NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT SECTION 7
BIOLOGICAL OPINION

Title: *Environmental Protection Agency's Registration of Pesticides containing Chlorpyrifos, Diazinon, and Malathion*

Action Agency: *Environmental Protection Agency*

Consultation Conducted By: Endangered Species Act Interagency Cooperation Division, Office of Protected Resources

Approved:

Donna S. Wieting
Director, Office of Protected Resources

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EXECUTIVE SUMMARY

Key Findings

This Biological Opinion (Opinion) evaluated the effects of the Environmental Protection Agency's (EPA) registration of the pesticides chlorpyrifos, diazinon, and malathion on the Endangered Species Act (ESA) -listed species and designated critical habitats under the National Marine Fisheries Service (NMFS) jurisdiction. These three pesticides belong to the organophosphate class of insecticides and are highly toxic to mammals, fish, and aquatic invertebrates. Current product labels permit use on a variety of sites including agricultural, developed, and forested lands. Additionally, malathion and chlorpyrifos are registered for use as mosquitocides that can be applied to a wide array of land types nationwide. Current application rates and application methods are expected to produce aquatic concentrations of all three pesticides that are likely to harm aquatic species as well as contaminate their designated critical habitats. Species and their prey residing in shallow aquatic habitats proximal to pesticide use sites are expected to be the most at risk.

As shown in Chapters 7 and 8, we concurred with the "not likely to adversely affect" (NLAA) determinations for the three pesticides that were made in EPA's Biological Evaluations. Therefore, our subsequent jeopardy and adverse modification analyses focused on species for which a "likely to adversely affect" (LAA) determination was made. In this Opinion we concluded that EPA's proposed registration of pesticides containing chlorpyrifos is likely to jeopardize the continued existence of 38 of the 77 listed species, and adversely modify 37 of the 50 designated critical habitats. Likewise, for diazinon, we found jeopardy for 25 of the 77 listed species and adverse modification of 18 of the 50 designated critical habitats. Furthermore, we concluded that registration of pesticides containing malathion is likely to jeopardize 38 of the 77 listed species and adversely modify 37 of the 50 designated critical habitats. The details of our jeopardy and adverse modification determinations for each species can be found in Chapters 19-24. In sum, this Opinion reaches "jeopardy" and "adverse modification" conclusions regarding 38 different species and 37 critical habitat units.

Analysis and Methods

We followed an ecological risk assessment framework that relied upon multiple lines of evidence to determine effects to populations, species, and their designated critical habitats. The Assessment Framework in Chapter 3 provides a description of the methodology used throughout this Opinion. The core of our analysis utilized information presented in EPA's Biological Evaluations, namely pesticide exposure estimates and toxicological response data, to predict the resulting risk to the species. When determining the effects of the action (i.e., the registration of pesticides containing chlorpyrifos, diazinon, and malathion) on listed species, we considered many pieces of information including: the direct and indirect toxicity of each chemical to aquatic taxa groups (e.g. fish, mammals, invertebrates); specific chemical characteristics of each pesticide (e.g. degradation rates, bioaccumulation rates, sorption affinities, etc.); expected environmental concentrations calculated for generic aquatic habitats; authorized pesticide product labels; maps showing the spatial overlap of listed species' habitats with pesticide use areas; and species' temporal use of those lands and/or aquatic habitats on which each pesticide has permitted uses.

The Effects Analysis focused around risk hypotheses, or statements of anticipated effects to life stage groupings of a species. We employed a weight-of-evidence approach to determine for each risk hypothesis whether the expected risk from pesticide exposure to groups of individuals organized by life stage was high, medium or low. To arrive at that rating for each risk hypothesis, we addressed not only the effect and likelihood of exposure, but also our level of confidence in the risk level. We utilized multiple data sources to evaluate both the likelihood of exposure and the magnitude of effect to groups of individuals occupying similar aquatic habitats. This allowed us to assess the body of evidence that either supported or refuted the risk hypotheses. For each species, all identified risk hypotheses were qualitatively combined into a single determination of risk at the population scale (i.e., the effect of the action) and represented graphically. A similar, yet separate, analysis was conducted for designated critical habitats where risk hypotheses were developed based on potential pesticide effects to physical or biological features of critical habitat. Generally, these included effects to water quality and species' prey items. Detailed Effects Analyses for both species and critical habitats can be found in Chapters 12-17.

The final determinations of jeopardy and adverse modification of designated critical habitat were made by combining the Effects of the Action with risk modifiers, namely the Status of the Species, Cumulative Effects, and Environmental Baseline. These bodies of information were combined qualitatively, described narratively, and presented graphically as a Species Scorecard (Chapters 19-24).

Avoiding Jeopardy and Adverse Modification

As prescribed by the ESA, our findings of jeopardy and adverse modification of designated critical habitat required the production of Recommended Prudent Alternatives (RPAs). These RPAs were drafted using the best available information on current agricultural practices and pesticide reduction strategies to reduce pesticide exposure to aquatic species and their habitats. RPAs include a flexible list of chemical-specific alternatives built upon listed species life histories and other characteristics. In addition to avoiding jeopardy and adverse modification of critical habitat, the RPAs are intended to reduce loading of pesticide chemicals into aquatic habitats, incorporate landowners' current stewardship efforts, and protect vulnerable aquatic habitats from adverse effects of pesticide exposure. RPAs are presented in Chapter 26 of the Opinion.

For species where the action, or implementation of an RPA, is not likely to jeopardize listed species or cause adverse modification of designated critical habitat, we have also prepared an Incidental Take Statement with associated Terms and Conditions to minimize such take. This discussion can be found in Chapter 26 of the Opinion.

Collaborations and Future Consultations

Federal agencies (NMFS, EPA, the U.S. Fish and Wildlife Service, and the U.S. Department of Agriculture) are collaborating to respond to the National Academy of Sciences' National Research Council report on specific scientific and technical issues related to pesticide risk assessments for listed species that was released on April 30, 2013. We expect this iterative process to take several years. Notably, this Opinion represents the first consultation using newly developed approaches and the first to assess all listed species throughout the U.S., its territories, and protectorates. Future Opinions regarding pesticides may utilize different analyses and approaches as the interagency consultation effort proceeds.

Preliminary Summary of National Marine Fisheries Service Biological Opinion for Chlorpyrifos, Diazinon, and Malathion – January 9, 2018

	Jeopardy (of 77)	Adverse modification of critical habitat (of 50 species with listed critical habitat)
Chlorpyrifos	38	37
Diazinon	25	18
Malathion	38	37

For chlorpyrifos and malathion, NOAA Fisheries made jeopardy and adverse modification of critical habitat calls for all listed Pacific salmon and steelhead; for diazinon, NOAA Fisheries made jeopardy calls for all but 7 listed salmon and steelhead and adverse modification for all but 12.

NOAA Fisheries made jeopardy and adverse modification of critical habitat calls for all three pesticides for Southern Resident Killer Whales which depend on salmon, and primarily chinook salmon, for their diet.

NOAA Fisheries also made jeopardy and adverse modification calls for most listed sturgeon for chlorpyrifos and malathion and jeopardy (but no adverse modification calls) for some of the listed sturgeon for diazinon; jeopardy and adverse modification for smalltooth sawfish (although no adverse modification for diazinon); and for Pacific smelt (for chlorpyrifos and malathion only).

NOAA Fisheries made no jeopardy and no adverse modification calls for the other listed species within its jurisdiction.

NOAA Fisheries has developed reasonable and prudent alternatives consisting of three options that would avoid jeopardy and adverse modification of critical habitat by reducing the concentrations of these pesticides that reach aquatic habitats. The options apply within 300 meters adjacent to or that drain into listed species habitat for which jeopardy or adverse modification calls have been made. The options are:

1. Prohibiting use of high risk uses within a species range, which could entail modifying the pesticide labels to reflect actual usage.
2. EPA could require no application buffers with a 6-meter vegetative filer strip for all high risk uses within the species range.
3. Adopt a point system that gives pesticide users flexibility to choose from a variety of risk reduction measures including no-spray buffers, vegetative filter strips, spray reduction technologies, and participation in pesticide stewardship programs like "Salmon-Safe."

CHAPTER 25

CONCLUSION

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25 CONCLUSION

25.1 Chlorpyrifos

After reviewing the current status of the Endangered Species Act (ESA)-listed species, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent actions, and cumulative effects, it is the National Marine Fisheries Services'(NMFS') biological opinion that the Environmental Protection Agency's (EPA's) registration of the uses, as described by product labels, of all pesticide products containing chlorpyrifos (the Action) is likely to jeopardize the continued existence of thirty-eight species and to destroy or adversely modify the designated critical habitat of thirty-seven listed species (***Table 1,Table 2***).

25.2 Diazinon

After reviewing the current status of the ESA-listed species, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent actions, and cumulative effects, it is NMFS' biological opinion that the EPA's registration of the uses, as described by product labels, of all pesticide products containing diazinon (the Action) is likely to jeopardize the continued existence of twenty-five listed species and to destroy or adversely modify the designated critical habitat of eighteen listed species (***Table 1, Table 2***).

25.3 Malathion

After reviewing the current status of the ESA-listed species, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent actions, and cumulative effects, it is NMFS' biological opinion that the EPA's registration of the uses, as described by product labels, of all pesticide products containing malathion (the Action) is likely to jeopardize the continued existence of thirty-eight listed species and to destroy or adversely modify the designated critical habitat of thirty-seven species (***Table 1, Table 2***).

Table 1. Jeopardy conclusions for ESA-listed species; chlorpyrifos, diazinon, and malathion.

