

US EPA ARCHIVE DOCUMENT

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

EPA MRID Number 458677-11

Data Requirement:

EPA DP Barcode D288775

EPA MRID 458677-11

EPA Guideline 70-1(Special Study)

Test material:

Purity: not reported

Common name: Atrazine

Chemical name: IUPAC

CAS name 6-chloro-N-ethyl-N'-(1-methylethyl)-1,3,5-triazine-2,4-diamine

CAS No. 1912-24-9

Synonyms

EPA PC Code: 80803

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EPA PC Code 080803

Date Evaluation Completed: 06/01/2003

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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CITATION: Du Preez, L., K. R. Solomon and A. M. 2003. Exposure of *Xenopus laevis* larvae to different concentrations of atrazine in semi-natural microcosms. School of Environmental Sciences and Development, Zoology Department, Potchefstroom University of CHE, Potchefstroom 2520, South Africa. Sponsor: Syngenta Crop Protection, Inc., Laboratory Study ID ECORISK Number SA-01-D.

EXECUTIVE SUMMARY:

This is an interim report to assess the effects of atrazine on gonadal abnormalities in *Xenopus laevis* metamorphs through the use of microcosm studies. *X. laevis* adults were collected from an earthen pond north (pond C6) of Potchefstroom, South Africa, based on the reported absence of atrazine use and corn production in its watershed and the presence of *X. laevis*. Adults were induced to spawn in the laboratory and the 96-hr old progeny were divided among 4 treatments (0, 1, 10 and 25 µg/L atrazine) with three replicates per treatment (800 tadpoles per replicate). Microcosms consisted of 1600-L cement tanks, lined with polyethylene with a 3-cm sand bottom, and filled with 1,100 L of tap water. Larvae were exposed until they reached NF stage 66 (forelimb emergence and complete tail resorption); the study was terminated after 133 days of exposure. A total of 150 stage-66 frogs were sampled per treatment. Snout-vent length, weight, days to stage 66 (metamorphosis) were recorded and animals were examined for gross gonadal morphology.

Mean measured concentrations of atrazine ranged from 0.9 to 1.82, 10 to 15.9 and 23.8 to 39.7 µg/L for the 1, 10 and 25 µg/L nominal treatments, respectively. Atrazine in reference tanks ranged from 0 to 0.1 µg/L. Although some animals reached stage 66 by 70 days, the majority did not reach metamorphosis until between 126 to 133 days. The study authors attributed low water temperatures to the delayed development of the tadpoles. Based on gross morphology, the incidence of gonadal deformities in 1, 10 and 25 µg/L atrazine groups was 1.3, 0.7 and 3.3% of the total frogs examined (150), respectively; reference frogs exhibited a 4% incidence of gonadal deformities. Discontinuous testis was the only gonadal abnormality identified; no abnormalities were observed in the ovaries except for one ovary that was reduced in size. Males comprised 48%, 39% and 47% of the 1.0, 10 and 25 µg/L atrazine-treated samples, respectively, while the reference samples was 45% male.

This interim microcosm study represents a reasonable step forward in testing for effects observed in the laboratory and may provide useful information when all the analyses are completed. The present study, though, showed that developmental rates across all treatments, in terms of time to metamorphosis, were delayed. Fluctuating water quality in the microcosm units may have impacted the developmental rate. Additionally, the study was designed with the assumption that phytoplankton growth would serve as a source of food for developing tadpoles. Although the authors note that phytoplankton “flourished,” no measure (*e.g.*, chlorophyll *a* concentration) of phytoplankton growth was reported and supplemental food (rabbit pellets) had to be provided to the developing tadpoles. However, phytoplankton growth could have been significantly limited by atrazine treatment, thereby resulting in indirect effects of atrazine on development. In support of this possibility, atrazine-treated male and female frogs were significantly smaller in terms of length and weight than their “untreated” counterparts, further complicating interpretation of the study results. This assessment was based on gross morphology alone, and the results may change when histology is completed.

I. MATERIALS AND METHODS

GUIDELINE FOLLOWED: Nonguideline Study
COMPLIANCE: Not conducted in accordance with the Good Laboratory Practices as outlined in 40 CFR Part 160, August 19, 1989. However, GLP elements were incorporated into study conduct including:

- This study was conducted in accordance with a written protocol, signed by the Study Director and Principal Investigator
- Standard Operating Procedures were developed/available for official activities.
- Protocol amendments/deviations were written and signed by the Study Director.

