CHAPTER 4

ASSESSEMENT FRAMEWORK

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4 Assessment Framework

Section 7(a)(2) of the Endangered Species Act (ESA) requires federal agencies, in consultation with the National Marine Fisheries Service (NMFS), to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species; or adversely modify or destroy their designated critical habitat.

“Jeopardize the continued existence of” means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of an ESA-listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 C.F.R. §402.02).

“Destruction or adverse modification” means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of an ESA-listed species (50 C.F.R. §402.02). An ESA section 7 assessment involves the following steps:

4.1 Effects of the Action

To conduct effects analyses, we follow an ecological risk assessment framework based on the National Research Council National Academies of Sciences report on pesticides and endangered species (NAS 2013). The Environemental Protection Agency (EPA), United States Department of Agriculture (USDA), Fish and Wildlife Service (FWS), and NMFS adapted the report’s framework to meet the specific needs of an ESA consultation. The framework divides the pesticide ESA consultation process into three steps (Figure 1). Each step builds upon analyses and findings from a previous step. The interagency group worked together to produce a transparent, systematic, and rigorous analysis based on ecological risk assessment principles. Under this framework EPA combines Steps 1 and 2 in their Biological Evaluations (BEs) and the NMFS conducts Step 3 in our Biological Opinions (Figure 1). A “no effect” determination indicates that the stressors of the proposed action will not affect an individual of a listed species or designated critical habitat. A “not likely to adversely affect” (NLAA) determination indicates that the effects of the proposed action on the fitness (survival or reproduction) of an individual of a listed species is expected to be discountable[1], insignificant[2], or completely beneficial[3] (Endangered Species Consultation Handbook). Note that if EPA concludes in its Step 2 determination that its action is “not likely to adversely affect” a particular species or

[1] Dicountable effects are those extremely unlikely to occur.

[2] Insignificant effects relate to the size of the impact, and are effects a person would not be able to meaningfully measure, detect or evaluate. They should never reach the scale where take occurs.

[3] Benefical effects are contemporeaneous positive effects without any adverse effect to the species.

habitat, and NMFS concurs, then the consultation process ends at Step 2. If individuals of a listed species are not adversely affected, then listed species and the populations that comprise them are not adversely affected and no further analysis is needed. A “likely to adversely affect” (LAA) determination is made if any adverse effect to any individual of a listed species may occur as a direct or indirect result of the proposed action and the effect is not discountable, insignificant, or beneficial (Endangered Species Consultation Handbook).

EPA wrote separate Biological Evaluations (BEs) for 1,3-D (EPA 2004) and metolachlor (EPA 2006) in which EPA made species’ effect determinations of either no effect or may affect. When may affect determinations were made, EPA concluded whether projected impacts were LAA or NLAA as shown in Figure 1. Within the Risk Characterization section of the BEs, EPA utilized a risk quotient approach and concluded that 1,3-D and metolachlor is LAA several listed Pacific salmonids. EPA did not make any conclusions regarding potential effects to designated critical habitat. The 1,3-D and metolachlor BEs were produced several years prior to the 2013 NAS report and the procedures implemented do not consistently align with NAS recommendations or interim interagency procedures (EPA 2013). In 2014, in an amendment to the August 1, 2008 settlement agreement, NMFS agreed to finalize and publish biological opinions on 1,3-D and metolachlor incorporating the methodologies developed in response to the NAS Report’s recommendations and addressing all species listed under NMFS jurisdiction. However, consultation on all species is currently not feasible as EPA has thus far only sought consultation on the salmonids and has not provided BEs addressing effects to other species under NMFS jurisdiction. Therefore, NMFS updated the exposure, response, and risk characterization information for the listed salmonids to achieve consistency with the NAS recommendations. This document represents NMFS’ Opinion on the impacts of EPA’s authorization of pesticide products containing 1,3-D and metolachlor on the listed Pacific salmonids and their designated critical habitats. This is a partial consultation intended to comply with the 2008 settlement agreement. This document does not provide NMFS' Opinion on jeopardy, or any incidental take coverage, for all listed species that may be present in the action area. Consultation with NMFS will not be complete for registration of these active ingredients until EPA makes effect determinations on all other species and designated critical habitat under NMFS jurisdiction and consults with NMFS as necessary.

In Step 3, the Biological Opinion (formal consultation) considers the potential impacts of the federal action to all listed Pacific salmonids and their designated critical habitats, including those that have been listed since the completion of the BEs. With regard to effects on listed species, the fundamental difference between Step 2, Biological

Evaluation, and Step 3, Biological Opinion, is we evaluate whether the anticipated adverse effects to individuals negatively affect populations and the species they comprise. Using the ecological risk assessment framework, described below, we conducted two distinct analyses within an Opinion. The first evaluated the risk to populations of listed species, when identified, and to entire listed species and provides the jeopardy analysis for each species; and the second evaluated the risk to a species' designated critical habitat, and provided the adverse modification of designated critical habitat analysis. The analyses were based on the best commercial and scientific data available.

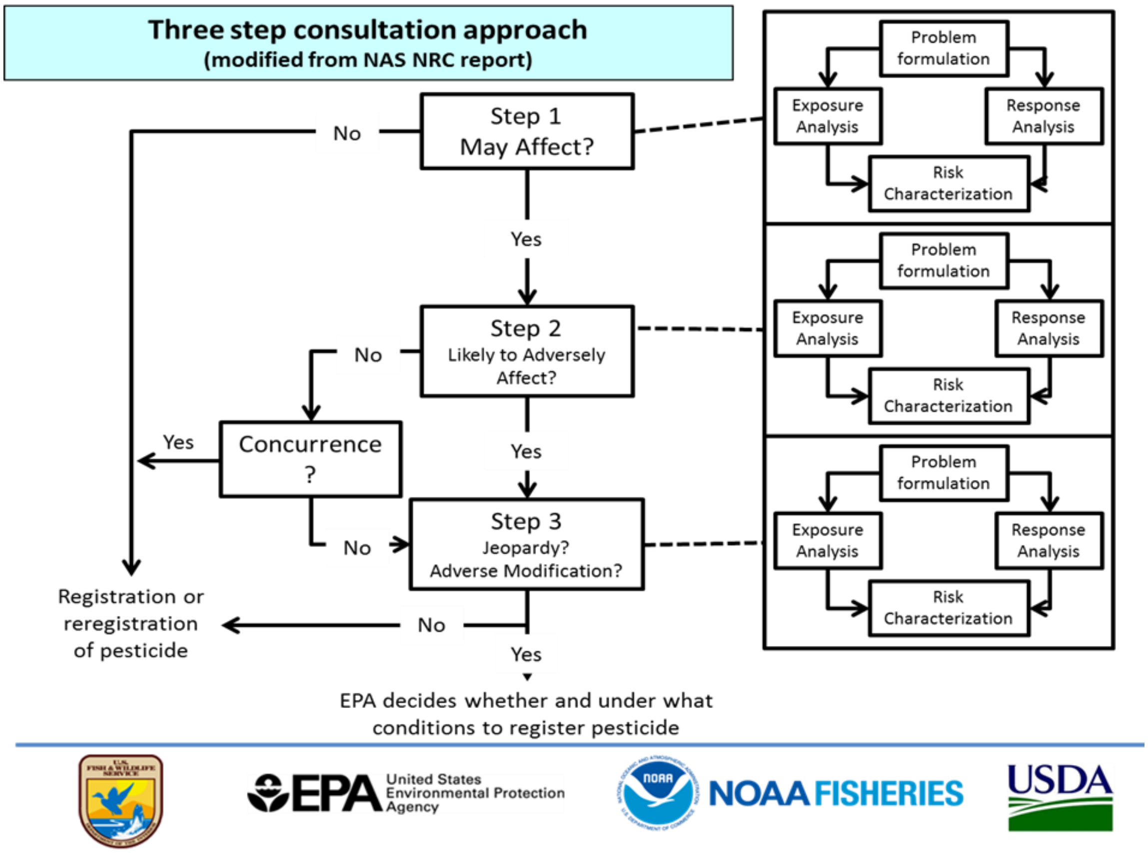

Figure 1. Three step consultation process

4.2 Information used in Biological Opinion

To comply with our obligation to use the best scientific and commercial data available, we collected information from a variety of sources. This Opinion is based on our review and analysis of various information sources, including:

- EPA's Biological Evaluations
  - Pesticide label information found in Description of the Action section
  - Exposure outputs (estimated environmental concentrations) from EPA's fate and transport modeling

    - Toxicity data found in Response sections
- EPA's ecological risk assessments prepared for Registration Review
- EPA's ECOTOX database; contains published scientific studies and pesticide manufacturer studies
- Pesticide usage information including Pesticide Use Reports from California Department of Pesticide Regulation and estimated pesticide usage information from surveys conducted by USDA and proprietary survey information summarized by EPA
- Geographic locations of label authorized pesticide use sites
    - USDA – National Agricultural Statistics Services (NASS) Census of Agriculture
    - USDA/NASS – Cropland Data Layer
    - USGS – National Land Cover Database
- Published Scientific literature
- Other scientific literature, such as reports of government agencies or non-governmental organizations
- Correspondence (with experts on the subject from EPA and others)
- Available biological and chemical surface water monitoring data and other local, county, and state information
- Pesticide registrant generated data and information
- Pesticide exposure models, i.e. mathematical models that estimate exposure of resources to pesticides
    - Salmonid population models
    - Pesticide exposure models
    - Pesticide Water Calculator
    - AgDRIFT
- Risk-Plots; NMFS' tool based on R-code that summarizes exposure and toxicity information by use site and is used to determine likelihood of exposure and effect of exposure to groups of individuals and designated critical habitat (see description below).
- Comments, information and data provided by the registrants identified as applicants
- Comments and information submitted by EPA
- Pesticide usage data
- Pesticide incident reports and field data

Collectively, the above information provided the basis for our determinations as to whether the EPA can insure that its authorization of 1,3-D and metolachlor is not likely to jeopardize the continued existence of threatened and endangered species, and is not likely to result in the destruction or adverse modification of designated critical habitat.