Species Jeopardy Analysis Conclusions			
Species Name	**Chlorpyrifos**	**Diazinon**	**Malathion**
Atlantic salmon, Gulf of Maine ESU	No	No	No
Chum salmon , Columbia River ESU	Jeopardy	No	Jeopardy
Chum salmon, Hood Canal summer-run ESU	Jeopardy	No	Jeopardy
Chinook salmon, California coastal ESU	Jeopardy	Jeopardy	Jeopardy
Chinook salmon, Central Valley spring-run ESU	Jeopardy	Jeopardy	Jeopardy
Chinook salmon, Lower Columbia River ESU	Jeopardy	Jeopardy	Jeopardy
Chinook salmon, Puget Sound ESU	Jeopardy	Jeopardy	Jeopardy
Chinook salmon, Sacramento River winter-run ESU	Jeopardy	Jeopardy	Jeopardy

Chinook salmon, Snake River fall-run ESU	Jeopardy	Jeopardy	Jeopardy
Chinook salmon, Snake River spring/summer run ESU	Jeopardy	Jeopardy	Jeopardy
Chinook salmon, Upper Columbia River spring-run ESU	Jeopardy	Jeopardy	Jeopardy
Chinook salmon, Upper Willamette River ESU	Jeopardy	Jeopardy	Jeopardy
Coho salmon, Central California coast ESU	Jeopardy	Jeopardy	Jeopardy
Coho salmon, Lower Columbia River ESU	Jeopardy	No	Jeopardy
Coho salmon, Oregon coast ESU	Jeopardy	No	Jeopardy
Coho salmon, S. Oregon and N. Calif coasts ESU	Jeopardy	No	Jeopardy
Sockeye, Ozette Lake ESU	Jeopardy	No	Jeopardy
Sockeye, Snake River ESU	Jeopardy	Jeopardy	Jeopardy
Steelhead, California Central Valley ESU	Jeopardy	Jeopardy	Jeopardy
Steelhead, Central California coast ESU	Jeopardy	Jeopardy	Jeopardy
Steelhead, Lower Columbia River ESU	Jeopardy	Jeopardy	Jeopardy
Steelhead, Middle Columbia River ESU	Jeopardy	Jeopardy	Jeopardy
Steelhead, Northern California ESU	Jeopardy	Jeopardy	Jeopardy
Steelhead, Puget Sound ESU	Jeopardy	No	Jeopardy
Steelhead, Snake River Basin ESU	Jeopardy	Jeopardy	Jeopardy
Steelhead, South-Central California coast ESU	Jeopardy	Jeopardy	Jeopardy
Steelhead, Southern California ESU	Jeopardy	Jeopardy	Jeopardy
Steelhead, Upper Columbia River ESU	Jeopardy	Jeopardy	Jeopardy
Steelhead, Upper Willamette River ESU	Jeopardy	Jeopardy	Jeopardy
Eulachon, Pacific smelt, Southern DPS	Jeopardy	No	Jeopardy
Green sturgeon, Southern DPS	Jeopardy	Jeopardy	Jeopardy
Shortnose sturgeon	Jeopardy	No	Jeopardy
Atlantic sturgeon, Carolina DPS	Jeopardy	No	Jeopardy
Atlantic sturgeon, Chesapeake Bay DPS	Jeopardy	No	Jeopardy
Atlantic sturgeon, Gulf of Maine DPS	Jeopardy	No	Jeopardy
Atlantic sturgeon, New York Bight DPS	Jeopardy	Jeopardy	Jeopardy
Atlantic sturgeon, South Atlantic DPS	Jeopardy	Jeopardy	Jeopardy
Gulf sturgeon	No	No	No
Yelloweye rockfish	No	No	No
Boccacio, Puget Sound/Georgia Basin	No	No	No
Gulf grouper	No	No	No
Nassau grouper	No	No	No
Smalltooth sawfish, U.S. DPS	Jeopardy	No	Jeopardy
Black abalone	No	No	No
White abalone	No	No	No
Staghorn coral	No	No	No
Elkhorn coral	No	No	No
Coral, Acropora globiceps	No	No	No
Coral, Acropora jacquelineae	No	No	No

Coral, Acropora retusa	No	No	No
Coral, Acropora speciosa	No	No	No
Coral, Euphyllia pardivisa	No	No	No
Coral, Isopora crateriformis	No	No	No
Coral, Seriatopora aculeata	No	No	No
Boulder star coral	No	No	No
Lobed star coral	No	No	No
Mountainous star coral	No	No	No
Pillar coral	No	No	No
Rough cactus coral	No	No	No
Green sea turtle, Central North Pacific DPS	No	No	No
Green sea turtle, Central South Pacific DPS	No	No	No
Green sea turtle, Central West Pacific DPS	No	No	No
Green sea turtle, East Pacific DPS	No	No	No
Green sea turtle, North Atlantic DPS	No	No	No
Green sea turtle, South Atlantic DPS	No	No	No
Hawksbill sea turtle	No	No	No
Kemp's ridley sea turtle	No	No	No
Leatherback sea turtle	No	No	No
Loggerhead sea turtle, North Pacific Ocean DPS	No	No	No
Loggerhead sea turtle, Northwest Atlantic Ocean DPS	No	No	No
Olive ridley sea turtle, Mexico's Pacific Coast breeding colonies	No	No	No
Olive ridley sea turtle, all other areas	No	No	No
Killer whale, Southern Resident DPS	Jeopardy	Jeopardy	Jeopardy
Steller sea lion, Western	No	No	No
Guadalupe fur seal	No	No	No
Hawaiian monk seal	No	No	No
Johnson's seagrass	No	No	No
Totals (Jeopardy determinations / total LAA species)	**38 / 77**	**25 / 77**	**38 / 77**

Table 2. Adverse Modification conclusions for designated critical habitat; chlorpyrifos, diazinon, and malathion.

Designated Critical Habitat Adverse Modification Analysis Conclusions			
Species Name	**Chlorpyrifos**	**Diazinon**	**Malathion**
Chum salmon , Columbia River ESU	Adverse Modification	No	Adverse Modification
Chum salmon, Hood Canal summer-run ESU	Adverse Modification	No	Adverse Modification
Chinook salmon, California coastal ESU	Adverse Modification	Adverse Modification	Adverse Modification
Chinook salmon, Central Valley spring-run ESU	Adverse Modification	Adverse Modification	Adverse Modification
Chinook salmon, Lower Columbia River ESU	Adverse Modification	No	Adverse Modification
Chinook salmon, Puget Sound ESU	Adverse Modification	No	Adverse Modification
Chinook salmon, Sacramento River winter-run ESU	Adverse Modification	Adverse Modification	Adverse Modification
Chinook salmon, Snake River fall-run ESU	Adverse Modification	Adverse Modification	Adverse Modification
Chinook salmon, Snake River spring/summer run ESU	Adverse Modification	No	Adverse Modification
Chinook salmon, Upper Columbia River spring-run ESU	Adverse Modification	Adverse Modification	Adverse Modification
Chinook salmon, Upper Willamette River ESU	Adverse Modification	Adverse Modification	Adverse Modification
Coho salmon, Central California coast ESU	Adverse Modification	Adverse Modification	Adverse Modification
Coho salmon, Lower Columbia River ESU	Adverse Modification	No	Adverse Modification
Coho salmon, Oregon coast ESU	Adverse Modification	No	Adverse Modification
Coho salmon, S. Oregon and N. Calif coasts ESU	Adverse Modification	No	Adverse Modification
Sockeye, Ozette Lake ESU	Adverse Modification	No	Adverse Modification
Sockeye, Snake River ESU	Adverse Modification	Adverse Modification	Adverse Modification
Steelhead, California Central Valley ESU	Adverse Modification	Adverse Modification	Adverse Modification
Steelhead, Central California coast ESU	Adverse Modification	Adverse Modification	Adverse Modification
Steelhead, Lower Columbia River ESU	Adverse Modification	No	Adverse Modification
Steelhead, Middle Columbia River ESU	Adverse Modification	Adverse Modification	Adverse Modification
Steelhead, Northern California ESU	Adverse Modification	No	Adverse Modification

Steelhead, Puget Sound ESU	Adverse Modification	No	Adverse Modification
Steelhead, Snake River Basin ESU	Adverse Modification	Adverse Modification	Adverse Modification
Steelhead, South-Central California coast ESU	Adverse Modification	Adverse Modification	Adverse Modification
Steelhead, Southern California ESU	Adverse Modification	Adverse Modification	Adverse Modification
Steelhead, Upper Columbia River ESU	Adverse Modification	Adverse Modification	Adverse Modification
Steelhead, Upper Willamette River ESU	Adverse Modification	Adverse Modification	Adverse Modification
Eulachon, Pacific smelt, Southern DPS	Adverse Modification	No	Adverse Modification
Green sturgeon, Southern DPS	Adverse Modification	Adverse Modification	Adverse Modification
Gulf sturgeon	No	No	No
Atlantic sturgeon, Carolina DPS	Adverse Modification	No	Adverse Modification
Atlantic sturgeon, Chesapeake Bay DPS	Adverse Modification	No	Adverse Modification
Atlantic sturgeon, Gulf of Maine DPS	Adverse Modification	No	Adverse Modification
Atlantic sturgeon, New York Bight DPS	Adverse Modification	No	Adverse Modification
Atlantic sturgeon, South Atlantic DPS	Adverse Modification	No	Adverse Modification
Yelloweye rockfish	No	No	No
Boccacio, Puget Sound/Georgia Basin	No	No	No
Smalltooth sawfish, U.S. DPS	Adverse Modification	No	Adverse Modification
Black abalone	No	No	No
Staghorn coral	No	No	No
Elkhorn coral	No	No	No
Green sea turtle, North Atlantic DPS	No	No	No
Hawksbill sea turtle	No	No	No
Leatherback sea turtle	No	No	No
Loggerhead sea turtle, Northwest Atlantic Ocean DPS	No	No	No
Killer whale, Southern Resident DPS	Adverse Modification	Adverse Modification	Adverse Modification
Steller sea lion, Western	No	No	No
Hawaiian monk seal	No	No	No
Johnson's seagrass	No	No	No
Totals (Adverse Modification determinations / total LAA designated critical habits)	**37 / 50**	**18 / 50**	**37 / 50**

CHAPTER 26

REASONABLE AND PRUDENT ALTERNATIVES; REASONABLE AND PRUDENT MEASURES; TERMS AND CONDITIONS; INCIDENTAL TAKE STATEMENT; CONSERVATION RECOMMENDATIONS; REINITIATION NOTICE

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26 Reasonable and Prudent Alternatives & Reasonable and Prudent Measures

26.1 RPA Introduction

When the National Marine Fisheries Service (NMFS) concludes that an action is likely to jeopardize an Endangered Species Act (ESA)-listed species or destroy or adversely modify critical habitat, NMFS suggests a reasonable and prudent alternative (RPA) that would allow the action to proceed in compliance with section 7(a)(2) and that can be taken by the action agency and the applicant (ESA Section 7(a)(3)(A)). Joint NMFS and U.S. Fish and Wildlife Service regulations (50 CFR §402.02) implementing section 7 define "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 a ESA-listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR §402.02). As noted above, NMFS relies on statutory language to determine adverse modification.

The NMFS' implementing regulations define reasonable and prudent alternatives as alternative actions, identified during formal consultation, that: (1) can be implemented in a manner consistent with the intended purpose of the action; (2) can be implemented consistent with the scope of the action agency's legal authority and jurisdiction; (3) are economically and technologically feasible; and (4) NMFS believes would avoid the likelihood of jeopardizing the continued existence of ESA-listed species or resulting in the destruction or adverse modification of critical habitat (50 CFR §402.02). The overarching requirement is that an RPA must be capable of avoiding jeopardizing ESA-listed species and adversely modifying critical habitat – all other elements of the definition must be evaluated within this context (*Greenpeace v. NMFS*, 55 F. Supp. 2d 1248, 1268 (W.D. Wa. 1999)). NMFS in the preamble to the final section 7 regulations make clear that the overriding consideration is whether a RPA avoids the likelihood of jeopardy. NMFS notes that the action agency's responsibility "permeates the full range of discretionary authority held by the action agency." Thus, NMFS can specify an RPA that involves the maximum exercise of the action agency's authority when the Services deem necessary to avoid the likelihood of jeopardy (51 FR 19926, 19937 (June 3, 1986)).

