COMPARISON OF ACUTE 9 - DAY TOXICITY TESTS USING CLAMTROL® ON *ANODONTA IMBECILIS* AND *ELLIPTIO ARCTATA*

Presbyterian College

Department of Biology/ AquaticToxicity Testing Laboratory

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THE ACUTE TOXICITY EFFECTS OF CLAMTROL ON TWO SPECIES OF FRESHWATER JUVENILE MUSSELS

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July 18, 1994

METHOD:

Organisms: Test was initiated with six-day old *Anodonta imbecilis* and *Elliptio arctata* juveniles (artificially transformed with the use of fish plasma in artificial medium (Isom and Hudson, 1982) from parents collected from Lake Monticello, Fairfield County, S.C. and from Duncan Creek, Laurens County, S.C. respectfully.

Temperature: 23-25 C.

Light: None.

Duration: 9 days, acute.

Medium: Reconstituted water (EPA moderately hard), changed daily with concentrated plankton (from centrifugation) and silt added. Plankton and silt provided by Damien Simbeck, TVA Toxicity Testing Laboratory, Browns Ferry Nuclear Power Plant, Athens Al.

Test Chamber: Mussels held in a 50 mm diameter glass cylinder with a 100 micron screen bottom which was placed in a 250 ml evaporation dish containing a minimum of 150 ml of the above medium.

Design: Six treatments (0.1, 0.4, 1.6, 6.4, 12.8, and 25.6 ppm)of ClamTrol (CT-1) and a control (reconstituted water) consisting of four repetitions each in separate chambers and dishes holding 10 mussels each (40 mussels/test group).

Dates: Day 0 = June 7, 1994; Day 9 = June 16, 1994.

Evaluation: Mussels were checked daily and recorded as alive, stressed (still alive) or dead.

RESULTS:

The results are presented in tables and figures in the following pages. These include:

1) tables of initial and final water chemistry, as well as summary data for mortality in each treatment,

2) figures of mortality trends through time,

3) figure of adjusted mortality for day 9 using Abbott's correction formula of

$$C = P' - P / 1 - P,$$

where C = Corrected mortality,
P'= proportion dead in treatment,

P = proportion dead in control,
All negative numbers are considered to have a mortality of zero, the same as the control,

4) calculated LC_{50} from graph on semi-log paper; also, calculated values using the trimmed Spearman-Karber method were provided by Damien Simbeck, TVA Toxicity Testing Laboratory, Browns Ferry Nuclear Power Plant, Athens Al.,

5) raw data for water chemistry and mussel mortality/survival.

COMMENTS:

1) This test produced the desired low control mortality (only 2.44 and 2.5%), but mortality was still adjusted with Abbott's correction factor for comparison. Increasing concentrations of effluent resulted in increased mortality, as expected; however, instead of a gradual increase in mortality, a saltatory effect was seen between 1.6 and 6.4 ppm in *Anodonta*, and 6.4 and 12.8 ppm in *Elliptio*.

2) The **LC_{50}** was determined (by graphing the actual mortality on semi-log paper) to be **2.97 ppm in Anodonta, and 8.75 ppm in Elliptio.** Those calculated by the trimmed Spearman-Karber method were similar, **2.85 (2.15-3.78) ppm** in ***Anodonta***, and **8.74 (7.99-9.57) ppm** in ***Elliptio***. **A chronic level** (below which there will be no chronic effect) is estimated by the ACR (acute chronic ratio) to be 1/6 the LC_{50}, or **0.5 ppm in *Anodonta*, and 1.5 ppm in *Elliptio*** (Schweinforth, R.L. and D.C. Wade, 1990).

3) Trends in water chemistry were normal, with the exception of dissolved oxygen values. These ran consistently higher than expected, which led us to chemically determine several oxygen levels in reconstituted test water using the Winkler technique and later to adjust our oxygen values by the regression of these new values on those made by our YSI oxygen meter. The correlation coefficient was 0.992 between the two sets of values, with an intercept of -11.05 and a slope of 1.46.

REFERENCES:

Isom, B.G., and R.G. Hudson, 1982. In vitro culture of parasitic freshwater mussel glochidia. Nautilus 96:147-151.

Schweinforth, R.L. and D.C. Wade. 1990. Effects from subchronic 90-day exposure of in vitro transformed juvenile freshwater mussels (*Anodonta imbecilis*) to manganese. Ab. 11th Ann. Meet. SETAC, Arlington, VA. Nov. 11-15, pg. 190.

FIGURE 1. Percent Mortality / Abbott's Percent Mortality of *Anodonta imbecilis* After Nine Day Exposure to ClamTrol.

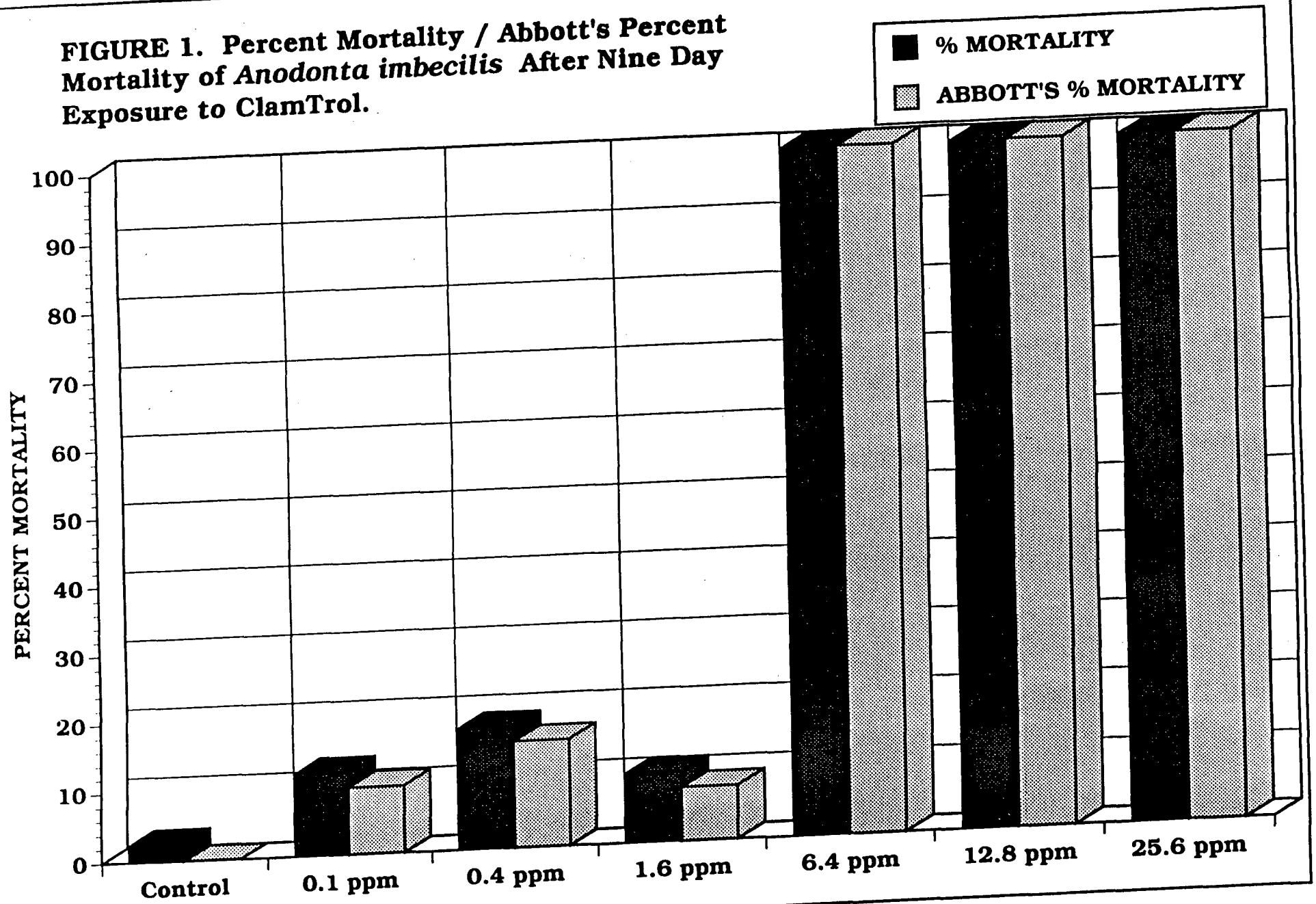

FIGURE 2. Percent Mortality / Abbott's Percent Mortality of *Elliptio arctata* After Nine Day Exposure to ClamTrol.

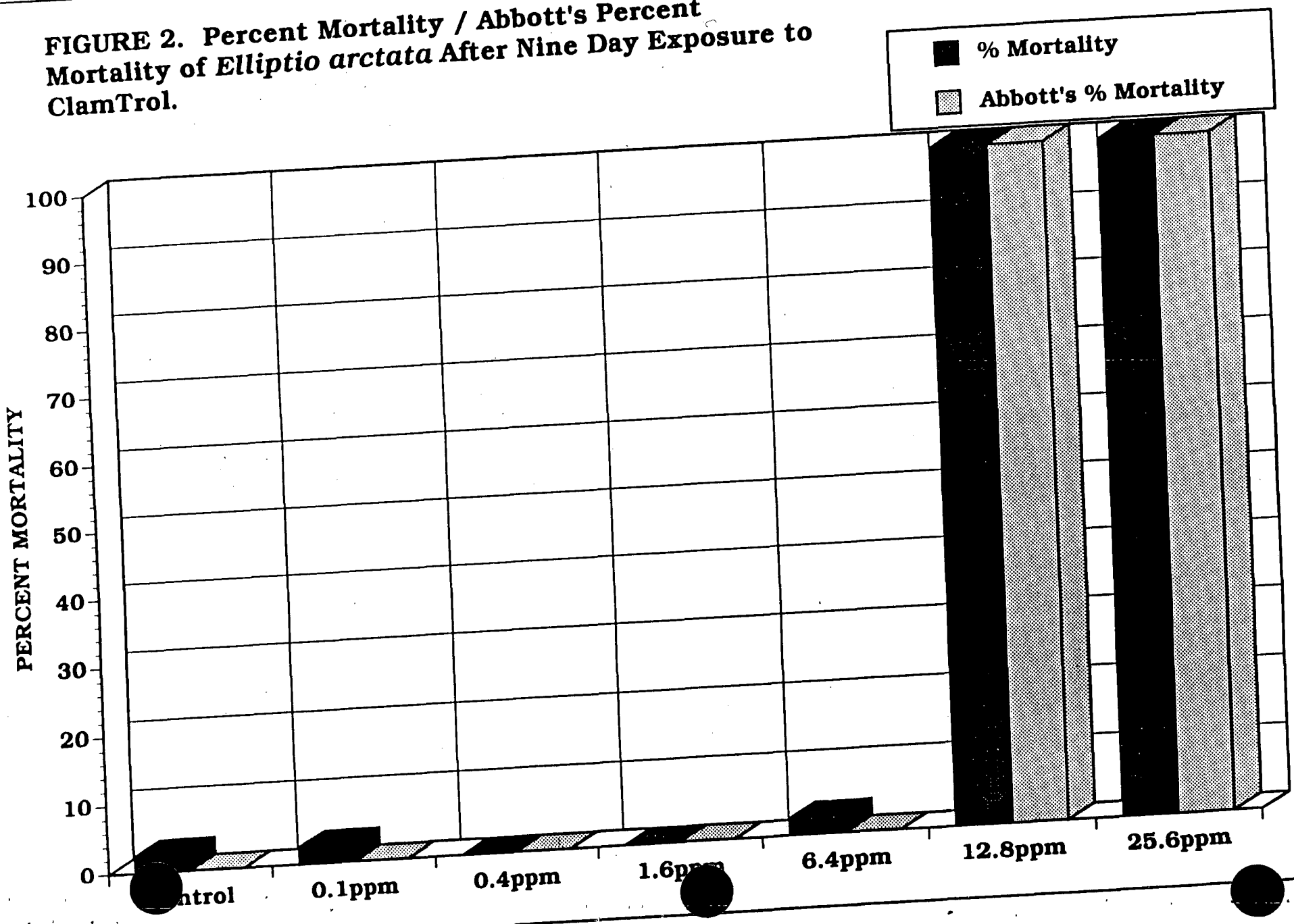

FIGURE 3. Percent Mortality of *Anodonta imbecilis* during Nine Day Exposure to ClamTrol.

