

Water Quality Criteria Report for Malathion

Appendix

Data summary sheets

Section 1: Studies rated RR (p. A2-A82)

Section 2: Studies rated RL, LR, LL (p. A83-A275)

Section 3: Studies rated N (p. A276-A406)

Abbreviations used in this appendix:

n/a = Not applicable

NC = Non Calculable

NR = Not Reported

Unused lines deleted from tables

Within each section, studies are listed in alphabetical order by species name, when there are multiple summaries for one species, they are listed in alphabetical order by author.

Appendix

Section 1 Studies rated RR

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Acroneuria pacifica

Study: Jensen LD, Gaufin AR. 1964a. Effects of Ten Organic Insecticides on Two Species of Stonefly Naiads. Trans. Am. Fish. Soc. 93:27-34.

Relevance

Score: 92.5 (Control response NR)

Rating: R

Reliability

Score: 74

Rating: R

Reference	Jensen & Gaufin 1964a	<i>A. pacifica</i>
Parameter	Value	Comment
Test method cited	APHA	
Phylum	Arthropoda	
Class	Insecta	
Order	Plecoptera	
Family	Perlidae	
Genus	<i>Acroneuria</i>	
Species	<i>pacifica</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Naiads, 2-2.5 cm	
Source of organisms	Collected from field, same as dilution water source	
Have organisms been exposed to contaminants?	Possibly	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes 48, 72, 96 h	
Effect 1	Mortality	
Control response 1	NR	
Temperature	11-12°C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Mill creek, near Salt lake City Utah	
pH	7.9-8.3	
Hardness	122-210 mg/L	
Alkalinity	150 -220 m/L	
Conductivity	NR	
Dissolved Oxygen	7.4-13.5 (initial)	NR during test, but they describe

Appendix, Section 1: Studies rated RR

Reference	Jensen & Gaufin 1964a	<i>A. pacifica</i>
Parameter	Value	Comment
		bubbling in compressed air to maintain DO-acceptable
Feeding	None	
Purity of test substance	95%	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone and emulsifier, up to 56 mg/L (0.056 mL/L, if density 1 g/mL)	
Concentration 1 Nom/Meas (µg/L)	5 concentrations, 1-10 µg/L	2 Reps and 10 per
Control	Yes, states species unaffected by solvent & emulsifier so used solvent control (?)	
LC50	(Listed below)	Graphical interpolation
48 h	12.0 µg/L	
72 h	16.0 µg/L	
96 h	7.0 µg/L	

Other notes:

Also reports effects on activity, loss of equilibrium, tremors and convulsions, and death, but only at one concentration (18 µg/L).

Reliability points taken off for:

Documentation: Analytical method (4), Measured concentrations (3), Dissolved oxygen (4), Conductivity (2), Photoperiod (3), Hypothesis tests (8)

Acceptability: Control response (9), Measured conc w/in 20% nominal (4), Prior contamination (4), Organisms randomized (1), Dilution water (2), Conductivity (1), Photoperiod (2), Random design (2), Hypothesis tests (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Acroneuria pacifica

Study: Jensen LD, Gaufin AR. 1964b. Long-Term Effects of Organic Insecticides on Two Species of Stonefly Naiads. Trans. Am. Fish. Soc. 93:357-363.

Relevance; 4d (96h) LC50

Score: 90 (no std method)

Rating: R

Reliability

Score: 77

Rating: R

Relevance; 5d-30d LC50- Value not appropriate for chronic distribution

Score: 90 (no std method)

Rating: R

Reliability

Score: 77

Rating: R

Relevance; 30d NOEC/LOEC

Score: 75 (no std method, No values)

Rating: L

Reliability

Score: 73.5

Rating: R

NOEC LOEC aren't calculated but can be estimated from graph. Only LC50 are calculated and reported as tox values.

Reference	Jensen & Gaufin 1964b	<i>A. pacifica</i>
Parameter	Value	Comment
Test method cited	APHA	More just for data analysis
Phylum	Arthropoda	
Class	Insecta	
Order	Amphipoda	
Family	Pteronarcyidae	
Genus	<i>Acroneuria</i>	
Species	<i>pacifica</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Naiad	
Source of organisms	Collected from field, same as dilution water source	Reported in Jensen & Gaufin 1964a
Have organisms been exposed to contaminants?	Possibly, because they were collected from the field	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	30 d	
Data for multiple times?	Yes: 4,5,10,15,20,25,30 d	
Effect 1	Mortality	
Control response 1	No effect *	
Temperature	12.8 ± 0.6°C	

Appendix, Section 1: Studies rated RR

Reference	Jensen & Gaufin 1964b	<i>A. pacifica</i>
Parameter	Value	Comment
Test type	Flow though	
Photoperiod/light intensity	NR	
Dilution water	Mill creek, near Salt lake City Utah	Reported in Jensen & Gaufin 1964a
pH	7.8-8.2	
Hardness	NR	
Alkalinity	165-225 m/L	
Conductivity	NR	
Dissolved Oxygen	9-11 mg/L	
Feeding	None	
Purity of test substance	95%	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	50 mg/L	
Concentration 1 Nom/Meas (µg/L)	8 concentrations, values NR	25 per rep
Control	Yes *	25 per rep
LC ₅₀ 4 day	7.7 µg/L	
LC ₅₀ 5-d	7.70 µg/L	
LC ₅₀ 10-d	5.10 µg/L	
LC ₅₀ 15-d	3.30 µg/L	
LC ₅₀ 20-d	3.20 µg/L	
LC ₅₀ 25-d	2.40 µg/L	
LC ₅₀ 30-d	0.78 µg/L ***	
NOEC	0.5 µg/L **	Method: no stats p: none MSD: none
LOEC	1 µg/L **	Method: no stats p: none MSD: none
MATC (GeoMean NOEC,LOEC)	0.71 µg/L **	
% control at NOEC	NR	
% of control LOEC	NR	

*States: exposure of both species to acetone and water for 30-d periods within a range of concentration of 5.0 to 50.0 ppm of acetone had no noticeable affect on either species.

**Values estimated from graph, not statically determined

***5-30d LC₅₀- Value is calculated, but not appropriate for chronic distribution or ACR

Reliability points taken off for:

Documentation: Analytical method (4), Measured concentrations (3), Hardness (2), Conductivity (2), Photoperiod (3), Hypothesis tests (6)

Appendix, Section 1: Studies rated RR

Acceptability: Appropriate duration (2), Appropriate control (6), Control response (9), Measured conc w/in 20% nominal (4), Prior contamination (4), Organisms randomized (1), Dilution water (2), Hardness (2), Conductivity (1), Photoperiod (2), Random design (2), Dilution factor (2), Minimum significant difference (1)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Anisops sardeus

Study: Lahr J, Badji A, Marquenie S, Schuiling E, Ndour KB, Diallo AO, Everts JW. 2001. Acute Toxicity of Locust Insecticides to Two Indigenous Invertebrates from Sahelian Temporary Ponds. *Ecotoxicol. Environ. Saf.* 48:66-75.

Relevance
Score: 100
Rating: R

Reliability
Score: 75.5
Rating: R

Reference	Lahr <i>et al.</i> 2001	<i>A. sardeus</i>
Parameter	Value	Comment
Test method cited	ASTM	
Phylum	Arthropoda	
Class	Insecta	
Order	Hemiptera	
Family	Notonectidae	
Genus	<i>Anisops</i>	
Species	<i>sardeus</i>	
Family in North America?	Yes, more in Europe	
Age/size at start of test/growth phase	Adult females	
Source of organisms	Nearby ponds	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	Not properly, only 2 h	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	24,48 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	< 10%	
Temperature	ca. 27 °C	Monitored During test
Test type	Static	
Photoperiod/light intensity	Ambient 13:11 light:dark	
Dilution water	Well water	
pH	6.9 ± 0.5	
Hardness	Ca & Mg: 32.5 & 9.1 mg/L as CaCO ₃	
Alkalinity	NR	
Conductivity	300uS/cm	
Dissolved Oxygen	Dropped to 36% at 48 h	Monitored during

Appendix, Section 1: Studies rated RR

Reference	Lahr <i>et al.</i> 2001	<i>A. sardeus</i>
Parameter	Value	Comment
		test
Feeding	None	
Purity of test substance	Formulation with high percent AI-1230 g/L AI**	>99%
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone max 0.5 mL/L	
Concentration 1 Nom ($\mu\text{g/L}$)	5-10 concentrations, logarithmically spaced	1 rep with 10 per (but tests repeated 3x, w varying concentrations)
Control	solvent	2 reps with 10 per
LC ₅₀ , 24 h	70.7 (57.4-78.0) $\mu\text{g/L}$ ***	parametric method of Kooijman (1981)
LC ₅₀ , 48 h	42.2 (40.5-44.9) $\mu\text{g/L}$ ***	Same as above

Other notes:

** density of malathion is 1.23 g/mL so this is apparently nearly 100% malathion

***LC₅₀ geomean of 3 tests

Reliability points taken off for:

Documentation: Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Alkalinity (2), Hypothesis tests (8)

Acceptability: Measured conc w/in 20% of nominal (4), Appropriate size (3), Prior contamination (4), Organisms randomized (1), Proper acclimation (1), Alkalinity (2), Dissolved oxygen (6), Temperature > +/- 1°C (3), Random design (2), Hypothesis tests (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Ceriodaphnia dubia

Study: Maul JD, Farris JL, Lydy MJ. 2006. Interaction of chemical cues from fish tissues and organophosphorous pesticides on *Ceriodaphnia dubia* survival. Environmental Pollution 141:90-97.

Relevance

Score: 100

Rating: R

Reliability

Score: 74

Rating: R

Reference	Maul <i>et al.</i> 2006	<i>C. dubia</i>
Parameter	Value	Comment
Test method cited	EPA	
Phylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	<i>Ceriodaphnia</i>	
Species	<i>dubia</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	≤ 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	> 90% survival	
Temperature	25 ± 1 °C	
Test type	Static	
Photoperiod/light intensity	16L:8D	
Dilution water	Synthetic moderately hard	
pH	NR, but monitored	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	> 4mg/L, 50%	recommend by EPA 2002
Feeding	Yes	

Appendix, Section 1: Studies rated RR

Reference	Maul <i>et al.</i> 2006	<i>C. dubia</i>
Parameter	Value	Comment
Purity of test substance	99.2 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	< 0.3mL/L	
Concentration 1 Nom ($\mu\text{g/L}$)	20.66	1? reps and 5 per
Concentration 2 Nom ($\mu\text{g/L}$)	12.40	1? reps and 5 per
Concentration 3 Nom ($\mu\text{g/L}$)	7.44	1? reps and 5 per
Concentration 4 Nom ($\mu\text{g/L}$)	4.46	1? reps and 5 per
Concentration 5 Nom ($\mu\text{g/L}$)	2.68	1? reps and 5 per
Control	Control and solvent control	1? reps and 5 per
LC ₅₀ (95% CI)	3.35 $\mu\text{g/L}$ (2.68 - 3.93)	Probit

Other notes:

A significant chemical cue (homogenized *Pimephales promelas*) and malathion interaction was observed on *C. dubia* survival ($P = 0.006$). Chemical cue and 2.82 mg/L malathion resulted in a 76.0% reduction in survival compared to malathion alone ($P < 0.01$).

Reliability points taken off for:

Documentation: Analytical method (4), Measured concentrations (3), Hardness (2), Alkalinity (2), Conductivity (2), pH (3), Hypothesis tests (8)

Acceptability: Measured conc w/in 20% of nominal (4), Organisms randomized (1), Appropriate feeding (3), Hardness (2), Alkalinity (2), Dissolved oxygen (6), Conductivity (1), pH (2), Random design (2), Adequate replication (2), Hypothesis tests (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Ceriodaphnia dubia

Study: Nelson SM, Roline RA. 1998. Evaluation of the Sensitivity of Rapid Toxicity Tests Relative to Daphnid Acute Lethality Tests. Bull. Environ. Contam. Toxicol. 60:292-299.

Which is nearly identical to:

Study: Nelson SM, Roline RA. 1997. Comparison of Rapid Toxicity Tests with a Standard Acute Test. Report BR-EE010, Technical Service Center, Bureau of Reclamation, Denver, CO.12 p. (NTIS #PB97-158919)

Relevance
Score: 100
Rating: R

Reliability
Score: 84
Rating: R

Reference	Nelson & Roline 1998	<i>C. dubia</i>
Parameter	Value	Comment
Test method cited	EPA	
Phylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	<i>Ceriodaphnia</i>	
Species	<i>dubia</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Commercial supplier*	Aquatic Bio Systems*
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	24, 48 h	
Effect 1	Mortality	
Control response 1	No mortality*	
Temperature	25 °C	
Test type	Static renewal (24 h)*	
Photoperiod/light intensity	18L:6D	
Dilution water	Moderately hard reconstituted water	

Appendix, Section 1: Studies rated RR

Reference	Nelson & Roline 1998	<i>C. dubia</i>
Parameter	Value	Comment
pH	7.30-8.31	
Hardness	8.05-8.54 mg/L	
Alkalinity	NR	
Conductivity	264-457 μ S/cm	
Dissolved Oxygen	5.8-10.0 mg/L	8.2 sat at 25= 70%
Feeding	Yes	
Purity of test substance	97%*	
Concentrations measured?	Yes in stock solution, but these concentrations are NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	States solvent not used	
Concentration 1 Nom (μ g/L)	6*	4 reps with 5 per
Concentration 2 Nom (μ g/L)	3*	4 reps with 5 per
Concentration 3 Nom (μ g/L)	1.5*	4 reps with 5 per
Concentration 4 Nom (μ g/L)	0.75*	4 reps with 5 per
Concentration 5 Nom (μ g/L)	0.375*	4 reps with 5 per
Control	Yes*	4 reps with 5 per
LC ₅₀ , 24 h (95% CI)	3.18 (2.36-4.27)	trimmed Spearman-Karber
LC ₅₀ , 48 h (95% CI)	1.14 (1.04-1.25)	trimmed Spearman-Karber

Other notes: Only summarized 24 h & 48 h standard tests here. The results of the other non-standard, faster tests compare very poorly (the authors confirm this), so they are not useful for criteria.

*Author communication used for this information

Emailed Author for missing info on June 2, 2009: SNelson@usbr.gov

Reliability points taken off for:

Documentation: Measured concentrations (3), Alkalinity (2), Hypothesis tests (8)

Acceptability: Measured w/in 20% of nominal (4), Organisms randomized (1),

Appropriate feeding (3), Proper acclimation (1), Alkalinity (2), Temperature > +/- 1°C (3), Random design (2), Hypothesis tests (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Chironomus dilutus (tentans)

Study: Belden JB, Lydy MJ. 2000. Impact of atrazine on organophosphate insecticide toxicity. Environ. Toxicol. Chem. 19: 2266-2274.

Relevance

Score: 92.5 (Control response NR)

Rating: R

Reliability

Score: 79

Rating: R

Reference	Belden & Lydy 2000	<i>C. dilutus (tentans)</i>
Parameter	Value	Comment
Test method cited	USEPA 1994	See full reference below
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Chironomidae	
Genus	<i>Chironomus</i>	
Species	<i>tentans</i>	
Found in	North America	
Age/size at start of test	4 th instar; 0.63-0.71 mm wide; ≥ 1.0 cm long	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Immobility + Mortality	
Control response 1	NR	
Temperature	20 ± 1°C	
Test type	Static	
Photoperiod	16L:8D	
Dilution water	MHSFW	
pH	7.3-7.8	
Hardness	NR	
Alkalinity	NR	
Conductivity	320-350 uS/cm	
Dissolved Oxygen	> 70%	
Feeding	NR	

Appendix, Section 1: Studies rated RR

Reference	Belden & Lydy 2000	<i>C. dilutus (tentans)</i>
Parameter	Value	Comment
Purity of test substance	> 98%	
Concentrations measured?	Yes	Nominal values used in calcs since measured values were w/in 10% (likely w/in error of extraction and analysis procedure)
Measured is what % of nominal?	> 90%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	50 µL/L acetone	
Concentration 1 Nom/Meas (µg/L)	NR; post-test values were 76-85% of initial values	Reps: 3 w/10 per
Concentration 2 Nom/Meas (µg/L)	NR; post-test values were 76-85% of initial values	Reps: 3 w/10 per
Concentration 3 Nom/Meas (µg/L)	NR; post-test values were 76-85% of initial values	Reps: 3 w/10 per
Concentration 4 Nom/Meas (µg/L)	NR; post-test values were 76-85% of initial values	Reps: 3 w/10 per
Concentration 5 Nom/Meas (µg/L)	NR; post-test values were 76-85% of initial values	Reps: 3 w/10 per
Control	Dilution water; solvent	Reps: 3 w/10 per
ECx (95% ci); ug/L	EC ₁ : 0.26 (0.13–0.40) EC ₅ : 0.44 (0.26–0.61) EC ₁₅ : 0.70 (0.48–0.90) EC ₅₀ : 1.5 (1.2–1.9)	probit

Other notes:

Study showed no synergism between malathion and atrazine. Only data for malathion alone is shown here for use in criteria derivation, but synergism data is useful for consideration of mixtures.

USEPA. 1994. Methods for measuring the toxicity and bioaccumulation of sediment-associated contaminant with freshwater invertebrates. EPA/600/R-94/024. US Environmental Protection Agency, Washington, DC.

Reliability points taken off for:

Documentation: Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Minimum significant difference (2), % control at NOEC/LOEC (2)
Acceptability: Control response (9), Organisms randomized (1), Hardness (2), Alkalinity (2), Random design (2), Dilution factor (2), Hypothesis tests (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Chironomus tentans

Study: Pape-Lindstrom PA, Lydy MJ. 1997. Synergistic toxicity of atrazine and organophosphate insecticides contravenes the response addition mixture model. *Environmental Toxicology and Chemistry* 16:2415-2420.

Relevance

Score: 90 (No std method)

Rating: R

Reliability

Score: 78

Rating: R

Reference	Pape-Lindstrom & Lydy 1997	<i>C. tentans</i>
Parameter	Value	Comment
Test method cited	EPA, but for water and culture only really	
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Chironomidae	
Genus	<i>Chironomus</i>	
Species	<i>tentans</i>	midge
Family in North America?	Yes	
Age/size at start of test/growth phase	4th instar	
Source of organisms	Lab culture, from EPA stock	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Immobility/mortality	
Control response 1	< 5%	
Temperature	20 ± 1 °C	
Test type	Static	
Photoperiod/light intensity	16:8 Light:dark	
Dilution water	EPA moderately hard water	
pH	7.95 (SD = 0.19)	
Hardness	NR	
Alkalinity	NR	
Conductivity	361 (SD = 10.3)	
Dissolved Oxygen	88.8 % (SD = 7.1)	
Feeding	None	

Appendix, Section 1: Studies rated RR

Reference	Pape-Lindstrom & Lydy 1997	<i>C. tentans</i>
Parameter	Value	Comment
Purity of test substance	99 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	0.5 mL/L acetone	
Concentrations Nom ($\mu\text{g/L}$)	5 concentrations	3 Reps -10 per rep
Control	Solvent and water only	3 Reps -10 per rep
EC ₅₀	19.09 (11.98-30.44) $\mu\text{g/L}$	Probit method

Other notes:

Greater than additive effects with atrazine

Reliability points taken off for:

Documentation: Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Hypothesis tests (8)

Acceptability: Standard method (5), Measured conc w/in 20% of nominal (4), Appropriate size (3), Organisms randomized (1), Hardness (2), Alkalinity (2), Random design (2), Hypothesis tests (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Clarias gariepinus

Study: Lien NTH, Adriaens D, Janssen CR. 1997. Morphological Abnormalities in African Catfish (*Clarias gariepinus*) Larvae Exposed to Malathion. *Chemosphere* 35:1475-1486.

Relevance: mortality, length

Score: 90 (no std method)

Rating: R

Reliability

Score: 73.5

Rating: R

Relevance: abnormality, yolk sac edema, notochord deformity

Score: 75 (Endpoint, No std method)

Rating: L

Reference	Lien <i>et al.</i> 1997	<i>C. gariepinus</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Chordata	
Class	Actinopterygii	
Order	Siluriformes	
Family	Clariidae	
Genus	<i>Clarias</i>	
Species	<i>gariepinus</i>	Airbreathing catfish
Family in North America?	Yes, invasive in Florida	Native to Africa/Asia
Age/size at start of test/growth phase	3-5 h post hatch	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	5 d	
Data for multiple times?	No	
Effect 1	Mortality (%)	
Control response 1	2.1 ± 4.2 %	
Effect 2	Abnormalities (%)	No link to survival growth or repro.
Control response 2	6.5 ± 8.1 %	
Effect 3	Body length (mm)	
Control response 3	7.82 ± 0.49 mm	
Effect 4	Abnormal notochord	No link to survival growth or repro.
Control response 4	0 %	

Appendix, Section 1: Studies rated RR

Reference	Lien <i>et al.</i> 1997	<i>C. gariepinus</i>
Parameter	Value	Comment
Effect 5	Yolk sac edema	No link to survival growth or repro.
Control response 5	About 7%	
Effect 6	Other abnormality	No link to survival growth or repro.
Control response 6	0%	
Temperature	27 ± 1°C	
Test type	Static with daily renewal	
Photoperiod/light intensity	Darkness	
Dilution water	'standard dilution water'	Actual source not clear
pH	7.6 ± 0.2	
Hardness	200 mg/L	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	8.0 ± 0.1 mg/L	
Feeding	None	
Purity of test substance	98 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	0.5 mL/L acetone	
Concentration 1 Nom (µg/L)	300	1 rep with 4 per*
Concentration 2 Nom (µg/L)	630	1 rep with 4 per
Concentration 3 Nom (µg/L)	1250	1 rep with 4 per
Concentration 4 Nom (µg/L)	2500	1 rep with 4 per
Concentration 5 Nom (µg/L)	5000	1 rep with 4 per
Control	Yes, probably water only. States elsewhere that solvent had no effect in a separate test.	1 rep with 4 per
LC50	NR	
Mortality		
NOEC	2500 µg/L	Method: ANOVA w Duncan's test p: 0.05, MSD: NR
LOEC	5000 µg/L	
MATC (GeoMean NOEC,LOEC)	3536 µg/L	
% control at NOEC	429 %	
% of control LOEC	1342 %	
Abnormality		
NOEC	1250 µg/L	Method: ANOVA w Duncan's test p: 0.05, MSD: NR
LOEC	2500 µg/L	

Appendix, Section 1: Studies rated RR

Reference	Lien <i>et al.</i> 1997	<i>C. gariepinus</i>
Parameter	Value	Comment
MATC (GeoMean NOEC,LOEC)	1768 µg/L	
% control at NOEC	257 %	
% of control LOEC	666 %	
Body length		
NOEC	1250 µg/L	Method: ANOVA w Duncan's test p: 0.05, MSD: NR
LOEC	2500 µg/L	
MATC (GeoMean NOEC,LOEC)	1768 µg/L	
% control at NOEC	94 %	
% of control LOEC	86 %	
Notochord		
NOEC	1250 µg/L	Method: ANOVA w Duncan's test p: 0.05, MSD: NR
LOEC	2500 µg/L	
MATC (GeoMean NOEC,LOEC)	1768 µg/L	
% control at NOEC	About 8/0 *100% Alternatively 92/100 = 92%	Control response was 0%, so converted negative response 100 %
% of control LOEC	About 40/0 *100% Alternatively 60/100 = 60%	
Yolk sac edema		
NOEC	2500 µg/L	Method: ANOVA w Duncan's test p: 0.05, MSD: NR
LOEC	5000 µg/L	
MATC (GeoMean NOEC,LOEC)	3536 µg/L	
% control at NOEC	About 171%	
% of control LOEC	About 457 %	

Other notes:

- ❑ In table 1 states $n \geq 4$
- ❑ 5 day larval test- Not clear if this is really chronic data. Can't be acute since no LC50. 5 d is short for chronic test, but newly hatched larvae are often the most sensitive life stage of fish.
- ❑ The second endpoint of abnormality was later divided into specific abnormalities of notochord abnormality, yolk sac edema and other abnormalities.

Reliability points taken off for:

Documentation: Analytical method (4), measured concentrations (3), Dilution water source (3), Alkalinity (2), Conductivity (2), Minimum significant difference (2), Point estimates (8)

Acceptability: Standard method (5), Appropriate control (6), Measured conc w/in 20% of nominal (4), Organisms randomized (1), Adequate number per rep (2), Hardness (2), Alkalinity (2), Conductivity (1), Random design (2), Minimum significant difference (1), Point estimates (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Clarias gariepinus

Study: Nguyen LTH, Janssen CR. 2002. Embryo-Larval Toxicity Tests with the African Catfish (*Clarias gariepinus*): Comparative Sensitivity of Endpoints. Arch. Environ. Contam. Toxicol. 42:256-262.

Relevance

Score: 90 (No std method)

Rating: R

Reliability

Score: 74.5

Rating: R

Reference	Nguyen & Janssen 2002	<i>C. gariepinus</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Chordata	
Class	Actinopterygii	
Order	Siluriformes	
Family	Clariidae	
Genus	<i>Clarias</i>	
Species	<i>gariepinus</i>	Airbreathing catfish
Family in North America?	Yes, invasive in Florida	Native to Africa/Asia
Age/size at start of test/growth phase	Eggs (immediately after fertilization)	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	5 d	
Data for multiple times?	No	
Effect 1	Larvae survival	
Control response 1	86%	
Effect 2	Larvae length	
Control response 2	7.39 mm	
Effect 3	Larvae weight	
Control response 3	0.33 mg	
Temperature	27 ± 1°C	
Test type	Static renewal (every 24 h)	
Photoperiod/light intensity	Dark	
Dilution water	Dechlorinated tap	
pH	7.7 ± 0.2	
Hardness	200 mg/L as CaCO ₃	

Appendix, Section 1: Studies rated RR

Reference	Nguyen & Janssen 2002	<i>C. gariepinus</i>
Parameter	Value	Comment
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	7.3 ± 0.1 mg/L	
Feeding	None	
Purity of test substance	98 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	0.1% acetone, about 1 mL/L	
Concentration 1 Nom/Meas (µg/L)	5 concentrations, levels NR	4 reps with 24 per
Control	Water only, but states max solvent concentration tested and no harmful effects	4 reps with 24 per
NOEC	Larval survival: 1250 µg/L Length : 630 µg/L Width: 630 µg/L	Method: ANOVA p: ≤ 0.05 MSD: NR
LOEC	Larval survival: 2500 µg/L Length: 1250 µg/L Width: 1250 µg/L	
MATC (GeoMean NOEC,LOEC)	Larval survival: 1768 µg/L Length: 887 µg/L Width: 887 µg/L	
% control at NOEC	Larval survival: 106% Length: 94% Width: 100%	
% of control LOEC	Larval survival: 69 % Length: 94% Width: 70%	

Other notes: Endpoint: NOEC/ LOEC is chronic, but test only 5 d. Documents chronic/sublethal effects in length weight. Survival can be chronic too but usually long term. Chronic usually partial life, though this covers transitions from egg to larvae.

Reliability points taken off for:

Documentation: Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Alkalinity (2), Conductivity (2), Minimum significant difference (2), Point estimates (8)

Acceptability: Standard method (5), Test duration (2), Measured conc w/in 20% of nominal (4), Carrier solvent (4), Organisms randomized (1), Alkalinity (2), Conductivity (1), Random design (2), Dilution factor (2), Minimum significant difference (1), Point estimates (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Daphnia magna

Blakemore G, Burgess D. 1990. Chronic toxicity of Cythion to *Daphnia magna* under flow-through test conditions. In *Malathion registration standard*, Analytical Bio-Chemistry laboratories, Inc.: Columbia, MO. pp 21-22.

Relevance

Score: 100

Rating: R

Reliability

Score: 97.5

Rating: R

Reference	Blakemore & Burgess 1990	<i>D. magna</i>
Parameter	Value	Comment
Test method cited	EPA-660/3-75-009 ASTM E-35.21	
Phylum	Arthropoda	
Class	Branchiopoda	
Order	Diplostraca	
Family	Daphniidae	
Genus	<i>Daphnia</i>	
Species	<i>magna</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	First instar (<24hr)	
Source of organisms	ABC labs in house culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	Yes	
Test duration	21 days	
Data for multiple times?	0, 4, 7, 14, 21	
Effect 1	Mortality	
Control response 1	See report	
Effect 2	Reproduction delay	
Control response 2	See report	
Effect 3	Decrease size	
Control response 3	See report	
Temperature	20 ± 2 °C	
Test type	Flow through	
Photoperiod/light intensity	16L:8D, 40-52 footcandles surf	
Dilution water	Blended hard + soft water	ABC well and RO

Appendix, Section 1: Studies rated RR

Reference	Blakemore & Burgess 1990	<i>D. magna</i>
Parameter	Value	Comment
pH	7.7-8.2	
Hardness	140-168 mg/L	
Alkalinity	168-188 mg/L	
Conductivity	310-380	
Dissolved Oxygen	See report	
Feeding	Yes 4 times a day	Algal suspension, trout chow and yeast
Purity of test substance	94%	
Concentrations measured?	Yes	
Measured is what % of nominal?	94%	
Chemical method documented?	Ext DCM, GC-FPD	
Concentration of carrier (if any) in test solutions	0.05mL/0.5L DMF	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	1 / 0.94 (0% survival)	4x 10
Concentration 2 Nom/Meas ($\mu\text{g/L}$)	0.5 / 0.46 (75% survival)	4x 10
Concentration 3 Nom/Meas ($\mu\text{g/L}$)	0.25 / 0.25 (97.5% survival)	4x 10
Concentration 4 Nom/Meas ($\mu\text{g/L}$)	0.12 / 0.10 (97.5% survival)	4x 10
Concentration 5 Nom/Meas ($\mu\text{g/L}$)	0.06 / 0.06 (100% survival)	4x 10
Control	Water Solvent (DMF)	2x 4x 10 97% survival
EC50; moving average (and binomial and probit method) 95%	0.52 (21d)	immobilization
NOEC; moving average ($p < 0.05$)	0.06	
LOEC; moving average ($p < 0.05$)	0.10	
MATC (GeoMean NOEC, LOEC)	0.077	
% control at NOEC	100% survival	Control 97.5% surv
% of control LOEC	97.5 % survival	

Other notes:

- Nested experimental design
- Survival data was analyzed using frequency analysis (test conc and control). This was coupled with one-tailed Fisher's exact test and Chi-square statistics (significance)
- Reproduction data was analyzed by a t-test. A Dunnett's one-tailed multiple means comparison was used (test conc and control signif).
- Daphnid length was assessed by one-way ANOVA. A Shapiro-Wilk's test was used to assess conc normality

Appendix, Section 1: Studies rated RR

Reliability points taken off for:

Documentation: Minimum significant difference (2), % control at NOEC/LOEC (2)

Acceptability: Minimum significant difference (1)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Daphnia magna

Study: Kikuchi M, Sasaki Y, Wakabayashi M. 2000. Screening of organophosphate insecticide pollution in water by using *Daphnia magna*. Ecotox Environ Safety 47:239-245.

Rating:

Relevance score: 100

Rating: R

Reliability

Score: 74.5

Rating: R

Reference	Kikuchi <i>et al.</i> 2000	<i>D. magna</i>
Parameter	Value	Comment
Test method cited	Japanese Industrial Standard Method	Full reference below
Phylum/subphylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	<i>Daphnia</i>	
Species	<i>magna</i>	
Native to	North America	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Immobility	
Control response 1	0%	
Temperature	21°C	
Test type	Static	
Photoperiod/light intensity	18L:8D (sic); perhaps 16L:8D ?	
Dilution water	Mineral water	
pH	7.4-7.9	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	7.8 mg/L	

Appendix, Section 1: Studies rated RR

Reference	Kikuchi <i>et al.</i> 2000	<i>D. magna</i>
Parameter	Value	Comment
Feeding	NR	
Purity of test substance	Analytical grade	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions; Density of acetone = 0.8 g/mL Density of DMSO = 1.1 g/mL	< 10 mg/L; either acetone or DMSO; not specified which solvent was used for which pesticides	If DMSO: 0.009 mL/L; If acetone: 0.01 mL/L
Concentration 1 Nom ($\mu\text{g/L}$)	Number and levels NR; dilution factor = 1.8	Reps: 4 w/5 per
Control	Mineral water	Reps: 4 w/5 per
EC ₅₀ (95% ci); $\mu\text{g/L}$	1.8 (1.5-2.0)	Probit

Japanese Industrial Standard (JIS K 0229). 1992. Testing Methods for Determination of the Inhibition of the Mobility of *Daphnia* by Chemicals.

Reliability points taken off for:

Documentation: Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Conductivity (2), Hypothesis tests (8)

Acceptability: Appropriate control (6), Measured conc w/in 20% of nominal (4), Organisms randomized (1), Hardness (2), Alkalinity (2), Temperature > +/- 1°C, Conductivity (1), Adequate number of concentrations (3), Random design (2), Hypothesis tests (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Gambusia affinis

Study: Tietze NS, Hester PG, Hallmon CF, Olson MA, Shaffer KR. 1991. Acute Toxicity of Mosquitocidal Compounds to Young Mosquitofish, *Gambusia affinis*. J. Am. Mosq. Control Assoc. 7:290-293.

Relevance

Score: 100

Rating: R

Reliability

Score: 78.5

Rating: R

Reference	Tietze <i>et al.</i> 1991	<i>G. affinis</i>
Parameter	Value	Comment
Test method cited	ASTM	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cyprinodontiformes	
Family	Poeciliidae	
Genus	<i>Gambusia</i>	
Species	<i>affinis</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	5 d	
Source of organisms	Eggs from females cultured in ponds	
Have organisms been exposed to contaminants?	probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	24 and 48 h	
Effect 1	Immobility/ mortality	
Control response 1	< 5%	
Temperature	27 ± 0.5 °C	
Test type	Static	
Photoperiod/light intensity	16:8 light:dark	
Dilution water	Well water	
pH	NR	
Hardness	ca 150 ppm	
Alkalinity	ca 150 ppm	
Conductivity	NR	
Dissolved Oxygen	> 40%	
Feeding	None	

Appendix, Section 1: Studies rated RR

Reference	Tietze <i>et al.</i> 1991	<i>G. affinis</i>
Parameter	Value	Comment
Purity of test substance	Cythion®, Cythion is >90% malathion	Cythion UVL is 95%
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone: 1 mL/500mL beaker = 2mL/L	
Concentrations Nom/Meas (µg/L)	7 concentrations*	6 reps with 5 per
Control	Yes, Solvent	6 reps with 5 per
LC ₅₀ 24 h	12,680 (12,110-13,200) µg/L	Probit method
LC ₅₀ 48 h	3440 (2720-4370) µg/L	

Other notes:

Test repeated 7x each

Concentrations used can be seen in graphs an estimated as:
500, 800, 1060, 1200, 1600, 1800, 10,600, 11,400, 12,200 ug/L

emailed for missing info, esp. on control type April 21, 2009

Noor.Tietze@deh.sccgov.org

Reply on April 22: control was solvent control

Reliability points taken off for:

Documentation: Analytical method (4), Measured concentration (3), Conductivity (2), pH (3), Hypothesis tests (8)

Acceptability: Measured conc w/in 20% of nominal (4), Carrier solvent (4), Organisms randomized (1), Dissolved oxygen (6), Conductivity (1), pH (2), Random design (2), Hypothesis tests (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Gila elegans

Study: Beyers DW, Keefe TJ, Carlson CA. 1994. Toxicity of carbaryl and malathion to two federally endangered fishes, as estimated by regression and ANOVA. *Environmental Toxicology and Chemistry* 13:101-107.

Relevance

Score: 92.5 (acute and chronic)

Rating: R

Reliability

Score: 83 acute / 77.5 chronic

Rating: R

Reference	Beyers <i>et al.</i> 1994	<i>G. elegans</i>
Parameter	Value	Comment
Test method cited	ASTM E729-88 - acute ASTM E1241-88 - ELS	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Gila</i>	
Species	<i>elegans</i>	
Family in North America?	yes (Colorado river)	
Age/size at start of test/growth phase	Acute 4d – 6d old (2mg, 6.8mm) ELS 32d – 48 d old (4mg, 8.6mm)	
Source of organisms	Eggs Dexter Nat fish hatchery	
Have organisms been exposed to contaminants?	no	
Animals acclimated and disease-free?	yes	
Animals randomized?	yes	1 to 7 treatments
Test vessels randomized?	yes	2 replicates
Test duration	4 d acute 32 d ELS	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Effect 2	Decrease in size	
Control response 2	NR	
Temperature	21.2-22.7 °C	
Test type	Renewal- 4 d acute Flow through- 32 d ELS	
Photoperiod/light intensity	16:8h light/dark	
Dilution water	Well in CSU	
pH	7.9-8.2	
Hardness	344 -378 mg/L as CaCO ₃	

Appendix, Section 1: Studies rated RR

Reference	Beyers <i>et al.</i> 1994	<i>G. elegans</i>
Parameter	Value	Comment
Alkalinity	237 – 259 mg/L as CaCO ₃	
Conductivity	720 – 780 uS/cm	
Dissolved Oxygen	6.1 – 7 mg/L	
Feeding	Acute 4d – no (before, during) ELS - live <24hr brine shrimp nauplii (2 to 3/day)	
Purity of test substance	93%	
Concentrations measured?	Yes	Acute – 2 times ELS – 4 times
Measured is what % of nominal?	NR	
Chemical method documented?	SPE w/ GC	
Concentration of carrier (if any) in test solutions	Acetone <0.5mL/L	
Concentration 1 Nom/Meas (µg/L)	5 conc nominal value NR, 1 solv control, 1 dil water control	Acute: 2 Reps and 10 larvae ELS: 2 reps and 40 larvae
LC50	4d acute - 15.3 mg/L	Probit analysis
NOEC	Growth: 990 ug/L Survival: 2000 ug/L	hyp test - ANOVA
LOEC	Growth: 2000 ug/L Survival: 4060 ug/L	hyp test - ANOVA
MATC	Growth: 1407 ug/L Survival: 2849 ug/L	Geo Mean

Other notes:

Linear-plateau regression model was used to calculate a threshold value between NOEC and LOEC (p=0.001)

Threshold value (95%)

Growth - (521 (487, 557))

Survival - (1420 (936, 2160))

Reliability points taken off for:

Documentation: Nominal concentrations (3), Measured concentrations (3), Hypothesis tests (8 – acute only), Minimum significant difference (2 – chronic only), % control at NOEC/LOEC (2 – chronic only), Point estimates (8 – chronic only)

Acceptability: Control response (9), Measured conc w/in 20% of nominal (4), Carrier solvent (4 – chronic only), Hardness (2), Dilution factor (2), Hypothesis tests (3), Point estimates (3 – chronic only)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Jordanella floridae

Study: Hermanutz RO. 1978. Endrin and Malathion Toxicity to Flagfish (*Jordanella Floridae*). *Archives of Environmental Contamination and Toxicology* 7:159-168.

Relevance

Score: 100

Rating: R

Reliability

Score: 90

Rating: R

Reference	Hermanutz 1978	<i>J. floridae</i>
Parameter	Value	Comment
Test method cited	Mount and Brungs 1967 McKin and Benoit 1971	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cyprinodontiformes	
Family	Cyprinodontidae	
Genus	<i>Jordanella</i>	
Species	<i>floridae</i>	
Family in North America?	yes	
Age/size at start of test/growth phase	1 to 2 d – chronic 33d old – acute	
Source of organisms	Laboratory cultured fish	
Have organisms been exposed to contaminants?	no	
Animals acclimated and disease-free?	NR	
Animals randomized?	yes	
Test vessels randomized?	yes	
Test duration	Chronic - 30d Acute - 216hr	
Data for multiple times?	no	
Effect 1	Survival	
Control response 1	90-98%	
Effect 2	Growth	
Control response 2	1 st gen: 15.9-16.2 mm 2 nd gen: 22.4-22.7 mm	
Temperature	25.1-25.4 (chronic) 24.4-25.2 (acute)	
Test type	Flow-through	
Photoperiod/light intensity	16hr light: 8hr dark	
Dilution water	Lake Superior (UV sterile)	aerated
pH	7.3-7.6	
Hardness	41-46 mg/L	

Appendix, Section 1: Studies rated RR

Reference	Hermanutz 1978	<i>J. floridae</i>
Parameter	Value	Comment
Alkalinity	39 – 44 mg/L	
Conductivity	NR	
Dissolved Oxygen	>80% saturation	
Feeding	<30d – live brine shrimp nauplii Older fish – frozen brine shrimp	3 times/day
Purity of test substance	95%	
Concentrations measured?	Yes (GC)	
Measured is what % of nominal?	95% recovery for chronic	
Chemical method documented?	US EPA 1974	
Concentration of carrier (if any) in test solutions	Acetone (1.4mg/L)	Tanks 54L and 6.3L
Concentration 1 Nom/Meas (µg/L)	Chronic – 36/31.5 ± 4.4 Acute – 516 ± 32	C - 2x 20 larvae A - 40 fish
Concentration 2 Nom/Meas (µg/L)	Chronic – 27/24.7 ± 3.4 Acute – 374 ± 36	C - 2x 20 larvae A - 40 fish
Concentration 3 Nom/Meas (µg/L)	Chronic – 20.3/19.3 ± 1.6 Acute – 294 ± 9	C - 2x 20 larvae A - 40 fish
Concentration 4 Nom/Meas (µg/L)	Chronic – 15.2/15.0 ± 1.6 Acute – 233 ± 20	C - 2x 20 larvae A - 40 fish
Concentration 5 Nom/Meas (µg/L)	Chronic – 11.5/10.9 ± 0.8 Acute – 170 ± 20	C - 2x 20 larvae A - 40 fish
Concentration 6 Nom/Meas (µg/L)	Chronic – 8.5/8.6 ± 1.0 Acute – 116 ± 12	C - 2x 20 larvae A - 40 fish
Concentration 7 Nom/Meas (µg/L)	Chronic – 6.4/5.8 ± 0.6	C - 2x 20 larvae
Control	Water (no solvent)	C - 2x 20 larvae A - 40 fish
LC ₅₀ , probit method (95%)	96hr – 349 ug/L (383-321) 216hr – 235 ± 22 ug/L	
NOEC	Growth – 8.6 ug/L Survival – 19.3 ug/L	Method: NR, MSD: NR p:0.05
LOEC	Growth – 10.9 ug/L Survival – 24.7 ug/L	(p=0.05) one way variance
MATC (GeoMean NOEC,LOEC)	Growth – 9.68 ug/L Survival – 21.83 ug/L	
% control at NOEC	2%	
% of control LOEC	Growth – 89.4% Survival – 67.4%	

Other notes: data for ACR

Appendix, Section 1: Studies rated RR

Reliability points taken off for:

Documentation: Conductivity (2), Minimum significant difference (2)

Acceptability: Standard method (5), Appropriate control (6), Proper acclimation (1),

Adequate replication (2), Minimum significant difference (1)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Jordanella floridae

Study: Hermanutz RO, Eaton JG, Mueller LH. 1985. Toxicity of endrin and malathion mixtures to flagfish (*Jordanella floridae*). *Archives of Environmental Contamination and Toxicology* **14**:307-314.

Relevance
Score: 100
Rating: R

Reliability
Score: 89
Rating: R

Reference	Hermanutz et al. 1985	<i>J. floridae</i>
Parameter	Value	Comment
Test method cited	Mount and Brungs 1967 McKin and Benoit 1971	APHA 1971
Phylum	Chordata	
Class	Actinopterygii	
Order	Cyprinodontiformes	
Family	Cyprinodontidae	
Genus	<i>Jordanella</i>	
Species	<i>floridae</i>	
Family in North America?	yes	
Age/size at start of test/growth phase	2 to 3 d – chronic 37d old – acute	
Source of organisms	Laboratory cultured fish	
Have organisms been exposed to contaminants?	no	
Animals acclimated and disease-free?	NR	
Animals randomized?	yes	
Test vessels randomized?	yes	
Test duration	Chronic - 140d Acute - 168hr	
Data for multiple times?	no	
Effect 1	Mortality	
Control response 1	85 ± 6.9 % survival	
Effect 2	Growth	
Control response 2	20.9 ± 3.1 mm	
Temperature	Chronic - 24.1-25.5 °C Acute – 23.4-24.5 °C	
Test type	Flow-through	
Photoperiod/light intensity	16hr light	
Dilution water	Lake Superior (UV sterile)	aerated
pH	6.9-7.8	
Hardness	43-48 mg/L	

Appendix, Section 1: Studies rated RR

Reference	Hermanutz <i>et al.</i> 1985	<i>J. floridae</i>
Parameter	Value	Comment
Alkalinity	39 – 45 mg/L	
Conductivity	NR	
Dissolved Oxygen	Chronic - 7.1-7.7 mg/L Acute - 97-107% sat	
Feeding	<30d – live brine shrimp nauplii Older fish – frozen brine shrimp	3 times/day
Purity of test substance	95%	
Concentrations measured?	Yes (GC-ECD)	
Measured is what % of nominal?	99-113%	
Chemical method documented?	US EPA 1974	
Concentration of carrier (if any) in test solutions	Acetone (1.9-3.5mg/L)	Tanks 54L and 6.3L
Concentration 1 Nom/Meas (µg/L)	Chronic – 35/23.1±3.1 Acute – 435/419	C - 2x 30 fish A – 2x40 fish
Concentration 2 Nom/Meas (µg/L)	Chronic – 26/18.5±2.2 Acute – 340/331	C - 2x 30 fish A – 2x40 fish
Concentration 3 Nom/Meas (µg/L)	Chronic – 20/13.8±1.4 Acute – 265/265	C - 2x 30 fish A – 2x40 fish
Control	Water (no solvent)	C - 2x 30 fish A – 2x40 fish
LC50	24hr – 320 ug/L 48hr – 280 ug/L	probit method (95%)
NOEC	Growth – 13.8 ug/L (30d)	Method: ANOVA p:0.05
LOEC	Growth – 18.5 ug/L (30d)	(p=0.05) ANOVA
MATC (GeoMean NOEC,LOEC)	Growth – 15.98 ug/L (30d)	
% control at NOEC	Growth – 95.7%	
% of control LOEC	Growth – 93.8%	

Other notes: data for ACR and mixture

Reliability points taken off for:

Documentation: Temperature (2), Minimum significant difference (2)

Acceptability: Appropriate control (6), Measured conc w/in 20% of nominal (4), Proper acclimation (1), Conductivity (1), Adequate # of concentrations (3), Dilution factor (2), Minimum significant difference (1)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Lepomis macrochirus

Study: Eaton JG. 1970. Chronic Malathion Toxicity to Bluegill (*Lepomis-Macrochirus-Rafinesque*). *Water Research* 4:673.

