Oryzalin
Analysis of Risks
to
Endangered and Threatened Salmon and Steelhead

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Summary

Oryzalin is an herbicide registered nationally for control of annual grasses and certain broadleaf weeds in fruit and nut crops, vineyards, Christmas tree plantations, ornamentals, turf, and several other noncrop sites. A Reregistration Eligibility Decision (RED) that includes an ecological risk assessment for freshwater fish, aquatic invertebrates, and aquatic plants was issued in September of 1994. Oryzalin is moderately toxic to fish, moderately to highly toxic to aquatic invertebrates, and highly toxic to aquatic plants. We modeled Estimated Environmental Concentrations (EECs) for use of oryzalin on grapes and almonds, the two major uses of oryzalin. Acute and chronic risk quotients calculated from these EECs and the available toxicity values indicate no direct risk to endangered fish or aquatic-invertebrate populations. However, risk to aquatic vascular plants exceeds OPP's level of concern when predicted aquatic concentrations are based on the maximum application rate. Loss of aquatic plants might indirectly impact listed Pacific salmon and steelhead through loss of plant cover. We conclude that oryzalin may affect but is not likely to adversely affect 17 ESUs and will have no effect on nine ESUs. Our determinations are based on usage or potential usage of oryzalin within the counties comprising each ESU and the possible adverse indirect effects to listed salmonids from loss of aquatic plant cover in spawning and rearing habitats.

Introduction

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

For a number of major pesticide products, testing has been conducted on the formulated end-use products that are used by the applicator. The results of fish toxicity tests with formulated products can be compared with the results of tests on the same species with the active ingredient only. A comparison of the results should indicate comparable sensitivity, relative to the percentage of active ingredient in the technical versus formulated product, if there is no extra activity due to the combination of inert ingredients. 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.

One area of significant weakness in modeling EECs relates to residential uses, especially by homeowners, but also to an extent by commercial applicators. There are no usage data in OPP that relate to pesticide use by homeowners on a geographic scale that would be appropriate for an assessment of risks to listed species. For example, we may know the maximum application rate for a lawn pesticide, but we do not know the size of the lawns, the proportion of the area in lawns, or the percentage of lawns that may be treated in a given geographic area. There is limited information on soil types, slopes, watering practices, and other aspects that relate to transport and fate of pesticides. We do know that some homeowners will attempt to control pests with chemicals and that others will not control pests at all or will use non-chemical methods. We would expect that in some areas, few homeowners will use pesticides, but in other areas, a high percentage could. As a result, OPP has insufficient information to develop a scenario or address the extent of pesticide use in a residential area. It is also important to note that pesticides used in urban areas can be expected to transport considerable distances if they should run off on to concrete or asphalt, such as with streets (e.g., TDK Environmental, 1991). This makes any quantitative analysis very difficult to address aquatic exposure from home use. It also indicates that a no-use or no-spray buffer approach for protection, which we consider quite viable for agricultural areas, may not be particularly useful for urban areas.

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

Indirect Effects - We also attempt to protect listed species from indirect effects of pesticides. We note that there is often not a clear distinction between indirect effects on a listed species and adverse modification of critical habitat (discussed below). By considering indirect effects first, we can provide appropriate protection to listed species even where critical habitat has not been designated. In the case of fish, the indirect concerns are routinely assessed for food and cover.

The primary indirect effect of concern would be for the food source for listed fish. These are best represented by potential effects on aquatic invertebrates, although aquatic plants or plankton may be relevant food sources for some fish species. However, it is not necessary to protect individual organisms that serve as food for listed fish. Thus, our goal is to ensure that pesticides will not impair populations of these aquatic arthropods. In some cases, listed fish may feed on other fish. Because our criteria for protecting the listed fish species is based upon the most sensitive species of fish tested, then by protecting the listed fish species, we are also protecting the species used as prey.

In general, but with some exceptions, pesticides applied in terrestrial environments will not affect the plant material in the water that provides aquatic cover for listed fish. Application rates for herbicides are intended to be efficacious, but are not intended to be excessive. Because only a portion of the effective application rate of an herbicide applied to land will reach water through runoff or drift, the amount is very likely to be below effect levels for aquatic plants. Some of the applied herbicides will degrade through photolysis, hydrolysis, or other processes. In addition, terrestrial herbicide applications are efficacious in part, due to the fact that the product will tend to stay in contact with the foliage or the roots and/or germinating plant parts, when soil applied. With aquatic exposures resulting from terrestrial applications, the pesticide is not placed in immediate contact with the aquatic plant, but rather reaches the plant indirectly after entering the water and being diluted. Aquatic exposure is likely to be transient in faster-flowing waterss. 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	>0.5	May be indirect effects on T&E fish through food supply reduction

Test data	Risk quotient	Presumption
Aquatic plant acute EC50	>0.5	May be indirect effects on aquatic vegetative cover for T&E fish

The Ecological Risk Assessment SEP (pages 2-6) discusses the quantitative estimates of how the acute toxicity data, in combination with the slope of the dose-response curve, can be used to predict the percentage mortality that would occur at the various risk quotients. The discussion indicates that using a "safety factor" of 10, as applies for restricted use classification, one individual in 30,000,000 exposed to the concentration would be likely to die. Using a "safety factor" of 20, as applies to aquatic T&E species, would exponentially increase the margin of safety. 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 oryzalin

Oryzalin is a 2,6-dinitroaniline herbicide registered for control of certain annual grasses and broadleaf weeds on a variety of crop and noncrop sites. Dinitroaniline herbicides act by inhibiting steps in plant cell division responsible for chromosome separation and cell wall formation. Oryzalin is applied prior to germination of targeted weeds or immediately after cultivation and, for effective weed control, it needs to be thoroughly watered in with at least ½ to 1" of rainfall or sprinkler irrigation. Oryzalin will not control existing weeds. Nationwide agricultural use sites include a variety of fruit and nut trees, berries, vineyards, and olives. Additional use sites include Christmas tree plantations, established trees grown for pulp, tall fescue and southern turf (home lawns, parks, golf courses, other ornamental and recreational turf), ornamentals (landscape, container-grown, field-grown, bulbs), ground covers, and various other noncrop sites (e.g., industrial, utility substations, highway guardrails, sign posts, delineations).

Thirty-eight oryzalin products are currently registered under Section 3 of FIFRA. Product formulation types include granular, wettable powder, water dispersible granules, emulsifiable concentrate, soluble concentrate, ready-to-use solutions, and dust. Some turf products also contain fertilizer for "weed and feed" application. Some products, especially those for use on turf, also contain a second active ingredient. Benfluralin (benefin), a preemergent herbicide, is present at 0.575 to 1.0% ai in 10 products, isoxaben (0.29% ai) is an ingredient in one turf product, and oxyfluorfen (2% ai), an herbicide for preemergent and/or postemergent weed control, is present in one product used on ornamentals. Glyphosate, a postemergent herbicide, is contained (20% ai) in one product that is sprayed over the top of undesired vegetation.

Application rates, obtained from product labels, are summarized in Table 3. Additional use directions, restrictions, and precautions are specified on the attached representative product labels. All applications outside California must be made with ground equipment (low-pressure herbicide sprayer or via chemigation). In California, aerial application is allowed on agricultural crops.

Table 3. Oryzalin use sites and application information (source: product labels)

Use site	appl. rate (lb ai/ acre)	appl. interval (months)	max. lb ai/year
Vineyards Tree nuts Fruits (citrus, pome and stone fruits, berries, kiwi, fig, guava, papaya, pomegranate) Olives Avocado Trees grown for pulp	2 to 6	2 to 2.5	12
Christmas tree plantations (not used in Douglas fir and Eastern hemlock)	2 to 8	2-3	8 to 16

Use site	appl. rate (lb ai/ acre)	appl. interval (months)	max. lb ai/year
Turf - home lawns - parks - golf courses - cemeteries - ornamental turf areas - recreational turfgrass	2 to 3	2 to 3	4 to 9
Other noncrop areas - ditch banks - fencerows - airports - highways and roadsides - farmsteads - utility rights-of-way - railroads - storage areas	3 to 4[a]	4	12
Ornamentals and ground covers	2 to 4	2 to 4	12 to 16
Industrial sites Utility substations Highway guardrails Sign posts and delineators	4 to 12	2 to 8	12 to 24

[a] Expedite Grass & Weed Plus Residual Herbicide (EPA Registration No. 524-449) also contains an equivalent amount of glyphosate (~4 lb ai per gallon) as an active ingredient

We have no recent national data on the amount of oryzalin applied annually in the U.S. The RED provides usage data for 1991 indicating that about 1.46 to 1.92 million pounds of active ingredient was applied to 1 million to 1.86 million acres of turf and crops. Most oryzalin was used on turf (800,000 lb ai), almonds (300,000 to 350,000 lb ai), and grapes (100,000 to 200,000 lb ai). Other major uses included apples (40,000 to 90,000 lb ai), plums and prunes (40,000 to 75,000 lb ai), pistachios (30,000 to 40,000 lb ai), and walnuts (25,000 to 50,000 lb ai).

Some additional data from the 1990s also 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 agricultural crops of highest oryzalin usage during the mid-1990s were grapes (~206,000 lb ai) and almonds (~179,000 lb ai). USGS also mapped oryzalin use on selected crops (Figure 1). This map is included here as a quick and easy visual depiction of where oryzalin 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.

At the state and county level, more data are available for oryzalin use in California than in Oregon, Washington, and Idaho. California requires full pesticide-use reporting by most applicators (excluding homeowners), and the California Department of Pesticide Regulation (DPR) provides the information at the county level (www.cdpr.ca.gov/docs/pur/purmain.htm). The amount of active ingredient applied from 1997 through 2001 is presented in Table 4. Decreased usage in 2000 and 2001 was mostly attributed to a factory explosion that limited the availability of oryzalin to farmers. Usage by crop in 1999 is provided in Table 5. County-level usage information is not provided here but is tabulated in section "4" where we address the potential for exposure of individual steelhead and salmon ESUs.

