



COMPLIANCE SERVICES INTERNATIONAL

National-level endangered species assessment for chlorpyrifos: aquatic species

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The process was designed to allow efficient identification of species at negligible risk so resources could be focused on those requiring further investigation.

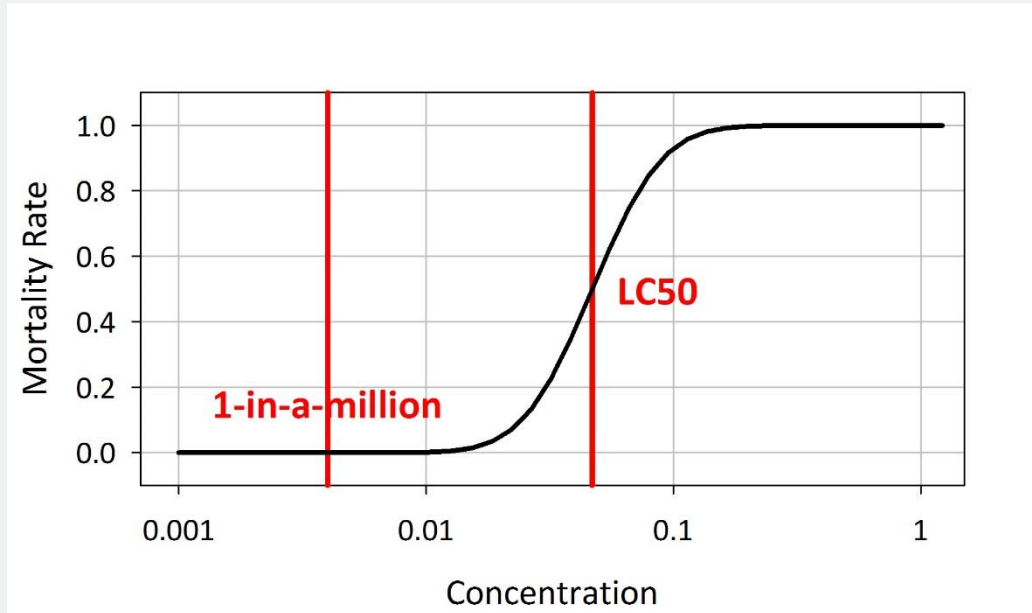
- Screening-level ecological risk assessment to determine whether taxa might be affected (directly or indirectly).
- Delineate Action Area where exposure might exceed effect thresholds.
- Identify areas where Action Area overlaps with species ranges (co-occurrences).
- Compile data on species habitat, life history, existing protections, and other factors relevant to risk.
- Assess risk to each species based on weight of evidence.

Steps in screening-level ecological risk assessment (SLERA)

- **Species Range and Habitats:** Determine counties and HUC2 regions where each listed species occurs, and assign each listed species to one or more aquatic habitat bins.
- **Crop Footprint:** Identify crop uses on product labels, determine counties and HUC2 regions where those crops are grown.
- **County Co-occurrence:** Determine counties where listed species co-occur with labelled crop groups.
- **Ecotoxicity:** Compile and evaluate toxicity data, match each listed species to taxonomically closest test species (surrogates), calculate effect thresholds for each listed species.
- **Exposure:** Model Estimated Environmental Concentrations (EECs) in each relevant habitat bin and HUC2 region for each crop group.
- **Risk Characterization:** Compare EECs with effect thresholds for each species (by habitat bin, county, and crop group); if $EEC < \text{effect threshold}$, presume negligible risk.