4.3 **Problem Formulation**

Problem formulation includes conceptual models based on the initial evaluation of the relationships between stressors of the action (pesticides and other identified chemical stressors) and listed species and their habitats. The conceptual model for 1,3-D and metolachlor pesticides is shown in Figure 2. The model identifies the stressors associated with the proposed actions and the pathways of exposure to Pacific salmonids and their habitats that may lead to effects. Step 2 of the analysis evaluates effects that have implications for individual fitness of the listed species, i.e. any effects that may alter an organisms ability to survive and produce viable offspring. We consider the available toxicity information and toxic mode and mechanism of action of the two pesticide active ingredients (a.i.s) to provide insight into potential consequences following exposure. Identification of the mode and mechanism of action allows us to identify other chemicals that might co-occur and affect species and their habitats (*i.e.*, identify potential toxic mixtures in the environment). 1,3-D has a broad range of toxicity and is used to control pest insects, nematodes, fungi and plants. Metolachlor is a broad-spectrum herbicide that controls plants by inhibiting seedling shoot and meristematic growth. The potential impacts of 1,3-D and metolachlor will be assessed by evaluating the likelihood of direct toxicity to salmon and impacts to their habitat (Figure 2). For example, potential impacts to vascular and nonvascular plants will be evaluated given their relationships to primary biological features (PBFs) in the designated critical habitat.

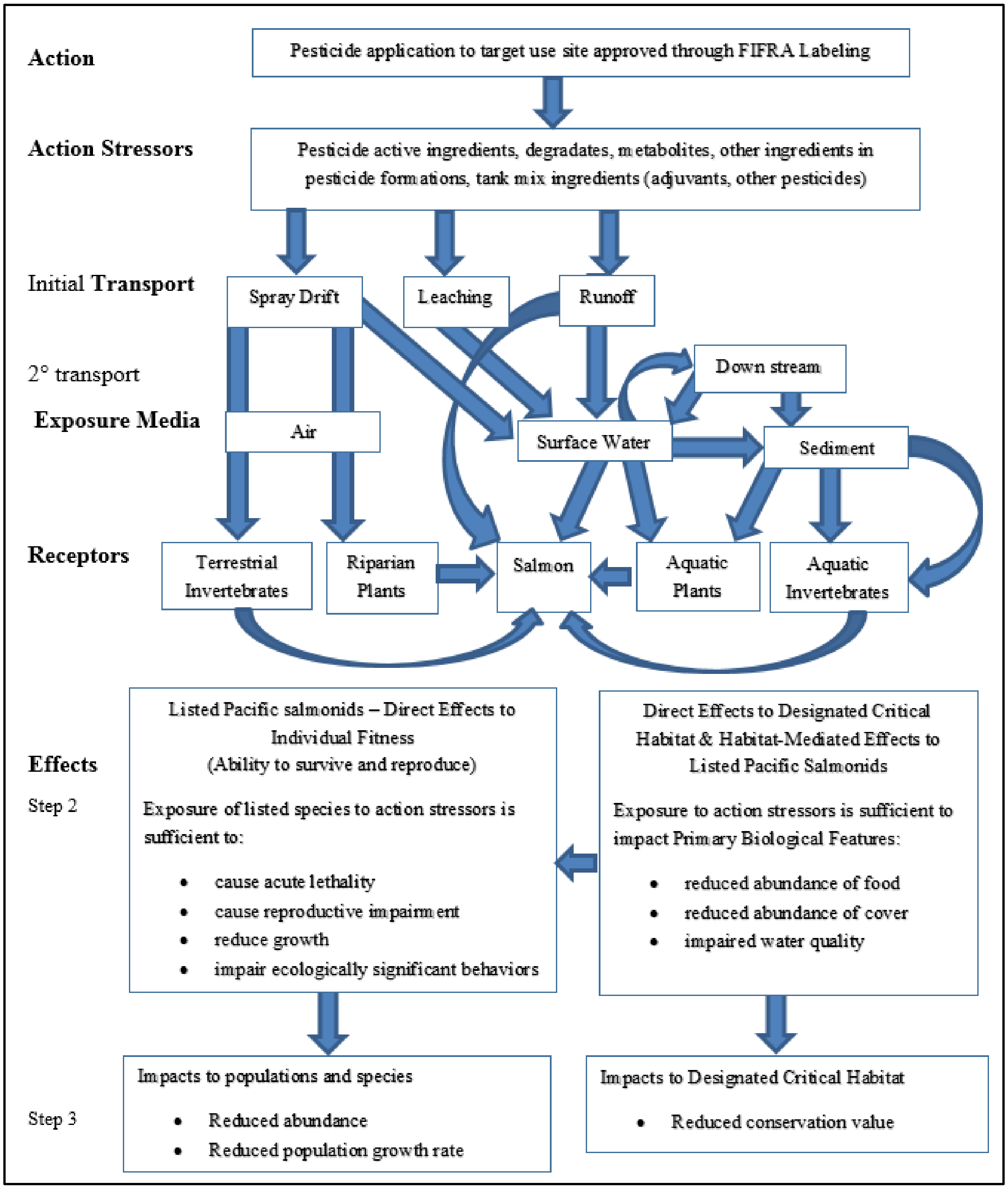

Figure 2. Conceptual model diagraming the relationships between the stressors of the action and listed Pacific salmonids and their Designated Critical Habitats.

Impacts to individual fitness can occur through direct toxicity of the stressors of the action to salmon, including both direct lethality or sublethal effects (e.g. ability of salmon to swim, avoid predation, reproduce, etc.). They may also occur due to impacts to salmon designated critical habitat including impacts to PBFs. For example, effects may include reductions in salmon prey (either through reduction in primary production or direct toxicity) and important cover (including aquatic and riparian vegetation in migration, spawning, and rearing sites).

In Step 3, we evaluate whether the anticipated adverse effects to individuals (described in the BEs) negatively affect populations and the species they comprise. However, we begin our Step 3 analysis by building on the Step 2 analysis. Additionally, we evaluate whether adverse effects to PBFs reduce designated critical habitat's conservation value. Direct deposition of 1,3-D and metolachlor onto treated sites as well as transport via spray drift, leaching, and runoff are depicted in the conceptual models as sources that result in the movement of the pesticides into aquatic and terrestrial habitats. Additionally, secondary transport including conveyance in flowing water and volatilization resulting in atmospheric (including long-range) transport account of additional mechanisms of pesticide distribution in the environment. The movement away from the site of application in turn represents exposure pathways for a broad range of biological receptors of concern (non-target organisms) and the potential attribute changes, *i.e.*, effects such as reduced survival, growth and reproduction.

Where it was determined that individual fitness is likely compromised by the action, the Step 3 analysis evaluated if those fitness reductions are likely to be sufficient to reduce the viability of the populations those individuals represent (assessed using changes in the populations' abundance, reproduction, spatial structure and connectivity, growth rates, or variance in these measures to make inferences about the population's extinction risks). Reductions in a population's abundance, reproductive rates, or growth rates (or increased variance in one or more of these rates) based on effects to individuals represents a *necessary* condition for reductions in a population's viability, which is itself a *necessary* condition for reductions in a species' viability. Finally, our assessment determines if changes in population viability structured as risk hypotheses are likely to be sufficient to reduce the viability of the species those populations comprise. In this step of our analyses, we consider the Environmental Baseline and Cumulative Effects, and consider the species' pre-action condition, established in the Status of the Species.

For designated critical habitat, we determined if adverse effects (primarily, effects on water quality, vegetative cover, and prey availability) are likely to be sufficient to appreciably reduce the value of the critical habitat as a whole for the conservation of the species. To determine whether this occurs, we consider the designated critical habitat's pre-action condition, established in the Status of the Listed Resources, as well as Cumulative Effects and the Environmental Baseline.

4.4 Analysis Plan

Our analysis plan applies information from EPA's Biological Evaluations and more recent information presented in EPA's risk assessments for Registration Review (EPA 2019a; EPA 2019b) to develop an assessment plan to conduct Step 3 population level analyses within the risk characterization section of this Opinion. We took the exposure and response information directly from EPA's ecological risk assessments and updated them to account for changes in the action, new information, and to bring them into alignment with the NAS recommendations (NAS 2013). In the Exposure Section we describe species life history information; describe the chemical and physical properties that influence the persistence and movement of the pesticides in the environment; and present estimates of exposure to the species and their designated critical habitat.

In the response section, we present the mode and mechanism of toxic action for each pesticide; identify the other stressors of the action such as other chemicals within pesticide formulations; and identified key assumptions and associated uncertainties of the analytical tools and models used in the effects analyses.

