



A statistical tool for setting water quality guidelines and testing water quality targets

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Introduction

- Need for objective and consistent ways of assessing water quality → water quality guidelines
- ANZECC & ARMCANZ 2000 provide national values and basic information on creating and applying water quality guidelines, QWQG 2006 provide values specific to Queensland waterways
- Software tool to calculate, manage and apply water quality guidelines as specified

Water Quality Guideline Tool

- Water quality guidelines – a recommended numerical concentration level of narrative statement that will support and maintain the designated use of a particular water body
- Tool accommodates the process described in ANZECC & ARMCANZ 2000 to set and apply guidelines
 - Database and search facility
 - Derive a guideline (biological effects and departure from reference data)
 - Applying a guideline

Using biological effects data

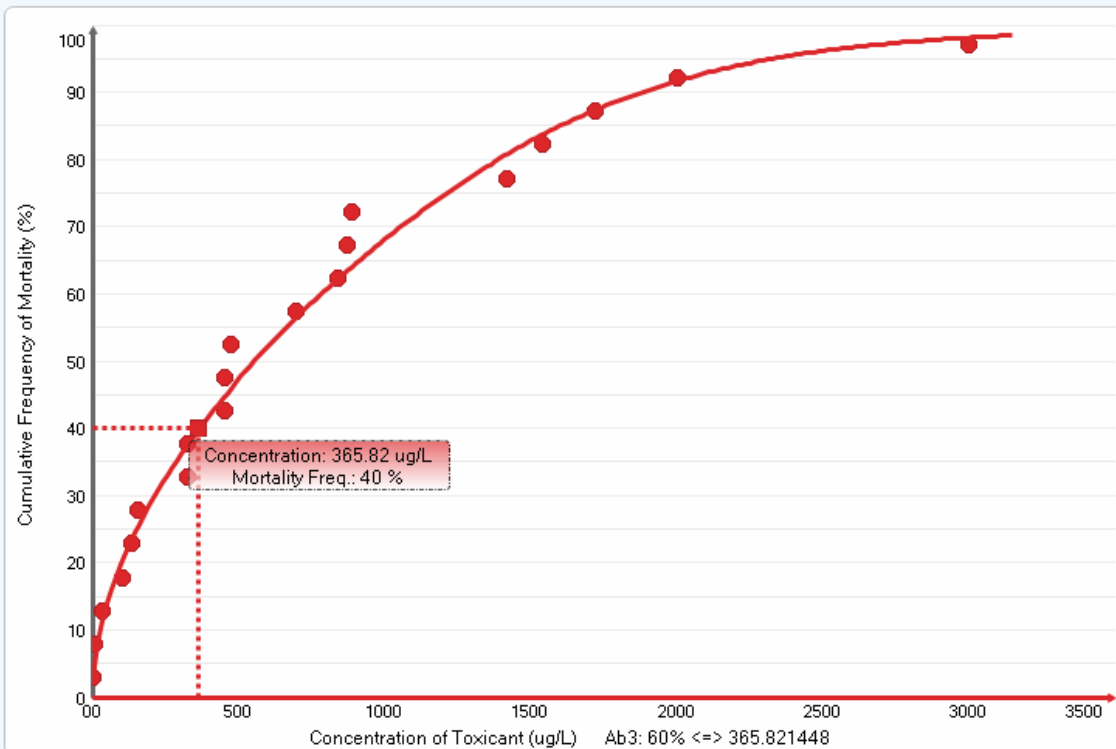
- Most preferable method
- Uses aquatic toxicity data from laboratory studies with single or multiple species under a controlled experiment
- Tool designed to estimate the protecting concentration such that a given percentage of species survive
- Burr III distribution fitted to toxicity data to estimate curve for calculating the percentage

$$f(x) = \frac{1}{\left[1 + \left(\frac{b}{x}\right)^c\right]^k}$$

Work with Guidelines

- Introduction
- Test Guidelines
 - Search
 - Test Setup
 - Create New
 - Guidelines Using Biological Effects Data
 - Guidelines Using Reference Data
 - Targets Using Proportional Improvement
- Manage Library
 - Guidelines and Targets
 - Information

