Fenbutatin Oxide
Analysis of Risks
to
Endangered and Threatened Salmon and Steelhead

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Summary

Fenbutatin oxide is an acaricide registered for restricted use in agriculture on a variety of fruits, berries, nuts, Christmas trees, and ornamentals. There are also two non-restricted use products containing fenbutatin oxide and other active ingredients for homeowner use on ornamental trees, shrubs, and flowers. Fenbutatin oxide controls a variety of mites.

Fenbutatin-oxide is very highly toxic to fish. It is persistent in the environment and is immobile in soils. Risk quotients exceed criteria of concern by a considerable amount. An endangered species risk assessment is developed for federally listed Pacific salmon and steelhead. This assessment applies the findings of the Reregistration Eligibility Decision developed for non-target fish and wildlife, along with other information, to determine the potential risks to the 26 listed Evolutionarily Significant Units of Pacific salmon and steelhead. The use of fenbutatin oxide may affect 23 of these ESUs, may affect but is not likely to adversely affect 1 ESU, and will not affect 2 ESUs.

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1. Background

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

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

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

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

LC50 or EC50	Category description
< 0.1 ppm	Very highly toxic

0.1- 1 ppm	Highly toxic
>1 < 10 ppm	Moderately toxic
> 10 < 100 ppm	Slightly toxic
> 100 ppm	Practically non-toxic

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

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

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

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

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

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

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

The comparison of formulated product and technical ingredient test results may not provide specific information on the individual inert ingredients, but rather is like a "black box" which sums up the effects of all ingredients. I consider this approach to be more appropriate than testing each individual inert and active ingredient because it incorporates any additivity, antagonism, and synergism effects that may occur and which might not be correctly evaluated from tests on the individual ingredients. I do note, however, that we do not have aquatic data on most formulated products, although we often have testing on one or perhaps two formulations of an active ingredient.

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

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

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

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

One area of significant weakness in modeling EECs relates to residential uses, especially by homeowners, but also to an extent by commercial applicators. There are no usage data in OPP that relate to pesticide use by homeowners on a geographic scale that would be appropriate for an assessment of risks to listed species. For example, we may know the maximum application rate for a lawn pesticide, but we do not know the size of the lawns, the proportion of the area in lawns, or the percentage of lawns that may be treated in a given geographic area.

There is limited information on soil types, slopes, watering practices, and other aspects that relate to transport and fate of pesticides. We do know that some homeowners will attempt to control pests with chemicals and that others will not control pests at all or will use non-chemical methods. We would expect that in some areas, few homeowners will use pesticides, but in other areas, a high percentage could. As a result, OPP has insufficient information to develop a scenario or address the extent of pesticide use in a residential area.

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

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

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

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

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

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

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

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

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

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

Table 2. Risk quotient criteria for fish and aquatic invertebrates

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

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

Fenbutatin-oxide, also known as hexakis, was originally registered in 1974, with the first end-use product registered in 1975 under the trade name Vendex. It is an organotin acaricide registered for use against mites on almonds, apples, cherries, citrus fruits, cucumbers, eggplant, grapes, papayas, peaches, pears, pecans, plums, raspberries, strawberries, and walnuts, greenhouse crops, and ornamentals. Fenbutatin-oxide is primarily used in agriculture with key markets in Florida and California. Fenbutatin-oxide residential products are used on ornamentals and are typically applied using hand-held equipment such as low pressure handwands, backpack sprayers, or hose-end sprayers.

As a result of the ecological risk assessment for the 1994 Reregistration Eligibility Decision (RED), the agricultural use of fenbutatin oxide was classified as restricted use due to high acute toxicity to aquatic organisms. Spray drift precautions were put on the label, along with additional limitations related to citrus use in Florida, because of the high potential for exposure of freshwater and estuarine environments from this use. These were not applied to citrus elsewhere, presumably because California, Arizona, and Texas citrus are not so associated with aquatic environments.

There are three registered end-use products in addition to the technical material. Vendex 50WP (50 % active ingredient) is the sole product registered for agricultural use. The other two products are for the homeowner market. One of these is formulated with 8% acephate and 0.5% fenbutatin oxide, and the other is formulated with 4% acephate, 3.25% triforine, and 0.75% fenbutatin-oxide. Labels are included as Attachment 1.

Applications of fenbutatin oxide need to provide "thorough and complete" coverage of infested foliage and fruit. While not specified as such on the label, this indicates that agricultural applications will typically be made to fruit trees with air blast sprayers. The label recommends applications only above 70º F. There are a number of warnings about spray drift and suggestions about how to control it. Applications may not be made through irrigation systems, nor in residential orchard settings. Aerial application is not prohibited, but the thorough coverage necessary indicates that applications will normally be by ground equipment.

Applications of home and garden fenbutatin products are made with standard home spray equipment, typically using hand held tank sprayers, backpack sprayers or garden hose-end spray equipment.

Agricultural use is typically 1 lb ai/A or less per application and 1 lb ai/A per year, but the maximum label rate is 1-2 lb ai/A per application and up to three applications per year, depending upon the crop (Table 3).

Table 3. Application information for crops where fenbutatin oxide may be applied within the range of Pacific salmon and steelhead.

crop	maximum rate per application (lb ai/A)	maximum rate per year (lb ai/A)	maximum number of applications	minimum spray interval
Apples, pears, strawberries (except CA)	1	2	2	not specified
strawberries (CA), eggplant	1.5	4.5	3	not specified
CA citrus	2	3	2	30 days
Grapes, almonds, pecans, walnuts	1.25	2	2	21 days
Peaches, plums, prunes, nectarines	1	1.5	2	not specified
cherries	1.5	2.25	2	not specified
raspberries, Christmas trees (OR, WA only)	1	1	1	not applicable
ornamentals for propagation*	0.5-1 lb per 100 gallons of spray	not specified	"as necessary"	not specified
established landscape ornamentals*	0.5-1 lb per 100 gallons of spray	not specified	4	not specified

* Fenbutatin oxide is restricted use and limited to certified applicators (i.e., there is no homeowner use of this product, but see section h below for non-restricted use products that can be used by homeowners)

According to the Qualitative Use Assessment (Attachment 2) for fenbutatin oxide, the annual estimate of use, based on data from 1990-2000, averaged 390,000 pounds of active ingredient per year, used on 503,000 treated acres. Over half of this usage is on citrus, and it appears that most citrus use is in Florida. Almonds, peaches, strawberries, other berries, apples, and grapes are other crops with 3-10% of the fenbutatin oxide pounds used. In terms of percentage of crop treated, high usage was for eggplant (29% treated, but that is only 1000 acres), raspberries (26% treated), peaches (14%), tart cherries (12%), nectarines (12%), almonds (10%), table grapes (10%). Various citrus crops had 10-27% treated. No information is available on the amount of fenbutatin oxide used by homeowners. The QUA has no information on residential or ornamental uses of fenbutatin oxide. However, California requires reporting of commercial treatment of the restricted use product to home areas and ornamentals. Landscape use in California amounted to only 3 pounds of active ingredient in 2001; an additional 197 pounds of use were reported for nursery use in greenhouses.

Table 4. Reported use of fenbutatin oxide in California, 1992-2001, in pounds of active ingredient

1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
104,854	80,586	84,462	80,156	114,700	120,887	101,277	103,465	73,287	62,623

Table 5. Use of fenbutatin oxide by crop or site in California in 2001

Crop	pounds active used	acres treated
Almonds	22,364	29,710
Apples	3449	3834
Cherries	387	694
Citrus	23	15
Eggplant	263	264
Grapes	7035	8586
Grapefruit	26	20
Landscape maintenance	3	not reported
Lemons	38	71
Nursery greenhouse	197	299
Nectarines	3459	4901
Oranges	959	1359
Pears	137	198
Plums	2517	3092
Prunes	5099	7732
Research	14	not reported
Rice	8	10
Rights-of-way	<1	not reported
Strawberries	230	154

Structural pest control	<1	not reported
Walnuts	2678	3247

I have attached a map of pesticide use for fenbutatin oxide as developed by the USGS. (Attachment 3) This is included as a quick and easy visual depiction of where fenbutatin oxide may have been used on agricultural crops, but it should not be used for any quantitative analysis because it is based on 1992 crop acreage data and was developed from 1990-1995 statewide estimates of use that were then applied to that county acreage without consideration of local practices and usage.

a. Aquatic toxicity of fenbutatin-oxide

Acute toxicity

The acute toxicity data for freshwater organisms (Table 6) indicate that fenbutatin oxide is very highly toxic to fish and aquatic invertebrates. There are two tests on the wettable powder formulation; the results are consistent with those on the active ingredient, indicating that ingredients other than active ones, provide no meaningful addition to the toxicity of the active ingredient. The emulsifiable concentrate formulation is less toxic to fish and more toxic to aquatic invertebrates, but is no longer registered.

Table 6. Aquatic organisms: acute toxicity of fenbutatin-oxide to freshwater fish and invertebrates.

Species	Scientific name	% a. i.	96-hour LC50 (ppb)	Toxicity Category
Waterflea	*Daphnia magna*	98.6	31(48-hr LC50)	Very highly toxic
Waterflea	*Daphnia magna*	42[b]	10 (48-hr LC50)	Very highly toxic
Waterflea	*Daphnia magna*	"tech"	42.9	Very highly toxic
Rainbow trout	*Oncorhynchus mykiss*	95	1.7	Very highly toxic
Rainbow trout	*Oncorhynchus mykiss*	100	1.7	Very highly toxic
Rainbow trout	*Oncorhynchus mykiss*	98.6	6.6	Very highly toxic
Bluegill sunfish	*Lepomis macrochirus*	95	4.8	Very highly toxic
Bluegill sunfish	*Lepomis macrochirus*	100	4.8	Very highly toxic
Rainbow trout	*Oncorhynchus mykiss*	50[a]	14 (24-hr LC50)	Very highly toxic
Rainbow trout	*Oncorhynchus mykiss*	42[b]	120	Very highly toxic
Bluegill sunfish	*Lepomis macrochirus*	42[b]	130	Very highly toxic
Fathead minnow	Pimephales promelas	50[a]	1.9	Very highly toxic

Table 6. Aquatic organisms: acute toxicity of fenbutatin-oxide to freshwater fish and invertebrates.				
Channel catfish	Ictalurus punctatus	50[a]	1.5	Very highly toxic

a. Wettable powder
b. Emulsifiable concentrate (discontinued product)

Two additional acute toxicity studies were found in the AQUIRE database. I reviewed the brine shrimp paper. For the Japanese eel paper, information is presented to the extent available in that data base; I did not review the original paper.

Table 7. Aquatic organisms: acute toxicity of fenbutatin-oxide to freshwater fish and invertebrates from AQUIRE database.

Species	Scientific name	test material % a. i.	LC50	Reference
Japanese eel	*Anguilla japonica*	Formulated product ?ai	48 hr 75 ppb	Yokoyama et al., 1988
Brine shrimp	*Artemia sp*	55% soluble concentrate[a]	24 hr 50 ppb (NOEC 20 ppb)	Machera et al. 1996

a. This formulation is not registered in the United States

Chronic toxicity

Data on the chronic toxicity of fenbutatin oxide to freshwater organisms is presented in Table 8 below. As with the acute data, fish are more sensitive than tested aquatic invertebrates.

Table 8. Aquatic organisms: chronic and subchronic toxicity of fenbutatin-oxide to freshwater fish and invertebrates

Species	Scientific name	duration	% a. i.	Endpoints affected	NOEC (ppb)	LOEC (ppb)
Waterflea	*Daphnia magna*	21 d	98.6	survival	16	39
Rainbow trout	*Oncorhynchus mykiss*	60 d	98.6	growth & survival	0.31	0.61

Unlike the freshwater organisms, the estuarine aquatic invertebrate is more sensitive than estuarine fish (Table 9). This may be simply because the sheepshead minnow is much less sensitive than rainbow trout. However, it should be noted that many compounds containing metals will have different effects in saltwater than in freshwater. The oyster is remarkably sensitive; again, this is not uncommon with metallic compounds.

Table 9. Aquatic organisms: acute toxicity of fenbutatin-oxide to estuarine fish and invertebrates				
Species	Scientific name	% a. i.	96-hour LC50	NOEC (ppb)
Sheepshead minnow	*Cyprinodon variegatus*	99%	20.8 ppb	very highly toxic
Mysid shrimp	*Americamysis bahia*	98%	2.8 ppb	very highly toxic
Oyster (embryo-larval)	*Crassostrea virginica*	98%	0.4 ppb	very highly toxic

There are no estuarine-marine chronic toxicity studies.

b. Environmental fate and transport

Fenbutatin-oxide is persistent in the environment, with no apparent major route of dissipation. In laboratory studies, fenbutatin-oxide is stable to hydrolysis at pH's 5, 7, and 9. Fenbutatin oxide photodegrades in sterile water with an estimated half life of over 100 days. The only major photolytic degradation product was IN-CG200 {1,3-dihydroxy-1,1,3,3-tetrakis (2-methyl-2-phenylpropyl) distannoxane}, which comprised 22.8% of the materials remaining at 15 days. The photodegradation half-life on sandy loam soil was 128 days, with the same degradate comprising 3.4% of the applied material after 31 days. Fenbutatin oxide is relatively stable to soil metabolism, with over 75% of the initial material remaining after 12 months in aerobic soils and after 60 days in anaerobic soils. Fenbutatin oxide shows low mobility in soils and is not expected to leach. It binds strongly to soil particles and does not readily desorb. It has very low solubility of 12.7 ppb in water.

In field dissipation studies, fenbutatin oxide was found to have a half-life of typically greater than one year (range 271-1370 days). Residues in the soil tend to accumulate from year to year, but not in crops. This may be due to the strong adsorption of fenbutatin oxide to soil particles. The RED does indicate that “because the chemical binds strongly to soil, it may be less available to fish in the water column.”

Fish bioconcentration of fenbutatin oxide was 490x-730x for whole fish. Depuration was relatively slow with only 51-70% of the accumulated residues being lost in 14 days. However, the data submitted by the registrant did not reach a plateau after 28 days, suggesting that the actual bioconcentration factor could be higher. Therefore a new test was required and subsequently submitted. This new test was considered valid and acceptable and showed whole fish bioconcentration to be 2600-4100x. By the end of the 49and 56 day depuration periods for the two test concentrations, more than 90% of the accumulated residues were eliminated from the fish tissues.

Additional details are on pages 18-23 of the fenbutatin oxide RED.

c. Incidents

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

There are no reported incidents of fenbutatin-oxide involving terrestrial or aquatic animals. There is one reported incident where a non-target plants (pine tree) was adversely affected.

d. Estimated and actual concentrations of fenbutatin oxide in water.

The RED (Attachment 4) includes surface water modeling for estimated environmental concentrations (EECs). The inputs and results are presented and discussed on pages 32-38, and summarized below. Although it is not stated, it appears that a PRZM-EXAMS model was used. This is based upon the statement in the RED that the EECs are "computer-estimated" (using K_d values) and the GENEEC model began to be used in 1995. The input details for these EECs are not presented in the RED. The typical PRZM-EXAMS model of the10-hectare field draining into a 1-hectare pond was used. The site scenarios were for citrus, apples, and grapes, but the geographic areas and associated soils and climate information were not indicated in the RED. Other information in the EFED files indicates that the citrus site was in Florida, but there was no information on the location of the others.

