Captan

Analysis of Risks

to

Endangered and Threatened Salmon and Steelhead

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Introduction

Captan is a non-systemic fungicide used to control diseases in orchard crops, berries, seeds, turf, and ornamentals. It was first registered in 1951 under the Federal Insecticide, Fungicide, and Rodenticide Act for the control of fungal disease in fruit crops. The parameters of use have changed on many occasions, with the latest revision (Reregistration Eligibility Decision, Case 120) issued in November 1999.

Problem Formulation - The purpose of this analysis is to determine whether the registration of captan as a fungicide for use on crops may affect threatened and endangered (T&E or listed) Pacific anadromous salmon and steelhead or adversely affect their designated critical habitat. The agency has previously addressed numerous areas of concern (Water Quality Risks, SACS/EFED, May 26. 1995 - Revised 9 July, 1996; PC Code 081301, EFED 5 October 1998, RED, Nov 1999) regarding the use and fate of captan. The ecological risk for captan was determined to be limited to fresh water fish, however no fish kills were noted and mitigation actions were initiated to reduce overall risk.

Scope - Although this analysis is specific to listed Pacific salmon and steelhead and the watersheds in which they occur, it is acknowledged that Captan 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. It is understood 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.

[1] COMMENT: Data obtained after the date of final issue was not included in this report, and the comments and observations noted do not reflect more recent studies or data.

Contents

Attachments:
1. Interim Reregistration Eligibility Decision for Captan, Case 102
2. EFED RED, Captan, Summary
3. Sample Labels
4. WSDA Summary Report, Captan

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. Exceptions are known to occur for only an occasional pesticide, as based on the several dozen fish species that have been frequently tested. Sappington et al. (2001), Beyers et al. (1994) and Dwyer et al. (1999), among others, have shown that endangered and threatened fish tested to date are similarly sensitive, on an acute basis, to a variety of pesticides and other chemicals as their non-endangered counterparts.

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

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

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

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

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

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

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

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

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

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

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

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

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

It is also important to note that pesticides used in urban areas can be expected to transport considerable distances if they should run off on to concrete or asphalt, such as with streets (e.g., TDK Environmental, 2001). 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 direct and indirect effects on T&E fish

Test data	Risk quotient	Presumption
Acute LC50	>0.5	Potentially high acute risk
Acute LC50	>0.1	Risk that may be mitigated through restricted use classification
Acute LC50	>0.05	Endangered species may be affected acutely, including sublethal effects

Chronic NOEC	>1	Chronic risk; endangered species may be affected chronically, including reproduction and effects on progeny
Acute invertebrate LC50[a]	>0.5	May be indirect effects on T&E fish through food supply reduction
Aquatic plant acute EC50[a]	>1[b]	May be indirect effects on aquatic vegetative cover for T&E fish

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

The Ecological Risk Assessment SEP (pages 2-6) discusses the quantitative estimates of how the acute toxicity data, in combination with the slope of the dose-response curve, can be used to predict the percentage mortality that would occur at the various risk quotients. The discussion indicates that using a "safety factor" of 10, as applies for restricted use classification, one individual in 30,000,000 exposed to the concentration would be likely to die. Using a "safety factor" of 20, as applies to aquatic T&E species, would exponentially increase the margin of safety. It has been calculated by one pesticide registrant (without sufficient information for OPP to validate that number), that the probability of mortality occurring when the LC50 is 1/20th of the EEC is 2.39×10^{-9}, or less than one individual in ten billion. It should be noted that the discussion (originally part of the 1975 regulations for FIFRA) is based upon slopes of primarily organochlorine pesticides, stated to be 4.5 probits per log cycle at that time. As organochlorine pesticides were phased out, OPP undertook an analysis of more current pesticides based on data reported by Johnson and Finley (1980), and determined that the "typical" slope for aquatic toxicity tests for the "more current" pesticides was 9.95. Because the slopes are based upon logarithmically transformed data, the probability of mortality for a pesticide with a 9.95 slope is again exponentially less than for the originally analyzed slope of 4.5.

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

Sublethal Effects - With respect to sublethal effects, Tucker and Leitzke (1979) did an extensive review of existing ecotoxicological data on pesticides. Among their findings was that sublethal effects as reported in the literature did not occur at concentrations below one-fourth to one-sixth of the lethal concentrations, when taking into account the same percentages or numbers affected, test system, duration, species, and other factors. This was termed the "6x hypothesis". Their review included cholinesterase inhibition, but was largely oriented towards externally observable parameters such as growth, food consumption, behavioral signs of intoxication, avoidance and repellency, and similar parameters. Even reproductive parameters fit into the hypothesis when the duration of the test was considered. This hypothesis supported the use of lethality tests for use in assessing acute 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. As discussed earlier, the entire focus of the early-life-stage and life-cycle chronic tests is on 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 for acute effects. 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 the 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 acute sublethal effects until there are additional data.

2. Description and use of Captan

Chemical Identification

- Common Name: Captan
- Chemical Name: N-trichloromethylthio-4-cyclohexane-1,2-dicaboximide
- Chemical Family: Dicarboximides
- CAS Registry Number: 133-0602
- OPP Chemical Code: 081301
- Empirical Formula: $C_9H_8Cl_3NO_2S$
- Molecular Weight: 300.61

- Trade and Other Names: Merpan, Orthocide, Vondcaptan, Vancide-89, SR-46

  Manufacturer: Gustafson, LLC; Makhteshim-Agan of North America; Drexel Chemical Co.; and Tomgen Agro, Inc.

Methods of Application: Captan is applied by broadcast, chemigation, dust, drip treatment to soil and as spot applications. Aerial applications and orchard airblast uses have been extensively reviewed in consultation with the Spray Drift Task Force (SDTF). Captan is also used as a seed treatment.

Captan is a component of multiple ingredient formulations. Additional active components, in various products, may include lindane, malathion, carbaryl, methoxychlor, metalaxyl, carboxin, pentachloronitrobenzene (PCNB), and diazinon. Malathion and lindane are compounds included in this current review, and their effects will be reported separately. Carbaryl, methoxychlor, metalaxyl, carboxin, PCNB, and diazinon are registered products with individually identified risks to T&E fish.

Application rates can vary for different sites, based largely on the method of application and the specific crop. The values below represent the maximum application rates for specific field and orchard crops (Table 3) produced in the area of study. These data are taken from the current labels:

Table 3: Application Rates for Foliar Captan

Use Site	Max. Single Rate lbs/A, a.i.	Max. No. of Appl./Year	Max. lbs a.i per Crop Year
Almonds	4.5	5	22.5
Apples	4	8	32
Apricots	2.5	14	42.5
Blueberries	2.5	14	42.5
Cherries	2	7	14
Grapes	2	7	14
Nectarines	4	8	32
Peaches	4	8	32
Pears	3	9	27
Plums	3	9	27
Prunes	3	9	27
Strawberries	5	7	35
Turf	4	8	32

Previously, the Agency reviewed seed treatment products, including those with active ingredients having much greater persistence and higher aquatic toxicity, and determined that they do not exceed the levels of concern for aquatic and estuarine fish or invertebrates. These conclusions were reached on the basis of overly conservative modeling data, overestimation of product release from treated seed, and elevated application rates. Captan is used extensively for pre-plant seed treatments. Specific data regarding the amount of captan used for this application is not readily available (with the possible exception of California.) and the mechanisms used not well defined (treatment in the field vs treatment in a warehouse or similar off-site location.

Post-harvest treatment on fruits and berries also represents an additional application site for captan use. As with seed treatment, definitive data on use and the site of the treatment were not readily available. For the county summary tables, only field use is included.

Table 4: Seed Treatments Application Rates in the Pail or Planter Box

Use Site	Max. Single Rate lbs a.i/100 lbs seed	Max. No. of Appl./Year	Max. lbs a.i per Crop Year
Alfalfa	0.125	1	0.125
Barley	0.5	1	0.5
Beans	0.25	1	0.25
Broccoli	0.125	1	0.125
Brussel Sprouts	0.125	1	0.125
Cabbage	0.125	1	0.125
Cauliflower	0.125	1	0.125
Clover	0.125	1	0.125
Flax	0.156	1	0.156
Lentils (WA, ID)	0.101	1	0.101
Cucumber	0.125	1	0.125
Cantaloup	0.125	1	0.125
Beets	0.5	1	0.5
Rutabaga	0.185	1	0.185
Sugar Beets	0.5	1	0.5
Turnip	0.125	1	0.125
Cotton	0.125	1	0.125
Cotton (Mech)	0.185	1	0.185

Eggplant	0.25	1	0.25
Peppers	0.125	1	0.125
Sesame	0.063	1	0.063
Carrot	0.5	1	0.5
Corn	0.216	1	0.216
Oats	0.125	1	0.125
Peas	0.25	1	0.25
Potatoes (cut seed)	1.0	1	1.0
Radishes	0.125	1	0.125
Rye	0.125	1	0.125
Sorghum	0.313	1	0.313
Spinach	0.25	1	0.25
Soybeans	0.175	1	0.175
Wheat	0.125	1	0.125

Table 5: Total Domestic Seed Treatment with Captan (1990)
(EPA Data 1991)

Site	**Seeds Treated (lbs)**	**lbs Applied**	**Units Treated** (pounds, cubic feet, pots, bushes, etc.)
Corn	1,020,000,000	714,000	72,857,000
Sweet Corn	18,000,000	18,000	1,100,000
Beans	144,000,000	144,000	2,384,000
Peas	99,000,000	99,000	451,000
Potatoes	290,000,000	246,000	145,000
Soybeans	141,000,000	98,000	2,342,000
Sorghum	77,000,000	123,000	10,694,000
Peanuts	106,000,000	170,000	1,040,000
Cotton	147,000,000	206,000	6,133,000

The total use of captan, as estimated by the Agency in considering re-registration, also separates the principal use on the basis of foliar and seed treatment. A brief summary, concentrating on the areas of interest for this review, is listed below. Full data is included with the RED (Attachment 1).

Table 6: Total Domestic Foliar Use of Captan
(EPA Data 1987-1997; USDA Data 1990-1997

Site	Total Acres	Acres Treated (avg)	lbs a.i. Applied (avg)	Major States
Almonds	429,000	80,000	300,000	CA, 100%
Apples	572,000	270,000	2,000,000	MI,NY,PA,NC,VT, VA, 59%
Apricots	19,000	4,000	13,000	
Blueberries	59,000	36,000	250,000	MI,ME,NJ, 88%
Cherries (Sweet)	64,000	8,000	18,000	MI,OR, 90%
Cherries (Tart)	64,000	18,000	62,000	NY,MI, 86%
Grapes	825,000	40,000	100,000	CA,NY,AZ,MO,AR, VA,83%
Nectarines	29,000	3,000	13,000	CA, 100%
Peaches	212,000	86,000	550,000	SC,AL,MI,NJ,PA,AR ,57%
Plums	64,000	8,000	32,000	MI,CA, 92%
Prunes	80,000	25,000	93,000	CA,100%
Raspberries	11,000	7,000	36,000	OR,WA,93%
Strawberries	50,000	31,000	540,000	FL,CA,PA,83%

In addition to the above listed agricultural sites, captan, ether alone or in formulations, is widely available for residential use by homeowners (most products prepared for residential use are labeled "not for commercial use"). Specific uses include Azaleas, Begonias, Camellias, Carnations, Chrysanthemum, Gladiolas, ornamental (non-pasture) grasses, Roses, and greenhouse soil and benches. Residential turf applications have been discontinued.

In the state of California detailed accounting of captan is available, indexed to both the major sites and the counties where the pesticide is applied to commercial sites**.** Table 7 summarized the major crop sites listed as registered use sites for captan.

Table 7: California Foliar Captan Use (CDPR) 2001

Crop Site	Pounds Applied	Acres
Almond	108,516	44,712
Apple	889	534
Apricot	324	192
Blueberry	14	6
Cherry	986	532
Grape	26,049	15,861
Grape, Wine	537	473
Landscape	484	Ns
N-Outdoor Flowers	683	333
N-Outdoor Plants	408	344
N-Outdoor Transplants	3,949	3,778
Nectarine	2,816	918
Peach	6,931	2,563
Plum	1,998	710
Prune	68,038	24,244
Raspberry	2	2
Research	20	NR
Rights of Way	2	NR
Strawberry	170,022	107,605
Structural Pest Cont.	2	NR
Non-Ag	8	1

Oregon, Washington, and Idaho do not release detailed reports on specific use of pesticides, but do offer state summaries of use. The combination of state-wide totals with USDA crop census data allow a reasonable approximation of the most extreme usage of pesticide, within the accepted labeling restrictions (maximum rate x acres planted). Survey of selected crop application by National Center for Food and Agricultural Policy is used where possible (census year 1997), except where the Washington State Department of Agriculture (WSDA, 2003) data from 2001 is available. Based on their acreage reports, the following tables estimate usage of captan.