The risk characterization section includes the bulk of our Step 3 analyses where we integrate the exposure and response information. We employed a weight-of-evidence approach to determine for each risk hypotheses whether the risk from the action (without consideration of the species status, the environmental baseline or cumulative effects) was high, medium or low. A risk hypothesis is a statement of anticipated effects to a species such as reductions in a population's abundance or productivity following exposure to the stressors of the action. To arrive at that level of risk for each risk hypothesis, we addressed not only effect of exposure and the likelihood of exposure, but also our level of confidence in the risk level. We developed rule-based criteria to provide a systematic approach for assessing the likelihood of exposure and the effect of the exposure. We constructed risk hypotheses for the listed Pacific salmonids and their designated critical habitats (shown in Table 1).

Table 1. risk hypotheses for listed Pacific salmonids and their designated critical habitat

Risk Hypotheses for species:
Exposure to the pesticide is sufficient to reduce abundance via acute lethality.

Exposure to the pesticide is sufficient to reduce productivity via impairments to reproduction.
Exposure to the pesticide is sufficient to reduce abundance via reduction in prey availability.
Exposure to the pesticide is sufficient to reduce abundance via impacts to growth (direct toxicity).
Exposure to the pesticide is sufficient to reduce abundance and productivity via impairments to ecologically significant behaviors.
Mixtures: Formulated products and tank mixtures containing the active ingredient are anticipated to increase risk to direct and indirect effects to fish in freshwater habitats.
Risk hypotheses for designated critical habitat:
1. Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration and rearing sites.
2. Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.
3. Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.

To evaluate risk hypotheses we used Risk-plot graphics, and when available and warranted, salmon population modelling. The Risk-plots are a NMFS' analytical tool that overlays toxicity data, i.e. values at which adverse effects are detected, with exposure information, i.e. estimated environmental concentrations (EECs) in differing types of aquatic habitats. The physical characteristics assumed in modeling the aquatic habitats were developed to reflect differences in habitat volume and flow rates used by the species that could contribute to different exposure ranges. We describe the Risk-plot tool immediately below.

4.4.1 Risk-plots

Risk-plots are used to summarize several types of information used in the Risk Characterization section. Risk-plots display expected environmental concentrations (i.e. EECs) of pesticides for different habitats and toxicity data. We use the data presented in the Risk-plots to determine whether effect of exposure to 1,3-D and metolachlor is low, medium or high for each use. We also use Risk-plots to aid in evaluating the likelihood of exposure for species and critical habitat. The sample Risk-plot below shows data for

Puget Sound Chinook salmon (Figure 3). The R code used to generate the plots and additional information on the code is included in Appendix F.

A Risk-plot graphic is read by (1) selecting an EEC for a use from the center of the plot; (2) reading up to effect concentrations associated with an endpoint e.g., mortality, to determine the level of effect predicted from the EEC; and (3) looking on the left side of the plot to identify the acreage and percentage of area that overlaps with the species range for a given use site (vegetables, corn, etc).

The EEC data can come from various exposure estimates. For aquatic habitats, they are based on the output of EPA's Pesticide Water Calculator (PWC, available from https://www.epa.gov/endangered-species/provisional-models-endangered-species-pesticide-assessments, accessed on 8/1/2019) and from available field-scale monitoring of runoff (Heim et al. 2002) as described in Chapter 11. For terrestrial habitats, they are based on EPA's AgDRIFT and TerrPlant models (also available from EPA at the above URL). EECs can be generated for specific uses based on information on the label. Details of the exposure modeling are presented in Chapter 11.

The Effect Concentration rows can summarize the available toxicity data in different ways, depending on the assessment endpoint and the number of toxicity studies. For endpoints with limited data, individual studies may be represented by a single concentration such as a LOAEC (Lowest Observable Adverse Effect Concentration) or an EC25 (the concentration producing an effect in 25 percent of the exposed population). Alternatively, a toxicity endpoint may be summarized using a dose-response relationship based on an LC50 and slope selected from either a single study or a species sensitivity distribution (SSD) if enough studies are available. In this case, the toxicity row can display different concentrations on the dose-response relationship (e.g. the concentrations producing 1 percent, 10 percent, and 50 percent mortality). Details regarding the derivation of the toxicity rows will be presented later in Chapter 11.

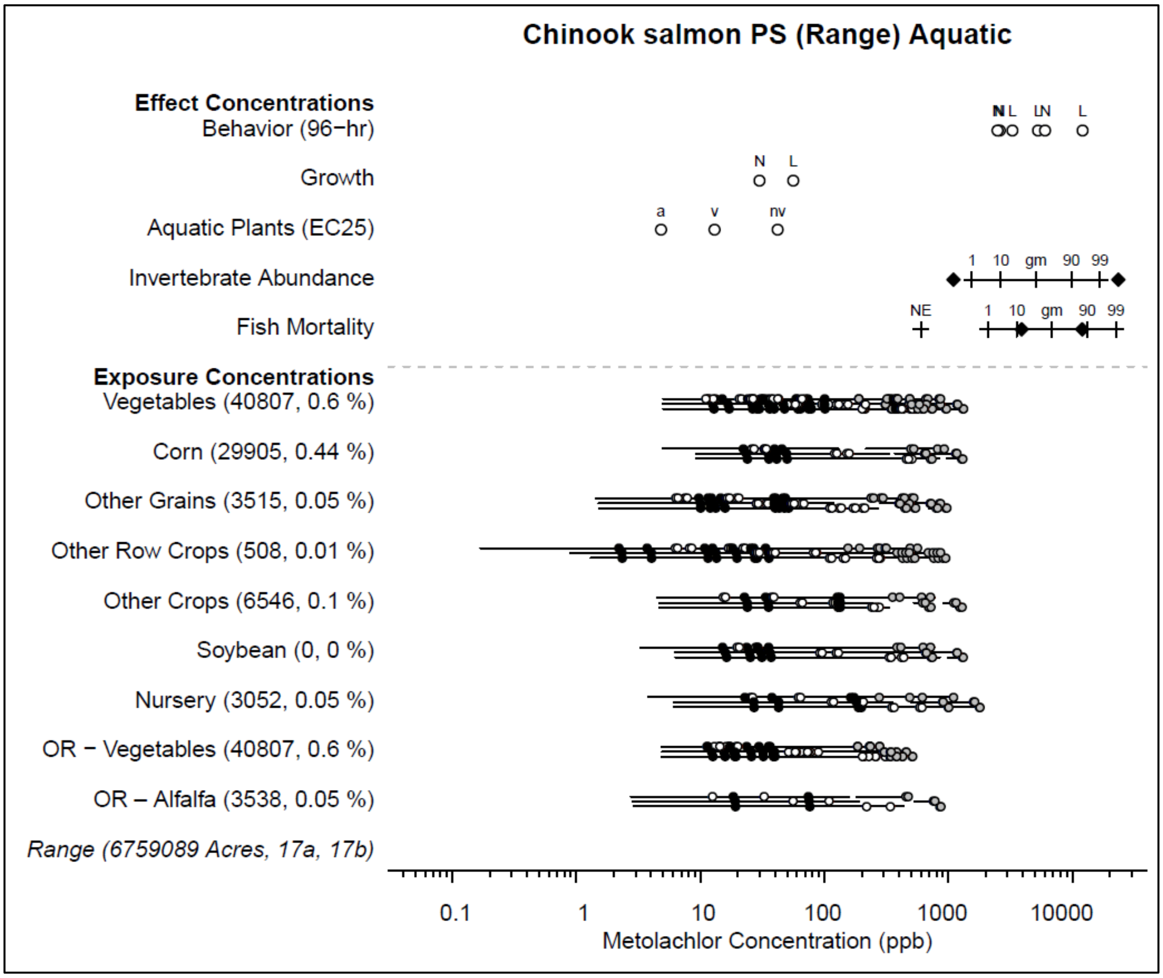

Figure 3. Example Risk Plot: Puget Sound Chinook Salmon and Metolachlor

The remainder of the plot is organized into several components:

1. The upper portion of the plot presents the toxicity data in a series of rows based on toxicological endpoints e.g., growth, mortality, etc under the heading Effect Concentrations. The concentrations displayed may represent different toxicity summaries (e.g. EC25 or LC01) and either a single study or a summary of multiple studies (e.g. from a SSD). Annotations associated with each point will indicate the nature of the toxicity value.

2. The lower portion of the plot shows EECs grouped by use under the heading Exposure Concentrations. For aquatic data, the EECs are further divided by aquatic habitat (bin), and averaging period (i.e., 1-d (one day), 4-d (four day), 21-d (twenty-one day). For this example for metalachlor, the EPA Pesticide Water

Calculator (PWC) runs for each use are shown as the median EECs with the 5-95 percent confidence intervals[4] depicted as a horizontal line. Each aquatic bin is shown as a different symbol. The three rows of points for each use show the different averaging periods for the aquatic EECs. From bottom to top, they are 1-d, 4-d, and 21-d. For terrestrial data, the EECs are further divided by application method (ground or air) using different symbols and exposure model (AgDRIFT or TerrPlant) using different rows.

3. The lower left portion of the Y-axis displays the overlap of pesticide use sites with the species range; shown in the parentheses following each use site (vegetables, corn, etc.). The first value represents the total median acres of the particular use found within the species range across the six years of Cropland Data Layer (CDL)[5] data. The second value represents the median percent overlap of the particular use site with the species range using the same data and timeframe.

4. The bottom row of the Y-axis identifies the total area of the species range (in this case 6759089 Acres) and the species range location at the HUC 12 sub-watershed(s) level (in this case HUC 17a and 17b).

4.4.2 Effect of Exposure Using Risk-plots

Each use site is evaluated to determine whether the effect of exposure is low, medium, or high based on the EECs and the toxicity information. Consideration was given to the duration of exposure when determining which EECs were relevant for comparison.

