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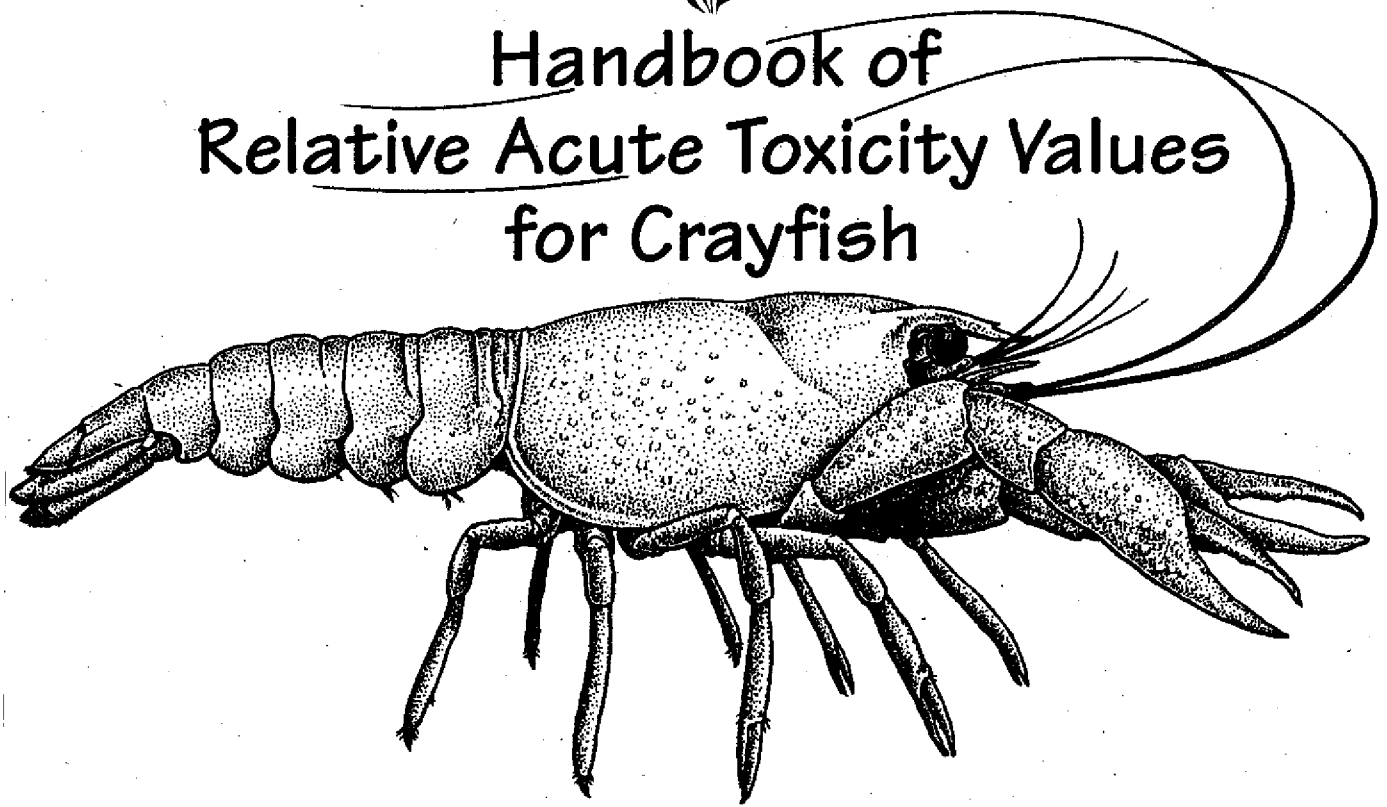
Handbook of Relative Acute Toxicity Values for Crayfish



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Handbook of Relative Acute Toxicity Values for Crayfish

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Crayfish, known as crawfish in the industry, are extensively cultured in the Southeast and to a lesser extent in other parts of the United States. Since crawfish farming occurs in agricultural areas there exists the potential for pesticide contamination and losses. Pesticides and other toxicants used in agriculture, forestry and man's endeavors accidently reach crawfish ponds through direct application, ground water, surface runoff and drift.