Relevance- ACUTE

Score: 82.5 (no std method, Control response NR)
Rating: L

Reliability

Score: 68
Rating: L

Relevance- CHRONIC -SPAWNING

Score: 75 (no std method, No values)
Rating: L

Reliability

Score: 77.5
Rating: R

Relevance- CHRONIC- SPINAL DEFORMATIES

Score: 67.5 (no std method, Control response NR, Endpoint)
Rating: N

Reliability

Score: NA
Rating: NA

Relevance- CHRONIC- AChE Inhibition

Score: 75 (no std method, Endpoint)
Rating: L

Reliability

Score: 77.5
Rating: R

Relevance- CHRONIC- SURVIVAL

Score: 90 (no std method)
Rating: **R**

Reliability

Score: 77.5
Rating: **R**

Reference	Eaton 1970	<i>L. macrochirus</i>
Parameter	Value	Comment
Test method cited	APHA for Water qual only	
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Centrarchidae	
Genus	<i>Lepomis</i>	
Species	<i>macrochirus</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	8 cm, 12g, about 1.5 y	
Source of organisms	Spring fed ponds	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	Acute: 96 h	Nov 11- Sept 5

Appendix, Section 1: Studies rated RR

Reference	Eaton 1970	<i>L. macrochirus</i>
Parameter	Value	Comment
	Chronic: 10 mo	
Data for multiple times?	NR	
Effect 1	Acute test-lethality	
Control response 1	NR	
Effect 2	Chronic –Reproduction: # spawning, %hatch, fry survival	No sig. effects seen
Control response 2	1.5 and 1.4 spawn/female, 93, 85% hatch survival, 700, 1400 # fry hatched	
Effect 3	Chronic spinal deformities	
Control response 3	NR	
Effect 4	Adult survival	
Control response 4	None by Sept 5, but fish that jumped out of tank	
Temperature	9-29 °C subject to ambient fluctuation over several months	
Test type	Flow-trough	
Photoperiod/light intensity	Ambient	
Dilution water	Described in a cited ref.	
pH	7.2-8.5	
Hardness	194-218 mg/L as CaCO ₃	
Alkalinity	144-186 mg/L as CaCO ₃	
Conductivity	372-526 umOhms	
Dissolved Oxygen	3.3-16.3 but mostly > 5 mg/L	
Feeding	Chronic: yes, acute: not	
Purity of test substance	95 %	
Concentrations measured?	Yes	
Measured is what % of nominal?	70-83%	
Chemical method documented?	Yes, GC ECD	
Concentration of carrier (if any) in test solutions	< 0.001 mg/L acetone <0.01 uL/L	
ACUTE	4-5 concentrations dilution factor of 0.75. Measured concentrations, but concentrations or % nom NR	10 fish /conc.
CHRONIC		
Concentration 1 Nom/Meas (µg/L)	80/66 (all fish died)	15 fish per conc. in 1 tank, later split
Concentration 2 Nom/Meas (µg/L)	40/28 (all fish died)	

Appendix, Section 1: Studies rated RR

Reference	Eaton 1970	<i>L. macrochirus</i>
Parameter	Value	Comment
Concentration 3 Nom/Meas (µg/L)	20/14.6 (5/15 fish died)	into 2 tanks: 1 indoors and 1 outdoors
Concentration 4 Nom/Meas (µg/L)	10/7.4	
Concentration 5 Nom/Meas (µg/L)	5/3.6	
Concentration 6 Nom/Meas (µg/L)	2.5/ 1.6	
Concentration 7 Nom/Meas (µg/L)	1.25/ 0.7	
Control	Yes, dilution water only	Same as above
LC ₅₀	Test 1: 131 ug/L Test 2: 89 ug/L	Graphical interpolation
AChE Inhibition 52%	20/ 14.6 ug/L (Nom/Meas)	
AChE Inhibition 54%	10/7.4ug/L	
AChE Inhibition 67%	5/3.6	
AChE Inhibition 65%	2.5/ 1.6	
AChE Inhibition 79%	1.25/ 0.7	
NOEC	3.6 ug/L- spinal def. 7.4 ug/L - survival	Method: no stats, just observation p: NR MSD: NR
LOEC	7.4 ug/L-spinal def 14.6 ug/L- survival	Method: no stats, just observation p: NR MSD: NR
MATC (GeoMean NOEC,LOEC)	5.2 ug/L-spinal def 10.4 ug/L- survival	
% control at NOEC	NR	
% of control LOEC	NR	

Other notes:

Experiment started in glass tanks. Then fish were moved into indoor stainless steel tanks and outdoor wooden tanks to provide more room for spawning. Sex was not really distinguishable, so it ended up that males were mostly moved outside and most of those left inside were females. Outdoors (wooden tanks) 7 males to 2 females was a common sex ratio. Indoors the sex ratio was more variable in all the different concentrations (Table 4).

No effect of malathion on spawning is apparent from TABLE 5. Early (larval) fry survival in all but one case was nearly as good as or better than the controls, indicating that malathion in concentrations up to 20 ug/L had no effect on survival up to 4 days after hatch (TABLE 5).

Effects seen on adult survival:

"The 80- and 40-ug/L concentrations were discontinued after all the fish died. The lethality of the highest concentration was determined twice; 15 fish were killed in 14 days in the first test and in 16 days in the second. All 15 fish were killed in 54 days in the 40 ug/L tank. Two new concentrations, 1.25 and 2.5/~g 1-1, were added at

Appendix, Section 1: Studies rated RR

this time lest none of the original ones would still be safe at the end of the chronic test period. The first death in 20 ug/L occurred on January 6 after 56 days of exposure, but 10 fish were still alive at the end of the test on September 5. The only other mortality in the test tanks resulted when a fish jumped out of the outdoor (wooden) control tank."

Although no adult fish were killed in the 10 ug /L tanks, two inside and three outside (one-third of the total) had spinal deformations, as did 60 per cent of those remaining alive in 20/~g 1-1. This is the basis for the NOEC and LOEC reported in the abstract. But reproduction not affected.

"As pointed out by WEISS (1959, 1961), LELAND (1968), GIBSON *et al* (1969), and others, the degree of inhibition by an organophosphate pesticide is dependent upon its concentration, the fish species involved, the duration of the exposure, and other factors not well understood."

Reliability points taken off **chronic** test for:

Documentation: Dilution water (3), Hypothesis tests (6)

Acceptability: Standard method (5), Appropriate control (6), Measured conc w/in 20% of nominal (4), Organisms randomized (1), Dilution water (2), Dissolved oxygen (6), Temperature >/- 1°C (3), Random design (2), Adequate replication (2), Statistics method (2), Minimum significant difference (1)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Morone saxatilis

Study: Fujimura R, Finlayson B, Chapman G. 1991. Evaluation of acute and chronic toxicity tests with larval striped bass. In: Mayes MA, Barron MG (eds). *Aquatic Toxicology and Risk Assessment*. ASTM, Philadelphia, PA, pp 193-211.

Note: Acute test with stripped bass is the only test with malathion. None of the chronic studies were conducted with malathion

Relevance-Acute 96 h test

Score: 92.5 (Control response NR)

Rating: R

Reliability

Score: 73.5

Rating: R

Reference	Fujimura <i>et al.</i> 1991	<i>M. saxatilis</i>
Parameter	Value	Comment
Test method cited	ASTM	
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Moronidae	
Genus	<i>Morone</i>	
Species	<i>saxatilis</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Acute: 6-45 d post hatch	
Source of organisms	Larval st. bass - CDFG hatchery	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	Yes	
Test duration	96 h acute 35-52 d chronic	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	ATL:17-19 (depending on test) ± 0.5 °C	
Test type	Flow through	
Photoperiod/light intensity	NR	
Dilution water	ATL: Filtered degassed ground water, adjusted to 1-2 ppt salinity with artificial sea salt mix EPA: Epa reconstituted water	

Appendix, Section 1: Studies rated RR

Reference	Fujimura <i>et al.</i> 1991	<i>M. saxatilis</i>
Parameter	Value	Comment
pH	ATL:7.8-8.2 EPA: 8.1	
Hardness	ATL: 110-140 mg/L as CaCO ₃ EPA:	
Alkalinity	ATL:110-150 mg/L as CaCO ₃ EPA: 150	
Conductivity	NR	
Dissolved Oxygen	Monitored daily, but NR	
Feeding	Yes in acute & chronic	
Purity of test substance	94.2% technical	
Concentrations measured?	Yes	
Measured is what % of nominal?	NR	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	≤ 0.5mL/L Triethylene glycol methyl ether: triethylene glycol (1:10)	
Acute test		
Concentration 1 Nom/Meas (µg/L)	5 concentration, plus control	2 reps with 20-25 larvae
Control	Water only, but in 1989, Solvent control	2 reps with 20-25 larvae
LC50 (SD), 96 h:	Listed below	Moving average analysis

Year of Test	96 h LC ₅₀ (SD)	Age (day post hatch)
1988	16 (13-19)	11 d
1988	25 (19-34)	45 d
1988	12 (11-14)	29 d
1989	64 (55-77)	13 d
1989	100 (87-150)	45 d
1989	66 (58-74)	45 d

Reliability points taken off for:

Documentation: Nominal concentrations (3), Measured concentrations (3), Dissolved oxygen (4), Conductivity (2), Photoperiod (3), Hypothesis tests (8)

Acceptability: Control response (9), Measured conc w/in 20% of nominal (4), Appropriate feeding (3), Dissolved oxygen (6), Conductivity (1), Photoperiod (2), Dilution factor (2), Hypothesis tests (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Neomysis mercedis

Brandt OM, Fujimura RW, Finlayson BJ. 1993. Use of *Neomysis mercedis* (Crustacea: Mysidacea) for estuarine toxicity tests. Transactions of the American Fisheries Society 122:279-288.

Relevance

Score: 92.5 (Control response NR)

Rating: R

Reliability

Score: 75

Rating: R

Reference	Brandt <i>et al.</i> 1993	<i>N. mercedis</i>
Parameter	Value	Comment
Test method cited	ASTM	
Phylum	Arthropoda	
Class	Crustacea	
Order	Malacostraca	
Family	Mysidacea	
Genus	<i>Neomysis</i>	
Species	<i>mercedis</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Neonates: ≤ 5d Juveniles: > 15d	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	Yes	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	mortality	
Control response 1	NR	
Temperature	17 ± 0.5 °C	
Test type	Flow through	
Photoperiod/light intensity	NR	
Dilution water	Well water, degassed, aerated, filtered	
pH	Monitored daily but NR	
Hardness	Monitored daily but NR	
Alkalinity	Monitored daily but NR	
Conductivity	Salinity: 2ppt	
Dissolved Oxygen	Monitored daily but NR	
Feeding	Yes	

Appendix, Section 1: Studies rated RR

Reference	Brandt <i>et al.</i> 1993	<i>N. mercedis</i>
Parameter	Value	Comment
Purity of test substance	94.2%	
Concentrations measured?	Yes	
Measured is what % of nominal?	94%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L of a 1:10 mix of triethylene glycol dimethyl ether and triethylene glycol	
Concentration 1 Meas (µg/L)	5 concentrations –Meas.	2 reps and NR per
Control	Solvent (some tests didn't have solvent control) water only	2 reps and NR per
LC ₅₀ ; indicate calculation method	By life-stage, below	
Juvenile	3.8 (2.9-5.3) µg/L	Moving ave. or nonlinear interp.
Neonate	2.2 (2.0-2.5) µg/L	
Neonate	1.5 (1.2-1.8) µg/L	(3 Repeated tests)
Neonate	1.4 (1.3-1.5) µg/L	

Other notes:

Reliability points taken off for:

Documentation: Nominal concentrations (3), Measured concentrations (3), Hardness (2), Alkalinity (2), Dissolved oxygen (4), pH (3), Photoperiod (3), Hypothesis tests (8)

Acceptability: Control response (9), Organisms randomized (1), Adequate number per rep (2), Appropriate feeding (3), Photoperiod (2), Random design (2), Hypothesis tests (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Oncorhynchus clarki

Study: Post G, Schroeder T. 1971. The toxicity of four insecticides to four Salmonid species. Bulletin of Environmental Contamination and Toxicology 6:144-155.

Relevance

Score: 92.5 (Control response NR)

Rating:R

Reliability

Score: 75.5

Rating:R

Reference	Post & Schroeder 1971	<i>O. clarki</i>
Parameter	Value	Comment
Test method cited	APHA	
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	<i>Oncorhynchus</i>	
Species	<i>clarki</i>	cutthroat trout
Family in North America?	Yes	
Age/size at start of test/growth phase	Test 1:0.33g, Test 2: 1.25 g	
Source of organisms	Hatcheries	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	72, 96 h	
Effect 1	Mortality	
Control response 1	NR	
Temperature	12.9 °C	
Test type	Static renewal 24 h	
Photoperiod/light intensity	NR	
Dilution water	well	
pH	7.2-7.6	
Hardness	318-348 mg/L as CaCO ₃	
Alkalinity	276-348 mg/L as CaCO ₃	
Conductivity	NR	
Dissolved Oxygen	5.9-6.0 mg/L	
Feeding	None	
Purity of test substance	95 %	
Concentrations measured?	NR	

Appendix, Section 1: Studies rated RR

Reference	Post & Schroeder 1971	<i>O. clarki</i>
Parameter	Value	Comment
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone -concentrations NR	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	5-6	2 Reps and 10 per
Control	Solvent control	2 Reps and 10 per
LC50; 72 h ($\mu\text{g/L}$)	Test 1: 200 (163-245)*	Probit method
LC50; 96 h ($\mu\text{g/L}$)	Test 1: 150 (133-170)* Test 2: 201 (175-231)	

Other notes:

* only one replicate

Reliability points taken off for:

Documentation: Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Conductivity (2), Photoperiod (3), Hypothesis tests (8)

Acceptability: Control response (9), Measured conc w/in 20% nominal (4), Carrier solvent (4), Organism randomized (1), Conductivity (1), Photoperiod (2), Random design (2), Dilution factor (2), Hypothesis tests (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Oncorhynchus kisutch

Study: Post G, Schroeder T. 1971. The toxicity of four insecticides to four Salmonid species. Bulletin of Environmental Contamination and Toxicology 6:144-155.

Relevance

Score: 92.5 (Control response NR)

Rating: R

Reliability

Score: 75.5

Rating: R

Reference	Post & Schroeder 1971	<i>O. kisutch</i>
Parameter	Value	Comment
Test method cited	APHA	
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	<i>Oncorhynchus</i>	
Species	<i>kisutch</i>	<i>Coho salmon</i>
Family in North America?	Yes	
Age/size at start of test/growth phase	1.70g,	
Source of organisms	Hatcheries	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24, 96 h	
Effect 1	Mortality	
Control response 1	NR	
Temperature	12.9 °C	
Test type	Static renewal 24 h	
Photoperiod/light intensity	NR	
Dilution water	well	
pH	7.2-7.6	
Hardness	318-348 mg/L as CaCO ₃	
Alkalinity	276-348 mg/L as CaCO ₃	
Conductivity	NR	
Dissolved Oxygen	5.9-6.0 mg/L	
Feeding	None	
Purity of test substance	95 %	
Concentrations measured?	NR	

Appendix, Section 1: Studies rated RR

Reference	Post & Schroeder 1971	<i>O. kisutch</i>
Parameter	Value	Comment
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone -concentrations NR	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	5-6	2 Reps and 10 per
Control	Solvent control	2 Reps and 10 per
LC50; 24 h ($\mu\text{g/L}$)	300 (211-346)	Probit method
LC50; 96 h ($\mu\text{g/L}$)	130 (208-388)	Probit method

Other notes:

Reliability points taken off for:

Documentation: Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Conductivity (2), Photoperiod (3), Hypothesis tests (8)

Acceptability: Control response (9), Measured conc w/in 20% nominal (4), Carrier solvent (4), Organism randomized (1), Conductivity (1), Photoperiod (2), Random design (2), Dilution factor (2), Hypothesis tests (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Oncorhynchus mykiss

Study: Cohle P. 1989. Early Life Stage Toxicity of cythion to rainbow trout (*Oncorhynchus mykiss*) in a flow-through system. In *Malathion registration standard*, Analytical Bio-Chemistry laboratories, Inc.: Columbia, MO.

Relevance
Score: 100
Rating: R

Reliability
Score: 92
Rating: R

Reference	Cohle 1989	<i>O. mykiss</i>
Parameter	Value	Comment
Test method cited	ASTM E-47.01 USEPA fry stages freshwater fish	
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	<i>Oncorhynchus</i>	
Species	<i>Oncorhynchus mykiss</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Eggs 8hr post fertilization	
Source of organisms	Mt Lassen trout farm, CA	
Have organisms been exposed to contaminants?	no	
Animals acclimated and disease-free?	yes	
Animals randomized?	Yes	
Test vessels randomized?	Yes	
Test duration	97 days (37+ 60 d post hatch)	04/27 – 08/02
Data for multiple times?	Yes (37 to 60d)	
Effect 1	Hatchability (up to 37d)	Not significant to do dose response
Control response 1	See report	
Effect 2	Growth	
Control response 2	See report	
Effect 3	Fry survival 0% level 5 50 % d 37, 43% d 60 level 4	(at 37 and 60d)
Control response 3	See report	
Temperature	7.8-13.6 oC	
Test type	Flow through ELS	
Photoperiod/light intensity	16hr day / 131 footcandles	
Dilution water	Well water, RO + blended	
pH	7.4-8.1	
Hardness	24-52 mg/L	

Appendix, Section 1: Studies rated RR

Reference	Cohle 1989	<i>O. mykiss</i>
Parameter	Value	Comment
Alkalinity	36-60 mg/L	
Conductivity	67-122	
Dissolved Oxygen	6.6-10.2 mg/L	65 to 94% sat at 10C
Feeding	Live brine shrimp nauplii Add ground salmon starter	Begin 46d After 54d - 3x day
Purity of test substance	94%	
Concentrations measured?	yes	
Measured is what % of nominal?	99 - 110%	
Chemical method documented?	GC/FPD	
Concentration of carrier (if any) in test solutions	DMF (50 uL into 4L)	
Concentration 1 Nom/Meas (µg/L)	5 / 5.1	4 x 35 eggs 4 x 15 larvae (after 39d)
Concentration 2 Nom/Meas (µg/L)	10 / 9.9	4 x 35 eggs 4 x 15 larvae (after 39d)
Concentration 3 Nom/Meas (µg/L)	20 / 21	4 x 35 eggs 4 x 15 larvae (after 39d)
Concentration 4 Nom/Meas (µg/L)	40 / 44	4 x 35 eggs 4 x 15 larvae (after 39d)
Concentration 5 Nom/Meas (µg/L)	80 / 84	4 x 35 eggs 4 x 15 larvae (after 39d)
Control	Water, solvent	2x 4 x 35 eggs 2x 4 x 15 larvae (after 39d)
NOEC	21 ug/L measured	ANOVA, (p<0.05) Tukey's mean comparison
LOEC	44 ug/L	ANOVA, (p<0.05)
MATC (GeoMean NOEC,LOEC)	30.4 ug/L	

Other notes:

Reliability points taken off for:

Documentation: Minimum significant difference (2), % control at NOEC/LOEC (2), Point estimates (8)

Acceptability: Minimum significant difference (1), Point estimates (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Oncorhynchus mykiss

Study: Post G, Schroeder T. 1971. The toxicity of four insecticides to four Salmonid species. Bulletin of Environmental Contamination and Toxicology 6:144-155.

Relevance

Score: 92.5 (Control response NR)

Rating: R

Reliability

Score: 75.5

Rating: R

Reference	Post & Schroeder 1971	<i>O. mykiss</i>
Parameter	Value	Comment
Test method cited	APHA	
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	<i>Oncorhynchus</i>	Rainbow trout
Species	<i>mykiss</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	0.41 g,	
Source of organisms	Hatcheries	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24, 48, 72, 96 h	
Effect 1	Mortality	
Control response 1	NR	
Temperature	12.9 °C	
Test type	Static renewal 24 h	
Photoperiod/light intensity	NR	
Dilution water	well	
pH	7.2-7.6	
Hardness	318-348 mg/L as CaCO ₃	
Alkalinity	276-348 mg/L as CaCO ₃	
Conductivity	NR	
Dissolved Oxygen	5.9-6.0 mg/L	
Feeding	None	
Purity of test substance	95 %	
Concentrations measured?	NR	

Appendix, Section 1: Studies rated RR

Reference	Post & Schroeder 1971	<i>O. mykiss</i>
Parameter	Value	Comment
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone -concentrations NR	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	5-6; values not reported	2 Reps and 10 per
Control	Solvent control	2 Reps and 10 per
LC50; 24h	240 (198-291) $\mu\text{g/L}$	Probit method
LC50; 48 h	196 (165-223) $\mu\text{g/L}$	Probit method
LC50; 72 h	175 (146-209) $\mu\text{g/L}$	Probit method
LC50; 96 h	122 (98-153) $\mu\text{g/L}$	Probit method

Other notes:

Reliability points taken off for:

Documentation: Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Conductivity (2), Photoperiod (3), Hypothesis tests (8)

Acceptability: Control response (9), Measured conc w/in 20% nominal (4), Carrier solvent (4), Organism randomized (1), Conductivity (1), Photoperiod (2), Random design (2), Dilution factor (2), Hypothesis tests (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Pimephales promelas

Study: Geiger DL, Call DJ, Brooke LT. 1984. Acute toxicities of organic chemicals to fathead minnows (*Pimephales promelas*). Vol 4. Center for Lake Superior Environmental Studies, University of Wisconsin-Superior. pp 235-236.

Relevance-mortality

Score: 90 (No standard method)

Rating: R

Relevance—sublethal effects

Score: 75 (No standard method; Endpoints not linked to survival, growth, reproduction)

Rating: L

Reliability -- mortality & sublethal effects

Score: 80.5

Rating: R

Geiger et al. 1988	Geiger et al. 1984	<i>P. promelas</i>
Parameter	Value	Comment
Test method cited	No standard method cited	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Pimephales</i>	
Species	<i>promelas</i>	
Found in N. America?	Yes	
Age/size at start of test/growth phase	29-30 d; 0.069 (± 0.032)g; 1.7 (± 0.2) cm	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes, see below	
Effect 1	Mortality	
Control response 1	0%	
Effect 2	Loss of equilibrium, spinal deformities, behavioral abnormalities, hemorrhaging	

Appendix, Section 1: Studies rated RR

Geiger et al. 1988	Geiger et al. 1984	<i>P. promelas</i>
Parameter	Value	Comment
Control response 2	0% affected fish	
Temperature	25.1 ± 0.19	
Test type	Flow-through	
Photoperiod/light intensity	NR	
Dilution water	Lake Superior or dechlorinated tap water (waters shown to be very similar)	
pH	7.7 ± 0.06	
Hardness	46.9 mg/L as CaCO ₃	
Alkalinity	44.5 mg/L as CaCO ₃	
Conductivity	NR	
Dissolved Oxygen	6.8 ± 0.27	
Feeding	None	
Purity of test substance	95 %	
Concentrations measured?	Yes	
Measured is what % of nominal?	102.6%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom/Meas (mg/L)	3.18/3.15 (A)	Reps: 1 w/20 per
Concentration 2 Nom/Meas (mg/L)	4.90/4.73 (B)	Reps: 1 w/20 per
Concentration 3 Nom/Meas (mg/L)	7.54/7.53 (C)	Reps: 1 w/20 per
Concentration 4 Nom/Meas (mg/L)	11.6/11.3 (D)	Reps: 1 w/20 per
Concentration 5 Nom/Meas (mg/L)	17.8/18.5 (E)	Reps: 1 w/20 per
Control	Dilution water	Reps: 1 w/20 per
LC50 (95% ci); mg/L	14.1 (12.3-16.1)	Trimmed Spearman-Kärber
EC50 (95% ci); mg/L	10.6 (9.07-12.4)	Trimmed Spearman-Kärber

Mortalities by concentration and day (20 fish per concentrations at start):

	Control	A	B	C	D	E
24 h	0	0	0	0	0	0
48 h	0	1	1	1	1	11
72 h	0	1	1	1	3	13
96 h	0	1	1	1	5	15

Reliability points taken off for:

Documentation: Conductivity (2), Photoperiod (3), Hypothesis tests (8)

Appendix, Section 1: Studies rated RR

Acceptability: Standard method (5), Concentrations exceed 2x solubility (4), Conductivity (1), Photoperiod (2), Random design (2), Adequate replication (2), Hypothesis tests (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Pteronarcys californica

Study: Jensen LD, Gaufin AR. 1964a. Effects of Ten Organic Insecticides on Two Species of Stonefly Naiads. Trans. Am. Fish. Soc. 93:27-34.

Relevance

Score: 92.5 (Control response NR)

Rating: R

Reliability

Score: 74

Rating: R

Reference	Jensen & Gaufin 1964a	<i>P. californica</i>
Parameter	Value	Comment
Test method cited	APHA	
Phylum	Arthropoda	
Class	Insecta	
Order	Neoptera	
Family	Pteronarcyidae	
Genus	<i>Pteronarcys</i>	
Species	<i>californica</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Naiads, 4-6 cm	
Source of organisms	Collected from field, same as dilution water source	
Have organisms been exposed to contaminants?	Possibly	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes 48, 72, 96 h	
Effect 1	Mortality	
Control response 1	NR	
Temperature	11-12°C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Mill creek, near Salt lake City Utah	
pH	7.9-8.3	
Hardness	122-210 mg/L	
Alkalinity	150 -220 m/L	
Conductivity	NR	
Dissolved Oxygen	7.4-13.5 (initial)	NR during test, but they describe

Appendix, Section 1: Studies rated RR

Reference	Jensen & Gaufin 1964a	<i>P. californica</i>
Parameter	Value	Comment
		bubbling in compressed air to maintain DO-acceptable
Feeding	None	
Purity of test substance	95%	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone and emulsifier, up to 56 mg/L (0.056 mL/L, if density 1 g/mL)	
Concentration 1 Nom/Meas (µg/L)	5 concentrations, 10-100 µg/L	2 Reps and 10 per
Control	Yes, states species unaffected by solvent & emulsifier so used solvent control (?)	Reps and # per (cell density for single
LC ₅₀	(Listed below)	Graphical interpolation
48 h	180	
72 h	72.5	
96 h	50.0	

Other notes:

Also reports effects on activity, loss of equilibrium, tremors and convulsions, and death, but only at one concentration (18 µg/L).

Reliability points taken off for:

Documentation: Analytical method (4), Measured concentrations (3), Dissolved oxygen (4), Conductivity (2), Photoperiod (3), Hypothesis tests (8)

Acceptability: Control response (9), Measured conc w/in 20% nominal (4), Prior contamination (4), Organisms randomized (1), Dilution water (2), Conductivity (1), Photoperiod (2), Random design (2), Hypothesis tests (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Pteronarcys californica

Study: Jensen LD, Gaufin AR. 1964b. Long-Term Effects of Organic Insecticides on Two Species of Stonefly Naiads. Trans. Am. Fish. Soc. 93:357-363.

Relevance; 4d(96h) LC50
Score: 90 (no std method)
Rating: R

Reliability
Score: 77
Rating: R

Relevance; 5d-30d LC50- Value not appropriate for chronic distribution
Score: 90 (no std method)
Rating: R

Reliability
Score: 77
Rating: R

Relevance; 30d NOEC/LOEC
Score: 75 (no std method, No values)
Rating: L

Reliability
Score: 73.5
Rating: R

NOEC LOEC aren't calculated but can be estimated from graph. Only LC₅₀ are calculated and reported as tox values.

Reference	Jensen & Gaufin 1964b	<i>P. californica</i>
Parameter	Value	Comment
Test method cited	APHA	More just for data analysis
Phylum	Arthropoda	
Class	Insecta	
Order	Amphipoda	
Family	Pteronarcyidae	stonefly
Genus	<i>Pteronarcys</i>	
Species	<i>californica</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Naiad	
Source of organisms	Collected from field, same as dilution water source	Reported in Jensen&Gaufin 1964a
Have organisms been exposed to contaminants?	Maybe because collected from field	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	30 d	
Data for multiple times?	Yes: 4,5,10,15,20,25,30 d	
Effect 1	Mortality	
Control response 1	No effect *	

Appendix, Section 1: Studies rated RR

Reference	Jensen & Gaufin 1964b	<i>P. californica</i>
Parameter	Value	Comment
Temperature	12.8 ± 0.6 °C	
Test type	Flow though	
Photoperiod/light intensity	NR	
Dilution water	Mill creek, near Salt lake City Utah	Reported in Jensen&Gaufin 1964a
pH	7.8-8.2	
Hardness	NR	
Alkalinity	165-225 m/L	
Conductivity	NR	
Dissolved Oxygen	9-11 mg/L	
Feeding	None	
Purity of test substance	95%	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	50 mg/L	
Concentration 1 Nom/Meas (µg/L)	8 concentrations, values NR	reps and 25 per
Control	Yes *	reps and 25 per
LC50 4 day	Not calculable	
LC50 15-d	45.00 µg/L	
LC50 20-d	24.00 µg/L	
LC50 25-d	15.50 µg/L	
LC50 30-d	8.80 µg/L ***	
NOEC	4 µg/L**	Method: no stats p: none MSD: none
LOEC; indicate calculation method	5 µg/L **	
MATC (GeoMean NOEC,LOEC)	4.5 µg/L **	
% control at NOEC	NR	
% of control LOEC	NR	

*States: exposure of both species to acetone and water for 30-d periods within a range of concentration of 5.0 to 50.0 ppm of acetone had no noticeable affect on either species.

**Values estimated from graph, not statistically determined

***5-30d LC50- Value is calculated, but not appropriate for chronic distribution or ACR

Reliability points taken off for:

Documentation: Analytical method (4), Measured concentrations (3), Hardness (2), Conductivity (2), Photoperiod (3), Hypothesis tests (6)

Acceptability: Appropriate duration (2), Appropriate control (6), Control response (9), Measured conc w/in 20% nominal (4), Prior contamination (4), Organisms randomized

Appendix, Section 1: Studies rated RR

(1), Dilution water (2), Hardness (2), Conductivity (1), Photoperiod (2), Random design
(2), Dilution factor (2), Minimum significant difference (1)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Ptychocheilus lucius

Study: Beyers DW, Keefe TJ, Carlson CA. 1994a. Toxicity of carbaryl and malathion to two federally endangered fishes, as estimated by regression and ANOVA. *Environmental Toxicology and Chemistry* 13:101-107.

Relevance

Score: 92.5 (acute and chronic)

Rating: R

Reliability

Score: 83 acute / 77.5 chronic

Rating: R

Reference	Beyers <i>et al.</i> 1994a	<i>P. lucius</i>
Parameter	Value	Comment
Test method cited	ASTM E729-88 - acute ASTM E1241-88 - ELS	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Ptychocheilus</i>	
Species	<i>lucius</i>	
Family in North America?	yes (Colorado river)	
Age/size at start of test/growth phase	Acute 4d – 26d old (4mg, 9.4mm) Chronic Early Life Stage (ELS) 32d – 41d old (9 mg, 12mm)	Acute - 10x2 /conc
Source of organisms	Eggs Dexter Nat fish hatchery	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	1 of 7 treatments
Test vessels randomized?	Yes	2 replicates
Test duration	4 d acute 32 d chronic	
Data for multiple times?	Yes	
Effect 1	Mortality	
Control response 1	NR	
Effect 2	Decrease in size	
Control response 2	NR	
Temperature	22 ±1 °C	
Test type	Renewal- 4 d acute Flow through- 32 d ELS	
Photoperiod/light intensity	16:8h light:dark	
Dilution water	From well at CSU	

Appendix, Section 1: Studies rated RR

Reference	Beyers <i>et al.</i> 1994a	<i>P. lucius</i>
Parameter	Value	Comment
pH	8.5-8.6	
Hardness	212 – 216 mg/L CaCO ₃	
Alkalinity	104 – 110 mg/L CaCO ₃	
Conductivity	600 uS/cm	
Dissolved Oxygen	7.1 – 7.2 mg/L	
Feeding	Acute 4d – no (before, during) ELS - live <24hr brine shrimp nauplii (2 to 3/day)	
Purity of test substance	93%	
Concentrations measured?	Yes	Acute – 2 times ELS – 4 times
Measured is what % of nominal?	NR	
Chemical method documented?	SPE with GC	
Concentration of carrier (if any) in test solutions	Acetone < 0.5mL/L	
Concentration 1 Nom/Meas (µg/L)	5 conc nominal value NR, 1 solv control, 1 dil water control	Acute: 2 Reps and 10 larvae ELS: 2 reps and 30 larvae
LC50 (95% CI) mg/L	4d acute - 9.14 (8.36-10.0)	Probit analysis
NOEC	Growth: 1680 ug/L Survival: 1680 ug/L	1) hyp test - ANOVA
LOEC	Growth: 3510 ug/L Survival: 3510 ug/L	Hyp test
MATC	Growth: 2428 ug/L Survival: 2428 ug/L	Geo mean

Other notes:

ACR values

Linear-plateau regression model was used to calculate a threshold value between NOEC and LOEC (p=0.001)

Threshold value (95%)

Growth - 1470 ug/L (1410, 1520)

Survival - 455 ug/L (236, 786)

Reliability points taken off for:

Documentation: Nominal concentrations (3), Measured concentrations (3), Hypothesis tests (8 – acute only), Minimum significant difference (2 – chronic only), % control at NOEC/LOEC (2 – chronic only), Point estimates (8 – chronic only)

Appendix, Section 1: Studies rated RR

Acceptability: Control response (9), Measured conc w/in 20% of nominal (4), Carrier solvent (4 – chronic only), Hardness (2), Dilution factor (2), Hypothesis tests (3), Point estimates (3 – chronic only)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Rana palustris

Study: Budischak SA, Belden LK, Hopkins WA. 2009. Relative Toxicity of Malathion to Trematode-Infected and Noninfected *Rana palustris* Tadpoles. Arch Environ Contam Toxicol 56:123–128

Relevance

Score: 100

Rating: R

Reliability

Score: 84

Rating: R

Reference	Budischak <i>et al.</i> 2009	<i>R. palustris</i>
Parameter	Value	Comment
Test method cited	ASTM	
Phylum	Chordata	
Class	Amphibia	
Order	Anura	
Family	Ranidae	
Genus	<i>Rana</i>	
Species	<i>palustris</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Gosner stage 26	
Source of organisms	Eggs collected from pond	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	0 % mortality	
Temperature	16.57 ± 0.04°C	
Test type	Static	
Photoperiod/light intensity	16:8 light: dark	
Dilution water	75/25 mix of dechloraminated town water and well water	
pH	7.29	
Hardness	172 mg/L	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	96.8 % - 86.3 %	
Feeding	None	
Purity of test substance	98 %	

Appendix, Section 1: Studies rated RR

Reference	Budischak <i>et al.</i> 2009	<i>R. palustris</i>
Parameter	Value	Comment
Concentrations measured?	Yes	
Measured is what % of nominal?	> 80%	
Chemical method documented?	No	
Concentration of carrier (if any) in test solutions	0.4% methanol ~4 mL/L	
Concentration 1 Nom/Meas (µg/L)	40,000 / 40,000	3 reps with 10 per
Concentration 2 Nom/Meas (µg/L)	24000	3 reps with 10 per
Concentration 3 Nom/Meas (µg/L)	14400 /14500	3 reps with 10 per
Concentration 4 Nom/Meas (µg/L)	8640	3 reps with 10 per
Concentration 5 Nom/Meas (µg/L)	5200 /5000	3 reps with 10 per
Control	Water only and solvent control	3 reps with 10 per
LC50	17,100 ug/L	Spearman–Karber

Other notes: emailed author to obtain original LC₅₀ values, since study only provides a range, 16,500–17,400 ug/L, which includes tadpoles infected with trematodes (trematodes were found not to significantly affect malathion toxicity, so all LC₅₀ values were reported together. The values were reported as a range not a mean, therefore the author was contacted to obtain a single value.)

The LC50 for the uninfected tadpoles was 17.1 mg/L
Hopkins, William: hopkinsw@vt.edu

Reliability points taken off for:

Documentation: Analytical method (4), Alkalinity (2), Conductivity (2), Hypothesis tests (8)

Acceptability: Carrier solvent (4), Prior contaminant exposure (4), Alkalinity (2), Conductivity (1), Random design (2), Hypothesis tests (3)

Toxicity Data Summary

Salvelinus fontinalis

Study: Post G, Schroeder T. 1971. The toxicity of four insecticides to four Salmonid species. Bulletin of Environmental Contamination and Toxicology 6:144-155.

Relevance

Score: 92.5 (Control response NR)

Rating: R

Reliability

Score: 75.5

Rating: R

Reference	Post & Schroeder 1971	<i>S. fontinalis</i>
Parameter	Value	Comment
Test method cited	APHA	
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	<i>Salvelinus</i>	
Species	<i>fontinalis</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Test 1: 1.15g, Test 2: 2.13 g	
Source of organisms	Hatcheries	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	72, 96 h	
Effect 1	Mortality	
Control response 1	NR	
Temperature	12.9 °C	
Test type	Static renewal 24 h	
Photoperiod/light intensity	NR	
Dilution water	Well	
pH	7.2-7.6	
Hardness	318-348 mg/L as CaCO ₃	
Alkalinity	276-348 mg/L as CaCO ₃	
Conductivity	NR	
Dissolved Oxygen	5.9-6.0 mg/L	
Feeding	None	
Purity of test substance	95 %	

Appendix, Section 1: Studies rated RR

Reference	Post & Schroeder 1971	<i>S. fontinalis</i>
Parameter	Value	Comment
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone -concentrations NR	
Concentration 1 Nom/Meas (µg/L)	5-6	2 Reps and 10 per
Control	Solvent control	2 Reps and 10 per
LC50; 72 h (µg/L)	Test 1: 160 (144-182) Test 2: 150 (104-216)	Probit method
LC50; 96 h (µg/L)	Test 1: 130 (110-154) Test 2: 120 (96-153)	

Other notes:

Reliability points taken off for:

Documentation: Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Conductivity (2), Photoperiod (3), Hypothesis tests (8)

Acceptability: Control response (9), Measured conc w/in 20% nominal (4), Carrier solvent (4), Organism randomized (1), Conductivity (1), Photoperiod (2), Random design (2), Dilution factor (2), Hypothesis tests (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Simulium vittatum

Study: Overmyer JP, Armbrust KL, Noblet R. 2003. Susceptibility of black fly larvae (Diptera : Simuliidae) to lawn-care insecticides individually and as mixtures. Environ Toxicol. Chem. 22:1582-1588.

Relevance

Score: 100

Rating: R

Reliability

Score: 86.5

Rating: R

Reference	Overmyer <i>et al.</i> 2003	<i>S. vittatum</i>
Parameter	Value	Comment
Test method cited	EPA	
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Simuliidae	
Genus	<i>Simulium</i>	
Species	<i>vittatum</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	6 and 7 th instar	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	< 10%	
Temperature	20.20-21.20 °C	
Test type	Static	
Photoperiod/light intensity	16:8-h light:dark	
Dilution water	Moderately hard reconstituted water	
pH	7.93-8.02	
Hardness	90 mg/L as CaCO ₃	
Alkalinity	63 mg/L as CaCO ₃	
Conductivity	275-296 uS/cm	
Dissolved Oxygen	8.8-9.2 mg/L	
Feeding	None	

Appendix, Section 1: Studies rated RR

Reference	Overmyer <i>et al.</i> 2003	<i>S. vittatum</i>
Parameter	Value	Comment
Purity of test substance	≥ 98 %	
Concentrations measured?	Yes	
Measured is what % of nominal?	About 25%	
Chemical method documented?	Yes, GC-MS	
Concentration of carrier (if any) in test solutions	0.7mL acetone/ 150mL ~ 4.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	1000/ 247	5 reps with 15 per
Concentration 2 Nom/Meas (µg/L)	500/ 109	5 reps with 15 per
Concentration 3 Nom/Meas (µg/L)	250/ 61	5 reps with 15 per
Concentration 4 Nom/Meas (µg/L)	125/ 22	5 reps with 15 per
Concentration 5 Nom/Meas (µg/L)	61/ 12	5 reps with 15 per
Concentration 6 Nom/Meas (µg/L)	31/ 7.9	5 reps with 15 per
Control	Solvent control and water only	5 reps with 15 per
LC50; indicate calculation method	54.20 (44.70-66.43) µg/L	Probit method

Other notes:

Nom LC50 also given: 283.00 (237.69-340.79) ug/L.

About concentrations: "Because concentrations of the insecticides detected in the water of the flasks after 48 h were much lower than the initial concentrations, the geometric mean of the initial and final concentrations for each of the six treatment levels was calculated for use in determination of the LC50 value for each insecticide. So the geomean is shown as measured above"

MIXTURES:

Mixtures of carbaryl, and malathion; and chlorpyrifos and malathion; and all three pesticides showed greater than additive toxicity. These results are expressed in toxic units (TU), the concentrations of the individual constituents are not clear, so no synergistic ratios can be calculated.

Reliability points taken off for:

Documentation: Hypothesis tests (8)

Acceptability: Measured conc w/in 20% of nominal (4), Carrier solvent (4), Appropriate size (3), Organisms randomized (1), Exposure type (2), Random design (2), Hypothesis tests (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Streptocephalus sudanicus

Study: Lahr J, Badji A, Marquenie S, Schuiling E, Ndour KB, Diallo AO, Everts JW. 2001. Acute Toxicity of Locust Insecticides to Two Indigenous Invertebrates from Sahelian Temporary Ponds. *Ecotoxicol. Environ. Saf.* 48:66-75.

Relevance
Score: 100
Rating: R

Reliability
Score: 75.5
Rating: R

Reference	Lahr <i>et al.</i> 2001	<i>S. sudanicus</i>
Parameter	Value	Comment
Test method cited	ASTM	
Phylum	Arthropoda	
Class	Crustacea/Brachiopoda	
Order	Anostraca	
Family	Streptocephalidae	
Genus	<i>Streptocephalus</i>	
Species	<i>sudanicus</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Adult females	
Source of organisms	Nearby ponds	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	Not properly, only 2 h	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Mortality/immobility/disorientation*	
Control response 1	< 10%	
Temperature	ca. 27 °C	Monitored During test
Test type	Static	
Photoperiod/light intensity	Ambient 13:11 light:dark	
Dilution water	Reconstituted water	
pH	5.9 ± 0.4	
Hardness	Ca & Mg: 0.3 & 7 mg/L as CaCO ₃	
Alkalinity	NR	
Conductivity	100 uS/cm	
Dissolved Oxygen	56%	Monitored during test

Appendix, Section 1: Studies rated RR

Reference	Lahr <i>et al.</i> 2001	<i>S. sudanicus</i>
Parameter	Value	Comment
Feeding	None	
Purity of test substance	Formulation with high percent AI-1230 g/L AI**	>99%
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone max 0.5 mL/L	
Concentration 1 Nom ($\mu\text{g/L}$)	5-10 concentrations, logarithmically spaced	1 reps with 10 per (but tests repeated 3x, w varying concentrations)
Control	solvent	2 reps with 10 per
EC ₅₀ , 48 h	67,750 (52,220-90,300) $\mu\text{g/L}$ ***	parametric method of Kooijman (1981)

Other notes:

* states animals suffering form immobility and almost all those suffering disorientation eventually died, so all counted as acute endpoints

** density of malathion is 1.23 g/mL so this is apparently nearly 100% malathion

***EC₅₀ geomean of 3 tests

Reliability points taken off for:

Documentation: Analytical method (4), Nominal concentrations (3), Measured concentrations (3), Alkalinity (2), Hypothesis tests (8)

Acceptability: Measured conc w/in 20% of nominal (4), Appropriate size (3), Prior contamination (4), Organisms randomized (1), Proper acclimation (1), Alkalinity (2), Dissolved oxygen (6), Temperature > +/- 1°C (3), Random design (2), Hypothesis tests (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Utterbackia imbecillis

Study: Keller AE, Ruessler DS. 1997. The toxicity of malathion to unionid mussels: Relationship to expected environmental concentrations. *Environmental Toxicology and Chemistry* **16**:1028-1033.