Effect Thresholds: Direct Effects

- Acute effects: 1-in-a-million mortality

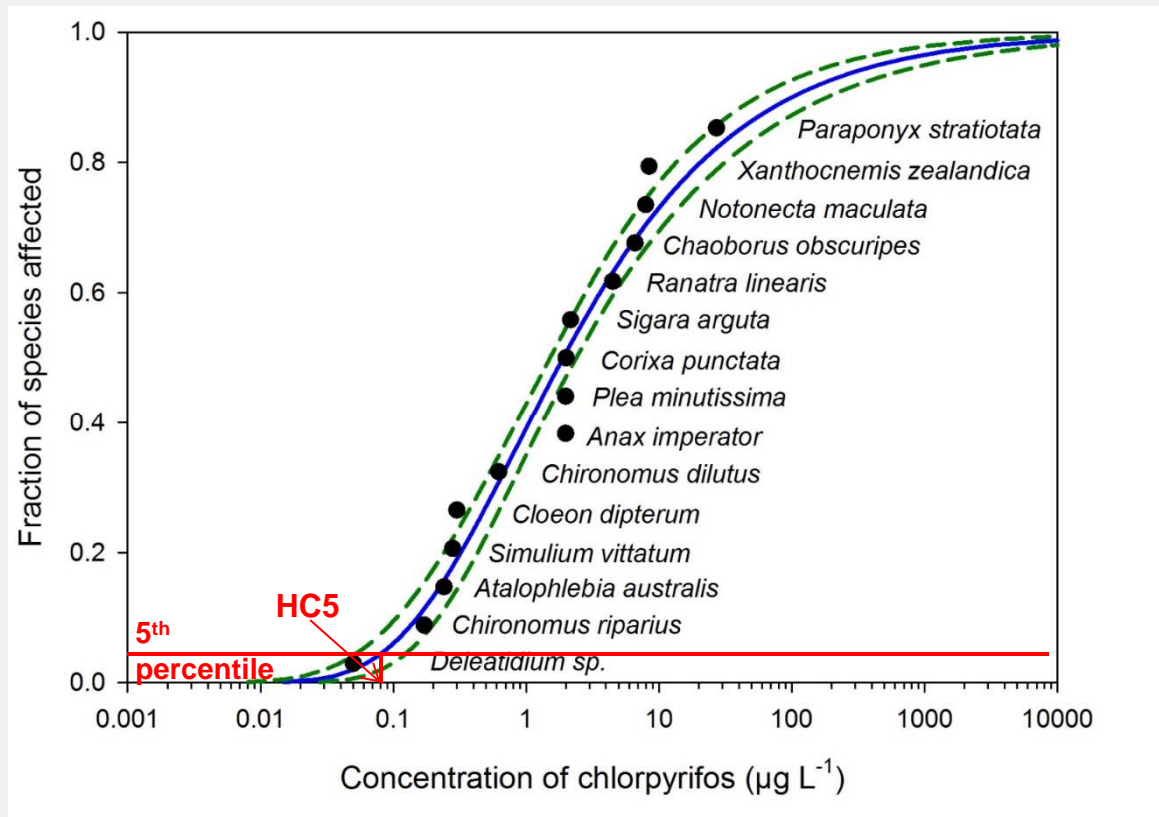


EPA and Services have not provided the rationale for using 1-in-a-million mortality as the effect threshold. In previous Services' biological opinions (non-pesticides), allowable take has been much greater than this.

- Chronic effects: No-Observed-Effect Concentration (NOEC)
- For each listed species, effect thresholds are based on most closely related species for which toxicity data are available (surrogates).

Effect Thresholds: Indirect Effects

- Indirect effects: 5th percentile of LC50 Species Sensitivity Distribution for invertebrates (potential indirect effects on fish) or for fish (potential indirect effects on mussels)



Results of aquatic SLERA for chlorpyrifos

Taxon	# species	Acute Effects ^a		Chronic Effects ^b	
		# species EEC < threshold	Range of EEC/threshold	# species EEC < threshold	Range of EEC/threshold
Mollusks	136	29	0.8-4.9	136	0.3-0.5
Amphibians	23	0	2.9-8.1	23	0.1
Fish	130	5	0.9-2000	0	8.8-54
Insects	6	0	15000-24000	0	391-644
Crustaceans	22	0	1500-32000	0	193-322
Corals	2	0	21000	0	424
Total	319	34	0.8-32000	154	0.1-644

SLERA shows that risk is negligible or very small for mollusks and amphibians, much greater for other taxa.

Difficulties with the SLERA

- Implementation of Surface Water Concentration Calculator (SWCC) for the flowing water habitat bins resulted in unrealistically high EECs. The low-volume static habitat bin was used as a surrogate for species in flowing water bins.
- Marine habitat bins were not modeled. Here too, the low-volume

Even with these difficulties, the value of the SLERA for identifying taxa with negligible risk is an efficiency in the overall process. Efficiency would increase with improved exposure predictions and an agreed realistic acute effect threshold.

