Azinphos methyl
Analysis of Risks
to
Endangered and Threatened Salmon and Steelhead

July 23, 2003

William Erickson, Ph.D. and Larry Turner, Ph.D.
Environmental Field Branch
Office of Pesticide Programs

Summary

Azinphos methyl is an organophosphate pesticide registered for control of insects on a variety of crops, mainly fruits and nuts. Azinphos methyl is very highly toxic to fish and aquatic invertebrates. An ecological risk assessment that includes nontarget aquatic organisms was prepared by OPP's Environmental Fate and Effects Division (EFED) in 1999, and an Interim Reregistration Eligibility Decision (IRED) was issued in October of 2001. The assessment concludes that acute and chronic Levels of Concern (LOCs) are exceeded for threatened and endangered (T&E or listed) freshwater fish as a result of runoff and drift of azinphos methyl from all treatment sites. Acute and chronic levels of concern also are exceeded for individuals of T&E invertebrates, as well as populations of invertebrates that may serve as food for listed fish. A subsequent agreement between azinphos methyl registrants and the Agency has led to 23 uses being canceled; seven other uses being phased out in 2005. Mitigation measures will reduce application rates and add no-spray buffers to product labels. Despite these measures, we conclude that azinphos methyl may affect 25 Evolutionarily Significant Units (ESUs) and will have no effect on one ESU. Our determinations are based on the known or potential use of azinphos methyl on various use sites in each county where there is habitat or a migration corridor for an ESU and the acute and chronic risks of azinphos methyl to endangered fish.

Introduction

Problem Formulation: The purpose of this analysis is to determine whether the registration of azinphos methyl as an insecticide for use on various treatment sites 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 Pacific anadromous salmon and steelhead and the watersheds in which they occur, it is acknowledged that azinphos methyl 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. We 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, we 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, 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. We 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. We 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. We 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.

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 aquatic invertebrates

Test data	Risk quotient	Presumption
Acute LC50	>0.5	Potentially high acute risk
Acute LC50	>0.1	Risk that may be mitigated through restricted use classification
Acute LC50	>0.05	Endangered species may be affected acutely, including sublethal effects
Chronic NOEC	>1	Chronic risk; endangered species may be affected chronically, including reproduction and effects on progeny
Acute invertebrate LC50[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.

In recent years, Moore and Waring (1996) challenged Atlantic salmon with diazinon and observed effects on olfaction as relates to reproductive physiology and behavior. Their work indicated that diazinon could have sublethal effects of concern for salmon reproduction. However, the nature of their test system, direct exposure of olfactory rosettes, could not be quantitatively related to exposures in the natural environment. Subsequently, Scholz et al. (2000) conducted a non-reproductive behavioral study using whole Chinook salmon in a model stream system that mimicked a natural exposure that is far more relevant to ecological risk assessment than the system used by Moore and Waring (1996). The Scholz et al. (2000) data

indicate potential effects of diazinon on Chinook salmon behavior at very low levels, with statistically significant effects at nominal diazinon exposures of 1 ppb, with apparent, but non-significant effects at 0.1 ppb.

It would appear that the Scholz et al (2000) work contradicts the 6x hypothesis. The research design, especially the nature and duration of exposure, of the test system used by Scholz et al (2000), along with a lack of dose-response, precludes comparisons with lethal levels in accordance with 6x hypothesis as used by Tucker and Leitzke (1979). Nevertheless, it is known that olfaction is an exquisitely sensitive sense. And this sense may be particularly well developed in salmon, as would be consistent with its use by salmon in homing (Hasler and Scholz, 1983). So the contradiction of the 6x hypothesis is not surprising. As a result of these findings, the 6x hypothesis needs to be re-evaluated with respect to olfaction. At the same time, because of the sensitivity of olfaction and because the 6x hypothesis has generally stood the test of time otherwise, it would be premature to abandon the hypothesis for other sublethal effects until there are additional data.

2. Description and use of azinphos methyl

Azinphos methyl is an organophosphate insecticide registered for control of insect pests on a variety of crops, mostly fruits and nuts. There are no residential or public health uses. After an Interim Reregistration Eligibility Decision (IRED) was issued in 2001 (see attachment 1), some uses of azinphos methyl are currently being canceled in accordance with a 2002 "Agreement Between the Environmental Protection Agency and the Registrants of Pesticide Products Containing Azinphos Methyl" (attachment 2). Those 23 uses are as follows:

- alfalfa
- beans (succulent and snap)
- birdsfoot trefoil
- broccoli
- cabbage (including Chinese)
- cauliflower
- citrus
- celery
- clover
- cucumbers
- eggplant
- filberts
- grapes
- melons (honeydew melons, muskmelon/cantaloupe, watermelons, other melons)
- onions, green
- onions, dry bulb
- pecans
- peppers
- plums and dried plums

- quince
- spinach
- strawberries
- tomatoes

Product labels have been revised to omit those uses. However, the Agency has not yet officially accepted those labels, because spray-drift language issues are still being finalized. The labels are expected to be finalized and accepted within the next month or soon thereafter. Because some uses are being canceled now, we do not address those uses in this assessment; however, we are addressing the uses that are being phased out.

Crops for which azinphos methyl will continue to be registered include the following:

- pome fruits: apples, crabapples, pears
- stone fruits: peaches, cherries, nectarines
- tree nuts: almonds, pistachios, walnuts
- potatoes (Columbia River Basin of Oregon and Washington only)
- Brussels sprouts
- cranberries
- caneberries: raspberries, blackberries, boysenberries, cranberries, loganberries
- nursery plants (only for control of black vine weevil in association with meeting state nursery stock inspection and certification requirements for woody shrubs, vines, seedling trees, and non-bearing fruit trees in outdoor commercial nursery settings; does not include Christmas trees)
- cotton (Texas and Missouri only)
- blueberries (Eastern and North Central states only)
- southern pine seed orchards (not registered for use in California and would not be used in the Pacific NW)

Some of these uses also will be phased out in 2005. However, because they will be used for the next two years, and may have some additional use after then under existing-stocks provisions, we do address these uses. Those uses to be phased out in 2005 include the following:

- cotton (not relevant to the current assessment)
- cranberries
- nectarines
- peaches
- potatoes
- caneberries
- southern pine seed orchards (not relevant to the current assessment)

After both the current deletions and the phaseout uses for 2005, the following uses will remain:

- pome fruits: apples, crabapples, pears

- stone fruits: cherries
- tree nuts: almonds, pistachios, walnuts
- Brussels sprouts
- nursery plants (quarantine use only)
- blueberries (Eastern and North Central states only)

Fifteen products are currently registered under Section 3 of FIFRA. All products are labeled as "Restricted Use" and thus can be purchased and applied only by certified (i.e., trained) applicators or persons under their direct supervision. Products are formulated as either a liquid emulsifiable concentrate (22% EC) or as a wettable powder in water soluble bags (35% and 50% WP). Additionally, seven products are registered to individual states under Special Local Needs (SLN) provisions in Section 24(c) of FIFRA. SLNs include use on grapes in California; control of beetles in alkali bee-nesting areas in Oregon and Washington; and aerial application to apples, crabapples, pears, and peaches in Washington and Idaho.

Application rates, obtained from product labels, are summarized in Table 3 for the individual use sites considered in this analysis. The maximum rate and number of applications decreased for most crops as a mitigation measure of the IRED. Uses other than cranberries and potatoes are limited to ground application only. Backpack or handheld spraying is prohibited for all uses. Chemigation is prohibited on pome fruits and peaches. Additional use directions, restrictions, and precautions are specified on the product labels. (Representative labels are included as attachment 3.)

Table 3. Azinphos methyl use sites and application information for those uses relevant to California and the Pacific Northwest

Use site	Max. appl. rate (lb ai/acre)	Max. no. appl. per crop season	Appl. interval (days)	Max lb ai/season
Almonds, Walnuts, Pistachios (ground application only)	2	1	n/a	2
Apples, Crabapples (ground application only)	1-1.5[a]	2-4	7	4
Pears (ground application only)	1-1.5[a]	2	7	2.5
Peaches, Nectarines[b] (ground application only)	1.125	2	14	2.5
Cherries (ground application only)	0.75	2	14	1.5
Caneberries[b] (ground application only)	0.5	2	10	1
Cranberries[b] (ground or aerial application)	1	2	14	2

Use site	Max. appl. rate (lb ai/acre)	Max. no. appl. per crop season	Appl. interval (days)	Max lb ai/season
Potatoes[b] (ground or aerial application)	1-1.5[a]	not reported	7	not reported
Brussel sprouts (ground application only)	0.75	1	n/a	0.75
Nursery stock[c] (ground application only)	1	4	10	4

[a] the higher rate can be used only as part of an IPM program.
[b] crops scheduled for phase-out in 2005.
[c] includes woody shrubs, vines, seedling trees, and non-bearing fruit trees in outdoor commercial nursery settings when being treated for black vine weevils in quarantine programs.

Agricultural usage of azinphos methyl from 1987 through 1997 is presented in Table 4 for the major nationwide use sites. According to OPP/BEAD's 1999 Quantitative Usage Analysis for Azinphos-methyl (attachment 4), an average of 2.2 million pounds of active ingredient (ai) was applied to about 1.8 million acres of crop annually during that period. Most crops are treated at $\leq$2 lb ai per acre per application and $\leq$2.5 lb ai per acre per year. Most use nationwide during this period was on apples (41% of poundage) and cotton (21%). Use on sugarcane has been cancelled. EPA's IRED of 2001 states that less than 2 million pounds of azinphos methyl is currently applied annually in the U. S.

Table 4. Major nationwide uses of azinphos methyl from 1987 through 1997. Tabulated values are weighted averages; the most recent years and more reliable data are weighted more heavily (source OPP/BEAD Quantitative Usage Analysis for Azinphos-methyl, 1999)

Site	acres grown	acres treated	% crop treated	lb ai applied	lb ai/ acre/year	states with most usage[a]
Apples	524,000	370,000	71	890,000	2.4	WA MI NY PA CA VA (67%)
Cotton	12,986,000	820,000	6	470,000	0.6	TX AR MS AZ TN (84%)
Almonds	435,000	93,000	21	160,000	1.7	CA (100%)
Pears	75,000	52,000	70	130,000	2.5	CA WA OR (93%)
Peaches	266,000	55,000	21	120,000	2.2	CA NJ TX OK IL MI (56%)
Walnuts	204,000	35,000	17	67,000	1.9	CA (97%)
Potatoes	1,434,000	90,000	6	65,000	0.7	MI ND ME MN NC NY (60%)
Sugarcane[b]	855,000	71,000	8	56,000	0.8	LA FL (87%)
Pistachios	52,000	23,000	43	41,000	1.8	CA (100%)
Cherries, tart	48,000	35,000	71	40,000	1.2	MI (84%)

Site	acres grown	acres treated	% crop treated	lb ai applied	lb ai/ acre/year	states with most usage[a]
Cherries, sweet	46,000	21,000	44	27,000	1.3	WA MI (97%)
Tomatoes	408,000	27,000	7	15,000	0.4-1.2	CA MI NJ FL (84-100%)
Blueberries	59,000	20,000	34	17,000	0.8	MI ME NJ (96%)
Grapefruit	156,000	12,000	7	14,000	1.2	FL (94%)
Plums, Prunes	140,000	9,000	6	13,000	1.5	CA MI ID WA (81%)
Oranges	879,000	9,000	1	11,000	1.2	FL (89%)
Grapes	831,000	8,000	1	9,000	1.1	CA MI WA TX PA (80%)

[a] % of total lb ai used on the crop is provided in parenthesis
[b] use of azinphos methyl on sugarcane was canceled in 1999

Some data from the early to mid-1990s are available from the U.S. Geological Survey (USGS). The USGS estimated county pesticide use for the conterminous United States by combining (1) state-level information on pesticide use rates available from the National Center for Food and Agricultural Policy from pesticide use information collected by state and federal agencies over a 4-year period (1992–1995), and (2) county-level information on harvested crop acreage from the 1992 Census of Agriculture. The average annual pesticide use, the total amount of pesticide applied (in pounds), and the corresponding area treated (in acres) were compiled for 208 pesticide compounds that are applied to crops in the conterminous United States. Pesticide use was ranked by compound and crop on the basis of the amount of each compound applied to 86 selected crops. Their data indicate that the crops of highest azinphos methyl usage during the mid-1990s were apples, cotton, almonds, sugarcane, and alfalfa (Figure 1). USGS also mapped azinphos methyl use on selected crops. This map is included here as a quick and easy visual depiction of where azinphos methyl may have been used on agricultural crops. However, 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.

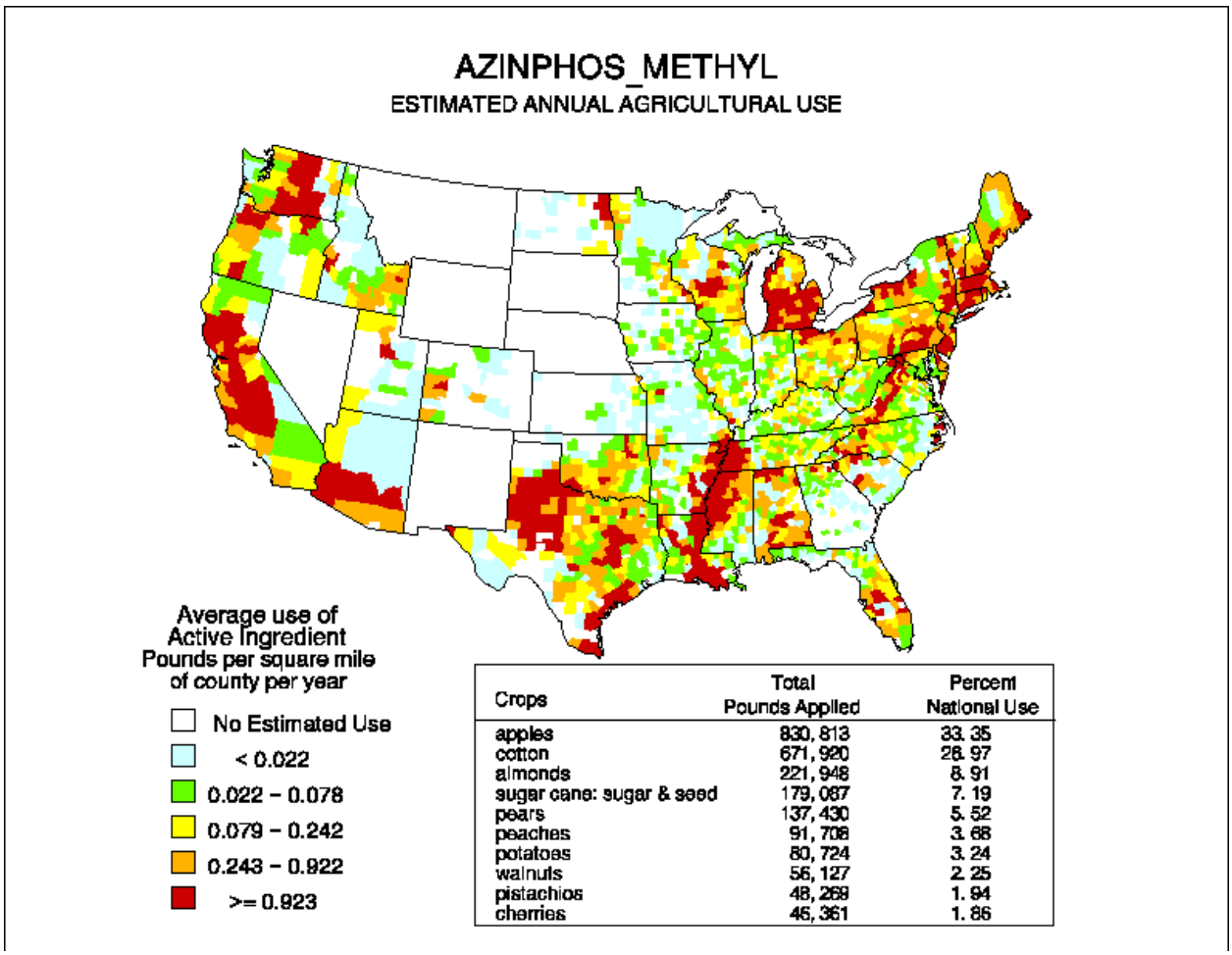

Figure 1. The estimated annual agricultural use of azinphos methyl in the United States (USGS, 1998).