We apply the following rules when dose-response relationships (i.e. LC_{50} and corresponding slope) are available:

<u>When evaluating acute lethality to Pacific salmonids</u>

- A "none expected" rank is achieved when all EECs are below the calculated one-in-a-million sensitivity level.
- A "low" rank is achieved when all EECs are below the one percent effect level.
- A "medium" is achieved when any EEC falls between the one percent and the median effect level.

[4] the 5-95% confidence interval line represents the range of values within which we are 95% confident that the true value falls, given the variability of the data.
[5] National Agricultural Statistics Service GIS data layers on cropland for all the lower forty -eight conterminous states.

- A “high” is achieved when any EEC exceeds the median effect level for a given toxicity range.

When evaluating reductions in Pacific salmonid prey abundance

- A “none expected” rank is achieved when all EECs are below the calculated one percent effect level.
- A “low” rank is achieved when any EECs fall between the one percent and ten percent effect level.
- A “medium” is achieved when any EECs falls between the 10 percent and the median effect level.
- A “high” is achieved when any EECs exceeds the median effect level for a given toxicity range.

We apply the following rules when dose-response relationships are not available:

- A “none expected” rank is achieved when all EECs are below all available no effect endpoints (e.g. NOEC).
- A “low” rank is achieved when any EEC falls between a no effect endpoint and corresponding lowest effect endpoint (e.g. LOEC).
- When EECs exceed the lowest effect endpoints we examine the effects reported at those concentrations to determine whether a “medium” or “high” characterization is appropriate.

We apply the following rules when evaluating effects to terrestrial vegetation:

- A “low” rank is achieved when all EECs are below all EC_{25} values available.
- A “medium” rank is achieved when EECs exceed up to half of the EC25 values available.
- A “high” rank is achieved when EECs exceed more than half of the EC25 values available.

4.4.3 Likelihood of Exposure

The likelihood of exposure assessment allows us to consider whether effects may occur to the species by taking into consideration the extent of exposure, species locations and movement, chemical properties, potential for repeated application, as well as the proximity of use sites to known areas of importance to the species. The six factors are:

1. Percent overlap of a species’ U.S. range with a pesticide’s approved uses.

   Each use is assigned a category of 1, 2, or 3 depending on the degree of geographic overlap of use acreage with the species’ U.S. range acreage (aggregation of HUC-12s that delineate the species range). In order to evaluate the full extent of EPA's approval, we assume that treatment may occur to any authorized use site at some time during the 15 year period of the action. We do not assume that usage will occur to every authorized use site, nor do we assume that all usage occurs at the same day and time. Instead, we assume that if EPA has authorized pesticide application for a particular site, that site may receive one or more pesticide applications during the course of the 15-year action. This distinction, between "will be applied to every" and "may be applied to any", is important in understanding the assumptions of our analysis. When we consider the extent of authorized use sites within a species range (e.g. acres of corn), we do not make the assumption that pesticides will be applied to every acre of corn. Instead, we assume that: 1) the pesticide may be applied to any acre of corn 2) the greater the extent of corn acres in the species range equates to a greater chance that application may occur in close proximity to species habitat. While we do not expect every site to be treated, it is imperative to consider the potential responses to treatments that may occur in close proximity to ESA-listed species locations to insure existing controls (i.e. product labeling) are adequate to avoid jeopardy and adverse modification.

Our interpretation of the percent overlap values was cognizant of the reality that all registered use sites are not likely to receive application of the pesticide active ingredient, and certainly not all at the same time. We considered the percent overlap value as one of six factors which qualitatively determines the likelihood of exposure. Our use of the percent overlap values was predicated on the assumption that a species chance of being exposed to a particular active ingredient would increase if that active ingredient was approved within greater portions of the species range. We assumed that, all else being equal, there is a positive relationship between the amount of land authorized for pesticide application and the chance that a species will be exposed. In recognition of the uncertainties in this relationship, as well as the numerous other factors influencing the likelihood of exposure, we developed a systematic but qualitative framework to help characterize risk. In this way, the percent overlap serves as a proxy for informing the potential for pesticide application in close proximity to species habitats.

Acreage of authorized use sites were provided by EPA (https://www.epa.gov/endangered-species/biological-evaluation-chapters-chlorpyrifos-esa-assessment) and are based largely on USDA's Cropland Data Layer; this information is presented on the left Y-axis of the Risk-plot. Species range comes from NMFS listing documents. In evaluating percent overlap we considered how well the available use-data-layer represented the labeled uses and, where feasible, made adjustments to the percent overlap value. Some 1,3-Dichloropropene labels approve applications to broadly defined use sites which required the evaluation of multiple GIS layers. For example 1,3-Dichloropropene is approved for use on “field crops” which we assessed by evaluating 6 different CDL layers: corn, cotton, other grains, pasture, soybeans, and wheat. These GIS overlap layers are not always mutually exclusive of each other. This was taken into consideration when evaluating those labels which are represented by multiple GIS layers. The uncertainties associated with acreage and percent overlap values were considered when making our risk and confidence characterizations. When estimating the extent of 1,3-Dichloropropene authorized uses we associated labeled uses to geospatial layers according to Table 2; for metolachlor, we associated labels to geospatial layers according to Table 3.

Table 2. 1,3-Dichloropropene crosswalk for percent overlap estimates

Label Authorized Use Site	GIS Overlap Layer
Vegetable Crops	Vegetables and Ground Fruit
Field Crops	Corn, Cotton, Other grains, Pasture, Soybeans, Wheat
Fruit and Nut Crops	Orchards and vineyards, Vegetables and ground fruit
Nursery Crops	Nursery
Mint	Vegetables and Ground Fruit
California – Containerized nursery stock	Nursery
Idaho potato – USDA Potato Cyst Nematode Eradication Program	Vegetables and Ground Fruit
Unspecified cropland in Idaho – certain weed control	Cultivated
Unspecified cropland in Oregon – certain weed control	Cultivated
Unspecified cropland in Washington – certain weed control	Cultivated

Table 3. Metolachlor crosswalk for percent overlap estimates

Label Authorized Use Site	GIS Overlap Layer
Beans and other pod crops; Horseradish; Potato; Pumpkin; Rhubarb; Tomato	Vegetables and Ground Fruit
Corn	Corn
Safflower; Sorghum;	Other Grains
Soybean	Soybean
Sugarbeets; Sunflower	Other Row Crops
Turf – commercial, residential, sod farms	Other Crops
Nursery and landscape plantings	Nursery
California Only: Pepper; Seeded and transplanted tomato; Swiss chard; Spinach; Dry bulb onion; Celery; Subgroup 1-B (beet, carrot, turnip, etc.) and 1-C (artichoke, ginger, yam, etc.)	Vegetables and Ground Fruit
California Only: Cotton	Cotton
Idaho Only: Carrot, collard, radish, beet, kale, mustard, parsnip, rutabaga, turnip; Dry bulb onion; Pepper	Vegetables and Ground Fruit
Oregon Only: Seed crops including radish, spinach, beets, and Swiss chard; Transplanted bell pepper; blueberry, blackberry, and raspberry; Sweet potato; Strawberry	Vegetables and Ground Fruit
Oregon Only: Alfalfa for seed	Pasture

2. Seasonal analysis based on allowable application timing overlaid with species' timing to determine co-occurrence. Application timing is based on authorized

label restrictions (*e.g.* language indicating applications are restricted to the pre-emergence period). Species timing of occupancy for aquatic areas is provided in the Status of the Species section. The co-occurrence addresses whether pesticides are allowed to be applied during species presence. We answer "yes" to the question of co-occurrence in cases where the pesticide may legally be applied when a species-life history suggests it may be present.

3. Persistence of the pesticide based on environmental fate issues. We evaluated the environmental fate information provided in the BE and EPA ecological risk assessments to determine whether the pesticide is considered persistent. As a rule of thumb, we answered "yes" to persistence if the pesticide has a half-life greater than 100 days.

4. Number of applications allowed. We assume that an increase in number of authorized applications increases the likelihood of an exposure and the potential of effect. We reviewed EPA's updated description of the action, as well as authorized labels, to determine whether multiple applications were allowed on each use site. When answering "yes" or "no", we considered the relative risk of a single application at the maximum allowed rate versus multiple applications at a reduced rate. Most of the 1,3-D and metolachlor labels do not explicitly state the number of repeat applications authorized, instead the labels specify a maximum single application rate as well as a maximum annual application rate. If, for the majority of labels in a given category (e.g. other grains), the maximum single application rate equals the maximum annual application rate then we answered "no" for this factor. Although it is possible that multiple applications could occur at lower rates, assuming a single application at the maximum rate allows us to capture and assess the potential for risk as authorized by the label.

5. Proximity analysis: for use sites with less than 1 percent overlap within a species range. We used GIS maps to determine: 1) whether use sites were within 300 meters of listed species aquatic habitats at sub HUC-12 scales, and 2) whether up-stream use sites were likely to substantially increase exposure via downstream transport. This allowed us to visually assess whether species habitats could be substantially exposed to a use site with <1 percent overlap.

6. Duration of species occupancy in aquatic systems. We review the species life history to determine the approximate duration for residency and migration.