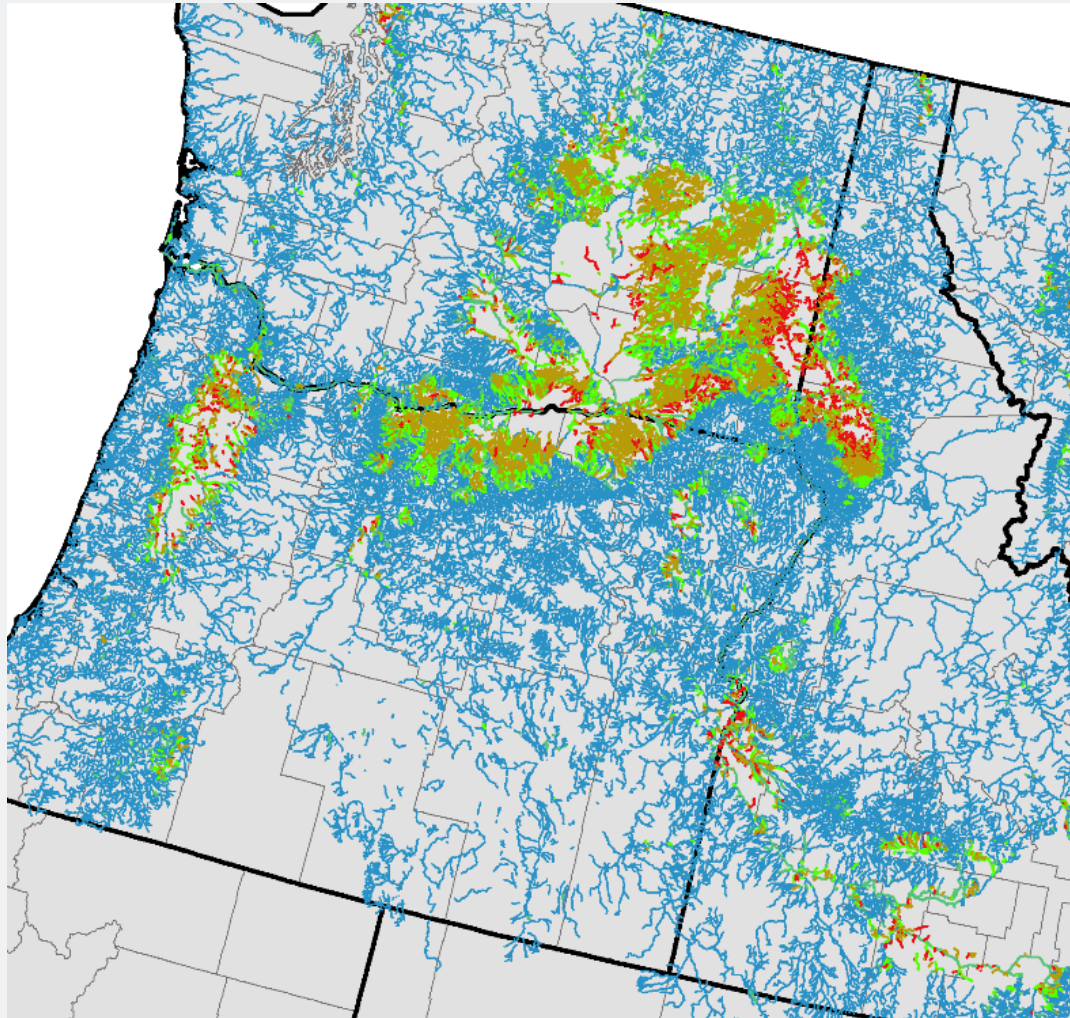
Assignment of species to habitat bins is conservative, and EECs for the worst-case bins are used in the risk characterization.

- The acute effect threshold (1-in-a-million mortality) is extremely conservative.

Action Area and refined co-occurrence analysis

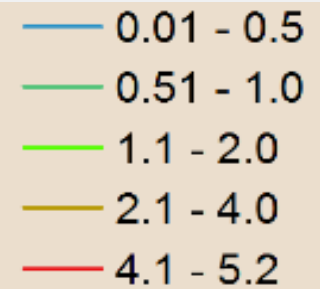
- Action Area includes crop group footprints (based on Cropland Data Layer 2010-2014) plus areas where concentrations from spray drift and downstream transport may exceed taxon-specific effect thresholds.
 - Spray drift and downstream areas are based on EECs and effect thresholds, so SLERA must be completed first.
- Spatial overlay of Action Area with species range identifies areas of co-occurrence.
- If no co-occurrence, negligible risk.