Table 4. Reported pounds of oryzalin (active ingredient) used in California from 1997 to 2001 (source: California DPR Pesticide Use Report)

Usage	1997	1998	1999	2000[a]	2001[a]
Lb ai applied	814,397	713,148	745,577	456,585	110,714

[a] according to the CA DPR "Summary of Pesticide Use Report Data 2001", a factory explosion significantly reduced the availability of oryzalin to farmers during most of 2000 and 2001

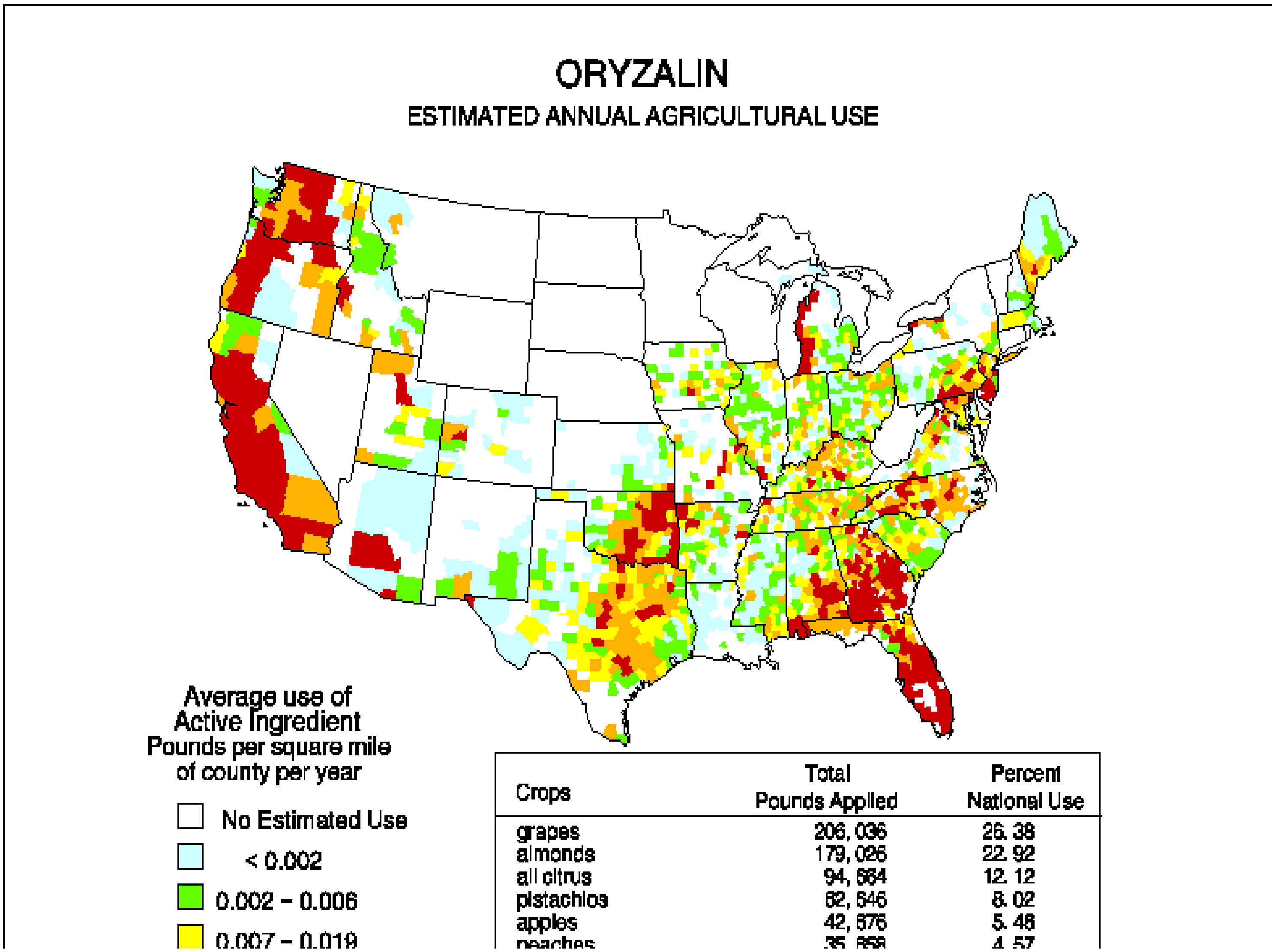

Figure 1. USGS Map for Oryzalin (http://ca.water.usgs.gov/pnsp/use92/)

Table 5. Major crop uses of oryzalin in California in 1999 (source: California DPR Pesticide Use Report)

Use site	lb ai applied	acres treated
Grapes	239,944	144,582
Almonds	167,288	94,480
Rights-of-way	69,516	>3213
Pistachios	67,950	36,383
Landscape maintenance	42,188	>16,000
Peaches	16,916	9852
Outdoor container/field-grown plants	14,097	not reported
Walnuts	13,760	11,731
Prunes	12,608	6536
Plums	10,927	5790
Nectarine	9835	6469
Oranges	8174	4900
Apples	6750	3451
Cherry	6444	4538
Fig	5196	1943
Pomegranate	4778	2913

We are not aware of any comprehensive sources of annual pesticide-use information for Oregon, Washington, or Idaho. Oregon is attempting to implement full pesticide-use reporting but has not yet done so. Information for selected crops in Washington is available from the USDA/NASS Washington Agricultural Statistics Service (www.nass.usda.gov/wa) for 1999 and 2001, but the data are not reported at the county level. State-wide pesticide use was reported for green peas, asparagus, onions, carrots, lima beans, sweet corn, potatoes, apples, grapes, pears, sweet cherries, and strawberries. Oryzalin was reported to have been used only on apples, grapes, and sweet cherries (Table 6).

Table 6. Oryzalin usage in Washington in 1999 and 2001 (source: USDA/NASS Washington Agricultural Statistics Service)

Crop	bearing acreage		% area treated		lb ai/acre/year		total lb ai applied	
	1999	2001	1999	2001	1999	2001	1999	2001
Apples	172,000	168,000	6	6	1.07	1.88	10,300	20,200
Grapes	41,000	48,000	6	7	1.80	1.60	4,400	5,300
Sweet cherries	18,000	22,000	11	5	2.05	2.71	4,000	3,000

a. Aquatic toxicity of oryzalin

The acute toxicity data indicate that technical-grade oryzalin is moderately toxic to both fish (Table 7) and aquatic invertebrates (Table 8). Tests with the scud and aquatic sowbug indicate that a formulation (75% wettable powder) is highly toxic to aquatic invertebrates. OPP has no toxicity data for degradates.

Table 7. Acute toxicity of oryzalin to freshwater fish (source: EFED Pesticide Ecotoxicity Database)

Species	Scientific name	% ai	96-h LC50 (ppm)	Toxicity category
Rainbow trout	*Oncorhynchus mykiss*	100	3.26	moderately toxic
		95	3.45	moderately toxic
Bluegill sunfish	*Lepomis macrochirus*	100	2.88	moderately toxic

Table 8. Acute toxicity of oryzalin to freshwater invertebrates (source: EFED Pesticide Ecotoxicity Database)

Species	Scientific name	% ai	48-h EC50 (ppm)	Toxicity category
Water flea	*Daphnia magna*	96.5	1.5	moderately toxic
Scud[a]	*Gammarus fasciatus*	75 WP[b]	0.2	highly toxic
Aquatic sowbug[a]	*Asellus brevicaudus*	75 WP[b]	0.4	highly toxic

[a] data obtained from Mayer and Ellersieck 1986
[b] WP = wettable powder

Adverse chronic effects on reproduction or growth of freshwater fish and invertebrates occurred at exposure concentrations of 0.43 ppm for fish and 0.60 ppm for the water flea (Table 9). Test organisms in these studies were continuously exposed to the test material for periods of 21 to 66 days.

Table 9. Chronic toxicity of oryzalin to freshwater fish and invertebrates (source: EFED Pesticide Ecotoxicity Database)

Species	Scientific name	% ai	test duration (days)	Endpoints affected	NOEC / LOEC (ppm)
Rainbow trout	*Oncorhynchus mykiss*	98.6	66	reproduction and/or growth	>0.46
Fathead minnow	*Pimephales promelas*	98.4	34	reproduction and/or growth	0.22 / 0.43
Water flea	*Daphnia magna*	96.9	21	eggs hatched, survival, growth	0.35 / 0.60

The available acute toxicity categorize technical-grade oryzalin as moderately toxic to estuarine fish and as moderately to highly toxic to estuarine invertebrates (Table 10).

Table 10. Aquatic organisms: acute toxicity of oryzalin to estuarine fish and invertebrates (source: EFED Pesticide Ecotoxicity Database)

Species	Scientific name	% ai	96-h LC50 or EC50 (ppm)	Toxicity category
Sheepshead minnow	*Cyprinodon variegatus*	96.9	3.04	moderately toxic
Grass shrimp	*Palaemonetes vulgaris*	96.9	>3.11	moderately toxic
Eastern oyster	*Crassostrea virginica*	96.9	0.28	highly toxic

OPP has no chronic toxicity data for estuarine organisms. These studies were not required by the RED.

The available OPP toxicity data for algae and aquatic plants is presented in Table 11. The data indicate that oryzalin, which is an herbicide, is much more toxic to aquatic plants than it is to either fish or aquatic invertebrates.

Table 11. Toxicity of oryzalin to algae and aquatic plants (source: EFED toxicity database)

Species	Scientific name	% ai	120-h EC50 (ppb)
Duckweed	*Lemna gibba*	96.9	15
Green algae	*Selanastrum capricornutum*	96.9	42
Blue-green algae	*Anabaena flos-aquae*	96.9	24
Diatom	*Navicula pelliculosa*	96.9	72
Diatom	*Skeletonema costatum*	96.9	41

b. Environmental fate and transport

OPP has data to characterize the mobility and dissipation route of oryzalin (3,5-dinitro-N^4,N^4-dipropylsulfanilamide). The basic chemical and fate properties of oryzalin are summarized below. Additional details can be found in the attached RED.

