**DERIVATION OF ACUTE AND CHRONIC TOXICITY CRITERIA**
**FOR TOXAPHENE**
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## EPA SPECIES MEAN ACUTE VALUES

(values from 9/86 EPA AWQC document, EPA 440/5-86-006 and 12/91 draft GLI Criteria Update)

**Cladoceran *(Daphnia magna)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 10 | S M | Sanders 1980 |
| 10 | S U | Johnson & Finley 1980 |
| 155 | S U | Bringmann and Kuhn 1960 |
| SMAV = 10 | | (1 measured result) |

**Cladoceran *(Daphnia pulex)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 14.2 | S U | Johnson & Finley 1980 |
| 15 | S U | Sanders and Cope 1966 |
| SMAV = 14.59 | | (2 results) |

**Cladoceran *(Simocephalus serrulatus)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 19 | S U | Sanders & Cope 1966 |
| 10 | S U | Sanders & Cope 1966 |
| SMAV = 13.78 | | (2 results) |

**Amphipod *(Gammarus fasciatus)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 35 | S U | Sanders 1972 |
| 6 | S U | Sanders 1972 |
| 26 | S U | Johnson & Finley 1980 |
| SMAV = 17.61 | | (3 results) |

**Prawn *(Palaemonetes kadiakensis)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 28 | S U | Sanders 1972 |
| 36 | ? U | Chalyarach et al. 1975 |
| SMAV = 28 | | (Sanders result) |

**Midge *(Chironomus plumosus)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 30 | S U | Johnson and Finley 1980 |
| 180 | S M | Sanders 1980 |
| 17 | | Meyer & Ellersieck 1986 |
| 24 | | Meyer & Ellersieck 1986 |
| 50 | | Meyer & Ellersieck 1986 |
| SMAV = 40.59 | | (5 results) |

**Coho salmon *(Onchorhynchus kisutch)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 8 | S U | Johnson & Finley 1980 |
| 4 | S U | Macek & McAllister 1970 |
| 9.4 | S U | Katz 1961 |
| SMAV = 6.70 | | (3 results) |

**Chinook salmon *(Onchorhynchus tshawytscha)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 1.54 | S U | Earnest 1970 |
| 2.5 | S U | Katz 1961 |
| SMAV = 1.96 | | (2 results) |

**Rainbow trout *(Onchorhynchus mykiss)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 28 (not used, not most sensitive life stage) | S U | Workman & Neuhold 1963 |
| 23 (not used, not most sensitive life stage) | S U | Workman & Neuhold 1963 |
| 5.4 | S U | Cope 1964 |
| 8.4 | S U | Mahdi 1966 |
| 10.6 | S U | Johnson & Finley 1980 |
| 2.7 | S U | Cope 1964 |
| 11 | S U | Macek & MCAllister 1970 |
| 1.8 | S U | Cope 1964 |
| 8.4 | S U | Katz 1961 |
| 12 | | Meyer & Ellersieck 1986 |
| 9 | | Meyer & Ellersieck 1986 |
| 6.7 | | Meyer & Ellersieck 1986 |
| SMAV = 6.60 | | (10 results) |

**Fathead minnow *(Pimephales promelas)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 14 | | Meyer & Ellersieck 1986 |
| 16.4 | | Meyer & Ellersieck 1986 |
| 18 | | Meyer & Ellersieck 1986 |
| 5.6 | | Meyer & Ellersieck 1986 |
| 6.9 | | Meyer & Ellersieck 1986 |
| SMAV = 10.98 | | (5 results) |

**Black bullhead *(Ictalurus moias)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 5 | S U | Macek & McAllister 1970 |
| 5.8 | S U | Johnson & Finley 1980 |
| SMAV = 5.39 | | (2 results) |

