Phorate
Analysis of Risks
to
Endangered and Threatened Salmon and Steelhead

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Summary

Phorate is an organophosphorus insecticide, acaricide, and nematicide used in agriculture and in residential areas. Primary agricultural uses are on orchard crops and vegetable crops. The residential use is being phased out and many of the agricultural uses are being modified or cancelled. Phorate is toxic to fish, and would warrant concerns for direct, lethal effects on fish. The high toxicity to organisms that serve as food for threatened and endangered Pacific salmon and steelhead is also of significant concern. 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 Evolutionarily Significant Units of Pacific salmon and steelhead. The use of phorate may affect 19 of these ESUs, and may affect but is not likely to adversely affect 3 ESUs. The remaining 4 ESUs show either no phorate use, or uses are confined to potatoes, where OPP concludes that releases to surface waters would be insignificant because of potato cultivation practices. These latter 4 ESUs, therefore, are not predicted to be impacted by phorate use under registration conditions outlined in the IRED.

Introduction

Problem Formulation - The purpose of this analysis is to determine whether the registration of phorate 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 - Although this analysis is specific to listed western salmon and steelhead and the watersheds in which they occur, it is acknowledged that phorate 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. I understand that any subsequent analyses, requests for consultation and resulting Biological Opinions may necessitate that Biological Opinions relative to this request be revisited, and could be modified.

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 level" (NOEL) and a "lowest observable effect level" (LOEL). 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 judgement.

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. Based upon our internal databases, I can find no product in which nonylphenol is now an ingredient. 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. I note that the "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. I consider this approach to be 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. I do note, however, that we do not have aquatic data on most formulated products, although we often have testing on one or perhaps two formulations of an active ingredient.

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 one 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.

It should be noted that prior to the development of the GENEEC model in 1995, a much more crude approach was used to determining EECs. Older reviews and Reregistration Eligibility Decisions (REDs) may use this approach, but it was excessively conservative and does not provide a sound basis for modern risk assessments. For the purposes of endangered species consultations, we will attempt to revise this old approach with the GENEEC model, where the old screening level raised risk concerns.

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. For some of the older OPP analyses, a very limited number of scenarios were available.

One area of significant weakness in modeling EECs relates to residential uses, especially by homeowners, but also to an extent by commercial applicators. There are no usage data in OPP that relate to pesticide use by homeowners on a geographic scale that would be appropriate for an assessment of risks to listed species. For example, we may know the maximum application rate for a lawn pesticide, but we do not know the size of the lawns, the proportion of the area in lawns, or the percentage of lawns that may be treated in a given geographic area. There is limited information on soil types, slopes, watering practices, and other aspects that relate to transport and fate of pesticides. We do know that some homeowners will attempt to control pests with chemicals and that others will not control pests at all or will use non-chemical methods. We would expect that in some areas, few homeowners will use pesticides, but in other areas, a high percentage could. As a result, OPP has insufficient information to develop a scenario or address the extent of pesticide use in a residential area.

It is, however, quite necessary to address the potential that home and garden pesticides may have to affect T&E species, even in the absence of reliable data. Therefore, I have developed a hypothetical scenario, by adapting an existing scenario, to address pesticide use on home lawns where it is most likely that residential pesticides will be used outdoors. It is exceedingly important to note that there is no quantitative, scientifically valid support for this modified scenario; rather it is based on my best professional judgement. I do note that the original scenario, based on golf course use, does have a sound technical basis, and the home lawn scenario is effectively the same as the golf course scenario. Three approaches will be used. First, the treatment of fairways, greens, and tees will represent situations where a high proportion of homeowners may use a pesticide. Second, I will use a 10% treatment to represent situations where only some homeowners may use a pesticide. Even if OPP cannot reliably determine the percentage of homeowners using a pesticide in a given area, this will provide two estimates. Third, where the risks from lawn use could exceed our criteria by only a modest amount, I can back-calculate the percentage of land that would need to be treated to exceed our criteria. If a smaller percentage is treated, this would then be below our criteria of concern. The percentage here would be not just of lawns, but of all of the treatable area under consideration; but in urban and highly populated suburban areas, it would be similar to a percentage of lawns. Should reliable data or other information become available, the approach will be altered appropriately.

It is also important to note that pesticides used in urban areas can be expected to transport considerable distances if they should run off on to concrete or asphalt, such as with streets (e.g., TDK Environmental, 1991). This makes any quantitative analysis very difficult to address aquatic exposure from home use. It also indicates that a no-use or no-spray buffer approach for protection, which we consider quite viable for agricultural areas, may not be particularly useful for urban areas.

Finally, the applicability of the overall EEC scenario, i.e., the 10 hectare watershed draining into a one 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 - We also attempt to protect listed species from indirect effects of pesticides. We note that 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, our 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 of our 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” by Urban and Cook (1986) (termed Ecological Risk Assessment SEP below), 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. In a very brief summary: 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 for direct and indirect effects on T&E fish

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[a]	>0.5	May be indirect effects on T&E fish through food supply reduction
Aquatic plant acute EC50[a]	>1[b]	May be indirect effects on aquatic vegetative cover for T&E fish

a. Indirect effects criteria for T&E species are not in Urban and Cook (1986); they were developed subsequently.
b. This criterion has been changed from previous requests. The basis is to bring the endangered species criterion for indirect effects on aquatic plant populations in line with EFED’s concern levels for these populations..

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. It has been calculated by one pesticide registrant (without sufficient information for OPP to validate that number), that the probability of mortality occurring when the LC50 is 1/20th of the EEC is 2.39×10^{-9}, or less than one individual in ten billion. It should be noted that the discussion (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 again 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, our criteria ensures that the EEC is below the no-observed-effect-level, where the "effects" include any observable sublethal effects. Because our EEC values are based upon "worst-case" chemical fate and transport data and a small farm pond scenario, it is rare that a non-target organism would be exposed to such concentrations over a period of time, especially for fish that live in lakes or in streams (best professional judgement). Thus, there is no additional safety factor 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 phorate

a. Registered uses

Phorate is registered in the United States as an organophosphate soil and systemic insecticide, and miticide used on a variety of crops including potatoes, radishes, beans, corn, wheat (IRED indicates that this use is not eligible for re-registration), sorghum, cotton, peanuts, sugarbeets, sugar cane, soy beans, and lilies. The agricultural uses of phorate are classified as restricted use.

(1) Agricultural uses

Crops currently under consideration for continued use (reregistration eligible) and which are grown in areas with Pacific salmon and steelhead (see Appendix A of the Interim Reregistration Eligibility Decision (IRED) document which is included as Attachment 1) are included in the assessment of potential effects to Endangered Species Units as follows:

beans
corn, field
corn, sweet
cotton
hops
potatoes
radishes, seed
lilies/daffodils field plant
sorghum
sugar beets

According to the IRED, alfalfa, oats, and wheat (crops treated with phorate in the past and within areas for salmon concern) are not being considered eligible for reregistration and so are not included in this document for analysis of future effects on salmon and steelhead ESUs.

According to the IRED, all aerial applications are being canceled. Applications are to be limited to 1 per season and these must be soil incorporated. Current agricultural use labels are included as Attachment 2 and changes to these labels resulting from the reregistration effort are on pages 54-66 of the IRED Current label uses pertinent to the subject salmon ESUs include the following:

Crop	Application Rate (lb a.i./acre)	Minimum Row Space	# Applications/Season
beans	1.5 - 2.0	30 in.	1
corn, field	1.3	30 in.	1
corn, sweet	1.3	30 in.	1
cotton	1.6 - 2.2	30 - 36 in.	1
hops	8.0	none	1
potatoes	2.3 - 3.5	32 - 38 in.	1
radishes	3.0	none	1
lilies/daffodils	8.0	none	1
sorghum	1.3	30 in.	1
sugar beets	1.4 - 1.5	20 - 22 in.	1

(2) Non-agricultural uses

Available usage data for the state of California indicates that 0.4 pounds of phorate have been used in one county (Alameda) for structural pest control. This use is not among the uses considered in the IRED to be eligible for reregistration.

(3) Usage of phorate

According to the IRED, an estimated 3 million pounds are produced annually. Crops with the highest usage with reference to pounds produced are corn (46%), potatoes (21%) and cotton (13%). Almost 2.5 million acres are treated annually. Crops with the highest percentage of acres treated include potatoes (20%), fresh sweet corn (10%) and peanuts (9%). Most of the usage is in FL, WI, CA, GA, MS, AL, TX, ID, MT, and MI. Crops with a high percentage of the total U.S. planted acres treated include potatoes (20%), fresh sweet corn (10%), peanuts (9%), and vegetables, cotton, and sugarcane (4%). More details can be found on pages 5-7 of the IRED.

Attached is a map of pesticide use for phorate as developed by the USGS. (Attachment 3). This is included as a quick and easy visual depiction of where phorate may have been used on agricultural crops, but it should not be used for any quantitative analysis because it is based on 1992 crop acreage data and was developed from 1990-1995 statewide estimates of use that were then applied to that county acreage without consideration of local practices and usage. The map also does not take into account the significant changes likely to result from the reregistration process.

The sources of data available on phorate usage 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. Washington and Idaho do not have such a mechanism to my knowledge. Information in the tables below for Oregon, Washington, and Idaho are for the acreage of the specific crops that were in the 1997 USDA agricultural census on which phorate could be used, based upon the decisions included in the current proposal for phorate. The tables below for each ESU do not included crops for which phorate use is not considered eligible for re-registration (i.e. wheat).

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 to EPA. Table 3 presents phorate usage over the past nine years in California; however, there will be substantial changes. Table 4 presents all of the phorate uses in California for 2001. Again changes may be expected. For example, crops which are likely to continue to be registered amount to about 375,000 pounds of the 966,000 pounds total usage reported. The tables for each ESU include all of the uses where more than 100 pounds was reported to California's Department of Pesticide Regulation (DPR), whether these uses are proposed to continue or not. Highlighted in bold font are the uses that are expected to continue. While California does not have use reporting by homeowners, this is not relevant for phorate.

Table 3. Reported use of phorate in California, 1993-2001, in pounds of active ingredient

1993	1994	1995	1996	1997	1998	1999	2000	2001

151,250	159,146	135,887	160,854	139,725	149,707	93,488	87,974	70,645

Table 4. Reported use of phorate, by crop or site, for 2001 in California.

crop or site	pounds active ingredient used	acres treated
alfalfa	69	55
beans	**63**	**75**
corn (forage-fodder)	**11,605**	**11,717**
corn (human consumption)	**7,458**	**6,773**
cotton	**32,732**	**33,474**
nursery greenhouse container plants	<1	1
nursery outdoor transplants	2,982	460
oats (forage-fodder)	18	14
potatoes	**10,057**	**4,397**
research commodity	1	nr
structural pest control	<1	nr
sugar beet	**5,285**	**5,867**
wheat	376	327
state total	70,645	

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

a. Aquatic toxicity of phorate

Table 5 presents the acute toxicity data that have been reviewed in OPP's files. See also the Environmental Risk Assessment (Attachment 4) developed for inclusion into the IRED.

