

Reasonable and Prudent Alternatives

This Opinion has concluded that EPA’s proposed registration of pesticides containing carbaryl and carbofuran is likely to jeopardize the continued existence of 22 endangered and threatened Pacific salmonids and is likely to destroy or adversely modify designated critical habitat for 20 threatened and endangered salmonids. The Opinion further concluded that EPA’s proposed registration of pesticides containing methomyl is likely to jeopardize the continued existence of 18 endangered and threatened Pacific salmonids and is likely to destroy or adversely modify designated critical habitat for 16 threatened and endangered salmonids. “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 listed species in the wild by reducing the reproduction, numbers, or distribution of that species” (50 CFR §402.02).

Regulations (50 CFR §402.02) implementing section 7 of the ESA 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 listed species or resulting in the destruction or adverse modification of critical habitat.

NMFS reached this conclusion because measured and predicted concentrations of the three a.i.s in salmonid habitats, particularly in off-channel habitats⁵, are likely to cause adverse effects to listed Pacific salmonids including significant reductions in growth and survival. For carbaryl and carbofuran, 22 ESUs/DPSs of listed Pacific salmonids are likely to suffer reductions in

⁵ Off-channel habitat – water bodies and/or inundated areas that are connected (accessible to salmonid juveniles) seasonally or annually to the main channel of a stream including but not limited to features such as side channels, alcoves, ox bows, ditches, and floodplains.

Main channel –the stream channel that includes the thalweg (longitudinal continuous deepest portion of the channel).

viability given the severity of expected changes in abundance and productivity associated with the proposed action. Similarly for methomyl, 18 ESUs/DPSs of listed Pacific salmonids are likely to suffer reductions in viability. These adverse effects are expected to appreciably reduce the likelihood of both the survival and recovery of these listed Pacific salmonids. EPA's proposed registration of carbaryl and carbofuran is also likely to result in the destruction or adverse modification of critical habitat for 20 affected ESUs/DPSs because of adverse effects on salmonid prey and water quality in freshwater rearing, spawning, and foraging areas. EPA's proposed registration of methomyl is also likely to result in the destruction or adverse modification of critical habitat for 16 affected ESUs/DPSs because of adverse effects on salmonid prey and water quality in freshwater rearing, spawning, and foraging areas.

The Reasonable and Prudent Alternative (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 listed species, including unspecified inert ingredients, adjuvants, and tank mixes; (2) exposure to chemical mixtures containing carbaryl, carbofuran, and methomyl and other cholinesterase-inhibiting compounds result in additive and synergistic responses; and (3) exposure to other chemicals and physical stressors (*e.g.*, pH and temperature) in the baseline habitat will likely intensify response to carbaryl, carbofuran, and methomyl.

The action as implemented under the RPA will remove the likelihood of jeopardy and of destruction or adverse modification of critical habitat. In the proposed RPA, NMFS does not attempt to ensure there is no take of listed species. NMFS believes take will occur, and has provided an incidental take statement exempting that take from the take prohibitions, so long as the action is conducted according to the RPA and reasonable and prudent measures (RPM). Avoiding take altogether would most likely entail canceling registration, or prohibiting use in watersheds inhabited by salmonids. NMFS recognizes that carbofuran's registration is currently in the process of being cancelled. However, NMFS is uncertain when and if cancellation will occur. Furthermore, existing stocks under older labels would remain and are currently allowed to be applied. The RPA and RPMs therefore apply to carbofuran as well. The goal of the RPA is to reduce exposure to ensure that the action is not likely to jeopardize listed species or destroy or adversely modify critical habitat.

The RPA is comprised of six required elements that must be implemented in its entirety within one year of the receipt of EPA’s Opinion to ensure the proposed registration of these pesticides is not likely to jeopardize endangered or threatened Pacific salmonids under the jurisdiction of NMFS or destroy or adversely modify critical habitat that has been designated for these species. All elements of the RPA apply only to those ESUs/DPSs where there is jeopardy or the destruction or adverse modification of critical habitat. These elements rely upon recognized practices for reducing drift and runoff of pesticide products into aquatic habitats.

Specific Elements of the Reasonable and Prudent Alternative

Elements 1-4 shall be specified on FIFRA labels of all pesticide products containing carbaryl, carbofuran, and methomyl used in California, Idaho, Oregon, and Washington. Alternatively, the label could direct pesticide users to the EPA’s Endangered Species Protection Program (ESPP) bulletins that specify elements 1-4. For purposes of this RPA salmonid habitats are defined as freshwaters, estuarine habitats, and nearshore marine habitats including bays within the ESU/DPS ranges including migratory corridors. The freshwater habitats include intermittent streams and other temporally connected habitats to salmonid-bearing waters. Freshwater habitats also include all known types of off-channel habitats as well as drainages, ditches, and other man-made conveyances to salmonid habitats that lack salmonid exclusion devices (*e.g.*, screens).

Element 1.