Molecular weight	346.35
Water solubility (25ºC):	2.5 ppm
Vapor pressure	$1x10^{-7}$ Hg @ 25ºC
Henry's law constant	$7.8x10^{-8}$
Hydrolysis ($t_{1/2}$):	pH 5: stable pH 7: stable pH 9: stable
Aqueous photolysis ($t_{1/2}$):	1.4 hours
Soil photolysis ($t_{1/2}$):	22.4 hours
Aerobic soil metabolism ($t_{1/2}$):	2.1 months
$K_{oc:}$	600

Some oryzalin products are applied by ground or aerial spray, and surface waters could be contaminated by spray drift from such application. Substantial quantities of oryzalin could also be available for runoff for several days to months post-application depending in part upon the degree of exposure to sunlight (photodegradation on soil half-life of 3.9 days; aerobic soil half-life = 2.1 months; terrestrial field dissipation half-lives of 77 to 146 and 58 to 138 days). The moderately low to intermediate soil/water partitioning (K_d = 2.1, 4.9, 8.4, and 12.9; K_{oc} = 600) indicates that substantial fractions of oryzalin could be transported via both dissolution in runoff water and adsorption to eroding soil.

The susceptibility of oryzalin to direct photolysis in water (half-life = 1.4 hours) should limit its persistence in clear shallow waters with low light attenuation. However, its resistance to abiotic hydrolysis coupled with only a moderate susceptibility to aerobic and anaerobic biodegradation indicate that it will be somewhat more persistent in receiving surface waters that are deeper, have high light attenuation, low microbiological activities and long hydrological resident times. Based upon its relatively low to intermediate soil/water partitioning, significant fractions of the oryzalin in receiving surface waters should exist both dissolved in the water column and adsorbed to suspended and bottom sediment.

Nine degradates have been identified. The major degradate is 4-hydroxy-3,5-dinitro-benzenesulfonamide, which accounted for a maximum of 4.7% of radioactivity at 1 month post-treatment in the soil aerobic metabolism study. Eight other degradates were isolated, but all comprised $\leq$2.4% of the applied radioactivity. The available data on the major degradates of oryzalin are insufficient to assess their runoff characteristics or persistence in surface waters. The RED indicates that the registrant is conducting a mobility/adsorption/desorption study to determine the mobility of nine oryzalin degradates and whether or not degradate leaching is a major route of dissipation. We found no evidence in the RED or elsewhere that any of these degradates have been flagged for toxicological concern, and none of them are found in significant amounts.

Oryzalin does not accumulate significantly in fish. BCFs were 32X in edible tissue, 105X in nonedible tissue, and 66X in whole fish. Depuration ranged from 79.2 to 80.8% after 24 hours and 88.7 to 95.1% after 14 days.

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).

We are aware of only two incident reports for oryzalin. One incident involved aquatic organisms and the other terrestrial plants. The aquatic incident occurred in a 3-acre pond in Georgia in 2001 where an estimated 450 to 500 bluegill and largemouth bass died. The cause of mortality was not determined, but investigators speculated that either oryzalin or a bacterial infection caused the deaths. Oryzalin had been sprayed on a windy day on a field located about 50 to 60 feet uphill from the pond, and the dead fish were found beginning a few days after the application. However, no residue analysis was done for the fish or for the pond water, so oryzalin was not confirmed as the cause of the fish kill. According to the report, a fisheries biologist speculated that a bacterial infection may have killed the fish.

d. Estimated and measured concentrations of oryzalin in surface waters

Estimated environmental concentrations (EECs)

In the environmental risk assessment in the 1994 RED, OPP's Environmental Fate and Effects Division (EFED) derived aquatic EECs from Tier I modeling that is now outdated. EFED has subsequently provided us with refined EECs using PRZM/EXAMS scenarios for almonds and grapes in California. These EECs are presented in Table 12.

Table 12. Estimated Environmental Concentrations (EECs) for Aquatic Exposure Modeled With PRZM/EXAMS

Use site	Appl. rate (lb ai/acre)	No. appl./appl. interval (days)	Peak EEC (ppb)	21-day-avg. EEC (ppb)	60-day-avg. EEC (ppb)
Grapes (CA)	6	2 (75)	15.4	6.4	2.6
Almonds (CA)	6	2 (75)	44.8	19.6	7.9

We note that these EECs are likely to be higher than we would actually expect in California and the Pacific Northwest, because the application information used in the modeling is based on a nationwide maximum application rate of 12 lb ai per acre per year (2 applications of 6 lb ai/acre/year). However, applications in California and the Pacific Northwest appear to be considerably less than the maximum. The usage information for California (Table 5) indicates that slightly less than 2 lb ai per acre per year is applied in almonds (167,288 lb ai on 94,480 acres) and grapes (239,944 lb ai on 144,582 acres). In Washington, approximately 1.6 to 1.8 lb ai was applied per acre per year in grapes in 1999 and 2001 (Table 6).

Measured Concentrations in Surface Water

Some information on measured concentrations of oryzalin in surface waters is available for California and the Pacific Northwest from USGS sources (Table 13). Oryzalin has not been frequently detected, and detected concentrations have been considerably less than modeled by PRZM/EXAMS for aquatic concentrations due to runoff and drift from maximum applications to grapes and almonds.

Table 13. Measured concentrations of oryzalin in surface waters

Location	detections	concentration (ug/L)	source
Puget Sound	detected but percentage unknown	not reported	Ebbert et al. 2000
San Joaquin-Tulare	8%	1.2	Dubrovsky et al. 1998
Central Columbia	no detects	na	Williamson et al. 1998
Willamette	1%	1.2	Wentz et al. 1998
Sacramento River Basin	detected but percentage unknown	not reported	Domagalski et al. 2000
Selected Surface Water Sites in Sacramento River Basin[a]	4.8%	0.03[b]	Domagalski 2000.
	21.4%	1.5	
	50%	0.02[b]	

[a] no aggregate representation was made for the selected surface water sites and some sites did not identify detects of oryzalin; the maximum concentrations are listed for each site where a detection occurred that had a measurable concentration

[b] estimated maximum concentration

e. Changes in registration status

The oryzalin RED issued in September of 1994 required several mitigation measures to reduce risks to freshwater invertebrates and mammals. These include the following:

- aerial application is prohibited except for agricultural uses in California.

- all end-use products must specify application rates, number of applications per year, total pounds of ai per year, and a time-interval between applications

- a fish-toxicity statement must be placed on product labels.

f. General risk conclusions

Our risk conclusions are based on risk quotients (RQs) derived from the available toxicity data (Tables 7 to 11) and EECs modeled from PRZM/EXAMS for almonds and grapes (section d. above), the two major crop uses of oryzalin. Acute toxicity data for estuarine fish and invertebrates also has become available since EFED conducted the environmental risk assessment for the RED. We are not able to derive RQs for noncrop uses (e.g., rights-of-way) or homeowner lawn uses, because OPP has no scenarios for EECs for those uses.

The RQs are presented in Table 14. The LOC (0.05) for acute risk to endangered fish is not exceeded for either freshwater or estuarine fish from a maximum application (12 lb ai/acre/year) in either almonds or grapes. The LOC (0.5) for acute risk to populations of aquatic invertebrates also is not exceeded for either freshwater or estuarine invertebrates for these uses. The chronic LOC (1) also is not exceeded for either fish or aquatic invertebrates. Therefore, we do not expect adverse direct effects to listed salmonids, nor do we expect indirect effects from depletion of their aquatic-invertebrate food sources. However, the LOC for risk to vascular aquatic plants is equaled for grapes and exceeded 3-fold for almonds. Thus, indirect risk to salmonids from loss of aquatic plant cover is a potential concern in those ESUs where there is significant use of oryzalin, including rights-of-way use.

Table 14. Acute and Chronic Risk Quotients for Freshwater and Estuarine Fish and Aquatic Invertebrates, Based on Toxicity for the Most Sensitive Species (Tables 7 to 11) and EECs Modeled from PRZM/EXAMS (Table 12)

Use site	no. applications	freshwater fish[a]	freshwater invertebrates[b]	estuarine fish[c]	estuarine invertebrates[d]	aquatic plants[e]
Acute RQs[f]						
Grapes	1	<0.01	0.08	<0.01	0.06	1.0
Almonds	2	0.02	0.22	0.01	0.16	3.0
Chronic RQs[g]						
Grapes	1	0.01	0.02	no data		not applicable
Almonds	2	0.04	0.06			

[a] blugill acute LC50 = 2880 ppb and fathead minnow chronic NOEC = 220 ppb
[b] scud acute EC50 = 200 ppb and water flea chronic NOEC - 350 ppb
[c] sheepshead minnow LC50 = 3040 ppb
[d] Easter oyster EC50 = 280 ppb
[e] duckweed EC50 = 15 ppb
[f] peak EEC/LC50 or EC50; the acute LOC is 0.05 for endangered fish, 0.5 for aquatic-invertebrate populations, and 1 for aquatic-plant populations
[b] peak EEC/EC50 for aquatic plants; the LOC is 1
[c] 21-day-avg EEC/NOEC for fish and the 21-day-avg EEC/NOEC for aquatic invertebrates; the chronic LOC is 1 for fish and invertebrates

According to an OPP/EFED plant biologist familiar with the dinitroaniline herbicides, oryzalin is more apt to have an effect on floating aquatic vegetation than on rooted aquatic vegetation. These herbicides also are more likely to pose risks to aquatic plants in areas of stagnant waters than in faster-flowing waterss. They tend to be somewhat bound to soil sediments and do not readily translocate through plant xylem. We presume that aquatic plant cover might be at risk in slower-moving waters of the tributaries but probably not in the faster-flowing waters of the migration corridors. Providing a buffer in areas where aquatic plants are at risk might reduce EECs sufficiently that indirect risk to salmonids would be eliminated.

We also note the EECs for the California almonds and grapes scenarios are likely to be conservative. The EECs are based on a maximum of 12 lb ai per acre per year (2 applications of 6 lb ai each). However, the California usage data in Table 5 indicate the average application to both almonds and grapes is only about 2 lb ai per acre per year. Because the RQ (1.0) for aquatic plants equals but does not exceed the LOC (1) for a maximum of 12 lb ai per acre for year in grapes, we presume that it would be below the LOC for anything less than a maximum application.

