

MRID No. 437904-01

**DATA EVALUATION RECORD
ESTUARINE FISH EARLY LIFE-STAGE TEST
GUIDELINE 72-4**

1. **CHEMICAL:** Dichlorvos (DDVP) PC Code No.: 084001
2. **TEST MATERIAL:** DDVP technical Purity: 98%
3. **CITATION:**
Authors: G.S. Ward and J.W. Davis
Title: DDVP Technical Grade: Toxicity to Embryos and Larvae of the Sheepshead Minnow (*Cyprinodon variegatus*) Under Flow-Through Test Conditions
Study Completion Date: September 13, 1995
Laboratory: Toxikon Environmental Sciences, Jupiter, FL
Laboratory Report ID: J9407006b
Sponsor: AMVAC Chemical Corporation, Los Angeles, CA
MRID No.: 437904-01
DP Barcode: D220208

4. **REVIEWED BY:** Rosemary Mora, M.S., Associate Scientist, KBN Engineering and Applied Sciences, Inc.

Signature: P. Kosalwat for RGM **Date:** 2/26/96 *3/12/96*

- APPROVED BY:** Mark Mossler, M.S., Toxicologist, KBN Engineering and Applied Sciences, Inc.

Signature: *Mark Mossler* **Date:** 2/26/96

5. **APPROVED BY:**

Signature: *L.G. D.* **Date:** 5/25/96

6. **CONCLUSIONS:** This study is scientifically sound and fulfills the guideline requirements for an estuarine fish early life-stage test. Based on the most sensitive parameters (survival and length), the NOEC and LOEC of DDVP technical for sheepshead minnow are 0.96 and 1.84 mg ai/L, respectively. The MATC is 1.33 mg ai/L.

7. **ADEQUACY OF THE STUDY**

A. **Classification:** Core.

B. **Rationale:** N/A.

C. **Repairability:** N/A.



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8. MAJOR GUIDELINE DEVIATIONS:

1. The %relative standard deviation (%RSD) for weight in one replicate of the dilution water control was 53%. The %RSD for any one control replicate must not be greater than 40%.
2. The dilution water was a mixture of natural seawater and treated municipal freshwater. It is likely that the freshwater was dechlorinated water; its use is discouraged.
3. Adult fish were treated with 20 ppm of nitrofurazone in an 8-day period prior to test initiation. Females were also treated with a 20-ppm solution of formalin immediately prior to strip spawning.
4. The test temperature ranged from 22.4 to 28.7°C during the test period. The test temperature should not deviate more than 2°C during the study.
5. The test consisted of only 2 true replicates; 4 replicates are recommended.

9. MATERIALS AND METHODS

A. Biological System

Guideline Criteria	Reported Information
<p>Species: An estuarine fish species, preferably a silversides species or sheepshead minnow (<i>Cyprinodon variegatus</i>).</p>	<p><i>Cyprinodon variegatus</i></p>
<p>Source</p>	<p>Adult fish were obtained from Aquatic Bio Systems, Fort Collins, CO. Female fish were injected with HCG to enhance egg production. Eggs were stripped from the females then fertilized by sperm obtained from excised testes of four male fish.</p>
<p>Age at beginning of test: Embryos 2 to 24 hours old.</p>	<p>Embryos less than 24 hours old.</p>

Guideline Criteria	Reported Information
<p>Replicates: Minimum of 20 embryos per replicate cup, 4 replicates per concentration.</p> <p>Minimum of 30 fish per treatment for post-hatch exposure.</p>	<p>20 embryos per cage; 2 cages per replicate vessel; 2 replicate vessels per treatment or control.</p> <p>Post hatch exposure: 20 fish per chamber; 2 chambers per replicate vessel; 2 replicate vessels per treatment.</p>
<p>Post Hatch: % of embryos that produce live fry must be $\geq 50\%$ in each control; % hatch in any control embryo cup must be no more than 1.6 times that in another control cup.</p>	<p>80-100% of embryos in each control produced live fry.</p>
<p>Feeding: Fish should be fed at least twice daily. Fish should not be fed for at least 24 hr prior to termination on day 32.</p>	<p>Fish were fed fatty-acid supplemented brine shrimp 2-3 times daily until the day prior to test termination when food was withheld.</p>
<p>Counts: At a minimum, live fish should be counted 11, 18, 25, and 32 days after hatching.</p>	<p>Survival of embryos and larvae were recorded daily.</p>
<p>Controls: Avg. survival at end of test must be $\geq 80\%$. Survival in any control chamber must not be $< 70\%$.</p>	<p>$\geq 88\%$ survival in the controls at test termination.</p>
<p>Controls: Negative control and carrier control (when applicable) are required.</p>	<p>A dilution water control and a solvent control (5.73 $\mu\text{L}/\text{TEG}/\text{L}$) were included in this study.</p>

Comments: "The adult fish were treated prophylactically with 20 ppm of nitrofurazone during the 8-day period between hormone injections and stripping of eggs to prevent infection during hormone injections...Just prior to stripping, females were dipped in a 20 ppm formalin solution to prevent the possible transfer of any external parasites which may have been present."

B. Physical System

Guideline Criteria	Reported Information
<p>Test Water: 1) May be natural (sterilized and filtered) or a commercial mixture; 2) Natural seawater should have weekly range of salinity less than 6‰, monthly pH range less than 0.8 pH units; 3) Salinity should be ≥ 15 parts per thousand; 4) Water must be free of pollutants.</p>	<ol style="list-style-type: none"> 1. Natural seawater with salinity adjusted to 20 parts per thousand (ppt) using municipal freshwater. The test water was aerated and activated-carbon filtered. 2. Not reported. 3. Salinity was 18-20 ppt during the study. 4. No significant levels of pollutants were detected.
<p>Test Temperature: Depends upon test species; should not deviate by more than 2°C from appropriate temperature. For sheepshead minnow, either 25°C or 30°C is recommended.</p>	<p>26.2°C (range 22.4-28.7°C).</p>
<p>Photoperiod: Recommend 16L/8D.</p>	<p>16 hours light/8 hours dark.</p>
<p>Dosing Apparatus: Intermittent flow proportional diluters or continuous flow serial diluters should be used. A minimum of 5 toxicant concentrations with a dilution factor not greater than 0.5 and controls should be used.</p>	<p>An intermittent flow proportional diluter was used. The test consisted of a dilution water control, a solvent control, and 5 concentrations with a dilution factor of 0.5.</p>
<p>Toxicant Mixing: 1) Mixing chamber is recommended but not required; 2) Aeration should not be used for mixing; 3) It must be demonstrated that the test solution is completely mixed before intro. into the test system; 4) Flow splitting accuracy must be within 10%.</p>	<ol style="list-style-type: none"> 1. A mixing chamber was used. 2. Not reported. 3. No undissolved test material was observed. 4. Flow splitting accuracy was within 5% of the desired volumes.