Table 8: Idaho Use of Captan (NCFAP, 2000 Report) 1997

Crop Site	Pounds Applied	Acres treated
(Foliar Application)	0	

Table 9: Washington Foliar Use of Captan (NCFAP Report, 2000) 1997

Crop Site	Pounds Applied	Acres Treated
Apples[1]	16,800	8,400
Blueberries[1]	6,000	1,000
Cherries	1,154	452
Peaches/Nectarines[1]	1,680	420
Plums/Prunes	291	116
Raspberries[1]	87,800	9,500
Strawberries	1,732	875

[1] Data provided by Washington State Department of Agriculture

Table 10: Oregon Foliar Captan Use (NCFAP Report, 2000) 1997

Crop Site	Pounds Applied	Acres Treated
Apples	1,335	308
Blackberries	5,259	1,955
Blueberries	7,418	1,713
Cherries	5,754	2,615
Grapes	287	192
Peaches	355	70
Plums/Prunes	862	345
Raspberries	4,415	1,660
Strawberries	7,861	2,074

The tabulated data for Oregon, Washington, and Idaho represents application rates that appear to conform with existing registration labeling.

3. General Aquatic Risk Assessment for Endangered and Threatened Salmon and Steelhead

Because captan is one of the active ingredients in many product formulations, a brief review of the other active ingredients in captan products was conducted. Carbaryl was demonstrated to have toxicity to rainbow trout ranging from 1.4 to 5.0 ppm and to bluegill from 1.4 to 290 ppm; diazinon had toxicities ranging from 0.09 to 1.8 ppm in trout and 0.136 to 0.460 in bluegill. PCNB was toxic to trout in the range of 0.31 to 1.6 ppm, and 0.1 to 0.88 in the bluegill. The trout model was sensitive to metalaxyl in the range 18.4 to 130 ppm, and 27 ppm in the bluegill. No studies were conducted to evaluate synergism between captan and other components of formulations, suggesting that overall toxicity of the formulations should be based on the component with the highest impact on aquatic organisms. The LC_{50} of captan for fish falls within the rather large range of toxicity seen in associated compounds, but the rapidly evolved degradates are much less toxic (essentially non-toxic) than other agents used in conjunction with captan.

a. Aquatic Toxicity:

i. Freshwater Fish, Acute

The acute toxicity data for fresh water fish (Table 11) indicates that captan has high activity in the freshwater fish used as models. For purposes of this review, data derived from the trout and salmon models is felt to be more accurate with respect to California and Pacific Northwest salmon and steelhead. This is based on similar ecological preference (i.e., cold water), and a more closely related genetic history. The brown trout was the most sensitive species (LC_{50} = 26.2 ppb) and the bluegill sunfish only slightly less sensitive (LC_{50} = 72 ppb).

Table 11: Acute Toxicity of Captan to Freshwater Fish

Name	***Taxonomic Name***	***% a.i.***	***LC50 (ppb a.i.)***	***Toxicity Category***
Bluegill Sunfish	*Lepomis macrochirus*	90	310	Highly Toxic
Bluegill Sunfish	*Lepomis macrochirus*	88.4	72	Very Highly Toxic
Fathead Minnow	*Pimephales promelas*	88.4	65	Very Highly Toxic
Brook Trout	*Salvelinus fontinalis*	88.4	34	Very Highly Toxic
Coho Salmon	*Oncorhynchus kisutch*	90	137	Highly Toxic
Brown Trout	*Salmo trutta*	90	26.2	Very Highly Toxic

Additional testing has been performed on degradates of captan, THPI and THPAm due to the short half life of parent captan (6 hours @ pH 7.0).

Table 12: Acute Toxicity of THPI and THPAm to Freshwater Fish

Name	*Taxonomic Name*	*% a.i.*	*LC50 (ppb a.i.)*	*Toxicity Category*
Rainbow Trout	*Oncorhynchus mykiss*	96 (THPI)	>120,000	Practically Non-Toxic
Rainbow Trout	*Oncorhynchus mykiss*	95 (THPAm)	>120,000	Practically Non-Toxic

ii. Freshwater Invertebrates, Acute

Acute Toxicity testing for freshwater invertebrates is conducted using technical grade active ingredient. (or equivalent). The preferred species is *Daphnia magna*.

Table 13: Acute Toxicity of Captan to Freshwater Invertebrates

Name	*Taxonomic Name*	*% a.i.*	*LC50 ppm*	*Toxicity Category*
Waterflea	*Daphnia magna*	90	804	Slightly Toxic
Waterflea	*Daphnia magna*	Tech	1.3	Moderately Toxic
Waterflea	*Daphnia magna*	Tech	>7.1	Moderately Toxic (or less)
Waterflea	*Daphnia magna*	93	>3.25	Moderately Toxic (or less)

.Since degradate testing was required, data also were submitted using *Daphnia magna*, exposed to 96% THPI.. Results indicated the 48 hr LC_{50} > 113 ppb. This was sufficient to characterize THPI as practically non-toxic. Results with THPAm in rainbow trout demonstrated a 96 hr LC_{50} > 126 ppm and the NOEC was 126 ppm. This was deemed by the Agency sufficient to determine THPAm is practically non-toxic to the rainbow trout.

An evaluation from the AQUIRE data revealed several additional acute studies, however the sensitivities appeared lower than those included for review in the RED (*i.e.* Cutthroat trout, LC_{50} = 0.056 ppm, Chinook Salmon LC_{50} = 0.057 ppm., Yellow Perch = 0.12 ppm). Aquatic plant toxicity appeared low (*Lemma gibba* LC = >12.7 ppm). In studies of estuarine/marine species, acute toxicity appeared less than freshwater species (*Cyprinodon variegatus* LC_{50} = 1.9 ppm). Some chronic testing has been requested by the Agency, but is not available, at this time, to the author.

A fish full life cycle evaluation of parent captan was submitted, indicating fathead minnow growth and survival is affected between 16.5 an 39.5 ppb. The NOEL is 16.5 and the LOEL is 39.5 ppb.

b. Environmental fate and transport:

Parent captan rapidly degrades in soil and water, with an aquatic half life of <24 hours. The major routes for captan dissipation appear to be hydrolysis and aerobic metabolism. In sterile buffer solutions at pH 5, 7, and 9 half lives of 18.8, 4.9, and 8.3 hours were seen, respectively. In water and soil the sulfur-nitrogen bond cleaves, separating the trichloromethylthio (TCMT) and tetrahydrophtalate (THPI) residues. The TCMT component degrades moderately rapidly to CO_2, inorganic sulfur and chlorine, and thiophosgene through aerobic metabolism. Thiophosgene dissipation is expected to be dependent on volatilization, but it was not detected as a volatile component in any of the laboratory studies. THPI also degrades rather rapidly, through a series of ring compounds (including THPAm) to $CO_{2.}$

Photodegradation in water was deemed by the Agency to be a relatively modest path to dissipation, and the Agency determined that captan is stable to photolysis in water at ph5. In irradiated soil, captan demonstrated half lives of 5 and 15 days, based largely on the site of radio labeled ^{14}C in the parent. Overall, most labeled degradates were present as THPI (21.3%) or cyclohex-4-ene-2-cyano-1-carboxylic acid (THCY) (9.4%). Other products were present at less than 3.2%, while $^{14}CO_2$ contained 41.7% of the original radio-label.

Soil aerobic studies demonstrated that radio-labeled captan degraded very rapidly, with 99% degradation by day 7. At 322 days, (5% of the parent label was present as $^{14}CO_2$, the final product of captan degradation. THPI and THPAm were the major intermediate degradates, with other intermediates seen at low concentration. In another soil study, with trichloromethyl (TCM) labeled captan, a half life of less than 1 day was observed. After 1 day, 46% of the label was observed as $^{14}CO_2$, while 19.4% remained undegraded captan, 16.7% remained as unextractable residues. In anaerobic metabolism studies, consisting of 1 day incubation followed by 29 days of anaerobic degradation, 85% of the labeled captan had degraded to $^{14}CO_2$, with THPI and THPAm and other compounds composing small percentages. THCY composed the largest organic component, containing up to 20% of the original radio-labeled captan. THCY and THPAm were found to be stable under anaerobic conditions.

A detailed study of aquatic fate indicated that on day 0, 81.2% of applied captan was found as THPI, 27% THPAm on day 7, 10.8% THPAm on day 14, and 9.4% THPI epoxide at the end of day 1. The Agency concluded that once captan reaches surface water and hydrolyzes (<24 hours), the degradates (THPI, THPAm, THPAI, and THPI epoxide) will not be present in water longer than 60 days.

Captan is only slightly mobile, however THPI and THPAm were found to have significantly more potential for soil movement. The benign nature of these compounds to aquatic organisms minimizes the potential effects of their soil mobility.

Because of the rapid abiotic hydrolysis and rapid microbiological degradation under both aerobic and anaerobic conditions, captan is not expected to persist in surface water. The major concern for captan reaching surface water is through dissolved compound in runoff or from spray drift. An attempt has been made to characterize the potential for aquatic exposure through a combined effort of the registrants, and formation of the Spray Drift Task Force (SDTF). The results of this collaboration have been submitted to the agency and are under review. Although reactive policies have not yet been developed, current label language includes statements such as “do not allow to drift” and “do not apply directly to water”.

. **c. Incidents**

A search of the Agency data, as summarized in the RED, and reviewed in Agency data files failed to produce definite or probable incidents for captan. No fish kills were noted. Many of the domestic incidents associated with captan, including residential use and indoor foggers, were attributed to other compounds in formulations where captan was an additional element.

d. Estimated and actual concentrations of Captan in water

Captan is not currently a monitored agent in the NAWQA data base. Due to variations in the field dissipation half life of captan (2.5 to 24 days) a potential for dissolved captan in runoff water was noted. The potential for biochemical accumulation is low. The State of Illinois (Moyer and Cross, 1990) sampled 30 sites, at various times, between October 1985 through October 1988. Total captan was not detected above the detection limit of 0.05µg/L in any of the 580 samples collected.

GENEEC Expected Environmental Concentration data (GENEEC), Pesticide Root Zone Model (PRZM2), and Exposure Analysis Modeling Systems (EXAMS II) modeling for captan in water from several sites (including California Almonds, Cherries, and Prunes) was conducted, based on the farm pond scenario. The results of this analysis are shown in Table 14.

Table 14: PRZM-EXAM (except GENEEC for turf) Estimated Environmental Concentrations (EEC) for Captan

Crop	Application Method	Application Rate in lbs a.i./A (#applications	Initial EEC (ppb)	4-day EEC (ppb)	21-day EEC (ppb)	60-day EEC (ppb)	90-day EEC (ppb)
Turf	foliar	4.0(8)	43.4	11.6	2.2	0.8	NR
Almonds (CA)	spray blast	4.5(5)	91.7	19.8	5.5	3.3	2.6
Apples (NY)	spray blast	4.0(8)	49.6	10.6	3.3	2.9	2.0
Peaches (CA)	spray blast	4.0(8)	104.8	19.5	6.9	6.0	4.0
Prunes (CA)	spray blast	3.0(9)	57.9	13.1	3.8	3.5	2.6
Cherries (CA)	spray blast	2.0(7)	6.9	2.0	1.1	0.97	0.65
Blueberries (MI)	spray blast	2.5(14)	36.8	6.7	1.7	1.6	1.5

e. Recent changes in Captan registrations

Most recent changes address occupational exposure risks to respond to potential carcinogenicity. The changes, in general, do not address ecological concerns. Spay and drift guidelines were added for aerial and spray blast applications. These included cautions of wind direction and humidity, and specific information on the apparatus for protection of sensitive areas, including surface water. Residential turf use was cancelled (voluntary) by the registrant. Restricted Entry Intervals (REI's) have been minimally altered to reflect current risk estimates, generally for reductions in occupational exposure.

f. Discussion and general risk conclusions for Captan

For freshwater fish, foliar applications to fruit, nut crops, and turf (except cherries and turf applications) exceeded high acute risk, restricted use, and endangered species Levels of Concern (LOC's). The Risk Quotients (RQ's) for freshwater fish are given in Table 15:

Table 15: Captan Risk Quotients (RQs) for Freshwater Fish

Crop/appl. rate (lbs a.i./# appls.	Acute RQ	Chronic RQ
Turf (4.0)/8	1.6	0.03
Almonds (4.5)/5	3.5	0.10
Apples (4.0)/8	1.9	0.08
Peaches (4.0)/8	4.0	0.16
Prunes (3.0)/9	2.2	0.10
Cherries (2.0)/7	0.3	0.03
Blueberries (2.5)/14	1.4	0.05

The RQ's above are based on the lowest LC_{50} for fish, 26.2 ppb, seen in the Brown Trout. The MATC (geometric mean of the NOEL and LOEL) was derived from the Fathead Minnow. Based on this analysis, there does not appear to be a chronic risk to fish.

Analysis of data for freshwater invertebrates produced RQ's that indicated endangered species acute LOC to be slightly exceeded for applications to almonds and peaches. The results are summarized in Table 16. There is no chronic risk to freshwater invertebrates from the application of captan.

Table 16: Captan Risk Quotients for Freshwater Invertebrates

Crop/appl. rate (lbs a.i./A).	Acute RQ	Chronic RQ
Turf (4.0)	0.03	<0.02
Almonds (4.5)	0.08	<0.02
Apples (4.0)	0.04	<0.02
Peaches (4.0)	0.08	<0.02
Prunes (3.0)	0.04	<0.02
Cherries (2.0)	0.01	<0.02
Blueberries (2.5)	0.03	<0.02

These studies suggest that the direct risk to fish is far more significant than the potential indirect effects resulting from adverse reactions in freshwater invertebrates, which serve as a major dietary element for T&E fish species. Similar findings in *Lemna sp.* studies suggest no reduction in cover for T&E species. Concentrating efforts on the direct effects of captan to fish would appear to adequately address any concern for freshwater invertebrates and the potential for indirect effects.

