Prometryn
Analysis of Risks
to
Endangered and Threatened Salmon and Steelhead

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Summary

Prometryn is a substituted thiomethyl triazine herbicide registered for control of annual grasses and broadleaved weeds in terrestrial food and feed crops, especially cotton and celery. A Reregistration Eligibility Decision (RED) that included an ecological risk assessment for nontarget fish and wildlife was issued in February of 1996. State registrations (SLNs) subsequently have been issued for various minor crops in California, Oregon, and Washington. Prometryn is slightly to moderately toxic to freshwater and estuarine animals but is not likely to occur in surface waters in high enough concentrations to directly impact listed Pacific salmon and steelhead. Much uncertainty exists as to possible indirect effects; but, prometryn is toxic to aquatic vascular plants, and listed Pacific salmon and steelhead might be indirectly affected by loss of cover in some spawning and rearing ESUs where prometryn use is high. Because migration corridors consist of larger, faster-flowing streams, impacts on aquatic-plant cover seem unlikely during migration. An endangered species risk assessment is developed for federally listed Pacific salmon and steelhead potentially exposed to prometryn. This assessment applies the findings of the environmental risk assessments developed as part of the reregistration process to determine the potential risks to the 26 listed Evolutionarily Significant Units of listed Pacific salmon and steelhead. We conclude that prometryn will have no effect on 17 ESUs but may affect nine ESUs, based on the extent of crop acreage potentially treated in counties within an ESU and possible adverse effects of prometryn on vascular aquatic-plant cover.

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

Scope: Although this analysis is specific to listed Pacific anadromous salmon and steelhead and the watersheds in which they occur, it is acknowledged that prometryn is registered for uses that may occur outside this geographic scope and that additional analyses may be required to address other T&E species in the Pacific states as well as across the United States. I understand that any subsequent analyses, requests for consultation and resulting Biological Opinions may necessitate that Biological Opinions relative to this request be revisited, and could be modified.

Contents

1. Background

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

It is, 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, we 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. We 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, we 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, we 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 x 10^{-9}, or less than one individual in ten billion. It should be noted that the discussion (originally part of the 1975 regulations for FIFRA) is based upon slopes of primarily organochlorine pesticides, stated to be 4.5 probits per log cycle at that time. As organochlorine pesticides were phased out, OPP undertook an analysis of more current pesticides based on data reported by Johnson and Finley (1980), and determined that the "typical" slope for aquatic toxicity tests for the "more current" pesticides was 9.95. Because the slopes are based upon logarithmically transformed data, the probability of mortality for a pesticide with a 9.95 slope is again exponentially less than for the originally analyzed slope of 4.5.

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

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

In recent years, Moore and Waring (1996) challenged Atlantic salmon with diazinon and observed effects on olfaction as relates to reproductive physiology and behavior. Their work indicated that diazinon could have sublethal effects of concern for salmon reproduction. However, the nature of their test system, direct exposure of olfactory rosettes, could not be quantitatively related to exposures in the natural environment. Subsequently, Scholz et al.

(2000) conducted a non-reproductive behavioral study using whole Chinook salmon in a model stream system that mimicked a natural exposure that is far more relevant to ecological risk assessment than the system used by Moore and Waring (1996). The Scholz et al. (2000) data indicate potential effects of diazinon on Chinook salmon behavior at very low levels, with statistically significant effects at nominal diazinon exposures of 1 ppb, with apparent, but non-significant effects at 0.1 ppb.

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

2. Description of prometryn

Prometryn is an herbicide that may be applied before or after weeds emerge for control of annual broadleaved weeds and grasses in terrestrial food and feed crops. Use sites on FIFRA section 3 product labels are cotton, celery (California and Florida only), parsley (California only), dill (California only), and pigeon peas (Puerto Rico only). Prometryn is currently formulated as a single active ingredient in emulsifiable, soluble, or flowable concentrates. One product, a flowable concentrate for use in cotton, also contains monosodium methanearsonate as an active ingredient. Although wettable powder formulations were registered when the RED was issued in 1996, the last wettable-powder product was canceled in December of 2000. Currently, there are nine FIFRA section 3 product registrations and 13 FIFRA section 24(c) registrations or “Special Local Needs” (SLNs). SLNs include use of prometryn on fennel and transplanted celery in California; seed parsley, seed carrots, and dill grown for oil in Oregon; and seed and oil dill, seed parsley, seed carrots, and seed parsnip in Washington. Idaho does not have any SLNs for prometryn.

Prometryn is a substituted thiomethyl triazine that affects photosynthesis by inhibiting electron transport in targeted broadleaved plants and grasses. When applied before weeds emerge, prometryn enters the plant through the root system; its effectiveness depends on moisture to move it into the soil. When applied to emerged weeds, prometryn provides foliar knockdown and, depending on the amount applied, residual control of later germinating weeds. Targeted plants include the following species:

Broadleaved: black nightshade, coclebur, coffeeweed, dock, Florida pusley, ground-cherry, henbit, lambsquarters, mallow, morningglory, mustard, pigweed, prairie sunflower, prickly sida, purslane, ragweed, rough blackfoot, smartweed, spurred anoda

Grasses: barnyardgrass, crabgrass, foxtail, goosegrass, junglerice, panicum, sandbur, signalgrass, wild oat

Relevant prometryn use sites, application methods, and rates of application are summarized below. Additional application instructions, use directions, and restrictions are found in the attached product labels.

- Cotton: In CA, prometryn can be applied preplant, postemergence, or to fall-bedded cotton land. Preplant application can be broadcast by ground or air at up to 2.4 lb ai/acre and must be immediately incorporated up to 4 inches deep in the soil. For postemergence application, when cotton is 12-18 inches tall, one lay-by ground application of up to 1.6 lb ai/acre can be made in cotton grown in sandy loam and loam soils (use is not allowed in sand and loamy sand soils in CA). For control of winter weeds on fall-bedded cotton land, up to 2.4 lb ai/acre canbe applied when weeds are less than 2 inches tall.

- Celery: For direct-seeded celery (CA), up to 1.6 lb ai/acre is applied by conventional ground sprayer at planting or shortly after planting, or up to 1.0 lb ai/acre after the celery has 2-5 true leaves. For transplanted celery (CA), up to 2 lb ai/acre is applied either in a single application before transplanting or in a split application pre- and post-planting.

- Dill: One pre- or postemergence application at up to 1.6 lb ai/acre by conventional ground spray (CA); for dill grown for seed (WA), 1 lb ai/acre is broadcast by ground equipment after dill plants have 3-5 true leaves; for dill grown for oil (OR, WA), a split application of 0.75 lb ai/acre per application is made before planting and again before weeds are 2 inches tall.

- Parsley: In CA, up to 2 lb ai/acre is applied by conventional ground spray as a single application shortly after planting; for seed parsley in OR and WA, up to 1 lb ai/acre can be applied by ground spray after parsley plants have 3-5 true leaves and before weeds are 2 inches tall

- Carrots: Up to 1 lb ai/acre can be applied by ground spray after carrot plants have 3-5 true leaves and before weeds are 2 inches tall

- Fennel: for direct-seeded fennel, 1 conventional ground-spray application of up to 1.6 lb ai/acre is made at or shortly after planting; for transplanted fennel, up to 2.0 lb ai/acre is applied before weeds are 2 inches tall

- Parsnip: up to 1 lb ai/acre can be applied by ground spray after parsnip plants have 3-5 true leaves and before weeds are 2 inches tall

Nationwide usage information reported in the RED is presented in Table 3. These data and the use-reporting data for California (Table 4) demonstrate that cotton is the predominant use of prometryn in terms of pounds applied and acreage treated annually. We have also attached a map of pesticide use for prometryn as developed by the USGS. This map is included as a quick and easy visual depiction of where prometryn 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.