A. MATERIALS:

1. Test Material Atrazine

Description: Not reported

Lot No./Batch No. : Not reported

Purity: Not reported

Stability of compound under Test Conditions: Not reported

Storage conditions of test chemicals: Not reported

2. Test organism:

Species: African clawed frog (*Xenopus laevis*)

Age at test initiation: 96-hr larvae

Weight at study initiation (mean and range): Not reported

Length at study initiation (mean and range): Not reported

Source: Adult *X. laevis* obtained from earthen pond (C6) 16 km north of the city of Potchefstroom, South Africa.

B. STUDY DESIGN:

Objective: 1. To assess the effects of exposure to atrazine on gonadal abnormalities in *Xenopus laevis* metamorphs and sub-adults under semi-natural conditions in microcosms.

1. Experimental Conditions

a) Range-finding Study:

b) Definitive Study

Table 1 . Experimental Parameters

Parameter	Details
Acclimation: period: Conditions: (same as test or not) Feeding: Health: (any mortality observed)	Microcosms stabilized for 5 months Adults paired and injected with chorionic gonadotropin (Pregnyl®) to induce spawning and placed in 300 x 240 x 240 mm spawning tanks at 30°C. After spawning, adults were removed from tanks and water was oxygenated.
Duration of the test	NF Stage 66 (forelimb emergence and tail resorbtion) or 19 weeks total exposure whichever came first.
Test condition static/flow- through Type of dilution system for flow-through method. Renewal rate for static renewal	static water maintained at 1,100 L mark by addition of tap water when necessary
Aeration, if any	not reported
Test vessel Material: (glass/stainless steel) Size: Fill volume:	Cement with polyethylene liner 2.25 m x 0.6 m x 1.2 m = 1.62 m ³ (1,620 L) 1,100 L plastic liner covered with 3-cm layer of sandy soil
Source of dilution water Quality:	Tap water

Parameter	Details
<p>Water parameters:</p> <p>Hardness</p> <p>pH</p> <p>Dissolved oxygen</p> <p>Total Organic carbon</p> <p>Particulate Matter</p> <p>Ammonia</p> <p>Nitrite</p> <p>Metals</p> <p>Pesticides</p> <p>Chlorine</p> <p>Temperature</p> <p>{Salinity for marine or estuarine species}</p> <p>Intervals of water quality measurement</p>	<p>Measured every Thursday mid-morning.</p>
<p>Number of replicates/groups: negative control: water treated ones:</p>	<p>3</p>
<p>Number of organisms per replicate /groups:</p>	<p>800 (from two separate spawns: 600 from on Sept. 5th and 200 from Sept. 12th)</p>
<p>Biomass loading rate</p>	<p>800 tadpoles per 1,100 L</p>
<p>Test concentrations: nominal: measured:</p>	<p>1, 10 and 25 µg/L 0.91 - 1.82 µg/L; 10 - 15.9 µg/L; 23.8 - 39.7 µg/L</p>
<p>Solvent (type, percentage, if used)</p>	<p>none</p>
<p>Lighting</p>	<p>natural sunlight</p>
<p>Feeding</p>	<p>supplemental rabbit food (Complete Rabbit Pellets); 20 grams homogenized in 500 ml of tap water provided once per week but later twice per week.</p>

Parameter	Details
Recovery of chemical	GC/MS used to measure atrazine
Level of Quantitation Level of Detection	0.1 µg/L
Positive control {if used, indicate the chemical and concentrations}	None
Other parameters, if any	

2. Observations:

Table 2: Observations

Criteria	Details
Parameters measured including the sublethal effects/toxicity symptoms	body weight, snout-vent length, time (days) to metamorphosis; gross morphology and histology of gonads.
Observation intervals	Every 14 days 1-L water samples collected for atrazine measurement; water chemistry weekly. From 11/5/02 until mid-January 2003, metamorphs removed from microcosms every 2 nd day.
Were raw data included?	Yes
Other observations, if any	

Report notes that 800 tadpoles per microcosm were well below the effective density of 1 tadpole/L for a frog to reach metamorphosis successfully (Weldon 1999). *Xenopus* bucket traps baited with marrow bones used to catch metamorphs.

The report notes that 150 metamorphs were collected from each treatment. The researchers attempted to collect 50 from each of the three replicates; however, they were apparently unable to do this in all cases and therefore had to sample more from one replicate than the others. According to the protocol, no more than 75 metamorphs would be collected from a single tank.

II. RESULTS and DISCUSSION: [All results discussed in this section and the next are those reported by the study authors. Although supplemental data are typically used in a qualitative manner only, EFED verified spreadsheet data and ran basic statistical analyses on the major study parameters. See attached appendix. If results differed in any substantive way, the difference was reported in the text below.]