Table 5. Aquatic organisms: acute toxicity of phorate to freshwater fish and invertebrates from EFED files.			
Species	Scientific name	% a. i.	96-hour LC50 (ppb)
Waterflea	*Daphnia magna*	20G	37(48 h)
Midge	*Paratanytarsus parthenogenica*	20G	41(48 h)
Mayfly	*Hexagenia* sp.	20G	65
Scud	*Gammarus fasciatus*	technical	0.68 LC50, 0.60 EC50
Scud	*Gammarus fasciatus*	technical	4
Scud	*Gammarus lacustris*	technical	9
Stonefly larvae	*Pteronarcys californica.*	100	4 (48-h)
Crayfish	*Orconectes nais*	technical	50
Rainbow trout	*Oncorhynchus mykiss*	100	13
Rainbow trout	*Oncorhynchus mykiss*	66	19
Rainbow trout	*Oncorhynchus mykiss*	20G	45
Cutthroat trout	*Oncorhynchus clarki*	100	66
Largemouth bass	*Micropterus salmoides*	91	5
Channel catfish	*Ictalurus punctatus*	91	280
Channel catfish	*Ictalurus punctatus*	20G	2.2
Northern pike	*Esox lucius*	91	110
Bluegill sunfish	*Lepomis macrochirus*	100	1
Bluegill sunfish	*Lepomis macrochirus*	91	2
Bluegill sunfish	*Lepomis macrochirus*	66	<2.8
Bluegill sunfish	*Lepomis macrochirus*	20G	12
Walleye	*Stizostedion vitreum v.*	100	57

The chronic toxicity data cited in OPP's ERA for phorate are summarized in Table 6.

Table 6. Aquatic organisms: chronic toxicity of phorate to freshwater fish and invertebrates from EFED files						
Water flea	*Daphnia magna*	21 d	92.1	number of offspring and parental growth	0.29	0.44
Water flea	*Daphnia magna*	21 d	100	number of offspring and parental growth	0.21	0.41
Rainbow trout	*Oncorhynchus mykiss*	88 d	92.1	Reduced growth (length)	1.9	4.2

Effects on estuarine fish and invertebrates are consistent with those for freshwater organisms that have been tested (Tables 7 and 8).

Species	Scientific name	% a. i.	
Sheepshead minnow	*Cyprinodon variegatus*	89.5	4
Sheepshead minnow	*Cyprinodon variegatus*	20G	8.2
Sheepshead minnow	*Cyprinodon variegatus*	90	1.3
Spot	*Leiostomus xanthurus*	89.5	5
Spot	*Leiostomus xanthurus*	90	3.9
Longnose killifish	*Fundulus similis*	90	0.36 (48-h)
White shrimp	*Penaeus stylirostris*	89.5	0.27
Pink shrimp	*Penaeus duorarum*	90	0.11
brown shrimp	*Penaeus aztecus*	90	0.46 (48-h)
Mysid shrimp	*Mysidopsis bahia*	89.5	1.9
Mysid shrimp	*Mysidopsis bahia*	90	0.31
Mysid shrimp	*Mysidopsis bahia*	20G	0.3
Mysid shrimp	*Mysidopsis bahia*	20G	1.4
Quahog clam	*Mercenaria mercenaria*	20G	17 (48-h)
Eastern oyster	*Crassostrea virginica*	89.5	900 (48-h)
Eastern oyster	*Crassostrea virginica*	90	640

Species	Scientific name	duration	% a. i.	Endpoints affected	NOEC (ppb)	
Sheepshead minnow	*Cyprinodon variegatus*	28 d	89.5		0.24	0.41
Sheepshead minnow	*Cyprinodon variegatus*	35 d	99	weight and length	0.096	0.19
Mysid shrimp	*Mysidopsis bahia*	28 d	89.5	Survival	0.21	0.09
Mysid shrimp	*Mysidopsis bahia*	28 d	99	weight and length	0.0098	0.0058

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.

Species	Scientific name	% a. i.	
Marine diatom	*Skeletonema costatum*	90	1300

There are additional aquatic toxicity data for phorate. Tables 10-11 summarize the available toxicity information from the AQUIRE data base. Included are the AQUIRE reference numbers and the specific references can be provided if necessary.

The data do show considerable variation. In summary, fish acute toxicity LC50 values range from a low of 1 ppb for bluegill to a high of 8600 ppb for carp and mosquitofish. As would be expected, there is even a greater range for aquatic invertebrates. LC50 values for various species of insects ranged from 8.3-108 ppb. Molluscs were generally less sensitive, with LC50 values ranging from 900 ppb to 64000 ppb. Other phyla of aquatic invertebrates showed considerable variability with acute effects values ranging from 0.1 ppb for daphnia to >5000 ppb for rotifers.

There are no data on aquatic macrophytes. In one with a diatom the EC50 value for growth was1300 ppb.

Table 10. Aquatic organisms: summary of acute toxicity of phorate to fish species, from AQUIRE literature.				
Freshwater species				
Bluegill	*Lepomis macrochirus*	2.3-4.9 (5*)		6797, 8096
Cutthroat trout	*Oncorhynchus clarki*	6.0 - 44 (2)		666, 6797
Rainbow trout	*Oncorhynchus mykiss*	21 (1)		6797
Western mosquitofish	*Gambusia affinis*		1.27 (1)	5345
Eastern mosquitofish	*Gambusia holbrooki*	8600 (duration not reported) (1)		283
Walking catfish	*Claries batrachus*	5200 (duration not reported) (1)		283
Carp	*Cyprinus carpio*	8600 (duration not reported) (1)		283
Saltwater species				
Longnose killifish	*Fundulus similis*		0.4 (1)	646

* Numbers in parentheses are the numbers of tests

Species	Scientific name	duration.	LC/EC50 (ppb) number of tests in parentheses	endpoint if not mortality	
Invertebrates other than insects					
Water flea	*Daphnia magna*	24 hr	0.1 - 0.2 (1)		2646
Water flea	*Daphnia magna*	26 hr	2.2 (1)		2820
Water flea	*Daphnia magna*	48 hr	19.5 (1)		12280
Pond snail	*Lymnaea acuminata*	72 hr	23000 (1)		917
Pond snail	*Lymnaea acuminata*	96 hr	15000 - 22000 (2)		10898, 917
Pond snail	*Lymnaea acuminata*	120 hr	12000 (1)		10898
Pond snail	*Lymnaea acuminata*	144 hr	7000 (1)		10898
Pond snail	*Lymnaea acuminata*	168 hr	14000 (5)		917
Pond snail	*Lymnaea acuminata*	240 hr	64000 (1)		917
Rotifer	*Brachionus plicatilis*	24 hr	>5000 (1)		18363
Swan mussel	*Anodonta cygnea*	7 d	8000 - 80000 (2)	immobilization	7158

Table 11. Aquatic organisms: summary of acute toxicity of phorate to aquatic invertebrate species, from AQUIRE literature.					
Swan mussel	*Anodonta cygnea*	0.42 h	80000 (1)	general physiology	6065
Swan mussel	*Anodonta cygnea*	0.5 h	8000 (1)	general physiology	7285
Brine shrimp	*Artemia salina*	24 hr	>50000 (1)		18363
Insects					
Mosquito	*Culex pipiens*	24 hr	8.3-9.7 (1)		2646
Midge	*Chironomus thummi*	48 hr	108 (1)		12280

Sublethal effects

The basis used by OPP to address sublethal effects is to add a safety factor to the statistically robust median lethal effect levels, as proposed by Tucker and Leitzke (1979) and discussed above in the background section. This approach has worked very well and is expected to continue to be appropriate in most cases, based upon extensive data.

Toxicity of degradates

No data were found on the aquatic toxicity of the major soil and water degradates, phorate sulfoxide and sulfone. The ERA considered phorate sulfoxide and sulfone, in the absence of any toxicity data to be equivalent to parent phorate. The combined water concentrations of parent and the two degradates was used to assess risks to aquatic organisms.

Toxicity of “inert” ingredients

Data on the formulated products, as compared to technical phorate, indicate that the 20G product is generally of equivalent toxicity, given the percent ai tested and normal variation. Catfish is a notable exception, with the 20G product having an LC50 nearly 100 times lower than the technical material. We cannot explain this, but given the similarity of the 20G and technical material for other species, it appears to be an anomaly which could be based on extreme sensitive of catfish to an ingredient in the granules, or more likely to differences in testing.

b. Environmental fate and transport

The ERA contains considerable detail on the environmental fate of phorate on pages 1-6. In general, phorate is not a persistent chemical; it degrades by chemical and microbial action and dissipates in the field with half-lives ranging from 2 to15 days. Although phorate is moderately mobile in soil, rapid hydrolysis and aerobic soil metabolism of 3 days reduces the potential of parent phorate to reach ground water. However, the degradates sulfoxide and sulfone are more mobile and persistent. Laboratory K_d values for parent in loamy sand and sandy loam soils with 1% O.C. are 1.5 and 3.5, respectively, which indicate potential mobility in permeable soils; the K_d range is from 1.5 to 20 in a variety of soils. No major degradate K_d values are available. Phorate degrades by hydrolysis at pH 5, 7, and 9 with half-lives of approximately 3 days and by direct photolysis in water (pH 7) with a half-life of one day. The aerobic and anaerobic soil metabolism half-lives in sandy loam soils were 3 and 32 days, respectively. The major degradates are the sulfoxide (t-1/2= 65 days aerobic soil) and sulfone (t-1/2= 137 days) which are more persistent than parent phorate.

c. Incidents

OPP maintains two data bases of reported incidents. One, the (EFED Incident Information System or EIIS) is populated with information on environmental incidents which are provided voluntarily to OPP by state and federal agencies and others. There have been periodic solicitations for such information to the states and the U. S. Fish and Wildlife Service. The second is a compilation of incident information known to pesticide registrants and any data conducted by them that shows results differing from those contained in studies provided to support registration. These data and studies (together termed incidents) are required to be submitted to OPP under regulations implementing FIFRA section 6(a)(2).

There are three use-related incidents known to OPP involving phorate and fish. In 1985 phorate was used on a sorghum field in Butler County, Nebraska. Four days following a heavy rain (a total of 9 days after application) hundreds of dead fish were observed. This incident is classified as possible, but it should be noted that both terbufos and phorate were applied to nearby fields. In 1970, runoff from a 60 acre Illinois cornfield to a 2 acre pond was reported to be associated with a kill involving a variety of warm water fish. Phorate was detected in the pond at concentrations ranging from 9.7 to 32.3 ppb 15 days after pesticide application. This incident is classified as probable, but propachlor and 2,4-D were also applied to the field. Again in 1970, runoff from a Illinois cornfield into a nearby pond was observed to be associated with a fish kill. In this case the concentration of phorate was12.1 ppb 37 days after pesticide application. This incident is classified as probable, but propachlor and atrazine were also applied to the field.

d. Estimated and actual concentrations of phorate in water

(1) EECs from models

A number of scenarios were modeled in the ERA. Table 12 summarizes the scenarios modeled. It should be noted that potato EECs and subsequent RQs are not presented here. The nature of potato agriculture and at-plant application of granular phorate is such that the pesticide is applied at an effective soil depth that significantly precludes run-off loadings of the pesticide to surface water. In all other cases of crops eligible for re-registration and modeled in the ERA, the fish acute and chronic levels of concern for endangered species were exceeded.

