry onions (4,074), apples (9,000), apricots (68), cherries (2,165), grapes (2,813), nectarines (129), peaches (262), pears (156), plums & prunes (43), walnuts, strawberries (17), mint (1,586)	225,338	794,999
WA	Garfield	wheat (71,689), grass seed (2,830), alfalfa (802)	75,321	454,744
WA	Lincoln	corn (564), wheat (355,317), sugarbeets, grass seed (1,676), alfalfa (15,972), carrots, apples, cherries (1)	373,350	1,479,196
WA	Spokane	corn, wheat (115,324), grass seed (22,657), alfalfa (35,493), snap beans, carrots (34), dry onions, apples (227), apricots (11), cherries (50), grapes (3), pears (24), plums & prunes (1), strawberries (30)	173,854	1,128,835
WA	Walla Walla	corn (6,539), wheat (232,419), grass seed (8,233), alfalfa (11,787), asparagus (1,414), snap beans (250), cabbage (6), carrots, dry onions (2,172), radishes, apples (5,222), cherries (280), grapes, plums & prunes (22)	268,344	813,108
WA	Whitman	corn (101), wheat (478,098), grass seed (4,251), alfalfa (6,644), apples (19), cherries, pears (2), mint (12,577)	501,692	1,382,006

Table 22. Crops on which chlorpyrifos can be used in counties in the migration corridor of the Snake River Basin steelhead ESU.

State	County	Crops and acreage planted	Acres	Total acreage
OR	Clackamas	corn (14), wheat (1,783), grass seed (9,829), alfalfa (1,072), snap beans (334), broccoli (184), cabbage (72), cauliflower (319), dry onions, radishes (144), turnips, apples (167), cherries (53), grapes (207), peaches (78), pears (37), plums & prunes (37), filberts (3,994), walnuts (51), strawberries (608)	18,983	1,195,712
OR	Clatsop	alfalfa, apples	0	529,482
OR	Columbia	corn (48), wheat, alfalfa (421), apples (39), cherries (7), grapes (6), peaches, pears (12), plums & prunes (2), filberts, walnuts (11), other nuts, strawberries (6)	552	420,332
OR	Gilliam	wheat (95,584), alfalfa (2,450)	98,034	770,664
OR	Hood River	wheat, alfalfa (443), broccoli, apples (2,592), cherries (1,081), grapes (63), peaches (13), pears (11,788)	15,980	334,328
OR	Morrow	corn (9,276), wheat (167,070), sugarbeets, grass seed (1,113), alfalfa (22,180), dry onions (1,284), apples	200,923	1,301,021
OR	Multnomah	wheat (1,688), grass seed, alfalfa (389), broccoli (29), cabbage (459), carrots, cauliflower (55), turnips, apples (51), cherries (8), grapes (28), peaches (36), pears (25), plums & prunes (3), walnuts (2), other nuts, strawberries (171)	2,944	278,570
OR	Sherman	wheat (99,837), alfalfa (230)	100,067	526,911
OR	Umatilla	corn (6,901), wheat (263,624), grass seed (10,064), alfalfa (24,013), asparagus (1,093), snap beans (587), dry onions (3,914), apples (3,927), apricots (14), cherries (349), grapes (163), nectarines, peaches (7), pears (4), plums & prunes (365), strawberries (9), mint	315,034	2,057,809
OR	Wasco	wheat (63,369), grass seed (169), alfalfa (7,239), apples (463), apricots (32), cherries (7,352), grapes (110), peaches (30), pears (385), plums & prunes, strawberries	79,149	1,523,958

State	County	Crops and acreage planted	Acres	Total acreage
WA	Benton	corn, wheat (130,981), sugarbeets (4,284), grass seed, alfalfa (13,241), asparagus (1,638), dry onions (3,398), apples (18,425), apricots (174), cherries (3,219), grapes (15,929), nectarines (106), peaches (149), pears (472), plums & prunes (180), walnuts (41), mint	192,237	1,089,993
WA	Cowlitz	wheat (293), alfalfa (105), snap beans (1), carrots, apples (14), cherries (2), grapes, pears (3), filberts (1), walnuts (5), strawberries	424	728,781
WA	Klickitat	wheat (40,401), grass seed, alfalfa (28,434), cabbage, apples (516), apricots (18), cherries (457), grapes (419), peaches (199), pears (923), plums & prunes (1), walnuts	71,368	1,198,385
WA	Pacific	alfalfa (110), apples, cherries, grapes	110	623,722
WA	Skamania	alfalfa (164), apples (75), grapes, pears (477), other nuts (4)	720	1,337,179
WA	Wahkiakum	alfalfa	0	169,125
WA	Walla Walla	corn (6,539), wheat (232,419), grass seed (8,233), alfalfa (11,787), asparagus (1,414), snap beans (250), cabbage (6), carrots, dry onions (2,172), radishes, apples (5,222), cherries (280), grapes, plums & prunes (22)	268,344	813,108
WA	Yakima	corn (12,680), wheat (50,430), grass seed (1,070), alfalfa (33,833), asparagus (7,034), snap beans (106), cabbage (144), dry onions, turnips (40), apples (75,264), apricots (285), cherries (6,129), grapes (15,529), nectarines (605), peaches (1,438), pears (10,190), plums & prunes (478), filberts (6), walnuts (11)	215,272	2,749,514

There is a considerable amount of acreage, especially orchard crops, where chlorpyrifos may be used within the reproductive area of this ESU. In these counties there are 68,000 acres of apples, 12,000 acres of cherries, and 64,000 acres of mint, sugarbeets, dry onions, and pears. Counties in the migration corridor contain nearly 150,000 acres of orchard and 15,000 acres of sugarbeets and dry onions. Depending on the location of orchards and other crops relative to the reproductive habitat and migration corridor of the fish, the use of chlorpyrifos may affect this ESU.

(8) Upper Willamette River steelhead ESU

The Upper Willamette River steelhead ESU was proposed for listing as threatened on March 10, 1998 (63FR11798-11809) and the listing was made final a year later (64FR14517-14528, March

25, 1999). Critical Habitat was proposed February 5, 1999 (64FR5740-5754) and designated on February 16, 2000 (65FR7764-7787). Only naturally spawned, winter steelhead trout are included as part of this ESU; where distinguishable, summer-run steelhead trout are not included.

Spawning and rearing areas are river reaches accessible to listed steelhead in the Willamette River and its tributaries above Willamette Falls up through the Calapooia River. This includes most of Benton, Linn, Polk, Clackamas, Marion, Yamhill, Clackamas, and Washington counties, and small parts of Lincoln and Tillamook counties. However, the latter two counties are small portions in mountainous forested areas where chlorpyrifos would not be used, and these counties are excluded from the analysis.

Hydrologic units where spawning and rearing occur are Upper Willamette, North Santiam (upstream barrier - Big Cliff Dam), South Santiam (upstream barrier - Green Peter Dam), Middle Willamette, Yamhill, Molalla-Pudding, and Tualatin. The areas below Willamette Falls and downstream in the Columbia River are considered migration corridors, and include Multnomah, Columbia, and Clatsop counties, Oregon, and Clark, Cowlitz, Wahkiakum, and Pacific counties, Washington.

Table 23 and Table 24 show the cropping information for Oregon counties where the Upper Willamette River steelhead ESU is located and for the Oregon and Washington counties where this ESU migrates. In these tables, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 23. Crops on which chlorpyrifos can be used in counties containing spawning and rearing habitat for the Upper Willamette steelhead ESU.

State	County	Crops and acreage planted	Acres	Total acreage
OR	Benton	wheat (4,338), grass seed, alfalfa (570), snap beans (3,080), broccoli, dry onions (3), apples (62), cherries (18), grapes (242), peaches (8), pears (7), plums & prunes (5), filberts (493), walnuts (23), strawberries (17), mint (2,925)	11,791	432,961
OR	Clackamas	corn (14), wheat (1,783), grass seed (9,829), alfalfa (1,072), snap beans (334), broccoli (184), cabbage (72), cauliflower (319), dry onions, radishes (144), turnips, apples (167), cherries (53), grapes (207), peaches (78), pears (37), plums & prunes (37), filberts (3,994), walnuts (51), strawberries (608)	18,983	1,195,712

State	County	Crops and acreage planted	Acres	Total acreage
OR	Linn	corn (4), wheat (5,306), grass seed (198,471), alfalfa (2,507), snap beans (2,688), broccoli (267), cabbage, carrots, cauliflower (164), dry onions (1), apples (133), cherries (157), grapes (93), nectarines (3), peaches (73), plums & prunes (14), filberts (1,820), walnuts (55), strawberries (52), mint (4,105)	215,913	1,466,507
OR	Marion	corn (16), wheat (10,341), grass seed (98,930), alfalfa (1,315), snap beans (12,101), broccoli (2,548), cabbage (157), carrots (76), cauliflower (1,505), dry onions (2,036), apples (555), cherries (1,568), grapes (761), nectarines, peaches (179), pears (150), plums & prunes (145), filberts (7,061), walnuts (15), strawberries (1,858), mint (3,695)	145,012	758,394
OR	Polk	wheat (9,741), grass seed (52,375), alfalfa (774), snap beans (598), broccoli, cabbage, carrots, apples (157), apricots, cherries (1,888), grapes (1,123), peaches (51), pears (63), plums & prunes (595), filberts (2,394), walnuts (33), other nuts, strawberries (22), mint (2,448)	72,262	474,296
OR	Washington	wheat (17,020), grass seed (18,465), alfalfa (1,680), snap beans (988), broccoli (400), cabbage, carrots (1), cauliflower, dry onions (196), apples (279), cherries (211), grapes (989), peaches (168), pears (69), plums & prunes (358), filberts (5,595), walnuts (679), other nuts, strawberries (1,257)	48,355	463,231
OR	Yamhill	corn, wheat (13,989), grass seed (32,904), alfalfa (2,294), snap beans (1,838), broccoli (308), dry onions, apples (310), cherries (1,693), grapes (2,887), nectarines, peaches (104), pears (54), plums & prunes (369), filberts (7,110), walnuts (608), other nuts (41), strawberries (265)	64,774	457,986

Table 24. Crops on which chlorpyrifos can be used in counties in the migration corridor of the Upper Willamette steelhead ESU.

State	County	Crops and acreage planted	Acres	Total acreage
OR	Clatsop	alfalfa, apples	0	529,482

State	County	Crops and acreage planted	Acres	Total acreage
OR	Columbia	corn (48), wheat, alfalfa (421), apples (39), cherries (7), grapes (6), peaches, pears (12), plums & prunes (2), filberts, walnuts (11), other nuts, strawberries (6)	552	420,332
OR	Multnomah	wheat (1,688), grass seed, alfalfa (389), broccoli (29), cabbage (459), carrots, cauliflower (55), turnips, apples (51), cherries (8), grapes (28), peaches (36), pears (25), plums & prunes (3), walnuts (2), other nuts, strawberries (171)	2,944	278,570
WA	Clark	grass seed, alfalfa (836), snap beans (2), cabbage, apples (33), cherries, grapes (32), peaches (46), pears (75), plums & prunes (10), filberts (87), walnuts (51), strawberries (162), mint	1,334	401,850
WA	Cowlitz	wheat (293), alfalfa (105), snap beans (1), carrots, apples (14), cherries (2), grapes, pears (3), filberts (1), walnuts (5), strawberries	424	728,781
WA	Pacific	alfalfa (110), apples, cherries, grapes	110	623,722
WA	Wahkiakum	alfalfa	0	169,125

There is only a small amount of acreage, less than 8,000 acres of orchard and 15,000 acres of mint and dry onion, where chlorpyrifos can be used in the reproductive and growth areas of this ESU. There is almost no acreage of crops with high chlorpyrifos use in the migration corridor. The use of chlorpyrifos is likely to have little or no effect on the Upper Willamette River steelhead ESU.

(9) Lower Columbia River Steelhead ESU

The Lower Columbia River steelhead ESU was proposed for listing as endangered on August 9, 1996 (61FR41541-41561) and the listing was made final a year later (62FR43937-43954, August 18, 1997). Critical Habitat was proposed February 5, 1999 (64FR5740-5754) and designated on February 16, 2000 (65FR7764-7787).

This ESU includes all tributaries from the lower Willamette River (below Willamette Falls) to Hood River in Oregon, and from the Cowlitz River up to the Wind River in Washington. These tributaries would provide the spawning and presumably the growth areas for the young steelhead. It is not clear if the young and growing steelhead in the tributaries would use the nearby mainstem of the Columbia prior to downstream migration. If not, the spawning and rearing habitat would occur in Hood River, Clackamas, and Multnomah counties in Oregon, and Skamania, Clark, Cowlitz, and Lewis counties in Washington. Tributaries of the extreme lower Columbia River, e.g., Grays River in Pacific and Wahkiakum counties, Washington and John Day River in Clatsop county, Oregon, are not discussed in the Critical Habitat FRNs; because they are not "between" the specified tributaries, they do not appear part of the spawning and rearing habitat for this steelhead ESU. The mainstem of the Columbia River from the mouth to Hood River constitutes the migration corridor. This would additionally include Columbia and Clatsop counties, Oregon, and Pacific and Wahkiakum counties, Washington.

Hydrologic units for this ESU are Middle Columbia-Hood, Lower Columbia-Sandy (upstream barrier - Bull Run Dam 2), Lewis (upstream barrier - Merlin Dam), Lower Columbia- Clatskanie, Lower Cowlitz, Lower Columbia, Clackamas, and Lower Willamette.

Table 25 and Table 26 show the cropping information for Oregon and Washington counties where the Lower Columbia River steelhead ESU is located and for the Oregon and Washington counties where this ESU migrates. In these tables, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 25. Crops on which chlorpyrifos can be used in counties containing spawning and rearing habitat for the Lower Columbia River steelhead ESU.

State	County	Crops and acreage planted	Acres	Total acreage
OR	Clackamas	corn (14), wheat (1,783), grass seed (9,829), alfalfa (1,072), snap beans (334), broccoli (184), cabbage (72), cauliflower (319), dry onions, radishes (144), turnips, apples (167), cherries (53), grapes (207), peaches (78), pears (37), plums & prunes (37), filberts (3,994), walnuts (51), strawberries (608)	18,983	1,195,712
OR	Hood River	wheat, alfalfa (443), broccoli, apples (2,592), cherries (1,081), grapes (63), peaches (13), pears (11,788)	15,980	334,328
OR	Multnomah	wheat (1,688), grass seed, alfalfa (389), broccoli (29), cabbage (459), carrots, cauliflower (55), turnips, apples (51), cherries (8), grapes (28), peaches (36), pears (25), plums & prunes (3), walnuts (2), other nuts, strawberries (171)	2,944	278,570
WA	Clark	grass seed, alfalfa (836), snap beans (2), cabbage, apples (33), cherries, grapes (32), peaches (46), pears (75), plums & prunes (10), filberts (87), walnuts (51), strawberries (162), mint	1,334	401,850
WA	Cowlitz	wheat (293), alfalfa (105), snap beans (1), carrots, apples (14), cherries (2), grapes, pears (3), filberts (1), walnuts (5), strawberries	424	728,781

State	County	Crops and acreage planted	Acres	Total acreage
WA	Lewis	wheat (1,104), alfalfa (937), snap beans, apples (77), cherries (10), grapes (4), pears (8), plums & prunes (3), filberts (25), walnuts (4), other nuts (14), strawberries	2,186	1,540,991
WA	Skamania	alfalfa (164), apples (75), grapes, pears (477), other nuts (4)	720	1,337,179

Table 26. Crops on which chlorpyrifos can be used in counties in the migration corridor of the Lower Columbia River steelhead ESU.

State	County	Crops and acreage planted	Acres	Total acreage
OR	Clatsop	alfalfa, apples	0	529,482
OR	Columbia	corn (48), wheat, alfalfa (421), apples (39), cherries (7), grapes (6), peaches, pears (12), plums & prunes (2), filberts, walnuts (11), other nuts, strawberries (6)	552	420,332
WA	Pacific	alfalfa (110), apples, cherries, grapes	110	623,722
WA	Wahkiakum	alfalfa	0	169,125

There is relatively little acreage where chlorpyrifos can be used in counties containing reproductive and growth areas of this ESU, except Hood River County, which contains about 15,000 acres of orchards. The counties included in the migratory corridor for this ESU contain almost no crops on which chlorpyrifos is likely to be used. The use of chlorpyrifos is unlikely to affect the Lower Columbia River steelhead ESU with the possible exception of Hood River County. Depending on the location of Hood River County orchards relative to the habitat of the steelhead, the use of chlorpyrifos in this county may affect the Lower Columbia River steelhead ESU.

(10) Middle Columbia River Steelhead ESU
The Middle Columbia River steelhead ESU was proposed for listing as threatened on March 10, 1998 (63FR11798-11809) and the listing was made final a year later (64FR14517-14528, March 25, 1999). Critical Habitat was proposed February 5, 1999 (64FR5740-5754) and designated on February 16, 2000 (65FR7764-7787).

This steelhead ESU occupies “the Columbia River Basin and tributaries from above the Wind River in Washington and the Hood River in Oregon (exclusive), upstream to, and including, the Yakima River, in Washington.” The Critical Habitat designation indicates the downstream boundary of the ESU to be Mosier Creek in Wasco County, Oregon; this is consistent with Hood River being “excluded ” in the listing notice. No downstream boundary is listed for the Washington side of the Columbia River, but if Wind River is part of the Lower Columbia steelhead ESU, it appears that Collins Creek, Skamania County, Washington would be the last stream down river in the Middle Columbia River ESU. Dog Creek may also be part of the ESU, but White Salmon River certainly is, since the Condit Dam is mentioned as an upstream barrier.

The only other upstream barrier, in addition to Condit Dam on the White Salmon River, is the Pelton Dam on the Deschutes River. As an upstream barrier, this dam would preclude steelhead from reaching the Metolius and Crooked Rivers as well the upper Deschutes River and its tributaries.

In the John Day River watershed, we have excluded Harney County, Oregon because there is only a tiny amount of the John Day River and several tributary creeks (e.g., Utley, Bear Cougar creeks) which get into high elevation areas (approximately 1700M and higher) of northern Harney County where there are no crops grown. Union and Wallowa Counties, Oregon were excluded because the small reaches of the Umatilla and Walla Walla Rivers in these counties occur in high elevation areas where crops are not grown.

The Oregon counties then that appear to have spawning and rearing habitat are Gilliam, Morrow, Umatilla, Sherman, Wasco, Crook, Grant, Wheeler, and Jefferson counties. Washington counties providing spawning and rearing habitat would be Benton, Columbia, Franklin, Kittitas, Klickitat, Skamania, Walla Walla, and Yakima. Only small portions of Franklin and Skamania Counties intersect with this ESU, and these counties were excluded from the analysis.

Migratory corridors include Hood River, Multnomah, Clackamas, Columbia, and Clatsop counties in Oregon, and Skamania, Clark, Cowlitz, Wahkiakum, and Pacific Counties in Washington.

Table 27 and Table 28 show the cropping information for Oregon and Washington counties where the Middle Columbia River steelhead ESU is located and for the Oregon and Washington counties where this ESU migrates. In these tables, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 27. Crops on which chlorpyrifos can be used in counties containing spawning and rearing habitat for the Middle Columbia River steelhead ESU.

State	County	Crops and acreage planted	Acres	Total acreage
OR	Crook	wheat (2,362), sugarbeets (1,510), grass seed (186), alfalfa (14,023), mint (5,501)	23,582	1,906,892
OR	Gilliam	wheat (95,584), alfalfa (2,450)	98,034	770,664
OR	Grant	wheat (579), alfalfa (11,296), apples, apricots (19), pears	11,894	2,898,444
OR	Jefferson	wheat (12,470), sugarbeets (2,396), grass seed (9,627), alfalfa (10,944), apples (4), mint (3,105)	38,546	1,139,744
OR	Morrow	corn (9,276), wheat (167,070), sugarbeets, grass seed (1,113), alfalfa (22,180), dry onions (1,284), apples	200,923	1,301,021
OR	Sherman	wheat (99,837), alfalfa (230)	100,067	526,911

State	County	Crops and acreage planted	Acres	Total acreage
OR	Umatilla	corn (6,901), wheat (263,624), grass seed (10,064), alfalfa (24,013), asparagus (1,093), snap beans (587), dry onions (3,914), apples (3,927), apricots (14), cherries (349), grapes (163), nectarines, peaches (7), pears (4), plums & prunes (365), strawberries (9), mint	315,034	2,057,809
OR	Wasco	wheat (63,369), grass seed (169), alfalfa (7,239), apples (463), apricots (32), cherries (7,352), grapes (110), peaches (30), pears (385), plums & prunes, strawberries	79,149	1,523,958
OR	Wheeler	wheat, alfalfa (5,494), apples (23)	5,517	1,097,601
WA	Benton	corn, wheat (130,981), sugarbeets (4,284), grass seed, alfalfa (13,241), asparagus (1,638), dry onions (3,398), apples (18,425), apricots (174), cherries (3,219), grapes (15,929), nectarines (106), peaches (149), pears (472), plums & prunes (180), walnuts (41), mint	192,237	1,089,993
WA	Chelan	wheat (1,864), alfalfa (1,210), apples (17,096), apricots (81), cherries (3,704), nectarines (22), peaches (21), pears (8,298), plums & prunes (3), walnuts	32,299	1,869,848
WA	Columbia	corn (51), wheat (77,511), grass seed (253), alfalfa (1,780), apples	79,595	556,034
WA	Franklin	corn (11,337), wheat (109,627), sunflower (698), sugarbeets, grass seed, alfalfa (70,943), asparagus (8,610), snap beans (236), carrots (3,574), dry onions (4,074), apples (9,000), apricots (68), cherries (2,165), grapes (2,813), nectarines (129), peaches (262), pears (156), plums & prunes (43), walnuts, strawberries (17), mint (1,586)	225,338	794,999
WA	King	corn (30), alfalfa (358), snap beans, broccoli (8), cabbage (88), carrots (10), cauliflower, dry onions (4), radishes, turnips (2), apples (64), apricots (1), cherries (8), grapes (2), peaches (1), pears (19), plums & prunes (4), filberts (3), walnuts (3), strawberries (42)	647	1,360,705
WA	Kittitas	wheat (5,224), alfalfa (8,571), apples (1,859), cherries, peaches (1), pears (331), plums & prunes (1), filberts (1), mint (409)	16,397	1,469,862
WA	Klickitat	wheat (40,401), grass seed, alfalfa (28,434), cabbage, apples (516), apricots (18), cherries (457), grapes (419), peaches (199), pears (923), plums & prunes (1), walnuts	71,368	1,198,385

State	County	Crops and acreage planted	Acres	Total acreage
WA	Lewis	wheat (1,104), alfalfa (937), snap beans, apples (77), cherries (10), grapes (4), pears (8), plums & prunes (3), filberts (25), walnuts (4), other nuts (14), strawberries	2,186	1,540,991
WA	Pierce	alfalfa (70), snap beans (200), cabbage (242), carrots, radishes, apples (61), cherries (5), grapes, pears (4), plums & prunes, filberts, strawberries (125)	707	1,072,350
WA	Skamania	alfalfa (164), apples (75), grapes, pears (477), other nuts (4)	720	1,337,179
WA	Walla Walla	corn (6,539), wheat (232,419), grass seed (8,233), alfalfa (11,787), asparagus (1,414), snap beans (250), cabbage (6), carrots, dry onions (2,172), radishes, apples (5,222), cherries (280), grapes, plums & prunes (22)	268,344	813,108
WA	Yakima	corn (12,680), wheat (50,430), grass seed (1,070), alfalfa (33,833), asparagus (7,034), snap beans (106), cabbage (144), dry onions, turnips (40), apples (75,264), apricots (285), cherries (6,129), grapes (15,529), nectarines (605), peaches (1,438), pears (10,190), plums & prunes (478), filberts (6), walnuts (11)	215,272	2,749,514

Table 28. Crops on which chlorpyrifos can be used in counties in the migration corridor of the Middle Columbia River steelhead ESU.

State	County	Crops and acreage planted	Acres	Total acreage
OR	Clackamas	corn (14), wheat (1,783), grass seed (9,829), alfalfa (1,072), snap beans (334), broccoli (184), cabbage (72), cauliflower (319), dry onions, radishes (144), turnips, apples (167), cherries (53), grapes (207), peaches (78), pears (37), plums & prunes (37), filberts (3,994), walnuts (51), strawberries (608)	18,983	1,195,712
OR	Clatsop	alfalfa, apples	0	529,482
OR	Columbia	corn (48), wheat, alfalfa (421), apples (39), cherries (7), grapes (6), peaches, pears (12), plums & prunes (2), filberts, walnuts (11), other nuts, strawberries (6)	552	420,332
OR	Hood River	wheat, alfalfa (443), broccoli, apples (2,592), cherries (1,081), grapes (63), peaches (13), pears (11,788)	15,980	334,328

State	County	Crops and acreage planted	Acres	Total acreage
OR	Multnomah	wheat (1,688), grass seed, alfalfa (389), broccoli (29), cabbage (459), carrots, cauliflower (55), turnips, apples (51), cherries (8), grapes (28), peaches (36), pears (25), plums & prunes (3), walnuts (2), other nuts, strawberries (171)	2,944	278,570
WA	Clark	grass seed, alfalfa (836), snap beans (2), cabbage, apples (33), cherries, grapes (32), peaches (46), pears (75), plums & prunes (10), filberts (87), walnuts (51), strawberries (162), mint	1,334	401,850
WA	Cowlitz	wheat (293), alfalfa (105), snap beans (1), carrots, apples (14), cherries (2), grapes, pears (3), filberts (1), walnuts (5), strawberries	424	728,781
WA	Pacific	alfalfa (110), apples, cherries, grapes	110	623,722
WA	Skamania	alfalfa (164), apples (75), grapes, pears (477), other nuts (4)	720	1,337,179
WA	Wahkiakum	alfalfa	0	169,125

There is a large acreage of crops in the counties containing this ESU on which chlorpyrifos is likely to be used. The counties containing habitat for the Middle Columbia River steelhead contain 132,000 acres of apples, 21,000 acres of pears, and 24,000 acres of cherries, as well as 34,000 acres of mint, sugarbeets, and dry onions. The counties containing the migration corridor have much lower acreage of crops on which chlorpyrifos is likely to be used, except for 12,000 acres of pears in Hood River County. Depending on the location of crops relative to the habitat of the steelhead, the use of chlorpyrifos in this county may affect the Middle Columbia River steelhead ESU.

(b) Chinook salmon

Chinook salmon *(Oncorhynchus tshawytscha)* is the largest salmon species; adults weighing over 120 pounds have been caught in North American waters. Like other Pacific salmon, chinook salmon are anadromous and die after spawning.

Juvenile stream-and ocean-type chinook salmon have adapted to different ecological niches. Ocean-type chinook salmon, commonly found in coastal streams, tend to utilize estuaries and coastal areas more extensively for juvenile rearing. They typically migrate to sea within the first three months of emergence and spend their ocean life in coastal waters. Summer and fall runs predominate for ocean-type chinook. Stream-type chinook are found most commonly in headwater streams and are much more dependent on freshwater stream ecosystems because of their extended residence in these areas. They often have extensive offshore migrations before returning to their natal streams in the spring or summer months. Stream-type smolts are much larger than their younger ocean-type counterparts and are therefore able to move offshore relatively quickly.

Coastwide, chinook salmon typically remain at sea for 2 to 4 years, with the exception of a small proportion of yearling males (called jack salmon) which mature in freshwater or return after 2 or 3 months in salt water. Ocean-type chinook salmon tend to migrate along the coast, while stream-type chinook salmon are found far from the coast in the central North Pacific. They return to their natal streams with a high degree of fidelity. Seasonal "runs" (i.e., spring, summer, fall, or winter), which may be related to local temperature and water flow regimes, have been identified on the basis of when adult chinook salmon enter freshwater to begin their spawning migration. Egg deposition must occur at a time to ensure that fry emerge during the following spring when the river or estuary productivity is sufficient for juvenile survival and growth.

Adult female chinook will prepare a spawning bed, called a redd, in a stream area with suitable gravel composition, water depth and velocity. After laying eggs in a redd, adult chinook will guard the redd from 4 to 25 days before dying. Chinook salmon eggs will hatch, depending upon water temperatures, between 90 to 150 days after deposition. Juvenile chinook may spend from 3 months to 2 years in freshwater after emergence and before migrating to estuarine areas as smolts, and then into the ocean to feed and mature. Historically, chinook salmon ranged as far south as the Ventura River, California, and their northern extent reaches the Russian Far East.

(1) Sacramento River Winter-run Chinook Salmon ESU

The Sacramento River Winter-run chinook was emergency listed as threatened with critical habitat designated in 1989 (54FR32085-32088, August 4, 1989). This emergency listing provided interim protection and was followed by (1) a proposed rule to list the winter-run on March 20, 1990, (2) a second emergency rule on April 20, 1990, and (3) a formal listing on November 20, 1990 (59FR440-441, January 4, 1994). A somewhat expanded critical habitat was proposed in 1992 (57FR36626-36632, August 14, 1992) and made final in 1993 (58FR33212-33219, June 16, 1993). In 1994, the winter-run was reclassified as endangered because of significant declines and continued threats (59FR440-441, January 4, 1994).

Critical Habitat has been designated to include the Sacramento River from Keswick Dam, Shasta County (river mile 302) to Chipps Island (river mile 0) at the west end of the Sacramento-San Joaquin delta, and then westward through most of the fresh or estuarine waters, north of the Oakland Bay Bridge, to the ocean. Estuarine sloughs in San Pablo and San Francisco bays (including San Mateo county) are excluded (58FR33212-33219, June 16, 1993).

Table 29 shows the chlorpyrifos usage in California counties supporting the Sacramento River winter-run chinook salmon ESU.

Table 29. Use of chlorpyrifos in counties with the Sacramento River winter-run chinook salmon ESU.

County	Crop	Usage (pounds)	Acres treated
Alameda	none > 100 lb		
Butte	alfalfa	342	645

County	Crop	Usage (pounds)	Acres treated
	almond	3,886	2,529
	orange	113	97
	peach	211	142
	prune	269	205
	walnut	18,536	10,019
Colusa	alfalfa	613	1,189
	almond	974	696
	cotton	2,880	3,373
	walnut	1,543	834
Contra Costa	asparagus	133	133
Glenn	alfalfa	1,548	2,796
	almond	3,754	2,327
	cotton	951	1,029
	orange	233	110
	sunflower	146	279
	walnut	6,488	3,771
Marin	none > 100 lb		
Napa	none > 100 lb		
Sacramento	alfalfa	1,632	2,325
	apple	326	162
	corn	180	181
	pear	696	348
	walnut	181	119
~~San Mateo~~	~~brussel sprout~~	~~1,816~~	~~2,257~~
San Francisco	none > 100 lb		
Shasta	mint	249	189
	turf/sod	324	320
	walnut	352	175
Solano	alfalfa	1,710	2,974
	almond	506	287
	grass, seed	705	231
	sorghum/milo	238	355
	sunflower	172	133
	walnut	2,768	1,514
Sonoma	apple	1,380	1,408
Sutter	alfalfa	547	1,143
	bean, dried	981	2,878 tons
	cabbage	104	133
	peach	610	376
	walnut	16,541	8,806
Tehama	alfalfa	553	863
	almond	2,704	1,422
	prune	107	160
	walnut	7,847	4,514

County	Crop	Usage (pounds)	Acres treated
Yolo	alfalfa	7,657	14,996
	almond	267	157
	cotton	699	751
	pear	143	96
	sorghum/milo	260	330
	walnut	5,005	2,869
Yuba	peach	160	80
	pear	268	162
	prune	540	285
	walnut	6,022	3,075

There is fairly high use of chlorpyrifos on orchards in several counties for this ESU, as well as alfalfa in Yolo County and others. Depending on the location of these crops relative to the habitat of the fish, the use of chlorpyrifos may affect the Sacramento River winter run chinook salmon.

(2) Snake River Fall-run Chinook Salmon ESU

The Snake River fall-run chinook salmon ESU was proposed as threatened in 1991 (56FR29547-29552, June 27, 1991) and listed about a year later (57FR14653-14663, April 22, 1992). Critical habitat was designated on December 28, 1993 (58FR68543-68554) to include all tributaries of the Snake and Salmon Rivers accessible to Snake River fall-run chinook salmon, except reaches above impassable natural falls and Dworshak and Hells Canyon Dams. The Clearwater River and Palouse River watersheds are included for the fall-run ESU, but not for the spring/summer run. This chinook ESU was proposed for reclassification on December 28, 1994 (59FR66784-57403) as endangered because of critically low levels, based on very sparse runs. However, because of increased runs in subsequent year, this proposed reclassification was withdrawn (63FR1807-1811, January 12, 1998).

In 1998, NMFS proposed to revise the Snake River fall-run chinook to include those stocks using the Deschutes River (63FR11482-11520, March 9, 1998). The John Day, Umatilla, and Walla Walla Rivers would be included; however, fall-run chinook in these rivers are believed to have been extirpated. It appears that this proposal has yet to be finalized. We have not included these counties here; however, the Middle Columbia River steelhead ESU encompasses these basins, and crop information is presented in that section of this analysis.

Hydrologic units with spawning and rearing habitat for this fall-run chinook are the Clearwater, Hells Canyon, Imnaha, Lower Grande Ronde, Lower North Fork Clearwater, Lower Salmon, Lower Snake-Asotin, Lower Snake-Tucannon, and Palouse. These units are in Wasco, Jefferson, Sherman, Gilliam, Wheeler, Morrow, ~~Baker~~, Umatilla, Grant, Wallowa, and Union counties in Oregon; Adams, Asotin, Benton, Columbia, Franklin, Garfield, Klickitat, Lincoln, Spokane, Walla Walla, Whitman, and Yakima counties in Washington; and Adams, Benewah, Clearwater, Idaho, Latah, Lewis, Nez Perce, Shoshone, and Valley counties in Idaho. Wasco, Jefferson, Sherman, Gilliam, Wheeler, Morrow, Umatilla, and Grant Counties were included to encompass the more recent definition including the Deschutes and John Day Rivers. However, several counties with at most a sliver of overlap were excluded: Union County in Oregon; Shoshone, Valley, and Benewah Counties in Idaho; and Adams, Lincoln, and Spokane Counties in Washington. The migratory corridor of Snake River fall-run chinook includes Wasco, Hood River, Clackamas, Multnomah, Columbia, and Clatsop Counties in Oregon, and Klickitat, Yakima, Skamania, Clark, Cowlitz, Wahkiakum, and Pacific Counties in Washington.

Table 30 and Table 31 show the cropping information for Pacific Northwest counties where the Snake River fall-run chinook salmon ESU is located and for the Oregon and Washington counties where this ESU migrates. In these tables, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 30. Crops on which chlorpyrifos can be used in counties containing spawning and rearing habitat for the Snake River fall-run chinook salmon ESU.

State	County	Crops and acreage planted	Acres	Total acreage
ID	Adams	corn (104), wheat (200), alfalfa (9,223), apples	9,527	873,399
~~ID~~	~~Benewah~~	~~wheat (29,431), grass seed, alfalfa (983), apples (6)~~	~~30,420~~	~~496,662~~
ID	Clearwater	wheat (9,106), grass seed (839), alfalfa (2,640)	12,585	1,575,396
ID	Idaho	wheat (62,283), grass seed, alfalfa (20,266), apples (6), cherries (2), grapes (1), peaches, pears (2), plums & prunes (2), filberts	82,562	5,430,522
ID	Latah	wheat (90,706), grass seed (3,161), alfalfa (7,202), apples (3), cherries (19), pears	101,091	689,089
ID	Lewis	wheat (64,367), grass seed, alfalfa (3,885)	68,252	306,601
ID	Nez Perce	corn, wheat (89,990), grass seed (5,739), alfalfa (6,262), apples (9), apricots (1), cherries (4), peaches (22)	102,027	543,434
~~ID~~	~~Shoshone~~	~~alfalfa (167)~~	~~167~~	~~1,685,770~~
~~ID~~	~~Valley~~	~~wheat (652), alfalfa (1,599), carrots~~	~~2,251~~	~~2,354,043~~
OR	Gilliam	wheat (95,584), alfalfa (2,450)	98,034	770,664
OR	Grant	wheat (579), alfalfa (11,296), apples, apricots (19), pears	11,894	2,898,444
OR	Jefferson	wheat (12,470), sugarbeets (2,396), grass seed (9,627), alfalfa (10,944), apples (4), mint (3,105)	38,546	1,139,744
OR	Morrow	corn (9,276), wheat (167,070), sugarbeets, grass seed (1,113), alfalfa (22,180), dry onions (1,284), apples	200,923	1,301,021
OR	Sherman	wheat (99,837), alfalfa (230)	100,067	526,911

State	County	Crops and acreage planted	Acres	Total acreage
OR	Umatilla	corn (6,901), wheat (263,624), grass seed (10,064), alfalfa (24,013), asparagus (1,093), snap beans (587), dry onions (3,914), apples (3,927), apricots (14), cherries (349), grapes (163), nectarines, peaches (7), pears (4), plums & prunes (365), strawberries (9), mint	315,034	2,057,809
~~OR~~	~~Union~~	~~wheat (36,394), sugarbeets (1,035), grass seed (7,236), alfalfa (25,818), carrots, apples (39), apricots, cherries (596), peaches (12), pears, plums & prunes, mint (9,226)~~	~~80,356~~	~~1,303,476~~
OR	Wallowa	wheat (14,502), grass seed (189), alfalfa (18,253), apples (8), peaches	32,952	2,013,071
OR	Wasco	wheat (63,369), grass seed (169), alfalfa (7,239), apples (463), apricots (32), cherries (7,352), grapes (110), peaches (30), pears (385), plums & prunes, strawberries	79,149	1,523,958
OR	Wheeler	wheat, alfalfa (5,494), apples (23)	5,517	1,097,601
~~WA~~	~~Adams~~	~~corn (5,388), wheat (303,813), sugarbeets (1,570), grass seed (7,487), alfalfa (22,350), asparagus (422), snap beans (102), dry onions (1,453), apples (3,457), cherries, grapes, pears, mint (7,328)~~	~~353,370~~	~~1,231,999~~
WA	Asotin	wheat (21,110), grass seed (1,136), alfalfa (1,648), apples (24), apricots (5), cherries (17), peaches (18), pears (6)	23,964	406,983
WA	Benton	corn, wheat (130,981), sugarbeets (4,284), grass seed, alfalfa (13,241), asparagus (1,638), dry onions (3,398), apples (18,425), apricots (174), cherries (3,219), grapes (15,929), nectarines (106), peaches (149), pears (472), plums & prunes (180), walnuts (41), mint	192,237	1,089,993
WA	Columbia	corn (51), wheat (77,511), grass seed (253), alfalfa (1,780), apples	79,595	556,034
WA	Franklin	corn (11,337), wheat (109,627), sunflower (698), sugarbeets, grass seed, alfalfa (70,943), asparagus (8,610), snap beans (236), carrots (3,574), dry onions (4,074), apples (9,000), apricots (68), cherries (2,165), grapes (2,813), nectarines (129), peaches (262), pears (156), plums & prunes (43), walnuts, strawberries (17), mint (1,586)	225,338	794,999
WA	Garfield	wheat (71,689), grass seed (2,830), alfalfa (802)	75,321	454,744

State	County	Crops and acreage planted	Acres	Total acreage
WA	Klickitat	wheat (40,401), grass seed, alfalfa (28,434), cabbage, apples (516), apricots (18), cherries (457), grapes (419), peaches (199), pears (923), plums & prunes (1), walnuts	71,368	1,198,385
~~WA~~	~~Lincoln~~	~~corn (564), wheat (355,317), sugarbeets, grass seed (1,676), alfalfa (15,972), carrots, apples, cherries (1)~~	~~373,350~~	~~1,479,196~~
~~WA~~	~~Spokane~~	~~corn, wheat (115,324), grass seed (22,657), alfalfa (35,493), snap beans, carrots (34), dry onions, apples (227), apricots (11), cherries (50), grapes (3), pears (24), plums & prunes (1), strawberries (30)~~	~~173,854~~	~~1,128,835~~
WA	Walla Walla	corn (6,539), wheat (232,419), grass seed (8,233), alfalfa (11,787), asparagus (1,414), snap beans (250), cabbage (6), carrots, dry onions (2,172), radishes, apples (5,222), cherries (280), grapes, plums & prunes (22)	268,344	813,108
WA	Whitman	corn (101), wheat (478,098), grass seed (4,251), alfalfa (6,644), apples (19), cherries, pears (2), mint (12,577)	501,692	1,382,006
WA	Yakima	corn (12,680), wheat (50,430), grass seed (1,070), alfalfa (33,833), asparagus (7,034), snap beans (106), cabbage (144), dry onions, turnips (40), apples (75,264), apricots (285), cherries (6,129), grapes (15,529), nectarines (605), peaches (1,438), pears (10,190), plums & prunes (478), filberts (6), walnuts (11)	215,272	2,749,514

Table 31. Crops on which chlorpyrifos can be used in counties in the migration corridor of the Snake River fall-run chinook salmon and the Snake River spring-summer-run chinook salmon ESUs.

State	County	Crops and acreage planted	Acres	Total acreage
OR	Clackamas	corn (14), wheat (1,783), grass seed (9,829), alfalfa (1,072), snap beans (334), broccoli (184), cabbage (72), cauliflower (319), dry onions, radishes (144), turnips, apples (167), cherries (53), grapes (207), peaches (78), pears (37), plums & prunes (37), filberts (3,994), walnuts (51), strawberries (608)	18,983	1,195,712
OR	Clatsop	alfalfa, apples	0	529,482

State	County	Crops and acreage planted	Acres	Total acreage
OR	Columbia	corn (48), wheat, alfalfa (421), apples (39), cherries (7), grapes (6), peaches, pears (12), plums & prunes (2), filberts, walnuts (11), other nuts, strawberries (6)	552	420,332
~~OR~~	~~Gilliam~~	~~wheat (95,584), alfalfa (2,450)~~	~~98,034~~	~~770,664~~
OR	Hood River	wheat, alfalfa (443), broccoli, apples (2,592), cherries (1,081), grapes (63), peaches (13), pears (11,788)	15,980	334,328
~~OR~~	~~Morrow~~	~~corn (9,276), wheat (167,070), sugarbeets, grass seed (1,113), alfalfa (22,180), dry onions (1,284), apples~~	~~200,923~~	~~1,301,021~~
OR	Multnomah	wheat (1,688), grass seed, alfalfa (389), broccoli (29), cabbage (459), carrots, cauliflower (55), turnips, apples (51), cherries (8), grapes (28), peaches (36), pears (25), plums & prunes (3), walnuts (2), other nuts, strawberries (171)	2,944	278,570
~~OR~~	~~Sherman~~	~~wheat (99,837), alfalfa (230)~~	~~100,067~~	~~526,911~~
~~OR~~	~~Umatilla~~	~~corn (6,901), wheat (263,624), grass seed (10,064), alfalfa (24,013), asparagus (1,093), snap beans (587), dry onions (3,914), apples (3,927), apricots (14), cherries (349), grapes (163), nectarines, peaches (7), pears (4), plums & prunes (365), strawberries (9), mint~~	~~315,034~~	~~2,057,809~~
OR	Wasco	wheat (63,369), grass seed (169), alfalfa (7,239), apples (463), apricots (32), cherries (7,352), grapes (110), peaches (30), pears (385), plums & prunes, strawberries	79,149	1,523,958
~~WA~~	~~Benton~~	~~corn, wheat (130,981), sugarbeets (4,284), grass seed, alfalfa (13,241), asparagus (1,638), dry onions (3,398), apples (18,425), apricots (174), cherries (3,219), grapes (15,929), nectarines (106), peaches (149), pears (472), plums & prunes (180), walnuts (41), mint~~	~~192,237~~	~~1,089,993~~
WA	Clark	grass seed, alfalfa (836), snap beans (2), cabbage, apples (33), cherries, grapes (32), peaches (46), pears (75), plums & prunes (10), filberts (87), walnuts (51), strawberries (162), mint	1,334	401,850
WA	Cowlitz	wheat (293), alfalfa (105), snap beans (1), carrots, apples (14), cherries (2), grapes, pears (3), filberts (1), walnuts (5), strawberries	424	728,781

State	County	Crops and acreage planted	Acres	Total acreage
WA	Klickitat	wheat (40,401), grass seed, alfalfa (28,434), cabbage, apples (516), apricots (18), cherries (457), grapes (419), peaches (199), pears (923), plums & prunes (1), walnuts	71,368	1,198,385
WA	Pacific	alfalfa (110), apples, cherries, grapes	110	623,722
WA	Skamania	alfalfa (164), apples (75), grapes, pears (477), other nuts (4)	720	1,337,179
WA	Wahkiakum	alfalfa	0	169,125
~~WA~~	~~Walla Walla~~	~~corn (6,539), wheat (232,419), grass seed (8,233), alfalfa (11,787), asparagus (1,414), snap beans (250), cabbage (6), carrots, dry onions (2,172), radishes, apples (5,222), cherries (280), grapes, plums & prunes (22)~~	~~268,344~~	~~813,108~~
WA	Yakima	corn (12,680), wheat (50,430), grass seed (1,070), alfalfa (33,833), asparagus (7,034), snap beans (106), cabbage (144), dry onions, turnips (40), apples (75,264), apricots (285), cherries (6,129), grapes (15,529), nectarines (605), peaches (1,438), pears (10,190), plums & prunes (478), filberts (6), walnuts (11)	215,272	2,749,514

There is a large acreage of crops in the counties containing this ESU on which chlorpyrifos is likely to be used. The counties containing spawning and rearing habitat for the Snake River Fall-Run chinook contain 112,000 acres of apples, 20,000 acres of cherries, 17,000 acres of mint, 7,000 acres of sugarbeet, and 15,000 acres of dry onions. The counties containing the migration corridor also have 118,000 acres of orchards. Depending on the location of crops relative to the habitat of the salmon, the use of chlorpyrifos in this county may affect the Snake River Fall-Run chinook ESU.

(3) Snake River Spring/Summer-run Chinook Salmon

The Snake River Spring/Summer-run chinook salmon ESU was proposed as threatened in 1991 (56FR29542-29547, June 27, 1991) and listed about a year later (57FR14653-14663, April 22, 1992). Critical habitat was designated on December 28, 1993 (58FR68543-68554) to include all tributaries of the Snake and Salmon Rivers (except the Clearwater River) accessible to Snake River spring/summer chinook salmon. Like the fall-run chinook, the spring/summer-run chinook ESU was proposed for reclassification on December 28, 1994 (59FR66784-57403) as endangered because of critically low levels, based on very sparse runs. However, because of increased runs in subsequent year, this proposed reclassification was withdrawn (63FR1807-1811, January 12, 1998).

Hydrologic units in the potential spawning and rearing areas include Hells Canyon, Imnaha, Lemhi, Little Salmon, Lower Grande Ronde, Lower Middle Fork Salmon, Lower Salmon, Lower Snake-Asotin, Lower Snake-Tucannon, Middle Salmon-Chamberlain, Middle Salmon-Panther, Pahsimerol, South Fork Salmon, Upper Middle Fork Salmon, Upper Grande Ronde, Upper Salmon, and Wallowa. Areas above Hells Canyon Dam are excluded, along with unnamed "impassable natural falls." Napias Creek Falls, near Salmon, Idaho, was later named an upstream barrier (64FR57399-57403, October 25, 1999). The Grande Ronde, Imnaha, Salmon, and Tucannon subbasins, and Asotin, Granite, and Sheep Creeks were specifically named in the Critical Habitat Notice.

Spawning and rearing counties mentioned in the Critical Habitat Notice include Union, Umatilla, and Wallowa~~, and Baker~~ counties in Oregon; Adams, Blaine, Custer, Idaho, Latah, Lemhi, Lewis, and Nez Perce~~, and Valley~~ counties in Idaho; and Asotin, Benton, Columbia, Franklin, Garfield, Walla Walla, and Whitman counties in Washington. We have excluded Umatilla ~~and Baker~~ County in Oregon and Blaine County in Idaho because accessible river reaches are all well above areas where chlorpyrifos can be used. Latah County, Idaho was excluded because it is north of the habitat. Benton County, Washington was excluded from the spawning and rearing counties because there is a very small overlap, but was included in the migratory corridor. Other counties with migratory corridors are all of those down stream from the confluence of the Snake and Columbia Rivers: Umatilla, Morrow, Gilliams, Sherman, Wasco, Hood River, Clackamas, Multnomah, Columbia, and Clatsop Counties in Oregon, and Walla Walla, Yakima, Klickitat, Skamania, Clark, Cowlitz, Wahkiakum, and Pacific Counties in Washington.

Table 32 shows the crop-acreage information for Oregon and Washington counties where the Snake River spring/summer-run chinook salmon ESU occurs. The cropping information for the migratory corridors is shown in Table 33. If there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 32. Crops on which chlorpyrifos can be used in counties containing spawning and rearing habitat for the Snake River spring-summer-run chinook salmon ESU.

State	County	Crops and acreage planted	Acres	Total acreage
ID	Adams	corn (104), wheat (200), alfalfa (9,223), apples	9,527	873,399
ID	Custer	wheat (645), alfalfa (24,467)	25,112	3,152,382
ID	Idaho	wheat (62,283), grass seed, alfalfa (20,266), apples (6), cherries (2), grapes (1), peaches, pears (2), plums & prunes (2), filberts	82,562	5,430,522
~~ID~~	~~Latah~~	~~wheat (90,706), grass seed (3,161), alfalfa (7,202), apples (3), cherries (19), pears~~	~~101,091~~	~~689,089~~
ID	Lemhi	alfalfa (28,143), apples (6), apricots, cherries (9), peaches (3), pears (2)	28,163	2,921,172
ID	Lewis	wheat (64,367), grass seed, alfalfa (3,885)	68,252	306,601
ID	Nez Perce	corn, wheat (89,990), grass seed (5,739), alfalfa (6,262), apples (9), apricots (1), cherries (4), peaches (22)	102,027	543,434
ID	Valley	wheat (652), alfalfa (1,599), carrots	2,251	2,354,043

State	County	Crops and acreage planted	Acres	Total acreage
OR	Union	wheat (36,394), sugarbeets (1,035), grass seed (7,236), alfalfa (25,818), carrots, apples (39), apricots, cherries (596), peaches (12), pears, plums & prunes, mint (9,226)	80,356	1,303,476
OR	Wallowa	wheat (14,502), grass seed (189), alfalfa (18,253), apples (8), peaches	32,952	2,013,071
WA	Adams	corn (5,388), wheat (303,813), sugarbeets (1,570), grass seed (7,487), alfalfa (22,350), asparagus (422), snap beans (102), dry onions (1,453), apples (3,457), cherries, grapes, pears, mint (7,328)	353,370	1,231,999
WA	Asotin	wheat (21,110), grass seed (1,136), alfalfa (1,648), apples (24), apricots (5), cherries (17), peaches (18), pears (6)	23,964	406,983
~~WA~~	~~Benton~~	~~corn, wheat (130,981), sugarbeets (4,284), grass seed, alfalfa (13,241), asparagus (1,638), dry onions (3,398), apples (18,425), apricots (174), cherries (3,219), grapes (15,929), nectarines (106), peaches (149), pears (472), plums & prunes (180), walnuts (41), mint~~	~~192,237~~	~~1,089,993~~
WA	Columbia	corn (51), wheat (77,511), grass seed (253), alfalfa (1,780), apples	79,595	556,034
WA	Franklin	corn (11,337), wheat (109,627), sunflower (698), sugarbeets, grass seed, alfalfa (70,943), asparagus (8,610), snap beans (236), carrots (3,574), dry onions (4,074), apples (9,000), apricots (68), cherries (2,165), grapes (2,813), nectarines (129), peaches (262), pears (156), plums & prunes (43), walnuts, strawberries (17), mint (1,586)	225,338	794,999
WA	Garfield	wheat (71,689), grass seed (2,830), alfalfa (802)	75,321	454,744
WA	Walla Walla	corn (6,539), wheat (232,419), grass seed (8,233), alfalfa (11,787), asparagus (1,414), snap beans (250), cabbage (6), carrots, dry onions (2,172), radishes, apples (5,222), cherries (280), grapes, plums & prunes (22)	268,344	813,108
WA	Whitman	corn (101), wheat (478,098), grass seed (4,251), alfalfa (6,644), apples (19), cherries, pears (2), mint (12,577)	501,692	1,382,006

Table 33. Crops on which chlorpyrifos can be used in counties in the migration corridor of the Snake River spring-summer-run chinook salmon ESU.