Action Area including downstream transport



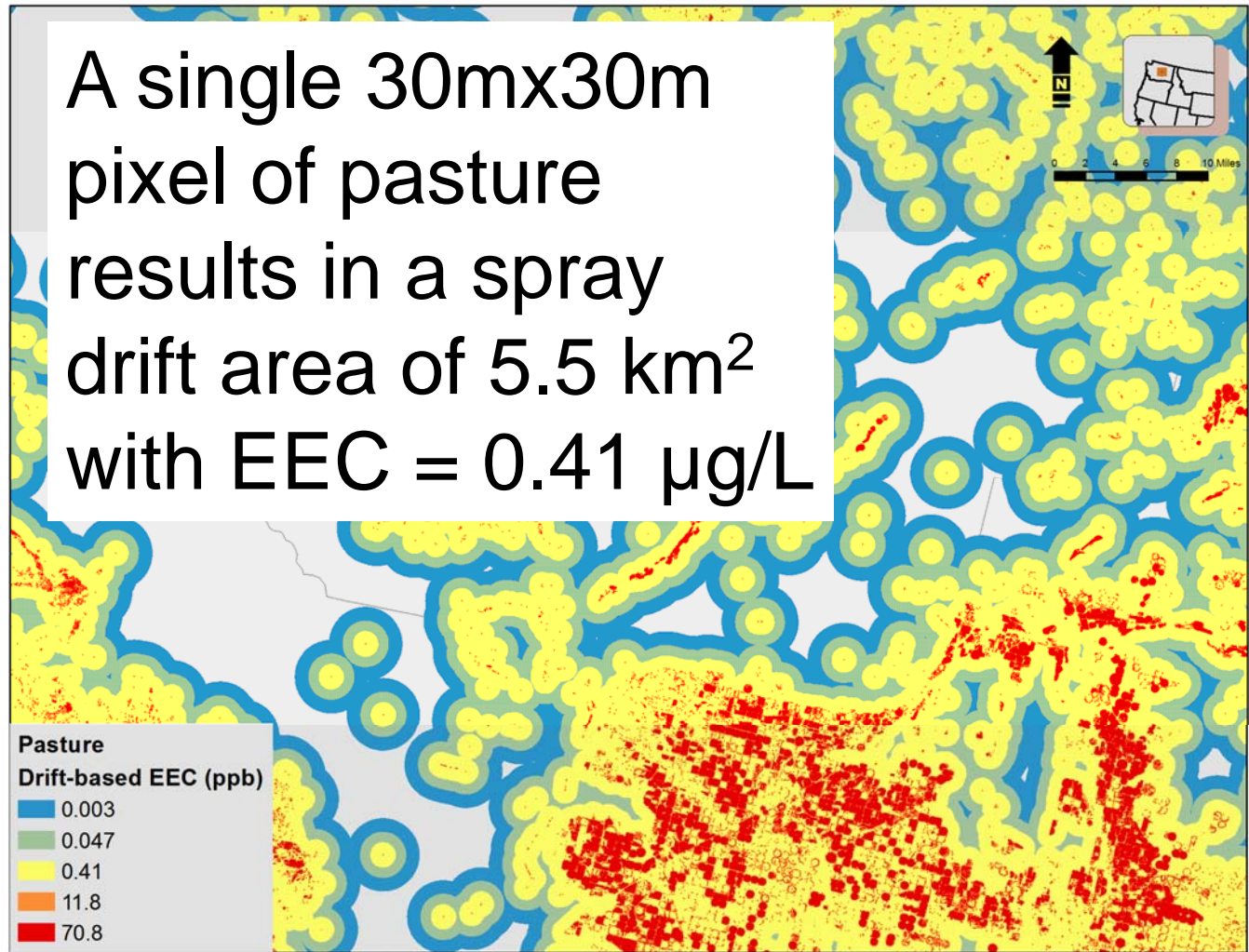
Brown area
represents
crop
footprint

EEC ($\mu\text{g/L}$)



Action Area including spray drift

A single 30m x 30m pixel of pasture results in a spray drift area of 5.5 km² with EEC = 0.41 µg/L



Outcome of Action Area delineation

- Because of the high SLERA EECs, a very large reduction in spray drift load was required to reduce exposure to the effect thresholds. Drift fractions near 0.0001 (0.01%) were needed for most fish species, and fractions less than 0.00001 (0.001%) were needed for insects, crustaceans, and corals.
- These extremely low drift loads are outside the limits of AgDrift, so the drift curve had to be extrapolated to estimate the width of the Action Area. For most crop groups, distances of 2 to 3 km were estimated for most fish species and for insects, crustaceans, and corals. IS THIS REASONABLE?
- The resulting Action Area was extremely large.