Relevance

Score: 92.5 (no control response)

Rating: R

Reliability

Score: 81

Rating: R

Reference	Keller & Ruessler 1997	<i>U. imbecillis</i>
Parameter	Value	Comment
Test method cited	EPA 540/9-85-001 EPA 440/5-86-001	
Phylum	Mollusca	
Class	Bivalvia	
Order	Unionoida	
Family	Unionidae	
Genus	<i>Utterbackia</i>	
Species	<i>imbecillis</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Mature glochidia Juvenile adults (5–8 cm)	(0.2–0.4 mm diam) Transf 7-19 days
Source of organisms	Collected from adult females	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48hr and 96hr	
Data for multiple times?	Yes	
Effect 1	Mortality	Ability to close when NaCl added
Control response 1	NR	
Temperature	25°C 32°C	
Test type	Static	
Photoperiod/light intensity	12 : 12	
Dilution water	DI water + MgCl ₂ + NaCl + KCl + H ₂ CO ₃ or dilution of well water	EPA 440/5-86-001
pH	Soft 7.5 (0.12)	

Appendix, Section 1: Studies rated RR

Reference	Keller & Ruessler 1997	<i>U. imbecillis</i>
Parameter	Value	Comment
	Mod hard 7.9 (0.23)	
Hardness	Soft 47 (5) Mod hard 76 (19)	
Alkalinity	Soft 40 (11) Mod hard 64 (12)	
Conductivity	Soft 131 (22) Mod hard 258 (56)	
Dissolved Oxygen	NR	
Feeding	none	
Purity of test substance	96%	
Concentrations measured?	Yes but NR	
Measured is what % of nominal?	Recovery 100-126%	
Chemical method documented?	Yes. GC	J. Chromatogr. Sci. 13:291–295 1975
Concentration of carrier (if any) in test solutions	Acetone	
Concentration 1 Nom/Meas (µg/L)	5 conc NR	3-4 x (50-100 gloc) 2-4 x (10-20 juv) 2-4 x (5-10 adults)
Control	Water and solvent	Same as above
LC ₅₀ ; Probit analysis 95% CI (nom conc, mg/L)	Gloc 24hr – 366 48hr – 324 24hr – 366 Juv 24hr - 667 48hr – 363 72hr - 262 96hr – 219 Juv 24hr - 341 48hr – 196 72hr - 161 96hr – 74 Juv 24hr - 568 48hr – 365 72hr - 295 96hr – 215 Juv 24hr - 391 48hr – 280 72hr - 165 96hr – 40	(pH 7.5, 25C) (pH 7.5, 32C) (pH 7.9, 25C) (pH 7.9, 32C) (pH 7.5, 25C) (pH 7.5, 32C)

Other notes:

Some LC₅₀ are above water solubility (140 mg/L)

Appendix, Section 1: Studies rated RR

Fifty percent mortality was not observed for adults of *V. lienosa*, *U. imbecillis*, or *E. ictarina* at concentrations of up to 350 mg/L after 96 h of exposure.

Reliability points taken off for:

Documentation: Nominal concentrations (3), Measured concentrations (3), Dissolved oxygen (4), Minimum significant difference (2), % control at NOEC/LOEC (2)

Acceptability: Measured conc w/in 20% of nominal (4), Exceed 2x water solubility (4), Carrier solvent (4), Organisms randomized (1), Dissolved oxygen (6), Random design (2), Dilution factor (2), Hypothesis tests (3)

Toxicity Data Summary

Various mussels

Glochidia: *Megalonaias nervosa*, *Lampsilis teres*, or *Lampsilis siliquoidea***Juveniles:** *Lampsilis straminea claibornensis*, *Lampsilis subangulata*, and *Elliptio icterina***Adults:** *Elliptio icterina*

Study: Keller AE, Ruessler DS. 1997. The toxicity of malathion to unionid mussels: Relationship to expected environmental concentrations. *Environmental Toxicology and Chemistry* **16**:1028-1033.

Relevance

Score: 92.5 (no control response)

Rating: R

Reliability

Score: 81

Rating: R

Reference	Keller & Ruessler 1997	Various mussels
Parameter	Value	Comment
Test method cited	EPA 540/9-85-001 EPA 440/5-86-001	
Phylum	Mollusca	
Class	Bivalvia	
Order	Unionoida	
Family	Unionidae	
Genus	<i>Megalonaias</i> , <i>Lampsilis</i> , <i>Elliptio</i>	
Species	Listed above	
Family in North America?	Yes	
Age/size at start of test/growth phase	Mature glochidia Juvenile Adults <i>E. icterina</i> (7–9.5 cm)	(0.2–0.4 mm diam) Transf 7-19 days
Source of organisms	Collected from adult females	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48hr and 96hr	
Data for multiple times?	yes	
Effect 1	Mortality	Ability to close when NaCl added
Control response 1	NR	
Temperature	25°C 32°C	

Appendix, Section 1: Studies rated RR

Reference	Keller & Ruessler 1997	Various mussels
Parameter	Value	Comment
Test type	Static	
Photoperiod/light intensity	12 : 12	
Dilution water	DI water + MgCl ₂ + NaCl + KCl + H ₂ CO ₃ or dilution of well water	EPA 440/5-86-001
pH	Soft 7.5 (0.12) Mod hard 7.9 (0.23)	
Hardness	Soft 47 (5) Mod hard 76 (19)	
Alkalinity	Soft 40 (11) Mod hard 64 (12)	
Conductivity	Soft 131 (22) Mod hard 258 (56)	
Dissolved Oxygen	NR	
Feeding	none	
Purity of test substance	96%	
Concentrations measured?	Yes but NR	
Measured is what % of nominal?	Recovery 100-126%	
Chemical method documented?	Yes. GC	J. Chromatogr. Sci. 13:291-295 1975
Concentration of carrier (if any) in test solutions	Acetone, NR	
Concentration 1 Nom/Meas (µg/L)	5 conc, NR	3-4 x (50-100 gloc) 2-4 x (10-20 juv) 2-4 x (5-10 adults)
Control	Water and solvent	Same as above
LC50; Probit analysis 95% CI (nom conc, mg/L)	<p style="text-align: center;">Glochidea</p> <p>L siliquoidea, 24hr – 8 48hr - 7</p> <p>L teres 4hr - 28</p> <p>L siliquoidea, 24hr – 8 48hr - 7</p> <p>M nervosa 24hr - 22</p> <p style="text-align: center;">Juveniles</p> <p>E icterina 24hr – 61 48hr – 54 72hr - 50 96hr – 32</p> <p>L subangulata 24hr – 43 48hr – 32 72hr - 32 96hr – 28</p>	<p>(pH 7.9, 25C)</p> <p>(pH 7.5, 25C)</p> <p>(pH 7.5, 25C)</p>

Appendix, Section 1: Studies rated RR

Other notes: Fifty percent mortality was not observed for adults of *V. lienosa*, *U. imbecillis*, or *E. icterina* at concentrations of up to 350 mg/L after 96 h of exposure

Reliability points taken off for:

Documentation: Nominal concentrations (3), Measured concentrations (3), Dissolved oxygen (4), Minimum significant difference (2), % control at NOEC/LOEC (2)

Acceptability: Measured conc w/in 20% of nominal (4), Exceed 2x water solubility (4), Carrier solvent (4), Organisms randomized (1), Dissolved oxygen (6), Random design (2), Dilution factor (2), Hypothesis tests (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Villosa lienosa

Study: Keller AE, Ruessler DS. 1997. The toxicity of malathion to unionid mussels: Relationship to expected environmental concentrations. *Environmental Toxicology and Chemistry* **16**:1028-1033.

Relevance

Score: 92.5 (no control response)

Rating: R

Reliability

Score: 81

Rating: R

Reference	Keller and Ruessler 1997	<i>V. lienosa</i>
Parameter	Value	Comment
Test method cited	EPA 540/9-85-001 EPA 440/5-86-001	
Phylum	Mollusca	
Class	Bivalvia	
Order	Unionoida	
Family	Unionidae	
Genus	<i>Villosa</i>	
Species	<i>lienosa</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Mature glochidia Juvenile Adults (2.5–5.0 cm)	(0.2–0.4 mm diam) Transf 7-19 days
Source of organisms	Collected from adult females	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48hr and 96hr	
Data for multiple times?	NR	
Effect 1	Mortality	Ability to close when NaCl added Activity and heartbeat reaction to stimulation
Control response 1	NR	
Temperature	25C 32C	
Test type	Static	
Photoperiod/light intensity	12 : 12	
Dilution water	DI water + MgCl ₂ + NaCl + KCl + H ₂ CO ₃ or dilution of well water	EPA 440/5-86-001
pH	Soft 7.5 (0.12)	

Appendix, Section 1: Studies rated RR

Reference	Keller and Ruessler 1997	<i>V. lienosa</i>
Parameter	Value	Comment
	Mod hard 7.9 (0.23)	
Hardness	Soft 47 (5) Mod hard 76 (19)	
Alkalinity	Soft 40 (11) Mod hard 64 (12)	
Conductivity	Soft 131 (22) Mod hard 258 (56)	
Dissolved Oxygen	NR	
Feeding	none	
Purity of test substance	96%	
Concentrations measured?	Yes but NR	
Measured is what % of nominal?	Recovery 100-126%	
Chemical method documented?	Yes. GC	J. Chromatogr. Sci. 13:291–295 1975
Concentration of carrier (if any) in test solutions	Acetone, NR	
Concentration 1 Nom/Meas (µg/L)	5 conc NR	3-4 x (50-100 gloc) 2-4 x (10-20 juv) 2-4 x (5-10 adults)
Control	Water and solvent	3-4 x (50-100 gloc) 2-4 x (10-20 juv) 2-4 x (5-10 adults)
LC50; Probit analysis 95% CI (nom conc, mg/L)	Gloc 24hr – 54 Juv 24hr >231 48hr – 181 72hr - 154 96hr – 109 Juv 24hr - 463 48hr – 192 72hr - 140 96hr – 111 Juv 24hr - 263 48hr – 160 72hr - 96 96hr – 74	(pH 7.9, 25C) (pH 7.9, 32C) (pH 7.5, 25C) (pH 7.5, 32C)

Other notes:

Fifty percent mortality was not observed for adults of *V. lienosa*, *U. imbecillis*, or *E. icterina* at concentrations of up to 350 mg/L after 96 h of exposure

Reliability points taken off for:

Documentation: Nominal concentrations (3), Measured concentrations (3), Dissolved oxygen (4), Minimum significant difference (2), % control at NOEC/LOEC (2)

Appendix, Section 1: Studies rated RR

Acceptability: Measured conc w/in 20% of nominal (4), Exceed 2x water solubility (4), Carrier solvent (4), Organisms randomized (1), Dissolved oxygen (6), Random design (2), Dilution factor (2), Hypothesis tests (3)

Appendix, Section 1: Studies rated RR

Toxicity Data Summary

Villosa villosa

Study: Keller AE, Ruessler DS. 1997. The toxicity of malathion to unionid mussels: Relationship to expected environmental concentrations. *Environmental Toxicology and Chemistry* **16**:1028-1033.

Relevance

Score: 92.5 (no control response)

Rating: R

Reliability

Score: 81

Rating: R

Reference	Keller and Ruessler 1997	<i>V. villosa</i>
Parameter	Value	Comment
Test method cited	EPA 540/9-85-001 EPA 440/5-86-001	
Phylum	Mollusca	
Class	Bivalvia	
Order	Unionoida	
Family	Unionidae	
Genus	<i>Villosa</i>	
Species	<i>villosa</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Mature glochidia Juvenile	(0.2–0.4 mm diam) Transf 7-19 days
Source of organisms	Collected from adult females	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48hr and 96hr	
Data for multiple times?	yes	
Effect 1	Mortality	Ability to close when NaCl added
Control response 1	NR	
Temperature	25°C 32°C	
Test type	Static	
Photoperiod/light intensity	12 : 12	
Dilution water	DI water + MgCl ₂ + NaCl + KCl + H ₂ CO ₃ or dilution of well water	EPA 440/5-86-001
pH	Soft 7.5 (0.12) Mod hard 7.9 (0.23)	

Appendix, Section 1: Studies rated RR

Reference	Keller and Ruessler 1997	<i>V. villosa</i>
Parameter	Value	Comment
Hardness	Soft 47 (5) Mod hard 76 (19)	
Alkalinity	Soft 40 (11) Mod hard 64 (12)	
Conductivity	Soft 131 (22) Mod hard 258 (56)	
Dissolved Oxygen	NR	
Feeding	none	
Purity of test substance	96%	
Concentrations measured?	Yes but NR	
Measured is what % of nominal?	Recovery 100-126%	
Chemical method documented?	Yes. GC	J. Chromatogr. Sci. 13:291–295 1975
Concentration of carrier (if any) in test solutions	Acetone	
Concentration 1 Nom/Meas (µg/L)	5 conc, NR	3-4 x (50-100 gloc) 2-4 x (10-20 juv) 2-4 x (5-10 adults)
Control	Water and solvent	Same as above
LC ₅₀ ; Probit analysis 95% CI (nom conc, mg/L)	Gloc 24hr – 117 48hr - 119 Juv 24hr - 431 48hr – 354 72hr - 255 96hr – 142 Juv 24hr - 326 48hr – 220 72hr - 199 96hr – 180	(pH 7.9, 32C) (pH 7.9, 25C) (pH 7.5, 32C)

Other notes:

Fifty percent mortality was not observed for *V. lienosa*, *U. imbecillis*, or *E. icterina* at concentrations of up to 350 mg/L after 96 h of exposure

Reliability points taken off for:

Documentation: Nominal concentrations (3), Measured concentrations (3), Dissolved oxygen (4), Minimum significant difference (2), % control at NOEC/LOEC (2)
Acceptability: Measured conc w/in 20% of nominal (4), Exceed 2x water solubility (4), Carrier solvent (4), Organisms randomized (1), Dissolved oxygen (6), Random design (2), Dilution factor (2), Hypothesis tests (3)

Appendix

Section 2
Studies rated RL, LR, LL

Toxicity Data Summary

Anabaena fertilissima

Study: Tandon RS, Lal R, Rao V. 1988. Interaction of endosulfan and malathion with blue green-algae *Anabaena* and *Aulosira-fertilissima*. Environ Pollut 52(1): 1-9.

Relevance: Growth

Score: 90 (No std method)

Rating: R

Reliability

Score: 64

Rating: L

Relevance: Nitrogenase activity

Score: 75 (No std method, Endpoint)

Rating: L

Reliability

Score: 64

Rating: L

Relevance: Photosynthesis

Score: 60 (No std method, Endpoint, No values)

Rating: N

Reference	Tandon <i>et al.</i> 1988	<i>A. fertilissima</i>
Parameter	Value	Comment
Test method cited	None	
Class	Cyanophyceae	Algae/ cyanobacteria
Order	Nostocales	
Family	Nostocaceae	
Genus	<i>Anabaena</i>	
Species	<i>fertilissima</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	NR	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	30 d	
Data for multiple times?	Yes	
Effect 1	Growth inhibition	chlorophyll
Control response 1	Reponses normalized to control	
Effect 2	CO ₂ (using C ¹⁴) uptake	Photosynthesis
Control response 2	20060 counts mL/min	at 90 min
Effect 3	Nitrogenase activity	
Control response 3	6757 n mol ethylene/ ml	
Temperature	28-30 °C	
Test type	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Tandon <i>et al.</i> 1988	<i>A. fertilissima</i>
Parameter	Value	Comment
Photoperiod/light intensity	Continuous 4000 lux	
Dilution water	Foggs medium	water source NR
pH	7.5	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	In nutrient medium	
Purity of test substance	95 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤1%	
Concentration 1 Nom/Meas (µg/L)	10,000	reps/cell density NR
Concentration 2 Nom/Meas (µg/L)	50,000	reps/cell density NR
Concentration 3 Nom/Meas (µg/L)	100,000	reps/cell density NR
Control	Solvent control	reps/cell density NR
GROWTH INHIBITION		
NOEC	10,000	Method: NR
LOEC; indicate calculation method	50,000	p: 0.05; MSD: NR
MATC (GeoMean NOEC,LOEC)	22,361	
% control at NOEC	2-13 % (for multiple time points)	
% of control LOEC	8-40 % (for multiple time points)	
C14 UPTAKE		
NOEC	Interrupted dose response	Method: NR
LOEC; indicate calculation method	Can not determine	p: 0.05; MSD: NR
MATC (GeoMean NOEC,LOEC)	Can not determine	
% control at NOEC	Can not determine	
% of control LOEC	Can not determine	
ACETYLENE REDUCTION (Nitrogenase activity)		
NOEC;	50,000	Method: NR
LOEC; indicate calculation method	100,000	p: 0.05; MSD: NR
MATC (GeoMean NOEC,LOEC)	70,711	
% control at NOEC	4681/3993 * 100%	
% of control LOEC	4814/3993 * 100%	

Other notes: ASTM and EPA algae method recognize growth inhibition as a standard endpoint, so that is the only endpoint recognized here as related to survival, growth, or reproduction.

Toxicity Data Summary

Ambystoma mexicanum

Study: Robles-Mendoza C, Garcia-Basilio C, Cram-Heydrich S, Hernandez-Quiroz M, Vanegas-Perez C. 2009. Organophosphorus pesticides effect on early stages of the axolotl *Ambystoma mexicanum* (Amphibia: Caudata). *Chemosphere* 74(5): 703-710.

Relevance

Score: 85 (No values)

Rating: L

Reliability

Score: 77.5

Rating: R

Reference	Robles-Mendoza 2009	<i>A. mexicanum</i>
Parameter	Value	Comment
Test method cited	UNEP, for stats only	
Phylum	Chordata	
Class	Amphibia	
Order	Caudata	
Family	Ambystomatidae	
Genus	<i>Ambystoma</i>	salamander
Species	mexicanum	
Family in North America?	Yes	
Age/size at start of test/growth phase	Early larvae, stage L44	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	Embryo development study included 250 h recovery period after 96 h exposure
Data for multiple times?	Yes, every 24 h	
Effect 1	Mortality	
Control response 1	No mortality	
Effect 2	Embryo development	
Control response 2	Stage 32 at 100h	
Effect 3	Hatching	
Control response 3	No data for malathion	
Temperature	20 ± 1 °C	
Test type	Static renewal (at 48 h)	
Photoperiod/light intensity	12:12 light:dark	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Robles-Mendoza 2009	<i>A. mexicanum</i>
Parameter	Value	Comment
Dilution water	Holtfreter's solution	Not described more
pH	8.5 ±0.2	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	>5.6 mg/L	
Feeding	None	
Purity of test substance	99.3%	
Concentrations measured?	Yes	
Measured is what % of nominal?	States not significantly different than nominal, p <0.05	
Chemical method documented?	Yes GC/NPD, EPA methods	
Concentration of carrier (if any) in test solutions	2mL/L acetone	
Concentration 1 Nom/Meas (µg/L)	30,000	For LC50:2 reps with 10 larvae
Concentration 2 Nom/Meas (µg/L)	25,000	
Concentration 3 Nom/Meas (µg/L)	20,000	For ED test: 2 reps with 20 eggs each
Concentration 4 Nom/Meas (µg/L)	15,000	
Concentration 5 Nom/Meas (µg/L)	10,000	
Control	Solvent and water only	
LC50 (Mortality)	20,000-25,000	probit
NOEC; indicate calculation method, significance level (p-value) and minimum significant difference (MSD)	Embryo development (ED): NR	Method: ANCOVA, Tukey test p: MSD:
LOEC; indicate calculation method	ED: 10,000	
MATC (GeoMean NOEC,LOEC)	ED: Can not calculate	
% control at NOEC	ED: Can not calculate	
% of control LOEC	ED: 22/32 * 100%	(Stage at 96 h)

Other notes: Study states "...mortality due MLT exposure was registered between 20 and 25 mg/L (Table 2). As in embryos, due the lack of response–concentration relationship it was not possible to calculate the pesticides LC50."

Toxicity Data Summary

Ameiurus melas

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

	Johnson & Finley 1980	<i>A. melas</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Chordata	
Class	Actinopterygii	
Order	Siluriformes	
Family	Ictaluridae	
Genus	<i>Ameiurus</i>	Black bullhead
Species	<i>melas</i>	
Found in	N. America	
Age/size at start of test/growth phase	1.2 g	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

	Johnson & Finley 1980	<i>A. melas</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	12 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported (states 2 reps for ‘larger’ fish at least 10 organisms used for each concentration)
LC50 (95% ci)	12,900 (10,700-15,600) µg/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Anodonta anatina

Varanka, I. 1986. Toxicity of mosquitocides on freshwater mussel larvae. Acta Biologica Hungarica 37(2):143-158.

Relevance-LC50

Score: 90 (No std method)

Rating: R

Reliability

Score: 65

Rating: L

Relevance-abductor muscle activity

Score: 75 (No std method, Endpoint)

Rating: L

Reliability

Score: 65.5

Rating: L

Reference	Varanka 1986	<i>A. anatina</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Mollusca	
Class	Bivalvia	
Order	Unionida	
Family	Unionidae	
Genus	<i>Anodonta</i>	
Species	sp.	
Family in North America?	Yes	
Age/size at start of test/growth phase	Larvae	
Source of organisms	Larvae collected from lake	L. Balton, Hungary
Have organisms been exposed to contaminants?	Possibly	
Animals acclimated and disease-free?	NR	Acclimated at 6 C, but tests run at 22 C
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes:24,48,72,96 h	
Effect 1	Mortality	
Control response 1	0%	
Effect 2	abductor muscle activity	(normal)
Control response 2	11,168 contractions	
Effect 3	abductor muscle activity after 24 h	
Control response 3	7185 contractions	
Temperature	22 °C	
Test type	Static	
Photoperiod/light intensity	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Varanka 1986	<i>A. anatina</i>
Parameter	Value	Comment
Dilution water	Lake water	L. Balton, Hungary
pH	8.31-8.36	
Hardness	259.5	
Alkalinity	NR	
Conductivity	480 uS	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	States agent was 95%, but then that is was used as a formulation	Fyfanon is a formulation with ~96% AI
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	States used as formulation, so emulsifiers 5%, no other solvent added	5% of probable highest concentration: 0.05 * 100mg/L =5mg/L, ~5uL/L
Acute effects		
Concentration 1 Nom	Max 3 fold dilution	1(?) reps with 50 per
Control	Yes, water only	1(?) reps with 50 per
Activity effect		
Concentration 1 Nom	100 mg/L	1(?) reps, 100 total
Concentration 2 Nom	50 mg/L	1(?) reps, 100 total
Concentration 3 Nom	10 mg/L	1(?) reps, 100 total
Concentration 4 Nom	0.1 mg/L	1(?) reps, 100 total
Concentration 5 Nom	0.01 mg/L	1(?) reps, 100 total
Control	Yes, water only	1(?) reps, 100 total
LC50; indicate calculation method	By time point (below)	Probit
24 h	25.0 (22.37-27.90) mg/L	25000 (22370-27900) ug/L
48 h	2.03 (1.82-2.27)	2030 (1820-2270)
72 h	0.21 (0.18-0.25)	210 (180-250)
96 h	0.08 (0.05-0.14)	80 (50-140)
Effects on activity		
EC50 –normal test	17.0	
EC50 –24 h test	0.9	
EC10 –normal test	0.09	
EC10 –24 h test	0.29	

Toxicity Data Summary

*Anodonta anatina**Anodonta cygnea*

Varanka, I. 1987. Effect of Mosquito Killer Insecticides on Freshwater Mussels.
Comp.Biochem.Physiol.C 86(1):157-162

Relevance-LC50

Score: 90 (No std method)

Rating: R

Reliability

Score: 65

Rating: L

Relevance-abductor muscle activity

Score: 60 (No std method, Endpoint, No Values)

Rating: N

Reference	Varanka 1987	<i>A. cygnea</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Mollusca	
Class	Bivalvia	
Order	Unionida	
Family	Unionidae	
Genus	<i>Anodonta</i>	
Species	sp.	
Family in North America?	Yes	
Age/size at start of test/growth phase	A. Antonia: 75 mm, 18 g A. cygnea: 92 mm, 22.8 g	
Source of organisms	Larvae collected from lake	L. Balton, Hungary
Have organisms been exposed to contaminants?	Possibly	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes:24,48,72,96 h	
Effect 1	Mortality	
Control response 1	No mortality	
Effect 2	abductor muscle activity	
Control response 2	Responses normalized to control (active: resting periods)	
Temperature	22 ± 1°C	
Test type	Static	
Photoperiod/light intensity	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Varanka 1987	<i>A. cygnea</i>
Parameter	Value	Comment
Dilution water	Lake water	L. Balton, Hungary
pH	8.4	
Hardness	259.5	
Alkalinity	NR	
Conductivity	480 uS	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	Fyfanon ULV, 95%,	Fyfanon is a formulation with ~96% AI
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	States used as formulation, no other solvent added	5% of probable highest concentration: 0.05 * 100mg/L =5mg/L, ~5uL/L
Acute effects		
Concentration 1 Nom	3 concentrations, NR	3 reps with 10 per
Control	Yes, water only	3 reps with 10 per
A antonia		
LC50	By time point (below)	Probit
24 h	NR	
48 h	NR	
72 h	14,250 uL/L	
96 h	5000	
7 d	500	
A. cygnea		
24 h	NR	
48 h	14,500 uL/L	
72 h	6350	
96 h	975	
7 d	225	
Effects on activity	No values	

Other notes:

Values in uL/L, study rates as N, so didn't try to convert values.

Toxicity Data Summary

Anodonta cygnea

Varanka, I. 1986. Toxicity of mosquitocides on freshwater mussel larvae. Acta Biologica Hungarica 37(2):143-158.

Relevance-LC50

Score: 90 (No std method)

Rating: R

Reliability

Score: 65

Rating: L

Relevance-abductor muscle activity

Score: 75 (No std method, Endpoint)

Rating: L

Reliability

Score: 65.5

Rating: L

Reference	Varanka 1986	<i>A. cygnea</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Mollusca	
Class	Bivalvia	
Order	Unionda	
Family	Unionidae	
Genus	<i>Anodonta</i>	
Species	sp.	
Family in North America?	Yes	
Age/size at start of test/growth phase	Larvae	
Source of organisms	Larvae collected from lake	L. Balton, Hungary
Have organisms been exposed to contaminants?	Possibly	
Animals acclimated and disease-free?	NR	Acclimated at 6 C, but tests run at 22 C
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes:24,48,72,96 h	
Effect 1	Mortality	
Control response 1	0%	
Effect 2	abductor muscle activity	(normal)
Control response 2	11,168 contractions	
Effect 3	abductor muscle activity after 24 h	
Control response 3	7185 contractions	
Temperature	22 °C	
Test type	Static	
Photoperiod/light intensity	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Varanka 1986	<i>A. cygnea</i>
Parameter	Value	Comment
Dilution water	Lake water	L. Balton, Hungary
pH	8.31-8.36	
Hardness	259.5	
Alkalinity	NR	
Conductivity	480 uS	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	States agent was 95%, but then that is was used as a formulation	Fyfanon is a formulation with ~96% AI
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	States used as formulation, so emulsifiers 5%, no other solvent added	5% of probable highest concentration: 0.05 * 100mg/L =5mg/L, ~5uL/L
Acute effects		
Concentration 1 Nom	Max 3 fold dilution	1(?) reps with 50 per
Control	Yes, water only	1(?) reps with 50 per
Activity effect		
Concentration 1 Nom	10 mg/L	1(?) reps, 100 total
Concentration 2 Nom	1 mg/L	1(?) reps, 100 total
Concentration 3 Nom	.1 mg/L	1(?) reps, 100 total
Concentration 4 Nom	.01 mg/L	1(?) reps, 100 total
Concentration 5 Nom	.001 mg/L	1(?) reps, 100 total
Control	Yes, water only	1(?) reps, 100 total
LC50; indicate calculation method	By time point (below)	Probit
24 h	43.8 (39.6-48.5) mg/L	43800 (39600-48500) ug/L
48 h	10.21 (9.41-11.36)	10210 (9410-11360)
72 h	3.26 (2.96-3.46)	3260 (2960-3460)
96 h	0.31 (0.28-0.36)	310 (280-360)
Effects on activity		
EC50 –normal test	12.0	
EC50 –24 h test	1.0	
EC10 –normal test	0.08	
EC10 –24 h test	0.03	

Toxicity Data Summary

Anopheles quadrimaculatus

Milam CD, Farris JL, Wilhide JD. 2000. Evaluating mosquito control pesticides for effect on target and nontarget organisms. Archives of Environmental Contamination and Toxicology 39(3):324-328.

Relevance

Score: 77.5 (Purity NR, Control response NR)

Rating: L

Reliability

Score: 60

Rating: L

Reference	Milam <i>et al.</i> 2000	<i>A. quadrimaculatus</i>
Parameter	Value	Comment
Test method cited	EPA , APHA	fathead minnow method
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Culicidae	
Genus	<i>Anopheles</i>	
Species	<i>quadrimaculatus</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	2nd and 3rd instar	
Source of organisms	Filed collected	
Have organisms been exposed to contaminants?	States area had no exposure to pesticides	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Survival	
Control response 1	No adverse effects to ditch receiving water	
Temperature	32 °C	
Test type	Static	
Photoperiod/light intensity	LD 14:10	
Dilution water	ambient ditch water	States no exposure to pesticides
pH	NR	Water chemistry parameters were measured as a requirement for
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Milam <i>et al.</i> 2000	<i>A. quadrimaculatus</i>
Parameter	Value	Comment
Dissolved Oxygen	NR	all test methods (U.S. EPA 1993; APHA 1995).
Feeding	None	
Purity of test substance	NR	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	NR	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	NR	4 Reps and 5 per
Control	Water only	4 Reps and 5 per
LC _x ; indicate calculation method	1.0 ($\mu\text{g/L}$)	Probit analysis or trimmed Spearman Karber

Toxicity Data Summary

Asellus brevicaudus

Study: Sanders HO. 1972. Toxicity of some insecticides to four species of Malacostracan crustaceans. Technical Papers of the Bureau of Sport Fisheries and Wildlife. United States Department of the Interior, Fish and Wildlife Service. Washington, D.C.

Relevance

Score: 92.5 (Control response NR)

Rating: R

Reliability

Score: 63

Rating: L

Reference	Sanders 1972	<i>A. brevicaudus</i>
Parameter	Value	Comment
Test method cited	NR	Pub. before std methods
Phylum	Arthropoda	
Class	Malacostraca	
Order	Isopoda?	
Family	<i>Aselloidae?</i>	
Genus	<i>Asellus</i>	Genus should be <i>Caecidotea</i> (?)
Species	<i>brevicaudus</i>	Aquatic sowbug
Family in North America?	Yes	
Age/size at start of test/growth phase	Mature	
Source of organisms	Local streams and ponds	
Have organisms been exposed to contaminants?	NR	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24, 96 h	
Effect 1	Mortality	
Control response 1	NR	
Temperature	Static: 21 ± 0.5 °C Flow thru: 18- 21 °C	
Test type	Acute -Static & Intermittent-flow	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted or Raw water	
pH	Reconstituted: 7.1 Raw water: 7.4	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Sanders 1972	<i>A. brevicaudus</i>
Parameter	Value	Comment
Hardness	Reconstituted: 10.2 ppm Ca & Mg Raw water: 368 ppm Ca & Mg	
Alkalinity	Reconstituted: 35 ppm methyl orange Raw water: 260 ppm methyl orange	
Conductivity	NR	
Dissolved Oxygen	8 ppm	
Feeding	NR-none	
Purity of test substance	w/o emulsifying agents	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 1mL/L ethanol	
Concentrations Nom (µg/L)	5 concentrations	2 Reps, 10 per rep
Control	'untreated'	2 Reps, 10 per rep
LC50; 24 h (95% CL); reconstituted water	6,000 (3,000-10,000) µg/L	probit
LC50; 96 h (95% CL); reconstituted water	3,000 (1,500-8,500) µg/L	probit

Toxicity Data Summary

Asellus sp

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>Asellus sp.</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Arthropoda	
Class	Malacostraca	
Order	Isopoda	
Family	Asellidae	
Genus	<i>Asellus</i>	
Species	Sp.	
Found in	N. America	
Age/size at start of test/growth phase	Mature	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>Asellus sp.</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	21 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported, at least 10 organisms used for each concentration
LC50 (95% ci)	3000 (1500-8500) µg/L	Litchfield & Wilcoxon (1949)

Probably reports data in Sanders 1972

Toxicity Data Summary

Atherix

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Athericidae	
Genus	<i>Atherix</i>	Water Snipe-flies
Species		
Found in	N. America	
Age/size at start of test/growth phase	Juvenile	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	15 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported, at least 10 organisms used for each concentration
LC50 (95% ci)	385 (246-602) µg/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Aulosira fertilissima

Study: Tandon RS, Lal R, Rao V. 1988. Interaction of endosulfan and malathion with blue green-algae Anabaena and Aulosira-fertilissima. Environ Pollut 52(1): 1-9.

Relevance: Growth

Score: 90 (No std method, No value)

Rating: L

Reliability

Score: 64

Rating: L

Relevance: Photosynthesis

Score: 75 (No std method, Endpoint)

Rating: L

Reliability

Score: 64

Rating: L

Relevance: Nitrogenase activity

Score: 60 (No std method, Endpoint, No Value)

Rating: N

Reference		
Parameter	Value	Comment
Test method cited	None	
Class	Cyanophyceae	Algae/ cyanobacteria
Order	Nostocales	
Family	Nostocaceae	
Genus	<i>Aulosira</i>	
Species	<i>fertilissima</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	NR	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	30 d	
Data for multiple times?	Yes	
Effect 1	Growth inhibition	chlorophyll
Control response 1	Reponses normalized to control	
Effect 2	CO ₂ (using C ¹⁴) uptake	Photosynthesis
Control response 2	26988 counts mL/min	at 90 min
Effect 3	Nitrogenase activity	
Control response 3	4196 n mol ethylene/ mL	
Temperature	28-30 °C	
Test type	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Reference		
Parameter	Value	Comment
Photoperiod/light intensity	Continuous 4000 lux	
Dilution water	Foggs medium	water source NR
pH	7.5	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	In nutrient medium	
Purity of test substance	95 %	
Concentrations measured?	NR	
Measured is what % of nominal?	Nr	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤1%	
Concentration 1 Nom/Meas (µg/L)	10,000	reps/cell density NR
Concentration 2 Nom/Meas (µg/L)	50,000	reps/cell density NR
Concentration 3 Nom/Meas (µg/L)	100,000	reps/cell density NR
Control	Solvent control	reps/cell density NR
GROWTH INHIBITION		
NOEC	NR	Method: NR
LOEC; indicate calculation method	10,000	p: 0.05; MSD: NR
MATC (GeoMean NOEC,LOEC)	Can not calculate	
% control at NOEC	Can not calculate	
% of control LOEC	12-27 % (for multiple time points)	
C14 UPTAKE		
NOEC	10,000	Method: NR
LOEC; indicate calculation method	50,000	p: 0.01; MSD: NR
MATC (GeoMean NOEC,LOEC)	22,361	
% control at NOEC	23516/26988 * 100%	
% of control LOEC	19533/26988 * 100%	
ACETYLENE REDUCTION (Nitrogenase activity)		
NOEC	NR	Method: NR
LOEC; indicate calculation method	10,000	p: 0.001; MSD: NR
MATC (GeoMean NOEC,LOEC)	Can not calculate	
% control at NOEC	Can not calculate	
% of control LOEC	2644/4196 * 100%	

Other notes: ASTM and EPA algae method recognize growth inhibition as a standard endpoint, so that is the only endpoint recognized here as related to survival, growth, or reproduction.

Appendix, Section 2: Studies rated RL, LR, LL

Brachionus calyciflorus

Toxicity Data Summary

Fernández-Casalderrey A, Ferrando MD, Andreu-Moliner E. 1992. Acute toxicity of several pesticides to rotifer (*Brachionus calyciflorus*). *Bull Environ Contam Toxicol* 48: 14-17.

Relevance

Score: 90 (No standard method)

Rating: R

Reliability

Score: 72

Rating: L

Fernández-Casalderrey et al. 1992		<i>B. calyciflorus</i>
Parameter	Value	Comment
Test method cited	None cited	
Phylum	Rotifera	
Class	Monogononta	
Order	Ploima	
Family	Brachionidae	
Genus	<i>Brachionus</i>	
Species	<i>calyciflorus</i>	
Found in	N. America	
Age/size at start of test/growth phase	Newly hatched	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	24 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	0% mortality	
Temperature	25°C	
Test type	Static	
Photoperiod/light intensity	Darkness	
Dilution water	Synthetic fresh water	EPA medium
pH	7.4-7.8	
Hardness	80-100 mg/L as CaCO ₃	
Alkalinity	60-70 mg/L as Ca CO ₃	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	

Appendix, Section 2: Studies rated RL, LR, LL

Fernández-Casalderrey et al. 1992		<i>B. calyciflorus</i>
Parameter	Value	Comment
Purity of test substance	95%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	NR (acetone)	
Concentration 1 Nom/Meas (mg/L)	5 concentrations; levels NR	Reps: 9 w/30 per
Control	Solvent (acetone)	Reps: 9 w/30 per
LC50 (95% ci); ug/L	33,720 (28,790-38,650)	Moving average

LC50 is fairly close to water solubility. Rotifers relatively insensitive

Toxicity Data Summary

Brachionus plicatilis

Snell TW, Persoone G. Acute toxicity bioassays using rotifers. II. A freshwater test with *Brachionus rubens*. *Aquatic Toxicology* 1989; 14: 81-91.

Relevance

Score: 85 (purity)

Rating: L

Reliability

Score: 71

Rating: L

Reference	Snell & Persoone 1989	<i>B. plicatilis</i>
Parameter	Value	Comment
Test method cited	EPA	
Phylum	Rotifera	
Class	Monogonata	
Order	Plioma	
Family	Brachionidae	
Genus	<i>Brachionus</i>	
Species	<i>plicatilis</i>	
Family in North America?		
Age/size at start of test/growth phase	Neonates	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	24 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	<10%	
Temperature	25	
Test type	Static	
Photoperiod/light intensity	Darkness	
Dilution water	EPA moderately hard water	
pH	7.4-7.8	
Hardness	80-100 m CaCO ₃ /L	
Alkalinity	60-70 mg/L	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	No	
Purity of test substance	50% malathion in a xylene	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Snell & Persoone 1989	<i>B. plicatilis</i>
Parameter	Value	Comment
	solvent*	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	80mg/L , 0.08mL/L	
Concentration 1 Nom/Meas (µg/L)	5 concentrations*	4 reps,10 per rep*
Control	Yes, xylene added*	4 reps, 10 per rep*
LCx; indicate calculation method	35,300 ug/L	Linear regression

Other notes:

* Information from

Acute toxicity bioassays using rotifers. II. A freshwater test with *Brachionus rubens*
Aquatic Toxicology, Volume 14, Issue 1, January 1989, Pages 81-91

Terry W. Snell, Guido Persoone

Appendix, Section 2: Studies rated RL, LR, LL

Toxicity Data Summary

Carassius auratus

Study: Birge, W.J., J.A. Black, and D.M. Bruser. 1979 Toxicity of Organic Chemicals to Embryo-Larval Stages of Fish. EPA-560/11-79-007, U.S.EPA, Washington, D.C.:60 p. (NTIS PB80-101637)

Relevance

Score: 85 (Purity NR)

Rating: L

Reliability

Score: 74.5

Rating: R

Reference	Birge <i>et al.</i> 1979	<i>C. auratus</i>
Parameter	Value	Comment
Test method cited	EPA, ASTM	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Carassius</i>	
Species	<i>auratus</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	1-2 h post spawning, eggs	
Source of organisms	Hatchery	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	About 8 days total, 4 d before hatch, then 4 d after	
Data for multiple times?	2 times	
Effect 1	Survival, at hatching	
Control response 1	99-98%	
Effect 2	Survival, 4 days post hatching	
Control response 2	98-96%	
Temperature	18.2-25.8 °C	
Test type	Flow-through	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted, from double deionized water	
pH	7.7±0.1 7.6±0.1	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Birge <i>et al.</i> 1979	<i>C. auratus</i>
Parameter	Value	Comment
Hardness	Soft: 50 mg/L CaCO ₃ 54.3 ± 1.3 Hard: 200 mg/L CaCO ₃ 196.6 ± 3.6	
Alkalinity	NR	
Conductivity	106.6 ± 0.7 220.0 ± 5.0	
Dissolved Oxygen	6.5-8.9	
Feeding	None	
Purity of test substance	NR	
Concentrations measured?	Yes	
Measured is what % of nominal?	NR	
Chemical method documented?	Yes, GC FID	
Concentration of carrier (if any) in test solutions	No solvent used, mixed with mechanical homogenization	
Concentration 1 Nom/Meas (µg/L)	5240	100-150 eggs per concentration Reps and # per NR
Concentration 2 Nom/Meas (µg/L)	1990	
Concentration 3 Nom/Meas (µg/L)	600	
Concentration 4 Nom/Meas (µg/L)	280	
Concentration 5 Nom/Meas (µg/L)	≤ 50	
Control	Yes dilution water	
Concentration 1 Nom/Meas (µg/L)	5500	
Concentration 2 Nom/Meas (µg/L)	2160	
Concentration 3 Nom/Meas (µg/L)	1020	
Concentration 4 Nom/Meas (µg/L)	110	
Concentration 5 Nom/Meas (µg/L)	≤ 50	
Control	Yes, water	
LC50	Hatching 2610 (2250-3080) soft water 3159 (2810-3560) hard water 4 days after hatching 1200 (1060-1350) soft water 1650 (1500-1800) hard water	Probit

Other notes:

Details for malathion on pg 30 and table 17.

It seems like high purity compounds were probably used, but this is not specified. First and second authors and likely the last are deceased, and cannot be contacted for more information on purity.

Toxicity Data Summary

Carassius auratus

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>C. auratus</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Carassius</i>	Goldfish
Species	<i>auratus</i>	
Found in	N. America	
Age/size at start of test/growth phase	0.9 g	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>C. auratus</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	18 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported (states 2 reps for ‘larger’ fish at least 10 organisms used for each concentration)
LC50 (95% ci)	10,700 (8340-13,80) µg/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Channa gachua

Study: Dalela, R.C., S.R. Verma, and M.C. Bhatnagar. 1978. Biocides in Relation to Water Pollution. Part I: Bioassay Studies on the Effects of a Few Biocides on Fresh Water Fish, *Channa gachua*. Acta Hydrochim.Hydrobiol. 6(1):15-25

Relevance

Score: 85 (50% formulation)

Rating:L

Reliability

Score: 64.5

Rating: L

Reference	Dalela <i>et al.</i> 1978	<i>C. gachu</i>
Parameter	Value	Comment
Test method cited	APHA	
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Channidae	
Genus	<i>Channa</i>	
Species	<i>gachua</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	10-15 cm	
Source of organisms	Local pond	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24,48,72,96 h	
Effect 1	Mortality	
Control response 1	No mortality	
Temperature	24 ± 2 °C, and 35 ± 3 °C	
Test type	Static (assume)	
Photoperiod/light intensity	NR	
Dilution water	Overhead tank at college	Not acceptable description
pH	7.5-8.6	
Hardness	60-108 mg/L	
Alkalinity	NT	
Conductivity	NT	
Dissolved Oxygen	5.0-7.2 mg/L	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Dalela <i>et al.</i> 1978	<i>C. gachu</i>
Parameter	Value	Comment
Feeding	None	
Purity of test substance	50 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	No carrier described	
Concentrations ($\mu\text{g/L}$)	Seven concentrations, levels NR	10 per rep, test repeated 3x
Control	Yes, probably water only	10 per rep, test repeated 3x
LC50s	See below	Graphical interpolation

Size	Temp C	pH	Time	LC50 $\mu\text{g/L}$
140 \pm 10 mm	24 \pm 2	7.5 \pm 0.3	24 h	9200
140 \pm 10 mm	24 \pm 2	7.5 \pm 0.3	48 h	8100
140 \pm 10 mm	24 \pm 2	7.5 \pm 0.3	72 h	7900
140 \pm 10 mm	24 \pm 2	7.5 \pm 0.3	96 h	7600
140 \pm 10 mm	35 \pm 3	7.5 \pm 0.3	24 h	8800
140 \pm 10 mm	35 \pm 3	7.5 \pm 0.3	48 h	7950
140 \pm 10 mm	35 \pm 3	7.5 \pm 0.3	72 h	7600
140 \pm 10 mm	35 \pm 3	7.5 \pm 0.3	96 h	7350
140 \pm 10 mm	24 \pm 2	8.4 \pm 0.2	24 h	8700
140 \pm 10 mm	24 \pm 2	8.4 \pm 0.2	48 h	7850
140 \pm 10 mm	24 \pm 2	8.4 \pm 0.2	72 h	7300
140 \pm 10 mm	24 \pm 2	8.4 \pm 0.2	96 h	7050
110 \pm10 mm	24 \pm 2	7.5 \pm 0.3	24 h	8750
110 \pm10 mm	24 \pm 2	7.5 \pm 0.3	48 h	8000
110 \pm10 mm	24 \pm 2	7.5 \pm 0.3	72 h	7650
110 \pm10 mm	24 \pm 2	7.5 \pm 0.3	96 h	6950

Toxicity Data Summary

Channa punctatus

Study: Haider, S., and R.M. Inbaraj. 1986. Relative Toxicity of Technical Material and Commercial Formulation of Malathion and Endosulfan to a Freshwater Fish, *Channa punctatus* (Bloch). *Ecotoxicol. Environ. Saf.* 11(3):347-351

Relevance -Technical

Score: 100

Rating: R

Reliability

Score: 63.5

Rating: L

Relevance -50% Formulation

Score: 85 (Purity)

Rating: L

Reliability

Score: 58.5

Rating: N

Reference	Haider & Inbaraj 1986	<i>C. punctatus</i>
Parameter	Value	Comment
Test method cited	APHA	
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Channidae	
Genus	<i>Channa</i>	
Species	<i>punctatus</i>	
Family in North America?	Yes, invasive	Native to Africa & Asia
Age/size at start of test/growth phase	adult, 59.8± 3 g, 19±1 cm	
Source of organisms	Field	Varanasi, India
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24,48,72,96	
Effect 1	Mortality	
Control response 1	0 %	
Temperature	18 ± 2 °C	
Test type	Static renewal (24 h)	
Photoperiod/light intensity	NR	
Dilution water	Well water	
pH	7.2	Initial condition
Hardness	18 mg/L	Initial condition

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Haider & Inbaraj 1986	<i>C. punctatus</i>
Parameter	Value	Comment
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	9-10 ppm	Initial condition, not monitored during test (?)
Feeding	None	
Purity of test substance	Tested both a technical and 50 % formulation	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone, concentration NR	
Concentration 1 Nom/Meas (µg/L)	NR	1(?) rep with 10 per
Control	yes, probably water only	Reps and # per (cell density for single
Technical		
LC50; 24 h	9.48 (8.59-10.47) µg/L	Trimmed Spearman-Kärber
LC50; 48 h	6,510 (5,740-7,307)	
LC50; 72 h	5,240 (4,770-5,770)	
LC50; 96 h	4,600 (4,22-5,020)	
50% Formulation		
LC50; 24 h	10,110 (9,290-11,000)	
LC50; 48 h	8,260 (7,510-9,890)	
LC50; 72 h	6,180 (5,290-7,220)	
LC50; 96 h	3,910 (3,270-4,670)	

Other notes: 10% trimmed values reported here

Toxicity Data Summary

Chironomus dilutus (formerly *tentans*)

Study: Hansen CR Jr, Kawatski JA. (1976) Application of 24-Hour postexposure observation to acute toxicity studies with invertebrates. *J Fish Res Board Can* 33(5):1198-1201.