The review of captan use in California, Oregon, Washington, and Idaho indicates expected usage and application rates, suggesting that the EPA models and known concentrations based on national data, as available, are appropriate. There are several features are of significance. Because the areas of concern are typically flowing, well oxygenated streams, rivers, and tributaries, the levels of captan can be expected to rapidly dissipate after crop treatments. Additionally, the ESU's of concern are often coastal and captan concentrations can be expected to rapidly assume oceanic levels through circulation and, particularly in the northwest, tidal displacement. In California, captan usage, as documented by the state agency, is relatively low, even in areas of intense agriculture. As an example, in the Central California Coast Steelhead ESU, of 12 counties represented, 9 reported no use of captan, with the remaining 3 reporting a total use rate of 99 lbs/year. In the California Central Valley Steelhead ESU, an area affected by large scale agriculture, of 28 counties, 19 reported no captan usage. In the remaining 9, a total of 6,568 lbs of captan were applied, with the majority (4,417 lbs) applied to beans (seed treatment) in a single county (Solano). The low usage rates reported support an opinion that captan does not affect designated ESU's associated solely with California agricultural interests.

The spawning and early stages of most salmon and steelhead tend to be located in upstream sites, often at higher elevations than are suitable for agriculture. Many are also located in national and state parks or in wilderness areas. Captan use in such areas is greatly reduced or prohibited. This, again, would reduced loss of aquatic invertebrates in areas of greatest significance to salmon and steelhead and preserve food sources.

g. Existing protections

Occupational standards require the use of PPE's and application of Worker Protection Standard 40 CFR, part 170.Warnings to avoid spray drift and against direct application to water are included in all formulation labels. A 140 foot no spray zone and soil incorporation guideline exist to protect surface water.

4. Listed Salmon and Steelhead ESUs and Comparison with Captan Use Areas

The sources of data available on captan use are considerably different for California than for other states. California has full pesticide use reporting by all applicators except homeowners, and detailed records on a county level. Oregon has initiated a process for full use reporting, but it has been delayed due to budgetary issues. Washington and Idaho do not have such a mechanism to my knowledge, although communication with the Washington State Department of Agriculture indicates such a monitoring and documentation program is being investigated and/or under development.

In Oregon, Washington, and Idaho, information on the actual amount of captan used is rather limited. For ESUs in these three states, the indicated amount of acreage, by county, where captan could be used according to the labels is multiplied by the maximum application rate, also according to the most current labels available for each site. These data are refined by available information on the percent of acreage actually treated, as derived from sources such as NCFAP Survey and sales/shipping data provided by the registrant. Additional modification to Washington tables has been included where data are available, from information provided to the Agency by the Washington State Department of Agriculture. Grape usage data have been refined by the presumption that on a statewide basis, the relative treated acres are similar to Oregon (2% from NCFAP data), as referenced to the NCFAP Survey. This is entirely founded on geographic location and presumed climatological similarity. The Washington State Department of Agriculture has also provided a summary report for selected crops (Attachment 4).

On a statewide basis, the use of captan in California during the period 1991-2001 The use of captan in California increased significantly and then declined during this period (perhaps el niño related). Additional information at CDPR's website (http://www.cdpr.ca.gov/docs/pur/purmain.htm).

Table 17: Reported use of captan in California, 1991-2001, in pounds of active ingredient (x1000)

1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
287	454	609	734	949	785	1,559	966	643	399

In the following discussion of specific ESUs and captan use, information is presented on the listed salmon and steelhead ESUs and a discussion of the potential for the use of captan where they occur. The information on the various ESUs was taken almost entirely from notices of listing, critical habitat, or status reviews. As noted above, usage data were derived from the 1997 Agricultural Census and CDPR's pesticide use reporting for the year 2002, with compensation factors used where data is not available on actual use. In addition, Washington State Department of Agriculture provided some quantitative data on usage, and then later indicated that use of captan on grapes is "minimal" because buyers are rather unwilling to purchase grapes on whihc captan has been used. We used the term "minimal" on Washington grapes.

In areas where supplemental data could not be obtained from local authorities or the registrant, use data reflects a "worst case" scenario, assuming maximum application rates to 100% of label approved sites. Data entries calculated in this manner are indicated in ***bold/italic type***. The calculated values for OR, WA, and ID are based on foliar application, and not seed treatment or post-harvest use. The RED states that the relatively rapid rate of captan degradation suggests seed treatment methods will pose a significantly lower risk to the species of interest than foliar application. Data is listed only for those counties in which known or, based on crop sites, potential captan use. The 1997 survey from NCFAP, the year from which census data on crops is based, indicates no captan use in Idaho.

A. Steelhead

Steelhead, *Oncorhynchus mykiss*, exhibit one of the most complex suites 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 indicate 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 non-anadromous forms: a coastal group and an inland group, separated approximately by the Cascade crest in Oregon and Washington. California is thought to have only coastal steelhead while Idaho has only inland steelhead.

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

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

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

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

Within San Diego County, the San Mateo Creek runs through Camp Pendleton Marine Base and into the Cleveland National Forest. While there are agricultural uses of pesticides in other parts of California within the range of this ESU, it would appear that there are no such uses in the vicinity of San Mateo Creek. Within Los Angeles County, this steelhead occurs in Malibu Creek and possibly, but unlikely, Topanga Creek. Neither of these creeks drain agricultural areas, however captan products for residential use may constitute some stream impact. In addition, there is no use of captan reported by DPR for either Los Angeles or San Diego counties for the year 2000. There is a potential for steelhead waters to drain agricultural areas in Ventura, Santa Barbara, and San Luis Obispo counties. Usage of captan in counties where this ESU occurs are presented in Table 18.

Table 18.

County	Crop	Captan usage (pounds)	Acres treated
Los Angeles	Strawberries	1,554	655
Los Angeles	Landscape	1	NR
San Diego	Strawberries	4,992	3,204
San Diego	Peach	27	3
San Diego	Outdoor container plants	2	2
San Diego	Outdoor Flowers	32	51
Santa Barbara	Broccoli	74	55
Santa Barbara	Strawberries	14,818	9,474
San Luis Obispo	Outdoor Flowers	214	37
San Luis Obispo	Strawberries	1,957	1,296
Ventura	Strawberries	100,382	61,539
Ventura	Outdoor Flowers	1	4

This Southern California Steelhead ESU lies within an area of dense, urban development with recognized difficulties in determining residential use and the potential rapid runoff on pavement and areas with large storm drain systems. My conclusion is that there may be some affect in this ESU, but it is not likely to be adverse.

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 19 shows that Captan usage is low in those counties where this ESU occurs.

Table 19.

County	Crop(s)	Captan usage (pounds)	Acres treated
Monterey	Research	1	NR
Monterey	Strawberries	48,588	32,675
San Benito	Strawberries	205	150
San Benito	Apples	47	16
Santa Cruz	Strawberries	15,119	9,009
Santa Cruz	Blueberries	45	24
Santa Cruz	Outdoor Flowers	13	5
San Luis Obispo	Strawberries	1,956	1,296
San Luis Obispo	Outdoor Flowers	214	37
San Mateo	Outdoor Flowers	10	10

Within the South Central California Steelhead ESU there is a modest amount of agricultural use (mainly strawberries). The use of captan on strawberries is of some concern, however other crops are treated at very low levels. In consideration of the duration of captan parent, and the subsequent low toxicity, I believe it may affect, but is not likely to affect, the South Central California Steelhead ESU.

3. Central California Coast Steelhead ESU

The Central California coast steelhead ESU was proposed for listing as endangered on August 9, 1996 (61FR41541-41561) and the listing was made final, as threatened, a year later (62FR43937-43954, August 18, 1997). Critical Habitat was proposed February 5, 1999 (64FR5740-5754) and designated on February 16, 2000 (65FR7764-7787). This coastal steelhead ESU occupies California river basins from the Russian River, Sonoma County, to Aptos Creek, Santa Cruz County, (inclusive), and the drainage 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 Captan in the counties where the Central California coast steelhead ESU is presented in Table 20.

Table 20.

County	Crop(s)	Captan Applied (lbs)	Acres
Alameda		none	
Contra Costa		none	
Marin		none	
Mendocino		none	
Napa		none	
San Francisco		none	
San Mateo	Outdoor Flowers	10	10
Santa Clara	Apple	1	1
Santa Clara	Grape, Wine	12	80

Santa Clara	Landscape Maint	77	NR
Santa Clara	Strawberries	212	161
Santa Cruz	Strawberries	15,119	9,009
Santa Cruz	Outdoor Flowers	13	5
Santa Cruz	Blueberries	45	24
Solano	Corn (Fodder)	<1	89
Solano	Grape, Wine	20	32
Solano	Prune	81	28
Sonoma	Apple	95	45
Sonoma	Landscape	<1	NR

This Central California Coast ESU contains a large urban area with undetermined captan usage, however agricultural use is relatively low and clearance to oceanic waters swift. I believe captan will have no affect on in this ESU.

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 Captan in counties where the California Central Valley steelhead ESU occurs is presented in Table 21.

Table 21.

County	Crop(s)	Captan Applied (lbs)	Acres
Alameda		none	
Amador		none	
Butte	Almond	4,818	2,232
Butte	Corn (fodder)	2	136
Butte	Cotton	1	4
Butte	Landscape Maint.	4	NR
Butte	Plum	12	8
Butte	Prune	7,491	2,727
Butte	Safflower	<1	72
Calaveras		none	
Colusa	Almond	417	1,232
Colusa	Prune	1,336	414
Contra Costa		none	
Glenn	Almond	6,954	2,474
Glenn	Corn (fodder)	4	450
Glenn	Outdoor Transplant	142	65
Glenn	Prune	6,206	2,337
Glenn	Strawberries	389	118
Glenn	Sunflower	1	290
Marin		none	
Merced	Almond	15,998	6,541
Merced	Blueberry	93	58
Merced	Cantaloupe	1	12
Merced	Commodity Fumigation	29	7

Merced	Corn (human consump)	8	NR
Merced	Corn (Fodder)	48	NR
Merced	Nectarine	5	2
Merced	Ornamentals	390	199
Nevada		none	
Placer	Outdoor Plants	4	1
Placer	Prune	688	235
Sacramento	Nectarine	3	2
Sacramento	Peach	24	11
Sacramento	Plum	3	1
Sacramento	Safflower	<1	51
Sacramento	Strawberries	69	28
San Francisco		none	
San Joaquin	Almonds	10,698	3,992
San Joaquin	Corn (fodder)	4	351
San Joaquin	Grape	290	151
San Joaquin	Outdoor Transplants	1,456	614
San Joaquin	Peach	717	255
San Mateo	Outdoor Flowers	10	10
Shasta	Apple	4	28
Shasta	Outdoor Transplants	929	388
Shasta	Peach	2	3
Shasta	Prune	267	91
Solano	Corn (fodder)	<1	89
Solano	Grape, Wine	20	32
Solano	Prune	81	28
Sonoma	Landscape	<1	NR

Sonoma	Apple	95	45
Stanislaus	Almond	24,195	8,840
Stanislaus	Outdoor Plants	1	10
Stanislaus	Outdoor Transplants	39	160
Stanislaus	Peach	1,046	367
Stanislaus	Tomato (Processing)	7	308
Sutter	Almond	58	30
Sutter	Apple	366	250
Sutter	Beans	677	NR
Sutter	Corn (fodder)	12	288
Sutter	Peach	176	60
Sutter	Prune	18,908	7,467
Sutter	Sunflower	<1	76
Tehama	Almond	4,640	2,481
Tehama	Outdoor Transplants	252	97
Tehama	Prune	4,962	7,966
Tuloumne	Apples	41	14
Tuloumne	Nectarines	4	2
Tuloumne	Peach	<1	2
Yolo	Almonds	<1	NR
Yolo	Corn (fodder)	2	362
Yolo	Cotton	2	374
Yolo	Grape, Wine	10	16
Yolo	Landscape Maint.	1	NR
Yolo	Prune	762	313
Yolo	Sudangrass	245	NR
Yolo	Sunflower	1427	NR

Yuba	Almond	241	80
Yuba	Apple	247	168
Yuba	Peach	88	30
Yuba	Plum	29	10
Yuba	Prune	8,984	3,658

This large California Central Valley Steelhead ESU includes many agricultural sites, however most are small or modest in size and overall captan use is relatively low. This suggests that the use of captan will have no effect on the California Central Valley Steelhead ESU.

5. Northern California Steelhead ESU

The Northern California steelhead ESU was proposed for listing as threatened on February 11, 2000 (65FR6960-6975) and the listing was made final on June 7, 2000 (65FR36074-36094). Critical Habitat has not yet been officially established.