Table 3. Percent of Various U.S. Crops Treated with Prometryn, 1990 - 1992 (source: RED)

Site	Acres grown	Acres treated	% crop treated	lb ai applied
Cotton	13,230,000	1,800,000-2,800,000	14-21	1,100,000-1,800,000
Celery	36,000	20,000-30,000	56-83	15,000-25,000
Other		40,00-50,000		20,000-25,000
Total		1,865,000-2,850,000		1,135,000-1,850,000

Table 4. Usage of prometryn in California in 2000 and 2001 (source: CA Pesticide Use Report; http://www.cdpr.ca.gov/docs/pur/purmain.htm)

Site	2000		2001	
	Acres treated	lb ai applied	Acres treated	lb ai applied
Cotton	172,023	258,786	126,572	188,946
Celery	17,266	20,636	19,375	24,063
Parsley	1,913	2,736	2,237	3,240
Tomato	2,288	5,006	658	1,403
Alfalfa	803	1,806	175	363
Fennel	562	387	543	385
Dill	40	59	42	67
Other	7,911	18,218	nr[b]	2,258
Total	202,806	307,634	>154,344	226,183

[a] some listed use sites (e.g., alfalfa, tomato) are not on currently registered product labels; use of prometryn at such sites presumably occurred under an existing stocks provision

[b] acreage treated is not reported for some noncrop uses (e.g., landscape maintenance)

a. Aquatic toxicity of prometryn

The acute toxicity data for freshwater organisms indicate that prometryn is slightly to moderately toxic to fish and invertebrates (Table 5). No data have been submitted to EPA on the emulsifiable concentrate formulation. Data on the wettable powder indicate that the toxicity of this formulation approximates that of the technical material when adjusted for the percentage of active ingredient, suggesting that the inert products in the formulation do not enhance the toxicity of the active ingredient. However, this formulation is no longer registered, and we are not aware of any other formulations that have been tested.

Table 5. Aquatic organisms: acute toxicity of prometryn to freshwater fish and invertebrates (source: RED/EFED toxicity database)

Species	Scientific name	% ai	96-hour LC50 (ppm)	Toxicity Category
Water flea	*Daphnia magna*	98.9	18.6 (48 hr EC50)	Slightly toxic
Rainbow trout	*Oncorhynchus mykiss*	99	2.9	Moderately toxic
Bluegill sunfish	*Lepomis macrochirus*	99	10	Slightly toxic
Bluegill sunfish	*Lepomis macrochirus*	80W[a]	10	Slightly toxic
Rainbow trout	*Oncorhynchus mykiss*	80W[a]	7.2	Moderately toxic
Goldfish	*Carassius auratus*	99	4.0	Moderately toxic

[a] wettable powder

Chronic toxicity data for freshwater fish and invertebrates are presented in Table 6. Adverse effects on growth of fish and aquatic invertebrates were reported at test concentrations of 1 to 2 ppm for daphnids and minnows exposed to prometryn for 21 or 32 days. The chronic data on fathead minnows reported in the RED were not used in the risk assessment, because the study was invalid, and data from invalid studies are not used in OPP risk assessments. However, an acceptable study was subsequently conducted, and those results are reported here.

Table 6. Aquatic organisms: chronic and subchronic toxicity of prometryn to freshwater fish and invertebrates (source: RED/EFED toxicity database)

Species	Scientific name	duration (days)	% ai	Endpoints affected	NOEC (ppm)	LOEC (ppm)
Water flea	*Daphnia magna*	21	98.1	growth	1.0	2.0
Fathead minnow	*Pimephales promelas*	32	98.1	growth	0.6	1.2

Toxicity data for estuarine fish and invertebrates are presented in Table 7. These data are comparable to those for freshwater animals and categorize prometryn as slightly to moderately toxic to estuarine animals.

Table 7. Aquatic organisms: acute toxicity of prometryn to estuarine organisms (source: RED/EFED toxicity database)

Species	Scientific name	% ai	96-hour LC50 or EC50 (ppm)	Toxicity Category
Sheepshead minnow	*Cyprinodon variegatus*	98.1	5.1	Moderately toxic
Spot	*Leiostomus xanthurus*	99	>1 (48-h LC50)	Moderately toxic
Eastern oyster	*Crassostrea virginica*	99	>1	Moderately toxic
Mysid shrimp	*Mysidopsis bahia*	98.1	1.7	Moderately toxic
Quahog clam	*Mercenaria mercenaria*	98.1	21 (48-h EC50)	Slightly toxic

Additional data that further characterize the toxicity of prometryn to aquatic organisms were obtained from the literature (Table 8). These data are comparable to those in the EFED toxicity database, except that brine shrimp appear to be more sensitive to prometryn than do the other aquatic invertebrates and fish tested.

Table 8. Aquatic organisms: acute toxicity of prometryn to freshwater fish and invertebrates (source: literature)

Species	Scientific name	Toxicity (ppm)	Reference
Water flea	*Daphnia pulex*	>40 (3-h LC50)	Nishiuchi & Hashimoto 1967[a]
Water flea	*Daphnia magna*	9.7 (48-h EC50)	Marchini et al. 1988
Water flea	*Moina macrocarpa*	>40 (3-h LC50)	Nishiuchi & Hashimoto 1967[a]
Brine shrimp	*Artemia salina*	0.02 (24-h EC50)	Gaggi et al. 1995[a]
Goldfish	*Carrasius auratus*	8.7 (48-h LC50)	Nishiuchi & Hashimoto 1967[a]
Carp	*Cyprinus carpio*	5.2 (48-h LC50)	Nishiuchi & Hashimoto 1967[a]
Carp	*Cyprinus carpio*	8-9 (96-h LC50)	Popova 1976[a]
Medaka	*Oryzias latipes*	4.3 (48-h LC50)	Nishiuchi & Hashimoto 1967[a]
Guppy	*Poecilia reticulata*	7 (72-h LC50)	Tscheu-Schluter 1976[a]

Species	Scientific name	Toxicity (ppm)	Reference
Minnow	*Phoximus phoxinus*	4.5 (96-h LC50)	Popova 1976[a]
Silver carp	*Hypothalmichthys molotrix*	7 (96-h LC50)	Popova 1976[a]

[a] data obtained from ECOTOX (USEPA/ORD/NHEERL Ecotoxicology Database: http://www.epa.gov/ecotox/; see "References" section for a full citation of each study)

The available data on the toxicity of prometryn to aquatic plants is provided in Tables 9 and 10. These data indicate that both vascular and nonvascular aquatic plants are much more sensitive to prometryn than are aquatic animals.

Table 9. Aquatic organisms: toxicity of prometryn to algae and aquatic plants (source: RED/EFED toxicity database)

Species	Scientific name	% ai	120-hour EC50 (ppm)
Green algae	*Selanastrum capricornutum*	98.1	0.012 (96-h EC50)
Blue-green algae	*Anabaena flos-aquae*	98.4	0.040
Diatom	*Navicula pelliculosa*	98.4	0.001
Diatom	*Skeletonema costatum*	98.4	0.008
Duckweed	*Lemna gibba*	98.4	0.012 (14-day EC50)

Table 10. Aquatic organisms: additional data to characterize acute toxicity of prometryn to algae and aquatic plants (source: literature).