Oryzalin can be used on residential lawns, but we do not think that homeowner use is likely to have any direct effects beyond that expected for other uses, which do not exceed the LOC. We also do not expect homeowner use to have much of an indirect effect on aquatic plants in areas inhabited by listed salmonids. The maximum application rate for lawns is lower than for crop uses, and drift into surface waters is not likely from homeowner products applied as granules or hose-end sprays. Some runoff from impervious surfaces (e.g., pavement) into storm sewers and streams might occur in residential areas but should be mitigated by the low likelihood that many lawns would be treated with oryzalin in any particular area.

g. Existing protective measures

Nationally, there are no specific protective measures for endangered and threatened species beyond the generic statements on the current oryzalin labels. As stated on product labels, it is a violation of Federal law to use a product in a manner inconsistent with its labeling. FIFRA section 3 labels for oryzalin (e.g., Snapshot 80 Dry Flowable, EPA Registration No. 62719-174, attached) warn that

"This pesticide is toxic to fish."

and requires that applicators

> "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 washwaters or rinsate. Drift may result in reduced germination or emergence of non-target plants adjacent to treated area."

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 DPR in the California Environmental Protection Agency also creates county bulletins consistent with those developed by OPP. The California bulletins include salmon and steelhead locations. Oryzalin is listed as being hazardous to terrestrial plants, but it is not currently listed as a hazard to aquatic organisms.

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

In the following discussion of individual ESUs and oryzalin use, we present available information on the listed Pacific salmon and steelhead ESUs and discuss the potential for the use of oryzalin and possible exposure and risk of 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. Usage data in California was obtained from the California Department of Pesticide Regulation's Summary of Pesticide Use Report Data. We use the report for 1999, because little oryzalin was available in 2000 and 2001 due to a factory explosion. As previously stated, information obtained from the USDA/NASS Washington Agricultural Statistics Service for 1999 and 2001 indicated that oryzalin is used predominantly on apples, grapes, and sweet cherries (see Table 6), but those data are not available at the county level. For those crops, we include the acreage grown in each county within each ESU. Because oryzalin might also be used on other crops for which we have no usage data, we include the entire crop acreage for each county. However, we believe that such usage is likely minimal. The nationwide data indicate that most oryzalin is used on grapes and almonds and most of that use is in California. We have no data on homeowner usage or usage in noncrop areas.

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. It is unknown where rights-of-way use occurs in Los Angeles Co. nor whether this would be in either the Malibu Creek or Topanga Creek watersheds. There is a potential for steelhead waters to drain agricultural areas in Ventura, Santa Barbara, and San Luis Obispo counties.

Usage of oryzalin in counties where this ESU occurs is presented in Table 15.

Table 15. Use of oryzalin (excluding homeowner uses) in 1999 in counties within the Southern California steelhead ESU

County	use site	oryzalin usage (lb ai)	acres treated
San Diego	rights-of-way landscape maintenance outdoor container/field grown plants others	3442 1405 557 154	
Los Angeles	rights-of-way landscape maintenance outdoor container/field grown plants others	11,464 2733 485 267	
Riverside	rights-of-way landscape maintenance grapes others	1795 660 151 233	 200
Ventura	landscape maintenance rights-of-way outdoor container/field grown plants others	1000 859 779 150	
San Luis Obispo	grapes vertebrate pest control landscape maintenance rights-of-way others	13,368 1724 911 614 534	6512
Santa Barbara	grapes rights-of-way others	6881 774 1314	5217

We conclude that use of oryzalin may affect but is not likely to adversely affect the Southern California steelhead ESU. We make this determination based on the amount of oryzalin applied to rights-of-way and landscape maintenance in these counties and the potential for indirect effects due to loss of aquatic plant cover. Direct adverse effects are not expected, and use in grapes at less than the maximum label rate is not likely to exceed the level of concern for aquatic plants.

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 oryzalin usage in 1999 in those counties where this ESU occurs.

Table 16 Use of oryzalin (excluding homeowner uses) in 1999 in counties with the South Central California steelhead ESU.

County	use site	oryzalin usage (lb ai)	acres treated
Santa Cruz	rights-of-way	225	
	landscape maintenance	135	
	others	103	
Santa Clara	landscape maintenance	3357	
	rights-of-way	3326	
	grapes	613	327
	others	142	
San Benito	grapes	1754	1174
	others	472	
Monterey	grapes	21,155	13,275
	others	823	
San Luis Obispo	grapes	13,368	6512
	vertebrate pest control	1724	
	landscape maintenance	911	
	rights-of-way	614	
	others	534	

We conclude that use of oryzalin may affect but is not likely to adversely affect the South Central California steelhead ESU. We make this determination based on the amount of oryzalin applied to rights-of-way and landscape maintenance in Santa Clara Co. and the potential for indirect effects due to loss of aquatic plant cover. Direct adverse effects are not expected, and use in grapes at less than the maximum label rate is not likely to exceed the level of concern for aquatic plants.

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 oryzalin in 1999 in counties in the Central California coast steelhead ESU is presented in Table 17.

Table 17. Use of oryzalin (excluding homeowner uses) in 1999 in counties with the Central California Coast steelhead ESU.

County	use site	oryzalin usage (lb ai)	acres treated
Santa Cruz	rights-of-way	225	
	landscape maintenance	135	
	others	103	
San Mateo	rights-of-way	1598	
	landscape maintenance	818	
	others	95	
San Francisco	all	51	
Marin	landscape maintenance	352	
	rights-of-way	248	
	others	247	
Sonoma	grapes	11,524	5653
	rights-of-way	3077	
	others	677	
Mendocino	grapes	3580	2889
	pears	756	312
	others	99	
Napa	grapes	8934	4069
	landscape maintenance	760	
	rights-of-way	323	
	others	3	
Alameda	landscape maintenance	2404	
	rights-of-way	1076	
	grapes	641	216
	others	75	
Contra Costa	landscape maintenance	3498	
	grapes	1296	537
	rights-of-way	658	
	others	916	

County	use site	oryzalin usage (lb ai)	acres treated
Solano	landscape maintenance	1895	
	outdoor container/field grown plants	1398	
	rights-of-way	1208	
	almonds	525	221
	walnuts	506	281
	others	748	
Santa Clara	landscape maintenance	3357	
	rights-of-way	3326	
	grapes	613	327
	others	142	

We conclude that use of oryzalin may affect but is not likely to adversely affect the Central California Coast steelhead ESU. We make this determination based on the amount of oryzalin applied to rights-of-way and landscape maintenance in these counties and the potential for indirect effects due to loss of aquatic plant cover. Direct adverse effects are not expected, and use in grapes at less than the maximum label rate is not likely to exceed the level of concern for aquatic plants.

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 oryzalin in this ESU is provided in Table 18.

Table 18. Use of oryzalin (excluding homeowner uses) in 1999 in counties with the California Central Valley steelhead ESU.

County	use site	oryzalin usage (lb ai)	acres treated
Alameda	landscape maintenance	2404	
	rights-of-way	1076	
	grapes	641	216
	others	75	
Amador	rights-of-way	756	
	grapes	329	215
	others	14	
Butte	almonds	11,684	8087
	prunes	2778	1091
	walnuts	1839	
	rights-of-way	1402	
	landscape maintenance	1087	
	others	1428	
Calaveras	rights-of-way	876	
	landscape maintenance	253	
	others	442	
Colusa	almonds	484	236
	others	196	
Contra Costa	landscape maintenance	3498	
	grapes	1296	537
	rights-of-way	658	
	others	916	
Glenn	almonds	9771	5746
	prunes	1176	997
	walnuts	580	321
	others	381	
Marin	landscape maintenance	352	
	rights-of-way	248	
	others	247	

County	use site	oryzalin usage (lb ai)	acres treated
Merced	almonds	11,806	8587
	grapes	6842	5127
	peaches	4254	1504
	pistachios	1342	601
	rights-of-way	1260	
	others	1862	
Nevada	all	71	
Placer	landscape maintenance	1105	
	rights-of-way	627	
	others	417	
Sacramento	grapes	12,095	8723
	landscape maintenance	2515	
	rights-of-way	1839	
	others	524	
San Joaquin	grapes	15,911	11,220
	almonds	15,713	13,154
	cherry	4491	3344
	walnuts	3310	3724
	rights-of-way	2130	
	others	3743	
San Mateo	rights-of-way	1598	
	landscape maintenance	818	
	others	95	
San Francisco	all	51	
Shasta	rights-of-way	595	
	landscape maintenance	167	
	others	188	
Solano	landscape maintenance	1895	
	outdoor container/field	1398	
	grown plants	1208	
	rights-of-way	525	221
	almonds	506	281
	walnuts	748	
	others		

County	use site	oryzalin usage (lb ai)	acres treated
Sonoma	grapes	11,524	5653
	rights-of-way	3077	
	others	677	
Stanislaus	almonds	622	564
	landscape maintenance	382	
	walnuts	283	248
	rights-of-way	253	
	others	393	
Sutter	prunes	1385	1070
	peaches	839	732
	walnuts	766	447
	almonds	366	160
	others	535	
Tehama	walnuts	358	196
	almonds	82	41
	rights-of-way	75	
	prunes	74	35
	others	107	
Tuloumne	landscape maintenance	62	
	others	8	
Yolo	landscape maintenance	251	
	grapes	137	168
	others	384	
Yuba	walnuts	122	55
	prunes	88	25
	peaches	64	18
	others	47	

We conclude that use of oryzalin may affect but is not likely to adversely affect the California Central Valley steelhead ESU. We make this determination based on the large amount of oryzalin applied to almonds, rights-of-way, and landscape maintenance in these counties and the potential for indirect effects due to loss of aquatic plant cover. Direct adverse effects are not expected, and use in grapes at less than the maximum label rate is not likely to exceed the level of concern for aquatic plants.

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.

Oryzalin use in this ESU is presented in Table 19.

Table 19. Use of oryzalin (excluding homeowner uses) in 1999 in counties with the Northern California steelhead ESU.

County	use site	oryzalin usage (lb ai)	acres treated
Humboldt	rights-of-way others	215 64	
Mendocino	grapes pears others	3580 756 99	2889 312
Trinity		0	
Lake	grapes pears others	602 349 234	271 163

We conclude that oryzalin will have no effect on the Northern California steelhead ESU. The only extensive use of oryzalin is in grapes in Mendocino Co., but use in grapes at less than the maximum label rate is not likely to exceed the level of concern for aquatic plants.

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.

Crop acreage in the counties within this ESU is provided in Tables 20 and 21.