The other three factors are intended to implement the statutory phrase "can be taken." The third factor, technological and economic feasibility, refers to the ability of the federal agency to implement the RPA: "[t]he requirement that a RPA be 'economically and technologically feasible' only requires that the Corps have the resources and technology necessary to implement the RPA." *In Re: Operation of the Missouri River System Litigation.* 363 F. Supp. 2d 1145, 1161 (D. Minn. 2004), citing *Kandra v. U.S.*, 145 F.Supp. 2d 1192, 1207 (D. Ore.) ("the RPAs must be economically and technically feasible for *the government* to implement."); see also San Luis & Delta-Mendota Water Authority v. Jewell, 2014 WL 975130 at 38-40 (C.A.9 (Cal.)). This regulatory factor was included in the final section 7 implementing regulations in response to a comment, without further explanation or discussion. The ESA contains no requirement for analysis of economic impacts resulting from implementation of a RPA, and the insertion of the phrase "economically feasible" in regulation cannot create this requirement. Any obligation that NMFS "balance the benefit to the species against the economic and technical burden on the industry before approving an RPA would be fundamentally inconsistent with the purposes of the

ESA and with case law interpreting the Act." *Greenpeace v. NMFS,* 55 F. Supp. 2d 1248, 1267 (W.D. Wash. 1999). While the Services will defer in most cases to the action agency's expertise as to whether a RPA is reasonable, including whether the RPA is technologically and economically feasible, the Services cannot abdicate their duty to formulate and recommend RPAs (51 FR at 19952). However, the action agency may choose or may be obligated to conduct an economic analysis and to evaluate impacts to interests other than the applicants when it implements a RPA pursuant to its authorities.

In this Opinion, NMFS concluded that the Environmental Protection Agency's (EPA's) proposed registration of chlorpyrifos, diazinon and malathion is likely to jeopardize 38 listed species and likely to adversely modify or destroy the designated critical habitat of 37 species. NMFS reached these conclusions because predicted concentrations of these three a.i.s are likely to have direct and indirect adverse effects to these species and to the primary biological features of their designated critical habitat. As a result, affected species are likely to suffer reductions in viability from one or more of the a.i.s given the severity of expected changes in abundance and productivity associated with the proposed action. These adverse effects are expected to appreciably reduce the likelihood of both the survival and recovery of these listed species and reduce the conservation value of some of the species' designated critical habitat.

The RPA accounts for the following issues: (1) the action will result in exposure to other chemical stressors in addition to the a.i. that may increase the risk of the action to ESA-listed species, including unspecified inert ingredients, adjuvants, and tank mixes; (2) exposure to chemical mixtures containing the a.i.s and other chemical compounds may result in greater toxicity; and (3) exposure to other chemicals and physical stressors (*e.g.,* temperature) in the baseline habitat will likely intensify response to the a.i.s.

The action as implemented under the RPA will remove the likelihood of jeopardy and of destruction or adverse modification of critical habitat by reducing exposure of the stressors of the action. In the proposed RPA, NMFS does not attempt to ensure there is no take of ESA-listed species. NMFS concludes that take will likely occur, and has provided an incidental take statement exempting that take from the take prohibitions as long as the action is conducted in compliance with the terms and conditions of the incidental take statement. Avoiding take altogether would most likely entail canceling registration, or prohibiting all use in watersheds inhabited by listed species. The goal of the RPA is to reduce exposure to ensure that the action is not likely to jeopardize ESA-listed species or destroy or adversely modify critical habitat.

For each active ingredient, the elements of the RPA apply only to the range of the ESUs/DPSs where NMFS has determined that EPA cannot ensure that its registration of that a.i. avoids jeopardy or the destruction or adverse modification of critical habitat (Chapter 25). These elements rely upon recognized practices for reducing loading of pesticide products into aquatic habitats.

Overall, the RPA listed here focus on reducing exposure potential to listed species and their habitats by targeting risk reduction measures that effectively reduce drift and runoff. The RPA include pesticide use restrictions that shall be specified on Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) labels of all pesticide products containing the three active ingredients; this shall be accomplished by incorporating the required elements of the RPA into the "Directions for Use" section of the FIFRA labels or on EPA Endangered Species Protection

Program Bulletins that serve as enforceable extensions to these labels (https://www.epa.gov/endangered-species/endangered-species-protection-bulletins).

The RPA listed here also incorporates risk reduction measures for pesticide users that participate in conservation activities. These include: 1) installing/maintaining riparian systems alongside aquatic habitats, and 2) participation in a recognized pesticide stewardship plan. Pesticide users that take advantage of these activities receive full points for required risk reduction measures for drift and runoff/drainage.

Riparian areas occur alongside watercourses or water bodies and are typically distinct from surrounding lands due to their unique soil and vegetation characteristics that are influenced by the hydrologic conditions of the soil. Pesticides can move from treated agricultural and forested areas via spray drift and surface water runoff into the broader environment. Riparian areas filter runoff and intercept drift thereby reducing loading into off target water bodies. Generally, the use of riparian areas, coupled with low-drift application methods, substantially reduce drift deposition and runoff into sensitive aquatic habitats adjacent to pesticide use sites. Therefore, a functional riparian zone substantially reduces pesticide loading, potentially negating the need for no-spray buffers. The effectiveness in reducing pesticide loading depends on site-specific factors such as dimensions, type, and complexity of the riparian vegetation.

Pesticide stewardship plans[1], such as Salmon-Safe, work with landowners to create a management plan that reduces or eliminates use of pesticides thereby removing potential exposure to listed species and their habitats. Therefore, landowners that participate in such plans would receive full credit for required risk reduction measures.

26.1.1 Reasonable and Prudent Alternatives

Five distinct elements are required to ensure jeopardy is avoided and to ensure designated critical habitat is not destroyed or modified. These elements are:

1. Reduce pesticide loading for high risk use sites;
2. Limit the frequency of application to once per year for persistent pesticides i.e., chlorpyrifos;
3. Limit area of application for mosquito control;
4. Limit area of application for wide area use;
5. Employ an effectiveness monitoring plan.

Element 1 involves three options which EPA can implement through label revisions that would reduce pesticide loading in listed species aquatic habitats (Table 1). The first of these options changes the action by prohibiting the use of high risk uses within a species range and/or modifying labels based on actual usage. In the second option, EPA could require specific no application buffers and mandate a 6 meter vegetative filter strip for all high risk uses within the species range. The third option provides flexibility for pesticide users to select risk reduction measures using the point system approach described below. This option includes a variety of risk reduction measures including no-spray buffers, vegetative filter strips, spray drift reduction technologies, and participation in pesticide stewardship programs such as "Salmon-Safe".

[1] NMFS approval of stewardship plan required to receive risk reduction credit

Table 1. RPA Elements

RPA Element	Description
Element 1	Reduce pesticide loading for all high risk use sites. Choose 1(a) or 1(b) or 1(c). 1(a) Remove label authorization for all high risk uses. If current usage on use sites effectively reduces exposure[2], modify labels to reflect current usage. 1(b) Modify labels to include standard buffers and vegetative filter strips: 300 meter no-spray buffer for all aerial applications; 150 meter buffer for all ground applications; 6 meter vegetative filter strip for all applications. 1(c) Point System. Implement a combination of risk reduction measures to reduce pesticide drift, runoff, and drainage.
Element 2	Limit the frequency of application to once per year for persistent pesticides e.g. chlorpyrifos.
Element 3	Restrict mosquito applications to residential and developed areas within species' range.
Element 4	Restrict wide area use to residential and developed areas with spot treatment only.
Element 5	EPA shall, in close coordination with NMFS Office of Protected Resources, develop and implement an effectiveness monitoring plan to ensure the RPA(s) selected is/are feasible, effective, and implemented.

26.1.2 Points System Overview: Element 1(c)

Pesticide end-users could also follow a simple point system to arrive at sufficient risk reduction measures. The points system is based on the European Union's Mitigating the Risks of Plant Protection Products in the Environment, referred to as MAgPIE (Alix et al. 2017). While the goal of MAgPIE was to develop a harmonized approach for risk management among EU countries, the approach achieves quantifiable reductions in pesticide loading while allowing maximum flexibility for the grower/applicator. It also rewards landowners who are already implementing reduction measures such as Best Management Practices (BMPs) that reduce loading and improve habitat for listed species.

Important aspects of the points approach:

- The pesticide applicator can choose from a list of risk reduction measures (e.g. Table 2) listed on EPA's Bulletins Live website.
- Each risk reduction measure on the list has a point value based on its effectiveness at reducing loading from drift and runoff/drainage.

[2]Requires NMFS concurrence that EPA-proposed alternative based on usage information effectively reduces exposure

- The applicator can choose which risk reduction measures to implement as long as the required number of points are achieved for each exposure pathway (drift and runoff/drainage).
- The point system is only required for high risk uses. High risk uses are those which received a high rating for effect of exposure and a high or medium rating for likelihood of exposure as presented in the Effects of the Proposed Action.

Risk reduction measures and associated points are presented below in Table 2, Table 3, and Table 4. The RPA and RPM for each of the three pesticides apply to applications on high risk use sites within 300 meters adjacent to, or that drain to listed species aquatic habitats for which jeopardy or adverse modification of designated critical habitat was determined.

Table 2. Chlorpyrifos Risk Reduction Measures and Associated Points

Drift Measures	Estimated % reduction in loading	Points	Runoff/drainage Measures	Estimated % reduction in loading	Points
No Spray Drift Buffers :			No Spray Buffer ≥300 meters to listed species habitat or water that drains to habitat	99	80
Ground boom[1] /chemigation buffer:					
10 meters	25	5			
20 meters	60	40			
100 meters	90	70			
200 meters	95	75			
300 meters	99	80			
Air blast buffer[2]:					
20 meters	40	20			
100 meters	99	80			
Aerial buffer[3]:					
100 meters	60	40			
300 meters	99	80			
Spray Drift Reduction Technology[4] (nozzles, etc.):			Vegetated filter strip[5]:		
			5 meters	40	20
Category one	25-50	20	10 meters	65	45
Category two	50-75	45	20 meters	80	60
Category three	75-90	65			
Category four	>90	75	Inter row	50	30
Granular treatment	99	80	Bunds[5]:		
			Edge of field	40	20
			In-field	50	30
Spot Applications <0.1 A[6]	99	80	Spot Applications <0.1A[6]	99	80
			Vegetated ditches[5]	50	30
Riparian plantings[7]	27-36	10	No-till or reduced tillage[5]	50	30
			Retention pond[5]	75	55
Participation in recognized stewardship program	99	80	Participation in recognized stewardship program	99	80
Functional riparian system alongside water ways, > 10 meters wide	99	80	Functional riparian system alongside water ways, > 10 meters wide	99	80

[1] AgDrift Tier 1 Ground Boom – point deposition estimates compared to 25 foot ground application buffer: low boom, very fine to fine distribution, 50th percentile distribution.