Some statewide data are available for California and the Pacific Northwest states. The California Department of Pesticide Regulation (DPR) requires full pesticide-use reporting by all applicators except homeowners (www.cdpr.ca.gov/docs/pur/purmain.htm). Use of azinphos methyl in California has declined from nearly 475,00 lb ai in 1993 to about 160,000 lb ai in 2001 (Table 5). Usage by crop from 1999 to 2001 is provided in Table 6. Approximately 55% of the amount of azinphos methyl applied in 2001 was to almonds, with 17% applied to apples, 11% to pears, and 7% to walnuts. The DPR also provides county-level usage information, and that is tabulated in section "4" where we address the potential for exposure of individual salmon and steelhead ESUs.

Table 5. Reported pounds of azinphos methyl (active ingredient) used and acreage treated in California from 1993 to 2001 (source: California DPR Pesticide Use Report Data)

Usage	1993	1994	1995	1996	1997	1998	1999	2000	2001
Lb ai applied	474,748	418,935	406,230	406,099	336,353	193,069	216,624	185,055	159,688
Acres treated	324,769	293,466	274,347	277,745	233,406	134,334	140,226	118,805	117,484

Table 6. Major uses of azinphos methyl in California from 1999 to 2001 (source: California DPR Pesticide Use Report Data)

Use site	1999		2000		2001	
	lb ai applied	acres treated	lb ai applied	acres treated	lb ai applied	acres treated
Almonds	106,047	58,556	83,656	47,626	87,821	51,827
Apples	25,544	21,335	23,291	20,718	27,701	23,063
Pears	18,090	15,908	14,786	12,761	17,831	13,829
Walnuts	35,100	22,332	19,873	12,563	11,891	7592
Pistachios	20,605	11,887	34,624	16,569	8414	15,696
Peaches	1376	910	2094	1565	1637	1113
Plums	963	735	1521	1156	1298	1151
Quince	895	654	722	612	752	599
Nectarines	915	562	1598	1330	634	406
Cherries	1774	580	62	89	285	354
Brussel sprouts	750	1014	320	471	280	397
Potatoes	815	1086	895	1211	274	365
Others[a]	4838	5349	1615	2133	870	1092

[a] includes apricots, artichokes, broccoli, cauliflower, celery, Chinese cabbage, cotton, cucumbers, garlic, grapes, lemons, melons, onions, oranges, pomegranates, prunes, spinach, strawberries, tangerines, tomatoes

Usage information for Washington, Oregon, and Idaho was obtained from USDA's National Agricultural Statistics Service's Agricultural Chemical Usage report (www.usda.mannlib.cornell.edu/reports/nassr/other/pcu-bb/) and is presented in Table 7. Excluding the quarantine use on nursery stock for which we have no usage data, most use of azinphos methyl is in Washington (90%), and most use in Washington is on apples (85%). Maximum use on apples in Washington between 1990 and 2001 was in 1995 (474,400 lb ai) and the least was in 2001 (241,400 lb ai), indicating that use may be declining. Use also occurred on pears, sweet cherries, potatoes, and peaches. In Oregon, azinphos methyl is used mostly on pears and apples, with some use on sweet cherries, pears, potatoes, and caneberries. Potato is the only crop on which usage was reported in Idaho, where an average of 6% of the crop was treated during this period. However, revised labels will allow use on potatoes only in the Columbia River Basin in Washington and Oregon.

Table 7. Major crop uses of azinphos methyl in the Pacific Northwest states (source: USDA/NASS Database Agricultural Chemical Statistics). Crop acreage is based on 2002 data and azinphos methyl usage on data collected from 1990 to 2001.

Crop	crop acreage	% crop treated	avg lb ai/year	avg no. appl.	avg lb ai/acre/ appl.
Washington					
Apples	164,000	85	353,030	2.8	0.94
Pears	24,800	73	37,970	2.2	0.97
Sweet cherries	25,000	78	16,280	1.6	0.77
Potatoes	170,000	12	8200	1.3	0.36
Peaches	2800	46	1980	1.8	0.88
Oregon					
Pears	17,000	69	22,100	1.9	0.96
Apples	8700	78	15,750	2.6	0.88
Potatoes	50,000	10	2000	1.3	0.32
Sweet cherries	12,000	12	1180	1.1	0.75
Raspberries	3600	13	500	1.0	0.76
Blackberries	5980	15	360	1.1	0.39
Idaho					
Potatoes	375,000	6	6000	1.0	0.27

a. Aquatic toxicity of azinphos methyl

The acute toxicity data for freshwater and estuarine fish indicate that technical-grade azinphos methyl is very highly toxic to most fish species, including salmonids and trout (Table 8). Toxicity data are primarily derived from EFED's Environmental Risk Assessment (EFED ERA, included as attachment 5). The most sensitive fish species tested was the brook trout (LC50 = 1.2 ppb). Catfish and bullheads were somewhat less sensitive than the other species tested. Testing for some species was done at different temperatures and pH, and the range of toxicity is provided for those tests. Additional testing with sheepshead minnow, rainbow trout and bluegill demonstrate that the various formulations tested (22% and 50% ai) also are very highly toxic. These data, along with the *Daphnia magna* and mysid shrimp data in table 11, indicate that the inert and other ingredients in the tested formulations do not add to the toxicity of the azinphos methyl active ingredient. The sheepshead minnow test with the formulated product has a somewhat lower LC50 than with the technical, but this is within normal intertest variation.

Table 8. Acute toxicity of azinphos methyl to freshwater and estuarine fish (source: EFED environmental risk assessment and toxicity database)

Species	Scientific name	% ai	96-h LC50 (ppb)	Toxicity Category
Freshwater species:				
Rainbow trout	*Oncorhynchus mykiss*	93	2.9-7.1 (3 tests)	very highly toxic
		50WP	8.8	very highly toxic
		22 (Guthion 2S)	28	very highly toxic
Bluegill sunfish	*Lepomis macrochirus*	93	4.1-34 (7 tests)	very highly toxic
		22 (Guthion 2S)	40	very highly toxic
Atlantic salmon	*Salmo salar*	93	2.1-3.6 and >15 (8 tests) 1.8-18 (yolk-sac fry; 5 tests)	very highly toxic
Northern pike	*Esox lucius*	93	0.36 (yolk-sac fry)	very highly toxic
Coho Salmon	*Oncorhynchus kisutch*	93	3.2-6.1 (4 tests)	very highly toxic
Brown trout	*Salmo trutta*	93	3.5-6.6 (6 tests)	very highly toxic

Species	Scientific name	% ai	96-h LC50 (ppb)	Toxicity Category
Brook trout	*Salvelinus fontinalis*	93	1.2	very highly toxic
Yellow perch	*Perca flavescens*	93	2.4-40 (13 tests)	very highly toxic
		93 aged 0 days[a]	10	very highly toxic
		93 aged 7 days[a]	24	very highly toxic
		93 aged 14 days[a]	20	very highly toxic
		93 aged 21 days[a]	33	very highly toxic
Black crappie	*Pomoxis nigromaculatus*	93	3	very highly toxic
Largemouth bass	*Micropterus salmoides*	93	4.8	very highly toxic
Green sunfish	*Lepomis cyanellus*	93	52	very highly toxic
Carp	*Cyprinus carpio*	93	695	highly toxic
Fathead minnow	*Pimephales promelas*	93	148 and 293 (2 tests)	highly toxic highly toxic
Golden orfe	*Leuciscus idus*	92.6	120	highly toxic
Channel catfish	*Ictalarus punctatus*	93	3290	moderately toxic
Black Bullhead	*Ictalurus melas*	93	3500-4810 (3 tests)	moderately toxic
Estuarine species:				
Sheepshead minnow	*Cyprinodon variegatus*	88.8	2.7	very highly toxic
		22 Guthion 2L	1.86	very highly toxic
Striped mullet	*Mugil cephalus*	96	3.2 (48 h)	very highly toxic
Spot	*Leiostomus xanthurus*	96	28 (48 h)	very highly toxic

[a] Mayer and Ellersieck (1986) report on test data for azinphos methyl using aged test solutions. The use of aged test solutions is intended to determine toxicity after a period of time in which loss of the parent pesticide may occur. There is no differentiation between chemical degradation, physical removal (e.g., volatilization), or even biological inactivation, but such tests can indicate whether toxicity increases, decreases, or is stable over time. The data for azinphos methyl indicate that toxicity decreases a small amount over time, indicating that no quick-forming degradates are of toxicological importance relative to the parent azinphos methyl.

Azinphos methyl also has displayed chronic effects on freshwater and estuarine fish. Endpoints affected at concentrations ranging from 0.4 to 0.98 ppb include growth, survival, and hatchling success of second-generation embryos (Table 9).

Table 9. Chronic toxicity of azinphos methyl to freshwater and estuarine fish (source: EFED environmental risk assessment and toxicity database)

Species	Scientific name	test duration (days)	% ai	Endpoints affected	NOEC (ppb)	LOEC (ppb)
Rainbow trout	*Oncorhynchus mykiss*	85	88.8	survival and growth	0.23	0.98
		47	87.3	weight	<0.29	<0.47
Sheepshead minnow	*Cyprinodon variegatus*	113	92.5	survival and hatchling success of 2nd generation embryos	0.2	0.4

The acute toxicity data for freshwater and estuarine invertebrates indicate that technical-grade azinphos methyl is very highly toxic to most species (Table 10). Additional testing with the water flea demonstrates that the formulation tested (50% ai) also is very highly toxic. However, that formulation is not more toxic than the active ingredient alone.

Table 10. Acute toxicity of azinphos methyl to freshwater and estuarine aquatic invertebrates (source: EFED environmental risk assessment and toxicity database)

Species	Scientific name	% ai	48- or 96-h EC50 (ppb)	Toxicity Category
Freshwater species:				
Water flea	*Daphnia magna*	90.6	1.1[a]	very highly toxic
		50	4.8[a]	very highly toxic
Scud	*Gammarus fasciatus*	93	0.16-0.25[a] (2 tests)	very highly toxic
Sowbug	*Asellus brevicaudus*	93	21[b]	very highly toxic
Crayfish	*Procambarus* sp.	93	56[b]	very highly toxic
Glass shrimp	*Palaemonetes kadiakemsis*	93	1.2[b]	very highly toxic
Stonefly	*Pteronarcys californica*	93	1.9[b]	very highly toxic
Estuarine species:				
Brown Shrimp	*Penaeus aztecus*	96	2.4[a]	very highly toxic

Species	Scientific name	% ai	48- or 96-h EC50 (ppb)	Toxicity Category
Mysid	*Mysidopsis bahia*	88.8	0.21[a]	very highly toxic
		22 Guthion 2L	0.26[a]	very highly toxic
Mysid	*Mysidopsis bahia*	88.8	0.21[a]	very highly toxic
Blue Crab	*Callinectes sapidus*	96	320[a]	highly toxic
Eastern Oyster	*Crassostrea virginica*	96	1000[b]	highly toxic
		88.8	>3100[b]	not determined

[a] 48-h test
[b] 96-h test

Chronic testing for aquatic invertebrates has been done only with the water flea. Adverse effects on reproduction and survival were reported at an exposure concentration of 0.4 ppb (Table 11).

Table 11. Chronic toxicity of azinphos methyl to freshwater invertebrates (source: EFED environmental risk assessment and toxicity database)

Species	Scientific name	test duration (days)	% ai	Endpoints affected	NOEC (ppb)	LOEC (ppb)
Water flea	*Daphnia magna*	21	99.6	reproduction and survival	0.25	0.4

Additional toxicity information

We also searched the USEPA/ORD/NHEERL ECOTOX: Ecotoxicity database (www.epa.gov/ecotox) for any additional data to characterize the acute toxicity of azinphos methyl to fish (Table 11). Many of the toxicity values in this database, such as those cited as EPA/OPP, Mayer and Ellersieck 1986, and Johnson and Finley 1980, also are contained in EFED's ecotoxicity database and were presented in Table 8. Those values are not repeated here. Values for most fish species are consistent with those presented in Table 8 and indicate that azinphos methyl is very highly toxic to most species of fish that have been tested. Catfish, however, do seem to be less sensitive than other fish (Table 8).

Table 11. Acute toxicity of azinphos methyl to fish (source: ECOTOX: Ecotoxicity database)

Species	Scientific name	test material (Active or Formulation)[a]	96-h LC50 (ppb)
Coho salmon	*Oncorhynchus kisutch*	A	17
		F	4.2
Rainbow trout	*Oncorhynchus mykiss*	A	4.3-14 (3 tests)
		F	3.2-7.1 (5 tests)
Bluegill	*Lepomis macrochirus*	A	2.2-22 (3 tests)
		F	4.2-32 and 120 (10 tests)
Sheepshead minnow	*Cyprinodon variegatus*	A	2.0
Western mosquitofish	*Gambusia affinis*	F	68-78 (2 tests)
Threespine stickleback	*Gasterosteus aculeatus*	F	4.8-12.1 (2 tests)
Red drum	*Sciaenops ocellatus*	F	6.2-7.1 (2 tests)
Fathead minnow	*Pimephales promelas*	A	64-3260 (23 tests)
		F	37-920 (11 tests)

[a] the ECOTOX database is not always reliable regarding the test being with the formulation or the active ingredient; unless the test indicates an active ingredient, it is inputted into ECOTOX as formulation testing. However, we have seen values reported for the technical material in Mayer & Ellersieck (1986) to be reported in ECOTOX as a formulation test We report the information on formulation versus active ingredient, but we need to note that it is not completely reliable.

b. Environmental fate and transport

Azinphos methyl is mobile and has a high potential to reach surface water through spray drift and via the dissolved phase of runoff. It is not likely to leach to ground water except in areas of high recharge, such as karst terrain. Azinphos methyl is moderately persistent at acid and neutral pH but is hydrolyzed fairly rapidly at high pH. It degrades rapidly by direct aqueous photolysis but rather slowly by soil photolysis. A major route of dissipation for azinphos-methyl is foliar degradation and wash off. The environmental fate characteristics for azinphos methyl are listed below.