Outcome of co-occurrence analysis

- The locations of many species were known only at the county level, and so were presumed to co-occur with the crop footprint in every county where the species occurred.
- Even for species with sub-county location data, nearly all species locations were found to co-occur with the Action Area. This was mainly due to the extremely large Action Area.
 - Only 92 species/county combinations (1.4% of total) were found to be outside the Action Area (78 for mollusks, 4 for fish, 9 for amphibians, 1 for insects).
 - Only two species (Chittenango ovate amber snail and Socorro springsnail) were outside the Action Area in all locations.

Overall, the refined co-occurrence analysis did not effectively remove species from further consideration in the assessment, largely due to the overprediction of spray drift at large distances.

Additional lines of evidence

- Information was obtained from USFWS Recovery Plans and 5-Year Reviews, NatureServe, NOAA, etc.
- **Habitat:** For some species and locations, habitat factors (e.g. occurrence at high elevations or deep within forests) preclude exposure from chlorpyrifos agricultural uses.

Example: Three Forks springsnail. This species inhabits springs and creeks at elevations over 8000 ft in meadow areas. These high elevation meadows are highly unlikely to be affected by use of pesticides on agriculture.

Example: Apache trout. Presently restricted to clear, cool, high-elevation mountain streams that flow through cienegas (marshes) and coniferous forests, upstream from natural barriers.

- **Federal Lands:** For some species and locations, all species occurrences are wholly within Federal and/or Tribal Lands.

Summary of findings for fish and mollusks

	Fish			Mollusks		
	Records	Species	Species resolved*	Records	Species	Species resolved*
Total	2563	128		3229	132	
SLERA	42	5	5	103	27	26
Co-occurrence	4	4	0	78	34	2
Habitat	200	25	23	136	10	10
Fed Lands	29	14	14	21	6	6
All findings**	251	36	31	306	68	41

* Species with negligible risk in all counties where they occur.

** Some species/county records had findings in more than one category.

Summary of findings for amphibians and other taxa

	Amphibians			Other Taxa		
	Records	Species	Species resolved*	Records	Species	Species resolved*
Total	325	24		214	36	
SLERA	1	1	0	0	0	0
Co-occurrence	9	5	0	1	1	0
Habitat	85	8	8	1	1	0
Fed Lands	19	3	3	11	7	2
All findings	88	11	8	12	8	2

* Species with negligible risk in all counties where they occur.

Summary of findings for all taxa

	All Aquatic Taxa		
	Records	Species	Species resolved*
Total	6351	320	
SLERA	146	33	31
Co-occurrence	92	44	2
Habitat	422	44	41
Fed Lands	80	36	25
All findings	657	123	82

Overall, the assessment found negligible risk for 10% of species/county records, and for 25% of listed aquatic species wherever they occur.

Next steps to refine the assessment

- Implement a flowing water model.
 - Update the SLERA risk characterization.
 - Update the Action Area and co-occurrence analysis.
- Gather additional information (including sub-county locations) about species still presumed to be at risk.
- Conduct formal Weight of Evidence analysis for remaining species to answer the question, “Is the risk of chlorpyrifos to this species negligible, or should the species be subject to consultation?”

Where does the ES assessment process for pesticides need to be improved?

- Need a better (more precise) understanding of what constitutes a real RISK to listed species.
- Need scientifically based effect thresholds for direct and indirect effects.
- Need reliable exposure models for flowing water and marine habitats.
- Need better estimates of spray drift deposition at distances from treated fields.
- Need to examine the uncertainties associated with the explicit and implicit assumptions in exposure models.
- Need to re-examine habitat bin definitions and assignments of listed species to bins.
- Need higher-resolution data on locations of listed species.



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Thank you!

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