State	County	Crops and acreage planted	Acres	Total acreage
OR	Clackamas	corn (14), wheat (1,783), grass seed (9,829), alfalfa (1,072), snap beans (334), broccoli (184), cabbage (72), cauliflower (319), dry onions, radishes (144), turnips, apples (167), cherries (53), grapes (207), peaches (78), pears (37), plums & prunes (37), filberts (3,994), walnuts (51), strawberries (608)	18,983	1,195,712
OR	Clatsop	alfalfa, apples	0	529,482
OR	Columbia	corn (48), wheat, alfalfa (421), apples (39), cherries (7), grapes (6), peaches, pears (12), plums & prunes (2), filberts, walnuts (11), other nuts, strawberries (6)	552	420,332
OR	Gilliam	wheat (95,584), alfalfa (2,450)	98,034	770,664
OR	Hood River	wheat, alfalfa (443), broccoli, apples (2,592), cherries (1,081), grapes (63), peaches (13), pears (11,788)	15,980	334,328
OR	Morrow	corn (9,276), wheat (167,070), sugarbeets, grass seed (1,113), alfalfa (22,180), dry onions (1,284), apples	200,923	1,301,021
OR	Multnomah	wheat (1,688), grass seed, alfalfa (389), broccoli (29), cabbage (459), carrots, cauliflower (55), turnips, apples (51), cherries (8), grapes (28), peaches (36), pears (25), plums & prunes (3), walnuts (2), other nuts, strawberries (171)	2,944	278,570
OR	Sherman	wheat (99,837), alfalfa (230)	100,067	526,911
OR	Umatilla	corn (6,901), wheat (263,624), grass seed (10,064), alfalfa (24,013), asparagus (1,093), snap beans (587), dry onions (3,914), apples (3,927), apricots (14), cherries (349), grapes (163), nectarines, peaches (7), pears (4), plums & prunes (365), strawberries (9), mint	315,034	2,057,809
OR	Wasco	wheat (63,369), grass seed (169), alfalfa (7,239), apples (463), apricots (32), cherries (7,352), grapes (110), peaches (30), pears (385), plums & prunes, strawberries	79,149	1,523,958
WA	Benton	corn, wheat (130,981), sugarbeets (4,284), grass seed, alfalfa (13,241), asparagus (1,638), dry onions (3,398), apples (18,425), apricots (174), cherries (3,219), grapes (15,929), nectarines (106), peaches (149), pears (472), plums & prunes (180), walnuts (41), mint	192,237	1,089,993

State	County	Crops and acreage planted	Acres	Total acreage
WA	Clark	grass seed, alfalfa (836), snap beans (2), cabbage, apples (33), cherries, grapes (32), peaches (46), pears (75), plums & prunes (10), filberts (87), walnuts (51), strawberries (162), mint	1,334	401,850
WA	Cowlitz	wheat (293), alfalfa (105), snap beans (1), carrots, apples (14), cherries (2), grapes, pears (3), filberts (1), walnuts (5), strawberries	424	728,781
WA	Klickitat	wheat (40,401), grass seed, alfalfa (28,434), cabbage, apples (516), apricots (18), cherries (457), grapes (419), peaches (199), pears (923), plums & prunes (1), walnuts	71,368	1,198,385
WA	Pacific	alfalfa (110), apples, cherries, grapes	110	623,722
WA	Skamania	alfalfa (164), apples (75), grapes, pears (477), other nuts (4)	720	1,337,179
WA	Wahkiakum	alfalfa	0	169,125
WA	Walla Walla	corn (6,539), wheat (232,419), grass seed (8,233), alfalfa (11,787), asparagus (1,414), snap beans (250), cabbage (6), carrots, dry onions (2,172), radishes, apples (5,222), cherries (280), grapes, plums & prunes (22)	268,344	813,108
WA	Yakima	corn (12,680), wheat (50,430), grass seed (1,070), alfalfa (33,833), asparagus (7,034), snap beans (106), cabbage (144), dry onions, turnips (40), apples (75,264), apricots (285), cherries (6,129), grapes (15,529), nectarines (605), peaches (1,438), pears (10,190), plums & prunes (478), filberts (6), walnuts (11)	215,272	2,749,514

There is a large acreage of crops in the counties containing this ESU on which chlorpyrifos is likely to be used. The counties containing habitat for the Snake River Spring-Summer-Run chinook contain 23,000 acres of apples, 3,000 acres of cherries, 31,000 acres of mint, 3,000 acres of sugarbeet, and 10,000 acres of dry onions. The counties containing the migration corridor also have 150,000 acres of orchards and 15,000 acres of sugarbeets and dry onions. Depending on the location of crops relative to the habitat of the salmon, the use of chlorpyrifos in this county may affect the Snake River Spring-Summer-Run chinook ESU.

(4) Central Valley Spring-run Chinook Salmon ESU

The Central Valley Spring-run chinook salmon ESU was proposed as threatened in 1998 (63FR11482-11520, March 9, 1998) and listed on September 16, 1999 (64FR50393-50415). Critical habitat was designated February 16, 2000 (65FR7764-7787) to encompass all river reaches accessible to listed chinook salmon in the Sacramento River and its tributaries in

California, along with the downstream river reaches into San Francisco Bay, north of the Oakland Bay Bridge, and to the Golden Gate Bridge.

Hydrologic units and upstream barriers within this ESU are the Sacramento-Lower Cow-Lower Clear, Lower Cottonwood, Sacramento-Lower Thomes (upstream barrier - Black Butte Dam), Sacramento-Stone Corral, Lower Butte (upstream barrier - Centerville Dam), Lower Feather (upstream barrier - Oroville Dam), Lower Yuba, Lower Bear (upstream barrier – Camp Far West Dam), Lower Sacramento, Sacramento-Upper Clear (upstream barriers – Keswick Dam, Whiskeytown dam), Upper Elder-Upper Thomes, Upper Cow-Battle, Mill-Big Chico, Upper Butte, Upper Yuba (upstream barrier - Englebright Dam), Suisin Bay, San Pablo Bay, and San Francisco Bay. These areas are in the counties of Shasta, Tehama, Butte, Glenn, Colusa, ~~Sutter,~~ Yolo, Yuba, Placer, Sacramento, Solano, Nevada, Contra Costa, Solano, Napa, Alameda, Marin, Sonoma, San Mateo, San Francisco, and Santa Clara.

Table 34 contains usage information for the California counties supporting the Central Valley spring-run chinook salmon ESU.

Table 34. Use of chlorpyrifos in counties with the Central Valley spring-run chinook salmon ESU.

County	Crop	Usage (pounds)	Acres treated
Shasta	mint	249	189
	turf/sod	324	320
	walnut	352	175
Tehama	alfalfa	553	863
	almond	2,704	1,422
	prune	107	160
	walnut	7,847	4,514
Butte	alfalfa	342	645
	almond	3,886	2,529
	orange	113	97
	peach	211	142
	prune	269	205
	walnut	18,536	10,019
Glenn	alfalfa	1,548	2,796
	almond	3,754	2,327
	cotton	951	1,029
	orange	233	110
	sunflower	146	279
	walnut	6,488	3,771
Colusa	alfalfa	613	1,189
	almond	974	696
	cotton	2,880	3,373
	walnut	1,543	834
~~Sutter~~	~~alfalfa~~	~~547~~	~~1,143~~
	~~bean, dried~~	~~981~~	~~2,878 tons~~

County	Crop	Usage (pounds)	Acres treated
	~~cabbage~~	~~104~~	~~133~~
	~~peach~~	~~610~~	~~376~~
	~~walnut~~	~~16,541~~	~~8,806~~
Yolo	alfalfa	7,657	14,996
	almond	267	157
	cotton	699	751
	pear	143	96
	sorghum/milo	260	330
	walnut	5,005	2,869
Yuba	peach	160	80
	pear	268	162
	prune	540	285
	walnut	6,022	3,075
Placer	none > 100 lb		
Sacramento	alfalfa	1,632	2,325
	apple	326	162
	corn	180	181
	pear	696	348
	walnut	181	119
Solano	alfalfa	1,710	2,974
	almond	506	287
	grass, seed	705	231
	sorghum/milo	238	355
	sunflower	172	133
	walnut	2,768	1,514
Nevada	none > 100 lb		
Contra Costa	asparagus	133	133
Napa	none > 100 lb		
Alameda	none > 100 lb		
Marin	none > 100 lb		
Sonoma	apple	1,380	1,408
San Mateo	brussel sprout	1,816	2,257
San Francisco	none > 100 lb		
Santa Clara	apple	24	16

There is considerable use of chlorpyrifos on orchards in the area supporting this ESU, especially in the upper Sacramento Valley (Glenn, Butte, Sutter, Yuba, and Yolo Counties). Depending on the location of these orchards relative to the habitat of the fish, the use of chlorpyrifos may affect the Central Valley spring run chinook salmon ESU.

(5) California Coastal Chinook Salmon ESU
The California coastal chinook salmon ESU was proposed as threatened in 1998 (63FR11482-11520, March 9, 1998) and listed on September 16, 1999 (64FR50393-50415). Critical habitat was designated February 16, 2000 (65FR7764-7787) to encompass all river reaches and estuarine areas accessible to listed chinook salmon from Redwood Creek (Humboldt County, California) to the Russian River (Sonoma County, California), inclusive.

The hydrologic units and upstream barriers are Mad-Redwood, Upper Eel (upstream barrier - Scott Dam), Middle Fort Eel, Lower Eel, South Fork Eel, Mattole, Big-Navarro-Garcia, Gualala-Salmon, Russian (upstream barriers - Coyote Dam; Warm Springs Dam), and Bodega Bay. Counties with agricultural areas where pesticides could be used are Humboldt, Trinity, Mendocino, Sonoma, and Marin. A small portion of Glenn County is also included in the Critical Habitat, but chlorpyrifos would not be used in the forested upper elevation areas. A small portion of Lake County contains habitat for this ESU, but is entirely within the Mendocino National Forest.

Table 35 contains usage information for the California counties supporting the California coastal chinook salmon ESU.

Table 35. Use of chlorpyrifos in counties with the California coastal chinook salmon ESU.

County	Crop	Usage (pounds)	Acres treated
Humboldt	none > 100 lb		
Trinity	none > 100 lb		
Mendocino	apple	225	112
	pear	2,195	1,867
Sonoma	apple	1,380	1,408
Marin	none > 100 lb		

Chlorpyrifos use is low to moderate in the counties where this ESU is found. Depending on the location of apple and pear orchards in Mendocino and Sonoma Counties relative to the habitat of the fish, the use of chlorpyrifos may affect the California coastal chinook salmon ESU.

(6) Puget Sound Chinook Salmon ESU
The Puget Sound chinook salmon ESU was proposed as threatened in 1998 (63FR11482-11520, March 9, 1998) and listed a year later (64FR14308-14328, March 24, 1999). Critical habitat was designated February 16, 2000 (65FR7764-7787) to encompass all marine, estuarine, and river reaches accessible to listed chinook salmon in Puget Sound and its tributaries, extending out to the Pacific Ocean.

The hydrologic units and upstream barriers are the Strait of Georgia, San Juan Islands, Nooksack, Upper Skagit, Sauk, Lower Skagit, Stillaguamish, Skykomish, Snoqualmie (upstream barrier - Tolt Dam), Snohomish, Lake Washington (upstream barrier – Landsburg Diversion), Duwamish, Puyallup, Nisqually (upstream barrier - Alder Dam), Deschutes, Skokomish, Hood

Canal, Puget Sound, Dungeness-Elwha (upstream barrier - Elwha Dam). Affected counties in Washington, apparently all of which could have spawning and rearing habitat, are Skagit, Whatcom, San Juan, Island, Snohomish, King, Pierce, Thurston, Lewis, Grays Harbor, Mason, Clallam, Jefferson, and Kitsap. Grays Harbor County was excluded because all habitat is within the Olympic National Forest.

Table 36 shows the acreage information for Washington counties where the Puget Sound chinook salmon ESU is located. In these tables, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 36. Crops on which chlorpyrifos can be used in counties containing spawning and rearing habitat for the Puget Sound chinook salmon ESU.

State	County	Crops and acreage planted	Acres	Total acreage
~~WA~~	~~Chelan~~	~~wheat (1,864), alfalfa (1,210), apples (17,096), apricots (81), cherries (3,704), nectarines (22), peaches (21), pears (8,298), plums & prunes (3), walnuts~~	~~32,299~~	~~1,869,848~~
WA	Clallam	alfalfa (1,790), carrots, apples (29), cherries (11), grapes (4), pears (1), plums & prunes (1), strawberries (13)	1,849	1,116,900
~~WA~~	~~Grays Harbor~~	~~alfalfa (125), apples (5), cherries (1), grapes, pears, filberts (2)~~	~~133~~	~~1,227,045~~
WA	Island	alfalfa (2,100), apples (18), grapes (14), pears (1), strawberries	2,133	133,499
WA	Jefferson	alfalfa, snap beans, apples (5)	5	1,157,642
WA	King	corn (30), alfalfa (358), snap beans, broccoli (8), cabbage (88), carrots (10), cauliflower, dry onions (4), radishes, turnips (2), apples (64), apricots (1), cherries (8), grapes (2), peaches (1), pears (19), plums & prunes (4), filberts (3), walnuts (3), strawberries (42)	647	1,360,705
WA	Kitsap	alfalfa, snap beans (1), carrots (1), apples (21), cherries (6), grapes (8), pears (4), plums & prunes (4), strawberries (7)	52	253,436
~~WA~~	~~Kittitas~~	~~wheat (5,224), alfalfa (8,571), apples (1,859), cherries, peaches (1), pears (331), plums & prunes (1), filberts (1), mint (409)~~	~~16,397~~	~~1,469,862~~
WA	Lewis	wheat (1,104), alfalfa (937), snap beans, apples (77), cherries (10), grapes (4), pears (8), plums & prunes (3), filberts (25), walnuts (4), other nuts (14), strawberries	2,186	1,540,991
WA	Mason	alfalfa (125), snap beans (2), carrots, apples (5), cherries (1), grapes, pears (1)	134	615,108

State	County	Crops and acreage planted	Acres	Total acreage
WA	Pierce	alfalfa (70), snap beans (200), cabbage (242), carrots, radishes, apples (61), cherries (5), grapes, pears (4), plums & prunes, filberts, strawberries (125)	707	1,072,350
WA	San Juan	alfalfa (170), snap beans, carrots (1), apples (64), cherries (1), grapes (13), peaches (1), pears (5), plums & prunes (2), filberts (2), strawberries (2)	261	11,963
WA	Skagit	wheat (3,477), grass seed, alfalfa (782), snap beans (4), broccoli, carrots (555), apples (357), cherries, grapes, pears (5), plums & prunes, filberts (12), strawberries (281)	5,473	1,110,583
WA	Snohomish	wheat (428), grass seed, alfalfa (235), snap beans (10), broccoli (4), cabbage, carrots (2), cauliflower, apples (47), cherries (3), grapes (1), peaches (42), pears (27), plums & prunes (2), filberts (11), strawberries (81)	893	1,337,728
WA	Thurston	alfalfa (543), snap beans (2), broccoli, cabbage (1), carrots, cauliflower (1), dry onions (1), radishes (1), apples (23), cherries (4), grapes, pears (5), filberts (2), strawberries (74)	657	465,322
WA	Whatcom	corn, wheat (626), alfalfa (708), snap beans (1), broccoli (1), cabbage, apples (174), cherries (4), grapes (10), pears (15), plums & prunes, filberts (206), walnuts (1), strawberries (297)	2,043	1,356,006
~~WA~~	~~Yakima~~	~~corn (12,680), wheat (50,430), grass seed (1,070), alfalfa (33,833), asparagus (7,034), snap beans (106), cabbage (144), dry onions, turnips (40), apples (75,264), apricots (285), cherries (6,129), grapes (15,529), nectarines (605), peaches (1,438), pears (10,190), plums & prunes (478), filberts (6), walnuts (11)~~	~~215,272~~	~~2,749,514~~

The counties containing this ESU include very few acres on which chlorpyrifos is likely to be used, mainly about 1,000 acres of apples spread across 12 counties. Use of chlorpyrifos is unlikely to affect the Puget Sound chinook ESU.

(7) Lower Columbia River Chinook Salmon ESU

The Lower Columbia River chinook salmon ESU was proposed as threatened in 1998 (63FR11482-11520, March 9, 1998) and listed a year later (64FR14308-14328, March 24, 1999). Critical habitat was designated February 16, 2000 (65FR7764-7787) to encompass all river reaches accessible to listed chinook salmon in Columbia River tributaries between the Grays and

White Salmon Rivers in Washington and the Willamette and Hood Rivers in Oregon, inclusive, along with the lower Columbia River reaches to the Pacific Ocean.

The hydrologic units and upstream barriers are the Middle Columbia-Hood (upstream barriers - Condit Dam, The Dalles Dam), Lower Columbia-Sandy (upstream barrier - Bull Run Dam 2), Lewis (upstream barrier - Merlin Dam), Lower Columbia-Clatskanie, Upper Cowlitz, Lower Cowlitz, Lower Columbia, Clackamas, and the Lower Willamette. Spawning and rearing habitat would be in the counties of Hood River, Wasco, Columbia, Clackamas, Marion, Multnomah, and Washington in Oregon, and Klickitat, Skamania, Clark, Cowlitz, Lewis, Wahkiakum, Pacific, Yakima, and Pierce in Washington. Only small parts of Wasco County and Washington County intersect the hydrologic units, and these were excluded from the analysis. The portion of Marion County overlapping with the hydrologic units is totally within the Bull of the Woods Wilderness, Mount Hood National Forest. We have excluded Pierce County, Washington because the very small part of the Cowlitz River watershed in this county is within the Mount Rainier National Park Wilderness. The migration corridors include portions of Clatsop and Columbia Counties in Oregon and Pacific County in Washington.

Table 37 shows the cropping information for Oregon and Washington counties where the Lower Columbia River chinook salmon ESU occurs. In these tables, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 37. Crops on which chlorpyrifos can be used in counties containing spawning and rearing habitat or migration corridor for the Lower Columbia River chinook salmon ESU.

State	County	Crops and acreage planted	Acres	Total acreage
OR	Clackamas	corn (14), wheat (1,783), grass seed (9,829), alfalfa (1,072), snap beans (334), broccoli (184), cabbage (72), cauliflower (319), dry onions, radishes (144), turnips, apples (167), cherries (53), grapes (207), peaches (78), pears (37), plums & prunes (37), filberts (3,994), walnuts (51), strawberries (608)	18,983	1,195,712
OR	Clatsop	alfalfa, apples	0	529,482
OR	Columbia	corn (48), wheat, alfalfa (421), apples (39), cherries (7), grapes (6), peaches, pears (12), plums & prunes (2), filberts, walnuts (11), other nuts, strawberries (6)	552	420,332
OR	Hood River	wheat, alfalfa (443), broccoli, apples (2,592), cherries (1,081), grapes (63), peaches (13), pears (11,788)	15,980	334,328

State	County	Crops and acreage planted	Acres	Total acreage
~~OR~~	~~Marion~~	~~corn (16), wheat (10,341), grass seed (98,930), alfalfa (1,315), snap beans (12,101), broccoli (2,548), cabbage (157), carrots (76), cauliflower (1,505), dry onions (2,036), apples (555), cherries (1,568), grapes (761), nectarines, peaches (179), pears (150), plums & prunes (145), filberts (7,061), walnuts (15), strawberries (1,858), mint (3,695)~~	~~145,012~~	~~758,394~~
OR	Multnomah	wheat (1,688), grass seed, alfalfa (389), broccoli (29), cabbage (459), carrots, cauliflower (55), turnips, apples (51), cherries (8), grapes (28), peaches (36), pears (25), plums & prunes (3), walnuts (2), other nuts, strawberries (171)	2,944	278,570
~~OR~~	~~Wasco~~	~~wheat (63,369), grass seed (169), alfalfa (7,239), apples (463), apricots (32), cherries (7,352), grapes (110), peaches (30), pears (385), plums & prunes, strawberries~~	~~79,149~~	~~1,523,958~~
~~OR~~	~~Washington~~	~~wheat (17,020), grass seed (18,465), alfalfa (1,680), snap beans (988), broccoli (400), cabbage, carrots (1), cauliflower, dry onions (196), apples (279), cherries (211), grapes (989), peaches (168), pears (69), plums & prunes (358), filberts (5,595), walnuts (679), other nuts, strawberries (1,257)~~	~~48,355~~	~~463,231~~
WA	Clark	grass seed, alfalfa (836), snap beans (2), cabbage, apples (33), cherries, grapes (32), peaches (46), pears (75), plums & prunes (10), filberts (87), walnuts (51), strawberries (162), mint	1,334	401,850
WA	Cowlitz	wheat (293), alfalfa (105), snap beans (1), carrots, apples (14), cherries (2), grapes, pears (3), filberts (1), walnuts (5), strawberries	424	728,781
WA	Klickitat	wheat (40,401), grass seed, alfalfa (28,434), cabbage, apples (516), apricots (18), cherries (457), grapes (419), peaches (199), pears (923), plums & prunes (1), walnuts	71,368	1,198,385
WA	Lewis	wheat (1,104), alfalfa (937), snap beans, apples (77), cherries (10), grapes (4), pears (8), plums & prunes (3), filberts (25), walnuts (4), other nuts (14), strawberries	2,186	1,540,991
WA	Pacific	alfalfa (110), apples, cherries, grapes	110	623,722

State	County	Crops and acreage planted	Acres	Total acreage
WA	Skamania	alfalfa (164), apples (75), grapes, pears (477), other nuts (4)	720	1,337,179
WA	Wahkiakum	alfalfa	0	169,125
WA	Yakima	corn (12,680), wheat (50,430), grass seed (1,070), alfalfa (33,833), asparagus (7,034), snap beans (106), cabbage (144), dry onions, turnips (40), apples (75,264), apricots (285), cherries (6,129), grapes (15,529), nectarines (605), peaches (1,438), pears (10,190), plums & prunes (478), filberts (6), walnuts (11)	215,272	2,749,514

The counties containing this ESU have a relatively large acreage of crops on which chlorpyrifos is likely to be used. These counties contain 79,000 acres of apples, 24,000 acres of pears, and 8,000 acres of cherries. Nearly all of this acreage is in Yakima and Hood River counties. Depending on the location of orchards relative to the habitat of the salmon, the use of chlorpyrifos in these counties may affect the Lower Columbia River chinook ESU.

(8) Upper Willamette River Chinook Salmon ESU

The Upper Willamette River Chinook Salmon ESU was proposed as threatened in 1998 (63FR11482-11520, March 9, 1998) and listed a year later (64FR14308-14328, March 24, 1999). Critical habitat was designated February 16, 2000 (65FR7764-7787) to encompass all river reaches accessible to listed chinook salmon in the Clackamas River and the Willamette River and its tributaries above Willamette Falls, in addition to all down stream river reaches of the Willamette and Columbia Rivers to the Pacific Ocean.

The hydrologic units included are the Lower Columbia-Sandy, Lower Columbia- Clatskanie, Lower Columbia, Middle Fork Willamette, Coast Fork Willamette (upstream barriers - Cottage Grove Dam, Dorena Dam), Upper Willamette (upstream barrier - Fern Ridge Dam), McKenzie (upstream barrier - Blue River Dam), North Santiam (upstream barrier – Big Cliff Dam), South Santiam (upstream barrier - Green Peter Dam), Middle Willamette, Yamhill, Molalla-Pudding, Tualatin, Clackamas, and Lower Willamette. Spawning and rearing habitat is in the Oregon counties of Clackamas, Douglas, Lane, Benton, Lincoln, Linn, Polk, Marion, Yamhill, Washington, and Tillamook. However, Lincoln and Tillamook counties include salmon habitat only in the forested parts of the coast range where chlorpyrifos would not be used. Salmon habitat for this ESU in Douglas County is entirely within the Willamette National Forest and Bureau of Land Management land. Lincoln, Tillamook, and Douglas Counties were therefore excluded from the analysis. Migration corridors include Clackamas, Multnomah, Columbia, and Clatsop Counties in Oregon, and Clark, Cowlitz, Wahkiakum, Lewis, and Pacific Counties in Washington.

Table 38 and Table 39 show the cropping information for Oregon counties where the Upper Willamette River chinook salmon ESU occurs and for the Oregon and Washington counties where this ESU migrates. In these tables, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 38. Crops on which chlorpyrifos can be used in counties containing spawning and rearing habitat for the Upper Willamette chinook ESU.

State	County	Crops and acreage planted	Acres	Total acreage
OR	Benton	wheat (4,338), grass seed, alfalfa (570), snap beans (3,080), broccoli, dry onions (3), apples (62), cherries (18), grapes (242), peaches (8), pears (7), plums & prunes (5), filberts (493), walnuts (23), strawberries (17), mint (2,925)	11,791	432,961
OR	Clackamas	corn (14), wheat (1,783), grass seed (9,829), alfalfa (1,072), snap beans (334), broccoli (184), cabbage (72), cauliflower (319), dry onions, radishes (144), turnips, apples (167), cherries (53), grapes (207), peaches (78), pears (37), plums & prunes (37), filberts (3,994), walnuts (51), strawberries (608)	18,983	1,195,712
~~OR~~	~~Douglas~~	~~wheat (123), grass seed (2,361), alfalfa (1,984), snap beans (19), broccoli (3), cabbage (4), carrots, cauliflower, apples (148), apricots (1), cherries (64), grapes (581), nectarines, peaches (53), pears (105), plums & prunes (305), filberts (55), walnuts (171), strawberries (24)~~	~~6,001~~	~~3,223,576~~
OR	Lane	wheat (2,651), grass seed (32,433), alfalfa (876), snap beans (1,796), broccoli (5), cabbage (11), carrots (270), cauliflower (4), dry onions (3), apples (174), cherries (249), grapes (631), nectarines (2), peaches (54), pears (51), plums & prunes (34), filberts (3,677), walnuts (105), strawberries (74), mint (5,350)	48,450	2,914,656
OR	Linn	corn (4), wheat (5,306), grass seed (198,471), alfalfa (2,507), snap beans (2,688), broccoli (267), cabbage, carrots, cauliflower (164), dry onions (1), apples (133), cherries (157), grapes (93), nectarines (3), peaches (73), plums & prunes (14), filberts (1,820), walnuts (55), strawberries (52), mint (4,105)	215,913	1,466,507

State	County	Crops and acreage planted	Acres	Total acreage
OR	Marion	corn (16), wheat (10,341), grass seed (98,930), alfalfa (1,315), snap beans (12,101), broccoli (2,548), cabbage (157), carrots (76), cauliflower (1,505), dry onions (2,036), apples (555), cherries (1,568), grapes (761), nectarines, peaches (179), pears (150), plums & prunes (145), filberts (7,061), walnuts (15), strawberries (1,858), mint (3,695)	145,012	758,394
OR	Polk	wheat (9,741), grass seed (52,375), alfalfa (774), snap beans (598), broccoli, cabbage, carrots, apples (157), apricots, cherries (1,888), grapes (1,123), peaches (51), pears (63), plums & prunes (595), filberts (2,394), walnuts (33), other nuts, strawberries (22), mint (2,448)	72,262	474,296
OR	Washington	wheat (17,020), grass seed (18,465), alfalfa (1,680), snap beans (988), broccoli (400), cabbage, carrots (1), cauliflower, dry onions (196), apples (279), cherries (211), grapes (989), peaches (168), pears (69), plums & prunes (358), filberts (5,595), walnuts (679), other nuts, strawberries (1,257)	48,355	463,231
OR	Yamhill	corn, wheat (13,989), grass seed (32,904), alfalfa (2,294), snap beans (1,838), broccoli (308), dry onions, apples (310), cherries (1,693), grapes (2,887), nectarines, peaches (104), pears (54), plums & prunes (369), filberts (7,110), walnuts (608), other nuts (41), strawberries (265)	64,774	457,986

Table 39. Crops on which chlorpyrifos can be used in counties in the migration corridor of the Upper Willamette chinook ESU.

State	County	Crops and acreage planted	Acres	Total acreage
OR	Clackamas	corn (14), wheat (1,783), grass seed (9,829), alfalfa (1,072), snap beans (334), broccoli (184), cabbage (72), cauliflower (319), dry onions, radishes (144), turnips, apples (167), cherries (53), grapes (207), peaches (78), pears (37), plums & prunes (37), filberts (3,994), walnuts (51), strawberries (608)	18,983	1,195,712
OR	Clatsop	alfalfa, apples	0	529,482

State	County	Crops and acreage planted	Acres	Total acreage
OR	Columbia	corn (48), wheat, alfalfa (421), apples (39), cherries (7), grapes (6), peaches, pears (12), plums & prunes (2), filberts, walnuts (11), other nuts, strawberries (6)	552	420,332
OR	Multnomah	wheat (1,688), grass seed, alfalfa (389), broccoli (29), cabbage (459), carrots, cauliflower (55), turnips, apples (51), cherries (8), grapes (28), peaches (36), pears (25), plums & prunes (3), walnuts (2), other nuts, strawberries (171)	2,944	278,570
WA	Clark	grass seed, alfalfa (836), snap beans (2), cabbage, apples (33), cherries, grapes (32), peaches (46), pears (75), plums & prunes (10), filberts (87), walnuts (51), strawberries (162), mint	1,334	401,850
WA	Cowlitz	wheat (293), alfalfa (105), snap beans (1), carrots, apples (14), cherries (2), grapes, pears (3), filberts (1), walnuts (5), strawberries	424	728,781
WA	Lewis	wheat (1,104), alfalfa (937), snap beans, apples (77), cherries (10), grapes (4), pears (8), plums & prunes (3), filberts (25), walnuts (4), other nuts (14), strawberries	2,186	1,540,991
WA	Pacific	alfalfa (110), apples, cherries, grapes	110	623,722
WA	Wahkiakum	alfalfa	0	169,125

There is only a small amount of acreage, 8,000 acres of orchard and 21,000 acres of mint and dry onion, where chlorpyrifos can be used in the reproductive and growth areas of this ESU. There is almost no acreage of crops with high chlorpyrifos use in the migration corridor. The use of chlorpyrifos is likely to have little or no effect on the Upper Willamette River chinook ESU.

(9) Upper Columbia River Spring-run Chinook Salmon ESU

The Upper Columbia River Spring-run Chinook Salmon ESU was proposed as endangered in 1998 (63FR11482-11520,March 9,1998)and listed a year later (64FR14308-14328, March 24, 1999). Critical habitat was designated February 16, 2000 (65FR7764-7787) to encompass all river reaches accessible to listed chinook salmon in Columbia River tributaries upstream of the Rock Island Dam and downstream of Chief Joseph Dam in Washington, excluding the Okanogan River, as well as all down stream migratory corridors to the Pacific Ocean. Hydrologic units and their upstream barriers are Chief Joseph (Chief Joseph Dam), Similkameen, Methow, Upper Columbia-Entiat, Wenatchee, Upper Columbia-Priest Rapids, Middle Columbia-Lake Wallula, Middle Columbia-Hood, Lower Columbia-Sandy, Lower Columbia-Clatskanie, Lower Columbia, and Lower Willamette. Counties in which spawning and rearing occur are Chelan, Douglas, Okanogan, ~~Grant,~~ and Kittitas~~, and Benton~~ (Table 40). The lower river reaches are migratory corridors and include Clatsop, Columbia, Gilliam, Hood River, Morrow, Multnomah, Sherman, Umatilla, Wasco, and Clackamas Counties in Oregon, and Benton, Clark, Cowlitz, Franklin, Kittitas, Klickitat, Skamania, Wahkiakum, Walla Walla, Yakima, Pacific, and Grant Counties in Washington (Table 41).

Table 40 and Table 41 show the cropping information for Washington counties that support the Upper Columbia River spring-run chinook salmon ESU and for the Oregon and Washington counties where this ESU migrates. In these tables, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 40. Crops on which chlorpyrifos can be used in counties containing spawning and rearing habitat for the Upper Columbia River spring-run chinook salmon ESU.

State	County	Crops and acreage planted	Acres	Total acreage
~~WA~~	~~Benton~~	~~corn, wheat (130,981), sugarbeets (4,284), grass seed, alfalfa (13,241), asparagus (1,638), dry onions (3,398), apples (18,425), apricots (174), cherries (3,219), grapes (15,929), nectarines (106), peaches (149), pears (472), plums & prunes (180), walnuts (41), mint~~	~~192,237~~	~~1,089,993~~
WA	Chelan	wheat (1,864), alfalfa (1,210), apples (17,096), apricots (81), cherries (3,704), nectarines (22), peaches (21), pears (8,298), plums & prunes (3), walnuts	32,299	1,869,848
WA	Douglas	wheat (200,291), alfalfa (1,763), apples (14,383), apricots (315), cherries (1,842), nectarines (91), peaches (167), pears (1,104)	219,956	1,165,158
~~WA~~	~~Grant~~	~~corn (29,953), wheat (203,498), sugarbeets (10,792), grass seed (6,801), alfalfa (115,509), asparagus (940), snap beans (671), carrots (2,207), dry onions (6,214), apples (33,615), apricots (266), cherries (3,470), grapes (3,132), nectarines (163), peaches (261), pears (998), plums & prunes (5), filberts, walnuts (5), strawberries (2), mint (15,610)~~	~~434,112~~	~~1,712,881~~
~~WA~~	~~King~~	~~corn (30), alfalfa (358), snap beans, broccoli (8), cabbage (88), carrots (10), cauliflower, dry onions (4), radishes, turnips (2), apples (64), apricots (1), cherries (8), grapes (2), peaches (1), pears (19), plums & prunes (4), filberts (3), walnuts (3), strawberries (42)~~	~~647~~	~~1,360,705~~
WA	Kittitas	wheat (5,224), alfalfa (8,571), apples (1,859), cherries, peaches (1), pears (331), plums & prunes (1), filberts (1), mint (409)	16,397	1,469,862

State	County	Crops and acreage planted	Acres	Total acreage
WA	Okanogan	wheat (8,410), alfalfa (21,880), broccoli (1), carrots (1), apples (24,164), apricots (13), cherries (1,003), nectarines (38), peaches (67), pears (3,280), plums & prunes (1), filberts (10), walnuts (29), strawberries	58,897	3,371,698
~~WA~~	~~Skagit~~	~~wheat (3,477), grass seed, alfalfa (782), snap beans (4), broccoli, carrots (555), apples (357), cherries, grapes, pears (5), plums & prunes, filberts (12), strawberries (281)~~	~~5,473~~	~~1,110,583~~
~~WA~~	~~Snohomish~~	~~wheat (428), grass seed, alfalfa (235), snap beans (10), broccoli (4), cabbage, carrots (2), cauliflower, apples (47), cherries (3), grapes (1), peaches (42), pears (27), plums & prunes (2), filberts (11), strawberries (81)~~	~~893~~	~~1,337,728~~
~~WA~~	~~Whatcom~~	~~corn, wheat (626), alfalfa (708), snap beans (1), broccoli (1), cabbage, apples (174), cherries (4), grapes (10), pears (15), plums & prunes, filberts (206), walnuts (1), strawberries (297)~~	~~2,043~~	~~1,356,006~~

Table 41. Crops on which chlorpyrifos can be used in counties in the migration corridor of the Upper Columbia River spring-run chinook salmon ESU.

State	County	Crops and acreage planted	Acres	Total acreage
OR	Clackamas	corn (14), wheat (1,783), grass seed (9,829), alfalfa (1,072), snap beans (334), broccoli (184), cabbage (72), cauliflower (319), dry onions, radishes (144), turnips, apples (167), cherries (53), grapes (207), peaches (78), pears (37), plums & prunes (37), filberts (3,994), walnuts (51), strawberries (608)	18,983	1,195,712
OR	Clatsop	alfalfa, apples	0	529,482
OR	Columbia	corn (48), wheat, alfalfa (421), apples (39), cherries (7), grapes (6), peaches, pears (12), plums & prunes (2), filberts, walnuts (11), other nuts, strawberries (6)	552	420,332
OR	Gilliam	wheat (95,584), alfalfa (2,450)	98,034	770,664
OR	Hood River	wheat, alfalfa (443), broccoli, apples (2,592), cherries (1,081), grapes (63), peaches (13), pears (11,788)	15,980	334,328
OR	Morrow	corn (9,276), wheat (167,070), sugarbeets, grass seed (1,113), alfalfa (22,180), dry onions (1,284), apples	200,923	1,301,021

State	County	Crops and acreage planted	Acres	Total acreage
OR	Multnomah	wheat (1,688), grass seed, alfalfa (389), broccoli (29), cabbage (459), carrots, cauliflower (55), turnips, apples (51), cherries (8), grapes (28), peaches (36), pears (25), plums & prunes (3), walnuts (2), other nuts, strawberries (171)	2,944	278,570
OR	Sherman	wheat (99,837), alfalfa (230)	100,067	526,911
OR	Umatilla	corn (6,901), wheat (263,624), grass seed (10,064), alfalfa (24,013), asparagus (1,093), snap beans (587), dry onions (3,914), apples (3,927), apricots (14), cherries (349), grapes (163), nectarines, peaches (7), pears (4), plums & prunes (365), strawberries (9), mint	315,034	2,057,809
OR	Wasco	wheat (63,369), grass seed (169), alfalfa (7,239), apples (463), apricots (32), cherries (7,352), grapes (110), peaches (30), pears (385), plums & prunes, strawberries	79,149	1,523,958
WA	Benton	corn, wheat (130,981), sugarbeets (4,284), grass seed, alfalfa (13,241), asparagus (1,638), dry onions (3,398), apples (18,425), apricots (174), cherries (3,219), grapes (15,929), nectarines (106), peaches (149), pears (472), plums & prunes (180), walnuts (41), mint	192,237	1,089,993
WA	Clark	grass seed, alfalfa (836), snap beans (2), cabbage, apples (33), cherries, grapes (32), peaches (46), pears (75), plums & prunes (10), filberts (87), walnuts (51), strawberries (162), mint	1,334	401,850
WA	Cowlitz	wheat (293), alfalfa (105), snap beans (1), carrots, apples (14), cherries (2), grapes, pears (3), filberts (1), walnuts (5), strawberries	424	728,781
WA	Franklin	corn (11,337), wheat (109,627), sunflower (698), sugarbeets, grass seed, alfalfa (70,943), asparagus (8,610), snap beans (236), carrots (3,574), dry onions (4,074), apples (9,000), apricots (68), cherries (2,165), grapes (2,813), nectarines (129), peaches (262), pears (156), plums & prunes (43), walnuts, strawberries (17), mint (1,586)	225,338	794,999

State	County	Crops and acreage planted	Acres	Total acreage
WA	Grant	corn (29,953), wheat (203,498), sugarbeets (10,792), grass seed (6,801), alfalfa (115,509), asparagus (940), snap beans (671), carrots (2,207), dry onions (6,214), apples (33,615), apricots (266), cherries (3,470), grapes (3,132), nectarines (163), peaches (261), pears (998), plums & prunes (5), filberts, walnuts (5), strawberries (2), mint (15,610)	434,112	1,712,881
WA	Kittitas	wheat (5,224), alfalfa (8,571), apples (1,859), cherries, peaches (1), pears (331), plums & prunes (1), filberts (1), mint (409)	16,397	1,469,862
WA	Klickitat	wheat (40,401), grass seed, alfalfa (28,434), cabbage, apples (516), apricots (18), cherries (457), grapes (419), peaches (199), pears (923), plums & prunes (1), walnuts	71,368	1,198,385
WA	Skamania	alfalfa (164), apples (75), grapes, pears (477), other nuts (4)	720	1,337,179
WA	Wahkiakum	alfalfa	0	169,125
WA	Walla Walla	corn (6,539), wheat (232,419), grass seed (8,233), alfalfa (11,787), asparagus (1,414), snap beans (250), cabbage (6), carrots, dry onions (2,172), radishes, apples (5,222), cherries (280), grapes, plums & prunes (22)	268,344	813,108
WA	Yakima	corn (12,680), wheat (50,430), grass seed (1,070), alfalfa (33,833), asparagus (7,034), snap beans (106), cabbage (144), dry onions, turnips (40), apples (75,264), apricots (285), cherries (6,129), grapes (15,529), nectarines (605), peaches (1,438), pears (10,190), plums & prunes (478), filberts (6), walnuts (11)	215,272	2,749,514

There is a considerable amount of acreage, especially orchard crops, where chlorpyrifos may be used within the spawning and rearing area of this ESU. In these counties there are 58,000 acres of apples, 13,000 acres of pears, and 7,000 acres of cherries. An even greater acreage is likely to be treated with chlorpyrifos in the migration corridor, especially in Yakima County. Depending on the location of orchards and other crops relative to the reproductive habitat and migration corridors of the fish, the use of chlorpyrifos may affect the Upper Columbia River Spring-Run Chinook ESU.

(10) Central Valley Fall/Late Fall-run Chinook Salmon ESU (candidate for listing)

The Central Valley Fall/Late Fall-run chinook salmon ESU was proposed as a candidate for listing in 1998 (63FR11482-11520, March 9, 1998). The National Marine Fisheries Service concluded at that time that "chinook salmon in this ESU are not presently in danger of extinction but are likely to become endangered in the foreseeable future." In a later reassessment (64FR50394-50415, September 16, 1999), NMFS stated that the populations had increased in abundance, and this ESU is *not* likely to become endangered in the foreseeable future. Critical habitat is still under development.

Hydrologic units and upstream barriers within this ESU are the San Pablo Bay (upstream barrier – San Pablo Reservoir), San Francisco Bay, Coyote (upstream barrier – Calaveras Reservoir), Suisun Bay, San Joaquin Delta, Middle San Joaquin-Lower Merced-Lower Stanislaus (upstream barrier – Crocker Diversion La Grange), Lower Calaveras-Mormon Slough (upstream barrier – New Hogan), Lower Consumnes-Lower Mokelumne (upstream barrier – Camanche Dam), Upper Consumnes, Lower Sacramento, Lower American (upstream barrier – Nimbus Dam), Upper Coon-Upper Auburn, Lower Bear (upstream barrier – Camp Far West Dam), Lower Feather (upstream barrier – Oroville Dam), Lower Yuba (upstream barrier – Englebright Dam), Lower Butte, Sacramento-Stone Corral, Upper Butte, Sacramento-Lower Thomes (upstream barrier – Black Butte Dam), Mill-Big Chico, Upper Elder-Upper Thomes, Cottonwood Headwaters, Lower Cottonwood, Sacrament-Lower Cow-Lower Clear (upstream barrier – Keswick Dam Shasta), Upper Cow-Battle (upstream barrier – Whiskeytown Dam), and Sacramento-Upper Clear.

These areas are in the counties of Shasta, Trinity, Tehama, Glenn, Butte, Colusa, Sutter, Yuba, Yolo, Placer, El Dorado, Amador, Sacramento, Solano, Napa, Marin, Sonoma, San Francisco, San Mateo, Santa Clara, Alameda, Contra Costa, San Joaquin, Calaveras, Stanislaus, and Merced.

Table 42 contains usage information for the California counties supporting the Central Valley Fall/Late Fall-run chinook salmon ESU.

Table 42. Use of chlorpyrifos in counties with the Central Valley Fall/Late Fall-run chinook salmon ESU.

County	Crop	Usage (pounds)	Acres treated
Alameda	none > 100 lb		
Amador	walnut	263	132
Butte	alfalfa	342	645
	almond	3,886	2,529
	orange	113	97
	peach	211	142
	prune	269	205
	walnut	18,536	10,019
Calaveras	walnut	260	155
Colusa	alfalfa	613	1,189
	almond	974	696
	cotton	2,880	3,373
	walnut	1,543	834

County	Crop	Usage (pounds)	Acres treated
Contra Costa	asparagus	133	133
El Dorado	none > 100 lb		
Glenn	alfalfa	1,548	2,796
	almond	3,754	2,327
	cotton	951	1,029
	orange	233	110
	sunflower	146	279
	walnut	6,488	3,771
Marin	none > 100 lb		
Merced	alfalfa	8,022	14,503
	almond	21,396	15,623
	asparagus	223	224
	chinese cabbage	138	132
	corn	2,964	3,020
	cotton	8,916	9,167
	fig	2,684	1,350
	orange	1,044	541
	sweet potato	4,868	2,457
	walnut	4,365	2,481
Napa	none > 100 lb		
Placer	none > 100 lb		
Sacramento	alfalfa	1,632	2,325
	apple	326	162
	corn	180	181
	pear	696	348
	walnut	181	119
San Francisco	none > 100 lb		
San Joaquin	alfalfa	5,650	11,422
	almond	5,890	3,265
	apple	661	538
	asparagus	2,263	2,311
	corn	3,179	2,348
	pear	146	73
	walnut	18,506	10,482
San Mateo	brussel sprout	1,816	2,257
Santa Clara	apple	24	16
Shasta	mint	249	189
	turf/sod	324	320
	walnut	352	175
Solano	alfalfa	1,710	2,974
	almond	506	287
	grass, seed	705	231
	sorghum/milo	238	355
	sunflower	172	133

County	Crop	Usage (pounds)	Acres treated
	walnut	2,768	1,514
Sonoma	apple	1,380	1,408
Stanislaus	alfalfa	5,199	10,136
	almond	36,984	20,605
	apple	1,528	872
	citrus	741	100
	corn	3,595	3,102
	sweet potato	671	325
	walnut	23,188	12,878
Sutter	alfalfa	547	1,143
	bean, dried	981	2,878 tons
	cabbage	104	133
	peach	610	376
	walnut	16,541	8,806
Tehama	alfalfa	553	863
	almond	2,704	1,422
	prune	107	160
	walnut	7,847	4,514
Trinity	none > 100 lb		
Yolo	alfalfa	7,657	14,996
	almond	267	157
	cotton	699	751
	pear	143	96
	sorghum/milo	260	330
	walnut	5,005	2,869
Yuba	peach	160	80
	pear	268	162
	prune	540	285
	walnut	6,022	3,075

There is considerable use of chlorpyrifos on orchards in the area supporting this ESU. Depending on the location of these crops relative to the habitat of the fish, the use of chlorpyrifos may affect the Central Valley fall/late fall-run chinook salmon ESU.

(c) Coho Salmon

Coho salmon, *Oncorhynchus kisutch*, were historically distributed throughout the North Pacific Ocean from central California to Point Hope, AK, through the Aleutian Islands into Asia. Historically, this species probably inhabited most coastal streams in Washington, Oregon, and central and northern California. Some populations may once have migrated hundreds of miles inland to spawn in tributaries of the upper Columbia River in Washington and the Snake River in Idaho.

Coho salmon generally exhibit a relatively simple, 3-year life cycle. Adults typically begin their freshwater spawning migration in the late summer and fall, spawn by mid-winter, then die. Southern populations are somewhat later and spend much less time in the river prior to spawning than do northern coho. Homing fidelity in coho salmon is generally strong; however their small tributary habitats experience relatively frequent, temporary blockages, and there are a number of examples in which coho salmon have rapidly recolonized vacant habitat that had only recently become accessible to anadromous fish.

After spawning in late fall and early winter, eggs incubate in redds for 1.5 to 4 months, depending upon the temperature, before hatching as alevins. Following yolk sac absorption, alevins emerge and begin actively feeding as fry. Juveniles rear in fresh water for up to 15 months, then migrate to the ocean as "smolts" in the spring. Coho salmon typically spend two growing seasons in the ocean before returning to their natal stream. They are most frequently recovered from ocean waters in the vicinity of their spawning streams, with a minority being recovered at adjacent coastal areas, decreasing in number with distance from the natal streams. However, those coho released from Puget Sound, Hood Canal, and the Strait of Juan de Fuca are caught at high levels in Puget Sound, an area not entered by coho salmon from other areas.

(1) Central California Coast Coho Salmon ESU

The Central California Coast Coho Salmon ESU includes all coho naturally reproduced in streams between Punta Gorda, Humboldt County, CA and San Lorenzo River, Santa Cruz County, CA, inclusive. This ESU was proposed in 1995 (60FR38011-38030, July 25, 1995) and listed as threatened, with critical habitat designated, on May 5, 1999 (64FR24049-24062). Critical habitat consists of accessible reaches along the coast, including Arroyo Corte Madera Del Presidio and Corte Madera Creek, tributaries to San Francisco Bay.

Hydrologic units within the boundaries of this ESU are: San Lorenzo-Soquel (upstream barrier - Newell Dam), San Francisco Coastal South, San Pablo Bay (upstream barrier – Phoenix Dam-Phoenix Lake), Tomales-Drake Bays (upstream barriers - Peters Dam-Kent Lake; Seeger Dam-Nicasio Reservoir), Bodega Bay, Russian (upstream barriers - Warm springs dam-Lake Sonoma; Coyote Dam-Lake Mendocino), Gualala-Salmon, and Big-Navarro-Garcia. California counties included are Santa Cruz, San Mateo, Marin, Napa, Sonoma, Mendocino, and San Francisco. San Francisco County was excluded, as the area is entirely urban.

Table 43 contains usage information for the California counties supporting the Central California coast coho salmon ESU.

Table 43. Use of chlorpyrifos in counties with the Central California Coast coho ESU.

County	Crop	Usage (pounds)	Acres treated
Santa Cruz	apple	1,255	818
	broccoli	168	130
	brussel sprout	3,224	3,516
	cauliflower	201	198
San Mateo	brussel sprout	1,816	2,257
Marin	none > 100 lb		

Sonoma	apple	1,380	1,408
Mendocino	apple	225	112
	pear	2,195	1,867
Napa	none > 100 lb		

Chlorpyrifos use is low to moderate in the counties where this ESU is found. Depending on the location of crops in these counties relative to the habitat of the fish, the use of chlorpyrifos in California may affect the Central California Coast coho salmon ESU.

(2) Southern Oregon/Northern California Coast Coho Salmon ESU
The Southern Oregon/Northern California coastal coho salmon ESU was proposed as threatened in 1995 (60FR38011-38030, July 25, 1995) and listed on May 6, 1997 (62FR24588-24609). Critical habitat was proposed later that year (62FR62741-62751, November 25, 1997) and finally designated on May 5, 1999 (64FR24049-24062) to encompass accessible reaches of all rivers (including estuarine areas and tributaries) between the Mattole River in California and the Elk River in Oregon, inclusive.

The Southern Oregon/Northern California Coast coho salmon ESU occurs between Punta Gorda, Humboldt County, California and Cape Blanco, Curry County, Oregon. Major basins with this salmon ESU are the Rogue, Klamath, Trinity, and Eel river basins, while the Elk River, Oregon, and the Smith and Mad Rivers, and Redwood Creek, California are smaller basins within the range. Hydrologic units and the upstream barriers are Mattole, South Fork Eel, Lower Eel, Middle Fork Eel, Upper Eel (upstream barrier - Scott Dam-Lake Pillsbury), Mad-Redwood, Smith, South Fork Trinity, Trinity (upstream barrier - Lewiston Dam-Lewiston Reservoir), Salmon, Lower Klamath, Scott, Shasta (upstream barrier - Dwinnell Dam-Dwinnell Reservoir), Upper Klamath (upstream barrier - Irongate Dam-Irongate Reservoir), Chetco, Illinois (upstream barrier - Selmac Dam-Lake Selmac), Lower Rogue, Applegate (upstream barrier – Applegate Dam-Applegate Reservoir), Middle Rogue (upstream barrier - Emigrant Lake Dam-Emigrant Lake), Upper Rogue (upstream barriers - Agate Lake Dam-Agate Lake; Fish Lake Dam-Fish Lake; Willow Lake Dam-Willow Lake; Lost Creek Dam-Lost Creek Reservoir), and Sixes. Related counties are Humboldt, Mendocino, Trinity, Glenn, Lake, Del Norte, and Siskiyou in California and Curry, Jackson, Josephine, Klamath, and Douglas in Oregon. The habitat in Glenn and Lake Counties is within the Mendocino National Forest, that in Klamath County is entirely in the Rouge River National Forest, and that in Douglas County is entirely within the Rouge River and Upmqua National Forests. Glenn, Lake, Klamath, and Douglas Counties were therefore excluded from this analysis.

The reportable chlorpyrifos usage in the California counties supporting the Southern Oregon/Northern California coastal coho salmon ESU is shown in Table 44. Table 45 shows the acreage where chlorpyrifos may be used on orchard crops in the Oregon counties where the Southern Oregon/Northern California coastal coho salmon ESU occurs. In Table 45, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 44. Use of chlorpyrifos in California counties with the Southern Oregon/Northern California coastal coho salmon ESU.