Parameter		Value
Molecular mass		317.32 g • mol^{-1}
Water solubility		25.10 ppm at 25° C
Vapor pressure		2.20 x 10^{-7} torr
Henry's law constant		3.66 x 10^{-9} m^3•mol^{-1}
Octanol/Water partition		K_{ow} = 543
Hydrolysis ($t_{1/2}$)	pH 5	38 days
	pH 7	37 days
	pH 9	6.9 days
Aqueous photolysis ($t_{½}$)		76.7 hours
Soil photolysis		180 days
Aerobic soil metabolism ($t_{½}$)		27 days - sandy loam soil
Anaerobic soil metabolism ($t_{½}$)		66 days
Aerobic aquatic metabolism ($t_{½}$)		no acceptable data

Azinphos methyl degradates include anthranilic acid, methyl anthranilate, azinphos methyl oxygen analog, mercaptomethyl benzazimide, hydroxymethyl benzazimide, benzazamide, and *bis*-methyl benzazamide sulfide, and methyl benzazimide sulfonic acid. Because of the limited concentrations of the identified degradates and their properties, EFED's environmental risk assessment was based solely on the parent material.

c. Incidents

OPP maintains two databases of reported incidents. The Ecological Incident Information System (EIIS) contains 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 database 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).

The Agency is aware of 256 incidents associated with the use of azinphos methyl prior to 2000. Of these, exposure to azinphos methyl was considered "highly probable" or "probable" for 143 incidents not attributed to misuse of the pesticide. Azinphos methyl is responsible for more than 21% of all reported aquatic incidents in the EIIS. Many of these incidents were associated with the use of azinphos methyl on cotton (77 incidents) and sugar cane (37 incidents). Another 15 incidents in Louisiana were unclassified or classified as "agricultural" and may have been associated with one of these two use patterns. Of the remaining incidents, 1 is associated with apples (MO), 1 with citrus (FL), 3 with potatoes (ME), and 1 with peaches

(MO). The details of individual incidents, including state and use site, date, fish species and numbers killed, and residue analysis of tissue and water samples are provided in Appendix I of EFED's Environmental Risk Assessment for Azinphos Methyl.

There are also 7 incidents that are unclassified or classified as "orchard" in New York (2), Washington (1), Wisconsin (1), North Carolina (1), Maine (1), and Michigan (1). Incidents in which there is less certainty include an almond incident (CA), a second apple incident (NC), 1 blueberry incident (ME), 1 forestry incident (AR), and one nursery incident (GA). Azinphos methyl fish incidents as a result of orchard applications have occurred in California (2 fish kills one with 3000 fish), Missouri (1 fish kill with 325 fish), New York (2 fish kills), Washington (1 fish kill) and Florida (1 fish kill with 1500 fish).

The Agency is aware of three additional incidents since EFED's risk assessment was written in 1999. Two of those incidents involved fish. Bayer reported an incident in Muskegon, Michigan in 2000 in which an aerial application of azinphos methyl resulted in a large fish kill in a 0.5- to 0.75-acre pond. More than 1000 bluegill were reported dead. No residue analysis was conducted. A faulty spray nozzle was blamed for the incident. Another incident occurred in 2003 at Parker Mills Pond in Massachusetts and was reported to have been the second fish kill there in a month. More than 1000 fish were affected. Analysis of pond water detected both azinphos methyl and chlorpyrifos, both of which apparently had been applied in adjacent cranberry bogs.

d. Estimated and actual concentrations of azinphos methyl in surface waters

Estimated environmental concentrations (EECs)

In the environmental risk assessment, EFED modeled aquatic EECs for several sites using PRZM/EXAMS scenarios (Table 12). Some EECs are generated from scenarios in eastern or north central states and most are based on maximum application rates that exceed the current rates. However, we will consider this qualitatively when evaluating the RQs and our risk conclusions for listed salmonids and steelhead.

Table 12. Estimated environmental concentrations of azinphos methyl in surface waters as predicted from PRZM/EXAMS (source: EFED environmental risk assessment)

Use site	appl. rate (lb ai/acre)	max. no. appl.	appl. interval (days)	EECs (ppb)		
				max..	21-day avg.	60-day avg.
Almonds (CA)	2.0	2	30	8.3	6.2	4.8
Apples (NY/OR)	1.5	4	7	13.9	11.0	9.0
Cherries (MI)	0.75	2	14	10.7	8.3	6.7
Potatoes (ME)				13.6	10.4	7.6

Use site	appl. rate (lb ai/acre)	max. no. appl.	appl. interval (days)	EECs (ppb)		
Peaches (GA)	2	4	14	40.6	33.5	25.5
Pears (OR)	1.5	4	7	8.9	6.8	4.9
Walnuts (OR)	2	3	14	12.0	9.1	7.3

Measured Concentrations in Surface Water

NAWQA: The United States Geologic Survey has analyzed for azinphos methyl in up to 40 basins from 1993 to 1997. In an overview based on 5133 samples, there were 164 detections (3.2% frequency of detection). These samples were collected from 760 unique stations in 14 states. States with the largest number of detectable levels were California (69), Washington (27), Pennsylvania (21), and Oregon (5). The maximum level detected in any sample was 1 ppb from a site in the San Joaquin-Tulare Basin. These data indicate that azinphos methyl is reaching surface waters. However, because many concentrations were estimated and analytical recovery was low, the data do not provide a good quantitative estimate of azinphos methyl in surface water. Two the NAWQA sites with highest azinphos methyl usage are the Columbia Plateau in Washington and the San Joaquin-Tulare Basin in California.

Central Columbia Plateau. The Central Columbia Plateau is a prominent apple growing region. Based on 1992 National Agricultural Statistics Service data, this NAWQA unit had the second highest azinphos methyl usage among the 20 NAWQA units initiated in 1991 and eighth among all 60 NAWQA study units. There were 40 sampling sites for surface water on the Central Columbia Plateau with detections at seven of the sites or 17.5% of the sites. The maximum value found in the Central Columbia Plateau was 0.20 ppb.

San Joaquin-Tulare Basin. The San Joaquin-Tulare Study Unit is used to grow a number of different orchard crops on which azinphos methyl is used. Based on 1992 USDA/NASS data, this NAWQA unit had the highest azinphos methyl usage among the 20 NAWQA units initiated in 1991 and was second among all 60 NAWQA study units. There were 40 different sites sampled in the San Joaquin-Tulare Basin. Nine sites (22.5%) had at least one detect. The Spanish Grant Combined Drain near Patterson, California had the highest detect (1 ppb) of any NAWQA site. This area was monitored prior to the development of California's interim measures county bulletins. Theoretically, these bulletins would have resulted in a buffer of 40 yards for ground applications, and a buffer of 200 yards for aerial applications when the wind is blowing towards the water.

STORET: U.S. EPA's Office of Water maintains the STORET database. These data serve as an indicator of potential presence of pesticide in water. However, STORET data are highly variable in quality, depending on how and why the data was generated. A major concern for pesticides is that measurements are often made at places and times when the chemical would not be expected to be present. Detects of azinphos methyl in several different kinds of water

bodies from STORET are presented in Table 13. Fifteen out of 1123 samples at 653 sites had detectable levels of azinphos methyl. The maximum detection was 3 ppb.

Table 13. Measurements of azinphos methyl in surface waters in the STORET database (source: EFED environmental risk assessment)

Water body	no. sites sampled	total no. samples	no. detects	maximum detected (ppb)	sampling dates
Canals	63	289	3	0.01	1974-1993
Estuaries	162	185	2	3	1969-1997
Lakes	242	406	1	0.01	1974-1996
Ocean	6	16	0	n/a	1980-1985
Reservoirs	57	91	9	0.01	1975-1995
Springs	123	136	0	0.5	1987-1996

e. Changes in registration status

As noted, a number of azinphos methyl uses are being canceled or will be phased out in 2005 as a result of the "Agreement Between the Environmental Protection Agency and the Registrants of Pesticide Products Containing Azinphos Methyl". Those uses were specified in section "2" of this assessment. In addition, the following labeling changes are required for each use site:

Almonds, Walnuts, Pistachios:

- a maximum of 1 application of 2.0 lbs ai/acre
- aerial application is prohibited
- application during the dormant period is prohibited
- for airblast applications, outward pointing nozzles must be turned off at row ends and when spraying the outer two rows.

Apples, Crabapples

- a maximum single application rate of 1.0 lb ai/acre (or 1.5 lbs ai/acre in conjunction with an IPM program) and 4.0 lbs ai/acre per year west of the Mississippi
- a 7-day application interval

- aerial application is prohibited
- dormant use is prohibited
- for airblast applications, outward pointing nozzles must be turned off at row ends and when spraying the outer two rows.

Pears

- a maximum of 2 applications and 2.5 lbs ai/acre per year
- a maximum single application rate of 1.0 lbs ai/acre (or 1.5 lbs ai/A in conjunction with an IPM program)
- a 7-day application interval
- aerial application is prohibited
- dormant use is prohibited
- for airblast applications, outward pointing nozzles must be turned off at row ends and when spraying the outer two rows.

Peaches and Nectarines (due for phase-out in 2005)

- limited to 2 applications of 1.125 lbs ai/acre per season
- minimum of 14 days between applications
- aerial application is prohibited
- dormant use is prohibited
- for airblast applications, outward pointing nozzles must be turned off at row ends and when spraying the outer two rows.

Cherries

- limited to 2 applications of 0.75 lbs ai/acre per year
- a 14-day application interval
- aerial application is prohibited
- dormant use is prohibited
- for airblast applications, outward pointing nozzles must be turned off at row ends and when spraying the outer two rows

Cranberries (due for phase-out in 2005)

- limited to 2 applications of 1.0 lb ai/acre per year
- minimum of 14 days between applications

Caneberries (due for phase-out in 2005)

- application is restricted to canes and soil and only for control of raspberry crown borer
- maximum label rate is 2 applications of 0.5 lbs ai/acre
- a 10-day application interval

Brussels sprouts

- limited to 1 application of 0.75 lbs ai/acre per year
- restricted to soil application at transplant and only for control of cabbage root maggot

Nursery stock

- limited to quarantine use only
- limited to 4 applications at 1.0 lb ai/acre
- a 10-day application interval
- aerial application is prohibited
- dormant use is prohibited
- for airblast applications, outward pointing nozzles must be turned off at row ends and when spraying the outer two rows

Potatoes (due for phase-out in 2005)

- limited to 2 applications at 0.75 lb ai/acre
- a 7-day application interval

f. General risk conclusions

According to EFED's environmental risk assessment of 1999, azinphos methyl poses high acute and chronic risks to fish and aquatic invertebrates. Based on the most sensitive species and aquatic EECs determined from PRZM/EXAMS, LOCs for endangered freshwater fish and invertebrates are exceeded for all use sites (Table 14).

Table 14. Acute and Chronic Risk Quotients for Freshwater and Estuarine Fish and Aquatic Invertebrates, Based on Toxicity for the Most Sensitive Test Species and EECs Modeled from PRZM/EXAMS

Use site	freshwater fish[a]	estuarine fish[b]	freshwater invertebrates[c]	estuarine invertebrates[d]
Acute RQs[e]				
Apples, Crabapples	3.3-11.5	5.1	12.3-86	66
Pears	2.1-7.4	3.3	7.8-55	42
Almonds	1.9-6.9	3.0	7.0-51	38
Walnuts	2.9-10	4.4	10.6-75	57
Cotton	11.9-73	18-32	43-548	232-418
Cherries	2.6-8.9	3.9	9.2-66	50

Use site	freshwater fish[a]	estuarine fish[b]	freshwater invertebrates[c]	estuarine invertebrates[d]
Peaches	9.9-33	15	35.9-253	193
Chronic RQs[f]				
Apples, Crabapples	39	38	44	no data
Pears	21	24	27	
Almonds	20	19	24	
Walnuts	31	31	36	
Cotton	119-215	109-202	162-276	
Cherries	29	28	33	
Peaches	110	106	134	

[a] based on LC50s for the brook trout (1.2 ppb), rainbow trout (2.9 ppb), and bluegill (4.1 ppb) and NOEC of 0.23 ppb for the rainbow trout

[b] based on the LC50 for the sheepshead minnow (2.7 ppb) and NOEC of 0.2 ppb

[c] based on EC50s for the water flea (1.13 ppb) and scud (0.16 ppb) and NOEC of 0.25 ppb for the water flea

[d] based on the LC50 for the mysid (0.21 ppb)

[e] peak EEC/LC50 or EC50; acute LOC is 0.05 for endangered fish and 0.5 for aquatic-invertebrate populations; EECs are provided in Table 12

[f] 60-day-average EEC for fish and 21-day-average EEC for invertebrates; chronic LOC is 1 for endangered fish and aquatic-invertebrate populations

We note that these RQs may be high, because application rates will decline for most uses in response to the mitigation measures stipulated in the IRED. However, azinphos methyl is very highly toxic to fish (brook trout LC50 = 1.2 ppb) and any EEC >0.06 ppb will exceed the LOC for endangered fish. Therefore, almost any runoff and/or drift into surface waters inhabited by listed salmonids and steelhead will pose an acute risk. Chronic risk also is a concern in standing waters adjacent to use sites with multiple applications or where toxic degradates may persist after the parent material has degraded. Aquatic invertebrates also are at risk, but we presume that listed salmonids and steelhead are at more risk from direct exposure than from possible adverse impacts of azinphos methyl on their food resources.

As previously noted in section “c.”, a number of fish kills have been associated with the use of azinphos-methyl on some crops. The majority of the fish-kill incidents were related to applications of azinphos methyl on sugarcane and cotton and were probably due to the proximity of these crops to water and to the intense and frequent rainfalls in the use areas. Use on sugarcane was canceled in 1999, and use on cotton has been limited to only Texas and Missouri.

A study by Crabtree et al. (1997) focused on GIS mapping of the proximity of apples to aquatic habitat in apple growing regions that appeared vulnerable to pesticide contamination of surface water. These regions were in the area of Brewster and Lake Chelan in Washington as well as areas in Michigan and New York. They concluded that in Washington, where 3% of the

land area was in apple orchards, less than 1% of the apple acreage was found directly adjacent to surface water ("directly adjacent" was apparently defined as orchard trees being within 10 m of a water body). However, 55% of the total apple acreage was within 400 m of flowing water and an additional 5% was within 400 m of a static water body.

The registrant also conducted a study to determine the proximity of almond orchards to surface waters in California. The study included both Tier 2 and GIS modeling and was based on information for Kern County. Very little naturally flowing water, mainly irrigation canals, is found in Kern County, and only 1.1% of the almond orchards were located within 400 ft of standing surface waters. The one in ten year annual peak EEC in the study was 7.5 ppb, which is comparable to EFED's predicted maximum EEC of 8.3 ppb for almonds (Table 12). The values are similar because the EEC is dominated by spray drift, which was estimated by the same method in both cases.

g. Existing protective measures

Nationally, there are no specific protective measures for endangered and threatened species beyond the generic statements on the product labels. As stated on all pesticide labels, "It is a violation of Federal law to use a product in a manner inconsistent with its labeling." FIFRA section 3 labels for azinphos methyl are currently being revised and will contain the following "Environmental Hazards" statements:

> "This pesticide is extremely toxic to fish and wildlife. For terrestrial uses, do not apply directly to water or to areas where surface water is present or to intertidal areas below the mean high-water mark. Do not contaminate water when disposing of equipment washwater or rinsate. Drift and runoff may be hazardous to aquatic organisms in neighboring areas."
>
> "This product is highly toxic to bees exposed directly to treatment of residues on crops. Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area. Protective information may be obtained from your cooperative Agricultural Extension Service."
>
> "This chemical can contaminate surface water through spray applications. Under some conditions, it may also have a high potential for runoff into surface water after application. These include poorly draining or wet soils with readily visible slopes toward adjacent surface waters, frequently flooded areas, areas overlaying extremely shallow ground water, areas with in-field canals or ditches that drain to surface water, areas not separated from adjacent surface waters with vegetated filter strips, and areas over-laying tile drainage systems that drain to surface water."