Table 20. Crop acreage in Washington counties where there is spawning and growth of the Upper Columbia River steelhead ESU. Acreage also is included for those crops on which oryzalin is used according to the USDA/NASS Washington Agricultural Statistics Service

State	county	cultivated cropland acreage[a]	crop	crop acreage
WA	Benton	268,372	apples grapes	18,425 15,929
WA	Franklin	291,696	apples grapes sweet cherries	9000 2813 1665
WA	Kittitas	57,456	apples grapes	1859 419
WA	Yakima	264,490	apples grapes sweet cherries	75,264 15,529 5922
WA	Chelan	31,423	apples sweet cherries	17,096 3698

State	county	cultivated cropland acreage[a]	crop	crop acreage
WA	Douglas	217,703	apples sweet cherries	14,383 1834
WA	Okanogan	72,732	apples sweet cherries	24,164 1001
WA	Grant	529,087	apples grapes	33,615 3132

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

Table 21. Crop acreage in Oregon and Washington counties that are migration corridors for the Upper Columbia River steelhead ESU. Acreage also is included for those crops on which oryzalin is used according to the USDA/NASS Washington Agricultural Statistics Service

State	county	cultivated cropland acreage[a]	crop	crop acreage
WA	Walla Walla	337,660	apples sweet cherries	5222 280
WA	Klickitat	93,193	apples grapes	516 419
WA	Skamania	1205+	apples	75
WA	Clark	27,860	apples grapes	33 32
WA	Cowlitz	8227+	apples sweet cherries	14 1
WA	Wahkiakum	3515+		0
WA	Pacific	5451		0
OR	Gilliam	100,729+		0
OR	Umatilla	384,163	apples grapes	3927 163
OR	Sherman	127,018+		0
OR	Morrow	220,149+		0

State	county	cultivated cropland acreage[a]	crop	crop acreage
OR	Wasco	97,230	apples grapes	463 110
OR	Hood River	17,346+	apples grapes	2592 63
OR	Multnomah	14,692	apples grapes sweet cherries	51 28 4
OR	Columbia	15,054+	apples grapes	39 6
OR	Clatsop	47720		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

We conclude that oryzalin may affect but is not likely to adversely affect the Upper Columbia River steelhead ESU. Our determination is made based on the acreage of apples, grapes, and sweet cherries in counties where there is spawning and growth of this ESU and the possibility for indirect effects due to loss of aquatic plant cover. Direct effects are not expected. We do not expect indirect effects to be significant in the faster-flowing waterss in the migration corridor.

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 oryzalin 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 oryzalin. 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 show the cropping information 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. Crop acreage in Pacific Northwest counties which provide spawning and rearing habitat for the Snake River Basin steelhead ESU. Acreage also is included for those crops on which oryzalin is used according to the USDA/NASS Washington Agricultural Statistics Service

State	county	cultivated cropland acreage[a]	crop	crop acreage
ID	Adams	16,779		0
ID	Idaho	147,557	apples grapes sweet cherries	6 1 2
ID	Nez Perce	168,365	apples sweet cherries	9 4
ID	Custer	34,754		0
ID	Lemhi	41,837+	apples sweet cherries	6 9
ID	Valley	6990+		0

State	county	cultivated cropland acreage[a]	crop	crop acreage
ID	Lewis	119,860		0
ID	Clearwater	24,266		0
ID	Latah	200,691	apples	3
WA	Adams	392,556	apples	3457
WA	Asotin	32,892	apples	24
WA	Garfield	108,553		0
WA	Columbia	97,743		0
WA	Whitman	804,893	apples	19
WA	Franklin	291,696	apples grapes sweet cherries	9000 2813 1665
WA	Walla Walla	337,660	apples sweet cherries	5222 280
WA	Lincoln	471,220		0
WA	Spokane	297,722	apples grapes sweet cherries	227 3 47
OR	Wallowa	54,138	apples	8
OR	Union	90,349	apples	39

[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

Table 23. Crop acreage in Washington and Oregon counties through which the Snake River Basin steelhead ESU migrates. Acreage also is included for those crops on which oryzalin is used according to the USDA/NASS Washington Agricultural Statistics Service

St	county	cultivated cropland acreage[a]	crop	crop acreage
WA	Benton	268,372	apples grapes	18,425 15,929

St	county	cultivated cropland acreage[a]	crop	crop acreage
WA	Klickitat	93,193	apples grapes	516 419
WA	Skamania	1205+	apples	75
WA	Clark	27,860	apples grapes	33 32
WA	Cowlitz	8227+	apples grapes sweet cherries	14 0 1
WA	Wahkiakum	3515+		0
WA	Pacific	5451		0
OR	Umatilla	384,163	apples grapes	3927 163
OR	Morrow	220,149+	apples	0
OR	Gilliam	100,729+		0
OR	Sherman	127,018+		0
OR	Wasco	97,230	apples grapes	463 110
OR	Hood River	17,346+	apples grapes	2592 63
OR	Multnomah	14,692	apples grapes sweet cherries	51 28 4
OR	Columbia	15,054+	apples grapes	39 6
OR	Clatsop	47720		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

We conclude that oryzalin may affect but is not likely to adversely affect the Snake River Basin steelhead ESU. Our determination is made based largely on the acreage of apples grown in

Franklin, Walla Walla, and Adams counties in Washington where there is spawning and growth of this ESU and the possibility for indirect effects due to loss of aquatic plant cover. Direct effects are not expected. We do not expect indirect effects to be significant in those counties with less acreage and in those counties encompassing the migration corridor where indirect effects are less likely due to faster-flowing waterss.

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 oryzalin 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 crop acreage for this ESU.

Table 24. Crop acreage in the spawning and rearing habitat of the Upper Willamette River steelhead ESU

State	county	cultivated cropland acreage[a]	crop	crop acreage
OR	Benton	69,214	apples grapes sweet cherries	62 242 14
OR	Linn	248,392	apples grapes	133 93
OR	Polk	89,599	apples grapes sweet cherries	157 1123 1484
OR	Clackamas	59,923	apples grapes sweet cherries	167 207 23
OR	Marion	202,353	apples grapes sweet cherries	555 761 1459
OR	Yamhill	95,440	apples grapes sweet cherries	310 2887 1140
OR	Washington	85,190	apples grapes sweet cherries	279 989 141

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

Table 25. Crop acreage in Oregon and Washington counties that are part of the migration corridors of the Upper Willamette River steelhead ESU. Acreage also is included for those crops on which oryzalin is used according to the USDA/NASS Washington Agricultural Statistics Service

State	county	cultivated cropland acreage[a]	crop	crop acreage
WA	Clark	27,860	apples grapes	33 32
WA	Cowlitz	8227+	apples sweet cherries	14 1

State	county	cultivated cropland acreage[a]	crop	crop acreage
WA	Wahkiakum	3515+		0
WA	Pacific	5451		0
OR	Multnomah	14,692	apples grapes sweet cherries	51 28 4
OR	Columbia	15,054+	apples grapes	39 6
OR	Clatsop	47720		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

We conclude that oryzalin may affect but is not likely to adversely affect the Upper Willamette River steelhead ESU. Our determination is made based on the acreage of sweet cherries and grapes grown in counties where there is spawning and growth of this ESU and the possibility for indirect effects due to loss of aquatic plant cover. Direct effects are not expected. We do not expect indirect effects to be significant in the faster-flowing waterss in the migration corridor.

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 crop acreage 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. Crop acreage in counties that provide spawning and rearing habitat for the Lower Columbia River Steelhead ESU. Acreage also is included for those crops on which oryzalin is used according to the USDA/NASS Washington Agricultural Statistics Service

State	county	cultivated cropland acreage[a]	crop	crop acreage
OR	Hood River	17,346+	apples grapes	2592 63
OR	Clackamas	59,923	apples grapes sweet cherries	167 207 23
OR	Multnomah	14,692	apples grapes sweet cherries	51 28 4
WA	Clark	27,860	apples grapes	33 32
WA	Lewis	119,860		0
WA	Cowlitz	8227+	apples sweet cherries	14 1
WA	Skamania	1205+	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

Table 27. Crop acreage in counties that are migratory corridors for the Lower Columbia River Steelhead ESU. Acreage also is included for those crops on which oryzalin is used according to the USDA/NASS Washington Agricultural Statistics Service

State	county	cultivated cropland acreage[a]	crop	crop acreage
OR	Columbia	15,054+	apples grapes	39 6
OR	Clatsop	47720		0
WA	Pacific	5451		0
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

We conclude that oryzalin may affect but is not likely to adversely affect the Lower Columbia River Steelhead ESU. Our determination is made based mainly on the acreage of apples grown in Hood River, Oregon where there is spawning and growth of this ESU and the possibility for indirect effects due to loss of aquatic plant cover. Direct effects are not expected. We do not expect indirect effects to be significant in other counties because of the low crop acreage on which oryzalin might be used.

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 crop acreage 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. Crop acreage in counties that provide spawning and rearing habitat for the Middle Columbia River Steelhead ESU. Acreage also is included for those crops on which oryzalin is used according to the USDA/NASS Washington Agricultural Statistics Service

State	county	cultivated cropland acreage[a]	crop	crop acreage
OR	Gilliam	100,729+		0
OR	Morrow	220,149+		0
OR	Umatilla	384,163	apples grapes	3927 163
OR	Sherman	127,018+		0
OR	Wasco	97,230	apples grapes	463 110

State	county	cultivated cropland acreage[a]	crop	crop acreage
OR	Crook	35,824		0
OR	Grant	46,399		0
OR	Wheeler	15,523	apples	23
OR	Jefferson	44,873	apples	4
WA	Benton	268,372	apples grapes	18,425 15,929
WA	Columbia	97,743		0
WA	Franklin	291,696	apples grapes sweet cherries	9000 2813 1665
WA	Kittitas	57,456	apples grapes	1859 419
WA	Klickitat	93,193	apples grapes	516 419
WA	Skamania	1205+	apples	75
WA	Walla Walla	337,660	apples sweet cherries	5222 280
WA	Yakima	264,490	apples grapes sweet cherries	75,264 15,529 5922

[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

Table 29. Crop acreage in Washington and Oregon counties through which the Middle Columbia River steelhead ESU migrates. Acreage also is included for those crops on which oryzalin is used according to the USDA/NASS Washington Agricultural Statistics Service

State	county	cultivated cropland acreage[a]	crop	crop acreage
WA	Skamania	1205+	apples	75

State	county	cultivated cropland acreage[a]	crop	crop acreage
WA	Clark	27,860	apples grapes	33 32
WA	Cowlitz	8227+	apples sweet cherries	14 1
WA	Pacific	5451		0
WA	Wahkiakum	3515+		0
OR	Hood River	17,346+	apples grapes	2592 63
OR	Multnomah	14,692	apples grapes sweet cherries	51 28 4
OR	Columbia	15,054+	apples grapes	39 6
OR	Clatsop	47720		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

We conclude that oryzalin may affect but is not likely to adversely affect the Middle Columbia River steelhead ESU. Our determination is made based on the acreage of apples and grapes grown in several counties where there is spawning and growth of this ESU and the possibility for indirect effects due to loss of aquatic plant cover. Direct effects are not expected. We do not expect indirect effects to be significant in the faster-flowing waterss in the migration corridor.