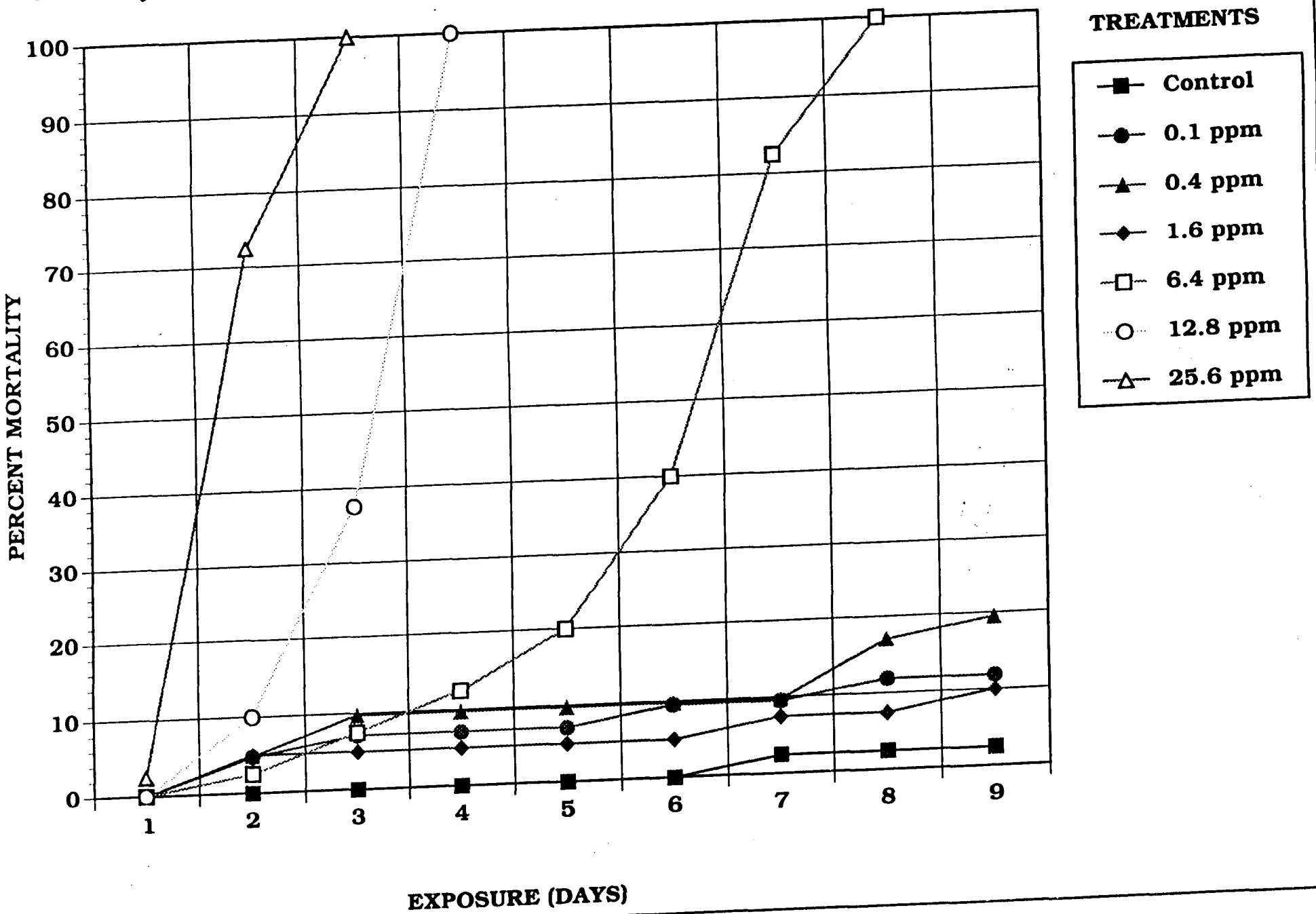

FIGURE 4. Percent Mortality of *Elliptio arctata* during Nine Day Exposure to ClamTrol.

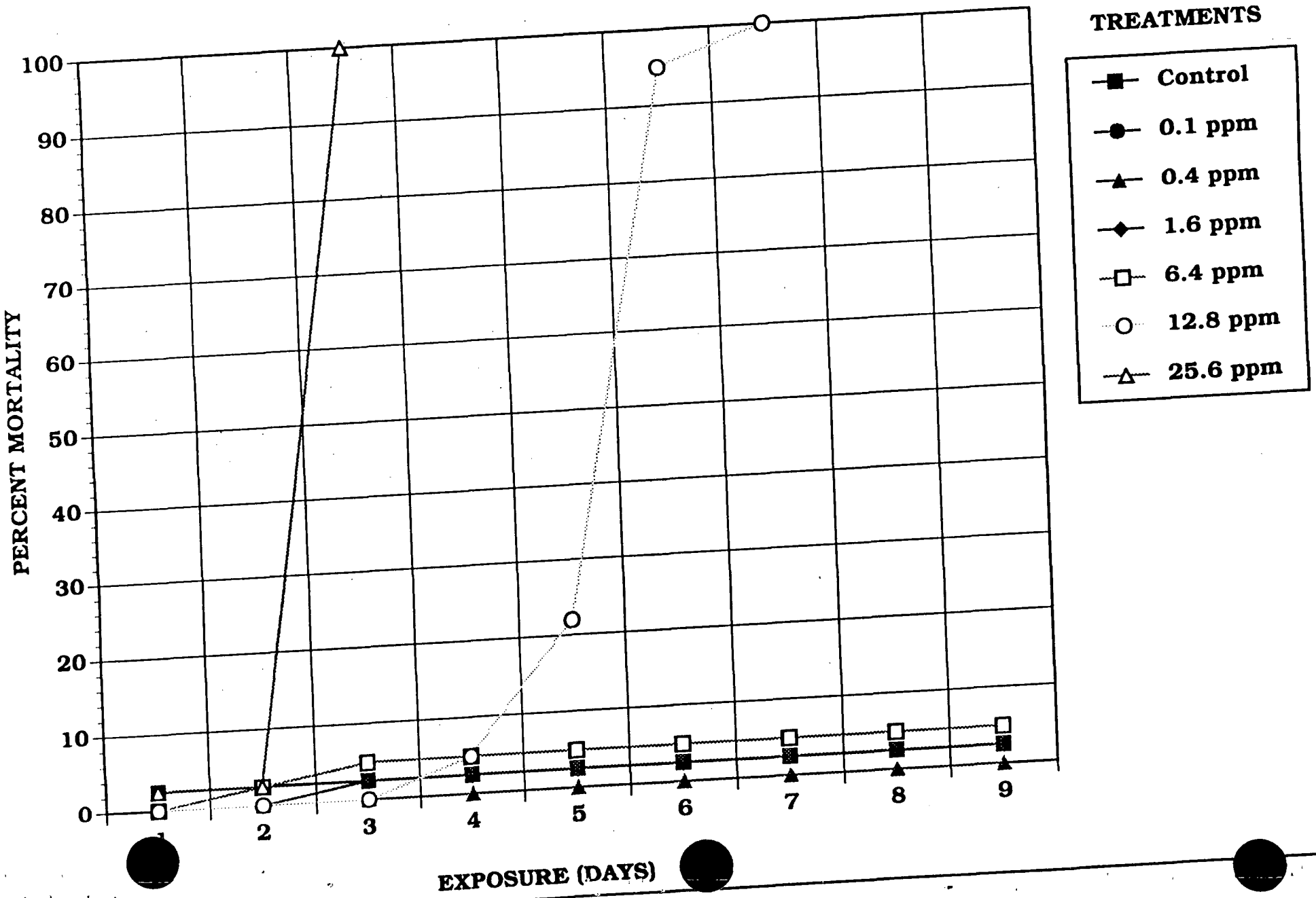

Table 1. Summary of Initial Water Chemistry of Aquatic Toxicity Test with ClamTrol on juvenile *Anodonta imbecilis* and *Elliptio arctata.*

TMT.	Temperature (C)	Oxygen (mg/l)	Adjusted Oxygen (mg/l)	pH	Conductivity (µmhos)	Alkalinity (mg$CaCO_3$/l)	Hardness (mg$CaCO_3$/l)
Control	23.7(23-24.3)	12.1(11.1-13.2)	6.6(5.2-8.2)	7.3(6.8-7.8)	270.3(263-278)	111.6(106-116)	80(71.8-88.9)
0.1 ppm	23.6(23-24.2)	12(11.2-13)	6.5(5.3-7.9)	7.3(6.6-7.6)	270.7(260-278)	110(106-116)	84.7(82.1-88.9)
0.4 ppm	23.7(23-24.2)	12.1(10.9-13)	6.6(4.9-7.9)	7.3(6.6-7.6)	270.4(260-280)	110.1(102-116)	87(85.5-90.6)
1.6 ppm	23.6(23.1-24.5)	12.1(10.8-13)	6.6(4.7-7.9)	7.3(6.6-7.6)	271.4(260-278)	109.7(106-114)	85.5(82.1-87.2)
6.4 ppm	23.7(23.1-24.2)	12.2(11.5-13.0)	6.7(5.7-7.9)	7.3(6.6-7.5)	270.3(263-278)	109.6(106-114)	85.9(83.8-90.6)
12.8ppm	23.9(23.1-24.5)	12.1(11-13)	6.7(5-7.9)	7.3(6.7-7.6)	269.9(262-278)	109.6(106-113)	85.5(83.8-87.2)
25.6ppm	23.8(23.5-24)	11.8(11.1-12.8)	6.1(5.2-7.6)	7.2(6.7-7.5)	270(265-275)	108.8(104-111)	83.8(82.1-85.5)