County	Crop	Usage (pounds)	Acres treated
~~Santa Cruz~~	~~apple~~	~~1,255~~	~~818~~
	~~broccoli~~	~~168~~	~~130~~
	~~brussel sprout~~	~~3,224~~	~~3,516~~
	~~cauliflower~~	~~201~~	~~198~~
~~San Mateo~~	~~brussel sprout~~	~~1,816~~	~~2,257~~
~~Marin~~	~~none > 100 lb~~		
~~Sonoma~~	~~apple~~	~~1,380~~	~~1,408~~
Del Norte	none > 100 lb		
Humboldt	none > 100 lb		
Mendocino	apple	225	112
	pear	2,195	1,867
~~Napa~~	~~none > 100 lb~~		
Siskiyou	alfalfa	335	671
Trinity	none > 100 lb		

Table 45. Crops on which chlorpyrifos can be used in Oregon counties containing habitat for the Southern Oregon/Northern California Coastal coho salmon ESU.

State	County	Crops and acreage planted	Acres	Total acreage
OR	Curry	broccoli, apples (27), cherries (4), grapes, pears (3), plums & prunes (6), strawberries (1)	41	1,041,557
~~OR~~	~~Douglas~~	~~wheat (123), grass seed (2,361), alfalfa (1,984), snap beans (19), broccoli (3), cabbage (4), carrots, cauliflower, apples (148), apricots (1), cherries (64), grapes (581), nectarines, peaches (53), pears (105), plums & prunes (305), filberts (55), walnuts (171), strawberries (24)~~	~~6,001~~	~~3,223,576~~
OR	Jackson	wheat (1,294), grass seed (315), alfalfa (3,954), snap beans, broccoli (1), cabbage, carrots (1), dry onions (40), apples (360), apricots (10), cherries (27), grapes (400), nectarines (14), peaches (198), pears (9,387), plums & prunes (15), filberts, walnuts (27), strawberries (18)	16,061	1,782,633

State	County	Crops and acreage planted	Acres	Total acreage
OR	Josephine	wheat (18), alfalfa (1,1,43), snap beans (1), broccoli (2), cabbage (1), carrots (4), cauliflower (1), dry onions (1), apples (181), cherries (9), grapes (355), peaches (29), pears, plums & prunes (1), walnuts (18), strawberries (3)	1,767	1,049,308
~~OR~~	~~Klamath~~	~~wheat (5,696), sugarbeets (3,499), grass seed (201), alfalfa (61,176), dry onions (278), apples (8), strawberries (17)~~	~~70,875~~	~~3,804,552~~

Chlorpyrifos use is low in the California counties where this ESU is found. In Oregon, there is only a small amount of acreage, 9,000 acres of pears and less than 1,000 acres of apples, where chlorpyrifos is likely to be used in the reproductive and growth areas of this ESU. The use of chlorpyrifos is likely to have little or no effect on the Southern Oregon/Northern California Coastal coho salmon ESU.

(3) Oregon Coast coho salmon ESU

The Oregon coast coho salmon ESU was first proposed for listing as threatened in 1995 (60FR38011-38030, July 25, 1995), and listed several years later (63FR42587-42591, August 10, 1998). Critical habitat was proposed in 1999 (64FR24998-25007, May 10, 1999) and designated on February 16, 2000 (65FR7764-7787).

This ESU includes coastal populations of coho salmon from Cape Blanco, Curry County, Oregon to the Columbia River. Spawning is spread over many basins, large and small, with higher numbers further south where the coastal lake systems (e.g., the Tenmile, Tahkenitch, and Siltcoos basins) and the Coos and Coquille Rivers have been particularly productive. Critical Habitat includes all accessible reaches in the coastal hydrologic reaches Necanicum, Nehalem, Wilson-Trask-Nestucca (upstream barrier - McGuire Dam), Siletz-Yaquina, Alsea, Siuslaw, Siltcoos, North Umpqua (upstream barriers - Cooper Creek Dam, Soda Springs Dam), South Umpqua (upstream barrier - Ben Irving Dam, Galesville Dam, Win Walker Reservoir), Umpqua, Coos (upstream barrier - Lower Pony Creek Dam), Coquille, Sixes. Related Oregon counties are Douglas, Lane, Coos, Curry, Benton, Lincoln, Polk, Tillamook, Yamhill, Washington, Columbia, and Clatsop. However, the portions of Yamhill, Washington, and Columbia counties that are within the ESU are primarily mountainous forested areas where chlorpyrifos cannot be used, and were excluded from this analysis.

Table 46 show the acreage where chlorpyrifos can be used for Oregon counties where the Oregon coast coho salmon ESU occurs. In this table, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 46. Crops on which chlorpyrifos can be used in counties containing habitat for the Oregon Coast coho salmon ESU.

State	County	Crops and acreage planted	Acres	Total acreage
OR	Benton	wheat (4,338), grass seed, alfalfa (570), snap beans (3,080), broccoli, dry onions (3), apples (62), cherries (18), grapes (242), peaches (8), pears (7), plums & prunes (5), filberts (493), walnuts (23), strawberries (17), mint (2,925)	11,791	432,961
OR	Clatsop	alfalfa, apples	0	529,482
OR	Coos	wheat, alfalfa, apples (28), apricots, cherries (11), grapes (12), nectarines (1), peaches (1), pears (4), plums & prunes (3), filberts (1), walnuts (1)	62	1,024,346
OR	Curry	broccoli, apples (27), cherries (4), grapes, pears (3), plums & prunes (6), strawberries (1)	41	1,041,557
OR	Douglas	wheat (123), grass seed (2,361), alfalfa (1,984), snap beans (19), broccoli (3), cabbage (4), carrots, cauliflower, apples (148), apricots (1), cherries (64), grapes (581), nectarines, peaches (53), pears (105), plums & prunes (305), filberts (55), walnuts (171), strawberries (24)	6,001	3,223,576
OR	Lane	wheat (2,651), grass seed (32,433), alfalfa (876), snap beans (1,796), broccoli (5), cabbage (11), carrots (270), cauliflower (4), dry onions (3), apples (174), cherries (249), grapes (631), nectarines (2), peaches (54), pears (51), plums & prunes (34), filberts (3,677), walnuts (105), strawberries (74), mint (5,350)	48,450	2,914,656
OR	Lincoln	alfalfa, snap beans (1), broccoli (1), apples (22), grapes (1), pears (1), plums & prunes	26	626,976
OR	Polk	wheat (9,741), grass seed (52,375), alfalfa (774), snap beans (598), broccoli, cabbage, carrots, apples (157), apricots, cherries (1,888), grapes (1,123), peaches (51), pears (63), plums & prunes (595), filberts (2,394), walnuts (33), other nuts, strawberries (22), mint (2,448)	72,262	474,296
OR	Tillamook	None	0	705,417

There is only a small amount of acreage in counties containing this ESU in which chlorpyrifos is likely to be used. These counties contain about 3,000 acres of orchard and 10,000 acres of mint.

The use of chlorpyrifos is likely to have little or no effect on the Oregon Coast coho salmon ESU.

(d) Chum Salmon

Chum salmon, *Oncorhynchus keta*, have the widest natural geographic and spawning distribution of any Pacific salmonid, primarily because its range extends farther along the shores of the Arctic Ocean. Chum salmon have been documented to spawn from Asia around the rim of the North Pacific Ocean to Monterey Bay in central California. Presently, major spawning populations are found only as far south as Tillamook Bay on the northern Oregon coast.

Most chum salmon mature between 3 and 5 years of age, usually 4 years, with younger fish being more predominant in southern parts of their range. Chum salmon usually spawn in coastal areas, typically within 100 km of the ocean where they do not have surmount river blockages and falls. However, in the Skagit River, Washington, they migrate at least 170 km. During the spawning migration, adult chum salmon enter natal river systems from June to March, depending on characteristics of the population or geographic location. In Washington, a variety of seasonal runs are recognized, including summer, fall,and winter populations. Fall-run fish predominate, but summer runs are found in Hood Canal, the Strait of Juan de Fuca, and in southern Puget Sound, and two rivers in southern Puget Sound have winter-run fish.

Redds are usually dug in the mainstem or in side channels of rivers. Juveniles outmigrate to seawater almost immediately after emerging from the gravel that covers their redds. This means that survival and growth in juvenile chum salmon depend less on freshwater conditions than on favorable estuarine and marine conditions.

(1) Hood Canal Summer-run Chum Salmon ESU

The Hood Canal summer-run chum salmon ESU was proposed for listing as threatened, and critical habitat was proposed, in 1998 (63FR11774-11795, March 10, 1998). The final listing was published a year later (63FR14508-14517, March 25, 1999), and critical habitat was designated in 2000 (65FR7764-7787).

Critical habitat for the Hood Canal ESU includes Hood Canal, Admiralty Inlet, and the straits of Juan de Fuca, along with all river reaches accessible to listed chum salmon draining into Hood Canal as well as Olympic Peninsula rivers between Hood Canal and Dungeness Bay, Washington. The hydrologic units are Skokomish (upstream boundary - Cushman Dam), Hood Canal, Puget Sound, Dungeness-Elwha, in the counties of Mason, Clallam, Jefferson, Kitsap, Island, and Grays Harbor. The habitat in Grays Harbor County is entirely within the Olympic National Forest, and this county was excluded from the analysis.

Streams specifically mentioned, in addition to Hood Canal, in the proposed critical habitat Notice include Union River, Tahuya River, Big Quilcene River, Big Beef Creek, Anderson Creek, Dewatto River, Snow Creek, Salmon Creek, Jimmycomelately Creek, Duckabush ‘stream,’ Hamma Hamma ‘stream,’ and Dosewallips ‘stream.’

Table 47 shows the acreage of crops in these counties on which chlorpyrifos can be used. In this table, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 47. Crops on which chlorpyrifos can be used in counties containing habitat for the Hood Canal summer-run chum salmon ESU.

State	County	Crops and acreage planted	Acres	Total acreage
WA	Clallam	alfalfa (1,790), carrots, apples (29), cherries (11), grapes (4), pears (1), plums & prunes (1), strawberries (13)	1,849	1,116,900
~~WA~~	~~Grays Harbor~~	~~alfalfa (125), apples (5), cherries (1), grapes, pears, filberts (2)~~	~~133~~	~~1,227,045~~
WA	Island	alfalfa (2,100), apples (18), grapes (14), pears (1), strawberries	2,133	133,499
WA	Jefferson	alfalfa, snap beans, apples (5)	5	1,157,642
WA	Kitsap	alfalfa, snap beans (1), carrots (1), apples (21), cherries (6), grapes (8), pears (4), plums & prunes (4), strawberries (7)	52	253,436
WA	Mason	alfalfa (125), snap beans (2), carrots, apples (5), cherries (1), grapes, pears (1)	134	615,108

There is almost no acreage in counties containing this ESU on which chlorpyrifos is likely to be used. The use of chlorpyrifos is likely to have little or no effect on the Hood Canal Summer-Run chum ESU.

(2) Columbia River Chum Salmon ESU

The Columbia River chum salmon ESU was proposed for listing as threatened, and critical habitat was proposed, in 1998 (63FR11774-11795, March 10, 1998). The final listing was published a year later (63FR14508-14517, March 25, 1999), and critical habitat was designated in 2000 (65FR7764-7787).

Critical habitat for the Columbia River chum salmon ESU encompasses all accessible reaches and adjacent riparian zones of the Columbia River (including estuarine areas and tributaries) downstream from Bonneville Dam, excluding Oregon tributaries upstream of Milton Creek at river km 144 near the town of St. Helens. These areas are the hydrologic units of Lower Columbia-Sandy (upstream barrier - Bonneville Dam), Lewis (upstream barrier – Merlin Dam), Lower Columbia-Clatskanie, Lower Cowlitz, Lower Columbia, Lower Willamette in the counties of Clark, Skamania, Cowlitz, Wahkiakum, Pacific, Lewis, Washington and Multnomah, Clatsop, Columbia, Clackamas, and Washington, Oregon. The habitat in Washington County is in a mountainous area and this county was excluded from the analysis.

Table 48 shows the cropping information for Oregon and Washington counties where the Columbia River chum salmon ESU occurs. In this table, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 48. Crops on which chlorpyrifos can be used in counties containing habitat for the Columbia River chum salmon ESU.

State	County	Crops and acreage planted	Acres	Total acreage
OR	Clackamas	corn (14), wheat (1,783), grass seed (9,829), alfalfa (1,072), snap beans (334), broccoli (184), cabbage (72), cauliflower (319), dry onions, radishes (144), turnips, apples (167), cherries (53), grapes (207), peaches (78), pears (37), plums & prunes (37), filberts (3,994), walnuts (51), strawberries (608)	18,983	1,195,712
OR	Clatsop	alfalfa, apples	0	529,482
OR	Columbia	corn (48), wheat, alfalfa (421), apples (39), cherries (7), grapes (6), peaches, pears (12), plums & prunes (2), filberts, walnuts (11), other nuts, strawberries (6)	552	420,332
OR	Multnomah	wheat (1,688), grass seed, alfalfa (389), broccoli (29), cabbage (459), carrots, cauliflower (55), turnips, apples (51), cherries (8), grapes (28), peaches (36), pears (25), plums & prunes (3), walnuts (2), other nuts, strawberries (171)	2,944	278,570
~~OR~~	~~Washington~~	~~wheat (17,020), grass seed (18,465), alfalfa (1,680), snap beans (988), broccoli (400), cabbage, carrots (1), cauliflower, dry onions (196), apples (279), cherries (211), grapes (989), peaches (168), pears (69), plums & prunes (358), filberts (5,595), walnuts (679), other nuts, strawberries (1,257)~~	~~48,355~~	~~463,231~~
WA	Clark	grass seed, alfalfa (836), snap beans (2), cabbage, apples (33), cherries, grapes (32), peaches (46), pears (75), plums & prunes (10), filberts (87), walnuts (51), strawberries (162), mint	1,334	401,850
WA	Cowlitz	wheat (293), alfalfa (105), snap beans (1), carrots, apples (14), cherries (2), grapes, pears (3), filberts (1), walnuts (5), strawberries	424	728,781

State	County	Crops and acreage planted	Acres	Total acreage
~~WA~~	~~Klickitat~~	~~wheat (40,401), grass seed, alfalfa (28,434), cabbage, apples (516), apricots (18), cherries (457), grapes (419), peaches (199), pears (923), plums & prunes (1), walnuts~~	~~71,368~~	~~1,198,385~~
WA	Lewis	wheat (1,104), alfalfa (937), snap beans, apples (77), cherries (10), grapes (4), pears (8), plums & prunes (3), filberts (25), walnuts (4), other nuts (14), strawberries	2,186	1,540,991
WA	Pacific	alfalfa (110), apples, cherries, grapes	110	623,722
WA	Skamania	alfalfa (164), apples (75), grapes, pears (477), other nuts (4)	720	1,337,179
WA	Wahkiakum	alfalfa	0	169,125

There is very little acreage (about 2,000 acres of orchards scattered among nine counties) in counties containing this ESU on which chlorpyrifos is likely to be used. The use of chlorpyrifos is likely to have little or no effect on the Columbia River chum ESU.

(e) Sockeye Salmon

Sockeye salmon, *Oncorhynchus nerka*, are the third most abundant species of Pacific salmon, after pink and chum salmon. Sockeye salmon exhibit a wide variety of life history patterns that reflect varying dependency on the fresh water environment. The vast majority of sockeye salmon typically spawn in inlet or outlet tributaries of lakes or along the shoreline of lakes, where their distribution and abundance is closely related to the location of rivers that provide access to the lakes. Some sockeye, known as kokanee, are non-anadromous and have been observed on the spawning grounds together with their anadromous counterparts. Some sockeye, particularly the more northern populations, spawn in mainstem rivers. Growth is influenced by competition, food supply, water temperature, thermal stratification, and other factors, with lake residence time usually increasing the farther north a nursery lake is located. In Washington and British Columbia, lake residence is normally 1 or 2 years. Incubation, fry emergence, spawning, and adult lake entry often involve intricate patterns of adult and juvenile migration and orientation not seen in other *Oncorhynchus* species.

Upon emergence from the substrate, lake-type sockeye salmon juveniles move either downstream or upstream to rearing lakes, where the juveniles rear for 1 to 3 years prior to migrating to sea. Smolt migration typically occurs beginning in late April and extending through early July.

Once in the ocean, sockeye salmon feed on copepods, euphausiids, amphipods, crustacean larvae, fish larvae, squid, and pteropods. They will spend from 1 to 4 years in the ocean before returning to freshwater to spawn. Adult sockeye salmon home precisely to their natal stream or lake. River-and sea-type sockeye salmon have higher straying rates within river systems than lake-type sockeye salmon.

(1) Ozette Lake Sockeye Salmon ESU
The Ozette Lake sockeye salmon ESU was proposed for listing, along with proposed critical habitat, in 1998 (63FR11750-11771, March 10, 1998). It was listed as threatened on March 25, 1999 (64FR14528-14536), and critical habitat was designated on February 16, 2000 (65FR7764-7787). This ESU spawns in Lake Ozette, Clallam County, Washington, as well as in its outlet stream and the tributaries to the lake. It has the smallest distribution of any listed Pacific salmon.

While Lake Ozette itself is part of Olympic National Park, its tributaries extend outside park boundaries, much of which is private land. There is limited agriculture in the whole of Clallam County. Table 49 shows the acreage within this county for crops in which chlorpyrifos can be used.

Table 49. Crops on which chlorpyrifos can be used in counties containing habitat for the Ozette Lake sockeye salmon ESU.

State	County	Crops and acreage planted	Acres	Total acreage
WA	Clallam	alfalfa (1,790), carrots, apples (29), cherries (11), grapes (4), pears (1), plums & prunes (1), strawberries (13)	1,849	1,116,900

Because there is almost no acreage of crops in Clallam County on which chlorpyrifos is likely to be used, the use of chlorpyrifos is unlikely to affect the Ozette Lake sockeye salmon ESU.

(2) Snake River Sockeye Salmon ESU
The Snake River sockeye salmon was the first salmon ESU in the Pacific Northwest to be listed. It was proposed and listed in 1991 (56FR14055-14066, April 5, 1991 & 56FR58619-58624, November 20, 1991). Critical habitat was proposed in 1992 (57FR57051-57056, December 2, 1992) and designated a year later (58FR68543-68554, December 28, 1993) to include river reaches of the mainstem Columbia River, Snake River, and Salmon River from its confluence with the outlet of Stanley Lake down stream, along with Alturas Lake Creek, Valley Creek, and Stanley, Redfish, Yellow Belly, Pettit, and Alturas lakes (including their inlet and outlet creeks).

Spawning and rearing habitats are considered to be all of the above-named lakes and creeks, even though at the time of the critical habitat Notice, spawning only still occurred in Redfish Lake. These habitats are in Custer and Blaine counties in Idaho. However, the habitat area for the salmon is high elevation areas in a National Wilderness area and National Forest. Chlorpyrifos cannot be used on such a site, and therefore there will be no exposure in the spawning and rearing habitat. Considering that the migratory corridors are larger rivers any exposure during migration should be well below levels of concern.

Table 50 shows the acreage of crops in counties containing habitat for this ESU. Table 51 shows the acreage in counties containing the migratory corridors for this ESU. If there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 50. Crops on which chlorpyrifos can be used in counties containing habitat for the Snake River sockeye ESU.

State	County	Crops and acreage planted	Acres	Total acreage
ID	Blaine	wheat (2,837), alfalfa (17,425)	20,262	1,692,735
ID	Custer	wheat (645), alfalfa (24,467)	25,112	3,152,382

Table 51. Crops on which chlorpyrifos can be used in counties in the migration corridor of the Snake River sockeye ESU.

State	County	Crops and acreage planted	Acres	Total acreage
ID	Blaine	wheat (2,837), alfalfa (17,425)	20,262	1,692,735
ID	Custer	wheat (645), alfalfa (24,467)	25,112	3,152,382
ID	Idaho	wheat (62,283), grass seed, alfalfa (20,266), apples (6), cherries (2), grapes (1), peaches, pears (2), plums & prunes (2), filberts	82,562	5,430,522
ID	Lemhi	alfalfa (28,143), apples (6), apricots, cherries (9), peaches (3), pears (2)	28,163	2,921,172
ID	Lewis	wheat (64,367), grass seed, alfalfa (3,885)	68,252	306,601
ID	Nez Perce	corn, wheat (89,990), grass seed (5,739), alfalfa (6,262), apples (9), apricots (1), cherries (4), peaches (22)	102,027	543,434
ID	Valley	wheat (652), alfalfa (1,599), carrots	2,251	2,354,043
OR	Clackamas	corn (14), wheat (1,783), grass seed (9,829), alfalfa (1,072), snap beans (334), broccoli (184), cabbage (72), cauliflower (319), dry onions, radishes (144), turnips, apples (167), cherries (53), grapes (207), peaches (78), pears (37), plums & prunes (37), filberts (3,994), walnuts (51), strawberries (608)	18,983	1,195,712
OR	Clatsop	alfalfa, apples	0	529,482
OR	Columbia	corn (48), wheat, alfalfa (421), apples (39), cherries (7), grapes (6), peaches, pears (12), plums & prunes (2), filberts, walnuts (11), other nuts, strawberries (6)	552	420,332
OR	Gilliam	wheat (95,584), alfalfa (2,450)	98,034	770,664
OR	Hood River	wheat, alfalfa (443), broccoli, apples (2,592), cherries (1,081), grapes (63), peaches (13), pears (11,788)	15,980	334,328
OR	Morrow	corn (9,276), wheat (167,070), sugarbeets, grass seed (1,113), alfalfa (22,180), dry onions (1,284), apples	200,923	1,301,021

State	County	Crops and acreage planted	Acres	Total acreage
OR	Multnomah	wheat (1,688), grass seed, alfalfa (389), broccoli (29), cabbage (459), carrots, cauliflower (55), turnips, apples (51), cherries (8), grapes (28), peaches (36), pears (25), plums & prunes (3), walnuts (2), other nuts, strawberries (171)	2,944	278,570
OR	Sherman	wheat (99,837), alfalfa (230)	100,067	526,911
OR	Umatilla	corn (6,901), wheat (263,624), grass seed (10,064), alfalfa (24,013), asparagus (1,093), snap beans (587), dry onions (3,914), apples (3,927), apricots (14), cherries (349), grapes (163), nectarines, peaches (7), pears (4), plums & prunes (365), strawberries (9), mint	315,034	2,057,809
OR	Wasco	wheat (63,369), grass seed (169), alfalfa (7,239), apples (463), apricots (32), cherries (7,352), grapes (110), peaches (30), pears (385), plums & prunes, strawberries	79,149	1,523,958
WA	Asotin	wheat (21,110), grass seed (1,136), alfalfa (1,648), apples (24), apricots (5), cherries (17), peaches (18), pears (6)	23,964	406,983
WA	Benton	corn, wheat (130,981), sugarbeets (4,284), grass seed, alfalfa (13,241), asparagus (1,638), dry onions (3,398), apples (18,425), apricots (174), cherries (3,219), grapes (15,929), nectarines (106), peaches (149), pears (472), plums & prunes (180), walnuts (41), mint	192,237	1,089,993
WA	Clark	grass seed, alfalfa (836), snap beans (2), cabbage, apples (33), cherries, grapes (32), peaches (46), pears (75), plums & prunes (10), filberts (87), walnuts (51), strawberries (162), mint	1,334	401,850
WA	Columbia	corn (51), wheat (77,511), grass seed (253), alfalfa (1,780), apples	79,595	556,034
WA	Cowlitz	wheat (293), alfalfa (105), snap beans (1), carrots, apples (14), cherries (2), grapes, pears (3), filberts (1), walnuts (5), strawberries	424	728,781

State	County	Crops and acreage planted	Acres	Total acreage
WA	Franklin	corn (11,337), wheat (109,627), sunflower (698), sugarbeets, grass seed, alfalfa (70,943), asparagus (8,610), snap beans (236), carrots (3,574), dry onions (4,074), apples (9,000), apricots (68), cherries (2,165), grapes (2,813), nectarines (129), peaches (262), pears (156), plums & prunes (43), walnuts, strawberries (17), mint (1,586)	225,338	794,999
WA	Garfield	wheat (71,689), grass seed (2,830), alfalfa (802)	75,321	454,744
WA	Klickitat	wheat (40,401), grass seed, alfalfa (28,434), cabbage, apples (516), apricots (18), cherries (457), grapes (419), peaches (199), pears (923), plums & prunes (1), walnuts	71,368	1,198,385
WA	Pacific	alfalfa (110), apples, cherries, grapes	110	623,722
WA	Skamania	alfalfa (164), apples (75), grapes, pears (477), other nuts (4)	720	1,337,179
WA	Wahkiakum	alfalfa	0	169,125
WA	Walla Walla	corn (6,539), wheat (232,419), grass seed (8,233), alfalfa (11,787), asparagus (1,414), snap beans (250), cabbage (6), carrots, dry onions (2,172), radishes, apples (5,222), cherries (280), grapes, plums & prunes (22)	268,344	813,108
~~WA~~	~~Whitman~~	~~corn (101), wheat (478,098), grass seed (4,251), alfalfa (6,644), apples (19), cherries, pears (2), mint (12,577)~~	~~501,692~~	~~1,382,006~~

There is unlikely to be any chlorpyrifos use on crops in the counties containing reproductive habitat for this ESU. The counties through which the Snake River sockeye migrates contain 70,000 acres of apples, pears, and cherries, and 21,000 acres of mint, sugarbeets, and dry onions. As mentioned above, the migratory corridors consist of larger rivers where chlorpyrifos exposure is likely to be low. Nevertheless, depending on the location of the crops relative to the migration corridors, there is a possibility that use of chlorpyrifos could affect the Snake River sockeye salmon ESU.

5. Screening-level conclusions for Pacific salmon and steelhead

1. There is no likely or very limited use of chlorpyrifos associated with several steelhead ESUs. Chlorpyrifos is not likely to affect the Central California Coast steelhead ESU, the Northern California steelhead ESU, or the Upper Willamette River steelhead ESU. Chlorpyrifos use may affect other steelhead ESUs, depending on the location of the treated crops relative to the habitat and migration corridors of the fish.

2. There is no likely or very limited use of chlorpyrifos associated with the Upper Willamette River chinook salmon ESU or the Puget Sound chinook salmon ESU. Chlorpyrifos it not likely to affect these ESUs. Chlorpyrifos use may affect other chinook salmon ESUs, depending on the location of the treated crops relative to the habitat and migration corridors of the fish.

3. There is no likely or very limited use of chlorpyrifos associated with the Oregon Coast coho salmon ESU or the Southern Oregon/Northern California Coast coho salmon ESU. Chlorpyrifos use may affect the Central California Coast coho salmon ESU, depending on the location of the treated crops relative to the habitat and migration corridors of the fish.

4. There is no likely or very limited use of chlorpyrifos associated with the Hood Canal Summer-Run chum salmon ESU or the Columbia River chum salmon ESU. Chlorpyrifos use is not likely to affect these ESUs.

5. There is no likely or very limited use of chlorpyrifos associated with the Ozette Lake sockeye salmon ESU. Chlorpyrifos use is not likely to affect this ESU. There is no likely or very limited use of chlorpyrifos associated with the breeding habitat of the Snake River sockeye salmon ESU, but chlorpyrifos is used in counties containing the migration corridor of this ESU. Chlorpyrifos use may affect the Snake River sockeye salmon ESU, depending on the location of the treated crops relative to the migration corridor.

6. For the ESUs with habitat or migration corridors within counties where significant use of chlorpyrifos is reported (for California) or containing significant acreage of crops on which chlorpyrifos is likely to be used (for Washington and Oregon), potential exposure to harmful concentrations of chlorpyrifos cannot be ruled out based on the data used in this analysis. In many counties where ESUs and chlorpyrifos-treated crops coincide, the crops may be so far from critical habitat that chlorpyrifos will not reach the water. More specific information on the location of chlorpyrifos-treated crops relative to the riverine habitats and migration corridors of these ESUs would improve the accuracy of the analysis. Measurements of chlorpyrifos concentrations in the critical habitats at times when salmon and steelhead are present would be necessary to confirm the risk, or lack of risk.

Table 52. Summary of screening-level conclusions on specific ESUs of salmon and steelhead for chlorpyrifos.

Species	ESU	Screening-level Finding
Steelhead	Southern California	may affect
Steelhead	South Central California	may affect
Steelhead	Central California Coast	not likely to affect
Steelhead	California Central Valley	may affect
Steelhead	Northern California	not likely to affect
Steelhead	Upper Columbia River	may affect
Steelhead	Snake River Basin	may affect
Steelhead	Upper Willamette River	not likely to affect
Steelhead	Lower Columbia River	may affect
Steelhead	Middle Columbia River	may affect
Chinook salmon	Sacramento River Winter-Run	may affect
Chinook salmon	Snake River Fall-Run	may affect
Chinook salmon	Snake River Spring/Summer-Run	may affect
Chinook salmon	Central Valley Spring-Run	may affect
Chinook salmon	Central Valley Fall/Late Fall-Run[a]	may affect
Chinook salmon	California Coastal	may affect
Chinook salmon	Puget Sound	not likely to affect
Chinook salmon	Lower Columbia River	may affect
Chinook salmon	Upper Willamette River	not likely to affect
Chinook salmon	Upper Columbia River Spring-Run	may affect
Coho salmon	Central California Coast	may affect
Coho salmon	Southern Oregon/Northern California Coast	not likely to affect
Coho salmon	Oregon Coast	not likely to affect
Chum salmon	Hood Canal Summer-Run	not likely to affect
Chum salmon	Columbia River	not likely to affect
Sockeye salmon	Ozette Lake	not likely to affect
Sockeye salmon	Snake River	may affect

[a] Candidate for listing

6. Refinement of risk conclusions through improved use estimates within ESUs

The previous risk conclusions can be characterized as resulting from a screening level of assessment. Estimates of chlorpyrifos use intensity within a particular ESU and the levels of chlorpyrifos transported to critical habitat tend to overpredict salmonid exposure, because it is assumed that the crop acreage in a county occurs adjacent to critical habitat. This assumption is appropriate for an initial assessment but should not be relied upon for definitive effects determinations if information is available to provide more realism in the analysis and reduce uncertainty in the conclusions. In this section we refine the exposure assessment through better estimates of the spatial occurrence of chlorpyrifos use.

In California this was accomplished using georeferenced section-level pesticide use reporting. For ESUs found in Washington, Oregon, and Idaho we relied primarily on NLCD (National Land Classification Database) land classification within ESUs, where potential chlorpyrifos use was associated with classifications of small grains, row crops, orchards, vineyards and other, and fallow (assuming rotation into a labeled crop). These classifications were not as detailed as the crop-level information presented in the screening-level assessments above, as more detailed classification (identifying cherries vs. apples, for example) was not technically possible with the spectral bands and spatial resolution of the satellite platforms used for the NLCD program. Thus, the assessment of the total area of potential use in this level of assessment is actually somewhat more conservative than the screening-level assessment; however, much greater refinement is gained because of the NLCD's ability to spatially locate the classified lands. Mapping of agricultural land for certain Washington counties provided by the Washington Department of Agriculture also provided useful information. Details of the method and analysis are presented in Attachment 6.

Table 53 summarizes the risk conclusions resulting from refined estimates of pesticide use intensity. In the NLCD analysis, it was concluded that chlorpyrifos may affect an ESU if more than 10% of the land area in spawning/rearing habitat, or more than 25% of the land area in migration corridors, was in potential chlorpyrifos crop groups. These cutoffs were based on professional judgement and take into account the generally applicable large dilution factor in corridor main stem rivers; exploitation of resources in local tributaries is assumed to be minimal for migrating fish. This judgement was later evaluated by examining surface water monitoring data (see Section 7).

Five ESUs designated as "may affect" in the screening analysis were changed to "not likely to affect" based on actual (California) or inferred (Washington, Oregon, and Idaho) chlorpyrifos use within the ESU boundary. These ESUs included Lower Columbia River Steelhead, Snake River Spring/Summer-Run Chinook, Lower Columbia River Chinook, Upper Columbia River Spring-Run Chinook, and Snake River Sockeye.

Three ESUs were designated as "may affect" in some HUCs in spawning/rearing areas but "not likely to affect" in the remaining HUCs in spawning/rearing areas and all HUCs in migration corridors. These ESUs included Upper Columbia River Steelhead, Snake River Basin Steelhead, and Snake River Fall-Run Chinook.

Three ESUs were designated as "may affect" in their entire spawning/rearing areas and as "not likely to effect" in their entire migration corridors. These ESUs included Middle Columbia River Steelhead, Sacramento River Winter-Run Chinook, and Central Valley Spring-Run Chinook.

The remaining six ESUs designated as "may affect" in the screening analysis remained "may affect" in their entire spawning/rearing and migration areas. These ESUs included Southern California Steelhead, South Central California Coast Steelhead, California Central Valley Steelhead, California Coastal Chinook, Central Valley Fall/Late Fall-Run Chinook, and Central California Coast Coho.

Proximity of surface water monitoring sampling sites to the areas designated as "may affect" will be considered in the following section.

Table 53. Risk conclusions based on pesticide use reports and NLCD statistics.

Species	ESU	Screening-Level Finding	12-yr PUR Summary Finding	PUR Commodity-level analysis finding	NLCD Statistics Finding	NLCD proximity finding
Steelhead	A1. Southern California	may affect	may affect	?	--	--
Steelhead	A2. South-Central California Coast	may affect	may affect	?	--	--
Steelhead	A3. Central California Coast	not likely to affect	--	-	--	--
Steelhead	A4. California Central Valley	may affect	may affect	?	--	--
Steelhead	A5. Northern California	not likely to affect	--	--	--	--
Steelhead	A6. Upper Columbia River	may affect	--	--	SR: may affect C: not likely to affect	SR: some HUCs may affect; other HUCs not likely to affect
Steelhead	A7. Snake River Basin	may affect	--	--	SR: may affect C: not likely to affect	SR: some HUCS may affect; other HUCs not likely to affect
Steelhead	A8. Upper Willamette River	not likely to affect	--	--	--	--
Steelhead	A9. Lower Columbia River	may affect	--	--	SR: not likely to affect C: not likely to affect	--
Steelhead	A10. Middle Columbia River	may affect	--	--	SR: may affect C: not likely to affect	SR: may affect

Species	ESU	Screening-Level Finding	12-yr PUR Summary Finding	PUR Commodity-level analysis finding	NLCD Statistics Finding	NLCD proximity finding
Chinook	B1. Sacramento River Winter-Run	may affect	SR: may affect C: not likely to affect	?	--	--
Chinook	B2. Snake River Fall-Run	may affect	--	--	SR: may affect C: not likely to affect	SR: near Columbia River, may affect; further upstream not likely to affect
Chinook	B3. Snake River Spring/Summer-Run	may affect	--		SR: not likely to affect C: not likely to affect	--
Chinook	B4. Central Valley Spring-Run	may affect	SR: may affect C: not likely to affect	?	--	--
Chinook	B5. California Coastal	may affect	may affect	?	--	--
Chinook	B6. Puget Sound	not likely to affect	--	--	--	--
Chinook	B7. Lower Columbia River	may affect	--	--	SR: not likely to affect C: not likely to affect	--
Chinook	B8. Upper Willamette River	not likely to affect	--	--	--	--

Species	ESU	Screening-Level Finding	12-yr PUR Summary Finding	PUR Commodity-level analysis finding	NLCD Statistics Finding	NLCD proximity finding
Chinook	B9. Upper Columbia River Spring-Run	may affect	--	--	SR: not likely to affect C: not likely to affect	--
Chinook	B10. Central Valley Fall/Late Fall-Run	may affect	may affect	?	--	--
Coho	C1. Central California Coast	may affect	may affect	?	--	--
Coho	C2. Southern Oregon/Northern California Coast	not likely to affect	--	--	--	--
Coho	C3. Oregon Coast	not likely to affect	--	--	--	--
Chum	D1. Hood Canal Summer-Run	not likely to affect	--	--	--	--
Chum	D2. Columbia River	not likely to affect	--	--	--	--
Sockeye	E1. Ozette Lake	not likely to affect	--	--	--	--
Sockeye	E2. Snake River	may affect	--	--	SR: not likely to affect C: not likely to affect	--

7. Refinement of risk conclusions through analysis of monitoring data

Surface water monitoring data were acquired from the following sources: the USGS National Ambient Water Quality Assessment Program (NAWQA), the CalEPA/Department of Pesticide Registration Surface Water Monitoring Database (DPR), the Washington State Department of Agriculture (WSDA), and the USEPA STORET database (STORET).

NAWQA included all data from the Study Units ccpt, sacr, sanj, wilm, and yaki, with the most recent sampling date of 5/30/02. All of the concentration data came from an analytical method having a method reporting limit (MRL) of 0.004 ug/L (ppb), and non-detects were reported as the MRL.

DPR data were downloaded from the DPR website. The most recent sampling date was 3/10/00. Various MRLs were listed, and concentration values less than the MRL were reported as zero.

WSDA consisted of USGS and STORET historical data. The most recent sampling date was 3/21/97. No MRLs were reported, and non-detects were reported as zero.

STORET data were obtained from an earlier study investigating exposure patterns across the entire US (Christensen et al. 1999). After extracting records for chlorpyrifos analyses reported from CA, OR, WA, or ID, the most recent sampling date was 8/17/95. Various MRLs were found, and concentration values less than the MRL were reported as zero.

Where necessary, latitude/longitude data in degree/minute/second format was converted to decimal degrees. All of the sampling sites were then plotted over the cumulative area represented by the ESUs designated as may effect in the screening-level assessment and examined for duplication in space. Samples duplicated in time at the same location were also identified. All duplicates were eliminated before calculating summary statistics.

Attachment 7 lists all of the monitoring stations found in the cumulative may effect ESU area from the screening-level assessment and provides the following information: source, state, NAWQA study unit, station name, latitude, longitude, average concentration, maximum concentration, number of samples, earliest sampling date, most recent sampling date, lowest MRL, and highest MRL. A total of 5416 chlorpyrifos concentration values from 252 locations are reported.

The previous refinement in the assessment identified some ESUs or portions of ESUs remaining in the may effect category after taking into account better estimates of chlorpyrifos use intensity. The 252 monitoring locations were clipped by each ESU and portion of ESU, where applicable, using the Geoprocessing Wizard in ArcView. Table 54 summarizes this information.

Table 54. Monitoring data reported from may effect ESUs.

ESU	HABITAT	NO. STATIONS	MAX. AVG. CONC.	MAX. MAX. CONC.	NO. SAMPLES	FIRST DATE	LAST DATE	MIN. MRL	MAX. MRL
A1 Southern California Steelhead	ESU	2	0.282	1.6	16	7/30/90	8/17/95	0.000	0.010
A2 South-Central California Coast Steelhead	ESU	3	0.004	0.12	65	8/1/94	8/1/95	0.050	0.050
A4 California Central Valley Steelhead	ESU	103	0.3	1.6	4487	5/1/90	5/22/02	0.004	0.050
A6 Upper Columbia River Steelhead	ESU	40	0.015	0.066	329	11/19/91	5/30/02	0.000	0.050
	SR	30	0.015	0.066	140	11/19/91	11/2/00	0.000	0.050
	C	10	0.01	0.046	189	10/26/92	5/30/02	0.000	0.050
A7 Snake River Basin Steelhead	ESU	26	0.01	0.046	367	10/26/92	5/30/02	0.000	0.050
	SR	16	0.004	0.011	178	3/25/93	5/6/02	0.004	0.004
	C	10	0.01	0.046	189	10/26/92	5/30/02	0.000	0.050
A10 Middle Columbia River Steelhead	ESU	94	0.012	0.046	459	4/11/90	5/30/02	0.004	0.140
	SR	86	0.012	0.02	276	4/11/90	5/14/02	0.004	0.140
	C	8	0.01	0.046	183	10/26/92	5/30/02	0.000	0.050
B1 Sacramento River Winter-Run Chinook	ESU	24	0.01	0.019	1092	5/1/90	5/22/02	0.004	0.050
	SR	23	0.01	0.019	1091	5/1/90	5/22/02	0.004	0.050
	C	1	0.000	0.000	1	2/10/92	2/10/92	0.050	0.050
B2 Snake River Fall-Run Chinook	ESU	10	0.004	0.005	39	4/11/90	11/2/00	0.004	0.140
	SR	8	0.004	0.005	33	4/11/90	11/2/00	0.004	0.140
	C	2	0.004	0.004	6	5/3/94	9/19/94	0.025	0.050
B4 Central Valley Spring-Run Chinook	ESU	24	0.01	0.019	1092	5/1/90	5/22/02	0.004	0.050
	SR	21	0.010	0.019	1072	5/1/90	5/22/02	0.004	0.050
	C	3	0	0	20	5/3/90	9/14/94	0.010	0.050
B5 California Coastal Chinook	ESU	2	0.000	0.000	51	8/16/94	8/8/95	0.050	0.050
B10 Central Valley Fall/Late Fall-Run Chinook	ESU	102	0.3	1.6	4486	5/1/90	5/22/02	0.004	0.050
C1 Central California Coast Coho	ESU	2	0.000	0.000	51	8/16/94	8/8/95	0.050	0.050

The summary data can be interpreted in terms of typical and maximum concentrations reported, number of stations, number of samples, and period of record. Concentrations less than 0.3 ppb were considered unlikely to affect invertebrates important in fish diets, and concentrations less than 0.4 ppb were considered unlikely to cause direct acute effects on salmonids (see Section 3g(4)). In evaluating risk, concentrations greater than 0.3 ppb were considered ecologically relevant concentrations that may affect listed salmonid ESUs. Maximum measured concentrations exceeded 0.3 ppb for three ESUs: Southern California Steelhead, California Central Valley Steelhead, and Central Valley Fall/Late Fall-Run Chinook. Two of the ESUs (California Coastal Chinook and Central California Coast Coho) had only two samples each, and although chlorpyrifos concentrations were below detection limits in these samples the data were considered insufficient to support a “not likely to affect” conclusion. Table 55 summarizes the risk conclusions.

Table 55. Risk conclusions based on monitoring data.

ESU	HABITAT	Previous Finding	New Finding	Rationale
A1 Southern California Steelhead	ESU	may affect	may affect	Max. conc. > 0.3 ppb, limited number of stations and samples
A2 South-Central California Coast Steelhead	ESU	may affect	not likely to affect	Max. and avg. conc < 0.3 ppb in highest use watershed (Salinas River)
A4 California Central Valley Steelhead	ESU	may affect	may affect	Max. conc. > 0.3 ppb, robust data set
A6 Upper Columbia River Steelhead	SR	may affect in some HUCs	not likely to affect	Max. and avg. max. conc. < 0.3 ppb, relatively large data set. Max. conc. found in ag. drain (14 sites). Max. of 7 non-drain sites was 0.01 ppb, suggesting tributaries used for SR not impacted.
	C	not likely to affect	not likely to affect	Confirms 25% land classification cutoff
A7 Snake River Basin Steelhead	SR	may affect in some HUCs	not likely to affect	Max. and avg. max. conc. < 0.3 ppb, relatively large data set. All sites are natural drainage of ag. land, suggesting tributaries used for SR likely to have similar or lower concentrations.
	C	not likely to affect	not likely to affect	Confirms 25% land classification cutoff
A10 Middle Columbia River Steelhead	SR	may affect	not likely to affect	Max. and avg. max. conc. < 0.3 ppb, relatively large data set
	C	not likely to affect	not likely to affect	Confirms 25% land classification cutoff
B1 Sacramento River Winter-Run Chinook	SR	may affect	not likely to affect	Max. and avg. max. conc. << 0.3 ppb, relatively large data set
	C	not likely to affect	not likely to affect	One observation only
B2 Snake River Fall-Run Chinook	SR	may affect in some HUCs	not likely to affect	Max. and avg. max. conc. << 0.3, 6 of 8 sites are ag. ditches near Columbia R. Tributaries used for SR likely to have lower conc.
	C	not likely to affect	not likely to affect	Confirms 25% land classification cutoff
B4 Central Valley Spring-Run Chinook	SR	may affect	not likely to affect	Max. and avg. max. conc. << 0.3 ppb, relatively large data set
	C	not likely to affect	not likely to affect	Confirms 25% land classification cutoff

ESU	HABITAT	Previous Finding	New Finding	Rationale
B5 California Coastal Chinook	ESU	may affect	may affect	Limited data. The 2 sites on the Russian River probably are close to the treated orchard acreage. Results suggest low conc. and PUR data indicate low use in ESU (about 4000 lb/yr).
B10 Central Valley Fall/Late Fall-Run Chinook	ESU	may affect	may affect	Max. conc. > 0.3 ppb, robust data set
C1 Central California Coast Coho	ESU	may affect	may affect	Limited data.

8. Refinement of risk conclusions through existing regulatory action

The ESUs with designations of may effect following interpretation of monitoring data are:

NAME	RATIONALE
A1 Southern California Steelhead	Max. conc. > 0.3 ppb
A4 California Central Valley Steelhead	Max. conc. > 0.3 ppb
B5 California Coastal Chinook	Limited data
B10 Central Valley Fall/Late Fall-Run Chinook	Max. conc. > 0.3 ppb
C1 Central California Coast Coho	Limited data

Clean Water Act Section 303(d) listings and TMDL development are in place for chlorpyrifos in the San Joaquin River basin and Delta Waterways (CVRWQCB 2003). The State of California declined to list waters in the Sacramento/Feather River basins for impairment due to chlorpyrifos (low, infrequently found concentrations, no toxicity). Management goals for TMDLs include target concentrations of 25 ng/L (parts per trillion) for acute effects and 14 ng/L for chronic effects. Because of these programmatic activities by the State to protect and restore water quality, chlorpyrifos is considered not likely to affect California Central Valley Steelhead and Central Valley Fall/Late Fall-Run Chinook ESUs.

The final determination for ESUs that may be affected by chlorpyrifos use is therefore restricted to Southern California Steelhead, California Coastal Chinook, and Central California Coast Coho.

9. Refinement of risk conclusions using local fish habitat data

State agencies are developing detailed maps of current and potential salmonid habitat which can be used for further refinement of assessments. Examples are provided in Attachment 8.

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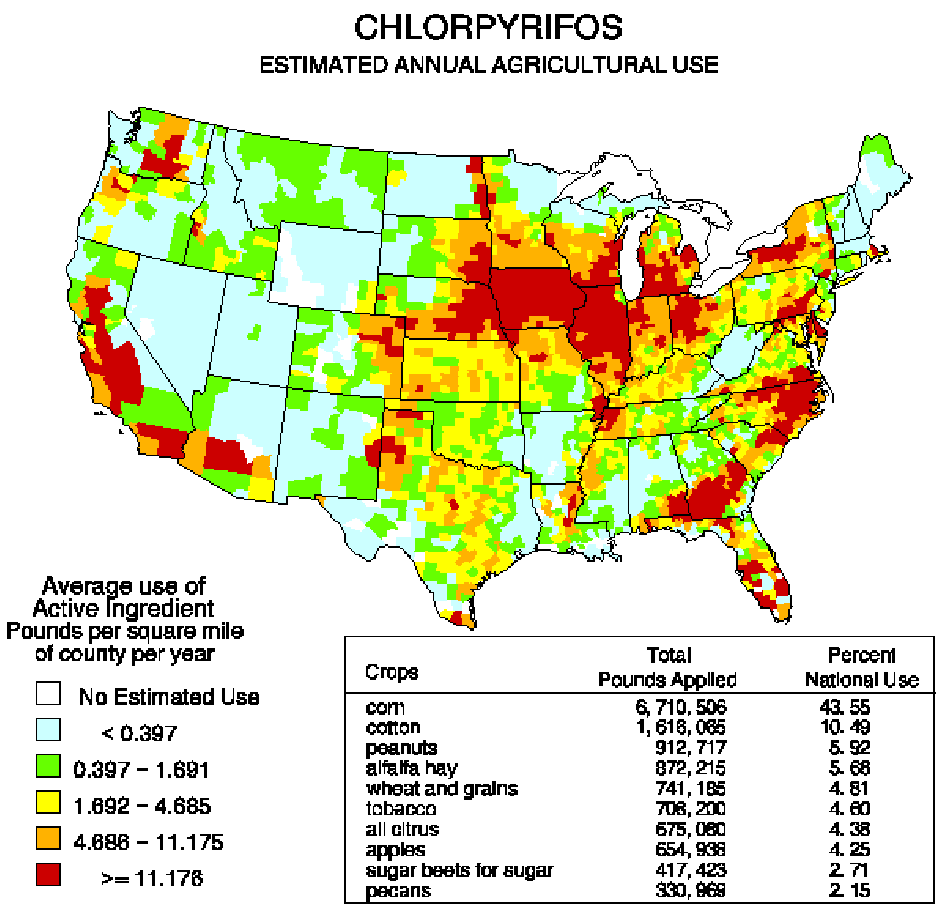
Attachment 1. USGS map of chlorpyrifos use.



Crops	Total Pounds Applied	Percent National Use
corn	6,710,506	43.55
cotton	1,616,065	10.49
peanuts	912,717	5.92
alfalfa hay	872,215	5.66
wheat and grains	741,185	4.81
tobacco	708,200	4.60
all citrus	675,080	4.38
apples	654,938	4.25
sugar beets for sugar	417,423	2.71
pecans	330,969	2.15

Attachment 2. Composition of US Lorsban formulations

Lorsban 4E

Role of Ingredient	Ingredient	CAS-# Ingredient	Wt.% in Lorsban 4E	Acute Toxicity (96-h LC_{50}/EC_{50}, µg/L)	Source
Active Ingredient	Chlorpyrifos, nominal	2921-88-2	44.90	*Daphnia magna*: 1.7 (48 h) *Onchoryhnchus mykiss*: 8.1 *Skeletonema costatum*: 300	RED; fish value is geomean of 4 guideline studies
Surfactant	Surfactant 1		1.43	*Daphnia* spp.: >40000 (3 h) *Oryzias latipes*: 3000 (48 h) (medaka) Algae: 27	USEPA ECOTOX database Talmage, 1994 (lowest value reported for all algae/all surfactants)
	Surfactant 2		1.50	See entry below for Surfactant 4	
	Surfactant 3		1.17	See entry below for Solvent	
	Surfactant 4		1.50	Invertebrates: 43 Fish: 135 Algae: 27	Talmage, 1994 (lowest value reported for all invertebrates, fish, and algae/all surfactants)
Solvent	Solvent[a]		48.444	*Daphnia magna*: 1600 (48 h) *Onchoryhnchus mykiss*: 1600 *Selenastrum capricornutum*: 2960 (4 h)	USEPA ECOTOX database, lowest value reported
Antifoam	Antifoam		0.05	No data, no QSAR possible	
Dye	Dye		0.006	Daphnid: 94 (48 h) see note Fish: 18 see note Green algae: 1.82	QSAR, USEPA EPI Suite V. 3.10 Note: log K_{ow} estimate of 7.63 suggests chemical may not be soluble enough to measure this predicted effect.
	TOTAL		100		

[a]Balance ingredient (includes impurities from technical).

Lorsban 15G

Role of Ingredient	Ingredient	CAS-# Ingredient	Wt.% in Lorsban 15G	Acute Toxicity (96-h LC_{50}/EC_{50}, μg/L)	Source
Active Ingredient	Chlorpyrifos	2921-88-2	15.0	*Daphnia magna*: 1.7 (48 h) *Onchoryhnchus mykiss*: 8.1 *Skeletonema costatum*: 300	RED; fish value is geomean of 4 guideline studies
Carrier	Carrier[a]		82.5	No data, no QSAR possible	
Stabilizer	Stabilizer		2.5	Daphnid: 8.6 x 10^6 Fish: 224000 Green algae: 16400	QSAR, USEPA EPI Suite V. 3.10
	TOTAL		100		

[a]Balance ingredient (includes impurities from technical).