Guideline Criteria	Reported Information
Test Vessels: All glass or glass with stainless steel frame.	Test vessels were 24-L glass tanks (40 X 29.5 X 20 cm).
Embryo Cups: 120 ml glass jars with bottoms replaced with 40 mesh stainless steel or nylon screen.	Embryo cages were constructed of glass tubes (60 mm diameter) and Nitex® screen.
Flow Rate: Flow rates to larval cups should provide 90% replacement in 8-12 hours. Flow rate must maintain D.O. at above 75% of saturation and maintain the toxicant level.	11 volume exchanges per 24 hours.
Aeration: Dilution water should be aerated to insure D.O. concentration at or near 100% saturation. Test tanks and embryo cups should not be aerated.	D.O. \geq 78% (5.6 mg/L) of saturation at all times.

Comments: None.

C. Chemical System

Guideline Criteria	Reported Information
<p>Concentrations: Minimum of 5 concentrations and a control, all replicated, plus solvent control if appropriate.</p> <ul style="list-style-type: none"> - Toxicant conc. must be measured in one tank at each toxicant level every week. - One concentration must adversely affect a life stage and one concentration must not affect any life stage. 	<ul style="list-style-type: none"> - Dilution water control, solvent control (5.73 μL TEG/L), and five nominal concentrations (0.25, 0.5, 1.0, 2.0, 4.0 mg ai/l). - Toxicant concentrations were measured on days 0, 7, 14, 21, 28, and 34 in each replicate vessel of the controls and treatments. - Yes, based on mean measured concentrations reported.

Guideline Criteria	Reported Information
<p>Other Variables:</p> <p>1) D.O. must be measured at each conc. at least once a week;</p> <p>2) Natural seawater must maintain a constant salinity and not fluctuate more than 6‰ weekly; monthly pH range <0.8 pH units.</p>	<p>1. D.O. was measured weekly in each replicate.</p> <p>2. Not reported.</p>
<p>Solvents: Should not exceed 0.1 ml/L in a flow-through system. Following solvents are acceptable: dimethylformamide, triethylene glycol, methanol, acetone, ethanol.</p>	<p>5.73 µL TEG/L</p>

Comments: Mean measured concentrations ranged from 88 to 96% of nominal concentrations.

10. REPORTED RESULTS

Guideline Criteria	Reported Information
<p>Data Endpoints must include:</p> <ul style="list-style-type: none"> - Number of embryos hatched; - Time to hatch; - Mortality of embryos, larvae, and juveniles; - Time to swim-up (if appropriate); - Measurement of growth; - Incidence of pathological or histological effects; - Observations of other effects or clinical signs. 	<p>All appropriate data endpoints listed were reported.</p>
<p>Raw data included? (Y/N)</p>	<p>Daily hatching and survival data were not presented in the report.</p>

Effects Data

Toxicant Concentration (mg ai/L)		Mean Percent Hatch	Percent Post- Hatch Survival (35 days)	Total Length (mm)	Wet Weight (mg)
Nominal	Measured				
Control	ND	95	92	17.4	171
Solvent	ND	96	88	17.4	172
0.25	0.234	95	89	17.6	179
0.50	0.438	95	86	17.6	184
1.0	0.960	93	86	17.5	177
2.0	1.84	90	72	16.5	159
4.0	3.67	88	27	15.1	126

ND = Not detected (detection limit = 18 µg/L)

Comments: "Sheepshead minnow embryos began hatching on day 2 of the test and all hatching was completed by day 7 (a total of 5 days). The day determined for hatch completion was day 6, the day when ≥95 percent of all viable control embryos had hatched."

Toxicity Observations: At 0.438 mg ai/L, one fish had a bent tail at test termination. No other deformities or abnormalities were observed.

Statistical Results:

Statistical Method: ANOVA with Dunnett's Test

NOEC: 0.96 mg ai/L LOEC: 1.84 mg ai/L MATC: 1.33 mg ai/L

Most sensitive endpoints: Larval survival and length.

11. REVIEWER'S STATISTICAL RESULTS:

Statistical Methods: Williams' and Dunnett's tests

NOEC: 0.96 mg ai/L LOEC: 1.84 mg ai/L MATC: 1.33 mg ai/L

Most sensitive endpoint: Larval survival.

12. **REVIEWER'S COMMENTS:** In Section 2.1 of the report, it was stated that measured test concentrations are reported as micrograms DDVP technical as active ingredient per liter, or parts per billion. This statement is incorrect. Based on the stock solution calculations, the treatment concentrations were in ppm ai or mg ai/L.

This study is scientifically sound and fulfills the guideline requirements for an estuarine fish early life-stage test. The NOEC and LOEC of DDVP technical for sheepshead minnow are 0.96 and 1.84 mg ai/L, respectively. The MATC is 1.33 mg ai/L.

DDVP Technical Grade: Percentage Hatch of SHM

File: 43790401.hat

Transform: NO TRANSFORM

t-test of Solvent and Blank Controls

Ho:GRP1 MEAN = GRP2 MEAN

GRP1 (SOLVENT CRTL) MEAN	=	0.9625	CALCULATED t VALUE	=	0.2928
GRP2 (BLANK CRTL) MEAN	=	0.9500	DEGREES OF FREEDOM	=	6
DIFFERENCE IN MEANS	=	0.0125			

TABLE t VALUE (0.05 (2), 6)	=	2.447	NO significant difference at alpha=0.05
TABLE t VALUE (0.01 (2), 6)	=	3.707	NO significant difference at alpha=0.01