Table 12. Estimated environmental concentrations for phorate total residues and selected crops, as extracted from the Environmental Risk Assessment

Crop and Application Method	Parent only or Total toxic residue	EECs (ug/L)		
		Peak	21-Day	60-Day
Sweet Corn T-banded at 1.3 lb ai/A (85 % in top 2 cm)	Parent	21.3	3.3	1.2
	TTR	26.9	8.2	5.9
Cotton (In-furrow at 0.5 inch)	Parent	23.1	3.9	1.4
	TTR	27.6	12.4	8.2
Field Corn T-banded at 1.3 lb ai/A (85 % in top 2 cm)	Parent	4.6	0.7	0.2
	TTR	7.7	3.9	2.5
Grain Sorghum T-banded at 1.3 lb ai/A (85 % in top 2 cm)	Parent	7.5	1.2	0.4
	TTR	12.7	7.1	4.2
Lilies/daffodils 8 lb ai/A (incorporated)	Parent	115	19.5	7
	TTR	138	62	41

(2) Measured residues in the environment

The ERA discusses available surface water monitoring data as follows:

"The State of Illinois (Moyer and Cross 1990) sampled 30 surface water sites for pesticides at various times from October 1985 through October 1988. Although substantial use in Illinois was a criteria for pesticides being included in the analyses, total phorate (parent phorate + phorate sulfoxide + phorate sulfone) was not detected in any of the samples above a detection limit of 0.05 ug/L."

"The USGS (Kimbrough and Litke 1995) has sampled the South Platte River in Colorado, Western Lake Michigan, and the Albemarle-Pamlico River in Virginia and North Carolina for parent phorate. With a detection limit of 0.002 ug/L, detected residues of parent phorate ranged from 0.009-0.082 ug/L except for one detection of 0.6 ug/L in the South Platte. These watersheds are locations where corn, grain sorghum, and sugar beets are grown. EFED counted 104 samples. USGS monitoring is designed to measure water quality in a watershed with an area of 10-2,000 square miles that is associated with specific chemical use. It is not specifically designed to measure drinking water exposure. Degradates were not analyzed for."

"The USGS (Coupe et al., 1995) sampled 8 widely dispersed locations in the Mississippi Basin from April 1991 through September 1992. Samples were collected once per week, twice per week, or once every two weeks depending upon the time of year. The samples were filtered before analysis. Parent phorate (dissolved) was not reported in any of the 360 samples (detection limit of 0.011 ug/L) for which an analysis for phorate was performed. Degradates were not analyzed for."

"The South Florida Water Management District (Miles and Pfeuffer 1994) collected samples every two to three months from 27 surface water sites within the SFWMD from November 1988 through November 1993. Approximately 810 samples (30 sampling intervals X 27 sites sampled/interval) were collected from the 27 sites from November 1988 through November 1993. Phorate was not detected in any of the samples above detection limits ranging from 0.016 to 0.13 ug/L."

"Monitoring for phorate residues in surface water does not usually include the phorate sulfoxide and sulfone degradates. Also, there is limited monitoring information for all phorate residues in surface water."

Monitoring data do not evaluate every use scenario under every runoff, drift, dilution and dissipation situation. However, comparisons of the ERA estimated surface water concentrations of parent phorate and combined residues of degradates with monitored data would suggest that the estimated concentrations are not excessive and that there may be underestimations of phorate surface water concentrations from registered uses of phorate. Most monitoring is done for a variety of pesticides at specific sites and is not targeted to potential residues near in time and space to phorate applications.

e. Recent changes in phorate registrations

Most of the changes in the registration of phorate are presented elsewhere, as pertinent. For example, use sites considered eligible for re-registration and selected IRED listed modifications to application methods are indicated in Section 2 of this document. For further details on changes, see the IRED for agricultural uses.

f. Existing protections

Nationally, there are no specific protective measures for endangered and threatened species beyond the generic statements on the current phorate labels. However, agricultural uses of phorate are classified as restricted use, which means it can only be applied by, or under the direct supervision of certified applicators. The basis for restricted use classification is high avian and aquatic toxicity.

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 phorate 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 phorate agricultural use label states:

> "This pesticide is extremely toxic to fish, and wildlife. Birds feeding in treated areas may be killed. Do not apply directly to water or to areas where surface water is present or to intertidal areas below the mean high water mark. Drift and runoff may be hazardous to aquatic organisms in neighboring areas. Collect or incorporate granules that are spilled during loading or are visible on soil surface areas. Do not contaminate water by cleaning of equipment or disposal of equipment washwaters."

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. Phorate is included in these county bulletins where they have been developed. 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. Phorate is currently included in these bulletins for protection of terrestrial and aquatic animals. For aquatic animals, the protective measures include, among others, a 40 yard ground and 200 yard aerial no-spray buffer when the wind is blowing towards the water to protect against spray drift and a 20 foot vegetated buffer strip between the application site and water to protect against runoff. The limitations for insecticides are the same for all insecticides having aquatic hazards, and thus do not take into account that phorate is not applied aerially and is only formulated as granules. 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 applicable limitations in these bulletins (Richard Marovich, Endangered Species Project, DPR, telephone communication, July 19, 2002).

g. Discussion and general risk conclusions for phorate

Table 12 presents the results of the risk quotient calculations presented in the OPP ERA

Table 12. Risk quotients for freshwater fish and invertebrates based on estimated combined concentration of parent Phorate, Phorate sulfone, and Phorate sulfoxide

Crop	RQ			
	fish, acute	fish, chronic	invert., acute	invert., chronic
Sweet Corn	27	2.3	45	39
Cotton	28	3.2	46	59
Field corn	7.7	1.0	13	19
Grain sorghum	13	1.6	21	34
Lilies & Daffodils	138	15.8	230	295

A. Fish

The lowest fish LC50 used by EFED is 1 ppb for bluegill sunfish. This endpoint is at least 2-fold lower than the next most sensitive freshwater fish species endpoint in the EFED and AQUIRE files and is one to two orders of magnitude lower than acute endpoints for two salmonids (rainbow LC50 13 ppb and cutthroat trout LC50 66 ppb). Using our endangered species criterion of concerns when the EEC exceeds 0.05 x LC50, OPP would have concerns for phorate concentrations that exceed 0.05 ppb based on the bluegill sunfish endpoint. It may be argued that the bluegill does not taxonomically represent T&E salmonids as closely as the rainbow and cutthroat trout. It may be further argued that toxicological sensitivity may have, in part, a taxonomical basis. If this is true, acute toxicity endpoints for rainbow and cutthroat trout may be appropriate toxicological surrogates for T&E salmonids and so OPP would have concerns for phorate concentrations that exceed 0.65 ppb (0.05 x rainbow trout LC50 13 ppb = 0.65 ppb). However appropriate a trout may be as a surrogate species, it has been OPP's approach to use the most sensitive typical test species on which to base an endpoint. With phorate, the acute toxicity is pronounced enough that the criteria of concern are exceeded regardless of the species used.

Comparing the acute toxicity endpoints for these two tested salmonid species (13 and 66 ppb) with the OPP ERA peak EECs for total phorate residues, shows that surface water concentrations still exceed the Agency level of concern for endangered fish species (0.05 x LC50) and indeed would often exceed the non-endangered fish level of concern for all pertinent use sites modeled in the OPP ERA except potatoes.

Chronic freshwater fish toxicity determinations are limited to the single tested species, rainbow trout. The NOEC and LOEC are 1.9 and 4.2 ppb, respectively and the endpoint used for OPP ERA risk quotient calculations was the MATC of 2.6 ppb. The sensitive effect noted in this study was growth. Excepting potatoes, all phorate uses evaluated in the OPP ERA that are pertinent to T&E salmonids were estimated to produce 60-day surface water concentrations in excess of the toxicity endpoint, thereby raising potential concerns for direct effects on growth from chronic exposure. Chronic exposure is not likely in lotic waters occupied by most salmon ESUs, and the use sites are not associated with the sockeye salmon ESUs.

B. Invertebrates

OPP's assessment used a *Gammarus* LC50 of 0.6 ppb as the most sensitive species in validated tests. At an EEC that is >0.5 times the LC50, there is a potential effect on populations of aquatic invertebrates that may serve as a food source for listed fish. On this basis, concerns for T&E fish would occur at 0.3 ppb. Additional aquatic invertebrate toxicity data for phorate, allows for an evaluation of the possibility that the less sensitive species could still be a food source at higher phorate concentrations. For example, available acute crayfish, daphnid, stonefly, mayfly, and midge toxicity endpoints (4 to 67 ppb) suggest that some of these important aquatic invertebrate food sources are orders of magnitude less sensitive than the *Gammarus* used as the basis for the ERA. However, total residue peak EECs from the OPP ERA, compared to these acute toxicity endpoints, would still trigger concerns for population effects in one or more of these other potential food sources for all use scenarios modeled. Indeed, with the exceptions of rotifers, and some molluscs, all of the available acute freshwater invertebrate toxicity endpoints reported from both OPP and AQUIRE sources are exceeded by the OPP ERA peak EECs in one or more use scenarios modeled.

C. Cover

Effects on cover are not expected from an insecticide. The single diatom study indicates toxicity is orders of magnitude less toxic than for aquatic animals. Relative to direct effects and effects on invertebrate food supply, cover is of no concern.

D. Conclusions

Available acute toxicity data, either for a sensitive bluegill or for taxonomically relevant tested salmonids, when compared to estimated surface water concentrations indicate concerns for direct acute toxic effects to T&E salmonids for pertinent phorate use sites except potatoes. Furthermore, invertebrate food supply may be affected regardless of whether the fish feed on the most sensitive aquatic invertebrates or any of a number of other aquatic invertebrates (with the exception of certain rotifers and molluscs). The disparity between the modeled EECs and the available monitoring data showing generally much lower values suggests that estimated surface water concentrations are not underestimates of exposure. However the lack of monitoring for phorate degradates remains a considerable limitation in the use of available monitoring data for quantitative risk assessment purposes.

There will be no effect on any salmon or steelhead ESU from the use of phorate on potatoes. Other uses may affect listed salmon and steelhead where phorate is used. These are indicated in section 4 below, and summarized in section 5.