Azinphos methyl products are classified as "restricted use". Therefore, they are for retail sale to and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's Certification.

Revised labels also will have no-spray buffers between treatment sites and permanent surface waters. For ground applications, buffers will be 25 feet. For aerial applications to potatoes and cranberries, buffers are 150 feet and 50 feet, respectively.

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. 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. The California Department of Pesticide Regulation (DPR), California Environmental Protection Agency, also creates county bulletins consistent with those developed by OPP. Azinphos methyl is addressed in these bulletins. California also has a system of County Agricultural Commissioners form whom commercial applicators must obtain a permit before using any restricted use pesticide. Before issuing a permit, the County Commissioner may require that applicators adhere to the use limitations in the California county bulletins. The DPR believes that the vast majority of agricultural applicators in California follow the use limitations in these bulletins (Richard Marovich, Endangered Species Project, DPR, telephone communication, July 19, 2002). Those that apply to azinphos methyl are as follows:

> "Do not use in currently occupied habitat (see Species Descriptions for possible exceptions)."
>
> "For sprayable or dust formulations: when the air is calm or moving away from habitat, commence applications on the side nearest the habitat and proceed away from the habitat. When air currents are moving toward habitat, do not make applications within 200 yards by air or 40 yards by ground upwind from occupied habitat. The county agricultural commissioner may reduce or waive buffer zones following a site inspection, if there is an adequate hedgerow, windbreak, riparian corridor or other physical barrier that substantially reduces the probability of drift."
>
> "Provide a 20 foot minimum strip of vegetation (on which pesticides should not be applied) along rivers, creeks, streams, wetlands, vernal pools and stock ponds or on the downhill side of fields where run-off could occur. Prepare land around fields to contain run-off by proper leveling, etc. Contain as much water "on-site" as possible. The planting of legumes, or other cover crops for several rows adjacent to off-target water sites is recommended. Mix pesticides in areas not prone to run-off such as concrete mixing/loading pads, disked soil in flat terrain or graveled mix pads, or use a suitable method to contain spills and/or rinsate. Properly empty and triple-rinse pesticide containers at time of use."
>
> "Conduct irrigations efficiently to prevent excessive loss of irrigation waters through run-off. Schedule irrigations and pesticide applications to maximize the interval of time between the pesticide application and the first subsequent irrigation. Allow at least 24 hours between application of pesticides listed in this bulletin and any irrigation that results in surface run-off into natural waters. Time applications to allow sprays to dry

prior to rain or sprinkler irrigations. Do not make aerial applications while irrigation water is on the field unless surface run-off is contained for 72 hours following the application."

Requirements for a no-spray buffer between treatment sites and surface waters and the California DPR's requirement for a vegetative filter strip should reduce exposure of aquatic organisms. However, we need to confer with NMFS to determine if these requirements are sufficient to mitigate risks to listed steelhead and salmon in California.

4. Listed salmon and steelhead ESUs and comparison with azinphos methyl use areas

In this section we present available information on the listed Pacific salmon and steelhead ESUs and evaluate potential exposure and risk based on known or potential use of azinphos methyl in each ESU. Our information on the various ESUs is taken almost entirely from various Federal Register Notices relating to listing, critical habitat, or status reviews. Azinphos methyl usage data for California was obtained from the DPR's 2001 Pesticide Use Summary Report Data, which provides county-level data for individual use sites. Statewide data for crops treated with azinphos methyl in the Pacific Northwest states are based on USDA/NASS (Table 7). Crop acreage for individual counties in those states was obtained from the 1997 Agricultural Census.

Separate from this or other pesticide-specific requests for consultation, OPP is preparing an analysis of the locations of the various salmon and steelhead ESUs. We will be requesting comments, modifications, and/or concurrence from NMFS on these locations. Most of the differences that we perceive may result from this analysis are either (1) on the fringes of various ESU ranges, or (2) reductions in what we consider current habitat. As a result, any changes in the locations seem unlikely to result in more risk than we have projected. It is our position that any changes resulting from this location review will be applied not only to azinphos-methyl, but also to previous consultation requests. And any changes will be incorporated into consultation packages following NMFS response.

A. Steelhead

Steelhead, *Oncorhyncus 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.

1. Southern California Steelhead ESU

The Southern California steelhead ESU was proposed for listing as endangered on August 9, 1996 (61FR41541-41561) and the listing was made final a year later (62FR43937-43954, August 18, 1997). Critical Habitat was proposed February 5, 1999 (64FR5740-5754) and designated on February 16, 2000 (65FR7764-7787). This ESU ranges from the Santa Maria River in San Luis Obispo County south to San Mateo Creek in San Diego County. Steelhead from this ESU may also occur in Santa Barbara, Ventura and Los Angeles counties, but this ESU apparently is no longer considered to be extant in Orange County (65FR79328-79336, December 19, 2000). 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 in Ventura, Santa Barbara, and San Luis Obispo counties.

Usage of azinphos methyl in 2001 in counties where this ESU occurs is presented in Table 15.

Table 15. Use of azinphos methyl in 2001 in counties within the Southern California steelhead ESU

County	use site	azinphos methyl usage (lb ai)	acres treated
San Diego	***tomatoes***[a]	223	345
Los Angeles	apples pears	38 22	38 17
Riverside	apples	2	15
Ventura	lemons[b]	120	60
San Luis Obispo	apples ***broccoli***	751 100	507 133
Santa Barbara	*potatoes*	274	365

[a] uses marked in bold italics are being canceled in 2003, although some use of existing stocks may occur
[b] not a currently registered use, but might have been used under an existing-stocks provision

We conclude that use of azinphos methyl may affect the Southern California steelhead ESU. Usage is low in most counties, but azinphos methyl poses a direct acute risk to endangered fish at very low concentrations. Where there are repeated applications, there is also a high potential for chronic risk. However, usage is low enough that while there is definite risk, it appears that azinphos methyl would not be used widely enough to jeopardize this ESU.

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 are agricultural areas in these counties, and these areas would be drained by waters where steelhead critical habitat occurs.

Table 16 shows azinphos methyl usage in 2001 in those counties where this ESU occurs.

Table 16. Use of azinphos methyl in 2001 in counties with the South Central California steelhead ESU

County	use site	azinphos methyl usage (lb ai)	acres treated
Santa Cruz	Brussels sprouts	183	263
Santa Clara	pears	4	6
	onions	15	20
	Chinese cabbage	4	5
San Benito	apples	105	100
	celery	15	30
Monterey	apples	50	35
	cauliflower	93	135
	broccoli	31	43
San Luis Obispo	apples	751	507
	broccoli	100	133

[a] uses marked in bold italics were voluntarily canceled in mid-2003, although some use of existing stocks may occur

We conclude that use of azinphos methyl may affect the South Central California steelhead ESU, especially in San Luis Obispo Co. Azinphos methyl poses a direct acute risk to endangered fish at very low concentrations. Where there are repeated applications, there is also a high potential for chronic risk. However, usage is low enough that while there is definite risk, it appears that azinphos methyl would not be used widely enough to jeopardize this ESU.

3. Central California Coast Steelhead ESU

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

Only winter steelhead are found in this ESU and those to the south. River entry ranges from October in the larger basins, late November in the smaller coastal basins, and continues

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

Usage of azinphos methyl in 2001 in counties in the Central California coast steelhead ESU is presented in Table 17.

Table 17. Use of azinphos methyl in 2001 in counties with the Central California Coast steelhead ESU

County	use site	azinphos methyl usage (lb ai)	acres treated
Santa Cruz	Brussels sprouts	183	263
San Mateo	Brussels sprouts	98	134
San Francisco		0	0
Marin		0	0
Sonoma	apples	57	40
Mendocino	pears apples	1403 107	985 104
Napa		0	0
Alameda		0	0
Contra Costa	apples *walnuts*[a] pears	3223 188 71	2618 149 47
Solano	pears apples *almonds*[a]	1192 145 24	1118 145 48
Santa Clara	pears ***onions*** ***Chinese cabbage***	4 15 4	6 20 5

[a] uses marked in bold italics were voluntarily canceled in mid-2003, although some use of existing stocks may occur; uses marked in italics will be phased out nationwide in 2005

We conclude that use of azinphos methyl may affect the Central California Coast steelhead ESU. There is considerable use of azinphos methyl in Contra Costa, Mendocino, and Solano counties within this ESU. Azinphos methyl poses a direct acute risk to endangered fish at very low concentrations. Where there are repeated applications, there is also a high potential for chronic risk.

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 azinphos methyl in 2001 in this ESU is provided in Table 18.

Table 18. Use of azinphos methyl in 2001 in counties with the California Central Valley steelhead ESU

County	use site	azinphos methyl usage (lb ai)	acres treated
Alameda		0	0
Amador		0	0
Butte	*almonds*[a]	2690	1458
	walnuts	1172	619
	apples	115	260
	prunes	45	102
Calaveras		0	0
Colusa	*almonds*	2641	1924
	pears	53	35
Contra Costa	apples	3223	2618
	walnuts	188	149
	pears	71	47

County	use site	azinphos methyl usage (lb ai)	acres treated
Glenn	*almonds*	2267	1389
	walnuts	155	125
Marin		0	0
Merced	*almonds*	555	525
	pistachios	400	156
	apples	177	120
	walnuts	155	120
	pears	8	5
Nevada		0	0
Placer	apples	12	14
	pears	10	10
	peaches	10	13
Sacramento	pears	5300	4112
	apples	150	137
	onions	40	60
San Joaquin	apples	3456	3172
	walnuts	1770	1154
	pears	372	173
	cherries	18	10
San Mateo	Brussels sprouts	98	134
San Francisco		0	0
Shasta	apples	7	29
Solano	pears	1192	1118
	apples	145	145
	almonds	24	48
Sonoma	apples	57	40
Stanislaus	*almonds*	3886	2473
	walnuts	1556	1138
	apples	1266	1016
	peaches	10	5

County	use site	azinphos methyl usage (lb ai)	acres treated
Sutter	pears	561	538
	walnuts	448	334
	apples	126	125
Tehama	*almonds*	1177	813
	apples	5	10
Tuloumne		0	0
Yolo	pears	1016	769
	apples	199	159
	almonds	150	100
	walnuts	122	172
Yuba	pears	2662	2517
	almonds	388	269
	apples	21	21
	prunes	68	80

[a] uses marked in bold italics were voluntarily canceled in mid-2003, although some use of existing stocks may occur; uses marked in italics will be phased out nationwide in 2005

We conclude that use of azinphos methyl may affect the California Central Valley steelhead ESU. We make this determination based on the large amount of azinphos methyl applied to pears, apples, almonds, and walnuts in several counties in 2001. Azinphos methyl poses a direct acute risk to endangered fish at very low concentrations. Where there are repeated applications, there is also a high potential for chronic risk.

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.

Azinphos methyl use in 2001 in this ESU is presented in Table 19.

Table 19. Use of azinphos methyl in 2001 in counties with the Northern California steelhead ESU

County	use site	azinphos methyl usage (lb ai)	acres treated
Humboldt		0	0
Mendocino	pears	1403	985
	apples	107	104
Trinity		0	0
Lake	pears	4278	2722
	apples	103	123
	walnuts[a]	25	20
	grapes	28	19

[a] uses marked in bold italics were voluntarily canceled in mid-2003, although some use of existing stocks may occur; uses marked in italics will be phased out nationwide in 2005

We conclude that azinphos methyl may affect the Northern California steelhead ESU. We make this determination based mainly on the amount of azinphos methyl applied to pears in Lake and Mendocino counties. Azinphos methyl poses a direct acute risk to endangered fish at very low concentrations. Where there are repeated applications, there is also a high potential for chronic risk

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.

Cropping information for counties within this ESU is provided in Tables 20 and 21.

Table 20. Cropping information for Washington counties where there is spawning and growth of the Upper Columbia River steelhead ESU

State	county	cultivated cropland[a]	crop	crop acreage
WA	Benton	268,372	*potatoes*	25,317
			apples	18,425
			cherries	3219
			pears	472
			nursery crops	161
			peaches[b]	149
			nectarines	106
			English walnuts	41
WA	Franklin	291,696	*potatoes*	35,770
			apples	9000
			cherries	2165
			peaches	262
			pears	156
			nectarines	129
			raspberries	70
			nursery crops	*
			English walnuts	*
WA	Kittitas	57,456	apples	1859
			pears	331
			cherries	*
WA	Yakima	264,490	apples	75,264
			pears	10,190
			cherries	6129
			potatoes	1929
			peaches	1438
			nectarines	605
			nursery crops	408
			English walnuts	11
			raspberries	10

State	county	cultivated cropland[a]	crop	crop acreage
WA	Chelan	31,423	apples	17,096
			pears	8298
			cherries	3704
			nectarines	22
			peaches	21
			nursery crops	12
			English walnuts	*
WA	Douglas	217,703	apples	14,383
			cherries	1842
			pears	1104
			peaches	16
			nectarines	91
			nursery crops	7
WA	Okanogan	72,732	apples	24,164
			pears	3280
			cherries	1003
			peaches	67
			nectarines	38
			nursery crops	25
			English walnuts	29
WA	Grant	529,087	*potatoes*	44,263
			apples	33,615
			cherries	3470
			nursery crops	1562
			pears	998
			peaches	261
			nectarines	163
			English walnuts	5

[a] cultivated cropland includes all harvested acreage and all failed acreage
[b] uses marked in italics will be phased out nationwide in 2005
* USDA withheld acreage data because county acreage is limited to one or only a few farms

Table 21. Cropping information for Washington and Oregon counties that are migration corridors for the Upper Columbia River steelhead ESU

State	county	cultivated cropland[a]	crop	crop acreage
WA	Walla Walla	337,660	*potatoes*	9256
			apples	5222
			cherries	280
WA	Klickitat	93,193	pears	923
			apples	516
			cherries	457
			peaches	199
			English walnuts	*
WA	Skamania	1205+	pears	477
			apples	75
WA	Clark	27,860	raspberries	634
			nursery crops	122
			pears	75
			English walnuts[b]	51
			peaches	46
			apples	33
			blackberries	8
			cherries	*
WA	Cowlitz	8227+	raspberries	439
			nursery crops	54
			apples	14
			English walnuts	5
			pears	3
			cherries	2
WA	Wahkiakum	3515+		0
WA	Pacific	5451	*cranberries*	1312
			cherries	*
			nursery crops	*
OR	Gilliam	100,729+		0

State	county	cultivated cropland[a]	crop	crop acreage
OR	Umatilla	384,163	apples *caneberries* nursery crops cherries	3927 7 * *
OR	Sherman	127,018+		0
OR	Morrow	220,149 +		0
OR	Wasco	97,230	apples cherries	463 *
OR	Hood River	17,346+	apples nursery crops cherries	2592 * *
OR	Multnomah	14,692	nursery crops *caneberries* apples cherries *English walnuts*	2609 814 51 7 2
OR	Columbia	15,054+	apples *English walnuts* nursery crops cherries	39 11 * *
OR	Clatsop	4772	*cranberries* nursery crops	32 3

[a] cultivated cropland includes all harvested acreage and all failed acreage; failed cropland acreage is not reported for some counties due to privacy concerns when only a few farms report such acreage - we denote this acreage with a "+" in the cultivated cropland column in the relevant tables; such acreage typically is small and statewide accounts for only 0.7% of harvested cropland acreage in Washington, 3.7% in Oregon, and 3.2% in Idaho

[b] uses marked in italics will be phased out nationwide in 2005

* USDA withheld acreage data because county acreage is limited to one or only a few farms

We conclude that azinphos methyl may affect the Upper Columbia River steelhead ESU. This determination is made based on the high amount of crop acreage on which azinphos methyl can be used in this ESU, especially potatoes (until 2005), apples, and pears, and the acute risk of azinphos methyl to endangered fish. On a statewide basis for Oregon and Washington, over 69% of the substantial acreage of apples and pears are treated with azinphos methyl (Table 7). Azinphos methyl poses a direct acute risk to endangered fish at very low concentrations. Where there are repeated applications, there is also a high potential for chronic risk.