Table 2. Summary of Final Water Chemistry of Aquatic Toxicity Test with ClamTrol on juvenile *Anodonta imbecilis.*

TMT.	Temperature (C)	Oxygen (mg/l)	Adjusted Oxygen (mg/l)	pH
Control	23.9(23.2-24.5)	11.3(10.5-12.1)	5.5(4.3-6.6)	7.6(7.2-8.1)
0.1 ppm	24.0(23.0-24.5)	11.3(10.2-11.9)	5.5(3.8-6.3)	7.7(7.2-8.1)
0.4 ppm	24.0(23.1-24.5)	11.3(10.0-11.9)	5.5(3.6-6.3)	7.7(7.2-8.5)
1.6 ppm	24.0(23.4-24.5)	11.3(10.2-11.9)	5.5(3.8-6.3)	7.7(7.3-8.0)
6.4 ppm	24.0(23.3-24.8)	11.2(10.2-11.7)	5.3(3.8-6.0)	7.6(7.2-8.0)
12.8ppm	23.8(23.1-24.3)	10.9(9.8-11.6)	4.9(3.3-5.9)	7.6(7.1-8.0)
25.6ppm	23.8(23.4-24.1)	10.8(9.5-11.6)	4.7(2.8-5.9)	7.6(7.1-7.9)

Table 3. Summary of Final Water Chemistry of Aquatic Toxicity Test with ClamTrol on juvenile *Elliptio arctata.*

TMT.	Temperature (C)	Oxygen (mg/l)	Adjusted Oxygen (mg/l)	pH
Control	23.7(23.0-24.1)	11.2(10.4-12.1)	5.4(4.1-6.6)	7.5(7.2-7.9)
0.1 ppm	23.7(23.0-24.2)	11.3(10.2-12.2)	5.5(3.8-6.8)	7.6(7.3-7.9)
0.4 ppm	23.7(23.0-24.4)	11.3(10.4-12.1)	5.5(4.1-6.6)	7.6(7.2-7.9)
1.6 ppm	23.9(23.0-24.5)	11.3(10.4-12.0)	5.5(4.1-6.5)	7.6(7.2-7.9)
6.4 ppm	23.8(23.0-24.5)	11.2(10.1-11.8)	5.3(3.8-6.2)	7.6(7.1-8.0)
12.8ppm	23.7(23.0-24.5)	11.0(10.0-11.7)	5.1(3.6-6.0)	7.5(7.1-7.9)
25.6ppm	23.5(23.0-24.0)	10.8(9.4-11.6)	4.8(2.7-5.9)	7.6(7.1-7.9)

Ellip. Counts Day 1. 6-8-94						
TMT	Rep	A	D	% ALIVE	% MORTALITY	ABBOTT'S
Control	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	9	1	90.00	10.00	
SUM		39	1	97.50	2.50	0
0.1 ppm	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		40	0	100.00	0.00	-2.56410
0.4 ppm	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		40	0	100.00	0.00	-2.56410
1.6 ppm	1	10	0	100.00	0.00	
	2	9	1	90.00	10.00	
	3	10	0	100.00	0.00	
	4	11	0	100.00	0.00	
SUM		40	1	97.56	2.44	-0.06254
6.4 ppm	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	11	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		41	0	100.00	0.00	-2.56410
12.8 ppm	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	11	0	100.00	0.00	
SUM		41	0	100.00	0.00	-2.56410
25.6 ppm	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	9	1	90.00	10.00	
SUM		39	1	97.50	2.50	0
Ellip. Counts Day				6-9-94	-	
TMT	Rep	A	D	% ALIVE	% MORTALITY	
Control	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	9	1	90.00	10.00	
SUM		39	1	97.50	2.50	0
0.1 ppm	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	

	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		40	0	100.00	0.00	-2.56410
0.4 ppm	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		40	0	100.00	0.00	-2.56410
1.6 ppm	1	10	0	100.00	0.00	
	2	9	1	90.00	10.00	
	3	10	0	100.00	0.00	
	4	11	0	100.00	0.00	
SUM		40	1	97.56	2.44	-0.06254
6.4 ppm	1	9	1	90.00	10.00	
	2	10	0	100.00	0.00	
	3	11	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		40	1	97.56	2.44	-0.06254
12.8 ppm	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	11	0	100.00	0.00	
SUM		41	0	100.00	0.00	-2.56410
25.6 ppm	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	9	1	90.00	10.00	
SUM		39	1	97.50	2.50	0
Ellip. Counts Day				**6-10-94**	-	
TMT	Rep	A	D	% ALIVE	% MORTALITY	
Control	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	9	1	90.00	10.00	
SUM		39	1	97.50	2.50	0
0.1 ppm	1	9	1	90.00	10.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		39	1	97.50	2.50	0
0.4 ppm	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		40	0	100.00	0.00	-2.56410
1.6 ppm	1	10	0	100.00	0.00	

	2	9	1	90.00	10.00	
	3	10	0	100.00	0.00	
	4	11	0	100.00	0.00	
SUM		40	1	97.56	2.44	-0.06254
6.4 ppm	1	9	1	90.00	10.00	
	2	10	0	100.00	0.00	
	3	10	1	90.91	9.09	
	4	10	0	100.00	0.00	
SUM		39	2	95.12	4.88	2.439024
12.8 ppm	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	11	0	100.00	0.00	
SUM		41	0	100.00	0.00	-2.56410
25.6 ppm	1	0	10	0.00	100.00	
	2	0	10	0.00	100.00	
	3	0	10	0.00	100.00	
	4	0	10	0.00	100.00	
SUM		0	40	0.00	100.00	100
Ellip. Counts Day				**6-11-94**	-	
TMT	Rep	A	D	% ALIVE	% MORTALITY	
Control	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	9	1	90.00	10.00	
SUM		39	1	97.50	2.50	0
0.1 ppm	1	9	1	90.00	10.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		39	1	97.50	2.50	0
0.4 ppm	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		40	0	100.00	0.00	-2.56410
1.6 ppm	1	10	0	100.00	0.00	
	2	9	1	90.00	10.00	
	3	10	0	100.00	0.00	
	4	11	0	100.00	0.00	
SUM		40	1	97.56	2.44	-0.06254
6.4 ppm	1	9	1	90.00	10.00	
	2	10	0	100.00	0.00	
	3	10	1	90.91	9.09	
	4	10	0	100.00	0.00	
SUM		39	2	95.12	4.88	2.439024

12.8 ppm	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	8	2	80.00	20.00	
	4	11	0	100.00	0.00	
SUM		39	2	95.12	4.88	2.439024
25.6 ppm	1	0	10	0.00	100.00	
	2	0	10	0.00	100.00	
	3	0	10	0.00	100.00	
	4	0	10	0.00	100.00	
SUM		0	40	0.00	100.00	100
Ellip. Counts Day				**6-12-94**	-	
TMT	Rep	A	D	% ALIVE	% MORTALITY	
Control	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	9	1	90.00	10.00	
SUM		39	1	97.50	2.50	0
0.1 ppm	1	9	1	90.00	10.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		39	1	97.50	2.50	0
0.4 ppm	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		40	0	100.00	0.00	-2.56410
1.6 ppm	1	10	0	100.00	0.00	
	2	9	1	90.00	10.00	
	3	10	0	100.00	0.00	
	4	11	0	100.00	0.00	
SUM		40	1	97.56	2.44	-0.06254
6.4 ppm	1	9	1	90.00	10.00	
	2	10	0	100.00	0.00	
	3	10	1	90.91	9.09	
	4	10	0	100.00	0.00	
SUM		39	2	95.12	4.88	2.439024
12.8 ppm	1	6	4	60.00	40.00	
	2	7	3	70.00	30.00	
	3	8	2	80.00	20.00	
	4	11	0	100.00	0.00	
SUM		32	9	78.05	21.95	19.94997
25.6 ppm	1	0	10	0.00	100.00	
	2	0	10	0.00	100.00	
	3	0	10	0.00	100.00	
	4	0	10	0.00	100.00	

SUM		0	40	0.00	100.00	100
Ellip. Counts Day				6-13-94	-	
TMT	Rep	A	D	% ALIVE	% MORTALITY	
Control	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	9	1	90.00	10.00	
SUM		39	1	97.50	2.50	0
0.1 ppm	1	9	1	90.00	10.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		39	1	97.50	2.50	0
0.4 ppm	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		40	0	100.00	0.00	-2.56410
1.6 ppm	1	10	0	100.00	0.00	
	2	9	1	90.00	10.00	
	3	10	0	100.00	0.00	
	4	11	0	100.00	0.00	
SUM		40	1	97.56	2.44	-0.06254
6.4 ppm	1	9	1	90.00	10.00	
	2	10	0	100.00	0.00	
	3	10	1	90.91	9.09	
	4	10	0	100.00	0.00	
SUM		39	2	95.12	4.88	2.439024
12.8 ppm	1	0	10	0.00	100.00	
	2	0	10	0.00	100.00	
	3	0	10	0.00	100.00	
	4	2	8	20.00	80.00	
SUM		2	38	5.00	95.00	94.87179
25.6 ppm	1	0	10	0.00	100.00	
	2	0	10	0.00	100.00	
	3	0	10	0.00	100.00	
	4	0	10	0.00	100.00	
SUM		0	40	0.00	100.00	100
Ellip. Counts Day				6-14-94	-	
TMT	Rep	A	D	% ALIVE	% MORTALITY	
Control	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	9	1	90.00	10.00	
SUM		39	1	97.50	2.50	0
0.1 ppm	1	9	1	90.00	10.00	

	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		39	1	97.50	2.50	0
0.4 ppm	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		40	0	100.00	0.00	-2.56410
1.6 ppm	1	10	0	100.00	0.00	
	2	9	1	90.00	10.00	
	3	10	0	100.00	0.00	
	4	11	0	100.00	0.00	
SUM		40	1	97.56	2.44	-0.06254
6.4 ppm	1	9	1	90.00	10.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		39	1	97.50	2.50	0
12.8 ppm	1	0	10	0.00	100.00	
	2	0	10	0.00	100.00	
	3	0	10	0.00	100.00	
	4	0	10	0.00	100.00	
SUM		0	40	0.00	100.00	100
25.6 ppm	1	0	10	0.00	100.00	
	2	0	10	0.00	100.00	
	3	0	10	0.00	100.00	
	4	0	10	0.00	100.00	
SUM		0	40	0.00	100.00	100
Ellip. Counts Day				**6-15-94**	-	
TMT	Rep	A	D	% ALIVE	% MORTALITY	
Control	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	9	1	90.00	10.00	
SUM		39	1	97.50	2.50	0
0.1 ppm	1	9	1	90.00	10.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		39	1	97.50	2.50	0
0.4 ppm	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		40	0	100.00	0.00	-2.56410