Species	Scientific name	96-hour LC50 or EC50 (ppm)	Reference
Green algae	*Ankistrodesmus falcatus*	0.02 (time?)	Tscheu-Schluter 1976[a]
Blue-green algae	*Anabaena flos-aquae*	0.72 (24 h)	Hawxby et al. 1977
Green algae	*Chlorella pyrenoidosa*	0.241 (24 h)	Hawxby et al. 1977
Green algae	*Chlorococcum*	0.723 (24 h)	Hawxby et al. 1977

Species	Scientific name	96-hour LC50 or EC50 (ppm)	Reference
Green algae	*Dunaliella tertiolecta*	0.053 (96-hour LC50)	Gaggi et al. 1995[a]
Blue-green algae	*Lyngbya* sp.	0.314	Hawxby et al. 1977
Green algae	*Selanastrum capricornutum*	0.021 (96-hour LC50)	Gaggi et al. 1995[a]
Large duckweed	*Spirodela polyrhiza*	0.085 (7-d EC50)	Liu and Cendeno-Maldonado 1974[a]
Duckweed	*Lemna perpusilla*	0.013 (7-day EC50)	Liu and Cendeno-Maldonado 1974[a]

[a] data obtained from ECOTOX (USEPA/ORD/NHEERL Ecotoxicology Database: http://www.epa.gov/ecotox/; see "References" section for a full citation of each study)

In summary, prometryn exhibits modest toxicity to aquatic animals but, consistent with its being an herbicide that affects photosynthesis, much higher toxicity to algae and aquatic vascular plants. Because fish are more sensitive than freshwater aquatic invertebrates, fish would be affected at lower concentrations of prometryn than would the invertebrates that provide a food supply for the fish. Therefore, there is no concern for indirect effects on food supply relative to direct effects on fish.

b. Environmental fate and transport

According to laboratory data submitted to OPP, prometryn is a persistent chemical. It has a half-life in excess of 270 days under aerobic conditions and is stable to hydrolysis and photolysis in water and soil. Prometryn also did not degrade under anaerobic conditions in the laboratory. An acceptable aerobic metabolism study indicates that prometryn forms two degradates: 2,4-bis(isopropylamino)-6-hydroxy-s-triazine (GS-11526), and 2-amino-4-isopropylamino-6-methylthio-s-triazine (GS-11354)., with GS-11526 being the primary degradate. OPP's Health Effects Division has not identified either degradate to be of toxicological concern.

According to the RED, prometryn has the potential to leach to ground water and move offsite into surface water. Batch equilibrium data and published literature suggest that prometryn and its degradates are mobile in sandy soils with low organic matter and clay, with Freundlich K_{ads} values of 0.86-3.18 and K_{oc} values of 117-448. However, prometryn was not observed to leach below 18 inches in the field, although degradate GS-11526 was found at depths down to 24 to 26 inches. Rapid dissipation was observed in terrestrial field dissipation studies conducted in Texas.

The mechanisms of field dissipation are not well understood, but dissipation occurred more quickly (14 to103 days) than in the laboratory. Prometryn dissipated with a first-order half-life of 71 days in an uncropped California sandy loam soil (0.9% organic matter) versus 103 days in California sandy loam in cotton cultivation. In a Texas silt loam with 2.1% organic matter, dissipation appeared to be either biphasic or higher order. A period of rapid early dissipation (estimated first half-life of 14 to 30 days) in soil was followed by an extended period of low concentration.

Prometryn residues did not accumulate to a significant degree in bluegill sunfish continuously exposed to prometryn at 0.05 ppm for 28 days in a flow through system. The low degree of bioconcentration of prometryn is sufficient to suggest that it does not bioaccumulate in fish.

Additional details on chemical fate and transport are presented in the RED (pages 31-37).

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).

The EIIS incident database contains two incidents of fish kills where prometryn was found in the water, although prometryn was not considered the cause of mortality in either incident. Both incidents occurred in Richland County, Louisiana in August, 1996 following heavy rainfall that totaled 6 to 8 inches during a one-week period. “Hundreds” of gar, buffalofish, and shad were killed in one incident, and “thousands” of shad and “hundreds”gar and shad were killed in the other. Cotton was planted nearby, and pesticide applications had been made to the cotton in accordance with label directions. Concentrations of prometryn in the water were well below levels expected to affect fish. Profenofos was considered the most likely cause of death in one of the incidents, and azinphos-methyl appeared to be the causative agent in the other incident.

d. Estimated and actual concentrations of prometryn in water.

Estimated environmental concentrations (EECs)

EECs were presented in the RED only for celery and cotton (ground and aerial application). Those EECs, reportedly modeled from PRZM/EXAMS scenarios, range from 183 to 277 ppb (Table 11).

Table 11. Estimated environmental concentrations of prometryn in surface water as predicted from PRZM-EXAMS scenarios (source: RED)

crop	appl. method	appl. rate (lb ai/A)	peak EEC (ppb)	60-day-avg EEC (ppb)
Celery	ground	3.2	261	222
Cotton	ground	2.8	277	224
Cotton	aerial	2.8	183	148

However, much uncertainty exists as to whether these EECs adequately represent use sites in California and the northwestern states. The RED provides no information on the geographical site scenarios, the environmental-fate input values, or whether incorporation was considered for preplant application to cotton. The only PRZM/EXAMS cotton scenario developed in 1995 was for a Mississippi site. However, cotton is grown under much more arid conditions in California than in Mississippi, and less runoff from treated fields is expected because of strict water-management practices. Because of these uncertainties and because OPP now has developed a cotton scenario for California, we obtained updated EECs for cotton in California, including for a lay-by application of 1.6 lb ai/acre when cotton plants are 12- to 18-inches tall and for preplant incorporated applications of 2.4 lb ai/acre by ground and air. Those EECs range from 2.2 to 16.3 ppb (Table 12). OPP has never had a PRZM/EXAMS scenario for celery, and the celery-scenario EECs provided in the RED must have been derived from a modified scenario for another crop, possibly the Mississippi cotton scenario. Because there is no celery scenario, we modeled aquatic EECs for celery by using GENEEC, as we also did for carrot, parsley, fennel, and parsnip. We also tabulated the risk quotients for freshwater fish and vascular aquatic plants derived from these EECs, and they will be discussed further in section "f. General risk conclusions".

Table 12. Aquatic EECs and risk quotients for freshwater fish and vascular aquatic plants

crop	appl. method	appl. rate (lb ai/acre)	peak EEC (ppb)	Fish acute RQ[a]	Aquatic plant RQ[b]	60-day-avg EEC (ppb)	Fish chronic RQ[c]
PRZM/EXAMS modeled							
Cotton	aerial, preplant incorporated	2.4	16.3	<0.01	1.4	14.8	<0.1
Cotton	ground, preplant incorporated	2.4	3.3	<0.01	0.3	3.1	<0.1
	ground, lay-by unincorporated	1.6	2.2	<0.01	0.2	2.0	<0.1
GENEEC modeled							
Celery, Parsley, Dill, Fennel	ground broadcast	2.0	82	0.03	6.8	78	0.1
Carrot, Parsnip	ground broadcast	1.0	35.4	0.01	3.0	33.3	<0.1

[a] based on the LC50 of 2900 ppb for the rainbow trout
[b] based on the EC50 of 12 ppb for duckweed
[c] based on the NOEC of 620 ppb for the fathead minnow

Actual Concentrations in Water

Prometryn is not included in the USGS NAWQA program, and no surface water montitoring data were found.

e. 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 environmental risk assessment 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. Changes that may alter the aquatic risk analysis for prometryn since the environmental risk assessment was completed in 1996 are:

- Wettable-powder formulations were canceled as of December, 2000
- SLN registrations have been issued for several new uses in California, Oregon, and Washington. The uses include fennel, parsley, carrots, dill, parsnip, and transplanted celery.

f. General risk conclusions

The RED evaluated risks to fish and aquatic invertebrates from use of prometryn on celery and cotton. Acute risks to endangered freshwater fish and estuarine fish and invertebrates were identified for both crops. Adverse effects also were expected for aquatic plants. No chronic risks were identified for any taxa. However, because of the uncertainty associated with the EECs modeled in the RED, we calculated risk quotients for fish and aquatic plants based on a California cotton scenario not previously available. We also used GENEEC to model aquatic EECs, and we calculated risk quotients for celery parsley, dill, fennel, carrots, and parsnip based on those EECs.

Based on our revised risk quotients in Table 12, we determine that acute and chronic risk levels of concern are not exceeded for fish. However, the level of concern for vascular aquatic plants (i.e., RQ $\geq$1) is exceeded for aerial application to cotton (RQ = 1.4); ground application to celery, parsley, dill, and fennel (RQs = 6.8); and ground application to carrots and parsnip (RQs = 3.0). Therefore, there might be an effect on listed Pacific salmon and steelhead as a result of adverse effects on aquatic plants used to provide cover. The level of concern is not exceeded for an incorporated ground application to cotton.

g. Existing protective measures

Nationally, there are no specific protective measures for prometryn and for endangered and threatened species beyond the generic statements on the current 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 variety of measures on labels for the protection of agricultural workers and other humans, which are not discussed here, but which may be seen on the attached labels. The "Environmental Hazards" section for Section 3 labels for prometryn products that may be applied to the various use sites contain the generic Environmental Hazard statement common to all outdoor use labels:

> “Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment washwaters.” and "Do not apply when weather conditions favor drift from areas treated.”