TITLE: DDVP Technical Grade: Percentage Hatch of SHM
 FILE: 43790401.hat
 TRANSFORM: NO TRANSFORM NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	GRPS 1&2 POOLED	1	1.0000	1.0000
1	GRPS 1&2 POOLED	2	0.9500	0.9500
1	GRPS 1&2 POOLED	3	0.9000	0.9000
1	GRPS 1&2 POOLED	4	1.0000	1.0000
1	GRPS 1&2 POOLED	5	1.0000	1.0000
1	GRPS 1&2 POOLED	6	0.9500	0.9500
1	GRPS 1&2 POOLED	7	0.8500	0.8500
1	GRPS 1&2 POOLED	8	1.0000	1.0000
2	0.234 ug ai/l	1	1.0000	1.0000
2	0.234 ug ai/l	2	1.0000	1.0000
2	0.234 ug ai/l	3	0.8500	0.8500
2	0.234 ug ai/l	4	0.9500	0.9500
3	0.438 ug ai/l	1	0.9000	0.9000
3	0.438 ug ai/l	2	1.0000	1.0000
3	0.438 ug ai/l	3	0.9000	0.9000
3	0.438 ug ai/l	4	1.0000	1.0000
4	0.960 ug ai/l	1	0.9000	0.9000
4	0.960 ug ai/l	2	0.8500	0.8500
4	0.960 ug ai/l	3	0.9500	0.9500
4	0.960 ug ai/l	4	1.0000	1.0000
5	1.84 ug ai/l	1	1.0000	1.0000
5	1.84 ug ai/l	2	0.9000	0.9000
5	1.84 ug ai/l	3	0.9000	0.9000
5	1.84 ug ai/l	4	0.8000	0.8000
6	3.67 ug ai/l	1	0.9000	0.9000
6	3.67 ug ai/l	2	0.8500	0.8500
6	3.67 ug ai/l	3	0.8000	0.8000
6	3.67 ug ai/l	4	0.9500	0.9500

DDVP Technical Grade: Percentage Hatch of SHM
 File: 43790401.hat Transform: NO TRANSFORM

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.025	0.005	1.170
Within (Error)	22	0.092	0.004	
Total	27	0.117		

Critical F value = 2.66 (0.05,5,22)
 Since F < Critical F FAIL TO REJECT Ho: All equal

DDVP Technical Grade: Percentage Hatch of SHM
File: 43790401.hat Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	1.876	6.776	10.696	6.776	1.876
OBSERVED	1	7	9	11	0

Calculated Chi-Square goodness of fit test statistic = 5.1945
Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

DDVP Technical Grade: Percentage Hatch of SHM
File: 43790401.hat Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

D = 0.092

W = 0.939

Critical W (P = 0.05) (n = 28) = 0.924

Critical W (P = 0.01) (n = 28) = 0.896

Data PASS normality test at P=0.01 level. Continue analysis.

DDVP Technical Grade: Percentage Hatch of SHM
 File: 43790401.hat Transform: NO TRANSFORM

BONFERRONI t-TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	GRPS 1&2 POOLED	0.956	0.956		
2	0.234 ug ai/l	0.950	0.950	0.158	
3	0.438 ug ai/l	0.950	0.950	0.158	
4	0.960 ug ai/l	0.925	0.925	0.788	
5	1.84 ug ai/l	0.900	0.900	1.419	
6	3.67 ug ai/l	0.875	0.875	2.050	

Bonferroni t table value = 2.51 (1 Tailed Value, P=0.05, df=22,5)

DDVP Technical Grade: Percentage Hatch of SHM
 File: 43790401.hat Transform: NO TRANSFORM

BONFERRONI t-TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	GRPS 1&2 POOLED	8			
2	0.234 ug ai/l	4	0.099	10.4	0.006
3	0.438 ug ai/l	4	0.099	10.4	0.006
4	0.960 ug ai/l	4	0.099	10.4	0.031
5	1.84 ug ai/l	4	0.099	10.4	0.056
6	3.67 ug ai/l	4	0.099	10.4	0.081

DDVP Technical Grade: Percentage Hatch of SHM
 File: 43790401.hat Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	GRPS 1&2 POOLED	8	0.956	0.956	0.956
2	0.234 ug ai/l	4	0.950	0.950	0.950
3	0.438 ug ai/l	4	0.950	0.950	0.950
4	0.960 ug ai/l	4	0.925	0.925	0.925
5	1.84 ug ai/l	4	0.900	0.900	0.900
6	3.67 ug ai/l	4	0.875	0.875	0.875

DDVP Technical Grade: Percentage Hatch of SHM
 File: 43790401.hat Transform: NO TRANSFORM

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
GRPS 1&2 POOLED	0.956				
0.234 ug ai/l	0.950	0.158		1.72	k= 1, v=22
0.438 ug ai/l	0.950	0.158		1.80	k= 2, v=22
0.960 ug ai/l	0.925	0.788		1.83	k= 3, v=22
1.84 ug ai/l	0.900	1.419		1.84	k= 4, v=22
3.67 ug ai/l	0.875	2.050	*	1.85	k= 5, v=22

s = 0.065

Note: df used for table values are approximate when v > 20.

DDVP Tech.: Survival of SHM Larvae

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Transform: NO TRANSFORMATION

t-test of Solvent and Blank Controls

Ho: GRP1 MEAN = GRP2 MEAN

GRP1 (SOLVENT CTRL) MEAN =	0.8827	CALCULATED t VALUE =	-0.7163
GRP2 (BLANK CTRL) MEAN =	0.9193	DEGREES OF FREEDOM =	6
DIFFERENCE IN MEANS =	-0.0365		

TABLE t VALUE (0.05 (2), 6) = 2.447 NO significant difference at alpha=0.05

TABLE t VALUE (0.01 (2), 6) = 3.707 NO significant difference at alpha=0.01

TITLE: DDVP Tech.: Survival of SHM Larvae
FILE: C:\TOXSTAT\43790401.SUR
TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	GRPS 1&2 POOLED	1	1.0000	1.0000
1	GRPS 1&2 POOLED	2	0.8420	0.8420
1	GRPS 1&2 POOLED	3	0.8890	0.8890
1	GRPS 1&2 POOLED	4	0.8000	0.8000
1	GRPS 1&2 POOLED	5	1.0000	1.0000
1	GRPS 1&2 POOLED	6	0.8950	0.8950
1	GRPS 1&2 POOLED	7	0.8820	0.8820
1	GRPS 1&2 POOLED	8	0.9000	0.9000
2	0.234 ug ai/l	1	0.8500	0.8500
2	0.234 ug ai/l	2	0.9500	0.9500
2	0.234 ug ai/l	3	0.8820	0.8820
2	0.234 ug ai/l	4	0.8950	0.8950
3	0.438 ug ai/l	1	0.9440	0.9440
3	0.438 ug ai/l	2	0.9000	0.9000
3	0.438 ug ai/l	3	0.7780	0.7780
3	0.438 ug ai/l	4	0.8000	0.8000
4	0.960 ug ai/l	1	0.8330	0.8330
4	0.960 ug ai/l	2	0.9410	0.9410
4	0.960 ug ai/l	3	0.8950	0.8950
4	0.960 ug ai/l	4	0.8000	0.8000
5	1.84 ug ai/l	1	0.8000	0.8000
5	1.84 ug ai/l	2	0.9440	0.9440
5	1.84 ug ai/l	3	0.6670	0.6670
5	1.84 ug ai/l	4	0.4380	0.4380
6	3.67 ug ai/l	1	0.3330	0.3330
6	3.67 ug ai/l	2	0.5290	0.5290
6	3.67 ug ai/l	3	0.1250	0.1250
6	3.67 ug ai/l	4	0.1050	0.1050

DDVP Tech.: Survival of SHM Larvae

File: C:\TOXSTAT\43790401.SUR

Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	1.876	6.776	10.696	6.776	1.876
OBSERVED	0	10	10	8	0

Calculated Chi-Square goodness of fit test statistic = 5.5524

Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

DDVP Tech.: Survival of SHM Larvae

File: C:\TOXSTAT\43790401.SUR

Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

D = 0.328

W = 0.967

Critical W (P = 0.05) (n = 28) = 0.924

Critical W (P = 0.01) (n = 28) = 0.896

Data PASS normality test at P=0.01 level. Continue analysis.