Relevance

Score: (No Std method)

Rating: R

Reliability

Score: 69

Rating: L

Relevance-EC50

Score: (No Std method, Endpoint not linked to survival)

Rating: L

Reliability

Score: 69

Rating: L

Explores use of immobility as endpoint for invertebrate toxicity tests.

Reference	Hansen & Kawatski 1976	<i>C. dilutus</i>
Parameter	Value	Comment
Test method cited	None, but EPA methods discussed	
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Chironomidae	
Genus	<i>Chironomus</i>	
Species	<i>dilutus</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	4 th instar	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	72 h, plus 24 h recovery period	
Data for multiple times?	24, 72 h	
Effect 1	Mortality	
Control response 1	> 15%	
Effect 2	Immobility	
Control response 2	NR	
Temperature	20 ± 0.5 °C	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Hansen & Kawatski 1976	<i>C. dilutus</i>
Parameter	Value	Comment
Test type	Static	
Photoperiod/light intensity	16 h light	
Dilution water	reconstituted	
pH	NR	
Hardness	40-48 mg/L	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	99 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	~ 0.550 mL/L	550 ppm
Concentrations ($\mu\text{g/L}$)	NR	3 reps, # per NR
Control	Solvent	3 reps, # per NR
LC50, 24 h	36000 (28900-44800) $\mu\text{g/L}^*$	Litchfield & Wilcoxon
Ec50, 24 h	30000 (25300-35500)*	
LC50, 72 h	620 (460-835)*	
EC50, 72 h	2500 (923-6770)*	

Other notes:

Use LC50 because EC50 not highly correlated to affect (some organism recovered). EC50 measured at end of test. Then organisms were put in clean water for 24 h. the LC50 calculated from mortality after this 24 h recovery period.

*Units don't seem right for final values?

Concentrations for tox values are mg/L. formula weight. Not sure what 'formula weight' indicates. Values multiplies by 1000 to convert to ug/L

Toxicity Data Summary

Chironomus riparius

Hoffman ER. 1995. Biochemical, fitness and genetic effects of DDT and Malathion selection on two populations of *Chironomus riparius*. Ph.D. Thesis, The Ohio State Univ. Columbus, OH

Also:

Hoffman, E.R., and S.W. Fisher. 1994. Comparison of a Field and Laboratory-Derived Population of *Chironomus riparius* (Diptera: Chironomidae): Biochemical and Fitness Evidence for Population Divergence. *J.Econ.Entomol.* 87(2):318-325.

This article contains same data and information as Chapter 1 of that dissertation. Methods and other sections read very similarly.

Relevance

Score: 82.5 (No Std method, Control Response NR)

Rating: L

Reliability

Score: 66

Rating: L

Reference	Hoffman 1995	<i>C. riparius</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Chironomidae	
Genus	<i>Chironomus</i>	
Species	riparius	
Family in North America?	Yes	
Age/size at start of test/growth phase	4th instar	
Source of organisms	Two populations: 1) First generation (F1) from larvae (fo) collected from sewage treatment plant 2) Lab culture, established 16 years earlier	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	24 h	
Data for multiple times?	No	
Effect 1	Mortality/ immobility	
Control response 1	NR	
Temperature	22 °C	
Test type	Static	

Appendix, Section 2: Studies rated RL, LR, LL

Ch4 seems to repeat 3 generations of Ch2, but data have slight differences so that that it appears these tests were conducted separately. The values are pretty close in Ch2 and Ch4, which, if nothing else, indicates these results are repeatable and these values may be combined like replicate tests.

Author shows that big (250 fold) significant differences can be found between lab and field strains of *C. riparius* (Ch1, Table 1).

Also the different populations with in the same generation can differ by as much as a factor of 3 (CH 3, Tables 15 & 17). Since these aren't clearly different strains these values may combined like replicate tests.

In Ch2 & 4 hand selection of resistant organisms didn't results in significant differences in sensitive (LC50s). Data from 'selected' groups will not be used for criteria tables.

Of all the LC50 determined, they will all be used except the data from selected trains. They will all be considered as replicate tests, except the Field and Lab strains will be kept separate. Values from selected organisms will not be used for criteria because they have been manipulated by researcher. Also for the most part they are fairly similar (and redundant) to the values form unselected organisms.

Dissertation was reviewed at Ohio State University Library

See next page for data summary

Appendix, Section 2: Studies rated RL, LR, LL

LC50s from Hoffman 1995
 no values used for 'selected' groups
 95% CI available see copies of tables from dissertation

Chapter	Description	Jackson Pike Strain	Laboratory Strain
Ch 1		111.7	0.44
CH 2	Generation 1	191.7	0.362
	Gen. 2	240.3	0.324
	Gen. 3	206.4	0.375
CH 3	Population 1	139.7	0.362
	pop 2	118.2	0.212
	pop 3	124.3	0.444
	pop 4	115.2	0.499
	pop 5	191	0.437
	pop 6	142.1	0.324
	pop 7	74.9	0.481
	pop 8	150	0.571
	pop 9	225.6	0.457
	pop 10	206.1	0.423
Ch 4	Generation 1	128.7	0.3
	gen 2	124.5	0.34
	gen 3	127.7	0.39
	gen 4	130.7	0.37
GEOMEANS			
	Geomean Ch1	111.70	0.44
	Geomean Ch2	211.85	0.35
	Geomean Ch3	142.08	0.41
	Geomean Ch4	127.88	0.35
	Geomean of all 18 values	146.38	0.39

Toxicity Data Summary

Chironomus riparius

Hoffman, E.R., and S.W. Fisher. 1994. Comparison of a Field and Laboratory-Derived Population of *Chironomus riparius* (Diptera: Chironomidae): Biochemical and Fitness Evidence for Population Divergence. *J.Econ.Entomol.* 87(2):318-325

Relevance

Score: 82.5 (No Std method, Control Response NR)

Rating: L

Reliability

Score: 66

Rating: L

See summary for Hoffman 1995. This article contains same data and information as Chapter 1 of that dissertation. Methods and other sections read very similarly.

Hoffman ER. 1995. Biochemical, fitness and genetic effects of DDT and Malathion selection on two populations of *Chironomus riparius*. Ph.D. Thesis, The Ohio State Univ. Columbus, OH

Toxicity Data Summary

Cirrhina mrigala

Study: Verma, S.R., I.P. Tonk, A.K. Gupta, and M. Saxena. 1984. Evaluation of an Application Factor for Determining the Safe Concentration of Agricultural and Industrial Chemicals. Water Res. 18(1):111-115

Relevance: acute 96 h LC50

Score: 77.5 (50% formulation, Control response NR)

Rating: L

Reliability

Score: 67.5

Rating: L

Relevance: Chronic: growth at 60 d

Score: 77.5 (50% formulation, Control response NR)

Rating: L

Reliability

Score: 69.5

Rating: L

Reference	Verma <i>et al.</i> 1984	<i>C. mrigala</i>
Parameter	Value	Comment
Test method cited	APHA	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Cirrhina</i>	
Species	<i>mrigala</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	4 day old larvae: 4.5 + 0.4 mm and weight 51.0 + 3.0 mg	
Source of organisms	Hatchery	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	OK, only 48 but test with larvae	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h 60 d	
Data for multiple times?	No	
Effect 1	Acute mortality (LC50)	
Control response 1	NR	
Effect 2	Growth of standing crop	After 60 d (chronic)
Control response 2	NR	
Effect 3	Long term survival	No values
Control response 3	NR	
Temperature	23 (21-25) °C	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Verma <i>et al.</i> 1984	<i>C. mrigala</i>
Parameter	Value	Comment
Test type	Static renewal (daily)	
Photoperiod/light intensity	NR	
Dilution water	NR	
pH	7.3 (7.2-7.4)	
Hardness	72.00 (70.00-74.00)	
Alkalinity	73.00 (72.00-74.00)	
Conductivity	NR	
Dissolved Oxygen	6.70 (6.50-9.60)	
Feeding	Yes	
Purity of test substance	50 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone: ethanol , concentration NR	
	ACUTE	
Concentrations 1 Nom (µg/L)	NR	3 reps with 20 per
Control	Solvent control	3 reps with 20 per
	CHRONIC	
Concentration 1 Nom (µg/L)	85.0	1 rep with 30 per
Concentration 2 Nom (µg/L)	77.0	1 rep with 30 per
Concentration 3 Nom (µg/L)	69.0	1 rep with 30 per
Concentration 4 Nom (µg/L)	61.0	1 rep with 30 per
Concentration 5 Nom (µg/L)	53.0	1 rep with 30 per
Concentration 6 Nom (µg/L)	45.0	1 rep with 30 per
Concentration 7 Nom (µg/L)	37.0	1 rep with 30 per
Concentration 8 Nom (µg/L)	29.0	1 rep with 30 per
Concentration 9 Nom (µg/L)	21.0	1 rep with 30 per
Control	Solvent control	1 rep with 30 per
LC50	880.0	probit
NOEC; indicate calculation method, significance level (p-value) and minimum significant difference (MSD)	53.0	Method: ANOVA p: 0.05 MSD: NR
LOEC; indicate calculation method	61.0	
MATC (GeoMean NOEC,LOEC)	56.9 *	
% control at NOEC	Can not calculate	
% of control LOEC	Can not calculate	

*MATC was reported 53.0-61.0. Since these are tests concentrations, these values are assumed to be the NOEC and LOEC, from which the geomean can be calculated.

Toxicity Data Summary

Claassenia

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>Claassenia</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Arthropoda	
Class	Insecta	
Order	Plecoptera	
Family	Perlidae	
Genus	<i>Claassenia</i>	
Species	NR	
Found in	N. America	
Age/size at start of test/growth phase	Second year class	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>Claassenia</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	15 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported, at least 10 organisms used for each concentration
LC50 (95% ci)	2.6 (1.4-4.3) µg/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Clarias gariepinus

Study: Nguyen, L.T.H., and C.R. Janssen. 2001. Comparative Sensitivity of Embryo-Larval Toxicity Assays with African Catfish (*Clarias gariepinus*) and Zebra Fish (*Danio rerio*). Environ.Toxicol. 16(6):566-571

Relevance-LC50, larval (5 d)

Score: 85 (control description & response NR)

Rating: L

Reliability

Score: 68

Rating: L

Relevance-Growth (5 d)

Score: 85 (control description & response NR)

Rating: L

Reliability

Score: 67

Rating: L

Relevance-Abnormality (5 d)

Score: 70 (Endpoint, control description & response NR)

Rating: L

Reliability

Score: 67

Rating: L

Relevance- Egg & larvae survival, hatching (5 d)

Score: 70 (No values, control description & response NR)

Rating: L

Reliability

Score: 67

Rating: L

Reference	Nguyen & Janssen 2001	<i>C. gariepinus</i>
Parameter	Value	Comment
Test method cited	ASTM & OCED	
Phylum	Chordata	
Class	Actinopterygii	
Order	Siluriformes	
Family	Clariidae	
Genus	<i>Clarias</i>	
Species	<i>gariepinus</i>	Airbreathing catfish
Family in North America?	Yes, invasive in Florida	Native to Africa/Asia
Age/size at start of test/growth phase	Eggs, immediately after fertilization, 2-4 cell stage	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	5 d	
Data for multiple times?	No	
Effects	See list of LOECs	
Control responses	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Nguyen & Janssen 2001	<i>C. gariepinus</i>
Parameter	Value	Comment
Temperature	27 ± 1 °C	
Test type	Static renewal (24 h)	
Photoperiod/light intensity	Darkness	
Dilution water	Aerated tap	
pH	7.2 ± 0.14	
Hardness	200 mg/L as CaCO ₃	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	8.3 ± 0.3	
Feeding	None	
Purity of test substance	98 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	NR	
Concentrations Nom (µg/L)	NR, but had 0.3 or 0.5 interval	4 reps with 1 per
Control	Mentioned in Stats section, type NR	Reps and # per (cell density for single
LC50, Larval survival, 5d	3420 (2910-4010) µg/L	Trimmed Spearman Karber
LOEC-Embryo survival	>5000 µg/L	
LOEC-Hatching	>5000	
LOEC- Larval survival	2500	
LOEC- Abnormality	1250	
LOEC- Growth	1250	
Abnormality /Growth	(below)	
NOEC	0630 µg/L	Method: ANOVA w/ Duncan's comp. p: 0.05, MSD: NR
LOEC	1250	
MATC (GeoMean NOEC, LOEC)	900	
% control at NOEC	NR	
% of control LOEC	NR	

Other notes: Study has tests that were 5 d for *C. gariepinus* and 12 for *D. rerio*. These different durations were time until larvae begin exogenous feeding.

12 day LC50 test with *D. rerio*. Non-standard length. And for chronic endpoints test of 5 and 12 d are shorter than standard chronic tests

This study reports LOEC for 5 endpoints, but no NOECs in Table 1. Then, later in table 3, one final NOEC and LOEC is given for each species, the endpoints were inferred from Table 1. This summary was arranged similarly. Those NOEC only values are used that are missing NOEC values have lower relevance score (-15 relevance).

Toxicity Data Summary

Colisa fasciatus

Study: Singh, S.K., P.K. Tripathi, R.P. Yadav, D. Singh, and A. Singh. 2004. Toxicity of Malathion and Carbaryl Pesticides: Effects on Some Biochemical Profiles of the Freshwater Fish *Colisa fasciatus*. Bull.Environ.Contam.Toxicol. 72(3):592-599

Relevance

Score: 77.5 (Not in N. America, Control Response NR)

Rating: L

Reliability

Score: 64.5

Rating: L

Reference	Singh et al. 2004	<i>C. fasciatus</i>
Parameter	Value	Comment
Test method cited	APHA: for water chem.	
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Osphronemidae	
Genus	<i>Colisa</i>	Gourami fish
Species	<i>fasciatus</i>	
Family in North America?	No	Native to Asia
Age/size at start of test/growth phase	6.3 cm, 2.4 g	
Source of organisms	Environment	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24, 48, 72, 96 h	
Effect 1	Mortality	
Control response 1	NR	
Temperature	23 ± 0.7 °C	
Test type	Static renewal	
Photoperiod/light intensity	NR	
Dilution water	Dechlorinated tap	
pH	7.3 ± 0.2	
Hardness	NR	
Alkalinity	107 ± 7.8 mg/L	
Conductivity	NR	
Dissolved Oxygen	7.2 ± 0.3	
Feeding	Yes	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Singh <i>et al.</i> 2004	<i>C. fasciatus</i>
Parameter	Value	Comment
Purity of test substance	94 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	No carrier reported	
Concentration 1 Nom ($\mu\text{g/L}$)	3500	6 reps with 10 per
Concentration 2 Nom ($\mu\text{g/L}$)	3000	6 reps with 10 per
Concentration 3 Nom ($\mu\text{g/L}$)	2500	6 reps with 10 per
Concentration 4 Nom ($\mu\text{g/L}$)	2000	6 reps with 10 per
Control	Yes, no mention of solvent so assume water only	6 reps with 10 per
LC50, 24 h	3150 (2930-3490)	LC50 calculation Method NR
LC50, 48 h	2850 (2670-3070)	
LC50, 72 h	2430 (2270-2580)	
LC50, 96 h	2120 (1940-2250)	

Appendix, Section 2: Studies rated RL, LR, LL

Toxicity Data Summary

Cypretta kawatai

Study: Hansen, C.R. Jr., and J.A. Kawatski. 1976. Application of 24-Hour Postexposure Observation to Acute Toxicity Studies with Invertebrates. J.Fish.Res.Board Can. 33(5):1198-1201

Relevance-LC50

Score: (No Std method)

Rating: R

Reliability

Score: 67.5

Rating: L

Relevance-EC50

Score: (No Std method, Endpoint not linked to survival)

Rating: L

Reliability

Score: 67.5

Rating: L

Explores use of immobility as endpoint for invertebrate toxicity tests.

Reference	Hansen & Kawatski 1976	<i>C. kawatai</i>
Parameter	Value	Comment
Test method cited	None, but EPA methods discussed	
Phylum	Arthropoda	
Class	Ostracoda	
Order	Podocopida	
Family	Cyprinidae	
Genus	<i>Cypretta</i>	
Species	Kawatai	
Family in North America?	Yes	
Age/size at start of test/growth phase	Adult	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	72 h, plus 24 h recovery period	
Data for multiple times?	24, 72 h	
Effect 1	Mortality	
Control response 1	> 15%	
Effect 2	Immobility	
Control response 2	NR	
Temperature	20 ± 0.5 °C	
Test type	Static	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Hansen & Kawatski 1976	<i>C. kawatai</i>
Parameter	Value	Comment
Photoperiod/light intensity	16 h light	
Dilution water	reconstituted	
pH	NR	
Hardness	40-48 mg/L	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	99 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	~ 0.550 mL/L	550 ppm
Concentrations ($\mu\text{g/L}$)	NR	3 reps, # per NR
Control	Solvent	3 reps, # per NR
LC50, 24 h	344 (238-498) $\mu\text{g/L}^*$	Litchfield & Wilcoxon
EC50, 24 h	459 (297-710)*	
LC50, 72 h	51 (38.8-76.9)*	
EC50, 72 h	86 (60.6-122)*	

Other notes:

Use LC50 because EC50 not highly correlated to affect (some organism recovered). EC50 measured at end of test. Then organisms were put in clean water for 24 h. the LC50 calculated from mortality after this 24 h recovery period.

*Units don't seem right for final values?

Concentrations for tox values are mg/L. formula weight. Not sure what 'formula weight' indicates. Values multiplies by 1000 to convert to ug/L

Toxicity Data Summary

Cypridopsis

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>Cypridopsis</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Arthropoda	
Class	Ostracoda	
Order	Podocopa	
Family	Cypridopsidae	
Genus	<i>Cypridopsis</i>	
Species	NR	
Found in	N. America	
Age/size at start of test/growth phase	Mature	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>Cypridopsis</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	21 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported, at least 10 organisms used for each concentration
LC50 (95% ci)	47 (32-69) µg/L	Litchfield & Wilcoxon (1949)

Appendix, Section 2: Studies rated RL, LR, LL

Cyprinus carpio

Toxicity Data Summary

Study: Alam MK, Maughan OE. 1992. The effect of malathion, diazinon, and various concentrations of zinc, copper, nickel, lead, iron, and mercury on fish. Biol Trace Elem Res 34: 225-236.

Relevance-acute values

Score: 75 (No standard method; formulation)

Rating: L

Reliability

Score: 62

Rating: L

	Alam & Maughan 1992	<i>C. carpio</i>
Parameter	Value	Comment
Test method cited	No standard method cited	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Cyprinus</i>	
Species	<i>carpio</i>	
Found in	N. America	
Age/size at start of test/growth phase	Test 1: 2.5 cm- juvenile Test 2: 5 cm - adult	
Source of organisms	NR	
Have organisms been exposed to contaminants?	Cannot determine	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	All Tests 0% mortality	
Temperature	25°C	
Test type	Static renewal; daily-2x daily	
Photoperiod/light intensity	NR	
Dilution water	NR	States 'water'
pH	7	

Appendix, Section 2: Studies rated RL, LR, LL

	Alam & Maughan 1992	<i>C. carpio</i>
Parameter	Value	Comment
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	6.43 mg/L	6.43/8.2= 78%
Feeding	None	
Purity of test substance	57%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom ($\mu\text{g/L}$) Assuming nominal (not specified)	8550	Reps: 1 w/10 per
Concentration 2 Nom ($\mu\text{g/L}$)	11400	Reps: 1 w/10 per
Concentration 3 Nom ($\mu\text{g/L}$)	14250	Reps: 1 w/10 per
Concentration 4 Nom ($\mu\text{g/L}$)	14800	Reps: 1 w/10 per
Concentration 5 Nom ($\mu\text{g/L}$)	17100	Reps: 1 w/10 per
Control	Dilution water	Reps: 1 w/10 per
LC50; $\mu\text{g/L}$	Juvenile: 13,800 Adult: 12,810	Probit
	Juvenile: 10,210 Adult: 10,380	Trimmed Spearman-Karber
Geomean of LC50s by different methods	Juvenile: 11,870 Adult: 11,531	
LC50, 30 d	1,400	
LC50, 60 d	800	
Sublethal effects of darkening skin	570	Not relevant endpoint

Study provides some long term/ sublethal/ chronic data but not LOEC or NOEC, and not relevant for criteria derivation.

Difficult to judge which calculation method most appropriate form information provided so use geomean of values:

LC50 Juvenile: 11,870 $\mu\text{g/L}$

LC50 Adult: 11,531 $\mu\text{g/L}$

Toxicity Data Summary

Cyprinus carpio

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>C. carpio</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Cyprinus</i>	
Species	carpio	
Found in	N. America	
Age/size at start of test/growth phase	0.6 g	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>C. carpio</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	18 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported (states 2 reps for 'larger' fish at least 10 organisms used for each concentration)
LC50 (95% ci)	6,590 (4920-8820) µg/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Cyprinus carpio

Study: Kaur, K., and A. Dhawan. 1993. Variable Sensitivity of *Cyprinus carpio* Eggs, Larvae, and Fry to Pesticides. *Bull. Environ. Contam. Toxicol.* 50(4):593-599

Relevance

Score: 85 (50% formulation)

Rating: L

Reliability

Score: 69.5

Rating: L

Reference	Kaur & Dhawan 1993	<i>C. carpio</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Cyprinus</i>	
Species	<i>carpio</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Eggs: early cleavage stages Larvae: 7d, 1 cm Fry: 30 d, 2.5 cm	
Source of organisms	Fish farm	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h eggs until 2 d after mean hatch time	
Data for multiple times?	No	
Effect 1	Mortality of eggs to larvae	Using different life stages
Control response 1	No mortality	
Temperature	24 ± 1 °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Tap water	
pH	7.5 ± 0.2	
Hardness	272 ± 2 mg/L as CaCO ₃	
Alkalinity	NR	
Conductivity	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Kaur & Dhawan 1993	<i>C. carpio</i>
Parameter	Value	Comment
Dissolved Oxygen	5.5 ± 0.5 mg/L	~66% saturation
Feeding	None	
Purity of test substance	50%	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	No solvent used	
Concentration 1 Nom (µg/L)	30,000	Eggs: 3 reps with about 50 Larvae: 20 Fry: 10
Concentration 2 Nom (µg/L)	25,000	
Concentration 3 Nom (µg/L)	20,000	
Concentration 4 Nom (µg/L)	15,000	
Concentration 5 Nom (µg/L)	10,000	
Concentration 6 Nom (µg/L)	5,000	
Concentration 7 Nom (µg/L)	1,000	
Concentration 8 Nom (µg/L)	100	
Control	Yes, water	
LC50s		Probit
Eggs	12,930 (10,810-15,450)	
Larvae	710 (240-1240)	
Fry	2100 (1220-3610)	

Toxicity Data Summary

Danio rerio

Ansari BA, Kumar K. 1986. Malathion Toxicity - Embryotoxicity and Survival of Hatchlings of Zebrafish (Brachydanio-Rerio). *Acta Hydrochimica Et Hydrobiologica* 14:567-570.

Relevance

Score: 75 (purity NR, No std method)

Rating: L

Reliability

Score: 60

Rating: L

Reference	Ansari & Kumar	<i>D. rerio</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Danio</i>	
Species	<i>rerio</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	eggs	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	216 h (9d)	
Data for multiple times?	72, 96, 120, 144, 168 h	
Effect 1	Hatchability (72 h)	
Control response 1	100% hatched	
Effect 2	Survival (other time points)	
Control response 2	100%	
Temperature	26 ± 1 °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Dechlorinated (probably tap)	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Ansari & Kumar	<i>D. rerio</i>
Parameter	Value	Comment
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	NR (probably technical, since a solvent is used)	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone – amount NR	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	11 concentrations: in steps of 20 $\mu\text{g/l}$, in the range of 30 to 230 $\mu\text{g/l}$)	3 lots of 100 eggs
Control	Solvent	3 lots of 100 eggs
LC50: 72 h (hatchability)	165 (161- 169) $\mu\text{g/L}$	probit
LC50: 96 h (survival of larvae)	155 (150-160)	
LC50: 120 h (survival of larvae)	105 (101-108)	
LC50: 144 h (survival of larvae)	50 (46-53)	
LC50: 168 h (survival of larvae)	35 (27-44)	

Other notes:

Appendix, Section 2: Studies rated RL, LR, LL

Toxicity Data Summary

Danio rerio

Study: Cook, L.W., C.J. Paradise, and B. Lom. 2005. The Pesticide Malathion Reduces Survival and Growth in Developing Zebrafish. Environ.Toxicol.Chem. 24(7):1745-1750.

Relevance: SURVIVAL, LENGTH

Score: 90 (No std method)

Rating: R

Reliability

Score: 69.5

Rating: L

Relevance: EYE DIAMETER, ABDOMINAL AREA

Score: 75 (No std method, Endpoint)

Rating: L

Reliability

Score: 69.5

Rating: L

Relevance: HATCHING

Score: 75 (No std method, No values)

Rating: L

Reliability

Score: 69.5

Rating: L

Reference	Cook et al. 2005	<i>D. rerio</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Danio</i>	
Species	<i>rerio</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Eggs	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	5d	
Data for multiple times?	72 h and 5 d	
Effect 1	Survival	
Control response 1	>90%	
Effect 2	Hatching	No sat. sig. values
Control response 2	100% in 96 h	
Effect 3	Body length	
Control response 3	3.5 mm	
Effect 4	Eye diameter	Solvent had a sig.

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Cook <i>et al.</i> 2005	<i>D. rerio</i>
Parameter	Value	Comment
Control response 4	0.3 mm	effect so results not included
Effect 5	Abdominal cavity area	
Control response 5	0.23 mm ²	
Temperature	28 °C	
Test type	Static	
Photoperiod/light intensity	Darkness	
Dilution water	Filtered tap water	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	99%	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	0.03% , ~0.3 mL/L	
Concentration 1 Nom (µg/L)	3000	2-3reps w/ 18-24 per
Concentration 2 Nom (µg/L)	2500	2-3reps w/ 18-24 per
Concentration 3 Nom (µg/L)	2000	2-3reps w/ 18-24 per
Concentration 4 Nom (µg/L)	1500	2-3reps w/ 18-24 per
Concentration 5 Nom (µg/L)	1000	2-3reps w/ 18-24 per
Concentration 6 Nom	500	2-3reps w/ 18-24 per
Control	Dilution water and solvent controls	9 reps with 18-24 per
NOEC; <u>SURVIVAL</u>	2000 ug/L	Method: ANOVA p: =0.009 MSD: NR
LOEC;	2500	
MATC (GeoMean NOEC,LOEC)	2236	
% control at NOEC	100%	
% of control LOEC	84%	
NOEC; <u>LENGHT</u>	1500	Method: ANOVA p: <0.0001 MSD: NR
LOEC;	2000	
MATC (GeoMean NOEC,LOEC)	1732	
% control at NOEC	Can est. in graph	
% of control LOEC	Can est. in graph	
NOEC; <u>ABDOMINAL AREA</u>	2000	Method: ANOVA p: < 0.017 MSD: NR
LOEC;	2500	
MATC (GeoMean NOEC,LOEC)	2236	
% control at NOEC	Can est. in graph	
% of control LOEC	Can est. in graph	

Toxicity Data Summary

Danio rerio

Study: Nguyen, L.T.H., and C.R. Janssen. 2001. Comparative Sensitivity of Embryo-Larval Toxicity Assays with African Catfish (*Clarias gariepinus*) and Zebra Fish (*Danio rerio*). Environ.Toxicol. 16(6):566-571

Relevance-LC50, larval (12 d)

Score: 85 (control description & response NR)

Rating: L

Reliability

Score: 68

Rating: L

Relevance-Hatching, Larval survival (12 d)

Score: 85 (control description & response NR)

Rating: L

Reliability

Score: 67

Rating: L

Relevance-Abnormality (12 d)

Score: 70 (Endpoint, control description & response NR)

Rating: L

Reliability

Score: 67

Rating: L

Relevance- Egg survival, Growth (12 d)

Score: 70 (No values, control description & response NR)

Rating: L

Reliability

Score: 67

Rating: L

Reference	Nguyen & Janssen 2001	<i>D. rerio</i>
Parameter	Value	Comment
Test method cited	ASTM & OCED	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Danio</i>	
Species	<i>rerio</i>	Zebrafish
Family in North America?	Yes	
Age/size at start of test/growth phase	Eggs, blastula stage	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	12 d	
Data for multiple times?	No	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Nguyen & Janssen 2001	<i>D. rerio</i>
Parameter	Value	Comment
Effects	See list of LOECs	
Control responses	NR	
Temperature	25 ± 1 °C	
Test type	Static renewal (24 h)	
Photoperiod/light intensity	16:8 light: dark	
Dilution water	Aerated tap	
pH	7.2 ± 0.14	
Hardness	200 mg/L as CaCO ₃	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	8.3 ± 0.3	
Feeding	None	
Purity of test substance	98 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	NR	
Concentrations Nom (µg/L)	NR, but had 0.3 or 0.5 interval	4 reps with 1 per interval
Control	Mentioned in Stats section, type NR	Reps and # per (cell density for single
LC50, larval survival 12 d	1800 (1500-2000) µg/L	Trimmed Spearman Karber
LOEC-Embryo survival	10,000 µg/L	
LOEC-Hatching	3000	
LOEC- Larval survival	3000	
LOEC- Abnormality	3000	
LOEC- Growth	> 1000	
Hatching/ larval survival / abnormality	(below)	
NOEC	1000 µg/L	Method: ANOVA w/ Duncan's comp. p: 0.05, MSD: NR
LOEC	3000	
MATC (GeoMean NOEC,LOEC)	1700	
% control at NOEC	NR	
% of control LOEC	NR	

Other notes: Study has tests that were 5 d for *C. gariepinus* and 12 for *D. rerio*. These different durations were time until larvae begin exogenous feeding.

12 day LC50 test with *D. rerio*. Non-standard length. And for chronic endpoints test of 5 and 12 d are shorter than standard chronic tests

Appendix, Section 2: Studies rated RL, LR, LL

This study reports LOEC for 5 endpoints, but no NOECs in Table 1. Then, later in table 3, one final NOEC and LOEC is given for each species, the endpoints were inferred from Table 1. This summary was arranged similarly. Those NOEC only values are used that are missing NOEC values have lower relevance score (-15 relevance).

Toxicity Data Summary

Daphnia magna

Barata C, Solayan A, Porte A. 2004. Role of B-esterases in assessing toxicity of organophosphorus (chlorpyrifos, malathion) and carbamate (carbofuran) pesticides to *Daphnia magna*. *Aquatic Toxicology* 66: 125–139

Relevance- Mortality

Score: 82.5 (no standard method, no control response)

Rating: L

Reliability

Score: 60

Rating: L

Relevance- AChE inhibition

Score: 75 (no standard method, Endpoint)

Rating: L

Reliability

Score: 64.5

Rating: L

Reference	Barata et al. 2004	<i>D. magna</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Arthropoda	
Class	Branchiopoda	
Order	Cladoceran	
Family	Daphniidae	
Genus	<i>Daphnia</i>	
Species	<i>magna</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	fourth instar (4–5 days) juveniles	
Source of organisms	culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	24h	
Data for multiple times?	No for LC50 data/ yes for AchE data	
Effect 1	Mortality	
Control response 1	NR	
Effect 2	AchE inhibition	
Control response 2	0% Inhibition	
Temperature	20 °C	From culture conditions
Test type	Static	
Photoperiod/light intensity	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Barata <i>et al.</i> 2004	<i>D. magna</i>
Parameter	Value	Comment
Dilution water	ASTM hard water	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	95 %	
Concentrations measured?	2	
Measured is what % of nominal?	94%	Nom: 6; Meas: 5.69 ± 0.16 Nom :12; Meas: 11.50 ± 0.21
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	<1mL/L	
Concentration 1 Nom/Meas (µg/L)	4-5 concentrations including 6 and 12 nM	20 total ?Reps ?per
Control	solvent	Reps and # per (cell density for single
LCx; indicate calculation method	12.38 (7.34-15.74) nM 4.09 (2.42 - 5.19) µg/L	Nonlinear regression
IC50x; indicate calculation method	6.5 (5.7-7.5) nM 2.14 µg/L	AchE inhibition

Conversion of units:

$$\frac{12.38 \text{ nM}}{\text{L}} \times \frac{1 \text{ M}}{1,000,000,000 \text{ nM}} \times \frac{330.35 \text{ g}}{\text{M}} \times \frac{1,000,000 \text{ ug}}{\text{g}} = 4.09 \text{ ug/L}$$

Concludes that AChE inhibition levels higher than 50% can be considered of environmental concern to *Daphnia* species.

Survival of *D. magna* juveniles exposed to organophosphorous pesticides was impaired at inhibition levels of AChE higher than 50%. More specifically, 56 and 80% AChE inhibition was needed to impair survival 10 and 50%, respectively.

LC50 is 24 h but time course shows 2.14 µg/L causing greater than 50% mortality at 48h (maybe, it is difficult to tell if this is 48h) (Fig3). AchE activity related to acute toxicity. 50% AchE inhibition equates to LC10 (approximately, but LC10 not standard acute value. And this data is not appropriate as a chronic endpoint because it is related to very short term survival. So AchE data not very useful

Toxicity Data Summary

Daphnia magna

Study: Burgess D (1989a) Acute flow-through toxicity of cythion 57% EC to *Daphnia magna*: report n° 37394. Unpublished study Analytical Bio-Chemistry labs. MRID 41029701.

Relevance

Score: 85

Rating: L

Reliability

Score: 88

Rating: R

MRID 41029701	Burgess 1989a	<i>D. magna</i>
Parameter	Value	Comment
Test method cited	EPA 660 / 3-75-009 APHA 1980	
Phylum	Arthropoda	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	<i>Daphnia</i>	
Species	<i>Daphnia magna</i>	
Family in North America?	yes	
Age/size at start of test/growth phase	Neonates (<24hrs)	
Source of organisms	ABC labs in house culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	yes	
Test vessels randomized?	NR	
Test duration	48hrs	
Data for multiple times?	24 and 48hr	
Effect 1	Mortality (absence of movement)	
Control response 1	No effect	
Temperature	19 – 20 oC	
Test type	Flow through	
Photoperiod/light intensity	16:8 L:D (30min transition) 50-70 footcandles	
Dilution water	RO +ABC well water	
pH	7.3 - 7.9	
Hardness	176 mg/L	

Appendix, Section 2: Studies rated RL, LR, LL

MRID 41029701	Burgess 1989a	<i>D. magna</i>
Parameter	Value	Comment
Alkalinity	180 mg/L	
Conductivity	320 uMHOS/cm	? units
Dissolved Oxygen	9.0 – 9.4 mg/L	
Feeding	NR	
Purity of test substance	57 % malathion (Cythion)	
Concentrations measured?	yes	
Measured is what % of nominal?	70% (60-94%)	
Chemical method documented?	yes	
Concentration of carrier (if any) in test solutions	NR	
Concentration 1 Nom/Meas (µg/L)	5/4.7	4 x 10 daphnids
Concentration 2 Nom/Meas (µg/L)	2.5/1.7	4 x 10 daphnids
Concentration 3 Nom/Meas (µg/L)	1.3/0.92	4 x 10 daphnids
Concentration 4 Nom/Meas (µg/L)	0.6/0.36	4 x 10 daphnids
Concentration 5 Nom/Meas (µg/L)	0.3/0.19	4 x 10 daphnids
Control (µg/L)	<0.044	
LC50 (95% CI) (µg/L)	2.2 (48hr) (1.9-2.5)	Moving average
NOEC (95% CI) (µg/L)	0.19 (48hr)	
LOEC (95% CI) (µg/L)	0.36 (48hr)	
MATC (GeoMean NOEC,LOEC)	0.26	
% control at NOEC	NR	

Toxicity Data Summary

Daphnia magna

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>D. magna</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Arthropoda	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	<i>Daphnia</i>	
Species	<i>magna</i>	
Found in	N. America	
Age/size at start of test/growth phase	First Instar	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>D. magna</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Immobilization	
Control response 1	NR	No control responses reported
Temperature	15 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported, at least 10 organisms used for each concentration
LC50 (95% ci)	1.0 (0.7-1.4) ug/L	Litchfield & Wilcoxon (1949)

Appendix, Section 2: Studies rated RL, LR, LL

Daphnia magna

Toxicity Data Summary

Printes LB, Callaghan A. 2004. A comparative study on the relation ship between acetylcholinesterase activity and acute toxicity in *Daphnia magna* exposed to anticholinesterase insecticides. *Environ Toxicol Chem* 23:1241-1247.

Rating:

Score: 82.5 (not std. method, controls not described)

Rating: L

Reliability

Score: 64.5

Rating: R

Printes & Callaghan 2004		<i>D. magna</i>
Parameter	Value	Comment
Test method cited	OECD, ASTM	
Phylum	Arthropoda	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	<i>Daphnia</i>	
Species	<i>magna</i>	
Native to	North America	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	immobility	
Control response 1	0 %	From Fig. 1
Effect 2	AChE inhibition	
Control response 2	0 %	From Fig. 1
Temperature	20 ± 2 C	
Test type	Static	
Photoperiod/light intensity	dark	
Dilution water	ASTM hard water	Credit for acceptability for hardness, alkalinity conductivity, and pH
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Printes & Callaghan 2004		<i>D. magna</i>
Parameter	Value	Comment
Dissolved Oxygen	NR	
Feeding	none	
Purity of test substance	98.6	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	0.5mL/L ethanol	
Concentrations Nom/Meas (µg/L)	1.5 – 8.0 µg/L	Reps: 6, w/ 20 per or total? 3reps for AChE assays
Control	Not described	Reps: 4 w/5 per
EC50 mobility (95% ci)	3.6 (3.35 to 3.89) µg/L	Probit
IC50 AchE ± Std. Error	3.1 (±0.5) µg/L	Linear regression

From Table 2, malathion EC50

$$10.56 \text{ pM} = \frac{10.56 \text{ pmol}}{\text{L}}$$

$$\frac{10.56 \text{ pmol}}{\text{L}} \times \frac{1 \text{ mol}}{1000,000,000,000} \times \frac{330.35 \text{ g}}{\text{mol}} \times \frac{1000,000 \text{ ug}}{\text{g}} = 0.00348 \text{ ug/L}$$

*** Emailed author about possible problem with units Feb 10, 2009,
Dra. Liane Biehl Printes Replied March 03, 2009 -Units are incorrect, off by factor of
1000. correct values are shown in summary table.

Toxicity Data Summary

Daphnia pulex

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>D. pulex</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Arthropoda	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	<i>Daphnia</i>	
Species	<i>pulex</i>	
Found in	N. America	
Age/size at start of test/growth phase	First Instar	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>D. pulex</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Immobilization	
Control response 1	NR	No control responses reported
Temperature	15 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported, at least 10 organisms used for each concentration
LC50 (95% ci)	1.8 (1.4-2.4) ug/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Euphlyctis hexadactylus (formerly *Rana hexadactyla*)

Study: Khangarot, B.S., A. Sehgal, and M.K. Bhasin. 1985. "Man and Biosphere" - Studies on the Sikkim Himalayas. Part 6: Toxicity of Selected Pesticides to Frog Tadpole *Rana hexadactyla* (Lesson). Acta Hydrochim.Hydrobiol. 13(3):391-394

Relevance

Score: 75 (50% formulation, No std method)

Rating:L

Reliability

Score: 65.5

Rating: L

Reference	Khangarot <i>et al.</i> 1985	<i>E. hexadactylus</i>
Parameter	Value	Comment
Test method cited	APHA, only for dilutions	
Phylum	Chordata	
Class	Amphibia	
Order	Anura	
Family	Ranidae	
Genus	<i>Euphlyctis</i>	
Species	<i>hexadactylus</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	20 mm (15-25mm) 0.5 g (0.35-0.80 g)	
Source of organisms	Field	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	No mortality	
Temperature	14 (12-17) °C	
Test type	Static renewal , every 24 h	
Photoperiod/light intensity	NR	
Dilution water	NR	
pH	6.2 (6.0-6.4)	
Hardness	20 (15-35) ppm as CaCO ₃	
Alkalinity	25 (20-40) ppm as Ca CO ₃	
Conductivity	NR	
Dissolved Oxygen	5.5-8ppm	
Feeding	None	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Khengarot <i>et al.</i> 1985	<i>E. hexadactylus</i>
Parameter	Value	Comment
Purity of test substance	50% (Commercial)	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	Concentrations NR, at least 7 concentrations	3 reps with 10 each
Control	Solvent	Reps and # per (cell density for single
LC50; 24 h	0.846 (0.798-0.94) $\mu\text{g/L}$	Probit/ Harris
LC50; 48 h	0.613 (0.55-0.69)	
LC50; 72 h	0.613 (0.55-0.69)	
LC50; 96 h	0.59 (0.43-0.78)	

Other notes:

Concentrations in ppb = $\mu\text{g/L}$

Toxicity Data Summary

Gambusia affinis

Milam CD, Farris JL, Wilhide JD. 2000. Evaluating mosquito control pesticides for effect on target and nontarget organisms. Archives of Environmental Contamination and Toxicology 39(3):324-328.

Relevance

Score: 75 (Purity NR, Control response NR)

Rating: L

Reliability

Score: 60

Rating: L

Reference	Milam <i>et al.</i> 2000	<i>G. affinis</i>
Parameter	Value	Comment
Test method cited	EPA , APHA	fathead minnow method
Phylum	Chordata	
Class	Actinopterygii	
Order	Cyprinodontiformes	
Family	Poeciliidae	
Genus	<i>Gambusia</i>	
Species	<i>affinis</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Adult	
Source of organisms	Filed collected	
Have organisms been exposed to contaminants?	States area had no exposure to pesticides	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Survival	
Control response 1	No adverse effects to ditch receiving water	
Temperature	32 °C	
Test type	Static	
Photoperiod/light intensity	LD 14:10	
Dilution water	ambient ditch water	States no exposure to pesticides
pH	NR	Water chemistry parameters were measured as a requirement for
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Milam <i>et al.</i> 2000	<i>G. affinis</i>
Parameter	Value	Comment
Dissolved Oxygen	NR	all test methods (U.S. EPA 1993; APHA 1995).
Feeding	None	
Purity of test substance	NR	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	NR	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	NR	4 Reps and 5 per
Control	Water only	4 Reps and 5 per
LC _x ; indicate calculation method	1230 ($\mu\text{g/L}$)	Probit analysis or trimmed Spearman Karber

Other notes:

Toxicity Data Summary

Gambusia affinis

Naqvi SM, Hawkins R. 1988. Toxicity of Selected Insecticides (Thiodan, Security, Spartan, and Sevin) to Mosquitofish, *Gambusia affinis*. *Bull Environ Contam Toxicol* 40(5):779-784.

Relevance

Score: 75 (Formulation, No Std method)

Rating: L

Reliability

Score: 72.5

Rating: L

Reference	Naqvi & Hawkins 1988	<i>G. affinis</i>
Parameter	Value	Comment
Test method cited	No	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cyprinodontiformes	
Family	Poeciliidae	
Genus	<i>Gambusia</i>	
Species	<i>affinis</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Adult: 0.289 + 0.031 g, 2.76 + 0.09 cm	
Source of organisms	ditch	Baton Rouge, Louisiana
Have organisms been exposed to contaminants?	No, did though to be pesticide free	
Animals acclimated and disease-free?	Yes acclimated, had some parasites- see notes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	1.7 % mortality	
Temperature	20 ± 3 °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Aged (de-chlorinated) tap	
pH	7.8	
Hardness	120 mg/L	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	6.5 -7.0 mg/L	
Feeding	No	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Naqvi & Hawkins 1988	<i>G. affinis</i>
Parameter	Value	Comment
Purity of test substance	56.1% formulation	Security R
Concentrations measured?	No	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	None (used formulation)	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	0.5	6 Reps w 10 per rep
Concentration 2 Nom/Meas ($\mu\text{g/L}$)	0.4	6 Reps w 10 per rep
Concentration 3 Nom/Meas ($\mu\text{g/L}$)	0.3	6 Reps w 10 per rep
Concentration 4 Nom/Meas ($\mu\text{g/L}$)	0.2	6 Reps w 10 per rep
Concentration 5 Nom/Meas ($\mu\text{g/L}$)	0.1	6 Reps w 10 per rep
Control	Water only	6 Reps w 10 per rep
LC50	200 (190-250) $\mu\text{g/L}$	Probit

Other notes:

Dead fish turned bluish-grey in color and many of them were observed live nematode worms protruding from the body

Toxicity Data Summary

Gammarus fasciatus

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>G. fasciatus</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Arthropoda	
Class	Malacostraca	
Order	Amphipoda	
Family	Gammaridae	
Genus	<i>Gammarus</i>	
Species	fasciatus	
Found in	N. America	
Age/size at start of test/growth phase	Mature	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>G. fasciatus</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	21 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported States 2 reps for larger fish? at least 10 organisms used for each concentration
LC50 (95% ci)	0.76 (0.63-0.92) ug/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Gammarus fasciatus

Study: Sanders HO. 1972. Toxicity of some insecticides to four species of Malacostracan crustaceans. Technical Papers of the Bureau of Sport Fisheries and Wildlife. United States Department of the Interior, Fish and Wildlife Service. Washington, D.C. MRID 05017538.