Knowledge of the crawfish culture cycle and the relative toxicity of chemicals will help reduce the potential impacts from chemical application. For example, crawfish burrow as the pond is drained in the summer and remain in these burrows until the pond is reflooded in fall. Juvenile crawfish which were hatched in the burrows enter the pond during reflooding. Since juvenile crawfish are about 4 times more sensitive to water-borne toxicants than adult crawfish, chemical application should be avoided at reflooding. Alternatively, treatment of the pond environment if necessary should be done when the pond is dry and the crawfish are in burrows. Details about crawfish culture and the life cycle can be found in Whetstone (1988).

A convenient indicator of the inherent hazard of a chemical compound is the acute toxicity test. The usual way of expressing acute toxicity is by means of an LC_{50} (median lethal concentration) value. The LC_{50} is a calculated estimate of the concentration that would be lethal to 50% of the test organisms, in this case crawfish. The toxicity data for crawfish have been determined in a number of different ways including different exposure times (24, 48, 72 and 96 hours), test conditions (static and flowthrough water supplies), and crawfish species, life stages and sizes. All of these test variants affect LC_{50} values. Consequently, a particular chemical formulation may have several LC_{50} values in the literature. To avoid some of the confusion associated with varying LC_{50} values, we assembled LC_{50} for crawfish from 183 tests and 97 toxicants as a data base to standardize a value for each chemical compound. Since most of the values were for adult crawfish in static tests for 96 hours, this was used to standardized LC_{50} values (Seller 1995). These values were then ranked according to their toxicity to adult crawfish from 1 to 8 where lower numbers represent more toxic substances (Table 1).

Table 1. Ranking of the 96-hour LC_{50} values for adult crawfish. Those values on a class boundry were assigned to a lower severity rank.

Rank	LC_{50} Range[1] (ppb)	Relative Toxicity
1	1-10	Extremely Toxic
2	10-100	
3	100-1,000	
4	1,000-10,000	
5	10,000-100,000	
6	100,000-1,000,000	
7	1,000,000-10,000,000	
8	>10,000,000	Nearly Nontoxic

[1] ppb = parts per billion (µg/l)

The chemical compound, CAS number, chemical family, use, toxicity rank and relative 96-hour LC_{50} value for adult crawfish are found in Table 2. Chemicals are arranged alphabetically by the accepted common name whenever possible, or by their commonly-used trade name. The Chemical Abstract Service (CAS) number, chemical family and use follow the chemical name. This information may prove useful in identifying unfamiliar chemical compounds. The next entry is the relative 96-hour LC_{50} value in parts per billion (ppb or µg/l). Compounds with larger LC_{50} values are relatively less toxic than compounds with smaller LC_{50} values. The last column gives the relative toxicity ranking 1 to 8 with the lower ranked chemical compounds being relatively more hazardous to crawfish than higher ranked compounds.

It was our intention that these 96-hour LC_{50} values and rankings would be used as a yardstick of relative toxicity. Individuals who are mindful of the potential toxicity of the chemical application could use this table in selecting less toxic chemicals for treatment in and around crawfish ponds. It is important to remember that these 96-hour LC_{50} values were adjusted from laboratory toxicity tests and therefore, they may not exactly represent what will happen in nature when contamination occurs.

When possible avoid chemical application and situations which could lead to potential contamination of crawfish ponds. Read and follow the label recommendation carefully when making applications to sites either adjacent or on crawfish farming sites. The chemical label is the final clearance and gives specific warnings to the time of application, amount of the product which can safely be utilized, and mixing instructions and safety requirements. While some chemicals may seem safe in or around crawfish ponds, the target species on which the chemical is to be applied must be identified on the chemical label and should mention a clearance for use in aquaculture if directly applied in the crawfish pond. If the applicator is unsure or has any questions about chemical applications, they should consult the Agricultural Chemicals Handbook for their state. A publication is available through the Cooperative Extension Service and can be obtained from your local Extension Service office.

Related Publications

Sellers, B. C. 1995. Acute toxicity data base for crawfish: Analysis and interpretation of 183 tests with 99 toxicants. M.Sc. Thesis, Clemson University.

Whetstone, J. M. 1988. Commercial crawfish production: A guide for prospective culturists. SC-SG-MEP-88-1.