Calculate guidelines using biological effects data



Input Series	
<input checked="" type="checkbox"/>	Ab3

- Work with Guidelines
- Calculate Loads
- Analyse Trends
- Manage Data

Model Fitting
 20 observations are fitted to:
 BurrIII Distribution

 b = 2034.693944
 c = 4.522305
 k = 0.118071
 log-likelihood = 151.678287

Protecting Percentile vs Concentration
 Percentile:
 Concentration:

Protecting Concentration
 To protect % of the species:
 Concentration should be <= 7.45

Current Library: C:\WQA\data\guidelines\defaults.db

Using reference data

- Tool uses a non-parametric procedure to calculate percentile based guideline values

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- Method
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$$Y_1, Y_2, \dots, Y_n$$

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$$1 + p(n - 1)$$

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- Tool uses a non-parametric procedure to calculate percentile based guideline values

- Method

- Sort the data into ascending order:

$$Y_1, Y_2, \dots, Y_n$$

- Calculate the rank of the required percentile:

$$1 + p(n - 1)$$

- Interpolate between the adjacent data to obtain the required percentile:

$$(1 - r_{frac})Y_{r_{int}} + r_{frac}Y_{r_{int} + 1}$$

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 - Estimate the rank (r_{upper}) of the intervals upper value interval by determining the $(1 - \alpha/2)$ quartile of a binomial dist. with size n and p

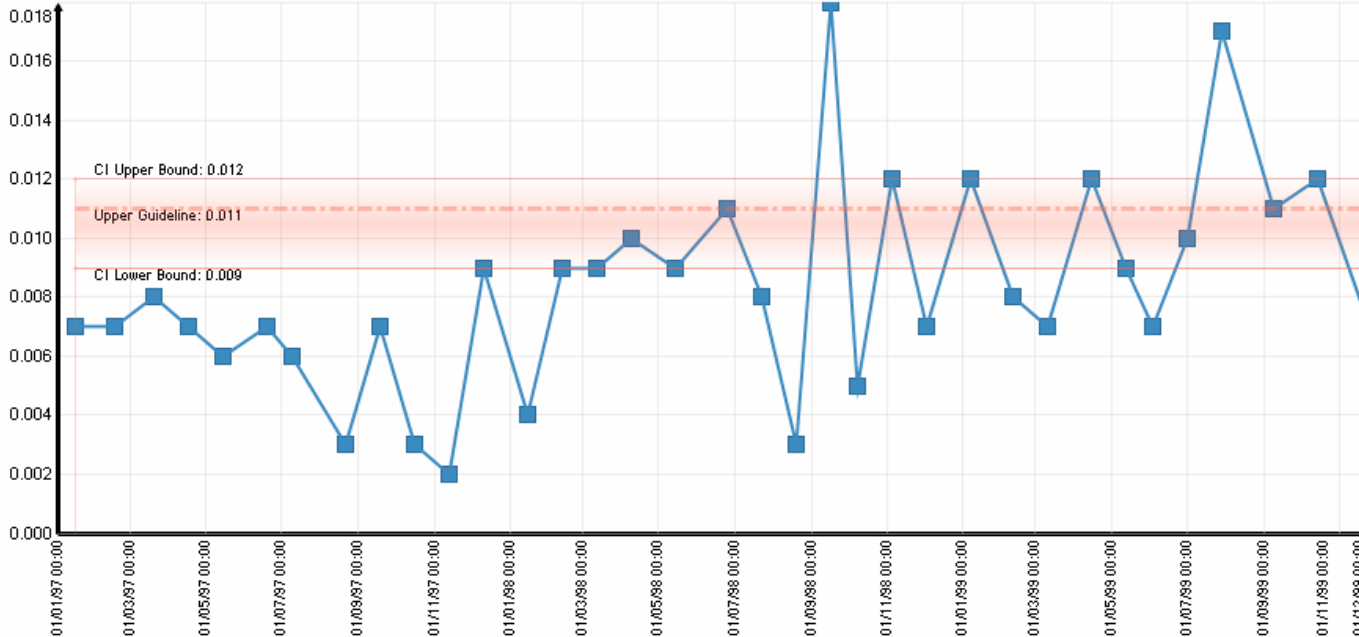
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 - Upper and lower values are the data points that correspond to the ranks r_{low} and r_{upper}

Calculate guidelines using reference data



Input Series
 site_2-ammonia.csv:...