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 oryzalin in this ESU in 1999 is presented in Table 30.

Table 30. Use of oryzalin (excluding homeowner uses) in 1999 in counties with the Sacramento River winter-run chinook salmon ESU. Spawning areas are primarily in Shasta and Tehama counties above the Red Bluff diversion dam

County	crop	oryzalin usage (lb ai)	acres treated
Alameda	landscape maintenance	2404	
	rights-of-way	1076	
	grapes	641	216
	others	75	
Butte	almonds	11,684	8087
	prunes	2778	1091
	walnuts	1839	
	rights-of-way	1402	
	landscape maintenance	1087	
	others	1428	
Colusa	almonds	484	236
	others	196	
Contra Costa	landscape maintenance	3498	
	grapes	1296	537
	rights-of-way	658	
	others	916	
Glenn	almonds	9771	5746
	prunes	1176	997
	walnuts	580	321
	others	381	
Marin	landscape maintenance	352	
	rights-of-way	248	
	others	247	
Sacramento	grapes	12,095	8723
	landscape maintenance	2515	
	rights-of-way	1839	
	others	524	
San Mateo	rights-of-way	1598	
	landscape maintenance	818	
	others	95	
San Francisco	all	51	

County	crop	oryzalin usage (lb ai)	acres treated
Shasta	rights-of-way	595	
	landscape maintenance	167	
	others	188	
Solano	landscape maintenance	1895	
	outdoor container/field	1398	
	grown plants	1208	
	rights-of-way	525	221
	almonds	506	281
	walnuts	748	
	others		
Sonoma	grapes	11,524	5653
	rights-of-way	3077	
	others	677	
Sutter	prunes	1385	1070
	peaches	839	732
	walnuts	766	447
	almonds	366	160
	others	535	
Tehama	almonds	2771	854
	prunes	1370	372
	rights-of-way	1211	
	others	743	
Yolo	grapes	3879	1901
	prunes	684	173
	landscape maintenance	906	
	almonds	481	545
	others	956	

We conclude that use of oryzalin may affect but is not likely to adversely affect the Sacramento River winter-run chinook salmon ESU. We make this determination based largely on the amount of oryzalin applied to almonds and landscape maintenance in these counties and the potential for indirect effects due to loss of aquatic plant cover. Direct adverse effects are not expected, and use in grapes at less than the maximum label rate is not likely to exceed the level of concern for aquatic plants.

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 oryzalin 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 crop acreage 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. Crop acreage in Pacific Northwest counties which provide spawning and rearing habitat for the Snake River fall-run chinook ESU. Acreage also is included for those crops on which oryzalin is used according to the USDA/NASS Washington Agricultural Statistics Service

State	county	cultivated cropland acreage[a]	crop	crop acreage
ID	Adams	16,779		0

State	county	cultivated cropland acreage[a]	crop	crop acreage
ID	Idaho	147,557	apples grapes sweet cherries	6 1 2
ID	Nez Perce	168,365	apples sweet cherries	9 4
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	apples	3
WA	Adams	392,556	apples	3457
WA	Lincoln	471,220		0
WA	Spokane	297,722	apples grapes sweet cherries	227 3 47
WA	Asotin	32,892	apples	24
WA	Garfield	108,553		0
WA	Columbia	97,743		0
WA	Whitman	804,893	apples	19
WA	Franklin	291,696	apples grapes sweet cherries	9000 2813 1665
WA	Walla Walla	337,660	apples sweet cherries	5222 280
OR	Wallowa	54,138	apples	8
OR	Union	90,349	apples	39

State	county	cultivated cropland acreage[a]	crop	crop acreage
OR	Wasco	97,230	apples grapes	463 110
OR	Jefferson	2151+	apples	5
OR	Sherman	127,018+		0
OR	Gilliam	100,729+		0
OR	Wheeler	15,523	apples	23
OR	Morrow	220,149+		0
OR	Grant	46,399		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

Table 32. Crop acreage in Washington and Oregon counties through which the Snake River fall-run chinook and the Snake River spring/summer-run chinook ESUs migrate. Acreage also is included for those crops on which oryzalin is used according to the USDA/NASS Washington Agricultural Statistics Service

State	county	cultivated cropland acreage[a]	crop	crop acreage
WA	Benton	268,372	apples grapes	18,425 15,929
WA	Klickitat	93,193	apples grapes	516 419
WA	Skamania	1205+	apples	75
WA	Clark	27,860	apples grapes	33 32
WA	Cowlitz	8227+	apples sweet cherries	14 1
WA	Wahkiakum	3515+		0
WA	Pacific	5451		0

State	county	cultivated cropland acreage[a]	crop	crop acreage
OR	Umatilla	384,163	apples grapes	3927 163
OR	Morrow	220,149+		0
OR	Gilliam	100,729+		0
OR	Sherman	127,018+		0
OR	Wasco	97,230	apples grapes	463 110
OR	Hood River	17,346+	apples grape	2592 63
OR	Multnomah	14,692	apples grapes sweet cherries	51 28 4
OR	Columbia	15,054+	apples grapes	39 6
OR	Clatsop	47720		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

We conclude that oryzalin may affect but is not likely to adversely affect the Snake River fall-run chinook ESU. Our determination is made based on the acreage of apples grown in Franklin, Walla Walla, and Adams counties, Washington and grapes and sweet cherries in Franklin Co. where there is spawning and growth of this ESU and the possibility for indirect effects due to loss of aquatic plant cover. Direct effects are not expected. We do not expect indirect effects to be significant in the faster-flowing waters in the migration corridor.

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

Table 33. Crop acreage in counties which provide spawning and rearing habitat for the Snake River spring/summer run chinook ESU. Acreage also is included for those crops on which oryzalin is used according to the USDA/NASS Washington Agricultural Statistics Service

State	county	cultivated cropland acreage[a]	crop	crop acreage
ID	Adams	16,779		0
ID	Idaho	147,557	apples grapes sweet cherries	6 1 2
ID	Nez Perce	168,365	apples sweet cherries	9 4
ID	Custer	34,754		0

State	county	cultivated cropland acreage[a]	crop	crop acreage
ID	Lemhi	41,837+	apples sweet cherries	6 9
ID	Valley	6990+		0
ID	Lewis	119,860		0
ID	Latah	200,691	apples	3
WA	Asotin	32,892	apples	24
WA	Garfield	108,553		0
WA	Columbia	97,743		0
WA	Whitman	804,893	apples	19
WA	Franklin	291,696	apples grapes sweet cherries	9000 2813 1665
OR	Wallowa	54,138	apples	8
OR	Union	90,349	apples	39

[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 oryzalin may affect but is not likely to adversely affect the Snake River spring/summer run chinook ESU. Our determination is made based on the acreage of apples, grapes, and sweet cherries grown in Franklin Co., Washington where there is spawning and growth of this ESU and the possibility for indirect effects due to loss of aquatic plant cover. Direct effects are not expected. We do not expect indirect effects to be significant in the faster-flowing waterss in the migration corridor.

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 oryzalin (excluding homeowner uses) in 1999 in counties with the Central Valley spring run chinook salmon ESU

County	use site	oryzalin usage (lb ai)	acres treated
Alameda	landscape maintenance	2404	
	rights-of-way	1076	
	grapes	641	216
	others	75	
Butte	almonds	11,684	8087
	prunes	2778	1091
	walnuts	1839	
	rights-of-way	1402	
	landscape maintenance	1087	
	others	1428	
Colusa	almonds	484	236
	others	196	
Contra Costa	landscape maintenance	3498	
	grapes	1296	537
	rights-of-way	658	
	others	916	
Glenn	almonds	9771	5746
	prunes	1176	997
	walnuts	580	321
	others	381	

County	use site	oryzalin usage (lb ai)	acres treated
Marin	landscape maintenance	352	
	rights-of-way	248	
	others	247	
Napa	grapes	8934	4069
	landscape maintenance	760	
	rights-of-way	323	
	others	3	
Nevada	all	71	
Placer	landscape maintenance	1105	
	rights-of-way	627	
	others	417	
Sacramento	grapes	12,095	8723
	landscape maintenance	2515	
	rights-of-way	1839	
	others	524	
San Mateo	rights-of-way	1598	
	landscape maintenance	818	
	others	95	
San Francisco	all	51	
Shasta	rights-of-way	595	
	landscape maintenance	167	
	others	188	
Solano	landscape maintenance	1895	
	outdoor container/field	1398	
	grown plants	1208	
	rights-of-way	525	221
	almonds	506	281
	walnuts	748	
	others		
Sonoma	grapes	11,524	5653
	rights-of-way	3077	
	others	677	

County	use site	oryzalin usage (lb ai)	acres treated
Sutter	prunes	1385	1070
	peaches	839	732
	walnuts	766	447
	almonds	366	160
	others	535	
Tehama	almonds	2771	854
	prunes	1370	372
	rights-of-way	1211	
	others	743	
Yolo	grapes	3879	1901
	prunes	684	173
	landscape maintenance	906	
	almonds	481	545
	others	956	
Yuba	prunes	1126	1035
	almonds	664	344
	walnuts	461	213
	others	913	

We conclude that use of oryzalin may affect but is not likely to adversely affect the Central Valley spring run chinook salmon ESU. We make this determination based mainly on the amount of oryzalin applied to almonds, rights-of-way, and landscape maintenance in these counties and the potential for indirect effects due to loss of aquatic plant cover. Direct adverse effects are not expected, and use in grapes at less than the maximum label rate is not likely to exceed the level of concern for aquatic plants.