1.6 ppm	1	10	0	100.00	0.00	
	2	9	1	90.00	10.00	
	3	10	0	100.00	0.00	
	4	11	0	100.00	0.00	
SUM		40	1	97.56	2.44	-0.06254
6.4 ppm	1	9	1	90.00	10.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		39	1	97.50	2.50	0
12.8 ppm	1	0	10	0.00	100.00	
	2	0	10	0.00	100.00	
	3	0	10	0.00	100.00	
	4	0	10	0.00	100.00	
SUM		0	40	0.00	100.00	100
25.6 ppm	1	0	10	0.00	100.00	
	2	0	10	0.00	100.00	
	3	0	10	0.00	100.00	
	4	0	10	0.00	100.00	
SUM		0	40	0.00	100.00	100
Ellip. Counts Day				**6-16-94**	-	
TMT	Rep	A	D	% ALIVE	% MORTALITY	
Control	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	9	1	90.00	10.00	
SUM		39	1	97.50	2.50	0
0.1 ppm	1	9	1	90.00	10.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		39	1	97.50	2.50	0
0.4 ppm	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		40	0	100.00	0.00	-2.56410
1.6 ppm	1	10	0	100.00	0.00	
	2	9	1	90.00	10.00	
	3	10	0	100.00	0.00	
	4	11	0	100.00	0.00	
SUM		40	1	97.56	2.44	-0.06254
6.4 ppm	1	9	1	90.00	10.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	

SUM		39	1	97.50	2.50	0
12.8 ppm	1	0	10	0.00	100.00	
	2	0	10	0.00	100.00	
	3	0	10	0.00	100.00	
	4	0	10	0.00	100.00	
SUM		0	40	0.00	100.00	100
25.6 ppm	1	0	10	0.00	100.00	
	2	0	10	0.00	100.00	
	3	0	10	0.00	100.00	
	4	0	10	0.00	100.00	
SUM		0	40	0.00	100.00	100

Ano. Counts Day 1, 6-8-94

TMT	Rep	ALIVE	DEAD	% ALIVE	% MORTALITY	ABBOTT'S MORT
Control	1	11	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		41	0	100.00	0.00	0
0.1 ppm	1	11	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	11	0	100.00	0.00	
SUM		42	0	100.00	0.00	0
0.4 ppm	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	11	0	100.00	0.00	
SUM		41	0	100.00	0.00	0
1.6 ppm	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		40	0	100.00	0.00	0
6.4 ppm	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		40	0	100.00	0.00	0
12.8 ppm	1	10	0	100.00	0.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		40	0	100.00	0.00	0
25.6 ppm	1	9	1	90.00	10.00	
	2	10	0	100.00	0.00	
	3	10	0	100.00	0.00	
	4	10	0	100.00	0.00	
SUM		39	1	97.50	2.50	2.5

Ano. Counts Da 2, 6-9-94

TMT	Rep	A	D	% ALIVE	% MORTALITY
Control	1	11	0	100.00	0.00
	2	10	0	100.00	0.00
	3	10	0	100.00	0.00
	4	10	0	100.00	0.00
SUM		41	0	100.00	0.00
0.1 ppm	1	10	1	90.91	9.09
	2	9	1	90.00	10.00

	3	10	0	100.00	0.00		
	4	11	0	100.00	0.00		
SUM		40	2	95.24	4.76	4.7619047619	
0.4 ppm	1	10	0	100.00	0.00		
	2	9	1	90.00	10.00		
	3	10	0	100.00	0.00		
	4	10	1	90.91	9.09		
SUM		39	2	95.12	4.88	4.8780487805	
1.6 ppm	1	10	0	100.00	0.00		
	2	10	0	100.00	0.00		
	3	8	2	80.00	20.00		
	4	10	0	100.00	0.00		
SUM		38	2	95.00	5.00	5	
6.4 ppm	1	10	0	100.00	0.00		
	2	10	0	100.00	0.00		
	3	9	1	90.00	10.00		
	4	10	0	100.00	0.00		
SUM		39	1	97.50	2.50	2.5	
12.8 ppm	1	10	0	100.00	0.00		
	2	8	2	80.00	20.00		
	3	10	0	100.00	0.00		
	4	8	2	80.00	20.00		
SUM		36	4	90.00	10.00	10	
25.6 ppm	1	3	7	30.00	70.00		
	2	2	8	20.00	80.00		
	3	6	4	60.00	40.00		
	4	0	10	0.00	100.00		
SUM		11	29	27.50	72.50	72.5	
Ano. Counts Da			**3,**	**6-10-94**	-		
TMT	Rep	A	D	% ALIVE	% MORTALITY		
Control	1	11	0	100.00	0.00		
	2	10	0	100.00	0.00		
	3	10	0	100.00	0.00		
	4	10	0	100.00	0.00		
SUM		41	0	100.00	0.00	0	
0.1 ppm	1	9	2	81.82	18.18		
	2	9	1	90.00	10.00		
	3	10	0	100.00	0.00		
	4	11	0	100.00	0.00		
SUM		39	3	92.86	7.14	7.1428571429	
0.4 ppm	1	8	2	80.00	20.00		
	2	9	1	90.00	10.00		
	3	10	0	100.00	0.00		
	4	10	1	90.91	9.09		
SUM		37	4	90.24	9.76	9.7560975610	
1.6 ppm	1	10	0	100.00	0.00		

	2	10	0	100.00	0.00		
	3	8	2	80.00	20.00		
	4	10	0	100.00	0.00		
SUM		38	2	95.00	5.00	5	
6.4 ppm	1	9	1	90.00	10.00		
	2	10	0	100.00	0.00		
	3	8	2	80.00	20.00		
	4	10	0	100.00	0.00		
SUM		37	3	92.50	7.50	7.5	
12.8 ppm	1	9	1	90.00	10.00		
	2	4	6	40.00	60.00		
	3	6	4	60.00	40.00		
	4	6	4	60.00	40.00		
SUM		25	15	62.50	37.50	37.5	
25.6 ppm	1	0	10	0.00	100.00		
	2	0	10	0.00	100.00		
	3	0	10	0.00	100.00		
	4	0	10	0.00	100.00		
SUM		0	40	0.00	100.00	100	
Ano. Counts Da		**4,**		**6-11-94**	-		
TMT	Rep	A	D	% ALIVE	% MORTALITY		
Control	1	11	0	100.00	0.00		
	2	10	0	100.00	0.00		
	3	10	0	100.00	0.00		
	4	10	0	100.00	0.00		
SUM		41	0	100.00	0.00	0	
0.1 ppm	1	9	2	81.82	18.18		
	2	9	1	90.00	10.00		
	3	10	0	100.00	0.00		
	4	11	0	100.00	0.00		
SUM		39	3	92.86	7.14	7.1428571429	
0.4 ppm	1	8	2	80.00	20.00		
	2	9	1	90.00	10.00		
	3	10	0	100.00	0.00		
	4	10	1	90.91	9.09		
SUM		37	4	90.24	9.76	9.7560975610	
1.6 ppm	1	10	0	100.00	0.00		
	2	10	0	100.00	0.00		
	3	8	2	80.00	20.00		
	4	10	0	100.00	0.00		
SUM		38	2	95.00	5.00	5	
6.4 ppm	1	9	1	90.00	10.00		
	2	9	1	90.00	10.00		
	3	7	3	70.00	30.00		
	4	10	0	100.00	0.00		
SUM		35	5	87.50	12.50	12.5	

12.8 ppm	1	0	10	0.00	100.00		
	2	0	10	0.00	100.00		
	3	0	10	0.00	100.00		
	4	0	10	0.00	100.00		
SUM		0	40	0.00	100.00	100	
25.6 ppm	1	0	10	0.00	100.00		
	2	0	10	0.00	100.00		
	3	0	10	0.00	100.00		
	4	0	10	0.00	100.00		
SUM		0	40	0.00	100.00	100	
Ano. Counts Da		**5,**		**6-12-94**	-		
TMT	Rep	A	D	% ALIVE	% MORTALITY		
Control	1	11	0	100.00	0.00		
	2	10	0	100.00	0.00		
	3	10	0	100.00	0.00		
	4	10	0	100.00	0.00		
SUM		41	0	100.00	0.00	0	
0.1 ppm	1	9	2	81.82	18.18		
	2	9	1	90.00	10.00		
	3	10	0	100.00	0.00		
	4	11	0	100.00	0.00		
SUM		39	3	92.86	7.14	7.1428571429	
0.4 ppm	1	8	2	80.00	20.00		
	2	9	1	90.00	10.00		
	3	10	0	100.00	0.00		
	4	10	1	90.91	9.09		
SUM		37	4	90.24	9.76	9.7560975610	
1.6 ppm	1	10	0	100.00	0.00		
	2	10	0	100.00	0.00		
	3	8	2	80.00	20.00		
	4	10	0	100.00	0.00		
SUM		38	2	95.00	5.00	5	
6.4 ppm	1	7	3	70.00	30.00		
	2	8	2	80.00	20.00		
	3	7	3	70.00	30.00		
	4	10	0	100.00	0.00		
SUM		32	8	80.00	20.00	20	
12.8 ppm	1	0	10	0.00	100.00		
	2	0	10	0.00	100.00		
	3	0	10	0.00	100.00		
	4	0	10	0.00	100.00		
SUM		0	40	0.00	100.00	100	
25.6 ppm	1	0	10	0.00	100.00		
	2	0	10	0.00	100.00		
	3	0	10	0.00	100.00		
	4	0	10	0.00	100.00		

SUM		0	40	0.00	100.00	100	
Ano. Counts Da		**6,**		**6-13-94**	-		
TMT	Rep	A	D	% ALIVE	% MORTALITY		
Control	1	11	0	100.00	0.00		
	2	10	0	100.00	0.00		
	3	10	0	100.00	0.00		
	4	10	0	100.00	0.00		
SUM		41	0	100.00	0.00	0	
0.1 ppm	1	8	3	72.73	27.27		
	2	9	1	90.00	10.00		
	3	10	0	100.00	0.00		
	4	11	0	100.00	0.00		
SUM		38	4	90.48	9.52	9.5238095238	
0.4 ppm	1	8	2	80.00	20.00		
	2	9	1	90.00	10.00		
	3	10	0	100.00	0.00		
	4	10	1	90.91	9.09		
SUM		37	4	90.24	9.76	9.7560975610	
1.6 ppm	1	10	0	100.00	0.00		
	2	10	0	100.00	0.00		
	3	8	2	80.00	20.00		
	4	10	0	100.00	0.00		
SUM		38	2	95.00	5.00	5	
6.4 ppm	1	4	6	40.00	60.00		
	2	6	4	60.00	40.00		
	3	5	5	50.00	50.00		
	4	9	1	90.00	10.00		
SUM		24	16	60.00	40.00	40	
12.8 ppm	1	0	10	0.00	100.00		
	2	0	10	0.00	100.00		
	3	0	10	0.00	100.00		
	4	0	10	0.00	100.00		
SUM		0	40	0.00	100.00	100	
25.6 ppm	1	0	10	0.00	100.00		
	2	0	10	0.00	100.00		
	3	0	10	0.00	100.00		
	4	0	10	0.00	100.00		
SUM		0	40	0.00	100.00	100	
Ano. Counts Da		**7,**		**6-14-94**	-		
TMT	Rep	A	D	% ALIVE	% MORTALITY		
Control	1	10	1	90.91	9.09		
	2	10	0	100.00	0.00		
	3	10	0	100.00	0.00		
	4	10	0	100.00	0.00		
SUM		40	1	97.56	2.44	0	
0.1 ppm	1	8	3	72.73	27.27		