Lorsban 75WG

Role of Ingredient	Ingredient	CAS-# Ingredient	Wt.% in Lorsban 75WG	Acute Toxicity (96-h LC_{50}/EC_{50}, μg/L)	Source
Active Ingredient	Chlorpyrifos, nominal	2921-88-2	75.0	*Daphnia magna*: 1.7 (48 h) *Onchoryhnchus mykiss*: 8.1 *Skeletonema costatum*: 300	RED; fish value is geomean of 4 guideline studies
Shell Wall	Shell Wall		3.29	No data, no QSAR possible	
Flow Aid	Flow Aid		0.35	No data, no QSAR possible	
Emulsifier	Emulsifier 1[a]		20.62	No data, no QSAR possible	
	Emulsifier 2		0.64	*Daphnia magna*: 19 (48 h) *Onchoryhnchus mykiss*: 4300 *Selenastrum capricornutum*: 9400	USEPA ECOTOX database, lowest reported value
Antimicrobial	Antimicrobial		0.10	*Daphnia magna*: 4400 (48 h) *Onchoryhnchus mykiss*: 1600 Algae: No data	USEPA ECOTOX database
	TOTAL		100		

[a]Balance ingredient (includes impurities from technical).

Attachment 3. Review of olfactory and behavioral effects of diazinon and other OP insecticides on salmonids

Some fish species, such as the salmonids, have an extremely sensitive olfactory sense. A number of papers in the last several years have concluded that some fishes' ability to smell may be affected by very low doses of pesticides, particularly organophosphate insecticides (OPs). The effects of the OP diazinon (residues of which are more frequently found in urban watersheds than in agricultural watersheds[1]) have been of particular interest. Researchers in the United Kingdom (U.K.) studying Atlantic salmon (*Salmo salar*) concluded that diazinon doses as low as 1 μg/L (ppb) could affect the normal nerve signals recorded in the nasal tissue responsible for sensing female reproductive priming pheromones, based on laboratory studies[2]. NMFS scientists have reported that diazinon at residue levels of 1 ppb in the lab affected the ability of the Chinook salmon (*Oncorhynchus tshawytscha*) nose to detect an alarm pheromone exuded when predators are nearby[3].

The reports from the U.K. and NMFS scientists identified a hazard heretofore not extensively studied. Furthermore, the hazard was reported to occur at environmentally relevant concentrations-levels that are over 100-fold less than the reported LC_{50} values for diazinon-exposed fish species related to salmon. As is customary with hazard identification research, several hypotheses have been proposed to describe how diazinon disrupts salmon smell[5]. First, the insecticide may bind to the nasal receptor proteins, reducing the ability of the pheromone molecules to bind. Second, the insecticide may alter the activation properties of the receptors. Third, the insecticide may move into the sensory cells (which are really specialized neurons) and modify intracellular signaling events. It is not known if any of these actions are related to the ability of diazinon to bind to and inhibit the enzyme acetylcholinesterase, the usual mechanism of toxicity associated with organophosphorus insecticides.

Regardless of the mechanism of diazinon's action on the fish's nasal or olfactory tissue, an increase in 'effect' would be expected with increases in dosage, up to a maximal response. For example, salmon should stop swimming activity and remain motionless when they sense alarm pheromones emitted by other salmon attacked by predators. Similarly, warned salmon should strike at food less often when they sense the alarm pheromone. These predator avoidance responses should diminish as the dosage of diazinon is increased, i.e., the responses should begin to look more like the behavior of fish not exposed to the pheromone, if the hypothesis is operational.

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[1] Larson, S. J., R. J. Gilliom, and P. D. Capel. Pesticides in streams of the United States-Initial Results from the National Water Quality Assessment Program. U.S. Geological Survey Water-Investigations Report 98-4222 (http://www.usgs.gov/)

[2] Moore, A. and C. P. Waring. 1996. Sublethal effects of the pesticide diazinon on olfactory function in mature male Atlantic salmon parr. J. Fish Biology 48:758-775.

[3] Scholz, N. L., N. K. Truelove, B. L. French, B. A. Berejikian, T. P. Quinn, E. Casillas, and T. K. Collier. 2000. Diazinon disrupts antipredator and homing behaviors in Chinook salmon *(Oncorhynchus tshawytscha).* Can. J. Fish Aquat. Sci. 57:1911-1918.

While the NMFS data[5] indicate that antipredator behavior was affected by doses of 1 ppb diazinon, popular accounts suggesting that the research proves that salmon populations are being affected by diazinon are misleading[4]. First of all, predator avoidance behavior was not eliminated by diazinon; anti-predator behavior was still significantly expressed, compared to the controls, by salmon exposed to doses of diazinon. Even fish not exposed to diazinon showed movement and attached food items in the presence of the alarm pheromones. More importantly, there was no clear relationship between the expected behavior and increasing dose, as would be anticipated in a receptor-mediated response. In the laboratory experiment, fish exposed to 1 ppb diazinon exhibited somewhat more of these behaviors. However, a significant problem with the data is that the average responses of fish at the 10 ppb dose level were actually lower than at the 1 ppb dose, i.e., a dose-response relationship between diazinon and antipredator response did not exist. Unless some unexpected mechanism of toxic effect is operational or, alternatively, the maximum effect on salmonid feeding behavior is reached at 1 ppb diazinon, the results do not show an unequivocal dose-response relationship between diazinon and predator/alarm response.

While the relationship between diazinon dose and magnitude of predator avoidance behavior is hazy[5], diazinon's effect on salmon's sense of smell is given plausibility by U.K. research on the Atlantic salmon[5]. The U.K. team surgically isolated the male salmon's nasal cavity in the laboratory to expose receptor-rich nasal tissue (called olfactory rosettes). The researchers then recorded the electrical potential (called an electro-olfactogram, EOG) when the tissue was exposed to female reproductive priming pheromone and then to a series of increasing doses of diazinon in aqueous solution. Electrical signals increased in the presence of the female pheromone, but progressively higher doses of diazinon seemed to inhibit the response.

The data of the U.K. researchers indicate that diazinon did impair olfactory responses to the priming pheromone, but the effect appears to be only significantly different than a control response at dose levels greater than 5 ppb (i.e, there were statistically significant declines in salmonid olfactory response at 10 and 20 ppb diazinon). Hence, the no-observed effect concentration (NOEC) for salmonid olfactory response with diazinon was 5 ppb (at a statistical confidence of 95%). The authors noted in their analysis[7] that significant effects were noted at 1 to 20 ppb, with a NOEC of 0.1 ppb. However, it is unclear how this could be true, given the high level of variability observed in their measured data of the EOG response.

Nevertheless, doses of diazinon between 5 and 20 ppb inhibit electrophysiological measurements of salmonid olfaction. The next question is what biological relevance would such inhibition have? When salmon are primed by the female reproductive pheromone, which is released in the urine of ovulating females, circulating blood levels of male steroid hormones like testosterone are increased, consequently stimulating increased production the sperm-containing fluid that salmon secrete to fertilize eggs, termed 'milt'. Researchers can forcefully express the milt from the male and measure its weight.

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[4] Cox, C. 2000. Lethal lawns: diazinon use threatens salmon survival. Oregon Pesticide Education Network, 20 pp. (Downloaded December 2000, http://www.pesticide.org)

[5] Moore, A. and C. P. Waring. 1996. Sublethal effects of the pesticide diazinon on olfactory function in mature male Atlantic salmon parr. J. Fish Biology 48:758-775.

The U.K. researchers noted that male salmon exposed to diazinon for five days followed by a three-hour exposure to female salmon urine had lower levels of reproductive hormones than unexposed males. They hypothesized that milt production would also be affected. However, upon "milking" the diazinon-exposed male fish, the researchers concluded that "*there was no significant difference in the level of expressible milt when compared to fish not exposed to female urine*"[9]. Overall, the U.K. data cannot be used to conclude that reproductive potential of Atlantic salmon has been affected as a consequence of olfactory inhibition by increasing doses of diazinon.

Surface water monitoring data are collected by the U.S. Geological Survey via its National Water Quality Assessment program (NAWQA)[6]. These residue measurements form a database that encompasses over 1000 separate monitoring sites in 21 major watersheds across the United States. The highest diazinon concentration reported in the total U.S. database was 3.8 ppb. In addition, there were large differences between urban and agricultural stream sites[8,9]. Diazinon was found in only 24% of agricultural sites with a 95th percentile concentration of 0.042 ppb, i.e.,95% of all diazinon stream residues were 0.042 ppb or less. In stark contrast, diazinon was detected in 50% of urban stream sites, with a 95th percentile concentration of 0.24 ppb – nearly six times the agricultural 95th percentile concentration. For both agricultural and urban stream sites, in half (50%) of the water samples, the reported diazinon concentration was at or below its detection limit in water (0.002 ppb).

As seen below in Text Table 1, virtually all (99.7%) the measured residues for diazinon in salmonid waters of concern in the PNW are less than the conservative behavioral trigger level of 1 ppb. Higher concentrations are reported in agricultural drains and creeks in California's Central Valley[9], but these habitats are not salmon spawning areas.

Text Table 1. Summary of diazinon concentrations in streams in the PNW, measured in the NAWQA program from 1993 to 1999 (http://water.usgs.gov/nawqa.home.html).

Study Area	Number of samples	>0.1 µg/L		>0.3 µg/L		>1 µg/L		Maximum Concen. (µg/L)
		Samples	(%)	Samples	(%)	Samples	(%)	
Willamette Basin	290	12	4%	3	1%	2	1%	1.28
Puget Basin	181	23	13%	5	3%	0	0%	0.50
Central Columbia Plateau	328	1	0.3%	0	0%	0	0%	0.27
Sacramento Basin	106	30	28%	12	11%	1	1%	1.38
Total	**906**	**66**	**7%**	**20**	**2%**	**3**	**0.3%**	

However, even if the likelihood of behavioral effect concentrations being exceeded is present, an important ecotoxicological challenge is to determine the consequences of these for salmon

6 Larson, S. J., R. J. Gilliom, and P. D. Capel. Pesticides in streams of the United States-Initial Results from the National Water Quality Assessment Program. U.S. Geological Survey Water-Investigations Report 98-4222 (http://www.usgs.gov/)

fitness. While behavioral responses may or may not affect fitness, the overall relevance of these effects can not be easily deduced without extensive studies on salmon populations, an impractical exercise. This is particularly true in the PNW, where salmon populations are already under considerable pressure from many anthropogenic stressors[7].

To find more information on population-level effects of pesticides and salmon, a similar situation on the East Coast of Canada may offer some key insights. During the 1970s and 1980s, both aminocarb (a carbamate insecticide) and fenitrothion (an OP insecticide) were sprayed over large areas (millions of acres) of New Brunswick, Quebec, and Newfoundland for the control of spruce budworm; the potential subtle effects of these active ingredients and their formulations on Atlantic salmon (*Salmo salar*) have been the subject of ecoepidemiological research[8]. As the pesticides were aerially applied, direct overspray of small streams occurred and the pesticide concentrations in surface water were generally greater than reported for pesticides in the PNW. Morin et al.[9] measured residues of fenitrothion in lentic and lotic waters 1-4 hours after treatment from 1979 to 1982 and reported mean residues of 7.3 to 109 μg/L (lentic systems) and 4 to 21 μg/L (lotic systems). The maximum concentrations of fenitrothion reported in lentic systems ranged from 20 μg/L[10] to 52 μg/L[11], while the maximum-reported residues in lotic water varied from 1 to 76 μg/L[12,13]. In a monitoring survey of streams during the 1982 spray program, fenitrothion residues of <0.01 to a maximum of 1.1 μg/L were reported[14].

Laboratory studies on the predation behavior of Atlantic salmon at concentrations of 6 and 21 μg/L fenitrothion have demonstrated effects at these levels[15]. However, despite the known exposure of Atlantic salmon to fenitrothion in eastern Canadian stream waters, the only forest spray activity associated with subtle, adverse population-level effects was the use of 4-nonylphenol as a diluent in some applications of aminocarb[15]. No population-level effects on salmon were observed to be associated with use of fenitrothion or aminocarb without the nonylphenol[15], suggesting that subtle effects of the pesticides themselves, if any, were masked by the resiliency of the salmon population.

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[7] Lackey, RT. 1999. Salmon policy: Science, society, restoration, and reality. Renew. Res. J. 17: 6-16.
[8] Fairchaild, WL, Swansburg, EO, Arsenault, JT, Brown, SB. 1999. Does an association between pesticide use and subsequent declines in catch of Atlantic salmon (*Salmo salar*) represent a case of endocrine disruption? Environ. Hlth Perspect. 107: 349-357.
[9] Morin, R, Gaboury, G, Mamarbachi, G. 1986. Fenitrothion and aminocarb residues in water and balsam fir foliage following spruce budworm spraying programs in Quebec, 1979 to 1982. Bull. Env. Contam. Toxicol. 36: 622-628.
[10] Mallet, VN, Volpe, A. 1982. A chemical residue survey in relation to the budworm spray program in New Brunswick (Canada). J. Environ. Sci. Health B17: 713-736.
[11] Holmes, kSB, Kingsbury, PD, Mamarbachi, G, Mathieu, P. 1984. Distribution of fenitrothion residues in brook trout (*Salvelinus fontinalis*) and lake trout (*Salvelinus namaycusyh*) tissue following aerial applications to Lac Ste-Anne, Quebec. Bull. Env. Contam. Toxicol. 33: 468-475.
[12] Eidt, DC, Sundaram, KMS. 1975. The insecticide fenitrothion in headwater streams from large-scale forest spraying. Can. Entomol. 107: 735-742.
[13] Flannagan, JF. 1973. Field and laboratory studies of the effect of exposure to fenitrothion on freshwater aquatic invertebrates. Manitoba Entomol. 7: 15-25.
[14] Mallet, VN, Cassista, A. 1984. Fenitrothion residue survey in relation to the 1982 spruce budworm spray program in New Brunswick, Canada. Bull. Env. Contam. Toxicol. 32: 65-74
[15] Morgan, MJ, Kieceniuk, JW. 1991. Recovery of foraging behaviour of Atlantic salmon exposed to a simulated commerciaal application of fenitrothion. Environ. Toxicol. Chem. 10: 961-965.

Pacific salmon species and Atlantic salmon are not necessarily equally sensitive to diazinon and fenitrothion, however, a reasonably large acute data base exists for fish[12][16]with both materials for an assessment. Solomon et al.[3] have compared the acute fish distributions for diazinon and fenitrothion (see Figure 1) and found that diazinon, with a 10th centile concentration of 80 μg/L, is generally more potent than fenitrothion, which has a 10th centile concentration of 1334 μg/L. Atlantic salmon were the most sensitive fish to fenitrothion, however, no test data exist for either chemical with Pacific salmon. There is a high level of correlation between acute toxicity in fish and anticholinesterase activity[17][18], the presumed mechanism of action on the olfactory system of the salmonids[8], thus the acute toxicity data may be used for comparison purposes. As noted in the PNW exposure data for diazinon (see Text Table 1), there are no exceedences of even the most sensitive LC50 values for either the diazinon or fenitrothion field data sets (see Figure 1). However, the ratio of the fish toxicity 10th centile values to the maximum PNW resides (diazinon) and mean eastern Canada concentrations (fenitrothion) are similar – 66 and 67 (see Figure 1), respectively; this suggests that fenitrothion is an acceptable surrogate for diazinon. Given the lack of observed population-level effects in Atlantic salmon resulting from fenitrothion exposures of similar potencies to those for diazinon in the PNW, it is logical to conclude that declines in salmonid populations in the PNW are the result of factors other than the detection of diazinon in watersheds from that region; a very small proportion of which even begin to approach concentrations at which behavioral changes have been observed.

Finally, gross data on salmon catches in the PNW and Atlantic do not support the contention that pesticides have adversely affected salmonid population levels. In Figure 2, the declared catch of Atlantic salmon is presented for the years 1960 to 1998, along with the 5-yr rolling mean; similar data are presented in Figure 3 for the British Columbia salmon catches from 1982 to 1997. These data that the Atlantic salmon populations may have begun a gradual decline in overall numbers circa 1975 (see Figure 2), while the more limited Pacific salmon data suggest increasing populations until approximately 1985, when populations began a decline that place current levels at less than 50% of peak catches (see Figure 3). If the hypothesis is true that widespread use of OP pesticides such as diazinon has resulted in a salmon population decline due to olfactory impairment, one would assume that OP applications in the PNW would be increasing or static during this period. Pesticide application data are available for numerous compounds for the years 1992 and 1997 from the National Pesticide Use Database, via the National Center for Food & Agricultural Policy (http://www.ncfap.org/database/default.htm). Selecting three OP insecticides from the pesticides listed, there were measurable, significant declines from 1992 to 1997 in application amounts in the state of Washington for chlorpyrifos (45% decline), diazinon (58% decline), and methyl parathion (27% decline); each of these chemicals are widely-used OP insecticides. If the hypothesis is correct that pesticides have adversely affected salmonid population levels, then the sharp declines in total amount of these OP insecticides applied in the state of Washington from 1992 to 1997 appear counterintuitive to the decrease in salmon catches

[16] Montague, B. 2000. Oneliner pesticide toxicity database. USEPA, Electronic data set, updated 2 May 2000.
[17] Coppage, DL, Matthews, E. 1975. Brain acetylcholinesterase inhibition in a maine teleost during lethal and sublethal exposures to 1,2-dibromo-2,2-dichloroethyl dimethylphosphate (Naled) in seawater. Toxicol. Appl. Pharmacol. 31: 128-133.
[18] Coppage, DL, Matthews, E, Cook, GH, Knight, J. 1975. Brain acetylcholinesterase inhibition in fish as a diagnosis of environmental poisoning by malathion, *O,O*-dimehtyl S-(1,2-dicarbethoxyethyl) phosphorodithioate. Pestic. Biochem. Physiol. 5: 536-542.

over the same time period, unless of course, other more significant, modifying factors are important in controlling salmon population numbers[13].

Summary

In summary, effect measures based on the neurological and behavioral sciences are quite new in ecotoxicology. Studies on the impact of pesticides and other substances on salmon behavior are of interest. It is inappropriate, however, to simply extrapolate from laboratory data to possible population-level effects. The analysis presented here on diazinon suggests that the U.S. EPA's risk characterization methodology has allowed for a sufficient margin of protection for salmonids in the PNW with this important OP pesticide.

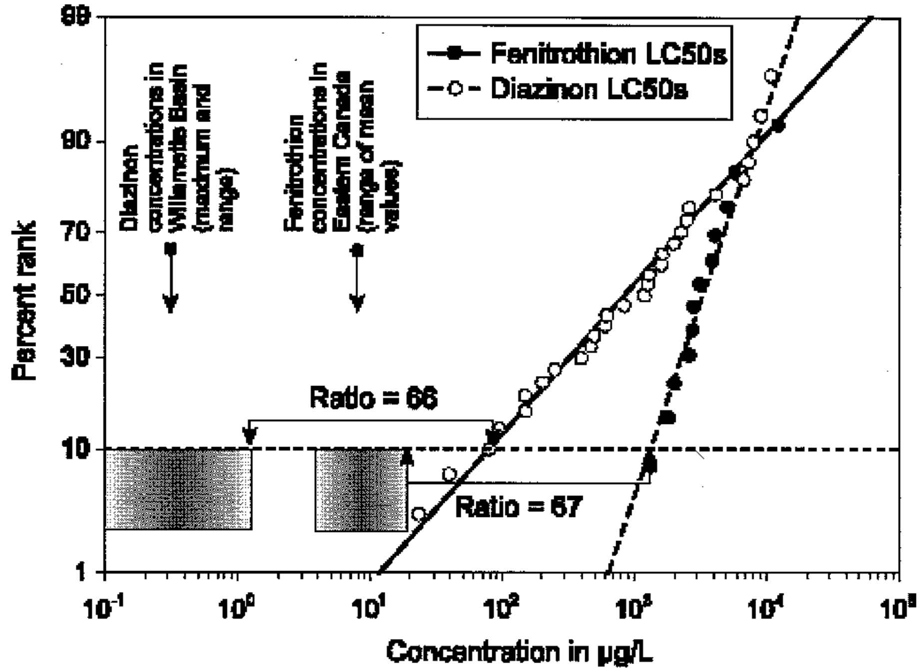

Figure 1 Distributions of acute toxicity values for diazinon and fenitrothion in fish with ranges of concentrations from surfaces waters in the Pacific NW and in New Brunswick.

Used with permission: Solomon, KR, Giddings, JM, Hall, LJ. 2001. Olfactory measures of effect, population endpoints in endangered salmon, and probabilistic risk assessment. SETAC Globe 2(3): 21-22.

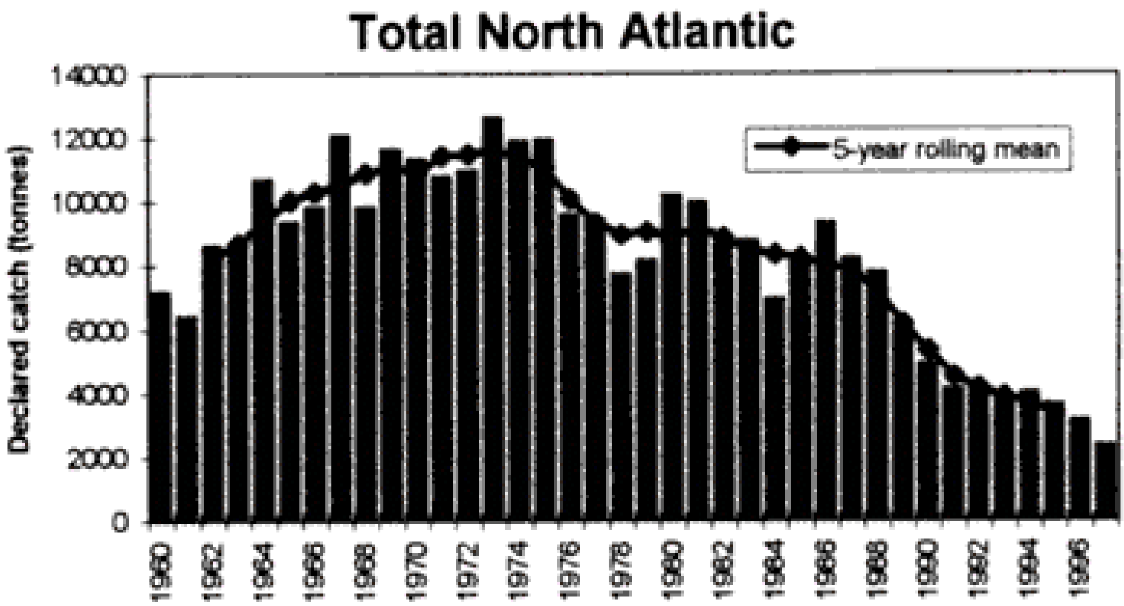

Figure 2. Atlantic salmon catch from 1960 to 1998. Source: Atlantic Salmon Facts--the State of Wild Salmon Stocks. (http://www.atlanticsalmontrust.org/9b.htm)

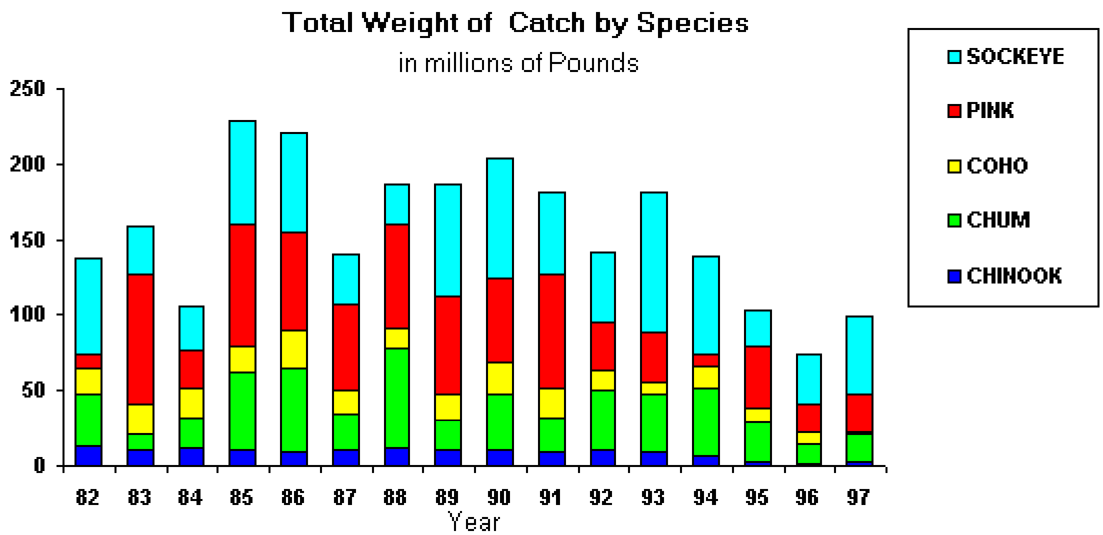

Figure 3. British Columbia (Canada) Salmon Catch Statistics from 1982 to 1997. From: (http://www.canfisco.com/fresh_salmon.html#BC Salmon Catch Statistics)

Attachment 4. Review of pesticide endocrine disruption

The first evidence for endocrine disruption in wild salmon was reported in a journal article by a team of scientists from the University of Idaho, Washington State University, and the Battelle Pacific Northwest National Laboratory; we will refer to the work as the UI study[1]. The researchers reported that over 80% of the female Chinook salmon collected from the Hanford Reach in Washington state (a free-flowing stretch of the Columbia River bordering the Hanford Nuclear Reservation) carried a piece of DNA known as a genetic marker that was uniquely characteristic of the male's Y chromosome. Thus, these phenotypic female (i.e., female-appearing) fish were really genetic male salmon masquerading as females.

Potentially, phenotypic female salmon that were genetically male fish could potentially have an impact on the salmon population maturing in proximity to the Hanford Reach. The female-appearing males are capable of normal reproduction as females, but therein lies the potential long-term trouble for salmon populations. Genetic females can only produce eggs containing an X chromosome. Genetic males with female reproductive organs can produce eggs contain either an X or Y chromosome, the same as the possible sex chromosomes contained in sperm. When a Y-containing egg is fertilized by a Y-containing sperm, an abnormal YY male embryo is produced. Under normal circumstances, a fertilized egg would have a 50% chance of becoming a female. However, fertilization of Y-containing eggs will always produce males. The worst-case scenario is that too few females would be produced to sustain the population.

Hatchery-reared fish were compared to fish collected at the Hanford Reach. No female-looking fish that were reared at the upstream Priest Rapids Hatchery on the Columbia River or at the Dworshak National Fish Hatchery on the Clearwater River in Idaho contained genetic evidence of "maleness." Because the only factor differing between the hatchery-reared fish and the wild fish was the location of spawning habitat, researchers with the UI study concluded that something related to the Hanford Reach was causing sex reversal of developing fish.

The authors of the UI study offered four hypotheses as to the basis of the sex reversal in the Hanford Reach fish, though only the “chemicals suspected” hypothesis attracted any attention from the media. However, we may now examine the four hypotheses for their respective plausibility.

Hypothesis #1 - ***Jumping Chromosome Pieces.***
Phenotypic females may contain the male DNA marker because there has been a chromosomal translocation of a piece of the Y chromosome to a non-sex chromosome during sperm development. However, the researchers dismissed this possibility with the explanation that female fish returning to the Priest Rapids Hatchery were "genetically indistinguishable" from the wild fish spawning in the Hanford Reach. Female fish returning to the hatchery did not contain the male genetic marker, therefore a translocation is unlikely.

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[1]Nagler, J. J. Bouma J., G. H. Thorgaard, and D. G. Dauble. 2001. High incidence of a male-specific genetic marker in phenotypic female Chinook salmon from the Columbia River. Environ. Health Perspectives 109:67-69.

Hypothesis #2 – Radioactive Exposure.
The Hanford Nuclear Reservation has a long history of processing and disposal of radioisotopes for nuclear weapons and this made radiation-induced sex reversal an obvious choice. However, excessive radiation causes sterility, not effects on sexual development. The levels of radioactivity occurring in the Columbia River were deemed too low to cause any effects and this hypothesis was discarded for lack of evidence and relevance.

Hypothesis #3 - Water Temperature Fluctuations During Embryonic Development.
Fish and reptile gender can be determined by environmental temperature during embryonic development. Hydroelectric dam operations, which occur upstream of the Hanford Reach, are known to cause water temperature fluctuations from 2 to 6 °C. Thus, the UI researchers suggested sex reversal may have been caused by timely water temperature fluctuations during incubation of the salmon 'redds' (spawning grounds containing eggs with developing embryos). Temperature-dependent sex determination has been well described in a handful of species, but whether low or high temperatures cause males or females to develop is not so easily generalized. For example, alligators tend to develop into females at cooler temperatures[2], but turtles tend to develop into males[3].

The UI study cited a number of papers supporting temperature as being an important factor in fish gender determination. However, the cited work suggest alternative data for the development of specific genders in fish: three of the cited papers indicated that females of three different species were favored at lower temperatures[4][5][6], and one paper showed that females of yet another species were favored at higher temperatures[7]. Sockeye salmon gender can be changed by a temperature shift during embryonic development[8], but specific effects on Chinook salmon are presently unknown.

Hypothesis #4 - Exposure to Chemicals that Mimic Sex Hormones.
It has been known for some time that sex ratio can be skewed to produce more female salmon by exposing developing embryos or newly hatched fish to sex hormones like estrogen. Indeed, some

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[2] Bull, J. J., W. H. N. Gutzke, and D. Crews. 1988. Sex reversal by estradiol in three reptilian orders. General and Comparative Endocrinology 70:425-428.

[3] Podreka, S., A. Georges, B. Maher, and C. J. Limpus. 1998. The environmental contaminant DDE fails to influence the outcome of sexual differentiation in the marine turtle *Chelonia mydas*. Environ. Health Perspectives 106(4):185-188.

[4] Pieau, C., M. Dorizzi, N. Richard-Mercier, and G. Desvages. 1998. Sexual differentiation of gonads as a function of temperature in the turtle Emys orbicularis: endocrine function, intersexuality and growth. J. Experimental Zoology 281(5):400-408.

[5] Strussmann, C. A., S. Tsuyoshi, U. Meisei, H. Yamada, and F. Takashima. 1997. Thermal thresholds and critical period of thermolabile sex determination in two atherinid fishes, *Odonthesthes bonariensis* and *Patagonina hatcheri*. J. Experimental Zoology 278(3):167-177.

[6] Wang, L. H., and C.-L. Tsai. 2000. Effects of temperature on the deformity and sex differentiation of tilapia, *Oreochromis mossambicus*. J. Experimental Zoology 286(5):534-537.

[7] Patino, R., K. B. Davis, J. E. Schoore, C. Uguz, C. A. Strüssmann, N. C. Simco, B. A. Parker, and C. A. Goudie. 1996. Sex differentiation of channel catfish gonads: normal development and effects of temperature. J. Experimental Zoology 276(3):209-218.

[8] Craig, J. K., C. J. Foote, and C. C. Wood. 1996. Evidence for temperature-dependent sex determination in sockeye salmon (*Oncorhynchus nerka*). Can. J. Fisheries Aquatic Sciences 69:141-147.

salmon hatcheries may purposefully use estrogen to manipulate fish sex ratios to increase production of females[9,10]. In wildlife studies, estradiol, the naturally occurring estrogen, can reverse the sex of reptiles developing at male-preferred temperatures[11]. However, only a small handful of studies have suggested that non-hormone environmental contaminants can actually reverse sex as opposed to affecting sexual development.

Despite the weak evidence that anything other than sex hormones can cause complete sex reversal, the researchers in the UI study did implicate pesticides as one possible type of "environmental estrogen" affecting salmonid sexual development. In actual fact, pesticides are an unlikely smoking gun because the levels of pesticides routinely detected in the Columbia River are generally in the parts per trillion (ppt) range. The UI researchers therefore concluded, "*no information exists to show that the measured concentrations of these compounds can effectively cause sex reversal in any fish species*." But as the Priest Rapids Hatchery fish were supposedly reared in clean (i.e., non-pesticide contaminated water), and the females did not contain the male marker DNA; therefore, the UI team concluded that pesticides "*remain valid candidates for causing the effects reported*."

The story of sexually confused salmon was reported in the media to give the impression that chemical causes are the best hypothesis to explain mistaken sexual identity in the Hanford Reach salmon.

Lack of evidence in the published literature led the UI team to quickly dismiss radioactivity exposure as a cause of phenotypic changes in gender. Despite their own words that pesticide concentrations were too low to affect fish sex, the UI team was not ready to ignore pesticides for lack of evidence.

But there was plenty of evidence suggesting that pesticides were not likely to be capable of causing sex reversal in salmon or related species. For example, at the same time the UI team was submitting its paper for publication, Oregon State University (OSU) researchers had reported in the same journal nearly six months earlier that DDE (the environmental breakdown product of the well-known insecticide DDT) failed to alter sex ratios of rainbow trout and Chinook salmon[12]. The OSU team made their observations after directly injecting DDE into embryos of rainbow trout and Chinook salmon and then histologically examining the gonads of six-month old fish. Furthermore, sex hormone levels in plasma and other morphological indicators of

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[9] Edmunds, J. S., R. A. McCarthy, and J. S. Ramsdell. 2000. Permanent and functional male-to-female sex reversal in d-rR strain medaka (*Oryzias latipes*) following egg microinjection of o,p'-DDT. Environ. Health Perspectives 108(3):219-224.

[10] Thorpe, K. L., T. H. Hutchinson, M. J. Hetheridge, J. P. Sumpter, and C. R. Tyler. 2000. Development of an in vivo screening assay for estrogenic chemicals using juvenile rainbow trout *(Oncorhynchus mykiss)*. Environ. Toxicol. Chem. 19(11):2812-2820.

[11] Bull, J. J., W. H. N. Gutzke, and D. Crews. 1988. Sex reversal by estradiol in three reptilian orders. General and Comparative Endocrinology 70:425-428.

[12] Carlson, D. B., L. R. Curtis, and D. E. Williams. 2000. Salmonid sexual development is not consistently altered by embryonic exposure to endocrine-active chemicals. Environ. Health Perspectives 108(3):249-255.

sexual development were unchanged by DDE treatment. DDE is known to have anti-androgenic (i.e., antagonistic to the effect of testosterone) properties, causing feminizing effects in rats[13].

Two years prior to the publication of the UI study, a different group of researchers at the University of Idaho published a study in which male rainbow trout were fed methoxychlor throughout early development prior to sexual differentiation[14]. While methoxychlor is a pesticide known from *in vitro* and *in vivo* studies to weakly bind to the estrogen receptor and cause feminization of male development, rainbow trout sexual differentiation and testicular development were unaffected by methoxychlor in this study. Considering that the trout sperm for this study came from the office of a Washington State University researcher involved in the later UI study, it is unfortunate that this methoxychlor work was not mentioned in subsequent discussions and publications.

Pesticides Are Weak Hormone Mimics

There are indeed other research studies that could or should have been discussed to determine the validity of the stated hypothesis that environmental contaminants cause sex reversal in fish and wildlife. In fact, very few experimental studies have actually shown sex reversal from exposure to non-hormone chemicals. The most notable experimental study supporting the hypothesis of sex reversal involved the application of PCBs directly to turtle eggs grown at male-producing temperatures[15]; the resulting hatchlings were overwhelmingly female. To date, only one pesticide has been experimentally shown capable of causing sex reversal in fish. When o,p'-DDT, a minor isomer in the DDT formulation, was injected into fertilized embryos of Japanese medaka fish at an egg concentration that was one-half of lethal (LC_{50}) levels, all male embryos were sex reversed to females[8]. Furthermore, these genetic males were grown to maturity and found to be fully reproductively functional as females.

Another highly cited study found “feminization” of gull embryos after directly injecting DDE into eggs[16]. Note, however, that the occurrence of feminization is distinct from sex reversal. Sex-reversed males are reproductively functional. “Feminization” results in abnormal development of male reproductive tissue that has female morphological characteristics. However, feminized males are not reproductively competent females.

Other studies have supposedly proven effects of pesticide contaminants on sexual differentiation, but they are essentially epidemiological in nature, not indicative of a mode of action. That is to say, there is an association (not to be mistaken with causation) of sexual abnormalities in animals collected from the wild with the presence of a mixture of environmental contaminants. Thus, Florida alligators from a lake impacted by a waste pesticide spill have reportedly smaller than

[13]Kelce, W. R., C. R. Stone, S. C. Laws, L. E. Gray, J. A. Kemppainen, and E. M. Wilson. 1995. Persistent DDT metabolite p,p'-DDE is a potent androgen receptor antagonist. Nature (June) 375:581-585.

[14]Krisfalusi, M., V. P. Eroschenko, and J. G. Cloud. 1998. Exposure of juvenile rainbow trout (*Oncorhynchus mykiss*) to methoxychlor results in a dose-dependent decrease in growth and survival but does not alter male sexual differentiation. Bull. Environ. Contam. Toxicol. 60:659-666.

[15]Crews, D., J. M. Bergeron, and J. A. McLachlan. 1995. The role of estrogen in turtle sex determination and the effect of PCBs. Environ. Health Perspectives 103, supplement 7(October):73-77.

[16] Fry, D. M., and C. K. Toone. 1981. DDT-induced feminization of gull embryos. Science 213:922-924.

normal penises (but no sex reversal)[17], and turtles have lower body shells more akin to females than to males (but have normal penises)[18].

Other sex reversal studies in animals have shown that masculinization rather than feminization is a possible outcome. Female marine mollusks exposed to tributyltin, an antifouling paint used on boats and ships, develop a pseudo-penis in a condition called imposex[19][20]. At sites contaminated by PCBs and dioxins, sex ratio in populations of cricket frogs (*Acris crepitans*) was skewed to male[21]. Fish downstream of kraft mill paper bleaching plants exhibit sex ratios favoring males rather than the normal ratio slightly dominated by females[22]. The hypothetical culprit in the kraft mill cases is believed to be phytosterols, natural plant biochemicals released during the pulping process, not synthetic chemicals.

Numerous experimental studies have shown no pesticide-related effect on sex reversal or any effect on male sexual differentiation. For example, separate studies on two different turtle species concluded that the pesticide metabolite DDE did not alter sex of eggs incubated at male producing temperatures[23][24]. Atrazine and 2,4-D, two herbicides definitively found in waters of the PNW, were painted on alligator eggs that were incubated at male-producing temperatures[25]. Neither pesticide caused sex reversal to females as did the natural estrogen, nor were sex hormone levels and associated enzyme activities altered in the alligators.

An increasing number of studies are showing that male oviparous fish can be induced to produce an egg developmental protein called vitellogenin (VTG) when exposed to sufficient levels of

[17]Guillette, L. J. Jr., T. S. Gross, G. R. Masson, J. M. Matter, H. F. Percival, and A. R. Woodward. 1994. Developmental abnormalities of the gonad and abnormal sex hormone concentrations in juvenile alligators from contaminated and control lakes in Florida. Environ. Health Perspectives 102(8):680-688.
[18]de Solla, S. R., C. A. Bishop, G. Van Der Kraak, and R. J. Brooks. 1998. Impact of organochlorine contamination on levels of sex hormones and external morphology of common snapping turtles (*Chelydra serpentina serpentina*) in Ontario, Canada. Environ. Health Perspectives 106: 253-260.
[19]Hung, T.-C., W.-K. Hsu, P.-J. Mang, and A. Chuang. 2001. Organotins and imposex in the rock shell, Thais clavigera, from oyster mariculture areas in Taiwan. Environ. Pollution 112:145-152.
[20]Svavarsson, J. 2000. Imposex in the dogwhelk *(Nucella lapillus)* due to TBT contamination: improvement at high latitudes. Marine Pollution Bulletin 40(11):893-897.
[21]Reeder, A. L., G. L. Foley, D. K. Nichols, L. G. Hansen, B. Wikoff, S. Faeh, J. Eisold, M. B. Wheeler, R. Warner, J. E. Murphy, and V. R. Beasley. 1998. Forms and prevalence of intersexuality and effects of environmental contaminants on sexuality in cricket frogs (*Acris crepitans*). Environ. Health Perspectives 106(5):261-266.
[22]Larsson, D. G. J., H. Hallman, and L. Forlin. 2000. More male fish embryos near a pulp mill. Environ. Toxicol. Chem. 19(12):2911-2917.
[23]Podreka, S., A. Georges, B. Maher, and C. J. Limpus. 1998. The environmental contaminant DDE fails to influence the outcome of sexual differentiation in the marine turtle *Chelonia mydas*. Environ. Health Perspectives 106(4):185-188.
[24]Portelli, M. J., S. R. de Solla, R. J. Brooks, and C. A. Bishop. 1999. Effect of dichlorodiphenyltrichlorethane on sex determiantion of the common snapping turtle (*Chelydra serpentina serpentina*). Ecotoxicol. Environ. Safety 43:284-291.
[25]Crain, D. A., I. D. Spiteri, and L. J. Guillette. 1999. The functional and structural observations of the neonatal reproductive system of alligators exposed in ovo to atrazine, 2,4-D, or estradiol. Toxicol. Industrial Health 15(1-2):180-185.

estradiol or a surfactant degradation product called nonylphenol[26][27][28]. Normally, only females produce VTG, as it is necessary to provide the egg with nourishment. Male oviparous fish do indeed contain the gene that codes for VTG synthesis, but it is not normally expressed.

In the field, fish near sewage treatment plant discharge sites have been found in some cases with abnormally high levels of VTG[29], although other field-exposed male fish downstream of sewage treatment plants have shown no detectable induction of VTG protein[30][31]. Natural waters containing pesticide residues have not been commonly associated thus far with VTG induction in male fish. However, in the laboratory, o,p'-DDT and methoxychlor, but not endosulfan, have induced VTG production in male fish[32][33][34]. Nevertheless, VTG production in male fish is not sex reversal nor necessarily an adverse reproductive effect but certainly a biomarker of exposure. There are no current studies that demonstrate that VTG induction in male fish from low level exposures is indicative of population level impacts on the species of interest[35].

One other endocrine effect measure studied to determine if pesticides (and other contaminants) affect sexual development is the gonadosomatic index or GSI. The gonads of fish are surgically removed, weighed, and then the gonadal weight is normalized to the whole body weight to calculate the GSI. A comparatively smaller index indicates that gonad development may have been affected, presumably by some hormonally active agent. Estrogens and nonylphenol have definitively been shown to reduce the GSI in fish. Thus far, laboratory data suggest that o,p'-DDT may be the only pesticide that can alter the GSI[32]. While methoxychlor at sufficient

[26]Hemmer, M. J., B. L. Hemmer, C. J. Bowman, K. J. Kroll, L. C. Folmar, D. Marcovich, M. D. Hoglund, and N. D. Denslow. 2001. Effects of p-nonylphenol, methoxychlor, and endosulfan on vitellogenin induction and expression in sheepshead minnow (*Cyprinodon variegatus*). Environ. Toxicol. Chem. 20(2):336-343.

[27] Jobling, S., and J. P. Sumpter. 1993. Detergent components in sewage effluent are weakly oestrogenic to fish: An in vitro study using rainbow trout (*Oncorhynchus mykiss*) hepatocytes. Aquatic Toxicology 27:361-372.

[28]Sumpter, J. P. and S. Jobling. 1995. Vitellogenesis as a biomarker for estrogenic contamination of the aquatic environment. Environ. Health Perspectives 103, supplement 7:173-178.

[29]Routledge, E. J., D. Sheahan, C. Desbrow, G. C. Brighty, M. Waldock, and J. P. Sumpter. 1998. Identification of estrogenic chemicals in STW effluent, Part 2: In vivo responses in trout and roach. Environ. Sci. Technol. 32(11):1559-1565.

[30]Nichols, KM, Miles-Richardson, SR, Snyder, EM, and Giesy, JP. 1999. Effects of exposure to municipal wastewater in situ on the reproductive physiology of the fathead minnow (*Pimephales promelas*). Environ. Toxicol. Chem. 18: 2001-2012.

[31]Angus, RA, Weaver, SA, Grizzle, JM, and Watson, RD. 2002. Reproductive characteristics of male mosquitofish (*Gambusia affinis*) inhabiting a small southeastern U.S. river receiving treated domestic sewage effluent. Environ. Toxicol. Chem. 21: 1404-1409.

[32]Donohoe, R. M., and L. R. Curtis. 1996. Estrogenic activity of chlordecone, o,p'-DDT and o,p'-DDE in juvenile rainbow trout: induction of vitellogenesis and interaction with hepatic estrogen binding sites. Aquatic Toxicology 36:31-52.

[33] Hemmer, M. J., B. L. Hemmer, C. J. Bowman, K. J. Kroll, L. C. Folmar, D. Marcovich, M. D. Hoglund, and N. D. Denslow. 2001. Effects of p-nonylphenol, methoxychlor, and endosulfan on vitellogenin induction and expression in sheepshead minnow (*Cyprinodon variegatus*). Environ. Toxicol. Chem. 20(2):336-343.

[34] Mills, L. J., R. E. Gutjahr-Bobell, R. A. Haebler, D. J. B. Horowitz, S. Jayaraman, R. J. Pruell, R. A. McKinney, G. R. Gardner, and G. E. Zaroogian. 2001. Effects of estrogenic (o,p'-DDT; octylphenol) and anti-androgenic (p,p'-DDE) chemicals on indicators of endocrine status in juvenile male summer flounder (*Paralichthys dentatus*). Aquatic Toxicol. 52:157-176.

[35]Matthiessen, P. 2000. Is endocrine disruption a significant ecological issue? Ecotoxicology 9: 21-24.

concentrations can induce VTG production in rainbow trout, it appears to be unable to alter the GSI[36].

The general absence of endocrine-induced population-level changes in wildlife is likely due to the enormous resilience of wildlife populations and ecosystems to perturbing influences. Fish in particular can show remarkable sexual plasticity in the face of natural environmental stresses, and many species cope with environmental uncertainties by producing eggs to huge excess. This plasticity and redundancy may well stand many fish species in good stead when faced with exposure to endocrine-disrupting chemicals, both natural and anthropogenic. In a recent multi-generation experiment, sticklebacks (*Gasterosteus aculeatus*) were exposed in mesocosms to environmentally relevant concentrations of ethynylestradiol or nonylphenol and failed to demonstrate any population-level changes[37].

Summary

In summary, the evidence that modern pesticides can cause sex reversal or even feminization of fish is weak. To date, only one isomer of the long-banned DDT has been shown capable of sex reversal, and as might be expected, it can induce VTG production and alterations in gonad development. Methoxychlor, which is a biodegradable analog of DDT with very limited use in the United States, can also induce VTG production, but seems incapable of sex reversal and feminization of male gonads.

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[36]Thorpe, K. L., T. H. Hutchinson, M. J. Hetheridge, J. P. Sumpter, and C. R. Tyler. 2000. Development of an *in vivo* screening assay for estrogenic chemicals using juvenile rainbow trout *(Oncorhynchus mykiss)*. Environ. Toxicol. Chem. 19(11):2812-2820.
[37]Sheahan, D, Matthiessan, P. In prep. The effects of environmentally realistic concentrations of nonylphenol and ethynylestradiol on stickleback population survival in freshwater mesocosms.

Attachment 5. Hydrologic ESU development and analysis for county contribution

Notes on redelineation of ESUs. As the NMFS ESU boundaries were out of date, the Critical Habitat descriptions from the official definitions (in the *Federal Register* (FR)) were consulted to form updated boundary GIS layers (as ESRI shapefiles)

Counties listed below in *italics* were not in or should be excluded from the screening-level analysis (which was taken from the EPA Diazinon assessment). The reasoning behind these is included in each ESU section x.x.4. (The same letter/number system identifying the listed ESUs in the screening-level assessment is used in this section.) Reasons for adding/removing counties included such things as analyses of elevation and national forest land ownership, for example. Counties listed below as '(delete)' were excluded from the screening-level assessment for various reasons (landuse, elevation). Counties listed as '*(exclude)*' were included in the screening-level assessment but may be deleted upon further analysis (often sliver polygons resulting from differences in the scales between county boundaries).

Exclusions for Federal lands were in National Forests (NF), Federal Wilderness Areas, Federal Recreation Areas, or BLM-owned public land.

Geographical data layers employed were:

ESU boundaries from NMFS downloaded from: (http://www.nwr.noaa.gov/1salmon/salmesa/mapswitc.htm)
Watercourses from the National Hydrography Dataset (NHD). Medium resolution data was used, downloaded from: http://edc.usgs.gov/pub/data/nhd/fod_cache/medium_resolution/arc/
Base map layers (states, counties, rivers, federal lands, cities) from the Environmental Systems Research Institute (ESRI) ESRI Data and Maps package (2002).
11-digit HUC boundaries from USGS downloaded from http://water.usgs.gov/GIS/huc.html
Various road atlases and gazetteers were also consulted.

"Cutting out" of portions of HUCs with the NHD data was done by inspection of the water courses and their apparent connections to define drainage areas. This is not a definitive watershed delineation using elevations, but should be more than sufficient for the scale of analysis done here. 11-digit HUC boundaries and high-resolution hydrography date would give a more exact delineation, but these data are not available, except in a few limited geographical areas.

a. Steelhead

a.1. Southern California Steelhead ESU

a.1.1. Reference: FR **65**(32), 7764 (Feb 16, 2000), update by proposed rule FR **65**(244), 79328 (Dec 19, 2000)

- **a.1.2.** HUCS: (18060007, 18060008, 18060009, 18060010, 18060013, 18070101, 18070102, 18070104, 18070301): Vaquero Dam (alternate name for Twitchell Dam, but it's in 18060007 – clip this HUC),18070101: Casitas Dam, Robles Dam (not found)18070102 Santa Felicia Dam,18070104: Rindge Dam (not found) 18070301: San Mateo Creek
- **a.1.3.** Counties: San Diego, Orange, Los Angeles, Ventura, Santa Barbara, San Luis Obispo

a.2. South-Central California Coast Steelhead ESU

- **a.2.1.** reference: FR **65**(32), 7764 (Feb 16, 2000)
- **a.2.2.** HUCS 18060002, 18060004, 18060005, 18060006, 18060011, 18060012, 18060002: Chesbro Res., North Fork Pacheco Res (not in GNIS, but found rch for North Fork Pacheco creek), 18060005: Nacimiento res. Salinas Dam, San Antonio res., 18060006: Lopez Dam, whale rock lake
- **a.2.3.** Counties: Santa Cruz, *Santa Clara*, San Benito, Monterey, San Luis Obispo
- **a.2.4.** County inclusion/exclusion justification: *Santa Clara* should be included as the Pajaro HUC (1806002) extends into this county. There is agricultural land along the Parajo River and its tributaries, Uvas and Llavas Creeks.

a.3. Central California Coast Steelhead ESU

- **a.3.1.** reference: FR **65**(32), 7764 (Feb 16, 2000)
- **a.3.2.** HUCS(FR): (18010110, 18010111, 18050001, 18050002, 18050003, 18050004, 18050005, 18050006, 18060001), 18010110: clipped w/nhd (not in NMFS), 18050002: Phoenix Dam, San Pablo Dam, clipped w/ nhd , 18050003: many reservoirs. Almaden (GNIS), Anderson, Calero, Guadalupe, Searsville, Stevens Creek, Vasona, 18050004: reservoirs: Calaveras, Chabot Dam, Crystal Springs (not found), Del Valle (very small, no clip), San Antonio, 18050005: Peters Dam, Seeger Dam (not found), Soulejule Dam (not found), 18050006: Pilarcitos Dam, 18060001: newell Dam
- **a.3.3.** Counties: Santa Cruz, San Mateo, San Francisco, Marin, Sonoma, Mendocino, Napa, Alameda, Contra Costa, Solano, Santa Clara

a.4. California Central Valley Steelhead ESU

- **a.4.1.** reference: FR **65**(32), 7764 (Feb 16, 2000)
- **a.4.2.** HUCS (FR): (18020101, 18020102, 18020103, 18020104, 18020105, 18020106, 18020107, 18020108, 18020109, 18020110, 18020111, 18020112, 18020113, 18020114, 18020118, 18020119, 18020120, 18020124, 18020125, 18020127, 18040002, 18040003, 18040004, 18040005, 18040010, 18040011, 18040014, 18050001, 18050002, 18050004), 18020103: black butte Dam; not significant part of HUC (very bottom southern edge), no change, 18020105: leave entire HUC; Centerville Dam not located; located the town of Centerville, but no res/Dam evident – also at edge of HUC, not likely much effect, 18020106: copy & paste from Chinook ESU above, 18020108 Dam at HUC boundary,18020111: NMFS clip OK, checked with NHD, 18020112: Keswik Dam NMFS clip is OK; Whiskeytown Dam clip not in NMFS, clipped with NHD, although this appears to isolate the NW corner of the HUC, 18020125: ditto, 18040002: La Grange Dam – at HUC boundary; Crocker diversion Dam, clips small portion (NHD), 18040005: Comanche Dam not in GNIS, found Comanche res in atlas, clipped w/ NHD, 18040010: Goodwin Dam: Dam for Tulloch Lake, clipped w/ NHD, 18040014:

Merced, San Benito, Fresno counties not in FR list, but HUC does intersect them; no obstructions listed, 18050011: New Hogan Dam on river/stream layer, clipped w/ NHD.