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 oryzalin 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 oryzalin 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 34. Use of oryzalin (excluding homeowner uses) in 1999 in counties within the California Coastal chinook salmon ESU

County	use site	oryzalin usage (lb ai)	acres treated
Humboldt	rights-of-way others	215 64	
Mendocino	grapes pears others	3580 756 99	2889 312
Sonoma	grapes rights-of-way others	11,524 3077 677	5653
Marin	landscape maintenance rights-of-way others	352 248 247	
Trinity		0	
Lake	grapes pears others	602 349 234	271 163

We conclude that oryzalin will have no effect on the California coastal chinook salmon ESU. The only extensive use of oryzalin is in grapes in Sonoma and Mendocino counties, but use in grapes at less than the maximum label rate is not likely to exceed the level of concern for aquatic plants.

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 crop acreage for Washington counties where the Puget Sound chinook salmon ESU is located.

Table 36. Crop acreage in counties within the Critical Habitat of the Puget Sound chinook salmon ESU. Acreage also is included for those crops on which oryzalin is used according to the USDA/NASS Washington Agricultural Statistics Service

State	county	cultivated cropland acreage[a]	crop	crop acreage
WA	Skagit	57,978	apples	327
WA	Whatcom	65,679	apples grapes sweet cherries	174 10 1
WA	San Juan	4057	apples grapes sweet cherries	64 13 1
WA	Island	9764	apples grapes	18 14
WA	Snohomish	28,836	apples grapes sweet cherries	47 1 2
WA	King	9827	apples grapes sweet cherries	64 2 4
WA	Pierce	13,430	apples sweet cherries	61 1

State	county	cultivated cropland acreage[a]	crop	crop acreage
WA	Thurston	12,130+	apples sweet cherries	23 3
WA	Lewis	119,860		0
WA	Grays Harbor	15,682	apples	5
WA	Mason	1703+	apples sweet cherries	5 1
WA	Clallam	6119	apples grapes	29 4
WA	Jefferson	2151+	apples	5
WA	Kitsap	1300+	apples grapes sweet cherries	21 8 5

[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 oryzalin will have no effect on the Puget Sound chinook salmon ESU. Our determination is made based on the extremely limited acreage of apples, grapes, and sweet cherries in counties where there is critical habitat of this ESU.

7. Lower Columbia River Chinook Salmon ESU

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

The hydrologic units and upstream barriers are the Middle Columbia-Hood (upstream barriers - Condit Dam, The Dalles Dam), Lower Columbia-Sandy (upstream barrier - Bull Run Dam 2), Lewis (upstream barrier - Merlin Dam), Lower Columbia-Clatskanie, Upper Cowlitz, Lower Cowlitz, Lower Columbia, Clackamas, and the Lower Willamette. Spawning and rearing habitat would be in the counties of Hood River, Wasco, Columbia, Clackamas, Marion, Multnomah, and Washington in Oregon, and Klickitat, Skamania, Clark, Cowlitz, Lewis, Wahkiakum, Pacific, Yakima, and Pierce in Washington. 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 oryzalin would not likely be used.

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

Table 37. Crop acreage in counties that are in the Critical Habitat of the Lower Columbia River chinook salmon ESU. Acreage also is included for those crops on which oryzalin is used according to the USDA/NASS Washington Agricultural Statistics Service

State	county	cultivated cropland acreage[a]	crop	crop acreage
OR	Wasco	97,230	apples grapes	463 110
OR	Hood River	17,346+	apples grapes	2592 63
OR	Marion	202,353	apples grapes sweet cherries	555 761 1459
OR	Clackamas	59,923	apples grapes sweet cherries	167 207 23
OR	Multnomah	14,692	apples grapes sweet cherries	51 28 4
OR	Washington	85,190	apples grapes sweet cherries	279 989 141
OR	Columbia	15,054+	apples grapes	39 6
OR	Clatsop	47720		0
WA	Pacific	5451		0
WA	Wahkiakum	3515+		0

State	county	cultivated cropland acreage[a]	crop	crop acreage
WA	Clark	27,860	apples grapes	33 32
WA	Cowlitz	8227+	apples sweet cherries	14 1
WA	Lewis	119,860		0
WA	Klickitat	93,193	apples grapes	516 419
WA	Skamania	1205+	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

We conclude that oryzalin may affect but is not likely to adversely effect the Lower Columbia River chinook salmon ESU. Our determination is made based mainly on the acreage of apples, grapes, and sweet cherries grown in Hood River and Marion counties in Oregon where there is critical habitat for this ESU and the possibility for indirect effects due to loss of aquatic plant cover. Direct effects are not expected.

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 oryzalin would not be used. Salmon habitat for this ESU is exceedingly limited in Douglas County also, but we cannot rule out future oryzalin use in Douglas County.

Tables 38 and 39 show the crop acreage 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. Crop acreage in the spawning and rearing habitat of the Upper Willamette River chinook salmon ESU.

State	county	cultivated cropland acreage[a]	crop	crop acreage
OR	Douglas	37,498	apples grapes sweet cherries	148 581 60
OR	Lane	73,841	apples grapes sweet cherries	174 631 158
OR	Benton	69,214	apples grapes sweet cherries	62 242 14
OR	Linn	248,392	apples grapes	133 93
OR	Polk	89,599	apples grapes sweet cherries	157 1123 1484
OR	Clackamas	59,923	apples grapes sweet cherries	167 207 23
OR	Marion	202,353	apples grapes sweet cherries	555 761 1459
OR	Yamhill	95,440	apples grapes sweet cherries	310 2887 1140

State	county	cultivated cropland acreage[a]	crop	crop acreage
OR	Washington	85,190	apples grapes sweet cherries	279 989 141

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

Table 39. Crop acreage in the migration corridors of the Upper Willamette River chinook salmon ESU. Acreage also is included for those crops on which oryzalin is used according to the USDA/NASS Washington Agricultural Statistics Service

State	county	cultivated cropland acreage[a]	crop	crop acreage
WA	Clark	27,860	apples grapes sweet cherries	33 32 0
WA	Cowlitz	8227+	apples sweet cherries	14 1
WA	Wahkiakum	3515+		0
WA	Pacific	5451		0
OR	Multnomah	14,692	apples grapes sweet cherries	51 28 4
OR	Columbia	15,054+	apples grapes	39 6
OR	Clatsop	47720		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

We conclude that oryzalin may affect but is not likely to adversely affect the the Upper Willamette River chinook salmon ESU. Our determination is made based on the acreage of apples, grapes, and sweet cherries grown in counties where there is spawning and growth of this ESU and the possibility for indirect effects due to loss of aquatic plant cover. Direct effects are not expected. We do not expect indirect effects to be significant in the faster-flowing waterss in the migration corridor.

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 crop acreage 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. Crop acreage in Washington counties where there is spawning and rearing habitat for the Upper Columbia River chinook salmon ESU. Acreage also is included for those crops on which oryzalin is used according to the USDA/NASS Washington Agricultural Statistics Service

State	county	cultivated cropland acreage[a]	crop	crop acreage
WA	Benton	268,372	apples grapes	18,425 15,929
WA	Kittitas	57,456	apples grapes	1859 419
WA	Chelan	31,423	apples sweet cherries	17,096 3698
WA	Douglas	217,703	apples sweet cherries	14,383 1834
WA	Okanogan	72,732	apples sweet cherries	24,164 1001

State	county	cultivated cropland acreage[a]	crop	crop acreage
WA	Grant	529,087	apples grapes	33,615 3132

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

[b] the Ag. Census data provides acreage only for cut trees; we have multiplied the cut acreage by 7 to account for uncut trees that also may be treated

Table 41. Crop acreage in counties that are migration corridors for the Upper Columbia River chinook salmon ESU. Acreage also is included for those crops on which oryzalin is used according to the USDA/NASS Washington Agricultural Statistics Service

State	county	cultivated cropland acreage[a]	crop	crop acreage
WA	Franklin	291,696	apples grapes sweet cherries	9000 2813 1665
WA	Yakima	264,490	apples grapes sweet cherries	75,264 15,529 5922
WA	Walla Walla	337,660	apples sweet cherries	5222 280
WA	Klickitat	93,193	apples grapes	516 419
WA	Skamania	1205+	apples	75
WA	Clark	27,860	apples grapes	33 32
WA	Cowlitz	8227+	apples sweet cherries	14 1
WA	Wahkiakum	3515+		0
WA	Pacific	5451		0
OR	Gilliam	100,729+		0

State	county	cultivated cropland acreage[a]	crop	crop acreage
OR	Umatilla	384,163	apples grapes	3927 163
OR	Sherman	127,018+		0
OR	Morrow	220,149+		0
OR	Wasco	97,230	apples grapes	463 110
OR	Hood River	17,346+	apples grapes	2592 63
OR	Multnomah	14,692	apples grapes sweet cherries	51 28 4
OR	Columbia	15,054+	apples grapes	39 6
OR	Clatsop	47720		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

We conclude that oryzalin may affect but is not likely to adversely affect the Upper Columbia River chinook salmon ESU. Our determination is made based on the extensive acreage of apples, grapes, and sweet cherries grown in counties where there is spawning and growth of this ESU and the possibility for indirect effects due to loss of aquatic plant cover. Direct effects are not expected. We do not expect indirect effects to be significant in the faster-flowing waters in the migration corridor.

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

Table 42. Use of oryzalin (excluding homeowner uses) in 1999 in counties with the Central California Coast coho ESU

County	use site	oryzalin usage (lb ai)	acres treated
Santa Cruz	rights-of-way landscape maintenance others	225 135 103	
San Mateo	rights-of-way landscape maintenance others	1598 818 95	
Marin	landscape maintenance rights-of-way others	352 248 247	
Sonoma	grapes rights-of-way others	11,524 3077 677	5653
Mendocino	grapes pears others	3580 756 99	2889 312
Napa	grapes landscape maintenance rights-of-way others	8934 760 323 3	4069

We conclude that use of oryzalin may affect but is not likely to adversely affect the Central California Coast coho salmon ESU. We make this determination based mainly on the amount of oryzalin applied to rights-of-way in San Mateo and Sonoma counties and the potential for indirect effects due to loss of aquatic plant cover. Direct adverse effects are not expected, and use in grapes at less than the maximum label rate is not likely to exceed the level of concern for aquatic plants.

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 County, California from this analysis because the salmon habitat in this county is not near the agricultural areas.