Although there are uncertainties regarding the sites and nature of the EECs below, EFED modeling has always used as conservative values as feasible. The RED does indicate that the almonds and stone fruit EECs were not specifically modeled, but were based on the other scenarios. Because there were two soil-water partition coefficient (K_d) values available, both were used in the citrus model. The "flowing water" EEC was based on the 10 ppb maximum residue actually measured at a discharge point immediately following application. Given the Florida location and aquatic environments associated with the study, and that the residue reported was for a discharge point, the flowing water EEC is unlikely to apply to environments relevant to Pacific salmon and steelhead.

Table 10. Adjusted acute EECs and risk quotients for fenbutatin oxide uses from the RED; all EEC values in ppb. Risk quotients are based upon the fish LC50= 1.7 ppb.

use site	rate (lb ai/A)	EEC using lower K_d value		EEC using higher K_d value		Flowing water EEC	risk quotient
citrus	2	12.7		5.4		10	5.9
apples	1.5			3.0			
grapes	1.25			2.5			
almonds	1.25			3.0	1.8		
peaches, nectarines, and cherries	1.00			2.0	1.2		

All of the risk quotients above indicate a considerable exceedance of criteria for acute toxicity to T&E fish. Even if these EECs are based upon a pond model, the risk quotients are at least 24 times higher than our fish criteria of concern for the high K_d value to 150 times for the low K_d value. I note that the citrus EEC of 12.7 ppb is the same as the solubility limit of fenbutatin oxide. Water column EECs cannot exceed the solubility limit even if the inputs are higher. Any additional material would be undissolved and would most likely adsorb rapidly to sediments and suspended materials.

The chronic risk of fenbutatin oxide to fish also exceeds our criteria of concern for citrus, but not for apples or grapes. I recalculated the risk quotients in the RED because the RED was based on the chronic MATC[1]. Current practice is to use the more conservative NOEC.

Table 11. Adjusted chronic (21-day) EECs and risk quotients for fenbutatin oxide uses from the RED; all EEC values in ppb. Risk quotients are based upon a fish NOEC of 0.31 ppb.

use site	rate (lb ai/A)	EEC using lower K_d value	risk quotient	EEC using higher K_d value	risk quotients	Flowing water EEC	risk quotient
citrus	2	12.7	41	0.5	1.6	0.77	2.5
apples	1.5			0.2	0.65		
grapes	1.25			0.14	0.45		

[1] MATC = Maximum Acceptable Toxicant Concentration, the geometric mean value between the no-observed-effect-concentration and lowest-observed-effect-concentration.

It does not appear the fenbutatin oxide was a pesticide for which the National Water Quality Assessment program analyzed. I could find no USGS reports indicating either positive or negative results.

Both the GENEEC and the PRZM-EXAMS models are based on the 1 hectare farm pond surrounded by 10 hectares of crop, all of which is treated with the pesticide. However, except for the sockeye salmon, all of the listed salmon and steelhead occur in streams, some of which are moderate size even where spawning occurs. OPP has determined that this model does approximate what might be found in first order streams, and those salmon that spawn in first order streams could be exposed to concentrations as modeled. Larger streams would have lower concentrations because modeled inputs are maximized relative to the crops at the edge of the stream. OPP cannot quantitate the amount of likely reduction in EECs that would result in larger streams except to note that it would be qualitatively less, perhaps much less.

It should also be noted that the pond scenario is not representative of the duration of exposure that would occur even in first order streams. Again, this can only be stated qualitatively because quantitative differences would be very site-specific based upon both size and flow rate of the stream.

e. Indirect effects

There are no toxicity data on fenbutatin oxide for terrestrial or aquatic plants or algae. There is no reason to expect that an acaricide would be toxic to aquatic plants, even though we have no data.

The data indicate that fenbutatin oxide is more toxic to fish than it is to aquatic invertebrates. There would be direct effects on T&E fish before there would be any effect on their aquatic invertebrate food supply.

I conclude that there will be no indirect effects on food or cover for Pacific salmon and steelhead that would not already be considered in the analysis for direct effects on these fish.

f. Changes in registration status

The development of a Reregistration Eligibility Decision (RED) document is a step in the process of reregistering existing pesticide products. The Ecological Effects portion of the RED used and referred to throughout much of this analysis provides an assessment at the point in time at which it is developed. Subsequent to the development of the RED, changes in uses may occur, label changes may be required, and additional data may be requested. As a result, there are nearly always changes in certain aspects of the registration that occur after the development of the RED.

Changes that may alter the aquatic risk analysis for fenbutatin oxide since the RED was completed are:

- Fenbutatin oxide is now classified as a "restricted use" pesticide due to high aquatic toxicity. In general, this means that all applicators of fenbutatin oxide must be "certified" as trained in the appropriate use of pesticides. Different states have different training programs, but all must meet minimum federal standards. In California, restricted use means that an applicator must obtain a permit from the County Agricultural Commissioner at least 48 hours before applying fenbutatin oxide. The permit may specify certain limitations on use appropriate to that county.
- Additional spray drift label directions regarding droplet size, wind speed and direction, application height, and a prohibition of applications during temperature inversions should also reduce drift into aquatic habitats.
- Some application rates were reduced, but the focus was primarily on Florida citrus; additional limitation to protect aquatic environments in Florida were also included on the label.

g. General risk conclusions

There are concerns for acute risk to fish, including endangered and threatened salmon and steelhead, based upon the RED, including my considerations applicable to western salmon states. The analyses use a "worst-case" scenario where OPP uses the highest application rates, shortest application intervals, lowest toxicity values, longest degradation rates, the farm pond model for EECs, and a very conservative criterion of concern. The acute risks of fenbutatin oxide exceed our criteria for the protection of individuals, and also exceed our concerns for population effects on exposed fish. However, no fish kills have been reported for fenbutatin oxide.

There are concerns for chronic risk to fish from citrus use. Fenbutatin oxide is persistent and could be a chronic concern, especially in lentic waters. This may be lessened in flowing waters, but because of the low solubility, there may be undissolved fenbutatin oxide which would tend to adsorb to sediments and particulate matter. There is no information on the adsorption-desorption coefficient which would provide an indication of how readily fenbutatin oxide would desorb from such material to become bioavailable.

h. Risk conclusions for the home garden use of fenbutatin oxide

There are two formulated products for use by home gardeners.

1. Orthonex garden insect and disease control, containing
   4% acephate (an insecticide)
   3.25% triforine (a fungicide)
   0.75% fenbutatin oxide (acaricide)

2. Ortho systemic insect killer
    8% acephate
    0.5% fenbutatin oxide

Both products are marketed in 16 oz containers. Application directions for Orthonex call for mixing one ounce of product with one gallon of water and spraying "thoroughly to cover all plant surfaces (upper and lower leaf surfaces, flowers, stems and branches) including new growth". Under the maximum use indicated on the label, applications could be made as often as every 7-10 days "if disease conditions persist" (i.e., no maximum number specified). For "hard to control pests such as two-spotted spider mites, it may be necessary to spray 2 to 3 times, waiting 7 to 10 days between each application".

There is no standard or typical scenario for looking at home garden uses of pesticides. In an unrealistically worst-case scenario for screening purposes, perhaps an entire bottle of product could be used on a small city lot, estimated to be 5000 square feet. Assuming a specific gravity of 1.0, this would amount to applying 0.04 lb ai of acephate, 0.034 lb ai of triforine, and 0.008 lb ai of fenbutatin oxide. If converted to pounds of active ingredient per acre, these amounts would result in 0.35 lb ai/A of acephate, 0.3 lb ai/A of triforine, and 0.07 lb ai/A of fenbutatin oxide.

Triforine is practically non-toxic to fish; the lowest fish LC50 in OPP's toxicity database is >1000 ppm for several species. Acephate is practically non-toxic to fish; the lowest fish LC50 in OPP's toxicity data base is 110 ppm for rainbow trout. Fenbutatin oxide is very highly toxic to fish; the lowest fish LC50 is 1.7 ppb. Since fenbutatin oxide is over 50,000 times more toxic to fish than acephate, which is almost 10 times more toxic than triforine, risks of Orthonex to fish would be exclusively from the fenbutatin oxide. The three active ingredients all have quite different toxicological modes of action, and therefore, the most likely toxicological result of the combination would be additivity, and again this would mean that the fenbutatin oxide is the only moiety of concern.

Even though it was not designed for home garden use, I ran the GENEEC program to see what the screening worst-case exposure would be for aquatic environments (based upon the ten-hectare field draining into a one-hectare farm pond). Application of 0.07 lb ai/A of fenbutatin oxide 3 times at 7 day intervals would result in an EEC of 0.62 ppb, using the low K_d value or 0.55 ppb using the high K_d value. One application would result in EECs of 0.21 and 0.18 ppb for the low and high K_d values.

Our criteria for concern for fenbutatin oxide toxicity to fish is exceeded when the EEC $\geq$ 0.05 x the LC50. In the case of fenbutatin oxide, our concern would be for exposures in excess of 0.085 ppb. The worst case screening EEC calculated above is 0.62 ppb for three applications, which is 7.3 times higher than our concentration of concern.

At this point, I am out of anything resembling data, but based on my best professional judgement and the reasons described below, I conclude that there will be no effect of either of these products on listed Pacific salmon and steelhead, or any other listed fish.

- While no "gallonage" is specified, the directions call for using 1 oz per gallon of water and indicate that, for the hose end sprayer, "unused product can be poured back into its original container". A 16 ounce bottle would allow for 16 gallons of finished spray material. I cannot tell how many gallons of water will be used for a home garden, but it should be far less than16 gallons.
- My scenario calls for applying the full amount to 5000 square feet of treated vegetation. The GENEEC model with a 10-hectare treatment area, which would amount to 1,076,350 square feet (2.47 Ha/A x 10 Ha x 43,560 square feet/A), is over 200 times the 5000 square foot lot. Thus, if the 1-hectare pond is still the receiving water, it would require that 200 lots of that size all be treated to yield that concentration. I note that it must be "all" because if only half the lots are treated, then the concentration will be half the estimated amount. It seems exceedingly unlikely that even 50% of the lots would be treated at all, let alone with the high amount I estimated being used.
- Orthonex is for use on ornamental flowers, shrubs, and trees. It is not for use on lawns. Therefore, considerably less than 5000 square feet would be treated except in the rarest of situations, and those situations would not be spread across many treated lots.
- Finally, the label indicates that the product "won't wash off with rain or watering", thus further reducing the potential movement of the product.
- The second product contains less fenbutatin oxide than Orthonex, and therefore should be even less of a concern.

i. Existing protective measures

Nationally, there are no specific protective measures for endangered and threatened species beyond the generic statements on the current fenbutatin oxide labels. As stated on all pesticide labels, it is a violation of Federal law to use this product in a manner inconsistent with its labeling. There are a few measures on fenbutatin oxide labels for the protection of applicators and other humans, which are not discussed here, but which may be seen on the attached labels. The Environmental Hazards section for the single section 3 label for fenbutatin oxide states: "This product is toxic to birds, mammals, fish and aquatic invertebrates. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Drift from runoff from treated areas may be hazardous to aquatic organisms in neighboring areas. Do not contaminate water when disposing of equipment washwater or rinsate." I note that fenbutatin oxide is practically non-toxic to birds and mammals, but the inclusion of these taxa was based upon a chronic concern.

Spray drift management statements are included as advisory, rather than as requirements, along with the warning that "Avoiding spray drift is the responsibility of the applicator."

Because fenbutatin oxide is a restricted use pesticide, a permit must be obtained from the county agricultural commissioner prior to use in California.

Fenbutatin oxide has not been a subject in previous ESA section 7 consultations. Therefore, no specific measures have been put in place relative to endangered species beyond the general label statements noted above. The following describe the protective mechanisms that are most feasible for protecting endangered species in Pacific salmon and steelhead states.

On a federal basis, 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. Fenbutatin oxide could be included in such bulletins.

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

The Washington State Department of Agriculture (WSDA) has formed a Task Force to address pesticide issues as they relate to salmon and steelhead. This Task Force includes representatives of NMFS. At present, we are aware that the Task Force has developed an approach to evaluate the need for protections from various pesticide uses. The Task Force is also planning on developing mechanisms to implement protections, as necessary, probably involving some kind of a county bulletin system (Jim Cowles, WSDA, personal communication, November 20, 2002). Fenbutatin oxide could be included in the WSDA approach, when it is developed. Because NMFS is involved, it is expected that whatever approach is developed will be acceptable in providing appropriate protection.

4. Listed salmon and steelhead ESUs and comparison with fenbutatin oxide use areas

The sources of data available on fenbutatin-oxide use are considerably different for California than for other states. California has full pesticide use reporting by all applicators except homeowners. Fenbutatin-oxide is in products with multiple ingredients that may be used by homeowners on ornamentals, and the California tables below do not include this use. However, this use is considered to have no effect on T&E fish. Oregon has initiated a process for full use reporting, but it is not in place yet. Washington and Idaho do not have such a mechanism to my knowledge.

The latest information for California pesticide use is for the year 2001 [URL: http://www.cdpr.ca.gov/docs/pur/purmain.htm]. The reported information to the County Agricultural Commissioners includes pounds used, acres treated, and the specific location treated. The pounds and acres are reported to the state, but the specific location infomation is retained at the county level and is not readily available to EPA. A summary of California usage of fenbutatin oxide is presented in the section 2 above.

In Oregon, Washington, and Idaho, information on the actual amount of fenbutatin-oxide used is rather limited. For ESUs in these three states, I have indicated the amount of acreage, by county, where fenbutatin-oxide could be used according to the labels. The actual 1997 acreage from USDA's agricultural census is provided, but we cannot tell which crops and how many acres were treated with fenbutatin-oxide.

For either California or the Pacific Northwest, crop lists for specific counties in the tables below begin with the highest acreage (Pacific Northwest) or highest fenbutatin-oxide use (California). Actual use in California is a reasonable predictor of future use. However, acreage planted to a specific crop in the Pacific Northwest is not a reasonable predictor of use. For example, the QUA reports than only 2% of the apple crop is treated (on a national basis), but 14% of the peach crop is treated and 26% of the raspberry crop. In addition to citrus, almonds, table grapes, strawberries, and nectarines all had 10% or more of the crop treated. Eggplant had a very high 29% of the crop treated, but the QUA estimates that only 3000 acres are grown nationally.

In the following discussion of specific ESUs and fenbutatin-oxide use, I present information on the listed salmon and steelhead ESUs and discuss the potential for the use of fenbutatin-oxide where they occur. My information on the various ESUs was taken almost entirely from various Federal Register Notices relating to listing, critical habitat, or status reviews. As noted above, usage data were derived from 1997 Agricultural Census, DPR's pesticide use reporting, and confidential sales information from the registrant. In the Pacific Northwest tables, I have also indicated, in the last column, the total acreage of land in each county and the acreage and percentage of land in farms, which includes ranches. Following this section, I make and discuss my conclusions.