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

The information on the various ESUs was taken almost entirely from various Federal Register Notices relating to listing, critical habitat, or status reviews. As noted above, usage data were derived from 1997 Agricultural Census, DPR's pesticide use reporting, and confidential sales information from the registrant. In the Pacific Northwest tables the last column presents the total acreage of land in each county and the acreage and percentage of land in farms, which includes ranches. As noted in other requests, we are currently re-evaluating the locations of the various salmon and steelhead ESUs and will be submitting these to the Service for review.

A. Steelhead

Steelhead, *Oncorhynchus mykiss*, exhibit one of the most complex suite 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 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.

<u>1. Southern California Steelhead ESU</u>

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). 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.

There is a potential for steelhead waters to drain agricultural areas. Reportable usage of phorate in counties where this ESU occurs are presented in Table 13.

Table 13. Use of phorate in counties with the Southern California steelhead ESU.

County	Crop or other use site	Usage (pounds)	Acres treated
San Diego	greenhouse container plants	0.02	nr
Los Angeles	none	0	0
Ventura	none	0	0
San Luis Obispo	**potato**	**115**	**71**
Santa Barbara	none	0	0

Phorate use within the Southern California steelhead ESU is low and is associated with potato agriculture, an application that the OPP ERA concluded did not pose significant potential for surface water contamination by phorate. The use of phorate will have no effect on this ESU directly or indirectly.

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, San Benito, Monterey, and San Luis Obispo.

There is considerable agricultural in most counties within this ESU. There is a potential for steelhead waters to drain agricultural areas. Reportable usage of phorate in counties where this ESU occurs are presented in Table 14.

Table 14. Use of phorate in counties with the South Central California steelhead ESU.

County	Crop	Usage (pounds)	Acres treated
Santa Cruz	none	0	0
San Benito	**sweet corn**	**280**	**188**
Monterey	none	0	0
San Luis Obispo	**potato**	**117**	**51**

Phorate use within the South Central California steelhead ESU is low and limited to sweet corn and potatoes. The use of phorate may affect this ESU directly through direct acute and chronic effects associated with sweet corn usage and there may be indirect effects on the food supply of the steelhead.

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. There is low agricultural use of phorate in Contra Costa County.

Table 15. Use of phorate in counties with the Central California Coast steelhead ESU.

County	Crop	Usage (pounds)	Acres treated
Santa Cruz	none	0	0
San Mateo	none	0	0
San Francisco	none	0	0
Marin	none	0	0
Sonoma	none	0	0
Mendocino	none	0	0
Napa	none	0	0
Alameda	structural pest control	0.4	nr
Contra Costa	**corn (forage-fodder)**	**588**	**342**
Solano	none	0	0
Santa Clara	none	0	0

It is not clear how much use the Central California Coast steelhead ESU makes of Santa Clara, Solano and Contra Costa counties, which drain into the San Francisco Bay. For the other counties within this ESU phorate is not used. The extremely minor reported use of phorate in Alameda county is expected to be insignificant and is not consistent with re-registration eligible labeled uses. With considerable uncertainty related to the use of Contra Costa by steelhead, it may be concluded that phorate may affect the Central California Coastal steelhead ESU both directly and through effects of food resources.

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, Nevada, Placer, Sacramento, San Francisco, San Joaquin, San Mateo, Solano, Sonoma, Stanislaus, Sutter, Tehama, Tuloumne, Yolo, and Yuba. A large proportion of this area is heavily agricultural. Usage of phorate in counties where the California Central Valley steelhead ESU occurs is presented in Table 16.

Table 16. Use of phorate in counties with the California Central Valley steelhead ESU.

County	Crop	Usage (pounds)	Acres treated
Alameda	structural pest control	0.4	nr
Amador	none	0	0
Butte	none	0	0
Calaveras	none	0	0
Colusa	**cotton**	**320**	**353**
Contra Costa	**corn (forage-fodder)**	**588**	**342**
Glenn	**corn (forage-fodder)**	**155**	**142**
Marin	none	0	0
Merced	alfalfa	69	55
	corn (forage-fodder)	**927**	**718**
	cotton	**1,594**	**1,660**
	oats	18	14
	sugar beets	**264**	**288**
Nevada	none	0	0
Placer	none	0	0
Sacramento	**sweet corn**	**6,825**	**6,195**
	wheat	29	27
San Joaquin	**corn (forage-fodder)**	**6,377**	**7,397**
	potato	**2,882**	**867**
San Francisco	none	0	0
San Mateo	none	0	0
Shasta	none	0	0
Solano	none	0	0
Sonoma	none	0	0
Stanislaus	**corn (forage-fodder)**	**61**	**303**
Sutter	**beans**	**63**	**75**
Tehama	none	0	0
Tuolumne	none	0	0
Yolo	none	0	0
Yuba	none	0	0

Phorate use within the California Central Valley steelhead ESU can be substantial on corn, cotton, and potatoes, in particular. The use of phorate in crops, other than potatoes, may affect this ESU directly and there may be indirect effects on the food supply of this steelhead. These effects would likely be in tributaries to, rather than directly in, the Sacramento and San Joaquin Rivers.

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, and Lake. Table 17 shows no reported use of phorate in these counties.

Table 17. Use of phorate in counties with the Northern California steelhead ESU.

County	Crop	Usage (pounds)	Acres treated
Humboldt	none	0	0
Mendocino	none	0	0
Trinity	none	0	0
Lake	none	0	0

With no use in this area, there will be no effect of phorate on the Northern California steelhead 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, 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, Skamania, Clark, Columbia, Cowlitz, Wahkiakum, and Pacific, Washington; and Gilliam, Morrow, Sherman, Umatilla, Wasco, Hood River, Multnomah, Columbia, and Clatsop, Oregon.

Tables 18 and 19 show the cropping information, where phorate can be used for Washington counties where the Upper Columbia River steelhead ESU is located and for the Oregon and Washington counties where this ESU migrates.

Table 18. Crops on which phorate can be used in counties containing spawning and rearing habitat for the Upper Columbia River steelhead ESU.

State	County	Crops and acreage planted	Total acres where phorate could be used	Total acreage in county
WA	Adams	**potatoes (8,148)**	8,148	1,231,999
WA	Benton	**potatoes (25,317)** **sweet corn (15,729)** **sugar beets (4,282)** **field corn (357)**	45,328	1,089,993
WA	Chelan	none	0	1,869,848
WA	Douglas	none	0	1,165,158
WA	Franklin	**potatoes (35,770)** **field corn (12,594)** **sweet corn (11,834)** **beans (2,706)**	62,704	794,999
WA	Grant	**potatoes (17,353)**	17,353	1,712,881
WA	Kittitas	**sweet corn (4,432)** **potatoes (442)** **field corn (110)**	4,984	1,469,862
WA	Okanogan	**sweet corn (7)**	7	3,371,698
WA	Yakima	**potatoes (2,145)**	2,145	2,749,514

Table 19. Crops on which phorate can be used in counties in the migration corridor of the Upper Columbia River steelhead ESU.

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
OR	Clatsop	**sweet corn (5)**	5	529482
OR	Columbia	**field corn (48)** **sweet corn**	48	420332
OR	Gilliam	none	0	770,664
OR	Hood River	**sweet corn (4)**	4	334,328
OR	Morrow	**potatoes (17,030)** **field corn (9,276)** **sweet corn (3,720)**	30,026	1301021
OR	Multnomah	**potatoes (336)**	336	278,570
OR	Sherman	none	0	526,911
OR	Umatilla	**potatoes (15,003)** **field corn (7,903)** **beans (2,088)** **sweet corn (2,077)**	26,771	2,057,809
WA	Clark	**field corn (1,730)** **sweet corn (87)** **beans (2)**	1,819	401,850

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
WA	Cowlitz	**sweet corn (1,144)** **field corn (460)** **wheat (293)** **beans (1)**	1,898	728,781
WA	Klickitat	**sweet corn** **potatoes**	no data[a]	1,198,385
WA	Pacific	none	0	623,722
WA	Skamania	none	0	1,337,179
WA	Wahkiakum	none	0	169,125
WA	Walla Walla	**potatoes (9,256)** **sweet corn (7,535)** **field corn (7,066)** **beans (5,707)** **radishes**	29,564	813,108

a. To protect privacy, acreage is not reported in the agricultural census when there are only 1-3 growers

There is substantial acreage where phorate can be used in the reproductive and growth areas of this ESU. The use of phorate may affect the Upper Columbia River steelhead ESU, both through direct toxic effects and on the invertebrate food supply.

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, and Walla Walla in Washington; and Adams, Idaho, Nez Perce, Blaine, Custer, Lemhi, Boise, Valley, Lewis, Clearwater, and Latah in Idaho. I have excluded Baker County, Oregon, which has a tiny fragment of the Imnaha River watershed. While a small part of Rock Creek that 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 phorate use in agricultural areas. I 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. However, crop areas of Umatilla County are considered in the migratory routes. 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. I have excluded these areas because they are not relevant to use of phorate. 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 that I was not able to exclude it.

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, Columbia, and Clatsop in Oregon; and Benton, Klickitat, Skamania, Clark, Cowlitz, Wahkiakum, and Pacific in Washington.

The USDA census indicates that there is limited acreage of crops on which phorate can be used in Idaho counties within this ESU, nor in the Washington counties bordering on Idaho. There is rather large acreage of potatoes in several counties along the lower Snake River and in the migratory corridors for this ESU.

Tables 20 and 21 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.

Table 20. Crops on which phorate can be used in counties containing spawning and rearing habitat for the Snake River Basin steelhead ESU.

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
ID	Adams	**field corn (104)**	104	873,399
ID	Clearwater	**beans (218)**	218	1,575,396
ID	Custer	**potatoes (507)**	507	3,152,382
ID	Idaho	**field corn (117)**	117	5,430,522
ID	Latah	**beans (1,135)**	1,135	689,089
ID	Lemhi	none	0	2,921,172
ID	Lewis	none	0	306,601
ID	Valley	**potatoes (225)**	225	2,354,043
OR	Union	**sugar beets (1,035)** **beans (661)** **potatoes (660)**	2,356	1,303,476
OR	Wallowa	none	0	2,013,071
WA	Adams	**potatoes (8,148)**	8,148	1,231,999
WA	Asotin	none	0	406,983
WA	Benton	**potatoes (25,317)** **sweet corn (15,729)** **sugar beets (4,282)** **field corn (357)**	45,328	1,089,993
WA	Columbia	**field corn (51)**	51	556,034

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
WA	Franklin	**potatoes (35,770)** **field corn (12,594)** **sweet corn (11,834)** **beans (2,706)**	62,704	794,999
WA	Garfield	none	0	454,744
WA	Lincoln	**potatoes (771)** **field corn (564)** **sweet corn**	1,335	1,479,196
WA	Spokane	**sweet corn (152)** **field corn (128)** **potatoes**	280	1,128,835
WA	Walla Walla	**potatoes (9,256)** **sweet corn (7,535)** **field corn (7,066)** **beans (5,707)** **radishes**	29,564	813,108
WA	Whitman	**beans (1,283)** **field corn (101)**	1,384	1,382,006

Table 21. Crops on which phorate can be used in counties in the migration corridor of the Snake River Basin steelhead ESU.