DDVP Tech.: Survival of SHM Larvae

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Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	1.267	0.253	17.013
Within (Error)	22	0.328	0.015	
Total	27	1.595		

Critical F value = 2.66 (0.05,5,22)
 Since F > Critical F REJECT Ho: All equal

DDVP Tech.: Survival of SHM Larvae

File: C:\TOXSTAT\43790401.SUR

Transform: NO TRANSFORMATION

BONFERRONI t-TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	GRPS 1&2 POOLED	0.901	0.901		
2	0.234 ug ai/l	0.894	0.894	0.090	
3	0.438 ug ai/l	0.856	0.856	0.609	
4	0.960 ug ai/l	0.867	0.867	0.452	
5	1.84 ug ai/l	0.712	0.712	2.525	*
6	3.67 ug ai/l	0.273	0.273	8.402	*

Bonferroni t table value = 2.51 (1 Tailed Value, P=0.05, df=22,5)

DDVP Tech.: Survival of SHM Larvae

File: C:\TOXSTAT\43790401.SUR

Transform: NO TRANSFORMATION

BONFERRONI t-TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	GRPS 1&2 POOLED	8			
2	0.234 ug ai/l	4	0.187	20.8	0.007
3	0.438 ug ai/l	4	0.187	20.8	0.046
4	0.960 ug ai/l	4	0.187	20.8	0.034
5	1.84 ug ai/l	4	0.187	20.8	0.189
6	3.67 ug ai/l	4	0.187	20.8	0.628

DDVP Tech.: Survival of SHM Larvae

File: C:\TOXSTAT\43790401.SUR

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	GRPS 1&2 POOLED	8	0.901	0.901	0.901
2	0.234 ug ai/l	4	0.894	0.894	0.894
3	0.438 ug ai/l	4	0.856	0.856	0.861
4	0.960 ug ai/l	4	0.867	0.867	0.861
5	1.84 ug ai/l	4	0.712	0.712	0.712
6	3.67 ug ai/l	4	0.273	0.273	0.273

DDVP Tech.: Survival of SHM Larvae

File: C:\TOXSTAT\43790401.SUR

Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
GRPS 1&2 POOLED	0.901				
0.234 ug ai/l	0.894	0.090		1.72	k= 1, v=22
0.438 ug ai/l	0.861	0.530		1.80	k= 2, v=22
0.960 ug ai/l	0.861	0.530		1.83	k= 3, v=22
1.84 ug ai/l	0.712	2.525	*	1.84	k= 4, v=22
3.67 ug ai/l	0.273	8.401	*	1.85	k= 5, v=22

s = 0.122

Note: df used for table values are approximate when v > 20.

OBS	LEVEL	REP	LEN	WT
1	CONTROL	1	17	160
2	CONTROL	1	18	180
3	CONTROL	1	17	150
4	CONTROL	1	17	160
5	CONTROL	1	10	20
6	CONTROL	1	17	160
7	CONTROL	1	17	160
8	CONTROL	1	18	170
9	CONTROL	1	18	190
10	CONTROL	1	19	200
11	CONTROL	1	17	160
12	CONTROL	1	18	180
13	CONTROL	1	20	220
14	CONTROL	1	17	140
15	CONTROL	1	18	170
16	CONTROL	1	18	170
17	CONTROL	1	14	80
18	CONTROL	1	16	130
19	CONTROL	1	18	200
20	CONTROL	1	16	110
21	CONTROL	2	18	210
22	CONTROL	2	19	210
23	CONTROL	2	17	160
24	CONTROL	2	18	170
25	CONTROL	2	17	170
26	CONTROL	2	19	210
27	CONTROL	2	17	140
28	CONTROL	2	16	110
29	CONTROL	2	17	140
30	CONTROL	2	18	160
31	CONTROL	2	17	160
32	CONTROL	2	16	120
33	CONTROL	2	15	100
34	CONTROL	2	18	180
35	CONTROL	2	15	120
36	CONTROL	2	18	160
37	CONTROL	2	11	110
38	CONTROL	3	22	340
39	CONTROL	3	21	300
40	CONTROL	3	18	200
41	CONTROL	3	18	210
42	CONTROL	3	18	170
43	CONTROL	3	22	320
44	CONTROL	3	18	190
45	CONTROL	3	18	220
46	CONTROL	3	16	120
47	CONTROL	3	20	270
48	CONTROL	3	19	240
49	CONTROL	3	19	200
50	CONTROL	3	12	40
51	CONTROL	3	12	30
52	CONTROL	3	9	20
53	CONTROL	4	19	250
54	CONTROL	4	18	180
55	CONTROL	4	20	220
56	CONTROL	4	20	210
57	CONTROL	4	18	180
58	CONTROL	4	15	100
59	CONTROL	4	16	130
60	CONTROL	4	17	130
61	CONTROL	4	18	180
62	CONTROL	4	18	190
63	CONTROL	4	20	210
64	CONTROL	4	19	200