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. We 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 azinphos methyl use in agricultural areas. We have similarly excluded the Upper Grande Ronde watershed tributaries (e.g., Looking Glass and Cabin Creeks) that are barely into higher elevation forested areas of Umatilla County. 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. We have excluded these areas because they are not relevant to use of azinphos methyl. 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 we were 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.

Tables 22 and 23 provide the cultivated acreage for the Pacific Northwest counties encompassing spawning and rearing habitat of the Snake River Basin steelhead ESU and for the Oregon and Washington counties where this ESU migrates.

Table 22. Cropping information for Pacific Northwest counties which provide spawning and rearing habitat for the Snake River Basin steelhead ESU

State	county	cultivated cropland[a]	crop	crop acreage
ID	Adams	16,779		0
ID	Idaho	147,557	apples	6
ID	Nez Perce	168,365	*peaches*	22
ID	Custer	34,754		0
ID	Lemhi	41,837+	apples	6
ID	Valley	6990+		0
ID	Lewis	119,860		0
ID	Clearwater	24,266		0
ID	Latah	200,691	cherries	19
WA	Adams	392,556	*potatoes* apples cherries	27,914 345 *
WA	Asotin	32,892	apples *peaches*[b] cherries pears	24 18 17 6
WA	Garfield	108,553		0
WA	Columbia	97,743		0
WA	Whitman	804,893	apples pears cherries	19 2 *

State	county	cultivated cropland[a]	crop	crop acreage
WA	Franklin	291,696	*potatoes*	35,770
			apples	9000
			cherries	2165
			peaches	262
			pears	156
			nectarines	129
			raspberries	70
			nursery crops	*
			English walnuts	*
WA	Walla Walla	337,660	*potatoes*	9256
			apples	5222
			cherries	280
OR	Wallowa	54,138	apples	8
OR	Union	90.349	apples	39
			cherries	*

[a] cultivated cropland includes all harvested acreage and all failed acreage; failed cropland acreage is not reported for some counties due to privacy concerns when only a few farms report such acreage - we denote this acreage with a "+" in the cultivated cropland column in the relevant tables; such acreage typically is small and statewide accounts for only 0.7% of harvested cropland acreage in Washington, 3.7% in Oregon, and 3.2% in Idaho

[b] uses marked in italics will be phased out nationwide in 2005

* USDA withheld acreage data because county acreage is limited to one or only a few farms

Table 23. Cropping information for Washington and Oregon counties through which the Snake River Basin steelhead ESU migrates

State	county	cultivated acreage[a]	crop	crop acreage
WA	Benton	268,372	*potatoes*	25,317
			apples	18,425
			cherries	3219
			pears	472
			nursery crops	161
			peaches[b]	149
			nectarines	106
			English walnuts	41

State	county	cultivated acreage[a]	crop	crop acreage
WA	Klickitat	93,193	pears apples cherries *peaches* *English walnuts*	923 516 457 199 *
WA	Skamania	1205+	pears apples	477 75
WA	Clark	27,860	raspberries nursery crops pears *English walnuts*[b] *peaches* apples blackberries cherries	634 122 75 51 46 33 8 *
WA	Cowlitz	8227+	raspberries nursery crops apples *English walnuts* pears cherries	439 54 14 5 3 2
WA	Wahkiakum	3515+		0
WA	Pacific	5451	*cranberries* cherries nursery crops	1312 * *
OR	Umatilla	384,163	apples *caneberries* nursery crops cherries	3927 7 * *
OR	Morrow	220,149 +		0
OR	Gilliam	100,729+		0
OR	Sherman	127,018+		0
OR	Wasco	97,230	apples cherries	463 *

State	county	cultivated acreage[a]	crop	crop acreage
OR	Hood River	17,346+	apples nursery crops cherries	2592 * *
OR	Multnomah	14,692	nursery crops *caneberries* apples cherries *English walnuts*	2609 814 51 7 2
OR	Columbia	15,054+	apples *English walnuts* nursery crops cherries	39 11 * *
OR	Clatsop	4772	*cranberries* nursery crops	32 3

[a] cultivated cropland includes all harvested acreage and all failed acreage; failed cropland acreage is not reported for some counties due to privacy concerns when only a few farms report such acreage - we denote this acreage with a "+" in the cultivated cropland column in the relevant tables; such acreage typically is small and statewide accounts for only 0.7% of harvested cropland acreage in Washington, 3.7% in Oregon, and 3.2% in Idaho

[b] uses marked in italics will be phased out nationwide in 2005.

We conclude that azinphos methyl may affect the Snake River Basin steelhead ESU. This determination is based on the high amount of crop acreage, especially apples (over 75% of which are treated) and potatoes (until 2005), on which azinphos methyl can be used in several counties in Oregon and Washington. Azinphos methyl poses a direct acute risk to endangered fish at very low concentrations. Where there are repeated applications, there is also a high potential for chronic risk. In Idaho, except possibly Latah and Nez Perce counties, risks are likely to be low because of low usage.

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. However, the latter two counties are small portions in forested areas where azinphos methyl would not be used, and these counties are excluded from my analysis. 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 migration corridors, and include Multnomah, Columbia and Clatsop counties, Oregon, and Clark, Cowlitz, Wahkiakum, and Pacific counties, Washington.

Tables 24 and 25 show the cultivated acreage, including potential azinphos methyl crop uses, for Oregon counties where the Upper Willamette River steelhead ESU is located and for the Oregon and Washington counties where this ESU migrates.

Table 24. Cropping information for Oregon counties in the spawning and rearing habitat of the Upper Willamette River steelhead ESU

State	county	cultivated acreage[a]	crop	crop acreage
OR	Benton	69,214	nursery crops	149
			apples	62
			English walnuts[b]	23
			cherries	18
			caneberries	5
OR	Linn	248,392	*caneberries*	422
			nursery crops	155
			apples	133
			English walnuts	55
			blackberries	35
			cherries	*
OR	Polk	89,599	cherries	1888
			apples	157
			caneberries	157
			English walnuts	33
			nursery crops	*

State	county	cultivated acreage[a]	crop	crop acreage
OR	Clackamas	59,923	nursery crops	10,503
			caneberries	2409
			apples	167
			cherries	53
			English walnuts	51
OR	Marion	202,353	nursery crops	7090
			caneberries	4182
			cherries	1459
			apples	555
			English walnuts	155
OR	Yamhill	95,440	nursery crops	3444
			cherries	1140
			English walnuts	608
			caneberries	453
			apples	310
OR	Washington	85,190	nursery crops	4130
			caneberries	2227
			English walnuts	679
			apples	279
			cherries	211

[a] cultivated cropland includes all harvested acreage and all failed acreage
[b] uses marked in italics will be phased out nationwide in 2005

Table 25. Cropping information in Oregon and Washington counties that are part of the migration corridors of the Upper Willamette River steelhead ESU

State	county	cultivated acreage[a]	crop	crop acreage
WA	Clark	27,860	raspberries	634
			nursery crops	122
			pears	75
			English walnuts[b]	51
			peaches	46
			apples	33
			blackberries	8
			cherries	*

State	county	cultivated acreage[a]	crop	crop acreage
WA	Cowlitz	8227+	raspberries	439
			nursery crops	54
			apples	14
			English walnuts	5
			pears	3
			cherries	2
WA	Wahkiakum	3515+		0
WA	Pacific	5451	*cranberries*	1312
			cherries	*
			nursery crops	*
OR	Multnomah	14,692	nursery crops	2609
			caneberries	814
			apples	51
			cherries	7
			English walnuts	2
OR	Columbia	15,054+	apples	39
			English walnuts	11
			nursery crops	*
			cherries	*
OR	Clatsop	4772	*cranberries*	32
			nursery crops	3

[a] cultivated cropland includes all harvested acreage and all failed acreage; failed cropland acreage is not reported for some counties due to privacy concerns when only a few farms report such acreage - we denote this acreage with a "+" in the cultivated cropland column in the relevant tables; such acreage typically is small and statewide accounts for only 0.7% of harvested cropland acreage in Washington, 3.7% in Oregon, and 3.2% in Idaho

[b] uses marked in italics will be phased out nationwide in 2005.

We conclude that azinphos methyl may affect the Upper Willamette River steelhead ESU. This determination is based on the amount of crop acreage on which azinphos methyl can be used in counties within this ESU. Actual usage information is typically meager for Oregon, but we do note that azinphos methyl is used on 1% of Oregon nursery crop operations, which is probably about 1% of the 25,000+ acres) grown in the Willamette Valley (USDA, 2002). Azinphos methyl poses a direct acute risk to endangered fish at very low concentrations. Where there are repeated applications, there is also a high potential for chronic risk

9. Lower Columbia River steelhead ESU

The Lower Columbia River steelhead ESU was proposed for listing as endangered on August 9, 1996 (61FR41541-41561) and the listing was made final a year later (62FR43937-

43954, August 18, 1997). Critical Habitat was proposed February 5, 1999 (64FR5740-5754) and designated on February 16, 2000 (65FR7764-7787).

This ESU includes all tributaries from the lower Willamette River (below Willamette Falls) to Hood River in Oregon, and from the Cowlitz River up to the Wind River in Washington. These tributaries would provide the spawning and presumably the growth areas for the young steelhead. It is not clear if the young and growing steelhead in the tributaries would use the nearby mainstem of the Columbia prior to downstream migration. If not, the spawning and rearing habitat would occur in 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 26 and 27 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 26. Cropping information in Oregon and Washington counties that provide spawning and rearing habitat for the Lower Columbia River Steelhead ESU

State	county	cultivated acreage[a]	crop	crop acreage
OR	Hood River	17,346+	apples	2592
			nursery crops	*
			cherries	*
OR	Clackamas	59,923	nursery crops	10,503
			caneberries	2409
			apples	167
			cherries	53
			English walnuts	51

State	county	cultivated acreage[a]	crop	crop acreage
OR	Multnomah	14,692	nursery crops	2609
			caneberries	814
			apples	51
			cherries	7
			English walnuts	2
WA	Clark	27,860	raspberries	634
			nursery crops	122
			pears	75
			English walnuts[b]	51
			peaches	46
			apples	33
			blackberries	8
			cherries	*
WA	Lewis	29,569	apples	77
			cherries	10
			English walnuts	4
			nursery crops	*
WA	Cowlitz	8227+	raspberries	439
			nursery crops	54
			apples	14
			English walnuts	5
			pears	3
			cherries	2
WA	Skamania	1205+	pears	477
			apples	75

[a] cultivated cropland includes all harvested acreage and all failed acreage; failed cropland acreage is not reported for some counties due to privacy concerns when only a few farms report such acreage - we denote this acreage with a "+" in the cultivated cropland column in the relevant tables; such acreage typically is small and statewide accounts for only 0.7% of harvested cropland acreage in Washington, 3.7% in Oregon, and 3.2% in Idaho

[b] uses marked in italics will be phased out nationwide in 2005

Table 27. Cropping information in Oregon and Washington counties that are migratory corridors for the Lower Columbia River Steelhead ESU

State	county	cultivated acreage[a]	crop	crop acreage
OR	Columbia	15,054+	apples	39
			English walnuts[b]	11
			nursery crops	*
			cherries	*

State	county	cultivated acreage[a]	crop	crop acreage
OR	Clatsop	4772	*cranberries* nursery crops	32 3
WA	Pacific	5451	*cranberries* cherries nursery crops	1312 * *
WA	Wahkiakum	3515+		0

[a] cultivated cropland includes all harvested acreage and all failed acreage; failed cropland acreage is not reported for some counties due to privacy concerns when only a few farms report such acreage - we denote this acreage with a "+" in the cultivated cropland column in the relevant tables; such acreage typically is small and statewide accounts for only 0.7% of harvested cropland acreage in Washington, 3.7% in Oregon, and 3.2% in Idaho

[b] uses marked in italics will be phased out nationwide in 2005

We conclude that azinphos methyl may affect the Lower Columbia River steelhead ESU. This determination is made based on the amount of azinphos methyl used in counties where there is spawning and rearing of this ESU. Azinphos methyl poses a direct acute risk to endangered fish at very low concentrations. Where there are repeated applications, there is also a high potential for chronic risk

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. We are unsure of the status of these Dog and Collins creeks.

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

In the John Day River watershed, we have excluded Harney County, Oregon because there is only a tiny amount of the John Day River and several tributary creeks (e.g., Utley, Bear Cougar creeks) which get into high elevation areas (approximately 1700M and higher) of northern Harney County where there are no crops grown. 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 we 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 28 and 29 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 28. Cropping information in Oregon and Washington counties that provide spawning and rearing habitat for the Middle Columbia River Steelhead ESU

State	county	cultivated acreage[a]	crop	crop acreage
OR	Gilliam	100,729+		0
OR	Morrow	220,149 +		0
OR	Umatilla	384,163	apples *caneberries* nursery crops cherries	3927 7 * *
OR	Sherman	127,018+		0
OR	Wasco	97,230	apples cherries	463 *
OR	Crook	35,824		0
OR	Grant	46,399	apples pears	* *
OR	Wheeler	15,523	apples	23

State	county	cultivated acreage[a]	crop	crop acreage
OR	Jefferson	44,873	*potatoes*	973
			apples	4
WA	Benton	268,372	*potatoes*	25,317
			apples	18,425
			cherries	3219
			pears	472
			nursery crops	161
			peaches[b]	149
			nectarines	106
			English walnuts	41
WA	Columbia	97,743		0
WA	Franklin	291,696	*potatoes*	35,770
			apples	9000
			cherries	2165
			peaches	262
			pears	156
			nectarines	129
			raspberries	70
			nursery crops	*
			English walnuts	*
WA	Kittitas	57,456	apples	1859
			pears	331
			cherries	*
WA	Klickitat	93,193	pears	923
			apples	516
			cherries	457
			peaches	199
			English walnuts	*
WA	Skamania	1205+	pears	477
			apples	75
WA	Walla Walla	337,660	*potatoes*	9256
			apples	5222
			cherries	280

State	county	cultivated acreage[a]	crop	crop acreage
WA	Yakima	264,490	apples	75,264
			pears	10,190
			cherries	6129
			potatoes	1929
			peaches	1438
			nectarines	605
			nursery crops	408
			English walnuts	11
			raspberries	10

[a] cultivated cropland includes all harvested acreage and all failed acreage; failed cropland acreage is not reported for some counties due to privacy concerns when only a few farms report such acreage - we denote this acreage with a "+" in the cultivated cropland column in the relevant tables; such acreage typically is small and statewide accounts for only 0.7% of harvested cropland acreage in Washington, 3.7% in Oregon, and 3.2% in Idaho

[b] uses marked in italics will be phased out nationwide in 2005

Table 29. Cropping information in Washington and Oregon counties through which the Middle Columbia River steelhead ESU migrates

State	county	cultivated acreage[a]	crop	crop acreage
WA	Skamania	1205+	pears	477
			apples	75
WA	Clark	27,860	raspberries	634
			nursery crops	122
			pears	75
			English walnuts[b]	51
			peaches	46
			apples	33
			blackberries	8
			cherries	*
WA	Cowlitz	8227+	raspberries	439
			nursery crops	54
			apples	14
			English walnuts	5
			pears	3
			cherries	2

State	county	cultivated acreage[a]	crop	crop acreage
WA	Pacific	5451	*cranberries*	1312
			cherries	*
			nursery crops	*
WA	Wahkiakum	3515+		0
OR	Hood River	17,346+	apples	2592
			nursery crops	*
			cherries	*
OR	Multnomah	14,692	nursery crops	2609
			caneberries	814
			apples	51
			cherries	7
			English walnuts	2
OR	Columbia	15,054+	apples	39
			English walnuts	11
			nursery crops	*
			cherries	*
OR	Clatsop	4772	*cranberries*	32
			nursery crops	3

[a] cultivated cropland includes all harvested acreage and all failed acreage; failed cropland acreage is not reported for some counties due to privacy concerns when only a few farms report such acreage - we denote this acreage with a "+" in the cultivated cropland column in the relevant tables; such acreage typically is small and statewide accounts for only 0.7% of harvested cropland acreage in Washington, 3.7% in Oregon, and 3.2% in Idaho

[b] uses marked in italics will be phased out nationwide in 2005

We conclude that azinphos methyl may affect the Middle Columbia River steelhead ESU. This determination is based on the extensive acreage of crops, particularly apples (most of which are treated) and potatoes (until 2005), on which azinphos methyl can be used in counties where there is spawning and rearing of this ESU. Azinphos methyl poses a direct acute risk to endangered fish at very low concentrations. Where there are repeated applications, there is also a high potential for chronic risk

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).