Table 2. Summary of 97 chemical compounds and the associated 96-hour LC_{50} values for adult crawfish in parts per billion. Toxicity ranks range from 1, extremely toxic, to 8 nearly nontoxic.

Chemical Compound	CAS#	Chemical Family	Toxicant Use	Relative 96-Hour LC_{50}*	Toxicity Rank
Amitrol-T	61-82-5	triazole	herbicide	>800,000	≥6
Arasan70-S Red		mixture (thiram)	fungicide	17,200	5
Arochlor 1254	11097-69-1	polychlorinated biphenyls	industrial	>6,600	≥4
Azinphos-methyl	85-50-0	organophosphorus (triazine)	insecticide	56	2
Bacillus sphaericus		biological	insecticide	300,000	6
Bacillus thuringiensis	68602-80-2	biological	insecticide	413,000	6
Bayluscide	1420-04-8	anilide	molluscicide	100,000	5
Bendiocarb	22781-23-3	carbamate	insecticide	22,200	5
Benomyl	17804-35-2	benzimidazole (MBC)	fungicide	1,030,000	7
Benzaldehyde	100-52-7	aromatic aldehyde (hydrocarbon)	bee repellent	>15,800	≥5
Bifenox	42576-02-3	organochlorine (bridged diphenyl)	herbicide	134,000	6
Bufencarb	2282-34-0	carbamate	insecticide	1,120	4
Cadmium chloride	10108-64-2	inorganic	fungicide	>18,000	≥5
Captan	133-06-2	phthalimide	fungicide	62,500,000	8
Carbaryl	63-35-2	carbamate	insecticide	2,200	4
Carbofuran	1563-66-2	carbamate	insecticide	2,000	4
Carboxin	5234-68-4	anilide	fungicide	868,000	6
Chlordane	57-74-9	organochlorine	insecticide	>1,110	≥4

Chemical Compound	CAS#	Chemical Family	Toxicant Use	Relative 96-Hour LC_{50}*	Toxicity Rank
Chlorpyrifos	2921-88-2	organophosphorus (pyridine)	insecticide	16.5	2
Copper		inorganic	algicide	16,800	5
Copper hydroxide	20427-59-2	inorganic	fungicide	11,700,000	8
Cutrine Plus		inorganic	algicide	2,950,000	7
DDT	50-29-3	organochlorine	insecticide	350	3
DEF	78-48-3	organophosphorus	herbicide	>5,600	≥4
Dicamba	1918-00-9	benzoic	herbicide	>800,000	≥6
Diclobenil	1194-65-6	nitrile	herbicide	177,000	6
Diclone	117-80-6	quinone	fungicide	25,700	5
Dicrotophos	141-66-2	organophosphorus	insecticide	3,000	4
Dieldrin	60-57-1	organochlorine	insecticide	560	3
Dimazine	57-14-7	mixture	fuel base	>800	≥3
Diphenamid	957-51-7	acetamide	herbicide	>800,000	≥6
DRC-1339	7745-89-3	aromatic amine (salt)	bird control	60,000	5
DRC-1347		aromatic amine (salt)	bird control	35,200	5
DRC-2698		aromatic amine (salt)	bird control	376,000	6
Endosulfan	115-29-7	organochlorine	insecticide	420	3
Endrin	72-02-8	organochlorine	insecticide	305	3
Fenac	85-34-7	organochlorine (bridged diphenyl)	herbicide	>800,000	≥6
Fenitrothion	122-14-5	organophosphorus	insecticide	56	2
Fenthion	55-38-9	organophosphorus	insecticide	350	3