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
OR	Clatsop	**sweet corn (5)**	5	529,482
OR	Columbia	**field corn (48)** **sweet corn**	48	420,332
OR	Gilliam	none	0	770,664
OR	Hood River	**sweet corn (4)**	4	334,328
OR	Morrow	**potatoes (17,030)** **field corn (9,276)** **sweet corn (3,720)**	30,026	1,301,021
OR	Multnomah	**potatoes (336)**	336	278,570
OR	Sherman	none	0	526,911
OR	Umatilla	**potatoes (15,003)**	15,003	2,057,809
OR	Wasco	**sweet corn (1)**	1	1,523,958
WA	Benton	**potatoes (25,317)** **sweet corn (15,729)** **sugar beets (4,282)** **field corn (357)**	45,328	1,089,993
WA	Cowlitz	**sweet corn (1,144)** **field corn (460)** **wheat (293)** **beans (1)**	1,898	728,781

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
WA	Klickitat	**sweet corn** **potatoes**	no data[a]	1,198,385
WA	Pacific	none	0	623,722
WA	Skamania	none	0	1,337,179
WA	Wahkiakum	none	0	169,125

a. To protect privacy, acreage is not reported in the agricultural census when there are only 1-3 growers

There is a substantial amount of acreage where phorate can be used in the reproductive and growth areas of this ESU, and also in the migratory corridors. While much of this acreage is potatoes, which should not result in any significant surface water loadings, there is still considerable acreage in other crops which are more likely to get into surface water. The use of phorate may affect the Snake River Basin steelhead ESU, both through direct toxic effects and on the invertebrate food supply.

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, and Washington counties, and small parts of Lincoln and Tillamook counties. While the Willamette River extends upstream into Lane County, the final Critical Habitat Notice does not include the Willamette River (mainstem, Coastal and Middle forks) in Lane County or the MacKenzie River and other tributaries in this county that were in the proposed Critical Habitat.

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 migrations corridors, and include Multnomah, Columbia and Clatsop counties, Oregon, and Clark, Cowlitz, Wahkiakum, and Pacific counties, Washington.

Tables 22 and 23 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.

Table 22. Crops on which phorate can be used in counties containing spawning and rearing habitat for the Upper Willamette steelhead ESU.

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
OR	Benton	**sweet corn (5,735) beans (3,080) sugar beets (687) field corn (525) potatoes (3)**	10,030	432,961
OR	Clackamas	**sweet corn (1,072) field corn (735) beans (337) sugar beets (106) potatoes (1)**	2,251	1,195,712
OR	Linn	**sweet corn (5,771) wheat (5,306) beans (2,688) field corn (1,976) sugar beets (281)**	16,022	1,466,507
OR	Marion	**sweet corn (14,533) beans (12,101) field corn (2,158) sugar beets (940) potatoes**	29,732	758,394
OR	Polk	**sweet corn (1,835) field corn (1,472) beans (598) sugar beets (130)**	4,035	474,296
OR	Washington	**sweet corn (4,962) field corn (3,193) beans (988) potatoes**	9,143	463,231
OR	Yamhill	**sweet corn (4,149) field corn (2,173) beans (1,838) sugar beets (151) potatoes (1)**	8,312	457,986

Table 23. Crops on which phorate can be used in counties in the migration corridor of the Upper Willamette steelhead ESU.

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
OR	Clatsop	**sweet corn (5)**	5	529,482
OR	Columbia	**field corn (48)** **sweet corn**	48	420,332
OR	Multnomah	**sweet corn (1,212)** **potatoes (336)** **field corn (193)** **beans (77)**	1,818	278,570
WA	Clark	**field corn (1,730)** **sweet corn (87)** **beans (2)**	1,819	401,850
WA	Cowlitz	**sweet corn (1,144)** **field corn (460)** **wheat (293)** **beans (1)**	1,898	728,781
WA	Pacific	none	0	623,722
WA	Wahkiakum	none	0	169,125

There is moderate to high acreage where phorate can be used in the reproductive and growth areas of this ESU. The use of phorate may affect the Upper Willamette River steelhead ESU, both through direct toxic effects and on the invertebrate food supply.

<u>9. Lower Columbia River steelhead ESU</u>

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 the counties of Hood River, Clackamas, and Multnomah counties in Oregon, and Skamania, Clark, and Cowlitz 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.

Tables 24 and 25 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.

Table 24. Crops on which phorate can be used in counties containing spawning and rearing habitat for the Lower Columbia River steelhead ESU.

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
OR	Clackamas	**sweet corn (1,072)** **field corn (735)** **beans (337)** **sugar beets (106)** **potatoes (1)**	2,251	1,195,712
OR	Hood River	**sweet corn (4)**	4	334,328
OR	Multnomah	**sweet corn (1,212)** **potatoes (336)** **field corn (193)** **beans (77)**	1,818	278,570
WA	Clark	**field corn (1,730)** **sweet corn (87)** **beans (2)**	1,819	401,850
WA	Cowlitz	**sweet corn (1,144)** **field corn (460)** **beans (1)**	1,605	728,781
WA	Lewis	**field corn (746)** **sweet corn (662)**	1,408	1,540,991
WA	Skamania	none	0	1,337,179

Table 25. Crops on which phorate can be used in counties in the migration corridor of the Lower Columbia River steelhead ESU.

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
OR	Clatsop	**sweet corn (5)**	5	529,482
OR	Columbia	**field corn (48)** **sweet corn**	48	420,332
WA	Pacific	none	0	623,722
WA	Wahkiakum	none	0	169,125

There is low to moderate acreage in several counties where phorate can be used in the reproductive and growth areas of this ESU. The use of phorate may affect the Lower Columbia River steelhead ESU, both through direct toxic effects and on the invertebrate food supply.

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, I 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. Similarly, the Umatilla River and Walla Walla River get barely into Union County OR, and the Walla Walla River even gets into a tiny piece of Wallowa County, Oregon. But again, these are high elevation areas where crops are not grown, and I have excluded these counties for this analysis.

The Oregon counties then that appear to have spawning and rearing habitat are Gilliam, Morrow, Umatilla, Sherman, Wasco, Crook, Grant, Wheeler, and Jefferson counties. Hood River, Multnomah, Columbia, and Clatsop counties in Oregon provide migratory habitat. Washington counties providing spawning and rearing habitat would be Benton, Columbia, Franklin, Kittitas, Klickitat, Skamania, Walla Walla, and Yakima, although only a small portion of Franklin County between the Snake River and the Yakima River is included in this ESU. Skamania, Clark, Cowlitz, Wahkiakum, and Pacific Counties in Washington provide migratory corridors.

Tables 26 and 27 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.

Table 26. Crops on which phorate can be used in counties containing spawning and rearing habitat for the Middle Columbia River steelhead ESU.

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
OR	Crook	**sugar beets (1,510)**	1,510	1,906,892
OR	Gilliam	none	0	770,664
OR	Grant	none	0	2,898,444
OR	Jefferson	**sugar beets (2,396) potatoes (973) beans (220)**	3,589	1,139,744
OR	Morrow	**potatoes (17,030) field corn (9,276) sweet corn (3,720)**	30,026	1,301,021
OR	Sherman	none	0	526,911
OR	Umatilla	**potatoes (15,003) field corn (7,903) beans (2,088) sweet corn (2,077)**	26,771	2,057,809
OR	Wasco	**sweet corn (1)**	1	1,523,958
OR	Wheeler	none	0	1,097,601
WA	Benton	**potatoes (25,317) sweet corn (15,729) sugar beets (4,282) field corn (357)**	45,328	1,089,993
WA	Columbia	**field corn (51)**	51	556,034
WA	Franklin	**potatoes (35,770) field corn (12,594) sweet corn (11,834) beans (2,706)**	62,704	794,999
WA	Kittitas	**sweet corn (4,432) potatoes (442) field corn (110)**	4,984	1,469,862
WA	Klickitat	**sweet corn potatoes**	no data[a]	1,198,385
WA	Skamania	none	0	1,337,179
WA	Walla Walla	**potatoes (9,256) sweet corn (7,535) field corn (7,066) beans (5,707) radishes**	29,564	813,108
WA	Yakima	**field corn (24,053) sweet corn (6,478) beans (2,251) potatoes (1,929)**	34,711	2,749,514

a. To protect privacy, acreage is not reported in the agricultural census when there are only 1-3 growers

Table 27. Crops on which phorate can be used in counties in the migration corridor of the Middle Columbia River steelhead ESU.

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
OR	Clatsop	**sweet corn (5)**	5	529,482
OR	Columbia	**field corn (48)** **sweet corn**	48	420,332
OR	Hood River	**sweet corn (4)**	4	334,328
OR	Multnomah	**sweet corn (1,212)** **potatoes (336)** **field corn (193)** **beans (77)**	1818	278,570
WA	Clark	**field corn (1,730)** **sweet corn (87)** **beans (2)**	1,819	401,850
WA	Cowlitz	**sweet corn (1,144)** **field corn (460)** **beans (1)**	1606	728,781
WA	Pacific	none	0	623,722
WA	Skamania	none	0	1,337,179
WA	Wahkiakum	none	0	169,125

There is moderate to high acreage where phorate can be used in the reproductive and growth areas of this ESU. However, a predominant crop area of potential phorate use is potatoes and OPP has determined that application methods of phorate on potatoes are not likely to result in significant runoff loading of phorate to surface waters. For the remaining crops, the use of phorate may affect the Middle Columbia River steelhead ESU, both through direct toxic effects and on the invertebrate food supply.

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 are excluded (58FR33212-33219, June 16, 1993).

Table 28 shows the phorate usage in California counties supporting the Sacramento River winter-run chinook salmon ESU.

Table 28. Use of phorate in counties with the Sacramento River winter-run Chinook salmon ESU. Spawning areas are primarily in Shasta and Tehama counties above the Red Bluff diversion dam.

County	Crop	Usage (pounds)	Acres treated
Alameda	structural pest control	0.4	nr
Amador	none	0	0
Butte	none	0	0
Colusa	**cotton**	**320**	**353**
Contra Costa	**corn (forage-fodder)**	**588**	**342**
Glenn	**corn (forage-fodder)**	**155**	**142**
Marin	none	0	0
Sacramento	**sweet corn**	**6,825**	**6,195**
	wheat	29	27
San Joaquin	**corn (forage-fodder)**	**6,377**	**7,397**
	potato	**2,882**	**867**
San Francisco	none	0	0
San Mateo	none	0	0
Shasta	none	0	0
Solano	none	0	0
Sonoma	none	0	0
Tehama	none	0	0
Yolo	none	0	0

There is moderate use of phorate on corn in four counties of this ESU. In addition there is some limited use of the pesticide on cotton in one county . Although considerable phorate mass is used in San Joaquin County on potatoes, this use site is not expected to provide significant loadings of the pesticide to surface waters. Wheat is not considered in the IRED to be eligible for re-registration. Corn and cotton usage of phorate may affect this ESU through both direct toxic effects and effects on invertebrate food supply.