- **a.4.3.** Counties: Alameda, Amador, Butte, Calaveras, Colusa, Contra Costa, Glenn, Marin, Merced, *Napa*, Nevada, Placer, Sacramento, *San Benito*, San Joaquin, San Mateo, San Francisco, *Santa Clara*, Shasta, Solano, Sonoma, Stanislaus, Sutter, Tehama, Tuolumne, Yolo, Yuba
- **a.4.4.** County inclusion/exclusion justification: *Napa*: include, San Pablo Bay HUC (18050002) includes more that half of the county. *San Benito* include, Panonche-San Luis Reservoir HUC (18040015) extends into the southeast part of the county. *Santa Clara*: San Francisco Bay HUC (18050004) extends into the northeastern part of the county.

a.5. Northern California Steelhead ESU

- **a.5.1.** reference: FR **65**(110), 36074 (June 7, 2000)
- **a.5.2.** Critical habitat has not been established; general description in the listing final rule (FR vol 65 (110) June 7, 2000, 36081) Redwood Creek in Humboldt County, CA, to the Gualala River, inclusive, in Mendocino County, CA. NMFS boundary appears reasonable. The southern extent includes portions of Sonoma country if the Southern Fork of the Gualala river and its drainage is included. The river forks a short distance inland of the coast in Mendocino County into North and South Forks. For conservative assessment, assume both forks are potential habitat.
- **a.5.3.** Counties: Humboldt, Trinity, Mendocino, *Glenn*, *Lake (exclude)*, *Sonoma*
- **a.5.4.** County inclusion/exclusion justification: *Glenn (exclude)*: do not include; although the HUC extends into the county, it is entirely within the Mendocino National Forest (NF), where there will be no chlorpyrifos use. Lake: do not include, also in Mendocino NF. *Sonoma*: include, drainage from the Southern Fork of the Gualala River extends into the county.

a.6. Upper Columbia River Steelhead ESU

- **a.6.1.** Reference: FR **65**(32), 7764 (Feb 16, 2000).
- **a.6.2.** HUCs**:** 17020005 (to Chief Joseph Dam),17020006,17020007,17020008,17020010,17020011,17020012,17020016,17070101,17070105,17080001 – includes portion of Clackamas County, OR – no impediments defined,17080003,17080006,17090012, Also, 17070010 was not included for some reason.
- **a.6.3.** Corridor definition: downstream of 17020016 defined as C from FR description. 'SR' Counties (WA): Chelan, Douglas, Okanagan, Grant, Benton, Franklin, *Adams*, Kittitas, Yakima. 'C' Counties: (WA) Walla Walla, Kickitat, Benton, Skamania, Cowlitz, Wahkiakum, Pacific; (OR) Umatilla, Morrow, Gilliam, Sherman, Wasco, Hood, River, *Clackamas*, Multnomah, *Washington*, Columbia, Clatsop
- **a.6.4.** County inclusion/exclusion justification: SR: *Adams*: this was just not in the text description in the Screening-level assessment, it was listed in the table of crops/acreage; the Upper Columbia-Priest Rapids HUC (17020016) extends into the county. C: *Clackamas*: the Lower Columbia-Sandy HUC (17080001) extends into the county and drains into the mainstem of the Columbia. *Washington (exclude)*: only a small portion of the county is intersected in the far northeastern corner; the

land appears to be mountainous. Small intersection in the southeastern part of the county is in the Portland metropolitan area.

a.7. Snake River Basin Steelhead ESU

- **a.7.1.** Reference: FR **65**(32), 7764 (Feb 16, 2000).
- **a.7.2.** HUCs 17060101 hells canyon Dam, 17060102, 17060103, 17060104, 17060105, 17060106, 17060107, 17060108, 17060110, 17060201, 17060202, 17060203, 17060204, 17060205, 17060206, 17060207, 17060208, 17060209, 17060210, 17060301, 17060302, 17060303, 17060304, 17060305, 17060306, 17060308, 17070101, 17070105, 17080001, 17080003, 17080006, 17090012)
- **a.7.3.** Corridor definition: C downstream from Snake river confluence with Columbia. SR Counties: (OR) Wallowa, *Baker (exclude)*, Union, *Umatilla (exclude)*; (WA) Asotin, Garfield, Columbia, Whitman, Franklin, Walla Walla, *Adams, Lincoln, Spokane*; (ID) Adams, Idaho, Nez Perce, *Blaine (exclude)*, Custer, Lemhi, *Boise (exclude)*, Valley, Lewis, Clearwater, Latah. C Counties: (OR) Umatilla, Morrow, Gilliam, Sherman, Wasco, Hood River, Mutnomah, *Clackamas*, Columbia, Clatsop, *Washington (exclude)*; (WA) *Walla Walla*, Benton, *Yakima*, Klickitat, Skamania, Clark, Cowlitz, Wahkiakum, Pacific.
- **a.7.4.** County inclusion/exclusion justification: SR: (OR) *Baker (exclude)* as in report, exclude – in the Eagle Cap Wilderness of the Whitman NF. *Umatilla(exclude)* as in the report, exclude-small area and almost all overlap in the Umatilla and Whitman NFs*;* (WA) *Adams, Lincoln, Spokane*: the Palouse HUC (17060108) extends into these counties (no obstruction listed in FR); (ID) *Boise (exclude)*: at most only slivers of overlap-also the entire potential overlap area is in the Boise NF. *Blaine (exclude)*: overlap is entirely within in the Sawtooth Nation Recreation Area in the Sawtooth NF. C: (OR) *Clackamas* the Lower Columbia-Sandy HUC (17080001) extends into the county and drains into the mainstem of the Columbia. *Washington (exclude)* only a small portion of the county is intersected in the far northeastern corner; the land appears to be mountainous. Small intersection in the southeastern part of the county is in the Portland metropolitan area; (WA) *Walla Walla* include, Middle Columbia-Lake Wallula HUC (17070101) extends into the county*, Yakima* include, Middle Columbia-Lake Wallula HUC (17070101) intersects the northeastern corner of the county.

a.8. Upper Willamette River Steelhead ESU

- **a.8.1.** reference: FR **65**(32), 7764 (Feb 16, 2000).
- **a.8.2.** HUCs: (17080001, 17080003, 17080006, 17090003 cut at Willamette/Calapooia River confluence, 17090005, 17090006, 17090007, 17090008, 17090009, 17090010, 17090011, 17090012);
- **a.8.3.** Corridor definition: Upstream of 17090012 is ‘SR’ (Willamette Falls) SR Counties (OR): Benton, Linn, Polk, Marion, Yamhill, Washington, Clackamas, Washington , *Tillamook (exclude)*, *Lincoln (exclude)*. C Counties: (OR) Multnomah, Columbia, Clatsop; (WA) Clark, Cowlitz, Wahkiakum, Pacific.
- **a.8.4.** County inclusion/exclusion justification: SR *Lincoln (exclude)* very small, mountainous area. *Tillamook (exclude)*: very small mountainous area, most BLM or Suislaw NF.

a.9. Lower Columbia River Steelhead ESU

- **a.9.1.** Reference: FR **65**(32), 7764 (Feb 16, 2000).

- **a.9.2.** HUCS: 17070105 cut at confluences of wind river and hood river & tributaries, 17080001, bull run Dam 2 , 17080002 Merwin Dam, 17080003, 17080005, 17080006, 17090011, 17090012
- **a.9.3.** Corridor definition: OR side: confluence of Willamette w/ Columbia; WA side confluence of Cowlitz w/ Columbia. SR Counties: (OR) Hood River, Clackamas, Multhomah; (WA) Skamania, Clark, Cowlitz, *Lewis*. C Counties: (OR) Columbia, Clatsop; (WA) Wahkiakum, Pacific.
- **a.9.4.** County inclusion/exclusion justification: *Lewis*: include, the Lower Cowlitz HUC (17080005) extends into the county (in FR listing of counties).

a.10. Middle Columbia River Steelhead ESU

- **a.10.1.** Reference: FR **65**(32), 7764 (Feb 16, 2000).
- **a.10.2.** HUCs 17020016; area include only downstream of Yakima/Columbia confluence, this remove a portion of the HUC, 17030001, 17030002, 17030003, 17070101, 17070102, 17070103, 17070104, 17070105 , 17070106, 17070201, 17070202, 17070203, 17070204, 17070306 Pelton Dam, 17070307, 17080001, 17080003, 17080006, 17090012
- **a.10.3.** Corridor definition: C/SR divide is at Mosier Creek confluence with the Columbia, split 17070105. SR Counties: (OR) *Harney (exclude)*, *Union (exclude)*, *Wallowa (exclude)*, Gilliam, Morrow, Umatilla, Sherman, Wasco, Crook, Grant, Wheeler, Jefferson; (WA) Benton, Columbia, *Franklin* (*exclude)*, Kittitas, Klickitat, *Skamania (exclude)*, Walla Walla, Yakima. C Counties: (OR) Hood River, Mutnomah, *Clackamas*, Columbia, Clatsop; (WA) Skamania, Clark, Cowlitz, Wahkiakum, Pacific.
- **a.10.4.** County inclusion/exclusion justification: SR: (OR) *Harney (exclude)*: very small area, in Malheur NF; *Union, Wallowa (exclude)*: in Umatilla NF. (WA) *Franklin (exclude)* at most sliver overlap; *Skamania (exclude)*: no overlap (but contributes to corridor). C (OR): *Clackamas*: the Lower Columbia-Sandy HUC (17080001) extends into the county and drains into the mainstem of the Columbia.

b. Chinook

b.1. Sacramento River Winter-run Chinook Salmon ESU

- **b.1.1.** Reference: FR **58**(114) 33212, June 16, 1993
- **b.1.2.** HUCs: Only a verbal description is given. Listed as Sacramento River from Keswick Dam (at 18020101 boundary) to Chipps Island and riparian zone. Define SR habitat as HUCs directly adjacent to the river (this is not in this earlier description, but is consistent with the more recent descriptions – possible that an updated description would take this approach). Define C habitat as HUCs directly draining to the defined corridor areas: from Chipps Island to Golden Gate Bridge/Oakland Bay Bridge
- **b.1.3.** Corridor definition: see b.1.2. SR Counties: Shasta, Tehama, Glenn, Butte, Colusa, *Sutter*, *Yuba*, Yolo, Sacramento, Solano. C Counties: Solano, *Napa*, Sonoma, Marin, San Francisco, Alameda, Contra Costa, *San Mateo (exclude)*
- **b.1.4.** County inclusion/exclusion justification: *Sutter*, *Yuba*: include, Lower Feather River HUC (18020106) drains to the Sacramento, crossing both counties. *Napa*; include, drains to San Pablo Bay which is part of the corridor habitat. *San Mateo (exclude)*: HUC drains to San Francisco Bay west of the Golden Gate Bridge.

b.2. Snake River Fall-run Chinook Salmon ESU

- **b.2.1.** Reference: FR **64**(45) 11519, March 9, 1998 (proposed rule)
- **b.2.2.** HUCs: 17080006, 17080003, 17080001bull run Dam, 17070101, 17070105 condit Dam ,17070306 pelton Dam, 17070307, 17070204, 17070201, 17070202, 17070203,17070104,17070103, 17070102, 17060110, 17060107, 17060103, 17060209,17060306, 17060106, 17060102, 17060101 Hells Canyon, Oxbow Dam, Brownlee (also hell's canyon Dam). Added Columbia River corridors above The Dalles Dam to connect to upstream areas on the Columbia.
- **b.2.3.** Corridor definition: From Dalles Dam upstream 'SR'. SR Counties: (OR) *Wasco, Jefferson, Sherman, Gilliam, Wheeler, Morrow, Umatilla, Grant*, Wallowa, *Union (exclude)*; (ID) Latah, Nez Perce, Clearwater, Lewis, *Shoshone (exclude)*, *Valley (exclude)*, Idaho, Adams, *Benewah (exclude)*; (WA) *Adams (exclude)*, Asotin, Garfield, *Lincoln (exclude)*, *Spokane (exclude)*, Whitman, Columbia, Franklin, Walla Walla, *Benton, Yakima, Klickitat*. C Counties: (OR) Wasco, Hood River, Clackamas, Multnomah, Columbia, Clatsop; (WA) Klickitat, Yakima, Skamania, Clark, Cowlitz, Wahkiakum, Pacific.
- **b.2.4.** Counties inclusion/exclusion justification: SR: (OR) *Wasco, Jefferson, Sherman, Gilliam, Wheeler, Morrow, Umatilla, Grant* include, to encompass more recent definition (Deschutes and John Day Rivers)*, Union (exclude)* very small potential overlap, any would be in NF land; Harney and Crook, similar; (ID) *Shoshone (exclude)* at most sliver of potential overlap*, Valley (exclude)* at most sliver of potential overlap *, Benewah (exclude)* no overlap*;* (WA) *Adams (exclude)* no overlap*, Lincoln (exclude)* no overlap*, Spokane (exclude)* no overlap*, Benton, Yakima, Klickitat* Middle Columbia-Lake Wallula HUC (17070101) extend across these counties (Glade, Alder, and Pine Creeks, and Wood Gulch)

b.3. Snake River Spring/Summer-run Chinook Salmon ESU

- **b.3.1.** Reference: FR **58**(247) 68543, Dec 28, 1993
- **b.3.2.** HUCs: 17060101 hells canyon Dam, 17060102, 17060103, 17060104, 17060105,17060106, 17060107, 17060110, 17060201, 17060202, 17060203, 17060204,17060205, 17060206, 17060207, 17060208, 17060209, 17060210 and downstream Columbia HUCs to the ocean.
- **b.3.3.** Corridor definition: Columbia/Snake confluence downstream is 'C'. SR Counties: (ID) Adams, Custer, Idaho, *Latah (exclude)*, Lemhi, Lewis, Nez Perce, *Blaine*; (OR) Union, Wallowa, *Umatilla (exclude)*; (WA) Asotin, *Benton (exclude)*, Columbia, Franklin, Garfield, Walla Walla, Whitman. C Counties: (OR) Umatilla, Morrow, Gilliam, Sherman, Wasco, Hood River, Clackamas, Multnomah, Columbia, Clatsop; (WA) Walla Walla, Benton, Yakima, Klickitat, Skamania, Clark, Cowlitz, Wahkiakum, Pacific.
- **b.3.4.** Counties inclusion/exclusion justification: SR: (ID) *Latah (exclude)* north of habitat*, Blaine* overlaps, but overlap is entirely within in the Sawtooth Nation Recreation Area in the Sawtooth NF, exclude *;* (OR): *Umatilla (exclude)* as in the report, exclude-small area and almost all overlap in the Umatilla and Whitman NFs (however, is included in the migration corridor*;* (WA): *Benton (exclude)* very small overlap (however, is part of migration corridor).

b.4. California Central Valley Spring-run Chinook Salmon ESU

- **b.4.1.** reference: FR **65**(32), 7764 (Feb 16, 2000)

- **b.4.2.** HUCs: 18020101, 18020102, 18020103, 18020104, 18020105, 18020106, 18020107, 18020108, 18020109, 18020112, 18020114, 18020118, 18020119, 18020120, 18020125, 18050001, 18050002, 18050004, 18020103: Black Butte Dam; not significant part of HUC (very bottom southern edge), 18020105: Centerville Dam – not in GNIS, can't locate, so leave entire HUC (as in NMFS); located the town of Centerville, but no res/Dam evident – also at edge of HUC, not likely much effect, 18020103: Oroville Dam not in NMFS: clip using NHD, 18020108: camp far west Dam: at HUC boundary 18020112: Keswik Dam NMFS clip is OK; Whiskeytown Dam clip not in NMFS, clipped with NHD, although this appears to isolate the NW corner of the HUC, 18020125: Englebright Dam not in GNIS, but found on atlas map. NMFS has additional cuts to the north the south (appear to be Dams), but not in FR. Clip only to Englebright Dam.
- **b.4.3.** Corridor definition: C Downstream of where Sacramento joins the Sacramento-San Joaquin Delta. SR Counties: Shasta, Tehama, Butte, Glenn, Colusa, Yolo, Yuba, Placer, Sacramento, Solano, *Sutter*, Nevada. C Counties: Contra Costa, *Solano*, Napa, Alameda, Marin, Sonoma, San Mateo, San Francisco, *Santa Clara*.
- **b.4.4.** County inclusion/exclusion justification: *Solano*: the county is split into SR (Lower Sacramento HUC [18020109]) and C (Suisun Bay HUC [18050001]). *Santa Clara*: San Francisco Bay HUC (18050004) extends into the northeastern part of the county.

b.5. California Coastal Chinook Salmon ESU

- **b.5.1.** reference: FR **65**(32), 7764 (Feb. 16, 2000)
- **b.5.2.** HUCs: 18010102, 18010103: Scott Dam, 18010104, 18010105, 18010106, 1801010, 18010108, 18010109, 18010110: Coyote Dam, Warm Springs Dam, 18010111
- **b.5.3.** All areas apparently SR habitat. Counties: Humboldt, Trinity, Mendocino, *Glenn (exclude)*, *Lake (exclude)*, Sonoma, Marin
- **b.5.4.** County inclusion/exclusion justification: Glenn and Lake should be excluded, overlaps of the ESU in these counties are entirely within the Mendocino NF.

b.6. Puget Sound Chinook Salmon ESU

- **b.6.1.** Reference: FR **65**(32), 7764 (Feb 16, 2000)
- **b.6.2.** HUCs: 17110002, 17110003, 17110004, 17110005, 17110006, 17110007,17110008, 17110009, 17110010,17110011,17110012 Landsburg Diversion in FR; not found, but found town of Landsburg and there is the Walsh Lake Diversion nearby; cut HUC at this point, 17110013,17110014, 17110015, 17110016, 17110017, 17110018, 17110019, 17110020, 17110005 is split by NMFS boundary; not in FR description (keep whole HUC), 17110010 split at Tolt Dam, 17110013, 17110020 Elwha Dam.
- **b.6.3.** All areas apparently SR habitat. Counties: Skagit, Whatcom, San Juan, Island, Snohomish, King, Pierce, Thurston, Lewis, *Grays Harbor (delete)*, Mason, Clallam, Jefferson , Kitsap
- **b.6.4.** County inclusion/exclusion justification: *Grays Harbor (delete)* all overlap within Olympic NF;

b.7. Lower Columbia River Chinook Salmon ESU

- **b.7.1.** Reference: FR **65**(32), 7764 (Feb 16, 2000)

- **b.7.2.** HUCs: 17070105 Condit Dam (on White Salmon River), also Washington-side area upstream of the White Salmon River cut out, The Dalles Dam is listed as a barrier, but cutting at the Hood River on the Oregon side makes this irrelevant (cut at Hood River), 7080001 Bull Run Dam #2, 17080002 Merwin Dam, 17080003, 17080004, 17080005, 17080006, 17090011, 17090012
- **b.7.3.** Corridor definition: Washington side: 17080006 split at Gray River: downstream in C, Oregon Side: downstream of Willamette confluence. C Counties: (OR) Clatsop, Columbia; (WA) Pacific. SR Counties: (OR) Hood River, *Wasco (delete)*, Columbia, Clackamas, *Marion (exclude)*, Mutnomah, *Washington (delete)*; (WA) Klickitat, Skamania, Clark, Cowlitz, Lewis, Wahkiakum, Pacific, Yakima, *Pierce (delete)*
- **b.7.4.** County inclusion/exclusion justification: SR: (OR) *Wasco (delete)* at most sliver of overlap, on the Warm Spring Indian Reservation, *Marion (exclude)* overlap totally within the Bull of the Woods Wilderness, Mount Hood NF, *Washington (delete)* only a small portion of the county is intersected in the far northeastern corner; the land appears to be mountainous. Small intersection in the southeastern part of the county is in the Portland metropolitan area; (WA) *Pierce (delete)* overlap within the Mount Rainier National Park Wilderness..

b.8. Upper Willamette River Chinook Salmon ESU

- **b.8.1.** Reference: FR **65**(32), 7764 (Feb 16, 2000)
- **b.8.2.** HUCs: 17080001, 17090002: Dorena Dam clip in NMFS is OK; Cottage Grove Dam clip not included (clip from nhd), 17080003, 17080006, 17090001, 17090002, 17090003 Fern Ridge Dam , 17090004 Blue River Dam, 17090005 there are two basins (potential error?); eastern basin obviously doesn't drain to the Willamette, delete. Big Cliff Dam, 17090006 green peter Dam, 17090007, 17090008, 17090009, 17090010, 17090011, 17090012
- **b.8.3.** Corridor definition: Upstream of 17090012 is 'SR' (Willamette Falls). C Counties: (OR) Clackamas, Multnomah, Columbia, Clatsop; (WA) Clark, Cowlita, Wahkiakum, Lewis, Pacific. SR Counties: (OR) Clackamas, *Douglas (delete)*, Lane, Benton, *Lincoln* (*delete*), Linn, Polk, Marion, Yamhill, Washington, *Tillamook* (*delete*).
- **b.8.4.** County inclusion/exclusion justification: SR: *Lincoln (exclude)* very small, mountainous area. *Douglas (delete)* overlap is in the Willamette NF and BLM land. *Tillamook (exclude)*: very small mountainous area, most BLM or Suislaw NF

b.9. Upper Columbia River Spring-run Chinook Salmon ESU

- **b.9.1.** Reference: FR **65**(32), 7764 (Feb 16, 2000)
- **b.9.2.** HUCs: 17020005 Chief Joseph Dam, 17020005, 17020007, 17020008, 17020010, 17020011, 17020016 includes Adams county (not in FR listing), 17070101, 17070105, 17080001, 17080003, 17080006, 17090012
- **b.9.3.** Corridor definition: 17020010 at Rock Island Dam for SR/C. SR Counties: Chelan, Douglas, Okanogan, *Grant (incorrect, delete for SR)*, Kittitas, *Benton (incorrect, delete for SR,)*. C Counties: (OR) Clatsop, Columbia, Gilliam, Hood River, Morrow, Multnomah, Sherman, Umatilla, Wasco, *Clackamas*; (WA) Benton, Clark, Cowlitz, Franklin, Kittitas, Klickitat, Skamania, Wahkiakum, Walla Walla, Yakima, *Pacific, Grant.*

- **b.9.4.** County inclusion/exclusion justification: SR: *Benton, Grant (delete for SR, include for C)* Rock Island Dam is in HUC 17020010, upstream of the counties. C: *Clackamas* the Lower Columbia-Sandy HUC (17080001) extends into the county and drains into the mainstem of the Columbia, C: *Pacific* the Lower Columbia HUC (17080006) crosses the county.

b.10. Central Valley Fall-/Late Fall-run Chinook Salmon ESU (note: not in **Screening-level/diazinon documents*)***

- **b.10.1.** Reference: FR **64**(45),11516 (March 9, 1998) – candidate listing, final critical habitat is still under development (FR **64**(179), 50415 (Sep 16, 1999).
- **b.10.2.** HUCs: 18050002 San Pablo Res., 18050004, 18050003 Calaveras (FR has Calavera) res. Not in this HUC in 18050004 clip 04, 18050001, 18040003, 18040002 Crocker Diversion, 18040004 New Hogan (outside of HUC), 18040005 Camanche Dam, 18040013, 18020109, 18020111 Nimbus Dam (at HUC boundary), 18020127, 18020108 camp far west (at HUC boundary), 18020106 Oroville Dam (at HUC boundary), 18020107 Englebright Dam (outside of HUC, 18020105, 18020104, 18020120, 18020103 black butte Dam (outside of HUC), 18020119,18020114, 18020113, 18020102, 18020101 Keswick Dam (extends 18020118, clip),18020118 Whiskeytown Dam, 18020112
- **b.10.3.** Counties: Shasta, Trinity, Tehama, Glenn, Butte, Colusa, Sutter, Yuba, Yolo, Placer, El Dorado, Amador, Sacramento, Solano, Napa, Marin, San Francisco, San Mateo, Santa Clara, Alameda, Contra Costa, San Joaquin, Calaveras, Stanislaus, Merced

c. Coho Salmon

c.1. Central California Coast Coho Salmon ESU

- **c.1.1.** Reference: FR **64**(86), 24049 (May 6, 1999)
- **c.1.2.** HUCs: 18060001: Newell Dam; southern boundary is San Lorenzo River drainage, 18050006, 18050002: Phoenix Dam, 18050005: Peters Dam, Seeger Dam; text description lists San Francisco Bay tributaries on the north side of the bay only, thus no poly in Contra Coast or Alameda counties , 18010110: Coyote Dam, Warm Springs Dam, 18010109, 18010108. Northern extent is described as Punta Gorda, which is in HUC 18010107, not in the FR list (added southern portion of this HUC, which give a small strip of coast in Humboldt county)
- **c.1.3.** Counties: Santa Cruz, San Mateo, Marin, Napa, Sonoma, Mendocino, S*an Francisco* (small portion of 18050006)
- **c.1.4.** County inclusion/exclusion justification: *San Francisco (exclude)*: although the San Francisco Bay coastal south HUC (18050006) includes part of the county, exclude, as the area is entirely urban.

c.2. Southern Oregon/Northern California Coast Coho Salmon ESU

- **c.2.1.** Reference: FR **64**(86), 24049 (May 6, 1999)
- **c.2.2.** HUCs: 18010107 cut out southern coastal area south of Punta Gorda (from text description), 18010106, 18010105, 18010104, 18010103 to Scott Dam, 18010102, 18010101, 18010212, 18010211 Lewiston Dam, 18010210, 18010209, 18010208, 18010207 Dwinnell Dam, 18010206 Irongate Dam, 17100312, 17100311 Lake Selmac – very small interior, no clip, 17100310, 17100309 Emigrant Lake Dam, 17100308, 17100307 agate lake; fish lake – very small no clip, willow lake – not

found, lost creek Dam, 17100306 Northernmost extent is Cape Blanco, excludes northern part of HUC (and Coos county).

c.2.3. Counties: (CA) Humboldt, Mendocino, Trinity, *Glenn*, Lake *(exclude)*, Del Norte, Siskiyou; (OR) Curry, Jackson, Josephine, Klamath *(exclude)*, Douglas *(exclude)*

c.2.4. County inclusion/exclusion justification: *Glenn (exclude)*: the overlap into the county is entirely within the Mendocino NF where no chlorpyrifos is used. Lake *(exclude)*: also Mendocino NF land. Klamath *(exclude)*: very small portion of the county, entirely in the Rouge River NF. Douglas *(exclude)*: small portion of the county, entirely with the Rouge River and Upmqua NFs.

c.3. Oregon Coast Coho Salmon ESU

c.3.1. Reference: FR **65**(32), 7764 (Feb 16, 2000)

c.3.2. HUCs: 17100201, 17100202, 17100203 McGuire Dam, 17100204, 17100205, 17100206, 1710020717100310, Cooper Creek Dam – very small, Soda Spring Dam, 17100302, Ben Irving Dam –not found; Galesville Dam—very small; Win Walker Res. – very small 17100303, 17100304, Lower Pony Creek Dam – very small, 17100305, 17100306 Cape Blanco southernmost point, cuts off some of HUC.

c.3.3. Counties: Douglas, Lane, Coos, Curry, Benton, Lincoln, Polk, Tillamook, *Yamhill (delete), Washington (delete), Columbia (delete)*, Clatsop

c.3.4. County inclusion/exclusion justification: *Yamhill (exclude)*, very small area, mostly BLM-owned land. *Washington (exclude)*: examination of a shaded relief map for the area shows these areas to be mountainous. *Columbia (exclude)*: also a mountainous area.

d. Chum Salmon

d.1. Hood Canal Summer-run Chum Salmon ESU

d.1.1. Reference: FR **65**(32), 7764 (Feb 16, 2000)

d.1.2. HUCs: 7110017 Cushman Dam, 17110018, 17110019, 17110020: additional FR descriptions: all drainage to Hood Canal, Olympic Peninsula rivers between and including Hood Canal and Dungeness Bay. Estuarine/marine areas of Hood Canal Admiralty Inlet and Straits of Juan De Fuca to Int'l boundary west to line north of Dungeness Bay, 1711019: This includes Whidby Island, but excludes east of there. Also excludes polygons on the east side of Puget Sound. Includes small portion on the Olympic Peninsula opposite Whidby Island (Kitsap county).

d.1.3. Counties: Mason, Clallam, Jefferson, Kitsap, Island, *Grays Harbor (exclude)*

d.1.4. County inclusion/exclusion justification: *Grays Harbor (exclude)* small overlap is entirely within the Olympic NF.

d.2. Columbia River Chum Salmon ESU

d.2.1. Reference: FR **65**(32), 7764 (Feb 16, 2000)

d.2.2. HUCs17080001 Bonneville Dam – at HUC boundary, 17080002 Merwin Dam , 17080003 FR list exclusion of Milton Creek drainage, very small portion of the HUC, ignore. 17080005, 17080006, 17090012

d.2.3. No C/SR distinction made. Counties: (WA) Clark, Skamania, Cowlitz, Wahkiakum, Pacific, Lewis; (OR) Multnomah, Clatsop, Columbia, *Clackamas*, *Washington (delete)*

d.2.4. County inclusion/exclusion justification: *Clackamas* the Lower Columbia-Sandy HUC (17080001) extends into the county and drains into the mainstem of the

Columbia, *Washington (delete)* examination of a shaded relief map for the area shows these areas to be mountainous.

e. Sockeye Salmon

e.1. Ozette Lake Sockeye Salmon ESU

e.1.1. Reference: FR **65**(32), 7764 (Feb 16, 2000)

e.1.2. HUCs: 17100101, Ozette Lake watershed

e.1.3. Counties: Clallam

e.2. Snake River Sockeye Salmon ESU

e.2.1. FR **58(**247), 68551 (Dec 28, 1993)

e.2.2. HUCs: 17060103, 17060107, 17060110, 17060201, 17060203, 17060207, 17060209) + columbia downstream HUCs to the sea.

e.2.3. Corridor description: From Snake/Columbia confluence downstream is 'C' and from Salmon River/Snake; SR areas only in Alturas, Stanley, Redfish, Yellow Belly, Pettit and Alturas Lakes watersheds and Valley Creek between Stanley Lake Creek and the Salmon River. C Counties: (OR) *Wallowa (exclude)*, Umatilla, Morrow, Gilliam, Sherman, Wasco, Hood River, Clackamas, Multnomah, Columbia, Clatsop ; (ID) Custer, Blaine, Lemhi, Valley, Idaho, Lewis, Nez Perce; (WA) Asotin, Garfield, Columbia, Walla Walla, Franklin, Benton, Klickitat, Skamania, Clark, Cowlitz, Wahkiakum, Pacific. SR Counties: (ID) Blaine, Custer

e.2.4. County inclusion/exclusion justification: *Wallowa (exclude)* overlap within the Hell's Canyon National Recreation Area and Wallowa NF.

Attachment 6. Refined assessment of pesticide use intensity and resulting risk conclusions

a. For California ESUs, comparison of 1990-2001 county-wide PUR data summary vs. the area actually within the ESUs:

CDPR PUR applications of chlorpyrifos were downloaded from the Pesticide Information Portal (CalPIP), at http://jolie.cdpr.ca.gov/cfdocs/calpip/prod/main.cfm. The downloaded text files were imported in a MS Access database and queries were created to give 12-year sums of all chlorpyrifos use by section. The resulting summary table was exported from Access as a .dbf file and joined at the section level to the Public Land Survey System (PLSS) coverage for California obtained from the Teale Data Center. For each ESU, summary chlorpyrifos use was obtained for each county intersected by the ESU (from the county lists previously developed) as well as the sections contained within the ESU boundaries themselves. The resulting information was summarized in Excel for presentation.

b. For California ESUs, comparison of 2001 county-wide PUR data by commodity vs. the area actually within the ESUs:

For full-county data, a 2001 chlorpyrifos-only query from CalPIP was imported into a MS Access database. For the ESU areas, the boundaries defined previously and a Public Land Survey (PLSS) coverage from the Teale Data Center were employed as spatial data layers. From the Access database a table of section-level information (fields: MTRS, commodity, acres, lbs chemical) was exported and a relate was established in ArcMap via the MTRS field in the PLSS layer (a one-to-many relationship). (MTRS field looks like: M05N09E04 – a concatenation of: meridian (M), township (05), township direction (N), range (09), range direction (E), section (04)). Sections were selected spatially for the ESU area, and then the related records were exported from ArcMap (as dbase files), imported into Excel, and summarized in pivot tables.

c. For OR, WA, ID (no detailed-level pesticide use reporting data is available):

For analysis with NLCD, a consistent coordinate system was used: Albers, units meters, NAD83, central meridian -96, standard parallel 1 29.5, standard parallel 2 24.4, latitude of origin 23, no false easting or northing. The cell size of the NLCD grids is 30x30 meters (900 m^2).

Analysis methodology: (in ArcMap, with the Spatial Analyst extension)

a. Because there are separate NLCD rasters for each state, steps b-g were repeated for each state intersecting with the ESU.
b. Select SR habitat type of the ESU.
c. Convert the selection features to a raster (spatial analyst=>convert=>features to raster) save as c:\arcworkspace\<esu#>SR (output cell size 30 – same as the NLCD grids).
d. Set the resulting raster as the analysis mask in spatial analyst (spatial analyst=>options=>general=>analysis mask.

e. Use the raster calculator: (spatial analyst=>raster calculator); enter expression as the NLCD layer (e.g. id_albers) . Resulting calculation is a temporary grid. Join to nlcd.lut (lookup table of NLCD classes).
f. Export the resulting vat table of the calculation to <esu#>sr.dbf.
g. Import to Excel. Sort the records and calculate the hectares of each class as count*900/10000 (each cell is 30x30 m, 900 m^2) (an Excel macro was built to do this).
h. Combine and summarize the land use classes with a pivot table.
i. For "C" habitat type, do the steps a-f (repeat for each state), using name <esu#>c<state> (example: e2cID).
j. Process in Excel as before, combining states with a pivot table.
k. "Land Use Classifications Relevant to Potential Chlorpyrifos Use" were assumed to have NLCD Classifications of 'small grains', 'row crops', 'orchards, vineyards, other', or 'fallow'. For spawning/rearing and corridor regions of each ESU, a table is presented showing the sums of the potential use classes and the sum of all other land use classes (these classes were extracted from the pivot tables described above). The following criteria were used as cutoffs for may affect vs. not likely to affect conclusions: for spawning/rearing areas: > 10% , may affect, ≤ 10, not likely to affect; for corridor areas, the cutoff is 25%. The higher value for corridor areas reflects the large dilution factor reducing exposure in the main stem rivers. Following each summary table, a table listing all land use classes and their corresponding areas and area percents is shown for completeness.

f. Steelhead

f.1. Southern California Steelhead ESU

f.1.1. initial finding – may effect

f.1.2. county vs. ESU – PUR data, 1990-2001 sum

	Entire county	ESU area
County	total lbs	total lbs
Los Angeles	431	0
Orange	5,223	172
San Diego	21,097	0
San Luis Obispo	115,477	33,756
Santa Barbara	275,190	275,190
Ventura	551,659	217,651
Total	969,076	526,597
Annual Mean	80756	43883

f.1.2.1. conclusion – may effect

f.1.3. county vs. ESU PUR data by commodity, 2001

		Entire county		ESU area	
County	Commodity	acres	lbs	acres	lbs
Los Angeles	Alfalfa (Forage - Fodder) (Alfalfa Hay)	1490	626	0	0

Orange	Beans, Succulent (Other Than Lima)	2	1	0	
	Lemon	152	152	152	152
	Orange (All Or Unspec)	44	30	44	30
	Strawberry (All Or Unspec)	1071	992	0	0
San Diego	Apple	24	18	0	0
	Avocado (All Or Unspec)	400	365	0	0
	Citrus Fruits (All Or Unspec)	35	35	0	0
	Corn (Forage - Fodder)	3	3	0	0
	Corn, Human Consumption	10	0	0	0
	Grapefruit	283	278	0	0
	Kumquat (All Or Unspec)	7	3	0	0
	Lemon	552	612	0	0
	Lime (Mexican Lime, Etc.)	14	9	0	0
	Orange (All Or Unspec)	2480	634	0	0
	Pear	7	4	0	0
	Strawberry (All Or Unspec)	285	283	66	66
San Luis Obispo	Alfalfa (Forage - Fodder) (Alfalfa Hay)	150	110	0	0
	Apple	90	180	0	0
	Bok Choy (Wong Bok)	485	542	18	17
	Broccoli	2817	3764	2070	2835
	Brussels Sprouts	27	27	0	0
	Cabbage	137	145	0	0
	Cauliflower	1235	980	0	0
	Chinese Cabbage (Nappa, Won Bok, Celery Cabbage)	1642	1853	61	58
	Corn, Human Consumption	3	3	0	0
	Grapefruit	20	19	20	19
	Grapes, Wine	1109	2199	0	0
	Kale	30	31	5	8
	Lemon	827	1386	515	938
	Orange (All Or Unspec)	164	373	0	0
	Radish	1	1	0	0
	Walnut (English Walnut, Persian Walnut)	6	12	0	0
Santa Barbara	Apple	200	343	201	343
	Beans (All Or Unspec)	663	31	663	31
	Bok Choy (Wong Bok)	103	96	99	96
	Broccoli	12525	14707	12523	14710
	Cabbage	1121	1096	1121	1096
	Cauliflower	5588	4783	5594	4787
	Chinese Cabbage (Nappa, Won Bok, Celery Cabbage)	320	310	321	311
	Corn, Human Consumption	179	163	179	163
	Grapes, Wine	1774	1550	1773	1552
	Kale	15	8	14	8
	Lemon	693	1535	694	1536

	Lime (Mexican Lime, Etc.)	4	9	4	9
	Pecan	5	4	5	4
	Potato (White, Irish, Red, Russet)	10	90	10	90
	Spinach	3	3	3	3
	Strawberry (All Or Unspec)	319	314	323	314
	Walnut (English Walnut, Persian Walnut)	467	479	467	479
Ventura	Bok Choy (Wong Bok)	7	13	0	0
	Broccoli	2433	1948	0	0
	Cabbage	1106	1070	319	309
	Cauliflower	76	76	0	0
	Celery, General	9	7	9	7
	Chinese Cabbage (Nappa, Won Bok, Celery Cabbage)	33	18	0	0
	Collards	38	38	0	0
	Corn, Human Consumption	720	711	0	0
	Gai Choy (Loose Leaf)	2	4	0	0
	Gai Lon	1	2	0	0
	Grapefruit	7	21	7	20
	Kale	9	9	0	0
	Lemon	14619	49399	7422	23131
	Mustard, General	23	23	23	23
	Onion (Dry, Spanish, White, Yellow, Red, Etc.)	20	36	0	0
	Orange (All Or Unspec)	1568	1817	1450	1435
	Strawberry (All Or Unspec)	3858	3434	1337	1255

f.2. South-Central California Coast Steelhead ESU

f.2.1. initial finding – may effect

f.2.2. county vs. ESU – PUR data, 1990-2001 sum

	entire county	ESU area
COUNTY	total lbs	total lbs
MONTEREY	632,190	630,711
SAN BENITO	60,358	60,358
SAN LUIS OBISPO	115,477	68,063
SANTA CLARA	10,337	9,301
SANTA CRUZ	125,177	64,480
Total	943,539	832,912
Annual Mean	78628	69409

f.2.2.1. conclusion – may affect

f.2.3. county vs. ESU PUR data by commodity, 2001

		Entire County	ESU Area

County	Commodity	Acres	Lbs	Acres	Lbs
Monterey	Apple	50	23	50	23
	Asparagus (Spears, Ferns, Etc.)	20	20	20	20
	Beans, Dried-Type	12	15	12	15
	Bok Choy (Wong Bok)	110	149	110	149
	Broccoli	24643	33002	24643	33,002
	Broccoli Raab (Rapa, Italian Turnip, Rapini)	136	253	136	253
	Brussels Sprouts	1550	1541	1550	1,541
	Cabbage	1975	2255	1975	2,255
	Carrots, General	0	0	0	0
	Cauliflower	11271	11166	11271	11,166
	Chicory (All Or Unspec)	28	67	28	67
	Chinese Cabbage (Nappa, Won Bok, Celery Cabbage)	159	205	159	205
	Corn, Human Consumption	46	102	46	102
	Grapes, Wine	1441	2568	1441	2,568
	Kale	818	734	818	734
	Lemon	229	428	229	428
	Lettuce, Head (All Or Unspec)	25	30	25	30
	Lettuce, Leaf (All Or Unspec)	53	66	53	66
	Onion (Dry, Spanish, White, Yellow, Red, Etc.)	37	81	37	81
	Radish	255	599	255	599
	Research Commodity	5	6	5	6
	Spinach	13	13	13	13
	Squash (Zucchini)	3	2	3	2
	Sugarbeet, General	21	21	21	21
	Turnip, General	17004	14	4	14
	Walnut (English Walnut, Persian Walnut)	120	239	120	239
San Benito	Apple	217	286	217	286
	Asparagus (Spears, Ferns, Etc.)	27	27	27	27
	Alfalfa (Forage - Fodder) (Alfalfa Hay)	210	209	210	209
	Broccoli	580	577	580	577

	Cabbage	580	577	580	577
	Cauliflower	162	144	162	144
	Collards	3	2	3	2
	Corn, Human Consumption	68	62	68	62
	Grapes, Wine	139	277	139	277
	Kale	31	30	31	30
	Onion (Dry, Spanish, White, Yellow, Red, Etc.)	58	63	58	63
	Walnut (English Walnut, Persian Walnut)	909	1239	909	1239
San Luis Obispo	Alfalfa (Forage - Fodder) (Alfalfa Hay)	150	110	60	30
	Apple	90	180	10	20
	Bok Choy (Wong Bok)	485	542	482	538
	Broccoli	2817	3764	1741	2,360
	Brussels Sprouts	27	27	27	27
	Cabbage	137	145	137	145
	Cauliflower	1235	980	896	716
	Chinese Cabbage (Nappa, Won Bok, Celery Cabbage)	1642	1853	1596	1,807
	Corn, Human Consumption	3	3	3	3
	Grapefruit	20	19	0	0
	Grapes, Wine	1109	2199	1109	2,199
	Kale	30	31	25	24
	Lemon	827	1386	341	551
	Orange (All Or Unspec)	164	373	152	343
	Radish	1	1	1	1
	Walnut (English Walnut, Persian Walnut)	6	12	6	12
Santa Clara	Alfalfa (Forage - Fodder) (Alfalfa Hay)	241	167	241	167
	Apple	391	25	391	25
	Beans (All Or Unspec)	42	50	42	50
	Broccoli	234	223	209	198
	Cabbage	18	18	18	18
	Cherry	3	6	0	0
	Chinese Cabbage (Nappa, Won Bok,	105	105	93	91

	Celery Cabbage)				
	Chinese Greens, Chinese Leafy Vegetables	8	60	8	60
	Corn, Human Consumption	358	329	258	321
	Grapes, Wine	314	626	314	626
	Kale	5	5	5	5
	Oats, General	70	52	70	52
	Onion (Dry, Spanish, White, Yellow, Red, Etc.)	12	12	12	12
	Orange (All Or Unspec)	12	15	0	0
	Pear	3	1	0	0
	Pome Fruits (All Or Unspec)	5	3	0	0
	Walnut (English Walnut, Persian Walnut)	31	60	31	60
Santa Cruz	Apple	814	1255	767	1,209
	Broccoli	131	168	100	137
	Brussels Sprouts	3517	3224	0	0
	Cabbage	70	68	70	68
	Cauliflower	198	201	132	129
	Collards	45	28	45	28
	Kale	0	0	0	0
	Kohlrabi	11	6	11	6
	Mustard, General	20	9	20	9

f.3. Central California Coast Steelhead ESU

f.3.1. initial finding - not likely to effect

f.4. California Central Valley Steelhead ESU

f.4.1. initial finding - may effect

f.4.2. county vs. ESU – PUR data, 1990-2001 sum

	Entire County	ESU Area
County	Total Lbs	Total Lbs
Amador	748	748
Butte	206,540	205,771
Calaveras	1,506	1,506
Colusa	14,567	14,567
Contra Costa	6,208	6,208
Glenn	63,021	63,021
Merced	478,940	183,727
Napa	138	138

Placer	5,947	5,947
Sacramento	12,216	10,235
San Joaquin	453,228	453,228
Santa Clara	10,337	212
Shasta	5,759	2,253
Solano	42,058	28,441
Sonoma	39,565	486
Stanislaus	728,086	727,341
Sutter	142,275	142,275
Tehama	76,896	76,896
Yolo	99,581	69,987
Yuba	45,240	37,855
Total	2,432,855	2,030,843
Annual Mean	202738	169237

f.4.2.1. Conclusion – may affect

f.4.3. county vs. ESU PUR data by commodity, 2001

		Entire county		ESU area	
County	Commodity	Acres	Lbs	Acres	Lbs
Amador	Alfalfa (Forage - Fodder) (Alfalfa Hay)	85	42	85	42
	Walnut (English Walnut, Persian Walnut)	132	263	100	199
Butte	Alfalfa (Forage - Fodder) (Alfalfa Hay)	645	342	645	342
	Almond	2527	3886	2527	3886
	Apple	28	41	28	41
	Citrus Fruits (All Or Unspec)	2	1	2	1
	Cotton, General	20	20	20	20
	Orange (All Or Unspec)	97	113	23	41
	Peach	141	211	141	211
	Prune	204	269	204	269
	Vegetables (All Or Unspec)	3	3	3	3
	Walnut (English Walnut, Persian Walnut)	10017	18536	10017	18536
Calaveras	Walnut (English Walnut, Persian Walnut)	155	260	155	260
Colusa	Alfalfa (Forage - Fodder) (Alfalfa Hay)	1189	613	1189	613
	Almond	697	974	697	974
	Cabbage	41	40	41	41
	Cauliflower	15	16	15	16
	Cotton, General	3370	2880	3370	2880
	Kohlrabi	4	4	4	5
	Sunflower, General	41	37	41	37
	Walnut (English Walnut, Persian Walnut)	834	1543	834	1543
Contra Costa	Alfalfa (Forage - Fodder) (Alfalfa Hay)	50	25	50	25
	Asparagus (Spears, Ferns, Etc.)	133	133	133	133
	Uncultivated Agricultural Areas (All Or Unspec)	1	0	1	1
	Walnut (English Walnut, Persian Walnut)	38	74	38	74
Glenn	Alfalfa (Forage - Fodder) (Alfalfa Hay)	2796	1548	2796	1548

	Almond	2325	3754	2325	3754
	Cauliflower	5	5	5	5
	Corn (Forage - Fodder)	30	15	30	15
	Cotton, General	1029	951	1029	951
	Orange (All Or Unspec)	110	233	110	233
	Sorghum/Milo General	32	16	32	16
	Sunflower, General	280	146	280	146
	Walnut (English Walnut, Persian Walnut)	3771	6488	3771	6488
Merced	Alfalfa (Forage - Fodder) (Alfalfa Hay)	14502	8022	1415	947
	Almond	15621	21396	10216	14830
	Apple	36	54	36	54
	Asparagus (Spears, Ferns, Etc.)	224	223	0	0
	Cauliflower	10	5	0	0
	Chinese Cabbage (Nappa, Won Bok, Celery Cabbage)	132	138	0	0
	Chinese Greens, Chinese Leafy Vegetables	20	16	0	0
	Corn (Forage - Fodder)	3020	2964	777	768
	Cotton, General	9167	8916	0	0
	Fig	1350	2684	0	0
	Grapes	38	62	0	0
	Nectarine	28	55	0	0
	Oats (Forage - Fodder)	20	10	0	0
	Orange (All Or Unspec)	13	52	0	0
	Ornamental Turf (All Or Unspec)	7	7	0	0
	Peach	541	1044	208	387
	Radish	109	74	0	0
	Strawberry (All Or Unspec)	0	0	0	0
	Sugarbeet, General	875	748	0	0
	Sweet Potato	2457	4868	250	478
	Walnut (English Walnut, Persian Walnut)	2482	4365	1355	2460
Napa	Walnut (English Walnut, Persian Walnut)	8	15	8	15
Placer	Walnut (English Walnut, Persian Walnut)	15	30	15	30
Sacramento	Alfalfa (Forage - Fodder) (Alfalfa Hay)	2326	1632	2004	1370
	Apple	162	326	142	286
	Corn, Human Consumption	181	180	181	180
	Peach	23	46	23	46
	Pear	348	696	80	160
	Walnut (English Walnut, Persian Walnut)	118	181	118	181
San Benito	Alfalfa (Forage - Fodder) (Alfalfa Hay)	210	209	0	0
	Apple	217	286	0	0
	Asparagus (Spears, Ferns, Etc.)	27	27	0	0
	Bok Choy (Wong Bok)	60	55	0	0
	Broccoli	580	577	0	0
	Cabbage	1027	1078	0	0
	Cauliflower	162	144	0	0

	Collards	3	2	0	0
	Corn, Human Consumption	68	62	0	0
	Grapes, Wine	139	277	0	0
	Kale	31	30	0	0
	Onion (Dry, Spanish, White, Yellow, Red, Etc.)	58	63	0	0
	Walnut (English Walnut, Persian Walnut)	909	1239	0	0
San Joaquin	Alfalfa (Forage - Fodder) (Alfalfa Hay)	11419	5650	11419	5650
	Almond	3265	5900	3265	5900
	Apple	537	661	537	661
	Asparagus (Spears, Ferns, Etc.)	2312	2263	2312	2263
	Cabbage	10	10	10	10
	Cauliflower	16	16	16	16
	Cherry	36	70	36	70
	Corn (Forage - Fodder)	2348	3179	2348	3179
	Corn, Human Consumption	110	99	110	99
	Grapes	32	64	32	64
	Pear	73	146	73	146
	Walnut (English Walnut, Persian Walnut)	10441	18506	10441	18506
San Mateo	Brussels Sprouts	2256	1816	0	0
Santa Clara	Alfalfa (Forage - Fodder) (Alfalfa Hay)	241	167	0	0
	Apple	391	25	0	0
	Beans (All Or Unspec)	42	50	0	0
	Broccoli	234	223	0	0
	Cabbage	18	18	0	0
	Cherry	3	6	0	0
	Chinese Cabbage (Nappa, Won Bok, Celery Cabbage)	105	105	0	0
	Chinese Greens, Chinese Leafy Vegetables	8	60	0	0
	Corn, Human Consumption	358	329	0	0
	Grapes, Wine	314	626	0	0
	Kale	5	5	0	0
	Oats, General	70	52	0	0
	Onion (Dry, Spanish, White, Yellow, Red, Etc.)	12	12	0	0
	Orange (All Or Unspec)	12	15	0	0
	Pear	3	1	0	0
	Pome Fruits (All Or Unspec)	5	3	0	0
	Research Commodity	1808	9	0	0
	Uncultivated Agricultural Areas (All Or Unspec)	13	13	0	0
	Walnut (English Walnut, Persian Walnut)	31	60	0	0
Shasta	Alfalfa (Forage - Fodder) (Alfalfa Hay)	82	82	14	14
	Mint (All Or Unspec)	189	249	0	0
	Strawberry (All Or Unspec)	3	0	3	0
	Walnut (English Walnut, Persian Walnut)	171	352	86	172
Solano	Alfalfa (Forage - Fodder) (Alfalfa Hay)	2883	1710	2750	1642
	Almond	287	506	287	506

	Grasses Grown For Seed (All Or Unspec)	231	705	116	638
	Prune	14	28	14	28
	Sorghum/Milo General	354	238	232	116
	Sunflower, General	133	172	133	172
	Walnut (English Walnut, Persian Walnut)	1513	2768	1016	1902
Sonoma	Apple	1408	1380	6	5
	Grapes, Wine	85	38	6	1
	Orange (All Or Unspec)	1	0	0	0
	Walnut (English Walnut, Persian Walnut)	32	18	30	17
Stanislaus	Alfalfa (Forage - Fodder) (Alfalfa Hay)	10135	5199	10135	5199
	Almond	20599	36984	20599	36984
	Apple	870	1528	870	1528
	Apricot	1	10	1	10
	Cherry	5	43	5	43
	Citrus Fruits (All Or Unspec)	201	741	201	741
	Corn (Forage - Fodder)	3101	3595	3101	3595
	Peach	1042	2030	1042	2030
	Pecan	15	15	15	15
	Plum (Includes Wild Plums For Human Consumption)	0	4	0	4
	Sweet Potato	325	671	325	671
	Walnut (English Walnut, Persian Walnut)	12874	23187	12874	23188
Sutter	Alfalfa (Forage - Fodder) (Alfalfa Hay)	1143	547	1143	547
	Almond	54	78	54	78
	Asparagus (Spears, Ferns, Etc.)	11	11	11	11
	Brussels Sprouts	1	1	1	1
	Cabbage	134	104	134	104
	Collards	10	10	10	10
	Cotton, General	100	90	100	90
	Peach	377	610	377	610
	Pear	30	41	30	41
	Rice (All Or Unspec)	70	20	70	20
	Sunflower, General	80	60	80	60
	Walnut (English Walnut, Persian Walnut)	8794	16541	8794	16541
Tehama	Alfalfa (Forage - Fodder) (Alfalfa Hay)	863	553	863	553
	Almond	1423	2704	1423	2704
	Prune	160	107	160	107
	Walnut (English Walnut, Persian Walnut)	4518	7846	4518	7847
Tuolumne	Apple	14	28	0	0
	Cherry	2	4	0	0
	Nectarine	1	1	0	0
	Peach	1	1	0	0
	Pear	2	4	0	0
Yolo	Alfalfa (Forage - Fodder) (Alfalfa Hay)	14996	7657	13005	6535
	Almond	158	267	138	227

	Apple	47	94	5	4
	Asparagus (Spears, Ferns, Etc.)	5	4	1	2
	Cabbage	1	2	6	6
	Collards	6	6	680	628
	Cotton, General	751	699	96	144
	Pear	96	144	138	104
	Sorghum/Milo General	330	260	9	11
	Sunflower, General	9	11	2207	3947
	Walnut (English Walnut, Persian Walnut)	2867	5005	13005	6535
	Peach	80	160	80	160
	Pear	162	268	162	268
	Prune	285	540	285	540
	Walnut (English Walnut, Persian Walnut)	3075	6022	3075	6022

f.5. Northern California Steelhead ESU

f.5.1. initial finding – not likely to affect

f.6. Upper Columbia River Steelhead ESU

f.6.1. initial finding – may effect

f.6.2. NLCD statistics

f.6.2.1. spawning/rearing area

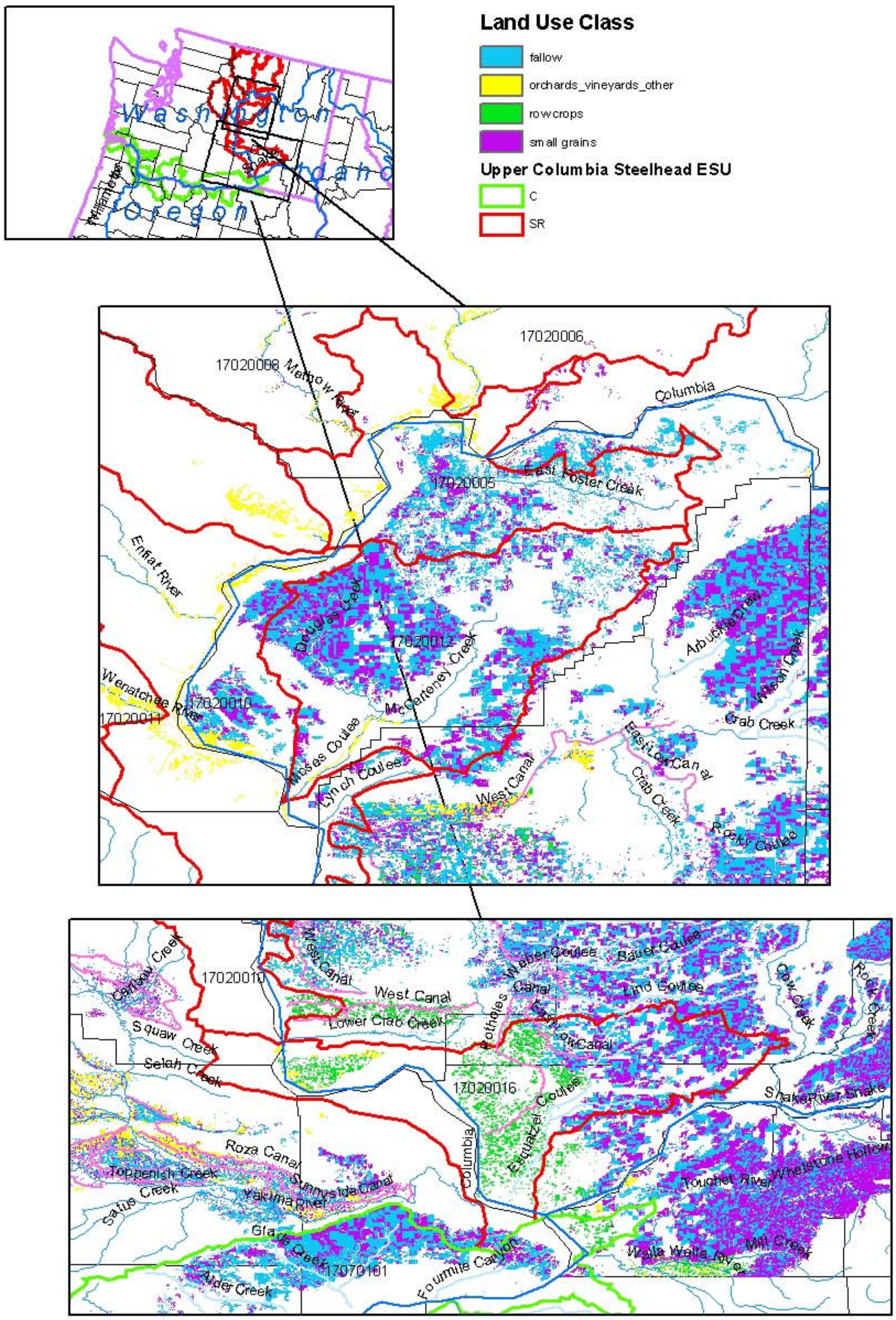
f.6.2.1.1. Land Use Classifications Relevant to Potential Chlorpyrifos Use

CLASS	Hectares	Percent
Fallow	158,293	5.79%
small grains	115,146	4.21%
row crops	51,259	1.87%
orchards_vineyards_other	36,162	1.32%
Sum	360,860	13.20%
other classes	2,373,224	86.80%

f.6.2.1.1.1. Conclusion: may affect spawning/rearing area

f.6.2.1.2. NLCD proximity analysis

Fallow and small grains production land is mainly limited to two HUCs: 17020012 (McCarteney and Douglas Creek drainages), 17020005 (East Foster Creek drainage) and 17020016 (Esquatzel Coulee and its tributaries), all east of the mainstem of the Columbia River. Row crop production areas are almost entirely with HUC 17020016, also east of the Columbia River, in the drainages of Esquatzel Coulee and Potholes Canal. Orchard crops areas are the only potential chlopyrifos use areas west of the Columbia, accounting for a small fraction of the ESU area and are mainly along the Okanogan and Wenatchee Rivers. If all of these water bodies are considered to be spawning/rearing areas, then a finding of may affect still applies (see figure below).