Table 4. Criteria used to determine likelihood of exposure

Factor	Criteria Description	Criteria
Percent overlap of use site within species HUC-12 watersheds	low overlap = <1 percent = category 1 Medium overlap = 1-5 percent = category 2 High overlap = >5 percent = category 3	category (1;2;3)
Seasonal Analysis (proportion of year life stages are potentially exposed)	Are any species life-stages present in overlapping areas when pesticide application are allowed? (Y/N)	Yes or No
Persistence of pesticide	Is pesticide considered persistent? (Y/N) Rule of thumb: pesticide has a half-life greater than 100 days.	Yes or No
Number of applications	Are multiple applications authorized per year? (Y/N)	Yes or No
Proximity Analysis: Use sites proximal to sensitive areas Or Potential for exposure from upstream sources	Are use sites within 300 meters of sensitive areas? (Y/N) Or Are upstream use sites likely to substantially increase exposure via downstream transport? (Y/N)	Yes or No
Time spent occupying aquatic areas	Species residency: Days, months, years <30 days=1 ; 1-6 months(1-2 seasons) = 2; multiple years = 3 Species migration: Days <7 days =1; 7-21 days =2 ; >21 days = 3	category (1;2;3) category (1;2;3)

For each species assessed, NMFS has characterized the "likelihood of exposure" relative to each use site (e.g. corn, wheat) within that species' range. The likelihood of exposure for each use site is characterized as either low, medium or high depending on the criteria determined for each of the six likelihood factors. Unique combinations of the six likelihood factors result directly in the likelihood of exposure being characterized as either low, medium, or high according to the decision key in Table 5.

The likelihood factor, "Proximity Analysis" was assessed qualitatively for each use site layer that represented less than 1 percent of the species range. NMFS used GIS mapping and species distribution/life history information to determine whether sites were aggregated in proximity to sensitive areas (e.g., known spawning areas). When evaluating a map, we classified use sites as "in proximity" when they either: 1) were within 300 meters of the sensitive habitat and exposure was deemed likely due to runoff or drift; or 2) when chemical fate, hydrologic properties, and the proximity of use sites upstream from sensitive habitat suggested exposure was likely through the downstream transport pathway. For many of the salmonids assessed, NMFS determined sensitive areas by identifying those streams which support populations that have been identified in recovery plans as "core populations."

Table 5. Likelihood of exposure decision key. The combinations provided in this key are not exhaustive of all possible combinations, rather they represent only those combinations which were encountered in this Opinion.

Percent Overlap Category	Seasonal Analysis	Persistence	Multiple Applications	Proximity Analysis	Duration of migration/residency	Likelihood of Exposure
3	yes	yes	yes	NA	3	**High**
3	yes	yes	yes	NA	2	**High**
3	yes	yes	yes	NA	1	**High**
3	yes	no	yes	NA	3	**High**
2	yes	yes	yes	NA	3	**High**
1	yes	no	yes	yes	3	**High**
1	yes	yes	yes	yes	3	**High**
3	yes	no	yes	NA	2	**Medium**
3	yes	no	no	NA	3	**Medium**
3	yes	no	no	NA	2	**Medium**
2	yes	no	yes	NA	3	**Medium**
2	yes	no	no	NA	3	**Medium**
2	yes	no	yes	NA	2	**Medium**
1	yes	no	yes	yes	2	**Medium**
1	yes	no	no	yes	3	**Medium**
1	no	yes	yes	yes	3	**Medium**
2	yes	no	no	NA	2	**Low**
1	yes/no	yes/no	yes/no	no	1/2/3	**Low**
1	yes/no	yes/no	yes/no	yes/no	1	**Low**
1	yes	no	no	yes	2	**Low**
1	no	no	yes	yes	3	**Low**

At this point in the analysis, we've determined the "likelihood of exposure" and the "effect of exposure" for each category of use (use site) or habitat bin, for the identified toxicity endpoints. For example, for each species, the above determines the effect of exposure and likelihood of exposure by use/ use site (e.g., "Wheat"), and each toxicity endpoint (e.g., "Growth").

4.4.4 Risk Determination for Each Risk Hypothesis

In this step, we evaluate each risk hypothesis using the combined results of the "likelihood of exposure" and "effect of exposure" determinations. As noted earlier, risk hypotheses are based on population level effects (abundance and productivity) which manifest when a group of individuals exhibit compromised fitness. For example, a risk hypothesis might be: "Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability". The use-specific "likelihood of exposure" and "effect of exposure" evaluations are compiled to rate each risk hypothesis as posing a high, medium, or low risk. This is illustrated in Figure 6. A "high" risk determination for a risk hypothesis is concluded when, for any toxicity endpoint relevant to a risk hypothesis, use sites had a high "effect of exposure" and a high "likelihood of exposure" ("high/high") and/or use sites with a high/medium combination (red squares in Figure 4). For example, taking the above example of a risk hypothesis involving "reduction in prey availability", if the uses showed a high "likelihood of exposure" and a high "effect of exposure" for "Prey" we would conclude that there was a "high" risk associated with this particular risk hypothesis for this particular species. If the uses showed a high "likelihood of exposure" and a high "effect of exposure" for such an endpoint, we would conclude that there was a "high" risk associated with this particular risk hypothesis for this particular species. In similar fashion, a medium risk determination for a risk hypothesis stems from likelihood of exposure and effect of exposure combinations of high/low; medium/low; and medium/ medium (yellow squares in Figure 4). A low risk determination for a risk hypothesis stems from likelihood of exposure and effect of exposure combinations of low/low, low/medium, or low/high (green squares in Figure 4). In cases where a single use category (e.g. other grains) is identified as leading the risk characterization, we take an additional step to ensure that our risk characterization is accurate. For example, if "other grains" is the only use category signaling high risk, the overall risk may be characterized as medium if we determine that a high risk is not appropriate. Information considering during this step includes that which informed the original "effect of exposure" and "likelihood of exposure" characterization as well as information used to determine the confidence.

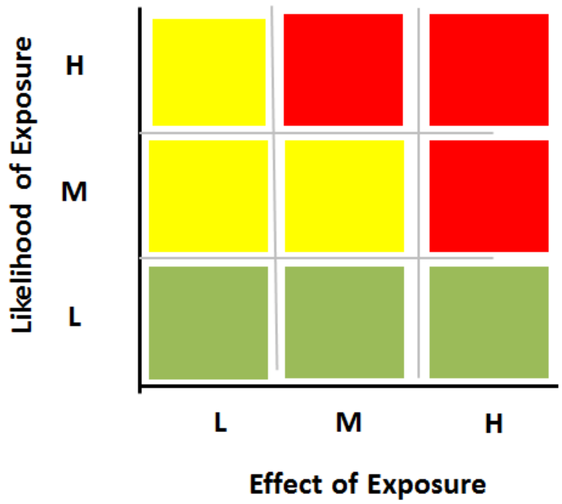

Figure 4. Ranking Risk Hypotheses Based on Uses. Each use is plotted based on Likelihood of Exposure finding and Effect of Exposure finding. L=low, M=medium, H=high; Red squares indicate a risk hypothesis has high risk; yellow squares indicate medium risk; and green squares indicate low risk.

4.4.5 Confidence Ranking for Each Risk Hypothesis

Once we have determined the risk ranking for a risk hypothesis, we then evaluate the level of confidence we have in that ranking. The confidence underscores the level of certainty or strength we have in the risk determination. The confidence level in the risk determination is evaluated and assigned a low, medium, or high level of confidence after evaluating five general factors:

1. Number of similar combinations of likelihood of exposure and effect of exposure e.g., the more uses and toxicity endpoints for which there is the same combination of "likelihood of exposure" and "risk of exposure" (e.g., "high/high," ("low/medium"), the more confidence we have in the low/medium/high risk assignment for the associated risk hypothesis.

2. Percentage of use site overlapping with species' range (e.g., the greater the percentage of overlap between use sites and the species' range, the more confidence we have in a risk hypothesis ranking of "high risk"; and the lower the percentage, the greater confidence we have in a risk hypothesis ranking of "low risk").

3. Evidence that registered uses within the species range are probable (e.g. they have previously occurred within the species range), or improbable (e.g. the registered use/crop cannot be cultivated within the species range). The percent overlap

estimates presented in the Risk-plots are based on overlap between species range and Cropland Data Layer (CLD) class groupings (e.g. vegetables and ground fruit). The CLD has over 100 different cultivated classes which were grouped by USEPA in order to reduce the likelihood of errors of omission and commission between similar crop categories (see attachment 1-3 in EPA 2017a; https://www.epa.gov/endangered-species/biological-evaluation-chapters-chlorpyrifos-esa-assessment). CDL groupings were designed to minimize uncertainties, however they also introduce the possibility that overlap percentages include uses for which 1,3-D and metolachlor have not been registered. Whether or not there is additional evidence, beyond the CDL, that registered uses have occurred in a species range will be considered in characterizing confidence. Sources of information used to assess this factor include USDA's NASS Census of Agriculture, monitoring data, incident data, and available usage information.

4. Representativeness of pesticide estimates as realistic exposure values for species' habitats (see Chapter 11 for a description of the habitats and the uncertainties associated with exposure estimates).

5. Representativeness of toxicity information for threatened and endangered species. We reviewed the available toxicity information in light of our data quality standards (see Chapter 11) to evaluate the level of confidence in the toxicity information used to determine effects to a listed species and its habitats. For example, we would ascribe higher confidence for a toxicity endpoint when a robust species sensitivity distribution (SSD) is available and lower confidence when SSDs are not available. Relatively few toxicity studies were available for 1,3-D and metolachlor and SSDs were not generated. We evaluated the number of studies and the representativeness of test species to asses the confidence. Species from the same genera as the species being assess were assigned a higher level of confidence. For sublethal effects, we evaluated confidence by reviewing the distribution of LOECs and the number of studies. The narrower the distribution of LOECs, the higher confidence we had in the effect and the more studies that were conducted the higher our confidence.