Use of azinphos methyl in this ESU in 2001 is presented in Table 30.

Table 30. Use of azinphos methyl 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	use site	azinphos methyl usage (lb ai)	acres treated
Alameda		0	0
Butte	*almonds*[a]	2690	1458
	walnuts	1172	619
	apples	115	260
	prunes	45	102
Colusa	*almonds*	2641	1924
	pears	53	35
Contra Costa	apples	3223	2618
	walnuts	188	149
	pears	71	47
Glenn	*almonds*	2267	1389
	walnuts	155	125
Marin		0	0
Sacramento	pears	5300	4112
	apples	150	137
	onions	40	60
San Mateo	Brussels sprouts	98	134
San Francisco		0	0
Shasta	apples	7	29
Solano	pears	1192	1118
	apples	145	145
	almonds	24	48
Sonoma	apples	57	40

County	use site	azinphos methyl usage (lb ai)	acres treated
Sutter	pears	561	538
	walnuts	448	334
	apples	126	125
Tehama	*almonds*	1177	813
	apples	5	10
Yolo	pears	1016	769
	apples	199	159
	almonds	150	100
	walnuts	122	172

[a] uses marked in bold italics were voluntarily canceled in mid-2003, although some use of existing stocks may occur; uses marked in italics will be phased out nationwide in 2005.

We conclude that use of azinphos methyl may affect the Sacramento River winter-run chinook salmon ESU. We make this determination based on the widespread use of azinphos methyl in these counties. Azinphos methyl poses a direct acute risk to endangered fish at very low concentrations. Where there are repeated applications, there is also a high potential for chronic risk

2. Snake River Fall-run Chinook Salmon ESU

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

In 1998, NMFS proposed to revise the Snake River fall-run chinook to include those stocks using the Deschutes River (63FR11482-11520, March 9, 1998). The John Day, Umatilla, and Walla Walla Rivers would be included; however, fall-run chinook in these rivers are believed to have been extirpated. It appears that this proposal has yet to be finalized. We have not included these counties here; however, we 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, we have excluded them from consideration because azinphos methyl would not be used in these areas. We have, however, kept Umatilla County as part of the migratory corridor.

Tables 31 and 32 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 31. Cropping information in Pacific Northwest counties which provide spawning and rearing habitat for the Snake River fall-run chinook ESU

State	county	cultivated acreage[a]	crop	crop acreage
ID	Adams	16,779		0
ID	Idaho	147,557	apples	6
ID	Nez Perce	168,365	*peaches*	22
ID	Valley	6990+		0
ID	Lewis	119,860		0
ID	Benewah	59,294	apples	6
ID	Shoshone	459+		0
ID	Clearwater	24,266		0
ID	Latah	200,691	cherries	19
WA	Adams	392,556	*potatoes* apples cherries	27,914 345 *
WA	Lincoln	471,220	cherries	1

State	county	cultivated acreage[a]	crop	crop acreage
WA	Spokane	297,722	apples	227
			nursery crops	128
			cherries	50
			peaches	42
			pears	24
			raspberries	15
WA	Asotin	32,892	apples	24
			peaches[b]	18
			cherries	17
			pears	6
WA	Garfield	108,553		0
WA	Columbia	97,743		0
WA	Whitman	804,893	apples	19
			pears	2
			cherries	*
WA	Franklin	291,696	*potatoes*	35,770
			apples	9000
			cherries	2165
			peaches	262
			pears	156
			nectarines	129
			raspberries	70
			nursery crops	*
			English walnuts	*
WA	Walla Walla	337,660	*potatoes*	9256
			apples	5222
			cherries	280
OR	Wallowa	54,138	apples	8
OR	Union	90.349	apples	39
			cherries	*
OR	Wasco	97,230	apples	463
			cherries	*
OR	Jefferson	44,873	*potatoes*	973
			apples	4

State	county	cultivated acreage[a]	crop	crop acreage
OR	Sherman	127,018+		0
OR	Gilliam	100,729+		0
OR	Wheeler	15,523	apples	23
OR	Morrow	220,149 +	*potatoes*	17,030
OR	Grant	46,399	apples pears	* *

[a] cultivated cropland includes all harvested acreage and all failed acreage; failed cropland acreage is not reported for some counties due to privacy concerns when only a few farms report such acreage - we denote this acreage with a "+" in the cultivated cropland column in the relevant tables; such acreage typically is small and statewide accounts for only 0.7% of harvested cropland acreage in Washington, 3.7% in Oregon, and 3.2% in Idaho

[b] uses marked in italics will be phased out nationwide in 2005

Table 32. Cropping information in Washington and Oregon counties through which the Snake River fall-run chinook and the Snake River spring/summer-run chinook ESUs migrate

State	county	cultivated acreage[a]	crop	crop acreage
WA	Benton	268,372	*potatoes*	25,317
			apples	18,425
			cherries	3219
			pears	472
			nursery crops	161
			peaches[b]	149
			nectarines	106
			English walnuts	41
WA	Klickitat	93,193	pears	923
			apples	516
			cherries	457
			peaches	199
			English walnuts	*
WA	Skamania	1205+	pears	477
			apples	75

State	county	cultivated acreage[a]	crop	crop acreage
WA	Clark	27,860	raspberries	634
			nursery crops	122
			pears	75
			English walnuts[b]	51
			peaches	46
			apples	33
			blackberries	8
			cherries	*
WA	Cowlitz	8227+	raspberries	439
			nursery crops	54
			apples	14
			English walnuts	5
			pears	3
			cherries	2
WA	Wahkiakum	3515+		0
WA	Pacific	5451	*cranberries*	1312
			cherries	*
			nursery crops	*
OR	Umatilla	384,163	*potatoes*	15,030
			apples	3927
			caneberries	7
			nursery crops	*
			cherries	*
OR	Morrow	220,149 +	*potatoes*	17,030
OR	Gilliam	100,729+		0
OR	Sherman	127,018+		0
OR	Wasco	97,230	apples	463
			cherries	*
OR	Hood River	17,346+	apples	2592
			nursery crops	*
			cherries	*

State	county	cultivated acreage[a]	crop	crop acreage
OR	Multnomah	14,692	nursery crops	2609
			caneberries	814
			apples	51
			cherries	7
			English walnuts	2
OR	Columbia	15,054+	apples	39
			English walnuts	11
			nursery crops	*
			cherries	*
OR	Clatsop	4772	*cranberries*	32
			nursery crops	3

[a] cultivated cropland includes all harvested acreage and all failed acreage; failed cropland acreage is not reported for some counties due to privacy concerns when only a few farms report such acreage - we denote this acreage with a "+" in the cultivated cropland column in the relevant tables; such acreage typically is small and statewide accounts for only 0.7% of harvested cropland acreage in Washington, 3.7% in Oregon, and 3.2% in Idaho

[b] uses marked in italics will be phased out nationwide in 2005

We conclude that azinphos methyl may affect the Snake River fall-run chinook ESU. This determination is made based on the high amount of crop acreage on which azinphos methyl might be used in this ESU, especially in Benton, Franklin, and Walla Walla counties in Washington. Azinphos methyl poses a direct acute risk to endangered fish at very low concentrations. Where there are repeated applications, there is also a high potential for chronic risk. In Idaho, except possibly Latah and Nez Perce counties, risks are likely to be low because of low usage.

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, we have excluded Umatilla and Baker counties in Oregon and Blaine County in Idaho because accessible river reaches are all well above areas where azinphos methyl can be used. Counties with migratory corridors are all of those down stream from the confluence of the Snake and Columbia Rivers.

Table 33 shows the cropping information for Oregon and Washington counties where the Snake River spring/summer-run chinook salmon ESU occurs. The cropping information for the migratory corridors is the same as for the Snake River fall-run chinook salmon (Table 32).

Table 33. Cropping information in Pacific Northwest counties which provide spawning and rearing habitat for the Snake River spring/summer run chinook ESU

State	county	cultivated acreage[a]	crop	crop acreage
ID	Adams	16,779		0
ID	Idaho	147,557	apples	6
ID	Nez Perce	168,365	*peaches*	22
ID	Custer	34,754		0
ID	Lemhi	41,837+	apples	6
ID	Valley	6990+		0
ID	Lewis	119,860		0
ID	Latah	200,691	cherries	19
WA	Asotin	32,892	apples *peaches*[b] cherries pears	24 18 17 6
WA	Garfield	108,553		0

State	county	cultivated acreage[a]	crop	crop acreage
WA	Columbia	97,743		0
WA	Whitman	804,893	apples	19
			pears	2
			cherries	*
WA	Franklin	291,696	*potatoes*	35,770
			apples	9000
			cherries	2165
			peaches	262
			pears	156
			nectarines	129
			raspberries	70
			nursery crops	*
			English walnuts	*
OR	Wallowa	54,138	apples	8
OR	Union	90.349	*potatoes*	660
			apples	39
			cherries	*

[a] cultivated cropland includes all harvested acreage and all failed acreage; failed cropland acreage is not reported for some counties due to privacy concerns when only a few farms report such acreage - we denote this acreage with a "+" in the cultivated cropland column in the relevant tables; such acreage typically is small and statewide accounts for only 0.7% of harvested cropland acreage in Washington, 3.7% in Oregon, and 3.2% in Idaho

[b] uses marked in italics will be phased out nationwide in 2005

We conclude that azinphos methyl may affect the Snake River spring/summer run chinook ESU. This determination is made based on the high amount of crop acreage on which azinphos methyl can be used in Franklin Co., Washington where there is spawning and rearing of this ESU and in several counties in the migration corridor. Azinphos methyl poses a direct acute risk to endangered fish at very low concentrations. Where there are repeated applications, there is also a high potential for chronic risk. In Idaho, except possibly Latah and Nez Perce counties, risks are likely to be low because of low usage.

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

Table 34. Use of azinphos methyl in 2001 in counties with the Central Valley spring run chinook salmon ESU

County	use site	azinphos methyl usage (lb ai)	acres treated
Alameda		0	
Butte	*almonds*[a]	2690	1458
	walnuts	1172	619
	apples	115	260
	prunes	45	102
Colusa	*almonds*	2641	1924
	pears	53	35
Contra Costa	apples	3223	2618
	walnuts	188	149
	pears	71	47
Glenn	*almonds*	2267	1389
	walnuts	155	125
Marin		0	0
Napa		0	0
Nevada		0	0
Placer	apples	12	14
	pears	10	10
	peaches	10	13

County	use site	azinphos methyl usage (lb ai)	acres treated
Sacramento	pears	5300	4112
	apples	150	137
	onions	40	60
San Mateo	Brussel sprouts	98	134
San Francisco		0	0
Shasta	apples	7	29
Solano	pears	1192	1118
	apples	145	145
	almonds	24	48
Sonoma	apples	57	40
Sutter	pears	561	538
	walnuts	448	334
	apples	126	125
Tehama	*almonds*	1177	813
	apples	5	10
Yolo	pears	1016	769
	apples	199	159
	almonds	150	100
	walnuts	122	172
Yuba	pears	2662	2517
	almonds	388	269
	prunes	68	80
	apples	21	21

[a] uses marked in bold italics were voluntarily canceled in mid-2003, although some use of existing stocks may occur; uses marked in italics will be phased out nationwide in 2005

We conclude that azinphos methyl may affect the Central Valley spring run chinook salmon ESU. We make this determination based on the amount of azinphos methyl applied in these counties. Azinphos methyl poses a direct acute risk to endangered fish at very low concentrations. Where there are repeated applications, there is also a high potential for chronic risk

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 azinphos methyl 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 azinphos methyl would not likely be used in the forested upper elevation areas.

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

Table 35. Use of azinphos methyl in 2001 in counties within the California coastal chinook salmon ESU

County	use site	azinphos methyl usage (lb ai)	acres treated
Humboldt		0	0
Mendocino	pears	1403	985
	apples	107	104
Sonoma	apples	57	40
Marin		0	0
Trinity		0	0
Lake	pears	4278	2722
	apples	103	123
	grapes	28	19
	walnuts	25	20

[a] uses marked in bold italics were voluntarily canceled in mid-2003, although some use of existing stocks may occur; uses marked in italics will be phased out nationwide in 2005

We conclude that azinphos methyl may effect the California coastal chinook salmon ESU. We make this determination based on the amount of azinphos methyl applied in Lake and Mendocino counties. Azinphos methyl poses a direct acute risk to endangered fish at very low concentrations. Where there are repeated applications, there is also a high potential for chronic risk

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 36 shows the cropping information for Washington counties where the Puget Sound chinook salmon ESU is located.