The following spray-drift language also is required on each product label for those products that can be applied aerially:

> "Avoiding spray drift at the application site is the responsibility of the applicator. The interaction of many equipment-and-weather-related factors determine the potential for spray drift. The applicator and the grower are responsible for considering all these factors when making decisions." Additionally, there are drift management requirements that must be followed to avoid off-target drift movement from aerial applications to

agricultural field crops (see attached product labels). Product labels also must state that applicators should be familiar with and take into account Aerial Drift Reduction Advisory Information. That advisory provides information on droplet size, controlling droplet size, boom length, application height, swath adjustment, wind speed, temperature and humidity, and temperature inversions. It also states that "The pesticide should only be applied when the potential for drift to adjacent sensitive areas (e.g. residential areas, bodies of water, known habitat for threatened or endangered species, non-target crops) is minimal (e.g. when wind is blowing away from the sensitive areas)."

The RED stipulated that OPP would require product labeling to prohibit the use of prometryn on sand and sandy loam soils in certain areas of the country. This prohibition is because "The laboratory mobility data for prometryn, taken as a whole, suggest that prometryn will be most mobile in sandy, alkaline soils which contain little organic matter or clay. In California, Arizona and New Mexico, prometryn labels instruct potential users not to apply the product to sand or loamy sand soils."

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.

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).

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

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

The latest information for California pesticide use is for the year 2001 [URL: http://www.cdpr.ca.gov/docs/pur/purmain.htm]. The reported information to the County Agricultural Commissioners includes the crop or noncrop site treated, pounds used, acres treated, and the specific location treated. This information is reported to the state, but the specific location information is retained at the county level and is not available to EPA. The amount of prometryn used annually in California from 1997 to 2001 is depicted in Table 13.

Table 13. Reported pounds of prometryn used in California from 1997 to 2001

1997	1998	1999	2000	2001
146,615	260,192	272,103	307,634	223,454

In Oregon, Washington, and Idaho, information on the amount of prometryn used is limited. For ESUs in these three states, we have indicated the amount of acreage, by county, where prometryn can be used according to product labels.

In the following discussion of specific ESUs and prometryn use, we present information on the listed salmon and steelhead ESUs and discuss the potential for the use of prometryn where they occur. Our information on the various ESUs is 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 and DPR's pesticide use reporting.

A. Steelhead

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

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

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

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

1. Southern California Steelhead ESU

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

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

Within San Diego County, the San Mateo Creek runs through Camp Pendleton Marine Base and into the Cleveland National Forest. While there are agricultural uses of pesticides in other parts of California within the range of this ESU, it would appear that there are no such uses in the vicinity of San Mateo Creek. Within Los Angeles County, this steelhead occurs in Malibu

Creek and possibly Topanga Creek. Neither of these creeks drain agricultural areas. Since home uses are not registered, there is little likelihood that prometryn would be used in these watersheds. In addition, there is little no reported use of prometryn in either Los Angeles or 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. Usage of prometryn in counties where this ESU occurs are presented in Table 14.

Table 14. Use of prometryn in 2001 in counties with the Southern California steelhead ESU

County	Crop	Prometryn usage (pounds)	Acres treated
San Diego		0	0
Los Angeles	dill	24	15
	parsley	64	65
Ventura	celery	8,619	7,057
	parsley	561	548
	rights-of-way	16	9
	outdoor flowers	12	6
San Luis Obispo	celery	956	1,262
	fennel	3	2
	parsley	66	47
	anise	61	70
Santa Barbara	celery	4,568	3,352
	fennel	160	153
	broccoli	10	5
	carrot	11	11
	lettuce, head	14	9
	parsley	51	43

We conclude that prometryn may affect the Southern California steelhead ESU spawning and rearing habitat. This conclusion is based on the extent of crop acreage on which prometryn is applied and its possible adverse effects on aquatic plant cover. We recommend requiring a buffer to minimize runoff and drift into surface waters.

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 15 shows prometryn usage in those counties where this ESU occurs.

Table 15. Use of prometryn in 2001 in counties with the South Central California steelhead ESU

County	Crop(s)	Prometryn usage (pounds)	Acres treated
Santa Cruz	celery	72	46
San Benito	celery parsley uncultivated	613 35 2	496 24 1
Monterey	celery parsley fennel lettuce, head spinach	8,387 1,420 223 13 27	6,569 912 388 9 17
San Luis Obispo	celery fennel parsley anise	956 3 66 61	1,262 2 47 70

We conclude that prometryn may affect the South Central California steelhead ESU spawning and rearing habitat. This conclusion is based on the extent of crop acreage on which prometryn is applied and its possible adverse effects on aquatic plant cover. We recommend requiring a buffer to minimize runoff and drift into surface waters.

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. Usage of prometryn in the counties where the Central California coast steelhead ESU is presented in Table 16.

Table 16. Use of prometryn in 2001 in counties with the Central California Coast steelhead ESU

County	Crop(s)	Prometryn usage (pounds)	Acres treated
Santa Cruz	celery	72	46
San Mateo		0	0
San Francisco		0	0
Marin		0	0
Sonoma		0	0

Mendocino		0	0
Napa		0	0
Alameda		0	0
Contra Costa		0	0
Solano		0	0
Santa Clara	celery parsley	544 18	271 12

We conclude that prometryn has no effect on the Central California Coast steelhead ESU, because little or no prometryn is used in these counties.

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 prometryn is mostly in Merced and San Joaquin counties in this ESU (Table 17).

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

County	Crop(s)	Prometryn usage (pounds)	Acres treated
Alameda		0	0
Amador		0	0
Butte		0	0
Calaveras		0	0
Colusa		0	0

Contra Costa		0	0
Glenn		0	0
Marin		0	0
Merced	cotton tomato alfalfa sudangrass	6,141 128 70 24	3,365 80 35 12
Nevada		0	0
Placer		0	0
Sacramento		0	0
San Joaquin	parsley	426	287
San Mateo		0	0
San Francisco		0	0
Shasta		0	0
Solano		0	0
Sonoma		0	0
Stanislaus	dill parsley	42 51	27 26
Sutter		0	0
Tehama		0	0
Tuloumne		0	0
Yolo		0	0
Yuba		0	0

We conclude that prometryn may affect the California Central Valley steelhead ESU. This conclusion is based on the extent of cotton acreage treated in Merced Co. and the possible adverse effects on aquatic plant cover. We recommend requiring a buffer to minimize runoff and drift into surface waters. Alternatively, sufficient mitigation could be achieved by restricting applications to ground only.

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. Prometryn appears not to be used in this ESU (Table 18).

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

County	Crop(s)	Prometryn usage (pounds)	Acres treated
Humboldt		0	0
Mendocino		0	0
Trinity		0	0
Lake		0	0

We conclude that prometryn has no effect on the Northern California steelhead ESU, because prometryn is not used in these counties.

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 19 and 20 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. The only use of prometryn in this ESU is on carrots in Franklin Co., Grant Co., and Cowlitz Co. in Washington and Multnomah Co. in Oregon. The number of acres of a crop is not reported when only a single grower or two occurs in a county.