1.6 ppm	1	24.0	10.8	7.38									
	2	24.0	11.1	7.36									
	3	24.0	11.2	7.32									
	4	23.0	11.1	7.38	23.75	23	24	11.05	10.8	11.2	7.36	7.32	7.38
6.4 ppm	1	23.0	11.0	7.40									
	2	24.0	11.1	7.32									
	3	23.9	11.0	7.28									
	4	24.0	10.9	7.33	23.725	23	24	11	10.9	11.1	7.3325	7.28	7.4
12.8 ppm	1	23.8	10.8	7.29									
	2	23.8	10.9	7.25									
	3	23.8	10.8	7.25									
	4	23.8	10.6	7.25	23.8	23.8	23.8	10.775	10.6	10.9	7.26	7.25	7.29
25.6 ppm	1	N/A	N/A	N/A									
	2	N/A	N/A	N/A									
	3	N/A	N/A	N/A									
	4	N/A	N/A	N/A									
Elliptic Final Water Chem. Day 6, 6-13-94													
TMT	Rep	Temp.	Oxygen	pH									
Control	1	24.1	11.6	7.48									
	2	23.0	11.9	7.57									
	3	24.0	11.8	7.47									
	4	23.3	11.6	7.48	23.6	23	24.1	11.725	11.6	11.9	7.5	7.47	7.57
0.1 ppm	1	23.9	11.8	7.50									
	2	23.9	11.8	7.48									
	3	24.0	11.8	7.45									
	4	24.1	11.8	7.42	23.975	23.9	24.1	11.8	11.8	11.8	7.4625	7.42	7.5
0.4 ppm	1	23.3	11.8	7.49									
	2	23.9	11.8	7.50									
	3	23.2	11.8	7.50									
	4	23.3	11.8	7.50	23.425	23.2	23.9	11.8	11.8	11.8	7.4975	7.49	7.5
1.6 ppm	1	24.0	11.7	7.45									
	2	23.9	11.7	7.45									
	3	23.5	11.8	7.48									
	4	23.5	11.7	7.50	23.725	23.5	24	11.725	11.7	11.8	7.47	7.45	7.5
6.4 ppm	1	23.8	11.7	7.41									
	2	23.8	11.7	7.45									
	3	23.2	11.5	7.49									
	4	23.3	11.7	7.50	23.525	23.2	23.8	11.65	11.5	11.7	7.4625	7.41	7.5
12.8 ppm	1	23.6	11.5	7.41									
	2	24.5	11.4	7.35									
	3	24.0	11.4	7.31									
	4	23.8	11.4	7.31	23.975	23.6	24.5	11.425	11.4	11.5	7.345	7.31	7.41
25.6 ppm	1	N/A	N/A	N/A									
	2	N/A	N/A	N/A									
	3	N/A	N/A	N/A									

	4	N/A	N/A	N/A									
Elliptio Final Water Chem. Day 7. 6-14-94													
TMT	Rep	Temp.	Oxygen	pH									
Control	1	23.8	11.2	7.65									
	2	24.0	11.2	7.65									
	3	24.0	11.4	7.70									
	4	24.0	11.2	7.70	23.95	23.8	24	11.25	11.2	11.4	7.675	7.65	7.7
0.1 ppm	1	24.0	11.2	7.80									
	2	24.0	11.2	7.80									
	3	23.8	11.4	7.80									
	4	24.0	11.2	7.80	23.95	23.8	24	11.25	11.2	11.4	7.8	7.8	7.8
0.4 ppm	1	23.9	11.4	7.80									
	2	24.0	11.4	7.83									
	3	23.9	11.2	7.83									
	4	24.0	11.3	7.86	23.95	23.9	24	11.325	11.2	11.4	7.83	7.8	7.86
1.6 ppm	1	24.0	11.4	7.88									
	2	23.8	11.2	7.89									
	3	23.8	11.4	7.89									
	4	24.1	11.2	7.88	23.925	23.8	24.1	11.3	11.2	11.4	7.885	7.88	7.89
6.4 ppm	1	24.0	11.2	7.82									
	2	23.9	11.3	7.86									
	3	24.0	11.4	7.89									
	4	23.9	11.2	7.90	23.95	23.9	24	11.275	11.2	11.4	7.8675	7.82	7.9
12.8 ppm	1	N/A	N/A	N/A									
	2	N/A	N/A	N/A									
	3	N/A	N/A	N/A									
	4	N/A	N/A	N/A									
25.6 ppm	1	N/A	N/A	N/A									
	2	N/A	N/A	N/A									
	3	N/A	N/A	N/A									
	4	N/A	N/A	N/A									
Elliptio Final Water Chem. Day 8. 6-15-94													
TMT	Rep	Temp.	Oxygen	pH									
Control	1	24.0	11.3	7.28									
	2	24.0	11.3	7.30									
	3	23.8	11.4	7.30									
	4	24.0	11.5	7.28	23.95	23.8	24	11.375	11.3	11.5	7.29	7.28	7.3
0.1 ppm	1	24.2	11.3	7.25									
	2	24.0	11.3	7.25									
	3	23.8	11.3	7.29									
	4	23.2	11.2	7.30	23.8	23.2	24.2	11.275	11.2	11.3	7.2725	7.25	
0.4 ppm	1	24.0	11.2	7.28									
	2	23.8	11.2	7.28									
	3	24.1	11.2	7.24									

	2	9	1	90.00	10.00		
	3	10	0	100.00	0.00		
	4	11	0	100.00	0.00		
SUM		38	4	90.48	9.52	7.2619047619	
0.4 ppm	1	8	2	80.00	20.00		
	2	9	1	90.00	10.00		
	3	10	0	100.00	0.00		
	4	10	1	90.91	9.09		
SUM		37	4	90.24	9.76	7.5	
1.6 ppm	1	9	1	90.00	10.00		
	2	10	0	100.00	0.00		
	3	8	2	80.00	20.00		
	4	10	0	100.00	0.00		
SUM		37	3	92.50	7.50	5.1875	
6.4 ppm	1	0	10	0.00	100.00		
	2	1	9	10.00	90.00		
	3	4	6	40.00	60.00		
	4	2	8	20.00	80.00		
SUM		7	33	17.50	82.50	82.0625	
12.8 ppm	1	0	10	0.00	100.00		
	2	0	10	0.00	100.00		
	3	0	10	0.00	100.00		
	4	0	10	0.00	100.00		
SUM		0	40	0.00	100.00	100	
25.6 ppm	1	0	10	0.00	100.00		
	2	0	10	0.00	100.00		
	3	0	10	0.00	100.00		
	4	0	10	0.00	100.00		
SUM		0	40	0.00	100.00	100	
Ano. Counts Da		**8,**		**6-15-94**	-		
TMT	Rep	A	D	% ALIVE	% MORTALITY		
Control	1	10	1	90.91	9.09		
	2	10	0	100.00	0.00		
	3	10	0	100.00	0.00		
	4	10	0	100.00	0.00		
SUM		40	1	97.56	2.44	0	
0.1 ppm	1	7	4	63.64	36.36		
	2	9	1	90.00	10.00		
	3	10	0	100.00	0.00		
	4	11	0	100.00	0.00		
SUM		37	5	88.10	11.90	9.7023809524	
0.4 ppm	1	8	2	80.00	20.00		
	2	9	1	90.00	10.00		
	3	9	1	90.00	10.00		
	4	8	3	72.73	27.27		
SUM		34	7	82.93	17.07	15	

1.6 ppm	1	9	1	90.00	10.00		
	2	10	0	100.00	0.00		
	3	8	2	80.00	20.00		
	4	10	0	100.00	0.00		
SUM		37	3	92.50	7.50	5.1875	
6.4 ppm	1	0	10	0.00	100.00		
	2	0	10	0.00	100.00		
	3	0	10	0.00	100.00		
	4	0	10	0.00	100.00		
SUM		0	40	0.00	100.00	100	
12.8 ppm	1	0	10	0.00	100.00		
	2	0	10	0.00	100.00		
	3	0	10	0.00	100.00		
	4	0	10	0.00	100.00		
SUM		0	40	0.00	100.00	100	
25.6 ppm	1	0	10	0.00	100.00		
	2	0	10	0.00	100.00		
	3	0	10	0.00	100.00		
	4	0	10	0.00	100.00		
SUM		0	40	0.00	100.00	100	
Ano. Counts Da		**9,**		**6-16-94**	-		
TMT	Rep	A	D	% ALIVE	% MORTALITY		
Control	1	10	1	90.91	9.09		
	2	10	0	100.00	0.00		
	3	10	0	100.00	0.00		
	4	10	0	100.00	0.00		
SUM		40	1	97.56	2.44	0	
0.1 ppm	1	7	4	63.64	36.36		
	2	9	1	90.00	10.00		
	3	10	0	100.00	0.00		
	4	11	0	100.00	0.00		
SUM		37	5	88.10	11.90	9.7023809524	
0.4 ppm	1	7	3	70.00	30.00		
	2	9	1	90.00	10.00		
	3	9	1	90.00	10.00		
	4	8	3	72.73	27.27		
SUM		33	8	80.49	19.51	17.5	
1.6 ppm	1	9	1	90.00	10.00		
	2	10	0	100.00	0.00		
	3	8	2	80.00	20.00		
	4	9	1	90.00	10.00		
SUM		36	4	90.00	10.00	7.75	
6.4 ppm	1	0	10	0.00	100.00		
	2	0	10	0.00	100.00		
	3	0	10	0.00	100.00		
	4	0	10	0.00	100.00		

SUM		0	40	0.00	100.00	100	
12.8 ppm	1	0	10	0.00	100.00		
	2	0	10	0.00	100.00		
	3	0	10	0.00	100.00		
	4	0	10	0.00	100.00		
SUM		0	40	0.00	100.00	100	
25.6 ppm	1	0	10	0.00	100.00		
	2	0	10	0.00	100.00		
	3	0	10	0.00	100.00		
	4	0	10	0.00	100.00		
SUM		0	40	0.00	100.00	100	