Do not apply pesticide products⁶ within specified buffers of salmonid habitats (Table 83). Buffers only apply to those salmonid habitats where NMFS concluded jeopardy or the destruction or adverse modification of designated critical habitat for listed Pacific salmonids. Buffers also only apply when water exists in the stream or habitat and shall be measured from the water’s edge of salmonid habitat, including off-channel habitat, to the point of deposition (below spray nozzle).

Pesticide buffers are recognized tools to reduce pesticide loading into aquatic habitats from drift. EPA, USFWS, NMFS, courts, and state agencies routinely enlist buffers as pesticide load

⁶ Use of the term “pesticide products” in the Reasonable and Prudent Alternative section of the Opinion refers to pesticide products containing carbaryl, carbofuran, and methomyl.

reduction measures. EPA requires the use of buffers on end-use product labels for ground and/or aerial applications for some products that pose risk to aquatic systems. For example, many methomyl containing end-use products have mandated buffers of 25, 100, and 450 ft for ground, aerial, and Ultra Low Volume applications, respectively. CDPR has pesticide use limitations of 120 and 600 ft buffers for carbaryl, carbofuran, and methomyl-containing pesticides when the wind is blowing toward sensitive areas. On June 14, 1989, USFWS issued a Biological Opinion for 165 listed species and 112 pesticide a.i.s. Prescribed buffers under species-specific RPAs ranged from 60 ft (ground applications) to one half mile (aerial applications). Many of EPA's historical county bulletins for endangered species referenced a 60 ft buffer for ground applications and a 300 ft buffer for aerial spraying. One court decision prescribed mandatory 60 ft (ground) and 300 ft (aerial) buffers for applications within the ranges of ESA-listed Pacific salmonids. NMFS has prescribed a range of buffers in ESA consultations for herbicide and insecticide application actions by agencies such as the U.S. Forest Service and Bureau of Land Management overlapping with ESA-listed salmonid habitats. Herbicide buffers ranged from 0 ft to 500 ft depending on application type, rate, and frequency. Insecticide buffers ranged from 0 ft to 200 ft depending on application type, rate, and frequency.

NMFS generated estimated environmental concentrations for the three *N*-methyl carbamates for off-channel habitats using the AgDrift model (set to EPA Tier 1 simulation defaults). NMFS generated values for a range of buffer sizes in 100 ft increments for ground applications (0 – 1,000 ft), and aerial applications (0 – 1,000 ft). The dimensions of the off-channel habitat modeled were 32.8 ft (10 m) wide and 0.328 ft (0.1 m) deep. Key model assumptions include:

- Drift as the only pathway of exposure;
- A single application of each a.i.; and
- The estimates represent instantaneous average concentrations across the entire habitat modeled.

Table 83. Mandatory pesticide no application buffers for ground and aerial applications

Rate	Carbaryl	Carbofuran	Methomyl
lbs/ acre	No Application Buffer (ft)		
Ground Applications			
0 -1	200	200	50
≥1-3	300	300	NA
≥3-5	400	400	NA
≥5-10	500	500	NA
≥10	600	600	NA
Aerial Applications			
All rates	1000	1000	600

NA – Not Applicable. Methomyl has no current registrations permitting maximum applications ≥ 1 lb ai/A

The estimated concentrations decline as buffer size increases (Table 84). We note the disparity between the concentrations predicted by the two models. For example, at 100 ft. the predicted concentrations are 4.4 µg/L from a ground application and 92.9 µg/L from an aerial application. The two results are not directly comparable because the models use different methods to predict amount of drift.

Table 84. Estimated environmental concentrations of carbaryl, carbofuran, and methomyl applied at the rate of 1 lb per acre for ground and aerial applications.

Ground application, low boom, ASAE very fine-fine droplet distribution, 50 th percentile estimates EPA Tier 1 simulations	
Buffer (ft)	Off-Channel (10 m * 0.1 m) (µg/L)
0	76.427
10	20.168
100	4.406
200	2.568
300	1.813
400	1.392
500	1.122
600	0.933
700	0.794
800	0.688
900	0.604
997	0.583
Aerial application, fine-medium droplet distribution. EPA Tier 1 simulation	
Buffer (ft)	Off-Channel (10 m * 0.1 m) (µg/L)
0	333.566
10	260.482
100	92.888
200	48.985
300	33.096
400	25.289
500	20.902
600	18.010
700	16.035
800	14.692
900	13.719
997	12.983

Based on the population growth modeling exercises, a four-day exposure to expected concentrations of carbaryl, carbofuran, and methomyl will substantially reduce a population's growth rate due to prey base reduction. All four life history types modeled demonstrated this effect. As exposure duration and application rate increases, we expect more pronounced effects on salmonid prey abundance and recovery timing leading to further reduced salmonid growth. We expect that some juvenile salmonids are likely to experience reductions in growth. However, the prescribed buffers are intended to avoid population-level effects. We also expect that prey

items will die from these exposures. The likelihood of impacting salmonid prey availability, an identified PCE, is substantially reduced by these buffers.