Relevance

Score: 92.5 (Control response NR)

Rating: R

Reliability

Score: 60.5

Rating: L

Reference	Sanders 1972	<i>G. fasciatus</i>
Parameter	Value	Comment
Test method cited	NR	Pub. before std methods
Phylum	Arthropoda	
Class	Malacostraca	
Order	Amphipoda	
Family	Evanioidae	
Genus	<i>Gammarus</i>	scud
Species	<i>fasciatus</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	NR	
Source of organisms	Local streams and ponds	Not described further
Have organisms been exposed to contaminants?	Cannot determine-maybe	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24, 48, 96, 120 h	
Effect 1	Mortality	
Control response 1	NR	
Temperature	Static: 21 ± 0.5 °C Flow thru: 18- 21 °C	
Test type	Acute -Static & & Intermittent-flow	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted or Well water ('Raw water')	
pH	Reconstituted: 7.1 Well water: 7.4	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Sanders 1972	<i>G. fasciatus</i>
Parameter	Value	Comment
Hardness	Reconstituted: 10.2 ppm Ca & Mg Well water: 368 ppm Ca & Mg	
Alkalinity	Reconstituted: 35 ppm methyl orange Well water: 260 ppm methyl orange	
Conductivity	NR	
Dissolved Oxygen	8 ppm	
Feeding	NR-none	
Purity of test substance	w/o emulsifying agents-technical grade	Table 3 stats 'technical grade'
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 1mL/L ethanol	
Concentrations Nom (µg/L)	5 concentrations	2 Reps, 10 per rep
Control	'untreated' so water only (?)	2 Reps, 10 per rep
Static		
LC50; 24 h (95% CL); reconstituted	3.8 (2.7-5.3) µg/L	probit
LC50; 96 h; reconstituted water	0.76 (0.63-0.92) µg/L	
Well water; LC50; 24 h (95% CL)	3.2 (2.0-5.1) µg/L	
Well water; LC50; 48 h	2.0 (NR) µg/L	
Well water; LC50; 96 h (95% CL)	0.90 (0.64-1.3) µg/L	
Well water; LC50; 120 h	0.48 (NR) µg/L	
Intermittent-flow		
Well water; LC50; 24 h	1.2 µg/L	95% CL NR
Well water; LC50; 48 h	0.5 µg/L	
Well water; LC50; 96 h	0.5 µg/L	
Well water; LC50; 120 h	0.5 µg/L	

Other notes: prefer flow though vs. static so **Intermittent-flow 96 h LC50** = 0.5 µg/L is preferred value, but reported all values in supplemental table

Toxicity Data Summary

Heteropneustes fossilis (also *Saccobranthus fossilis*)

Study: Verma, S.R., S.K. Bansal, A.K. Gupta, N. Pal, A.K. Tyagi, M.C. Bhatnagar, V. Kumar, and R.C. Dalela. 1982. Bioassay Trials with Twenty Three Pesticides to a Fresh Water Teleost, *Saccobranthus fossilis*. *Water Res.* 16(5):525-529.

Relevance

Score: 85 (50% formulation)

Rating: L

Reliability

Score: 63

Rating: L

Study used malathion from two different manufactures:

"Malatox" (brand name formation) which was 50% malathion and "Malathion" which was reportedly 50% malathion.

The authors note later that the malathion from two different manufactures tested had different toxicities and this is seen in the somewhat different LC50s.

Reference	Verma <i>et al.</i> 1982	<i>H. fossilis</i>
Parameter	Value	Comment
Test method cited	APHA	
Phylum	Chordata	
Class	Actinopterygii	
Order	Siluriformes	
Family	Heteropneustidae	
Genus	<i>Heteropneustes</i>	
Species	<i>fossilis</i>	
Family in North America?	Yes	Invasive in Florida
Age/size at start of test/growth phase	50-75 mm, 5-10 g	
Source of organisms	Near by ponds	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24, 48, 72, 96 h	
Effect 1	Mortality	
Control response 1	No Mortality	
Temperature	18.2 ± 2 °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Source NR	
pH	7.2 ± 0.2	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Verma <i>et al.</i> 1982	<i>H. fossilis</i>
Parameter	Value	Comment
Hardness	NR	
Alkalinity	59 mg/L as CaCO ₃	
Conductivity	NR	
Dissolved Oxygen	4.84 mg/L	at 18 C 4.8 mg/L is ~ 50% saturation
Feeding	None	
Purity of test substance	50 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Yes, acetone: ethanol, concentration NR	
Concentrations Nom (µg/L)	NR	2 reps with 10 per
Control	Yes, solvent control	2 reps with 10 per
LC50s	Malatox	
24 h	11,750	Probit
48 h	10,960	Probit
72 h	10,580	Probit
96 h	9,790	Probit
	Malathion	
24 h	18,490	Probit
48 h	17,180	Probit
72 h	16,180	Probit
96 h	15,000	Probit

Toxicity Data Summary

Hexagenia

Carlson, C.A. Effects of Three Organophosphorus Insecticides on Immature *Hexagenia* and *Hydropsyche* of the Upper Mississippi River. *Trans.Am.Fish.Soc.* 95(1):1-5.1966

Relevance
Score: 100
Rating: R

Reliability
Score: 64
Rating: L

Reference	Carlson 1966	<i>Hexagenia</i>
Parameter	Value	Comment
Test method cited	APHA	
Phylum	Arthropoda	
Class	Insecta	
Order	Ephemeroptera	
Family	Ephemeridae	
Genus	<i>Hexagenia</i>	mayfly
Species		
Family in North America?	Yes	
Age/size at start of test/growth phase	naiads	
Source of organisms	Mississippi River, near Keokuk, IA	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	Not properly-1-2 h	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	24 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	< 3.3%	
Temperature	23-25 °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Mississippi River water	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	8.0-2.8	
Feeding	None	
Purity of test substance	95%	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Carlson 1966	<i>Hexagenia</i>
Parameter	Value	Comment
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.56 mL/L (calculated from stock and reported concentrations)	
Concentration 1 Nom (µg/L)	180-5,600 µg/L	2 reps w 5 per
Control	Water only	2 reps w 5 per
LC50	631	Graphical interpolation
LC50 (95% CL)	631 (429-834)	Probit

Other notes:

Use values by probit- the two are the same, but probit provide CL

Toxicity Data Summary

Hydropsyche

Carlson, C.A. 1966. Effects of Three Organophosphorus Insecticides on Immature Hexagenia and Hydropsyche of the Upper Mississippi River. Trans.Am.Fish.Soc. 95(1):1-5.

Relevance
Score: 100
Rating: R

Reliability
Score: 67
Rating: L

Reference	Carlson 1966	<i>Hydropsyche</i>
Parameter	Value	Comment
Test method cited	APHA	
Phylum	Arthropoda	
Class	Insecta	
Order	Trichoptera	
Family	Hydropsychidae	
Genus	<i>Hydropsyche</i>	
Species		
Family in North America?	Yes	
Age/size at start of test/growth phase	naiads	
Source of organisms	Mississippi River, near Keokuk, IA	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	Not properly-1-2 h	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	24 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	< 3.3%	
Temperature	22-24 °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Mississippi River water	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	7.0-6.3	
Feeding	None	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Carlson 1966	<i>Hydropsyche</i>
Parameter	Value	Comment
Purity of test substance	95%	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.56 mL/L (calculated from stock and reported concentrations)	
Concentration 1 Nom (µg/L)	1.8-32.0 µg/L	2 reps w 5 per
Control	Water only	2 reps w 5 per
LC50	12.9	Graphical interpolation
LC50 (95% CL)	12.3 (10.2-15.1)	Probit

Other notes:

Use values by probit- the two are the same, but probit provide CL

Toxicity Data Summary

Hydropsyche

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>Hydropsyche</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Arthropoda	
Class	Insecta	
Order	Trichoptera	
Family	Hydropsychidae	
Genus	<i>Hydropsyche</i>	
Species		
Found in	N. America	
Age/size at start of test/growth phase	juvenile	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>Hydropsyche</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	15 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported, at least 10 organisms used for each concentration
LC50 (95% ci)	5 (2.9-8.6) µg/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Ictalurus punctatus

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>I. punctatus</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Chordata	
Class	Actinopterygii	
Order	Siluriformes	
Family	Ictaluridae	
Genus	<i>Ictalurus</i>	
Species	<i>punctatus</i>	Channel catfish
Found in	N. America	
Age/size at start of test/growth phase	1.5 g	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>I. punctatus</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	12 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported (states 2 reps for ‘larger’ fish at least 10 organisms used for each concentration)
LC50 (95% ci)	8970 (6780-12,000) µg/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Isoperia

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>Isoperia</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Arthropoda	
Class	Insecta	
Order	Plecoptera	Stone fly
Family	Perlodidae	
Genus	<i>Isoperia</i>	
Species		
Found in	N. America	
Age/size at start of test/growth phase	Second year class	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>Isoperia</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	15 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported, at least 10 organisms used for each concentration
LC50 (95% ci)	0.69 (0.20-2.4) µg/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Labeo rohita

Study: Patil, V. K., David, M., 2008. Behaviour and Respiratory Dysfunction as an Index of Malathion Toxicity in the Freshwater Fish, *Labeo rohita* (Hamilton). Turkish Journal of Fisheries and Aquatic Sciences. 8, 233-237.

Relevance: Acute, LC50

Score: 77.5 (50% formulation, Control response NR)

Rating: L

Reliability

Score: 73.5

Rating: R

Relevance: Sublethal endpoints

Score: 55 (50% formulation, No value, Endpoint)

Rating: N

Reference	Patil & David 2008	<i>L. rohita</i>
Parameter	Value	Comment
Test method cited	APHA, water chemistry	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Labeo</i>	
Species	Rohita	
Family in North America?	Yes	
Age/size at start of test/growth phase	fingerlings weighing 5±2 g and average length of 7.5±0.23 cm	
Source of organisms	State Fisheries Dept.	Assuming this is a hatchery
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h (acute) 15 d (sublethal)	
Data for multiple times?	For O ₂ consumption	
Effect 1	Mortality	Acute
Control response 1	NR	
Effect 2	Oxygen consumption	Sublethal
Control response 2	0.1662 ml of oxygen consumed/g wet wt. of fish/h	
Effect 3	Behavior	Sublethal

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Patil & David 2008	<i>L. rohita</i>
Parameter	Value	Comment
Control response 3	No data for this endpoint	
Temperature	24±2°C	
Test type	Static renewal	
Photoperiod/light intensity	12:12 h light: dark	
Dilution water	dechlorinated tap water	
pH	7.1±0.2	
Hardness	23.4±3.4 mg as CaCO ₃ /L,	
Alkalinity	NR	
Conductivity	< 10 µS _{cm} -1.	
Dissolved Oxygen	9.3±0.8 mg/L,	
Feeding	None	
Purity of test substance	50 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	No solvent mentioned	
Concentrations Nom (µg/L)	Range 6.0 to 10.1 µl/L	6 reps with 10 per
Control	Yes	6 reps with 10 per
LC50; indicate calculation method	9.0 µl/L. (9.9828 - 8.1139)	Probit
NOEC; indicate calculation method, significance level (p-value) and minimum significant difference (MSD)	NR	Method: Duncan's multiple range test p: 0.5 MSD: NR
LOEC; indicate calculation method	Effects at 0.9 µl/L but only tested two concentrations	
MATC (GeoMean NOEC,LOEC)	Can not calculate	
% control at NOEC	Can not calculate	
% of control LOEC	0.1588/0.1662 at d 15	

Other notes: Also no dose response for chronic data, only 2 concentrations tested.

Toxicity Data Summary

Lepomis cyanellus

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>L. cyanellus</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Centrarchidae	
Genus	<i>Lepomis</i>	
Species	<i>cyanellus</i>	Green sunfish
Found in	N. America	
Age/size at start of test/growth phase	1.1 g	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>L. cyanellus</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	12 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported (states 2 reps for 'larger' fish at least 10 organisms used for each concentration)
LC50 (95% ci)	175 (134-228) µg/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Lepomis macrochirus

Eaton JG. 1970. Chronic Malathion Toxicity to Bluegill (*Lepomis-Macrochirus-Rafinesque*). *Water Research* 4:673-684.

Relevance- ACUTE

Score: 82.5 (no std method, Control response NR)

Rating: L

Reliability

Score: 68

Rating: L

Relevance- CHRONIC -SPAWNING

Score: 75 (no std method, No values)

Rating: L

Reliability

Score: 77.5

Rating: R

Relevance- CHRONIC- SPINAL DEFORMATIES

Score: 67.5 (no std method, Control response NR, Endpoint)

Rating: N

Reliability

Score: NA

Rating: NA

Relevance- CHRONIC- AChE Inhibition

Score: 75 (no std method, Endpoint)

Rating: L

Reliability

Score: 77.5

Rating: R

Relevance- CHRONIC- SURVIVAL

Score: 90 (no std method)

Rating: R

Reliability

Score: 77.5

Rating: R

Reference	Easton 1970	<i>L. macrochirus</i>
Parameter	Value	Comment
Test method cited	APHA for Water qual only	
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Centrarchidae	
Genus	<i>Lepomis</i>	
Species	<i>macrochirus</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	8 cm, 12g, about 1.5 y	
Source of organisms	Spring fed ponds	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	Acute: 96 h	Nov 11- Sept 5

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Easton 1970	<i>L. macrochirus</i>
Parameter	Value	Comment
	Chronic: 10 mo	
Data for multiple times?	NR	
Effect 1	Acute test-lethality	
Control response 1	NR	
Effect 2	Chronic –Reproduction: # spawning, %hatch, fry survival	No sig. effects seen
Control response 2	1.5 and 1.4 spawn/female, 93, 85% hatch survival, 700, 1400 # fry hatched	
Effect 3	Chronic spinal deformities	
Control response 3	NR	
Effect 4	Adult survival	
Control response 4	None by Sept 5, but fish that jumped out of tank	
Temperature	9-29 °C subject to ambient fluctuation over several months	
Test type	Flow-trough	
Photoperiod/light intensity	Ambient	
Dilution water	Described in a cited ref.	
pH	7.2-8.5	
Hardness	194-218 mg/L as CaCO ₃	
Alkalinity	144-186 mg/L as CaCO ₃	
Conductivity	372-526 umOhms	
Dissolved Oxygen	3.3-16.3 but mostly > 5 mg/L	
Feeding	Chronic: yes, acute: not	
Purity of test substance	95 %	
Concentrations measured?	Yes	
Measured is what % of nominal?	70-83%	
Chemical method documented?	Yes, GC ECD	
Concentration of carrier (if any) in test solutions	< 0.001 mg/L acetone <0.01 uL/L	
ACUTE	4-5 concentrations dilution factor of 0.75. Measured concentrations, but concentrations or % nom NR	10 fish /conc.
CHRONIC		
Concentration 1 Nom/Meas (µg/L)	80/66NR (all fish died)	15 fish per conc. in 1 tank, later split
Concentration 2 Nom/Meas (µg/L)	40/28NR (all fish died)	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Easton 1970	<i>L. macrochirus</i>
Parameter	Value	Comment
Concentration 3 Nom/Meas (µg/L)	20/14.6 (5/15 fish died)	into 2 tanks: 1 indoors and 1 outdoors
Concentration 4 Nom/Meas (µg/L)	10/7.4	
Concentration 5 Nom/Meas (µg/L)	5/3.6	
Concentration 6 Nom/Meas (µg/L)	2.5/ 1.6	
Concentration 7 Nom/Meas (µg/L)	1.25/ 0.7	
Control	Yes, dilution water only	Same as above
LC50	Test 1: 131 ug/L Test 2: 89 ug/L	Graphical interpolation
AChE Inhibition 52%	20/ 14.6 ug/L (Nom/Meas)	
AChE Inhibition 54%	10/7.4ug/L	
AChE Inhibition 67%	5/3.6	
AChE Inhibition 65%	2.5/ 1.6	
AChE Inhibition 79%	1.25/ 0.7	
NOEC; indicate calculation method, significance level (p-value) and minimum significant difference (MSD)	3.6 ug/L- spinal def. 7.4 ug/L - survival	Method: no stats, just observation p: NR MSD: NR
LOEC; indicate calculation method	7.4 ug/L-spinal def 14.6 ug/L- survival	
MATC (GeoMean NOEC,LOEC)	5.2 ug/L-spinal def 10.4 ug/L- survival	
% control at NOEC	NR	
% of control LOEC	NR	

Other notes:

Experiment started in glass tanks. Then fish were dived into indoor stainless steel tanks and outdoor wooden tanks to provide more room for spawning. Sex was not really distinguishable, so it ended up that males were mostly moved out side and most of those left inside were females. Outdoors (wooden tanks) 7 males to 2 females was a common sex ratio. Indoors the sex ratio was more variable in all the different concentrations (Table 4).

No effect of malathion on spawning is apparent from TABLE 5. Early (larval) fry survival in all but one case was nearly as good as or better than the controls, indicating that malathion in concentrations up to 20 ug/L had no effect on survival up to 4 days after hatch (TABLE 5).

Effects seen on adult survival:

"The 80-and 40-ug/L concentrations were discontinued after all the fish died. The lethality of the highest concentration was determined twice; 15 fish were killed in 14 days in the first test and in 16 days in the second. All 15 fish were killed in 54 days in the 40 ug/L tank. Two new concentrations, 1.25 and 2.5/~g 1-1, were added at this time lest none of the original ones would still be safe at the end of the chronic test period. The first death in 20 ug/L occurred on January 6 after 56 days of exposure, but

Appendix, Section 2: Studies rated RL, LR, LL

10 fish were still alive at the end of the test on September 5. The only other mortality in the test tanks resulted when a fish jumped out of the outdoor (wooden) control tank."

Although no adult fish were killed in the 10 ug /L tanks, two inside and three outside (one-third of the total) had spinal deformations, as did 60 per cent of those remaining alive in 20/~g 1-1. This is the basis for the NOEC and LOEC reported in the abstract. But reproduction not affected.

"As pointed out by WEISS (1959, 1961), LELAND (1968), GIBSON *et al* (1969), and others, the degree of inhibition by an organophosphate pesticide is dependent upon its concentration, the fish species involved, the duration of the exposure, and other factors not well understood."

Toxicity Data Summary

Lepomis macrochirus

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>L. macrochirus</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Centrarchidae	
Genus	<i>Lepomis</i>	
Species	macrochirus	Bluegill
Found in	N. America	
Age/size at start of test/growth phase	1.5 g	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>L. macrochirus</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	12 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported (states 2 reps for 'larger' fish at least 10 organisms used for each concentration)
LC50 (95% ci)	103 (87-122) µg/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Lepomis macrochirus

Study: Macek, K.J., C. Hutchinson, and O.B. Cope. 1969. The Effects of Temperature on the Susceptibility of Bluegills and Rainbow Trout to Selected Pesticides. Bull. Environ. Contam. Toxicol. 4(3):174-183

Relevance

Score: 82.5 (No standard method, Control response NR)

Rating: L

Reliability

Score: 64.5

Rating: L

Reference	Macek <i>et al.</i> 1969	<i>L. macrochirus</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Centrarchidae	
Genus	<i>Lepomis</i>	
Species	<i>macrochirus</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	0.6 – 1.5 g	
Source of organisms	Hatchery	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24 and 96 h	
Effect 1	Mortality	
Control response 1	NR	
Temperature	12.7 ± 0.6 °C 18.3 ± 0.6 °C 23.8 ± 0.6 °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted	
pH	7.1	
Hardness	NR, but ion concentrations given	
Alkalinity	35 ppm (methyl orange)	
Conductivity	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Macek <i>et al.</i> 1969	<i>L. macrochirus</i>
Parameter	Value	Comment
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	Technical grade	
Concentrations measured?	No	
Measured is what % of nominal?	NR	
Chemical method documented?	No	
Concentration of carrier (if any) in test solutions	Acetone concentration NR	
Concentrations 1 Nom ($\mu\text{g/L}$)	NR	2 reps with 10 per
Control	Solvent control	Reps and # per (cell density for single
LC50 24 h	In $\mu\text{g/L}$	probit
12.7 C	220 (200-240)	
18.3 C	140 (120-160)	
23.8 C	110 (97-1200)	
LC50 96 h		
12.7 C	120 (67-210)	
18.3 C	55 (51-59)	
23.8 C	46 (40-52)	

Toxicity Data Summary

Lepomis macrochirus

Pickering, Q.H., C. Henderson, and A.E. Lemke. 1962. The Toxicity of Organic Phosphorus Insecticides to Different Species of Warmwater Fishes. *Trans. Am. Fish. Soc.* 91:175-184.

Relevance

Score: 85 (control description & response NR)

Rating: L

Reliability

Score: 61.5

Rating: L

Reference	Pickering <i>et al.</i> 1962	<i>L. macrochirus</i>
Parameter	Value	Comment
Test method cited	APHA	
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Centrarchidae	
Genus	<i>Lepomis</i>	
Species	<i>macrochirus</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	1.5-2.5 in., 1-2 g,	
Source of organisms	Hatchery, except guppy: lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24,48 96 h	
Effect 1	Mortality	
Control response 1	NR	
Temperature	25 °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Soft water: 5:95 natural spring water: deionized water	
pH	7.4-7.5	These seem to be initial measurements, but says these
Hardness	20 mg/L	
Alkalinity	18 mg/L	
Conductivity	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Pickering <i>et al.</i> 1962	<i>L. macrochirus</i>
Parameter	Value	Comment
Dissolved Oxygen	8 mg/L	parameters ere monitored during tests also
Feeding	None	
Purity of test substance	100%	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone, concentration NR	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	Logarithmic series in quarter pints	2 reps and 5 per
Control	Not described	
LC50; indicate calculation method	Listed below	Graphical interpolation
Bluegill, 24 h	140	
Bluegill, 48 h	120	
Bluegill, 96 h	90	

Other notes:

Toxicity Data Summary

Lepomis microlophus

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>L. microlophus</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Centrarchidae	Redear Sunfish
Genus	<i>Lepomis</i>	
Species	<i>microlophus</i>	
Found in	N. America	
Age/size at start of test/growth phase	3.2 g	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>L. microlophus</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	24 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported (states 2 reps for 'larger' fish at least 10 organisms used for each concentration)
LC50 (95% ci)	62 (58-67) µg/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Lestes

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>Lestes sp.</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Arthropoda	
Class	Insecta	
Order	Odonata	
Family	Lestidae	
Genus	<i>Lestes</i>	
Species	NR	
Found in	N. America	
Age/size at start of test/growth phase	Juvenile	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>Lestes sp.</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	15 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported, at least 10 organisms used for each concentration
LC50 (95% ci)	10 (6.5-15) µg/L	Litchfield & Wilcoxon (1949)

Appendix, Section 2: Studies rated RL, LR, LL

Lestes congener

Toxicity Data Summary

Study: Federle PF, Collins WJ. 1976. Insecticide toxicity to three insects from Ohio ponds. Ohio J Sci 76: 19-24.

Relevance

Score: 90 (No standard method cited)

Rating: R

Reliability

Score: 61

Rating: L

Federle & Collins 1976		<i>L. congener</i>
Parameter	Value	Comment
Test method cited	No standard method cited	
Phylum	Arthropoda	
Class	Insecta	
Order	Odonata	
Family	Lestidae	
Genus	<i>Lestes</i>	damselfly
Species	<i>congener</i>	
Found in	N. America	
Age/size at start of test/growth phase	Late instar nymphs; 0.044 g	
Source of organisms	Farm Pond, Ohio St. Univ. campus; no pesticide spraying for 2 yr	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes; 24 hr in lab	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	LC50 for 24h only
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	6%	
Temperature	25 ± 2°C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Aerated tap water	
pH	7.4	
Hardness	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Federle & Collins 1976		<i>L. congener</i>
Parameter	Value	Comment
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	≥ 94%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	1% acetone (10 mL/L)	
Concentration 1 Nom	Four concentrations ranging from 0.001 – 1 mg/L	Reps: 1 w/10 per
Control	Solvent control	
LC50; 24h	300 ug/L	probit

Toxicity Data Summary

Limnephilus

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>Limnephilus sp.</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Arthropoda	
Class	Insecta	
Order	Trichoptera	
Family	Limnephilidae	
Genus	<i>Limnephilus</i>	caddisflies
Species	Sp.	
Found in	N. America	
Age/size at start of test/growth phase	Juvenile	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>Limnephilus sp.</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality/	
Control response 1	NR	No control responses reported
Temperature	15 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported, at least 10 organisms used for each concentration
LC50 (95% ci)	1.3 (0.8-2.0) µg/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Micropterus salmoides

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>M. salmoides</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Centrarchidae	
Genus	<i>Micropterus</i>	Largemouth bass
Species	<i>salmoides</i>	
Found in	N. America	
Age/size at start of test/growth phase	0.9 g	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>M. salmoides</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	18 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported (states 2 reps for 'larger' fish at least 10 organisms used for each concentration)
LC50 (95% ci)	285 (254-320) µg/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Moina macrocopa

Study: Wong C.K., Chu K.H. & Shum F.F. (1995). Acute and Chronic Toxicity of Malathion to the Fresh-Water Cladoceran *Moina-Macrocopa*. *Water Air and Soil Pollution*, 84, 399-405.

Relevance: ACUTE

Score: 60 (No std method, Control description & response NR, No values)

Rating: N

Relevance: CHRONIC

Score: 75 (No std method, No values)

Rating: L

Reliability

Score: 63.5

Rating: L

Reference	Wong <i>et al.</i> 1995	<i>M. macrocopa</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Arthropoda	
Class	Branchiopoda	
Order	Diplostraca	Or Cladoceran?
Family	Moinidae	
Genus	<i>Moina</i>	
Species	<i>macrocopa</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	< 18 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	72 h and 8 d	
Data for multiple times?	Can be estimated from graph	But error/variability not shown
Effect 1	Mortality (acute) 24-72 h	
Control response 1	NR	
Effect 2	longevity (chronic) 11 d	
Control response 2	50% mortality at 8 d	
Effect 3	# of broods (chronic) 11 d	
Control response 3	625 young	
Temperature	25 ± 2 °C	
Test type	Static renewal (every 24 h)	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Wong <i>et al.</i> 1995	<i>M. macrocopa</i>
Parameter	Value	Comment
Photoperiod/light intensity	Ambient, NR	
Dilution water	NR (filtered aquarium water)	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Yes, both acute and chronic	
Purity of test substance	81 % active ingredient	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	No carrier used, but some amount of solvent	initial compound only 81% a.i.
ACUTE		
Concentration 1 Nom/Meas (µg/L)	0.01	7 reps with 10 per
Concentration 2 Nom/Meas (µg/L)	0.10	7 reps with 10 per
Concentration 3 Nom/Meas (µg/L)	1.00	7 reps with 10 per
Concentration 4 Nom/Meas (µg/L)	5.00	7 reps with 10 per
Concentration 5 Nom/Meas (µg/L)	10.00	7 reps with 10 per
Concentration 6Nom/Meas (µg/L)	50.00	7 reps with 10 per
Control	No control in acute (?)	7 reps with 10 per
CHRONIC		
Concentration 1 Nom/Meas (µg/L)	0.01	3 reps with 10 per
Concentration 2 Nom/Meas (µg/L)	0.10	3 reps with 10 per
Concentration 3 Nom/Meas (µg/L)	1.00	3 reps with 10 per
Concentration 4 Nom/Meas (µg/L)	10.00	3 reps with 10 per
Control	Yes and solvent control* 10 µg/L xylene	3 reps with 10 per
LCx; indicate calculation method	NR	Can not calculate LC50 from graph. only ave. shown, no error/variability
ECx; indicate calculation method	NR	
NOEC	NR	Method: Mann-Whitney p: < 0.01 MSD: NR
LOEC; indicate calculation method	0.01 µg/L	
MATC (GeoMean NOEC,LOEC)	Can not calculate	
% control at NOEC	Can not calculate	
% of control LOEC	About 80%, (longevity, LT%, of about 6 vs. 8 d	

Toxicity Data Summary

Mysidopsis bahia

Study: Cripe GM, Ingley-Guezou A, Goodman LR, Forester J. 1989. Effect of Food availability on the acute toxicity of four chemicals to *Mysidopsis bahia* (Mysidacea) in static exposures. *Environmental Toxicology and Chemistry* 8:333-358.

Relevance

Score: 85 (Saltwater)

Rating: L

Reliability

Score: 87.5

Rating: R

Reference	Cripe et al. 1989	<i>M. bahia</i>
Parameter	Value	Comment
Test method cited	Toxic Substances Control Act Guide lines	
Phylum	Arthropoda	
Class	Crustacea	
Order	Mysida	
Family	Mysidae	
Genus	<i>Mysidopsis</i>	
Species	<i>bahia</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	≤ 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes, same conditions as culture	
Animals randomized?	Yes	
Test vessels randomized?	Yes	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	5.3% (3.3 SD) % mortality	Except 15%, where fed 60 Artemia/day
Temperature	25 ± 1 ° C	
Test type	Static	
Photoperiod/light intensity	14 L:10 D	
Dilution water	Seawater filtered 20 uM, diluted with charcoal filtered freshwater	Water from Santa Rosa Sound, Gulf Breeze FL
pH	7.8-8.3	
Hardness	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	<i>Cripe et al. 1989</i>	<i>M. bahia</i>
Parameter	Value	Comment
Alkalinity	NR	
Conductivity	20 ppt	Salinity
Dissolved Oxygen	5.9- 7.0 mg/L	
Feeding	Summarized tests without	Feeding was part of experiment
Purity of test substance	94.5 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	0.1 mL/L triethylene glycol	
Concentration 1 Nom (µg/L)	2.9 (states 7 concentrations used but give 5 Nom-?)	2 Reps, 10 per beaker
Concentration 2 Nom (µg/L)	4.1	2 Reps, 10 per rep
Concentration 3 Nom (µg/L)	5.9	2 Reps, 10 per rep
Concentration 4 Nom (µg/L)	8.4	2 Reps, 10 per rep
Concentration 5 Nom (µg/L)	12.0	2 Reps, 10 per rep
Control	Sea water and solvent control	2 Reps, 10 per rep
LC50; Fed 10 Artemia/d; Test 1	4.0 (3.3-4.8)	Trimmed Spearman-Kärber
LC50; Fed 10 Artemia/d; Test 2	3.2 (2.7-3.7)	Same as above
LC50; Fed 60 Artemia/d; Test 1	5.2 (4.8- 5.5)	Same as above
LC50; Fed 60 Artemia/d; Test 2	5.7 (5.1-6.4)- Control mortality 15%	Same as above
LC50; Fed 110 Artemia/d; Test 1	5.0 (4.2-5.9)	Same as above
LC50; Fed 110 Artemia/d; Test 2	5.4 (4.8-6.1)	Same as above

Feeding regime:

10 Artemia/mysid/day (A/m/d) –supports survival, but min growth

60 (A/m/d) - midpoint food amount

110 (A/m/d) – excess of food.

60 and 110 regime significantly different than 10, indicating lack of food adversely affects mysid static test.

EPA's 'OPPTS 850.1035-Mysid Acute Toxicity Test' and EPA's 'Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms' standard methods state feed mysids daily during test (unlike other species).

Recommend including values for 60 A/m/d in report table. The second value (5.7) loses points for acceptable control survival so would score 78.2 Relevance and 83 Reliability. Still LR.

Appendix, Section 2: Studies rated RL, LR, LL

Notonecta undulata

Toxicity Data Summary

Study: Federle PF, Collins WJ. 1976. Insecticide toxicity to three insects from Ohio ponds. Ohio J Sci 76: 19-24.

Relevance

Score: 90 (No standard method cited)

Rating: R

Reliability

Score: 61

Rating: L

Federle & Collins 1976		<i>N. undulata</i>
Parameter	Value	Comment
Test method cited	No standard method cited	
Phylum	Arthropoda	
Class	Insecta	
Order	Hemiptera	
Family	Notonectidae	
Genus	<i>Notonecta</i>	backswimmer
Species	<i>undulata</i>	
Found in	N. America	
Age/size at start of test/growth phase	Late instar nymphs; 0.066 g	
Source of organisms	Farm Pond, Ohio St. Univ. campus; no pesticide spraying for 2 yr	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes; 24 hr in lab	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24, 48, 72, 96 h	
Effect 1	Mortality	
Control response 1	4%	
Temperature	25 ± 2°C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Aerated tap water	
pH	7.4	
Hardness	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Federle & Collins 1976		<i>N. undulata</i>
Parameter	Value	Comment
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	≥ 94%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	0.1% acetone (1 mL/L)	
Concentration 1 Nom	Four concentrations ranging from 0.001 – 1 mg/L	Reps: 1 w/10 per
Control	Solvent control	
LC50; 24h	220 ug/L	probit
LC50; 48h	110 ug/L	probit
LC50; 72h	80 ug/L	probit
LC50; 96h	80 ug/L	probit

Toxicity Data Summary

Notopterus notopterus

Study: Gupta AK, Dutt D, Anand M, Dalela RC. 1994. Combined toxicity of chlordane, malathion and furadan to a test fish *Notopterus-notopterus* (Mor) *Journal of environmental biology* 15: 1 -6.

Relevance

Score: 85 (Family not in NA)

Rating: L

Reliability

Score: 71.5

Rating: L

Reference	Gupta <i>et al.</i> 1994	<i>N. notopterus</i>
Parameter	Value	Comment
Test method cited	APHA	
Phylum	Chordata	
Class	Actinopterygii	
Order	Osteoglossiformes	
Family	Notopteridae	
Genus	<i>Notopterus</i>	
Species	<i>notopterus</i>	
Family in North America?	No, India, Asia, Africa	
Age/size at start of test/growth phase	8.6-11 cm, 14.4-19.0 g	
Source of organisms	Near by river, Kalindai R.	Meerut, India
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	No mortality	
Temperature	22 ± 2 °C	
Test type	Static renewal (24 h)	
Photoperiod/light intensity	NR	
Dilution water	Tap water	
pH	7.2-7.5	
Hardness	116.00 (units NR)	
Alkalinity	108.00 (units NR)	
Conductivity	NR	
Dissolved Oxygen	7.14 (units NR)	
Feeding	None	
Purity of test substance	Technical	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Gupta <i>et al.</i> 1994	<i>N. notopterus</i>
Parameter	Value	Comment
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone: ethanol (1:1), amt NR	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	Concentrations NR	3 Reps with 10 per
Control	Solvent control	3 Reps with 10 per
LCx; indicate calculation method	77 (61-103) $\mu\text{g/L}$	Graphical interpolation

Other notes: Actually 1 rep used, but test repeated 3x, and only one value reported.

Toxicity Data Summary

Oncorhynchus clarki

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>O. clarki</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	Cutthroat trout
Family	Salmonidae	
Genus	<i>Oncorhynchus</i>	
Species	<i>clarki</i>	
Found in	N. America	
Age/size at start of test/growth phase	1.0 g	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>O. clarki</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	12 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported (states 2 reps for 'larger' fish at least 10 organisms used for each concentration)
LC50 (95% ci)	280 (270-310) µg/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Oncorhynchus kisutch

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>O. kisutch</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	<i>Oncorhynchus</i>	Coho salmon
Species	<i>kisutch</i>	
Found in	N. America	
Age/size at start of test/growth phase	0.9 g	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>O. kisutch</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	12 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported (states 2 reps for ‘larger’ fish at least 10 organisms used for each concentration)
LC50 (95% ci)	170 (160-180) µg/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Oncorhynchus kisutch

Study: Laetz CA, Baldwin DH, Collier TK, Hebert V, Stark JD, Scholz NL. 2009. The Synergistic Toxicity of Pesticide Mixtures: Implications for Risk Assessment and the Conservation of Endangered Pacific Salmon. *Environ Health Perspect* 117(3): 348-353.

Relevance

Score: 75 (No std method, Endpoint)

Rating: L

Reliability

Score: 82

Rating: R

Reference	Laetz et al. 2009	<i>O. kisutch</i>
Parameter	Value	Comment
Test method cited	Chem analysis followed EPA methods	Animal use guide for animal treatment
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	<i>Oncorhynchus</i>	
Species	kisutch	
Family in North America?	Yes	
Age/size at start of test/growth phase	4-7 mo; 4.9 ± 1.0 cm and 1.3 ± 0.9 g	
Source of organisms	University of Washington hatchery	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	AChE inhibition	50% inhibition
Control response 1	Values compared to control	
Temperature	12 ± 1 °C	
Test type	Static renewal (24 h)	
Photoperiod/light intensity	12 h, light & dark	
Dilution water	Dechlorinated municipal	
pH	7.0-7.5	
Hardness	110-120 mg/L	
Alkalinity	74 mg/L	
Conductivity	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Laetz <i>et al.</i> 2009	<i>O. kisutch</i>
Parameter	Value	Comment
Dissolved Oxygen	90-100%	
Feeding	None	
Purity of test substance	98 %	
Concentrations measured?	Yes	
Measured is what % of nominal?	Says 80-120 %, but for malathion recovery at EC50 was 44% (Table 3)	Concentration were reported as nom. B/c meas. were close on ave., (5-14% loss over 96h)
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	100uL/25 L methanol, ≤ 0.0004% of the total volume	
Concentrations Nom/Meas (µg/L)	4-7 concentrations with in 0.5-100 µg/L	1 rep with 8 per
Control	Solvent and water only	1 rep with 8 per
LC50	NR	
EC50	74.5 µg/L (Nom)	Nonlinear regress. & log transform.

Other notes: Also reports a mixture study of malathion and other OPs (chlorpyrifos and diazinon) and Carbamates: carbaryl and carbofuran. Especially for malathion + chlorpyrifos or malathion + diazinon effects were greater than additive. In these combinations 100% mortality was produced where 50% AChE inhibition was expected.

So it found synergisms at environmentally relevant concentrations (beyond additive), but this study does not provide a qualitative means to account for the synergism (i.e.: synergistic ratios). But this synergism seems important to bring up in report.

Authors acknowledge need to “establish a quantitative connection between the mixture toxicity observed in this study and higher biological scales via effects on growth and survival.”

For mixtures section:

In a study by Laetz et al. (2009) Coho salmon (*Oncorhynchus kisutch*) exposed to combinations of diazinon with malathion as well as chlorpyrifos with malathion had synergistic, rather than additive effects on AChE activities. Mixtures were designed to produce 50% AChE inhibition based on additive interactions, however the pairing of diazinon (7.3 µg/L) with malathion (3.7 µg/L) produced severe AChE inhibition (> 90%). Many fish species die after high rates of acute brain AChE inhibition (> 70–90%) (Fulton and Key 2001). While, the mixtures of these OPs with malathion were found to have synergistic toxicity effects, the study did not provide a way to incorporate this interaction qualitatively into compliance. At the same time, in light of the recent dramatic decline of Chinook and ban on commercial salmon fishing off California, this finding has possibly

Appendix, Section 2: Studies rated RL, LR, LL

very import implications for environmentally relevant concentrations of OPs in mixtures and their toxic effects on endangered salmonids.

Oncorhynchus mykiss

Toxicity Data Summary

Study: Beauvais SL, Jones SB, Brewer SK, Little EE. 2000. Physiological measures of neurotoxicity of diazinon and malathion to larval rainbow trout (*Oncorhynchus mykiss*) and their correlation with behavioral measures. Environ Toxicol Chem 19: 1875-1880.

Cholinesterase/ neurological endpoints (Swimming endpoint not summarized here)

Relevance

Score: 70 (Endpoint; No values)

Rating: L

Reliability

Score: 71.5

Rating: L

Beauvais et al. 2000		<i>O. mykiss</i>
Parameter	Value	Comment
Test method cited	USEPA 1975; ASTM 1994	Outdated EPA method
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	<i>Oncorhynchus</i>	
Species	<i>mykiss</i>	
Found in	California	
Age/size at start of test/growth phase	40 d posthatch; 30.8 ± 2.9 mm; 0.24 ± 0.08 g	
Source of organisms	Hatchery	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	24 h 96 h 96 h w/48 h recovery	
Data for multiple times?	Yes	
Effect 1	Cholinesterase inhibition	
Control response 1	Baseline	
Effect 2	Muscarinic cholinergic receptor number	No effects seen
Control response 2	Baseline	
Effect 3	Muscarinic cholinergic receptor affinity	No effects seen
Control response 3	Baseline	
Temperature	15 C	

Appendix, Section 2: Studies rated RL, LR, LL

Beauvais et al. 2000		<i>O. mykiss</i>
Parameter	Value	Comment
Test type	Static renewal; daily	
Photoperiod/light intensity	NR	
Dilution water	Well water	
pH	8.10-8.29	
Hardness	272-304 mg/L as CaCO ₃	
Alkalinity	242-256 mg/L as CaCO ₃	
Conductivity	630-641 µS/cm	
Dissolved Oxygen	6.99-10.08 mg/L	In dilution water; not in test chambers
Feeding	None	
Purity of test substance	99.5%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	≤ 1% acetone, so ≤ 10 mL/L	
Concentration 1 Nom (µg/L)	20	Reps: 3 w/30 per; 10 removed after 24 h; 10 removed after 96 h; 10 remained for 48-h recovery period
Concentration 2 Nom (µg/L)	40	Reps: Same as above
Control	Solvent (no plain dilution water)	Reps: Same as above
NOEC; AchE activity; µg/L	24 h: <20 96 h: 40(interrupted dose-response) 96 h + recovery: < 20	Method: ANOVA W Dunnett's p: NR MSD: NR
LOEC, AchE activity; µg/L	24 h: 20 96 h: >40 (interrupted dose-response) 96 h + recovery: 20	
MATC (GeoMean NOEC,LOEC)	NC in all cases	
% control at NOEC	24 h: NC 96 h: 30% 96 h + recovery: NC	Estimated from Figure 1
% of control LOEC	24 h: 30% 96 h: NC 96 h + recovery: 80%	Estimated from Figure 1

Mortality was 12% or less in both malathion treatments.

Endpoint not linked to survival, growth, reproduction; Toxicity values not calculated/calculable

Toxicity Data Summary

Oncorhynchus mykiss

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>O. mykiss</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	<i>Oncorhynchus</i>	Rainbow trout
Species	mykiss	
Found in	N. America	
Age/size at start of test/growth phase	1.4 g	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>O. mykiss</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	12 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported (states 2 reps for 'larger' fish at least 10 organisms used for each concentration)
LC50 (95% ci)	200 (160-240) µg/L	Litchfield & Wilcoxon (1949)

Appendix, Section 2: Studies rated RL, LR, LL

Toxicity Data Summary

Oncorhynchus tshawytscha

Parkhurst, Z.E., and H.E. Johnson. 1955. Toxicity of Malathion 500 to Fall Chinook Salmon Fingerlings. Prog.Fish-Cult. 17(3):113-116.

Relevance

Score: 90 (No standard method, Purity)

Rating: R

Reliability

Score: 60.5

Rating: L

Reference	Parkhurst & Johnson 1955	<i>O. tshawytscha</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	<i>Oncorhynchus</i>	
Species	tshawytscha	Chinook
Family in North America?	Yes	
Age/size at start of test/growth phase	1.5 inches = 3.8 cm	
Source of organisms	Hatchery	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes, 24, 48, 96 h	
Effect 1	Mortality	
Control response 1	No mortality	
Temperature	8.3 -9.4 °C	
Test type	Static - Not stated directly, but describes test in good detail and does not describe any renewal	
Photoperiod/light intensity	NR	
Dilution water	Spring water	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Parkhurst & Johnson 1955	<i>O. tshawytscha</i>
Parameter	Value	Comment
Purity of test substance	5 lbs/ gallon	Malathion 500
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	No carrier used	
Concentration 1 Nom ($\mu\text{g/L}$). Concentrations nominal, but based on amount of active ingredient	320	1 rep with 20 per
Concentration 2 Nom ($\mu\text{g/L}$)	240	1 rep with 20 per
Concentration 3 Nom/ ($\mu\text{g/L}$)	180	1 rep with 20 per
Concentration 4 Nom ($\mu\text{g/L}$)	135	1 rep with 20 per
Concentration 5 Nom ($\mu\text{g/L}$)	115	1 rep with 20 per
Concentration 6 Nom ($\mu\text{g/L}$)	100	1 rep with 20 per
Concentration 7 Nom ($\mu\text{g/L}$)	87	1 rep with 20 per
Control	Yes, water only	2 reps with 20 per
LC50, 24 h	170 $\mu\text{g/L}$	Linear interpolation
LC50, 48 h	150	
LC50, 96 h	120	

Other notes:

Also found similar LC50 in test where malathion was aged 4 days in tanks before fish added. Interesting because other tests find majority of malathion dissipates after 96 h. Maybe it didn't dissipate in these tests because these test run at fairly cold temp.

Temp reported as 47-49° F. Converted to 8.3 -9.4 °C

Toxicity Data Summary

Orconectes nais

Study: Sanders HO. 1972. Toxicity of some insecticides to four species of Malacostracan crustaceans. Technical Papers of the Bureau of Sport Fisheries and Wildlife. United States Department of the Interior, Fish and Wildlife Service. Washington, D.C.