Land Use Class
fallow
orchards_vineyards_other
rowcrops
small grains
Upper Columbia Steelhead ESU
C
SR
Washington
Idaho
Oregon
17020006
17020008
Methow River
Columbia
17020005
East Foster Creek
Entiat River
Douglas Creek
17020012
McCartney Creek
Arbuckle Draw
Wenatchee River
17020010
17020011
Moses Coulee
Lynch Coulee
Crab Creek
East Low Canal
West Canal
Rocky Coulee
Caribou Creek
West Canal
Weber Coulee
Bauer Coulee
Lind Coulee
Lower Crab Creek
Squaw Creek
Selah Creek
17020016
Esquatzel Coulee
Snake River
Roza Canal
Toppenish Creek
Satus Creek
Yakima River
Sunnyside Canal
Touchet River
Whetstone Hollow
Glade Creek
17070101
Fourmile Canyon
Walla Walla River
Mill Creek
Alder Creek

f.6.2.1.3. all classes

CLASS	Hectares	Percent
evergreen forest	896,148	32.78%
shrubland	764,666	27.97%
grasslands_herbaceous	428,566	15.67%
fallow	158,293	5.79%
small grains	115,146	4.21%
pasture_hay	111,083	4.06%
row crops	51,259	1.87%
bare rock_sand_clay	44,113	1.61%
water	43,516	1.59%
orchards_vineyards_other	36,162	1.32%
transitional	18,992	0.69%
commercial_industrial_transportion	18,750	0.69%
deciduous forest	14,378	0.53%
mixed forest	13,678	0.50%
low intensity residential	12,987	0.47%
perennial ice_snow	2,534	0.09%
woody wetlands	1,592	0.06%
urban_recreational grasses	1,164	0.04%
emergent herbaceous wetlands	700	0.03%
quarries_strip mines_gravel pits	180	0.01%
high intensity residential	140	0.01%
background	38	0.00%
Grand Total	2,734,084	100.00%

f.6.2.2. corridor area

f.6.2.2.1. Land Use Classifications Relevant to Potential Chlorpyrifos Use

CLASS	Hectares	Percent
fallow	146,407	7.30%
small grains	105,891	5.28%
row crops	13,147	0.66%
orchards_vineyards_other	12,012	0.60%
Sum	277,458	13.83%
Other classes	1,728,546	86.17%

f.6.2.2.1.1. Conclusion: not likely to affect corridor area

f.6.2.2.2. all classes

CLASS	Hectares	Percent
evergreen forest	643,364	32.07%
shrubland	333,500	16.63%
deciduous forest	171,761	8.56%
fallow	146,407	7.30%
pasture_hay	126,476	6.30%

small grains	105,891	5.28%
water	105,066	5.24%
grasslands_herbaceous	100,199	4.99%
mixed forest	95,499	4.76%
transitional	58,810	2.93%
low intensity residential	41,513	2.07%
commercial_industrial_transportion	26,910	1.34%
row crops	13,147	0.66%
orchards_vineyards_other	12,012	0.60%
bare rock_sand_clay	8,920	0.44%
woody wetlands	7,472	0.37%
urban_recreational grasses	3,094	0.15%
emergent herbaceous wetlands	2,573	0.13%
perennial ice_snow	1,993	0.10%
quarries_strip mines_gravel pits	848	0.04%
high intensity residential	547	0.03%
Grand Total	2,006,003	100.00%

f.7. Snake River Basin Steelhead ESU

f.7.1. initial finding – may affect

f.7.2. NLCD statistics

f.7.2.1. spawning/rearing area

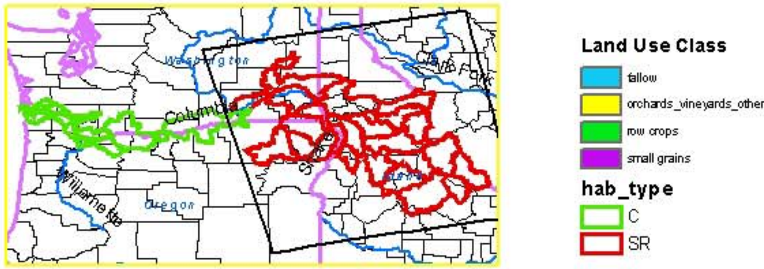
f.7.2.1.1. Land Use Classifications Relevant to Potential Chlorpyrifos Use

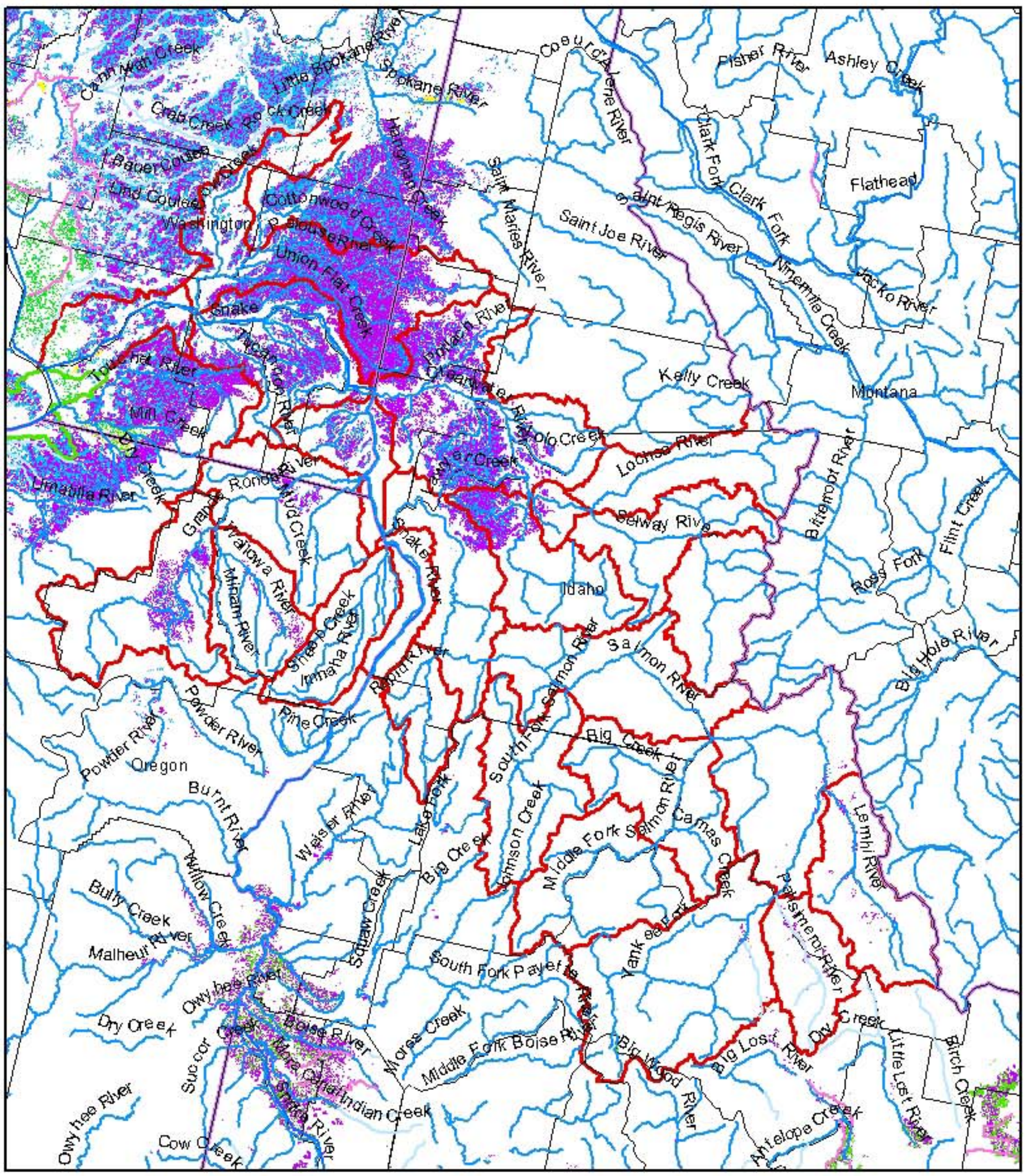
CLASS	Hectares	Percent
fallow	299,819	3.65%
small grains	693,108	8.44%
row crops	8,280	0.10%
orchards_vineyards_other	1,619	0.02%
Sum	1,002,826	12.21%
Other classes	7,211,261	87.79%

f.7.2.1.1.1. Conclusion: may affect spawning/rearing area

f.7.2.1.2. NLCD proximity analysis

Large amounts of small grain-growing areas exist along the Snake River and its tributaries in Eastern Washington and Western Idaho, especially along the Snake itself and the Palouse and Clearwater Rivers. In Oregon , the area of small grain production is much smaller and is primarily limited to the Grande Ronde River drainage, including the Wallowa River. If these rivers and their immediate tributaries are considered spawning/rearing areas, the may affect conclusion holds. Very little agricultural land exists upstream of HUCs 17060305, 17060306 or 17060209 (see figure below). In this upstream portion of the spawning/rearing area of the ESU, there is little likelihood of adverse effects.


Land Use Class
fallow
orchards_vineyards_other
row crops
small grains
hab_type
C
SR
Columbia
Willamette
Oregon


Spokane River
Crab Creek
Cottonwood Creek
Union Flat Creek
Snake
Touchet River
Mill Creek
Umatilla River
Grande Ronde River
Wallowa River
Minam River
Imnaha River
Snake River
Powder River
Oregon
Burnt River
Weiser River
Willow Creek
Bully Creek
Malheur River
Owyhee River
Dry Creek
Succor Creek
Boise River
Indian Creek
Cow Creek
South Fork Payette River
Middle Fork Boise River
Big Wood River
Big Lost River
Little Lost River
Birch Creek
Antelope Creek
Lemhi River
Pahsimeroi River
Yankee Fork
Middle Fork Salmon River
Camas Creek
Big Creek
Johnson Creek
South Fork Salmon River
Salmon River
Idaho
Selway River
Lochsa River
Lolo Creek
Kelly Creek
Saint Joe River
Saint Regis River
Clark Fork
Flathead
Fisher River
Ashley Creek
Jocko River
Ninemile Creek
Montana
Bitterroot River
Rock Creek
Ross Fork
Flint Creek
Big Hole River
Saint Maries River
Coeur d'Alene River
Potlatch River
Clearwater River
Pine Creek
Lake Fork
Big Creek
Squaw Creek

f.7.2.1.3. all classes

CLASS	Hectares	Percent
evergreen forest	3,978,681	48.44%
Shrubland	1,749,460	21.30%
grasslands_herbaceous	885,435	10.78%
small grains	693,108	8.44%
Fallow	299,819	3.65%
bare rock_sand_clay	230,499	2.81%
pasture_hay	108,145	1.32%
Transitional	84,602	1.03%
mixed forest	54,619	0.66%
Water	39,845	0.49%
deciduous forest	27,777	0.34%
woody wetlands	15,539	0.19%
commercial_industrial_transportion	13,514	0.16%
low intensity residential	11,788	0.14%
emergent herbaceous wetlands	8,772	0.11%
row crops	8,280	0.10%
orchards_vineyards_other	1,619	0.02%
perennial ice_snow	896	0.01%
urban_recreational grasses	833	0.01%
quarries_strip mines_gravel pits	736	0.01%
high intensity residential	120	0.00%
Grand Total	8,214,088	100.00%

f.7.2.2. corridor area

f.7.2.2.1. Land Use Classifications Relevant to Potential Chlorpyrifos Use

CLASS	Hectares	Percent
fallow	146,404	7.30%
small grains	105,884	5.28%
row crops	13,141	0.66%
orchards_vineyards_other	12,014	0.60%
sum	277,444	13.83%
other classes	1,728,571	86.17%

f.7.2.2.1.1. Conclusion: not likely to affect corridor area

f.7.2.2.2. all classes

CLASS	Hectares	Percent
evergreen forest	643,375	32.07%
shrubland	333,458	16.62%
deciduous forest	171,765	8.56%
fallow	146,404	7.30%
pasture_hay	126,491	6.31%
small grains	105,884	5.28%

water	105,105	5.24%
grasslands_herbaceous	100,202	5.00%
mixed forest	95,486	4.76%
transitional	58,808	2.93%
low intensity residential	41,525	2.07%
commercial_industrial_transportion	26,913	1.34%
row crops	13,141	0.66%
orchards_vineyards_other	12,014	0.60%
bare rock_sand_clay	8,922	0.44%
woody wetlands	7,472	0.37%
urban_recreational grasses	3,094	0.15%
emergent herbaceous wetlands	2,576	0.13%
perennial ice_snow	1,985	0.10%
quarries_strip mines_gravel pits	849	0.04%
high intensity residential	547	0.03%
Grand Total	2,006,015	100.00%

f.8. Upper Willamette River Steelhead ESU

f.8.1. initial finding – not likely to affect

f.9. Lower Columbia River Steelhead ESU

f.9.1. initial finding – may affect

f.9.2. NLCD statistics

f.9.2.1. spawning/rearing area

f.9.2.1.1. Land Use Classifications Relevant to Potential Chlorpyrifos Use

CLASS	Hectares	Percent
fallow	404	0.03%
small grains	2,602	0.19%
row crops	15,217	1.13%
orchards_vineyards_other	10,123	0.75%
sum	28,346	2.11%
other classes	1,315,663	97.89%

f.9.2.1.1.1. Conclusion: not likely to affect spawning/rearing area

f.9.2.1.2. all classes

CLASS	Hectares	Percent
evergreen forest	686,026	51.04%
deciduous forest	170,379	12.68%
mixed forest	116,674	8.68%
transitional	93,219	6.94%
pasture_hay	79,275	5.90%
low intensity residential	40,651	3.02%
water	39,178	2.91%
shrubland	26,575	1.98%
commercial_industrial_transportion	21,310	1.59%

grasslands_herbaceous	18,587	1.38%
row crops	15,217	1.13%
bare rock_sand_clay	13,699	1.02%
orchards_vineyards_other	10,123	0.75%
woody wetlands	3,808	0.28%
urban_recreational grasses	3,189	0.24%
small grains	2,602	0.19%
emergent herbaceous wetlands	983	0.07%
perennial ice_snow	968	0.07%
quarries_strip mines_gravel pits	602	0.04%
high intensity residential	539	0.04%
fallow	404	0.03%
Grand Total	1,344,009	100.00%

f.9.2.2. corridor area

f.9.2.2.1. Land Use Classifications Relevant to Potential Chlorpyrifos Use

CLASS	Hectares	Percent
fallow	3	0.00%
small grains	129	0.04%
row crops	722	0.23%
orchards_vineyards_other	277	0.09%
sum	1,131	0.36%
other classes	316,152	99.64%

f.9.2.2.1.1. Conclusion: not likely to affect corridor area

f.9.2.2.2. all classes

CLASS	Hectares	Percent
evergreen forest	128,303	40.44%
deciduous forest	76,593	24.14%
mixed forest	47,302	14.91%
water	20,265	6.39%
pasture_hay	14,879	4.69%
transitional	13,913	4.39%
woody wetlands	4,870	1.53%
shrubland	2,635	0.83%
low intensity residential	2,607	0.82%
emergent herbaceous wetlands	1,605	0.51%
commercial_industrial_transportion	1,533	0.48%
grasslands_herbaceous	1,311	0.41%
row crops	722	0.23%
orchards_vineyards_other	277	0.09%
bare rock_sand_clay	235	0.07%
small grains	129	0.04%
urban_recreational grasses	94	0.03%
quarries_strip mines_gravel pits	7	0.00%

fallow	3	0.00%
Grand Total	317,283	100.00%

f.10. Middle Columbia River Steelhead ESU

f.10.1. initial finding – may affect

f.10.2. NLCD statistics

f.10.2.1. spawning/rearing area

f.10.2.1.1. Land Use Classifications Relevant to Potential Chlorpyrifos Use

CLASS	Hectares	Percent
Fallow	479,893	6.93%
small grains	506,929	7.32%
row crops	13,664	0.20%
orchards_vineyards_other	43,153	0.62%
Sum	1,043,638	15.08%
other classes	5,877,044	84.92%

f.10.2.1.1.1. Conclusion: may affect spawning/rearing area

f.10.2.1.2. NLCD proximity analysis

Near the Columbia River, there are large area of grain production, both in Washington and Oregon. The ESU also includes the Yakima River Valley, a heavily agricultural area. The may affect conclusion is confirmed.

f.10.2.1.3. all classes

CLASS	Hectares	Percent
shrubland	2,575,964	37.22%
evergreen forest	2,125,295	30.71%
grasslands_herbaceous	555,266	8.02%
small grains	506,929	7.32%
fallow	479,893	6.93%
pasture_hay	290,011	4.19%
transitional	81,747	1.18%
water	73,935	1.07%
orchards_vineyards_other	43,153	0.62%
low intensity residential	35,796	0.52%
deciduous forest	33,456	0.48%
mixed forest	32,794	0.47%
commercial_industrial_transportion	30,521	0.44%
bare rock_sand_clay	29,311	0.42%
row crops	13,664	0.20%
emergent herbaceous wetlands	6,166	0.09%
perennial ice_snow	2,477	0.04%
woody wetlands	2,125	0.03%
urban_recreational grasses	1,490	0.02%

quarries_strip mines_gravel pits	419	0.01%
high intensity residential	271	0.00%
Grand Total	6,920,682	100.00%

f.10.2.2. corridor area

f.10.2.2.1. Land Use Classifications Relevant to Potential Chlorpyrifos Use

CLASS	Hectares	Percent
fallow	193	0.02%
small grains	1,126	0.11%
row crops	9,678	0.93%
orchards_vineyards_other	9,832	0.95%
sum	20,828	2.01%
other classes	1,015,537	97.99%

f.10.2.2.1.1. Conclusion: not likely to affect corridor area

f.10.2.2.2. all classes

CLASS	Hectares	Percent
evergreen forest	506,230	48.85%
deciduous forest	158,548	15.30%
mixed forest	89,050	8.59%
Water	53,699	5.18%
pasture_hay	50,714	4.89%
Transitional	47,597	4.59%
low intensity residential	36,458	3.52%
Shrubland	20,197	1.95%
commercial_industrial_transportion	19,809	1.91%
grasslands_herbaceous	12,172	1.17%
orchards_vineyards_other	9,832	0.95%
row crops	9,678	0.93%
woody wetlands	7,069	0.68%
bare rock_sand_clay	6,550	0.63%
urban_recreational grasses	3,037	0.29%
emergent herbaceous wetlands	2,353	0.23%
small grains	1,126	0.11%
perennial ice_snow	968	0.09%
quarries_strip mines_gravel pits	550	0.05%
high intensity residential	538	0.05%
Fallow	193	0.02%
Grand Total	1,036,365	100.00%

g. Chinook Salmon

g.1. Sacramento River Winter-run Chinook Salmon ESU

g.1.1. initial finding – may affect

g.1.2. county vs. ESU – PUR data, 1990-2001 sum

g.1.2.1.Spawning/rearing areas

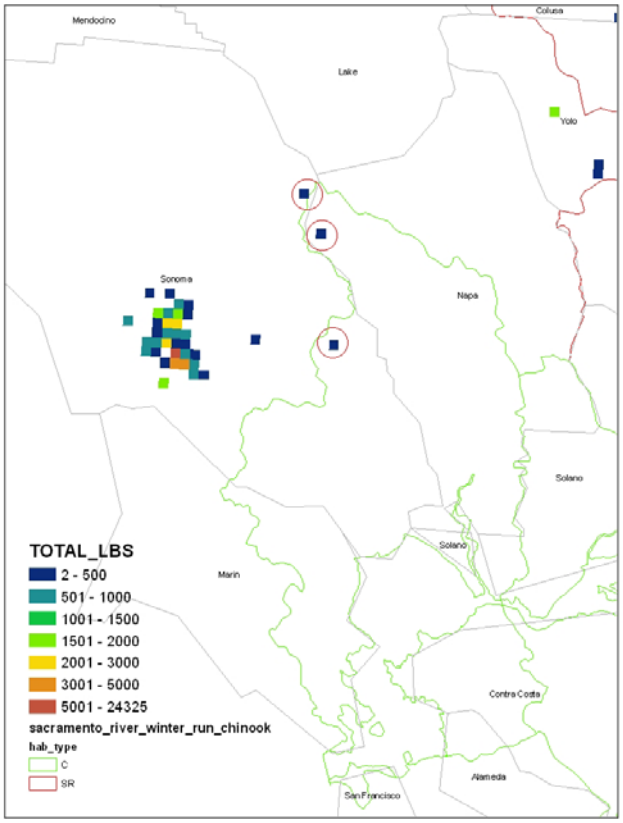
	Entire county	ESU Area
County	Total lbs	total lbs
Butte	206,540	204,988
Colusa	14,567	14,567
Glenn	63,021	63,021
Sacramento	12,216	6,840
Shasta	5,759	2,253
Solano	42,058	28,441
Sutter	142,275	85,765
Tehama	76,896	76,896
Yolo	99,581	67,410
Yuba	45,240	19,713
Total	708,153	569,895
Annual Mean	59013	47491

g.1.2.1.1. Conclusion – may affect spawning/rearing area

g.1.2.2.Corridor areas

	entire county	**ESU area**
County	**total lbs**	**total lbs**
Alameda	0	0
Contra Costa	6,208	0
Marin	0	0
Napa	138	138
San Francisco	0	0
Solano	42,058	0
Sonoma	39,565	486
Total	87,969	624
Annual Mean	7331	52

g.1.2.2.1. Conclusion – not likely to affect corridor area. Very small amounts of chlorpyrifos were applied in these watersheds. Applications were not near the corridor waters themselves, as shown in the figure below.



g.1.3. county vs. ESU PUR data by commodity, 2001

g.1.3.1.spawning/rearing areas

		Entire County		ESU S/R Area	
County	Commodity	Acres	Lbs	Acres	Lbs
Butte	Alfalfa (Forage - Fodder) (Alfalfa Hay)	645	342	645	342
	Almond	2527	3886	2527	3886
	Apple	28	41	4	6
	Citrus Fruits (All Or Unspec)	2	1	0	0
	Cotton, General	20	20	20	20
	Orange (All Or Unspec)	97	113	22	31
	Peach	141	211	121	181
	Prune	204	269	204	269
	Vegetables (All Or Unspec)	3	3	3	3
	Walnut (English Walnut, Persian Walnut)	10017	18536	10017	18536
Colusa	Alfalfa (Forage - Fodder) (Alfalfa Hay)	1189	613	1189	613
	Almond	697	974	697	974
	Cabbage	41	40	41	41
	Cauliflower	15	16	15	16
	Cotton, General	3370	2880	3370	2880
	Kohlrabi	4	4	4	5
	Sunflower, General	41	37	41	37

	Walnut (English Walnut, Persian Walnut)	834	1543	834	1543
Glenn	Alfalfa (Forage - Fodder) (Alfalfa Hay)	2796	1548	2796	1548
	Almond	2325	3754	2325	3754
	Cauliflower	5	5	5	5
	Corn (Forage - Fodder)	30	15	30	15
	Cotton, General	1029	951	1029	951
	Orange (All Or Unspec)	110	233	110	233
	Sorghum/Milo General	32	16	32	16
	Sunflower, General	280	146	280	146
	Walnut (English Walnut, Persian Walnut)	3771	6488	3771	6488
Sacramento	Alfalfa (Forage - Fodder) (Alfalfa Hay)	2326	1632	1844	1296
	Apple	162	326	142	286
	Corn, Human Consumption	181	180	0	0
	Peach	23	46	23	46
	Pear	348	696	80	160
	Walnut (English Walnut, Persian Walnut)	118	181	8	16
Shasta	Alfalfa (Forage - Fodder) (Alfalfa Hay)	82	82	14	14
	Mint (All Or Unspec)	189	249	0	0
	Strawberry (All Or Unspec)	3	0	3	0
	Walnut (English Walnut, Persian Walnut)	171	352	86	172
Solano	Alfalfa (Forage - Fodder) (Alfalfa Hay)	2883	1710	2750	1642
	Almond	287	506	287	506
	Grasses Grown For Seed (All Or Unspec)	231	705	116	638
	Prune	14	28	14	28
	Sorghum/Milo General	354	238	232	116
	Sunflower, General	133	172	133	172
	Walnut (English Walnut, Persian Walnut)	1513	2768	1016	1902
Sutter	Alfalfa (Forage - Fodder) (Alfalfa Hay)	1143	547	1143	547
	Almond	54	78	54	78
	Asparagus (Spears, Ferns, Etc.)	11	11	11	11
	Brussels Sprouts	1	1	1	1
	Cabbage	134	104	134	104
	Collards	10	10	10	10
	Cotton, General	100	90	100	90
	Peach	377	610	337	529
	Pear	30	41	0	0
	Rice (All Or Unspec)	70	20	70	20
	Sunflower, General	80	60	80	60
	Walnut (English Walnut, Persian Walnut)	8794	16541	6276	11790
Tehama	Alfalfa (Forage - Fodder) (Alfalfa Hay)	863	553	863	553
	Almond	1423	2704	1423	2704
	Prune	160	107	160	107
	Walnut (English Walnut, Persian Walnut)	4518	7846	4518	7847
Yolo	Alfalfa (Forage - Fodder) (Alfalfa Hay)	14996	7657	5788	5788
	Almond	158	267	138	227

	Apple	47	94	0	0
	Asparagus (Spears, Ferns, Etc.)	5	4	4	4
	Cabbage	1	2	2	2
	Collards	6	6	6	6
	Cotton, General	751	699	628	628
	Pear	96	144	144	144
	Sorghum/Milo General	330	260	104	104
	Sunflower, General	9	11	0	0
	Walnut (English Walnut, Persian Walnut)	2867	5005	2027	3587
Yuba	Peach	80	160	80	160
	Pear	162	268	72	144
	Prune	285	540	285	540
	Walnut (English Walnut, Persian Walnut)	3075	6022	1499	2832

g.1.3.2.corridor areas

		Entire county		ESU C area	
COUNTY	**COMMODITY**	**acres**	**lbs**	**acres**	**lbs**
Contra Costa	Alfalfa (Forage - Fodder) (Alfalfa Hay)	50	25	0	0
	Asparagus (Spears, Ferns, Etc.)	133	133	0	0
	Uncultivated Agricultural Areas (All Or Unspec)	1	0	0	0
	Walnut (English Walnut, Persian Walnut)	38	74	0	0
Napa	Walnut (English Walnut, Persian Walnut)	8	15	8	15
Solano	Alfalfa (Forage - Fodder) (Alfalfa Hay)	2883	1710	0	0
	Almond	287	506	0	0
	Grasses Grown For Seed (All Or Unspec)	231	705	0	0
	Prune	14	28	0	0
	Sorghum/Milo General	354	238	0	0
	Sunflower, General	133	172	0	0
	Uncultivated Agricultural Areas (All Or Unspec)	53	23	0	0
	Walnut (English Walnut, Persian Walnut)	1513	2768	0	0
Sonoma	Apple	1408	1380	6	5
	Grapes, Wine	85	38	6	0
	Orange (All Or Unspec)	1	0	0	0
	Walnut (English Walnut, Persian Walnut)	32	18	30	17

g.2. Snake River Fall-run Chinook Salmon ESU

g.2.1. initial finding – may affect

g.2.2. NLCD statistics

g.2.2.1.spawning/rearing area

g.2.2.1.1. Land Use Classifications Relevant to Potential Chlorpyrifos Use

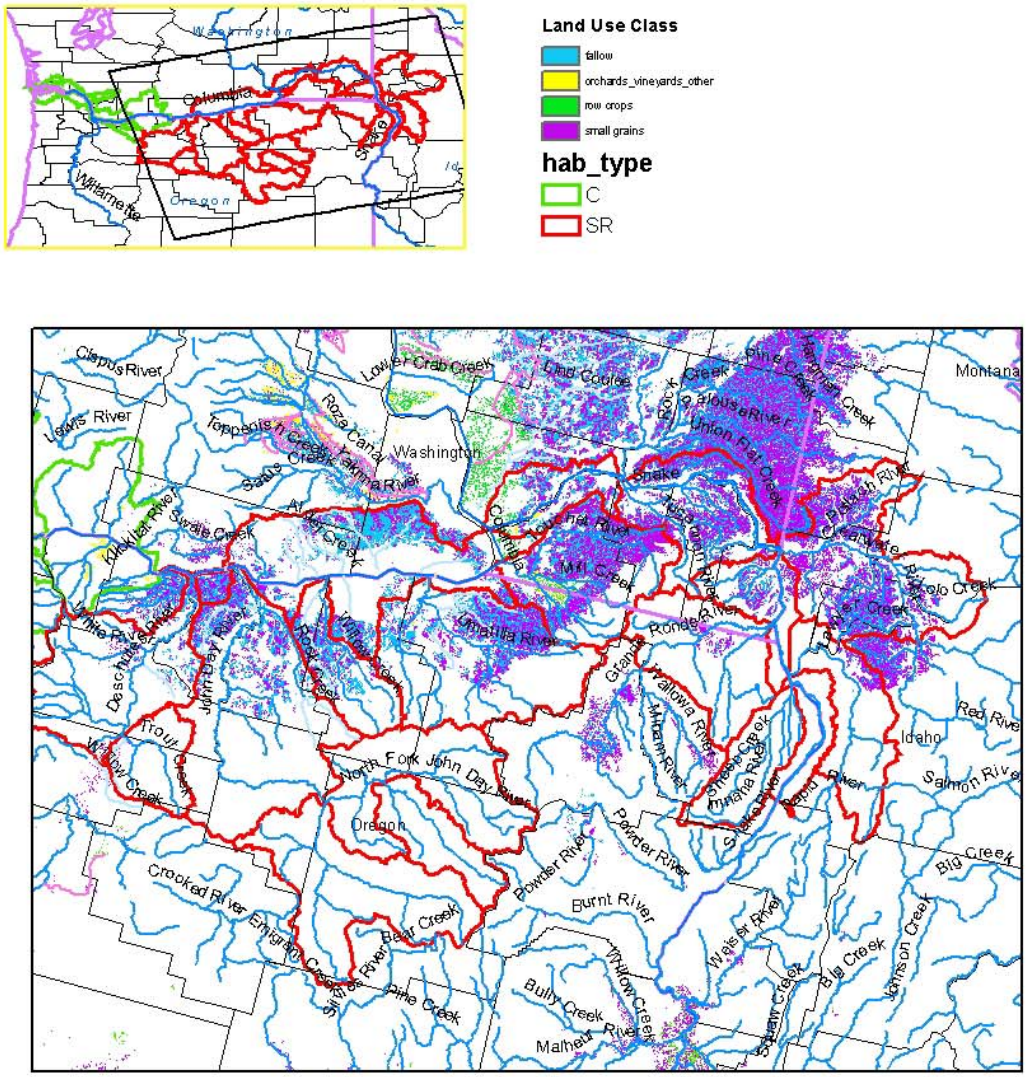
CLASS	Hectares	Percent
Fallow	549,730	7.65%
small grains	759,886	10.58%

row crops	19,854	0.28%
orchards_vineyards_other	5,851	0.08%
Sum	1,335,321	18.58%
other classes	5,850,014	81.42%

g.2.2.1.1.1.Conclusion: may affect spawning/rearing area

g.2.2.1.2. NLCD Proximity Analysis

Near the Columbia River, there are large area of grain production, in Washington, Oregon and Western Idaho. For area near the mainstem of the Columbia, a may affect determination is applies. However, areas further upstream along the Deschutes, John Day, Imnaha and Salmon Rivers and their tributaries are not agricultural areas. There is little likelihood of effect in these areas (see figure below).


Land Use Class
fallow
orchards_vineyards_other
row crops
small grains
hab_type
C
SR
Columbia
Willamette
Oregon
Cispus River
Lewis River
Lower Crab Creek
Montana
Toppenish Creek
Roza Canal
Yakima River
Washington
Satus Creek
Klickitat River
Swale Creek
Snake
Union Flat Creek
Palouse River
Columbia
Mill Creek
Umatilla River
Grande Ronde River
Clearwater River
White River
Deschutes River
John Day River
Rock Creek
Willow Creek
Trout Creek
Wallowa River
Minam River
Sheep Creek
Imnaha River
Snake River
Rapid River
Idaho
Salmon River
Red River
North Fork John Day River
Oregon
Powder River
Burnt River
Big Creek
Crooked River
Emigrant Creek
Bear Creek
Pine Creek
Bully Creek
Willow Creek
Malheur River
Weiser River
Squaw Creek
Johnson Creek

g.2.2.1.3. all classes

CLASS	Hectares	Percent
Shrubland	2,666,223	37.11%
evergreen forest	2,035,692	28.33%
small grains	759,886	10.58%
grasslands_herbaceous	658,113	9.16%
Fallow	549,730	7.65%
pasture_hay	210,344	2.93%
Water	77,019	1.07%
transitional	56,750	0.79%
Mixed forest	47,460	0.66%
deciduous forest	31,994	0.45%
commercial_industrial_transportion	20,320	0.28%
row crops	19,854	0.28%
bare rock_sand_clay	19,297	0.27%
low intensity residential	18,401	0.26%
orchards_vineyards_other	5,851	0.08%
emergent herbaceous wetlands	5,465	0.08%
woody wetlands	1,027	0.01%
Urban_recreational grasses	882	0.01%
perennial ice_snow	598	0.01%
quarries_strip mines_gravel pits	367	0.01%
high intensity residential	62	0.00%
Grand Total	7,185,335	100.00%

g.2.2.2.corridor area

g.2.2.2.1. Land Use Classifications Relevant to Potential Chlorpyrifos Use

CLASS	Hectares	Percent
Fallow	632	0.06%
small grains	1,630	0.15%
row crops	5,387	0.51%
orchards_vineyards_other	11,226	1.05%
sum	18,875	1.77%
other classes	1,045,206	98.23%

g.2.2.2.1.1.Conclusion: not likely to affect corridor area

g.2.2.2.2. all classes

CLASS	Hectares	Percent
evergreen forest	556,837	52.33%
deciduous forest	151,508	14.24%
mixed forest	84,304	7.92%
Transitional	54,196	5.09%
Water	53,942	5.07%
pasture_hay	48,120	4.52%

Shrubland	27,176	2.55%
low intensity residential	18,623	1.75%
Grasslands_herbaceous	17,955	1.69%
commercial_industrial_transportion	11,338	1.07%
orchards_vineyards_other	11,226	1.05%
bare rock_sand_clay	8,131	0.76%
woody wetlands	6,753	0.63%
row crops	5,387	0.51%
emergent herbaceous wetlands	2,146	0.20%
perennial ice_snow	1,989	0.19%
urban_recreational grasses	1,790	0.17%
small grains	1,630	0.15%
Fallow	632	0.06%
quarries_strip mines_gravel pits	330	0.03%
high intensity residential	66	0.01%
Grand Total	1,064,081	100.00%

g.3. Snake River Spring/Summer-run Chinook Salmon ESU

g.3.1. initial finding – may affect

g.3.2. NLCD statistics

g.3.2.1.spawning/rearing areas

g.3.2.1.1. Land Use Classifications Relevant to Potential Chlorpyrifos Use

CLASS	Hectares	Percent
Fallow	107,830	1.86%
small grains	243,896	4.20%
row crops	7,780	0.13%
orchards_vineyards_other	1,619	0.03%
Sum	361,124	6.22%
other classes	5,443,674	93.78%

g.3.2.1.1.1.Conclusion: not likely to affect spawning/rearing areas

g.3.2.1.2. all classes

CLASS	Hectares	Percent
evergreen forest	2,727,104	46.98%
Shrubland	1,469,204	25.31%
Grasslands_herbaceous	752,669	12.97%
small grains	243,896	4.20%
bare rock_sand_clay	201,325	3.47%
Fallow	107,830	1.86%
pasture_hay	99,539	1.71%
Transitional	62,293	1.07%
mixed forest	44,879	0.77%
Water	31,172	0.54%

deciduous forest	19,966	0.34%
woody wetlands	14,539	0.25%
row crops	7,780	0.13%
emergent herbaceous wetlands	7,050	0.12%
low intensity residential	6,101	0.11%
Commercial_industrial_transportion	5,781	0.10%
orchards_vineyards_other	1,619	0.03%
perennial ice_snow	779	0.01%
quarries_strip mines_gravel pits	736	0.01%
urban_recreational grasses	507	0.01%
high intensity residential	30	0.00%
Grand Total	5,804,798	100.00%

g.3.2.2.corridor area

g.3.2.2.1. Land Use Classifications Relevant to Potential Chlorpyrifos Use

CLASS	Hectares	Percent
Fallow	146,407	7.30%
small grains	105,891	5.28%
row crops	13,147	0.66%
orchards_vineyards_other	12,012	0.60%
Sum	277,458	13.83%
other classes	1,728,546	86.17%

g.3.2.2.1.1.Conclusion: not likely to affect corridor areas

g.3.2.2.2. all classes

CLASS	Hectares	Percent
evergreen forest	643,364	32.07%
Shrubland	333,500	16.63%
deciduous forest	171,761	8.56%
Fallow	146,407	7.30%
pasture_hay	126,476	6.30%
small grains	105,891	5.28%
Water	105,066	5.24%
grasslands_herbaceous	100,199	4.99%
mixed forest	95,499	4.76%
Transitional	58,810	2.93%
low intensity residential	41,513	2.07%
Commercial_industrial_transportion	26,910	1.34%
row crops	13,147	0.66%
orchards_vineyards_other	12,012	0.60%
bare rock_sand_clay	8,920	0.44%
woody wetlands	7,472	0.37%
urban_recreational grasses	3,094	0.15%
emergent herbaceous wetlands	2,573	0.13%

perennial ice_snow	1,993	0.10%
quarries_strip mines_gravel pits	848	0.04%
high intensity residential	547	0.03%
Grand Total	2,006,003	100.00%

g.4. California Central Valley Spring-run Chinook Salmon ESU

g.4.1. initial finding – may affect

g.4.2. county vs. ESU – PUR data, 1990-2001 sum

g.4.2.1.spawning/rearing areas

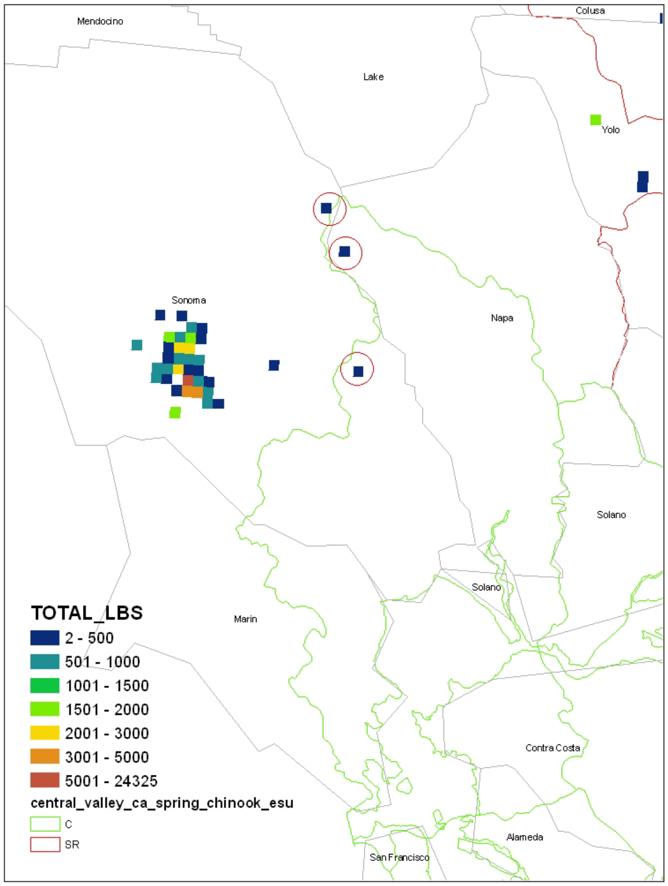
	Entire county	ESU area
County	**total lbs**	**total lbs**
Butte	206,540	205,767
Colusa	14,567	14,567
Glenn	63,021	63,021
Nevada	0	-
Placer	5,947	5,947
Sacramento	12,216	6,840
Shasta	5,759	2,253
Solano	42,058	28,441
Sutter	142,275	142,275
Tehama	76,896	76,896
Yolo	99,581	67,410
Yuba	45,240	37,855
Total	714,100	651,273
Annual Mean	59508	54273

g.4.2.2.Conclusion – may affect

g.4.2.3.corridor areas

	Entire county	ESU area
County	**total lbs**	**total lbs**
Alameda	0	0
Contra Costa	6,208	
Marin	0	
Napa	138	138
San Francisco	0	
San Mateo	1,897	
Santa Clara	10,337	212
Solano	42,058	
Sonoma	39,565	486
Total	100,202	836
Annual Mean	8350	70

g.4.2.4.Conclusion – not likely to affect. Very small amounts of chlorpyrifos were applied in these watersheds. Applications were not near the corridor waters themselves, as shown in the figure below.



g.4.3. county vs. ESU PUR data by commodity, 2001

g.4.3.1.spawning/rearing areas

		Entire County		ESU S/R Area	
County	Commodity	Acres	Lbs	Acres	Lbs
Butte	Alfalfa (Forage - Fodder) (Alfalfa Hay)	645	342	645	342
	Almond	2527	3886	2527	3886
	Apple	28	41	28	41
	Citrus Fruits (All Or Unspec)	2	1	20	20
	Cotton, General	20	20	22	31
	Orange (All Or Unspec)	97	113	141	211
	Peach	141	211	204	269
	Prune	204	269	3	3
	Vegetables (All Or Unspec)	3	3	10017	18536
	Walnut (English Walnut, Persian Walnut)	10017	18536	20	20
Colusa	Alfalfa (Forage - Fodder) (Alfalfa Hay)	1189	613	1189	613

	Almond	697	974	697	974
	Cabbage	41	40	41	41
	Cauliflower	15	16	15	16
	Cotton, General	3370	2880	3370	2880
	Kohlrabi	4	4	4	5
	Sunflower, General	41	37	41	37
	Walnut (English Walnut, Persian Walnut)	834	1543	834	1543
Glenn	Alfalfa (Forage - Fodder) (Alfalfa Hay)	2796	1548	2796	1548
	Almond	2325	3754	2325	3754
	Cauliflower	5	5	5	5
	Corn (Forage - Fodder)	30	15	30	15
	Cotton, General	1029	951	1029	951
	Orange (All Or Unspec)	110	233	110	233
	Sorghum/Milo General	32	16	32	16
	Sunflower, General	280	146	280	146
	Walnut (English Walnut, Persian Walnut)	3771	6488	3771	6488
Placer	Walnut (English Walnut, Persian Walnut)	15	30	15	30
Sacramento	Alfalfa (Forage - Fodder) (Alfalfa Hay)	2326	1632	1844	1296
	Apple	162	326	142	286
	Corn, Human Consumption	181	180	0	0
	Peach	23	46	23	46
	Pear	348	696	80	160
	Walnut (English Walnut, Persian Walnut)	118	181	8	16
Shasta	Alfalfa (Forage - Fodder) (Alfalfa Hay)	82	82	14	14
	Mint (All Or Unspec)	189	249	0	0
	Strawberry (All Or Unspec)	3	0	3	0
	Walnut (English Walnut, Persian Walnut)	171	352	86	172
Solano	Alfalfa (Forage - Fodder) (Alfalfa Hay)	2883	1710	2750	1642
	Almond	287	506	287	506
	Grasses Grown For Seed (All Or Unspec)	231	705	116	638
	Prune	14	28	14	28
	Sorghum/Milo General	354	238	232	116
	Sunflower, General	133	172	133	172
	Walnut (English Walnut, Persian Walnut)	1513		1016	1902
Sutter	Alfalfa (Forage - Fodder) (Alfalfa Hay)	1143	547	1143	547
	Almond	54	78	54	78
	Asparagus (Spears, Ferns, Etc.)	11	11	11	11
	Brussels Sprouts	1	1	1	1
	Cabbage	134	104	134	104
	Collards	10	10	10	10
	Cotton, General	100	90	100	90
	Peach	377	610	377	610
	Pear	30	41	30	41
	Rice (All Or Unspec)	70	20	70	20
	Sunflower, General	80	60	80	60