4.4.6 Overall Risk

Once we assessed each individual risk hypothesis for its level of risk and confidence, we then translated these values into an assessment of the overall risk posed to the species (low, medium, or high) based on all of the risk hypotheses. To make this conclusion, we plotted the risk hypotheses on a graph based on the risk and confidence determinations for each risk hypothesis. This is illustrated in Figure 7 below. For the acute lethality risk hypothesis we also consider evidence provided by the salmonid population models (see Appendix A). For example, if one or more risk hypotheses had high risk and high confidence then we determined that the overall risk to the species was high, placing it in the red squares in Figure 7. We also determined the overall risk to the species as "high" if, for any risk hypothesis, one of the variables (level and confidence of risk) was high and the other was medium. If all risk hypotheses landed in the yellow and green squares in Figure 7, then the conclusion was determined to be medium risk for the species. If most risk hypotheses landed in the green squares the conclusion was determined to be low risk for the species.

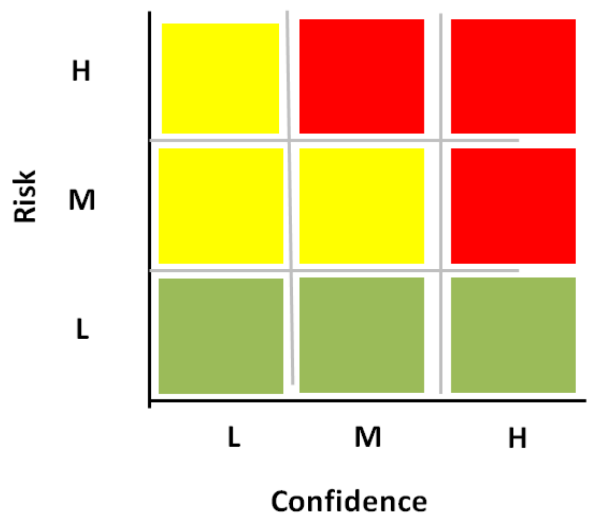

Figure 5. Each individual risk hypothesis is plotted based on its associated risk and confidence. Overall Risk is determined based on where the risk hypotheses fall within the matrix.

4.4.7 Salmon Population Models

For certain salmon, we applied a peer-reviewed, published population model as a tool to estimate population level responses to the two herbicides (see Appendix A). The salmon model outputs were used as an additional source to evaluate whether or not the acute lethaly risk hypotheses were supported.

Sufficient data were available to construct population models for four Pacific salmon life history strategies. We ran life-history matrix models for ocean-type and stream-type Chinook salmon (*O. tshawytscha*), coho salmon (*O. kisutch*), and sockeye salmon (*O. nerka*). The basic salmonid life history we modeled consisted of hatching and rearing in freshwater, smoltification in estuaries, migration to the ocean, maturation at sea, and returning to the natal freshwater stream for spawning followed shortly by death. For specific information on the construction and parameterization of the models, see

Appendix A. Potential impacts resulting from freshwater exposure to pesticides were integrated into the models as alterations in the first year survival rate. Population level impacts were assessed as changes in the intrinsic population growth rate and quantified as the percent change in population growth rate. Changes that exceeded the variability in the baseline (*i.e.*, one standard deviation) were considered significant.

Acute toxicity models were constructed that estimated the population-level impacts resulting from sub-yearling exposure to 1,3-D and metolachlor. The model did not consider multiple exposures, effects to other life stages, or any sublethal or habitat-related effects. We determined population outcomes when different percents of sub-yearlings are exposed (10, 25, 50, 80, and 100 percent exposed) to EECs sufficient to cause lethality to different percents of the individuals exposed (0 to 100 percent mortality in 5 percent increments), the approximate range of mortality corresponding to maximum EECs on 1,3-D and metolachlor Risk-plots. The models assessed impacts to population growth rates for ocean-type Chinook, stream-type Chinook, sockeye, and coho salmon.

The Risk-plot and population modeling results are considered when determining whether a risk hypothesis is supported or not. If results from one of the tools indicated that abundance or productivity would be reduced, then we answered “yes”: the risk hypothesis was supported. In this manner, we gave the benefit of the doubt to species. If results from both tools indicated that neither abundance nor productivity were reduced, we answered “no”. We followed this systematic approach for each species. We reported findings for each species with in a summary table (Table 6).

Table 6. Example summary table of risk hypotheses

Risk Hypothesis	Risk-plot Derived		Population Model Results	Risk Hypothesis Supported? Yes/No
	Risk	Confidence		
Exposure to metolachlor is sufficient to reduce abundance via acute lethality.	Low	Medium	No significant reductions in population growth rate. See Appendix A for details.	No
Exposure to metolachlor is sufficient to reduce abundance via reduction in prey availability.	Medium	Low	Not modelled	No
Exposure to metolachlor is sufficient to reduce abundance via impacts to growth (direct toxicity).	Low	Medium	Not modelled	No
Exposure to metolachlor is sufficient to reduce productivity via impairments to reproduction.	Low	Medium	Not modelled	No

4.4.8 Summary of Effects Analyses

Each risk hypothesis and associated risk and confidence assignments are presented in a summary table along with results from population modeling (see Table 6 for example) Based on the arrangement of risk and confidence pairings of the risk hypotheses (indicated in Figure 5), a bar is placed along a risk continuum (less risk to more risk) to graphically denote the overall risk identified in the effects analysis section of the species or designated critical habitat. Each pesticide and chemical pairing receives a risk bar. An example is shown in Figure 6 . We also ascribe an overall level of confidence to the risk finding based on the aggregation of confidence rankings for the individual risk hypotheses.

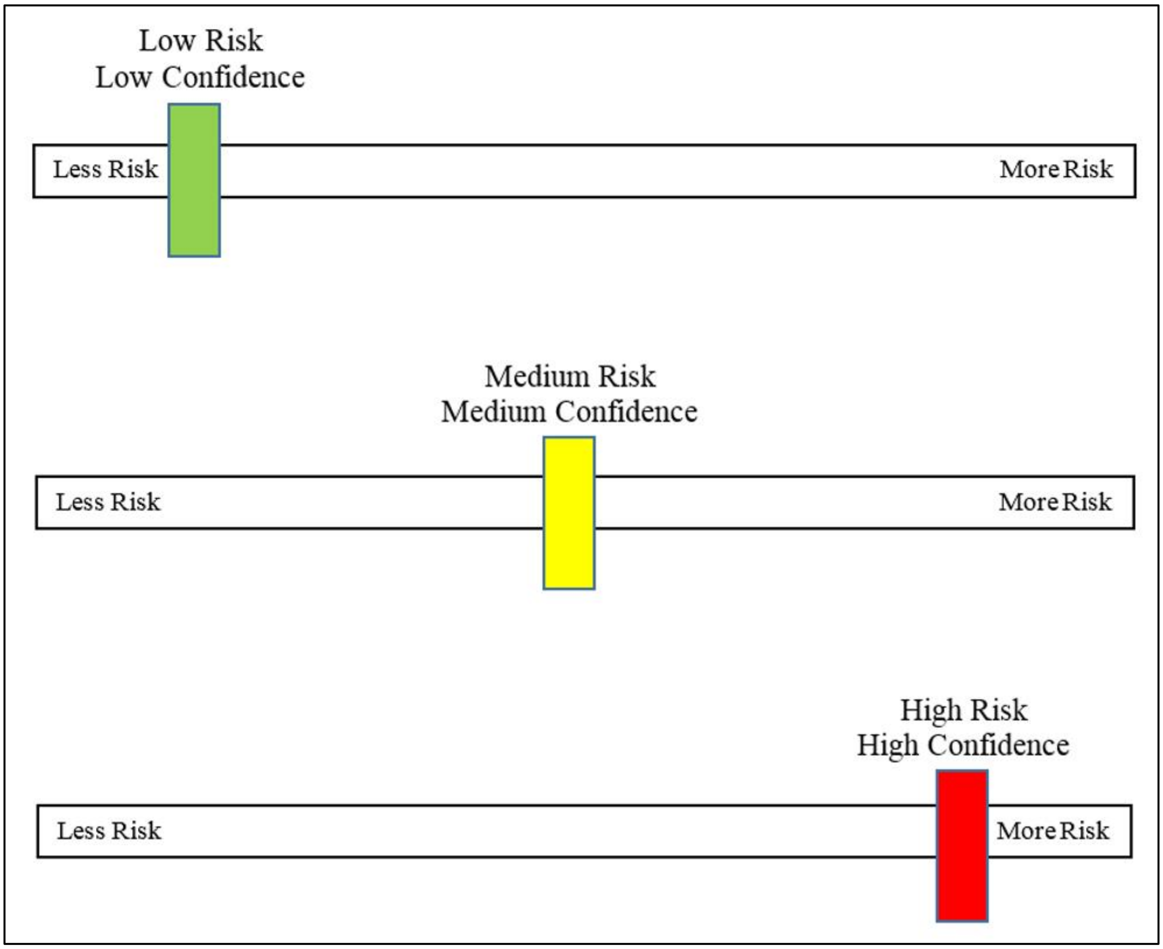

Figure 6. Depiction of risk associated with the stressors of the action

We conclude the Effects of the Action analysis for species and designated critical habitat by composing a narrative to summarize our evaluation and findings of risk hypotheses. The statement of risk for a species and chemical is carried forward in the Integration and Synthesis where it is presented as a horizontal bar to denote the overall finding for risk and confidence found at the top of a scorecard. The possible permutations for risk and confidence are High Risk/ High Confidence; High Risk/ Medium Confidence; High Risk/Low Confidence; Medium Risk/ High Confidence; Medium Risk/ Medium Confidence; Medium Risk/ Low Confidence; Low Risk/ High Confidence; Low Risk/ Medium Confidence; Low Risk/ Low Confidence.