This Northern California coastal steelhead ESU occupies river basins from Redwood Creek in Humboldt County, CA to the Gualala River, inclusive, in Mendocino County, CA. River entry ranges from August through June and spawning from December through April, with peak spawning in January in the larger basins and in late February and March in the smaller coastal basins. The Northern California ESU has both winter and summer steelhead, including what is presently considered to be the southernmost population of summer steelhead, in the Middle Fork Eel River. Counties included appear to be Humboldt, Mendocino, Trinity, and Lake. Table 22 shows the use of Captan in the counties where the Northern California steelhead ESU occurs.

Table 22.

County	Crop(s)	Captan Applied (lbs)	Acres
Humboldt		none	
Lake		none	
Sonoma	Landscape	<1	NR
Sonoma	Apple	95	45
Trinity		none	

This Northern California Steelhead ESU contains minimal agricultural activity and is relatively sparsely populated. In my opinion, no effects from captan are expected to the Northern California Steelhead ESU.

6. Upper Columbia River steelhead ESU

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

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

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

Tables 23 and 24 show the cropping information and maximum potential Captan use for Washington counties where the Upper Columbia River steelhead ESU is located and for the Oregon and Washington counties where this ESU migrates.

Table 23.

St	County	Crops	Acres	Captan Applied (lbs)
WA	Benton	Cherries	3,219	901
WA	Benton	Peaches	149	***60***
WA	Benton	Apples	18,425	***7,370***
WA	Benton	Plums and Prunes	180	729
WA	Benton	Grapes	16,929	minimal
WA	Chelan	Grapes	2,813	minimal
WA	Chelan	Apples	17,096	***6,838***
WA	Chelan	Cherries	3,704	1,037
WA	Clark	Raspberries	860	***10,320***

WA	Douglas	Apples	14,383	***5,753***
WA	Franklin	Apples	9,000	***3,600***
WA	Franklin	Cherries	2,165	606
WA	Franklin	Raspberries	70	382
WA	Franklin	Plums and Prunes	43	174
WA	Franklin	Strawberries	17	411
WA	Franklin	Peaches	262	335
WA	Grant	Grapes	3,132	minimal
WA	Grant	Apples	33,615	***13,446***
WA	Grant	Peaches	261	***104***
WA	Grant	Cherries	3,470	971
WA	Kittitas	Apples	1,859	***744***
WA	Klickitat			none
WA	Okanogan	Peaches	67	***27***
WA	Okanogan	Cherries	1,003	281
WA	Okanogan	Apples	24,164	***9,666***
WA	Pacific			none
WA	Wahkiakum			none
WA	Yakima	Apples	75,264	***30,106***
WA	Yakima	Grapes	15,526	minimal
WA	Yakima	Strawberries	10	242
WA	Yakima	Plums and Prunes	478	1,935
WA	Yakima	Peaches	1,438	***575***
WA	Yakima	Cherries	6,129	1,716
WA	Yakima	Raspberries	10	55

Table 24: Crops on which Captan can be used in Oregon and Washington counties that are migration corridors for the Upper Columbia River steelhead ESU.

St	County	Crops	Acres	Captan Use (lbs)
OR	Clatsop			none
OR	Columbia	Raspberries	1,550	1,484
OR	Columbia	Cherries	7	3
OR	Columbia	Apples	39	16
OR	Columbia	Grapes	6	16
OR	Gilliam			none
OR	Hood River	Peaches	13	***5***
OR	Hood River	Blueberries	29	25
OR	Hood River	Apples	2,592	2,488
OR	Hood River	Grapes	63	18
OR	Multnomah	Cherries	1,568	3,372
OR	Multnomah	Apples	51	49
OR	Multnomah	Raspberries	741	1,601
OR	Multnomah	Grapes	28	8
OR	Multnomah	Blackberries	65	1,050
OR	Multnomah	Plums and Prunes	3	12
OR	Multnomah	Peaches	38	24
OR	Multnomah	Strawberries	171	2,813
OR	Multnomah	Blueberries	545	15,982
OR	Sherman			none
OR	Umatilla	Apples	3,927	3,770
OR	Umatilla	Plums and Prunes	365	701
OR	Umatilla	Cherries	1,888	4,493
OR	Umatilla	Strawberries	9	148

OR	Umatilla	Grapes	1,123	314
OR	Umatilla	Peaches	7	7
OR	Wasco	Apples	463	60
OR	Wasco	Apples	463	445
WA	Clark	Grapes	32	minimal
WA	Clark	Raspberries	860	***10,320***
WA	Clark	Blueberries	130	***390***
WA	Clark	Plums and Prunes	10	41
WA	Clark	Cherries	2	1
WA	Clark	Apples	33	***13***
WA	Cowlitz	Apples	14	***6***
WA	Skamania	Apples	75	***30***
WA	Walla Walla	Cherries	280	78
WA	Walla Walla	Apples	5,222	***2,089***

This Upper Columbia River Steelhead ESU occupies portions of several large agricultural zones where, in some cases, there may be extensive use of captan. The short half life of the active ingredient significantly reduces the potential exposure of T&E fish species, however in my judgement the extensive use prevents complete exclusion of all potential effects. High water flow rates lead me to believe that captan may affect, but is not likely to adversely affect, the Upper Columbia River Steelhead ESU .

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. Baker County, Oregon, which has a tiny fragment of the Imnaha River watershed was excluded. 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 captan use in agricultural areas. Similarly excluded are 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. They have been excluded because they are not relevant to use of captan. 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 it was not able to exclude it.

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

Tables 25 and 26 show the cropping information for the Pacific Northwest counties where the Snake River Basin steelhead ESU is located and for the Oregon and Washington counties where this ESU migrates.

Table 25 .

St	County	Crops	Acres	Captan Use (lbs)
ID	Adams			none
ID	Clearwater			none
ID	Idaho			none
ID	Lemhi			none
ID	Latah			none
ID	Lewis			none
ID	Nez Perce			none
ID	Valley			none
OR	Hood River	Peaches	13	***5***
OR	Hood River	Blueberries	29	25
OR	Hood River	Apples	2,592	2,488

OR	Hood River	Grapes	63	18
OR	Wasco	Apples	463	60
WA	Adams	Apples	3,457	***1,383***
WA	Asotin	Cherries	17	5
WA	Asotin	Apples	24	***10***
WA	Columbia			none
WA	Franklin	Apples	9,000	***3,600***
WA	Franklin	Peaches	262	335
WA	Franklin	Strawberries	17	411
WA	Franklin	Raspberries	70	382
WA	Franklin	Cherries	2,165	606
WA	Franklin	Plums and Prunes	43	174
WA	Garfield			none
WA	Pacific			none
WA	Skamania	Apples	75	***30***
WA	Wahkiakum			none
WA	Walla Walla	Cherries	280	78
WA	Walla Walla	Apples	5,222	***2,089***
WA	Whitman			none
WA	Whitman	Apples	19	8

Table 26:. Crops on which Captan can be used in Washington and Oregon counties through which the Snake River Basin steelhead ESU migrates

St	County	Crops	Acres	Captan Use (lbs)
OR	Columbia	Plums and Prunes	2	1
OR	Columbia	Cherries	7	3
OR	Columbia	Grapes	6	<1
OR	Columbia	Raspberries	1	1

OR	Columbia	Apples	39	5
OR	Multnomah	Cherries	1,568	3,372
OR	Multnomah	Apples	51	49
OR	Multnomah	Blackberries	65	1,050
OR	Multnomah	Raspberries	741	1,601
OR	Multnomah	Plums and Prunes	3	12
OR	Multnomah	Peaches	38	24
OR	Multnomah	Strawberries	171	2,813
OR	Multnomah	Blueberries	545	15,982
OR	Multnomah	Grapes	28	8
OR	Sherman			none
OR	Umatilla	Cherries	1,888	706
OR	Umatilla	Strawberries	9	16
OR	Umatilla	Grapes	1,123	34
OR	Umatilla	Peaches	7	2
OR	Umatilla	Plums and Prunes	365	137
OR	Umatilla	Apples	3,927	511
OR	Wasco	Apples	463	60
WA	Benton	Cherries	3,219	901
WA	Benton	Apples	18,425	***7,370***
WA	Benton	Peaches	149	60
WA	Benton	Plums and Prunes	180	729
WA	Benton	Grapes	16,929	minimal
WA	Clark	Plums and Prunes	10	41
WA	Clark	Apples	33	***13***
WA	Clark	Cherries	2	1
WA	Clark	Blueberries	130	***390***

WA	Clark	Grapes	32	minimal
WA	Clark	Raspberries	860	***10,320***
WA	Cowlitz	Raspberries	634	***3,457***
WA	Cowlitz	Strawberries	162	221
WA	Cowlitz	Apples	33	***13***
WA	Walla Walla	Cherries	280	14
WA	Walla Walla	Apples	5,222	***2,089***
WA	Whitman	Apples	19	5

This Snake River Basin Steelhead ESU occupies portions of several large agricultural zones where, in some cases, there is extensive use of captan. The short half life of the active ingredient significantly reduces the potential exposure of T&E fish species, however the extensive use prevents complete exclusion of all potential effects. I conclude, however, that captan may affect, but is not likely to adversely affect the Snake River Basin Steelhead ESU.

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 captan 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 27 and 28 show the cropping information for Oregon counties where the Upper Willamette River steelhead ESU is located and for the Oregon and Washington counties where this ESU migrates.

Table 27. Crops on which captan can be used that are part of the spawning and rearing habitat of the Upper Willamette River steelhead ESU.

St	County	Crops	Acres	Captan Used (lbs)
OR	Benton	Cherries	18	43
OR	Benton	Grapes	242	68
OR	Benton	Peaches	8	15
OR	Benton	Plums and Prunes	5	20
OR	Benton	Blackberries	3	49
OR	Benton	Raspberries	2	4
OR	Benton	Apples	50	48
OR	Benton	Blueberries	109	3,196
OR	Benton	Strawberries	17	280
OR	Clackamas	Raspberries	1,435	3,100
OR	Clackamas	Blackberries	718	11,596
OR	Clackamas	Strawberries	608	9,145
OR	Clackamas	Blueberries	334	9,975
OR	Clackamas	Cherries	53	126
OR	Clackamas	Peaches	37	71
OR	Clackamas	Apples	167	160
OR	Clackamas	Grapes	207	58
OR	Clackamas	Plums and Prunes	37	150
OR	Linn	Grapes	93	26

OR	Linn	Apples	133	128
OR	Linn	Peaches	73	140
OR	Linn	Raspberries	387	836
OR	Linn	Strawberries	52	855
OR	Linn	Blueberries	58	1,701
OR	Linn	Plums and Prunes	14	57
OR	Linn	Blackberries	58	996
OR	Linn	Cherries	157	374
OR	Marion	Peaches	179	344
OR	Marion	Plums and Prunes	145	587
OR	Marion	Apples	555	532
OR	Marion	Cherries	1,568	3,731
OR	Marion	Blackberries	545	8,802
OR	Marion	Raspberries	546	1,245
OR	Marion	Strawberries	1,858	23,411
OR	Marion	Blueberries	545	1,628
OR	Marion	Grapes	761	213
OR	Polk	Apples	10	10
OR	Polk	Grapes	1,123	314
OR	Polk	Blackberries	21	321
OR	Polk	Strawberries	22	362
OR	Polk	Blueberries	21	615
OR	Polk	Peaches	36	69
OR	Polk	Plums and Prunes	595	2,410
OR	Polk	Cherries	1,888	4,493
OR	Washington	Grapes	989	277
OR	Washington	Apples	229	220

OR	Washington	Cherries	211	502
OR	Washington	Peaches	168	323
OR	Washington	Plums and Prunes	358	1,450
OR	Washington	Blackberries	654	10,006
OR	Washington	Raspberries	1,150	2,484
OR	Washington	Strawberries	1,257	20,678
OR	Washington	Blueberries	654	19,179
OR	Yamhill	Strawberries	265	4,359
OR	Yamhill	Blackberries	324	5,233
OR	Yamhill	Peaches	104	200
OR	Yamhill	Plums and Prunes	389	1,576
OR	Yamhill	Raspberries	114	246
OR	Yamhill	Blueberries	324	9,501
OR	Yamhill	Grapes	2,887	808
OR	Yamhill	Apples	310	298
OR	Yamhill	Cherries	1,693	4,029

Table 28. Crops on which captan 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	Captan Use (lbs)
OR	Clackamas	Blackberries	718	11,596
OR	Clackamas	Strawberries	608	9,145
OR	Clackamas	Blueberries	334	9,975
OR	Clackamas	Cherries	53	126
OR	Clackamas	Raspberries	1,435	3,100
OR	Clackamas	Peaches	37	71
OR	Clackamas	Apples	167	160

OR	Clackamas	Grapes	207	58
OR	Clackamas	Plums and Prunes	37	150
OR	Clatsop			none
OR	Multnomah	Apples	51	49
OR	Multnomah	Cherries	1,568	3,372
OR	Multnomah	Raspberries	741	1,601
OR	Multnomah	Blackberries	65	1,050
OR	Multnomah	Plums and Prunes	3	12
OR	Multnomah	Peaches	38	24
OR	Multnomah	Strawberries	171	2,813
OR	Multnomah	Blueberries	545	15,982
OR	Multnomah	Grapes	28	8
WA	Clark	Cherries	2	1
WA	Clark	Raspberries	860	***10,320***
WA	Clark	Blueberries	130	***390***
WA	Clark	Plums and Prunes	10	41
WA	Clark	Apples	33	***13***
WA	Clark	Grapes	32	minimal
WA	Cowlitz	Apples	33	***13***
WA	Cowlitz	Raspberries	634	***3,457***
WA	Cowlitz	Strawberries	162	221

The Upper Willamette River Steelhead ESU includes numerous agricultural zones where captan is, or can be, applied. These zones are present in both the migratory corridor and in the more sensitive spawning and rearing portions of the ESU. The large volume of product used (actual or potential) prevents a determination of no possible effect from captan use, however I believe the high water flow rates and short life span of the parent ingredient will not cause serious adverse effects on salmon and steelhead within the ESU. I conclude that captan may affect, but is not likely to adversely affect, the Upper Willamette River Steelhead ESU.