The majority of buffers described earlier are smaller than the buffers prescribed in this element. Concentrations expected with smaller buffers would lead to a greater probability of affecting populations and PCEs especially in habitats that are compromised from a variety of stressors (described in the *Environmental Baseline* section).

The scenario we modeled with AgDrift in this RPA element is expected to occur when all of the modeled variables are present *e.g.*, specific wind speed, wind direction, release height, size of off-channel habitat, droplet size distribution, etc. The input variables are relevant to field conditions and the frequency of this exact scenario occurring remains unknown. We selected this scenario to represent off-channel habitats used by a sensitive salmonid life stage *i.e.*, juveniles. NMFS believes that these buffers will remove a substantial portion of risk attributed to pesticide drift.

Element 2. Do not apply when wind speeds are greater than or equal to 10 mph as measured using an anemometer immediately prior to application. Because wind conditions may change during application of pesticide products, commence applications on the side nearest the aquatic habitat and proceed away from the aquatic habitat.

Element 3. For all uses do not apply 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/NWS (National Weather Service), to occur within 48 h following application.

Element 4. Report all incidents of fish mortality that occur within four days of application and within the vicinity of the treatment area to EPA OPP (703-305-7695).

Element 5. In addition to the labeling requirements above, EPA shall develop and implement a NMFS-approved effectiveness monitoring plan for off-channel habitats with annual reports. The plan shall identify representative off-channel habitats within agricultural areas prone to drift and

runoff of pesticides. The number and locations of off-channel habitat sampling sites shall include currently used off-channel habitats by threatened and endangered Pacific salmonids identified by NMFS biologists and will include at least two sites for each general species (ESU or DPS; *i.e.*, coho salmon, chum salmon, steelhead, sockeye salmon, and ocean-type Chinook and stream-type Chinook salmon). The plan shall collect daily surface water samples targeting at least three periods during the application season for seven days. Collected water samples will be analyzed for current-use OPs and carbamates following USGS schedule for analytical chemistry. The report shall be submitted to NMFS OPR and will summarize annual monitoring data and provide all raw data.

Element 6. This element is specific to Washington State's 24(c) for carbaryl applications on estuarine mudflats. As this use is specific for application on mudflats within estuaries, elements 1, 3, and 4 are not applicable for this use. Elements 2 and 5 are required. A monitoring program approved by NMFS OPR shall be established in Willapa Bay and Grays Harbor to determine the presence, AChE activity, and genetic source populations of captured juvenile salmonids. For example, a monitoring program shall be implemented to determine salmonid health at five locations using beach seines with the first incoming tide after carbaryl application. Additionally, fyke nets placed in five channels proximate to sprayed mudflats shall be used to determine and health at first outgoing tide after carbaryl application. All dead or dying salmonids, if any, shall be collected and genetically analyzed to determine source population origin. Additionally, muscle and brain AChE activity shall be measured in collected dead or dying salmonids. A subset of the live salmonids captured in seines and nets shall be genetically analyzed to determine source population origin. Annual reports shall be submitted to NMFS and include the raw data and summaries of the raw data including number of fish caught, species of salmonids, genetic analysis results, AChE activity results of brain and muscle samples, and number of dead or dying salmonids collected. The sampling effort shall be conducted annually as long as carbaryl is allowed for use in Willapa Bay and Grays Harbor.

Although NMFS has concluded that EPA's action for carbaryl and carbofuran is likely to jeopardize 22 listed ESUs/DPSs and destroy or adversely modify 20 designated critical habitats during the 15-year duration of the proposed action, NMFS does not believe that the effects of the

action will attain this level in the year between issuance of this Opinion and EPA's implementation of the RPA. NMFS has further concluded that EPA's action for methomyl is likely to jeopardize 18 listed ESUs/DPSs and destroy or adversely modify designated critical habitats for 16 listed species during the 15-year duration of the proposed action. As with carbaryl and carbofuran, NMFS does not believe that the effects of the action for methomyl will attain this level in the year between issuance of this Opinion and EPA's implementation of the RPA. Products containing these three a.i.s have been in use for some time. NMFS believes that these products have contributed to ESU/DPS declines, but not to the extent that one year of additional use as now authorized would lead to likely jeopardy or adverse modification.

Based on the above conclusions on the effects of EPA's proposed registration of pesticide products containing carbaryl, carbofuran, and methomyl, the EPA is required to notify NMFS OPR of its final decision on implementation of the RPA.

Incidental Take Statement

Section 9 of the ESA and federal regulation pursuant to section 4(d) of the ESA prohibits the take of endangered and threatened species, respectively, without special exemption. 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. Harm is further defined by NMFS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. 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 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.

Amount or Extent of Take Anticipated

As described earlier in this Opinion, this is a consultation on the EPA's registration of pesticide products containing carbaryl, carbofuran, and methomyl, and their formulations as they are used