Elliptio Final Water Chem. Day 1. 6-8-94

TMT	Rep	Temp.	Oxygen	pH	TempAve	TempMin	TempMax	Oxy.Ave	Oxy.Min	Oxy.Max	pH Ave	pH Min	pH Max
Control	1	23.7	11.4	7.85									
	2	23.1	11.4	7.89									
	3	23.5	11.4	7.85									
	4	23.5	11.4	7.85	23.45	23.1	23.7	11.4	11.4	11.4	7.86	7.85	7.89
0.1 ppm	1	23.9	11.5	7.85									
	2	23.2	11.5	7.90									
	3	23.5	11.5	7.88									
	4	23.8	11.5	7.89	23.6	23.2	23.9	11.5	11.5	11.5	7.88	7.85	7.9
0.4 ppm	1	23.3	11.6	7.89									
	2	23.6	11.3	7.90									
	3	23.3	11.4	7.88									
	4	23.0	11.7	7.83	23.3	23	23.6	11.5	11.3	11.7	7.875	7.83	7.9
1.6 ppm	1	23.6	11.6	7.90									
	2	23.5	11.6	7.90									
	3	23.5	11.7	7.90									
	4	23.8	11.6	7.90	23.6	23.5	23.8	11.625	11.6	11.7	7.9	7.9	7.9
6.4 ppm	1	23.8	11.6	7.88									
	2	24.0	11.5	7.90									
	3	24.0	11.4	7.90									
	4	23.0	11.5	7.98	23.7	23	24	11.5	11.4	11.6	7.915	7.88	7.98
12.8 ppm	1	23.3	11.6	7.92									
	2	23.9	11.6	7.89									
	3	24.0	11.5	7.88									
	4	23.8	11.5	7.87	23.75	23.3	24	11.55	11.5	11.6	7.89	7.87	7.92
25.6 ppm	1	24.0	11.5	7.89/									
	2	24.0	11.6	7.88									
	3	23.7	11.6	7.88									
	4	23.9	11.6	7.88	23.9	23.7	24	11.575	11.5	11.6	7.88	7.88	7.88

Elliptio Final Water Chem. Day 2. 6-9-94

TMT	Rep	Temp.	Oxygen	pH									
Control	1	24.0	11.2	7.23									
	2	24.0	11.4	7.26									
	3	24.0	11.3	7.26									
	4	24.0	12.1	7.25	24	24	24	11.5	11.2	12.1	7.25	7.23	7.26
0.1 ppm	1	23.0	11.9	7.31									
	2	23.1	12.2	7.31									
	3	23.0	12.2	7.30									
	4	23.3	12.2	7.30	23.1	23	23.3	12.125	11.9	12.2	7.305	7.3	7.31
0.4 ppm	1	23.1	12.0	7.30									
	2	23.0	12.1	7.29									
	3	23.6	12.0	7.25									
	4	23.3	12.0	N/R	23.25	23	23.6	12.025	12	12.1	7.28	7.25	
1.6 ppm	1	24.0	11.8	7.24									

	2	23.4	12.0	7.22									
	3	24.0	11.9	7.20									
	4	23.6	11.9	7.20	23.75	23.4	24	11.9	11.8	12	7.215	7.2	7.24
6.4 ppm	1	23.6	11.8	7.17									
	2	23.0	11.8	7.15									
	3	23.6	11.8	7.15									
	4	23.9	11.8	7.13	23.525	23	23.9	11.8	11.8	11.8	7.15	7.13	7.17
12.8 ppm	1	23.0	11.7	7.17									
	2	23.2	11.6	7.16									
	3	23.9	11.6	7.12									
	4	23.5	11.5	7.12	23.4	23	23.9	11.6	11.5	11.7	7.1425	7.12	7.17
25.6 ppm	1	23.1	11.4	7.13									
	2	23.0	11.5	7.19									
	3	23.8	11.3	7.10									
	4	23.5	11.5	7.11	23.35	23	23.8	11.425	11.3	11.5	7.1325	7.1	7.19
Elliptio Final Water Chem. Day 3. 6-10-94													
TMT	Rep	Temp.	Oxygen	pH									
Control	1	23.8	10.4	7.80									
	2	23.5	10.5	7.80									
	3	23.0	10.6	7.85									
	4	23.1	10.4	7.85	23.35	23	23.8	10.475	10.4	10.6	7.825	7.8	7.85
0.1 ppm	1	23.1	10.2	7.89									
	2	23.4	10.5	7.90									
	3	23.4	10.5	7.89									
	4	23.0	10.5	7.88	23.225	23	23.4	10.425	10.2	10.5	7.89	7.88	7.9
0.4 ppm	1	23.3	10.5	7.89									
	2	23.5	10.5	7.90									
	3	23.4	10.4	7.90									
	4	23.8	10.5	7.90	23.5	23.3	23.8	10.475	10.4	10.5	7.8975	7.89	7.9
1.6 ppm	1	23.8	10.5	7.90									
	2	23.5	10.6	7.90									
	3	24.0	10.4	7.89									
	4	24.0	10.4	7.85	23.825	23.5	24	10.475	10.4	10.6	7.885	7.85	7.9
6.4 ppm	1	23.0	10.3	7.90									
	2	23.8	10.5	7.90									
	3	23.1	10.3	7.92									
	4	24.0	10.1	7.88	23.475	23	24	10.31	10.14	10.5	7.9	7.88	7.92
12.8 ppm	1	23.0	10.2	7.85									
	2	23.0	10.2	7.88									
	3	23.8	10.2	7.85									
	4	23.1	10.0	7.82	23.225	23	23.8	10.15	10	10.2	7.85	7.82	7.88
25.6 ppm	1	23.0	9.6	7.75									
	2	23.1	9.5	7.78									
	3	23.8	9.4	7.70									
	4	23.6	9.5	7.72	23.375	23	23.8	9.5	9.4	9.6	7.7375	7.7	7.78

Elliptio Final Water Chem. Day 4. 6-11-94

TMT	Rep	Temp.	Oxygen	pH									
Control	1	24.0	10.5	7.42									
	2	23.8	11.0	7.42									
	3	23.5	11.1	7.52									
	4	23.4	10.7	7.60	23.675	23.4	24	10.825	10.5	11.1	7.49	7.42	7.6
0.1 ppm	1	24.0	11.0	7.55									
	2	23.9	10.9	7.52									
	3	24.1	10.9	7.45									
	4	23.5	10.7	7.70	23.875	23.5	24.1	10.875	10.7	11	7.555	7.45	7.7
0.4 ppm	1	23.9	11.1	7.58									
	2	24.4	11.2	7.52									
	3	24.0	11.2	7.52									
	4	24.0	11.0	7.72	24.075	23.9	24.4	11.125	11	11.2	7.585	7.52	7.72
1.6 ppm	1	23.5	11.2	7.62									
	2	24.0	11.3	7.50									
	3	24.0	11.0	7.50									
	4	23.9	11.0	7.48	23.85	23.5	24	11.125	11	11.3	7.525	7.48	7.62
6.4 ppm	1	24.1	11.0	7.50									
	2	24.2	11.0	7.45									
	3	24.2	10.8	7.43									
	4	24.0	10.9	7.45	24.125	24	24.2	10.925	10.8	11	7.4575	7.43	7
12.8 ppm	1	23.8	10.8	7.48									
	2	24.0	10.5	7.45									
	3	23.4	10.7	7.42									
	4	24.0	10.6	7.35	23.8	23.4	24	10.65	10.5	10.8	7.425	7.35	7.48
25.6 ppm	1	N/A	N/A	N/A									
	2	N/A	N/A	N/A									
	3	N/A	N/A	N/A									
	4	N/A	N/A	N/A									

Elliptio Final Water Chem. Day 5. 6-12-94

TMT	Rep	Temp.	Oxygen	pH									
Control	1	23.9	11.2	7.30									
	2	23.0	11.1	7.30									
	3	24.0	11.1	7.30									
	4	24.0	11.1	7.28	23.725	23	24	11.125	11.1	11.2	7.295	7.28	7.3
0.1 ppm	1	23.8	11.1	7.30									
	2	23.9	11.1	7.32									
	3	24.0	11.2	7.32									
	4	24.0	11.2	7.32	23.925	23.8	24	11.15	11.1	11.2	7.315	7.3	7.32
0.4 ppm	1	23.3	11.1	7.35									
	2	23.2	11.0	7.35									
	3	23.8	11.1	7.35									
	4	24.0	10.8	7.38	23.575	23.2	24	11	10.8	11.1	7.3575	7.35	7.38

	4	23.9	11.2	7.26	23.95	23.8	24.1	11.2	11.2	11.2	7.265	7.24	7.28
1.6 ppm	1	24.2	11.2	7.27									
	2	24.2	11.3	7.25									
	3	24.1	11.1	7.25									
	4	24.1	11.2	7.25	24.15	24.1	24.2	11.2	11.1	11.3	7.255	7.25	7.27
6.4 ppm	1	24.0	11.0	7.25									
	2	24.0	11.1	7.25									
	3	24.0	11.1	7.25									
	4	23.9	11.1	7.25	23.975	23.9	24	11.075	11	11.1	7.25	7.25	7.25
12.8 ppm	1	N/A	N/A	N/A									
	2	N/A	N/A	N/A									
	3	N/A	N/A	N/A									
	4	N/A	N/A	N/A									
25.6 ppm	1	N/A	N/A	N/A									
	2	N/A	N/A	N/A									
	3	N/A	N/A	N/A									
	4	N/A	N/A	N/A									
Elliptio Final Water Chem. Day 9, 6-16-94													
TMT	Rep	Temp.	Oxygen	pH									
Control	1	23.7	11.5	7.62									
	2	24.1	11.5	7.62									
	3	23.3	11.3	7.69									
	4	24.0	11.5	7.65	23.775	23.3	24.1	11.45	11.3	11.5	7.645	7.62	7.69
0.1 ppm	1	24.0	11.4	7.68									
	2	24.1	11.4	7.70									
	3	24.2	11.4	7.68									
	4	24.1	11.5	7.68	24.1	24	24.2	11.425	11.4	11.5	7.685	7.68	7.7
0.4 ppm	1	24.0	11.5	7.70									
	2	24.0	11.5	7.70									
	3	24.2	11.5	7.69									
	4	23.8	11.5	7.71	24	23.8	24.2	11.5	11.5	11.5	7.7	7.69	7.71
1.6 ppm	1	24.0	11.5	7.71									
	2	24.0	11.5	7.70									
	3	24.5	11.5	7.69									
	4	24.0	11.4	7.70	24.125	24	24.5	11.475	11.4	11.5	7.7	7.69	7.71
6.4 ppm	1	24.0	11.5	7.70									
	2	24.2	11.3	7.61									
	3	24.0	11.3	7.68									
	4	24.5	11.4	7.62	24.175	24	24.5	11.38	11.3	11.5	7.6525	7.61	7.7
12.8 ppm	1	N/A	N/A	N/A									
	2	N/A	N/A	N/A									
	3	N/A	N/A	N/A									
	4	N/A	N/A	N/A									
25.6 ppm	1	N/A	N/A	N/A									
	2	N/A	N/A	N/A									

	3	N/A	N/A	N/A									
	4	N/A	N/A	N/A									
SUMMARY OF FINAL WATER CHEMIST					RY FOR ELLIPTIO								
TMT.		TEMP			OXYGEN			pH		ADJUSTEI	OXYGEN		
	AVE	MIN	MAX	AVE	MIN	MAX	AVE	MIN	MAX	AVE	MIN	MAX	
Control	23.72	23.00	24.10	11.24	10.40	12.10	7.54	7.23	7.89	5.35	4.13	6.62	
0.1 ppm	23.73	23.00	24.20	11.31	10.20	12.20	7.57	7.25	7.90	5.47	3.84	6.76	
0.4 ppm	23.67	23.00	24.40	11.33	10.40	12.10	7.59	7.24	7.90	5.49	4.13	6.62	
1.6 ppm	23.86	23.00	24.50	11.32	10.40	12.00	7.58	7.20	7.90	5.48	4.13	6.47	
6.4 ppm	23.80	23.00	24.50	11.21	10.14	11.80	7.55	7.13	7.98	5.32	3.75	6.18	
12.8 ppm	23.66	23.00	24.50	11.03	10.00	11.70	7.49	7.12	7.92	5.05	3.55	6.03	
25.6 ppm	23.54	23.00	24.00	10.83	9.40	11.60	7.58	7.10	7.88	4.77	2.67	5.89	