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 29 and 30 show the cropping information for Oregon and Washington counties where the Lower Columbia River steelhead ESU is located and for the Oregon and Washington counties where this ESU migrates.

Table 29. .

St	County	Crops	Acres	Captan Use (lbs)
OR	Clatsop			
OR	Hood River	Blueberries	29	850
OR	Hood River	Apples	2,592	2,488
OR	Hood River	Peaches	13	25
OR	Hood River	Grapes	63	14
OR	Multnomah	Apples	51	49
OR	Multnomah	Cherries	1,568	3,372
OR	Multnomah	Blackberries	65	1,050

OR	Multnomah	Raspberries	741	1,601
OR	Multnomah	Plums and Prunes	3	12
OR	Multnomah	Grapes	28	8
OR	Multnomah	Strawberries	171	2,813
OR	Multnomah	Peaches	38	24
OR	Multnomah	Blueberries	545	15,982
WA	Cowlitz	Raspberries	634	***3,457***
WA	Cowlitz	Strawberries	162	221
WA	Cowlitz	Apples	33	***13***
WA	Pacific			none
WA	Skamania	Apples	75	***30***

Table 30: Crops and acreage where Captan can be used in counties that are migratory corridors for the Lower Columbia River Steelhead ESU.

St	County	Crops	Acres	Captan Use (lbs)
OR	Columbia	Grapes	6	2
OR	Columbia	Cherries	7	17
OR	Columbia	Plums and Prunes	2	3
OR	Columbia	Raspberries	1	2
OR	Columbia	Apples	39	37
WA	Pacific			none

The Lower Columbia River Steelhead ESU contains a few areas of moderate captan usage, however the generally large size and high flow rates expected in this area should provide for high rates of dissipation and dilution. This, and the proximity of the area to an oceanic sink, lead me to believe that no effects from captan will be seen in either the major waterways or the smaller tributaries associated with the mainstem of the Columbia.

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 captan because there are only 716 acres of potential use sites in Skamania for captan, and it would be expected that these acres would be in the agricultural rather than forest areas of the county.

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

In the John Day River watershed, I have excluded Harney County, Oregon because there is only a tiny amount of the John Day River and several tributary creeks (e.g., Utley, Bear Cougar creeks) which get into high elevation areas (approximately 1700M and higher) of northern Harney County where there are no crops grown. Similarly, the Umatilla River and Walla Walla River get barely into Union County OR, and the Walla Walla River even gets into a tiny piece of Wallowa County, Oregon. But again, these are high elevation areas where crops are not grown, and are excluded 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 31 and 32 show the cropping information for Oregon and Washington counties where the Middle Columbia River steelhead ESU is located and for the Oregon and Washington counties where this ESU migrates.

Table 31.

State	County	Crop	Acres	Captan Use (lbs)
OR	Benton	Peaches	8	15
OR	Benton	Plums and Prunes	5	20
OR	Benton	Grapes	242	68
OR	Benton	Blackberries	3	3
OR	Benton	Cherries	18	43
OR	Benton	Raspberries	2	12
OR	Benton	Apples	50	48
OR	Benton	Blueberries	109	3,197
OR	Benton	Strawberries	17	280
OR	Clatsop			none
OR	Columbia	Apples	39	37
OR	Columbia	Plums and Prunes	2	3
OR	Columbia	Grapes	6	2
OR	Columbia	Cherries	7	17
OR	Columbia	Raspberries	1	2
OR	Crook			none
OR	Gilliam			none
OR	Jefferson	Apples	4	4
OR	Umatilla	Strawberries	9	59
OR	Umatilla	Apples	3,927	3,770
OR	Umatilla	Cherries	1,888	4,493
OR	Umatilla	Peaches	7	13
OR	Umatilla	Plums and Prunes	365	1,478
OR	Umatilla	Grapes	1,123	314
WA	Franklin	Raspberries	70	382

WA	Franklin	Strawberries	17	23
WA	Franklin	Plums and Prunes	43	174
WA	Franklin	Peaches	262	49
WA	Franklin	Cherries	2,165	606
WA	Franklin	Apples	9,000	***3,600***
WA	Grant	Cherries	3,470	971
WA	Grant	Grapes	3,132	minimal
WA	Grant	Apples	33,615	***13.446***
WA	Grant	Peaches	261	***104***
WA	Kittitas			none
WA	Kittitas	Apples	1,859	***744***
WA	Walla Walla	Cherries	280	78
WA	Walla Walla	Apples	5,222	***2,089***
WA	Yakima	Apples	75,264	***30,106***
WA	Yakima	Grapes	15,526	minimal
WA	Yakima	Strawberries	10	242
WA	Yakima	Plums and Prunes	478	1,935
WA	Yakima	Peaches	1,438	575
WA	Yakima	Cherries	6,129	1,716
WA	Yakima	Raspberries	10	55

Table 32. Crops on which captan can be used in Washington and Oregon counties through which the Middle Columbia River steelhead ESU migrates

St	County	Crops	Acres	Captan Use (lbs)
OR	Columbia	Raspberries	1	2
OR	Columbia	Plums and Prunes	2	9
OR	Columbia	Cherries	7	17
OR	Columbia	Grapes	6	14

OR	Columbia	Apples	39	37
OR	Hood River	Peaches	13	25
OR	Hood River	Apples	2,592	2,488
OR	Hood River	Grapes	63	18
OR	Hood River	Blueberries	29	850
OR	Multnomah	Apples	51	49
OR	Multnomah	Cherries	1,568	3,372
OR	Multnomah	Plums and Prunes	3	12
OR	Multnomah	Grapes	28	8
OR	Multnomah	Peaches	38	24
OR	Multnomah	Raspberries	741	1,601
OR	Multnomah	Strawberries	171	2,813
OR	Multnomah	Blackberries	65	66
OR	Multnomah	Blueberries	545	15,982
WA	Clark	Plums and Prunes	10	4
WA	Clark	Cherries	2	0.1
WA	Clark	Grapes	32	minimal
WA	Clark	Raspberries	162	883
WA	Clark	Apples	33	9
WA	Cowlitz	Strawberries	162	221
WA	Cowlitz	Raspberries	634	3,457

The Middle Columbia River Steelhead ESU contains numerous agricultural zones where captan is, or potentially could, be used. As in most other downstream watersheds, there is a considerable volume of water present, high oxygenation, and rapid flow. These factors tend to dissipate and degrade contaminants faster than seen in small, slow streams elsewhere**.** Although there is likely to be no adverse effects from the use of captan, the potential can not be entirely eliminated due to the potential volume of use. I conclude that captan may affect, but is not likely to adversely affect the Middle Columbia River Steelhead ESU.**.**

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.

Coast-wide, 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 Redds 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 estuary 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 estuary waters, north of the Oakland Bay Bridge, to the ocean. Estuary sloughs in San Pablo and San Francisco bays are excluded (58FR33212-33219, June 16, 1993).

Table 33 shows the Captan usage in California counties supporting the Sacramento River winter-run chinook salmon ESU.

Table 33. Use of Captan 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)	Captan Applied (lbs)	Acres
Alameda		none	
Butte	Almond	4,818	2,232
Butte	Landscape Maint.	1	NR
Butte	Corn (fodder)	2	136
Butte	Cotton	1	4
Butte	Safflower	<1	72
Butte	Plum	12	8
Butte	Prune	7,491	2,727
Colusa	Almond	417	1,232
Colusa	Prune	1,336	414
Contra Costa		none	
Glenn	Almond	6,954	2,474
Glenn	Strawberries	389	118
Glenn	Sunflower	1	290
Glenn	Outdoor Transplant	142	65
Glenn	Corn (fodder)	4	450
Glenn	Prune	6,206	2,337
Marin		none	

Merced	Almond	15,998	6,541
Merced	Commodity Fumigation	29	7
Merced	Nectarine	5	2
Merced	Ornamentals	390	199
Merced	Blueberry	93	58
Merced	Cantaloupe	1	12
Merced	Corn (human consump)	8	772
Merced	Corn (Fodder)	48	23,717
Nevada		none	
Placer	Outdoor Plants	4	1
Placer	Prune	688	235
Sacramento	Nectarine	3	2
Sacramento	Peach	24	11
Sacramento	Strawberries	69	28
Sacramento	Safflower	<1	51
Sacramento	Plum	3	1
San Francisco		none	
San Mateo	Outdoor Flowers	10	10
San Joaquin	Almonds	10,698	3,992
San Joaquin	Corn (fodder)	4	351
San Joaquin	Grape	290	151
San Joaquin	Out Door Transplants	1,456	614
San Joaquin	Peach	717	255
Shasta	Outdoor Transplants	929	388
Shasta	Peach	2	3
Shasta	Prune	267	91
Shasta	Apple	4	28

Solano	Corn (fodder)	<1	89
Solano	Grape, Wine	20	32
Solano	Prune	81	28
Sonoma	Landscape	<1	NR
Sonoma	Apple	95	45
Stanislaus	Almond	24,195	8,840
Stanislaus	Outdoor Plants	1	10
Stanislaus	Outdoor Transplants	39	160
Stanislaus	Peach	1,046	167
Stanislaus	Tomato (Processing)	7	308
Sutter	Almond	58	30
Sutter	Apple	366	250
Sutter	Beans	677	NR
Sutter	Corn (fodder)	12	288
Sutter	Sunflower	<1	76
Sutter	Peach	176	60
Sutter	Prune	18,908	7,467
Tehama	Almond	4,640	2,481
Tehama	Outdoor Transplants	252	97
Tehama	Prune	4,962	7,966
Yolo	Almonds	<1	NR
Yolo	Corn (fodder)	2	362
Yolo	Landscape Maint.	2	374
Yolo	Cotton	10	16
Yolo	Grape, Wine	1	NR
Yolo	Prune	762	313
Yolo	Sudangrass	245	NR
Yolo	Sunflower	1427	NR

This large California Sacramento River Winter-run Chinook ESU includes many agricultural sites, however most are small or modest in size and overall captan use is low. In addition, the Sacramento River has substantial flow to provide for dilution of any captan that did enter the river. My conclusion is that there will be no effect from captan use to the California Sacramento River Winter-run Chinook ESU.

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, they were excluded them from consideration because captan would not be used in these areas.

Tables 34 and 35 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 34

St	County	Crops	Acres	Captan Use (lbs)
ID	Adams			none
ID	Clearwater			none
ID	Idaho			none
ID	Lemhi			none
ID	Latah			none
ID	Lewis			none
ID	Nez Perce			none
ID	Valley			none
OR	Union	Peach	12	15
OR	Union	Cherries	596	170
OR	Union	Apples	3,927	***1,571***
OR	Union	Plums and Prunes	365	1,460
OR	Wasco	Apples	463	184
WA	Adams	Apples	3,457	***1,383***
WA	Asotin	Apples	24	***10***
WA	Asotin	Cherries	17	5
WA	Franklin	Strawberries	17	411
WA	Franklin	Cherries	2,165	606
WA	Franklin	Raspberries	70	382
WA	Franklin	Peaches	262	335
WA	Franklin	Apples	9,000	***3,600***
WA	Franklin	Plums and Prunes	43	174
WA	Garfield			none
WA	Skamania	Apples	75	***30***
WA	Walla Walla	Apples	5,222	***2,089***
WA	Walla Walla	Cherries	280	78
WA	Whitman			none
WA	Whitman	Apples	19	8

Table 35 Crops on which Captan 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	Captan Use (lbs)
ID	Adams			none
ID	Clearwater			none
ID	Idaho			none
ID	Lemhi			none
ID	Latah			none
ID	Lewis			none
ID	Nez Perce			none
ID	Valley			none
OR	Clatsop			none
OR	Columbia	Raspberries	1	1
OR	Columbia	Plums and Prunes	2	1
OR	Columbia	Cherries	7	3
OR	Columbia	Grapes	6	0.2
OR	Columbia	Apples	39	5
OR	Hood River	Blueberries	29	87
OR	Hood River	Apples	2,592	338
OR	Hood River	Grapes	63	2
OR	Hood River	Peaches	13	4
OR	Multnomah	Cherries	1,568	586
OR	Multnomah	Apples	51	7
OR	Multnomah	Grapes	28	1
OR	Multnomah	Raspberries	741	710
OR	Multnomah	Plums and Prunes	3	1
OR	Multnomah	Blackberries	65	66
OR	Multnomah	Strawberries	171	305
OR	Multnomah	Peaches	38	12

OR	Multnomah	Blueberries	545	1,628
OR	Sherman			none
OR	Umatilla	Cherries	1,888	706
OR	Umatilla	Plums and Prunes	365	137
OR	Umatilla	Grapes	1,123	34
OR	Umatilla	Strawberries	9	16
OR	Umatilla	Peaches	7	2
OR	Umatilla	Apples	3,927	511
OR	Wasco	Apples	463	60
WA	Benton	Peaches	149	***60***
WA	Benton	Cherries	3,219	901
WA	Benton	Apples	18,425	***7,370***
WA	Benton	Grapes	16,929	minimal
WA	Benton	Plums and Prunes	180	***729***
WA	Clark	Plums and Prunes	10	41
WA	Clark	Raspberries	162	***10,320***
WA	Clark	Grapes	32	minimal
WA	Clark	Blueberries	130	***390***
WA	Clark	Cherries	2	1
WA	Clark	Apples	33	***13***
WA	Cowlitz	Raspberries	634	***10,320***
WA	Cowlitz	Strawberries	162	221

Within the Snake River, Fall-run Chinook ESU, the upstream spawning and rearing areas are located near areas of moderate agricultural use of captan. The long migratory corridor, however, passes through many areas of large scale agriculture and associated captan use. Due to high water flow in the lower portions of the ESU, there will not be significant adverse effects. The presence of captan throughout the ESU does not, however, allow me to presume there will be no effects. Captan may affect, but is not likely to adversely affect, the Snake River, Fall-run Chinook ESU.