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. I have not included these counties here; however, I would note that 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 Baker, Umatilla, Wallowa, and Union counties in Oregon; Adams, Asotin, Columbia, Franklin, Garfield, Lincoln, Spokane, Walla Walla, and Whitman counties in Washington; and Adams, Benewah, Clearwater, Idaho, Latah, Lewis, Nez Perce, Shoshone, and Valley counties in Idaho. I note that Custer and Lemhi counties in Idaho are not listed as part of the fall-run ESU, although they are included for the spring/summer-run ESU. Because only high elevation forested areas of Baker and Umatilla counties in Oregon are in the spawning and rearing areas for this fall-run chinook, I have excluded them from consideration because phorate would not be used in these areas. I have, however, kept Umatilla County as part of the migratory corridor.

Tables 29 and 30 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.

Table 29. Crops on which phorate 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 that can be treated with phorate	Total acreage in county
ID	Adams	**field corn (104)**	104	873,399
ID	Clearwater	**beans (218)**	218	1,575,396
ID	Idaho	**field corn (117)**	117	5,430,522
ID	Latah	**beans (1,135)**	1,135	689,089
ID	Lewis	none	0	306,601
ID	Nez Perce	**beans (4,561)** **sweet corn (15)** **potatoes**	4,576	543,434
OR	Gilliam	none	0	770,664
OR	Jefferson	**sugar beets (2,396)** **potatoes (973)** **beans (220)**	3,589	1,139,744
OR	Morrow	**potatoes (17,030)** **field corn (9,276)** **sweet corn (3,720)**	30,026	1,301,021
OR	Sherman	none	0	526,911

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
OR	Union	**sugar beets (1,035)** **beans (661)** **potatoes (660)**	2,356	1,303,476
OR	Wallowa	none	0	2,013,071
WA	Asotin	none	0	406,983
WA	Columbia	**field corn (51)**	51	556,034
WA	Franklin	**potatoes (35,770)** **field corn (12,594)** **sweet corn (11,834)** **beans (2,706)**	62,704	794,999
WA	Garfield	none	0	454,744
WA	Walla Walla	**potatoes (9,256)** **sweet corn (7,535)** **field corn (7,066)** **beans (5,707)** **radishes**	29,564	813,108
WA	Whitman	**beans (1,283)** **field corn (101)**	1,384	1,382,006

Table 30. Crops on which phorate 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 that can be treated with phorate	Total acreage in county
OR	Clatsop	**sweet corn (5)**	5	529,482
OR	Columbia	**field corn (48)** **sweet corn**	48	420,332
OR	Hood River	**sweet corn (4)**	4	334,328
OR	Multnomah	**sweet corn (1,212)** **potatoes (336)** **field corn (193)** **beans (77)**	1,818	278,570
OR	Umatilla	**potatoes (15,003)** **field corn (7,903)** **beans (2,088)** **sweet corn (2,077)**	27,071	2,057,809

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
WA	Benton	**potatoes (25,317)** **sweet corn (15,729)** **sugar beets (4,282)** **field corn (357)**	45,328	1,089,993
WA	Clark	**field corn (1,730)** **sweet corn (87)** **beans (2)**	1,819	401,850
WA	Cowlitz	**sweet corn (1,144)** **field corn (460)** **beans (1)**	1,605	728,781
WA	Klickitat	**sweet corn** **potatoes**	no data[a]	1,198,385
WA	Pacific	none	0	623,722
WA	Skamania	none	0	1,337,179
WA	Wahkiakum	none	0	169,125

a. To protect privacy, acreage is not reported in the agricultural census when there are only 1-3 growers

There is a fairly large amount acreage in Washington where phorate can be used in the reproductive and growth areas of this ESU. However, much of this acreage is in potatoes, which OPP believes will not result in significant phorate loads via runoff. For the other uses in this ESU phorate may affect the Snake River fall run chinook salmon ESU, both through direct toxic effects and on the invertebrate food supply.

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, Wallowa, and Baker counties in Oregon; Adams, Blaine, Custer, Idaho, Lemhi, Lewis, Nez Perce, and Valley counties in Idaho; and Asotin, Columbia, Franklin, Garfield, Walla Walla, and Whitman counties in Washington. However, I have excluded Umatilla and Baker counties in Oregon and Blaine County in Idaho because accessible river reaches are all well above areas where phorate can be used. Counties with migratory corridors are all of those down stream from the confluence of the Snake and Columbia Rivers.

Tables 31 and 32 shows the crop-acreage information for Oregon and Washington counties where the Snake River spring/summer-run chinook salmon ESU occurs.

Table 31. Crops on which phorate 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 that can be treated with phorate	Total acreage in county
ID	Adams	**field corn (104)**	104	873,399
ID	Blaine	**potatoes (848)**	848	1,692,735
ID	Custer	**potatoes (507)**	507	3,152,382
ID	Idaho	**field corn (117)**	117	5,430,522
ID	Lemhi	none	0	2,921,172
ID	Lewis	none	0	306,601
ID	Nez Perce	**beans (4,561)** **sweet corn (15)** **potatoes**	4,576	543,434
OR	Union	**sugar beets (1,035)** **beans (661)** **potatoes (660)**	2,356	1,303,476
OR	Wallowa	none	0	2,013,071
WA	Adams	**potatoes (27,914)** **beans (8,250)** **field corn (6,878)** **sugar beets (1,570)** **sweet corn (1,289)**	45,901	1,231,999
WA	Asotin	none	0	406,983
WA	Columbia	**field corn (51)**	51	556,034
WA	Franklin	**potatoes (35,770)** **field corn (12,594)** **sweet corn (11,834)** **beans (2,706)**	62,704	794,999
WA	Garfield	none	0	454,744

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
WA	Walla Walla	**potatoes (9,256)** **sweet corn (7,535)** **field corn (7,066)** **beans (5,707)** **radishes**	29,564	813,108
WA	Whitman	**beans (1,283)** **field corn (101)**	1,384	1,382,006

Table 32. Crops on which phorate 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 that can be treated with phorate	Total acreage in county
OR	Clatsop	**sweet corn (5)**	5	529,482
OR	Columbia	**field corn (48)** **sweet corn**	48	420,332
OR	Hood River	**sweet corn (4)**	4	334,328
OR	Multnomah	**sweet corn (1,212)** **potatoes (336)** **field corn (193)** **beans (77)**	1,818	278,570
OR	Umatilla	**potatoes (15,003)** **field corn (7,903)** **beans (2,088)** **sweet corn (2,077)**	27,071	2,057,809
WA	Benton	**potatoes (25,317)** **sweet corn (15,729)** **sugar beets (4,282)** **field corn (357)**	45,328	1,089,993
WA	Clark	**field corn (1,730)** **sweet corn (87)** **beans (2)**	1,819	401,850
WA	Cowlitz	**sweet corn (1,144)** **field corn (460)** **beans (1)**	1,605	728,781
WA	Klickitat	**sweet corn** **potatoes**	no data[a]	1,198,385
WA	Pacific	none	0	623,722
WA	Skamania	none	0	1,337,179
WA	Wahkiakum	none	0	169,125

a. To protect privacy, acreage is not reported in the agricultural census when there are only 1-3 growers

There is a fairly large amount acreage in Oregon and Washington where phorate can be used in the reproductive and growth areas of this ESU. However, much of this acreage is in potatoes, which OPP believes will not result in significant phorate loads via runoff. For the other uses in this ESU phorate may affect the Snake River fall run chinook salmon ESU, both through direct toxic effects and on the invertebrate food supply.

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 down stream 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 said to be in the counties of Shasta, Tehama, Butte, Glenn, Colusa, Sutter, Yolo, Yuba, Placer, Sacramento, Solano, Nevada, Contra Costa, Napa, Alameda, Marin, Sonoma, San Mateo, and San Francisco. However, with San Mateo County being well south of the Oakland Bay Bridge, it is difficult to see why this county was included.

Table 33 contains usage information for the California counties supporting the Central Valley spring-run chinook salmon ESU.

Table 33. Use of phorate in counties with the Central Valley spring run chinook salmon ESU.

County	Crop	Usage (pounds)	Acres treated
Alameda	structural pest control	0.4	nr
Butte	none	0	0
Colusa	cotton	320	353
Contra Costa	**corn (forage-fodder)**	**588**	**342**
Glenn	**corn (forage-fodder)**	**155**	**142**
Marin	none	0	0
Napa	none	0	0
Nevada	none	0	0
Placer	none	0	0
Sacramento	**sweet corn**	**6,825**	**6,195**
	wheat	29	27
San Francisco	none	0	0
San Mateo	none	0	0
Shasta	none	0	0

County	Crop	Usage (pounds)	Acres treated
Solano	none	0	0
Sonoma	none	0	0
Sutter	**beans**	**63**	**75**
Tehama	none	0	0
Yolo	none	0	0
Yuba	none	0	0

Corn usage of phorate occurs in 3 counties within this ESU and beans is a use site in one, though the latter use appears quite small (only 75 acres) . It should be noted that while wheat is a use site historically for Sacramento County, the IRED does not include this use site as eligible for reregistration. Based primarily upon the corn and bean use, phorate may be concluded to affect the Central Valley spring run chinook salmon ESU, both through direct toxic effects and on the invertebrate food supply.

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, Lake, Sonoma, and Marin. A small portion of Glenn County is also included in the Critical Habitat, but phorate would not be used in the forested upper elevation areas.

Table 34 contains usage information for the California counties supporting the California coastal chinook salmon ESU.

Table 34. Use of phorate in counties with the California coastal chinook salmon ESU.

County	Crop	Usage (pounds)	Acres treated
Humboldt	none	0	0
Mendocino	none	0	0
Sonoma	none	0	0
Marin	none	0	0
Trinity	none	0	0
Lake	none	0	0

There are no recorded uses of phorate in this ESU and so there will be no effect from phorate on this 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.

Table 35 shows the acreage information for Washington counties where the Puget Sound chinook salmon ESU is located.

Table 35. Crops on which phorate can be used in counties containing spawning and rearing habitat for the Puget Sound chinook salmon ESU.