OBS	LEVEL	REP	LEN	WT
65	CONTROL	4	21	270
66	CONTROL	4	17	160
67	CONTROL	4	19	220
68	CONTROL	4	21	280
69	CONTROL	4	17	170
70	CONTROL	4	15	110
71	SOL_CONT	1	20	230
72	SOL_CONT	1	18	180
73	SOL_CONT	1	18	200
74	SOL_CONT	1	18	200
75	SOL_CONT	1	17	140
76	SOL_CONT	1	10	30
77	SOL_CONT	1	17	160
78	SOL_CONT	1	16	140
79	SOL_CONT	1	18	180
80	SOL_CONT	1	18	190
81	SOL_CONT	1	17	140
82	SOL_CONT	1	17	150
83	SOL_CONT	1	19	220
84	SOL_CONT	1	19	210
85	SOL_CONT	1	18	190
86	SOL_CONT	1	18	160
87	SOL_CONT	1	15	110
88	SOL_CONT	1	10	30
89	SOL_CONT	1	18	170
90	SOL_CONT	1	17	160
91	SOL_CONT	2	17	130
92	SOL_CONT	2	18	190
93	SOL_CONT	2	20	280
94	SOL_CONT	2	19	240
95	SOL_CONT	2	19	220
96	SOL_CONT	2	18	180
97	SOL_CONT	2	20	220
98	SOL_CONT	2	18	180
99	SOL_CONT	2	18	180
100	SOL_CONT	2	16	120
101	SOL_CONT	2	16	160
102	SOL_CONT	2	18	190
103	SOL_CONT	2	18	190
104	SOL_CONT	2	16	150
105	SOL_CONT	2	16	140
106	SOL_CONT	2	13	60
107	SOL_CONT	3	17	150
108	SOL_CONT	3	18	210
109	SOL_CONT	3	18	190
110	SOL_CONT	3	16	140
111	SOL_CONT	3	19	210
112	SOL_CONT	3	17	140
113	SOL_CONT	3	18	190
114	SOL_CONT	3	18	190
115	SOL_CONT	3	20	250
116	SOL_CONT	3	20	230
117	SOL_CONT	3	17	180
118	SOL_CONT	3	18	180
119	SOL_CONT	3	16	130
120	SOL_CONT	3	20	260
121	SOL_CONT	3	17	150
122	SOL_CONT	3	17	160
123	SOL_CONT	4	10	20
124	SOL_CONT	4	20	250
125	SOL_CONT	4	19	220
126	SOL_CONT	4	17	170
127	SOL_CONT	4	17	140
128	SOL_CONT	4	18	210

OBS	LEVEL	REP	LEN	WT
129	SOL CONT	4	15	130
130	SOL CONT	4	18	210
131	SOL CONT	4	18	160
132	SOL CONT	4	15	130
133	SOL CONT	4	19	220
134	SOL CONT	4	18	190
135	SOL CONT	4	18	180
136	SOL CONT	4	18	190
137	SOL CONT	4	18	180
138	SOL CONT	4	18	160
139	TRT1	1	20	280
140	TRT1	1	17	170
141	TRT1	1	17	160
142	TRT1	1	16	140
143	TRT1	1	16	150
144	TRT1	1	17	180
145	TRT1	1	17	150
146	TRT1	1	17	160
147	TRT1	1	18	190
148	TRT1	1	18	180
149	TRT1	1	18	160
150	TRT1	1	15	110
151	TRT1	1	15	100
152	TRT1	1	19	200
153	TRT1	1	20	220
154	TRT1	1	18	180
155	TRT1	1	17	170
156	TRT1	2	17	160
157	TRT1	2	17	140
158	TRT1	2	17	140
159	TRT1	2	16	140
160	TRT1	2	18	210
161	TRT1	2	17	140
162	TRT1	2	18	160
163	TRT1	2	17	120
164	TRT1	2	16	130
165	TRT1	2	18	150
166	TRT1	2	13	60
167	TRT1	2	19	210
168	TRT1	2	18	210
169	TRT1	2	15	110
170	TRT1	2	16	150
171	TRT1	2	16	150
172	TRT1	2	19	210
173	TRT1	2	18	180
174	TRT1	2	19	220
175	TRT1	3	20	240
176	TRT1	3	18	190
177	TRT1	3	20	220
178	TRT1	3	20	200
179	TRT1	3	18	190
180	TRT1	3	18	190
181	TRT1	3	20	290
182	TRT1	3	16	120
183	TRT1	3	20	240
184	TRT1	3	18	190
185	TRT1	3	16	130
186	TRT1	3	18	210
187	TRT1	3	20	230
188	TRT1	3	18	180
189	TRT1	3	17	170
190	TRT1	4	18	190
191	TRT1	4	18	200
192	TRT1	4	19	240

OBS	LEVEL	REP	LEN	WT
193	TRT1	4	18	190
194	TRT1	4	18	200
195	TRT1	4	19	220
196	TRT1	4	18	180
197	TRT1	4	18	220
198	TRT1	4	17	160
199	TRT1	4	16	120
200	TRT1	4	15	110
201	TRT1	4	18	220
202	TRT1	4	19	250
203	TRT1	4	18	230
204	TRT1	4	18	200
205	TRT1	4	18	180
206	TRT1	4	18	170
207	TRT2	1	18	180
208	TRT2	1	19	210
209	TRT2	1	20	280
210	TRT2	1	17	150
211	TRT2	1	19	220
212	TRT2	1	19	200
213	TRT2	1	16	130
214	TRT2	1	18	180
215	TRT2	1	20	260
216	TRT2	1	20	260
217	TRT2	1	18	170
218	TRT2	1	18	190
219	TRT2	1	17	160
220	TRT2	1	16	140
221	TRT2	1	18	170
222	TRT2	1	17	170
223	TRT2	1	18	190
224	TRT2	1	16	110
225	TRT2	2	16	140
226	TRT2	2	16	120
227	TRT2	2	16	120
228	TRT2	2	15	110
229	TRT2	2	14	80
230	TRT2	2	17	180
231	TRT2	2	19	190
232	TRT2	2	18	160
233	TRT2	2	18	190
234	TRT2	2	17	170
235	TRT2	2	18	190
236	TRT2	2	15	110
237	TRT2	2	18	210
238	TRT2	2	13	60
239	TRT2	2	16	130
240	TRT2	2	18	190
241	TRT2	2	16	110
242	TRT2	3	18	200
243	TRT2	3	18	180
244	TRT2	3	17	180
245	TRT2	3	18	200
246	TRT2	3	17	150
247	TRT2	3	210	18
248	TRT2	3	12	40
249	TRT2	3	18	220
250	TRT2	3	20	270
251	TRT2	3	20	250
252	TRT2	3	18	200
253	TRT2	3	17	170
254	TRT2	3	19	240
255	TRT2	3	18	230
256	TRT2	4	20	260