[2] AgDrift Tier 1 Orchard Airblast - point deposition estimates for sparse orchard compared to 50 foot airblast application buffer.

[3] AgDrift Tier 1 Aerial – point deposition estimates compared to 150 foot aerial application buffer.

[4] EPA may have not verified any products yet (https://www.epa.gov/reducing-pesticide-drift/epa-verified-and-rated-drift-reduction-technologies).

[5] MAgPIE. 2017

[6] Assumes median field size of 0.278 km² (Yan and Roy 2016)

[7] Washington State Department of Agriculture riparian vegetation pilot study (2015)

Table 3. Diazinon Risk Reduction Measures and Associated Points

Drift Measures	Estimated % reduction in loading	Points	Runoff/drainage Measures	Estimated % reduction in loading	Points
No Spray Drift Buffers :			No Spray Buffer >300 meters to listed species habitat or water that drains to habitat	99	80
Ground boom[1] /chemigation buffer:					
10 meters	90	70			
Air blast buffer[2]:					
10 meters	80	60			
20 meters	95	75			
Aerial buffer[3]:					
10 meters	55	35			
20 meters	70	50			
100 meters	95	75			
Spray Drift Reduction Technology[4] (nozzles, etc.):			Vegetated filter strip[5]:		
Category one			5 meters	40	20
Category two	25-50	20	10 meters	65	45
Category three	50-75	45	20 meters	80	60
Category four	75-90	65			
	>90	75	Inter row	50	30
Granular treatment	99	80	Bunds[5]:		
			Edge of field	40	20
			In-field	50	30
Spot Applications <0.1 A[6]	99	80	Spot Applications <0.1A[6]	99	80
			Vegetated ditches[5]	50	30
Riparian plantings[7]	27-36	10	No-till or reduced tillage[5]	50	30
			Retention pond[5]	75	55
Participation in recognized stewardship program	99	80	Participation in recognized stewardship program	99	80
Functional riparian system alongside water ways, > 10 meters wide	99	80	Functional riparian system alongside water ways, > 10 meters wide	99	80

[1] AgDrift Tier 1 Ground Boom – point deposition estimates compared to field edge (1 m buffer): low boom, very fine to fine distribution, 50th percentile distribution.

[2] AgDrift Tier 1 Orchard Airblast - point deposition estimates for sparse orchard compared to field edge (1m buffer).

[3] AgDrift Tier 1 Aerial – point deposition estimates compared to field edge (1 meter buffer)

[4] EPA may have not verified any products yet (https://www.epa.gov/reducing-pesticide-drift/epa-verified-and-rated-drift-reduction-technologies).

[5] MAgPIE 2017

[6] Assumes median field size of 0.278 km² (Yan and Roy 2016)

[7] Washington State Department of Agriculture riparian vegetation pilot study (2015)

Table 4. Malathion Risk Reduction Measures and Associated Points

Drift Measures	Estimated % reduction in loading	Points	Runoff/drainage Measures	Estimated % reduction in loading	Points
No Spray Drift Buffers :			No Spray Buffer ≥300 meters to listed species habitat or water that drains to habitat	99	80
Ground boom[1] /chemigation buffer:					
10 meters	90	70			
Air blast buffer[2]:					
10 meters	80	60			
20 meters	95	75			
Aerial buffer[3]:					
20 meters	35	15			
100 meters	85	65			
150 meters	90	70			
Spray Drift Reduction Technology[4](nozzles, etc.):			Vegetated filter strip[5]:		
			5 meters	40	20
			10 meters	65	45
			20 meters	80	60
Category one	25-50	20			
Category two	50-75	45			
Category three	75-90	65	Inter row	50	30
Category four	>90	75			
Granular treatment	99	80	Bunds[5]:		
			Edge of field	40	20
			In-field	50	30
Spot Applications <0.1 A[6]	99	80	Spot Applications <0.1A[6]	99	80
			Vegetated ditches[5]	50	30
Riparian plantings[7]	27-36	10	No-till or reduced tillage[5]	50	30
			Retention pond[5]	75	55
Participation in recognized stewardship program	99	80	Participation in recognized stewardship program	99	80
Functional riparian system alongside water ways, > 10 meters wide	99	80	Functional riparian system alongside water ways, > 10 meters wide	99	80

[1] AgDrift Tier 1 Ground Boom – point deposition estimates compared to field edge (1 nt buffer): low boom, very fine to fine distribution, 50th percentile distribution.

[2] AgDrift Tier 1 Orchard Airblast - point deposition estimates for sparse orchard compared to field edge (1m buffer).

[3] AgDrift Tier 1 Aerial – Fine to medium distribution, point deposition estimates compared to 25 foot non-ULV aerial buffer.

[4] Range corresponds with EPA star program (https://www.epa.gov/reducing-pesticide-drift/epa-verified-and-rated-drift-reduction-technologies).

[5] MAgPIE 2017

[6] Assumes median field size of 0.278 km² (Yan and Roy 2016)

[7] Washington State Department of Agriculture riparian vegetation pilot study (2015)

26.2 Reasonable and Prudent Alternatives for Each Species and Pesticide

This section describes chemical-specific RPA elements for each of the ESA-listed species for which jeopardy or adverse modification of designated critical habitats was determined.

26.2.1 Chlorpyrifos RPA

- Reduce pesticide loading for all high risk use sites.
  - 1(a) Remove label authorization for all high risk uses. If current usage on use sites effectively reduces exposure, modify labels to reflect current usage.
  - 1(b) Modify labels to include 300 meter no-spray buffer for all aerial applications; 150 meter buffer for all ground applications; 6 meter vegetative filter strip for all applications.
  - 1(c) Point System. Implement a combination of risk reduction measures to reduce pesticide drift and runoff (Table 5).
- Limit the frequency of application to once per year.
- Restrict mosquito applications to residential and developed areas within species' range.
- Restrict wide area use to residential and developed areas with spot treatment only.
- EPA shall, in close coordination with NMFS Office of Protected Resources, develop and implement an effectiveness monitoring plan to ensure the elements selected are feasible, effective, and implemented.

Table 5. High risk uses for chlorpyrifos and risk reduction points required for drift and runoff/drainage

Chlorpyrifos	**Risk Reduction Options for High Risk Uses**		
Species	**Remove label authorization for all high risk uses**	**No-spray Buffer: 300m aerial application, 150m ground application; and 6m vegetative filter strip**	**Required Points: Drift Runoff/drainage**
Chum salmon , Columbia River Evolutionarily Significant Unit (ESU) (T)	Right of Way Pasture Developed	Right of Way Pasture Developed	80 drift 80 runoff
Chum salmon, Hood Canal summer-run ESU (T)	Managed Forest Right of Way Pasture Developed	Managed Forest Right of Way Pasture Developed	80 drift 80 runoff
Chinook salmon, California coastal ESU (T)	Pasture Managed Forest Right of Way Developed Orchards and Vineyards	Pasture Managed Forest Right of Way Developed Orchards and Vineyards	80 drift 80 runoff
Chinook salmon, Central Valley spring-run ESU (T)	Pasture Orchards and Vineyards Right of Way Developed	Pasture Orchards and Vineyards Right of Way Developed	80 drift 80 runoff

Chlorpyrifos	Risk Reduction Options for High Risk Uses		
Species	**Remove label authorization for all high risk uses**	**No-spray Buffer: 300m aerial application, 150m ground application; and 6m vegetative filter strip**	**Required Points: Drift Runoff/drainage**
	Other Crops Corn Managed Forest Vegetables and Ground Fruit Wheat Other Grains Cotton Other Row Crops	Other Crops Corn Managed Forest Vegetables and Ground Fruit Wheat Other Grains Cotton Other Row Crops	
Chinook salmon, Lower Columbia River ESU (T)	Managed Forest Right of Way Pasture Developed Christmas Trees Orchards and Vineyards Other Crops Vegetables and Ground Fruit Corn Wheat Other Grains	Managed Forest Right of Way Pasture Developed Christmas Trees Orchards and Vineyards Other Crops Vegetables and Ground Fruit Corn Wheat Other Grains	80 drift 80 runoff
Chinook salmon, Puget Sound ESU (T)	Managed Forest Right of Was Developed Pasture Vegetables and Ground Fruit Corn Other Grains Wheat	Managed Forest Right of Was Developed Pasture Vegetables and Ground Fruit Corn Other Grains Wheat	80 drift 80 runoff
Chinook salmon, Sacramento River winter-run ESU (E)	Pasture Right of Way Developed Orchards and Vineyards Other Crops Corn Managed Forest Vegetables and Ground Fruit Wheat Other Grains Other Row Crops	Pasture Right of Way Developed Orchards and Vineyards Other Crops Corn Managed Forest Vegetables and Ground Fruit Wheat Other Grains Other Row Crops	80 drift 80 runoff
Chinook salmon, Snake River fall-run ESU (T)	Pasture Managed Forest Right of Way Wheat Developed Other Crops	Pasture Managed Forest Right of Way Wheat Developed Other Crops	80 drift 80 runoff

Chlorpyrifos	Risk Reduction Options for High Risk Uses		
Species	**Remove label authorization for all high risk uses**	**No-spray Buffer: 300m aerial application, 150m ground application; and 6m vegetative filter strip**	**Required Points: Drift Runoff/drainage**
	Vegetables and Ground Fruit orchards and Vineyards Corn Other Grains	Vegetables and Ground Fruit orchards and Vineyards Corn Other Grains	
Chinook salmon, Snake River spring/summer run ESU (T)	Managed Forest Pastures Wheat Right of Way Other Crops Developed Vegetables and Ground Orchards and Vineyards Corn	Managed Forest Pastures Wheat Right of Way Other Crops Developed Vegetables and Ground Orchards and Vineyards Corn	80 drift 80 runoff
Chinook salmon, Upper Columbia River spring-run ESU (E)	Managed Forest Pasture Right of Way Developed Orchards and Vineyards Wheat Other Crops Vegetables and Ground Fruit Corn	Managed Forest Pasture Right of Way Developed Orchards and Vineyards Wheat Other Crops Vegetables and Ground Fruit Corn	80 drift 80 runoff
Chinook salmon, Upper Willamette River ESU (T)	Managed Forest Pasture Right of Way Developed Other Crops Vegetables and Ground fruit Wheat Christmas Trees Orchards and Vineyards Corn Other grains Other Row Crops	Managed Forest Pasture Right of Way Developed Other Crops Vegetables and Ground fruit Wheat Christmas Trees Orchards and Vineyards Corn Other grains Other Row Crops	80 drift 80 runoff
Coho salmon, Central California coast ESU (E)	Right of Way Pasture Developed Managed Forest Orchards and Vineyards	Right of Way Pasture Developed Managed Forest Orchards and Vineyards	80 drift 80 runoff
Coho salmon, Lower Columbia River ESU (E)	Managed Forest Right of Way Pasture Developed	Managed Forest Right of Way Pasture Developed	80 drift 80 runoff