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
WA	Clallam	**field corn (79)** **sweet corn (44)**	123	1,116,900
WA	Island	**field corn (850)** **sweet corn (15)**	865	133,499
WA	Jefferson	**sweet corn**	nr	1,157,642
WA	King	**field corn (770)** **sweet corn (155)** **potatoes (2)** **radishes**	927	1,360,705
WA	Kitsap	**sweet corn (4)** **potatoes (2)** **beans (1)**	7	253,436
WA	Lewis	**field corn (746)** **sweet corn (662)**	1,408	1,540,991
WA	Mason	**sweet corn (109)** **beans (2)**	111	615,108

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
WA	Pierce	**sweet corn (367)** **field corn (358)** **beans (200)** **potatoes (7)** **radishes**	932	1,072,350
WA	San Juan	**potatoes (1)** **sweet corn**	1	11,963
WA	Skagit	**potatoes (6,948)** **field corn (6,681)** **sweet corn (656)** **beans (4)**	14,289	1,110,583
WA	Snohomish	**field corn (3,758)** **sweet corn (259)** **beans (10)**	4,027	1,337,728
WA	Thurston	**sweet corn (55)** **beans (2)** **radishes (1)** **potatoes**	58	465,322
WA	Whatcom	**field corn (15,118)** **potatoes (1,585)** **sweet corn (236)** **beans (1)**	16,940	1,356,006

Corn and beans comprise a large proportion of the potential acreage of phorate. The use of phorate on these sites may affect the Puget Sound chinook salmon ESU, both through direct toxic effects and on the invertebrate food supply.

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. Clatsop County appears to be the only county in the critical habitat that does not contain spawning and rearing habitat, although there is only a small part of Marion County that is included as critical habitat. I have excluded Pierce County, Washington because the very small part of the Cowlitz River watershed in this county is at a high elevation where phorate would not be used.

Table 36 shows the cropping information for Oregon and Washington counties where the Lower Columbia River chinook salmon ESU occurs.

Table 36. Crops on which phorate 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 that can be treated with phorate	Total acreage in county
OR	Clackamas	**sweet corn (1,072)** **field corn (735)** **beans (337)** **sugar beets (106)** **potatoes (1)**	2,251	1,195,712
OR	Clatsop	**sweet corn (5)**	5	529,482
OR	Columbia	**field corn (48)** **sweet corn**	48	420,332
OR	Hood River	**sweet corn (4)**	4	334,328
OR	Multnomah	**sweet corn (1,212)** **potatoes (336)** **field corn (193)** **beans (77)**	1,818	278,570
WA	Clark	**field corn (1,730)** **sweet corn (87)** **beans (2)**	1,819	401,850
WA	Cowlitz	**sweet corn (1,144)** **field corn (460)** **beans (1)**	1,605	728,781
WA	Klickitat	**sweet corn** **potatoes**	no data[a]	1,198,385
WA	Lewis	**field corn (746)** **sweet corn (662)**	1,408	1,540,991
WA	Pacific	none	0	623,722
WA	Skamania	none	0	1,337,179
WA	Wahkiakum	none	0	169,125

a. To protect privacy, acreage is not reported in the agricultural census when there are only 1-3 growers

Corn and beans dominate the agricultural acreage where phorate can be used in this ESU. Phorate use on these crops may affect the Lower Columbia River chinook salmon ESU, both through direct toxic effects and on the invertebrate food supply.

<u>8. Upper Willamette River Chinook Salmon ESU</u>

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.

Tables 37 and 38 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.

Table 37. Crops on which phorate can be used in counties containing spawning and rearing habitat for the Upper Willamette chinook ESU.

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
OR	Benton	**sweet corn (5,735) beans (3,080) sugar beets (687) field corn (525) potatoes (3)**	10,030	432,961
OR	Clackamas	**sweet corn (1,072) field corn (735) beans (337) sugar beets (106) potatoes (1)**	2,251	1,195,712
OR	Lane	**sweet corn (2,593) beans (1,796) sugar beets (773) field corn (500) potatoes (9)**	5,671	2,914,656

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
OR	Linn	**sweet corn (5,771)** **beans (2,688)** **field corn (1,976)** **sugar beets (281)**	10,716	1,466,507
OR	Marion	**sweet corn (14,533)** **beans (12,101)** **field corn (2,158)** **sugar beets (940)** **potatoes**	29,732	758,394
OR	Polk	**sweet corn (1,835)** **field corn (1,472)** **beans (598)** **sugar beets (130)**	4,035	474,296
OR	Washington	**sweet corn (4,962)** **field corn (3,193)** **beans (988)** **potatoes**	9,143	463,231
OR	Yamhill	**sweet corn (4,149)** **field corn (2,173)** **beans (1,838)** **sugar beets (151)** **potatoes (1)**	8,312	457,986

Table 38. Crops on which phorate can be used in counties in the migration corridor of the Upper Willamette chinook ESU.

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
OR	Clackamas	**sweet corn (1,072)** **field corn (735)** **beans (337)** **sugar beets (106)** **potatoes (1)**	2,251	1,195,712
OR	Clatsop	**sweet corn (5)**	5	529,482
OR	Columbia	**field corn (48)** **sweet corn**	48	420,332

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
OR	Multnomah	**sweet corn (1,212)** **potatoes (336)** **field corn (193)** **beans (77)**	1,818	278,570
WA	Clark	**field corn (1,730)** **sweet corn (87)** **beans (2)**	1,819	401,850
WA	Cowlitz	**sweet corn (1,144)** **field corn (460)** **beans (1)**	1,605	728,781
WA	Lewis	**field corn (746)** **sweet corn (662)**	1,408	1,540,991
WA	Pacific	none	0	623,722
WA	Wahkiakum	none	0	169,125

Based upon the moderate acreage of corn, beans, and sugar beets where phorate can be used within the Upper Willamette River chinook salmon ESU, there may be effects both through direct toxic effects and on the invertebrate food supply.

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, Kittitas, and Benton, with the lower river reaches being migratory corridors.

Tables 39 and 40 show the cropping information for Washington counties that support the Upper Columbia River chinook salmon ESU and for the Oregon and Washington counties where this ESU migrates.

Table 39. Crops on which phorate 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 that can be treated with phorate	Total acreage in county
WA	Chelan	none	0	1,869,848
WA	Douglas	none	0	1,165,158
WA	Okanogan	**sweet corn (7)**	7	3,371,698

Table 40. Crops on which phorate 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 that can be treated with phorate	Total acreage in county
OR	Clatsop	**sweet corn (5)**	5	529,482
OR	Columbia	**field corn (48)** **sweet corn**	48	420,332
OR	Gilliam	none	0	770,664
OR	Hood River	**sweet corn (4)**	4	334,328
OR	Morrow	**potatoes (17,030)** **field corn (9,276)** **sweet corn (3,720)**	30,026	1,301,021
OR	Multnomah	**sweet corn (1,212)** **potatoes (336)** **field corn (193)** **beans (77)**	1,818	278,570
OR	Sherman	none	0	526,911
OR	Umatilla	**potatoes (15,003)** **field corn (7,903)** **beans (2,088)** **sweet corn (2,077)**	27,071	2,057,809
OR	Wasco	**sweet corn (1)**	1	1,523,958
WA	Benton	**potatoes (25,317)** **sweet corn (15,729)** **sugar beets (4,282)** **field corn (357)**	45,685	1,089,993
WA	Clark	**field corn (1,730)** **sweet corn (87)** **beans (2)**	1,819	401,850
WA	Cowlitz	**sweet corn (1,144)** **field corn (460)** **beans (1)**	1,606	728,781
WA	Franklin	**potatoes (35,770)** **field corn (12,594)** **sweet corn (11,834)** **beans (2,706)**	62,704	794,999

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
WA	Grant	**beans (44,263)** **field corn (35,123)** **sweet corn (32,540)** **beans (18,024)** **sugar beets (10,792)**	140,742	1,712,881
WA	Kittitas	**sweet corn (4,432)** **potatoes (442)** **field corn (110)**	4,984	1,469,862
WA	Klickitat	**sweet corn** **potatoes**	no data[a]	1,198,385
WA	Pacific	none	0	623,722
WA	Skamania	none	0	1,337,179
WA	Wahkiakum	none	0	169,125
WA	Walla Walla	**potatoes (9,256)** **sweet corn (7,535)** **field corn (7,066)** **beans (5,707)** **radishes**	29,564	813,108
WA	Yakima	**field corn (24,053)** **sweet corn (6,478)** **beans (2,251)** **potatoes (1,929)**	34,711	2,749,514

a. To protect privacy, acreage is not reported in the agricultural census when there are only 1-3 growers

With only 7 acres of corn grown, phorate is unlikely to affect this ESU in its reproduction and rearing areas. However, there is substantial potential use in the migratory corridors, and phorate has sufficient toxicity both directly to fish and also to invertebrate food sources that even with the dilution expected in the Columbia River, there are still concerns, although we have a fair amount of uncertainty. Phorate may affect the Upper Columbia River chinook salmon ESU, both through direct toxic effects and on the invertebrate food supply.

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, and Mendocino.

Table 41 contains usage information for the California counties supporting the Central California coast coho salmon ESU. No usage of phorate is recorded in the ESU.

Table 41. Use of phorate in counties with the Central California Coast coho ESU.

County	Crop	Usage (pounds)	Acres treated
Santa Cruz	none	0	0
San Mateo	none	0	0
Marin	none	0	0
Sonoma	none	0	0
Mendocino	none	0	0
Napa	none	0	0

With no usage in this ESU, phorate will have no effect on 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, Siskiyou in California and Curry, Jackson, Josephine, Klamath, and Douglas, in Oregon.

Table 42 shows reportable phorate usage in one California county supporting the Southern Oregon/Northern California coastal coho salmon ESU, and this use is not on the IRED eligibility list for reregistration. Table 43 shows small areas for corn potatoes and beans where phorate may be used in the Oregon counties where the Southern Oregon/Northern California coastal coho salmon ESU occurs.

Table 42. Use of phorate in California counties with the Southern Oregon/Northern California coastal coho salmon ESU.

County	Crop	Usage (pounds)	Acres treated
Humboldt	none	0	0
Mendocino	none	0	0
Del Norte	nursery outdoor transplants	2,982	460
Siskiyou	none	0	0
Trinity	none	0	0
Lake	none	0	0

Table 43. Crops on which phorate 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 that can be treated with phorate	Total acreage in county
OR	Curry	none	0	1,041,557
OR	Jackson	**sweet corn (283)** **field corn (247)**	530	1,782,633
OR	Josephine	**sweet corn (37)** **wheat (18)** **potatoes (7)** **beans (1)**	63	1,049,308

Based upon the limited acreages for potential phorate use in Oregon and that the phorate use in California is on transplant stock, I conclude that the use of phorate may affect but is not likely to adversely effect on the Northern California/Southern Oregon 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, Clatsop.

Table 44 shows the acreage where phorate can be used for Oregon counties where the Oregon coast coho salmon ESU occurs.

Table 44. Crops on which phorate can be used in counties containing habitat for the Oregon Coast coho salmon ESU.