Table 19. Crops on which prometryn can be used in Washington counties where there is spawning and growth of the Upper Columbia River steelhead ESU

St	County	Crops	Acres planted
WA	Benton		0
WA	Franklin	carrot	3,574
WA	Kittitas		0
WA	Yakima		0
WA	Chelan		0
WA	Douglas		0
WA	Okanogan	carrot	1
WA	Grant	carrot	2,207

Table 20. Crops on which prometryn can be used in Oregon and Washington counties that are migration corridors for the Upper Columbia River steelhead ESU

St	County	Crops	Acres planted
WA	Walla Walla		0
WA	Klickitat		0
WA	Skamania		0
WA	Clark		0

St	County	Crops	Acres planted
WA	Cowlitz	carrot	not reported
WA	Wahkiakum		0
WA	Pacific		0
OR	Gilliam		0
OR	Umatilla		0
OR	Sherman		0
OR	Morrow		0
OR	Wasco		0
OR	Hood River		0
OR	Multnomah	carrot	not reported
OR	Columbia		0
OR	Clatsop		0

We conclude that prometryn may affect the Upper Columbia River steelhead ESU in spawning and growth habitat, because of the extent of crop acreage of carrots grown in Franklin and Grant counties and its possible adverse effects on aquatic plant cover. However, no data are available on how many acres of carrots are actually treated annually or how many pounds of prometryn are actually applied in these two counties. Because the migration corridors consist of larger, faster-flowing streams, impacts on aquatic-plant cover seem unlikely where steelhead migrate. For Franklin and Grant counties, we recommend requiring a buffer to minimize runoff and drift into surface waters. Alternatively, the Washington State Department of Agriculture's task force may provide more focused protective measures that would be acceptable.

7. Snake River Basin steelhead ESU

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

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

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

Tables 21 and 22 show the cropping information for the Pacific Northwest counties where the Snake River Basin steelhead ESU is located and for the Oregon and Washington counties where this ESU migrates. In this ESU, prometryn is used only on carrots in Valley Co. in Idaho, Franklin and Cowlitz counties.in Washington, and Union and Multnomah counties in Oregon. The number of acres of a crop is not reported when only a single grower or two occurs in a county.

Table 21. Crops on which prometryn can be used in Pacific Northwest counties which provide spawning and rearing habitat for the Snake River Basin steelhead ESU

St	County	Crops	Acres planted
ID	Adams		0
ID	Idaho		0
ID	Nez Perce		0
ID	Custer		0
ID	Lemhi		0
ID	Valley	carrot	not reported

St	County	Crops	Acres planted
ID	Lewis		0
ID	Clearwater		0
ID	Latah		0
WA	Adams		0
WA	Asotin		0
WA	Garfield		0
WA	Columbia		0
WA	Whitman		0
WA	Franklin	carrot	3,574
WA	Walla Walla		0
OR	Wallowa		0
OR	Union	carrot	not reported

Table 22. Crops on which prometryn can be used in Washington and Oregon counties through which the Snake River Basin steelhead ESU migrates

St	County	Crops	Acres planted
WA	Walla Walla		0
WA	Benton		0
WA	Klickitat		0
WA	Skamania		0
WA	Clark		0
WA	Cowlitz	carrot	not reported
WA	Wahkiakum		0
WA	Pacific		0
OR	Umatilla		0
OR	Morrow		0

St	County	Crops	Acres planted
OR	Gilliam		0
OR	Sherman		0
OR	Wasco		0
OR	Hood River		0
OR	Multnomah	carrot	not reported
OR	Columbia		0
OR	Clatsop		0

We conclude that prometryn may affect the Snake River Basin steelhead ESU in spawning and growth habitat, because of the extent of crop acreage of carrots grown in Franklin Co. and its possible adverse effects on aquatic plant cover. However, no data are available on how many acres of carrots are actually treated annually or how many pounds of prometryn are actually applied in this county. Because the migration corridors consist of larger, faster-flowing streams, impacts on aquatic-plant cover seem unlikely where steelhead migrate. We recommend requiring a buffer to minimize runoff and drift into surface waters in Franklin Co. Alternatively, the Washington State Department of Agriculture's task force may provide more focused protective measures that would be acceptable.

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 prometryn 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 23 and 24 show the cropping information for Oregon counties where the Upper Willamette River steelhead ESU is located and for the Oregon and Washington counties where this ESU migrates. Prometryn is used on carrots in this ESU in Linn, Polk, Marion, Washington, and Multnomah counties in Oregon and in Cowlitz Co. in Washington. Prometryn also is used on celery in Marion Co., Oregon. The number of acres of a crop is not reported when only a single grower or two occurs in a county.

Table 23. Crops on which prometryn can be used that are part of the spawning and rearing habitat of the Upper Willamette River steelhead ESU

St	County	Crops	Acres planted
OR	Benton		0
OR	Linn	carrot	not reported
OR	Polk	carrot	not reported
OR	Clackamas		0
OR	Marion	carrot celery	76 32
OR	Yamhill		0
OR	Washington	carrot	1

Table 24. Crops on which prometryn 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	Acres planted
WA	Clark		0
WA	Cowlitz	carrot	not reported
WA	Wahkiakum		0
WA	Pacific		0

St	County	Crops	Acres planted
OR	Multnomah	carrot	not reported
OR	Columbia		0
OR	Clatsop		0

We conclude that prometryn has no effect on the Upper Willamette River steelhead ESU, because little or no prometryn is used in these counties.

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 25 and 26 show the cropping information for Oregon and Washington counties where the Lower Columbia River steelhead ESU is located and for the Oregon and Washington counties where this ESU migrates. Prometryn is applied to carrots in Multnomah Co., Oregon and Cowlitz Co., Washington in this ESU. The number of acres of crop is not reported when only a single grower or two occurs in a county.

Table 25. Crops and acreage where prometryn can be used in counties that provide spawning and rearing habitat for the Lower Columbia River Steelhead ESU

St	County	Crops	Acres planted
OR	Hood River		0
OR	Clackamas		0
OR	Multnomah	carrot	not reported
WA	Clark		0
WA	Cowlitz	carrot	not reported
WA	Skamania		0

Table 26. Crops and acreage where prometryn can be used in counties that are migratory corridors for the Lower Columbia River Steelhead ESU

St	County	Crops	Acres planted
OR	Columbia		0
OR	Clatsop		0
WA	Pacific		0
WA	Wahkiakum		0

We conclude that prometryn has no effect on the Lower Columbia River Steelhead ESU, because little or no prometryn is used in these counties.

10. Middle Columbia River Steelhead ESU

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

This steelhead ESU occupies "the Columbia River Basin and tributaries from above the Wind River in Washington and the Hood River in Oregon (exclusive), upstream to, and including, the Yakima River, in Washington." The Critical Habitat designation indicates the downstream boundary of the ESU to be Mosier Creek in Wasco County, Oregon; this is consistent with Hood River being "excluded" in the listing notice. No downstream boundary is listed for the Washington side of the Columbia River, but if Wind River is part of the Lower Columbia steelhead ESU, it appears that Collins Creek, Skamania County, Washington would be the last stream down river in the Middle Columbia River ESU. Dog Creek may also be part of the ESU, but White Salmon River certainly is, since the Condit Dam is mentioned as an upstream barrier. Although I am unsure of the status of these Dog and Collins creeks, they have little relevance to the analysis of prometryn because there are only 716 acres of potential use sites in Skamania for prometryn, 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, we have excluded Harney County, Oregon because there is only a tiny amount of the John Day River and several tributary creeks (e.g., Utley, Bear Cougar creeks) which get into high elevation areas (approximately 1700M and higher) of northern Harney County where there are no crops grown. Similarly, the Umatilla River and Walla Walla River get barely into Union County OR, and the Walla Walla River even gets into a tiny piece of Wallowa County, Oregon. But again, these are high elevation areas where crops are not grown, and 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 27 and 28 show the cropping information for Oregon and Washington counties where the Middle Columbia River steelhead ESU is located and for the Oregon and Washington counties where this ESU migrates. In this ESU, prometryn is used on carrots in Franklin and Cowlitz counties in Washington and Multnomah Co., Oregon. The number of acres of crop is not reported when only a single grower or two occurs in a county.