	Walnut (English Walnut, Persian Walnut)	8794	16541	8794	16541
Tehama	Alfalfa (Forage - Fodder) (Alfalfa Hay)	863	553	0	0
	Almond	1423	2704	0	0
	Prune	160	107	0	0
	Walnut (English Walnut, Persian Walnut)	4518	7846	0	0
Yolo	Alfalfa (Forage - Fodder) (Alfalfa Hay)	14996	7657	11769	5788
	Almond	158	267	138	227
	Apple	47	94	0	0
	Asparagus (Spears, Ferns, Etc.)	5	4	5	4
	Cabbage	1	2	1	2
	Collards	6	6	6	6
	Cotton, General	751	699	680	628
	Pear	96	144	96	144
	Sorghum/Milo General	330	260	138	104
	Sunflower, General	9	11	0	0
	Walnut (English Walnut, Persian Walnut)	2867	5005	2027	3587
Yuba	Peach	80	160	80	160
	Pear	162	268	162	268
	Prune	285	540	285	540
	Walnut (English Walnut, Persian Walnut)	3075	6022	3075	6022

g.4.3.2.corridor areas

		Entire County		ESU C Area	
County	**Commodity**	**Acres**	**Lbs**	**Acres**	**Lbs**
Contra Costa	Alfalfa (Forage - Fodder) (Alfalfa Hay)	50	25	0	0
	Asparagus (Spears, Ferns, Etc.)	133	133	0	0
	Uncultivated Agricultural Areas (All Or Unspec)	1	0	0	0
	Walnut (English Walnut, Persian Walnut)	38	74	0	0
Napa	Walnut (English Walnut, Persian Walnut)	8	15	8	15
San Mateo	Brussels Sprouts	2256	1816	0	0
Santa Clara	Alfalfa (Forage - Fodder) (Alfalfa Hay)	241	167	0	0
	Apple	391	25	0	0
	Beans (All Or Unspec)	42	50	0	0
	Broccoli	234	223	0	0
	Cabbage	18	18	0	0
	Cherry	3	6	0	0
	Chinese Cabbage (Nappa, Won Bok, Celery Cabbage)	105	105	0	0
	Chinese Greens, Chinese Leafy Vegetables	8	60	0	0
	Corn, Human Consumption	358	329	0	0
	Grapes, Wine	314	626	0	0
	Kale	5	5	0	0
	Oats, General	70	52	0	0
	Onion (Dry, Spanish, White, Yellow, Red, Etc.)	12	12	0	0
	Orange (All Or Unspec)	12	15	0	0

	Pear	3	1	0	0
	Pome Fruits (All Or Unspec)	5	3	0	0
	Research Commodity	1808	9	0	0
	Uncultivated Agricultural Areas (All Or Unspec)	13	13	0	0
	Walnut (English Walnut, Persian Walnut)	31	60	0	0
Solano	Alfalfa (Forage - Fodder) (Alfalfa Hay)	2883	1710	0	0
	Almond	287	506	0	0
	Grasses Grown For Seed (All Or Unspec)	231	705	0	0
	Prune	14	28	0	0
	Sorghum/Milo General	354	238	0	0
	Sunflower, General	133	172	0	0
	Uncultivated Agricultural Areas (All Or Unspec)	53	23	0	0
	Walnut (English Walnut, Persian Walnut)	1513	2768	0	0
Sonoma	Apple	1408	1380	6	5
	Grapes, Wine	85	38	6	0
	Orange (All Or Unspec)	1	0	0	0
	Walnut (English Walnut, Persian Walnut)	32	18	30	17

g.5. California Coastal Chinook Salmon ESU

g.5.1. initial finding – may affect

g.5.2. county vs. ESU – PUR data, 1990-2001 sum

	Entire county	ESU area
County	total lbs	total lbs
Humboldt	0	0
Marin	0	0
Mendocino	15,920	15,920
Sonoma	39,565	39,322
Trinity	0	0
Total	55,485	55,243
Annual Mean	4624	4604

g.5.2.1. Conclusion – may affect

g.5.3. county vs. ESU PUR data by commodity, 2001

		Entire county		ESU area	
COUNTY	COMMODITY	acres	lbs	acres	lbs
Humboldt	Apple	4	2	4	2
Mendocino	Alfalfa (Forage - Fodder) (Alfalfa Hay)	20	20	20	20
	Apple	112	225	112	225
	Grapes, Wine	1	1	1	1
	Pear	1866	2195	1866	2195
Sonoma	Apple	1408	1380	1408	1380

	Grapes, Wine	85	38	85	38
	Orange (All Or Unspec)	1	0	1	0
	Walnut (English Walnut, Persian Walnut)	32	18	2	2

g.6. Puget Sound Chinook Salmon ESU

g.6.1. initial finding – not likely to affect

g.7. Lower Columbia River Chinook Salmon ESU

g.7.1. initial finding – may affect

g.7.2. NLCD statistics

g.7.2.1.spawning/rearing area

g.7.2.1.1. Land Use Classifications Relevant to Potential Chlorpyrifos Use

CLASS	Hectares	Percent
Fallow	411	0.02%
small grains	2,699	0.16%
row crops	15,567	0.89%
orchards_vineyards_other	10,322	0.59%
Sum	28,999	1.67%
other classes	1,711,628	98.33%

g.7.2.1.1.1.Conclusion: not likely to affect spawning/rearing area

g.7.2.1.2. all classes

CLASS	Hectares	Percent
evergreen forest	926,943	53.25%
deciduous forest	206,785	11.88%
mixed forest	140,447	8.07%
Transitional	121,046	6.95%
pasture_hay	87,410	5.02%
Water	61,894	3.56%
low intensity residential	41,975	2.41%
Shrubland	39,691	2.28%
grasslands_herbaceous	23,174	1.33%
commercial_industrial_transportion	22,608	1.30%
bare rock_sand_clay	22,065	1.27%
row crops	15,567	0.89%
orchards_vineyards_other	10,322	0.59%
woody wetlands	6,674	0.38%
perennial ice_snow	4,606	0.26%
urban_recreational grasses	3,204	0.18%
small grains	2,699	0.16%
emergent herbaceous wetlands	1,958	0.11%
quarries_strip mines_gravel pits	608	0.03%
high intensity residential	539	0.03%
Fallow	411	0.02%
Grand Total	1,740,627	100.00%

g.7.2.2.corridor area

g.7.2.2.1. Land Use Classifications Relevant to Potential Chlorpyrifos Use

CLASS	Hectares	Percent
Fallow	2	0.00%
small grains	93	0.05%
row crops	501	0.28%
orchards_vineyards_other	252	0.14%
Sum	847	0.47%
other classes	180,947	99.53%

g.7.2.2.1.1.Conclusion: not likely to affect corridor area

g.7.2.2.2. all classes

CLASS	Hectares	Percent
evergreen forest	71,976	39.59%
deciduous forest	52,401	28.82%
mixed forest	29,930	16.46%
pasture_hay	9,083	5.00%
Transitional	7,662	4.21%
woody wetlands	2,293	1.26%
Water	2,263	1.24%
low intensity residential	1,485	0.82%
Shrubland	1,369	0.75%
commercial_industrial_transportion	870	0.48%
grasslands_herbaceous	800	0.44%
emergent herbaceous wetlands	590	0.32%
row crops	501	0.28%
orchards_vineyards_other	252	0.14%
bare rock_sand_clay	139	0.08%
small grains	93	0.05%
urban_recreational grasses	78	0.04%
quarries_strip mines_gravel pits	6	0.00%
Fallow	2	0.00%
Grand Total	181,793	100.00%

g.8. Upper Willamette River Chinook Salmon ESU

g.8.1. initial finding – not likely to affect

g.9. Upper Columbia River Spring-run Chinook Salmon ESU

g.9.1. initial finding – may affect

g.9.2. NLCD statistics

g.9.2.1.spawning/rearing area

g.9.2.1.1. Land Use Classifications Relevant to Potential Chlorpyrifos Use

CLASS	Hectares	Percent
fallow	35,961	2.58%
small grains	18,230	1.31%
row crops	78	0.01%
orchards_vineyards_other	20,015	1.44%
sum	74,283	5.34%
other classes	1,317,152	94.66%

g.9.2.1.1.1.Conclusion: not likely to affect spawning/rearing area

g.9.2.1.2. all classes

CLASS	Hectares	Percent
evergreen forest	744,793	53.527%
grasslands_herbaceous	243,401	17.493%
Shrubland	216,104	15.531%
bare rock_sand_clay	42,796	3.076%
Fallow	35,961	2.584%
orchards_vineyards_other	20,015	1.438%
small grains	18,230	1.310%
Water	16,945	1.218%
Transitional	14,712	1.057%
deciduous forest	11,221	0.806%
mixed forest	10,913	0.784%
pasture_hay	4,666	0.335%
commercial_industrial_transportion	4,101	0.295%
low intensity residential	3,357	0.241%
perennial ice_snow	2,534	0.182%
woody wetlands	1,227	0.088%
urban_recreational grasses	233	0.017%
emergent herbaceous wetlands	93	0.007%
row crops	78	0.006%
high intensity residential	41	0.003%
quarries_strip mines_gravel pits	15	0.001%
Grand Total	1,317,152	100.00%

g.9.2.2.corridor area

g.9.2.2.1. Land Use Classifications Relevant to Potential Chlorpyrifos Use

CLASS	Hectares	Percent
fallow	207,271	7.69%
small grains	161,364	5.99%
row crops	64,325	2.39%
orchards_vineyards_other	15,719	0.58%
sum	448,679	16.64%
other classes	2,246,928	83.36%

g.9.2.2.1.1.Conclusion: not likely to affect corridor area

g.9.2.2.2. all classes

CLASS	Hectares	Percent
shrubland	656,510	24.35%
evergreen forest	653,602	24.25%
pasture_hay	218,810	8.12%
fallow	207,271	7.69%
deciduous forest	172,208	6.39%
small grains	161,364	5.99%
grasslands_herbaceous	151,991	5.64%
water	123,642	4.59%
mixed forest	95,644	3.55%
row crops	64,325	2.39%
transitional	59,061	2.19%
low intensity residential	50,246	1.86%
commercial_industrial_transportion	37,580	1.39%
orchards_vineyards_other	15,719	0.58%
bare rock_sand_clay	9,219	0.34%
woody wetlands	7,615	0.28%
urban_recreational grasses	4,024	0.15%
emergent herbaceous wetlands	3,130	0.12%
perennial ice_snow	1,993	0.07%
quarries_strip mines_gravel pits	1,008	0.04%
high intensity residential	645	0.02%
Grand Total	2,695,607	100.00%

g.10. Central Valley Fall-/Late Fall-run Chinook Salmon ESU

g.10.1. initial finding – may affect

g.10.2. county vs. ESU – PUR data, 1990-2001 sum

	Entire county	**ESU area**
County	**total lbs**	**total lbs**
Alameda	0	0
Amador	748	748
Butte	206,540	206,535
Calaveras	1,506	1,506
Colusa	14,567	14,567
Contra Costa	6,208	6,208
El Dorado	-	-
Glenn	63,021	63,021
Marin	-	-
Merced	478,940	183,727
Napa	138	138
Placer	5,947	5,947
Sacramento	12,216	10,235

San Francisco	-	-
San Joaquin	453,228	453,228
San Mateo	1,897	-
Santa Clara	10,337	696
Shasta	5,759	2,253
Solano	42,058	28,441
Stanislaus	728,086	727,341
Sutter	142,275	142,275
Tehama	76,896	76,896
Trinity	-	-
Yolo	99,581	67,410
Yuba	45,240	37,855
Total	2,395,187	2,029,028
Annual Mean	199599	169086

g.10.2.1. Conclusion – may affect

g.10.3. county vs. ESU PUR data by commodity, 2001

		Entire County		ESU Area	
County	**Commodity**	**Acres**	**Lbs**	**Acres**	**Lbs**
Amador	Alfalfa (Forage - Fodder) (Alfalfa Hay)	85	42	85	42
	Walnut (English Walnut, Persian Walnut)	132	263	132	263
Butte	Alfalfa (Forage - Fodder) (Alfalfa Hay)	645	342	645	342
	Almond	2527	3886	2527	3886
	Apple	28	41	28	41
	Citrus Fruits (All Or Unspec)	2	1	20	20
	Cotton, General	20	20	96	103
	Orange (All Or Unspec)	97	113	141	211
	Peach	141	211	204	269
	Prune	204	269	3	3
	Vegetables (All Or Unspec)	3	3	10017	18536
	Walnut (English Walnut, Persian Walnut)	10017	18536	645	342
Calaveras	Walnut (English Walnut, Persian Walnut)	155	260	155	260
Colusa	Alfalfa (Forage - Fodder) (Alfalfa Hay)	1189	613	1189	613
	Almond	697	974	697	974
	Cabbage	41	40	41	41
	Cauliflower	15	16	15	16
	Cotton, General	3370	2880	3370	2880
	Kohlrabi	4	4	4	5
	Sunflower, General	41	37	41	37
	Walnut (English Walnut, Persian Walnut)	834	1543	834	1543
Contra Costa	Alfalfa (Forage - Fodder) (Alfalfa Hay)	50	25	50	25
	Asparagus (Spears, Ferns, Etc.)	133	133	133	133
	Walnut (English Walnut, Persian Walnut)	38	74	38	74
Glenn	Alfalfa (Forage - Fodder) (Alfalfa Hay)	2796	1548	2796	1548

	Almond	2325	3754	2325	3754
	Cauliflower	5	5	5	5
	Corn (Forage - Fodder)	30	15	30	15
	Cotton, General	1029	951	1029	951
	Orange (All Or Unspec)	110	233	110	233
	Sorghum/Milo General	32	16	32	16
	Sunflower, General	280	146	280	146
	Walnut (English Walnut, Persian Walnut)	3771	6488	3771	6488
Merced	Alfalfa (Forage - Fodder) (Alfalfa Hay)	14502	8022	1401	940
	Almond	15621	21396	10216	14830
	Apple	36	54	36	54
	Asparagus (Spears, Ferns, Etc.)	224	223	0	0
	Cauliflower	10	5	0	0
	Chinese Cabbage (Nappa, Won Bok, Celery Cabbage)	132	138	0	0
	Chinese Greens, Chinese Leafy Vegetables	20	16	0	0
	Corn (Forage - Fodder)	3020	2964	777	768
	Cotton, General	9167	8916	0	0
	Fig	1350	2684	0	0
	Grapes	38	62	0	0
	Nectarine	28	55	0	0
	Oats (Forage - Fodder)	20	10	0	0
	Orange (All Or Unspec)	13	52	0	0
	Peach	541	1044	208	387
	Radish	109	74	0	0
	Strawberry (All Or Unspec)	0	0	0	0
	Sugarbeet, General	875	748	0	0
	Sweet Potato	2457	4868	250	478
	Walnut (English Walnut, Persian Walnut)	2482	4365	1355	2460
Napa	Walnut (English Walnut, Persian Walnut)	8	15	8	15
Placer	Walnut (English Walnut, Persian Walnut)	15	30	15	30
Sacramento	Alfalfa (Forage - Fodder) (Alfalfa Hay)	2326	1632	2004	1370
	Apple	162	326	142	286
	Corn, Human Consumption	181	180	181	180
	Peach	23	46	23	46
	Pear	348	696	80	160
	Walnut (English Walnut, Persian Walnut)	118	181	118	181
San Joaquin	Alfalfa (Forage - Fodder) (Alfalfa Hay)	11419	5650	11419	5650
	Almond	3265	5900	3265	5900
	Apple	537	661	537	661
	Asparagus (Spears, Ferns, Etc.)	2312	2263	2312	2263
	Cabbage	10	10	10	10
	Cauliflower	16	16	16	16
	Cherry	36	70	36	70
	Corn (Forage - Fodder)	2348	3179	2348	3179

	Corn, Human Consumption	110	99	110	99
	Grapes	32	64	32	64
	Pear	73	146	73	146
	Walnut (English Walnut, Persian Walnut)	10441	18506	10441	18506
San Mateo	Brussels Sprouts	2256	1816	0	0
Santa Clara	Alfalfa (Forage - Fodder) (Alfalfa Hay)	241	167	0	0
	Apple	391	25	0	0
	Beans (All Or Unspec)	42	50	0	0
	Broccoli	234	223	25	25
	Cabbage	18	18	0	0
	Cherry	3	6	3	6
	Chinese Cabbage (Nappa, Won Bok, Celery Cabbage)	105	105	20	21
	Chinese Greens, Chinese Leafy Vegetables	8	60	0	0
	Corn, Human Consumption	358	329	100	8
	Grapes, Wine	314	626	0	0
	Kale	5	5	0	0
	Oats, General	70	52	0	0
	Onion (Dry, Spanish, White, Yellow, Red, Etc.)	12	12	0	0
	Orange (All Or Unspec)	12	15	12	15
	Pear	3	1	3	1
	Pome Fruits (All Or Unspec)	5	3	5	3
	Walnut (English Walnut, Persian Walnut)	31	60	0	0
Shasta	Alfalfa (Forage - Fodder) (Alfalfa Hay)	82	82	14	14
	Mint (All Or Unspec)	189	249	0	0
	Strawberry (All Or Unspec)	3	0	3	0
	Walnut (English Walnut, Persian Walnut)	171	352	86	172
Solano	Alfalfa (Forage - Fodder) (Alfalfa Hay)	2883	1710	2750	1642
	Almond	287	506	287	506
	Grasses Grown For Seed (All Or Unspec)	231	705	116	638
	Prune	14	28	14	28
	Sorghum/Milo General	354	238	232	116
	Sunflower, General	133	172	133	172
	Walnut (English Walnut, Persian Walnut)	1513	2768	1016	1902
Stanislaus	Alfalfa (Forage - Fodder) (Alfalfa Hay)	10135	5199	10135	5199
	Almond	20599	36984	20599	36984
	Apple	870	1528	870	1528
	Apricot	1	10	1	10
	Cherry	5	43	5	43
	Citrus Fruits (All Or Unspec)	201	741	201	741
	Corn (Forage - Fodder)	3101	3595	3101	3595
	Peach	1042	2030	1042	2030
	Pecan	15	15	15	15
	Plum (Includes Wild Plums For Human Consumption)	0	4	0	4
	Sweet Potato	325	671	325	671

	Walnut (English Walnut, Persian Walnut)	12874	23187	12874	23188
Sutter	Alfalfa (Forage - Fodder) (Alfalfa Hay)	1143	547	1143	547
	Almond	54	78	54	78
	Asparagus (Spears, Ferns, Etc.)	11	11	11	11
	Brussels Sprouts	1	1	1	1
	Cabbage	134	104	134	104
	Collards	10	10	10	10
	Cotton, General	100	90	100	90
	Peach	377	610	377	610
	Pear	30	41	30	41
	Rice (All Or Unspec)	70	20	70	20
	Sunflower, General	80	60	80	60
	Walnut (English Walnut, Persian Walnut)	8794	16541	8794	16541
Tehama	Alfalfa (Forage - Fodder) (Alfalfa Hay)	863	553	863	553
	Almond	1423	2704	1423	2704
	Prune	160	107	160	107
	Walnut (English Walnut, Persian Walnut)	4518	7846	4518	7847
Yolo	Alfalfa (Forage - Fodder) (Alfalfa Hay)	14996	7657	11769	5788
	Almond	158	267	138	227
	Apple	47	94	0	0
	Asparagus (Spears, Ferns, Etc.)	5	4	5	4
	Cabbage	1	2	1	2
	Collards	6	6	6	6
	Cotton, General	751	699	680	628
	Pear	96	144	96	144
	Sorghum/Milo General	330	260	138	104
	Sunflower, General	9	11	0	0
	Walnut (English Walnut, Persian Walnut)	2867	5005	2027	3587
Yuba	Peach	80	160	80	160
	Pear	162	268	162	268
	Prune	285	540	285	540
	Walnut (English Walnut, Persian Walnut)	3075	6022	3075	6022

h. *Coho Salmon*

h.1. Central California Coast Coho Salmon ESU

h.1.1. initial finding – may affect

h.1.2. county vs. ESU – PUR data, 1990-2001 sum

County	Entire county total lbs	ESU area total lbs
Marin	-	-
Mendocino	15,920	15,615
Napa	138	138
San Mateo	1,897	1,897
Santa Cruz	125,177	38,973

Sonoma	39,565	39,565
Total	182,697	96,188
Annual Mean	15225	8016

h.1.2.1. conclusion – may affect

h.1.3. county vs. ESU PUR data by commodity, 2001

		Entire County		ESU Area	
County	Commodity	Acres	Lbs	Acres	Lbs
Mendocino	Alfalfa (Forage - Fodder) (Alfalfa Hay)	20	20	0	0
	Apple	112	225	112	225
	Grapes, Wine	1	1	1	1
	Pear	1866	2195	1685	2055
Napa	Walnut (English Walnut, Persian Walnut)	8	15	8	15
San Mateo	Brussels Sprouts	2256	1816	2256	1816
Santa Cruz	Apple	814	1255	0	0
	Broccoli	131	168	0	0
	Brussels Sprouts	3517	3224	3009	2650
	Cabbage	70	68	0	0
	Cauliflower	198	201	0	0
	Collards	45	28	0	0
	Kale	0	0	0	0
	Kohlrabi	11	6	0	0
	Mustard, General	20	9	0	0
Sonoma	Apple	1408	1380	1408	1380
	Grapes, Wine	85	38	85	38
	Orange (All Or Unspec)	1	0	1	0
	Walnut (English Walnut, Persian Walnut)	32	18	32	18

h.2. Southern Oregon/Northern California Coast Coho Salmon ESU

h.2.1. initial finding – not likely to affect

h.3. Oregon Coast Coho Salmon ESU

h.3.1. initial finding – not likely to affect

i. Chum Salmon

i.1. Hood Canal Summer-run Chum Salmon ESU

i.1.1. initial finding – not likely to affect

i.2. Columbia River Chum Salmon ESU

i.2.1. initial finding – not likely to affect

j. Sockeye Salmon

j.1. Ozette Lake Sockeye Salmon ESU

j.1.1. initial finding – not likely to affect

j.2. Snake River Sockeye Salmon ESU

j.2.1. initial finding – may affect

j.2.2. NLCD statistics

j.2.2.1. spawning/rearing area

j.2.2.1.1. Land Use Classifications Relevant to Potential Chlorpyrifos Use

CLASS	Hectares	Percent
fallow	21	0.03%
small grains	56	0.09%
row crops	18	0.03%
sum	95	0.15%
other classes	62,219	99.85%

j.2.2.1.1.1. Conclusion: not likely to affect spawning/rearing area

j.2.2.1.2. all classes

CLASS	hectares	percent
evergreen forest	29,995	48.136%
bare rock_sand_clay	17,738	28.466%
Grasslands_herbaceous	5,684	9.122%
Shrubland	4,711	7.560%
Water	1,889	3.032%
woody wetlands	898	1.441%
pasture_hay	891	1.429%
emergent herbaceous wetlands	242	0.389%
deciduous forest	68	0.110%
small grains	56	0.090%
commercial_industrial_transportion	54	0.086%
Fallow	21	0.034%
mixed forest	20	0.032%
row crops	18	0.029%
urban_recreational grasses	14	0.022%
perennial ice_snow	8	0.013%
high intensity residential	3	0.005%
low intensity residential	3	0.005%
transitional	1	0.001%
Grand total	62,314	100%

j.2.2.2. corridor area

j.2.2.2.1. Land Use Classifications Relevant to Potential Chlorpyrifos Use

CLASS	Hectares	Percent
fallow	241,384	4.92%
small grains	289,522	5.90%
row crops	20,153	0.41%
orchards_vineyards_other	13,626	0.28%
sum	564,685	11.51%
other classes	4,340,369	88.49%

j.2.2.2.1.1. Conclusion: not likely to affect corridor area

j.2.2.2.2. all classes

CLASS	Hectares	Percent
evergreen forest	1,975,179	40.27%
shrubland	1,016,927	20.73%
grasslands_herbaceous	511,571	10.43%
small grains	289,522	5.90%
fallow	241,384	4.92%
deciduous forest	179,277	3.65%
pasture_hay	159,669	3.26%
water	128,066	2.61%
mixed forest	103,234	2.10%
bare rock_sand_clay	96,133	1.96%
transitional	68,938	1.41%
low intensity residential	45,045	0.92%
commercial_industrial_transportion	30,941	0.63%
row crops	20,153	0.41%
woody wetlands	13,869	0.28%
orchards_vineyards_other	13,626	0.28%
emergent herbaceous wetlands	3,823	0.08%
urban_recreational grasses	3,501	0.07%
perennial ice_snow	2,049	0.04%
quarries_strip mines_gravel pits	1,580	0.03%
high intensity residential	568	0.01%
Grand Total	4,905,054	100.00%

Attachment 7. Surface water monitoring data.

Surface water monitoring data (concentrations and method reporting limits reported as µg/L (ppb))

SOURCE	STATE	STUDY	STATION NAME	LAT.	LONG.	AVG.	MAX.	NO.	FIRST	LAST	MIN.	MAX.
		UNIT				CONC.	CONC.	SAMPLES	DATE	DATE	MRL	MRL
DPR	CA		Arcade Creek at Norwood	38.62444	-121.45770	0.012	0.045	30	11/26/1996	4/23/1998	0.004	0.004
DPR	CA		Bishop Cut at Eight Mile Rd (in Delta)	38.04972	-121.41720	0.010	0.010	1	4/13/1992	4/13/1992	0.050	0.050
DPR	CA		Bishop Tract Main Drain (in Delta)	38.05192	-121.40540	0.000	0.000	3	3/16/1992	4/13/1992	0.050	0.050
DPR	CA		Calaveras River at Pacific Avenue.	37.98417	-121.30910	0.000	0.000	1	10/29/1996	10/29/1996	0.050	0.050
DPR	CA		Clarks Ditch, trib. to Colusa Basin Drain	38.99199	-121.95970	0.000	0.000	3	2/10/1992	2/24/1992	0.050	0.050
DPR	CA		Colusa Basin Drain at Rd. 99E, near Knights Landing	38.81250	-121.77300	0.004	0.019	24	1/26/1994	4/15/1998	0.004	0.005
DPR	CA		Del Puerto Creek (trib. to SJR)	37.53917	-121.12050	0.008	0.120	55	3/4/1991	2/10/1993	0.010	0.050
DPR	CA		Duck Creek at El Dorado Street	37.91444	-121.27300	0.043	0.043	1	10/29/1996	10/29/1996	0.050	0.050
DPR	CA		Feather River near Nicolaus at Hwy 99 Bridge	38.89056	-121.60330	0.000	0.000	27	2/23/1996	4/20/1998	0.025	0.025
DPR	CA		Feather River near Olivehurst at Lee Rd and Garden Hwy	39.07944	-121.60270	0.000	0.000	1	2/17/1992	2/17/1992	0.050	0.050
DPR	CA		Five Mile Slough at Plymouth (southwest corner of golf course)	38.01389	-121.34940	0.057	0.104	3	10/29/1996	4/30/1998	0.050	0.050
DPR	CA		French Camp Slough at Manthey Bridge	37.91194	-121.29020	0.000	0.000	5	1/27/1992	2/10/1992	0.050	0.050
DPR	CA		Gilsizer Slough at G. Washington Rd (trib to Butte Slough)	38.93182	-121.68040	0.000	0.000	5	1/27/1992	2/24/1992	0.050	0.050
DPR	CA		Highline Spillway (trib. to SJR)	37.38750	-120.80360	0.070	0.070	1	2/8/1993	2/8/1993	0.050	0.050
DPR	CA		Ingram/Hospital Creek (trib. to SJR)	37.61583	-121.20410	0.020	0.570	58	3/4/1991	2/10/1993	0.010	0.050
DPR	CA		Ledgewood Creek in City of Fairfield	38.28085	-122.10570	0.000	0.000	1	2/10/1992	2/10/1992	0.050	0.050
DPR	CA		Livingston Spillway (trib. to SJR)	37.40839	-120.72110	0.050	0.100	2	1/15/1993	2/8/1993	0.050	0.050
DPR	CA		Lone Tree Creek at Austin Rd trib to French Camp Slough	37.86385	-121.19070	0.000	0.000	5	1/20/1992	2/17/1992	0.050	0.050
DPR	CA		Los Banos Creek (trib. to SJR)	37.27667	-120.95440	0.001	0.010	9	4/2/1991	2/8/1993	0.010	0.050
DPR	CA		Marsh Creek at Cypress Rd bridge (trib to western Delta)	37.99151	-121.70830	0.000	0.000	1	2/10/1992	2/10/1992	0.050	0.050
DPR	CA		Merced River at Hatfield State Park	37.35083	-120.96050	0.004	0.130	92	4/3/1991	6/12/1995	0.010	0.050
DPR	CA		Merced River at Oakdale Road	37.45222	-120.59500	0.035	0.070	2	1/14/1993	2/7/1993	0.050	0.050
DPR	CA		Merced River at River Road Bridge near Newman	37.35056	-120.96160	0.028	0.260	40	1/22/2093	12/27/2093	0.004	0.004
DPR	CA		Mokelumne River at New Hope Rd Bridge (in Delta)	38.23736	-121.42330	0.000	0.000	3	1/27/1992	2/17/1992	0.050	0.050
DPR	CA		Mosher Slough at Mariners Drive, 100 yards from City of Stockton outfall	38.02917	-121.35830	0.111	0.118	2	10/29/1996	11/13/1997	0.050	0.050
DPR	CA		Old River at Tracy Road (inside Delta)	37.81823	-121.44350	0.000	0.000	2	3/16/1992	3/16/1992	0.050	0.050
DPR	CA		Old River off Cohen Road	37.81927	-121.35140	0.000	0.000	4	2/3/1992	2/17/1992	0.050	0.050

DPR	CA		Orestimba Creek at River Road (trib. to SJR)[a]	37.41361	-121.01500	0.046	1.455	535	2/25/1991	3/1/2000	0.001	0.050
DPR	CA		Paradise Cut north of MacArthur Rd and Delta Ave (north of Tracy, inside Delta)	37.81845	-121.42510	0.000	0.000	3	3/9/1992	4/13/1992	0.050	0.050
DPR	CA		Russian River at Hacienda Bridge	38.50889	-122.92160	0.000	0.000	16	1/17/1995	5/1/1995	0.050	0.050
DPR	CA		Russian River at Midway Beach	38.51333	-122.98000	0.000	0.000	35	8/16/1994	8/8/1995	0.050	0.050
DPR	CA		Sacramento Outfall at DWR PP on Sacramento Road	38.93278	-121.63410	0.010	0.010	1	2/8/1994	2/8/1994	0.005	0.005
DPR	CA		Sacramento River 2.5 mi downstream of confluence of Sacramento and Feather rivers	38.76056	-121.59130	0.000	0.000	52	11/15/1993	11/7/1994	0.050	0.050
DPR	CA		Sacramento River at Alamar Marina Dock, 9 mi below confluence of Feather River	38.67444	-121.62860	0.000	0.000	98	12/1/1997	3/10/2000	0.040	0.040
DPR	CA		Sacramento River at Bryte	38.64833	-121.54910	0.000	0.000	24	12/2/1996	3/7/1997	0.040	0.040
DPR	CA		Sacramento River at I Street Bridge	38.58639	-121.50500	0.000	0.000	562	8/2/1991	4/29/1994	0.028	0.044
DPR	CA		Salinas Lagoon	36.81778	-121.78630	0.000	0.000	12	8/29/1994	8/1/1995	0.050	0.050
DPR	CA		Salinas River at Chualar River Rd. bridge	36.55361	-121.54860	0.000	0.000	25	1/24/1995	8/1/1995	0.050	0.050
DPR	CA		Salinas River at Gonzales River Rd. bridge	36.48667	-121.46860	0.004	0.120	28	8/1/1994	7/11/1995	0.050	0.050
DPR	CA		San Joaquin River at Bowman Rd	37.86321	-121.31510	0.002	0.010	5	2/3/1992	2/24/1992	0.050	0.050
DPR	CA		San Joaquin River at Hills Ferry	37.34944	-120.97520	0.001	0.020	69	4/3/1991	2/9/1993	0.010	0.050
DPR	CA		San Joaquin River at Laird Park	37.56167	-121.15160	0.007	0.350	184	3/4/1991	2/25/1993	0.010	0.050
DPR	CA		San Joaquin River at Maze Blvd.	37.64083	-121.22770	0.002	0.020	11	4/4/1991	2/10/1993	0.010	0.050
DPR	CA		San Joaquin River at West Main	37.49333	-121.07940	0.007	0.090	48	4/3/1991	2/10/1993	0.010	0.050
DPR	CA		San Joaquin River near Stevinson	37.29556	-120.84080	0.000	0.000	11	4/2/1991	2/8/1993	0.010	0.050
DPR	CA		San Joaquin River near Vernalis	37.67611	-121.26520	0.000	0.043	761	1/13/1991	3/3/2000	0.010	0.050
DPR	CA		Smith Canal at Pershing.	37.96667	-121.31110	0.046	0.046	1	10/29/1996	10/29/1996	0.050	0.050
DPR	CA		Spanish Grant Drain (trib. to SJR)	37.43556	-121.03220	0.042	0.470	43	3/4/1991	2/9/1993	0.010	0.050
DPR	CA		Stanislaus River at Caswell State Park	37.69528	-121.20270	0.001	0.010	33	4/4/1991	2/10/1993	0.010	0.050
DPR	CA		Stevinson Spillway (trib. to SJR)	37.37710	-120.92720	0.000	0.000	1	2/9/1993	2/9/1993	0.050	0.050
DPR	CA		Sutter Bypass at Karnak Pumping Sta.	38.78500	-121.65330	0.000	0.000	39	12/2/1996	2/9/2000	0.040	0.040
DPR	CA		Sutter Bypass at Kirkville Road	38.90944	-121.63830	0.000	0.000	46	1/20/1997	3/8/2000	0.040	0.040
DPR	CA		Tuolumne River at Shiloh	37.60333	-121.13050	0.003	0.030	29	4/4/1991	2/10/1993	0.010	0.050
DPR	CA		Turlock Irrig. Dist. Drain #3 at Jennings Rd Bridge	37.53694	-121.06610	0.094	1.600	34	3/4/1991	6/22/1992	0.010	0.010
DPR	CA		Turlock Irrig. Dist. Drain #5	37.46444	-121.03000	0.024	0.230	49	3/4/1991	2/9/1993	0.010	0.050
DPR	CA		Turlock Irrig. Drain #6, 200 yds W of Central Ave (trib to SJR)	37.40194	-120.95860	0.037	0.250	34	5/28/1991	6/22/1992	0.010	0.010

[a] Duplicate data from upstream sites at Hwy 33 and above Crow Creek Drain reported from a Dow AgroSciences study were excluded.

DPR	CA		Ulatis Creek at Brown Road	38.35302	-121.99560	0.000	0.000	3	3/16/1992	4/6/1992	0.050	0.050
DPR	CA		Wadsworth Canal at Franklin Rd	39.12778	-121.75550	0.000	0.000	44	12/7/1998	3/8/2000	0.040	0.040
NAWQA	CA	sacr	ARCADE C NR DEL PASO HEIGHTS CA	38.64194	-121.38166	0.012	0.045	45	1996-11-26	2002-05-10	0.004	0.004
NAWQA	CA	sacr	COLUSA BASIN DR A RD 99E NR KNIGHTS LANDING CA	38.8125	-121.77305	0.006	0.016	21	1996-11-07	1998-04-15	0.004	0.004
NAWQA	CA	sanj	DEL PUERTO C AT VINEYARD ROAD NR PATTERSON	37.52083	-121.14861	0.015	0.120	35	1994-06-23	2001-08-21	0.004	0.004
NAWQA	CA	sanj	DRY C A CLAUS RD BRIDGE A MODESTO CA	37.65694	-120.91861	0.006	0.025	22	1995-02-13	2000-02-14	0.004	0.004
NAWQA	CA	sanj	DRY C A GALLO BRIDGE BL HWY 132 A MODESTO CA	37.63638	-120.98333	0.030	0.093	14	1995-02-13	2000-02-14	0.004	0.004
NAWQA	CA	sanj	DRY C A LEASK BRIDGE BL CASHMAN C NR WATERFORD CA	37.67416	-120.71166	0.004	0.004	1	1995-02-14	1995-02-14	0.004	0.004
NAWQA	CA	sanj	FARABUINDO STORMDRAIN A CLAUS RD A MODESTO CA	37.6575	-120.92027	0.300	0.300	1	1995-02-13	1995-02-13	0.004	0.004
NAWQA	CA	sacr	FEATHER R NR NICOLAUS	38.9	-121.58333	0.005	0.005	10	2000-01-30	2001-02-14	0.004	0.004
NAWQA	CA	sanj	HARDING DRAIN A CARPENTER RD NR PATTERSON CA	37.46444	-121.03111	0.019	0.060	37	1992-04-22	2001-08-02	0.004	0.004
NAWQA	CA	sanj	HIGHLINE CN SPILL NR HILMAR CA	37.38972	-120.80472	0.034	0.240	16	1994-02-08	2002-03-07	0.004	0.004
NAWQA	CA	sanj	HOSPITAL C A RIVER RD NR PATTERSON CA	37.61055	-121.22361	0.010	0.020	3	1994-06-23	2001-08-02	0.004	0.004
NAWQA	CA	sanj	INGRAM C A RIVER RD NR PATTERSON CA	37.60055	-121.22361	0.011	0.021	3	1994-06-24	2001-08-02	0.004	0.004
NAWQA	CA	sanj	LIVINGSTON CN A LVNGSTN TRMNT PLANT NR LVNGSTN CA	37.40666	-120.72444	0.013	0.048	15	1994-02-08	2001-08-01	0.004	0.004
NAWQA	CA	sanj	MCHENRY STORMDRAIN A BODEM ST A MODESTO CA	37.64638	-120.98555	0.044	0.079	16	1995-02-13	2001-01-26	0.004	0.004
NAWQA	CA	sanj	MERCED R A RIVER ROAD BRIDGE NR NEWMAN CA	37.35111	-120.96083	0.013	0.260	193	1993-01-22	2002-04-09	0.004	0.004
NAWQA	CA	sanj	MERCED R BL MERCED FALLS DAM NR SNELL CA	37.52222	-120.33194	0.004	0.004	1	1994-06-18	1994-06-18	0.004	0.004
NAWQA	CA	sanj	NINTH ST STORMDRAIN A SEVENTH ST BR A MODESTO CA	37.63027	-120.99361	0.050	0.050	1	1995-02-13	1995-02-13	0.004	0.004
NAWQA	CA	sanj	OAKDALE ID DRAINAGE A ELLENWOOD RD NR WATERFORD CA	37.67333	-120.77333	0.008	0.008	1	1995-02-14	1995-02-14	0.004	0.004
NAWQA	CA	sanj	OLIVE AVE DR NR PATTERSON CA	37.5075	-121.08722	0.095	0.270	3	1994-06-23	2001-08-02	0.004	0.004
NAWQA	CA	sanj	ORESTIMBA C NR NEWMAN CA	37.31527	-121.12361	0.007	0.009	2	1993-02-17	1993-02-18	0.004	0.004
NAWQA	CA	sanj	ORESTIMBA CR AT RIVER RD NR CROWS LANDING CA	37.41361	-121.015	0.022	0.300	231	1992-04-15	2002-04-09	0.004	0.004
NAWQA	CA	sacr	SACRAMENTO R A COLUSA CA	39.21388	-121.99861	0.005	0.005	13	2001-02-10	2002-03-07	0.004	0.004
NAWQA	CA	sacr	SACRAMENTO R A FREEPORT CA	38.45555	-121.50138	0.004	0.006	67	1996-11-15	2002-05-22	0.004	0.004
NAWQA	CA	sacr	SACRAMENTO SLOUGH NR KNIGHTS LANDING CA	38.785	-121.65333	0.005	0.011	16	1996-11-07	2002-05-22	0.004	0.004
NAWQA	CA	sanj	SAN JOAQUIN R A PATTERSON BR NR PATTERSON CA	37.4975	-121.08194	0.006	0.030	47	1994-06-09	2001-08-21	0.004	0.004

NAWQA	CA	sanj	SAN JOAQUIN R AT MAZE RD BRIDGE NR MODESTO CA	37.64027	-121.22777	0.007	0.015	20	2001-04-11	2001-08-21	0.004	0.004
NAWQA	CA	sanj	SAN JOAQUIN R BL WSID PMP AB TUOL R NR WESTLEY CA	37.60583	-121.17444	0.009	0.020	7	1994-06-09	2001-08-02	0.004	0.004
NAWQA	CA	sanj	SAN JOAQUIN R NR VERNALIS CA	37.67611	-121.26416	0.008	0.033	252	1992-04-22	2002-04-09	0.004	0.004
NAWQA	CA	sanj	SONOMA STORMDRAIN A SCENIC DRIVE A MODESTO CA	37.65277	-120.95166	0.250	0.250	1	1995-02-13	1995-02-13	0.050	0.050
NAWQA	CA	sanj	SPANISH GRANT COMBINED DRAIN NR PATTERSON CA	37.43583	-121.0325	0.015	0.029	3	1994-06-22	2001-08-01	0.050	0.050
NAWQA	CA	sanj	STANISLAUS R A CASWELL STATE PARK NR RIPON CA	37.7025	-121.17722	0.007	0.100	64	1994-02-09	2001-08-21	0.050	0.050
NAWQA	CA	sanj	STANISLAUS R A RIPON CA	37.72972	-121.10944	0.005	0.015	22	1993-12-27	1994-06-23	0.050	0.050
NAWQA	CA	sanj	STEVINSON LOWER LATERAL NR STEVINSON CA	37.37138	-120.92972	0.004	0.004	2	1994-02-08	1994-02-08	0.050	0.050
NAWQA	CA	sanj	TUOLUMNE R A CARPENTER RD BRIDGE A MODESTO CA	37.60888	-121.02972	0.005	0.010	16	1995-02-13	1995-03-12	0.050	0.050
NAWQA	CA	sanj	TUOLUMNE R A MITCHELL RD BRIDGE A MODESTO CA	37.61694	-120.93777	0.004	0.004	5	1995-02-13	1995-03-11	0.004	0.005
NAWQA	CA	sanj	TUOLUMNE R A MODESTO CA	37.62722	-120.98638	0.010	0.032	28	1993-12-27	1995-03-21	0.010	0.050
NAWQA	CA	sanj	TUOLUMNE R A ROBERTS FERRY BR NR ROBERTS FERRY CA	37.63583	-120.61722	0.004	0.004	1	1995-02-14	1995-02-14	0.004	0.004
NAWQA	CA	sanj	TUOLUMNE R A SHILOH RD BRIDGE NR GRAYSON CA	37.60277	-121.13055	0.006	0.021	70	1994-02-09	2001-08-21	0.004	0.004
NAWQA	CA	sanj	TURLOCK ID CERES MAIN SPILL NR CERES CA	37.61083	-120.91944	0.021	0.021	1	1995-02-14	1995-02-14	0.004	0.004
NAWQA	CA	sanj	TURLOCK ID HICKMAN SPILL NR HICKMAN CA	37.63138	-120.73638	0.007	0.007	1	1995-02-14	1995-02-14	0.050	0.050
NAWQA	CA	sanj	WEST SIDE STORMDRAIN A NEECE DRIVE A MODESTO CA	37.62527	-120.99833	0.031	0.031	1	1995-02-13	1995-02-13	0.050	0.050
NAWQA	CA	sanj	WESTPORT DRAIN NR MODESTO CA	37.54222	-121.09416	0.012	0.015	3	1994-06-23	2001-08-02	0.004	0.050
NAWQA	CA	sacr	YOLO BYPASS A I-80 NR W SACRAMENTO CA	38.56694	-121.61416	0.004	0.004	6	1997-01-07	2000-03-02	0.004	0.004
NAWQA	ID	ccpt	PALOUSE RIVER AT LAIRD PARK NR HARVARD, ID	46.94305	-116.6375	0.004	0.004	2	1994-04-19	1994-05-02	0.004	0.004
NAWQA	OR	will	BEAVER CREEK NEAR TROUTDALE, OR	45.53472	-122.37694	0.004	0.004	2	1994-05-24	1994-08-05	0.025	0.025
NAWQA	OR	will	FANNO CREEK AT DURHAM, OR	45.40361	-122.75361	0.010	0.046	62	1993-03-01	2002-05-30	0.050	0.050
NAWQA	OR	will	JOHNSON CREEK AT MILWAUKIE,OREG.	45.45305	-122.64194	0.007	0.010	2	1993-03-14	1993-03-14	0.050	0.050
NAWQA	OR	will	SANDY RIVER NEAR TROUTDALE, OR	45.51555	-122.36027	0.004	0.004	4	1994-05-03	1994-09-19	0.050	0.050
NAWQA	OR	will	WILLAMETTE RIVER AT LINNTON, OR	45.59638	-122.775	0.003	0.004	2	1992-10-26	1992-10-26	0.050	0.050
NAWQA	OR	will	WILLAMETTE RIVER AT PORTLAND,OREG.	45.51861	-122.66666	0.005	0.014	108	1993-09-01	2002-04-29	0.050	0.050
NAWQA	WA	yaki	319 TEST SITE DRAIN NR	46.73358	-120.96691	0.004	0.005	3	2000-06-20	2000-10-30	0.010	0.050

			WALTERS ROAD									
NAWQA	WA	yaki	AHTANUM CREEK AT 62ND AVENUE	46.54833	-120.46680	0.004	0.005	3	2000-06-20	2000-10-31	0.050	0.050
NAWQA	WA	yaki	AHTANUM CREEK AT UNION GAP, WASH.	46.53611	-120.47222	0.004	0.004	2	1999-08-03	2000-08-29	0.050	0.050
NAWQA	WA	yaki	AHTANUM CREEK BELOW BACHELOR CREEK	46.52972	-120.93355	0.004	0.005	3	2000-06-20	2000-10-31	0.050	0.050
NAWQA	WA	yaki	BADGER CREEK AT SILICA ROAD	46.06672	-120.45019	0.004	0.005	3	2000-06-14	2000-11-02	0.004	0.050
NAWQA	WA	yaki	BADGER CREEK UPSTREAM OF WIPPLE WASTEWAY	46.90777	-120.35972	0.004	0.004	2	2000-06-13	2000-07-11	0.010	0.050
NAWQA	WA	yaki	CARIBOU CREEK AT SOUTH FERGUSON ROAD	46.13347	-120.08344	0.004	0.004	1	2000-08-30	2000-08-30	0.050	0.050
NAWQA	WA	yaki	CASCADE CANAL AT THRALL ROAD	46.60025	-120.25011	0.004	0.004	2	2000-06-13	2000-07-11	0.004	0.004
NAWQA	WA	yaki	CHERRY CREEK AB WHIPPLE WASTEWAY AT THRALL, WA	46.93222	-120.49111	0.004	0.004	1	2000-08-30	2000-08-30	0.050	0.050
NAWQA	WA	yaki	CHERRY CREEK AT THRALL, WASH.	46.92611	-120.4975	0.004	0.004	1	1999-08-02	1999-08-02	0.050	0.050
NAWQA	WA	yaki	DR 19 AT FACTORY ROAD	46.3175	-119.23336	0.004	0.005	10	2000-06-15	2000-11-01	0.050	0.050
NAWQA	WA	yaki	DR 2 AT VANBELLE ROAD	46.76680	-120.91680	0.004	0.005	3	2000-06-19	2000-10-30	0.050	0.050
NAWQA	WA	yaki	DR 2 AT YAKIMA VALLEY HIGHWAY	46.36683	-120.85013	0.004	0.005	3	2000-06-19	2000-10-30	0.004	0.004
NAWQA	WA	yaki	DR 2 NEAR OUTLOOK FIRE STATION	46.86688	-120.85008	0.004	0.005	3	2000-06-16	2000-11-01	0.004	0.004
NAWQA	WA	yaki	DRAIN AT BADGER ROAD, MILE 7.3	46.26683	-119.08388	0.004	0.004	1	2000-06-14	2000-06-14	0.050	0.050
NAWQA	WA	yaki	DRAIN AT BADGER ROAD, MILE 8.8	46.53341	-119.81677	0.004	0.004	1	2000-06-14	2000-06-14	0.050	0.050
NAWQA	WA	yaki	DRAIN AT BORQUIN ROAD	46.58347	-120.43347	0.005	0.008	5	2000-06-12	2000-07-14	0.001	0.001
NAWQA	WA	yaki	DRAIN AT COLWASH ROAD	46.90002	-120.08694	0.004	0.004	2	2000-06-16	2000-07-13	0.001	0.050
NAWQA	WA	yaki	DRAIN AT DRAPER ROAD	46.71675	-120.90002	0.012	0.016	2	2000-06-19	2000-07-14	0.001	0.001
NAWQA	WA	yaki	DRAIN AT EVANS ROAD	46.26677	-119.75019	0.012	0.020	2	2000-06-13	2000-07-13	0.050	0.050
NAWQA	WA	yaki	DRAIN AT FAUCHER ROAD	46.96672	-120.46686	0.004	0.004	1	2000-06-15	2000-06-15	0.050	0.050
NAWQA	WA	yaki	DRAIN AT GRIFFIN ROAD	46.51680	-119.03352	0.004	0.004	1	2000-07-19	2000-07-19	0.050	0.050
NAWQA	WA	yaki	DRAIN AT HAMILTON ROAD	46.38358	-120.08341	0.004	0.005	3	2000-06-13	2000-11-02	0.005	0.005
NAWQA	WA	yaki	DRAIN AT HILAND DRIVE	46.43416	-120.70013	0.007	0.009	2	2000-06-21	2000-07-10	0.050	0.050
NAWQA	WA	yaki	DRAIN AT LOMBARD LOOP	46.75005	-120.38352	0.005	0.008	3	2000-06-19	2000-10-30	0.040	0.040
NAWQA	WA	yaki	DRAIN AT PARK CREEK ROAD	46.28355	-120.51680	0.004	0.005	3	2000-06-14	2000-11-02	0.040	0.040
NAWQA	WA	yaki	DRAIN AT SORENSON ROAD	46.50025	-120.75011	0.004	0.005	3	2000-06-22	2000-11-02	0.004	0.004
NAWQA	WA	yaki	DRAIN NEAR POSTMA ROAD	46.56388	-120.50008	0.004	0.005	10	2000-06-20	2000-11-01	0.028	0.044
NAWQA	WA	yaki	E TOPPENISH DRAIN AT WILSON RD NR TOPPENISH,WASH	46.36777	-120.25	0.004	0.004	1	1999-08-03	1999-08-03	0.050	0.050
NAWQA	WA	ccpt	EL 68 D WASTEWAY NEAR OTHELLO, WASH	46.72972	-119.04888	0.012	0.066	32	1993-04-01	1997-02-10	0.004	0.004
NAWQA	WA	yaki	ELLENSBURG WWTP	46.80013	-120.88338	0.004	0.004	1	1999-08-02	1999-08-02	0.050	0.050
NAWQA	WA	ccpt	ESQUATZEL DIV CHANNEL BL HEADWORKS NR PASCO, WA	46.36333	-119.08777	0.004	0.004	6	1994-04-05	1996-02-27	0.004	0.004