Chlorpyrifos	Risk Reduction Options for High Risk Uses		
Species	**Remove label authorization for all high risk uses**	**No-spray Buffer: 300m aerial application, 150m ground application; and 6m vegetative filter strip**	**Required Points: Drift Runoff/drainage**
Coho salmon, Oregon coast ESU (T)	Managed Forest Pasture Right of Way Developed	Managed Forest Pasture Right of Way Developed	80 drift 80 runoff
Coho salmon, S. Oregon and N. Calif coasts ESU (T)	Managed Forest Pasture Right of Way Developed Other Crops	Managed Forest Pasture Right of Way Developed Other Crops	80 drift 80 runoff
Sockeye, Ozette Lake ESU (T)	Managed Forest Right of Way Pasture	Managed Forest Right of Way Pasture	80 drift 80 runoff
Sockeye, Snake River ESU (E)	Managed Forest Pasture Right of Way	Managed Forest Pasture Right of Way	80 drift 80 runoff
Steelhead, California Central Valley ESU (T)	Pasture Orchards and Vineyards Right of Way Developed Other Crops Managed Forest Corn Vegetables and Ground Fruit What Other Grains Cotton Other Row Crops	Pasture Orchards and Vineyards Right of Way Developed Other Crops Managed Forest Corn Vegetables and Ground Fruit What Other Grains Cotton Other Row Crops	80 drift 80 runoff
Steelhead, Central California coast ESU (T)	Right of Way Pasture Developed Managed Forest Orchards and Vineyards Other grains Other Crops Wheat	Right of Way Pasture Developed Managed Forest Orchards and Vineyards Other grains Other Crops Wheat	80 drift 80 runoff
Steelhead, Lower Columbia River ESU (T)	Managed Forest Right of Way Pasture Developed Orchards and Vineyards Other Crops Vegetables and Ground Fruit Corn Wheat	Managed Forest Right of Way Pasture Developed Orchards and Vineyards Other Crops Vegetables and Ground Fruit Corn Wheat	80 drift 80 runoff

Chlorpyrifos	Risk Reduction Options for High Risk Uses		
Species	**Remove label authorization for all high risk uses**	**No-spray Buffer: 300m aerial application, 150m ground application; and 6m vegetative filter strip**	**Required Points: Drift Runoff/drainage**
	Other Grains	Other Grains	
Steelhead, Middle Columbia River ESU (T)	Managed Forest Pasture Right of Way Wheat Other Crops Developed Orchards and Vineyards Vegetables and Ground Fruit Corn Other Row Crops	Managed Forest Pasture Right of Way Wheat Other Crops Developed Orchards and Vineyards Vegetables and Ground Fruit Corn Other Row Crops	80 drift 80 runoff
Steelhead, Northern California ESU (T)	Managed Forest Pasture Right of Way Developed Golf Courses Orchards and Vineyards	Managed Forest Pasture Right of Way Developed Golf Courses Orchards and Vineyards	80 drift 80 runoff
Steelhead, Puget Sound ESU (T)	Managed Forests Right of Way Developed Pasture	Managed Forests Right of Way Developed Pasture	80 drift 80 runoff
Steelhead, Snake River Basin ESU (T)	Managed Forest Pasture Wheat Right of Way Other Crops Developed Vegetables and Ground Fruit Other Grains Orchards and Vineyards Corn	Managed Forest Pasture Wheat Right of Way Other Crops Developed Vegetables and Ground Fruit Other Grains Orchards and Vineyards Corn	80 drift 80 runoff
Steelhead, South-Central California coast ESU (T)	Pasture Right of Way Orchards and Vineyards Developed Managed Forest Other Crops Vegetables and Ground Fruit Other Grains Wheat Corn Cotton	Pasture Right of Way Orchards and Vineyards Developed Managed Forest Other Crops Vegetables and Ground Fruit Other Grains Wheat Corn Cotton	80 drift 80 runoff
Steelhead, Southern California ESU (E)	Right of Way Developed	Right of Way Developed	80 drift 80 runoff

Chlorpyrifos	Risk Reduction Options for High Risk Uses		
Species	**Remove label authorization for all high risk uses**	**No-spray Buffer: 300m aerial application, 150m ground application; and 6m vegetative filter strip**	**Required Points: Drift Runoff/drainage**
	Pasture Managed Forest Golf Courses Orchards and Vineyards Vegetables and Ground Fruit Other Crops Other Grains Cotton Corn	Pasture Managed Forest Golf Courses Orchards and Vineyards Vegetables and Ground Fruit Other Crops Other Grains Cotton Corn	
Steelhead, Upper Columbia River ESU (T)	Managed Forest Pasture Right of Way Developed Orchards and Vineyards Wheat Other Crops Vegetables and Ground Fruit Corn	Managed Forest Pasture Right of Way Developed Orchards and Vineyards Wheat Other Crops Vegetables and Ground Fruit Corn	80 drift 80 runoff
Steelhead, Upper Willamette River ESU (T)	Managed Forest Pasture Right of Way Developed Other Crops Christmas Trees Wheat Vegetables and Ground Fruit Orchards and Vineyards Corn Other Grains Golf Courses Other Row Crops	Managed Forest Pasture Right of Way Developed Other Crops Christmas Trees Wheat Vegetables and Ground Fruit Orchards and Vineyards Corn Other Grains Golf Courses Other Row Crops	80 drift 80 runoff
Eulachon, Pacific smelt, Southern Distinct Population Segment (DPS) (T)	Managed Forest Right of Way Pasture Developed	Managed Forest Right of Way Pasture Developed	80 drift 80 runoff
Green sturgeon, Southern DPS (T)	Right of Way Pasture Managed Forest Developed Orchards and Vineyards Other Crops Corn Vegetables and Ground Fruit Wheat	Right of Way Pasture Managed Forest Developed Orchards and Vineyards Other Crops Corn Vegetables and Ground Fruit Wheat	80 drift 80 runoff

Chlorpyrifos	Risk Reduction Options for High Risk Uses		
Species	**Remove label authorization for all high risk uses**	**No-spray Buffer: 300m aerial application, 150m ground application; and 6m vegetative filter strip**	**Required Points: Drift Runoff/drainage**
	Other Grains Golf Courses Other Row Crops	Other Grains Golf Courses Other Row Crops	
Shortnose sturgeon (E)	Managed Forest Right of Way Developed Pasture Soybean Corn	Managed Forest Right of Way Developed Pasture Soybean Corn	80 drift 80 runoff
Atlantic sturgeon, Carolina DPS (E)	Managed Forest Right of Way Soybeans Pasture Corn Developed Cotton Other Crops Wheat	Managed Forest Right of Way Soybeans Pasture Corn Developed Cotton Other Crops Wheat	80 drift 80 runoff
Atlantic sturgeon, Chesapeake Bay DPS (E)	Right of Way Managed Forest Soybean Developed Corn Pasture Golf Courses Cotton Wheat	Right of Way Managed Forest Soybean Developed Corn Pasture Golf Courses Cotton Wheat	80 drift 80 runoff
Atlantic sturgeon, Gulf of Maine DPS (T)	Right of Way Developed Pasture Managed forest	Right of Way Developed Pasture Managed forest	80 drift 80 runoff
Atlantic sturgeon, New York Bight DPS (E)	Right of Way Developed Managed Forest Pasture Corn Soybeans Other Crops Golf Courses Vegetables and Ground Fruit Wheat Orchards and Vineyards	Right of Way Developed Managed Forest Pasture Corn Soybeans Other Crops Golf Courses Vegetables and Ground Fruit Wheat Orchards and Vineyards	80 drift 80 runoff

Chlorpyrifos	Risk Reduction Options for High Risk Uses		
Species	**Remove label authorization for all high risk uses**	**No-spray Buffer: 300m aerial application, 150m ground application; and 6m vegetative filter strip**	**Required Points: Drift Runoff/drainage**
Atlantic sturgeon, South Atlantic DPS (E)	Managed Forest Pasture Right of Way Developed Cotton Other Crops Corn Other Row Crops Soybeans Orchards and Vineyards Wheat	Managed Forest Pasture Right of Way Developed Cotton Other Crops Corn Other Row Crops Soybeans Orchards and Vineyards Wheat	80 drift 80 runoff
Smalltooth sawfish, U.S. DPS.*	Managed Forest Right of Way Pasture Developed Golf Course Orchards	Managed Forest Right of Way Pasture Developed Golf Course Orchards	80 drift 80 runoff
Killer whale, Southern Resident DPS	Implementation of RPAs for all west coast Chinook ESUs		

For smalltooth sawfish, risk reduction measures are only required at use sites within the species nursery areas, as opposed to within the entire species range.

26.2.2 Diazinon RPA

- Reduce pesticide loading for all high risk use sites.
    - 1(a) Remove label authorization for all high risk uses. If current usage on use sites effectively reduces exposure, modify labels to reflect current usage.
    - 1(b) Modify labels to include 300 meter no-spray buffer for all aerial applications; 150 meter buffer for all ground applications; 6 meter vegetative filter strip for all applications.
    - 1(c) Point System. Implement a combination of risk reduction measures to reduce pesticide drift and runoff (Table 6)
- EPA shall, in close coordination with NMFS Office of Protected Resources, develop and implement an effectiveness monitoring plan to ensure the RPA(s) selected is/are feasible, effective, and implemented.