Table 27. Crops and acreage where prometryn can be used in counties that provide spawning and rearing habitat for the Middle Columbia River Steelhead ESU

St	County	Crops	Acres planted
OR	Gilliam		0
OR	Morrow		0
OR	Umatilla		0

St	County	Crops	Acres planted
OR	Sherman		0
OR	Wasco		0
OR	Crook		0
OR	Grant		0
OR	Wheeler		0
OR	Jefferson		0
WA	Benton		0
WA	Columbia		0
WA	Franklin	carrot	3,574
WA	Kittitas		0
WA	Klickitat		0
WA	Skamania		0
WA	Walla Walla		0
WA	Yakima		0

Table 28. Crops on which prometryn can be used in Washington and Oregon counties through which the Middle Columbia River steelhead ESU migrates

St	County	FIPS code	Crops	Acres planted
WA	Skamania	53059		0
WA	Clark	53011		0
WA	Cowlitz	53015	carrot	not reported
WA	Pacific	53049		0
WA	Wahkiakum	53069		0
OR	Hood River	41027		0
OR	Multnomah	41051	carrot	not reported
OR	Columbia	41009		0

St	County	FIPS code	Crops	Acres planted
OR	Clatsop	41007		0

We conclude that prometryn may affect the Middle Columbia River Steelhead ESU in spawning and growth habitat, because of the extent of crop acreage of carrots grown in Franklin Co. and its possible adverse effects on aquatic plant cover. However, no data are available on how many acres of carrots are actually treated annually or how many pounds of prometryn are actually applied in this county. Because the migration corridors consist of larger, faster-flowing streams, impacts on aquatic-plant cover seem unlikely where steelhead migrate. We recommend requiring a buffer to minimize runoff and drift into surface waters in Franklin Co. Alternatively, the Washington State Department of Agriculture's task force may provide more focused protective measures that would be acceptable.

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).

Prometryn was not used in this ESU in 2001 (Table 29).

Table 26. Use of prometryn in counties with the Sacramento River winter-run Chinook salmon ESU. Spawning areas are primarily in Shasta and Tehama counties above the Red Bluff diversion dam

County	Crop(s)	Prometryn usage (pounds)	Acres treated
Alameda		0	0
Butte		0	0
Colusa		0	0
Contra Costa		0	0
Glenn		0	0
Marin		0	0

Sacramento		0	0
San Mateo		0	0
San Francisco		0	0
Shasta		0	0
Solano		0	0
Sonoma		0	0
Sutter		0	0
Tehama		0	0
Yolo		0	0

We conclude that prometryn has no effect on the Sacramento River winter-run Chinook salmon ESU, because prometryn is not used in these counties.

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 prometryn would not be used in these areas. I have, however, kept Umatilla County as part of the migratory corridor.

Tables 30 and 31 show the cropping information for Pacific Northwest counties where the Snake River fall-run chinook salmon ESU is located and for the Oregon and Washington counties where this ESU migrates.

Table 30. Crops on which prometryn can be used in Pacific Northwest counties which provide spawning and rearing habitat for the Snake River fall-run chinook ESU

St	County	Crops	Acres planted
ID	Adams		0
ID	Idaho		0
ID	Nez Perce		0
ID	Valley	carrot	not reported
ID	Lewis		0
ID	Benewah		0
ID	Shoshone		0
ID	Clearwater		0
ID	Latah		0
WA	Adams		0
WA	Lincoln	carrot	not reported
WA	Spokane	carrot	34
WA	Asotin		0
WA	Garfield		0
WA	Columbia		0
WA	Whitman		0
WA	Franklin	carrot	3,574

St	County	Crops	Acres planted
WA	Walla Walla		0
OR	Wallowa		0
OR	Union	carrot	not reported

Table 31. Crops on which prometryn 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	Acres planted
WA	Walla Walla		0
WA	Benton		0
WA	Klickitat		0
WA	Skamania		0
WA	Clark		0
WA	Cowlitz	carrot	not reported
WA	Wahkiakum		0
WA	Pacific		0
OR	Umatilla		0
OR	Morrow		0
OR	Gilliam		0
OR	Sherman		0
OR	Wasco		0
OR	Hood River		0
OR	Multnomah		0
OR	Columbia		0
OR	Clatsop		0

We conclude that prometryn may affect the Snake River fall-run chinook ESU in spawning and growth habitat, because of the extent of crop acreage of carrots grown in Franklin

Co. and its possible adverse effects on aquatic plant cover. However, no data are available on how many acres of carrots are actually treated annually or how many pounds of prometryn are actually applied in this county. Because the migration corridors consist of larger, faster-flowing streams, impacts on aquatic-plant cover seem unlikely where chinook migrate. For Franklin Co., we recommend requiring a buffer to minimize runoff and drift into surface waters. Alternatively, the Washington State Department of Agriculture's task force may provide more focused protective measures that would be acceptable.

3. Snake River Spring/Summer-run Chinook Salmon

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

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

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

Table 32 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 31 above.

Table 32. Crops on which prometryn can be used in counties which provide spawning and rearing habitat for the Snake River spring/summer run chinook ESU

St	County	Crops	Acres planted
ID	Adams		0
ID	Idaho		0
ID	Nez Perce		0
ID	Custer		0
ID	Lemhi		0
ID	Valley	carrot	not reported
ID	Lewis		0
ID	Latah		0
WA	Asotin		0
WA	Garfield		0
WA	Columbia		0
WA	Whitman		0
WA	Franklin	carrot	3,574
OR	Wallowa		0
OR	Union	carrot	not reported

We conclude that prometryn may affect the Snake River spring/summer run chinook ESU in spawning and growth habitat, because of the extent of crop acreage of carrots grown in Franklin Co. and its possible adverse effects on aquatic plant cover. However, no data are available on how many acres of carrots are actually treated annually or how many pounds of prometryn are actually applied in this county. Because the migration corridors consist of larger, faster-flowing streams, impacts on aquatic-plant cover seem unlikely where chinook migrate. For Franklin Co., we recommend requiring a buffer to minimize runoff and drift into surface waters. Alternatively, the Washington State Department of Agriculture's task force may provide more focused protective measures that would be acceptable.

4. Central Valley Spring-run Chinook Salmon ESU

The Central valley Spring-run chinook salmon ESU was proposed as threatened in 1998 (63FR11482-11520, March 9, 1998) and listed on September 16, 1999 (64FR50393-50415). Critical habitat was designated February 16, 2000 (65FR7764-7787) to encompass all river reaches accessible to listed chinook salmon in the Sacramento River and its tributaries in California, along with the down stream river reaches into San Francisco Bay, north of the Oakland Bay Bridge, and to the Golden Gate Bridge

Hydrologic units and upstream barriers within this ESU are the Sacramento-Lower Cow-Lower Clear, Lower Cottonwood, Sacramento-Lower Thomes (upstream barrier - Black Butte Dam), Sacramento-Stone Corral, Lower Butte (upstream barrier - Centerville Dam), Lower Feather (upstream barrier - Oroville Dam), Lower Yuba, Lower Bear (upstream barrier - Camp Far West Dam), Lower Sacramento, Sacramento-Upper Clear (upstream barriers - Keswick Dam, Whiskeytown dam), Upper Elder-Upper Thomes, Upper Cow-Battle, Mill-Big Chico, Upper Butte, Upper Yuba (upstream barrier - Englebright Dam), Suisin Bay, San Pablo Bay, and San Francisco Bay. These areas are said to be in the counties of Shasta, Tehama, Butte, Glenn, Colusa, Sutter, Yolo, Yuba, Placer, Sacramento, Solano, Nevada, Contra Costa, Napa, Alameda, Marin, Sonoma, San Mateo, and San Francisco. However, with San Mateo County being well south of the Oakland Bay Bridge, it is difficult to see why this county was included.

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

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

County	Crop(s)	Prometryn usage (pounds)	Acres treated
Alameda		0	0
Butte		0	0
Colusa		0	0
Contra Costa		0	0
Glenn		0	0
Marin		0	0
Napa		0	0
Nevada		0	0
Placer		0	0
Sacramento		0	0

County	Crop(s)	Prometryn usage (pounds)	Acres treated
San Mateo		0	0
San Francisco		0	0
Shasta		0	0
Solano		0	0
Sonoma		0	0
Sutter		0	0
Tehama		0	0
Yolo		0	0
Yuba		0	0

We conclude that prometryn has no effect on the Central Valley spring run chinook salmon ESU, because prometryn is not used in these counties.