**Channel catfish *(Ictalurus punctatus)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 0.8 | S U | Johnson & Julin 1980 |
| 2.4 | | Meyer & Ellersieck 1986 |

| | | |
|---|---|---|
| SMAV = 1.39 | | (2 results) |

**Striped bass *(Morone saxatilis)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 4.4 | FT U | Korn & Earnest 1974 |
| 5.4 | S U | Palawski et al. 1975 |
| SMAV = 4.87 | | (2 results) |

**Bluegill *(Lepomis macrochirus)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 5 | | Isensee et al. 1979 |
| 3.2 | S U | Macek et al. 1969 |
| 2.6 | S U | Macek et al. 1969 |
| 2.6 | S U | Johnson & Julin 1980 |
| 4.7 | FT U | Johnson & Julin 1980 |
| 2.4 | S U | Macek et al. 1969 |
| 3.5 | S U | Henderson et al. 1960 |
| 4.6 | S U | Henderson et al. 1960 |
| 4.4 | S U | Henderson et al. 1960 |
| 7.3 | | Meyer & Ellersieck 1986 |
| 10 | | Meyer & Ellersieck 1986 |
| 3.3 | | Meyer & Ellersieck 1986 |
| 3.3 | | Meyer & Ellersieck 1986 |
| 3.2 | | Meyer & Ellersieck 1986 |
| 7.8 | | Isensee et al. 1979 |
| SMAV = 4.13 | | (15 results) |

**Green sunfish *(Lepomis cyanellus)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 13 | | Meyer & Ellersieck 1986 |
| 11 | | Meyer & Ellersieck 1986 |
| SMAV = 11.96 | | (2 results) |

**Species with single test results:**

| SPECIES | METHOD | VALUE (ug/L) | REFERENCE |
|---|---|---|---|
| Goldfish (*Carassius auratus*) | | 14 | Meyer & Ellersieck 1986 |
| Amphipod (*Gammarus lacustris*) | S U | 26 | Sanders 1969 |
| Amphipod (*Gammarus pseudolimnaeus)* | S M | 24 | Sanders 1980 |
| Stonefly (*Pteronarcella badia*) | S U | 3 | Sanders & Cope 1968 |
| Stonefly (*Pteronarcys californica* | S U | 2.3 | Sanders & Cope 1968 |
| Stonefly (*Claassenia sabulosa*) | S U | 1.3 | Sanders & Cope 1968 |
| Crane fly (*Tipula* sp.) | S U | 18 | Johnson & Finley 1980 |
| Snipe fly (*Atherix variegata*) | S U | 40 | Johnson & Finley 1980 |
| Brown trout (*Salmo trutta*) | S U | 3.1 | Johnson & Finley 1980 |
| Brook trout (*Salvelinus fontinalis*) | FT M | 10.8 | Mayer et al. 1975 |
| Carp (*Cyprinus carpio*) | | 3.7 | Meyer & Ellersieck 1986 |
| Redear sunfish (*Lepomis microiophus*) | S U | 13 | Macek & McAllister 1970 |
| Largemouth bass (*Micropterus salmoides*) | S U | 2 | Johnson & Finley 1980 |
| Yellow perch (*Perca flavescens*) | S U | 12 | Johnson & Finley 1980 |
| Western chorus frog (*Pseudacris triserata*) | S U | 500 | Sanders 1970 |
| Snail (*Physa* sp.) | | 63.2 | (not available) |
| Fowler's toad (*Bufo fowleri*) | S U | 140 | Sanders 1970 |

MINIMUM DATABASE REQUIREMENT EVALUATION

According to s. NR 105.05(1)(a), acute toxicity criteria can be calculated if data are available on one or more species of freshwater animal in at least 8 different families, provided that of the 8 species:

1. At least one is a salmonid fish in the family Salmonidae in the class Osteichthyes,
2. At least one is a non-salmonid fish from another family in the class Osteichthyes, preferably a commercially or recreationally important species,
3. At least one is a planktonic crustacean (e.g., cladoceran, copepod),
4. At least one is a benthic crustacean (e.g., ostracod, isopod, amphipod, crayfish),
5. At least one is an insect (e.g., mayfly, dragonfly, damselfly, stonefly, caddisfly, mosquito, midge),
6. At least one is a fish or amphibian from a family in the phylum Chordata not already represented in one of the other subdivisions,
7. At least one is an organism from a family in a phylum other than Arthropoda or Chordata (e.g., Rotifera, Annelida, Mollusca), and
8. At least one is an organism from a family in any order of insect or any other phylum not already represented in subds. 1. to 7.