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

Table 36 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 35 above.

Table 36

St	County	Crops	Acres	Captan Use (lbs)
OR	Union	Cherries	596	170
OR	Union	Apples	3,927	***1,571***
OR	Union	Peach	12	15
OR	Union	Plums and Prunes	365	1,460
OR	Wasco	Apples	463	60
OR	Wallowa	Apples	8	2
WA	Asotin	Cherries	17	1
WA	Asotin	Apples	24	7
WA	Franklin	Cherries	2,165	110

WA	Franklin	Raspberries	70	382
WA	Franklin	Apples	9,000	2,421
WA	Franklin	Plums and Prunes	43	37
WA	Franklin	Strawberries	17	23
WA	Franklin	Peaches	262	49
WA	Walla Walla	Apples	5,222	1,405
WA	Walla Walla	Cherries	280	14
WA	Whitman	Apples	19	5

Within the Snake River, Spring/Summer-run Chinook ESU, the upstream spawning and rearing areas are located near areas of moderate agricultural use of captan. The long migratory corridor, however, passes through many areas of large scale agriculture and associated captan use. Due to high water flow in the lower portions of the ESU, there will not be significant adverse effects. The presence of captan throughout the ESU does not, however, allow me to presume there will be no effects. Captan may affect, but is not likely to adversely affect, the Snake River, Spring/Summer-run Chinook ESU.

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 Thomas (upstream barrier - Black Butte Dam), Sacramento-Stone Corral, Lower Butte (upstream barrier - Chesterville Dam), Lower Feather (upstream barrier - Orville Dam), Lower Yuba, Lower Bear (upstream barrier - Camp Far West Dam), Lower Sacramento, Sacramento-Upper Clear (upstream barriers - Keswick Dam, Whiskey town dam), Upper Elder-Upper Thomas, 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 37 contains usage information for the California counties supporting the Central Valley spring-run chinook salmon ESU.

Table 37

County	Crop(s)	Acres	Captan Applied (lbs)
Butte	Almond	4,818	2,232
Butte	Corn (fodder)	2	136
Butte	Cotton	1	4
Butte	Landscape Maint.	1	NR
Butte	Plum	12	8
Butte	Prune	7,491	2,727
Butte	Safflower	<1	72
Colusa	Almond	417	1,232
Colusa	Prune	1,336	414
Contra Costa			none
Glenn	Almond	6,954	2,474
Glenn	Corn (fodder)	4	450
Glenn	Outdoor Transplant	142	65
Glenn	Prune	6,206	2,337
Glenn	Strawberries	389	118
Glenn	Sunflower	1	290
Marin			none
Merced	Almond	15,998	6,541
Merced	Blueberry	93	58
Merced	Cantaloupe	1	12
Merced	Commodity Fumigation	29	7
Merced	Corn (human consump)	8	772
Merced	Corn (Fodder)	48	23,717
Merced	Nectarine	5	2
Merced	Ornamentals	390	199
Nevada			none
Placer	Outdoor Plants	4	1
Placer	Prune	688	235

Sacramento	Nectarine	3	2
Sacramento	Peach	24	11
Sacramento	Plum	3	1
Sacramento	Safflower	<1	51
Sacramento	Strawberries	69	28
San Francisco			none
San Joaquin	Corn (fodder)	4	351
San Joaquin	Grape	290	151
San Joaquin	Out Door Transplants	1,456	614
San Joaquin	Almonds	10,698	3,992
San Joaquin	Peach	717	255
San Mateo	Outdoor Flowers	10	10
Shasta	Apple	4	28
Shasta	Outdoor Transplants	929	388
Shasta	Peach	2	3
Shasta	Prune	267	91
Solano	Corn (fodder)	<1	89
Solano	Grape, Wine	20	32
Solano	Prune	81	28
Sonoma	Landscape	<1	NR
Sonoma	Apple	95	45
Stanislaus	Almond	24,195	8,840
Stanislaus	Outdoor Plants	1	10
Stanislaus	Outdoor Transplants	39	160
Stanislaus	Peach	1,046	167
Stanislaus	Tomato (Processing)	7	308
Sutter	Almond	58	30
Sutter	Apple	366	250
Sutter	Beans	677	NR
Sutter	Corn (fodder)	12	288

Sutter	Peach	176	60
Sutter	Prune	18,908	7,467
Sutter	Sunflower	<1	76
Tehama	Almond	4,640	2,481
Tehama	Outdoor Transplants	252	97
Tehama	Prune	4,962	7,966
Yolo	Almonds	<1	NR
Yolo	Corn (fodder)	2	362
Yolo	Cotton	2	374
Yolo	Grape, Wine	10	16
Yolo	Landscape Maint.	1	NR
Yolo	Prune	762	313
Yolo	Sudangrass	245	NR
Yolo	Sunflower	1427	NR
Yuba	Almond	241	80
Yuba	Apple	247	168
Yuba	Peach	88	30
Yuba	Plum	29	10
Yuba	Prune	8,984	3,658

The Central Valley Spring-run Chinook ESU includes many agricultural sites, however most are small or modest and overall captan use is relatively low. In light of the additional recommendations on captan in California, I conclude that the use of captan will have no effect on the Central Valley Spring-run Chinook Salmon ESU.

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 estuary 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 Captan 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 Captan would not be used in the forested upper elevation areas.

Table 38 contains usage information for the California counties supporting the California coastal chinook salmon ESU.

Table 38.

County	Crop(s)	Captan Use (lbs)	Acres
Humboldt		none	
Lake		none	
Sonoma	Apple	95	45
Sonoma	Landscape	2	NR
Trinity		none	

The California Coastal Chinook salmon ESU has minimal use of captan there will be no effect.

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, estuary, 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 39 shows the cropping information for Washington counties where the Puget Sound chinook salmon ESU is located.

Table 39

St	County	Crops	Acres	Captan Use (lbs)
WA	Clallam	Apples	29	***12***
WA	Grays Harbor	Apples	5	***2***

WA	Grays Harbor	Cherries	1	<1
WA	Island	Apples	18	***7***
WA	Island	Grapes	14	minimal
WA	Jefferson	Raspberries	2	***20***
WA	King	Apples	21	***2***
WA	King	Cherries	8	1
WA	King	Grapes	2	minimal
WA	King	Peaches	1	<1
WA	King	Plums and Prunes	4	1.5
WA	King	Blueberries	32	***96***
WA	King	Raspberries	26	***312***
WA	King	Strawberries	42	57
WA	Kitsap	Blueberries	5	***15***
WA	Kitsap	Apples	64	***26***
WA	Kitsap	Cherries	6	<1
WA	Kitsap	Grapes	8	minimal
WA	Kitsap	Raspberries	9	***108***
WA	Kitsap	Strawberries	7	10
WA	Lewis	Apples	77	21
WA	Lewis	Grapes	4	minimal
WA	Lewis	Plums and Prunes	3	1
WA	Lewis	Blueberries	137	***1,644***
WA	Lewis	Cherries	10	<1
WA	Mason	Blueberries	1	4
WA	Mason	Apples	5	2
WA	Mason	Cherries	1	<1
WA	Pierce	Apples	61	***24***
WA	Pierce	Cherries	5	<1
WA	Pierce	Blackberries	27	NR

WA	Pierce	Raspberries	108	589
WA	Pierce	Strawberries	125	171
WA	Pierce	Blueberries	70	***168***
WA	San Juan	Apples	64	***26***
WA	San Juan	Cherries	1	<1
WA	San Juan	Peach	1	<1
WA	San Juan	Raspberries	2	9
WA	San Juan	Strawberries	2	3
WA	San Juan	Grapes	13	minimal
WA	Skagit	Plums and Prunes	2	1
WA	Skagit	Raspberries	1,088	***6,528***
WA	Skagit	Strawberries	281	384
WA	Skagit	Apples	357	***143***
WA	Snohomish	Grapes	1	minimal
WA	Snohomish	Plums and Prunes	1	<1
WA	Snohomish	Raspberries	71	387
WA	Snohomish	Strawberries	81	111
WA	Snohomish	Apples	47	13
WA	Snohomish	Cherries	3	0.2
WA	Thurston	Blueberries	96	408
WA	Thurston	Raspberries	25	***150***
WA	Thurston	Strawberries	74	101
WA	Thurston	Apples	23	1
WA	Thurston	Cherries	4	<1
WA	Thurston	Raspberries	5,255	***31,530***
WA	Whatcom	Blueberries	482	***1,446***
WA	Whatcom	Strawberries	297	406
WA	Whatcom	Apples	174	***70***
WA	Whatcom	Cherries	4	<1
WA	Whatcom	Grapes	10	minimal

The Puget Sound Chinook ESU is located in an area of dense urban development, which alters dispersal patterns. Focal areas of agriculture with large applications of captan are present. Although there will, in my opinion, be no significant adverse effects, the presence of significant agriculture, urban complexity, and the enclosed flow patterns in Puget Sound (as opposed to open ocean) prevent a determination that no effects will be seen. Therefore, captan may affect, but is not likely to adversely affect, the Puget Sound Chinook Salmon ESU.

7. Lower Columbia River Chinook Salmon ESU

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

The hydrologic units and upstream barriers are the Middle Columbia-Hood (upstream barriers - Condit Dam, The Dalles Dam), Lower Columbia-Sandy (upstream barrier - Bull Run Dam 2), Lewis (upstream barrier - Merlin Dam), Lower Columbia-Clatskanie, Upper Cowlitz, Lower Cowlitz, Lower Columbia, Clackamas, and the Lower Willamette. Spawning and rearing habitat would be in the counties of Hood River, Waco, 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. Pierce County, Washington was excluded because the very small part of the Cowlitz River watershed in this county is at a high elevation where captan would not be used.

Tables 40 shows the cropping information for Oregon and Washington counties where the Lower Columbia River chinook salmon ESU occurs.

Table 40.

St	County	Crops	Acres	Captan Use (lbs)
WA	Clark	Apples	33	9
WA	Clark	Plums and Prunes	10	4
WA	Clark	Raspberries	162	883
WA	Clark	Grapes	32	minimal
WA	Clark	Cherries	2	0.1
OR	Columbia	Apples	39	5
OR	Columbia	Grapes	6	<1
OR	Columbia	Cherries	7	3
OR	Columbia	Plums and Prunes	2	1

OR	Columbia	Raspberries	1	1
WA	Cowlitz	Raspberries	634	3,457
WA	Cowlitz	Strawberries	162	221
OR	Hood River	Peaches	13	4
OR	Hood River	Blueberries	29	87
OR	Hood River	Grapes	63	2
OR	Hood River	Apples	2,592	338
WA	Klickitat	Apples	616	166
WA	Klickitat	Cherries	457	23
WA	Klickitat	Grapes	419	minimal
WA	Klickitat	Peaches	199	37
WA	Klickitat	Plums and Prunes	1	0.4
WA	Lewis	Apples	77	21
WA	Lewis	Grapes	4	minimal
WA	Lewis	Plums and Prunes	3	1
WA	Lewis	Blueberries	137	582
WA	Lewis	Cherries	10	0.5
OR	Marion	Strawberries	1,858	3,310
OR	Marion	Blueberries	545	1,628
OR	Marion	Blackberries	2,935	3,000
OR	Marion	Apples	555	72
OR	Marion	Cherries	1,568	5586
OR	Marion	Grapes	761	23
OR	Marion	Peaches	179	55
OR	Marion	Plums and Prunes	145	54
OR	Marion	Strawberries	1,858	3,310
OR	Multnomah	Apples	51	7
OR	Multnomah	Cherries	1,568	586
OR	Multnomah	Plums and Prunes	3	1
OR	Multnomah	Grapes	28	1

OR	Multnomah	Raspberries	741	710
OR	Multnomah	Blackberries	65	66
OR	Multnomah	Blueberries	545	1,628
OR	Multnomah	Strawberries	171	305
OR	Washington	Apples	229	30
OR	Washington	Cherries	211	79
OR	Washington	Peaches	168	51
OR	Washington	Plums and Prunes	358	134
OR	Washington	Blackberries	654	669
OR	Washington	Raspberries	1,150	1,101
OR	Washington	Strawberries	1,257	2,239
OR	Washington	Blueberries	654	1,954
OR	Wasco	Apples	463	60

The Lower Columbia Chinook Salmon ESU is located in an area of scattered, albeit moderately high, agriculture with the potential for large applications of captan. The presence of significant agriculture, some urban areas, and the size of the Columbia River tributaries leads me to determine that captan may affect, but is not likely to adversely affect, the Lower Columbia River Chinook Salmon ESU.