Anodonta Final Water Chem. Day 1. 6-8-94

TMT	Rep	Temp.	Oxygen	pH	TempAve	TempMin	TempMax	Oxy.Ave	Oxy.Min	Oxy.Max	pH Ave	pH Min	pH Max
Control	1	23.3	11.5	7.70									
	2	23.2	11.7	7.75									
	3	23.6	11.9	7.75									
	4	23.5	12.1	7.75	23.4	23.2	23.6	11.8	11.5	12.1	7.7375	7.7	7.75
0.1 ppm	1	23.0	11.4	7.80									
	2	23.6	11.6	7.80									
	3	23.7	11.5	7.80									
	4	23.5	11.6	7.85	23.45	23	23.7	11.525	11.4	11.6	7.8125	7.8	7.85
0.4 ppm	1	23.1	11.6	7.85									
	2	24.0	11.7	7.85									
	3	23.5	11.7	7.85									
	4	24.0	11.8	7.85	23.65	23.1	24	11.7	11.6	11.8	7.85	7.85	7.85
1.6 ppm	1	23.6	11.6	7.88									
	2	23.6	11.6	7.90									
	3	23.9	11.7	7.90									
	4	23.6	11.6	7.91	23.675	23.6	23.9	11.625	11.6	11.7	7.8975	7.88	7.91
6.4 ppm	1	24.1	11.6	7.90									
	2	23.6	11.6	7.90									
	3	24.0	11.5	7.90									
	4	23.6	11.4	7.90	23.825	23.6	24.1	11.525	11.4	11.6	7.9	7.9	7.9
12.8 ppm	1	23.5	11.4	7.91									
	2	23.9	11.5	7.92									
	3	23.4	11.6	7.91									
	4	23.5	11.4	7.95	23.575	23.4	23.9	11.475	11.4	11.6	7.9225	7.91	7.95
25.6 ppm	1	23.5	11.4	7.91									
	2	23.4	11.4	7.90									
	3	23.4	11.5	7.89									
	4	23.6	11.6	7.89	23.475	23.4	23.6	11.475	11.4	11.6	7.8975	7.89	7.91

Anodonta Final Water Chem. Day 2. 6-9-94

TMT	Rep	Temp.	Oxygen	pH									
Control	1	24.0	11.7	7.20									
	2	23.6	11.9	7.25									
	3	24.0	11.7	7.25									
	4	23.9	11.6	7.25	23.875	23.6	24	11.725	11.6	11.9	7.2375	7.2	7.25
0.1 ppm	1	23.4	11.8	7.25									
	2	23.9	11.9	7.28									
	3	23.9	11.8	7.26									
	4	24.0	11.8	7.22	23.8	23.4	24	11.825	11.8	11.9	7.2525	7.22	7.28
0.4 ppm	1	23.8	11.8	7.25									
	2	23.2	11.9	7.28									
	3	23.8	11.9	7.25									
	4	24.1	11.7	7.21	23.725	23.2	24.1	11.825	11.7	11.9	7.2475	7.21	7.28
1.6 ppm	1	24.0	11.7	7.26									

	2	23.9	11.8	7.26									
	3	23.9	11.9	7.25									
	4	24.1	11.9	7.25	23.975	23.9	24.1	11.825	11.7	11.9	7.255	7.25	7.26
6.4 ppm	1	24.0	11.4	7.20									
	2	23.8	11.5	7.20									
	3	24.0	11.6	7.20									
	4	24.0	11.7	7.20	23.95	23.8	24	11.55	11.4	11.7	7.2	7.2	7.2
12.8 ppm	1	23.6	11.6	7.23									
	2	23.4	11.5	7.20									
	3	24.0	11.6	7.21									
	4	24.0	11.4	7.12	23.75	23.4	24	11.525	11.4	11.6	7.19	7.12	7.23
25.6 ppm	1	23.9	11.3	7.15									
	2	23.7	11.3	7.12									
	3	23.9	11.3	7.12									
	4	24.0	11.1	7.05	23.875	23.7	24	11.25	11.1	11.3	7.11	7.05	7.15
Anodonta Final Water Chem. Day 3. 6-10-94													
TMT	Rep	Temp.	Oxygen	pH									
Control	1	24.0	10.6	7.70									
	2	24.0	10.5	7.80									
	3	24.5	10.5	8.00									
	4	24.0	10.5	8.00	24.125	24	24.5	10.525	10.5	10.6	7.875	7.7	
0.1 ppm	1	24.5	10.2	8.00									
	2	24.0	10.4	8.05									
	3	24.0	10.3	8.00									
	4	24.2	10.3	8.00	24.175	24	24.5	10.3	10.2	10.4	8.0125	8	8.05
0.4 ppm	1	24.3	10.1	8.00									
	2	24.2	10.1	8.00									
	3	23.9	10.1	8.00									
	4	24.0	10.0	8.00	24.1	23.9	24.3	10.075	10	10.1	8	8	8
1.6 ppm	1	23.9	10.2	8.00									
	2	24.3	10.3	8.00									
	3	23.4	10.2	8.00									
	4	23.9	10.2	8.00	23.875	23.4	24.3	10.225	10.2	10.3	8	8	8
6.4 ppm	1	24.5	10.2	8.00									
	2	24.0	10.3	8.00									
	3	24.1	10.2	7.95									
	4	24.3	10.2	7.95	24.225	24	24.5	10.225	10.2	10.3	7.975	7.95	8
12.8 ppm	1	24.2	9.9	7.90									
	2	24.1	9.8	7.90									
	3	24.3	10.1	7.90									
	4	23.1	10.4	7.90	23.925	23.1	24.3	10.05	9.8	10.4	7.9	7.9	7.9
25.6 ppm	1	23.8	9.8	7.90									
	2	23.8	9.8	7.90									
	3	24.1	9.5	7.85									
	4	N/A	N/A	N/A	23.9	23.8	24.1	9.7	9.5	9.8	7.8833	7.85	7.9

Anodonte Final Water Chem. Day 4. 6-11-94													
TMT	Rep	Temp.	Oxygen	pH									
Control	1	23.8	11.1	7.50									
	2	24.2	11.0	7.43									
	3	24.0	10.8	7.45									
	4	24.0	11.0	7.45	24	23.8	24.2	10.975	10.8	11.1	7.4575	7.43	7.5
0.1 ppm	1	23.9	11.1	7.55									
	2	24.5	11.1	7.49									
	3	24.1	11.2	7.50									
	4	23.9	11.1	7.49	24.1	23.9	24.5	11.125	11.1	11.2	7.5075	7.49	7.55
0.4 ppm	1	24.0	11.2	7.50									
	2	23.7	11.2	7.52									
	3	24.0	11.2	7.60									
	4	24.3	11.3	7.50	24	23.7	24.3	11.225	11.2	11.3	7.53	7.5	7.6
1.6 ppm	1	24.2	11.1	7.50									
	2	24.0	11.2	7.50									
	3	24.0	11.2	7.51									
	4	24.1	11.2	7.50	24.075	24	24.2	11.175	11.1	11.2	7.5025	7.5	7.51
6.4 ppm	1	23.5	11.2	7.55									
	2	24.1	11.1	7.45									
	3	24.8	11.0	7.40									
	4	24.5	11.0	7.41	24.225	23.5	24.8	11.075	11	11.2	7.4525	7.4	7.55
12.8 ppm	1	24.2	10.8	7.35									
	2	24.0	10.8	7.42									
	3	24.1	10.8	7.40									
	4	24.2	10.4	7.30	24.125	24	24.2	10.7	10.4	10.8	7.3675	7.3	7.42
25.6 ppm	1	N/A	N/A	N/A									
	2	N/A	N/A	N/A									
	3	N/A	N/A	N/A									
	4	N/A	N/A	N/A									
Anodonte Final Water Chem. Day 5. 6-12-94													
TMT	Rep	Temp.	Oxygen	pH									
Control	1	24.1	11.8	7.80									
	2	24.1	11.5	7.88									
	3	24.0	11.4	7.90									
	4	23.5	11.2	8.05	23.925	23.5	24.1	11.475	11.2	11.8	7.9075	7.8	8.05
0.1 ppm	1	24.0	11.4	8.00									
	2	24.1	11.4	7.95									
	3	24.1	11.3	8.00									
	4	24.0	11.3	7.95	24.05	24	24.1	11.35	11.3	11.4	7.975	7.95	8
0.4 ppm	1	24.0	11.4	7.95									
	2	24.5	11.3	7.90									
	3	24.0	11.2	7.90									
	4	23.8	11.2	7.95	24.075	23.8	24.5	11.275	11.2	11.4	7.925	7.9	7.95

1.6 ppm	1	24.2	11.3	7.95									
	2	24.1	11.4	7.91									
	3	23.9	11.4	7.92									
	4	23.7	11.4	8.00	23.975	23.7	24.2	11.375	11.3	11.4	7.945	7.91	8
6.4 ppm	1	23.3	11.2	7.95									
	2	23.3	11.4	7.95									
	3	23.9	11.3	7.95									
	4	24.5	11.3	7.85	23.75	23.3	24.5	11.3	11.2	11.4	7.925	7.85	7.95
12.8 ppm	1	N/A	N/A	N/A									
	2	N/A	N/A	N/A									
	3	N/A	N/A	N/A									
	4	N/A	N/A	N/A									
25.6 ppm	1	N/A	N/A	N/A									
	2	N/A	N/A	N/A									
	3	N/A	N/A	N/A									
	4	N/A	N/A	N/A									

Anodonta Final Water Chem. Day 6. 6-13-94

TMT	Rep	Temp.	Oxygen	pH									
Control	1	24.0	11.6	7.50									
	2	24.0	11.7	7.48									
	3	23.6	11.7	7.50									
	4	23.8	11.7	7.50	23.85	23.6	24	11.675	11.6	11.7	7.495	7.48	
0.1 ppm	1	24.0	11.6	7.50									
	2	23.5	11.8	7.60									
	3	24.2	11.7	7.55									
	4	23.9	11.7	7.51	23.9	23.5	24.2	11.7	11.6	11.8	7.54	7.5	7.6
0.4 ppm	1	23.9	11.7	7.53									
	2	23.7	11.7	7.60									
	3	24.1	11.7	7.55									
	4	24.2	11.7	7.50	23.975	23.7	24.2	11.7	11.7	11.7	7.545	7.5	7.6
1.6 ppm	1	24.2	11.6	7.52									
	2	24.4	11.6	7.51									
	3	24.0	11.7	7.52									
	4	24.2	11.7	7.53	24.2	24	24.4	11.65	11.6	11.7	7.52	7.51	7.53
6.4 ppm	1	23.8	11.7	7.53									
	2	24.0	11.5	7.52									
	3	24.1	11.7	7.54									
	4	24.1	11.4	7.60	24	23.8	24.1	11.575	11.4	11.7	7.5475	7.52	7.6
12.8 ppm	1	N/A	N/A	N/A									
	2	N/A	N/A	N/A									
	3	N/A	N/A	N/A									
	4	N/A	N/A	N/A									
25.6 ppm	1	N/A	N/A	N/A									
	2	N/A	N/A	N/A									
	3	N/A	N/A	N/A									