Table 36. Cropping information in Washington counties within the Critical Habitat of the Puget Sound chinook salmon ESU

State	county	cultivated acreage[a]	crop	crop acreage
WA	Skagit	57,978	raspberries	1088
			nursery crops	359
			apples	357
			blackberries	6
			cherries	*
WA	Whatcom	65,679	raspberries	5255
			nursery crops	396
			pears	15
			cherries	4
WA	San Juan	4057	apples	64
			pears	5
			cherries	1
			nursery crops	*
WA	Island	9764	apples	18
			nursery crops	14

State	county	cultivated acreage[a]	crop	crop acreage
WA	Snohomish	28,836	nursery crops	414
			raspberries	71
			apples	47
			pears	27
			blackberries	4
			cherries	3
WA	King	9827	nursery crops	328
			apples	64
			raspberries	26
			cherries	8
			English walnuts[b]	3
WA	Pierce	13,430	nursery crops	160
			blackberries	108
			apples	61
			raspberries	27
			cherries	5
WA	Thurston	12,130+	raspberries	25
			apples	23
WA	Lewis	29,569	apples	77
			cherries	10
			English walnuts	4
			nursery crops	*
WA	Grays Harbor	15,682	*cranberries*	240
			nursery crops	*
WA	Mason	1703+	apples	5
WA	Clallam	6119	apples	29
			nursery crops	27
			cherries	11
WA	Jefferson	2151+	nursery crops	17
			apples	5
WA	Kitsap	1300+	nursery crops	88
			apples	21
			blackberries	12
			raspberries	9
			cherries	6

[a] cultivated cropland includes all harvested acreage and all failed acreage; failed cropland acreage is not reported for some counties due to privacy concerns when only a few farms report such acreage - we denote this acreage with a "+" in the cultivated cropland column in the relevant tables; such acreage typically is small and statewide accounts for only 0.7% of harvested cropland acreage in Washington, 3.7% in Oregon, and 3.2% in Idaho
[b] uses marked in italics will be phased out nationwide in 2005

We conclude that azinphos methyl may affect the Puget Sound chinook salmon ESU. Our determination is based on the amount of crop acreage, especially raspberries, on which azinphos methyl might be used within this ESU. Azinphos methyl poses a direct acute risk to endangered fish at very low concentrations. Where there are repeated applications, there is also a high potential for chronic risk

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. We have excluded Pierce County, Washington because the very small part of the Cowlitz River watershed in this county is at a high elevation where azinphos methyl would not likely be used.

Table 37 shows the cropping information for Oregon and Washington counties where the Lower Columbia River chinook salmon ESU occurs.

Table 37. Cropping information in Oregon and Washington counties that are in the Critical Habitat of the Lower Columbia River chinook salmon ESU

State	county	cultivated acreage[a]	crop	crop acreage
OR	Wasco	97,230	apples cherries	463 *

State	county	cultivated acreage[a]	crop	crop acreage
OR	Hood River	17,346+	apples nursery crops cherries	2592 * *
OR	Marion	202,353	nursery crops *caneberries* cherries apples *English walnuts*[b]	7090 4182 1459 555 155
OR	Clackamas	59,923	nursery crops *caneberries* apples cherries *English walnuts*	10,503 2409 167 53 51
OR	Multnomah	14,692	nursery crops *caneberries* apples cherries *English walnuts*	2609 814 51 7 2
OR	Washington	85,190	nursery crops *caneberries* *English walnuts* apples cherries	4130 2227 679 279 211
OR	Columbia	15,054+	apples *English walnuts* nursery crops cherries	39 11 * *
OR	Clatsop	4772	*cranberries* nursery crops	32 3
WA	Pacific	5451	*cranberries* cherries nursery crops	1312 * *
WA	Wahkiakum	3515+		0

State	county	cultivated acreage[a]	crop	crop acreage
WA	Clark	27,860	raspberries	634
			nursery crops	122
			pears	75
			English walnuts[b]	51
			peaches	46
			apples	33
			blackberries	8
			cherries	*
WA	Cowlitz	8227+	raspberries	439
			nursery crops	54
			apples	14
			English walnuts	5
			pears	3
			cherries	2
WA	Lewis	29,569	apples	77
			cherries	10
			English walnuts	4
			nursery crops	*
WA	Klickitat	93,193	pears	923
			apples	516
			cherries	457
			peaches	199
			English walnuts	*
WA	Skamania	1205+	pears	477
			apples	75

[a] cultivated cropland includes all harvested acreage and all failed acreage; failed cropland acreage is not reported for some counties due to privacy concerns when only a few farms report such acreage - we denote this acreage with a "+" in the cultivated cropland column in the relevant tables; such acreage typically is small and statewide accounts for only 0.7% of harvested cropland acreage in Washington, 3.7% in Oregon, and 3.2% in Idaho

[b] uses marked in italics will be phased out nationwide in 2005

We conclude that azinphos methyl may affect the Lower Columbia River chinook salmon ESU. This determination is based on the amount of crop acreage on which azinphos methyl can be used in several counties within this ESU. Azinphos methyl poses a direct acute risk to endangered fish at very low concentrations. Where there are repeated applications, there is also a high potential for chronic risk

8. Upper Willamette River Chinook Salmon ESU

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

The hydrologic units included are the Lower Columbia-Sandy, Lower Columbia-Clatskanie, Lower Columbia, Middle Fork Willamette, Coast Fork Willamette (upstream barriers - Cottage Grove Dam, Dorena Dam), Upper Willamette (upstream barrier - Fern Ridge Dam), McKenzie (upstream barrier - Blue River Dam), North Santiam (upstream barrier - Big Cliff Dam), South Santiam (upstream barrier - Green Peter Dam), Middle Willamette, Yamhill, Molalla-Pudding, Tualatin, Clackamas, and Lower Willamette. Spawning and rearing habitat is in the Oregon counties of Clackamas, Douglas, Lane, Benton, Lincoln, Linn, Polk, Marion, Yamhill, Washington, and Tillamook. However, Lincoln and Tillamook counties include salmon habitat only in the forested parts of the coast range where azinphos methyl would not be used. Salmon habitat for this ESU is exceedingly limited in Douglas County also, but we cannot rule out future azinphos methyl use in Douglas County.

Tables 38 and 39 show the cropping information for Oregon counties where the Upper Willamette River chinook salmon ESU occurs and for the Oregon and Washington counties where this ESU migrates.

Table 38. Cropping information for Oregon counties encompassing spawning and rearing habitat of the Upper Willamette River chinook salmon ESU

State	county	cultivated acreage[a]	crop	crop acreage
OR	Douglas	37,498	*English walnuts*[b]	171
			apples	148
			nursery crops	121
			cherries	60
			caneberries	28
OR	Lane	73,841	nursery crops	325
			apples	174
			cherries	158
			caneberries	122
			English walnuts	105

State	county	cultivated acreage[a]	crop	crop acreage
OR	Benton	69,214	nursery crops	149
			apples	62
			English walnuts	23
			cherries	18
			caneberries	5
OR	Linn	248,392	*caneberries*	422
			nursery crops	155
			apples	133
			English walnuts	55
			blackberries	35
			cherries	*
OR	Polk	89,599	cherries	1888
			apples	157
			caneberries	157
			English walnuts	33
			nursery crops	*
OR	Clackamas	59,923	nursery crops	10,503
			caneberries	2409
			apples	167
			cherries	53
			English walnuts	51
OR	Marion	202,353	nursery crops	7090
			caneberries	4182
			cherries	1459
			apples	555
			English walnuts	155
OR	Yamhill	95,440	nursery crops	3444
			cherries	1140
			English walnuts	608
			caneberries	453
			apples	310
OR	Washington	85,190	nursery crops	4130
			caneberries	2227
			English walnuts	679
			apples	279
			cherries	211

[a] cultivated cropland includes all harvested acreage and all failed acreage

[b] uses marked in italics will be phased out nationwide in 2005

Table 39. Cropping information for Washington and Oregon counties that are part of the migration corridors of the Upper Willamette River chinook salmon ESU

State	county	cultivated acreage[a]	crop	crop acreage
WA	Clark	27,860	raspberries	634
			nursery crops	122
			pears	75
			English walnuts[b]	51
			peaches	46
			apples	33
			blackberries	8
			cherries	*
WA	Cowlitz	8227+	raspberries	439
			nursery crops	54
			apples	14
			English walnuts	5
			pears	3
			cherries	2
WA	Wahkiakum	3515+		0
WA	Pacific	5451	*cranberries*	1312
			cherries	*
			nursery crops	*
OR	Multnomah	14,692	nursery crops	2609
			caneberries	814
			apples	51
			cherries	7
			English walnuts	2
OR	Columbia	15,054+	apples	39
			English walnuts	11
			nursery crops	*
			cherries	*
OR	Clatsop	4772	*cranberries*	32
			nursery crops	3

[a] cultivated cropland includes all harvested acreage and all failed acreage; failed cropland acreage is not reported for some counties due to privacy concerns when only a few farms report such acreage - we denote this acreage with a "+" in the cultivated cropland column in the relevant tables; such acreage typically is small and statewide accounts for only 0.7% of harvested cropland acreage in Washington, 3.7% in Oregon, and 3.2% in Idaho

[b] uses marked in italics will be phased out nationwide in 2005

We conclude that azinphos methyl may affect the Upper Willamette River chinook salmon ESU. This determination is based on the amount of crop acreage on which azinphos methyl can be used in several counties within this ESU. Azinphos methyl poses a direct acute risk to endangered fish at very low concentrations. Where there are repeated applications, there is also a high potential for chronic risk

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 (Table 31), with the lower river reaches being migratory corridors (Table 32).

Tables 40 and 41 present cropping information for those Washington counties that support the Upper Columbia River chinook salmon ESU and for Oregon and Washington counties where this ESU migrates.

Table 40. Cropping information for Washington counties where there is spawning and rearing habitat for the Upper Columbia River chinook salmon ESU

State	county	cultivated acreage[a]	crop	crop acreage
WA	Chelan	31,423	apples	17,096
			pears	8298
			cherries	3704
			nectarines	22
			peaches[b]	21
			nursery crops	12
			English walnuts	*
WA	Douglas	217,703	apples	14,383
			cherries	1842
			pears	1104
			peaches	16
			nectarines	91
			nursery crops	7

State	county	cultivated acreage[a]	crop	crop acreage
WA	Okanogan	72,732	apples	24,164
			pears	3280
			cherries	1003
			peaches	67
			nectarines	38
			nursery crops	25
			English walnuts	29

[a] cultivated cropland includes all harvested acreage and all failed acreage
[b] uses marked in italics will be phased out nationwide in 2005

Table 41. Cropping information for Washington and Oregon counties that are migration corridors for the Upper Columbia River chinook salmon ESU

State	county	cultivated acreage[a]	crop	crop acreage
WA	Benton	268,372	*potatoes*	25,317
			apples	18,425
			cherries	3219
			pears	472
			nursery crops	161
			peaches[b]	149
			nectarines	106
			English walnuts	41
WA	Kittitas	57,456	apples	1859
			pears	331
			cherries	*
WA	Grant	529,087	*potatoes*	44,263
			apples	33,615
			cherries	3470
			nursery crops	1562
			pears	998
			peaches	261
			nectarines	163
			English walnuts	5

State	county	cultivated acreage[a]	crop	crop acreage
WA	Franklin	291,696	*potatoes*	35,770
			apples	9000
			cherries	2165
			peaches	262
			pears	156
			nectarines	129
			raspberries	70
			nursery crops	*
			English walnuts	*
WA	Yakima	264,490	apples	75,264
			pears	10,190
			cherries	6129
			potatoes	1929
			peaches	1438
			nectarines	605
			nursery crops	408
			English walnuts	11
			raspberries	10
WA	Walla Walla	337,660	*potatoes*	9256
			apples	5222
			cherries	280
WA	Klickitat	93,193	pears	923
			apples	516
			cherries	457
			peaches	199
			English walnuts	*
WA	Skamania	1205+	pears	477
			apples	75
WA	Clark	27,860	raspberries	634
			nursery crops	122
			pears	75
			English walnuts[b]	51
			peaches	46
			apples	33
			blackberries	8
			cherries	*

State	county	cultivated acreage[a]	crop	crop acreage
WA	Cowlitz	8227+	raspberries nursery crops apples *English walnuts* pears cherries	439 54 14 5 3 2
WA	Wahkiakum	3515+		0
WA	Pacific	5451	*cranberries* cherries nursery crops	1312 * *
OR	Gilliam	100,729+		0
OR	Umatilla	384,163	*potatoes* apples *caneberries* nursery crops cherries	15,030 3927 7 * *
OR	Sherman	127,018+		0
OR	Morrow	220,149 +	*potatoes*	17,030
OR	Wasco	97,230	apples cherries	463 *
OR	Hood River	17,346+	apples nursery crops cherries	2592 * *
OR	Multnomah	14,692	nursery crops *caneberries* apples cherries *English walnuts*	2609 814 51 7 2
OR	Columbia	15,054+	apples *English walnuts* nursery crops cherries	39 11 * *

State	county	cultivated acreage[a]	crop	crop acreage
OR	Clatsop	4772	*cranberries* nursery crops	32 3

[a] cultivated cropland includes all harvested acreage and all failed acreage; failed cropland acreage is not reported for some counties due to privacy concerns when only a few farms report such acreage - we denote this acreage with a "+" in the cultivated cropland column in the relevant tables; such acreage typically is small and statewide accounts for only 0.7% of harvested cropland acreage in Washington, 3.7% in Oregon, and 3.2% in Idaho

[b] uses marked in italics will be phased out nationwide in 2005

We conclude that azinphos methyl may affect the Upper Columbia River chinook salmon ESU. This determination is based on the extensive amount of crop acreage on which azinphos methyl can be used in a number of counties encompassing this ESU. Azinphos methyl poses a direct acute risk to endangered fish at very low concentrations. Where there are repeated applications, there is also a high potential for chronic risk

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

Table 42. Use of azinphos methyl in 2001 in counties with the Central California Coast coho ESU

County	use site	azinphos methyl usage (lb ai)	acres treated
Santa Cruz	Brussel sprouts	183	263
San Mateo	Brussel sprouts	98	134
Marin		0	0
Sonoma	apples	57	40
Mendocino	pears apples	1403 107	985 104
Napa		0	0

We conclude that use of azinphos methyl may affect the Central California Coast coho salmon ESU. We make this determination based on the amount of azinphos methyl applied in these counties, especially Mendocino Co., in 2001, although the usage is low enough that it is unlikely to affect populations of this salmon ESU. Azinphos methyl poses acute and chronic risks to endangered fish at very low exposure concentrations.

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. However, we have excluded Glenn and Lake counties, California, and Douglas County, Oregon, from this analysis because the salmon habitat in these counties is not near the agricultural areas.

Use of azinphos methyl in counties occupied by this ESU is presented in Tables 43 and 44.

Table 43. Use of azinphos methyl in 2001 in California counties within the Southern Oregon/Northern California coastal coho salmon ESU

County	use site	azinphos methyl usage (lb ai)	acres treated
Humboldt		0	0
Mendocino	pears apples	1403 107	985 104
Del Norte		0	0
Siskiyou		0	0
Trinity		0	0

[a] uses marked in bold italics were voluntarily canceled in mid-2003, although some use of existing stocks may occur; uses marked in italics will be phased out nationwide in 2005

Table 44. Cropping information for Oregon counties where there is habitat for the Southern Oregon/Northern California coastal coho salmon ESU

State	county	cultivated acreage[a]	crop	crop acreage
OR	Curry	1807	*cranberries*	581
			apples	27
			cherries	*
			nursery crops	*
OR	Jackson	33,529	apples	360
			nursery crops	39
			English walnuts[b]	27
			cherries	22
			caneberries	13
OR	Josephine	9015	apples	181
			sweet cherries	9
			blackberries	4

[a] cultivated cropland includes all harvested acreage and all failed acreage
[b] uses marked in italics will be phased out nationwide in 2005

We conclude that azinphos methyl may affect the Southern Oregon/Northern California coastal coho salmon ESU. Our determination is made based on amount of acreage treated in Mendocino County in California in 2001 and the potential acreage on which azinphos methyl might be used in the Oregon counties within this ESU's habitat, although the usage and acreage is low enough that it is unlikely to affect populations of this salmon ESU. Azinphos methyl poses a direct acute risk to endangered fish at very low concentrations. Where there are repeated applications, there is also a high potential for chronic risk

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. However, the portions of Yamhill, Washington, and Columbia counties that are within the ESU do not include agricultural areas, and we have eliminated them in this analysis.