Table 6. High risk uses for diazinon and risk reduction points required for drift and runoff

Diazinon	**Risk Reduction Options for High Risk Uses**		
Species	**Remove label authorization for all high risk uses**	**No-spray Buffer: 300m aerial application, 150m ground application; and 6m vegetative filter strip**	**Required Points: Drift Runoff/drainage**
Chinook salmon, Central Valley spring-run ESU (T)	Orchards and Vineyards Vegetables and Ground Fruit	Orchards and Vineyards Vegetables and Ground Fruit	80 drift 80 runoff
Chinook salmon, Lower Columbia River ESU (T)	Orchards and Vineyards Vegetables and Ground Fruit	Orchards and Vineyards Vegetables and Ground Fruit	80 drift 80 runoff
Chinook salmon, Puget Sound ESU (T)	Vegetables and Ground Fruit	Vegetables and Ground Fruit	80 drift 80 runoff
Chinook salmon, Sacramento River winter-run ESU (E)	Orchards and Vineyards Vegetables and Ground Fruit	Orchards and Vineyards Vegetables and Ground Fruit	80 drift 80 runoff
Chinook salmon, Snake River fall-run ESU (T)	Vegetables and Ground Fruit Orchards and Vineyards	Vegetables and Ground Fruit Orchards and Vineyards	80 drift 80 runoff
Chinook salmon, Snake River spring/summer run ESU (T)	Vegetables and Ground Fruit Orchards and Vineyards	Vegetables and Ground Fruit Orchards and Vineyards	80 drift 80 runoff
Chinook salmon, Upper Columbia River spring-run ESU (E)	Orchards and Vineyards Vegetables and Ground Fruit	Orchards and Vineyards Vegetables and Ground Fruit	80 drift 80 runoff
Chinook salmon, Upper Willamette River ESU (T)	Vegetables and Ground Fruit Orchards and Vineyards	Vegetables and Ground Fruit Orchards and Vineyards	80 drift 80 runoff
Coho salmon, Central California coast ESU (E)	Orchards and Vineyards	Orchards and Vineyards	80 drift 80 runoff

Diazinon	Risk Reduction Options for High Risk Uses		
Species	**Remove label authorization for all high risk uses**	**No-spray Buffer: 300m aerial application, 150m ground application; and 6m vegetative filter strip**	**Required Points: Drift Runoff/drainage**
Sockeye, Snake River ESU (E)	Vegetables & Ground Fruit Orchards and Vineyards	Vegetables & Ground Fruit Orchards and Vineyards	80 drift 80 runoff
Steelhead, California Central Valley ESU (T)	Orchards and Vineyards Vegetables and Ground Fruit	Orchards and Vineyards Vegetables and Ground Fruit	80 drift 80 runoff
Steelhead, Central California coast ESU (T)	Orchards and Vineyards	Orchards and Vineyards	80 drift 80 runoff
Steelhead, Lower Columbia River ESU (T)	Orchards and Vineyards Vegetables and Ground Fruit	Orchards and Vineyards Vegetables and Ground Fruit	80 drift 80 runoff
Steelhead, Middle Columbia River ESU (T)	Orchards and Vineyards Vegetables and Ground Fruit	Orchards and Vineyards Vegetables and Ground Fruit	80 drift 80 runoff
Steelhead, Northern California ESU (T)	Orchards and Vineyards	Orchards and Vineyards	80 drift 80 runoff
Steelhead, Snake River Basin ESU (T)	Vegetables and Ground Fruit Orchards and Vineyards	Vegetables and Ground Fruit Orchards and Vineyards	80 drift 80 runoff
Steelhead, South-Central California coast ESU (T)	Orchards and Vineyards Vegetables and Ground Fruit	Orchards and Vineyards Vegetables and Ground Fruit	80 drift 80 runoff
Steelhead, Southern California ESU (E)	Orchards and Vineyards Vegetables and Ground Fruit	Orchards and Vineyards Vegetables and Ground Fruit	80 drift 80 runoff
Steelhead, Upper Columbia River ESU (T)	Orchards and Vineyards Vegetables and Ground Fruit	Orchards and Vineyards Vegetables and Ground Fruit	80 drift 80 runoff
Steelhead, Upper Willamette River ESU (T)	Vegetables and Ground Fruit Orchards and Vineyards	Vegetables and Ground Fruit Orchards and Vineyards	80 drift 80 runoff
Green sturgeon, Southern DPS (T)	Orchards and Vineyards Vegetables and Ground Fruit	Orchards and Vineyards Vegetables and Ground Fruit	80 drift 80 runoff
Atlantic sturgeon, New York Bight DPS (E)	Vegetables and Ground Fruit Orchards and Vineyards	Vegetables and Ground Fruit Orchards and Vineyards	70 drift 70 runoff
Atlantic sturgeon, South Atlantic DPS (E)	Orchards and Vineyards	Orchards and Vineyards	70 drift 70 runoff
Killer whale, Southern Resident DPS	Implementation of RPAs for all west coast Chinook ESUs		

26.2.3 Malathion RPA

- Reduce pesticide loading for all high risk use sites.
    - 1(a) Remove label authorization for all high risk uses. If current usage on use sites effectively reduces exposure, modify labels to reflect current usage.
    - 1(b) Modify labels to include 300 meter no-spray buffer for all aerial applications; 150 meter buffer for all ground applications; 6 meter vegetative filter strip for all applications.
    - 1(c) Point System. Implement a combination of risk reduction measures to reduce pesticide drift and runoff (Table 7).
- Restrict mosquito applications to residential and developed areas within species' range.
- EPA shall, in close coordination with NMFS Office of Protected Resources, develop and implement an effectiveness monitoring plan to ensure the RPA(s) selected is/are feasible, effective, and implemented.

Table 7. High risk uses for malathion and risk reduction points required for drift and runoff

Malathion	**Risk Reduction Options for High Risk Uses**		
Species	**Remove label authorization for all high risk uses**	**No-Spray Buffer: 300m aerial application, 150m ground application; and 6m vegetative filter strip**	**Required Points: Drift Runoff/drainage**
Chum salmon , Columbia River ESU (T)	Pasture Developed	Pasture Developed	80 drift 80 runoff
Chum salmon, Hood Canal summer-run ESU (T)	Pasture Developed	Pasture Developed	80 drift 80 runoff
Chinook salmon, California coastal ESU (T)	Pasture Developed Orchards and Vineyards	Pasture Developed Orchards and Vineyards	80 drift 80 runoff
Chinook salmon, Central Valley spring-run ESU (T)	Pasture Orchards and Vineyards Developed Other Crops Corn Vegetables and Ground fruits Wheat Other Grains Cotton Other Row Crops	Pasture Orchards and Vineyards Developed Other Crops Corn Vegetables and Ground fruits Wheat Other Grains Cotton Other Row Crops	80 drift 80 runoff
Chinook salmon, Lower Columbia River ESU (T)	Pasture Developed Christmas Trees Orchards and Vineyards Other Crops Vegetables and Ground fruit	Pasture Developed Christmas Trees Orchards and Vineyards Other Crops Vegetables and Ground fruit	80 drift 80 runoff

Malathion	Risk Reduction Options for High Risk Uses		
Species	**Remove label authorization for all high risk uses**	**No-Spray Buffer: 300m aerial application, 150m ground application; and 6m vegetative filter strip**	**Required Points: Drift Runoff/drainage**
	Corn Nurseries Other Grains	Corn Nurseries Other Grains	
Chinook salmon, Puget Sound ESU (T)	Developed Pasture Vegetables and Ground Fruit Corn Other Grains Wheat	Developed Pasture Vegetables and Ground Fruit Corn Other Grains Wheat	80 drift 80 runoff
Chinook salmon, Sacramento River winter-run ESU (E)	Pasture Developed Orchards and Vineyards Other Crops Corn Vegetables and Ground Fruit Wheat Other Grains Other Row Crops	Pasture Developed Orchards and Vineyards Other Crops Corn Vegetables and Ground Fruit Wheat Other Grains Other Row Crops	80 drift 80 runoff
Chinook salmon, Snake River fall-run ESU (T)	Pasture Wheat Developed Other Crops Vegetables and Ground fruit Orchards and Vineyards Corn Other Grains	Pasture Wheat Developed Other Crops Vegetables and Ground fruit Orchards and Vineyards Corn Other Grains	80 drift 80 runoff
Chinook salmon, Snake River spring/summer run ESU (T)	Pasture Wheat Other Crops Developed Vegetables and Ground fruit Orchards and Vineyards Corn	Pasture Wheat Other Crops Developed Vegetables and Ground fruit Orchards and Vineyards Corn	80 drift 80 runoff
Chinook salmon, Upper Columbia River spring-run ESU (E)	Pasture Developed Orchards and Vineyards Wheat Other Crops Vegetables and Ground Fruit Corn	Pasture Developed Orchards and Vineyards Wheat Other Crops Vegetables and Ground Fruit Corn	80 drift 80 runoff
Chinook salmon, Upper Willamette River ESU (T)	Pasture Developed Other Crops Vegetables and Ground Fruit	Pasture Developed Other Crops Vegetables and Ground Fruit	80 drift 80 runoff

Malathion	Risk Reduction Options for High Risk Uses		
Species	**Remove label authorization for all high risk uses**	**No-Spray Buffer: 300m aerial application, 150m ground application; and 6m vegetative filter strip**	**Required Points: Drift Runoff/drainage**
	Wheat Christmas Trees Orchards and Vineyards Corn Other Grains Other Row Crops	Wheat Christmas Trees Orchards and Vineyards Corn Other Grains Other Row Crops	
Coho salmon, Central California coast ESU (E)	Pasture Developed Orchards and Vineyards	Pasture Developed Orchards and Vineyards	80 drift 80 runoff
Coho salmon, Lower Columbia River ESU (E)	Pasture Developed	Pasture Developed	80 drift 80 runoff
Coho salmon, Oregon coast ESU (T)	Pasture Developed	Pasture Developed	80 drift 80 runoff
Coho salmon, S. Oregon and N. Calif coasts ESU (T)	Pasture Developed Other Crops	Pasture Developed Other Crops	80 drift 80 runoff
Sockeye, Ozette Lake ESU (T)	Pasture	Pasture	80 drift 80 runoff
Sockeye, Snake River ESU (E)	Pasture	Pasture	80 drift 80 runoff
Steelhead, California Central Valley ESU (T)	Pasture Orchards and Vineyards Developed Other Crops Corn Vegetables and Ground Fruit Wheat Other Grains Cotton Other Row Crops	Pasture Orchards and Vineyards Developed Other Crops Corn Vegetables and Ground Fruit Wheat Other Grains Cotton Other Row Crops	80 drift 80 runoff
Steelhead, Central California coast ESU (T)	Pasture Developed Orchards and Vineyards Other Grains Other Crops Wheat	Pasture Developed Orchards and Vineyards Other Grains Other Crops Wheat	80 drift 80 runoff
Steelhead, Lower Columbia River ESU (T)	Pasture Developed Christmas Trees Orchards and Vineyards Other Crops Vegetables and Ground Fruit Corn	Pasture Developed Christmas Trees Orchards and Vineyards Other Crops Vegetables and Ground Fruit Corn	80 drift 80 runoff