Calculated Guidelines
 Upper Guideline

Add to Database

■ site_2-ammonia.csv: Ammonia
 - Upper Guideline

General

Start: 16/01/1997
 End: 25/11/1999
 Units: [dropdown]

Input Data

Median: 0.008
 Sites: 1
 Sample size: 35

Guideline Type

Upper Limit
 Lower Limit
 Both*

Set Guideline Limits

Upper percentile: 80
 Upper guideline: 0.011

Confidence intervals

Upper guideline	0.009	0.012
Median	0.007	0.009

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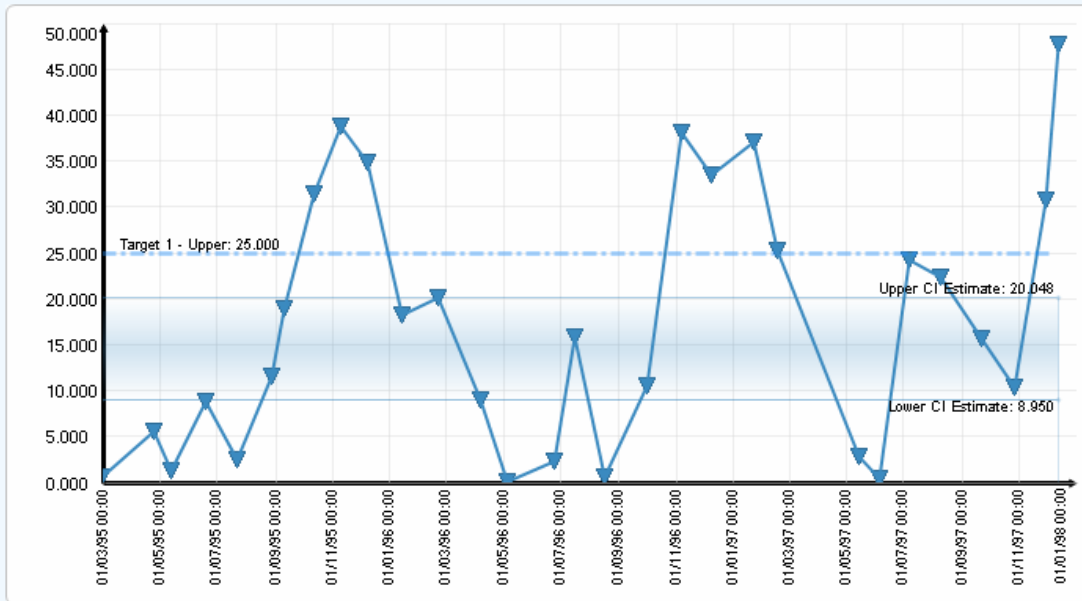
Applying Water Quality Guidelines

- Test data from a water body against a selected national or state-specific guideline value
- Compare the guideline against an appropriately sized confidence interval around the median of the test data
- Interval size is approximately
 - 95% for a single upper or lower guideline
 - 90% for a guideline consisting of both
 - Maintains Type I error rate to 5%

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Test current condition



Input Series	
<input checked="" type="checkbox"/>	Conductivity
<input checked="" type="checkbox"/>	Target 1 - Upper

Conductivity
Target 1 - Upper

Work with Guidelines

Calculate Loads

Analyse Trends

Manage Data

Time Period

Start: 01/03/1995

End: 03/12/1997

Guideline Type

Upper Limit

Lower Limit

Both*

Test Guideline

Upper: 25

+ Add User-defined

Search Library

Results

Collapse All Expand All View Option: Series -> Target Target -> Series

Input Series	Median	Confidence Interval
Conductivity	15.7685	8.950, 20.048

Guideline Name	Guideline Value	Test Result
Target 1	25.000	Pass

Current Library: C:\WOA\data\guidelines\defaults.db

Conclusions

- User friendly software tool to calculate, store and test against locally relevant water quality guidelines
- To be available at www.toolkit.net.au soon!
- Application by a wider audience will trigger refinements and enhancements as required

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