	4	N/A	N/A	N/A									
Anodonta Final Water Chem. Day 7, 6-14-94													
TMT	Rep	Temp.	Oxygen	pH									
Control	1	24.0	11.2	7.70									
	2	23.8	11.2	7.80									
	3	24.1	11.4	7.80									
	4	24.2	11.6	7.90	24.025	23.8	24.2	11.35	11.2	11.6	7.8	7.7	7.9
0.1 ppm	1	24.0	11.4	7.90									
	2	23.8	11.6	7.90									
	3	24.1	11.4	7.90									
	4	24.1	11.6	7.90	24	23.8	24.1	11.5	11.4	11.6	7.9	7.9	7.9
0.4 ppm	1	23.5	11.6	8.05									
	2	24.0	11.6	8.50									
	3	23.9	11.6	8.00									
	4	24.1	11.4	7.90	23.875	23.5	24.1	11.55	11.4	11.6	8.1125	7.9	8.5
1.6 ppm	1	24.0	11.6	8.00									
	2	24.0	11.2	8.00									
	3	24.0	11.2	8.00									
	4	23.8	11.3	8.00	23.95	23.8	24	11.325	11.2	11.6	8	8	8
6.4 ppm	1	24.0	11.4	7.85									
	2	23.9	11.2	7.90									
	3	24.1	11.2	7.90									
	4	24.1	11.4	7.90	24.025	23.9	24.1	11.3	11.2	11.4	7.8875	7.85	7.9
12.8 ppm	1	N/A	N/A	N/A									
	2	N/A	N/A	N/A									
	3	N/A	N/A	N/A									
	4	N/A	N/A	N/A									
25.6 ppm	1	N/A	N/A	N/A									
	2	N/A	N/A	N/A									
	3	N/A	N/A	N/A									
	4	N/A	N/A	N/A									
Anodonta Final Water Chem. Day 8, 6-15-94													
TMT	Rep	Temp.	Oxygen	pH									
Control	1	23.9	10.8	7.36									
	2	23.9	11.3	7.35									
	3	23.8	11.2	7.35									
	4	24.1	11.4	7.32	23.925	23.8	24.1	11.175	10.8	11.4	7.345	7.32	7.36
0.1 ppm	1	24.1	11.3	7.30									
	2	24.2	11.3	7.28									
	3	24.5	11.2	7.28									
	4	23.9	11.3	7.26	24.175	23.9	24.5	11.275	11.2	11.3	7.28	7.26	7.3
0.4 ppm	1	24.0	11.3	7.27									
	2	24.2	11.3	7.25									
	3	24.2	11.2	7.23									

	4	24.3	11.2	7.28	24.175	24	24.3	11.25	11.2	11.3	7.2575	7.23	7.28
1.6 ppm	1	23.6	11.2	7.30									
	2	24.0	11.4	7.28									
	3	23.9	11.2	7.29									
	4	24.2	11.3	7.25	23.925	23.6	24.2	11.275	11.2	11.4	7.28	7.25	7.3
6.4 ppm	1	N/A	N/A	N/A									
	2	24.2	11.1	7.21									
	3	24.2	11.2	7.22									
	4	23.9	11.2	7.28	24.1	23.9	24.2	11.1667	11.1	11.2	7.2367	7.21	7.28
12.8 ppm	1	N/A	N/A	N/A									
	2	N/A	N/A	N/A									
	3	N/A	N/A	N/A									
	4	N/A	N/A	N/A									
25.6 ppm	1	N/A	N/A	N/A									
	2	N/A	N/A	N/A									
	3	N/A	N/A	N/A									
	4	N/A	N/A	N/A									

Anodonta Final Water Chem. Day 9. 6-16-94

TMT	Rep	Temp.	Oxygen	pH									
Control	1	24.2	11.3	7.80									
	2	24.1	11.4	7.80									
	3	24.2	11.3	7.78									
	4	24.0	11.3	7.78	24.125	24	24.2	11.325	11.3	11.4	7.79	7.78	7.8
0.1 ppm	1	24.0	11.4	7.80									
	2	24.3	11.4	7.80									
	3	24.2	11.2	7.80									
	4	24.0	11.3	7.80	24.125	24	24.3	11.325	11.2	11.4	7.8	7.8	7.8
0.4 ppm	1	24.0	11.3	7.80									
	2	23.9	11.4	7.85									
	3	24.5	11.2	7.80									
	4	24.3	11.3	7.80	24.175	23.9	24.5	11.3	11.2	11.4	7.8125	7.8	7.85
1.6 ppm	1	24.5	11.2	7.80									
	2	24.0	11.2	7.82									
	3	24.0	11.3	7.81									
	4	24.0	11.2	7.81	24.125	24	24.5	11.225	11.2	11.3	7.81	7.8	7.82
6.4 ppm	1	N/A	N/A	N/A									
	2	N/A	N/A	N/A									
	3	N/A	N/A	N/A									
	4	N/A	N/A	N/A									
12.8 ppm	1	N/A	N/A	N/A									
	2	N/A	N/A	N/A									
	3	N/A	N/A	N/A									
	4	N/A	N/A	N/A									
25.6 ppm	1	N/A	N/A	N/A									
	2	N/A	N/A	N/A									

	3	N/A	N/A	N/A									
	4	N/A	N/A	N/A									
SUMMARY OF FINAL WATER CHEMISTRY FOR ANODONTA													
TMT.		TEMP			OXYGEN			pH		ADJUSTED	OXYGEN		
	AVE	MIN	MAX	AVE	MIN	MAX	AVE	MIN	MAX	AVE	MIN	MAX	
Control	23.92	23.20	24.50	11.34	10.50	12.10	7.63	7.20	8.05	5.50	4.28	6.62	
0.1 ppm	23.97	23.00	24.50	11.32	10.20	11.90	7.68	7.22	8.05	5.48	3.84	6.32	
0.4 ppm	23.97	23.10	24.50	11.32	10.00	11.90	7.70	7.21	8.50	5.48	3.55	6.32	
1.6 ppm	23.97	23.40	24.50	11.30	10.20	11.90	7.69	7.25	8.00	5.45	3.84	6.32	
6.4 ppm	24.01	23.30	24.80	11.21	10.20	11.70	7.64	7.20	8.00	5.32	3.84	6.03	
12.8 ppm	23.84	23.10	24.30	10.94	9.80	11.60	7.59	7.12	7.95	4.92	3.26	5.89	
25.6 ppm	23.75	23.40	24.10	10.81	9.50	11.60	7.63	7.05	7.91	4.73	2.82	5.89	

Figure 5. Hand graph of Anodonta LC_{50} for Clamtrol using actual % mortality (top graph)

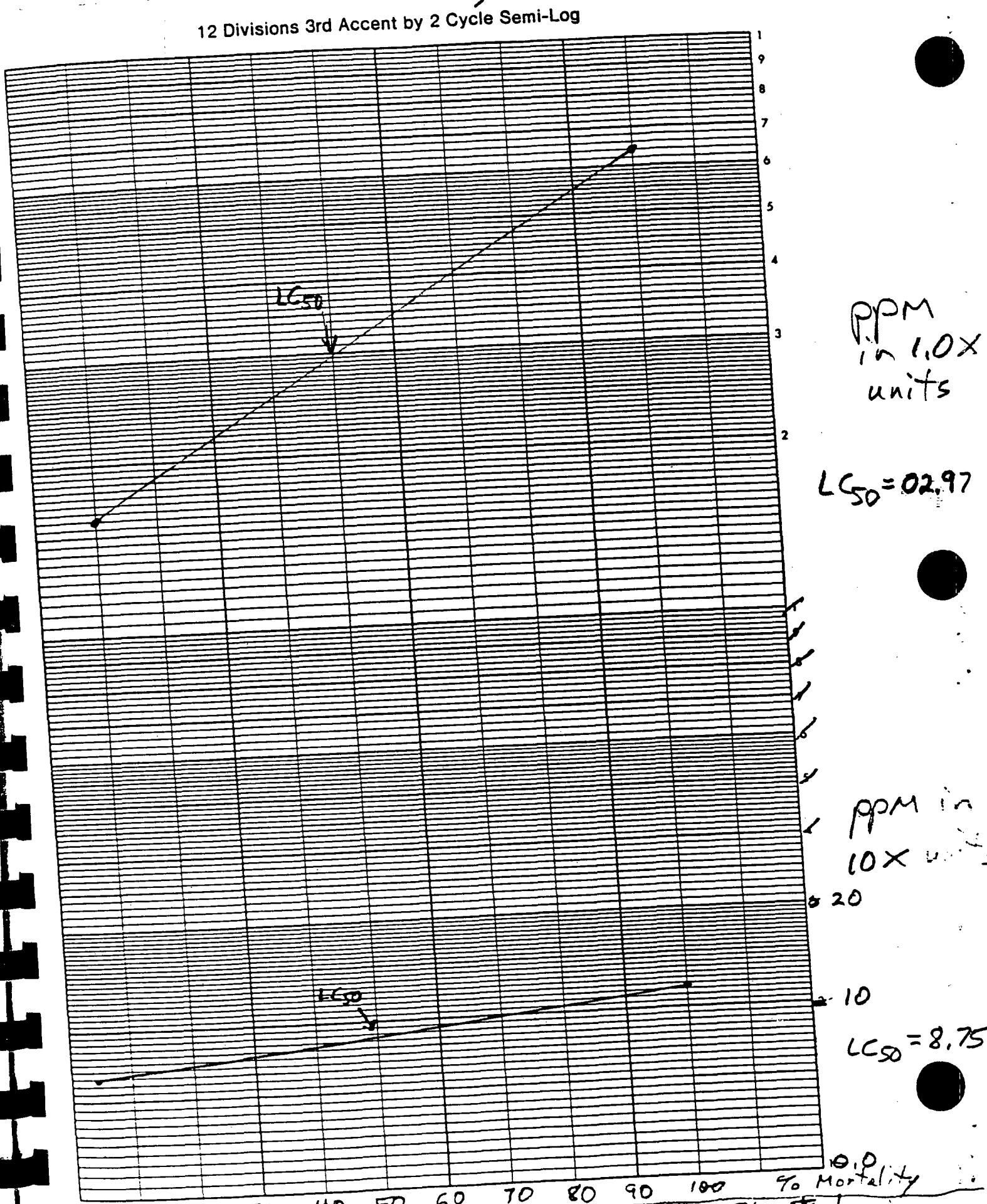

Figure 6. Hand graph of Elliptio LC_{50} for Clamtrol using actual mortality percentages (bottom graph)