A. Steelhead

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

Steelhead typically migrate to marine waters after spending 2 years in fresh water. They then reside in marine waters for typically 2 or 3 years prior to returning to their natal stream to spawn as 4- or 5-year-olds. Unlike Pacific salmon, they are capable of spawning more than once before they die. However, it is rare for steelhead to spawn more than twice before dying; most that do so are females. Steelhead adults typically spawn between December and June. Depending on water temperature, steelhead eggs may incubate in redds for 1.5 to 4 months before hatching as alevins. Following yolk sac absorption, alevins emerge as fry and begin actively feeding. Juveniles rear in fresh water from 1 to 4 years, then migrate to the ocean as ‘‘smolts.’’

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

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

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, however, there is a possibility of exposure from homeowner use on ornamentals. Agricultural use of fenbutatin oxide reported by DPR is limited for Los Angeles and San Diego counties for the year 2001. There is a potential for steelhead waters to drain agricultural areas in Ventura, Santa Barbara, and San Luis Obispo counties, but usage of fenbutatin oxide is very low in these counties. Usage of fenbutatin oxide in counties where this ESU occurs are presented in Table 12.

Table12. Use of fenbutatin-oxide in counties with the Southern California steelhead ESU. Data do not include homeowner use on ornamentals.

County	Agricultural Crop(s)	Ag usage pounds	Ag Acres treated	Non-agricultural uses	Non-Ag usage pounds
San Diego	Nursery container plants, oranges, lemon, grapefruit, apple, nursery greenhouse, nursery outdoor flower	114	122	Landscape, Structural	2
Los Angeles	Peaches, nectarines, plums, pears, nursery container plants, strawberry	628	649	Landscape	<1
Ventura	Nursery container plants	2	8	Landscape	<1
San Luis Obispo	Citrus, apples, nursery container plants	24	18	Landscape	<1
Santa Barbara	none			Landscape, structural	<1

There is only low usage of fenbutatin oxide within the habitat of the Southern California steelhead ESU. However, in conjunction with the high fish toxicity and the uncertainties associated with where fenbutatin oxide may be actually used with respect to aquatic habitats, I must conclude that fenbutatin oxide may affect the Southern California steelhead ESU. I do note, however, that San Diego locations of this ESU are largely separate from agricultural production. The same may be true for Los Angeles county, but I have no relevant data. Despite the high toxicity, I do not believe there is enough concentrated use in the San Luis Obispo, Ventura, and Santa Barbara counties to be a concern.

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 13 shows that fenbutatin oxide usage is low to very low in those counties where this ESU occurs.

Table 13. Use of fenbutatin-oxide in counties with the South Central California steelhead ESU. Data do not include homeowner use on ornamentals.

County	Agricultural Crop(s)	Ag usage pounds	Ag Acres treated	Non-agricultural uses	Non-Ag usage pounds
Santa Cruz	Apples, strawberries, nursery outdoor flowers	8	16	Landscape	<1
San Benito	none			Landscape	<1
Monterey	Strawberry, nursery container plants	210	140	Landscape	<1
San Luis Obispo	Citrus, apples, nursery container plants	24	18	Landscape	<1

There is only low usage of fenbutatin oxide within the habitat of the South Central California steelhead ESU. However, in conjunction with the high fish toxicity and the uncertainties associated with where fenbutatin oxide may be actually used with respect to aquatic habitats, particularly in Monterey County, I must conclude that fenbutatin oxide may affect the South Central California steelhead ESU. Despite the high toxicity, I do not believe there is enough concentrated use in the San Luis Obispo, Santa Cruz and San Benito counties to be a concern.

3. Central California Coast Steelhead ESU

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

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

Counties of occurrence for this ESU are Santa Cruz, San Mateo, San Francisco, Marin, Sonoma, Mendocino, Napa, Alameda, Contra Costa, Solano, and Santa Clara counties. Again, usage of fenbutatin oxide in most of the coastal counties is very low, but it is somewhat higher in Sonoma County. Usage of fenbutatin oxide in the counties where the Central California coast steelhead ESU is presented in Table 14. Within a county, crops are listed in order from greatest fenbutatin oxide use to smallest.

Table 14. Use of fenbutatin-oxide in counties with the Central California Coast steelhead ESU. Data do not include homeowner use on ornamentals.

County	Agricultural Crop(s)	Ag usage pounds	Ag Acres treated	Non-agricultural uses	Non-Ag usage pounds

Santa Cruz	Apples, strawberries, nursery outdoor flowers	8	16	Landscape	<1
San Mateo	Nursery container plants	<1	<1	Landscape	<1
San Francisco	none			Landscape	<1
Marin	none			Landscape	<1
Sonoma	Grapes, nursery container plants	443	452	Landscape	<1
Mendocino	Nursery container plants	<1	<1	Landscape	<1
Napa	Grapes	156	156	Landscape	<1
Alameda	none			Landscape	<1
Contra Costa	none			Landscape, structural	<1
Solano	Prunes	65	92	Landscape	<1
Santa Clara	Nursery container plants, strawberries, nursery greenhouse flowers	32	45	Landscape, rights-of-way	<1

There is only low usage of fenbutatin oxide within the habitat of the Central California Coast steelhead ESU. However, in conjunction with the high fish toxicity and the uncertainties associated with where fenbutatin oxide may be actually used with respect to aquatic habitats, I must conclude that fenbutatin oxide may affect the Central California Coast steelhead ESU. Concerns are primarily for grape use in Sonoma and Napa counties and prunes in Solano County. I do note that, of these three, only Sonoma County is coastal; the others are in the San Pablo Bay watershed.

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 fenbutatin oxide is heaviest in areas where almonds, peaches, prunes, plums, walnuts, and grapes are grown. Usage of fenbutatin oxide in counties where the California Central Valley steelhead ESU occurs is presented in Table 15. Within a county, crops are listed in order from greatest fenbutatin oxide use to smallest.

Table 15. Use of fenbutatin-oxide in counties with the California Central Valley steelhead ESU. Data do not include homeowner use on ornamentals.

County	Agricultural Crop(s)	Ag usage pounds	Ag Acres treated	Non-agricultural uses	Non-Ag usage pounds
Alameda	none			Landscape	<1
Amador	Grapes	5	10	none	
Butte	Almonds, prunes, peaches, walnut	2792	4310	Landscape	<1
Calaveras	none			none	
Colusa	Almonds	273	654	none	
Contra Costa	none			Landscape, structural	<1
Glenn	Almond, prune, walnut	778	1549	none	
Marin	none			Landscape	<1
Merced	Almonds, peaches, grapes, plums, nectarines, walnuts, oranges	2377	4063	none	
Nevada	none			none	
Placer	Prunes, walnuts, peaches, apples, nursery container plants, pears	98		none	

Sacramento	none			Landscape	<1
San Joaquin	Almonds, cherries, peaches, grapes, apples, walnuts, strawberries	1384	2422	none	
San Mateo	Nursery container plants	<1	<1	Landscape	<1
San Francisco	none			Landscape	<1
Shasta	Walnuts	3	4	Landscape	<1
Solano	Prunes	65	92	Landscape	<1
Sonoma	Grapes, nursery container plants	443	452	Landscape	<1
Stanislaus	Almonds, peaches, walnuts, prunes, plums, apples, nectarines, cherries	3467	4464	Landscape	<1
Sutter	Peaches, prunes, walnuts, apples, nursery transplants, nursery container plants, almonds, rice cherries	5702	9943	none	
Tehama	Prunes, walnuts	62	58	none	
Tuolumne	Nursery container plants	<1	<1	none	
Yolo	Prunes, walnuts, almonds	151	225	Research, landscape	14
Yuba	Peaches, prunes, walnuts, apples, almonds, nectarines, plums	2055	3395	none	

There is only moderate usage of fenbutatin oxide in several counties within the habitat of the Central Valley steelhead ESU, particularly on almonds and peaches. Based upon the very high fish toxicity and the likelihood that, with this much usage there is likely to be exposure, I conclude that fenbutatin oxide may affect the Central California Coast steelhead ESU. Concerns are primarily for almonds, peaches, and other orchard crops.

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. 510 shows that use of fenbutatin oxide in the counties where the Northern California steelhead ESU occurs is very limited and is on grapes.

Table 16. Use of fenbutatin-oxide in counties with the Northern California steelhead ESU. Data do not include homeowner use on ornamentals.

County	Agricultural Crop(s)	Ag usage pounds	Ag Acres treated	Non-agricultural uses	Non-Ag usage pounds
Humboldt	none			none	
Mendocino	Nursery container plants	<1	<1	Landscape	<1
Trinity	none			none	
Lake	Grapes	49	98	none	

Even with the low usage of fenbutatin oxide in Lake county, the high fish toxicity and the uncertainties associated with where fenbutatin oxide may be actually used leads me to conclude that fenbutatin oxide may affect the Northern California steelhead ESU.

6. Upper Columbia River steelhead ESU

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

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

Areas downstream from the Yakima River are used for migration. Additional counties through which the ESU migrates are Walla Walla, Klickitat, Skamania, Clark, Columbia, Cowlitz, Wahkiakum, and Pacific, Washington; and Gilliam, Morrow, Sherman, Umatilla, Wasco, Hood River, Multnomah, Columbia, and Clatsop, Oregon.

Tables 17 and 18 show the cropping information for Washington counties where the Upper Columbia River steelhead ESU is located and for the Oregon and Washington counties where this ESU migrates. In these tables, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 17. Crops on which fenbutatin-oxide can be used in Washington counties where there is spawning and growth of the Upper Columbia River steelhead ESU

St	County	Crops and acres planted	Acres	<u>total acreage</u> land in farms % farmed
WA	Benton	Apples 18,245 Grapes 15,929 Cherries 3219 Pears 472 Plums & prunes 180 Peaches 149 Walnuts 41	38,235	<u>1,089,993</u> 640,370 58.7%

WA	Franklin	Apples 9000 Grapes 2813 Cherries 2165 Peaches 262 Pears 156 Nectarines 129 Raspberries 70 Plums & prunes 43 Strawberries 17 Walnuts	14,655	<u>794,999</u> 670,149 84.3%
WA	Kittitas	Apples 1859 Pears 331 Plums & prunes 1 Peaches 1 Cherries	2192	<u>1,469,862</u> 355,360 24.2%
WA	Yakima	Apples 75,264 Grapes 15,529 Pears 10,190 Cherries 6129 Peaches 1438 Nectarines 605 Plums & prunes 478 Walnuts 11 Raspberries 10 Eggplant 5	109,659	<u>2,749,514</u> 1,639,965 59.6%
WA	Chelan	Apples 17,096 Pears 8298 Cherries 3704 Nectarines 22 Peaches 21 Plums & prunes 3 Walnuts	29,144	<u>1,869,848</u> 112,085 6%
WA	Douglas	Apples 14,383 Cherries 1842 Pears 1104 Peaches 167 Nectarines 91 Raspberries	17,587	<u>1,165,168</u> 918,033 78.8%

WA	Okanogan	Apples 24,164 Pears 3280 Cherries 1003 Peaches 67 Nectarines 38 Walnuts 29 Raspberries 1 Plums & prunes 1	28,583	3,371,698 1,291,118 38.3%
WA	Grant	Apples 33,165 Cherries 3470 Grapes 3132 Pears 998 Peaches 261 Nectarines 163 Walnuts 5 Plums & prunes 5 Strawberries 2 Raspberries 1	41,202	1,712,881 1,086,045 63.4%

Table 18. Crops on which fenbutatin-oxide can be used in Oregon and Washington counties that are migration corridors for the Upper Columbia River steelhead ESU.

St	County	Crops and acres planted	Acres	total acreage land in farms % farmed
WA	Walla Walla	Apples 5222 Cherries 280 Plums & prunes 22 Grapes	5524	813,108 710,546 87.4%
WA	Klickitat	Pears 923 Apples 516 Cherries 457 Grapes 419 Peaches 199 Plums & prunes 1 Walnuts	2515	1,198,385 689,639 57.5%
WA	Skamania	Pears 477 Apples 75 Grapes	552	1,337,179 4043 0.4%

WA	Clark	Raspberries 634 Strawberries 162 Pears 75 Walnuts 51 Peaches 46 Apples 33 Grapes 32 Plums & prunes 10 Cherries	1043	<u>401,850</u> 82,967 20.6
WA	Cowlitz	Raspberries 439 Apples 14 Walnuts 5 Pears 3 Cherries 2 Grapes Strawberries	463	<u>728,781</u> 35,678 4.9%
WA	Wahkiakum	none		<u>169,125</u> 12,611 7.5%
WA	Pacific	Cherries Grapes Apples	NR	<u>623,722</u> 32,637 5.2%
OR	Gilliam	none		<u>770,664</u> 766,373 99.4%
OR	Umatilla	Apples 3927 Plums & prunes 365 Cherries 349 Grapes 163 Strawberries 9 Raspberries 7 Peaches 7 Pears 4 Nectarines	4831	<u>2,057,809</u> 1,466,580 71.3%
OR	Sherman	none		<u>526,911</u> 487,534 92.5%

OR	Morrow	Apples	NR	1,301,021 1,119,004 86%
OR	Wasco	Cherries 7352 Apples 463 Pears 385 Grapes 110 Peaches 30 Plums & prunes Strawberries	8340	1,523,958 1,152,965 75.7%
OR	Hood River	Pears 11,788 Apples 2592 Cherries 1081 Grapes 63 Peaches 13 Raspberries 1	15,538	334,328 27,201 8.1%
OR	Multnomah	Raspberries 741 Strawberries 171 Apples 51 Peaches 36 Grapes 28 Pears 25 Cherries 8 Plums & prunes 3 Walnuts 2 Eggplant	1065	278,570 31,294 11.2%
OR	Columbia	Apples 39 Pears 12 Walnuts 11 Cherries 7 Grapes 6 Strawberries 6 Plums & prunes 2 Raspberries 1 Peaches	84	420,332 71,839 17.1%
OR	Clatsop	Apples	NR	529,482 24,740 4.7%

Fenbutatin oxide may only be used a small percentage of the apple crop, but there is a large acreage where it could be used, and it may also be used on other crops. Based upon the very high toxicity, I conclude that fenbutatin oxide may affect the Upper Columbia River steelhead ESU in its spawning and growth areas. Despite the high toxicity, I believe there would be sufficient dilution that fish in the migratory corridors would not be affected.

