Kolmogorov-Smirnov Goodness of Fit Test Confidence Intervals

Addendum to

Demonstration of the Wildlife Ecological Assessment Program (WEAP)

September 2001

3.3.4 Kolmogorov-Smirnov Goodness of Fit Test Confidence Intervals

The Kolmogorov-Smirnov (K-S) Goodness of Fit Test (Hogg and Tanis 1977)[a] is used to define confidence intervals (i.e., confidence bands) surrounding the output results produced by WEAP. The K-S test determines confidence bands for unknown distribution functions [i.e., $F_n(x)$] (Hogg and Tanis 1977). The probability of an event (e.g., concentration, body burden, ecological hazard quotient) is obtained from the simulation results by identifying the probability of exceeding the event, thereby defining the distribution function [i.e., $F_n(x)$] of that event. In the case of time, it is the probability of exceeding a given duration of exposure. The lower and upper limits associated with the empirical distribution are defined as follows:

- Lower Limit = $F_n(x)$ - d
- Upper Limit = $F_n(x)$ + d

where d is the critical value for the Kolmogorov-Smirnov Test Statistic, which can be obtained from published tables (e.g., Hogg and Tanis 1977, Table VII, pg 431). The following Confidence Interval pairs are provided as part of the output: 99% & 1%, 95% & 5%, 90% & 10%, and 80% & 20%.

An example set of calculations, corresponding to the values in Table 3.3 and figure 3.5 are presented and illustrated in Table 3.5 and Figure 3.8, respectively, for 11 values (n=11) for the 5% and 95% Confidence Interval with a d statistic of 0.39. Table 3.5 presents the concentration, probability of equaling or exceeding the concentration, and 5% and 95% Confidence Intervals, using the K-S Goodness of Fit test.

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[a]Hogg, R.V. and E.A. Tanis. 1977. Probability and Statistical Inference. MacMillan Publishing, Co., New York.

Table 3.5   Example Calculation for the 5% and 95% Confidence Intervals, using the Kolmogorov-Smirnov Goodness of Fit Test

Index on Values	x Concentration	$F_n(x)$ Probability of Equaling or Exceeding a Concentration, based on Exposure Duration	Confidence Interval (CI) 5% Confidence Interval $[F_n(x) - d]$	Confidence Interval (CI) 95% Confidence Interval $[F_n(x) + d]$
	(mg/L)	(expressed as a fraction)	(expressed as a fraction)	(expressed as a fraction)
1	0	1.00	0.61	1.39
2	10	0.85	0.46	1.24
3	20	0.72	0.33	1.11
4	30	0.63	0.24	1.02
5	40	0.57	0.18	0.96
6	50	0.48	0.09	0.87
7	60	0.37	0.00	0.76
8	70	0.24	0.00	0.63
9	80	0.11	0.00	0.50
10	90	0.02	0.00	0.41
11	100	0.00	0.00	0.39

d=critical value for the Kolmogorov-Smirnov Test Statistic [obtained from published tables (e.g., Hogg and Tanis 1977, Table VII, pg 431) for n=15 and for the 5% and 95% CIs, d=0.39)].
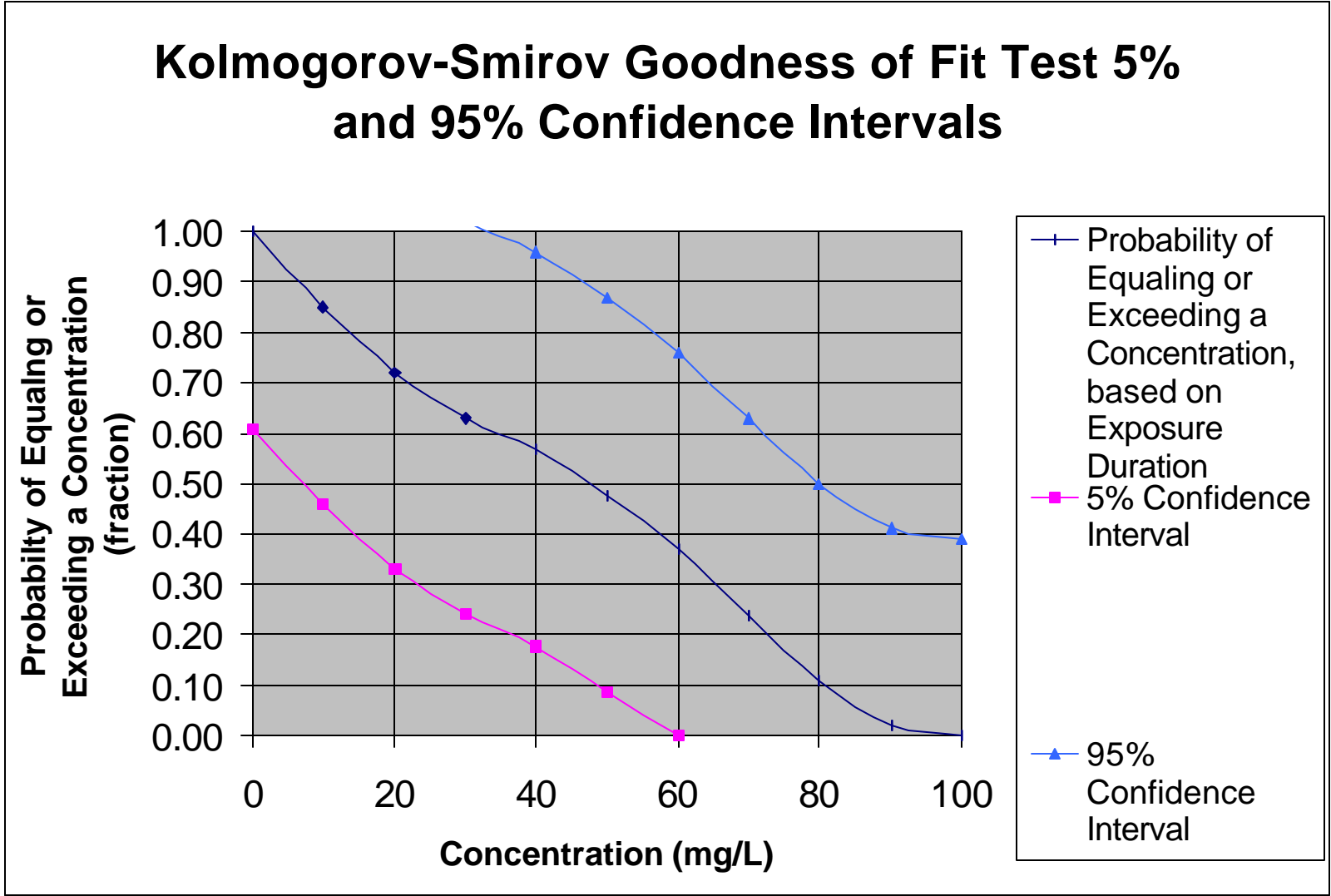
Figure 3.8 Example Illustration for the 5% and 95% Confidence Intervals, using the Kolmogorov-Smirnov Goodness of Fit Test