Relevance

Score: 92.5 (Control response NR)

Rating: R

Reliability

Score: 63.5

Rating: L

Reference	Sanders 1972	<i>O. nais</i>
Parameter	Value	Comment
Test method cited	NR	Pub. before std methods
Phylum	Arthropoda	
Class	Malacostraca	
Order	Decapoda	
Family	Cambaridae	
Genus	<i>Orconectes</i>	
Species	<i>nais</i>	crayfish
Family in North America?	Yes	
Age/size at start of test/growth phase	Early instar, 3-5 w old, 30-50mg; Mature, 7-11 g	
Source of organisms	Cultured from local streams and ponds	
Have organisms been exposed to contaminants?	NR	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24, 96 h	
Effect 1	Mortality	
Control response 1	NR	
Temperature	Static: 21 ± 0.5 °C Flow thru: 18- 21 °C	
Test type	Acute -Static & Intermittent-flow	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted or Raw water	
pH	Reconstituted: 7.1 Raw water: 7.4	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Sanders 1972	<i>O. nais</i>
Parameter	Value	Comment
Hardness	Reconstituted: 10.2 ppm Ca & Mg Raw water: 368 ppm Ca & Mg	
Alkalinity	Reconstituted: 35 ppm methyl orange Raw water: 260 ppm methyl orange	
Conductivity	NR	
Dissolved Oxygen	8 ppm	
Feeding	NR-none	
Purity of test substance	w/o emulsifying agents	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 1mL/L ethanol	
Concentrations Nom (µg/L)	5 concentrations	1 Reps, 10 per rep
Control	'untreated'	1 Reps, 10 per rep
LC50; 24 h (95% CL) static, well water	290 (210-370) µg/L	probit
LC50; 96 h (95% CL) static, well water	180 (140-230) µg/L	

Other notes:

Adults insensitive to 100,000 µg/L, after 96 h

Toxicity Data Summary

Oreochromis niloticus

Study: Pathiratne, A., and S.G. George. 1998. Toxicity of malathion to Nile tilapia, *Oreochromis niloticus* and modulation by other environmental contaminants. *Aquatic Toxicology* 43: 261–271

Relevance

Score: 92.5 (Control Response NR)

Rating: R

Reliability

Score: 63.5

Rating: L

Reference	Pathiratne & George 1998	<i>O. niloticus</i>
Parameter	Value	Comment
Test method cited	United Nations Food and Agriculture Organisation (Reish and Oshida, 1986)	
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Cichlidae	
Genus	<i>Oreochromis</i>	
Species	<i>niloticus</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Fingerlings, 5-8 g	
Source of organisms	Institute of Aquaculture, Stirling	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Effect 2	Sublethal effects: but these were measured after 24 h exposure to 3ppm malathion, no dose response was done. So these effects were not summarized.	Effects: Non-specific carboxylesterase (CE), Malathion carboxylesterase (MCE) activity, Acetylcholinesterase (AChE) activity, Glutathione S transferase (GST) activity, Total

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Pathiratne & George 1998	<i>O. niloticus</i>
Parameter	Value	Comment
		cytochrome P-450 content, CYP2B1, CYP2C and CYP3A activity
Temperature	28 °C	Culture
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Dechlorinated municipal water	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	98 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone, conc NR	
Concentration 1 Nom/Meas (µg/L)	10,000	1 reps and 15 per
Concentration 2 Nom/Meas (µg/L)	5,000	1 reps and 15 per
Concentration 3 Nom/Meas (µg/L)	3,000	1 reps and 15 per
Concentration 4 Nom/Meas (µg/L)	1,000	1 reps and 15 per
Concentration 5 Nom/Meas (µg/L)	500	1 reps and 15 per
Concentration 6 Nom/Meas (µg/L)	100	1 reps and 15 per
Control	Solvent control	1 reps and 15 per
LC50	2200	probit

Other notes:

Appendix, Section 2: Studies rated RL, LR, LL

Toxicity Data Summary

Palaemonetes kadiakensis

Study: Sanders HO. 1972. Toxicity of some insecticides to four species of Malacostracan crustaceans. Technical Papers of the Bureau of Sport Fisheries and Wildlife. United States Department of the Interior, Fish and Wildlife Service. Washington, D.C.

Relevance

Score: 92.5 (Control response NR)

Rating: R

Reliability

Score: 63

Rating: L

Reference	Sanders 1972	<i>P. kadiakensis</i>
Parameter	Value	Comment
Test method cited	NR	Pub. before std methods
Phylum	Arthropoda	
Class	Malacostraca	
Order	Decapoda	
Family	Palaemonoidea	
Genus	<i>Palaemonetes</i>	
Species	<i>kadiakensis</i>	Glass shrimp
Family in North America?	Yes	
Age/size at start of test/growth phase	Late instar	
Source of organisms	Local streams and ponds	
Have organisms been exposed to contaminants?	NR	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24, 48, 96, 120 h	
Effect 1	Mortality	
Control response 1	NR	
Temperature	Static: 21 ± 0.5 °C Intermittent-flow: 18- 21 °C	
Test type	Acute -Static & Intermittent-flow	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted or Raw water	
pH	Reconstituted: 7.1 Raw water: 7.4	
Hardness	Reconstituted: 10.2 ppm Ca	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Sanders 1972	<i>P. kadiakensis</i>
Parameter	Value	Comment
	& Mg Raw water: 368 ppm Ca & Mg	
Alkalinity	Reconstituted: 35 ppm methyl orange Raw water: 260 ppm methyl orange	
Conductivity	NR	
Dissolved Oxygen	8 ppm	
Feeding	NR-none	
Purity of test substance	w/o emulsifying agents	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 1mL/L ethanol	
Concentrations Nom (µg/L)	5 concentrations	2 Reps, 10 per rep
Control	'untreated'	2 Reps, 10 per rep
Static		
Well water; LC50; 24 h (95% CL)	320 (200-500) µg/L	probit
Well water; LC50; 48 h	100 (NR) µg/L	
Well water; LC50; 96 h (95% CL)	90 (67-120) µg/L	
Well water; LC50; 120 h	60 (NR) µg/L	
Intermittent-flow		
Well water; LC50; 24 h	150 µg/L	95% CL NR
Well water; LC50; 48 h	25 µg/L	
Well water; LC50; 96 h	12 µg/L	
Well water; LC50; 120 h	9.0 µg/L	

Other notes:

Appendix, Section 2: Studies rated RL, LR, LL

Paratya compressa improvisa

Toxicity Data Evaluation

Shigehisa H, Shiraishi H. 1998. Biomonitoring with Shrimp to Detect Seasonal Change in River Water Toxicity. *Environ Toxicol Chem* 17:687-694

Relevance

Score: 82.5 (no std. method, control response NR)

Rating: L

Reliability

Score: 61.5

Rating: L

Shigehisa & Shiraishi 1998		<i>P. compressa</i>
Parameter	Value	Comment
Test method cited	No standard method cited	
Phylum	Arthropoda	
Class	Malacostraca	
Order	Decapoda	
Family	Atyidae	
Genus	<i>Paratya</i>	
Species	<i>compressa improvisa</i>	
Family in NA?	Yes	
Age/size at start of test	4 wk; 8.27 ± 1.03 mm	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	22 ± 1° C	
Test type	Static	
Photoperiod/light intensity	14L: 10D	
Dilution water	Reconstituted soft water	(different from culture water)
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	Analytical grade; 98-99%	

Appendix, Section 2: Studies rated RL, LR, LL

Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	0.1% (1 mL/L) ethanol	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	Number and levels NR	Reps: 3 w/ 7 per
Control	Dilution water	Reps: 3 w/ 7 per
LC50; $\mu\text{g/L}$	3.62	probit

Toxicity Data Summary

Pelophylax ridibundus (also *Rana ridibunda*)

Study: Sayim, F., 2008. Acute toxic effects of malathion on the 21(st) stage larvae of the marsh frog. Turkish Journal of Zoology. 32, 99-106.

Relevance

Score: 90 (no standard method)

Rating: R

Reliability

Score: 63.5

Rating: L

Reference	Sayim 2008	<i>P. ridibundus</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Chordata	
Class	Amphibia	
Order	Anura	
Family	Ranidae	
Genus	Pelophylax	
Species	ridibundus	
Family in North America?	Yes	
Age/size at start of test/growth phase	21st Gosner stage larvae	
Source of organisms	Eggs collected from field	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	No mortality	
Temperature	Room temp.	Temp measured, but NR
Test type	Static	
Photoperiod/light intensity	Natural, no approximation	
Dilution water	Dechlorinated tap	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Sayim 2008	<i>P. ridibundus</i>
Parameter	Value	Comment
Purity of test substance	95 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	No solvents mentioned	
Concentration 1 Nom ($\mu\text{g/L}$)	28,000	3 reps with 10 per
Concentration 2 Nom ($\mu\text{g/L}$)	30,000	3 reps with 10 per
Concentration 3 Nom ($\mu\text{g/L}$)	32,000	3 reps with 10 per
Concentration 4 Nom ($\mu\text{g/L}$)	34,000	3 reps with 10 per
Concentration 5 Nom ($\mu\text{g/L}$)	36,000	3 reps with 10 per
Concentration 6 Nom ($\mu\text{g/L}$)	38,000	3 reps with 10 per
Control	Yes	3 reps with 10 per
LC50; indicate calculation method	38,000 $\mu\text{g/L}$ (35.11-48.25)	Probit
NOEC; indicate calculation method, significance level (p-value) and minimum significant difference (MSD)	NR	Method: NR p: < 0.05 MSD: NR
LOEC; indicate calculation method	28,000 growth	
MATC (GeoMean NOEC,LOEC)	Can not calculate	
% control at NOEC	Can not calculate	
% of control LOEC	7.37/9.00	

Other notes:

Formulation grade more toxic at 28,000 $\mu\text{g/L}$

LC 50 is not really bracketed by the test concentrations tested. It is equivalent to the highest concentrations tested.

Appendix, Section 2: Studies rated RL, LR, LL

Peltodytes spp.

Toxicity Data Summary

Study: Federle PF, Collins WJ. 1976. Insecticide toxicity to three insects from Ohio ponds. Ohio J Sci 76: 19-24.

Relevance

Score: 90 (No standard method cited)

Rating: R

Reliability

Score: 62

Rating: L

Federle & Collins 1976		<i>Peltodytes spp.</i>
Parameter	Value	Comment
Test method cited	No standard method cited	
Phylum	Arthropoda	
Class	Insecta	
Order	Coleoptera	
Family	Haliplidae	
Genus	<i>Peltodytes</i>	
Species	<i>edentulous</i> , ca 60%; <i>lengi</i> , ca 30%; <i>sexmaculatus</i> , ca 10%	Crawling water beetles
Found in	N. America	
Age/size at start of test/growth phase	Adult; 0.005 g	
Source of organisms	Small lake in West Jefferson, Ohio; no pesticide spraying for 2 yr	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes; 24 hr in lab	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24, 48, 72, 96 h	
Effect 1	Mortality	
Control response 1	5%	
Temperature	25 ± 2°C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Aerated tap water	
pH	7.4	

Appendix, Section 2: Studies rated RL, LR, LL

Federle & Collins 1976		<i>Peltodytes spp.</i>
Parameter	Value	Comment
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	≥ 94%	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	0.1% acetone (1 mL/L)	
Concentration 1 Nom	Four concentrations ranging from 0.001 – 1 mg/L	Reps: 3 w/10 per
Control	Solvent control	
LC50; 24h	6800 ug/L	probit
LC50; 48h	1500 ug/L	probit
LC50; 72h	1200 ug/L	probit
LC50; 96h	1000 ug/L	probit

Toxicity Data Summary

Perca flavescens

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>P. flavescens</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Percidae	
Genus	<i>Perca</i>	
Species	<i>flavescens</i>	
Found in	N. America	
Age/size at start of test/growth phase	1.4 g	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>P. flavescens</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	18 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported (states 2 reps for 'larger' fish at least 10 organisms used for each concentration)
LC50 (95% ci)	263 (205-338) µg/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Pimephales promelas

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>P. promelas</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Pimephales</i>	
Species	promelas	
Found in	N. America	
Age/size at start of test/growth phase	0.9 g	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>P. promelas</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	18 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported (states 2 reps for ‘larger’ fish at least 10 organisms used for each concentration)
LC50 (95% ci)	8650 (6450-11,500) µg/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Pimephales promelas

Mount, D.I., and C.E. Stephan. A Method for Establishing Acceptable Toxicant Limits for Fish--Malathion and the Butoxyethanol Ester of 2,4-D. Trans.Am.Fish.Soc. 96(2):185-193. 1967

Relevance-Spawning

Score: 75 (No std method, No values)

Rating: L

Reliability

Score: 83

Rating: R

Relevance- 10 mo survival

Score: 75 (No std method, No values)

Rating: L

Reliability

Score: 82

Rating: R

Relevance-acute LC50

Score: 85 (Control not described or response reported)

Rating: L

Reliability

Score: 51

Rating: N

Reference	Mount & Stephan 1967	<i>P. promelas</i>
Parameter	Value	Comment
Test method cited	Standard methods (1960)	More for acute test and water quality monitoring in chronic
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Pimephales</i>	
Species	<i>promelas</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	1 inch (acute :adult)	
Source of organisms	NR	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	10 mo	
Data for multiple times?	No	
Effect 1	Spawning	
Control response 1	5 and 1 spawning per female in the two replicates	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Mount & Stephan 1967	<i>P. promelas</i>
Parameter	Value	Comment
Effect 2	Survival	
Control response 2	100%	
Temperature	15-26 °C, slowly rose through season. Acute 23°C	Fish won't spawn in constant temp
Test type	Flow through	
Photoperiod/light intensity	12 h light 'til June, then increased to 16 h light	
Dilution water	Dechlorinated carbon filter tap, then spring water	
pH	7.4-8.4	
Hardness	111-192 mg/L CaCO ₃	
Alkalinity	40-148 mg/L methyl orange	
Conductivity	320-470 umhos	
Dissolved Oxygen	5-10mg/L	
Feeding	Yes (but not in acute exposure)	
Purity of test substance	95%	
Concentrations measured?	Yes	
Measured is what % of nominal?	About 68%	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	Acetone 2 mg/L, ~ 2uL/L Triton-X: 0.3 mg/L ~ .3uL/L	
Concentration 1 Nom/Meas (µg/L)	1.00/ 0.58	2 reps and 5 per
Concentration 2 Nom/Meas (µg/L)	0.33/0.20	2 reps and 5 per
Concentration 3 Nom/Meas (µg/L)	0.11/0.07	2 reps and 5 per
Concentration 4 Nom/Meas (µg/L)	0.04/ 0.03	2 reps and 5 per
Control	Solvent control	2 reps and 5 per
LCx; indicate calculation method	9000 µg/L	
NOEC-estimated	200 µg/L	Method: no stats
LOEC-estimated	580 µg/L	
MATC (GeoMean NOEC,LOEC)	341	
% control at NOEC	90%	
% of control LOEC	80%	

Other notes: Sex ratios were not uniform. With only 5 fish per jar, it was 2:3, 4:1 males: females or the reverse. The authors point out this was problematic for a spawning study.

No significant effects on spawning,

There were effects on long term survival, but no stats done, NOEC LOEC estimated from these descriptions:

-20% (4/20) fish died at highest conc: 580 ug/L, 4 more deformed or sickly

-1 fish died at second highest concentration: 200 mg/L

Also report results of 96 h static acute study but not much other info about this test.

Appendix, Section 2: Studies rated RL, LR, LL

Toxicity Data Summary

Pimephales promelas

Pickering, Q.H., C. Henderson, and A.E. Lemke. 1962. The Toxicity of Organic Phosphorus Insecticides to Different Species of Warmwater Fishes. *Trans.Am.Fish.Soc.* 91:175-184.

Relevance

Score: 85 (control description & response NR)

Rating: L

Reliability

Score: 61.5

Rating: L

Reference	Pickering <i>et al.</i> 1962	<i>P. promelas</i>
Parameter	Value	Comment
Test method cited	APHA	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cyriniformes	
Family	Cyprinidae	
Genus	<i>Pimephales</i>	
Species	<i>promelas</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	1.5-2.5 in., 1-2 g,	
Source of organisms	Hatchery, except guppy: lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24,48 96 h	
Effect 1	Mortality	
Control response 1	NR	
Temperature	25 °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Soft water: 5:95 natural spring water: deionized water Hard water: spring water	
pH	Soft water: 7.4-7.5 Hard water: 8.2	These seem to be initial measurements, but says these
Hardness	Soft water: 20 mg/L	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Pickering <i>et al.</i> 1962	<i>P. promelas</i>
Parameter	Value	Comment
	Hard water: 400 mg/L	parameters ere monitored during tests also
Alkalinity	Soft water: 18 mg/L Hard water: 360 mg/L	
Conductivity	NR	
Dissolved Oxygen	Soft water: 8 mg/L Hard water: 8mg/L, but maintained between 4-8	
Feeding	None	
Purity of test substance	100%	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone, concentration NR	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	Logarithmic series in quarter pints	2 reps and 5 per
Control	Not described	
LC50; indicate calculation method	Listed below	
Fathead minnow 24 h	26,000 (soft water) 23,000 (hard water)	Graphical interpolation
Fathead minnow 48 h	24,000 (soft water) 18,000 (hard water)	
Fathead minnow 96 h	23,000 (soft water) 16,000 (hard water)	

Other notes:

Appendix, Section 2: Studies rated RL, LR, LL

Toxicity Data Summary

Poecilia reticulata

Pickering, Q.H., C. Henderson, and A.E. Lemke. 1962. The Toxicity of Organic Phosphorus Insecticides to Different Species of Warmwater Fishes. *Trans.Am.Fish.Soc.* 91:175-184.

Relevance

Score: 85 (control description & response NR)

Rating: L

Reliability

Score: 61.5

Rating: L

Reference	Pickering <i>et al.</i> 1962	<i>P. reticulata</i>
Parameter	Value	Comment
Test method cited	APHA	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cyprinodontiformes	
Family	Poeciliidae	
Genus	<i>Poecilia</i>	
Species	<i>reticulata</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	6mo., 0.75-1 in., 0.1-0.2 g	
Source of organisms	Hatchery, except guppy: lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24,48 96 h	
Effect 1	Mortality	
Control response 1	NR	
Temperature	25 °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Soft water: 5:95 natural spring water: deionized water	
pH	7.4-7.5	These seem to be initial measurements, but says these
Hardness	20 mg/L	
Alkalinity	18 mg/L	
Conductivity	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Pickering <i>et al.</i> 1962	<i>P. reticulata</i>
Parameter	Value	Comment
Dissolved Oxygen	8 mg/L	parameters ere monitored during tests also
Feeding	None	
Purity of test substance	100%	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone, concentration NR	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	Logarithmic series in quarter pints	2 reps and 5 per
Control	Not described	
LC50; indicate calculation method	Listed below	
Guppy, 24 h	930	Graphical interpolation
Guppy, 48 h	880	
Guppy, 96 h	840	

Other notes:

Toxicity Data Summary

Procambarus clarkii

Study: Andreu-Moliner, E.S., M.M. Almar, I. Legarra, and A. Nunez. 1986. Toxicity of Some Rice field Pesticides to the Crayfish p. clarkii, Under Laboratory and Field Conditions in Lake Albufera (Spain). J.Environ.Sci.Health Part B 21(6):529-537

Relevance

Score: 70 (No values, Purity NR)

Rating: L

Reliability

Score: 62

Rating: L

Reference	Andreu-Moliner <i>et al.</i> 1986	<i>P. clarkii</i>
Parameter	Value	Comment
Test method cited	EPA 1975	
Phylum	Arthropoda	Crustacea
Class	Malacostraca	
Order	Decapoda	
Family	Cambaridae	
Genus	<i>Procambarus</i>	
Species	Clarkii	
Family in North America?	Yes	
Age/size at start of test/growth phase	15 to 38g	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	No Mortality	
Temperature	19.0 ± 0.5 °C	
Test type	Static	
Photoperiod/light intensity	16 h light	
Dilution water	Valencia City water (dechlorinated)/ water from nearby lake	
pH	7.8 /8.4	
Hardness	250/350 ppm as CaCO ₃	
Alkalinity	4.1/3.7 mmol/L	
Conductivity	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Andreu-Moliner <i>et al.</i> 1986		<i>P. clarkii</i>
Parameter	Value		Comment
Dissolved Oxygen	NR		
Feeding	None		
Purity of test substance	NR	Report recommended concentration for field use 0.80 mg/L	
Concentrations measured?	NR		
Measured is what % of nominal?	NR		
Chemical method documented?	NR		
Concentration of carrier (if any) in test solutions	NR		
Concentration 1 Nom ($\mu\text{g/L}$)	1600		5 reps with 4 per
Concentration 2 Nom ($\mu\text{g/L}$)	800		5 reps with 4 per
Concentration 3 Nom ($\mu\text{g/L}$)	400		5 reps with 4 per
Control	Yes,		5 reps with 4 per
No tox values	No harmful effects recorded		

Other notes:

Toxicity Data Summary

Pteronarcella

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>Pteronarcella</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Arthropoda	
Class	Insecta	
Order	Amphipoda	
Family	Pteronarcyidae	
Genus	<i>Pteronarcella</i>	
Species	sp	
Found in	N. America	
Age/size at start of test/growth phase	Naiad	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>Pteronarca</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	15 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported, at least 10 organisms used for each concentration
LC50 (95% ci)	1.1 (0.8-1.5) µg/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Pteronarcys

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>Pteronarcys sp.</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Arthropoda	
Class	Insecta	
Order	Amphipoda	
Family	Pteronarcyidae	
Genus	<i>Pteronarcys</i>	
Species	sp	
Found in	N. America	
Age/size at start of test/growth phase	Second Year Class	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>Pteronarcys sp.</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	15 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported, at least 10 organisms used for each concentration
LC50 (95% ci)	10 (7.0-13) µg/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Salmo trutta

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>S. trutta</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	<i>Salmo</i>	Brown trout
Species	trutta	
Found in	N. America	
Age/size at start of test/growth phase	1.1 g	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>S. trutta</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	12 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported (states 2 reps for 'larger' fish at least 10 organisms used for each concentration)
LC50 (95% ci)	101 (84-115) µg/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Salvelinus namaycush

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>S. namaycush</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	<i>Salvelinus</i>	Lake trout
Species	<i>namaycush</i>	
Found in	N. America	
Age/size at start of test/growth phase	0.3 g	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>S. namaycush</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	12 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	162-272- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported (states 2 reps for 'larger' fish at least 10 organisms used for each concentration)
LC50 (95% ci)	76 (47-123) µg/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Sander vitreus

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>S. vitreus</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Percidae	
Genus	<i>Sander vitreus</i>	
Species	<i>Sander vitreus</i>	
Found in	N. America	
Age/size at start of test/growth phase	1.3 g	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>S. vitreus</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Lethality	
Control response 1	NR	No control responses reported
Temperature	18 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported (states 2 reps for ‘larger’ fish at least 10 organisms used for each concentration)
LC50 (95% ci)	64 (59-70) µg/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Simocephalus spp.

Study: Johnson, W.W. and M.T. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. Resource Publication 137. U.S. Fish and Wildlife Serv., Washington DC.

And:

Mayer FL Jr, Ellersieck MR. 1986. Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals. US Fish and Wildlife Service Resource Publication No. 160. US Department of the Interior, Washington, DC.

These two publications are complimentary; the test methods are detailed in Johnson & Finley (1980), but some additional results are included in Mayer & Ellersieck (1986). All of the studies are from the same database from the same lab.

Relevance

Score: 85 (Controls not described or reported)

Rating:L

Reliability

Score: 63.5

Rating:L

Johnson & Finley 1980		<i>Simocephalus spp.</i>
Parameter	Value	Comment
Test method cited	Method described by Lennon and Walker (1964), and Macek and McAllister (1970)	Recommended by Brauhn and Schoettger (1975), the Committee on Methods for Toxicity Tests with Aquatic Organisms
Phylum	Arthropoda	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	<i>Simocephalus</i>	
Species	Spp.	
Found in	N. America	
Age/size at start of test/growth phase	First Instar	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	

Appendix, Section 2: Studies rated RL, LR, LL

Johnson & Finley 1980		<i>Simocephalus spp.</i>
Parameter	Value	Comment
Data for multiple times?	NR	
Effect 1	Immobilization	
Control response 1	NR	No control responses reported
Temperature	15 ± 1° C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted from deionized water	
pH	7.2 – 7.5	Not reported for specific tests
Hardness	40 – 5- mg/L	Not reported for specific tests
Alkalinity	30-35 mg/L	Not reported for specific tests
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Not Fed	
Purity of test substance	95%	
Concentrations measured?	NR, stock solutions prepared with commercial grade acetone as carrier solvent	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤ 0.5 mL/L	
Concentration 1 Nom/Meas (µg/L)	At least 6 concentrations used; levels NR	At least 10 organisms used for each concentration
Control	NR	No reps reported, at least 10 organisms used for each concentration
LC50 (95% ci)	3.5 (2.6-4.8) ug/L	Litchfield & Wilcoxon (1949)

Toxicity Data Summary

Simocephalus vetulus

Olvera-Hernandez E, Martinez-Tabche L, Martinez-Jeronimo F. 2004. Bioavailability and effects of malathion in artificial sediments on *Simocephalus vetulus* (Cladocera: Daphniidae). *Bulletin of Environmental Contamination and Toxicology* 73(1):197-204.

Relevance

Score: 82.5 (No std method, control response NR)

Rating: L

Reliability

Score: 61.5

Rating: L

Reference	Olvera-Hernandez <i>et al.</i> 2004	<i>S. vetulus</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Arthropoda	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	<i>Simocephalus</i>	
Species	<i>vetulus</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	≤ 24 h, neonates	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	23.5 ± 1.5 °C	
Test type	Static	
Photoperiod/light intensity	16: 8 light:dark	
Dilution water	Reconstituted semi hard water	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Olvera-Hernandez <i>et al.</i> 2004	<i>S. vetulus</i>
Parameter	Value	Comment
Feeding	None	
Purity of test substance	Technical	
Concentrations measured?	No	Measured in sediment exposures, but looks like not for water only exposures
Measured is what % of nominal?	NR	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	None used	Acetone used for sediment spikes, but no mention that solvent was used for water exposures
Concentration 1 Nom ($\mu\text{g/L}$)	5.1	3 reps w 10 per rep
Concentration 2 Nom ($\mu\text{g/L}$)	3.4	3 reps w 10 per rep
Concentration 3 Nom ($\mu\text{g/L}$)	2.3	3 reps w 10 per rep
Concentration 4 Nom ($\mu\text{g/L}$)	1.5	3 reps w 10 per rep
Concentration 5 Nom ($\mu\text{g/L}$)	1.0	3 reps w 10 per rep
Control	Yes, water only	3 reps w 10 per rep
LC50; indicate calculation method	2.9 (2.4-3.6)	probit

Other notes:

Also includes tests on bioavailability from sediments

Toxicity Data Summary

Various fish

Macek KJ, McAllister WA. 1970. Insecticide susceptibility of some common fish family representatives. *Transactions of the American Fisheries Society*. 99: 20-27.

Relevance

Score: 82.5 (control response NR, no std method)

Rating:L

Reliability

Score: 64

Rating: L

Reference		Various fish
Parameter	Value	Comment
Test method cited	None	
Genus	<i>See below</i>	
Species	<i>See below</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	0.6-1.7 g ($\pm 20\%$ within the same species)	
Source of organisms	hatchery	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	18 \pm 0.5 °C, except salmonids: 13 \pm 0.5 °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted water (from deionized water)	
pH	7.1	
Hardness	Not monitored, but can calculate from recipe	
Alkalinity	35 mg/L methyl orange	
Conductivity	1 million Ohms resistivity	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	95 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Reference		Various fish
Parameter	Value	Comment
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone-amt NR	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	At least 6 concentrations	1 (?) reps w 10 per rep
Control	Solvent	Reps and # per (cell density for single
LC50	<i>See below</i>	probit

Other notes:

Species	Common name	Temp	LC50
<i>Ictalurus punctatus</i>	Catfish	18	8970 (6780-12,000)
<i>Ictalurus melas</i>	Bullhead	18	12,900 (10,700-15,600)
<i>Carassius auratus</i>	Goldfish	18	10,700 (8340-13,800)
<i>Pimephales promelas</i>	Minnow	18	8650 (6450-11,500)
<i>Cyprinus carpio</i>	Carp	18	6590 (4920-8820)
<i>Lepomis microlophus</i>	Sunfish	18	170 (132-220)
<i>Lepomis macrochirus</i>	Bluegill	18	103 (87-122)
<i>Micropterus salmoides</i>	Bass	18	285 (254-320)
<i>Oncorhynchus mykiss</i>	Rainbow trout	13	170 (160-180)
<i>Salmo trutta</i>	Brown trout	13	200 (160-240)
<i>Oncorhynchus kisutch</i>	Coho	13	101 (89-115)
<i>Perca flavescens</i>	Perch	18	263 (205-338)

Toxicity Data Summary

Various microcrustaceans:

Alonella sp, Cypria sp, Diaptomus sp, Eucyclops sp

Naqvi SM, Hawkins RH. 1989. Responses and Lc50 Values for Selected Microcrustaceans Exposed to Spartan, Malathion, Sonar, Weedtrine-D and Oust Pesticides. Bulletin of Environmental Contamination and Toxicology 43(3):386-393.

Relevance

Score: 75 (Formulation, No Std method)

Rating:L

Reliability

Score: 68

Rating: L

Exposure were done will multiple species colleted from field in nets. Exposures were conducted in jars with all species together. Only data on species of interest were recorded.

Class, Order, Family (common identifier)

Branchiopoda, Diplostraca, Chydoridae, Alonella sp., (cladocerans)

Ostracoda, Podocopida, Candonidae, Cypria sp. (Ostracods)

Maxillapoda, Calaodia, Diaptomidae, Diaptomus sp (copepods)

Maxillapoda, Majoidea, Cyclopidae, Eucyclops sp., (Calanoid copepods)

Reference	Naqvi & Hawkins 1989	Various species
Parameter	Value	Comment
Test method cited	No	
Phylum	Arthropoda	
Class	See above	
Order	See above	
Family	See above	all microcrustaceans
Genus	See above	
Species	See above	
Family in North America?	Yes	
Age/size at start of test/growth phase	NR	
Source of organisms	Lake Kernan	Baton Rouge, LA
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	<2.3%	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Naqvi & Hawkins 1989	Various species
Parameter	Value	Comment
Temperature	20-22 °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Aged (de-chlorinated)tap	
pH	8.0-8.5	
Hardness	26-28 mg/kg,	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	6.6 -7.5	
Feeding	None	
Purity of test substance	56.1 %	
Concentrations measured?	No	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	None (formulation)	
Concentration 1 Nom/Meas (µg/L)	3.0	3 jars with 300-350 microcrustaceans (a variety of species) used at each concentration & control
Concentration 2 Nom/Meas (µg/L)	2.5	
Concentration 3 Nom/Meas (µg/L)	2.0	
Concentration 4 Nom/Meas (µg/L)	1.0	
Concentration 5 Nom/Meas (µg/L)	0.5	
Control	Water only	
LC50:	For each species, below:	Probit
Alonella sp	2.0 (1.5-2.51) µg/L	
Cypria sp	2.0 (1.6-2.7) µg/L	
Diaptomus sp	2.0 (1.8-2.5) µg/L	
Eucyclops sp	1.0 (0.8-1.3) µg/L	

Other notes:

Organisms were exposed all together, not individually by species (see beginning)

Toxicity Data Summary

Wyeomyia smithii

Study: Strickman D. 1985. Aquatic Bioassay of 11 Pesticides Using Larvae of the Mosquito, *Wyeomyia-Smithii* (Diptera, Culicidae). *Bulletin of Environmental Contamination and Toxicology* 35:133-142.

Relevance

Score: 75 (No std method, No Toxicity values)

Rating: L

Reliability

Score: 63

Rating: L

Reference	Strickman 1985	<i>W. smithii</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Culicidae	
Genus	<i>Wyeomyia</i>	
Species	<i>smithii</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	2 nd instar	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	7 d	
Data for multiple times?	Each day	
Effect 1	Survival	
Control response 1	No mortality	
Temperature	27 °C	
Test type	Static	
Photoperiod/light intensity	16:8 light:dark	
Dilution water	Aged tap water	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Yes	
Purity of test substance	> 92%	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Strickman 1985	<i>W. smithii</i>
Parameter	Value	Comment
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	0.1ml/50mL = 2 mL/L acetone	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	200 $\mu\text{g/L}$	9 reps with 10 per
Concentration 2 Nom/Meas ($\mu\text{g/L}$)	100	9 reps with 10 per
Concentration 3 Nom/Meas ($\mu\text{g/L}$)	50	9 reps with 10 per
Control	Solvent	9 reps with 10 per
LC5; indicate calculation method	Not calculated 96h LC50 estimated from graph as between 50-100 $\mu\text{g/L}$	

Other notes:

Study documents attempt to optimize bioassay (using mosquito larvae) to detect insecticides. Not really designed to determine toxicity values.

Appendix, Section 2: Studies rated RL, LR, LL

Toxicity Data Summary

Xenopus laevis

Study: Snawder, J.E., and J.E. Chambers. 1989. Toxic and Developmental Effects of Organophosphorus Insecticides in Embryos of the South African Clawed Frog. J.Environ.Sci.Health Part B 24(3):205-218.

Relevance- LC50 96 h

Score: 82.5 (No std method, Control response NR)

Rating: L

Reliability

Score: 60

Rating: L

Relevance-EC50-96h notochord deformity

Score: 82.5 (No std method, Control response NR)

Rating: L

Reliability

Score: 60

Rating: L

Relevance: EC50-96h pigment deformity (NOT Summarized)

Score: 68.5 (No std method, Endpoint, Control response NR)

Rating: N

Relevance: EC50-96h gut deformity (NOT Summarized)

Score: 68.5 (No std method, Endpoint, Control response NR)

Rating: N

Relevance-96h length LOEC (no NOEC)

Score: 75 (no std method, No values)

Rating: L

Reliability

Score: 67

Rating: L

Relevance-96h NADH (NOT Summarized)

Score: 60 (no std method, No values, Endpoint)

Rating: N

Reference	Snawder & Chambers 1989	<i>X. laevis</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Chordata	
Class	Amphibia	
Order	Anura	
Family	Pipidae	
Genus	<i>Xenopus</i>	
Species	laevis	
Family in North America?	Yes	
Age/size at start of test/growth phase	Eggs (and tadpoles) *	
Source of organisms	Culture	
Have organisms been exposed to contaminants?	No	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Snawder & Chambers 1989	<i>X. laevis</i>
Parameter	Value	Comment
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Effect 2	Notochord abnormality	
Control response 2	NR	
Effect 3	Embryo length	
Control response 3	8.3mm	
Temperature	23 ± °C	
Test type	Static	
Photoperiod/light intensity	12:12 light:dark	
Dilution water	FETAX solution	From filtered water
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	<90%	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	1 mL/L acetone	
Concentrations Nom-for LENGTH only, mg/L	(est. from graph: 0.1, 0.25, 0.5, 0.75, 1, 2.5, 5, 7.5, 10	1 reps with 25 per.
Control	Water & solvent control	1 reps with 25 per.
LC50	10,900 (10,600-11,300) µg/L	
EC50	2,160 (2030-2310) µg/L	
NOEC: length	NR	Method: ANOVA p: 0.05, MSD: NR
LOEC; indicate calculation method	100 ug/L	
MATC (GeoMean NOEC,LOEC)	Cannot calculate	
% control at NOEC	NOEC NR	
% of control LOEC	~7.7/8.3	

Other notes: It is not clear how many tests were run. Tests with Eggs and tadpoles are described. Concentrations shown on graphs for length and NADP, but these are too low to correspond to LC50 (LC50 is higher than the highest concentrations shown). Guess

Appendix, Section 2: Studies rated RL, LR, LL

tadpole used for LC50, then eggs tests (other endpoints) were done with concentrations below that.

Appendix, Section 2: Studies rated RL, LR, LL

Toxicity Data Summary

Xenopus laevis

Study: Snawder JE, Chambers JE. 1993. Osteolathyrogenic Effects of Malathion in Xenopus-Embryos. *Toxicology and Applied Pharmacology* 121:210-216.

Relevance

Score: 70 (No values, Endpoint)

Rating: L

Significant effects at 3uM on notochord index. But only 3 concentrations tested. Only LOEC, no NOEC.

Reliability

Score: 65.5

Rating: L

Reference	Snawder & Chambers 1993	<i>X. laevis</i>
Parameter	Value	Comment
Test method cited	FETAX: frog embryo teratogenesis assay	
Phylum	Chordata	
Class	Amphibia	
Order	Anura	
Family	Pipidae	
Genus	<i>Xenopus</i>	
Species	laevis	
Family in North America?	Yes	
Age/size at start of test/growth phase	Eggs (and tadpoles) *	
Source of organisms	Culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Notochord index	
Control response 1	29.6	
Temperature	23 °C	
Test type	Static	
Photoperiod/light intensity	12:12	
Dilution water	FETAX solution	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	

Appendix, Section 2: Studies rated RL, LR, LL

Reference	Snawder & Chambers 1993	<i>X. laevis</i>
Parameter	Value	Comment
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	95%	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	0.1 % acetone ~1mL/L	
Concentration 1 Nom/Meas (µg/L)	3 uM = µg/L	1 rep with 10 per
Concentration 2 Nom/Meas (µg/L)	15 = µg/L	1 rep with 10 per
Concentration 3 Nom/Meas (µg/L)	30 = µg/L	1 rep with 10 per
Control	Solvent	1 rep with 10 per
NOEC; indicate calculation method, significance level (p-value) and minimum significant difference (MSD)	NR	Method: ANOVA p: < 0.05 MSD: NR
LOEC; indicate calculation method	3 uM = 990 µg/L	
MATC (GeoMean NOEC,LOEC)	Can not calculate	
% control at NOEC	Can not calculate	
% of control LOEC	123 %	

Other notes:

Unit conversion:

$$3 \text{ uM} = \frac{3 \text{ umol}}{\text{L}} \times \frac{1 \text{ mol}}{1000,000 \text{ umol}} \times \frac{330 \text{ g}}{\text{mol}} \times \frac{1000,000 \text{ ug}}{\text{g}} = 990 \text{ ug/L}$$

Significant effect at 15 uM malathion on embryo length, but that was the only the concentration tested (no dose-response).

Other tests were in vitro, with other compounds and not summarized.

Appendix
Section 3
Studies rated N

Toxicity Data Summary

Anodonta cygnea

Desi I, Dura L, Gonczi L, Kneffel Z, Strohmayer A, Szabo Z. 1976. Toxicity of malathion to mammals, aquatic organisms and tissue culture cells. *Arch Environ Contamin 3*: 410-425.

Mussel activity -48 h NOEC/LOEC-not appropriate for acute or chronic
Activity not related to survival growth or reproduction.

Relevance

Score: 60 (No Std method, Endpoint, Control not described and response NR)

Rating: N

Appendix, Section 3: Studies rated RN, LN, N

Toxicity Data Summary

Artemia sp

Brachionus plicatis

Guzella L, Gronda A, Colombo L. (1997) Acute toxicity of organophosphorus insecticides to marine invertebrates. *Bull Environ Contam Toxicol* 59:313-320.

Relevance- *Artemia sp* (brine shrimp)

Score: 52.5 (Saltwater, No values, Control response NR, No standard method)

Rating: N

Relevance- *Brachionus plicatis* (estuarine rotifer)

Score: 67.5 (Saltwater, Control response NR, No standard method)

Rating: N

Appendix, Section 3: Studies rated RN, LN, N

Barilius vagra

Toxicity Data Summary

Study: Alam MK, Maughan OE. 1992. The effect of malathion, diazinon, and various concentrations of zinc, copper, nickel, lead, iron, and mercury on fish. Biol Trace Elem Res 34: 225-236.

Relevance-acute

Score: 75 (No standard method, formulation)

Rating:L

Reliability

Score: 58.5

Rating:N

Reference	Alam & Maughan 1992	<i>B. vagra</i>
Parameter	Value	Comment
Test method cited	No standard method cited	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Barilius</i>	
Species	<i>vagra</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	6.0 cm	
Source of organisms	NR	
Have organisms been exposed to contaminants?	Cannot determine	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 hr	
Data for multiple times?	No	
Effect 1	Acute: mortality	
Control response 1	0% mortality	
Effect 2	Chronic: impaired dark skin, 7 day	
Control response 2	All Tests 0% mortality	
Temperature	20 °C	
Test type	Static bidaily renewal	
Photoperiod/light intensity	NR	
Dilution water	NR	
pH	7.2	
Hardness	NR	
Alkalinity	NR	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Alam & Maughan 1992	<i>B. vagra</i>
Parameter	Value	Comment
Conductivity	NR	
Dissolved Oxygen	6.5 mg/L	6.5/8.9 = 73 %
Feeding	None	
Purity of test substance	57 %	
Concentrations measured?	No	
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration of carrier (if any) in test solutions	None used	
Concentration 1 Nom (µg/L), Assuming nominal (not specified)	4000	Reps: 1 w/10 per
Concentration 2 Nom/ (µg/L)	6500	Reps: 1 w/10 per
Concentration 3 Nom (µg/L)	8550	Reps: 1 w/10 per
Concentration 4 Nom (µg/L)	11400	Reps: 1 w/10 per
Control	Dilution water	Reps: 1 w/10 per
LC50; indicate calculation method	Test 1: 7390 ug/L Test 2: 7660 ug/L	probit
Sublethal effect: Scoliosis	8500 ug/L	Not relevant endpoint
Sublethal effect: darkening skin	4000 ug/L	Not relevant endpoint

Study provides some long term/ sublethal/ chronic data but not LOEC or NOEC, and not relevant for criteria derivation.

Toxicity Data Summary

Barilius vagra

Study: Alam MK, Maughan OE. (1993) Acute toxicity of selected organophosphorus pesticides to *Cyprinus carpio* and *Barilius vagra*. *J Environ Sci Health Part B* 28(1):81-89.

Relevance

Score: 75 (No std method, 57% Formulation)

Rating: L

Reliability

Score: 53.5

Rating: N

Reference	Alam & Maughan 1993	<i>B. vagra</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Barilius</i>	
Species	<i>vagra</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	6.8 cm	
Source of organisms	NR	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	No Mortality	
Temperature	20 °C	
Test type	Static renewal	
Photoperiod/light intensity	NR	
Dilution water	NR	
pH	7.2	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	6.5	
Feeding	None	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Alam & Maughan 1993	<i>B. vagra</i>
Parameter	Value	Comment
Purity of test substance	57 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	None	
Concentrations (µg/L)	NR	1 reps with 10 per
Control	Yes, water only	1 reps with 10 per
LC50s (TEST 1) µg/L		
Probit	Adjusted slope probit	
7666	6020	
LC50s (TEST 2) µg/L		
Probit	Adjusted slope probit	
7390	5020	

Toxicity Data Summary

Biomphalaria havanensis

Helisoma trivolvis

Tchounwou PB, Englande AJ Jr, Malek EA. (1991) Toxicity evaluation of Bayluscid and malathion to three developmental stages of freshwater snails. *Arch Environ Contam Toxicol* 21:351-358.

Relevance

values above water solubility

Rating: N

Water solubility of malathion is about 125 mg/L. that these values are above that, so this study will not be used. Shows snails are pretty insensitive to malathion.

Toxicity Data Summary

Bufo arenarum

Study: Anguiano OL, Caballero de Castro A, Pechen de D'Angelo AM. (2001) The role of glutathion conjugation in the regulation of early toad embryos' tolerance to pesticides. *Compar Biochem Physiol Part C* 128: 35-43.

Not relevant

Other notes: Study mostly on GSH, which is not linked to survival growth or reproduction. The mortality measurement was done with only 2 concentrations, so no dose response, and therefore no values.

Toxicity Data Summary

Bufo woodhousii fowleri

Study: Sanders HO. (1970) Pesticides toxicities to tadpoles of the western chorus frog *Pseudacris triseriata* and Fowler's toad *Bufo woodhousii fowleri*. *Copeia* 2:246-251. MRID 00084757.

Relevance

Score: 68.5 (No Std method, Chem grade NR, Control response NR)

Rating:N

Reference	Sanders 1970	<i>B. woodhousii fowleri</i>
Parameter	Value	Comment
Test method cited	NR	
Phylum	Chordata	
Class	Amphibia	
Order	Anura	
Family	Bufonidae	
Genus	<i>Bufo</i>	
Species	<i>woodhousii</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	4-5 w old	
Source of organisms	Eggs from ponds near the research laboratory Columbia, MO	
Have organisms been exposed to contaminants?	maybe	
Animals acclimated and disease-free?	2 h	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24, 48, 96 h	
Effect 1	mortality	
Control response 1	NR	
Temperature	15.5 ± °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	De-mineralized with 0.45g CaSO ₄ , 0.45g MgSO ₄ , 0.72g Na ₂ CO ₃ , 0.8g KCl per 15L	
pH	7.1	
Hardness	7.1 ppm calcium, 3.1 ppm	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Sanders 1970	<i>B. woodhousii fowleri</i>
Parameter	Value	Comment
	magnesium	
Alkalinity	30 ppm methyl orange	
Conductivity	NR	
Dissolved Oxygen	NR- aerated	
Feeding	Yes- organic debris	
Purity of test substance	NR	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Ethanol, concentration NR	
Concentrations ($\mu\text{g/L}$)	(4- 5 concentrations) NR	1 Rep (?),10 per rep
Control	Solvent control	1 Rep (?),10 per rep
LC50 - 24 h	1.9 (1.4-3.5) mg/L	Litchfield and Wilcoxon's
LC50 - 48 h	0.50 (0.25-1.3) mg/L	
LC50 - 96 h	0.42 (0.09-0.98) mg/L	

Toxicity Data Summary

Ceriodaphnia dubia

Ankley GT, Dierkes JR, Jensen DA, Peterson GS. (1991) Piperonyl butoxide as a tool in aquatic toxicological research with organophosphate insecticides. *Ecotox Environ Saf* 21: 266-274.

Relevance

Score: 82.5 (no std method, control response NR)

Rating: L

Reliability

Score: 54.5

Rating: N

Reference	Ankley <i>et al.</i> 1991	<i>C. dubia</i>
Parameter	Value	Comment
Test method cited	None	Done in EPA lab
Phylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	<i>Ceriodaphnia</i>	
Species	<i>dubia</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	≤ 48 h	
Source of organisms	EPA Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	0% mortality	Probably, see notes
Temperature	25 ± °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	10% mineral water in ultra pure water	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Ankley <i>et al.</i> 1991	<i>C. dubia</i>
Parameter	Value	Comment
Purity of test substance	95-99%	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	1.5 % methanol 15mL/L	
Concentration 1 Nom ($\mu\text{g/L}$)	NR	2 Reps, 5 per
Concentration 2 Nom ($\mu\text{g/L}$)	NR	2 Rep , 5 per
Concentration 3 Nom ($\mu\text{g/L}$)	NR	2 Reps, 5 per
Concentration 4 Nom ($\mu\text{g/L}$)	NR	2 Reps, 5 per
Control	Dilution water	2 Reps, 5 per
LCx; indicate calculation method	2.12 $\mu\text{g/L}$	trimmed Spearman-Karber method

Table 5 has concentrations and responses, the but explanation in footnote a seems to indicate this is a test after the LC50 was determined. So these are probably not the concentrations and responses for the LC50. in all table control survival is > or = 90%

Toxicity Data Summary

Ceriodaphnia quadrangula

Mansour SA, Hassan TM. (1993) Pesticides and *Daphnia*. 3. An analytical bioassay method, using *Ceriodaphnia quadrangula*, for measuring extremely low concentrations of insecticides in waters. *Int J Toxicol Occup Environ Health* 2(2):34-39.