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

Tables 41 and 42 show the cropping information for Oregon counties where the Upper Willamette River chinook salmon ESU occurs and for the Oregon and Washington counties where this ESU migrates.

Table 41..

St	County	Crops	Acres	Captan Use (lbs)
OR	Columbia	Apples	39	5
OR	Columbia	Raspberries	1	1
OR	Columbia	Grapes	6	<1
OR	Columbia	Cherries	7	3
OR	Columbia	Plums and Prunes	2	1
OR	Hood River	Blueberries	29	87
OR	Hood River	Apples	2,592	338
OR	Hood River	Peaches	13	4
OR	Hood River	Grapes	63	2
OR	Lane	Peaches	54	259
OR	Lane	Grapes	431	889
OR	Lane	Cherries	249	934
OR	Lane	Apples	174	111
OR	Lane	Plums and Prunes	34	46
OR	Lane	Raspberries	20	587
OR	Lane	Blueberries	91	1,469
OR	Linn	Grapes	93	26
OR	Linn	Apples	133	128
OR	Linn	Peaches	73	140
OR	Linn	Raspberries	387	836
OR	Linn	Strawberries	52	855
OR	Linn	Blueberries	58	1,701
OR	Linn	Plums and Prunes	14	57
OR	Linn	Blackberries	58	996
OR	Linn	Cherries	157	374

OR	Marion	Cherries	1,568	5586
OR	Marion	Grapes	761	23
OR	Marion	Grapes	761	23
OR	Marion	Apples	555	72
OR	Marion	Blackberries	2,935	3,000
OR	Marion	Blueberries	545	1,628
OR	Marion	Strawberries	1,858	3,310
OR	Marion	Peaches	179	55
OR	Marion	Peaches	179	55
OR	Marion	Strawberries	1,858	3,310
OR	Marion	Plums and Prunes	145	54
OR	Marion	Strawberries	1,858	3,310
OR	Marion	Plums and Prunes	145	54
OR	Multnomah	Apples	51	7
OR	Multnomah	Cherries	1,568	586
OR	Multnomah	Raspberries	741	710
OR	Multnomah	Blackberries	65	66
OR	Multnomah	Grapes	28	1
OR	Multnomah	Strawberries	171	305
OR	Multnomah	Plums and Prunes	3	1
OR	Multnomah	Blueberries	545	1,628
OR	Umatilla	Cherries	1,888	706
OR	Umatilla	Grapes	1,123	34
OR	Umatilla	Peaches	7	2
OR	Umatilla	Strawberries	9	16
OR	Umatilla	Apples	3,927	511
OR	Umatilla	Plums and Prunes	365	137
OR	Wasco	Apples	463	60
WA	Chelan	Cherries	3,704	189
WA	Chelan	Apples	17,096	4,599

WA	Chelan	Grapes	2,813	minimal
WA	Clark	Raspberries	162	883
WA	Clark	Plums and Prunes	10	4
WA	Clark	Grapes	32	minimal
WA	Clark	Apples	33	9
WA	Clark	Cherries	2	0.1
WA	Cowlitz	Strawberries	162	221
WA	Cowlitz	Raspberries	634	3,457
WA	Douglas	Apples	14,383	3,869
WA	Franklin	Strawberries	17	23
WA	Franklin	Apples	9,000	2,421
WA	Franklin	Cherries	2,165	110
WA	Franklin	Raspberries	70	382
WA	Franklin	Plums and Prunes	43	37
WA	Franklin	Peaches	262	49
WA	Klickitat	Cherries	457	23
WA	Klickitat	Grapes	419	minimal
WA	Klickitat	Peaches	199	37
WA	Klickitat	Plums and Prunes	1	0.4
WA	Klickitat	Apples	616	166
WA	Lewis	Cherries	10	0.5
WA	Lewis	Apples	77	21
WA	Lewis	Blueberries	137	582
WA	Lewis	Plums and Prunes	3	1
WA	Lewis	Grapes	4	minimal
WA	Okanogan	Apples	24,164	6,500
WA	Okanogan	Peaches	67	13
WA	Okanogan	Cherries	1,003	51
WA	Pacific			none
WA	Walla Walla	Apples	5,222	1,405

WA	Walla Walla	Cherries	280	14
WA	Yakima	Grapes	15,526	minimal
WA	Yakima	Cherries	6,129	313
WA	Yakima	Strawberries	10	14
WA	Yakima	Peaches	1,438	269
WA	Yakima	Raspberries	10	54.52
WA	Yakima	Plums and Prunes	478	179
WA	Yakima	Apples	75,264	20,246

Table 42. Crops on which Captan can be used that are part of the migration corridors of the Upper Willamette River chinook salmon ESU.

St	County	Crops	Acres	Captan Use (lbs)
OR	Columbia	Cherries	7	3
OR	Columbia	Plums and Prunes	2	1
OR	Columbia	Apples	39	5
OR	Columbia	Raspberries	1	1
OR	Columbia	Grapes	6	<1
OR	Multnomah	Cherries	1,568	586
OR	Multnomah	Apples	51	7
OR	Multnomah	Strawberries	171	305
OR	Multnomah	Raspberries	741	710
OR	Multnomah	Blackberries	65	66
OR	Multnomah	Grapes	28	1
OR	Multnomah	Plums and Prunes	3	1
OR	Multnomah	Blueberries	545	1,628
WA	Clark	Cherries	2	0.1
WA	Clark	Raspberries	162	883
WA	Clark	Plums and Prunes	10	4
WA	Clark	Grapes	32	minimal
WA	Clark	Apples	33	9

WA	Cowlitz	Raspberries	634	3,457
WA	Cowlitz	Strawberries	162	221
WA	Wahkiakum			none

There is a potential for considerable use of captan in this moderately agricultural area. The size of the streams and rivers low enough within the watershed to be near agriculture should preclude likely effects, but not to the extent of expecting no effect. I conclude that the use of captan may affect, but is not likely to adversely affect, the Upper Willamette Chinook Salmon ESU.

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).

Most usage occurs upstream from the confluence of the Snake River with the Columbia River, but not as far north as Chelan, and Okanogan counties, where there is limited acreage of the major crops for captan. However, a modest amount is used on crops below that confluence in counties on either side of the Columbia River, but all upstream of the John Day Dam.

Tables 43 and 44 show the cropping information for Washington counties that support the Upper Columbia River chinook salmon ESU and for the Oregon and Washington counties where this ESU migrates.

Table 43. .

St	County	Crops	Acres	Captan Use (lbs)
WA	Benton	Plums and Prunes	180	68
WA	Benton	Peaches	149	28
WA	Benton	Cherries	3,219	164
WA	Benton	Apples	18,425	4,956
WA	Benton	Grapes	16,929	minimal
WA	Chelan	Cherries	3,704	189

WA	Chelan	Grapes	2,813	minimal
WA	Chelan	Apples	17,096	4,599
WA	Clark	Grapes	32	minimal
WA	Clark	Raspberries	162	883
WA	Clark	Plums and Prunes	10	4
WA	Clark	Cherries	2	<1
OR	Columbia	Plums and Prunes	2	1
OR	Columbia	Raspberries	1	1
OR	Columbia	Apples	39	5
OR	Columbia	Cherries	7	3
OR	Columbia	Grapes	6	<1
OR	Sherman			none
WA	Douglas	Apples	14,383	3,869
WA	Franklin	Peaches	262	49
WA	Franklin	Strawberries	17	23
WA	Franklin	Apples	9,000	2,421
WA	Franklin	Plums and Prunes	43	37
WA	Franklin	Cherries	2,165	110
WA	Franklin	Raspberries	70	382
WA	Grant	Apples	33,615	9,042
WA	Grant	Peaches	261	49
WA	Grant	Grapes	3,132	minimal
WA	Grant	Cherries	3,470	177
OR	Hood River	Apples	2,592	338
OR	Hood River	Grapes	63	2
OR	Hood River	Peaches	13	4
OR	Hood River	Blueberries	29	87
WA	Kittitas	Apples	1,859	500
WA	Klickitat	Grapes	419	minimal
WA	Klickitat	Apples	616	166

WA	Klickitat	Peaches	199	37
WA	Klickitat	Cherries	457	23
WA	Klickitat	Plums and Prunes	1	0.4
OR	Multnomah	Cherries	1,568	586
OR	Multnomah	Strawberries	171	305
OR	Multnomah	Plums and Prunes	3	1
OR	Multnomah	Blackberries	65	66
OR	Multnomah	Grapes	28	1
OR	Multnomah	Raspberries	741	710
OR	Multnomah	Blueberries	545	1,628
WA	Okanogan	Apples	24,164	6,500
WA	Okanogan	Peaches	67	13
WA	Okanogan	Cherries	1,003	51
WA	Walla Walla	Apples	5,222	1,405
WA	Walla Walla	Cherries	280	14
WA	Yakima	Strawberries	10	14
WA	Yakima	Raspberries	10	54.52
WA	Yakima	Cherries	6,129	313
WA	Yakima	Apples	75,264	20,246
WA	Yakima	Plums and Prunes	478	179
WA	Yakima	Peaches	1,438	269
WA	Yakima	Grapes	15,526	minimal

Table 44. Crops on which captan can be used that are migration corridors for the Upper Columbia River chinook salmon ESU.

St	County	Crops	Acres	Captan Use (lbs)
WA	Clark	Ornamentals	1,371	157
WA	Cowlitz	Ornamentals	690	230
WA	Franklin	Ornamentals	5,946	1,982
WA	Walla Walla	Apples	5,222	1,405

WA	Walla Walla	Cherries	280	14
WA	Walla Walla	Apples	5,222	1,405
WA	Yakima	Strawberries	10	14
WA	Yakima	Raspberries	10	54.52
WA	Yakima	Cherries	6,129	313
WA	Yakima	Apples	75,264	20,246
WA	Yakima	Plums and Prunes	478	179
WA	Yakima	Peaches	1,438	269
WA	Yakima	Grapes	15,526	minimal
WA	Clark	Cherries	2	0.1
WA	Clark	Raspberries	162	883
WA	Clark	Plums and Prunes	10	4
WA	Clark	Grapes	32	minimal
WA	Clark	Apples	33	9
WA	Cowlitz	Raspberries	634	3,457
WA	Cowlitz	Strawberries	162	221

The Upper Columbia River Chinook ESU is in an area of extensive agriculture, and large quantities of captan are use. The magnitude of use in the upstream Columbia watershed, in my opinion, may affect the Upper Columbia River Chinook Salmon ESU.

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 re-colonized 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 45 contains usage information for the California counties supporting the Central California coast coho salmon ESU.

Table 45.

County	Crop(s)	Acres	Captan usage (pounds)
Santa Cruz	Blueberry	47	24
Santa Cruz	Strawberry	15,120	9,009
Santa Cruz	Landscape	2	NR
San Mateo	Outdoor Flowers	10	10
Sonoma	Apple	95	45
Sonoma	Landscape	<1	10

Only a single large crop is present in the Central California Coast Coho ESU (Santa Cruz Strawberries). I believe that this single use would have no effect on the Central California Coast Coho Salmon ESU.

2. Southern Oregon/Northern California Coast Coho Salmon ESU

The Southern Oregon/Northern California coastal coho salmon ESU was proposed as threatened in 1995 (60FR38011-38030, July 25, 1995) and listed on May 6, 1997 (62FR24588-24609). Critical habitat was proposed later that year (62FR62741-62751, November 25, 1997) and finally designated on May 5, 1999 (64FR24049-24062) to encompass accessible reaches of all rivers (including estuary 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 captan can be used.

Tables 46 shows the usage of Captan in the California counties supporting the Southern Oregon/Northern California coastal coho salmon ESU. Table 47 shows the cropping information for Oregon counties where the Southern Oregon/Northern California coastal coho salmon ESU occurs..

Table 46.

St	County	Crop	Captan Use (lbs)	Acres
CA	Del Norte	Outdoor Transplant	24	24
CA	Humboldt		none	
CA	Lake		none	
CA	Mendocino		none	
CA	Trinity		none	

Table 47. Captan use in Oregon counties where there is habitat for the Southern Oregon/Northern California coastal coho salmon ESU.

