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SECONDARY VALUES FOR MANGANESE

A search was conducted for information on the toxicity of manganese to fish and aquatic life using the ECOTOX database.

Fish and Aquatic Life Secondary Values

To derive an acute toxicity criterion for aquatic life, acute toxicity test results are required for at least one species in each of eight different families. Specific requirements and the data available to meet these requirements are found in Table 1. Following a search for information on the toxicity of manganese to fish and other aquatic life, it was determined that data are available to meet only two out of the eight requirements. However, because data are available for a Daphnid species, it was possible to calculate secondary values for manganese.

Cold Water

To calculate a secondary acute value (SAV), the lowest genus mean acute value (GMAV) in the database is divided by the secondary acute factor (SAF; an adjustment factor corresponding to the number of satisfied requirements).

SAF for two out of eight requirements met = 13.0

Lowest GMAV = 21,874.84 μg/L (*Daphnia magna*)

SAV = GMAV/SAF
= 21,874.84 / 13.0
= 1,682.68 μg/L

Secondary chronic value (SCV) = SAV/secondary acute to chronic ratio (SACR)
=1,682.68 / 18
= **93.48 μg/L**

Warm Water Sportfish, Warm Water Forage Fish, Limited Forage Fish, Limited Aquatic Life

The lowest GMAV in the cold water database is for an invertebrate (*Daphnia magna*). Because invertebrate species do not drop out of the database for Warm Water Sportfish, Warm Water Forage Fish, Limited Forage Fish, or Limited Aquatic Life designated waters, the secondary values will be the same for these water bodies as for cold water designated water bodies.

Table 1. Requirements for calculation of an acute toxicity criterion for protection of aquatic life for manganese and corresponding acute toxicity data.

Species Name	Common Name	Duration/ Endpoint	Value µg/L	Reference #[a]	Source
1. At least one salmonid fish in the family Salmonidae, in the class Osteichthyes.					
2. At least one non-salmonid fish from another family in the class Osteichthyes, preferably a commercially or recreationally important warmwater species.					
3. At least one planktonic crustacean (e.g., cladoceran, copepod).					
Daphnia magna	**water flea**	**48-h/EC50**	**40,000**	**1**	**ECOTOX**
Daphnia magna	**water flea**	**48-h/EC50**	**9,800**	**2**	**ECOTOX**
Daphnia magna	**water flea**	**48-h/EC50**	**4,700**	**3**	**ECOTOX**
Daphnia magna	**water flea**	**48-h/EC50**	**20,000**	**3**	**ECOTOX**
Daphnia magna	**water flea**	**48-h/EC50**	**32,300**	**3**	**ECOTOX**
Daphnia magna	**water flea**	**48-h/EC50**	**56,100**	**3**	**ECOTOX**
Daphnia magna	**water flea**	**48-h/EC50**	**34,500**	**3**	**ECOTOX**
Daphnia magna	**water flea**	**48-h/EC50**	**22,800**	**3**	**ECOTOX**
EC50s vary by slightly over 10X, but since the majority of results are on the high end of the range, all values are used to calculate the SMAV.					
Species mean acute value (SMAV):			21,874.84		
4. At least one benthic crustacean (e.g., ostracod, isopod, amphipod, crayfish).					
Asellus aquaticus	**aquatic sowbug**	**96-h/EC50**	**333,000**	**4**	**ECOTOX**
Crangonyx pseudogracilis	**scud**	**96-h/EC50**	**694,000**	**4**	**ECOTOX**
Orconectes limosus	**crayfish**	**96-h/LC50**	**51,000**	**5**	**ECOTOX**
5. At least one insect (e.g., mayfly, dragonfly, damselfly, stonefly, caddisfly, mosquito, midge).					

6. At least one fish or amphibian from a family in the phylum Chordata not already represented in one of the other subdivisions.
7. At least one organism from a family in a phylum other than Arthropoda or Chordata (e.g., Rotifera, Annelida, Mollusca).

8. At least one organism from a family in any order of insect or any other phylum not already represented in subdivisions 1 through 7.

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[2]Biesinger, K.E. and G.M. Christensen. 1972. Effects of various metals on survival, growth, reproduction and metabolism of *Daphnia magna*. J. Fish. Res. Board Can. 29:1691-1700.

[3]Baird, D.J., I. Barber, M. Bradley, A.M.V.M. Soares, and P. Calow. 1991. A comparative study of genotype sensitivity to acute toxic stress using clones of *Daphnia magna* Straus.

[4]Martin, T.R. and D.M. Holdich. 1986. The acute lethal toxicity of heavy metals to Peracarid crustaceans (with particular reference to freshwater Asellids and Gammarids. Water Research 20(9):1137-1147.

[5]Boutet, C. and C. Chaisemartin. 1973. Specific toxic properties of metallic salts in *Austropotamobius pallipes pallipes* and *Orconectes limosus*. C.R. Soc. Biol. (Paris) 167(12):1933-1938.