Table 45 shows the cultivated acreage for Oregon counties where the Oregon coast coho salmon ESU occurs.

Table 45. Cropping information for Oregon counties where there is habitat for the Oregon coast coho salmon ESU

State	county	cultivated acreage[a]	crop	crop acreage
OR	Curry	1807	*cranberries*	581
			apples	27
			cherries	*
			nursery crops	*
OR	Coos	14,115+	*cranberries*	1499
			apples	28
			nursery crops	21
			cherries	11
			caneberries	1
OR	Douglas	37,498	*English walnuts*[b]	171
			apples	148
			nursery crops	121
			cherries	60
			caneberries	28
OR	Lane	73,841	nursery crops	325
			apples	174
			cherries	158
			caneberries	122
			English walnuts	105
OR	Lincoln	3626+	apples	22
			blackberries	2
			nursery crops	*

State	county	cultivated acreage[a]	crop	crop acreage
OR	Benton	69,214	nursery crops	149
			apples	62
			English walnuts	23
			cherries	18
			caneberries	5
OR	Polk	89,599	cherries	1888
			apples	157
			caneberries	157
			English walnuts	33
			nursery crops	*
OR	Tillamook	6448	nursery crops	0
OR	Clatsop	4772	*cranberries*	32
			nursery crops	3

[a] cultivated cropland includes all harvested acreage and all failed acreage; failed cropland acreage is not reported for some counties due to privacy concerns when only a few farms report such acreage - we denote this acreage with a "+" in the cultivated cropland column in the relevant tables; such acreage typically is small and statewide accounts for only 0.7% of harvested cropland acreage in Washington, 3.7% in Oregon, and 3.2% in Idaho

[b] uses marked in italics will be phased out nationwide in 2005

We conclude that azinphos methyl may affect the Oregon coast coho salmon ESU. This determination is based on the amount of crop acreage on which azinphos methyl can be used in several counties included in the habitat of this ESU. Azinphos methyl poses acute and chronic risks to endangered fish at very low exposure concentrations.

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 to 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 46 shows the cultivated acreage for Washington counties where the Hood Canal summer-run chum salmon ESU occurs.

Table 46. Cropping information for Washington counties where there is habitat for the Hood Canal Summer-run chum salmon ESU

State	county	cultivated acreage[a]	crop	crop acreage
WA	Mason	1703+	apples	5

State	county	cultivated acreage[a]	crop	crop acreage
WA	Clallam	6119	apples nursery crops cherries	29 27 11
WA	Jefferson	2151+	nursery crops apples	17 5
WA	Kitsap	1300+	nursery crops apples blackberries raspberries cherries	88 21 12 9 6
WA	Island	9764	apples nursery crops	18 14

[a] cultivated cropland includes all harvested acreage and all failed acreage; failed cropland acreage is not reported for some counties due to privacy concerns when only a few farms report such acreage - we denote this acreage with a "+" in the cultivated cropland column in the relevant tables; such acreage typically is small and statewide accounts for only 0.7% of harvested cropland acreage in Washington, 3.7% in Oregon, and 3.2% in Idaho

We conclude that azinphos methyl may affect the Hood Canal Summer-run chum salmon ESU. The potential acreage on which azinphos methyl might be applied is relatively low, but azinphos methyl poses a direct acute risk to endangered fish at very low concentrations. Where there are repeated applications, there is also a high potential for chronic risk.

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 47 shows the cultivated acreage for Oregon and Washington counties where the Columbia River chum salmon ESU occurs.

Table 47. Cultivated acreage and crops on which azinphos methyl can be used in counties where there is habitat for the Columbia River chum salmon ESU

State	county	cultivated acreage[a]	crop	crop acreage
WA	Skamania	1205+	pears	477
			apples	75
WA	Clark	27,860	raspberries	634
			nursery crops	122
			pears	75
			English walnuts[b]	51
			peaches	46
			apples	33
			blackberries	8
			cherries	*
WA	Lewis	29,569	apples	77
			cherries	10
			English walnuts	4
			nursery crops	*
WA	Cowlitz	8227+	raspberries	439
			nursery crops	54
			apples	14
			English walnuts	5
			pears	3
			cherries	2
WA	Pacific	5451	*cranberries*	1312
			cherries	*
			nursery crops	*
WA	Wahkiakum	3515+		0
OR	Multnomah	14,692	nursery crops	2609
			caneberries	814
			apples	51
			cherries	7
			English walnuts	2

State	county	cultivated acreage[a]	crop	crop acreage
OR	Columbia	15,054+	apples	39
			English walnuts	11
			nursery crops	*
			cherries	*
OR	Washington	85,190	nursery crops	4130
			caneberries	2227
			English walnuts	679
			apples	279
			cherries	211
OR	Clatsop	4772	*cranberries*	32
			nursery crops	3

[a] cultivated cropland includes all harvested acreage and all failed acreage; failed cropland acreage is not reported for some counties due to privacy concerns when only a few farms report such acreage - we denote this acreage with a "+" in the cultivated cropland column in the relevant tables; such acreage typically is small and statewide accounts for only 0.7% of harvested cropland acreage in Washington, 3.7% in Oregon, and 3.2% in Idaho

[b] uses marked in italics will be phased out nationwide in 2005

We conclude that azinphos methyl may affect the Columbia River chum salmon ESU. This determination is based on the amount of crop acreage on which azinphos methyl can be used in several counties included in the habitat of this ESU. Azinphos methyl poses a direct acute risk to endangered fish at very low concentrations. Where there are repeated applications, there is also a high potential for chronic risk

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 48), and most of that is in the eastern part of the county, well away from Ozette Lake.

Table 48. Cropping information for Clallum County where there is habitat for the Ozette Lake sockeye salmon ESU

State	county	cultivated acreage[a]	crop	crop acreage
WA	Clallam	6119	apples	29
			nursery crops	27
			cherries	11

[a] cultivated cropland includes all harvested acreage and all failed acreage

We conclude that azinphos methyl will have no effect on the Ozette Lake sockeye salmon ESU, because there is minimal acreage on which azinphos methyl might be applied in Clallum County.

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. Azinphos methyl cannot be used in this area. It is possible that this salmon ESU could be exposed to azinphos methyl in the lower and larger river reaches during its juvenile or adult migration.

Tables 49 and 50 show the cropping information for counties where this ESU occurs.

Table 49. Cropping information for Idaho counties where there is spawning and rearing habitat for the Snake River sockeye salmon ESU

State	county	cultivated acreage[a]	crop	crop acreage
ID	Custer	34,754		0
ID	Blaine	47,565		0

[a] cultivated cropland includes all harvested acreage and all failed acreage

Table 50. Cropping information for Pacific Northwest counties within the migratory corridors for the Snake River sockeye salmon ESU

State	county	cultivated acreage[a]	crop	crop acreage
ID	Idaho	147,557	apples	6
ID	Lemhi	41,837+	apples	6
ID	Lewis	119,860		0
ID	Nez Perce	168,365	*peaches*	22
ID	Valley	6990+		0
WA	Asotin	32,892	apples *peaches*[b] cherries pears	24 18 17 6
WA	Garfield	108,553		0
WA	Whitman	804,893	apples pears cherries	19 2 *
WA	Columbia	97,743		0
WA	Walla Walla	337,660	*potatoes* apples cherries	9256 5222 280

State	county	cultivated acreage[a]	crop	crop acreage
WA	Franklin	291,696	*potatoes*	35,770
			apples	9000
			cherries	2165
			peaches	262
			pears	156
			nectarines	129
			raspberries	70
			nursery crops	*
			English walnuts	*
WA	Benton	268,372	*potatoes*	25,317
			apples	18,425
			cherries	3219
			pears	472
			nursery crops	161
			peaches[b]	149
			nectarines	106
			English walnuts	41
WA	Klickitat	93,193	pears	923
			apples	516
			cherries	457
			peaches	199
			English walnuts	*
WA	Skamania	1205+	pears	477
			apples	75
WA	Clark	27,860	raspberries	634
			nursery crops	122
			pears	75
			English walnuts[b]	51
			peaches	46
			apples	33
			blackberries	8
			cherries	*

State	county	cultivated acreage[a]	crop	crop acreage
WA	Cowlitz	8227+	raspberries nursery crops apples *English walnuts* pears cherries	439 54 14 5 3 2
WA	Wahkiakum	3515+		0
WA	Pacific	5451	*cranberries* cherries nursery crops	1312 * *
OR	Wallowa	54,138	apples	8
OR	Umatilla	384,163	*potatoes* apples *caneberries* nursery crops cherries	15,030 3927 7 * *
OR	Morrow	220,149 +	*potatoes*	17,030
OR	Gilliam	100,729+		0
OR	Sherman	127,018+		0
OR	Wasco	97,230	apples cherries	463 *
OR	Hood River	17,346+	apples nursery crops cherries	2592 * *
OR	Multnomah	14,692	nursery crops *caneberries* apples cherries *English walnuts*	2609 814 51 7 2
OR	Columbia	15,054+	apples *English walnuts* nursery crops cherries	39 11 * *

State	county	cultivated acreage[a]	crop	crop acreage
OR	Clatsop	4772	*cranberries* nursery crops	32 3

[a] cultivated cropland includes all harvested acreage and all failed acreage; failed cropland acreage is not reported for some counties due to privacy concerns when only a few farms report such acreage - we denote this acreage with a "+" in the cultivated cropland column in the relevant tables; such acreage typically is small and statewide accounts for only 0.7% of harvested cropland acreage in Washington, 3.7% in Oregon, and 3.2% in Idaho

We conclude that azinphos methyl may affect the Snake River sockeye salmon ESU. This determination is based on the high amount of crop acreage on which azinphos methyl can be used in several counties within the migration corridor of this ESU. Azinphos methyl poses substantial acute and chronic risks to endangered fish; we have concerns even though there would be considerable dilution in the lower Snake and Columbia Rivers. Because there is no azinphos-methyl usage in the spawning and rearing areas, we conclude no effect in these areas. In the migratory corridors of Idaho, except possibly Nez Perce county, risks are likely to be low because of low usage.

5. Summary conclusions for listed Pacific salmon and steelhead

Based on the available information and best professional judgement, our conclusions on potential adverse direct and indirect effects of azinphos methyl on listed Pacific salmon and steelhead are provided in Table 51. We conclude that azinphos methyl may affect 25 ESUs and will have no effect on one ESU.

For those ESUs in California, we base our determinations on reported usage of azinphos methyl in each county in 2001 and the potential acute and chronic risks to endangered fish. Azinphos methyl is a restricted use pesticide, and applicators are encouraged to follow the use limitations in the California bulletins. Those bulletins include a 200-yard buffer for aerial application and a 40-yard buffer for ground application as well as a 20-foot minimum vegetative strip between the treatment site and surface waters. Although the use limitations in the bulletins are voluntary, applicators must obtain a permit from their County Ag. Commissioner's Office. The Ag. Commissioner's Office may require in the permit that the applicator must adhere to the use limitations. We need to confer with NMFS to determine if these measures are sufficiently protective for listed steelhead and salmonids.

The buffers stipulated on national product labels apply to azinphos methyl applications in Oregon, Washington, and Idaho. Again, we need to confer with NMFS as to whether these measures provide adequate protection for these ESUs or if other mitigation measures also are needed. It would be of value to discuss any proposed mitigation strategy with the affected state pesticide regulatory agencies to ensure consideration of local conditions and use practices.

Table 51. Summary conclusions on specific ESUs of listed Pacific salmon and steelhead for azinphos methyl

Species	ESU	Finding
Steelhead	Southern California	may affect
Steelhead	South-Central California Coast	may affect
Steelhead	Central California Coast	may affect
Steelhead	Central Valley, California	may affect
Steelhead	Northern California	may affect
Steelhead	Upper Columbia River	may affect
Steelhead	Snake River Basin	may affect
Steelhead	Upper Willamette River	may affect
Steelhead	Lower Columbia River	may affect
Steelhead	Middle Columbia River	may affect
Chinook Salmon	Sacramento River winter-run	may affect
Chinook Salmon	Snake River fall-run	may affect
Chinook Salmon	Snake River spring/summer-run	may affect
Chinook Salmon	Central Valley spring-run	may affect
Chinook Salmon	California Coastal	may affect
Chinook Salmon	Puget Sound	may affect
Chinook Salmon	Lower Columbia	may affect
Chinook Salmon	Upper Willamette	may affect
Chinook Salmon	Upper Columbia	may affect
Coho salmon	Central California	may affect
Coho salmon	Southern Oregon/Northern California Coasts	may affect
Coho salmon	Oregon Coast	may affect
Chum salmon	Hood Canal summer-run	may affect
Chum salmon	Columbia River	may affect

Species	ESU	Finding
Sockeye salmon	Ozette Lake	no effect
Sockeye salmon	Snake River	may affect

References

Beyers, D.W., T.J. Keefe, and C.A. Carlson. 1994. Toxicity of carbaryl and malathion to two federally endangered fishes, as estimated by regression and ANOVA. Environ. Toxicol. Chem. 13:101-107.

Dwyer, F.J., D.K. Hardesty, C.E. Henke, C.G. Ingersoll, G.W. Whites, D.R. Mount, and C.M. Bridges. 1999. Assessing contaminant sensitivity of endangered and threatened species: Toxicant classes. U.S. Environmental Protection Agency Report No. EPA/600/R-99/098, Washington, DC. 15 p.

Effland, W.R., N.C. Thurman, and I. Kennedy. Proposed Methods For Determining Watershed-Derived Percent Cropped Areas and Considerations for Applying Crop Area Adjustments To Surface Water Screening Models; USEPA Office of Pesticide Programs; Presentation To FIFRA Science Advisory Panel, May 27, 1999.

Hasler, A.D. and A.T. Scholz. 1983. Olfactory Imprinting and Homing in Salmon. New York: Springer-Verlag. 134 p.

Johnson, W.W., and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. USFWS Publication No. 137.

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

Sappington, L.C., F.L. Mayer, F.J. Dwyer, D.R. Buckler, J.R. Jones, and M.R. Ellersieck. 2001. Contaminant sensitivity of threatened and endangered fishes compared to standard surrogate species. Environ. Toxicol. Chem. 20:2869-2876.

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

Tucker, R.K. and J.S. Leitzke. 1979. Comparative toxicology of insecticides for vertebrate wildlife and fish. Pharmacol. Ther., 6:167-220.

Urban, D.J. and N.J. Cook. 1986. Hazard Evaluation Division - Standard Evaluation Procedure - Ecological Risk Assessment, U. S. EPA Publication 540/9-86-001.

U. S. Department of Agriculture. 2002. Agricultural Chemical Usage: 2000 Nursery and Floriculture Summary, USDA National Agricultural Statistics Service. Online at: http://usda.mannlib.cornell.edu/reports/nassr/other/pcu-bb/#nursery.

Zucker E. 1985. Hazard Evaluation Division - Standard Evaluation Procedure - Acute Toxicity Test for Freshwater Fish. U. S. EPA Publication 540/9-85-006.