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
OR	Benton	**sweet corn (5,735)** **beans (3,080)** **sugar beets (687)** **field corn (525)** **potatoes (3)**	10,030	432,961
OR	Clatsop	**sweet corn (5)**	5	529,482
OR	Coos	**field corn (203)**	203	1,024,346
OR	Curry	none	0	1,041,557
OR	Douglas	**sweet corn (175)** **wheat (123)** **beans (19)**	317	3,223,576
OR	Lane	**sweet corn (2,593)** **beans (1,796)** **sugar beets (773)** **field corn (500)** **potatoes (9)**	5,671	2,914,656
OR	Lincoln	**beans (1)**	1	626,976
OR	Polk	**sweet corn (1,835)** **field corn (1,472)** **beans (598)** **sugar beets (130)**	4,035	474,296
OR	Tillamook	none	0	705,417

It is highly likely that the high acreage areas of Benton, Douglas, Lane, and Polk counties are actually in the Willamette River watershed, rather than the coastal watersheds for this ESU. However, there is some uncertainty and there is also enough field corn in Coos County to be of concern for a pesticide as toxic as phorate. Phorate may affect the Oregon Coast coho salmon ESU through both direct toxic effects and impacts on invertebrate food supply.

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, and Island.

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 45 shows that the acreage where phorate can be used is very low in the Washington counties where the Hood Canal summer-run chum salmon ESU occurs.

Table 45. Crops on which phorate can be used in counties containing habitat for the Hood Canal summer-run chum salmon ESU.

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
WA	Clallam	**field corn (79)** **sweet corn (44)**	123	1,116,900
WA	Island	**field corn (850)** **sweet corn (15)**	865	133,499
WA	Jefferson	**sweet corn**	no data[a]	1,157,642

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
WA	Kitsap	**sweet corn (4)** **potatoes (2)** **beans (1)**	7	253,436
WA	Mason	**sweet corn (109)** **beans (2)**	111	615,108

a. To protect privacy, acreage is not reported in the agricultural census when there are only 1-3 growers

Based upon the low crop acreage, I conclude that the use of phorate may affect, but is not likely to affect, the Hood Canal summer run chum salmon 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, and Washington, Oregon. It appears that there are three extant populations in Grays River, Hardy Creek, and Hamilton Creek.

Table 46 shows the cropping information for Oregon and Washington counties where the Columbia River chum salmon ESU occurs.

Table 46. Crops on which phorate can be used in counties containing habitat for the Columbia River chum salmon ESU.

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
OR	Clatsop	**sweet corn (5)**	5	529,482
OR	Columbia	**field corn (48)** **sweet corn**	48	420,332
OR	Multnomah	**sweet corn (1,212)** **potatoes (336)** **field corn (193)** **beans (77)**	1,818	278,570

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
WA	Clark	**field corn (1,730)** **sweet corn (87)** **beans (2)**	1,819	401,850
WA	Cowlitz	**sweet corn (1,144)** **field corn (460)** **beans (1)**	1,606	728,781
WA	Lewis	**field corn (746)** **sweet corn (662)**	1,408	1,540,991
WA	Pacific	none	0	623,722
WA	Skamania	none	0	1,337,179
WA	Wahkiakum	none	0	169,125

There is moderate acreage of phorate within the critical habitat of this ESU. Phorate may affect the Lower Columbia River chum salmon ESU, through both direct toxic effects and impacts on invertebrate food supply.

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 47 shows that there is only a small amount of agricultural acreage where phorate can be used within the county.

Table 47. Crops on which phorate can be used in counties containing habitat for the Ozette Lake sockeye salmon ESU.

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
WA	Clallam	**field corn (79)** **sweet corn (44)**	123	1,116,900

Based upon the low acreage where phorate can be used phorate is concluded to may affect, but not likely to affect, the Ozette Lake sockeye salmon ESU. It is very likely that all of the corn is grown well away from the tributaries to Ozette Lake, but that has not yet been verified. If it is verified, there would be no effect on this ESU, and we will inform the Service.

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. Phorate cannot be used on such a site, and therefore there will be no exposure in the spawning and rearing habitat. There is a probability that this salmon ESU could be exposed to pesticides in the lower and larger river reaches during its juvenile or adult migration, but considering that the migratory corridors are larger rivers any exposure should be well below levels of concern.

Table 48 shows that there is only a small acreage of potatoes in Idaho counties where this ESU reproduces or migrates. Potatoes is a use not considered by OPP to pose significant risks of runoff loading of phorate to surface waters. Table 49 shows that phorate may be used in the migratory corridor from the lower Snake River downstream .

Table 48. Crops on which phorate can be used in counties containing habitat for the Snake River sockeye ESU.

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
ID	Blaine	**potatoes (848)**	848	1,692,735
ID	Custer	**potatoes (507)**	507	3,152,382

Table 49. Crops on which phorate can be used in counties in the migration corridor of the Snake River sockeye ESU.

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
ID	Idaho	**field corn (117)**	117	5,430,522
ID	Lemhi	none	0	2,921,172
ID	Lewis	none	0	306,601
ID	Nez Perce	**beans (4,561)** **sweet corn (15)** **potatoes**	4,576	543,434
OR	Clatsop	**sweet corn (5)**	5	529,482
OR	Columbia	**field corn (48)** **sweet corn**	48	420,332
OR	Gilliam	none	0	770,664
OR	Hood River	**sweet corn (4)**	4	334,328
OR	Morrow	**potatoes (17,030)** **field corn (9,276)** **sweet corn (3,720)**	30,026	1,301,021
OR	Multnomah	**sweet corn (1,212)** **potatoes (336)** **field corn (193)** **beans (77)**	1,818	278,570
OR	Sherman	none	0	526,911
OR	Umatilla	**potatoes (15,003)** **field corn (7,903)** **beans (2,088)** **sweet corn (2,077)**	27,071	2,057,809
OR	Wasco	**sweet corn (1)**	1	1,523,958
WA	Asotin	none	0	406,983

State	County	Crops and acreage planted	Acres that can be treated with phorate	Total acreage in county
WA	Benton	**potatoes (25,317)** **sweet corn (15,729)** **sugar beets (4,282)** **field corn (357)**	45,328	1,089,993
WA	Clark	**field corn (1,730)** **sweet corn (87)** **beans (2)**	1,819	401,850
WA	Columbia	**field corn (51)**	51	556,034
WA	Cowlitz	**sweet corn (1,144)** **field corn (460)** **beans (1)**	1,606	728,781
WA	Franklin	**potatoes (35,770)** **field corn (12,594)** **sweet corn (11,834)** **beans (2,706)**	62,704	794,999
WA	Garfield	none	0	454,744
WA	Klickitat	**sweet corn** **potatoes**	no data[a]	1,198,385
WA	Pacific	none	0	623,722
WA	Skamania	none	0	1,337,179
WA	Wahkiakum	none	0	169,125
WA	Walla Walla	**potatoes (9,256)** **sweet corn (7,535)** **field corn (7,066)** **beans (5,707)** **radishes**	29,564	813,108
WA	Whitman	**beans (1,283)** **field corn (101)**	1,384	1,382,006

a. To protect privacy, acreage is not reported in the agricultural census when there are only 1-3 growers

There would be no effect on the Snake River sockeye salmon ESU in its spawning and rearing areas. In general, migratory corridors provide sufficient dilution to preclude concerns. But with considerable acreage of beans in Nez Perce County, primarily, and also other phorate crop acreages further downstream, there are concerns for a pesticide as toxic as phorate. Phorate may affect the Snake River sockeye salmon ESU both through direct toxic effects and impacts on invertebrate food supply.

5. Specific conclusions and recommendations for Pacific salmon and steelhead

1. Phorate is very highly toxic to fish. Risk quotients are exceeded hundred-fold for most uses when taking into account the total residue load of the parent, sulfoxide, and sulfone. A notable exception is that the way phorate is used on potatoes along with the deep incorporation, there will be insufficient transport to water to pose a risk. Other than for potatoes, where there is exposure, there is risk. Therefore, I must conclude that phorate may affect most salmon and steelhead ESUs, except California coastal chinook salmon, central California coastal coho

salmon, northern California steelhead, and southern California steelhead ESUs, where there is no usage or only usage on potatoes. I also consider that phorate may affect, but is not likely to affect the Ozette Lake sockeye salmon, the Hood Canal summer-run chum salmon, and the southern Oregon/northern California coho salmon ESU.

2. In California, the restricted use classification requires phorate applicators to be certified and to obtain a permit from the County Agricultural Commissioners. Many, but not necessarily all, commissioners will not give a permit unless the county bulletins for the protection of endangered and threatened species are followed as a condition of the permit. Phorate is included in the California county bulletins as a risk to all taxa of T&E animals. Therefore, phorate is subject to several use limitations. In addition to certain good management practices, these bulletins specify a no-spray buffer of 40 yards for ground applications and 200 yards for aerial applications. These buffers apply from the edge of the habitat when the wind is blowing towards that habitat. A vegetated buffer strip is also specified to protect aquatic habitats from runoff. I believe that the California limitations would be adequate to protect salmon and steelhead from phorate. It may be appropriate to have a dialogue among EPA, NMFS, and DPR to consider this and possibly other aspects of use limitations.

3. In Oregon and Idaho, I am aware of no specific state programs to address pesticides and salmon and steelhead. I recommend that OPP develop county bulletins for use in these states and that the EPA and NMFS work with the state pesticide agencies to develop appropriate protective measures. Should buffers be the appropriate means of protection such buffers should not be applied to granular phorate use since spray drift does not occur from this type of formulation.

4. In Washington, I recommend that OPP and NMFS work with the WSDA Task Force to implement appropriate protection. I believe that this protection should be consistent with the reduction in exposure that would result from the use of buffers of the size indicated above and in DPR's bulletins for aquatic hazards (i.e., 40 yards for ground applications), but the protective method may take a form entirely different from buffers.

Table 50. Summary conclusions on specific ESUs of salmon and steelhead for phorate

Species	ESU	finding
Chinook Salmon	Upper Columbia	may affect
Chinook Salmon	Snake River spring/summer-run	may affect
Chinook Salmon	Snake River fall-run	may affect
Chinook Salmon	Upper Willamette	may affect
Chinook Salmon	Lower Columbia	may affect
Chinook Salmon	Puget Sound	may affect

Chinook Salmon	California Coastal	no effect
Chinook Salmon	Central Valley spring-run	may affect
Chinook Salmon	Sacramento River winter-run	may affect
Coho salmon	Oregon Coast	may affect
Coho salmon	Southern Oregon/Northern California Coasts	may affect, but not likely to adversely affect
Coho salmon	Central California	no effect
Chum salmon	Hood Canal summer-run	may affect, but not likely to adversely affect
Chum salmon	Columbia River	may affect
Sockeye salmon	Ozette Lake	may affect, but not likely to adversely affect
Sockeye salmon	Snake River	may affect
Steelhead	Snake River Basin	may affect
Steelhead	Upper Columbia River	may affect
Steelhead	Middle Columbia River	may affect
Steelhead	Lower Columbia River	may affect
Steelhead	Upper Willamette River	may affect
Steelhead	Northern California	no effect
Steelhead	Central California Coast	may affect
Steelhead	South-Central California Coast	may affect
Steelhead	Southern California	no effect
Steelhead	Central Valley, California	may affect

6. References

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Attachments
1. Interim Reregistration Eligibility Decision document (with Appendix A only)
2. Selected labels
3. USGS map of phorate use
4. Environmental Risk Assessment for Phorate