OBS	LEVEL	REP	LEN	WT
257	TRT2	4	19	230
258	TRT2	4	17	160
259	TRT2	4	18	210
260	TRT2	4	19	220
261	TRT2	4	8	190
262	TRT2	4	20	290
263	TRT2	4	18	220
264	TRT2	4	18	170
265	TRT2	4	18	200
266	TRT2	4	19	230
267	TRT2	4	16	150
268	TRT2	4	18	200
269	TRT2	4	18	200
270	TRT2	4	16	160
271	TRT2	4	20	310
272	TRT3	1	18	180
273	TRT3	1	18	190
274	TRT3	1	17	170
275	TRT3	1	18	220
276	TRT3	1	17	150
277	TRT3	1	17	150
278	TRT3	1	18	180
279	TRT3	1	17	180
280	TRT3	1	19	230
281	TRT3	1	20	260
282	TRT3	1	12	60
283	TRT3	1	16	120
284	TRT3	1	17	160
285	TRT3	1	19	190
286	TRT3	1	18	220
287	TRT3	2	15	110
288	TRT3	2	18	180
289	TRT3	2	15	100
290	TRT3	2	18	200
291	TRT3	2	20	240
292	TRT3	2	16	150
293	TRT3	2	17	150
294	TRT3	2	20	260
295	TRT3	2	18	170
296	TRT3	2	17	160
297	TRT3	2	19	200
298	TRT3	2	18	200
299	TRT3	2	18	170
300	TRT3	2	18	180
301	TRT3	2	16	120
302	TRT3	2	17	160
303	TRT3	3	18	180
304	TRT3	3	17	170
305	TRT3	3	20	230
306	TRT3	3	18	180
307	TRT3	3	17	150
308	TRT3	3	17	150
309	TRT3	3	19	200
310	TRT3	3	18	180
311	TRT3	3	15	80
312	TRT3	3	16	130
313	TRT3	3	18	210
314	TRT3	3	18	160
315	TRT3	3	18	200
316	TRT3	3	18	190
317	TRT3	3	18	200
318	TRT3	3	19	220
319	TRT3	3	18	180
320	TRT3	4	19	220

OBS	LEVEL	REP	LEN	WT
321	TRT3	4	21	330
322	TRT3	4	18	210
323	TRT3	4	18	220
324	TRT3	4	20	240
325	TRT3	4	18	160
326	TRT3	4	18	210
327	TRT3	4	15	130
328	TRT3	4	16	140
329	TRT3	4	17	180
330	TRT3	4	18	190
331	TRT3	4	19	230
332	TRT3	4	19	220
333	TRT3	4	15	110
334	TRT3	4	15	100
335	TRT3	4	11	40
336	TRT4	1	15	100
337	TRT4	1	18	210
338	TRT4	1	14	70
339	TRT4	1	18	200
340	TRT4	1	16	140
341	TRT4	1	17	180
342	TRT4	1	16	130
343	TRT4	1	16	140
344	TRT4	1	17	170
345	TRT4	1	17	160
346	TRT4	1	17	180
347	TRT4	1	16	170
348	TRT4	1	18	160
349	TRT4	1	13	60
350	TRT4	1	16	150
351	TRT4	1	15	120
352	TRT4	2	17	160
353	TRT4	2	16	160
354	TRT4	2	16	150
355	TRT4	2	18	210
356	TRT4	2	18	200
357	TRT4	2	18	190
358	TRT4	2	17	170
359	TRT4	2	16	130
360	TRT4	2	17	170
361	TRT4	2	15	120
362	TRT4	2	18	190
363	TRT4	2	12	40
364	TRT4	2	16	150
365	TRT4	2	15	130
366	TRT4	2	18	170
367	TRT4	2	13	70
368	TRT4	2	7	40
369	TRT4	3	18	160
370	TRT4	3	15	110
371	TRT4	3	20	280
372	TRT4	3	15	110
373	TRT4	3	10	30
374	TRT4	3	12	50
375	TRT4	3	20	220
376	TRT4	3	18	220
377	TRT4	3	19	230
378	TRT4	3	18	190
379	TRT4	3	18	180
380	TRT4	3	18	170
381	TRT4	4	18	170
382	TRT4	4	20	230
383	TRT4	4	20	260
384	TRT4	4	18	180

DDVP Technical Grade: Effects to the ELS of Sheephead Minnows
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OBS	LEVEL	REP	LEN	WT
385	TRT4	4	20	270
386	TRT4	4	18	200
387	TRT4	4	18	210
388	TRT5	1	15	90
389	TRT5	1	13	70
390	TRT5	1	16	140
391	TRT5	1	19	210
392	TRT5	1	18	210
393	TRT5	1	16	140
394	TRT5	2	13	70
395	TRT5	2	13	80
396	TRT5	2	11	40
397	TRT5	2	14	100
398	TRT5	2	15	130
399	TRT5	2	13	70
400	TRT5	2	15	130
401	TRT5	2	15	120
402	TRT5	2	14	130
403	TRT5	3	17	180
404	TRT5	3	13	70
405	TRT5	4	19	230
406	TRT5	4	17	180

DDVP Technical Grade: Effects to the ELS of Sheephead Minnows
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	LEVEL			
	CONTROL	SOL_CONT	TRT1	TRT2
	MEAN	MEAN	MEAN	MEAN
LEN	17.37	17.35	17.63	17.45
WT	171.43	172.65	178.97	184.15

(CONTINUED)

DDVP Technical Grade: Effects to the ELS of Sheephead Minnows
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	LEVEL		
	TRT3	TRT4	TRT5
	MEAN	MEAN	MEAN
LEN	17.50	16.52	15.05
WT	177.34	158.85	125.79

DDVP Technical Grade: Effects to the ELS of Sheephead Minnows
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LEVEL=CONTROL

Variable	N	Mean	Std Dev	CV
REP	70	2.443	1.163	47.594
LEN	70	17.371	2.456	14.141
WT	70	171.429	62.282	36.331

LEVEL=SOL_CONT

Variable	N	Mean	Std Dev	CV
REP	68	2.412	1.149	47.646
LEN	68	17.353	2.086	12.021
WT	68	172.647	49.884	28.894

LEVEL=TRT1

Variable	N	Mean	Std Dev	CV
REP	68	2.471	1.126	45.574
LEN	68	17.632	1.445	8.193
WT	68	178.971	43.405	24.253

LEVEL=TRT2

Variable	N	Mean	Std Dev	CV
REP	65	2.446	1.132	46.291
LEN	65	17.446	2.031	11.643
WT	65	184.154	52.823	28.684

LEVEL=TRT3

Variable	N	Mean	Std Dev	CV
REP	64	2.531	1.112	43.941
LEN	64	17.500	1.746	9.976
WT	64	177.344	49.256	27.774

LEVEL=TRT4

Variable	N	Mean	Std Dev	CV
REP	52	2.192	1.030	46.970
LEN	52	16.519	2.532	15.328
WT	52	158.846	57.791	36.382

DDVP Technical Grade: Effects to the ELS of Sheephead Minnows
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LEVEL=TRT5

Variable	N	Mean	Std Dev	CV
REP	19	2.000	0.943	47.140
LEN	19	15.053	2.223	14.768
WT	19	125.789	55.409	44.049

DDVP Technical Grade: Effects to the ELS of Sheephead Minnows
1. ANALYSIS OF Length

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General Linear Models Procedure
Class Level Information

Class Levels Values
 LEVEL 7 CONTROL SOL_CONT TRT1 TRT2 TRT3 TRT4 TRT5

Number of observations in data set = 406

DDVP Technical Grade: Effects to the ELS of Sheepshead Minnows.