St	County	Crops	Acres	Captan Use (lbs)
OR	Curry	Apples	27	43
OR	Curry	Cherries	11	23
OR	Curry	Plums and Prunes	3	14
OR	Jackson	Blueberries	11	323
OR	Jackson	Apples	360	576
OR	Jackson	Cherries	27	27
OR	Jackson	Grapes	400	112
OR	Jackson	Peach	198	99
OR	Jackson	Plums and Prunes	16	60
OR	Jackson	Raspberries	5	147
OR	Josephine	Plums and Prunes	1	4
OR	Josephine	Raspberries	2	59
OR	Josephine	Peach	29	109
OR	Josephine	Grapes	365	102
OR	Josephine	Cherries	9	19
OR	Josephine	Apples	181	290
OR	Douglas	Apples	148	237

There is generally modest use of captan in the Oregon/Northern California Coastal Coho ESU. In my opinion, there will be no effect from captan usage on the Southern Oregon/Northern California Coastal Coho Salmon ESU.

3. Oregon Coast coho salmon ESU

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

This ESU includes coastal populations of coho salmon from Cape Blanco, Curry County, Oregon to the Columbia River. Spawning is spread over many basins, large and small, with higher numbers further south where the coastal lake systems (e.g., the Tenmile, Tahkenitch, and Siltcoos basins) and the Coos and Coquille Rivers have been particularly productive. Critical Habitat includes all accessible reaches in the coastal hydrologic reaches Necanicum, Nehalem, Wilson-Trask-Nestucca (upstream barrier - McGuire Dam), Siletz-Yaquina, Alsea, Siuslaw, Siltcoos, North Umpqua (upstream barriers - Cooper Creek Dam, Soda Springs Dam), South Umpqua (upstream barrier - Ben Irving Dam, Galesville Dam, Win Walker Reservoir), Umpqua, Coos (upstream barrier - Lower Pony Creek Dam), Coquille, Sixes. Related Oregon counties are Douglas, Lane, Coos, Curry, Benton, Lincoln, Polk, Tillamook, Yamhill, Washington, Columbia, Clatsop. However, the portions of Yamhill, Washington, and Columbia counties that are within the ESU do not include agricultural areas where captan can be used, and they were eliminated them in this analysis. Table 48 show the cropping information for Oregon counties where the Oregon coast coho salmon ESU occurs.

Table 48

St	County	Crops	Acres	Captan Use (lbs)
OR	Curry	Apples	27	43
OR	Curry	Cherries	11	23
OR	Curry	Plums and Prunes	3	14
OR	Lane	Peaches	54	259
OR	Lane	Grapes	431	889
OR	Lane	Cherries	249	934
OR	Lane	Apples	174	111
OR	Lane	Plums and Prunes	34	46
OR	Lane	Raspberries	20	587
OR	Benton	Peaches	8	15
OR	Benton	Plums and Prunes	5	20
OR	Benton	Grapes	242	68
OR	Benton	Blackberries	3	3
OR	Benton	Cherries	18	43
OR	Benton	Raspberries	2	12
OR	Benton	Apples	50	48
OR	Benton	Blueberries	109	3,197
OR	Benton	Strawberries	17	280
OR	Polk	Apples	10	10
OR	Polk	Grapes	1,123	314

OR	Polk	Blackberries	21	321
OR	Polk	Strawberries	22	362
OR	Polk	Blueberries	21	615
OR	Polk	Peaches	36	69
OR	Polk	Plums and Prunes	595	2,410
OR	Polk	Cherries	1,888	4,493
OR	Coos	Blueberries	9	264
OR	Lincoln	Raspberries	3	49
OR	Tillamook			None
OR	Douglas	Blueberries	108	3,167
OR	Douglas	Plums and Prunes	305	405
OR	Douglas	Peach	53	66
OR	Douglas	Grapes	581	163
OR	Douglas	Apples	148	237
OR	Douglas	Raspberries	14	226

In the Oregon Coast Coho ESU there is a low level of captan usage; most of the agriculture in Polk, Douglas, Lane, and Benton counties is not in coastal watersheds, but rather in the Willamette River watershed. With the limited captan use in the coastal rivers, there will be no effect on the Oregon Coast Coho Salmon ESU.

D. Chum Salmon

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

Most chum salmon mature between 3 and 5 years of age, usually 4 years, with younger fish being more predominant in southern parts of their range. Chum salmon usually spawn in coastal areas, typically within 100 km of the ocean where they do not have surmount river blockages and falls. However, in the Skagit River, Washington, they migrate at least 170 km.

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

Redds are usually dug in the mainstem or in side channels of rivers. Juveniles outmigrate to seawater almost immediately after emerging from the gravel that covers their redds. This means that survival and growth in juvenile chum salmon depend less on freshwater conditions than on favorable estuary 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 49 shows the cropping information for Washington counties where the Hood Canal summer-run chum salmon ESU occurs.

Table 49.

St	County	Crops	Acres	Captan Use lbs
WA	Mason	Blueberries	1	4
WA	Mason	Apples	5	2
WA	Mason	Cherries	1	<1
WA	Clallam			none
WA	Kitsap	Blueberries	5	***15***
WA	Kitsap	Apples	64	***26***
WA	Kitsap	Cherries	6	<1
WA	Kitsap	Grapes	8	minimal
WA	Kitsap	Raspberries	9	***108***
WA	Kitsap	Strawberries	7	10
WA	Jefferson	Ornamentals	120	40

There is minimal use of captan in the Hood Canal Chum Salmon ESU. The amount of captan used in comparison to the size of the ESU and the otherwise protected nature of the watershed results in my conclusion that there will be no effect on the Hood Canal Summer-run Chum Salmon ESU.

2. Columbia River Chum Salmon ESU

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

Critical habitat for the Columbia River chum salmon ESU encompasses all accessible reaches and adjacent riparian zones of the Columbia River (including estuary 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 50 shows the cropping information for Oregon and Washington counties where the Columbia River chum salmon ESU occurs.

Table 50.

St	County	Crops	Acres	Captan Use (lbs)
WA	Clark	Plums and Prunes	10	41
WA	Clark	Raspberries	162	***10,320***
WA	Clark	Grapes	32	minimal
WA	Clark	Blueberries	130	***390***
WA	Clark	Cherries	2	1
WA	Clark	Apples	33	***13***
WA	Cowlitz	Raspberries	634	***10,320***
WA	Cowlitz	Strawberries	162	221
WA	Wahkiakum			none
WA	Pacific			none
WA	Skamania			none
OR	Multnomah	Apples	51	7

OR	Multnomah	Cherries	1,568	586
OR	Multnomah	Plums and Prunes	3	1
OR	Multnomah	Grapes	28	1
OR	Multnomah	Raspberries	741	710
OR	Multnomah	Blackberries	65	66
OR	Multnomah	Blueberries	545	1,628
OR	Multnomah	Strawberries	171	305
OR	Washington	Apples	229	30
OR	Washington	Cherries	211	79
OR	Washington	Peaches	168	51
OR	Washington	Plums and Prunes	358	134
OR	Washington	Blackberries	654	669
OR	Washington	Raspberries	1,150	1,101
OR	Washington	Strawberries	1,257	2,239
OR	Washington	Blueberries	654	1,954
OR	Clatsop			none
OR	Columbia	Plums and Prunes	2	1
OR	Columbia	Raspberries	1	1
OR	Columbia	Apples	39	5
OR	Columbia	Cherries	7	3
OR	Columbia	Grapes	6	<1
WA	Lewis	Ornamentals	1,455	485

The Columbia River Chum Salmon ESU contains several areas of moderate agricultural development and captan use. However, the breeding and rearing areas are only in Skamania, Pacific, and Wahkiakum counties where there is no acreage where captan would be used. For non-breeding areas, the size of the streams and rivers is significant. I conclude that there will be no effect on the Columbia River Chum Salmon ESU.

E. Sockeye Salmon

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

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

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

1. Ozette Lake Sockeye Salmon ESU

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

While Lake Ozette, itself, is part of Olympic National Park, its tributaries extend outside park boundaries, much of which is private land. There is limited agriculture in the whole of Clallam County.

Table 51: Crops on which captan can be used that are in Clallum County where there is habitat for the Ozette Lake sockeye salmon ESU.

St	County	Crops	Acres	Captan Use (lbs)
WA	Clallam			none

There is no use of captan within the borders of the Ozette Lake Sockeye Salmon ESU, and there will be no effect on the Ozette Lake Sockeye Salmon ESU.

2. Snake River Sockeye Salmon ESU

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

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

Table 52 shows the limited acreage of crops in Idaho counties where this ESU reproduces. Table 53 shows the acreage of crops where Captan can be used in Oregon and Washington counties along the migratory corridor for this ESU.

Table 52. Crops on which captan can be used in Idaho counties where there is spawning and rearing habitat for the Snake River sockeye salmon ESU.

St	County	Crops	Acres	Captan Use (lbs)
ID	Custer			none
ID	Blaine			none

Table 53. Crops on which Captan 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	Captan Use (lbs)
WA	Clark	Plums and Prunes	10	41
WA	Clark	Raspberries	162	***10,320***
WA	Clark	Grapes	32	minimal
WA	Clark	Blueberries	130	***390***
WA	Clark	Cherries	2	1
WA	Clark	Apples	33	***13***
WA	Cowlitz	Raspberries	634	***10,320***
WA	Cowlitz	Strawberries	162	221
OR	Columbia	Plums and Prunes	2	1
OR	Columbia	Raspberries	1	1
OR	Columbia	Apples	39	5

OR	Columbia	Cherries	7	3
OR	Columbia	Grapes	6	<1
OR	Multnomah	Apples	51	7
OR	Multnomah	Cherries	1,568	586
OR	Multnomah	Plums and Prunes	3	1
OR	Multnomah	Grapes	28	1
OR	Multnomah	Raspberries	741	710
OR	Multnomah	Blackberries	65	66
OR	Multnomah	Blueberries	545	1,628
OR	Multnomah	Strawberries	171	305
OR	Hood River	Peaches	13	***5***
OR	Hood River	Blueberries	29	25
OR	Hood River	Apples	2,592	2,488
OR	Hood River	Grapes	63	18
OR	Umatilla	Cherries	1,888	706
OR	Umatilla	Strawberries	9	16
OR	Umatilla	Grapes	1,123	34
OR	Umatilla	Peaches	7	2
OR	Umatilla	Plums and Prunes	365	137
OR	Umatilla	Apples	3,927	511
OR	Wasco	Apples	463	60
OR	Gilliam			none
OR	Clatsop			none
OR	Sherman			none
WA	Walla Walla	Apples	5,222	1,405
WA	Walla Walla	Cherries	280	14
WA	Whitman			none

Although the spawning and rearing areas of the Snake River Sockeye ESU appear well protected from adverse effects, the long migration path and intense agriculture leads me to conclude that the species in the ESU may be affected by captan use.

5. Specific conclusions for Pacific salmon and steelhead

For purposes of this directed review, seed treatments were not included in the county level evaluations. Data is not available on the fraction of seed treatments actually performed in the designated ESUs, as opposed to remote, industrial sites, potentially located in other counties or other states. In addition, the observed half-life of captan suggests that only field level treatment in the planter box has significant potential for the injection of parent captan into the environment. With this provision, fruit, berry, and ornamental crops are the major sites of interest.

Several formulations are specifically identified as residential use, for flowers, shrubs, and home orchards. In general, the concentration of active ingredient in these products is significantly lower than those intended for agriculture and industrial use (see attached, representative labels). Little data is available regarding the total amount of residential use, however the ESUs do contain numerous large, metropolitan areas (Seattle, Portland, San Francisco, Los Angeles, San Diego) and this may indicate that total usage is substantial. Residential use, where significant portions of the acreage are paved, tend to have higher runoff rates. In considering the relatively high solubility of captan, it must be presumed that significant amounts of captan will be deposited into drains and other structures. Of note, however, is the observation that most of the major urban areas in the ESUs are coastal with major drainage directly to the sea. This pattern is not likely to add substantially to any risk for the T&E species being addressed.

In the table below, several ESUs are reported as “no effect”. Some, such as Ozette Lake Sockeye and Southern Oregon/Northern California Coho, are in areas where no captan is reported as being used. In other areas, such as the Snake River Sockeye, no captan use was determined in the breeding areas where redds are located. In some “no effect” areas, the level of captan use reported is sufficiently low to warrant no effects when the product is used according to the label. Such areas include the Hood Canal Chum (99 lbs a.i./yr on 40 acres) and the central California Coastal Steelhead (99 lbs a.i./yr in 3 of 12 counties). Those areas listed as “not likely to adversely affect” represent ESUs that traverse areas of intense agriculture, however the general levels of captan use and short half life make it unlikely that adverse situations will arise, provided label guidelines are followed.

In regard to indirect effects, most notable is the potential risk to invertebrate food sources for young fish. However, the toxic sensitivity of the fish population is greater than that for the invertebrates. This observation attests to the primary importance of preventing events leading to acute fish toxic incidents. As noted earlier, there are no reported fish kills associated with captan. The findings for this review suggest that the current guidelines and recommendations are adequate, in most cases, for the use of captan. Any additional qualifications should address the goal of insuring that captan is not applied directly to water resources or used in a manner that could lead to immediate runoff of the parent compound by application under unfavorable weather conditions.

Table 54: Final conclusions on the use of captan and its effects on Western Salmon and Steelhead ESU's.

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

Steelhead	Central California Coast	no effect
Steelhead	South-Central California Coast	may affect but not likely to adversely affect
Steelhead	Southern California	may affect, but not likely to adversely affect
Steelhead	Central Valley, California	no effect

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