Malathion	Risk Reduction Options for High Risk Uses		
Species	**Remove label authorization for all high risk uses**	**No-Spray Buffer: 300m aerial application, 150m ground application; and 6m vegetative filter strip**	**Required Points: Drift Runoff/drainage**
	Wheat Other Grains	Wheat Other Grains	
Steelhead, Middle Columbia River ESU (T)	Pasture Wheat Other Crops Developed Orchards and Vineyards Vegetables and Ground Fruit Corn Other Row Crops	Pasture Wheat Other Crops Developed Orchards and Vineyards Vegetables and Ground Fruit Corn Other Row Crops	80 drift 80 runoff
Steelhead, Northern California ESU (T)	Pasture Developed Orchards and Vineyards	Pasture Developed Orchards and Vineyards	80 drift 80 runoff
Steelhead, Puget Sound ESU (T)	Developed Pasture	Developed Pasture	80 drift 80 runoff
Steelhead, Snake River Basin ESU (T)	Pasture Wheat Other Crops Developed Vegetables and Ground Fruit Other Grains Orchards and Vineyards Corn	Pasture Wheat Other Crops Developed Vegetables and Ground Fruit Other Grains Orchards and Vineyards Corn	80 drift 80 runoff
Steelhead, South-Central California coast ESU (T)	Pasture Orchards and Vineyards Developed Other Crops Vegetables and Ground Fruit Other Grains Wheat Corn Cotton	Pasture Orchards and Vineyards Developed Other Crops Vegetables and Ground Fruit Other Grains Wheat Corn Cotton	80 drift 80 runoff
Steelhead, Southern California ESU (E)	Developed Pasture Orchards and Vineyards Vegetables and Ground Fruit Cotton Corn	Developed Pasture Orchards and Vineyards Vegetables and Ground Fruit Cotton Corn	80 drift 80 runoff
Steelhead, Upper Columbia River ESU (T)	Pasture Developed Orchards and Vineyards Wheat Other Crops Vegetables and Ground fruit	Pasture Developed Orchards and Vineyards Wheat Other Crops Vegetables and Ground fruit	80 drift 80 runoff

Malathion	Risk Reduction Options for High Risk Uses		
Species	**Remove label authorization for all high risk uses**	**No-Spray Buffer: 300m aerial application, 150m ground application; and 6m vegetative filter strip**	**Required Points: Drift Runoff/drainage**
	Corn	Corn	
Steelhead, Upper Willamette River ESU (T)	Pasture Developed Other Crops Christmas Trees Wheat Vegetables and Ground Fruit Orchards and Vineyards Corn Other Grains Other Row Crops	Pasture Developed Other Crops Christmas Trees Wheat Vegetables and Ground Fruit Orchards and Vineyards Corn Other Grains Other Row Crops	80 drift 80 runoff
Eulachon, Pacific smelt, Southern DPS (T)	Pasture Developed	Pasture Developed	80 drift 80 runoff
Green sturgeon, Southern DPS (T)	Pasture Developed Orchards and Vineyards Other Crops Corn Vegetables and Ground Fruit Wheat Other Grains Other Row Crops	Pasture Developed Orchards and Vineyards Other Crops Corn Vegetables and Ground Fruit Wheat Other Grains Other Row Crops	70 drift 70 runoff
Shortnose sturgeon (E)	Developed Pasture Corn	Developed Pasture Corn	70 drift 70 runoff
Atlantic sturgeon, Carolina DPS (E)	Pasture Corn Developed Cotton Other Crops Wheat	Pasture Corn Developed Cotton Other Crops Wheat	70 drift 70 runoff
Atlantic sturgeon, Chesapeake Bay DPS (E)	Developed Corn Pasture Cotton Wheat	Developed Corn Pasture Cotton Wheat	70 drift 70 runoff
Atlantic sturgeon, Gulf of Maine DPS (T)	Developed Pasture	Developed Pasture	70 drift 70 runoff
Atlantic sturgeon, New York Bight DPS (E)	Developed Pasture Corn Other Crops Vegetables and Ground fruit	Developed Pasture Corn Other Crops Vegetables and Ground fruit	70 drift 70 runoff

Malathion	Risk Reduction Options for High Risk Uses		
Species	**Remove label authorization for all high risk uses**	**No-Spray Buffer: 300m aerial application, 150m ground application; and 6m vegetative filter strip**	**Required Points: Drift Runoff/drainage**
	Wheat Orchards and Vineyards	Wheat Orchards and Vineyards	
Atlantic sturgeon, South Atlantic DPS (E)	Pasture Developed Cotton Other Crops Corn Other Row Crops Orchards and Vineyards Wheat	Pasture Developed Cotton Other Crops Corn Other Row Crops Orchards and Vineyards Wheat	70 drift 70 runoff
Smalltooth sawfish, U.S. DPS*	Developed Pasture Orchards and Vineyards	Developed Pasture Orchards and Vineyards	80 drift 80 runoff
Killer whale, Southern Resident DPS	Implementation of RPAs for all west coast Chinook ESUs		
For smalltooth sawfish, risk reduction measures are only required at use sites within the species nursery areas, as opposed to within the entire species range.			

26.3 RPM Introduction

Section 7(b)(4) of the ESA requires that when a proposed agency action is found to be consistent with section 7(a)(2) of the ESA, either as proposed by the action agency or modified by a RPA, and the proposed action may incidentally take individuals of ESA-listed species, NMFS will issue a statement that specifies the impact of any incidental taking of endangered or threatened species ("incidental take statement" or "ITS"). To minimize such impacts, NMFS provides reasonable and prudent measures "RPM", and terms and conditions to implement the RPM. Action agency compliance with the terms and conditions provides an exemption from the prohibitions against "take" of listed species. NMFS believes the RPM and the implementing terms and conditions described below are necessary and appropriate to minimize the impacts of incidental take on threatened and endangered species. The measures described below are nondiscretionary, and must be undertaken by the U.S. Environmental Protection Agency so that they become binding conditions for the exemption in section 7(o)(2) to apply. Section 7(b)(4) of the ESA requires that when a proposed agency action is found to be consistent with section 7(a)(2) of the ESA and the proposed action may incidentally take individuals of ESA-listed species, NMFS will issue a statement that specifies the impact of any incidental taking of endangered or threatened species. To minimize such impacts, reasonable and prudent measures, and term and conditions to implement the measures, must be provided. Only incidental take resulting from the agency actions and any specified reasonable and prudent measures and terms and conditions identified in the incidental take statement are exempt from the taking prohibition of section 9(a), pursuant to section 7(o) of the ESA.

Reasonable and prudent measures (RPM)

"Reasonable and prudent measures" are nondiscretionary measures to minimize the amount or extent of incidental take (50 C.F.R. §402.02). The reasonable and prudent measures described below are necessary and appropriate to minimize the impacts of incidental take on threatened and endangered species:

- RPM 1. Revise all chlorpyrifos, diazinon, and malathion product labels and develop relevant EPA Endangered Species Protection Plan Bulletins to conserve listed species.
- RPM 2. Develop user education program, and incident tracking and reporting system.

26.4 Incidental Take Statement

Section 9(a)(1) of the ESA prohibits the taking of endangered species without a specific permit or exemption. Protective regulations adopted pursuant to section 4(d) of the ESA extend the prohibition to threatened species. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct (50 CFR 222.102). Harm is further defined by NMFS an act which actually kills or injures fish or wildlife, and may to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). Incidental take is defined as takings that result from, but are is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action, whether implemented as proposed or as modified by reasonable and prudent alternatives, is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement. NMFS cannot issue an Incidental Take Statement to cover any take of marine mammals that would also be prohibited under the Marine Mammal Protection Act, unless such take has been authorized pursuant to section 101(a)(5) of that Act. Consequently, any exemption of incidental take of marine mammals under this Incidental Take Statement is conditional upon the issuance of an authorization for such take under the MMPA.

26.4.1 Amount or Extent & Effects of Take

Section 7 regulations require NMFS to specify the impact of any incidental take of endangered or threatened species; that is, the amount or extent, of such incidental taking on the species (50 C.F.R. §402.14(i)(1)(i)). The amount of take represents the number of individuals that are expected to be taken by actions. As described earlier in this Opinion, the proposed action for this consultation is EPA's registrations of all pesticides containing chlorpyrifos, diazinon and malathion for use as described on product labels. The proposed action includes (1) approved product labels containing chlorpyrifos, diazinon and malathion, (2) degradates and metabolites of chlorpyrifos, diazinon and malathion, (3) formulations, including other ingredients within formulations, (4) adjuvants, and (5) tank mixtures. EPA is required to reassess currently registered pesticide active ingredients every 15 years. The EPA authorizes use of these pesticide products for pest control purposes across multiple landscapes. The goal of this Opinion is to evaluate the impacts to NMFS' listed resources from the EPA's broad authorization of applied pesticide products.

For this Opinion, NMFS anticipates the general direct and indirect effects that would occur from EPA's registration of pesticide products to 77 listed species under NMFS' jurisdiction during the 15-year duration of the proposed action. The RPA are designed to reduce exposure but not eliminate it. Pesticide runoff and drift of chlorpyrifos, diazinon, and malathion are most likely to reach streams and other aquatic sites when they are applied to crops and other land use settings located adjacent to wetlands, riparian areas, ditches, flood plain habitats, intermittent streams, nearshore estuarine and marine habitats. These inputs into aquatic habitats are especially high when rainfall immediately follows applications, or if wind conditions exacerbate inputs from drift. The effects of pesticides and other contaminants found in urban runoff, especially from areas with a high degree of impervious surfaces, may also exacerbate degraded water quality conditions of receiving waters. Urban runoff is also generally warmer in temperature, and elevated water temperature poses negative effects to many listed species. The range of effects of the 3 a.i.s on listed species includes killing species directly and reductions in prey leading to starvation and impaired growth. For example, impaired growth lends juveniles prone to becoming prey to predators, and starvation may make species more susceptible to disease. In addition, exposed individuals may change normal behaviors (e.g. feeding, sheltering, breeding, etc.). These results are not the purpose of the proposed action. Therefore, incidental take of listed species is reasonably certain to occur over the 15-year duration of the proposed action.

Given the variability of real-life conditions, the broad nature and scope of the proposed action, and the wide-ranging distributions of individuals of listed species, the best scientific and commercial data available are not sufficient to enable NMFS to estimate a specific amount of incidental take associated with the proposed action. As explained in the Description of the Proposed Action and the Effects of the Proposed Action sections, NMFS identified multiple uncertainties associated with the proposed action. Areas of uncertainty include:

1. Limited use and exposure data on stressors of the action for non-agricultural uses of these pesticides;
2. Minimal information on exposure and toxicity for pesticide formulations, adjuvants, and other/inert ingredients within registered formulations;
3. Minimal information on tank mixtures and associated exposure estimates;
4. Limited data on toxicity of environmental mixtures;
5. Variability in annual land use, crop cover, and pest pressure;
6. Temporal and spatial variability of individuals;
7. Pesticide concentrations in nearshore estuarine and marine habitats
8. Pesticide concentrations resulting from non-agricultural uses

Additionally, NMFS recognizes there are multiple impediments that reduce the likelihood of detecting take to listed species from the use of pesticides. It's important to place the significance of mortality incidents in the proper context. Vyas (1999) concluded that most wildlife mortality is unaccounted for as only a small fraction are likely observed, reported, and confirmed. The likelihood of detecting impacts becomes even more difficult in species with limited abundance. Sublethal impacts such as reduced reproduction are nearly impossible to detect without rigorous environmental monitoring. For these reasons, NMFS uses surrogates for the allowable extent of take of listed species, as described below within each of the species groupings.