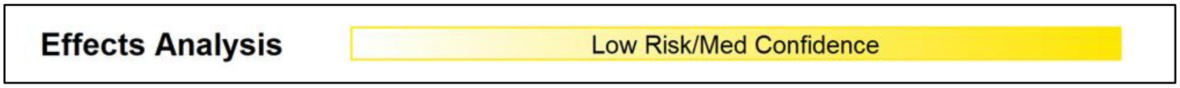

Figure 7. Example statement of risk summarizing results of effects analyses

4.4.9 Designated Critical Habitat Analyses

We translated each PBF into a risk hypothesis (Table 7) to assess potential impacts on designated critical habitat. The assessment first considers the "effect of exposure", and then considers whether that effect may occur at a larger scale by evaluating the "likelihood of exposure". By combining the effect of exposure and likelihood of exposure we arrive at an overall determination of risk and confidence for each of the risk hypotheses.

Table 7 Example summary of designated critical habitat risk hypotheses

	Risk-plot Derived		**Risk Hypothesis Supported? Yes/No**
Designated Critical Habitat; Risk Hypotheses	**Risk**	**Confidence**	
1. Exposure to the stressors of the action is sufficient to reduce the conservation value via reductions in prey in migration and rearing sites.	low, medium, high	low, medium, high	Yes/no
2. Exposure to the stressors of the action is sufficient to reduce the conservation value via degradation of water quality in migration, spawning, and rearing sites.	low, medium, high	low, medium, high	Yes/no
3. Exposure to the stressors of the action is sufficient to reduce the conservation value via impacts to vegetative cover in migration, spawning, and rearing sites.	low, medium, high	low, medium, high	Yes/no

To determine the effect of exposure, we used Risk-plots, when available, to evaluate the support for effects to species' PBFs. As with the species assessment, each use site is evaluated to determine whether the effect of exposure is low, medium, or high based on the EECs and the toxicity information. Consideration was given to the duration of exposure when determining which EECs were relevant for comparison.

To determine the likelihood of exposure, we evaluated four factors to arrive at a low, medium, or high finding. Unique combinations of the four likelihood factors result directly in the likelihood of exposure being characterized as either low, medium, or high according to the decision key in Table 5. The likelihood of exposure assessment allows us to consider whether effects may occur across the critical habitat by taking into consideration the extent of exposure, the chemical properties (e.g. persistence), as well as the proximity of use sites to PBFs (when spatial data are available). The four factors considered are:

1. Percent overlap of a designated critical habitat range with a pesticide's approved uses. Each use is assigned a category of 1, 2, or 3 depending on the degree of geographic overlap of use acreage with the species' U.S. range acreage (aggregation of HUC-12s that delineate the species range). Use acreage comes from EPA-derived GIS layers and is presented on the left Y-axis of the Risk-plot. Designated critical habitat range comes from NMFS listing documents.

2. Persistence of the pesticide based on environmental fate issues. We evaluated the environmental fate information provided in the BE to determine whether the pesticide is considered persistent. As a rule of thumb, we answered yes to persistence if the pesticide has a half-life greater than 100 days.

3. Number of applications allowed. We reviewed EPA approved labels to determine whether multiple applications were allowed on each use site.

4. Proximity analysis: for use sites with less than 1 percent overlap within designated critical habitat. NMFS used GIS mapping and critical habitat information to determine whether sites were aggregated in proximity to sensitive areas (e.g., known spawning areas). When evaluating a map, we classified use sites as "in proximity" when they were either: 1) within 300 meters of the sensitive habitat and exposure was deemed likely due to runoff or drift; or 2) chemical fate, hydrologic properties, and the proximity of use sites upstream from sensitive habitat suggested exposure was likely through the downstream transport pathway.

Percent Overlap Category	Persistence	Multiple Applications	Proximity Analysis	Likelihood of Exposure
3	yes	yes	NA	**High**
3	no	yes	NA	**High**
2	yes	yes	NA	**High**
1	yes	yes	yes	**High**
1	no	yes	yes	**High**
3	no	no	NA	**Medium**
2	no	yes	NA	**Medium**
1	no	no	yes	**Medium**
2	no	no	NA	**Low**
1	yes/no	yes/no	no	**Low**

Figure 8. Decision key for likelihood of exposure finding for designated critical habitat

The effect of exposure and likelihood of exposure determinations are then combined for each use site to determine the overall risk associated with the risk hypothesis. This is done following the same criteria as with the species assessment (described earlier). Once we have determined the risk ranking for a risk hypothesis, we then evaluate the level of confidence we have in that ranking. The level of confidence underscores the level of certainty we have in the risk determination for each risk hypothesis. The confidence level in the risk determination is evaluated and assigned a low, medium, or high level. The factors evaluated in characterizing confidence in the critical habitat assessment are similar to those used in the species assessment (described above).

Similar to the effects of the action on the species, the arrangement of risk and confidence pairing of the risk hypotheses dictated the placement of a risk bar along a risk continuum. The graphic denotes the overall risk identified in the effects analysis section of designated critical habitat (see Figure 6). Each pesticide and designated critical habitat pairing receives a risk bar.

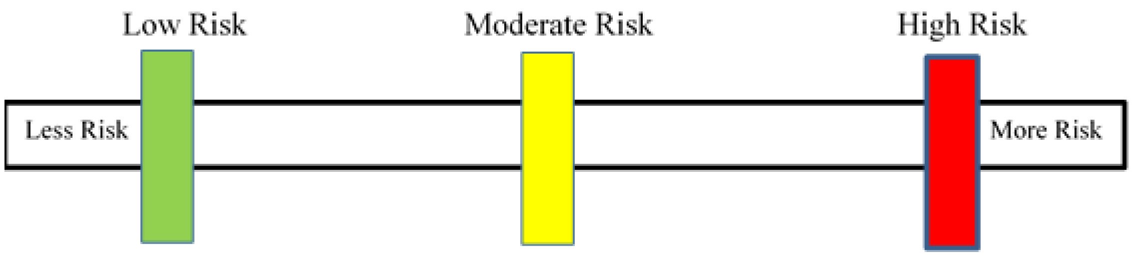

Figure 9. Depiction of risk to designated critical habitat from the stressors of the action

We conclude the Effects of the Action analysis for designated critical habitat by composing a narrative to summarize our evaluation and findings of risk hypotheses. The statement of risk for a species and chemical is carried forward in the integration and synthesis section. The risk statement is presented as a horizontal bar to denote the overall finding for risk and confidence found at the top of a score card.

4.5 Integration and Synthesis

The integration and synthesis section is the final step in our assessment of the risk posed to critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action to the status, baseline and the cumulative effects to formulate the agency's biological opinion as to whether the proposed action is likely to appreciably diminish the value of designated critical habitat as a whole for the conservation of an ESA-listed species.

The effects analysis (Chapter 16) evaluated the effects of the action on the primary and biological features of the designated critical habitat for each species. This analysis included the evaluation of risk hypotheses. The effects analysis concluded with a determination of risk posed to the primary and biological features by the effects of the action, as well as a characterization of confidence. In this section, these effects analysis conclusions are considered in the context of the status, baseline and cumulative effects to determine whether the effects of the action will appreciably diminish the conservation value as a whole.

We treat the information from the status, environmental baseline, and cumulative effects, as "risk modifiers," in that the effects described in the effects analysis section may be modified by the condition of the environmental baseline, and anticipated cumulative effects. To help guide our risk assessors in making transparent and consistent determinations, we developed several key-questions which were examined for each species and critical habitat (see Chapters 8, 9, 10). However, the ultimate consideration of increased or decreased risk attributable to the status of the species, environmental baseline, or cumulative effects is not restricted to the consideration of the key questions alone. Additional relevant factors were considered depending on the species or critical habitat being assessed.

Once each of the above sections is evaluated, the effects of the action and the risk modifiers are depicted graphically on a “scorecard.” The influence of each modifier on the effects of the action is represented by an arrow. The magnitude of influence (low or high) is represented by the length of the arrow (short or long). The direction an arrow is pointed indicates the directionality of the risk modifier, increasing or decreasing risk. For example, an environmental baseline arrow pointing towards more risk may indicate that environmental mixtures and elevated temperatures occur in the Environmental Baseline, which further stresses the species in question. The level of confidence in the magnitude of modification is indicated by bolding (high confidence) or unbolding (low confidence) the arrow.

An additional arrow representing the influence on risk is graphically depicted on each of the designated critical habitat scorecards. The effects of the proposed action are characterized as high, medium, or low risk to the species on the top bar (“Effects Analysis”) of the scorecard. The scorecard also summarizes how the risk posed by the effects of the action is modified by the environmental baseline, cumulative effects, and status of the critical habitat, as depicted by the three arrows below the Effects Analysis bar. At the bottom of the scorecard, the bar labeled conclusion shows the overall risk and adverse modification determination (the colored bar beginning with green (less risk) to red (more risk)). A narrative is also presented below the scorecard to identify risk drivers and summarize the overall conclusion. The no adverse modification/adverse modification determination for each species designated critical habitat is ultimately an informed best professional judgement, based on best commercial and scientific data available, following ecological risk assessment principles (see Chapters 3 and 14).