Oryzalin use in counties occupied by this ESU is presented in Tables 43 and 44.

Table 43. Oryzalin usage (exclduing homeowner uses) in 1999 in California counties within the Southern Oregon/Northern California coastal coho salmon ESU

County	crop	oryzalin usage (lb ai)	acres treated
Humboldt	rights-of-way others	215 64	
Mendocino	grapes pears others	3580 756 99	2889 312
Del Norte	rights-of-way others	144 8	
Siskiyou	rights-of-way others	72 9	
Trinity		0	
Lake	grapes pears others	602 349 234	271 163

Table 44. Crop acreage in Oregon counties where there is habitat for the Southern Oregon/Northern California coastal coho salmon ESU.

State	county	cultivated cropland[a]	crop	crop acreage
OR	Curry	1807	apples	27
OR	Jackson	33,529	apples grapes sweet cherries	360 400 22
OR	Josephine	9015	apples grapes sweet cherries	181 355 9
OR	Douglas	37,498	apples grapes sweet cherries	148 581 60

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

We conclude that use of oryzalin will have no effect on the Southern Oregon/Northern California coastal coho salmon ESU. We make this determination based mainly on the small amount of oryzalin used or potentially used in these counties. Direct adverse effects are not expected. Although a considerable amount of oryzalin is used on grapes, especially in Mendocino Co., California, use in grapes at less than the maximum label rate is not likely to exceed the level of concern for aquatic plants.

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 crop acreage for Oregon counties where the Oregon coast coho salmon ESU occurs.

Table 45. Crop acreage in counties where there is habitat for the Oregon coast coho salmon ESU.

State	county	cultivated cropland[a]	crop	crop acreage
OR	Curry	1807	apples	27
OR	Coos	14,115+	apples grapes sweet cherries	28 12 3
OR	Douglas	37,498	apples grapes sweet cherries	148 581 60
OR	Lane	73,841	apples grapes sweet cherries	174 631 158
OR	Lincoln	3626+	apples grapes	22 1
OR	Benton	69,214	apples grapes sweet cherries	62 242 14
OR	Polk	89,599	apples grapes sweet cherries	157 1123 1484
OR	Tillamook	6448		0
OR	Clatsop	47720		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

We conclude that oryzalin will have no effect on the Oregon coast coho salmon ESU. Carbaryl is potentially used in several counties, but crop acreage in most or all of Polk Co. and agricultural parts of Douglas and Lane counties are in the Willamette watershed, not in coastal watersheds. Coastal streams are generally fast-flowing as they move out of the mountains.

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 crop acreage for Washington counties where the Hood Canal summer-run chum salmon ESU occurs.

Table 46. Crop acreage in counties where there is habitat for the Hood Canal Summer-run chum salmon ESU. Acreage also is included for those crops on which oryzalin is used according to the USDA/NASS Washington Agricultural Statistics Service

State	county	cultivated cropland[a]	crop	crop acreage
WA	Mason	1703+	apples sweet cherries	5 1
WA	Clallam	6119	apples grapes	29 4
WA	Jefferson	2151+	apples	5
WA	Kitsap	1300+	apples grapes sweet cherries	21 8 5
WA	Island	9764	apples grapes	18 14
WA	Grays Harbor	15,682	apples	5

[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 oryzalin will have no effect on the Hood Canal Summer-run chum salmon ESU. Our determination is based on the minuscule acreage on which oryzalin might be used in the counties within this ESU.

2. Columbia River Chum Salmon ESU

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

Critical habitat for the Columbia River chum salmon ESU encompasses all accessible reaches and adjacent riparian zones of the Columbia River (including estuarine areas and tributaries) downstream from Bonneville Dam, excluding Oregon tributaries upstream of Milton Creek at river km 144 near the town of St. Helens. These areas are the hydrologic units of Lower Columbia - Sandy (upstream barrier - Bonneville Dam, Lewis (upstream barrier - Merlin Dam), Lower Columbia - Clatskanie, Lower Cowlitz, Lower Columbia, Lower Willamette in the counties of Clark, Skamania, Cowlitz, Wahkiakum, Pacific, Lewis, Washington and Multnomah, Clatsop, Columbia, and Washington, Oregon. It appears that there are three extant populations in Grays River, Hardy Creek, and Hamilton Creek.

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

Table 47. Crop acreage in counties where there is habitat for the Columbia River chum salmon ESU. Acreage also is included for those crops on which oryzalin is used according to the USDA/NASS Washington Agricultural Statistics Service

State	county	cultivated cropland[a]	crop	crop acreage
WA	Skamania	1205+	apples	75
WA	Clark	27,860	apples grapes	33 32
WA	Lewis	119,860		0
WA	Cowlitz	8227+	apples sweet cherries	14 1
WA	Pacific	5451		0
WA	Wahkiakum	3515+		0
OR	Multnomah	14,692	apples grapes sweet cherries	51 28 4
OR	Columbia	15,054+	apples grapes sweet cherries	39 6 0
OR	Washington	85,190	apples grapes sweet cherries	279 989 141

OR	Clatsop	47720		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

We conclude that oryzalin will have no effect on the Columbia River chum salmon ESU. Our determination is based on the small acreage on which oryzalin might be used in the counties within this ESU.

E. Sockeye Salmon

Sockeye salmon, *Oncorhynchus nerka*, are the third most abundant species of Pacific salmon, after pink and chum salmon. Sockeye salmon exhibit a wide variety of life history patterns that reflect varying dependency on the fresh water environment. The vast majority of sockeye salmon typically spawn in inlet or outlet tributaries of lakes or along the shoreline of lakes, where their distribution and abundance is closely related to the location of rivers that provide access to the lakes. Some sockeye, known as kokanee, are non-anadromous and have been observed on the spawning grounds together with their anadromous counterparts. Some sockeye, particularly the more northern populations, spawn in mainstem rivers.

Growth is influenced by competition, food supply, water temperature, thermal stratification, and other factors, with lake residence time usually increasing the farther north a nursery lake is located. In Washington and British Columbia, lake residence is normally 1 or 2 years. Incubation, fry emergence, spawning, and adult lake entry often involve intricate patterns of adult and juvenile migration and orientation not seen in other *Oncorhynchus* species. Upon emergence from the substrate, lake-type sockeye salmon juveniles move either downstream or upstream to rearing lakes, where the juveniles rear for 1 to 3 years prior to migrating to sea. Smolt migration typically occurs beginning in late April and extending through early July.

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

<u>1. Ozette Lake Sockeye Salmon ESU</u>

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).

Table 48. Crop acreage in Clallum County where there is habitat for the Ozette Lake sockeye salmon ESU

State	county	cultivated cropland[a]		crop acreage
WA	Clallam	6119	apples grapes	29 4

[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 oryzalin will have no effect on the Ozette Lake sockeye salmon ESU. Our determination is based on the minute acreage on which oryzalin might be used in the counties within this ESU, and because direct effects are not expected.

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

Crop acreage in counties encompassing spawning and rearing habitat and migratory corridors for the Snake River sockeye salmon ESU is provided in Tables 49 and 50.

Table 49. Crop acreage in Idaho counties where there is spawning and rearing habitat for the Snake River sockeye salmon ESU

State	county	cultivated cropland[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; 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

Table 50. Crop acreage in counties within the migratory corridors for the Snake River sockeye salmon ESU. Acreage also is included for those crops on which oryzalin is used according to the USDA/NASS Washington Agricultural Statistics Service

State	county	cultivated cropland[a]	crop	crop acreage
ID	Idaho	147,557	apples grapes sweet cherries	6 1 2
ID	Lemhi	41,837+	apples sweet cherries	6 9
ID	Lewis	119,860		0
ID	Nez Perce	168,365	apples sweet cherries	9 4
ID	Valley	6990+		0
WA	Asotin	32,892	apples	24
WA	Garfield	108,553		0
WA	Whitman	804,893	apples sweet cherries	19 0
WA	Columbia	97,743		0
WA	Walla Walla	337,660	apples sweet cherries	5222 280
WA	Franklin	291,696	apples grapes sweet cherries	9000 2813 1665

State	county	cultivated cropland[a]	crop	crop acreage
WA	Benton	268,372	apples grapes	18,425 15,929
WA	Klickitat	93,193	apples grapes	516 419
WA	Skamania	1205+	apples	75
WA	Clark	27,860	apples grapes sweet cherries	33 32 0
WA	Cowlitz	8227+	apples grapes sweet cherries	14 0 1
WA	Wahkiakum	3515+		0
WA	Pacific	5451		0
OR	Wallowa	54,138	apples	8
OR	Umatilla	384,163	apples grapes	3927 163
OR	Morrow	220,149+		0
OR	Gilliam	100,729+		0
OR	Sherman	127,018+		0
OR	Wasco	97,230	apples grapes	463 110
OR	Hood River	17,346+	apples grapes	2592 63
OR	Multnomah	14,692	apples grapes sweet cherries	51 28 4
OR	Columbia	15,054+	apples grapes sweet cherries	39 6 0
OR	Clatsop	47720		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

We conclude that oryzalin will have no effect on the Snake River sockeye salmon ESU. Our determination is made based on no usage of oryzalin in the two Idaho counties where there is spawning and rearing habitat for this ESU. We do not expect indirect effects to be significant in the faster-flowing waterss in the migration corridor.

5. Summary conclusions for listed Pacific salmon and steelhead

Based on the available information and best professional judgement, our conclusions on potential adverse effects on listed Pacific salmon and steelhead are provided in Table 51. We conclude that oryzalin may affect but will not adversely affect 17 ESUs from possible indirect effects on aquatic-plant cover and will have no effect on nine ESUs.

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

Species	ESU	Finding
Steelhead	Southern California	may affect but not likely to adversely affect
Steelhead	South-Central California Coast	may affect but not likely to adversely affect
Steelhead	Central California Coast	may affect but not likely to adversely affect
Steelhead	Central Valley, California	may affect but not likely to adversely affect
Steelhead	Northern California	no effect
Steelhead	Upper Columbia River	may affect but not likely to adversely affect
Steelhead	Snake River Basin	may affect but not likely to adversely affect
Steelhead	Upper Willamette River	may affect but not likely to adversely affect
Steelhead	Lower Columbia River	may affect but not likely to adversely affect

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

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