Anadromous and Marine Fish

NMFS therefore identifies, as a surrogate for the allowable extent of take of anadromous and marine fish, the ability of this action to proceed without any fish kills within the action area attributed to the legal use of chlorpyrifos, diazinon or malathion, or any compounds, degradates, or mixtures affecting aquatic habitats containing listed species. Because of the difficulty of detecting mortality of listed species, individuals killed do not have to be listed species in order for their death to be considered a relevant surrogate for take. For example, salmonids are relatively sensitive to pesticides compared to other species of fish, so that if there are kills of other freshwater fishes attributed to use of these pesticides, it is likely that salmonids have also died, even if no dead salmonids can be located. In addition, if stream conditions due to pesticide use kill less sensitive fishes in certain areas, the potential for lethal and non-lethal takes in downstream areas increases. A fish kill is considered attributable to one of these three ingredients, its metabolites, or degradates, if any of the a.i.s is known to have been applied in the vicinity and may reasonably be supposed to have run off or drifted into the affected area, or if surface water samples or pathology indicate lethal levels of the a.i.(s).

NMFS notes that increased monitoring and study of the impact of these pesticides on water quality, particularly water quality in flood plain habitats, nearshore estuarine, and marine habitats will inform subsequent pesticide consultations and future incidental take statements. Such monitoring and studies will potentially allow other measures of the extent of take.

Marine Invertebrates

NMFS therefore identifies, as a surrogate for the allowable extent of take of marine invertebrates, the ability of this action to proceed without any mortality or adverse reproductive effects to corals or molluscs within the action area attributed to the legal use of chlorpyrifos, diazinon or malathion, or any compounds, degradates, or mixtures affecting aquatic habitats containing listed species. Because of the difficulty of detecting mortality of listed species, individuals killed or adversely affected do not have to be listed species in order for their death or adverse effects to be considered relevant surrogate for take. An adverse effect is considered attributable to one of these three ingredients, its metabolites, or degradates, if any of the a.i.s is known to have been applied in the vicinity and may reasonably be supposed to have run off or drifted into the affected area, or if surface water samples or pathology indicate lethal levels of the a.i.(s).

Sea Turtles

NMFS therefore identifies, as a surrogate for the allowable extent of take sea turtles, the ability of this action to proceed without any mortality or sublethal effects to sea turtles including adverse impacts to swimming or reproduction within the action area attributed to the legal use of chlorpyrifos, diazinon or malathion, or any compounds, degradates, or mixtures affecting aquatic habitats containing listed species. Because of the difficulty of detecting mortality of listed species, individuals killed or adversely affected do not have to be listed species in order for their death or adverse effects to be considered relevant surrogate for take. An adverse effect is considered attributable to one of these three ingredients, its metabolites, or degradates, if any of the a.i.s is known to have been applied in the vicinity and may reasonably be supposed to have run off or drifted into the affected area, or if surface water samples or pathology indicate lethal levels of the a.i.(s).

Pinnipeds
NMFS therefore identifies, as a surrogate for the allowable extent of take of pinnipeds, the ability of this action to proceed without any mortality or adverse impacts to to pinniped swimming or reproduction attributed to the legal use of chlorpyrifos, diazinon or malathion, or any compounds, degradates, or mixtures affecting aquatic habitats containing listed species. Because of the difficulty of detecting mortality or other adverse effects to of listed species, individuals killed or adversely affected do not have to be listed species in order for their death or adverse effects to be considered relevant surrogate for take. An adverse effect is considered attributable to one of these three ingredients, its metabolites, or degradates, if any of the a.i.s is known to have been applied in the vicinity and may reasonably be supposed to have run off or drifted into the affected area, or if surface water samples or pathology indicate lethal levels of the a.i.(s).

Cetaceans - Southern Resident Killer Whale (SRKW)
NMFS therefore identifies, as a surrogate for the allowable take of SRKW, the ability of this action to proceed without any mortality to Pacific Salmonids attributed to the legal use of chlorpyrifos, diazinon, or malathion. Salmon, in particular Chinook salmon, are the prey for SRKW. Currently, the numbers of Chinook and other salmon are insufficient to support increases in the SRKW population size. The reduction in production of Pacific salmon throughout their range that would occur under the Proposed Action would therefore result in harm to SRKW by further reducing prey availability, which may cause animals to forage for longer periods, travel to alternate locations, or abandon foraging efforts. The extent of take from the Proposed Action is not anticipated to cause direct take by serious injury or mortality to SRKWs. However, the Proposed Action is expected to result in take in the form of a reduction in available prey.

26.5 Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, the Environmental Protection Agency must comply with the following terms and conditions, which implement the Reasonable and Prudent Measures described above. These include the take minimization, monitoring and reporting measures required by the section 7 regulations (50 C.F.R. §402.14(i)). These terms and conditions are non-discretionary. If the Environmental Protection Agency fails to ensure compliance with these terms and conditions and their implementing reasonable and prudent measures, the protective coverage of section 7(o)(2) may lapse.

To address RPM number 1, EPA shall implement the following revisions on all chlorpyrifos, diazinon, and malathion labels:

a. Prohibit application of pesticide products when wind speeds are greater than or equal to 10 mph.
b. Prohibit application of pesticide products when soil moisture is at field capacity, or when a storm event likely to produce runoff from the treated area is forecasted (by NOAA/National Weather Service, or other similar forecasting service) to occur within 48 hours following application.

c. Prohibit co-application (tank mixing) with other neurotoxic pesticides (i.e., organophosphate, carbamate, pyrethroid, and neonicotinoid pesticides).

To implement RPM number 2, EPA shall:

a) Provide home owner and commercial applicator training on relevant endangered species and designated critical habitats including information on risk reduction measures, best management practices, etc.
b) Report all incidents of mortality and adverse effects to non-target species that occur within the vicinity of the treatment area, including areas downstream and downwind, in the four days following application of and of these a.i.s to EPA's Office of Pesticide Programs (phone: 703-305-7090). Within one year of receipt of this Opinion, EPA shall submit an annual report to NMFS Office of Protected Resources that identifies the total number of non-target species affected and incident locations.
c) EPA shall, in close coordination with NMFS Office of Protected Resources, develop and implement an effectiveness monitoring plan for aquatic habitats. A report summarizing annual monitoring data and including all raw data shall be submitted to NMFS Office of Protected Resources and will summarize annual monitoring data and provide all raw data.
d) EPA shall include the following instructions requiring reporting of mortality events either on the labels for all products containing chlorpyrifos, diazinon, and malathion in ESPP Bulletins:

   NOTICE: Incidents where listed species appear injured or killed as a result of pesticide applications shall be reported to NMFS Office of Protected Resources at 301-713-1401 and EPA's Office of Pesticide Programs. The finder should leave the individuals alone, make note of any circumstances likely causing the death or injury, location and number of individuals involved, and take photographs, if possible. Individuals should generally not be disturbed unless circumstances arise where the individual is obviously injured or killed by pesticide exposure, or some unnatural cause. NMFS Office of Protected Resources or Office of Law Enforcement may request the finder to collect specimens or take other measures to ensure that evidence intrinsic to the specimen is preserved.
e) EPA shall report to NMFS Office of Protected Resources any incidences regarding chlorpyrifos, diazinon, and malathion effects on aquatic ecosystems added to its incident database that it has classified as probable or highly probable.
f) EPA shall provide OPR a commencement date for annual reporting of monitoring results.

26.6 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on ESA-listed species or critical habitat, to help implement recovery plans or develop information (50 C.F.R. §402.02).

The following conservation recommendations would provide information for future consultations involving future authorizations of pesticide active ingredients that may affect ESA-listed species:

1. Develop models that more accurately quantify pesticide exposure in estuarine and near-shore ocean environments.
2. Work with other appropriate federal, state, and local partners to determine efficacy of riparian area management methods in reducing pesticide loading from authorized uses especially the types of vegetation and width of riparian areas needed.
3. Identify and implement other methods that eliminate or significantly reduce pesticide loading into species' habitats.
4. Carryout educational outreach on pesticide risks to threatened and endangered species to pesticide users in high use agriculture and residential environments.
5. Develop improved methods for characterizing exposure from non-agricultural uses.
6. Develop criteria that addresses when pesticide-contaminated sediment is an important route of exposure to aquatic organisms.

In order for NMFS' Office of Protected Resources Endangered Species Act Interagency Cooperation Division to be kept informed of actions minimizing or avoiding adverse effects on, or benefiting, ESA-listed species or their critical habitat, the Environmental Protection Agency should notify the Endangered Species Act Interagency Cooperation Division of any conservation recommendations they implement in their final action.

26.7 Reinitiation Notice

This concludes formal consultation for the Environmental Protection Agency's proposed registration of pesticide products containing chlorpyrifos, diazinon, and malathion to ESA-listed species under the jurisdiction of the NMFS. As 50 C.F.R. §402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if:

1. The amount or extent of taking specified in the incidental take statement is exceeded.
2. New information reveals effects of the agency action that may affect ESA-listed species or critical habitat in a manner or to an extent not previously considered.
3. The identified action is subsequently modified in a manner that causes an effect to ESA-listed species or designated critical habitat that was not considered in this opinion.
4. A new species is listed or critical habitat designated under the ESA that may be affected by the action.

NMFS' analysis and conclusions are based on EPA's action. If changes to product labeling result in modifications to the action that were not considered in this Opinion, including but not limited to label modifications authorizing pesticide application to new locations, additional application methods, or increased application rates or numbers of applications, EPA must contact NMFS to discuss reinitiation. If reinitiation of consultation appears warranted due to one or more of the above circumstances, EPA must contact NMFS Office of Protected Resources, ESA Interagency Cooperation Division. In the event reinitiation conditions (1), (2), or (3) is met, reinitiation will be only for the a.i.(s) which meet that condition, not for all 3 a.i.s considered in the Opinion. If none of these reinitiation triggers are met within the next 15 years, then reinitiation will be required because the Opinion only covers the action for 15 years. It is recommended that EPA request reinitiation with sufficient time prior to reaching 15 years to allow sufficient time to consult and to prevent lapse of coverage for the active ingredients in this Opinion.