Chemical Compound	CAS#	Chemical Family	Toxicant Use	Relative 96-Hour LC_{50}*	Toxicity Rank
Fosamine ammonium	25954-13-6	carbamate	herbicide	1,470,000	7
Glyphosate	1071-83-6	organophosphorus	herbicide	189,000	6
Heptachlor	76-44-8	organochlorine	insecticide	6	1
Hexachloroethane		alcohol	narcotic	20,000	5
Isoteraryl alcohol		alcohol	insecticide	>40,000,000	8
Leptophos	21609-90-5	organophosphorus	insecticide	>84,000	≥5
Linuron	330-55-2	urea	herbicide	35,200	5
Malathion	121-75-5	organophosphours	insecticide	198,000	6
Mancozeb	8018-01-7	carbamate (organomanganese)	fungicide	35,200	5
Maneb	12427-38-2	carbamate (organomanganese)	fungicide	35,200	5
Methiocarb	2032-65-7	carbamate	bird control	5,200	4
Methomyl	16752-77-5	carbamate	insecticide	4,000	4
Methoxychlor	72-43-5	organochlorine (bridged diphenyl)	insecticide	2	1
Mexacarbate	315-18-4	carbamate	insecticide	8,300	4
Mirex	2385-85-5	organochlorine	insecticide	4,000	4
Mobil MC-A-600		carbamate	insecitcide	463	3
Molinate	2212-67-1	carbamate (azepine)	herbicide	26,000	5
Monocrotophos	6923-22-4	organophosphorus	insecticide	32	2
MSMA	2163-80-6	organoarsenic	herbicide	1,020,000	7
Naled	300-76-5	organophosphorus	insecticide	4,000	4
Oust	74222-97-2	urea (benzoate)	herbicide	29,000,000	8

Chemical Compound	CAS#	Chemical Family	Toxicant Use	Relative 96-Hour LC_{50}*	Toxicity Rank
PA-14		surfactant	bird control	168,000	6
Paraquat dichloride	1910-42-5	bipyridylium	herbicide	10,000	4
Parathion	56-38-2	organophosphorus (nitro compound)	insecticide	15	2
Parathion methyl	298-00-0	organophosphorus (nitro compound)	insecticide	20	2
Pentachlorophenol	87-65-5	organochlorine	herbicide	>339,000	≥6
Permethrin	52645-53-1	pyrethroid	insecticide	2.5	1
Phosphamidon	13171-21-6	organophosphorus	insecticide	5,500	4
Phoxim	14816-18-3	organophosphorus (nitrile)	insecticide	26	2
Phthalate, dibutyl	84-74-2	aromatic ester	industrial	>120,000	≥6
Phthalic acid esters		aromatic ester mixture	industrial	>120,000	≥6
Potassium azide	12136-44-6	azide	herbicide	1,500	4
Propanil	709-98-8	amide	herbicide	28,300	5
Propoxur	114-26-1	carbamate	insecticide	5,720	4
Pydraul 50E		mixture (hydraulic fluid)	industrial	>2,780	≥4
Siduron	1982-49-6	urea	herbicide	40,000	5
Silvex (BEE)	19398-13-1	phenoxl	herbicide	60,000	5
Simazine	122-34-9	triazine	herbicide	>8,000,000	≥7
Sodium azide	26628-22-8	azide	herbicide	700	3
Sulfur (pH acid)	7704-34-9	inorganic	fungicide	2.65	1
TFM	654-66-0	anilide	lampricide	220,000	6
Thiobencarb	28249-77-6	carbamate	herbicide	6,500	4

Chemical Compound	CAS#	Chemical Family	Toxicant Use	Relative 96-Hour LC_{50}*	Toxicity Rank
Thiram	137-26-8	carbamate	fungicide	4,300	4
Toxaphene	8001-35-2	organochlorine (terpenoid)	insecticide	200	3
Trichlorfon	52-86-6	organophosphorus (organochlorine)	insecticide	42,000	5
Trichloronat	327-98-0	organophosphorus (organochlorine)	insecticide	429	3
Trifluralin	1582-09-8	dinitroasniline	herbicide	26,600	5
Vernolate	1927-77-7	carbamate	herbicide	193,000	6
a-bromo-2',5' dimethoxxyaceetophenone		brominated hydrocarbon		422	3
1,3 dichloro-4,6-dinitrobenzene		organochlorine		233	3
2-chloroethanol		alcohol		285,000	6
2-methyl-1-propanol		alcohol		3,800,000	7
2-methyl-2,4-pentamediol		alcohol		365,000,000	8
2,4-D	94-75-7	phenoxyl	herbicide	5,560,000	7
2-(2 ethoxyethoxy)-ethanol		alcohol		257,000,000	8
2,4-pentamendione		B-diketone		11,70,000	7
2,2,2-trichloroethanol		alcohol	fungicide	154,000	7
4-AP	504-24-5	pyridine	bird control	8,800	4

*Estimated 96-hour static LC_{50} for adult crawfish.