1. ANALYSIS OF Length

02:25 Tuesday, February 6, 1996

General Linear Models Procedure
 Type I Estimable Functions for: LEVEL

Effect Coefficients

INTERCEPT		0
LEVEL	CONTROL	L2
	SOL_CONT	L3
	TRT1	L4
	TRT2	L5
	TRT3	L6
	TRT4	L7
	TRT5	-L2-L3-L4-L5-L6-L7

DDVP Technical Grade: Effects to the ELS of Sheepshead Minnows

1. ANALYSIS OF Length

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General Linear Models Procedure

Dependent Variable: LEN

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	137.48194	22.91366	5.32	0.0001
Error	399	1719.67077	4.30995		
Corrected Total	405	1857.15271			
	R-Square	C.V.	Root MSE	LEN Mean	
	0.074028	12.05138	2.0760	17.227	

Source	DF	Type I SS	Mean Square	F Value	Pr > F
LEVEL	6	137.48194	22.91366	5.32	0.0001

DDVP Technical Grade: Effects to the ELS of Sheepshead Minnows

1. ANALYSIS OF Length

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General Linear Models Procedure
 Least Squares Means

LEVEL	LEN LSMEAN	LSMEAN Number
CONTROL	17.3714286	1

SOL_CONT 17.3529412 2
 TRT1 17.6323529 3
 TRT2 17.4461538 4
 TRT3 17.5000000 5
 TRT4 16.5192308 6
 TRT5 15.0526316 7

Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

i/j	1	2	3	4	5	6	7
1		0.9583	0.4609	0.8346	0.7205	0.0255	0.0001
2	0.9583		0.4330	0.7959	0.6844	0.0298	0.0001
3	0.4609	0.4330		0.6054	0.7145	0.0038	0.0001
4	0.8346	0.7959	0.6054		0.8830	0.0169	0.0001
5	0.7205	0.6844	0.7145	0.8830		0.0118	0.0001
6	0.0255	0.0298	0.0038	0.0169	0.0118		0.0087
7	0.0001	0.0001	0.0001	0.0001	0.0001	0.0087	

NOTE: To ensure overall protection level, only probabilities associated with pre-planned comparisons should be used.

DDVP Technical Grade: Effects to the ELS of Sheepshead Minnows

1. ANALYSIS OF Length

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General Linear Models Procedure

Tukey's Studentized Range (HSD) Test for variable: LEN

NOTE: This test controls the type I experimentwise error rate.

Alpha= 0.05 Confidence= 0.95 df= 399 MSE= 4.309952
 Critical Value of Studentized Range= 4.191

Comparisons significant at the 0.05 level are indicated by '***'.

LEVEL Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit
TRT1 - TRT3	-0.9391	0.1324	1.2038
TRT1 - TRT2	-0.8810	0.1862	1.2534
TRT1 - CONTROL	-0.7866	0.2609	1.3085
TRT1 - SOL_CONT	-0.7757	0.2794	1.3345
TRT1 - TRT4	-0.0202	1.1131	2.2465
TRT1 - TRT5	0.9832	2.5797	4.1762

TRT3 - TRT1	-1.2038	-0.1324	0.9391
TRT3 - TRT2	-1.0295	0.0538	1.1372
TRT3 - CONTROL	-0.9354	0.1286	1.1926
TRT3 - SOL_CONT	-0.9244	0.1471	1.2185
TRT3 - TRT4	-0.1678	0.9808	2.1294
TRT3 - TRT5	0.8400	2.4474	4.0547

TRT2 - TRT1	-1.2534	-0.1862	0.8810
TRT2 - TRT3	-1.1372	-0.0538	1.0295
TRT2 - CONTROL	-0.9850	0.0747	1.1345
TRT2 - SOL_CONT	-0.9740	0.0932	1.1604
TRT2 - TRT4	-0.2177	0.9269	2.0716
TRT2 - TRT5	0.7890	2.3935	3.9980

CONTROL - TRT1	-1.3085	-0.2609	0.7866
CONTROL - TRT3	-1.1926	-0.1286	0.9354
CONTROL - TRT2	-1.1345	-0.0747	0.9850
CONTROL - SOL_CONT	-1.0291	0.0185	1.0660
CONTROL - TRT4	-0.2741	0.8522	1.9785

CONTROL - TRT5	0.7273	2.3188	3.9103	***
SOL_CONT - TRT1	-1.3345	-0.2794	0.7757	
SOL_CONT - TRT3	-1.2185	-0.1471	0.9244	
SOL_CONT - TRT2	-1.1604	-0.0932	0.9740	
SOL_CONT - CONTROL	-1.0660	-0.0185	1.0291	
SOL_CONT - TRT4	-0.2997	0.8337	1.9671	
SOL_CONT - TRT5	0.7038	2.3003	3.8968	***

TRT4 - TRT1	-2.2465	-1.1131	0.0202	
TRT4 - TRT3	-2.1294	-0.9808	0.1678	
TRT4 - TRT2	-2.0716	-0.9269	0.2177	
TRT4 - CONTROL	-1.9785	-0.8522	0.2741	
TRT4 - SOL CONT	-1.9671	-0.8337	0.2997	
TRT4 - TRT5	-0.1826	1.4666	3.1158	

TRT5 - TRT1	-4.1762	-2.5797	-0.9832	***
TRT5 - TRT3	-4.0547	-2.4474	-0.8400	***
TRT5 - TRT2	-3.9980	-2.3935	-0.7890	***
TRT5 - CONTROL	-3.9103	-2.3188	-0.7273	***
TRT5 - SOL CONT	-3.8968	-2.3003	-0.7038	***

DDVP Technical Grade: Effects to the ELS of Sheepshead Minnows

1. ANALYSIS OF Length

02:25 Tuesday, February 6, 1996

General Linear Models Procedure

LEVEL Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit
TRT5 - TRT4	-3.1158	-1.4666	0.1826

DDVP Technical Grade: Effects to the ELS of Sheepshead Minnows

1. ANALYSIS OF Length

02:25 Tuesday, February 6, 1996

General Linear Models Procedure

Dunnett's One-tailed T tests for variable: LEN

NOTE: This tests controls the type I experimentwise error for comparisons of all treatments against a control.