Relevance

Score: 52.5 (Purity 57%, No std method, No values, Control response NR)

Rating: N

Other notes: Study reports only EC 20 and EC 90 values from 1 hr exposure

Toxicity Data Summary

Channa gachua &
Cirrhina mrigala

Study: Verma SR, Tyagi AK, Bhatnagar MC, Dalela RC. (1979) Organophosphate poisoning to some fresh water teleosts - Acetylcholinesterase inhibition. *Bull Environ Contam Toxicol* 21(4/5):502-506

AChE results only, doesn't report LC50s. All exposure results in elevated AchE activity, so no NOEC/LOEC. No ECX values calculated

Relevance

Score: 55 (50% formulation, Endpoint, No values)

Rating:N

Other notes: Cites a standard method, but more for LC50 determination

Channa gachua: family Channidae- in NA

Cirrhina mrigala: family Cyprinidae- in NA

Toxicity Data Summary

Channa punctatus

Study: Shukla JP. (1988) Malathion induced biochemical alterations in the liver of the fingerlings of *Channa punctatus* (Bl). *Acta Hydrochimica et Hydrobiologica* 18:621-624.

Shows changes in DNA RNA and protein content in liver after 20 d exposures to 2.5 mg/L malathion. No dose response (only one concentrations) and no firm link to survival growth or reproduction for observed effects.

Not relevant

Toxicity Data Summary

Channa punctatus

Study: Shukla JP, Banerjee M, Pandey K. (1987) Deleterious effects of malathion on survivality and growth of the fingerlings of *Channa punctatus* (Bloch), a freshwater Murrel. *Acta Hydrochim Hydrobiol* 15(6):653-657.

Relevance

Score: 92.5 (Control response NR)

Rating: R

Reliability

Score: 57

Rating: N

30 day growth test conducted also but this consisted of only one concentration and no NOEC was available.

Reference	Shukla <i>et al.</i> 1987	<i>C. punctatus</i>
Parameter	Value	Comment
Test method cited	APHA	
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Channidae	
Genus	<i>Channa</i>	
Species	<i>punctatus</i>	
Family in North America?	Yes, invasive	Native to Africa & Asia
Age/size at start of test/growth phase	Fingerling, maybe 0.07 g (from table 2)	
Source of organisms	Local lake	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24,48,72,96 h	
Effect 1	Mortality	
Control response 1	NR	
Temperature	24 ± 1.2 °C	
Test type	Static (assumed)	
Photoperiod/light intensity	NR	
Dilution water	Tap water	
pH	7.21	
Hardness	174.90 mg/L	
Alkalinity	NR	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Shukla <i>et al.</i> 1987	<i>C. punctatus</i>
Parameter	Value	Comment
Conductivity	539.0 us/cm	
Dissolved Oxygen	6.38 ± 0.57 mg/L	
Feeding	None	
Purity of test substance	95 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	NR, but malathion was high purity, so seems like a solvent would have been used	
Concentrations (µg/L)	NR	Reps and # per: NR
Control	Yes, assume it was dilution water only, can't tell if solvent used.	Reps and # per: NR
LC50, 24 h	10,950 µg/L	
LC50, 48 h	8,360	
LC50, 72 h	4,920	
LC50, 96 h	3,220	

Other notes:

Toxicity Data Summary

*Channa punctatus**Heteropneustes fossilis*

Study: Singh VP, Gupta S, Saxena PK. (1984) Evaluation of acute toxicity of carbaryl and malathion to freshwater teleosts, *Channa punctatus* (Bloch) and *Heteropneustes fossilis* (Bloch). *Toxicol Lett* 20:271-276.

Relevance

Score: 70 (50% formulation, Control description & response NR)

Rating: L

Reliability

Score: 42.5

Rating: N

Reference	Singh <i>et al.</i> 1984	<i>C. punctatus</i>
Parameter	Value	Comment
Test method cited	APHA, more for dilutions	
Phylum	Chordata	Chordata
Class	Actinopterygii	Actinopterygii
Order	Perciformes	Siluriformes
Family	Channidae	Clariidae
Genus	<i>Channa</i>	
Species	<i>punctatus</i>	
Family in North America?	Yes, invasive	
Age/size at start of test/growth phase	24.5 ± 2.6 g	
Source of organisms	Environment	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24, 48, 72, 96 h	
Effect 1	Mortality	
Control response 1	hardly any	
Temperature	NR	
Test type	NR	
Photoperiod/light intensity	NR	
Dilution water	Dechlorinated	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Singh <i>et al.</i> 1984	<i>C. punctatus</i>
Parameter	Value	Comment
Feeding	None	
Purity of test substance	50% formulation	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	NR, probably none since already in emulsifier	
Concentrations Nom/Meas ($\mu\text{g/L}$)	NR	1 reps with 10 per
Control	Yes, mentioned in results, but not described	NR
LC50, 24 h	4.20 (4.12-4.25)	LC50 determine by graphical interpolation, but ranges calculated via methods of Litchfield & Wilcoxon [confusing]
LC50, 48 h	3.70 (3.66-3.75)	
LC50, 72 h	3.32 (3.27-3.36)	
LC50, 96 h	2.90 (2.87-2.94)	
LC50, 24 h	5.80 (5.70-5.92)	
LC50, 48 h	3.35 (5.25-5.50)	
LC50, 72 h	4.50-6.00* (4.80-5.10)	
LC50, 96 h	4.00-5.50* (4.35-4.60)	

Other notes:

States: 'hardly any mortality occurred' in control. This was not counted as acceptable control response. Not clear what this amount it.

*Not clear why there is not one value here.

Toxicity Data Summary

Chironomus dilutus (formerly *tentans*)

Study: Karnak RE, Collins WJ. (1974) The susceptibility to selected insecticides and acetylcholinesterase activity in a laboratory colony of midge larvae, *Chironomus tentans*. (Diptera: Chironomidae). *Bull Environ Contamin Toxicol* 12:62-69.

Relevance

Score: 75 (no std method, Control not described, Control mortality high)

Rating: L

Reliability

Score: 49

Rating: N

Reference	Karnak & Collins 1974	<i>C. dilutus</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Chironomidae	
Genus	<i>Chironomus</i>	
Species	<i>tentans</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	3 - 4th instar	
Source of organisms	Eggs from adults collected at a sewage treatment plant	
Have organisms been exposed to contaminants?	Eggs probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	24 h	
Data for multiple times?	No	
Effect 1	Immobility/Mortality	
Control response 1	20 ± 12%	
Temperature	22 °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Dechlorinated tap	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Karnak & Collins 1974	<i>C. dilutus</i>
Parameter	Value	Comment
Feeding	Yes	
Purity of test substance	>90 %	
Concentrations measured?	NR	
Measured is what % of nominal?	Nr	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone, concentration NR	
Concentrations Nom/Meas ($\mu\text{g/L}$)	NR	3 reps with 3 per
Control	NR*	Reps and # per (cell density for single
LC50	1.7 $\mu\text{g/L}$	Graphical interpolation
LC50, corrected for check mortality	2.0 $\mu\text{g/L}$	

Other notes:

*states results corrected for check [control] mortality but, control type or response NR.

There was no AChE data from organisms exposed to malathion.

Toxicity Data Summary

Chironomus riparius

Belden JB, Lydy MJ. 2001. Effects of atrazine on acetylcholinesterase activity in midges (*Chironomus tentans*) exposed to organophosphorus insecticides. *Chemosphere* 44:1685-1689.

Not Relevant

Relevant info is just re-reported from the same authors' 2000 study that is summarized separately.

Toxicity Data Summary

Chironomus riparius

Kallander DB, Fisher SW, Lydy MJ. (1997) Recovery following pulsed exposure to organophosphorus and carbamate insecticides in the midge, *Chironomus riparius*. *Arch Environ Contam Toxicol* 33(1):29-33.

Not Relevant

Study only has a 1 hr EC20 of 32 ug/L

"These results contribute to the belief that episodic exposure to insecticides is less toxic if recovery in clean water is provided." ...but not really for Ops tested...

"Two 1-h pulses were equally toxic as a single 2-h continuous exposure for the two organophosphorus insecticides."

May be useful for microcosm section

Toxicity Data Summary

Chironomus tepperi

Study: Stevens MM. (1991) Insecticide treatments used against a rice bloodwork, *Chironomus tepperi* (Diptera: Chironomidae): toxicity and residual effects in water. *J Econ Entom* 84:795-800.

Relevance

Score: 60 (No standard method; formulation; No toxicity values calculated/calculable)

Rating: N

Appendix, Section 3: Studies rated RN, LN, N

Chironomus tepperi

Toxicity Data Summary

Study: Stevens MM. 1992a. Toxicity of organophosphorus insecticides to fourth-instar larvae of *Chironomus tepperi* Skuse (Diptera: Chironimidae). *J Aust Ent Soc* 31:335-337.

Relevance

Score: 67.5 (No standard method, purity, control response NR)

Rating: N

Toxicity Data Summary

Chironomus tepperi

Study: Stevens MM, Warren GN. 1992. Insecticide treatments used against a rice bloodworm, *Chironomus tepperi* (Diptera: Chironomidae): suppression of larval populations. *J Econ Entom* 85: 1606-1613.

Relevance

Score: 60 (No standard method; formulation; No toxicity values calculated/calculable)

Rating: N

Toxicity Data Summary

Chironomus tepperi

Study: Stevens MM, Warren GN. (1995) Efficacy of malathion seed treatments for Chironomid control in aerially-sown rice crops. *Int J Pest Manag* 41(3):157-160.

Not relevant

Lab bioassays tests mortality of water samples collected from a field that had malathion (500 or 300 formulations) applied. No water concentrations of malathion were reported.

Other organism responses were measured in the field (i.e. emergence) but again not water concentration were available for comparison, making this data not useful for criteria calculation or the field/mesocosm section.

Appendix, Section 3: Studies rated RN, LN, N

Chrysophyta
 Cyanophyta
 Chlorophyta phyla; multiple species

Toxicity Data Summary

Study: Murray HE, Guthrie RK. (1980) Effects of carbaryl, diazinon, and malathion on native aquatic populations of microorganisms. *Bull Environ Contam Toxicol* 24: 535-542.

Relevance
 Score: 70 (purity, not tox values)
 Rating: L

Reliability
 Score: 46
 Rating: N

Reference	Murray & Guthrie 1980	Various Chrysophyta, Cyanophyta, Chlorophyta
Parameter	Value	Comment
Test method cited	APHA 1975	
Phylum	Chrysophyta, Cyanophyta, and Chlorophyta	No genus, species identified
Class	NR	
Order	NR	
Family	NR	
Genus	NR	
Species	NR	
Found in	N. America	
Age/size at start of test/growth phase	NR	
Source of organisms	Lake Houston	
Have organisms been exposed to contaminants?	Possibly	
Animals acclimated and disease-free?	NR	
Animals randomized?	Yes	
Test vessels randomized?	Yes	
Test duration	14 days	Long for static test
Data for multiple times?	No raw data reported	
Effect 1	Algal cells/mL	p < 0.05, significant compared to control
Control response 1	Baseline	
Temperature	21 ± 2 degrees C	Monitored daily during testing
Test type	NR	
Photoperiod/light intensity	12 hour light:dark	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Murray & Guthrie 1980	Various Chrysophyta, Cyanophyta, Chlorophyta
Parameter	Value	Comment
Dilution water	Lake Houston, aerated 1 wk prior to testing	Not sterilized; study looked at effects on bacterial counts, too
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	Value not recorded, but monitored daily	
Feeding	NR	
Purity of test substance	NR	
Concentrations measured?	No	Only one concentration used
Measured is what % of nominal?	NA	
Chemical method documented?	NA	
Concentration 1 Nom/Meas (mg/L)	5.0; only one concentrations used	3 reps, 10 ³ cells/mL
Control	Lake Houston water	1 rep, 10 ³ cells/mL

No toxicity values calculated/reported.

Direct algal counts not significantly altered (p>0.05)

Slight increase in biological oxygen demand (BOD).

ATP biomass increased on d 7; changed little after.

Toxicity Data Summary

Colpidium campylum

Study: Dive D, Leclerc H, Persoone G. (1980) Pesticide toxicity on the ciliate protozoan *Colpidium campylum*: Possible consequences of the effect of pesticides in the aquatic environment. *Ecotoxicol Environ Saf* 4:129-133.

Relevance

Score: 52.5 (no std. method, no values, purity NR, control response NR)

Rating: N

Not toxic at 10 ppm

Culex tritaeniorhynchus

Toxicity Data Summary

Study: Takahashi M, Yasutomi K. (1978) Insecticidal resistance of *Culex tritaeniorhynchus* (Diptera: Culicidae) in Japan: genetics and mechanisms of resistance to organophosphorous insecticides. *J Med Ent* 24:595-603.

Relevance

Score: 75 (No standard method; Controls not described/reported)

Rating:L

Reliability

Score: 45.5

Rating:N

Reference	Takahashi & Yasutomi 1978	<i>C. tritaeniorhynchus</i>
Parameter	Value	Comment
Test method cited	NR	
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Culicidae	
Genus	<i>Culex</i>	
Species	<i>tritaeniorhynchus</i>	
Family in North America?	Yes-mosquitoes	
Age/size at start of test/growth phase	4th instar	
Source of organisms	colony	
Have organisms been exposed to contaminants?	no	
Animals acclimated and disease-free?	yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	24 h	
Data for multiple times?	no	
Effect 1	Mortality	
Control response 1	NR	
Temperature	25 C	
Test type	static	
Photoperiod/light intensity	NR	
Dilution water	NR	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Takahashi & Yasutomi 1978	<i>C. tritaeniorhynchus</i>
Parameter	Value	Comment
Feeding	NR	
Purity of test substance	97.7%	
Concentrations measured?	no	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	NR	
Concentration 1 Nom/Meas (µg/L)	NR	Reps 1(?), 24 per rep
Concentration 2 Nom/Meas (µg/L)	NR	
Concentration 3 Nom/Meas (µg/L)	NR	
Concentration 4 Nom/Meas (µg/L)	NR	
Concentration 5 Nom/Meas (µg/L)	NR	
Control	Not described	
LC50; indicate calculation method	4 µg/L	probit
ECx; indicate calculation method	NR	
NOEC; indicate calculation method, significance level (p-value) and minimum significant difference (MSD)	NR	Method: p: MSD:
LOEC; indicate calculation method	NR	
MATC (GeoMean NOEC,LOEC)	NR	
% control at NOEC	NR	
% of control LOEC	NR	

Other notes: used data on susceptible strain only

Toxicity Data Summary

Cyprinus carpio

Study: Alam, M.K., and O.E. Maughan. 1993. Acute Toxicity of Selected Organophosphorus Pesticides to *Cyprinus carpio* and *Barilius vagra*. J.Environ.Sci.Health Part B 28(1):81-89

Relevance

Score: 75 (No std method, 57% Formulation)

Rating: L

Reliability

Score: 53.5

Rating: N

Reference	Alam & Maughan 1993	<i>C. carpio</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Cyprinus</i>	
Species	<i>carpio</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	2.5, 5 cm	
Source of organisms	NR	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	No Mortality	
Temperature	25 °C	
Test type	Static renewal	
Photoperiod/light intensity	NR	
Dilution water	NR	
pH	7	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	6.43	
Feeding	None	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Alam & Maughan 1993	<i>C. carpio</i>
Parameter	Value	Comment
Purity of test substance	57 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	None	
Concentrations ($\mu\text{g/L}$)	NR	1 reps with 10 per
Control	Yes, water only	1 reps with 10 per
LC50s (2.5 cm fish) $\mu\text{g/L}$		
Probit	Adjusted slope probit	Trimmed Spearman Karber
13800	12300	10210
LC50s (5.0 cm fish) $\mu\text{g/L}$		
Probit	Adjusted slope probit	Trimmed Spearman Karber
12810	9460	10380

Toxicity Data Summary

Cyprinus carpio

Study: Dutt N, Guha RS. (1988) Toxicity of few organophosphorus insecticides to fingerlings of bound water fishes, *Cyprinus Carpio* (Linn.) and *Tilapia mossambica* Peters. *Indian J Ent* 50:403-21.

Relevance

Score: 60 (No std method, Purity NR, Control description and response NR)

Rating: N

Other notes: performed exposures with and without soil. Presence of soil reduce toxicity slightly. LC50 lower by 5-10%.

Toxicity Data Summary

Cyprinus carpio

Study: Verma SR, Tonk IP, Dalela RC. (1981) Determination of the maximum acceptable toxicant concentration (MATC) and the safe concentration for certain aquatic pollutants. *Acta Hydrochim Hydrobiol* 9(3):247-254.

Relevance

Score: 68.5 (No std method, Purity NR, Control Response)

Rating: N

Toxicity Data Summary

Danio rerio

Kumar K, Ansari BA. (1984) Malathion toxicity - Skeletal deformities in Zebrafish (*Brachydanio rerio*, Cyprinidae). *Pestic Sci* 15(2):107-111.

Relevance

Score: 82.5 (Control response NR, No std method)

Rating: L

Reliability

Score: 55.5

Rating: N

Relevance-Sublethal 4 mo

Score: 60 (No Control, No std method, No values)

Rating: N

Relevance-Sublethal 7 d

Score: 75 (No std method, No Values, Endpoint)

Rating: L

Reliability

Score: 57.5

Rating: N

Reference	Kumar & Ansari 1984	<i>D. rerio</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cypriniformes	
Family	Cyprinidae	
Genus	<i>Danio</i>	
Species	<i>rerio</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	NR, Mature for chronic	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	Acute: 96 h / Chronic: 4mo	
Data for multiple times?	In acute: 24, 48, 72, 96	
Effect 1	Mortality	
Control response 1	NR	
Effect 2	Sublethal effects after 4 mo	GSI, spawning etc
Control response 2	No control in this test	
Effect 2	Sublethal effects after 7 day	Only GSI reported
Control response 2	GSI= 14.87	
Temperature	25-27 °C, but for culture	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Kumar & Ansari 1984		<i>D. rerio</i>
Parameter	Value		Comment
Test type	Static		
Photoperiod/light intensity	NR		
Dilution water	'Dechlorinated water'		(probably tap)
pH	6.6-8.5 , but for culture		
Hardness	NR		
Alkalinity	NR		
Conductivity	NR		
Dissolved Oxygen	NR		
Feeding	None		
Purity of test substance	95%		
Concentrations measured?	NR		
Measured is what % of nominal?	NR		
Chemical method documented?	NR		
Conc of carrier in test solutions	Acetone – amount NR		
ACUTE			
Concentrations	5 conc's- NR (probably 700, 900, and 1100, were 3/5 concentrations tested)		6 reps with ?in each
Control	Solvent		6 reps with ?in each
CHRONIC- 1 concentration			
LC50: 24 h	1450 (1380-1520) µg/L		probit
LC50: 48 h	1250 (1220-1280)		
LC50: 72 h	115 (1110-1190)		
LC50: 96 h	1050 (1020-1090)		
Sublethal effects after 4 mo, no spawning:	500 µg/L	(can't label this a LOEC-only 1 conc. tested)	
Effects after 7 days on GSI:	700 µg/L	(only 3 conc's, and no NOEC, so can't label this a LOEC)	

Also looked at fish that survived acute test (plus 3 more days exposure, for a total of 7 days exposure) after 7 day recovery period. The GSI (gonadal somatic index) of fish after the 7 day exposure was compared to control and significant difference were found. Fish after the 7 day exposure were also compared to after the 7 day recovery, but this comparison lacks control. Seems to demonstrate recovery, but that's not really how it is discussed.

In the 4 month chronic test GSI of fish at end of 4 mo exposure was compared to those of fish treated them same, but then allowed a 2 month recovery. This experiment lacks a control. And series of concentrations needed to construct a dose response relationship. Effects seen: The zebrafish under continuous malathion stress for 4 months, became slimmer and failed to spawn. Fifty per cent of these fish looked abnormal and showed twitch-like movements, X-rays revealed alteration and fractured backbones, especially in the posterior region

Toxicity Data Summary

Daphnia magna

Desi I, Dura L, Gonczi L, Kneffel Z, Strohmayer A, Szabo Z. (1976) Toxicity of malathion to mammals, aquatic organisms and tissue culture cells. *Arch Environ Contamin* 3: 410-425.

No LC50- 7 day NOEC/LOEC- chronic value

Relevance

Score: 75 (No Std method, Control not described and response NR,)

Rating: L

Reliability

Score: 30.5

Rating: N

Reference	Desi et al. 1976	<i>D. magna</i>
Parameter	Value	Comment
Test method cited	NR	
Phylum	Arthropoda	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	<i>Daphnia</i>	
Species	<i>magna</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	NR	
Source of organisms	NR	
Have organisms been exposed to contaminants?	Source NR-but probably lab culture	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	7d	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	NR	
Test type	NR	
Photoperiod/light intensity	NR	
Dilution water	NR	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Desi <i>et al.</i> 1976	<i>D. magna</i>
Parameter	Value	Comment
Dissolved Oxygen	NR	
Feeding	NR- probably none	
Purity of test substance	95%	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	NR	
Concentration 1 Nom/Meas (µg/L)	1	3 reps, 30 per rep
Concentration 2 Nom/Meas (µg/L)	10	3 reps, 30 per rep
Concentration 3 Nom/Meas (µg/L)	100	3 reps, 30 per rep
Concentration 4 Nom/Meas (µg/L)	1000	3 reps, 30 per rep
Concentration 5 Nom/Meas (µg/L)	10,000	3 reps, 30 per rep
Concentration 6 Nom/Meas (µg/L)	100,000	3 reps, 30 per rep
Control	Type not described	3 reps, 30 per rep
LCx;	NR	
NOEC; 7 days	1	Method: ANOVA p: NR MSD: NR
LOEC; indicate calculation method	10	
MATC (GeoMean NOEC,LOEC)	3.16	
% control at NOEC	NR	
% of control LOEC	NR	

Other notes:

Toxicity Data Summary

Daphnia magna

Study: Hermens J, Canton H, Steyger N, Wegman R. (1984) Joint effects of a mixture of 14 chemicals on mortality and inhibition of reproduction of *Daphnia magna*. *Aquat Toxicol* 5(4):315-322.

Relevance

Score: 70 (Purity NR, Control not described and response NR)

Rating: L

Reliability

Score: 43.5

Rating: N

Reference	Hermens <i>et al.</i> 1984	<i>D. magna</i>
Parameter	Value	Comment
Test method cited	Dutch Standard 1980	
Phylum	Arthropoda	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	<i>Daphnia</i>	
Species	<i>magna</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	<24 h	
Source of organisms	NR	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48h; 16 d	
Data for multiple times?	No	
Effect 1	48h LC50- mortality	
Control response 1	NR	
Effect 2	16-d EC50-reproduction	
Control response 2	NR	
Temperature	19 ± 1 °C	
Test type	Static (acute); Static renewal (chronic) : 3x /wk	
Photoperiod/light intensity	NR	
Dilution water	Dutch Standard	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Hermens <i>et al.</i> 1984	<i>D. magna</i>
Parameter	Value	Comment
Dissolved Oxygen	NR	
Feeding	Yes chronic; no acute	
Purity of test substance	NR	
Concentrations measured?	Yes	
Measured is what % of nominal?	63and 64% (acute and chronic test)	
Chemical method documented?	Yes	
Concentration of carrier (if any) in test solutions	NR	
Concentration 1 Meas (µg/L)	Dilution factor 3.2	reps with 25 per (acute); 2 reps with 15 per (chronic)
Control	NR	
LC50	33 ug/L	Based on measured concentrations; calculation method NR
EC50	0.36 ug/L	

Other notes:

Also contain data on mixture, but mixture contained 14 different compounds so information not useful for criteria.

Toxicity Data Summary

Daphnia magna

Lilius H, Isomaa B, Holmstrom T. (1994) A comparison of the toxicity of 50 reference chemicals to freshly isolated rainbow trout hepatocytes and *Daphnia magna*. *Aquat Toxicol* 30:47-60.

Relevance

Score: 85 (Control not described and response NR)

Rating: L

Reliability

Score: 59.5

Rating: N*

*Reliability of 59.5 would normally round up to 60, a low L, but since this is so close to and N rating and there is a likely problem with units, this is being rating as N

Reference	Lilius et al. 1994	<i>D. magna</i>
Parameter	Value	Comment
Test method cited	OECD 1980	
Phylum	Arthropoda/Crustacea	
Class	Branchiopoda	
Order	Cladocera	
Family	Daphniidae	
Genus	<i>Daphnia</i>	
Species	<i>magna</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	< 24 h	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	24 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	21 ± 1 °C	
Test type	Static	
Photoperiod/light intensity	12:12	
Dilution water	standard reference water	Recipe given
pH	7.6	No clear that is was actually monitored or just part recipe
Hardness	Calcium concentration	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Lilius <i>et al.</i> 1994	<i>D. magna</i>
Parameter	Value	Comment
	given in recipe	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	95 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone or ethanol, concentration NR	
Concentrations Nom/Meas (µg/L)	5 concentrations, levels NR	3 reps** and 20 per
Control	NR	Reps and # per (cell density for single
LCx; indicate calculation method	1.07 µM (± 0.11)	Linear regression of log-transformed values

Other notes:

**Test with 1 rep was actually repeated 3 times

Conversion of LC50:

$$\frac{1.07 \text{ umol}}{\text{L}} \times \frac{\text{mol}}{1000,000 \text{ umol}} \times \frac{330.35 \text{ g}}{\text{mol}} \times \frac{1000,000 \text{ ug}}{\text{g}} = 353.5 \text{ ug/L}$$

Units are likely incorrectly reported- this LC50 is at least 100x higher than other values

Toxicity Data Summary

Daphnia pulex

Study: Sanders HO, Cope OB. (1966) Toxicities of several pesticides to two species of cladocerans. *Trans Am Fish Soc* 95: 165-169.

Relevance

Score: 60 (No standard method; Purity NR; Controls not described and not reported)

Rating: N

Toxicity Data Summary

Dreissena polymorpha

Dauberschmidt C, Dietrich DR, Schlatter C. (1996) Toxicity of organophosphorus insecticides in the Zebra Mussel, *Dreissena polymorpha* P. *Arch Environ Contam Toxicol* 30(3):373-378.

Not relevant

Only 2 concentrations tested with malathion- no dose-response and no values

Appendix, Section 3: Studies rated RN, LN, N

Dugesia tigrina

Toxicity Data Summary

Villar D, González M, Gualda MJ, Schaeffer DJ. (1994) Effects of organophosphorus insecticides on *Dugesia tigrina*; cholinesterase activity and head regeneration. *Bull Environ Contam Toxicol* 52: 319-324.

Relevance

Score: 60 (no std. method, purity, controls not described or response reported)

Rating: N

Toxicity Data Summary

Gammarus lacustris

Study: Nebeker AV, Gaufin AR. (1964) Bioassays to determine pesticide toxicity to the amphipod crustacean, *Gammarus lacustris*. *Proc Utah Acad Sci* 4(1):64-67.

Relevance

Score: 85 (Control type and response NR)

Rating: L

Reliability

Score: 44

Rating: N

Reference	Nebeker & Gaufin 1964	<i>G. lacustris</i>
Parameter	Value	Comment
Test method cited	Fed. of Sewage and Industrial Wastes Asc.	
Phylum	Arthropoda	
Class	Malacostraca	
Order	Amphipoda	
Family	Evanioidae	
Genus	<i>Gammarus</i>	
Species	<i>lacustris</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	NR	
Source of organisms	NR (field?)	States dilution water and specimens obtained from same place
Have organisms been exposed to contaminants?	NR	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	Held at 59 F °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	NR (natural water)	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Nebeker & Gaufin 1964	<i>G. lacustris</i>
Parameter	Value	Comment
Dissolved Oxygen	NR (aerated)	
Feeding	None	
Purity of test substance	Technical grade	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	5 concentrations spaced logarithmically	2 reps with 10 per
Control	Yes, but type NR	2 reps with 10 per
LC50	1.62 $\mu\text{g/L}$	Graphical interpolation

Appendix, Section 3: Studies rated RN, LN, N

Toxicity Data Summary

Gammarus lacustris

Study: Sanders HO. (1969) Toxicity of pesticides to the crustacean *Gammarus lacustris*. Tech. Pap. No. 25, U.S.D.I., Bur. Sports Fish. Wildl., Fish Wildl. Serv., Washington, DC: 18 p.

Data repeated in Mayer & Ellersieck 1986

Relevance

Score: 75 (No std method, Control Not described)

Rating:L

Reliability

Score: 58

Rating: N

Reference	Sanders 1969	<i>G. lacustris</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Arthropoda	
Class	Malacostraca	
Order	Amphipoda	
Family	Evanioidae	
Genus	<i>Gammarus</i>	
Species	<i>lacustris</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	2 month old	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24, 48, 96h	
Effect 1	Mortality	
Control response 1	NR	
Temperature	70 ± 1 °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted	
pH	7.1	
Hardness	States Ca 7.1ppm, Mg =3.1 ppm	And give water recipe
Alkalinity	30 pp,	
Conductivity	NR	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Sanders 1969	<i>G. lacustris</i>
Parameter	Value	Comment
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	Technical	Stated in Table 3 header
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	≤1 mL/L ethanol	
Concentrations 1 Nom/Meas (µg/L)	4-5, Concentrations NR	1 Rep with 10per
Control	Yes, type NR	1 Rep with 10per
LC50, 24 h	3.8 (3.5-4.1)	Litchfield & Wilcoxon
LC50, 48 h	1.8 (1.3-2.4)	
LC50, 96 h	1.0 (0.55-1.5)	

Toxicity Data Summary

Gammarus oceanicus, and others

Study: Shacklock PF, Croft GB. (1981) Effect of grazers on *Chondrus crispus* in culture. *Aquacult* 22:331-342.

Only tests two concentrations of malathion, so no dose response and no values calculated.
Not relevant

Other notes: 25% malathion

Toxicity Data Summary

Gasterosteus aculeatus

Katz M. (1961) Acute toxicity of some organic insecticides to three species of Salmonids and to the Threespine Stickleback. *Trans Am Fish Soc* 90(3):264-268.

Relevance

Score: 75 (Formulation, No std. method)

Rating: L

Reliability

Score: 55

Rating: N

Reference	Katz 1961	<i>G. aculeatus</i>
Parameter	Value	Comment
Test method cited	Cite another ref.:Doudoroff 1951	
Phylum	Chordata	
Class	Actinopterygii	
Order	Gasterosteiformes	
Family	Gasterosteidae	
Genus	<i>Gasterosteus</i>	
Species	<i>aculeatus</i>	
Family in North America?	Yes	Stickleback
Age/size at start of test/growth phase	0.83-1.75 in., 0.38-0.77 g	
Source of organisms	Yaquina Bay, Oregon	
Have organisms been exposed to contaminants?	Possibly	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	0%	
Temperature	20 ± 0.5 °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Spring water, but 5ppt salinity	No explanation of source of salt water
pH	6.8-7.4	
Hardness	NR	
Alkalinity	45-57 mg/L CaCO ₃	
Conductivity	NR	
Dissolved Oxygen	Bubbled in compressed gas to maintain, but levels NR	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Katz 1961	<i>G. aculeatus</i>
Parameter	Value	Comment
Feeding	None	
Purity of test substance	57 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone, amt NR	
Concentration 1 Nom/Meas (µg/L)	NR	2 (?) reps with 3-5 per rep; Total of 10-20 fish. Except half at highest and lowest concentrations
Control	Solvent control	2 (?) reps with 3-5 per rep; Total of 10-20 fish.
LC50; 24 h	96.9 µg/L	Method- NR
LC50; 48 h	94.0	
LC50; 72 h	94.0	
LC50; 96 h	94.0	

Other notes:

tested in replicate during successive weeks

Statistical method NR

Also tested stickleback at 25 ppt salinity, but these results were not summarized as they rate N

Toxicity Data Summary

Glochidum

Desi I, Dura L, Gonczi L, Kneffel Z, Strohmayer A, Szabo Z. 1976. Toxicity of malathion to mammals, aquatic organisms and tissue culture cells. *Arch Environ Contamin* 3: 410-425.

Glochidum

Larval Mussel Shell closing activity- NOEC: 0.1 ug/L, LOEC: 1 ug/L; 5 days
Reports control t-value, but no way to determine if this is an acceptable control response
Larval Mussel Shell closing activity- related to survival, growth or reproduction?
NOEC/LOEC data but short tem, not appropriate for acute or chronic?

Relevance

Score: 60 (No Std method, Endpoint, Control not described, response NR)

Rating: N

Toxicity Data Summary

Heteropneustes fossilis

Study: Singh PB, Singh TP. (1992) Impact of malathion and gamma-BHC on steroidogenesis in the freshwater Catfish, *Heteropneustes fossilis*. *Aquat Toxicol* 22:69-80.

Relevance

Score: 52.5 (control response NR, No std method, Purity NR, Family not in NA)

Rating: N

Appendix, Section 3: Studies rated RN, LN, N

Lepomis macrochirus

Toxicity Data Summary

Macek KJ. 1975. Acute toxicity of pesticide mixtures to bluegills. *Bull Environ Contam Toxicol* 14: 648-652.

Relevance

Score: 67.5 (no std. method, not tox values, controls response reported)

Rating: N

Toxicity Data Summary

Limnonectus limnocharis

Study: Gurushankara HP, Krishnamurthy SV, Vasudev V. (2007) Effect of malathion on survival, growth, and food consumption of Indian Cricket Frog (*Limnonectus limnocharis*) Tadpoles. *Arch Environ Contam Toxicol* 52(2):251-256.

Relevance –Food consumption

Score: 62.5 (50% formulation, Control response NR, Endpoint)

Rating: N

Relevance –Gosner stage (growth and weight) & Survival

Score: 70 (50% formulation, No values)

Rating: L

Reliability

Score: 59

Rating: N

Reference	Gurushankara <i>et al.</i> 2007	<i>L. limnocharis</i>
Parameter	Value	Comment
Test method cited	EPA, ASTM	
Phylum	Chordata	
Class	Amphibia	
Order	Anura	
Family	Ranidae	
Genus	<i>Limnonectus</i>	
Species	<i>Limnocharis</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Tadpoles, Gosner stage 24	
Source of organisms	Field	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	28 d	
Data for multiple times?	No	
Effect 1	Gosner stage	Includes weight, length
Control response 1	Developmental stage 44	
Effect 2	Food consumption	
Control response 2	NR	
Effect 3	Survival (number and days)	
Control response 3	All control survived to day 28 (last day)	
Temperature	22-25 °C	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Gurushankara <i>et al.</i> 2007	<i>L. limnocharis</i>
Parameter	Value	Comment
Test type	Static renewal (48 h renewal)	
Photoperiod/light intensity	14:10 light:dark	
Dilution water	Reconstituted water	
pH	NR	
Hardness	Ca & Mg concentrations given as RW recipe	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	Yes	
Purity of test substance	50 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone 1mL/L	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	3000 $\mu\text{g/L}$ of AI	20 reps with 1 per
Concentration 2 Nom/Meas ($\mu\text{g/L}$)	2000	20 reps with 1 per
Concentration 3 Nom/Meas ($\mu\text{g/L}$)	1500	20 reps with 1 per
Concentration 4 Nom/Meas ($\mu\text{g/L}$)	1000	20 reps with 1 per
Concentration 5 Nom/Meas ($\mu\text{g/L}$)	500	20 reps with 1 per
Control	Solvent and water only	20 reps with 1 per
NOEC; indicate calculation method, significance level (p-value) and minimum significant difference (MSD)	Food consumption 1000 $\mu\text{g/L}$	Method: ANOVA p:0.0001 MSD: NR
LOEC; indicate calculation method	Food consumption; 1500 $\mu\text{g/L}$	
MATC (GeoMean NOEC,LOEC)	1225	
% control at NOEC	NR	
% of control LOEC	NR	

There were no statically significant differences between individual treatment groups, but the difference between controls and all treatments grouped together was significant. This provides no tox values.

Other notes:

The LC50s of malathion at 24, 48, 72, and 96 hours were 13.27, 8.73, 6.3 and 5.37 ppm, respectively (Gurushankara *et al.* 2003).

Find:

Gurushankara HP, Vasudev V, Krishnamurthy SV (2003) Estimation of acute toxicity of malathion insecticide on tadpoles and adults of *Rana* (*Limnonectus*) *limnocharis*. *Indian J Comp Anim Physiol* 21:48–54.

Toxicity Data Summary

Macrobrachium rosenbergii

Study: Natarajan E, Biradar RS, George JP. (1992) Acute toxicity of pesticides to giant freshwater prawn *Macrobrachium rosenbergii* (De Man). *J Aquacult Trop* 7(2):183-187 1992.

Relevance

Score: 70 (Control description & response NR, Purity NR)

Rating: L

Reliability

Score: 52.5

Rating: N

Reference	Natarajan <i>et al.</i> 1992	<i>M. rosenbergii</i>
Parameter	Value	Comment
Test method cited	APHA more for water quality only	
Phylum	Arthropoda	
Class	Malacostraca	
Order	Decapoda	
Family	Palaemonoidea	
Genus	<i>Macrobrachium</i>	
Species	Rosenbergii	
Family in North America?	Yes	
Age/size at start of test/growth phase	Postlarvae: 20 ± 2mm; 0.25 ± 0.1 g	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24, 48, 96 h	
Effect 1	Mortality	
Control response 1	NR	
Temperature	24 ± 1 °C	
Test type	Static renewal, daily renewal	
Photoperiod/light intensity	NR	
Dilution water	NR	
pH	7.8 ± 0.4	
Hardness	NR	
Alkalinity	200 ± 20 ppm	
Conductivity	NR	
Dissolved Oxygen	7.0 ± 0.5ppm	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Natarajan <i>et al.</i> 1992	<i>M. rosenbergii</i>
Parameter	Value	Comment
Feeding	None	
Purity of test substance	NR	States only 'liquid'
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	NR	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	1-1000 $\mu\text{g/L}$	3 reps with 20 per
Control	Yes, type NR	Reps and # per (cell density for single
LC50, 24 h	241 (13-4638) $\mu\text{g/L}$ 220 (11-4359)	Probit Angular transform.
LC50, 48 h	16 (0.7-391) 28 (1-578)	
LC50, 96 h	9 (0.4-210) 13 (1-267)	

Other notes:

Toxicity Data Summary

Macrocyclus albidus

Study: Johnson CR. (1978) Effect of 5 organophosphorus insecticides on survival and temperature tolerance in Copepod, *Macrocyclus albidus* (Copepoda: Cyclopidae). *Zoological J Linnean Soc* 64:59-62.

Relevance

Score: (No std method, Purity NR, No values)

Rating: N

Other notes: tested thermal lethal range simultaneously.

Toxicity Data Summary

Macrocyclus albidus

Study: Marten GG, Che W, Bordes ES. (1993) Compatibility of cyclopoid copepods with mosquito insecticides. *J Am Mosq Control Assoc* 9(2):150-154.

Relevance

Score: 82.5 (No std method, control response NR)

Rating:L

Reliability

Score: 53.5

Rating: N

Reference	Marten <i>et al.</i> 1993	<i>M. albidus</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Arthropoda	
Class	Maxillopoda	Crustacea
Order	Cyclopoida	
Family	Noctuoidea	
Genus	<i>Macrocyclus</i>	Copepods
Species	albidus	
Family in North America?	Yes	
Age/size at start of test/growth phase	Adult	
Source of organisms	Cultures form organism collect in ponds	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	24 h	
Data for multiple times?	No	
Effect 1	Mortality/Immobility	
Control response 1	NR	
Temperature	25 °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	NR	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	91 %	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Marten <i>et al.</i> 1993	<i>M. albidus</i>
Parameter	Value	Comment
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone, 0.1% was conc. in control, ~ 1 mL/L	
Concentrations Nom ($\mu\text{g/L}$)	NR	4 reps with 20 per
Control	Solvent control	4 reps with 20 per
LC50	760 (280-2700) $\mu\text{g/L}$	Probit

Toxicity Data Summary

Melanotaenia fluviatilis

Study: Reid HP, Ahokas JT, Holdway DA. (1995) Use of cyanazine and malathion pulse-exposure toxicity to estimate the age of onset of functional liver metabolism in larval Australian Crimson-Spotted Rainbowfish (*Melanotaenia fluviatilis*). *Water Res* 29(8):2010-2013.

Relevance

Score: 52.5 (No std method, Control response, 50% Purity, Not in N. America)

Rating:N

Appendix, Section 3: Studies rated RN, LN, N

Metapenaeus ensis

Toxicity Data Summary

Study: Chu KH, Lau PY. (1994) Effects of diazinon, malathion, and paraquat on the behavioral response of the shrimp *Metapenaeus ensis* to chemoattractants. *Bull Environ Contam Toxicol* 53: 127-133.

Relevance

Score: 45 (No standard method; Endpoints not linked to survival, growth, reproduction; Saltwater; No toxicity values calculated/calculable)

Rating: N

Genus may be *Metabetaeus*?

Toxicity Data Summary

Metapenaeus monoceros (also *Penaeopsis monoceros* or *Penaeus monoceros*)Reddy MS, Rao KVR. (1992) Toxicity of selected insecticides to the Penaeid Prawn *Metapenaeus monoceros* (Fabricius). *Bull Environ Contam Toxicol* 48:622-629.Relevance

Score: 70 (Saltwater, Control description & response NR)

Rating: L

Reliability

Score: 50

Rating: N

Reference	Reddy & Rao 1992	<i>M. monoceros</i>
Parameter	Value	Comment
Test method cited	APHA	
Phylum	Arthropoda	
Class	Crustacea	
Order	Malacostraca	
Family	Penaeidae	
Genus	<i>Metapenaeus</i>	
Species	monoceros	
Family in North America?	Yes	
Age/size at start of test/growth phase	75 + 5 mm in length and 2.5 + 0.2 g weight	
Source of organisms	Collected from canal	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	23 ± 2 °C	
Test type	Static renewal (24 h)	
Photoperiod/light intensity	NR	
Dilution water	"Seawater"	
pH	7.1 ± 0.2	
Hardness	NR	
Alkalinity	NR	
Conductivity	Salinity 15 ± 1 ppt	
Dissolved Oxygen	Nr	
Feeding	None	
Purity of test substance	95 %	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Reddy & Rao 1992	<i>M. monoceros</i>
Parameter	Value	Comment
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	In acetone, concentration NR	
Concentrations Nom ($\mu\text{g/L}$)	NR	5 reps with 20 per
Control	NR	5 reps with 20 per
LC50, graphical sigmoidal	1360 $\mu\text{g/L}$	95 % CL: 1312- 1652 $\mu\text{g/L}$
LC50, graphical linear	1520	
LC50, Dragestedt-Behren's method	1120	
LC50, Finney's Regression	1930	

Toxicity Data Summary

Moina brachiata and *M. micrura*

Acanthocyclops vernalis

Study: Fores E, Comin FA. (1988) Action of malathion plus lindane pesticide on Crustacean populations. *Ecotoxicol Environ Safety* 15: 180- 185.

Relevance

Score: 60 (No std method, Purity NR, Control description and response NR)

Rating: N

Toxicity Data Summary

Morone saxatilis

Korn S, Earnest R. (1974) Acute toxicity of 20 insecticides to Striped Bass, *Morone saxatilis*. *California Fish and Game* 60(3):128-131.

Relevance

Score: 60 (no std method, control description/ response NR, Saltwater)

Rating: N

Other notes: 96 h LC50: 14 ug/L

Toxicity Data Summary

Morone saxatilis

Palawski D, Hunn JB, Dwyer FJ. (1985) Sensitivity of young striped bass to organic and inorganic contaminants in fresh and saline waters. *Trans Am Fish Soc* 114(5):748-753.

Relevance

Score: 77.5 (Purity NR, Control not described)

Rating: L

Reliability

Score: 58

Rating: N

Reference	Palawski <i>et al.</i> 1985	<i>M. saxatilis</i>
Parameter	Value	Comment
Test method cited	ASTM	
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Moronidae	
Genus	<i>Morone</i>	
Species	saxatilis	
Family in North America?	Yes	
Age/size at start of test/growth phase	35- 80 d	
Source of organisms	Larvae from hatchery, reared in lab for about 4 weeks	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	< 90%	
Temperature	20 ± 2 °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Soft water: well water 1% Saline: well water, plus Instant Ocean sea salt	
pH	Soft: 8.1 1% saline: 7.9	
Hardness	Soft: 40 mg/L CaCO ₃	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Palawski <i>et al.</i> 1985	<i>M. saxatilis</i>
Parameter	Value	Comment
	1% saline: 455 mg/L CaCO ₃	
Alkalinity	Soft: 30 mg/L CaCO ₃ 1% saline: 270 mg/L CaCO ₃	
Conductivity	Soft: 285 uS/cm 1% saline: 1,600 uS/cm	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	NR	
Concentrations measured?	No	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	NR	
Concentration 1 Nom/Meas (µg/L)	Logarithmic progression, nominal, concentrations NR	1 reps and 10 per
Control	Response reported, but type NR	Reps and # per (cell density for single
LC50; indicate calculation method	Soft water: 24.5 (17.2-34.8) µg/L 1% Saline: 65 (51-83) µg/L	Litchfield and Wilcoxon

Other notes:

Toxicity Data Summary

Mytilus galloprovincialis

Losso C, His E, Ghetti PF, Ghirardini AV. (2004) Sensitivity of embryotoxicity test with *Mytilus galloprovincialis* (LMK) towards some compounds of environmental interest (copper and pesticides). *Environ Tech* 25 (7): 841 -846.

Relevance

Score: 62.5 (Saltwater, Purity NR, Control response)

Rating: N

Other notes: States control response was > 80 survival, should be \geq 90% survival.

Toxicity Data Summary

Nothobranchius guentheri

Study: Shedd TR, Widder MW, Toussaint MW, Sunkel MC, Hull E. (1999) Evaluation of the annual Killifish *Nothobranchius guentheri* as a tool for rapid acute toxicity screening. *Environ Toxicol Chem* 18(10):2258-2261.