7. Snake River Basin steelhead ESU

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

Spawning and early growth areas of this ESU consist of all areas upstream from the confluence of the Snake River and the Columbia River as far as fish passage is possible. Hells Canyon Dam on the Snake River and Dworshak Dam on the Clearwater River, along with Napias Creek Falls near Salmon, Idaho, are named as impassable barriers. These areas include the counties of Wallowa, Baker, Union, and Umatilla (northeastern part) in Oregon; Asotin, Garfield, Columbia, Whitman, Franklin, and Walla Walla in Washington; and Adams, Idaho, Nez Perce, Blaine, Custer, Lemhi, Boise, Valley, Lewis, Clearwater, and Latah in Idaho. I have excluded Baker County, Oregon, which has a tiny fragment of the Imnaha River watershed. While a small part of Rock Creek that extends into Baker County, this occurs at 7200 feet in the mountains (partly in a wilderness area) and is of no significance with respect to fenbutatin oxide use in agricultural areas. I have similarly excluded the Upper Grande Ronde watershed tributaries (e.g., Looking Glass and Cabin Creeks) that are barely into higher elevation forested areas of Umatilla County. However, crop areas of Umatilla County are considered in the migratory routes. In Idaho, Blaine and Boise counties technically have waters that are part of the steelhead ESU, but again, these are tiny areas which occur in the Sawtooth National Recreation Area and/or National Forest lands. I have excluded these areas because they are not relevant to use of fenbutatin oxide. The agricultural areas of Valley County, Idaho, appear to be primarily associated with the Payette River watershed, but there is enough of the Salmon River watershed in this county that I was not able to exclude it.

Critical Habitat also includes the migratory corridors of the Columbia River from the confluence of the Snake River to the Pacific Ocean. Additional counties in the migratory corridors are Umatilla, Gilliam, Morrow, Sherman, Wasco, Hood River, Multnomah, Columbia, and Clatsop in Oregon; and Benton, Klickitat, Skamania, Clark, Cowlitz, Wahkiakum, and Pacific in Washington.

Tables 19 and 20 show the cropping information for the Pacific Northwest counties where the Snake River Basin steelhead ESU is located and for the Oregon and Washington counties where this ESU migrates. In these tables, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 19. Crops on which fenbutatin-oxide can be used in Pacific Northwest counties which provide spawning and rearing habitat for the Snake River Basin steelhead ESU.

St	County	Crops and acres planted	Acres	total acreage land in farms % farmed
ID	Adams	Apples 5	5	873,399 221,209 25.3%
ID	Idaho	Apples 6 Pears 2 Plums & prunes 2 Cherries 2 Grapes 1 Peaches	13	5,430,522 744,295 13.7%
ID	Nez Perce	Peaches 22 Apples 9 Cherries 4	35	543,434 477,839 87.9%
ID	Custer	none		3,152,382 140,701 4.5%
ID	Lemhi	Cherries 9 Apples 6 Peaches 3 Pears 2	20	2,921,172 193,908 6.6%
ID	Valley	none		2,354,043 78,813 3.3%
ID	Lewis	none		306,601 211,039 68.8%
ID	Clearwater	none		1,575,396 103,246 6.6%
ID	Latah	Cherries 19 Apples 3 Pears	22	689,089 347,293 50.4%

WA	Adams	Apples 3457 Pears Grapes Cherries	3457	1,231,999 996,742 80.9%
WA	Asotin	Apples 24 Peaches 18 Cherries 17 Pears 6	65	406,983 274,546 67.5%
WA	Garfield	none		454,744 325,472 84.3%
WA	Columbia	Apples 5	5	556,034 304,928 54.8%
WA	Whitman	Apples 19 Pears 2 Cherries	21	1,382,006 1,404,289 101.6%
WA	Franklin	Apples 9000 Grapes 2813 Cherries 2165 Peaches 262 Pears 156 Nectarines 129 Raspberries 70 Plums & prunes 43 Strawberries 17 Walnuts	14,655	794,999 670,149 84.3%
WA	Walla Walla	Apples 5222 Cherries 280 Plums & prunes 22 Grapes	5524	813,108 710,546 87.4%
OR	Wallowa	Apples 8 Peaches	8	2,013,071 694,304 34.5%

OR	Union	Cherries 596 Apples 39 Peaches 12 Plums & prunes Pears	647	1,303,476 473,316 36.3%

Table 20. Crops on which fenbutatin-oxide can be used in Washington and Oregon counties through which the Snake River Basin steelhead ESU migrates

St	County	Crops and acres planted	Acres	total acreage land in farms % farmed
WA	Walla Walla	Apples 5222 Cherries 280 Plums & prunes 22 Grapes	5524	813,108 710,546 87.4%
WA	Benton	Apples 18,245 Grapes 15,929 Cherries 3219 Pears 472 Plums & prunes 180 Peaches 149 Walnuts 41	38,235	1,089,993 640,370 58.7%
WA	Klickitat	Pears 923 Apples 516 Cherries 457 Grapes 419 Peaches 199 Plums & prunes 1 Walnuts	2515	1,198,385 689,639 57.5%
WA	Skamania	Pears 477 Apples 75 Grapes	552	1,337,179 4043 0.4%

WA	Clark	Raspberries 634 Strawberries 162 Pears 75 Walnuts 51 Peaches 46 Apples 33 Grapes 32 Plums & prunes 10 Cherries	1043	<u>401,850</u> 82,967 20.6
WA	Cowlitz	Raspberries 439 Apples 14 Walnuts 5 Pears 3 Cherries 2 Grapes Strawberries	463	<u>728,781</u> 35,678 4.9%
WA	Wahkiakum	none		<u>169,125</u> 12,611 7.5%
WA	Pacific	Cherries Grapes Apples	NR	<u>623,722</u> 32,637 5.2%
OR	Umatilla	Apples 3927 Plums & prunes 365 Cherries 349 Grapes 163 Strawberries 9 Raspberries 7 Peaches 7 Pears 4 Nectarines	4831	<u>2,057,809</u> 1,466,580 71.3%
OR	Morrow	Apples	NR	<u>1,301,021</u> 1,119,004 86%
OR	Gilliam	none		<u>770,664</u> 766,373 99.4%

OR	Sherman	none		526,911 487,534 92.5%
OR	Wasco	Cherries 7352 Apples 463 Pears 385 Grapes 110 Peaches 30 Plums & prunes Strawberries	8340	1,523,958 1,152,965 75.7%
OR	Hood River	Pears 11,788 Apples 2592 Cherries 1081 Grapes 63 Peaches 13 Raspberries 1	15,538	334,328 27,201 8.1%
OR	Multnomah	Raspberries 741 Strawberries 171 Apples 51 Peaches 36 Grapes 28 Pears 25 Cherries 8 Plums & prunes 3 Walnuts 2 Eggplant	1065	278,570 31,294 11.2%
OR	Columbia	Apples 39 Pears 12 Walnuts 11 Cherries 7 Grapes 6 Strawberries 6 Plums & prunes 2 Raspberries 1 Peaches	84	420,332 71,839 17.1%
OR	Clatsop	Apples	NR	529,482 24,740 4.7%

Fenbutatin oxide may only be used a relatively small acreage of crops within Idaho, but there is considerable acreage of relevant crops along the lower Snake River. Because this is part of the spawning and growth areas of the Snake River steelhead ESU, I must consider the probability that steelhead would not be limited to the Snake River itself. Therefore, based upon the very high toxicity, I conclude that fenbutatin oxide may affect the Snake River steelhead ESU in its spawning and growth areas. Despite the high toxicity, I believe there would be sufficient dilution that fish in the migratory corridors would not be affected.

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

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

Table 21. Crops on which fenbutatin-oxide can be used that are part of the spawning and rearing habitat of the Upper Willamette River steelhead ESU.

St	County	Crops and acres planted	Acres	total acreage land in farms % farmed
OR	Benton	Grapes 242 Apples 62 Walnuts 23 Cherries 18 Strawberries 17 Peaches 8 Pears 7 Plums & prunes 5 Raspberries 2 Eggplant	384	432,961 118,818 27.4%
OR	Linn	Raspberries 387 Cherries 157 Apples 133 Grapes 93 Peaches 73 Walnuts 55 Strawberries 52 Pears 26 Plums & prunes 14 Nectarines 3	993	1,466,507 380,464 25.9%
OR	Polk	Cherries 1888 Grapes 1123 Plums & prunes 595 Apples 157 Pears 63 Peaches 51 Walnuts 33 Strawberries 22 Raspberries	3932	474,296 167,880 35.4%

OR	Clackamas	Raspberries 1435 Strawberries 608 Grapes 207 Apples 167 Peaches 78 Cherries 53 Walnuts 51 Plums & prunes 37 Pears 37	2673	<u>1,195,712</u> 148,848 12.4%
OR	Marion	Strawberries 1858 Cherries 1568 Grapes 761 Apples 555 Raspberries 546 Peaches 179 Walnuts 155 Pears 150 Plums & prunes 145 Nectarines	5917	<u>758,394</u> 302,462 39.9%
OR	Yamhill	Grapes 2887 Cherries 1693 Walnuts 608 Plums & prunes 369 Apples 310 Strawberries 265 Raspberries 114 Peaches 104 Pears 54 Nectarines Eggplant	6404	<u>457,986</u> 179,787 39.3%
OR	Washington	Strawberries 1257 Raspberries 1150 Grapes 989 Walnuts 679 Plums & prunes 358 Apples 279 Cherries 211 Peaches 168 Pears 69 Eggplant 1	5161	<u>463,231</u> 139,820 30.2%

Table 22. Crops on which fenbutatin-oxide can be used in Oregon and Washington counties that are part of the migration corridors of the Upper Willamette River steelhead ESU.

St	County	Crops and acres planted	Acres	total acreage land in farms % farmed
WA	Clark	Raspberries 634 Strawberries 162 Pears 75 Walnuts 51 Peaches 46 Apples 33 Grapes 32 Plums & prunes 10 Cherries	1043	401,850 82,967 20.6
WA	Cowlitz	Raspberries 439 Apples 14 Walnuts 5 Pears 3 Cherries 2 Grapes Strawberries	463	728,781 35,678 4.9%
WA	Wahkiakum	none		169,125 12,611 7.5%
WA	Pacific	Cherries Grapes Apples	NR	623,722 32,637 5.2%
OR	Multnomah	Raspberries 741 Strawberries 171 Apples 51 Peaches 36 Grapes 28 Pears 25 Cherries 8 Plums & prunes 3 Walnuts 2 Eggplant	1065	278,570 31,294 11.2%

OR	Columbia	Apples 39 Pears 12 Walnuts 11 Cherries 7 Grapes 6 Strawberries 6 Plums & prunes 2 Raspberries 1 Peaches	84	420,332 71,839 17.1%
OR	Clatsop	Apples	NR	529,482 24,740 4.7%

Fenbutatin oxide may be used on rather substantial acreage within the spawning and growth areas of the Upper Willamette River steelhead ESU. I also note that raspberries in particular have a high percentage (26%) of the crop treated. Based upon the very high toxicity and the considerable acreage where it could be used, I conclude that fenbutatin oxide may affect the Upper Willamette River steelhead ESU in its spawning and growth areas. Despite the high toxicity, I believe there would be sufficient dilution that fish in the migratory corridors would not be affected.

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

Table 23. Crops and acreage where fenbutatin-oxide can be used in counties that provide spawning and rearing habitat for the Lower Columbia River Steelhead ESU.

St	County	Crops and acres planted	Acres	total acreage land in farms % farmed
OR	Hood River	Pears 11,788 Apples 2592 Cherries 1081 Grapes 63 Peaches 13 Raspberries 1	15,538	334,328 27,201 8.1%
OR	Clackamas	Raspberries 1435 Strawberries 608 Grapes 207 Apples 167 Peaches 78 Cherries 53 Walnuts 51 Plums & prunes 37 Pears 37	2673	1,195,712 148,848 12.4%
OR	Multnomah	Raspberries 741 Strawberries 171 Apples 51 Peaches 36 Grapes 28 Pears 25 Cherries 8 Plums & prunes 3 Walnuts 2 Eggplant	1065	278,570 31,294 11.2%

WA	Clark	Raspberries 634 Strawberries 162 Pears 75 Walnuts 51 Peaches 46 Apples 33 Grapes 32 Plums & prunes 10 Cherries	1043	401,850 82,967 20.6
WA	Cowlitz	Raspberries 439 Apples 14 Walnuts 5 Pears 3 Cherries 2 Grapes Strawberries	463	728,781 35,678 4.9%
WA	Skamania	Pears 477 Apples 75 Grapes	552	1,337,179 4043 0.4%

Table 24. Crops and acreage where fenbutatin-oxide can be used in counties that are migratory corridors for the Lower Columbia River Steelhead ESU.

St	County	Crops and acres planted	Acres	total acreage land in farms % farmed
OR	Columbia	Apples 39 Pears 12 Walnuts 11 Cherries 7 Grapes 6 Strawberries 6 Plums & prunes 2 Raspberries 1 Peaches	84	420,332 71,839 17.1%
OR	Clatsop	Apples	NR	529,482 24,740 4.7%

WA	Pacific	Cherries Grapes Apples	NR	<u>623,722</u> 32,637 5.2%
WA	Wahkiakum	none		<u>169,125</u> 12,611 7.5%

Fenbutatin oxide may be used on rather substantial acreage within the spawning and growth areas of the Lower Columbia River steelhead ESU. I also note that raspberries in particular have a high percentage (26%) of the crop treated. While only 2-6% of pears are treated, the high acreage would be of concern for this crop also. Based upon the very high toxicity and the considerable acreage where it could be used, I conclude that fenbutatin oxide may affect the Lower Columbia River steelhead ESU in its spawning and growth areas. Despite the high toxicity, I believe there would be sufficient dilution that fish in the migratory corridors would not be affected.

<u>10. Middle Columbia River Steelhead ESU</u>

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. Although I am unsure of the status of these Dog and Collins creeks, they have little relevance to the analysis of fenbutatin oxide because there are only 716 acres of potential use sites in Skamania for fenbutatin oxide, and it would be expected that these acres would be in the agricultural rather than forest areas of the county.

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

In the John Day River watershed, I have excluded Harney County, Oregon because there is only a tiny amount of the John Day River and several tributary creeks (e.g., Utley, Bear Cougar creeks) which get into high elevation areas (approximately 1700M and higher) of northern Harney County where there are no crops grown. Similarly, the Umatilla River and Walla Walla River get barely into Union County OR, and the Walla Walla River even gets into a tiny piece of Wallowa County, Oregon. But again, these are high elevation areas where crops are not grown, and I have excluded these counties for this analysis.

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

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

Table 25. Crops and acreage where fenbutatin-oxide can be used in counties that provide spawning and rearing habitat for the Middle Columbia River Steelhead ESU.