Using the above numbering scheme, the following species are represented in the minimum database requirements for criteria calculation. If any of the 8 categories are not represented in the database, a criterion cannot be calculated under ch. NR 105. Instead, a secondary value must be calculated.

1. Rainbow trout
2. Bluegill
3. Cladoceran *(D. magna)*
4. Amphipod (*G. fasciatus*)
5. Stonefly
6. Fathead minnow, family Cyprinidae
7. Prawn
8. Channel catfish, family Ictaluridae

CONCLUSION: An acute toxicity criterion can be calculated for toxaphene according to ch. NR 105.

| GENUS NAME (w/ component species) | GMAV (ug/L) | CLASSIFICATIONS * CW | WW | LFF | LAL |
|---|---|---|---|---|---|
| Pseudacris | 500.0 | x | x | x | x |
| Bufo | 140.0 | x | x | x | x |
| Physa | 63.20 | x | x | x | x |
| Chironomus | 40.59 | x | x | x | x |
| Atherix | 40.00 | x | x | x | x |
| Palaemontes | 28.00 | x | x | x | x |
| Gammarus | 22.23 | x | x | x | x |
| G. fasciatus 17.61 | | | | | |
| G. pseudolimnaeus 24.00 | | | | | |
| G. lacustris 26.00 | | | | | |
| Tipula | 18.00 | x | x | x | x |
| Carassius | 14.00 | x | x | x | |
| Simocephalus | 13.78 | x | x | x | x |
| Daphnia | 12.08 | x | x | x | x |
| D. pulex 14.59 | | | | | |
| D. magna 10.00 | | | | | |
| Perca | 12.00 | x | x | | |
| Pimephales | 10.98 | x | x | x | |
| Salvelinus | 10.80 | x | | | |
| Lepomis | 8.62 | x | x | | |
| L. macrochirus 4.13 | | | | | |
| L. cyanellus 11.96 | | | | | |
| L. microphoius 13.00 | | | | | |
| Morone | 4.87 | x | x | | |
| Onchorhynchus | 4.43 | x | | | |
| O. mykiss 6.60 | | | | | |
| O. kisutch 6.70 | | | | | |
| O. tshawytscha1.96 | | | | | |
| Cyprinus | 3.70 | x | x | x | |
| Salmo | 3.10 | x | | | |
| Pteronarcella | 3.00 | x | x | x | x |
| Ictalurus | 2.73 | x | x | | |
| I. moias 5.39 | | | | | |
| I. punctatus 1.39 | | | | | |
| MIcropterus | 2.00 | x | x | | |
| Claassenia | 1.30 | x | x | x | x |
| TOTAL NUMBER OF GENERA REPRESENTED: | | 23 | 19 | 14 | 11 |

* - KEY TO CLASSIFICATIONS (an X is listed for species considered in each):

CW = Coldwater community, all genera are considered here.

WW = Warmwater sportfish community, only the coldwater fish are excluded from this database (also includes warmwater forage).

LFF = Limited forage fish community, all sport fish are excluded from this database.

LAL = Limited aquatic life, all fish are excluded from this database.

The four most sensitive genera in each classification are used to calculate the criteria under each classification, pursuant to s. NR 105.05 (2). From this point, the results of the calculation are shown using the variables listed in sub. (2).