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 prometryn 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 prometryn would not be used in the forested upper elevation areas.

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

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

County	Crop(s)	Prometryn usage (pounds)	Acres treated
Humboldt		0	0
Mendocino		0	0
Sonoma		0	0
Marin		0	0
Trinity		0	0
Lake		0	0

We conclude that prometryn has no effect on the California coastal chinook salmon ESU, because prometryn is not used in these counties.

6. Puget Sound Chinook Salmon ESU

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

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

Table 35 shows the cropping information for Washington counties where the Puget Sound chinook salmon ESU is located. The number of acres planted is not provided for those counties having only onw or two growers.

Table 35. Crops and acreage where prometryn can be used in counties that are in the Critical Habitat of the Puget Sound chinook salmon ESU

St	County	Crops	Acres planted
WA	Skagit	carrot	555
WA	Whatcom	carrot	not reported
WA	San Juan	carrot	1
WA	Island		0
WA	Snohomish	carrot	2
WA	King	carrot	10
WA	Pierce	carrot celery	not reported 64
WA	Thurston	carrot	not reported
WA	Lewis		0
WA	Grays Harbor		0
WA	Mason		0
WA	Clallam	carrot	not reported
WA	Jefferson		0
WA	Kitsap	carrot	1

We conclude that prometryn has no effect on the Critical Habitat of the Puget Sound chinook salmon ESU, because of the limited use of prometryn in these counties.

7. Lower Columbia River Chinook Salmon ESU

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

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

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

Table 36. Crops and acreage where prometryn can be used in counties that are in the Critical Habitat of the Lower Columbia River chinook salmon ESU

St	County	Crops	Acres planted
OR	Wasco		0
OR	Hood River		0
OR	Marion	carrot celery	76 32
OR	Clackamas		0
OR	Multnomah	carrot	not reported
OR	Washington	carrot	1
OR	Columbia		0
OR	Clatsop		0
WA	Pacific		0
WA	Wahkiakum		0
WA	Clark		0
WA	Cowlitz	carrot	not reported
WA	Lewis		0
WA	Klickitat		0
WA	Skamania		0

We conclude that prometryn has no effect on the Critical Habitat of the Lower Columbia River chinook salmon ESU, because of the limited use of prometryn in these counties.

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

Tables 37 and 38 show the cropping information for Oregon counties where the Upper Willamette River chinook salmon ESU occurs and for the Oregon and Washington counties where this ESU migrates. In these tables, crops where there is less than 100 acres in the county do not indicate the specific acres planted.

Table 37. Crops on which prometryn can be used that are part of the spawning and rearing habitat of the Upper Willamette River chinook salmon ESU

St	County	Crops	Acres planted
OR	Douglas		0
OR	Lane	carrot	270
OR	Benton		0
OR	Linn	carrot	not reported
OR	Polk	carrot	not reported
OR	Clackamas		0

St	County	Crops	Acres planted
OR	Marion	carrot celery	76 32
OR	Yamhill		0
OR	Washington	carrot	1

Table 38. Crops on which prometryn can be used that are part of the migration corridors of the Upper Willamette River chinook salmon ESU

St	County	Crops	Acres planted
WA	Clark		0
WA	Cowlitz	carrot	not reported
WA	Wahkiakum		0
WA	Pacific		0
OR	Multnomah	carrot	not reported
OR	Columbia		0
OR	Clatsop		0

We conclude that prometryn has no effect on the Upper Willamette River chinook salmon ESU, because of the limited use of prometryn in these counties.

9. Upper Columbia River Spring-run Chinook Salmon ESU

The Upper Columbia River Spring-run Chinook Salmon ESU was proposed as endangered in 1998 (63FR11482-11520, March 9, 1998) and listed a year later (64FR14308-14328, March 24, 1999). Critical habitat was designated February 16, 2000 (65FR7764-7787) to encompass all river reaches accessible to listed chinook salmon in Columbia River tributaries upstream of the Rock Island Dam and downstream of Chief Joseph Dam in Washington, excluding the Okanogan River, as well as all down stream migratory corridors to the Pacific Ocean. Hydrologic units and their upstream barriers are Chief Joseph (Chief Joseph Dam), Similkameen, Methow, Upper Columbia-Entiat, Wenatchee, Upper Columbia-Priest Rapids, Middle Columbia-Lake Wallula, Middle Columbia-Hood, Lower Columbia-Sandy, Lower Columbia-Clatskanie, Lower Columbia, and Lower Willamette. Counties in which spawning and rearing occur are Chelan, Douglas, Okanogan, Grant, Kittitas, and Benton (Table 31), with the lower river reaches being migratory corridors (Table 32).

Tables 39 and 40 show the cropping information for Washington counties that support the Upper Columbia River chinook salmon ESU and for the Oregon and Washington counties where this ESU migrates. In these tables, crops where there is less than 100 acres in the county do not indicate the specific acres planted.

Table 39. Crops on which prometryn can be used in Washington counties where there is spawning and rearing habitat for the Upper Columbia River chinook salmon ESU

St	County	Crop	Acres planted
WA	Benton		0
WA	Kittitas		0
WA	Chelan		0
WA	Douglas		0
WA	Okanogan	carrot	1
WA	Grant	carrot	2,207

Table 40. Crops on which prometryn can be used that are migration corridors for the Upper Columbia River chinook salmon ESU

St	County	FIPS code	Crops	Acres planted
WA	Franklin	53021	carrot	3,574
WA	Yakima	53077		0
WA	Walla Walla	53071		0
WA	Klickitat	53039		0
WA	Skamania	53059		0
WA	Clark	53011		0
WA	Cowlitz	53015	carrot	not reported
WA	Wahkiakum	53069		0
WA	Pacific	53049		0
OR	Gilliam	41021		0
OR	Umatilla	41059		0
OR	Sherman	41055		0

St	County	FIPS code	Crops	Acres planted
OR	Morrow	41049		0
OR	Wasco	41065		0
OR	Hood River	41027		0
OR	Multnomah	41051	carrot	not reported
OR	Columbia	41009		0
OR	Clatsop	41007		0

We conclude that prometryn may affect the Upper Columbia River chinook salmon ESU in spawning and growth habitat, because of the extent of crop acreage of carrots grown in Grant Co. and its possible adverse effects on aquatic plant cover. However, no data are available on how many acres of carrots are actually treated annually or how many pounds of prometryn are actually applied in this county. Because the migration corridors consist of larger, faster-flowing streams, impacts on aquatic-plant cover seem unlikely where chinook migrate. For Grant Co., we recommend requiring a buffer to minimize runoff and drift into surface waters. Alternatively, the Washington State Department of Agriculture's task force may provide more focused protective measures that would be acceptable.

C. Coho Salmon

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

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

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

1. Central California Coast Coho Salmon ESU

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

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

Table 41 contains usage information for the California counties supporting the Central California coast coho salmon ESU.

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

County	Crop(s)	Prometryn usage (pounds)	Acres treated
Santa Cruz	celery	72	46
San Mateo		0	0
Marin		0	0
Sonoma		0	0
Mendocino		0	0
Napa		0	0

We conclude that prometryn has no effect on the Central California Coast coho ESU, because little or no prometryn is used in these counties.

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 prometryn can be used.

Table 42 shows that there is no use of prometryn in the California counties supporting the Southern Oregon/Northern California coastal coho salmon ESU. Table 43 shows the cropping information for Oregon counties where the Southern Oregon/Northern California coastal coho salmon ESU occurs.

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

County	Crop(s)	Prometryn usage (pounds)	Acres treated
Humboldt		0	0
Mendocino		0	0
Del Norte		0	0
Siskiyou		0	0
Trinity		0	0
Lake		0	0

Table 43. Prometryn use in Oregon counties where there is habitat for the Southern Oregon/Northern California coastal coho salmon ESU

St	County	Crops	Acres planted
OR	Curry		0
OR	Jackson	carrot	1
OR	Josephine	carrot	4
OR	Douglas	carrot	not reported
OR	Klamath		0

We conclude that prometryn has no effect on the Southern Oregon/Northern California coastal coho salmon ESU, because little or no prometryn is used in these counties.