St	County	Crops and acres planted	Acres	total acreage land in farms % farmed
OR	Gilliam	none		770,664 766,373 99.4%
OR	Morrow	Apples	NR	1,301,021 1,119,004 86%

OR	Umatilla	Apples 3927 Plums & prunes 365 Cherries 349 Grapes 163 Strawberries 9 Raspberries 7 Peaches 7 Pears 4 Nectarines	4831	<u>2,057,809</u> 1,466,580 71.3%
OR	Sherman	none		<u>526,911</u> 487,534 92.5%
OR	Wasco	Cherries 7352 Apples 463 Pears 385 Grapes 110 Peaches 30 Plums & prunes Strawberries	8340	<u>1,523,958</u> 1,152,965 75.7%
OR	Crook	none		<u>1,906,892</u> 894,853 46.9%
OR	Grant	Apples Pears	NR	<u>2,898,444</u> 1,154,399 39.8%
OR	Wheeler	Apples 23	23	<u>1,097,601</u> 728,131 66.3%
OR	Jefferson	Apples 4	4	<u>1,139,744</u> 530,960 46.6%
WA	Benton	Apples 18,245 Grapes 15,929 Cherries 3219 Pears 472 Plums & prunes 180 Peaches 149 Walnuts 41	38,235	<u>1,089,993</u> 640,370 58.7%

WA	Columbia	Apples 5	5	556,034 304,928 54.8%
WA	Franklin	Apples 9000 Grapes 2813 Cherries 2165 Peaches 262 Pears 156 Nectarines 129 Raspberries 70 Plums & prunes 43 Strawberries 17 Walnuts	14,655	794,999 670,149 84.3%
WA	Kittitas	Apples 1859 Pears 331 Plums & prunes 1 Peaches 1 Cherries	2192	1,469,862 355,360 24.2%
WA	Klickitat	Pears 923 Apples 516 Cherries 457 Grapes 419 Peaches 199 Plums & prunes 1 Walnuts	2515	1,198,385 689,639 57.5%
WA	Skamania	Pears 477 Apples 75 Grapes	552	1,337,179 4043 0.4%
WA	Walla Walla	Apples 5222 Cherries 280 Plums & prunes 22 Grapes	5524	813,108 710,546 87.4%

WA	Yakima	Apples 75,264 Grapes 15,529 Pears 10,190 Cherries 6129 Peaches 1438 Nectarines 605 Plums & prunes 478 Walnuts 11 Raspberries 10 Eggplant 5	109,659	2,749,514 1,639,965 59.6%

Table 26. Crops on which fenbutatin-oxide can be used in Washington and Oregon counties through which the Middle Columbia River steelhead ESU migrates

St	County	Crops and acres planted	Acres	total acreage land in farms % farmed
WA	Skamania	Pears 477 Apples 75 Grapes	552	1,337,179 4043 0.4%
WA	Clark	Raspberries 634 Strawberries 162 Pears 75 Walnuts 51 Peaches 46 Apples 33 Grapes 32 Plums & prunes 10 Cherries	1043	401,850 82,967 20.6
WA	Cowlitz	Raspberries 439 Apples 14 Walnuts 5 Pears 3 Cherries 2 Grapes Strawberries	463	728,781 35,678 4.9%
WA	Pacific	Cherries Grapes Apples	NR	623,722 32,637 5.2%

WA	Wahkiakum	none		169,125 12,611 7.5%
OR	Hood River	Pears 11,788 Apples 2592 Cherries 1081 Grapes 63 Peaches 13 Raspberries 1	15,538	334,328 27,201 8.1%
OR	Multnomah	Raspberries 741 Strawberries 171 Apples 51 Peaches 36 Grapes 28 Pears 25 Cherries 8 Plums & prunes 3 Walnuts 2 Eggplant	1065	278,570 31,294 11.2%
OR	Columbia	Apples 39 Pears 12 Walnuts 11 Cherries 7 Grapes 6 Strawberries 6 Plums & prunes 2 Raspberries 1 Peaches	84	420,332 71,839 17.1%
OR	Clatsop	Apples	NR	529,482 24,740 4.7%

Fenbutatin oxide may be used on very high acreage within the spawning and growth areas of the Middle Columbia River steelhead ESU. Yakima County has over 100,000 acres of crops on which fenbutatin oxide may be used. Based upon the very high toxicity and the very high acreage where it could be used, I conclude that fenbutatin oxide may affect the Middle Columbia River steelhead ESU in its spawning and growth areas. Despite the high toxicity, I believe there would be sufficient dilution that fish in the migratory corridors would not be affected.

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).

In these tables, crops are listed in order of the greatest use of fenbutatin oxide to the smallest.

Table 27. Use of fenbutatin-oxide in counties with the Sacramento River winter-run Chinook salmon ESU. Does not include homeowner use on ornamentals. Spawning areas are primarily in Shasta and Tehama counties above the Red Bluff diversion dam.

County	Agricultural Crop(s)	Ag usage pounds	Ag Acres treated	Non-agricultural uses	Non-Ag usage pounds
Alameda	none			Landscape	<1
Butte	Almonds, prunes, peaches, walnut	2792	4310	Landscape	<1
Colusa	Almonds	273	654	none	
Contra Costa	none			Landscape, structural	<1
Glenn	Almond, prune, walnut	778	1549	none	
Marin	none			Landscape	<1
Sacramento	none			Landscape	<1
San Mateo	Nursery container plants	<1	<1	Landscape	<1
San Francisco	none			Landscape	<1
Shasta	Walnuts	3	4	Landscape	<1
Solano	Prunes	65	92	Landscape	<1

Sonoma	Grapes, nursery container plants	443	452	Landscape	<1
Tehama	Prunes, walnuts	62	58	none	
Yolo	Prunes, walnuts, almonds	151	225	Research, landscape	14

There is not a large usage of fenbutatin oxide in the spawning areas that are primarily in Shasta and Tehama counties above the Red Bluff diversion dam and the Sacramento River should provide moderate dilution. But the young chinook will use more of the river prior to migrating downstream to the ocean, and there is moderate usage of fenbutatin oxide in Butte and Glenn counties. Based upon this usage being potentially near chinook habitat and the very high toxicity, I conclude that fenbutatin oxide may affect the Sacramento River Winter Run chinook salmon ESU. Despite the high toxicity, I believe there would be sufficient dilution that fish in the migratory corridors would not be affected below Honker Bay and possibly below the City of Sacramento.

2. Snake River Fall-run Chinook Salmon ESU

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

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

Hydrologic units with spawning and rearing habitat for this fall-run chinook are the Clearwater, Hells Canyon, Imnaha, Lower Grande Ronde, Lower North Fork Clearwater, Lower Salmon, Lower Snake-Asotin, Lower Snake-Tucannon, and Palouse. These units are in Baker, Umatilla, Wallowa, and Union counties in Oregon; Adams, Asotin, Columbia, Franklin, Garfield, Lincoln, Spokane, Walla Walla, and Whitman counties in Washington; and Adams, Benewah, Clearwater, Idaho, Latah, Lewis, Nez Perce, Shoshone, and Valley counties in Idaho. I note that Custer and Lemhi counties in Idaho are not listed as part of the fall-run ESU, although they are included for the spring/summer-run ESU. Because only high elevation forested areas of Baker and Umatilla counties in Oregon are in the spawning and rearing areas for this fall-run chinook, I have excluded them from consideration because fenbutatin oxide would not be used in these areas. I have, however, kept Umatilla County as part of the migratory corridor.

Tables 28 and 29 show the cropping information for Pacific Northwest counties where the Snake River fall-run chinook salmon ESU is located and for the Oregon and Washington counties where this ESU migrates. In these tables, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 28. Crops on which fenbutatin-oxide can be used in Pacific Northwest counties which provide spawning and rearing habitat for the Snake River fall-run chinook ESU

St	County	Crops and acres planted	Acres	total acreage land in farms % farmed
ID	Adams	Apples 5	5	873,399 221,209 25.3%
ID	Idaho	Apples 6 Pears 2 Plums & prunes 2 Cherries 2 Grapes 1 Peaches	13	5,430,522 744,295 13.7%
ID	Nez Perce	Peaches 22 Apples 9 Cherries 4	35	543,434 477,839 87.9%
ID	Valley	none		2,354,043 78,813 3.3%
ID	Lewis	none		306,601 211,039 68.8%
ID	Benewah	Apples 6	6	496,662 111,510 22.5%

ID	Shoshone	none		1,685,770 4,428 0.3%
ID	Clearwater	none		1,575,396 103,246 6.6%
ID	Latah	Cherries 19 Apples 3 Pears	22	689,089 347,293 50.4%
WA	Adams	Apples 3457 Pears Grapes Cherries	3457	1,231,999 996,742 80.9%
WA	Lincoln	Cherries 1 Apples	1	1,479,196 1,465,788 99.1%
WA	Spokane	Apples 227 Cherries 50 peaches 42 Strawberries 30 Pears 24 Raspberries 15 Plums & prunes 1	389	1,128,835 625,769 55.4%
WA	Asotin	Apples 24 Peaches 18 Cherries 17 Pears 6	65	406,983 274,546 67.5%
WA	Garfield	none		454,744 325,472 84.3%
WA	Columbia	Apples 5	5	556,034 304,928 54.8%
WA	Whitman	Apples 19 Pears 2 Cherries	21	1,382,006 1,404,289 101.6%

WA	Franklin	Apples 9000 Grapes 2813 Cherries 2165 Peaches 262 Pears 156 Nectarines 129 Raspberries 70 Plums & prunes 43 Strawberries 17 Walnuts	14,655	<u>794,999</u> 670,149 84.3%
WA	Walla Walla	Apples 5222 Cherries 280 Plums & prunes 22 Grapes	5524	<u>813,108</u> 710,546 87.4%
OR	Wallowa	Apples 8 Peaches	8	<u>2,013,071</u> 694,304 34.5%
OR	Union	Cherries 596 Apples 39 Peaches 12 Plums & prunes Pears	647	<u>1,303,476</u> 473,316 36.3%

Table 29. Crops on which fenbutatin-oxide can be used in Washington and Oregon counties through which the Snake River fall-run chinook and the Snake River spring/summer-run chinook ESUs migrate.

St	County	Crops and acres planted	Acres	<u>total acreage</u> land in farms % farmed
WA	Walla Walla	Apples 5222 Cherries 280 Plums & prunes 22 Grapes	5524	<u>813,108</u> 710,546 87.4%

WA	Benton	Apples 18,245 Grapes 15,929 Cherries 3219 Pears 472 Plums & prunes 180 Peaches 149 Walnuts 41	38,235	<u>1,089,993</u> 640,370 58.7%
WA	Klickitat	Pears 923 Apples 516 Cherries 457 Grapes 419 Peaches 199 Plums & prunes 1 Walnuts	2515	<u>1,198,385</u> 689,639 57.5%
WA	Skamania	Pears 477 Apples 75 Grapes	552	<u>1,337,179</u> 4043 0.4%
WA	Clark	Raspberries 634 Strawberries 162 Pears 75 Walnuts 51 Peaches 46 Apples 33 Grapes 32 Plums & prunes 10 Cherries	1043	<u>401,850</u> 82,967 20.6
WA	Cowlitz	Raspberries 439 Apples 14 Walnuts 5 Pears 3 Cherries 2 Grapes Strawberries	463	<u>728,781</u> 35,678 4.9%
WA	Wahkiakum	none		<u>169,125</u> 12,611 7.5%
WA	Pacific	Cherries Grapes Apples	NR	<u>623,722</u> 32,637 5.2%

OR	Umatilla	Apples 3927 Plums & prunes 365 Cherries 349 Grapes 163 Strawberries 9 Raspberries 7 Peaches 7 Pears 4 Nectarines	4831	<u>2,057,809</u> 1,466,580 71.3%
OR	Morrow	Apples	NR	<u>1,301,021</u> 1,119,004 86%
OR	Gilliam	none		<u>770,664</u> 766,373 99.4%
OR	Sherman	none		<u>526,911</u> 487,534 92.5%
OR	Wasco	Cherries 7352 Apples 463 Pears 385 Grapes 110 Peaches 30 Plums & prunes Strawberries	8340	<u>1,523,958</u> 1,152,965 75.7%
OR	Hood River	Pears 11,788 Apples 2592 Cherries 1081 Grapes 63 Peaches 13 Raspberries 1	15,538	<u>334,328</u> 27,201 8.1%

OR	Multnomah	Raspberries 741 Strawberries 171 Apples 51 Peaches 36 Grapes 28 Pears 25 Cherries 8 Plums & prunes 3 Walnuts 2 Eggplant	1065	<u>278,570</u> 31,294 11.2%
OR	Columbia	Apples 39 Pears 12 Walnuts 11 Cherries 7 Grapes 6 Strawberries 6 Plums & prunes 2 Raspberries 1 Peaches	84	<u>420,332</u> 71,839 17.1%
OR	Clatsop	Apples	NR	<u>529,482</u> 24,740 4.7%

Fenbutatin oxide may only be used a relatively small acreage of crops within Idaho, but there is considerable acreage of relevant crops along the lower Snake River. Because this is part of the spawning and growth areas of the Snake River fall-run chinook salmon ESU, I must consider the probability that these fish would not be limited to the Snake River itself. Therefore, based upon the very high toxicity, I conclude that fenbutatin oxide may affect the Snake River fall-run chinook salmon ESU in its spawning and growth areas. Despite the high toxicity, I believe there would be sufficient dilution that fish in the migratory corridors would not be affected.

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

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

Table 30 shows the cropping information for Oregon and Washington counties where the Snake River spring/summer-run chinook salmon ESU occurs. The cropping information for the migratory corridors is the same as for the Snake River fall-run chinook salmon and is in Table 29 above. In these tables, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 30. Crops on which fenbutatin-oxide can be used in Idaho counties which provide spawning and rearing habitat for the Snake River spring/summer run chinook ESU

St	County	Crops and acres planted	Acres	total acreage land in farms % farmed
ID	Adams	Apples 5	5	873,399 221,209 25.3%
ID	Idaho	Apples 6 Pears 2 Plums & prunes 2 Cherries 2 Grapes 1 Peaches	13	5,430,522 744,295 13.7%

ID	Nez Perce	Peaches 22 Apples 9 Cherries 4	35	543,434 477,839 87.9%
ID	Custer	none		3,152,382 140,701 4.5%
ID	Lemhi	Cherries 9 Apples 6 Peaches 3 Pears 2	20	2,921,172 193,908 6.6%
ID	Valley	none		2,354,043 78,813 3.3%
ID	Lewis	none		306,601 211,039 68.8%
ID	Latah	Cherries 19 Apples 3 Pears	22	689,089 347,293 50.4%
WA	Asotin	Apples 24 Peaches 18 Cherries 17 Pears 6	65	406,983 274,546 67.5%
WA	Garfield	none		454,744 325,472 84.3%
WA	Columbia	Apples 5	5	556,034 304,928 54.8%
WA	Whitman	Apples 19 Pears 2 Cherries	21	1,382,006 1,404,289 101.6%

WA	Franklin	Apples 9000 Grapes 2813 Cherries 2165 Peaches 262 Pears 156 Nectarines 129 Raspberries 70 Plums & prunes 43 Strawberries 17 Walnuts	14,655	<u>794,999</u> 670,149 84.3%
OR	Wallowa	Apples 8 Peaches	8	<u>2,013,071</u> 694,304 34.5%
OR	Union	Cherries 596 Apples 39 Peaches 12 Plums & prunes Pears	647	<u>1,303,476</u> 473,316 36.3%

Fenbutatin oxide may only be used a relatively small acreage of crops within Idaho, but there is considerable acreage of relevant crops along the lower Snake River. Because this is part of the spawning and growth areas of the Snake River spring/summer run chinook salmon ESU, I must consider the probability that steelhead would not be limited to the Snake River itself. Therefore, based upon the very high toxicity, I conclude that fenbutatin oxide may affect the Snake River spring/summer run chinook salmon ESU in its spawning and growth areas. Despite the high toxicity, I believe there would be sufficient dilution that fish in the migratory corridors would not be affected.