Relevance

Score: 60 (No std method, Purity NR, Control description & response NR)

Rating: N

Toxicity Data Summary

Oncorhynchus mykiss

Study: Douglas MT, Chanter DO, Pell IB, Burney GM. (1986) A proposal for the reduction of animal numbers required for the acute toxicity to fish test (LC50 determination). *Aquat Toxicol* 8(4):243-249.

Relevance

Score: 85 (control not described, response NR)

Rating: L

Reliability

Score: 45

Rating: N

Reference	Douglas <i>et al.</i> 1986	<i>O. mykiss</i>
Parameter	Value	Comment
Test method cited	OECD 1981	
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	<i>Oncorhynchus</i>	
Species	<i>mykiss</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Juvenile (size not given)	
Source of organisms	NR	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	NR °C	
Test type	Static renewal	
Photoperiod/light intensity	NR	
Dilution water	NR	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	Technical	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Douglas <i>et al.</i> 1986	<i>O. mykiss</i>
Parameter	Value	Comment
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	5% Tween-80 in dimethylformamide at a maximum final concentration of 40 u1/1	
Concentration 1 Nom/Meas (µg/L)	Seven concentrations spaced as 1.0 : 1.8 : 2.2 : 3.2 : 4.6: 5.6 : 10	1 reps with 10 per
Control	Type not described	Reps and # per (cell density for single
LC50	Test 1: 161 (137-201) ug/L Test 1: 115 (94-146)	probit

Other notes:

Toxicity Data Summary

Oncorhynchus mykiss

Marking LL, Bills TD, Crowther JR. (1984) Effects of five diets on sensitivity of Rainbow Trout to eleven chemicals. *Prog Fish-Cult* 46(1):1-5.

Relevance

Score: 70 (Purity NR, Control description & response NR)

Rating: L

Reliability

Score: 45.5

Rating: N

Reference	Marking <i>et al.</i> 1984	<i>O. mykiss</i>
Parameter	Value	Comment
Test method cited	ASTM	
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	<i>Oncorhynchus</i>	
Species	<i>mykiss</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	1 g, 8 mo	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	Yes	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	12 °C	
Test type	NR , probably static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted (probably using well water)	
pH	8.0	
Hardness	120 mg/L as CaCO ₃	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	Test affects of diet so fish probably fed

Appendix, Section 3: Studies rated RN, LN, N

Reference	Marking <i>et al.</i> 1984	<i>O. mykiss</i>
Parameter	Value	Comment
Purity of test substance	NR	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	States " water or solvent stock" used	
Concentrations Nom ($\mu\text{g/L}$)	NR	1 reps with 10 per. Just states 10 fish per concentration Reps and # per (cell density for single
Control	NR	
LC50s* Litchfield Wilcoxon	190 (154-235) 200 (164-244) 191 (155-236) 234 (184-298) 111 (93.9-131)	

Other notes:

*LC50s for 5 different diets. No significant difference were found among these LC50s, so the could be considered replicate that could be eventually combined in the same mean

Toxicity Data Summary

Oncorhynchus mykiss

Study: McKim JM, Schmieder K, Niemi GJ, Carlson RW, Henry TR. (1987) Use of respiratory-cardiovascular responses of rainbow trout (*Salmo gairdneri*) in identifying acute toxicity syndromes in fish: Part 2. Malathion, carbaryl, acrolein and benzaldehyde. *Environ Toxicol Chem* 6:313-328.

Not Relevant

Other notes: Study contains an 96 h LC50 for R. trout of 160 ug/L. The footnote indicates that this test was performed separately with different animals, and is essentially not described in the article.

Other endpoints included are not standard makers of toxicity. This is more about the mechanism of action

Toxicity Data Summary

Oncorhynchus mykiss

Study: Schoettger RA. (1970) Fish pesticide research laboratory. Progress in sport fishery research. U.S. Dept. of the Interior, Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife. Resource publication 106: 2-49.

Relevance

Score: 75 (No std method, Control description & response NR)

Rating: L

Reliability

Score: 44

Rating: N

Study contains data on other species, but these were saltwater. Relevance of these values (including factors above) would score 60 and rate as N.

Reference	Schoettger 1970	<i>O. mykiss</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	<i>Oncorhynchus</i>	
Species	mykiss	
Family in North America?	Yes	
Age/size at start of test/growth phase	1.0 g	
Source of organisms	NR	
Have organisms been exposed to contaminants?	NR	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	24 & 96 h	
Effect 1	Mortality	
Control response 1	NR	
Temperature	12 °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Reconstituted	
pH	7.1	
Hardness	40 mg/L	
Alkalinity	35 mg/L	
Conductivity	NR	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Schoettger 1970	<i>O. mykiss</i>
Parameter	Value	Comment
Dissolved Oxygen	NR	
Feeding	Yes (not clear-vague comment about food quality during test)	
Purity of test substance	95%	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	NR	
Concentrations ($\mu\text{g/L}$)	NR	Reps and # per NR
Control	NR	Reps and # per NR
LC50, 24 h	160 (85-301) $\mu\text{g/L}$	Method: NR
LC50, 96 h	93.5 $\mu\text{g/L}$	Method: NR

Appendix, Section 3: Studies rated RN, LN, N

Toxicity Data Summary

Oncorhynchus mykiss

Cyprinella lutrensis (*Notropis lutrensis*)

Smith JW, Grigoropoulos SG. (1968) Toxic effects of odorous trace organics. *Am Water Works Assoc J* 60:969-979.

Relevance: acute

Score: 70 (Purity 57%, Control description & Response NR)

Rating: L

Reliability

Score: 56.5

Rating: N

Relevance: long term

Score: 52.5 (Purity 57%, No values, No standard method, Control response)

Rating: N

Summary for mainly for acute test only

Reference	Smith & Grigoropoulos 1968	<i>O. mykiss</i>
Parameter	Value	Comment
Test method cited	APHA	
	R. Trout	Red shiner (minnow)
Phylum	Chordata	Chordata
Class	Actinopterygii	Actinopterygii
Order	Salmoniformes	Cypriniformes
Family	Salmonidae	Cyprinidae
Genus	<i>Oncorhynchus</i>	<i>Cyprinella</i>
Species	mykiss	<i>lutrensis</i>
Family in North America?	Yes	
Age/size at start of test/growth phase	Trout: 10 cm, 15 g Shiner 4.8 cm, 1.9 g	
Source of organisms	Trout: Mo. Conservation commission Shiner: local hatchery	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96h long term test had 5 d exposure plus 5 d recovery, then 5 d exposure again continuing on and off until 50% fish killed	No feeding during exposure

Appendix, Section 3: Studies rated RN, LN, N

Reference	Smith & Grigoropoulos 1968	<i>O. mykiss</i>
Parameter	Value	Comment
Data for multiple times?	Yes 24,48,96 120 h	
Effect 1	Mortality	
Control response 1	NR	
Effect 2	Time until death of 50% fish	Chronic exposure
Control response 2	> 19 d	
Temperature	12.2 (12.0-13.0) °C 21.0 (20.0-21.5) °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Well water (aerated)	
pH	7.6 (7.4-8.2)	
Hardness	140 (95-170) mg/L	
Alkalinity	130 (100-160) mg/L	
Conductivity	NR	
Dissolved Oxygen	6.9 (6.7-7.1)	
Feeding	None	
Purity of test substance	57 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	None reported	
Concentrations 1 Nom (µg/L)	NR	Reps and # per NR
Control	NR	Reps and # per NR
LC50, 24 h	5	
LC50, 48 h	4.6	
LC50, 96 h	2.8	
LC50, 120 h	2.3	
LC50, 24 h	40	
LC50, 48 h	36	
LC50, 96 h	25	
LC50, 120 h	23	

Toxicity Data Summary

Oncorhynchus tshawytscha

Katz, M. Acute Toxicity of Some Organic Insecticides to Three Species of Salmonids and to the Threespine Stickleback. Trans.Am.Fish.Soc. 90(3):264-268. 1961

Relevance

Score: 75 (Formulation, No std. method)

Rating: L

Reliability

Score: 57

Rating: N

Reference	Katz 1961	<i>O. tshawytscha</i>
Parameter	Value	Comment
Test method cited	Cite another ref.:Doudoroff 1951	
Phylum	Chordata	
Class	Actinopterygii	
Order	Salmoniformes	
Family	Salmonidae	
Genus	<i>Oncorhynchus</i>	
Species	<i>tshawytscha</i>	
Family in North America?	Yes	Chinook & Stickleback
Age/size at start of test/growth phase	2.0-4.5 in., 1.45-5.0 g	
Source of organisms	Hatchery	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	0%	
Temperature	20 ± 0.5 °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Spring water	
pH	6.8-7.4	
Hardness	NR	
Alkalinity	45-57 mg/L CaCO ₃	
Conductivity	NR	
Dissolved Oxygen	Bubbled in compressed gas to maintain, but levels NR	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Katz 1961	<i>O. tshawytscha</i>
Parameter	Value	Comment
Feeding	None	
Purity of test substance	57 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone, amt NR	
Concentration 1 Nom/Meas (µg/L)	NR	2 (?) reps with 3-5 per rep; Total of 10-20 fish. Except half at highest and lowest concentrations
Control	Solvent control	2 (?) reps with 3-5 per rep; Total of 10-20 fish.
LC50; 24 h	24.5 µg/L	Method- NR
LC50; 48 h	23.9	
LC50; 72 h	23.6	
LC50; 96 h	23.0	

Other notes:

tested in replicate during successive weeks
 Statistical method NR

Since study rated N data for stickle back not summarized

Toxicity Data Summary

Procambarus clarki

Study: Muncy RJ, Oliver AD Jr. (1963) Toxicity of ten insecticides to the Red Crayfish, *Procambarus clarki* (Girard). *Trans Am Fish Soc* 92(4):428-431.

Relevance

Score: 62.5 (No values, Purity NR, Control response NR)

Rating: N

Other notes: malathion apparently non toxic to this species of crayfish.

Toxicity Data Summary

Procambarus clarkii

Study: Holck AR, Meek CL. (1987) Dose-mortality responses of crawfish and mosquitoes to selected pesticides. *J Am Mosq Control Assoc* 3(3):407-411.

Relevance

Score: 85 (control description and response not reported)

Rating: L

Reliability

Score: 55

Rating: N

Reference	Holck & Meek 1987	<i>P. clarkii</i>
Parameter	Value	Comment
Test method cited	EPA	
Phylum	Arthropoda	
Class	Malacostraca	
Order	Decapoda	
Family	Cambaridae	
Genus	<i>Procambarus</i>	
Species	<i>clarkii</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	Immature, 25-40 mm	
Source of organisms	Field	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	NR	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Tap water, aerated 12 h	
pH	NR	
Hardness	100 mg/L	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	95 %	
Concentrations measured?	NR	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Holck & Meek 1987	<i>P. clarkii</i>
Parameter	Value	Comment
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	NR	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	5 concentrations	4 reps with 10 per
Control	Yes, Type NR	4 reps with 10 per
LC50	49,170 (43,260-54,140) $\mu\text{g/L}$	probit

Other notes: Seem like solvent would have been used with the high purity formulation. Doesn't specify diluted with water either.

Toxicity Data Summary

Procambarus clarkii

Study: Jimenez A, Cano E, Ocete ME. (2003) Mortality and survival of *Procambarus clarkii* Girard, 1852 upon exposure to different insecticide products. *Bull Environ Contam Toxicol* 70(1):131-137.

Relevance

Score: 68.5 (50% formulation, no std method, Control response NR)

Rating: N

Toxicity Data Summary

Oryzias latipes

Study: Beaman JR, Finch R, Gardner H, Hoffmann F, Rosencrance A, Zelikoff JT. (1999) Mammalian immunoassays for predicting the toxicity of malathion in a laboratory fish model. *J Toxicol Environ Health A* 56(8):523-542.

Relevance: Prelim LC50 and NOEC

Score: 60 (Not in N. America, Control description & response NR, No std method)

Rating: N

Relevance: LOC/NOEC 8 day survival

Score: 60 (Not in N. America, No Values, No std method)

Rating: N

Toxicity Data Summary

Oryzias latipes

Study: Tsuda T, Kojima M, Harada H, Nakajima A, Aoki S. (1997) Acute toxicity, accumulation and excretion of organophosphorous insecticides and their oxidation products in killifish. *Chemosphere* 35:939-949.

Relevance

Score: 70 (Family not in N. America, Control description and response NR)
Rating: L

Reliability

Score: 56.6
Rating: N

Reference	Tsuda <i>et al.</i> 1997	<i>O. latipes</i>
Parameter	Value	Comment
Test method cited	OECD	
Phylum	Chordata	
Class	Actinopterygii	
Order	Beloniformes	
Family	Adrianichthyidae	
Genus	<i>Oryzias</i>	
Species	<i>latipes</i>	Japanese killifish
Family in North America?	No	medaka
Age/size at start of test/growth phase	2.4-2.9 cm; 0.18-0.25 g	
Source of organisms	Pet store	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	24, 48 h	
Effect 1	Survival	
Control response 1	NR	
Temperature	22 ± 1 °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Dechlorinated tap water	
pH	7.3-7.4	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	6.2-6.7	
Feeding	None	
Purity of test substance	> 95 %	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Tsuda <i>et al.</i> 1997	<i>O. latipes</i>
Parameter	Value	Comment
Concentrations measured?	For BCF, but doesn't seem to be for LC50s	
Measured is what % of nominal?	For BCF only (100%)	
Chemical method documented?	For BCF only (Yes)	
Concentration of carrier (if any) in test solutions	Ethanol, concentration, NR	
Concentration 1 Nom/Meas (µg/L)	5000	2 reps with 5 per
Concentration 2 Nom/Meas (µg/L)	3100	2 reps with 5 per
Concentration 3 Nom/Meas (µg/L)	2000	2 reps with 5 per
Concentration 4 Nom/Meas (µg/L)	1200	2 reps with 5 per
Concentration 5 Nom/Meas (µg/L)	760	2 reps with 5 per
Control	Yes, type NR	2 reps with 5 per
LC50, 24 h	2400 µg/L	
LC50, 48 h	1800 µg/L	

Other notes:

Acute test is static, but BCF is flow-trough and concentrations measured, so Ok to use.

Toxicity Data Summary

Pimephales promelas

Bender ME. Toxicity of Hydrolysis and Breakdown Products of Malathion to Fathead Minnow (*Pimephales Promelas*, Rafinesque). Water Research 1969; 3: 571-582

Relevance

Score: 85 (control type and response NR)

Rating: R

Reliability

Score: 58.5

Rating: N

The results of the experiments demonstrated the following: (1) the basic hydrolysis product, diethyl fumarate, was more toxic than malathion to the test species; (2) a pronounced synergistic effect was demonstrated between malathion

Reference	Bender 1969	<i>P. promelas</i>
Parameter	Value	Comment
Test method cited	'Standard methods 1960'	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cyriniformes	
Family	Cyprinidae	
Genus	<i>Pimephales</i>	
Species	<i>promelas</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	About 1.5 g	
Source of organisms	Field	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96h and longer	
Data for multiple times?	Yes	
Effect 1	Mortality	
Control response 1	0%	
Temperature	17 C	
Test type	Static and flow	
Photoperiod/light intensity	NR	
Dilution water	Dechlorinated, filtered tap water	
pH	7.0-7.3	
Hardness	NR	
Alkalinity	50 -70 mg/L	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Bender 1969	<i>P. promelas</i>
Parameter	Value	Comment
Conductivity	NR	
Dissolved Oxygen	7-8 mg/L	
Feeding	No	
Purity of test substance	Analytical grade	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone stock solutions uses, but concentration NR	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	2	10 fish per vessel, 180 fish total in test, in 3 experiments. cannot determine exact # for each concentration.
Concentration 2 Nom/Meas ($\mu\text{g/L}$)	4	
Concentration 3 Nom/Meas ($\mu\text{g/L}$)	6	
Concentration 4 Nom/Meas ($\mu\text{g/L}$)	8	
Concentration 5 Nom/Meas ($\mu\text{g/L}$)	14	
Concentration 6 Nom/Meas ($\mu\text{g/L}$)	18	
Concentration 7 Nom/Meas ($\mu\text{g/L}$)	22	
Concentration 8 Nom/Meas ($\mu\text{g/L}$)	26	
Control	Not described	
LCx; indicate calculation method	9 mg/L (from Fig 1)	Graphical? (value taken from graph)

Other notes:

The results of the experiments demonstrated the following: (1) the basic hydrolysis product, diethyl fumarate, was more toxic than malathion to the test species; (2) a pronounced synergistic effect was demonstrated between malathion

Toxicity Data Summary

Poecilia reticulata (synonym used in report: *Lebistes reticulatus*)

Desi I, Dura L, Gonczi L, Kneffel Z, Strohmayer A, Szabo Z. 1976. Toxicity of malathion to mammals, aquatic organisms and tissue culture cells. *Arch Environ Contamin* 3: 410-425.

LC50 –duration???

Behavior test, which resulted in mortality in most studies not summarized, probably the same duration as LC50

Relevance

Score: 75 (No Std method, Control not described and response NR,)

Rating: L

Reliability

Score: 28

Rating: N

Reference	Desi et al. 1976	<i>P. reticulata</i>
Parameter	Value	Comment
Test method cited	NR	
Phylum	Chordata	
Class	Actinopterygii	
Order	Cyprinodontiformes	
Family	Poeciliidae	
Genus	<i>Poecilia</i>	
Species	<i>reticulata</i>	
Family in North America?	Yes	
Age/size at start of test/growth phase	NR	
Source of organisms	NR	
Have organisms been exposed to contaminants?	Source NR-but probably lab culture	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	NR	Assume acute
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	NR	
Test type	NR	
Photoperiod/light intensity	NR	
Dilution water	NR	
pH	NR	
Hardness	NR	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Desi <i>et al.</i> 1976	<i>P. reticulata</i>
Parameter	Value	Comment
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR- probably none	
Purity of test substance	95%	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	NR	
Concentration 1 Nom/Meas (µg/L)	500	? Reps, 21-22 per (calculated from 108/5 = 21.6)
Concentration 2 Nom/Meas (µg/L)	1000	? Reps 21-22 per
Concentration 3 Nom/Meas (µg/L)	1200	? Reps 21-22 per
Concentration 4 Nom/Meas (µg/L)	1500	? Reps 21-22 per
Concentration 5 Nom/Meas (µg/L)	2000	? Reps 21-22 per
Control	Not described	? reps and 28 per
LCx; indicate calculation method	819 µg/L	probit

Other notes:

In behavior test 100,000, 10,000, and 1,000 ug/L lethal, while 100 ug/L was NOEC.

Agrees with LC50 result.

Duration not reported but other tests in article were not longer than 7 days, so use LC50 as (supplemental) acute value.

Toxicity Data Summary

Pseudacris regilla (formerly *Hyla-Regilla*)

Johnson CR. (1980) The effects of 5 organophosphorus insecticides on thermal stress in tadpoles of the Pacific Tree Frog, *Hyla regilla*. *Zoological J Linnean Soc* 69: 143-147.

Relevance

Score: 60 (Purity NR, No std method, Endpoint)

Rating: N

Study looked at effects of OP on lowering of temperature tolerance- Frogs were exposed to OP pesticides subject to heat stress. Temp of Onset of spasms recoded as endpoint.

Toxicity Data Summary

Pseudacris triseriata

Study: Sanders, OH 1970. Pesticides toxicities to tadpoles of the western chorus frog *Pseudacris triseriata* and Fowler's toad *Bufo woodhousii fowleri*. Copeia 2:246-251. MRID 00084757.

Relevance

Score: 68.5 (No Std method, Chem grade NR, Control response NR)

Rating:N

Appendix, Section 3: Studies rated RN, LN, N

Toxicity Data Summary

Rana boylei

Sparling DW, Fellers G. (2007) Comparative toxicity of chlorpyrifos, diazinon, malathion and their oxon derivatives to larval *Rana boylei*. *Environ Pollut* 147(3): 535 - 539.

Relevance

Score: 82.5 (No Std. Method, No Control Response)

Rating: L

Reliability

Score: 55

Rating: N

	Sparling & Fellers 2006	<i>R. boylei</i>
Parameter	Value	Comment
Test method cited	ASTM	
Phylum	Chordata	
Class	Amphibia	
Order	Anura	
Family	Ranidae	
Genus	<i>Rana</i>	
Species	<i>boylei</i>	foothill yellow-legged frog
Family in North America?	yes	
Age/size at start of test/growth phase	Gosner 32 to Gosner 44	
Source of organisms	Coast Range stream, Fort Bragg, CA	
Have organisms been exposed to contaminants?	Probably not	
Animals acclimated and disease-free?	Yes, Weeks acc	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	yes	
Effect 1	mortality	
Control response 1	NR	
Effect 2	acetylcholinesterase inhibition	
Control response 2	100% (responses relative to control)	
Temperature	NR	
Test type	NR	
Photoperiod/light intensity	NR	
Dilution water	medium soft reconstituted water ASTM	
pH	NR	

Appendix, Section 3: Studies rated RN, LN, N

	Sparling & Fellers 2006	<i>R. boyllii</i>
Parameter	Value	Comment
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	On fist day	
Purity of test substance	99%	
Concentrations measured?	no	
Concentration of carrier (if any) in test solutions	Acetone 0.29 ml/L	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	1,250	1 Rep and 9 per rep
Concentration 2 Nom/Meas ($\mu\text{g/L}$)	2,500	1 Rep and 9 per rep
Concentration 3 Nom/Meas ($\mu\text{g/L}$)	5,000	1 Rep and 9 per rep
Concentration 4 Nom/Meas ($\mu\text{g/L}$)	10,000	1 Rep and 9 per rep
Concentration 5 Nom/Meas ($\mu\text{g/L}$)	none	
Control	Solvent control and water only	
LC50; indicate calculation method	2137 $\mu\text{g/L}$	Probit
EC50; indicate calculation method	Not calculated for ACE inhibition, no raw data	
NOEC; indicate calculation method, significance level (p-value) and minimum significant difference (MSD)	none	Method: ANOVA p: MSD:
LOEC; indicate calculation method	1,250 $\mu\text{g/L}$ AChE inhibition	
MATC (GeoMean NOEC,LOEC)	Can't calculate	
% control at NOEC	Can't calculate	
% of control LOEC		

Other notes:

For diazinon, normalized cholinesterase values differed between controls and those exposed to 5 mg/L or higher ($p = 0.0125$). Controls had higher values than all other treatments except 0.025 mg/L ($p < 0.0001$).

Fig 1b

ACE inhibition approx - 40% at 1,250 $\mu\text{g/L}$ to 55% at 10,000 $\mu\text{g/L}$

In this study the oxon derivatives of chlorpyrifos, malathion and diazinon were significantly more toxic than their respective parental forms.

Emailed for missing information for diazinon in Jul 2008. The authors mentioned that they did not want to share unpublished information and never sent info.

dsparl@siu.edu (D.W. Sparling)

Appendix, Section 3: Studies rated RN, LN, N

Rasbora heteromorpha

Toxicity Data Summary

Study: Alabaster JS. (1969) Survival of fish in 164 herbicides, insecticides, fungicides, wetting agents and miscellaneous substances. *Intl Pest Cont* 11:29-35.

Relevance

Score: 70 (Formulation; Controls not described/reported)

Rating: L

Reliability

Score: 51

Rating: N

Reference	Alabaster 1969	<i>R. heteromorpha</i>
Parameter	Value	Comment
Test method cited	described in Pesticides Safety Preceed. (referenced)	
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Culicidae	
Genus	Rasbora	
Species	heteromorpha	
Family in North America?	Yes	
Age/size at start of test/growth phase	1.3-3cm	
Source of organisms	NR	
Have organisms been exposed to contaminants?	NR	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	24hr	
Data for multiple times?	no	
Effect 1	Mortality	
Control response 1	NR	
Temperature	20 C	
Test type	flow thru	
Photoperiod/light intensity	NR	
Dilution water	Prepared soft water	
pH	NR	
Hardness	20ppm CaCO3	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Alabaster 1969	<i>R. heteromorpha</i>
Parameter	Value	Comment
Purity of test substance	60 %	
Concentrations measured?	no	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	NR, states that formulations usually used without solvent	
Concentrations Nom/Meas (µg/L)	NR	Reps and 10 per NR
Control	NR	Reps and # per NR
LC50; 24 h LC50; 48h	17 µg/L, 13 µg/L	graphical interpolation

Other notes: Provides 'threshold' concentration estimated to kill 50% of fish in 3 months as: 7,800 µg/L.

Toxicity Data Summary

Romanormis culicivorax

Culex quinquefasciatus

Study: Winner RA, Steelman CD, Schilling PE. (1978) Effects of selected insecticides on *Romanormis culicivorax*, a mermithid nematode parasite of mosquito larvae. *Mosq News* 38(4):546-552.

Relevance

Score: 67.2 (No Standard Method, purity NR, Control response NR)

Rating: N

Toxicity Data Summary

Salmo salar

Peterson RH. (1976) Temperature selection of juvenile Atlantic salmon (*Salmo salar*) as influenced by various substances. *J Fish Res Can* 33:1722-1730.

Relevance

Score: 60 (no std method, Endpoint not linked to survival growth or reproduction, No toxicity values)

Rating: N

Other notes: shows how malathion exposure made fish prefer a temp of 12.8 vs. 14.9 C.

Toxicity Data Summary

Sciaenops ocellatus

Study: Alvarez MD, Fuiman LA. (2006) Ecological performance of red drum (*Sciaenops ocellatus*) larvae exposed to environmental levels of the insecticide malathion. *Environ Toxicol Chem* 25:1426-1432.

Relevance

Score: 60 (Saltwater, no tox values)

Rating: N

96 hr test no responses reported/ no LC50 calc.

7 d tests

- growth – no sig diff
- no effect on routine behavior
- Escape behavior was unaffected by malathion exposure.
- Finally, treated fish had respiration rates that were not significantly
- different from those of control fish

Toxicity Data Summary

Simocephalus serrulatus

Study: Sanders HO, Cope OB. 1966. Toxicities of several pesticides to two species of cladocerans. Trans Am Fish Soc 95: 165-169.

Relevance

Score: 60 (No standard method; Purity NR; Controls not described and not reported)

Rating: N

Appendix, Section 3: Studies rated RN, LN, N

Simulium aokii

Simulium venustum

Plecoglossus altivelis

Toxicity Data Summary

Study: Matsuo K, Tamura T. (1970) Laboratory experiments on the effect of insecticides against blackfly larvae (Diptera: Simuliidae) and fishes. *Botyu-Kagaku* 35: 125-130.

Relevance

Score: 60 (No standard method; 10% formulation; No toxicity value calculated)

Rating: N

Toxicity Data Summary

Tilapia mossambica

Study: Basha SM, Rao KSP, Rao KRS, Rao KVR. (1983) Differential toxicity of malathion, BHC, and carbaryl to the freshwater fish, *Tilapia mossambica* (Peters). *Bull Environ Contam Toxicol* 31(5):543-546.

Relevance

Score: 60 (Purity NR, No Std method, Control description & response NR)

Rating: N

Other notes: Not clear if solvent control or water only. Just states Commercial grade used.

Toxicity Data Summary

Tilapia mossambica

Study: Dutt N, Guha RS. 1988 Toxicity of few organophosphorus insecticides to fingerlings of bound water fishes, *Cyprinus Carpio* (Linn.) and *Tilapia mossambica* Peters. Indian J. Ent. 50:403-21

Relevance

Score: 60 (No std method, Purity NR, Control description and response NR)

Rating: N

Other notes: performed exposures with and without soil. Presence of soil reduced toxicity slightly. LC50 lower by 5-10%.

Toxicity Data Summary

Tilapia mossambica

Cyclops viridis

Branchiura sowerbyi

Study: Konar SK, Ghosh TK. (1981) Effects of organophosphorus insecticides on fish and fish food organisms. *IAWPC Tech Annual* 8:147-160.

Relevance: Acute

Score: 70 (50% formulation, Control description and response NR)

Rating: L

Reliability

Score: 48.5

Rating: N

Relevance: Chronic

Score: 70 (50% formulation, No values)

Rating: L

Reliability

Score: 64

Rating: L

Endpoints of growth, maturity, fecundity, egg size -all show discontinuous dose-response (could be partly due to lack of replication). This study rates pretty low, because other than the discontinuous dose response (and no clear values) this study is judged to be, not reliable.

N

Other notes:

Feeding rate not summarized (not linked to survival growth or reproduction.)

Effects on other species (no real negative effects recorded)

Minimal decreases in gastropods.

Increase in Chironomus

Toxicity Data Summary

Tilapia mossambica

Study: Sahib IKA, Rao KVR. (1980a) Correlation between subacute toxicity of malathion and acetylcholinesterase inhibition in the tissues of the teleost *Tilapia mossambica*. *Bull Environ Contam Toxicol* 24(5):711-718.

Relevance

Score: 60 (No standard method, Endpoint not linked to survival growth or reproduction, No toxicity values, Control not described)

Rating: N

Toxicity Data Summary

Tilapia mossambica

Study: Sahib IKA, Rao KVR. (1980b) Toxicity of malathion to the freshwater fish *Tilapia mossambica*. Bull Environ Contam Toxicol 24(6):870-874.

Relevance

Score: 75 (No std method, Control description and response NR)

Rating: L

Reliability

Score: 42.5

Rating: N

Reference	Sahib & Rao 1980b	<i>T. mossambica</i>
Parameter	Value	Comment
Test method cited	No, cited another reference	
Phylum	Chordata	
Class	Actinopterygii	
Order	Perciformes	
Family	Cichlidae	
Genus	<i>Tilapia</i>	
Species	mossambica	
Family in North America?	Yes	
Age/size at start of test/growth phase	8 ± 2 g	
Source of organisms	NR	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	NR	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Tap water	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	95 %	
Concentrations measured?	NR	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Sahib & Rao 1980b	<i>T. mossambica</i>
Parameter	Value	Comment
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone, concentrations NR	
Concentration 1 Nom/Meas ($\mu\text{g/L}$)	10/16 depending on type or data analyses	5 reps with 2 per
Concentration 2 Nom/Meas ($\mu\text{g/L}$)	8	5 reps with 2 per
Concentration 3 Nom/Meas ($\mu\text{g/L}$)	6	5 reps with 2 per
Concentration 4 Nom/Meas ($\mu\text{g/L}$)	4	5 reps with 2 per
Concentration 5 Nom/Meas ($\mu\text{g/L}$)	2	5 reps with 2 per
Concentration 6 Nom/Meas ($\mu\text{g/L}$)	1	5 reps with 2 per
Control	NR	
LC50	5,500 $\mu\text{g/L}$	Graphical interpolation
LC50	5,600	probit
LC50	5,700	DRAGSTEDT-BEHRENS method

Other notes:

Each experiment repeated 5 times and analyzed 3 different ways

Toxicity Data Summary

Toxorhynchites splendens

Study: Tietze NS, Schreiber ET, Hester PG, Hallmon CF, Olson MA, Shaffer KR. (1993) Susceptibility of first instar *Toxorhynchites splendens* to malathion, naled and resmethrin. *J Am Mosq Control Assoc* 9(1):97-99.

Relevance

Score: 100

Rating: R

Reliability

Score: 56

Rating: N

Reference	Tietze et al. 1993	<i>T. splendens</i>
Parameter	Value	Comment
Test method cited	ASTM	
Phylum	Arthropoda	
Class	Insecta	
Order	Diptera	
Family	Culicidae	
Genus	Toxorhynchites	
Species	splendens	
Family in North America?	Yes	
Age/size at start of test/growth phase	1st instar larvae	
Source of organisms	Lab culture	
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	48 h	
Data for multiple times?	24 and 48 h	
Effect 1	Mortality	
Control response 1	< 5% mortality	
Temperature	NR	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Aged well water	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	> 40%	
Feeding	None	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Tietze <i>et al.</i> 1993	<i>T. splendens</i>
Parameter	Value	Comment
Purity of test substance	Used Cythion®, which is >90% malathion	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	NR*	
Concentration 1 Nom/Meas (µg/L)	6-7 concentrations	30 reps with 1 per
Control	Yes, type NR	30 reps with 1 per
LC50, 24 h	69.1 ng/mL, 69.1 ug/L	Probit
LC50, 48 h	49.8 ug/L	

Other notes:

Units Conversion ng/mL = ug/L

*No mention of solvent used. seems like on would be use with high amount of active ingredient.

Toxicity Data Summary

*Tubifex**Limnodrilus*

Study: Whitten BK, Goodnight CJ. (1966) Toxicity of some common insecticides to tubificids. *J Water Pollut Control Fed* 38(2):227-235.

Relevance

Score: 75(no standard method, Control description & response NR)

Rating: L

Reliability

Score: 50.5

Rating: N

Reference	Whitten & Goodnight 1966	<i>Tubifex sp.</i> <i>Limnodrilus sp.</i>
Parameter	Value	Comment
Test method cited	None	
Phylum	Annelida	
Class	Clitellata	
Order	Haplotaxida	
Family	Naididae (Tubificidae)	
Genus	<i>Tubifex</i> & <i>Limnodrilus</i> *	
Species	NR	
Family in North America?	Yes	
Age/size at start of test/growth phase	NR	
Source of organisms	Wilson's Ditch, Lafayette, Indiana	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	Yes, 24, 48, 96 h	
Effect 1	Mortality	
Control response 1	NR	
Temperature	20 °C	
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	Knop's solution	
pH	7.5	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	> 4mg/L	4/8.9~ 45% sat.

Appendix, Section 3: Studies rated RN, LN, N

Reference	Whitten & Goodnight 1966	<i>Tubifex sp.</i> <i>Limnodrilus sp.</i>
Parameter	Value	Comment
Feeding	None	
Purity of test substance	99.6 %	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	NR, acetone**	
Concentration 1 Nom/Meas (µg/L)	Logarithmic series i.e.: 10, 5.6, 3.2, 1.8, and 1 mg/L	5 reps with 10 per
Control	Yes, Type NR	5 reps with 10 per
LC50, 24 h ± 95% Confidence Limits, µg/L	26,500 ± 3500	Probit
LC50, 48 h	20,700 ± 2700	Probit
LC50, 96 h	16,700 ± 1750 µg/L	Probit

Other notes:

**Exposed both genus at once- had similar response*

* *Some description of the amount of acetone used was given: “Acetone was used as a solvent and carrier for all of the insecticides ... The toxic effects of various concentrations of these inert materials were determined. ...Solutions of acetone below a concentration of 2,500 mg/l had little or no effect on the survival of tubificid worms.” ... “the carrier was used in a concentration well below any concentration which had shown detrimental effects in the preliminary testing of these carrying agents.”

Toxicity Data Summary

Various Chironomids:

Chironomus decorus

Dicrotendipes californicus

Cricotopus bicinctus

Cricotopus sylvestris

Tanypus

Study: Ali A, Mulla MS. (1980) Activity of organophosphate and synthetic pyrethroid insecticides against pestiferous midges in some Southern California flood control Channels. *Mosq News* 40:593-597.

Relevance

Score: 67.2 (No Standard Method, purity NR, Control response NR)

Rating: N

Toxicity Data Summary

Various Chironomids:

Glyptotendies paripes

Chironomus decorus

Chironomus crassicaudatus

Goeldichironomus holoprasinus

Tanutarsus

Study: Ali A. (1981) Laboratory evaluation of organophosphate and new synthetic pyrethroid insecticides against pestiferous Chironomid midges of Central Florida. *Mosq News* 41(1):157-161.

Relevance

Score: 67.2 (No Standard Method, purity NR, Control response NR)

Rating: N

Toxicity Data Summary

Various fish

Study: Rehwoldt RE, Kelley E, Mahoney M. (1977) Investigations into the acute toxicity and some chronic effects of selected herbicides and pesticides on several fresh water fish species. *Bull Environ Contam Toxicol* 18(3):361-365.

Relevance-Acute

Score: 70 Control not describe or response reported,
Purity (0.1% solution /1000ppm)

Rating: L

Relevance- Chronic: N -only tested one concentration -no dose response
No values, Purity (0.1% solution /1000ppm)

Reliability-Acute

Score: 42

Rating: N

Other notes: Study had so little information that it was probably not going to rate well, so just rated for reliability right away and did not summarize.

1000 mg/L = 1g/L = 0.1%

Toxicity Data Summary

Various fish sp.

Study: Weiss CM. (1961) Physiological effect of organic phosphorus insecticides on several species of fish. *Trans Am Fish Soc* 90(2):143-152.

Relevance

Score: 60 (No std method, Purity NR, No values)

Rating: N

Other notes: No dose response. Effects on Ache and recovery reported from exposures to one concentration.

Appendix, Section 3: Studies rated RN, LN, N

Toxicity Data Summary

Various invertebrate species

Study: Gaufin AR, Jensen L, Nelson T. (1961) Bioassays to determine pesticide toxicity to aquatic invertebrates. *Water Sewage Works* 108:355-359.

Relevance

Score: 60 (57% Formulation, No std method, Control description & response NR)

Rating:N

Other notes: Article more about bioassay development.

Toxicity Data Summary

Various invertebrates

Hydropsyche californica (caddisfly) - larvae*Arcropsyche grandis* (caddisfly) -larvae*Pteronarcys californica* (stonefly) -naiad 2-2.5 cm*Acroneuria pacifica* (stonefly) - naiad 4-6 cm*Gammarus lacustris* (freshwater shrimp/amphipod) -larvae*Ephemerella grandis* (mayfly)-nymph

Study: Gaufin AR, Jensen LD, Nebeker AV, Nelson T, Teel RW. (1965) Toxicity of ten organic insecticides to various aquatic invertebrates. *Water Sewage Works* 112:276-279.

Relevance

Score: 77.5 (Purity NR, Control response NR)

Rating: L

Reliability

Score: 48.5

Rating: N

Reference	Gaufin <i>et al.</i> 1965	Various invertebrates
Parameter	Value	Comment
Test method cited	APHA Standard methods	
Phylum	various	
Class	various	
Order	various	
Family	various	
Genus	various	
Species	various	
Family in North America?	Yes	
Age/size at start of test/growth phase	See above	
Source of organisms	Field	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR, but no effects in solvent test	
Temperature	51-54 F (caddisflies) 52-54 F (stoneflies) 59 F (amphipod) 48-50 F (mayfly)	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Gaufin <i>et al.</i> 1965	Various invertebrates
Parameter	Value	Comment
Test type	Static	
Photoperiod/light intensity	NR	
Dilution water	'similar to organism source'	
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	NR	
Purity of test substance	NR	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone and surfactant, concentration NR	
Concentrations ($\mu\text{g/L}$)	5 concentrations, logarithmic spacing, concentrations within one factor of 10 (ie:1-10)	2 reps with 10 per
Control	Yes, type NR, maybe water only because solvent tested separately	2 reps with 10 per
Solvent test	Acetone and surfactant tested in a separately conducted test at 56 mg/L- No effects	

SPECIES	LC50 ($\mu\text{g/L}$)	LC50 calculation method not described
<i>Hydropsyche californica</i>	22.5	
<i>Arcopsyche grandis</i>	32	
<i>Pteronarcys californica</i>	50.0	
<i>Acroneuria pacifica</i>	7.00	
<i>Gammarus lacustris</i>	1.620	
<i>Ephemerella grandis</i>	100	

Toxicity Data Summary

Various species

Study: Cano E, Jimenez A, Cabral JA, Ocete ME. (1999) Acute toxicity of malathion and the new surfactant "Genapol OXD 080" on species of rice basins. *Bull Environ Contam Toxicol* 63(1):133-138.

Relevance

Score: 68.5 (no std method, purity NR, Control response NR)

Rating: N

Toxicity Data Summary

Various species

Coppage DL, Matthews E. (1974) Short-term effects of organophosphate pesticides on cholinesterases of estuarine fishes and pink shrimp. *Bull Environ Contam Toxicol* 11:483-488.

Relevance

Score: 60 (Saltwater, no standard method, control description and response NR)

Rating: N

Other notes: The survivors of populations of fish in which 40-60 percent were killed by exposure to organophosphate pesticide had mean brain AChE reductions of 70-96 percent.

Species:

spot (*Lelostomus xanthurus*; 65-150 mm total length),
pinfish (*Lagodon rhomboides*; 65-125 mm),
Atlantic croaker (*Micropogon undulatus*; 85-150 mm), and
sheepshead minnows (*Cyprinodon variegatus*; 45-70 mm),
pink shrimp (*Penaeus duorarum*; 78-122 mm).

Toxicity Data Summary

Various species:

Planorbis corneus (snail)*Tubifex sp.* (tubificid worm)*Asellus aquaticus* (snail)*Lymnaea stagnalis* (snail)*Chironomus riparius* (midge)*Cyprinus carpio* (carp)*Abramis brama* (bream)*Oreochromis mossambicus* (tilapia)

Study: Frumin GT, Chuiko GM, Pavlov DF, Menzykova OV. (1992) A new rapid method to evaluate the median effect concentrations of xenobiotics in hydrobionts. *Bull Environ Contam Toxicol* 49(3):361-367.

Relevance

Score: 70 (40% formulation, control response NR, control type NR)

Rating: L

Reliability

Score: 50.5

Rating: N

Reference	Frumin <i>et al.</i> 1992	Various species
Parameter	Value	Comment
Test method cited	EPA	
Phylum	various	
Class	various	
Order	various	
Family	various	
Genus	various	
Species	various	
Family in North America?	Yes	
Age/size at start of test/growth phase	Adult mollusks, worms; Larvae midge; >1 y carp, perch, bream; 4-5 m tilapia	
Source of organisms	NR	
Have organisms been exposed to contaminants?	Maybe	
Animals acclimated and disease-free?	NR	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	Mortality	
Control response 1	NR	
Temperature	17-21 °C	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Frumin <i>et al.</i> 1992	Various species
Parameter	Value	Comment
Test type	Static renewal, every 24 h	
Photoperiod/light intensity	NR	
Dilution water	Well water	
pH	7.8-8.1	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	6.5-8.0 mg/L	
Feeding	NR	
Purity of test substance	40 % formulation	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	Acetone 0.01 %, ~0.1mL/L	
Concentration 1 Nom/Meas (µg/L)	Reports 4 nominal concentrations for most species, see article	10- 30 total n, reps NR
Control	Yes, type NR	Reps and # per (cell density for single
LC50	Yes, reported for several species, see below	Litchfield Wilcoxon -probit

Species	LC50 mg/L
<i>Tubifex sp.</i>	44.7 (29.8-61.7)
Asellus	60.0 (38.9-92.7)
Lymnaea	13.5 (53.5-32.0)
Planorbis	81.3 (33.6-196.8)
Chironomus	26.9 (20.0-36.2)

Toxicity Data Summary

Xenopus laevis

Study: Snawder JE, Chambers JE. (1990) Critical time periods and the effect of tryptophan in malathion-induced developmental defects in *Xenopus* embryos. *Life Sciences* 46:1635-1642.

Relevance: length

Score: 77.5 (No values, Control not described)

Rating: L

Reliability

Score: 52.5

Rating: N

Relevance: atria effect

Score: 77.5 (Control not described, Endpoint)

Rating: L

Reliability

Score: 52.5

Rating: N

Relevance: nodo chord deformities, # loops in gut, intestine diameter, NAD

Score: 62.5 (No values, Control not described, Endpoint)

Rating: N

Reference	Snawder & Chamber 1990	<i>X. laevis</i>
Parameter	Value	Comment
Test method cited	FETAX: frog embryo teratogenesis assay	
Phylum	Chordata	
Class	Amphibia	
Order	Anura	
Family	Pipidae	
Genus	<i>Xenopus</i>	
Species	laevis	
Family in North America?	Yes	
Age/size at start of test/growth phase	Blastulae	
Source of organisms	Commercial Breeder	(adults)
Have organisms been exposed to contaminants?	No	
Animals acclimated and disease-free?	Yes	
Animals randomized?	NR	
Test vessels randomized?	NR	
Test duration	96 h	
Data for multiple times?	No	
Effect 1	see relevance scoring	
Control response 1	see tables 1 and 2 in article	
Temperature	23 °C	
Test type	Static (assumed)	
Photoperiod/light intensity	12:12	

Appendix, Section 3: Studies rated RN, LN, N

Reference	Snawder & Chamber 1990	<i>X. laevis</i>
Parameter	Value	Comment
Dilution water	FETAX solution	Source NR
pH	NR	
Hardness	NR	
Alkalinity	NR	
Conductivity	NR	
Dissolved Oxygen	NR	
Feeding	None	
Purity of test substance	>90%	
Concentrations measured?	NR	
Measured is what % of nominal?	NR	
Chemical method documented?	NR	
Concentration of carrier (if any) in test solutions	acetone 1mL/L	
Concentration 1 Nom/Meas (µg/L)	1000 µg/L	8-9 rep with 25 per*
Concentration 2 Nom/Meas (µg/L)	5000 µg/L	8-9 rep with 25 per*
Concentration 3 Nom/Meas (µg/L)	10,000 µg/L	8-9 rep with 25 per*
Control	Yes, type NR	8-9 rep with 25 per*
NOEC; indicate calculation method, significance level (p-value) and minimum significant difference (MSD)	Length: NR NAD: NR # loops in gut: NR Ant. Intest. Dia.: NR Atria width: 1000	Method: ANOVA, w/ Fishers Least sig. differences p: < 0.05 MSD: NR
LOEC; indicate calculation method	Length: 1000 NAD:1000 # loops in gut: 1000 Ant. Intest. Dia.: 1000 Atria width: 5000	
MATC (GeoMean NOEC,LOEC)	Can calculate, Atria only	
% control at NOEC	Atria: 0.23/0.21 *100%	
% of control LOEC	Atria: 0.37/0.21 *100%	

Other notes: Abnormalities and Notochord bending not presented with statistically tested differences. NAD⁺ reduction was not linked to survival growth or reproduction: “appears to be a symptom of stress in *Xenopus* embryos and not a cause of defects.” Atria effect had no discussion on link to survival growth or reproduction. Table 3 is just effects from tests with one concentration, so not summarized.

*Methods just state that 25 were used per container, but table 1 has ‘n’s of 196-240 per concentration.

Emailed same authors for more info on their 1993 article, they decided not to share so didn’t try to contact them about this article.