NAWQA	WA	yaki	GRANDVIEW PUMP LATERAL AT MCCREADIE ROAD	46.25833	-119.6835	0.004	0.004	2	2000-06-15	2000-07-19	0.050	0.050
NAWQA	WA	yaki	GRANGER DRAIN AT GRANGER, WA	46.34361	-120.18583	0.004	0.010	47	1999-05-20	2002-05-14	0.050	0.050
NAWQA	WA	yaki	GRANGER WWTP	46.13344	-120.65025	0.004	0.004	1	1999-08-04	1999-08-04	0.010	0.050
NAWQA	WA	yaki	JD 27.5 AT VANBELLE ROAD	46.78341	-120.86691	0.004	0.004	1	2000-08-29	2000-08-29	0.010	0.050
NAWQA	WA	yaki	JD 32.0 UPSTREAM OF DR 2	46.30002	-120.85019	0.003	0.005	3	2000-06-19	2000-10-30	0.010	0.050
NAWQA	WA	yaki	JD 34.2 AT WOODIN ROAD	46.30002	-120.31680	0.004	0.005	3	2000-06-15	2000-11-01	0.010	0.050
NAWQA	WA	yaki	JD 37.9 AT EAST EDISON ROAD	46.32472	-119.97	0.004	0.005	3	2000-06-13	2000-11-02	0.004	0.050
NAWQA	WA	yaki	JD 43.9 AT MABTON SUNNYSIDE ROAD	46.00013	-119.88352	0.004	0.005	3	2000-06-13	2000-11-02	0.050	0.050
NAWQA	WA	yaki	JD 51.4 AT YAKIMA RIVER	46.66686	-119.00025	0.004	0.005	4	2000-06-13	2000-11-01	0.004	0.004
NAWQA	WA	yaki	JD 52.8 AT WAMBA ROAD AT PROSSER, WA	46.2125	-119.77777	0.004	0.005	3	2000-06-13	2000-10-30	0.010	0.050
NAWQA	WA	yaki	JD 55.1 AT BETTINSON ROAD	46.25008	-119.40016	0.004	0.004	1	2000-08-30	2000-08-30	0.010	0.050
NAWQA	WA	yaki	JOHNSON DRAIN AT SOUTH FERGUSON ROAD	46.94444	-120.93355	0.004	0.005	3	2000-06-13	2000-11-02	0.050	0.050
NAWQA	WA	yaki	JT DR 2 AT LEMLEY ROAD	46.06680	-119.68341	0.004	0.005	3	2000-06-15	2000-11-02	0.050	0.050
NAWQA	WA	yaki	KRD CANAL AT WIPPLE SPILLWAY	46.91777	-120.93344	0.004	0.004	2	2000-06-13	2000-07-11	0.050	0.050
NAWQA	WA	yaki	MARION DRAIN AT INDIAN CHURCH RD AT GRANGER, WA	46.33111	-120.19833	0.004	0.004	1	1999-08-04	1999-08-04	0.040	0.040
NAWQA	WA	yaki	MOXEE DRAIN AT BEANE ROAD	46.45013	-120.71688	0.003	0.005	3	2000-06-20	2000-10-31	0.040	0.040
NAWQA	WA	yaki	MOXEE DRAIN AT BIRCHFIELD ROAD NEAR UNION GAP, WA	46.54611	-120.43694	0.004	0.005	28	1999-05-18	2000-10-31	0.004	0.004
NAWQA	WA	yaki	NACHES RIVER NR NORTH YAKIMA, WA	46.62833	-120.51944	0.004	0.004	1	1999-08-03	1999-08-03	0.004	0.004
NAWQA	WA	yaki	NORTH DRAIN AT SATUS LONGHOUSE ROAD	46.71691	-120.14583	0.004	0.005	10	2000-06-15	2000-11-02	0.004	0.004
NAWQA	WA	yaki	PACIFIC POWER & LIGHT COMPANY WASTEWAY	46.69555	-120.65305	0.004	0.004	1	1999-08-03	1999-08-03	0.004	0.004
NAWQA	WA	ccpt	PALOUSE R. AT ENDICOTT-ST. JOHN RD NR COLFAX, WA	46.99722	-117.61944	0.004	0.004	1	1994-04-21	1994-04-21	0.004	0.004
NAWQA	WA	ccpt	PALOUSE RIVER AT HOOPER, WA	46.75861	-118.14777	0.004	0.011	113	1993-03-25	2002-05-06	0.004	0.004
NAWQA	WA	ccpt	PALOUSE RIVER NEAR COLFAX, WASH.	46.92083	-117.31777	0.004	0.004	5	1994-04-14	1995-07-24	0.004	0.004
NAWQA	WA	ccpt	PARADISE CREEK AT PULLMAN, WASH.	46.72111	-117.13611	0.004	0.004	1	1994-04-20	1994-04-20	0.004	0.004
NAWQA	WA	yaki	PARK CREEK AT PARK CREEK ROAD	46.10025	-120.46680	0.004	0.005	3	2000-06-14	2000-11-02	0.010	0.050
NAWQA	WA	yaki	PARK CREEK AT SOUTH FERGUSON ROAD	46.78338	-120.93352	0.004	0.005	3	2000-06-13	2000-11-02	0.004	0.004
NAWQA	WA	yaki	PROSSER WWTP	46.75013	-119.71669	0.004	0.004	1	1999-08-05	1999-08-05	0.004	0.004
NAWQA	WA	ccpt	REBEL FLAT CREEK AT WINONA, WA	46.94333	-117.79694	0.004	0.004	6	1994-04-12	1995-07-06	0.004	0.004
NAWQA	WA	ccpt	ROCK CR NR WINONA,WASH.	46.91638	-117.92694	0.004	0.004	1	1994-04-21	1994-04-21	0.004	0.004

NAWQA	WA	yaki	ROZA CANAL AT BEANE ROAD	46.36688	-120.71686	0.004	0.004	2	2000-06-21	2000-07-17	0.010	0.010
NAWQA	WA	yaki	ROZA CANAL AT RAY ROAD	46.35011	-119.40019	0.004	0.004	2	2000-06-21	2000-07-19	0.010	0.050
NAWQA	WA	ccpt	S.F. PALOUSE RIVER AT COLFAX, WA	46.87555	-117.345	0.004	0.004	5	1994-04-12	1995-07-24	0.004	0.004
NAWQA	WA	ccpt	SAND HOLLOW CR AT S RD SW NR VANTAGE, WA	46.93055	-119.89861	0.005	0.008	7	1994-04-14	1997-02-11	0.004	0.004
NAWQA	WA	yaki	SATUS CR BELOW DRY CR NEAR TOPPENISH, WASH.	46.25	-120.37777	0.004	0.005	3	1999-08-04	2000-10-31	0.010	0.010
NAWQA	WA	yaki	SATUS CREEK AB SHINANDO CREEK NR TOPPENISH, WA	46.00016	-120.91680	0.004	0.004	1	1999-08-03	1999-08-03	0.050	0.050
NAWQA	WA	yaki	SATUS CREEK AT GAGE AT SATUS, WA	46.27388	-120.14222	0.004	0.004	1	1999-08-04	1999-08-04	0.040	0.040
NAWQA	WA	ccpt	SCBID MATTAWA WASTEWAY NR MATTAWA, WA	46.65472	-119.79666	0.012	0.059	8	1994-04-15	1995-07-18	0.004	0.004
NAWQA	WA	ccpt	SCBID PE 16.4 WASTEWAY NR MOUTH NR HANFORD, WA	46.50611	-119.25888	0.005	0.009	9	1994-04-04	1996-02-28	0.004	0.004
NAWQA	WA	ccpt	SCBID SADDLE MOUNTAIN WASTEWAY NR MATTAWA, WA	46.7025	-119.66027	0.004	0.004	2	1996-02-27	1997-02-11	0.004	0.004
NAWQA	WA	yaki	SELAH WWTP	46.93344	-120.48347	0.004	0.004	1	1999-08-03	1999-08-03	0.004	0.004
NAWQA	WA	yaki	SELAH-MOXEE CANAL AT DUFFIELD ROAD	46.18338	-120.65011	0.004	0.004	1	2000-07-19	2000-07-19	0.004	0.004
NAWQA	WA	yaki	SNIPES CREEK AT MCCREADIE ROAD	46.28341	-119.40025	0.004	0.005	3	2000-06-21	2000-10-31	0.004	0.004
NAWQA	WA	yaki	SNIPES CREEK AT MOUTH AT WHITSTRAN, WA	46.23388	-119.67694	0.004	0.004	1	2000-09-01	2000-09-01	0.004	0.004
NAWQA	WA	yaki	SNIPES CREEK BELOW CHANDLER CANAL NR PROSSER, WA	46.23347	-119.70005	0.004	0.004	1	1999-08-05	1999-08-05	0.004	0.004
NAWQA	WA	yaki	SOUTH DRAIN NEAR SATUS, WA	46.25972	-120.1325	0.004	0.005	5	1999-08-04	2000-11-01	0.004	0.004
NAWQA	WA	yaki	SPRING CREEK AT EVANS ROAD	46.28338	-119.08347	0.004	0.005	3	2000-06-21	2000-10-31	0.004	0.004
NAWQA	WA	yaki	SPRING CREEK AT HANKS RD NR PROSSER, WA	46.27277	-119.73805	0.004	0.005	3	2000-06-21	2000-10-31	0.004	0.004
NAWQA	WA	yaki	SPRING CREEK AT HESS ROAD NEAR PROSSER, WA	46.23444	-119.05025	0.004	0.004	1	1999-08-05	1999-08-05	0.004	0.004
NAWQA	WA	yaki	SPRING CREEK AT MCCREADIE RD NR PROSSER	46.2575	-119.71027	0.004	0.004	1	2000-08-31	2000-08-31	0.004	0.004
NAWQA	WA	yaki	SPRING CREEK AT MOUTH AT WHITSTRAN, WA	46.23333	-119.67722	0.004	0.004	1	2000-09-01	2000-09-01	0.004	0.004
NAWQA	WA	yaki	SUB 35 DRAIN AT PARTON ROAD NEAR GRANGER,WASH	46.33638	-120.23	0.003	0.003	1	1999-08-03	1999-08-03	0.004	0.004
NAWQA	WA	yaki	SULPHUR CR WASTEWAY NR SUNNYSIDE WASH	46.25083	-120.01861	0.004	0.004	2	1999-08-04	1999-08-05	0.004	0.004
NAWQA	WA	yaki	SUNNYSIDE CANAL AT EAST EDISON ROAD	46.46683	-119.25005	0.004	0.004	1	2000-07-18	2000-07-18	0.004	0.004
NAWQA	WA	yaki	SUNNYSIDE CANAL AT NORTH OUTLOOK ROAD	46.96669	-120.53336	0.004	0.004	1	2000-07-18	2000-07-18	0.004	0.004
NAWQA	WA	yaki	SUNNYSIDE CANAL NEAR PARKER	46.63352	-120.43336	0.004	0.004	1	2000-06-21	2000-06-21	0.004	0.004
NAWQA	WA	yaki	SUNNYSIDE WWTP	46.83344	-120.96683	0.004	0.004	1	1999-08-04	1999-08-04	0.004	0.004

NAWQA	WA	yaki	TOPPENISH CR AT INDIAN CHURCH RD NR GRANGER,WASH	46.31444	-120.19805	0.004	0.004	1	1999-08-04	1999-08-04	0.004	0.004
NAWQA	WA	yaki	TOPPENISH CREEK BL SIMCOE CR NR WHITE SWAN, WA	46.375	-120.61944	0.004	0.004	1	2000-08-29	2000-08-29	0.004	0.004
NAWQA	WA	yaki	TOPPENISH CREEK NEAR FORT SIMCOE, WASH.	46.31111	-120.78694	0.004	0.004	1	2000-08-31	2000-08-31	0.004	0.004
NAWQA	WA	yaki	UMTANUM CREEK NR MOUTH AT UMTANUM, WA	46.8575	-120.49611	0.004	0.005	4	1999-08-02	2000-11-01	0.004	0.004
NAWQA	WA	ccpt	UNION FLAT CR NR LACROSSE,WASH.	46.86166	-117.8925	0.004	0.004	1	1994-04-21	1994-04-21	0.004	0.004
NAWQA	WA	ccpt	UNION FLAT CREEK NEAR COLFAX, WASH.	46.81027	-117.43111	0.004	0.004	1	1994-04-20	1994-04-20	0.004	0.004
NAWQA	WA	yaki	UNION GAP CANAL AT BLUE GOOSE ROAD	46.73341	-120.83336	0.004	0.004	1	2000-07-10	2000-07-10	0.004	0.004
NAWQA	WA	yaki	WEST LATERAL AT SATUS PUMP STATION NUMBER 2	46.16672	-120.85019	0.004	0.004	2	2000-06-14	2000-07-12	0.004	0.004
NAWQA	WA	yaki	WIDE HOLLOW CREEK NEAR MOUTH AT UNION GAP,WASH	46.54305	-120.47416	0.004	0.004	1	1999-08-03	1999-08-03	0.004	0.004
NAWQA	WA	yaki	WILSON CREEK ABOVE CHERRY CREEK AT THRALL, WA	46.92638	-120.50027	0.004	0.004	1	1999-08-02	1999-08-02	0.004	0.004
NAWQA	WA	yaki	YAKIMA R ABV AHTANUM CR AT UNION GAP, WASH.	46.53444	-120.46611	0.004	0.004	1	1999-08-03	1999-08-03	0.004	0.004
NAWQA	WA	yaki	YAKIMA R AT EUCLID BR AT RM 55 NR GRANDVIEW,WA	46.21694	-119.91666	0.004	0.004	1	1999-08-05	1999-08-05	0.004	0.004
NAWQA	WA	yaki	YAKIMA RIVER AT CLE ELUM, WASH.	47.19305	-120.94861	0.004	0.004	1	1999-08-02	1999-08-02	0.004	0.004
NAWQA	WA	yaki	YAKIMA RIVER AT KIONA, WASH.	46.25361	-119.47694	0.005	0.007	35	1999-05-19	2002-05-06	0.004	0.004
NAWQA	WA	yaki	YAKIMA RIVER AT RM 72 AB SATUS CR NR SUNNYSIDE, WA	46.26972	-120.09166	0.004	0.004	1	1999-08-04	1999-08-04	0.004	0.004
NAWQA	WA	yaki	YAKIMA RIVER AT UMTANUM, WASH.	46.86277	-120.47888	0.004	0.004	1	1999-08-02	1999-08-02	0.004	0.004
NAWQA	WA	yaki	YAKIMA WWTP	46.78344	-120.83355	0.004	0.004	1	1999-08-03	1999-08-03	0.004	0.004
NAWQA	WA	yaki	YAKIMA-TIETON CANAL AT OCCIDENTAL ROAD	46.80022	-120.06686	0.004	0.004	1	2000-07-13	2000-07-13	0.004	0.004
NAWQA	WA	yaki	ZILLAH WWTP	46.85019	-120.25833	0.004	0.004	1	1999-08-03	1999-08-03	0.004	0.004
NAWQA-WSDA	WA		JD 34.2 AT WOODIN ROAD	46.33821	-120.02324	0.003	0.003	2				
STORET-OP CASE	CA		BIG BREAK NEAR OAKLEY	38.01805	-121.71055	0.000	0.000	10	5/4/1990	9/14/1994	0.010	0.020
STORET-OP CASE	CA		FRANKS TRACT NEAR RUSSOS LANDING	38.04388	-121.61361	0.000	0.000	10	5/3/1990	9/13/1994	0.010	0.020
STORET-OP CASE	CA		GREEN CYN C A MAIN ST NR GUADALUPE CA	34.9575	-120.63166	0.282	1.600	11	7/30/1990	8/17/1995	0.000	0.010
STORET-OP CASE	CA		OLD RIVER OPPOSITE RANCHO DEL RIO	37.97055	-121.57194	0.000	0.000	10	5/2/1990	9/12/1994	0.010	0.020
STORET-OP CASE	CA		SACRAMENTO RIVER AT GREENES LANDING	38.34583	-121.545	0.000	0.000	10	5/1/1990	9/9/1994	0.010	0.020

STORET-OP CASE	CA		SACTO R AB PT SACTO	38.0625	-121.81944	0.000	0.000	9	5/3/1990	9/13/1994	0.010	0.020
STORET-OP CASE	CA		SAN ANTONIO C NR CASMALIA CA	34.78222	-120.52972	0.014	0.060	5	4/4/1991	8/6/1993	0.000	0.010
STORET-OP CASE	CA		SAN JOAQUIN R A ANTIOCH SHIP CH	38.02083	-121.80777	0.000	0.000	10	5/4/1990	9/14/1994	0.010	0.020
STORET-OP CASE	CA		SAN JOAQUIN R A MOSSDALE BR	37.78638	-121.30611	0.000	0.000	10	5/1/1990	9/9/1994	0.010	0.020
STORET-OP CASE	CA		SAN JOAQUIN RIVER AT BUCKLEY COVE	37.97833	-121.38194	0.000	0.000	10	5/2/1990	9/12/1994	0.010	0.020
STORET-OP CASE	CA		SHERMAN LAKE NEAR ANTIOCH	38.04277	-121.79277	0.000	0.000	10	5/4/1990	9/14/1994	0.010	0.020
STORET-OP CASE	OR		FANNO CREEK AT DURHAM,OREG.	45.40361	-122.75361	0.000	0.000	2	7/22/1993	7/22/1993	0.010	0.010
STORET-OP CASE	OR		HERMISTON DITCH 500 FT FROM WELL 5 4/28-3K	45.85583	-119.29583	0.000	0.000	2	4/11/1990	9/19/1990	0.030	0.140
STORET-OP CASE	OR		JOHNSON CREEK AT MILWAUKIE,OREG.	45.45305	-122.64194	0.000	0.000	1	3/14/1993	3/14/1993	0.000	0.000
STORET-OP CASE	WA		EL 68 D WASTEWAY NEAR OTHELLO, WASH	46.72972	-119.04888	0.010	0.030	3	11/19/1991	7/14/1992	0.000	0.010
STORET-OP CASE	WA		ESQUATZEL COULEE AT SAGEMOOR RD NR PASCO, WA	46.38694	-119.06833	0.003	0.010	3	11/20/1991	7/16/1992	0.000	0.010
STORET-OP CASE	WA		IRRIGAT. DITCH AT WHITMAN MISSION NHS WEST BDRY.	46.04111	-118.46444	0.000	0.000	1	7/15/1992	7/15/1992	0.100	0.100
STORET-OP CASE	WA		IRRIGATION DITCH CLOSE TO GREAT GRAVE	46.04194	-118.46138	0.000	0.000	1	8/25/1992	8/25/1992	0.100	0.100
STORET-OP CASE	WA		MILL POND	46.03972	-118.46138	0.000	0.000	2	7/28/1992	9/24/1992	0.100	0.100
STORET-OP CASE	WA		SAND HOLLOW AT CR S SW NR VANTAGE, WA	46.93055	-119.89861	0.000	0.000	2	3/4/1992	7/16/1992	0.010	0.010
STORET-OP CASE	WA		SAND HOLLOW AT MOUTH NR VANTAGE, WA	46.92944	-119.95027	0.000	0.000	1	11/20/1991	11/20/1991	0.010	0.010
STORET-OP CASE	WA		SCBID PE16.4 WASTEWAY AT RICKERT RD NR RINGOLD,	46.5225	-119.23833	0.003	0.010	3	11/20/1991	7/16/1992	0.000	0.010
STORET-OP CASE	WA		SCBID SADDLE MOUNTAIN WASTEWAY NR MATTAWA, WA	46.7025	-119.66027	0.000	0.000	1	7/17/1992	7/17/1992	0.010	0.010
STORET-OP CASE	WA		WAHLUKE BRANCH 10A WSTWY NR OTHELLO, WA	46.64277	-119.33277	0.000	0.000	3	11/19/1991	7/17/1992	0.010	0.010
STORET-WSDA	WA		COLUMBIA R AT VERNITA BR NR PRIEST RAPIDS DAM,WA	46.64000	-119.73167	0.000	0.000	8	1/17/1996	3/3/1997		
STORET-WSDA	WA		EL 68 D WASTEWAY NEAR OTHELLO, WASH	46.72972	-119.04889	0.000	0.000	2	2/15/1995	2/10/1997		
STORET-WSDA	WA		ESQUATZEL DIV CHANNEL BL HEADWORKS NR PASCO, WA	46.36333	-119.08778	0.000	0.000	2	2/16/1995	2/27/1996		
STORET-WSDA	WA		PALOUSE RIVER AT HOOPER, WA	46.75861	-118.14778	0.000	0.000	18	1/9/1995	3/21/1997		
STORET-WSDA	WA		PALOUSE RIVER NEAR COLFAX, WASH.	46.92500	-117.31944	0.000	0.000	1	7/24/1995	7/24/1995		

STORET-WSDA	WA		REBEL FLAT CREEK AT WINONA, WA	46.94333	-117.79694	0.000	0.000	1	7/6/1995	7/6/1995		
STORET-WSDA	WA		S.F. PALOUSE RIVER AT COLFAX, WA	46.87556	-117.34500	0.000	0.000	1	7/24/1995	7/24/1995		
STORET-WSDA	WA		SAND HOLLOW AT CR S SW NR VANTAGE, WA	46.93056	-119.89861	0.000	0.000	3	2/14/1995	2/11/1997		
STORET-WSDA	WA		SCBID MATTAWA WASTEWAY NR MATTAWA, WA	46.65472	-119.79667	0.015	0.060	4	6/27/1995	7/18/1995		
STORET-WSDA	WA		SCBID PE 16.4 WASTEWAY NR MOUTH NR HANFORD, WA	46.50611	-119.25889	0.000	0.000	5	2/16/1995	2/28/1996		
STORET-WSDA	WA		SCBID SADDLE MOUNTAIN WASTEWAY NR MATTAWA, WA	46.70250	-119.66028	0.000	0.000	2	2/27/1996	2/11/1997		
STORET-WSDA	WA		SNAKE RIVER AT BURBANK, WASH.	46.21639	-119.02278	0.000	0.000	20	11/7/1995	3/5/1997		

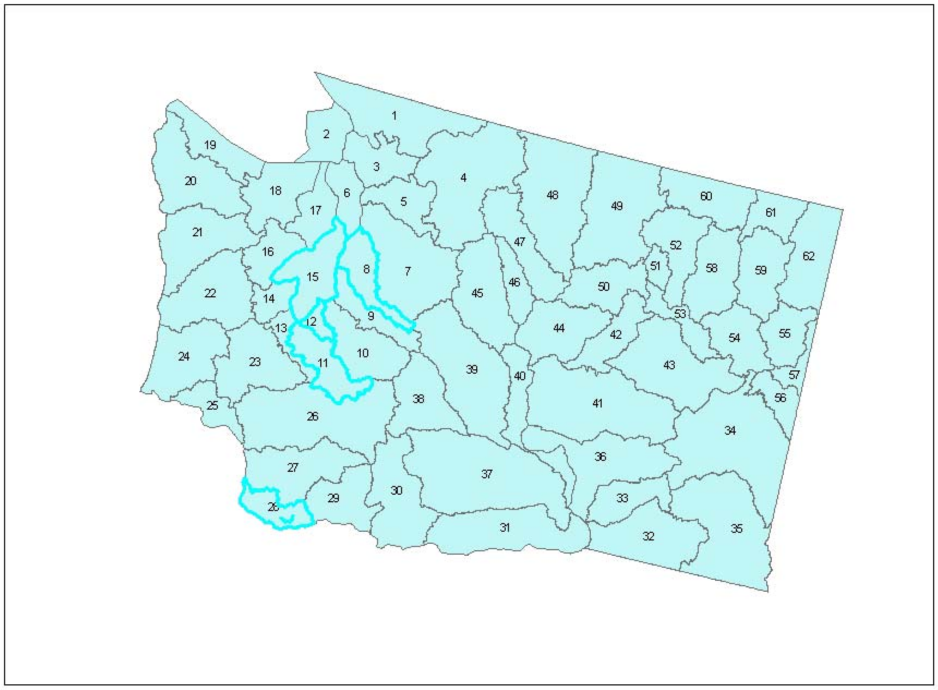
Attachment 8. Examples of using local fish habitat data to further refine assessments

Washington

For the State of Washington, the Salmon and Steelhead Habitat Inventory and Assessment Program (SSHIAP) is the most detailed source of information about salmonid habitats. The program is ongoing, and publishes its information via the WWW. The programs executive summary is (from the SSHIAP home page at http://www.wa.gov/wdfw/hab/sshiap):

> The Salmon and Steelhead Habitat Inventory and Assessment Program (SSHIAP) is a partnership-based information system that characterizes freshwater and estuary habitat conditions and distribution of salmonid stocks in Washington at the 1:24,000 scale. The SSHIAP system delineates streams into segments based on physical characteristics and habitat types. These segments provide a consistent spatial data framework for integrating a wide variety of habitat information and for subsequent analyses. The SSHIAP system quantitatively characterizes habitat conditions, incorporates Salmonid Stock Inventory (SaSI) stock distribution and status, and links habitat conditions and stock distribution with productivity modeling efforts. Begun in 1995, the western Washington Treaty Indian Tribes and the Washington Department of Fish and Wildlife (WDFW) are the co-managers on the project. SSHIAP currently covers Water Resource Inventory Areas (WRIA's) 1-23; work is partially funded and underway to extend SSHIAP coverage to WRIA's 24-62.

The WRIA areas referred to above are shown on the map below. The highlighted areas are the WRIAs that been completed and published.

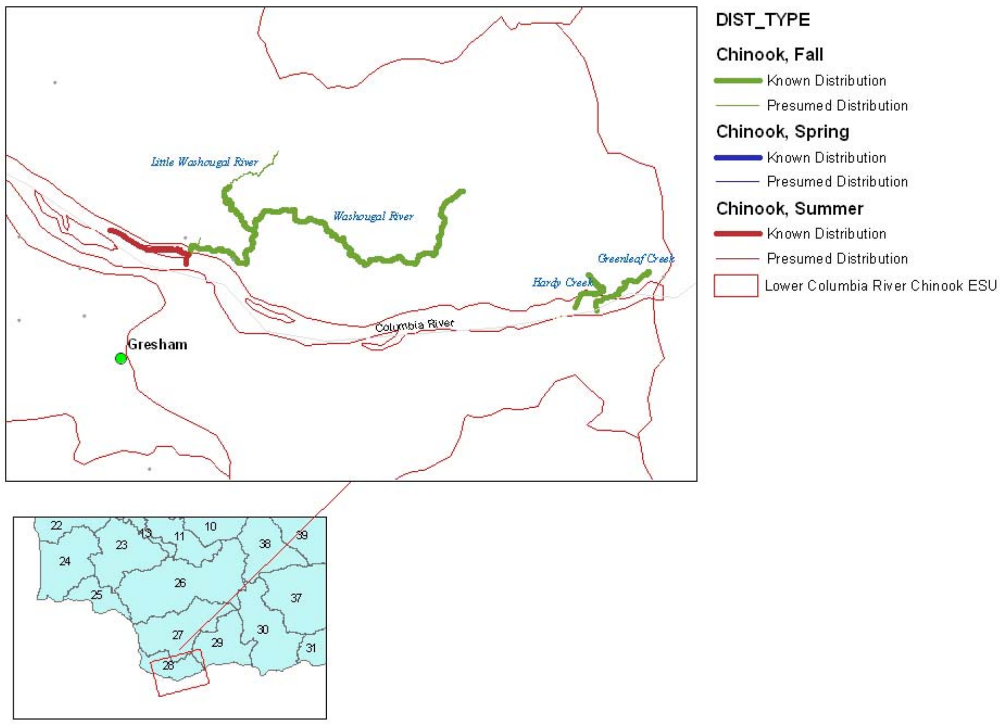


The only complete WRIA that corresponds to the salmonid ESUs classified as "may affect" is Salmon-Washougal WRIA, number 28, along the Columbia River. The WRIA has the same boundary as HUC 17080001, the Lower-Columbia-Sandy HUC. The only ESUs containing spawing/rearing habitat type for this WRIA are: A9. Lower Columbia River Steelhead and B7. Lower Columbia River Chinook Salmon. Both of the ESUs had a "not likely to affect" determination at a lower tier level, based on overall NLCD land use statistics; however, as a case study, a higher tier evaluation of potential exposure employing SHHIAP data will be done for the portion of Lower Columbia Chinook ESU intersecting with WRIA 28. This analysis will demonstrate the usefulness of the SHHIAP-type data for assessing potential exposure for salmonids. As the SHHIAP is ongoing, more detailed risk management decision will be possible as the program completes more areas.

The data product employed for the analysis is the "fish distribution" data, distributed as a ESRI Shapefile. The shapefile includes the following attributes:

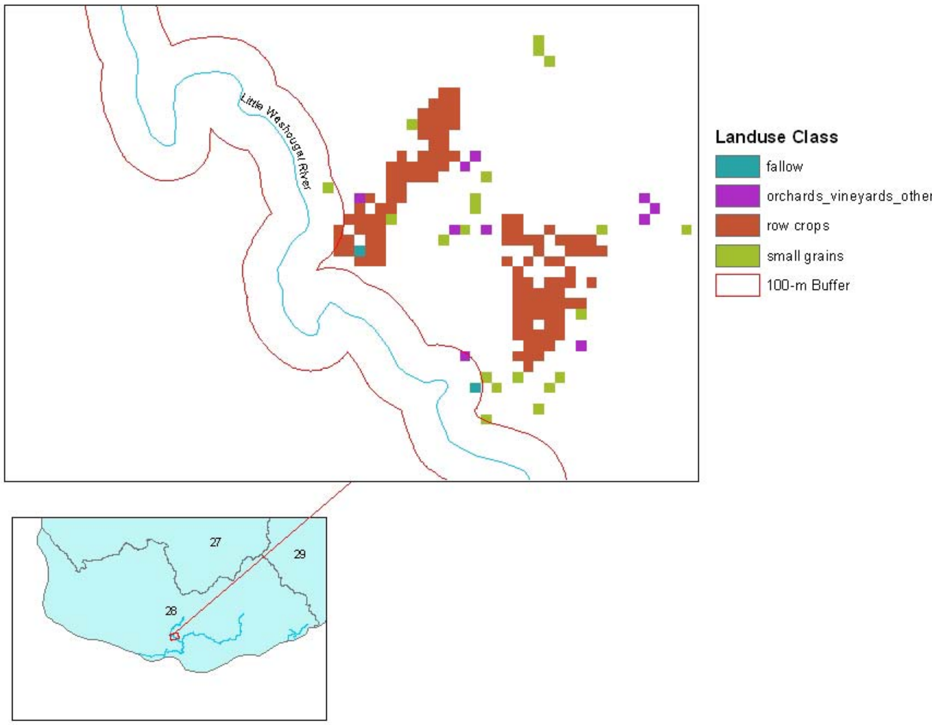
Variable	Size	Type	Decimals	Description	Values
LLID	13	C		Stream ID	From 24 and 100K
BEGMEAS	13	N	3	Begin Event Measure	
ENDMEAS	13	N	3	End Event Measure	
LENGTH	13	N	3	Event Length	BEGMEAS minus ENDMEAS
SPPCODE	4	C		Species Code	Standard 4-character codes (old WDFW)
DIST_TYPE	2	I		Distribution Category	1=Known 2=Presumed 3=Potential 4=Artificial 5=Undetected-AFS 6=Undetected-Other 7=Historic 8=Unknown
USE_TYPE	2	I		Type of Use	1=Occupied 2=Spawning 3=Pionier Spawning 4=Rearing 9=Unknown
WRIA	2	I		WRIA Number	Standard two-digit code (*for a complete list, see Hydromodifications Data Dictionary)*
STRM_NAME	50	C		Stream Name	From hydrolayer
DATA_SRC	2	I		Data Source Code	1=StreamNet 2=Bull Trout 2000 3=LFA Report 4=SSHIAP 9=Other Update
REV_DATE	8	C		Revision Date	Last date record was revised

The species codes (SPPCODE) include an abbreviation of the species name (CH for Chinook salmon) and the season of their run (SP for spring, SU for summer, and FA for fall). The present analysis considered CHSP (Spring Chinook), CHSU (Summer Chinook), and CHFA (Fall Chinook). The map below shows the stream reaches of interest.



As can be seem from the map, the extent of the streams employed by the salmon is quite limited (the Columbia River itself is not included, as it is solely a migration route, i.e., corridor habitat).

The estimate the proximity of potential chlorpyrifos use to the habitat identified, a series of buffers were defined at various distances from the identified streams, employing the buffering tools in ArcGIS. Buffers were defined at 10, 50 and 100 meters and 300 feet (to correspond to EPA-proposed 300-ft buffers) from the stream centerline. The buffers were then intersected with the NLCD imagery (using the subset of classes of potential chlorpyrifos use only – fallow, small grains, orchards, and row crops) for Washington and the resulting land use statistics compiled. An example of a small area of the Little Washougal River is shown below.



This example show that there is a small amount of intersection of the buffer at 100 meters and landuse where there is the potential for chlorpyrifos use.

Results:

Hardy Creek – No potential use classes within 100 meters of the waterbody
Greenleaf Creek – No potential use classes within 100 meters of the waterbody

Washougal River/Little Washougal River

Total stream length of the known and presumed habitat is 258,000 m (846,457 ft), so the buffer areas are:
2*10*258,000 = 5,160,000 m^2 , or 516 ha (for the 10-meter buffer)
2*50*258,000 = 25,800,00 m^2 , or 2580 ha (for the 50-meter buffer)
2*100*258,000 = 51,600,00 m^2 , or 5160 ha (for the 100-meter buffer)
2*300*846,457 = 11,659 acres (for the 300-ft buffer)

10-meter buffer: No potential use classes
50-meter buffer: < 1 ha potential use (1 pixel, 900 m^2, small grains class)
100-meter buffer:

Landuse Class	Area in buffer (ha)	% of total buffer area
Orchards/vineyards	0.09	0.0017 %
Row Crops	0.36	0.0069 %
Small grains	0.9	0.0174 %
Fallow	0.09	0.0017 %

300-ft buffer:

Landuse Class	Area in buffer (acres)	% of total buffer area
Row Crops	0.44	0.0038 %
Small grains	1.77	0.015 %
Fallow	0.22	0.0019 %

From this analysis, it can be concluded that there a very small chance of impact of the use of chlorpyrifos on the salmonids inhabiting the known and potential stream habitat in this WRIA.

Oregon

The Natural Resources Information Management Program, within the Oregon Department of Fish and Wildlife (ODFW) , lists the following goals at their website (http://oregonstate.edu/dept/nrimp/index.htm):

- Identifying and prioritizing natural resource information needs for fish and wildlife management.
- Developing and promoting the use of modern data collection and analysis techniques.
- Promoting the use of technology that will benefit the department's natural resource data collection and management needs.
- Developing and providing consistent, accessible, high-quality information.
- Encouraging the synthesis and transfer of scientific information into management recommendations.
- Developing and promoting a multidisciplinary approach to fish, wildlife, and habitat management.

The program is part of the regional Streamnet network, with the work being done in close cooperation with Oregon State University. The program publishes extensive GIS datalayers on salmonid habitat (http://oregonstate.edu/dept/nrimp/information/index.htm); the website hosts a sophisticated data query and online mapping system. The collection program is somewhat different from the SHHIAP effort in that the WA program attempts to delineate presumed and potential (as well as existing and historical) habitat, while the OR program primarily addresses existing and historical habitat.

For this case study, 1:100,000 scale arc shapefiles were downloaded for summer-run steelhead and spring-run Chinook salmon. It must be noted that the various runs of the different species are not identified as a specific population as in the ESU listings. The shapefiles include the attributes by stream reach identifying habitat usage type, federal and state status, and data quality criteria. The habitat usage types are (from the metadata for the hydrology shapefiles):

- Spawning and rearing. Defined as areas where eggs are deposited and fertilized, where gravel emergence occurs, and where at least some juvenile development occurs.

- Rearing and migration. Defined as areas outside primary spawning habitats where juvenile fish take up residence during some stage of juvenile development and use the area for feeding, shelter, and growth. Some migration also occurs as juvenile and adult fish move between the ocean and spawning grounds.

- Migration. Defined as areas where juvenile and/or adult fish pass through as they move between the ocean and spawning and rearing areas. While all migratory corridors provide some rearing opportunities, areas with this designation are distinguished by fish moving through fairly quickly making contributions to juvenile rearing insignificant.

- Previous/Historic. Historic observation of species no longer present or not detected within past five reproductive cycles.

- Present, usetype unknown or unspecified. Fish are present, but biologists are unsure of how habitat is being used.

- Unknown presence and usetype.

- Disputed. Presence and/or usetype is disputed between participating biologists.

- Outlier. Defined as distribution that meets all four of the following criteria: 1) the site must be accessible, 2) the species must occur elsewhere in the fourthfield hydrologic unit, 3) the species does not successfully reproduce at a sufficient level to sustain a population, possibly due to habitat constraints such as stream gradient, flow regime, sediment, etc., 4) the species is routinely observed at the site in its adult lifestage.

Federal Status types are:

NW Not warranted at this time

PT Proposed Threatened

LT Listed Threatened

C Candidate

PE Proposed Endangered

LE Listed Endangered

NS No Status

Quality criteria are:

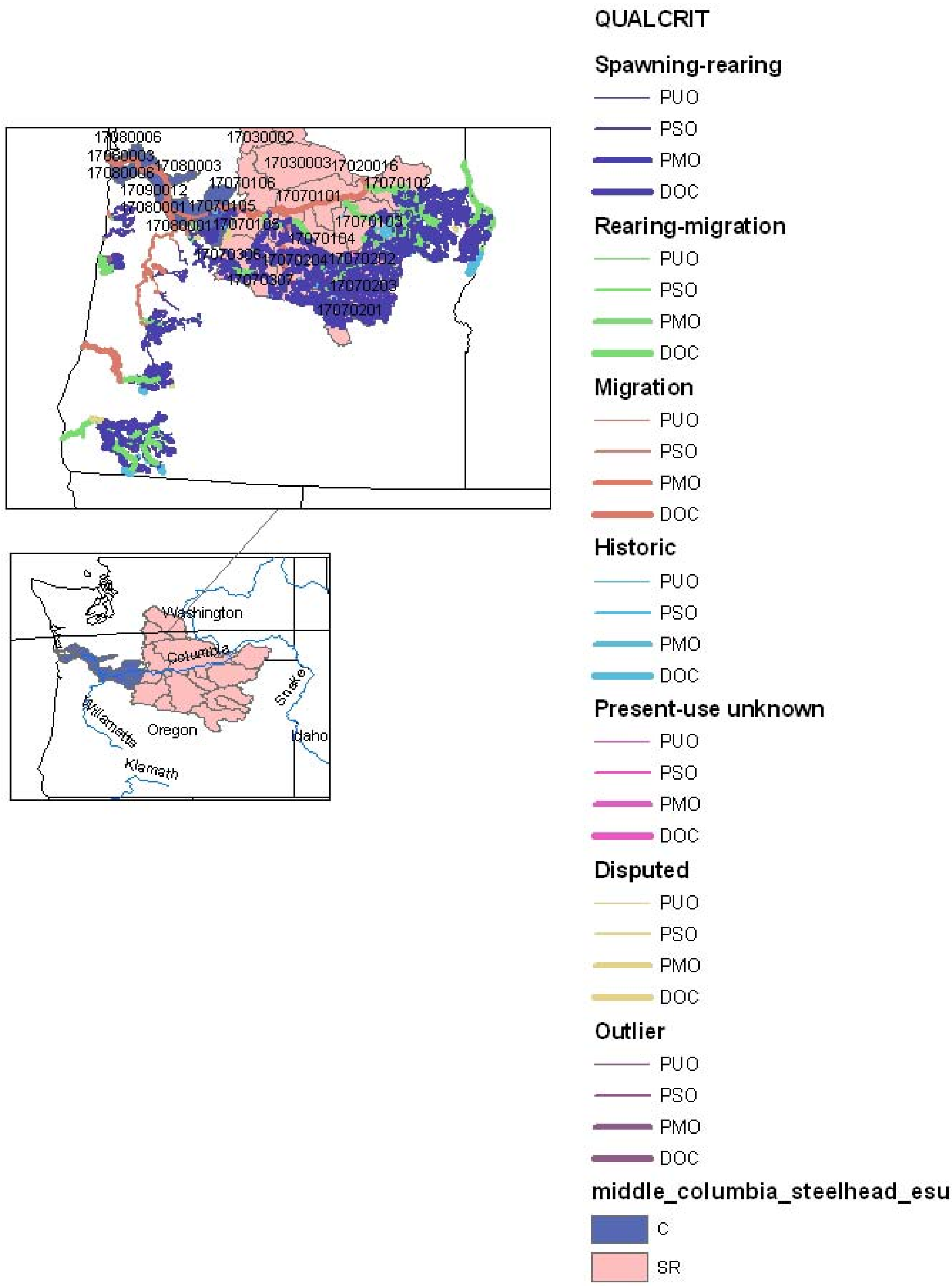
1 (PUO) Present based on Undocumented professional Observation. Areas where field biologists have observed the species in question, or know of other professional biologists that have observed the species in question, but the observation was not recorded in a manner that allows is to be used as official documentation.

2 (PSO) Present based on Strong professional Opinion. Areas where field biologists feel the species in question is present, but where they had not been specifically surveyed. This classification is usually based on geographically similar information (ie. data from neighboring streams strongly supports presence in the stream in question).

3 (PMO) Present based on Modest professional Opinion. Areas where field biologists feel the species in question is present because there is nothing to suggest the species shouldn't be present. This classification is not based on geographically similar information (ie. there is no data from neighboring streams to support or refute presence).

4 (DOC) Documented presence. Written information describing the observed life stage and-or behavior of a given species and run of fish in a specific stream will be considered documentation, if the information is determined to meet one of the following two conditions. -Condition 1: This information must be observed and reported by a natural resource agency or its staff members or any other credible natural resource professional in order to be used as a documentation source. -Condition 2: Incidental observation data must have been collected while conducting a legitimate research or monitoring effort. Observation specific, site specific and non-site specific data sources will be maintained in separate data tables and will be uniquely displayed on distribution maps.

The Middle Columbia River ESU (previous finding – may affect for S/R area) was examined in relationship to the winter steelhead habitat ODFW arcs. The reaches within the Spawning-rearing area of the ESU (defined in screening-level assessments) are all identified as “Listed Threatened” Federal status. Reaches were symbolized by usetype and quality criteria, as shown in the map below.



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17070306
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17070203
17070201
Washington
Columbia
Snake
Willamette
Oregon
Idaho
Klamath
QUALCRIT
Spawning-rearing
PUO
PSO
PMO
DOC
Rearing-migration
PUO
PSO
PMO
DOC
Migration
PUO
PSO
PMO
DOC
Historic
PUO
PSO
PMO
DOC
Present-use unknown
PUO
PSO
PMO
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Disputed
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PSO
PMO
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Outlier
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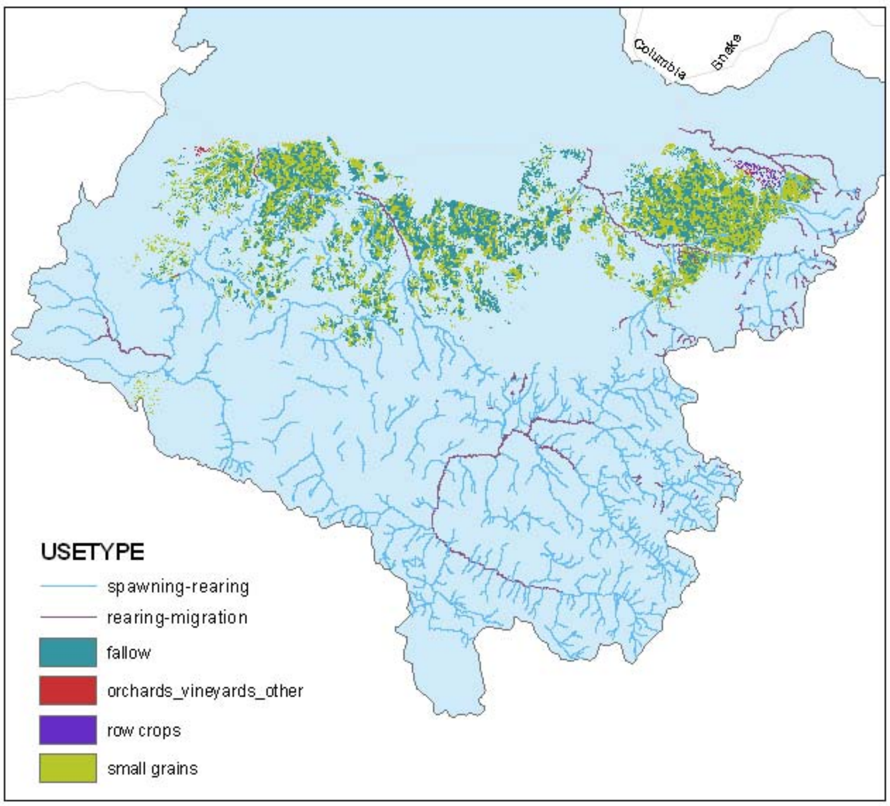
PMO
DOC
middle_columbia_steelhead_esu
C
SR

This view shows that there is no overlap of inhabited stream reaches in HUC 17070104, not in the Oregon side of 17070101. These HUCs could possibly be excluded from the ESU definition.

To assess the spatial relationship of the habitat stream reaches to the place where chlorpyrifos may be applied, the NLCD imagery for Oregon was employed. As can be seen in the figure below, the majority of the spawning-rearing stream reaches are well upstream of the concentrated agricultural area near the Columbia, although there are stream which pass through this area (rearing-migration class). These stream reaches



Within the Spawning-Rearing HUCs of the ESU, the distribution of agricultural areas with potential for chlorpyrifos use is:

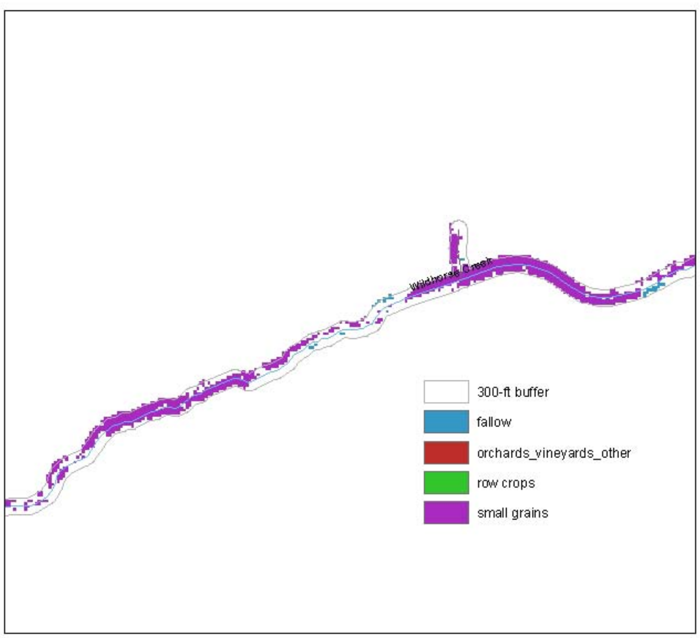
Class	Acres
small grains	739,040

fallow	717,442
row crops	9,373
Orchard/vineyards/other	7,055
Total	1,472,910

As was done in the SSHIAP case study above, various buffer distances can be defined to estimate proximity of potential uses to habitat stream reaches. For example, with a 300-ft buffer, the following is the result:

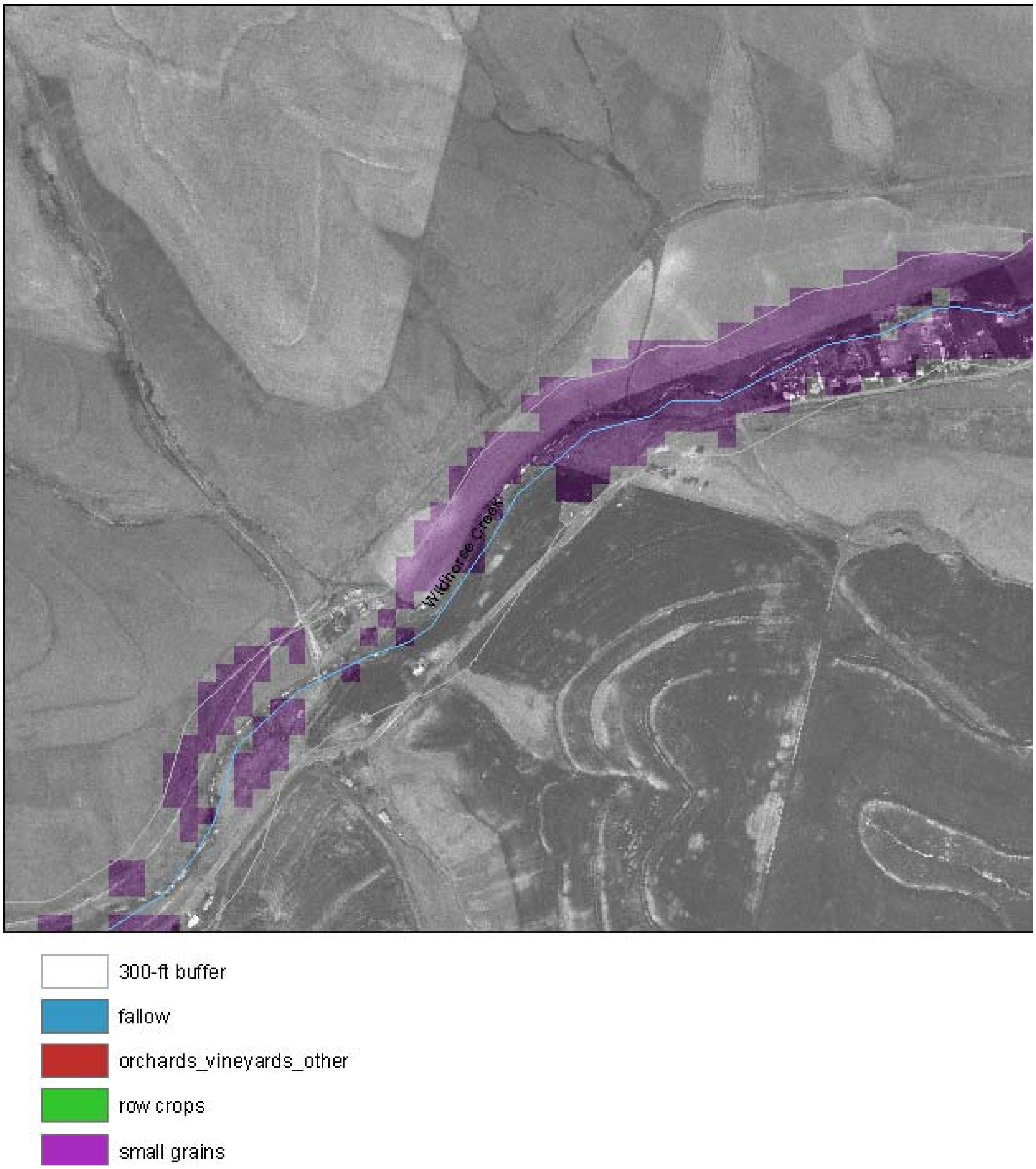
Class	Acres in buffer
small grains	5,083
fallow	653
row crops	59
Orchard/vineyards/other	35
Total	5,830
Total buffer area	316,823

A detailed view of a short reach of Wildhorse Creek (Umatilla County) shows the potential proximity of small grain production within the buffer.



The resulting total is 5,830/1,427,910 = 0.4 % of the cropped area in the ESU and 1.8% of the total buffer area, indicating that only a small fraction of the potential chlorpyrifos use areas have the proximity to steelhead spawning-rearing or rearing-migration habitat.

This analysis assumes that the habitat description scale (1:100,000) is a sufficiently conservative descriptor of the steelhead habitat; as well as that the NLCD is sufficiently precise in its land use classification. For local management decisions, local-scale data may be necessary, such as highly detailed imagery and/or ground survey. For example, USGS Digital Orthophoto Quadangles (DOQs) could potentially be useful in this capacity. An example is shown below, zoomed in further to a reach of Wildhorse Creek.



In this example, obviously tilled fields can be seen on the northern bank of the creek, some within the 300-ft buffer. In addition, it can be seen that the NLCD classification is likely to be reasonable, with some ‘false positive’ classifications in what appear to be residential areas on the southern bank of the creek (this may also be a result of the times when the various images were captured – NLCD was c. 1992, the DOQ 1994).

Idaho

At the current time, Idaho does not appear to have collected any GIS-compatible data products depicting salmonid habitats.

Recommendations

In order to carry out higher-tier risk assessments, more detailed data on habitat and potential product use is required. In Washington and Oregon, two similar programs are in progress to systematically address the surveying of historical, existing, and potential salmon stocks and their habitat under defined methodology and quality control standards. The WA SSHIAP effort collects the most detailed information, especially relating to potential habitat; however (as of February 2003), the program has published only five of the 62 Water Resource Inventory Areas that cover the state. The OR Natural Resources Management Program (ONRMP) has a more complete data collection, but concentrates on existing habitats; in addition, the bulk of their data is at the 1:100,000 scale and it is unknown how much habitat is excluded by using information at larger scales. Neither program is directly aligned with the ESA, the various salmonid species are not differentiated as individual populations (as described in the ESU definitions). Idaho does not appear to have a systematic program for habitat delineation in place.

Collection of product use information is also spotty and varies widely from state to state. In the absence of definitive data, cropping (land use) data can serve as a conservative surrogate for product use. The WA Department of Agriculture has begun a program to collect geographically-referenced cropping data; the effort is ongoing, while Oregon and Idaho do not appear to have an organized effort in place. Remote sensed data has promise for classifying land use, although costs, technical problems and questions about accuracy have plagued wide adoption of this technology.

Two case studies were presented above. Both used the NLCD (National Land Cover Data) data as a surrogate for potential product use. This data product has a resolution of 30x30 m per pixel, which should be sufficient for broad delineation of surface water buffers and cropped areas. However, the methodology for classification, although documented, has evolved with time and there have been questions about its accuracy. Habitat delineations for Washington employed the SHHIAP data for the only WRIA classified as “may affect” in lower tier assessments. The study for Oregon used the ONRMP data; because of the higher data availability, an assessment was possible to cover an entire ESU. Both assessments showed that buffers as large as 300 ft from stream reaches encompassed little agricultural land (even in the heavily agricultural area of north-central Oregon, along the Columbia River) and could be highly protective of salmonid habitat.

Assessment such as those in these case studies can show a high degree of refinement of the potential exposures to these threatened and endangered species. However, before they can be used in a regulatory context, questions about data completeness and potential sources of error must be addressed. For local-level management of these important fisheries resources, the States should be encouraged to continue and update their habitat survey efforts, as well as continue to work with stakeholders, to develop practical and scientifically defensible management strategies.