<u>4. Central Valley Spring-run Chinook Salmon ESU</u>

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 31 contains usage information for the California counties supporting the Central Valley spring-run chinook salmon ESU. Within a county, crops are listed from the most fenbutatin oxide use to the least.

Table 31. Use of fenbutatin-oxide in counties with the Central Valley spring run chinook salmon ESU.

County	Agricultural Crop(s)	Ag usage pounds	Ag Acres treated	Non-agricultural uses	Non-Ag usage pounds
Alameda	none			Landscape	<1
Butte	Almonds, prunes, peaches, walnut	2792	4310	Landscape	<1
Colusa	Almonds	273	654	none	
Contra Costa	none			Landscape, structural	<1
Glenn	Almond, prune, walnut	778	1549	none	
Marin	none			Landscape	<1
Napa	Grapes	156	156	Landscape	<1
Nevada	none			none	
Placer	Prunes, walnuts, peaches, apples, nursery container plants, plums	98	143	none	
Sacramento	none			Landscape	<1
San Mateo	Nursery container plants	<1	<1	Landscape	<1
San Francisco	none			Landscape	<1

Shasta	Walnuts	3	4	Landscape	<1
Solano	Prunes	65	92	Landscape	<1
Sonoma	Grapes, nursery container plants	443	452	Landscape	<1
Sutter	Peaches, prunes, walnuts, apples, nursery transplants, nursery container plants, almonds, rice cherries	5702	9943	none	
Tehama	Prunes, walnuts	62	58	none	
Yolo	Prunes, walnuts, almonds	151	225	Research, landscape	14
Yuba	Peaches, prunes, walnuts, apples, almonds, nectarines, plums	2055	3395	none	

Fenbutatin oxide usage has been reported on a moderate amount of acreage within several counties for the Central Valley spring run chinook salmon ESU, especially on peaches and almonds. Based upon this usage and the very high toxicity, I conclude that fenbutatin oxide may affect the Central Valley spring run chinook salmon ESU. As with the Sacramento River winter run chinook, I believe there would be sufficient dilution that fish in the migratory corridors would not be affected below Honker Bay and possibly below the City of Sacramento.

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 fenbutatin oxide 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 fenbutatin oxide would not be used in the forested upper elevation areas.

Table 32 contains usage information for the California counties supporting the California coastal chinook salmon ESU.

Table 32. Use of fenbutatin-oxide in counties with the California coastal chinook salmon ESU. Does not include homeowner use on ornamentals.

County	Agricultural Crop(s)	Ag usage pounds	Ag Acres treated	Non-agricultural uses	Non-Ag usage pounds
Humboldt	none			none	
Mendocino	Nursery container plants	<1	<1	Landscape	<1
Sonoma	Grapes, nursery container plants	443	452	Landscape	<1
Marin	none			Landscape	<1
Trinity	none			none	
Lake	Grapes	49	98	none	

Fenbutatin oxide is only be used a relatively small acreage of grapes in Sonoma and Lake counties. But with the high fish toxicity and the uncertainties associated with where fenbutatin oxide may be actually used leads me to conclude that fenbutatin oxide may affect the California Coastal chinook salmon ESU.

6. Puget Sound Chinook Salmon ESU

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

The hydrologic units and upstream barriers are the Strait of Georgia, San Juan Islands, Nooksack, Upper Skagit, Sauk, Lower Skagit, Stillaguamish, Skykomish, Snoqualmie (upstream barrier - Tolt Dam), Snohomish, Lake Washington (upstream barrier - Landsburg Diversion), Duwamish, Puyallup, Nisqually (upstream barrier - Alder Dam), Deschutes, Skokomish, Hood Canal, Puget Sound, Dungeness-Elwha (upstream barrier - Elwha Dam). Affected counties in Washington, apparently all of which could have spawning and rearing habitat, are Skagit, Whatcom, San Juan, Island, Snohomish, King, Pierce, Thurston, Lewis, Grays Harbor, Mason, Clallam, Jefferson, and Kitsap.

Table 33 shows the cropping information for Washington counties where the Puget Sound chinook salmon ESU is located. In these tables, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 33. Crops and acreage where fenbutatin-oxide can be used in counties that are in the Critical Habitat of the Puget Sound chinook salmon ESU.

St	County	Crops and acres planted	Acres	total acreage land in farms % farmed
WA	Skagit	Raspberries 1088 Apples 357 Strawberries 281 Pears 5 Cherries Grapes	1731	1,110,583 92,074 8.3%
WA	Whatcom	Raspberries 5255 Strawberries 297 Apples 174 Pears 15 Grapes 10 Cherries 4 Walnuts 1 Plums & prunes	5756	1,356,835 118,136 8.7%
WA	San Juan	Apples 64 Grapes 13 Pears 5 Plums & prunes 2 Raspberries 2 Strawberries 2 Cherries 1 Peaches 1	90	11,963 20,529 18.3%
WA	Island	Apples 18 Grapes 14 Pears 1 Raspberries Strawberries	33	133,499 19,526 14.6%

WA	Snohomish	Strawberries 81 Raspberries 71 Apples 47 Pears 27 Cherries 3 Plums & prunes 2 Grapes 1	232	<u>1,337,728</u> 74,153 5.5%
WA	King	Apples 64 Strawberries 42 Raspberries 26 Pears 19 Cherries 8 Plums & prunes 4 Grapes 2 Peaches 1 Eggplant 1	167	<u>1,360,705</u> 42,290 3.1%
WA	Pierce	Strawberries 125 Raspberries 108 Apples 61 Cherries 5 Pears 4 Grapes	303	<u>1,072,350</u> 58,750 5.5%
WA	Thurston	Strawberries 74 Raspberries 25 Apples 23 Pears 5 Cherries 4 Eggplant 1 Grapes	132	<u>465,322</u> 59,890 12.9%
WA	Lewis	Apples 77 Cherries 10 Pears 8 Walnuts 4 Grapes 4 Plums & prunes 3 Raspberries Strawberries	106	<u>1,540,991</u> 112,263 7.3%

WA	Grays Harbor	Apples 5 Cherries 1 Pears	6	1,227,045 44,742 3.6%
WA	Mason	Apples 5 Pears 1 Cherries 1 Grapes	7	615,108 10,965 1.8%
WA	Clallam	Apples 29 Strawberries 13 Cherries 11 Grapes 4 Plums & prunes 1 Pears 1 Raspberries	59	1,116,900 24,253 2.2%
WA	Jefferson	Apples 5 Raspberries 2	7	1,157,642 9,603 0.8%
WA	Kitsap	Apples 21 Raspberries 9 Grapes 8 Strawberries 7 Cherries 6 Plums & prunes 4 Pears 4	59	253,436 10,302 4.1%

Fenbutatin oxide may be used on moderate acreage within the spawning and growth areas of the Puget Sound chinook salmon ESU. I also note that raspberries in particular have a high percentage (26%) of the crop treated and this is a prominent crop in Skagit and Whatcom counties. Based upon the very high toxicity and the considerable acreage where it could be used, I conclude that fenbutatin oxide may affect the Puget Sound chinook salmon ESU in its spawning and growth areas. Despite the high toxicity, I believe there would be sufficient dilution that fish would not be affected in Puget Sound itself.

7. Lower Columbia River Chinook Salmon ESU

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

The hydrologic units and upstream barriers are the Middle Columbia-Hood (upstream barriers - Condit Dam, The Dalles Dam), Lower Columbia-Sandy (upstream barrier - Bull Run Dam 2), Lewis (upstream barrier - Merlin Dam), Lower Columbia-Clatskanie, Upper Cowlitz, Lower Cowlitz, Lower Columbia, Clackamas, and the Lower Willamette. Spawning and rearing habitat would be in the counties of Hood River, Wasco, Columbia, Clackamas, Marion, Multnomah, and Washington in Oregon, and Klickitat, Skamania, Clark, Cowlitz, Lewis, Wahkiakum, Pacific, Yakima, and Pierce in Washington. Clatsop County appears to be the only county in the critical habitat that does not contain spawning and rearing habitat, although there is only a small part of Marion County that is included as critical habitat. I have excluded Pierce County, Washington because the very small part of the Cowlitz River watershed in this county is at a high elevation where fenbutatin oxide would not be used.

Tables 34 shows the cropping information for Oregon and Washington counties where the Lower Columbia River chinook salmon ESU occurs. In these tables, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 34. Crops and acreage where fenbutatin-oxide can be used in counties that are in the Critical Habitat of the Lower Columbia River chinook salmon ESU.

St	County	Crops and acres planted	Acres	<u>total acreage</u> land in farms % farmed
OR	Wasco	Cherries 7352 Apples 463 Pears 385 Grapes 110 Peaches 30 Plums & prunes Strawberries	8340	<u>1,523,958</u> 1,152,965 75.7%
OR	Hood River	Pears 11,788 Apples 2592 Cherries 1081 Grapes 63 Peaches 13 Raspberries 1	15,538	<u>334,328</u> 27,201 8.1%

OR	Marion	Strawberries 1858 Cherries 1568 Grapes 761 Apples 555 Raspberries 546 Peaches 179 Walnuts 155 Pears 150 Plums & prunes 145 Nectarines	5917	<u>758,394</u> 302,462 39.9%
OR	Clackamas	Raspberries 1435 Strawberries 608 Grapes 207 Apples 167 Peaches 78 Cherries 53 Walnuts 51 Plums & prunes 37 Pears 37	2673	<u>1,195,712</u> 148,848 12.4%
OR	Multnomah	Raspberries 741 Strawberries 171 Apples 51 Peaches 36 Grapes 28 Pears 25 Cherries 8 Plums & prunes 3 Walnuts 2 Eggplant	1065	<u>278,570</u> 31,294 11.2%
OR	Washington	Strawberries 1257 Raspberries 1150 Grapes 989 Walnuts 679 Plums & prunes 358 Apples 279 Cherries 211 Peaches 168 Pears 69 Eggplant 1	5161	<u>463,231</u> 139,820 30.2%

OR	Columbia	Apples 39 Pears 12 Walnuts 11 Cherries 7 Grapes 6 Strawberries 6 Plums & prunes 2 Raspberries 1 Peaches	84	420,332 71,839 17.1%
OR	Clatsop	Apples	NR	529,482 24,740 4.7%
WA	Pacific	Cherries Grapes Apples	NR	623,722 32,637 5.2%
WA	Wahkiakum	none		169,125 12,611 7.5%
WA	Clark	Raspberries 634 Strawberries 162 Pears 75 Walnuts 51 Peaches 46 Apples 33 Grapes 32 Plums & prunes 10 Cherries	1043	401,850 82,967 20.6
WA	Cowlitz	Raspberries 439 Apples 14 Walnuts 5 Pears 3 Cherries 2 Grapes Strawberries	463	728,781 35,678 4.9%

WA	Lewis	Apples 77 Cherries 10 Pears 8 Walnuts 4 Grapes 4 Plums & prunes 3 Raspberries Strawberries	106	1,540,991 112,263 7.3%
WA	Klickitat	Pears 923 Apples 516 Cherries 457 Grapes 419 Peaches 199 Plums & prunes 1 Walnuts	2515	1,198,385 689,639 57.5%
WA	Skamania	Pears 477 Apples 75 Grapes	552	1,337,179 4043 0.4%

Fenbutatin oxide may be used on rather substantial acreage within the spawning and growth areas of the Lower Columbia River chinook salmon ESU. I also note that raspberries in particular have a high percentage (26%) of the crop treated. While only 2-6% of pears are treated, the high acreage would be of concern for this crop also. Based upon the very high toxicity and the considerable acreage where it could be used, I conclude that fenbutatin oxide may affect the Lower Columbia River chinook salmon ESU in its spawning and growth areas. Despite the high toxicity, I believe there would be sufficient dilution that fish in the migratory corridors would not be affected.

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

Tables 35 and 36 show the cropping information for Oregon counties where the Upper Willamette River chinook salmon ESU occurs and for the Oregon and Washington counties where this ESU migrates. In these tables, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 35. Crops on which fenbutatin-oxide can be used that are part of the spawning and rearing habitat of the Upper Willamette River chinook salmon ESU.

St	County	Crops and acres planted	Acres	total acreage land in farms % farmed
OR	Douglas	Grapes 581 Plums & prunes 305 Walnuts 171 Apples 148 Pears 105 Cherries 64 Peaches 53 Strawberries 24 Raspberries 14 Nectarines	1465	3,223,576 402,023 12.5%
OR	Lane	Grapes 631 Cherries 249 Apples 174 Walnuts 105 Strawberries 74 Peaches 54 Pears 51 Plums & prunes 34 Raspberries 20 Nectarines 2	1394	2,914,656 242,121 8.3%

OR	Benton	Grapes 242 Apples 62 Walnuts 23 Cherries 18 Strawberries 17 Peaches 8 Pears 7 Plums & prunes 5 Raspberries 2 Eggplant	384	432,961 118,818 27.4%
OR	Linn	Raspberries 387 Cherries 157 Apples 133 Grapes 93 Peaches 73 Walnuts 55 Strawberries 52 Pears 26 Plums & prunes 14 Nectarines 3	993	1,466,507 380,464 25.9%
OR	Polk	Cherries 1888 Grapes 1123 Plums & prunes 595 Apples 157 Pears 63 Peaches 51 Walnuts 33 Strawberries 22 Raspberries	3932	474,296 167,880 35.4%
OR	Clackamas	Raspberries 1435 Strawberries 608 Grapes 207 Apples 167 Peaches 78 Cherries 53 Walnuts 51 Plums & prunes 37 Pears 37	2673	1,195,712 148,848 12.4%

OR	Marion	Strawberries 1858 Cherries 1568 Grapes 761 Apples 555 Raspberries 546 Peaches 179 Walnuts 155 Pears 150 Plums & prunes 145 Nectarines	5917	<u>758,394</u> 302,462 39.9%
OR	Yamhill	Grapes 2887 Cherries 1693 Walnuts 608 Plums & prunes 369 Apples 310 Strawberries 265 Raspberries 114 Peaches 104 Pears 54 Nectarines Eggplant	6404	<u>457,986</u> 179,787 39.3%
OR	Washington	Strawberries 1257 Raspberries 1150 Grapes 989 Walnuts 679 Plums & prunes 358 Apples 279 Cherries 211 Peaches 168 Pears 69 Eggplant 1	5161	<u>463,231</u> 139,820 30.2%

Table 36. Crops on which fenbutatin-oxide can be used that are part of the migration corridors of the Upper Willamette River chinook salmon ESU.