Alpha= 0.05 Confidence= 0.95 df= 399 MSE= 4.309952
Critical Value of Dunnett's T= 2.324

Comparisons significant at the 0.05 level are indicated by '***'.

LEVEL Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit	
TRT1 - CONTROL	-0.5606	0.2609	1.0824	
TRT3 - CONTROL	-0.7058	0.1286	0.9630	
TRT2 - CONTROL	-0.7563	0.0747	0.9058	
SOL CONT - CONTROL	-0.8400	-0.0185	0.8030	
TRT4 - CONTROL	-1.7355	-0.8522	0.0311	
TRT5 - CONTROL	-3.5668	-2.3188	-1.0707	***

DDVP Technical Grade: Effects to the ELS of Sheepshead Minnows

2. ANALYSIS OF Weight

02:25 Tuesday, February 6, 1996

General Linear Models Procedure
Class Level Information

Class	Levels	Values
LEVEL	7	CONTROL SOL_CONT TRT1 TRT2 TRT3 TRT4 TRT5

Number of observations in data set = 406

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General Linear Models Procedure
Type I Estimable Functions for: LEVEL

Effect Coefficients

INTERCEPT	0
LEVEL CONTROL	L2
SOL CONT	L3
TRT1	L4
TRT2	L5
TRT3	L6
TRT4	L7
TRT5	-L2-L3-L4-L5-L6-L7

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General Linear Models Procedure

Dependent Variable: WT

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	64348.886	10724.814	3.83	0.0010
Error	399	1117629.440	2801.076		
Corrected Total	405	1181978.325			
	R-Square	C.V.	Root MSE	WT Mean	
	0.054442	30.74933	52.925	172.12	

Source	DF	Type I SS	Mean Square	F Value	Pr > F
LEVEL	6	64348.886	10724.814	3.83	0.0010

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General Linear Models Procedure
Least Squares Means

LEVEL	WT LSMEAN	LSMEAN Number
CONTROL	171.428571	1
SOL_CONT	172.647059	2
TRT1	178.970588	3
TRT2	184.153846	4
TRT3	177.343750	5
TRT4	158.846154	6
TRT5	125.789474	7

Pr > |T| H0: LSMEAN(i)=LSMEAN(j)

i/j	1	2	3	4	5	6	7
1		0.8925	0.4031	0.1635	0.5185	0.1948	0.0009
2	0.8925		0.4864	0.2108	0.6106	0.1577	0.0007
3	0.4031	0.4864		0.5727	0.8600	0.0397	0.0001
4	0.1635	0.2108	0.5727		0.4654	0.0105	0.0001
5	0.5185	0.6106	0.8600	0.4654		0.0619	0.0002
6	0.1948	0.1577	0.0397	0.0105	0.0619		0.0203
7	0.0009	0.0007	0.0001	0.0001	0.0002	0.0203	

NOTE: To ensure overall protection level, only probabilities associated with pre-planned comparisons should be used.

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General Linear Models Procedure

Tukey's Studentized Range (HSD) Test for variable: WT

NOTE: This test controls the type I experimentwise error rate.

Alpha= 0.05 Confidence= 0.95 df= 399 MSE= 2801.076
Critical Value of Studentized Range= 4.191

Comparisons significant at the 0.05 level are indicated by '****'.

LEVEL Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit
TRT2 - TRT1	-22.023	5.183	32.390
TRT2 - TRT3	-20.809	6.810	34.429
TRT2 - SOL_CONT	-15.700	11.507	38.713
TRT2 - CONTROL	-14.291	12.725	39.741
TRT2 - TRT4	-3.873	25.308	54.488
TRT2 - TRT5	17.460	58.364	99.269
TRT1 - TRT2	-32.390	-5.183	22.023
TRT1 - TRT3	-25.688	1.627	28.942
TRT1 - SOL_CONT	-20.575	6.324	33.222
TRT1 - CONTROL	-19.163	7.542	34.247
TRT1 - TRT4	-8.769	20.124	49.018
TRT1 - TRT5	12.482	53.181	93.881
TRT3 - TRT2	-34.429	-6.810	20.809
TRT3 - TRT1	-28.942	-1.627	25.688
TRT3 - SOL_CONT	-22.618	4.697	32.012
TRT3 - CONTROL	-21.210	5.915	33.040
TRT3 - TRT4	-10.784	18.498	47.779
TRT3 - TRT5	10.578	51.554	92.531
SOL_CONT - TRT2	-38.713	-11.507	15.700

SOL_CONT - TRT1	-33.222	-6.324	20.575
SOL_CONT - TRT3	-32.012	-4.697	22.618
SOL_CONT - CONTROL	-25.487	1.218	27.924
SOL_CONT - TRT4	-15.092	13.801	42.694
SOL_CONT - TRT5	6.158	46.858	87.557
CONTROL - TRT2	-39.741	-12.725	14.291
CONTROL - TRT1	-34.247	-7.542	19.163
CONTROL - TRT3	-33.040	-5.915	21.210
CONTROL - SOL_CONT	-27.924	-1.218	25.487
CONTROL - TRT4	-16.131	12.582	41.296
CONTROL - TRT5	5.067	45.639	86.211
TRT4 - TRT2	-54.488	-25.308	3.873
TRT4 - TRT1	-49.018	-20.124	8.769
TRT4 - TRT3	-47.779	-18.498	10.784
TRT4 - SOL_CONT	-42.694	-13.801	15.092
TRT4 - CONTROL	-41.296	-12.582	16.131
TRT4 - TRT5	-8.988	33.057	75.101
TRT5 - TRT2	-99.269	-58.364	-17.460
TRT5 - TRT1	-93.881	-53.181	-12.482
TRT5 - TRT3	-92.531	-51.554	-10.578
TRT5 - SOL_CONT	-87.557	-46.858	-6.158
TRT5 - CONTROL	-86.211	-45.639	-5.067

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LEVEL Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit
TRT5 - TRT4	-75.101	-33.057	8.988

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General Linear Models Procedure

Dunnnett's One-tailed T tests for variable: WT

NOTE: This tests controls the type I experimentwise error for comparisons of all treatments against a control.

Alpha= 0.05 Confidence= 0.95 df= 399 MSE= 2801.076
Critical Value of Dunnnett's T= 2.324

Comparisons significant at the 0.05 level are indicated by '****'.

LEVEL Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit
TRT2 - CONTROL	-8.461	12.725	33.911
TRT1 - CONTROL	-13.400	7.542	28.484
TRT3 - CONTROL	-15.356	5.915	27.187
SOL_CONT - CONTROL	-19.724	1.218	22.161
TRT4 - CONTROL	-35.100	-12.582	9.935
TRT5 - CONTROL	-77.456	-45.639	-13.822