CRITERION CALCULATION:

| | | **CW** | **WW** | **LFF** | **LAL** |
|---|---|---|---|---|---|
| GMAV RANKS | | | | | |
| | 4 | 3 | 3 | 10.98 | 12.08 |
| | 3 | 2.73 | 2.73 | 3.7 | 10.98 |
| | 2 | 2 | 2 | 3 | 3 |
| | 1 | 1.3 | 1.3 | 1.3 | 1.3 |
| | n | 23 | 19 | 14 | 11 |
| ln GMAV | | | | | |
| | 4 | 1.0986123 | 1.0986123 | 2.3960754 | 2.4915512 |
| | 3 | 1.0043016 | 1.0043016 | 1.3083328 | 2.3960754 |
| | 2 | 0.6931472 | 0.6931472 | 1.0986123 | 1.0986123 |
| | 1 | 0.2623643 | 0.2623643 | 0.2623643 | 0.2623643 |
| (ln GMAV)^2 | | | | | |
| | 4 | 1.206949 | 1.206949 | 5.7411775 | 6.2078273 |
| | 3 | 1.0086217 | 1.0086217 | 1.7117348 | 5.7411775 |
| | 2 | 0.480453 | 0.480453 | 1.206949 | 1.206949 |
| | 1 | 0.068835 | 0.068835 | 0.068835 | 0.068835 |
| P | | | | | |
| | 4 | 0.166667 | 0.2 | 0.266667 | 0.333333 |
| | 3 | 0.125 | 0.15 | 0.2 | 0.25 |
| | 2 | 0.083333 | 0.1 | 0.133333 | 0.166667 |
| | 1 | 0.041667 | 0.05 | 0.066667 | 0.083333 |
| sq rt P | | | | | |
| | 4 | 0.4082483 | 0.4472136 | 0.5163978 | 0.5773503 |
| | 3 | 0.3535534 | 0.3872983 | 0.4472136 | 0.5 |
| | 2 | 0.2886751 | 0.3162278 | 0.3651484 | 0.4082483 |
| | 1 | 0.2041241 | 0.2236068 | 0.2581989 | 0.2886751 |
| EV | | 3.0584253 | 3.0584253 | 5.0653848 | 6.2486032 |
| EW | | 2.7648587 | 2.7648587 | 8.7286962 | 13.224789 |
| EP | | 0.416667 | 0.5 | 0.666667 | 0.833333 |
| EPR | | 1.254601 | 1.3743465 | 1.5869586 | 1.7742737 |
| | | | | | |
| J | | 0.05 | 0.05 | 0.05 | 0.05 |
| S | | 4.2905742 | 3.9167404 | 7.9024303 | 8.6470475 |
| L | | -0.581133 | -0.581133 | -1.868861 | -2.273406 |
| A | | 0.3782683 | 0.2946765 | -0.101824 | -0.339868 |
| FAV | | 1.4597545 | 1.3426919 | 0.9031883 | 0.7118644 |
| ATC | | 0.7298772 | 0.671346 | 0.4515942 | 0.3559322 |

CRITERIA:

| | CW | WW | LFF | LAL |
|---|---|---|---|---|
| calc. ATC | 0.73 | 0.67 | 0.45 | 0.36 |

The calculated criteria for WW, LFF, and LAL will be less than that for CW due to the smaller databases, overruling the fact that the same organisms aren't present in each classification. Essentially, this means that there is no relief available for the criteria in these other classifications. It was deemed appropriate to set the criteria equal to those for the coldwater database rather than having more restrictive criteria applied to these "subset" classifications.

**Acute toxicity criteria for toxaphene:**
**ATC = 0.73 ug/L (all classifications)**

**EPA SPECIES MEAN CHRONIC VALUES**
(values from 9/86 EPA AWQC document, EPA 440/5-86-006 and 12/91 draft GLI Criteria Update)

**Cladoceran *(Daphnia magna)***

| VALUE (ug/L) | METHOD | REFERENCE |
|---|---|---|
| 0.091 | | Sanders 1980 |
| SMCV = 0.091 | | (1 result) |

Since no fish chronic data are available, a chronic criterion cannot be calculated.