St	County	Crops and acres planted	Acres	<u>total acreage</u> land in farms % farmed

WA	Clark	Raspberries 634 Strawberries 162 Pears 75 Walnuts 51 Peaches 46 Apples 33 Grapes 32 Plums & prunes 10 Cherries	1043	<u>401,850</u> 82,967 20.6
WA	Cowlitz	Raspberries 439 Apples 14 Walnuts 5 Pears 3 Cherries 2 Grapes Strawberries	463	<u>728,781</u> 35,678 4.9%
WA	Wahkiakum	none		<u>169,125</u> 12,611 7.5%
WA	Pacific	Cherries Grapes Apples	NR	<u>623,722</u> 32,637 5.2%
OR	Multnomah	Raspberries 741 Strawberries 171 Apples 51 Peaches 36 Grapes 28 Pears 25 Cherries 8 Plums & prunes 3 Walnuts 2 Eggplant	1065	<u>278,570</u> 31,294 11.2%

OR	Columbia	Apples 39 Pears 12 Walnuts 11 Cherries 7 Grapes 6 Strawberries 6 Plums & prunes 2 Raspberries 1 Peaches	84	<u>420,332</u> 71,839 17.1%
OR	Clatsop	Apples	NR	<u>529,482</u> 24,740 4.7%

Fenbutatin oxide may be used on rather substantial acreage within the spawning and growth areas of the Upper Willamette River chinook salmon ESU. I also note that raspberries in particular have a high percentage (26%) of the crop treated. Based upon the very high toxicity and the considerable acreage where it could be used, I conclude that fenbutatin oxide may affect the Upper Willamette River chinook salmon ESU in its spawning and growth areas. Despite the high toxicity, I believe there would be sufficient dilution that fish in the migratory corridors would not be affected.

<u>9. Upper Columbia River Spring-run Chinook Salmon ESU</u>

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 37), with the lower river reaches being migratory corridors (Table 38).

Tables 37 and 38 show the cropping information for Washington counties that support the Upper Columbia River chinook salmon ESU and for the Oregon and Washington counties where this ESU migrates. In these tables, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 37. Crops on which fenbutatin-oxide can be used in Washington counties where there is

spawning and rearing habitat for the Upper Columbia River chinook salmon ESU.

St	County	Crops and acres planted	Acres	total acreage land in farms % farmed
WA	Benton	Apples 18,245 Grapes 15,929 Cherries 3219 Pears 472 Plums & prunes 180 Peaches 149 Walnuts 41	38,235	1,089,993 640,370 58.7%
WA	Kittitas	Apples 1859 Pears 331 Plums & prunes 1 Peaches 1 Cherries	2192	1,469,862 355,360 24.2%
WA	Chelan	Apples 17,096 Pears 8298 Cherries 3704 Nectarines 22 Peaches 21 Plums & prunes 3 Walnuts	29,144	1,869,848 112,085 6%
WA	Douglas	Apples 14,383 Cherries 1842 Pears 1104 Peaches 167 Nectarines 91 Raspberries	17,587	1,165,168 918,033 78.8%
WA	Okanogan	Apples 24,164 Pears 3280 Cherries 1003 Peaches 67 Nectarines 38 Walnuts 29 Raspberries 1 Plums & prunes 1	28,583	3,371,698 1,291,118 38.3%

WA	Grant	Apples 33,165 Cherries 3470 Grapes 3132 Pears 998 Peaches 261 Nectarines 163 Walnuts 5 Plums & prunes 5 Strawberries 2 Raspberries 1	41,202	1,712,881 1,086,045 63.4%

Table 38. Crops on which fenbutatin-oxide can be used that are migration corridors for the Upper Columbia River chinook salmon ESU.

St	County	Crops and acres planted	Acres	total acreage land in farms % farmed
WA	Franklin	Apples 9000 Grapes 2813 Cherries 2165 Peaches 262 Pears 156 Nectarines 129 Raspberries 70 Plums & prunes 43 Strawberries 17 Walnuts	14,655	794,999 670,149 84.3%
WA	Yakima	Apples 75,264 Grapes 15,529 Pears 10,190 Cherries 6129 Peaches 1438 Nectarines 605 Plums & prunes 478 Walnuts 11 Raspberries 10 Eggplant 5	109,659	2,749,514 1,639,965 59.6%
WA	Walla Walla	Apples 5222 Cherries 280 Plums & prunes 22 Grapes	5524	813,108 710,546 87.4%

WA	Klickitat	Pears 923 Apples 516 Cherries 457 Grapes 419 Peaches 199 Plums & prunes 1 Walnuts	2515	1,198,385 689,639 57.5%
WA	Skamania	Pears 477 Apples 75 Grapes	552	1,337,179 4043 0.4%
WA	Clark	Raspberries 634 Strawberries 162 Pears 75 Walnuts 51 Peaches 46 Apples 33 Grapes 32 Plums & prunes 10 Cherries	1043	401,850 82,967 20.6
WA	Cowlitz	Raspberries 439 Apples 14 Walnuts 5 Pears 3 Cherries 2 Grapes Strawberries	463	728,781 35,678 4.9%
WA	Wahkiakum	none		169,125 12,611 7.5%
WA	Pacific	Cherries Grapes Apples	NR	623,722 32,637 5.2%
OR	Gilliam	none		770,664 766,373 99.4%

OR	Umatilla	Apples 3927 Plums & prunes 365 Cherries 349 Grapes 163 Strawberries 9 Raspberries 7 Peaches 7 Pears 4 Nectarines	4831	<u>2,057,809</u> 1,466,580 71.3%
OR	Sherman	none		<u>526,911</u> 487,534 92.5%
OR	Morrow	Apples	NR	<u>1,301,021</u> 1,119,004 86%
OR	Wasco	Cherries 7352 Apples 463 Pears 385 Grapes 110 Peaches 30 Plums & prunes Strawberries	8340	<u>1,523,958</u> 1,152,965 75.7%
OR	Hood River	Pears 11,788 Apples 2592 Cherries 1081 Grapes 63 Peaches 13 Raspberries 1	15,538	<u>334,328</u> 27,201 8.1%
OR	Multnomah	Raspberries 741 Strawberries 171 Apples 51 Peaches 36 Grapes 28 Pears 25 Cherries 8 Plums & prunes 3 Walnuts 2 Eggplant	1065	<u>278,570</u> 31,294 11.2%

OR	Columbia	Apples 39 Pears 12 Walnuts 11 Cherries 7 Grapes 6 Strawberries 6 Plums & prunes 2 Raspberries 1 Peaches	84	<u>420,332</u> 71,839 17.1%
OR	Clatsop	Apples	NR	<u>529,482</u> 24,740 4.7%

Fenbutatin oxide may only be used a small percentage of the apple crop, but there is a large acreage where it could be used, and it may also be used on other crops. Based upon the very high toxicity, I conclude that fenbutatin oxide may affect the Upper Columbia River chinook salmon ESU in its spawning and growth areas. Despite the high toxicity, I believe there would be sufficient dilution that fish in the migratory corridors would not be affected.

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

Table 39 Use of fenbutatin-oxide in counties with the Central California Coast coho ESU. Does not include homeowner use on ornamentals.

County	Agricultural Crop(s)	Ag usage pounds	Ag Acres treated	Non-agricultural uses	Non-Ag usage pounds
Santa Cruz	Apples, strawberries, nursery outdoor flowers	8	16	Landscape	<1
San Mateo	Nursery container plants	<1	<1	Landscape	<1
Marin	none			Landscape	<1
Sonoma	Grapes, nursery container plants	443	452	Landscape	<1
Mendocino	Nursery container plants	<1	<1	Landscape	<1

Napa	Grapes	156	156	Landscape	<1

There is only low usage of fenbutatin oxide within the habitat of the Central California Coast coho salmon ESU. However, in conjunction with the high fish toxicity and the uncertainties associated with where fenbutatin oxide may be actually used with respect to aquatic habitats, I must conclude that fenbutatin oxide may affect the Central California Coast coho salmon ESU. Concerns are primarily for grape use in Sonoma and Napa counties. I do note that Sonoma County is coastal while Napa County is in the San Pablo Bay watershed.

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, I have excluded Glenn County, California from this analysis because the salmon habitat in this county is not near the agricultural areas where fenbutatin oxide can be used.

Table 40 shows the usage of fenbutatin oxide in the California counties supporting the Southern Oregon/Northern California coastal coho salmon ESU. Crops are listed in order from the greatest fenbutatin oxide use to the smallest. Table 41 shows the cropping information for Oregon counties where the Southern Oregon/Northern California coastal coho salmon ESU occurs. In Table 41, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 40. Use of fenbutatin-oxide in California counties with the Southern Oregon/Northern California coastal coho salmon ESU. Does not include homeowner use on ornamentals

County	Agricultural Crop(s)	Ag usage pounds	Ag Acres treated	Non-agricultural uses	Non-Ag usage pounds
Humboldt	none			none	
Mendocino	Nursery container plants	<1	<1	Landscape	<1
Del Norte	none			none	
Siskiyou	none			none	
Trinity	none			none	
Lake	Grapes	49	98	none	

Table 41. Fenbutatin-oxide use in Oregon counties where there is habitat for the Southern Oregon/Northern California coastal coho salmon ESU.

St	County	Crops and acres planted	Acres	total acreage land in farms % farmed
OR	Curry	Apples 27 Plums & prunes 6 Cherries 4 Pears 3 Strawberries 1 Grapes	41	1,041,557 74,375 7.1%
OR	Jackson	Pears 9387 Grapes 400 Apples 360 Peaches 198 Walnuts 27 Cherries 27 Strawberries 18 Plums & prunes 15 Nectarines 14 Raspberries 5 Eggplant 3	10,454	1,782,633 262,251 14.7%

OR	Josephine	Grapes 355 Apples 181 Peaches 29 Walnuts 18 Cherries 9 Strawberries 3 Raspberries 2 Plums & prunes 1 Pears	599	<u>1,049,308</u> 31,249 3.0%
OR	Douglas	Grapes 581 Plums & prunes 305 Walnuts 171 Apples 148 Pears 105 Cherries 64 Peaches 53 Strawberries 24 Raspberries 14 Nectarines	1465	<u>3,223,576</u> 402,023 12.5%
OR	Klamath	Strawberries 17 Apples 8 Raspberries	25	<u>3,804,552</u> 720,153 18.9%

There is relatively low usage of fenbutatin oxide in Lake County, CA, but there is a high amount of acreage where it could be used in Oregon, especially in Jackson County. Based upon the high fish toxicity, the uncertainties associated with where fenbutatin oxide may be actually used in Lake County, and the high acreage in Jackson County and to a lesser extent in Douglas and Josephine counties, I conclude that fenbutatin oxide may affect the Southern Oregon/Northern California coastal coho salmon ESU.

<u>3. Oregon Coast coho salmon ESU</u>

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 where fenbutatin oxide can be used, and I have eliminated them in this analysis.

Table 42 show the cropping information for Oregon counties where the Oregon coast coho salmon ESU occurs. In this table, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 42. Crops on which fenbutatin-oxide can be used that are in counties where there is habitat for the Oregon coast coho salmon ESU.

St	County	Crops and acres planted	Acres	total acreage land in farms % farmed
OR	Curry	Apples 27 Plums & prunes 6 Cherries 4 Pears 3 Strawberries 1 Grapes	41	1,041,557 74,375 7.1%
OR	Coos	Apples 28 Grapes 12 Cherries 11 Pears 4 Plums & prunes 3 Peaches 1 Walnuts 1 Nectarines 1	61	1,024,346 174,872 17.1%

OR	Douglas	Grapes 581 Plums & prunes 305 Walnuts 171 Apples 148 Pears 105 Cherries 64 Peaches 53 Strawberries 24 Raspberries 14 Nectarines	1465	<u>3,223,576</u> 402,023 12.5%
OR	Lane	Grapes 631 Cherries 249 Apples 174 Walnuts 105 Strawberries 74 Peaches 54 Pears 51 Plums & prunes 34 Raspberries 20 Nectarines 2	1394	<u>2,914,656</u> 242,121 8.3%
OR	Lincoln	Apples 22 Raspberries 3 Pears 1 Grapes 1	27	<u>626,976</u> 34,292 5,5%
OR	Benton	Grapes 242 Apples 62 Walnuts 23 Cherries 18 Strawberries 17 Peaches 8 Pears 7 Plums & prunes 5 Raspberries 2 Eggplant	384	<u>432,961</u> 118,818 27.4%

OR	Polk	Cherries 1888 Grapes 1123 Plums & prunes 595 Apples 157 Pears 63 Peaches 51 Walnuts 33 Strawberries 22 Raspberries	3932	474,296 167,880 35.4%
OR	Tillamook	none		705,417 39,559 5.6%
OR	Clatsop	Apples	NR	529,482 24,740 4.7%

I believe from personal experience that most of the crop acreage in Table 42 for Polk, Lane, and Benton counties is in the Willamette River watershed, rather than coastal. But the Umpqua River is coastal and drains a good portion of Douglas County. Based upon the uncertainties of where fenbutatin oxide may be used in the coastal watersheds of this ESU and because of the very high toxicity, I conclude that fenbutatin oxide may affect the Oregon coast coho salmon ESU.

D. Chum Salmon

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

Most chum salmon mature between 3 and 5 years of age, usually 4 years, with younger fish being more predominant in southern parts of their range. Chum salmon usually spawn in

coastal areas, typically within 100 km of the ocean where they do not have surmount river blockages and falls. However, in the Skagit River, Washington, they migrate at least 170 km.

During the spawning migration, adult chum salmon enter natal river systems from June to March, depending on characteristics of the population or geographic location. . In Washington, a variety of seasonal runs are recognized, including summer, fall, and winter populations. Fall-run fish predominate, but summer runs are found in Hood Canal, the Strait of

Juan de Fuca, and in southern Puget Sound, and two rivers in southern Puget Sound have winter-run fish.

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

1. Hood Canal Summer-run chum salmon ESU

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

Critical habitat for the Hood Canal ESU includes Hood Canal, Admiralty Inlet, and the straits of Juan de Fuca, along with all river reaches accessible to listed chum salmon draining into Hood Canal as well as Olympic Peninsula rivers between Hood Canal and Dungeness Bay, Washington. The hydrologic units are Skokomish (upstream boundary - Cushman Dam), Hood Canal, Puget Sound, Dungeness-Elwha, in the counties of Mason, Clallam, Jefferson, Kitsap, 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 43 shows the cropping information for Washington counties where the Hood Canal summer-run chum salmon ESU occurs. In this table, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 43. Crops on which fenbutatin-oxide can be used that are in counties where there is habitat for the Hood Canal Summer-run chum salmon ESU

St	County	Crops and acres planted	Acres	total acreage land in farms % farmed
WA	Mason	Apples 5 Pears 1 Cherries 1 Grapes	7	615,108 10,965 1.8%

WA	Clallam	Apples 29 Strawberries 13 Cherries 11 Grapes 4 Plums & prunes 1 Pears 1 Raspberries	59	<u>1,116,900</u> 24,253 2.2%
WA	Jefferson	Apples 5 Raspberries 2	7	<u>1,157,642</u> 9,603 0.8%
WA	Kitsap	Apples 21 Raspberries 9 Grapes 8 Strawberries 7 Cherries 6 Plums & prunes 4 Pears 4	59	<u>253,436</u> 10,302 4.1%
WA	Island	Apples 18 Grapes 14 Pears 1 Raspberries Strawberries	33	<u>133,499</u> 19,526 14.6%

There is a rather low amount of acreage where fenbutatin oxide may be used within the habitat of the Hood Canal chum salmon ESU. Mites would most likely occur in sufficient quantities to warrant treatment in drier areas such as in the rain shadow of Mt. Olympus. While I consider it a rather low probability, I cannot discount the small possibility of effects. Therefore, I conclude that the use of fenbutatin oxide may affect the Hood Canal chum salmon ESU.