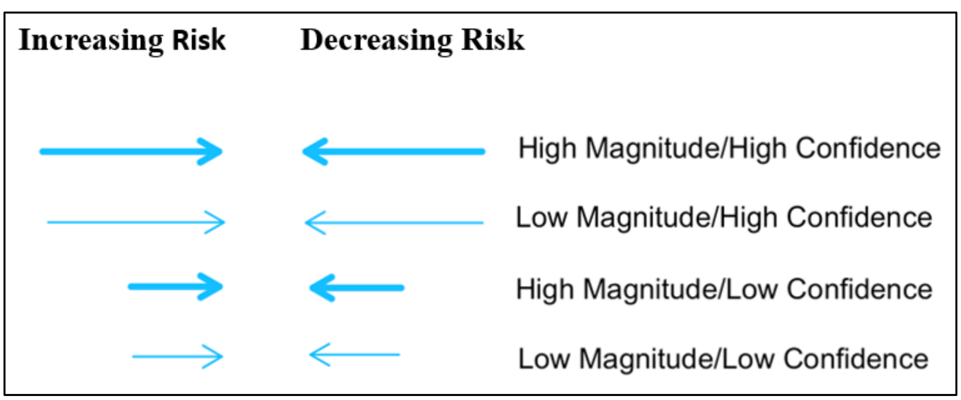

Figure 10. Example of arrows to represent direction, magnitude, and confidence of risk modifiers

4.6 Conclusion

With full consideration of the status of the species and the designated critical habitat, we consider the effects of the action within the action area on populations or subpopulations and on essential habitat features when added to the environmental baseline and the cumulative effects to determine whether the action could reasonably be expected to:

- Reduce appreciably the likelihood of survival and recovery of an ESA-listed species in the wild by reducing its numbers, reproduction, or distribution, and state our conclusion as to whether the action is likely to jeopardize the continued existence of such species; or

- Appreciably diminish the value of designated critical habitat as a whole for the conservation of an ESA-listed species, and state our conclusion as to whether the action is likely to destroy or adversely modify designated critical habitat.

A “scorecard” is generated for each species and designated critical habitat (Figure 12 and Figure 12). The effects of the proposed action are characterized as high, medium, or low risk to the species on the top bar (“Effects Analysis”) of the scorecard, using the analytical process already described. The scorecard also summarizes how the risk posed by the effects of the action is modified by the environmental baseline, cumulative effects, and status of the species, as depicted by the three arrows below the Effects Analysis bar. At the bottom of the scorecard, the bar labeled Conclusion shows the overall risk and jeopardy determination (the colored bar beginning with green (less risk) to red (more risk)). A narrative is also presented below the scorecard to identify risk drivers and summarize the overall conclusion. The No Jeopardy/ Jeopardy determination and the No adverse modification/ Adverse modification determination for each species or designated critical habitat is ultimately a best professional judgement, based on best commercial and scientific data available, following ecological risk assessment principles.

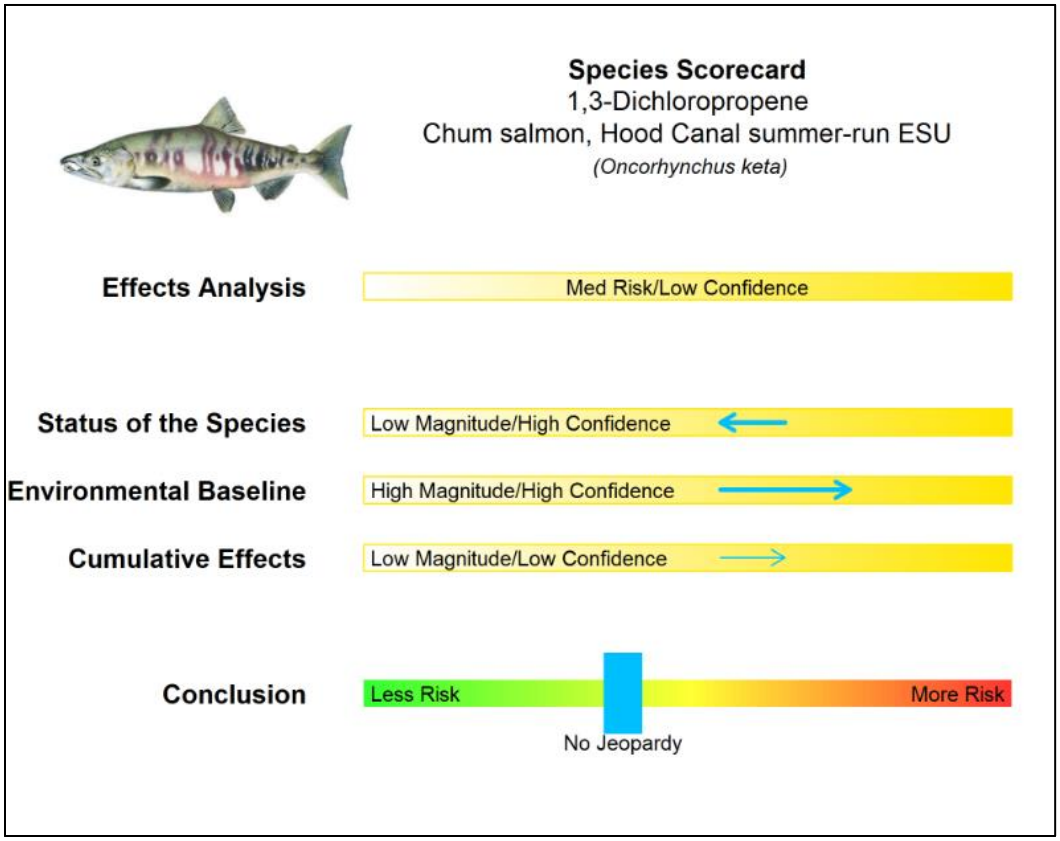

Figure 11. Example species scorecard

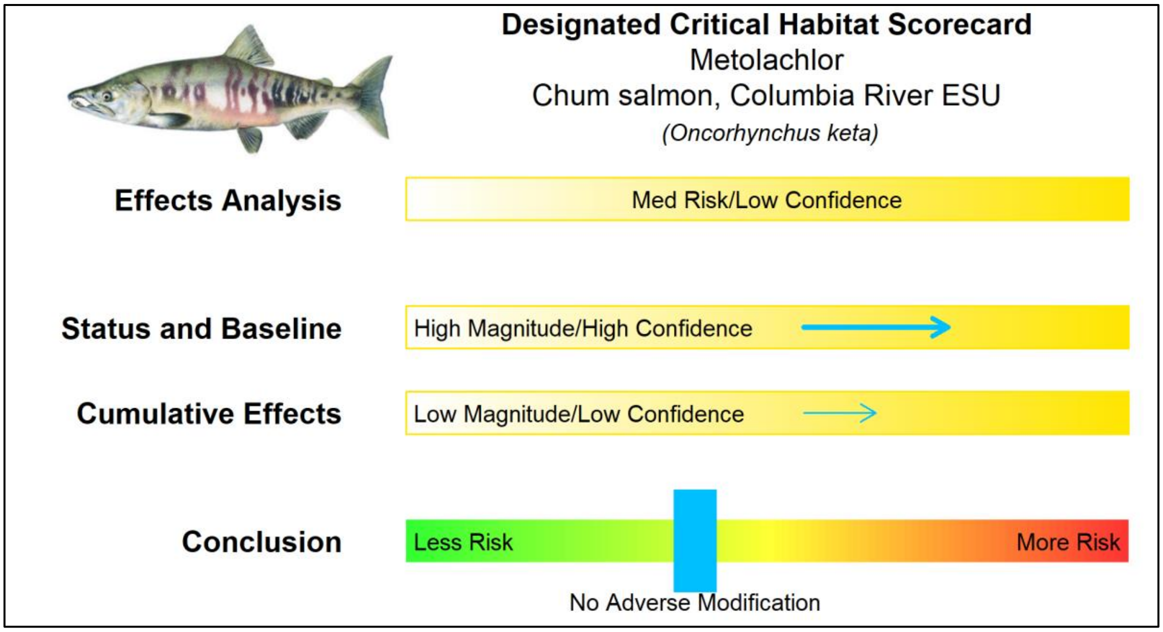

Figure 12. Example critical habitat scorecard

If, in completing the last step in the analysis we determine that the action under consultation is likely to jeopardize the continued existence of ESA-listed species or destroy or adversely modify designated critical habitat, then we must identify reasonable and prudent alternative(s) to the action, if any, or indicate that to the best of our knowledge there are no reasonable and prudent alternatives (See 50 C.F.R. §402.14).

In addition, we include an incidental take statement that specifies the impact of the take, reasonable and prudent measures to minimize the impact of the take, and terms and conditions to implement the reasonable and prudent measures (ESA section 7 (b)(4); 50 C.F.R. §402.14(i)). We also provide discretionary conservation recommendations that may be implemented by action agency (50 C.F.R. §402.14(j)). Finally, we identify the circumstances in which reinitiation of consultation is required (50 C.F.R. §402.16).

“Take” means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (16 U.S.C. § 1532). "Harass” is further defined as an act that would “create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering” (NMFSPD 02-110-19).