3. Oregon Coast coho salmon ESU

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

This ESU includes coastal populations of coho salmon from Cape Blanco, Curry County, Oregon to the Columbia River. Spawning is spread over many basins, large and small, with higher numbers further south where the coastal lake systems (e.g., the Tenmile, Tahkenitch, and Siltcoos basins) and the Coos and Coquille Rivers have been particularly productive. Critical

Habitat includes all accessible reaches in the coastal hydrologic reaches Necanicum, Nehalem, Wilson-Trask-Nestucca (upstream barrier - McGuire Dam), Siletz-Yaquina, Alsea, Siuslaw, Siltcoos, North Umpqua (upstream barriers - Cooper Creek Dam, Soda Springs Dam), South Umpqua (upstream barrier - Ben Irving Dam, Galesville Dam, Win Walker Reservoir), Umpqua, Coos (upstream barrier - Lower Pony Creek Dam), Coquille, Sixes. Related Oregon counties are Douglas, Lane, Coos, Curry, Benton, Lincoln, Polk, Tillamook, Yamhill, Washington, Columbia, Clatsop. However, the portions of Yamhill, Washington, and Columbia counties that are within the ESU do not include agricultural areas where prometryn can be used, and I have eliminated them in this analysis.

Table 44 shows the cropping information for Oregon counties where the Oregon coast coho salmon ESU occurs.

Table 44. Crops on which prometryn can be used that are in counties where there is habitat for the Oregon coast coho salmon ESU

St	County	Crops	Acres planted
OR	Curry		0
OR	Coos		0
OR	Douglas	carrot	not reported
OR	Lane	carrot	270
OR	Lincoln		0
OR	Benton		0
OR	Polk	carrot	not reported
OR	Tillamook		0
OR	Clatsop		0

We conclude that prometryn has no effect on the Oregon coast coho salmon ESU, because little or no prometryn is used in these counties.

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’.

Tables 45 shows the cropping information for Washington counties where the Hood Canal summer-run chum salmon ESU occurs.

Table 45. Crops on which prometryn 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
WA	Mason		0
WA	Clallam	carrot	not reported
WA	Jefferson		0
WA	Kitsap	carrot	1
WA	Island		0

We conclude that prometryn has no effect on the Hood Canal Summer-run chum salmon ESU, because little or no prometryn is used in these counties.

2. Columbia River Chum Salmon ESU

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

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

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

Table 46. Crops on which prometryn can be used that are in counties where there is habitat for the Columbia River chum salmon ESU

St	County	Crops	Acres planted
WA	Skamania		0
WA	Clark		0

St	County	Crops	Acres planted
WA	Lewis		0
WA	Cowlitz	carrot	not reported
WA	Pacific		0
WA	Wahkiakum		0
OR	Multnomah	carrot	not reported
OR	Columbia		0
OR	Washington	carrot	1
OR	Clatsop		0

We conclude that prometryn has no effect on the Columbia River chum salmon ESU, because little or no prometryn is used in these counties.

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. Prometryn is used on carrots, but the number of acres planted is not reported (Table 47).

Table 47. Crops on which prometryn can be used that are in Clallam County where there is habitat for the Ozette Lake sockeye salmon ESU

St	County	Crops	Acres planted
WA	Clallam	carrot	not reported

We conclude that prometryn has no effect on the Ozette Lake sockeye salmon ESU, because little prometryn is used in this county.

2. Snake River Sockeye Salmon ESU

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

Spawning and rearing habitats are considered to be all of the above-named lakes and creeks, even though at the time of the critical habitat Notice, spawning only still occurred in Redfish Lake. These habitats are in Custer and Blaine counties in Idaho. However, the habitat area for the salmon is high elevation areas in a National Wilderness area and National Forest. Prometryn 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 prometryn in the lower and larger river reaches during its juvenile or adult migration.

Prometryn was not used in the two counties where this ESU reproduces (Table 48). Prometryn is used on carrots in three counties in Oregon and Washington along the migratory corridor for this ESU (Table 49).

Table 48. Crops on which prometryn 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	Acres planted
ID	Custer		0
ID	Blaine		0

Table 49. Crops on which prometryn 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	Acres planted
ID	Idaho		0
ID	Lemhi		0
ID	Lewis		0
ID	Nez Perce		0
WA	Asotin		0
WA	Garfield		0
WA	Whitman		0
WA	Columbia		0
WA	Walla Walla		0
WA	Franklin	carrot	3,574
WA	Benton		0
WA	Klickitat		0
WA	Skamania		0
WA	Clark		0
WA	Cowlitz	carrot	not reported

St	County	Crops	Acres planted
WA	Wahkiakum		0
WA	Pacific		0
OR	Wallowa		0
OR	Umatilla		0
OR	Morrow		0
OR	Gilliam		0
OR	Sherman		0
OR	Wasco		0
OR	Hood River		0
OR	Multnomah	carrot	not reported
OR	Columbia		0
OR	Clatsop		0

We conclude that prometryn has no effect on the Snake River sockeye salmon ESU, because prometryn is not used where there is spawning and rearing habitat. Because the migration corridors consist of larger, faster-flowing streams, impacts on aquatic-plant cover seem unlikely where sockeye migrate.

5. Specific conclusions for Pacific salmon and steelhead

Based on the available information and best professional judgement, our conclusions on potential adverse indirect effects on listed Pacific salmon and steelhead are provided in Table 50. We conclude that prometryn will have no effect on 17 ESUs but may affect nine ESUs. The may-affect determinations are based on the extent of crop acreage potentially treated in counties within an ESU and possible adverse effects of prometryn on aquatic-plant cover.

Table 50. Summary conclusions on specific ESUs of listed Pacific salmon and steelhead for metolachlor

Species	ESU	Finding
Steelhead	Southern California	may affect
Steelhead	South-Central California Coast	may affect
Steelhead	Central California Coast	no effect

Species	ESU	Finding
Steelhead	Central Valley, California	may affect
Steelhead	Northern California	no effect
Steelhead	Upper Columbia River	may affect
Steelhead	Snake River Basin	may affect
Steelhead	Upper Willamette River	no effect
Steelhead	Lower Columbia River	no effect
Steelhead	Middle Columbia River	may affect
Chinook Salmon	Sacramento River winter-run	no effect
Chinook Salmon	Snake River fall-run	may affect
Chinook Salmon	Snake River spring/summer-run	may affect
Chinook Salmon	Central Valley spring-run	no effect
Chinook Salmon	California Coastal	no effect
Chinook Salmon	Puget Sound	no effect
Chinook Salmon	Lower Columbia	no effect
Chinook Salmon	Upper Willamette	no effect
Chinook Salmon	Upper Columbia	may affect
Coho salmon	Central California	no effect
Coho salmon	Southern Oregon/Northern California Coasts	no effect
Coho salmon	Oregon Coast	no effect
Chum salmon	Hood Canal summer-run	no effect
Chum salmon	Columbia River	no effect
Sockeye salmon	Ozette Lake	no effect
Sockeye salmon	Snake River	no effect

Many factors will affect how much, if any, prometryn reaches surface waters inhabited by listed Pacific salmon and steelhead. A major factor is proximity of the treatment site to waters potentially receiving drift and runoff. Major concern would be treatment sites located nearby receiving waters used for spawning and rearing. We currently have insufficient information to determine where prometryn treatment sites are located. This is especially true in Oregon, Washington, and Idaho where the only information available is which crops are grown in counties within the ESUs; however, we do not know how much of those crops are actually treated with prometryn. For those nine ESUs for which we conclude that prometryn might adversely affect aquatic plant cover, a buffer could be required to minimize drift and runoff into surface waters. Alternatively, the Washington State Department of Agriculture's task force may provide other more focused protective measures that would be acceptable to mitigate risk.

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