<u>2. Columbia River Chum Salmon ESU</u>

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

Table 44. Crops on which fenbutatin-oxide can be used that are in counties where there is habitat for the Columbia River chum salmon ESU

St	County	Crops and acres planted	Acres	total acreage land in farms % farmed
WA	Skamania	Pears 477 Apples 75 Grapes	552	1,337,179 4043 0.4%
WA	Clark	Raspberries 634 Strawberries 162 Pears 75 Walnuts 51 Peaches 46 Apples 33 Grapes 32 Plums & prunes 10 Cherries	1043	401,850 82,967 20.6
WA	Lewis	Apples 77 Cherries 10 Pears 8 Walnuts 4 Grapes 4 Plums & prunes 3 Raspberries Strawberries	106	1,540,991 112,263 7.3%

WA	Cowlitz	Raspberries 439 Apples 14 Walnuts 5 Pears 3 Cherries 2 Grapes Strawberries	463	<u>728,781</u> 35,678 4.9%
WA	Pacific	Cherries Grapes Apples	NR	<u>623,722</u> 32,637 5.2%
WA	Wahkiakum	none		<u>169,125</u> 12,611 7.5%
OR	Multnomah	Raspberries 741 Strawberries 171 Apples 51 Peaches 36 Grapes 28 Pears 25 Cherries 8 Plums & prunes 3 Walnuts 2 Eggplant	1065	<u>278,570</u> 31,294 11.2%
OR	Columbia	Apples 39 Pears 12 Walnuts 11 Cherries 7 Grapes 6 Strawberries 6 Plums & prunes 2 Raspberries 1 Peaches	84	<u>420,332</u> 71,839 17.1%

OR	Washington	Strawberries 1257 Raspberries 1150 Grapes 989 Walnuts 679 Plums & prunes 358 Apples 279 Cherries 211 Peaches 168 Pears 69 Eggplant 1	5161	463,231 139,820 30.2%
OR	Clatsop	Apples	NR	529,482 24,740 4.7%

There is essentially no use of fenbutatin oxide in the currently inhabited Grays River, Hardy Creek and Hamilton Creek. Therefore, I conclude that there will be no effect from the use of fenbutatin oxide to the Lower Columbia River chum salmon ESU in its current occupied area. Should this ESU expand its range, either naturally or through reintroduction, into Columbia River tributaries above Clatsop and Wahkiakum counties, I would want to revisit this conclusion.

E. Sockeye Salmon

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

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

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

1. Ozette Lake Sockeye Salmon ESU

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

While Lake Ozette, itself, is part of Olympic National Park, its tributaries extend outside park boundaries, much of which is private land. There is limited agriculture in the whole of Clallam County. Table 45 shows that there are only 29 acres of apples on which fenbutatin oxide can be used in the county.

Table 45. Crops on which fenbutatin-oxide can be used that are in Clallam County where there is habitat for the Ozette Lake sockeye salmon ESU.

St	County	Crops and acres planted	Acres	total acreage land in farms % farmed
WA	Clallam	Apples 29 Strawberries 13 Cherries 11 Grapes 4 Plums & prunes 1 Pears 1 Raspberries	59	1,116,900 24,253 2.2%

There is only a small amount of acreage in Clallum County where fenbutatin oxide may be used. Mites are generally a problem worth treating only in arid areas, and Ozette Lake and the surrounding area do not qualify as arid. I believe the chances of fenbutatin oxide being used within the area of this ESU are so small as to be discountable. Even if it were used, the use may not be proximate to relevant aquatic habitats. Therefore, I conclude that Fenbutatin oxide may affect, but is not likely to adversely affect, the Ozette Lake sockeye salmon ESU.

2. Snake River Sockeye Salmon ESU

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

Spawning and rearing habitats are considered to be all of the above-named lakes and creeks, even though at the time of the critical habitat Notice, spawning only still occurred in Redfish Lake. These habitats are in Custer and Blaine counties in Idaho. However, the habitat area for the salmon is high elevation areas in a National Wilderness area and National Forest. Fenbutatin oxide cannot be used on such a site, and therefore there will be no exposure in the spawning and rearing habitat. There is a probability that this salmon ESU could be exposed to fenbutatin oxide in the lower and larger river reaches during its juvenile or adult migration.

Table 46 shows the limited acreage of crops in Idaho counties where this ESU reproduces.

Table 47 shows the acreage of crops where fenbutatin oxide can be used in Oregon and Washington counties along the migratory corridor for this ESU. In these tables, if there is no acreage given for a specific crop, this means that there are too few growers in the area for USDA to make the data available.

Table 46. Crops on which fenbutatin-oxide can be used that are in Idaho counties where there is spawning and rearing habitat for the Snake River sockeye salmon ESU.

St	County	Crops and acres planted	Acres	total acreage land in farms % farmed
ID	Custer	none		3,152,382 140,701 4.5%
ID	Blaine	none		1,692,735 266,293 15.7%

Table 47. Crops on which fenbutatin-oxide can be used that are in Oregon and Washington counties that are in the migratory corridors for the Snake River sockeye salmon ESU.

St	County	Crops and acres planted	Acres	total acreage land in farms % farmed
ID	Idaho	Apples 6 Pears 2 Plums & prunes 2 Cherries 2 Grapes 1 Peaches	13	5,430,522 744,295 13.7%
ID	Lemhi	Cherries 9 Apples 6 Peaches 3 Pears 2	20	2,921,172 193,908 6.6%
ID	Lewis	none		306,601 211,039 68.8%
ID	Nez Perce	Peaches 22 Apples 9 Cherries 4	35	543,434 477,839 87.9%
WA	Asotin	Apples 24 Peaches 18 Cherries 17 Pears 6	65	406,983 274,546 67.5%
WA	Garfield	none		454,744 325,472 84.3%
WA	Whitman	Apples 19 Pears 2 Cherries	21	1,382,006 1,404,289 101.6%
WA	Columbia	Apples 5	5	556,034 304,928 54.8%
WA	Walla Walla	Apples 5222 Cherries 280 Plums & prunes 22 Grapes	5524	813,108 710,546 87.4%

WA	Franklin	Apples 9000 Grapes 2813 Cherries 2165 Peaches 262 Pears 156 Nectarines 129 Raspberries 70 Plums & prunes 43 Strawberries 17 Walnuts	14,655	794,999 670,149 84.3%
WA	Benton	Apples 18,245 Grapes 15,929 Cherries 3219 Pears 472 Plums & prunes 180 Peaches 149 Walnuts 41	38,235	1,089,993 640,370 58.7%
WA	Klickitat	Pears 923 Apples 516 Cherries 457 Grapes 419 Peaches 199 Plums & prunes 1 Walnuts	2515	1,198,385 689,639 57.5%
WA	Skamania	Pears 477 Apples 75 Grapes	552	1,337,179 4043 0.4%
WA	Clark	Raspberries 634 Strawberries 162 Pears 75 Walnuts 51 Peaches 46 Apples 33 Grapes 32 Plums & prunes 10 Cherries	1043	401,850 82,967 20.6

WA	Cowlitz	Raspberries 439 Apples 14 Walnuts 5 Pears 3 Cherries 2 Grapes Strawberries	463	<u>728,781</u> 35,678 4.9%
WA	Wahkiakum	none		<u>169,125</u> 12,611 7.5%
WA	Pacific	Cherries Grapes Apples	NR	<u>623,722</u> 32,637 5.2%
OR	Wallowa	Apples 8 Peaches	8	<u>2,013,071</u> 694,304 34.5%
OR	Umatilla	Apples 3927 Plums & prunes 365 Cherries 349 Grapes 163 Strawberries 9 Raspberries 7 Peaches 7 Pears 4 Nectarines	4831	<u>2,057,809</u> 1,466,580 71.3%
OR	Morrow	Apples	NR	<u>1,301,021</u> 1,119,004 86%
OR	Gilliam	none		<u>770,664</u> 766,373 99.4%
OR	Sherman	none		<u>526,911</u> 487,534 92.5%

OR	Wasco	Cherries 7352 Apples 463 Pears 385 Grapes 110 Peaches 30 Plums & prunes Strawberries	8340	<u>1,523,958</u> 1,152,965 75.7%
OR	Hood River	Pears 11,788 Apples 2592 Cherries 1081 Grapes 63 Peaches 13 Raspberries 1	15,538	<u>334,328</u> 27,201 8.1%
OR	Multnomah	Raspberries 741 Strawberries 171 Apples 51 Peaches 36 Grapes 28 Pears 25 Cherries 8 Plums & prunes 3 Walnuts 2 Eggplant	1065	<u>278,570</u> 31,294 11.2%
OR	Columbia	Apples 39 Pears 12 Walnuts 11 Cherries 7 Grapes 6 Strawberries 6 Plums & prunes 2 Raspberries 1 Peaches	84	<u>420,332</u> 71,839 17.1%
OR	Clatsop	Apples	NR	<u>529,482</u> 24,740 4.7%

There is no use of fenbutatin oxide within the spawning and growth areas of the Snake River sockeye salmon ESU, and therefore there will be no effect. The migratory corridors above the Snake River in Idaho may not be large streams, but there is quite low acreage where fenbutatin oxide may be used. The migratory corridors of the Snake and Columbia Rivers are nearer larger acreage where fenbutatin oxide may be used, but these are rather large rivers with considerable water to dilute any pesticide input. Therefore, I conclude that the use of fenbutatin oxide will have no effect on the Snake River sockeye salmon ESU.

5. Specific conclusions and recommendations for Pacific salmon and steelhead

1. Fenbutatin oxide is very highly toxic to fish. Risk quotients are exceeded by up to 150 times above our criteria of concern. Where there is exposure, there is risk. Where there is potential exposure, there is potential risk, and this cannot be discounted unless there are better data that indicate the potential exposure will not be realized. Therefore, I must conclude that fenbutatin oxide may affect all salmon and steelhead ESUs except the Lower Columbia River chum salmon ESU and the Snake River sockeye salmon ESU. I also consider that fenbutatin oxide is not likely to affect the Ozette Lake sockeye salmon ESU.

2. In California, the new restricted use classification requires fenbutatin oxide applicators to be certified and to obtain a permit from the County Agricultural Commissioners. Many, but not necessarily all, commissioners will not give a permit unless the county bulletins for the protection of endangered and threatened species are followed as a condition of the permit. However, fenbutatin oxide is not currently include in the California county bulletins. If it were, it would be subject to several use limitations. In addition to certain good management practices, these bulletins specify a no-spray buffer of 40 yards for ground applications and 200 yards for aerial applications. These buffers apply from the edge of the habitat when the wind is blowing towards that habitat. A vegetated buffer strip is also specified to protect aquatic habitats from runoff. I believe that the California limitations would be adequate to protect salmon and steelhead from fenbutatin oxide if they also included a specification that air blast sprayers used within 100 to 200 yards of aquatic habitats should be directed only away from the water. It may be appropriate to have a dialogue among EPA, NMFS, and DPR to consider this and possibly other aspects of use limitations.

3. In Oregon and Idaho, I am aware of no specific state programs to address pesticides and salmon and steelhead. I recommend that OPP develop county bulletins for use in these states and that the primary means of protection be a buffer area from aquatic habitats. I note that it is OPP policy to work with states, even those without specific programs, during bulletin development. The size of the buffer should be based upon sound science and expert judgement. Drift models can assist for spray drift from air blast sprayers, but there are no valid, quantitative runoff models. I note that for similar levels of risk, OPP has recommended a 100 yard ground and 1/4 mile aerial buffer when the concern levels are exceeded by more than 100, and a 20 yard ground and 200 yard buffer when the concern levels are exceed by 11 to 100. With the strong propensity of fenbutatin oxide to adsorb to soil, and the limited desorption, the bioavailability is likely a modest amount less than would warrant the larger size buffer.

4. In Washington, I recommend that OPP and NMFS work with the WSDA Task Force to implement appropriate protection. I believe that this protection should be consistent with the

reduction in exposure that would result from the use of buffers of the size indicated above and in DPR's bulletins for aquatic hazards (i.e., 200 yards for air or air blast, and 20-40 yards for other ground equipment), but the method may take a form entirely different from buffers.

Table 48. Summary conclusions on specific ESUs of salmon and steelhead for fenbutatin oxide

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

Steelhead	Northern California	may affect
Steelhead	Central California Coast	may affect
Steelhead	South-Central California Coast	may affect
Steelhead	Southern California	may affect
Steelhead	Central Valley, California	may affect

6. References

Beyers DW, Keefe TJ, Carlson CA. 1994. Toxicity of carbaryl and malathion to two federally endangered fishes, as estimated by regression and ANOVA. Environ. Toxicol. Chem. 13:101-107.

Dwyer FJ, Hardesty DK, Henke CE, Ingersoll CG, Whites GW, Mount DR, Bridges CM. 1999. Assessing contaminant sensitivity of endangered and threatened species: Toxicant classes. U.S. Environmental Protection Agency Report No. EPA/600/R-99/098, Washington, DC. 15 p.

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

Hasler AD, Scholz AT. 1983. Olfactory Imprinting and Homing in Salmon. New York: Springer-Verlag. 134p.

Johnson WW, Finley MT. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. USFWS Publication No. 137.

Machera K, Cotou E, Anastassiadou P. 1996. Fenbutatin Acute Toxicity on Artemia nauplii: Effects of Sublethal Concentrations on ATPase Activity. Bull. Environ. Contam. Toxicol. 56(1):159-164.

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

Sappington LC, Mayer FL, Dwyer FJ, Buckler DR, Jones JR, Ellersieck MR. 2001. Contaminant sensitivity of threatened and endangered fishes compared to standard surrogate species. Environ. Toxicol. Chem. 20:2869-2876.

Scholz NT, Truelove NK, French BL, Berejikian BA, Quinn TP, Casillas E, Collier TK. 2000. Diazinon disrupts antipredator and homing behaviors in chinook salmon (*Oncorhynchus tshawytscha*). Can. J. Fish. Aquat. Sci., 57:1911-1918.

Tucker RK, Leitzke JS. 1979. Comparative toxicology of insecticides for vertebrate wildlife and fish. Pharmacol. Ther., 6, 167-220.

Urban DJ, Cook NJ. 1986. Hazard Evaluation Division - Standard Evaluation Procedure - Ecological Risk Assessment, U. S. EPA Publication 540/9-86-001.

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

Secondary reference cited in AQUIRE data:

Yokoyama T, Saka H, Fujita S, Nishiuchi Y. 1988. Sensitivity of Japanese Eel, Anguilla japonica, to 68 Kinds of Agricultural Chemicals. Bull. Agric. Chem. Insp. Stn. 28:26-33 (JPN) (ENG ABS).

Attachments

1. Product Labels
2. Qualitative Use Assessment for Fenbutatin oxide
3. USGS map of Fenbutatin Oxide Use Areas
4. Reregistration Eligibility Decision (RED) (without appendices)