Atrazine concentrations were relatively consistent with nominal levels. On one occasion, atrazine was detected in one of the reference microcosms at a concentration equal to the method detection limit (0.1 µg/L).

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Microcosms were colder than natural water bodies (no data provided). Extensive early mortality was observed in microcosm 1 (1 µg/L), while extensive mortality and slow development was observed in microcosm 8(10 µg/L); both were excluded from the analysis.

First metamorphs reached development stage 66 in the 10th week. Collection of metamorphs terminated in week 19 when the target number (150/treatment) was reached. The majority of frogs reaching stage 66 appears to have occurred between 126 and 133 days of exposure.

All 600 specimens (150 frogs/treatment * 4 treatments) were examined visually and under a dissecting microscope for gonadal deformities. Of the total number of frogs exposed to 1, 10 and 25 µg/L of atrazine, 1.33%, 0.67% and 3.33% exhibited gonadal deformities, respectively, compared to 4% in reference microcosms. No intersex gonads were observed. Discontinuous testis was the most frequently observed anomaly and ranged from 1.7% to 7.1% in atrazine -treated animals and 8.8% in controls. No gonadal abnormalities were detected in females except for one female with a reduced-size ovary. The study concludes that based on gross morphology, atrazine had no adverse effect on gonadal development at mean concentrations ranging from 1.4 to 30.8 µg/L under semi-field conditions.

Table 3. Total number of frogs examined and percentage of gonadal deformities.

Nominal Concentration (measured) µg/L	Frogs Collected	Total Number		Gonadal Abnormalities	Percent Gonadal Abnormalities	
		Males	Females		Total Frogs	Males
0 (0 - 0.1)	150	68	82	6	4.0	8.8
1 (0.91 - 1.82)	150	72	78	2	1.3	2.8
10 (10 - 15.9)	150	59	91	1	0.7	1.7
25 (23.8 - 39.7)	150	70	80	5	3.3	7.1

C. REPORTED STATISTICS: Little to no statistics are reported in this interim report.

D. VERIFICATION OF STATISTICAL RESULTS: Statistical analyses run using SAS[®] (Statistical Analysis System, Release 8.01, Cary, North Carolina); see attached output.

E. STUDY DEFICIENCIES: The purity of atrazine used to make up exposure solutions was not reported. The length of exposure for test animals differed; one group consisting of 600 were exposed for approximately one week longer than the complement of 200 additional animals added later. Tap water was used as the

source of dilution water. Dissolved oxygen in several of the microcosms dropped below 3 mg/L. Exposure tanks were not all at the same temperature, but were dependent on the amount of shade from a nearby tree. The number of animals sampled from each replicate may have been different; a total of 150 were sampled from each treatment, but up to 75 may have been sampled from a replicate rather than 50 from each replicate. Atrazine was detected at 0.1 µg/L (detection limit of method) in a reference tank (microcosm 3)

F. REVIEWER'S COMMENTS:

Frogs were collected from site C6 because of the absence of atrazine use in the watershed; however, this site was characterized in previous studies (Smith *et al.* 2003) as having measurable atrazine concentrations averaging 0.15 µg/L. Although this concentration is relatively low, it does represent a level that has been reported to cause gonadal deformities in males (Hayes *et al.* 2002). The potential for gonadal deformities in the control limits the usefulness of this study in testing the hypothesis. .

The conditions under which the tests were conducted probably resulted in poor water quality, which contributed to the relatively retarded development, although low temperatures in the initial few weeks of the study were also a factor. However, the exposure media was never changed and the total volume was not replenished to make up for evaporative losses. This approach would lead to the accumulation of waste products, especially since the study was run for 19 weeks. Unfortunately, mortality was not evaluated throughout the study, so it is difficult to assess the appropriateness of the exposure protocol. All that one can tell is that a maximum of 75 organisms were sampled from any one tank, representing less than 10% of the initial set. It is unclear why the study started out with so many organisms in each tank.

Microcosms 1 and 8 reportedly exhibited extensive mortality early in the study and the authors alluded to possible temperature shock because microcosm 1 was shaded; however, several of the microcosms were shaded by trees and it is unclear why only one would have had such excessively low temperature. Also, temperature shock usually results from too high a temperature, not too low a temperature. Microcosm 8 exhibited slow metamorphosis and the frogs were not at stage 66 by 133 days. Although microcosms were excluded from the study, the cause of mortality and delayed development was not adequately characterized.

The method detection limit (0.1 µg/L) seems unusually high for GC/MS given that ELISA assays have a detection limit of 0.025 µg/L.

Frogs were relatively slow to reach metamorphosis stage 66. According to the authors, under controlled laboratory conditions of 20 - 25°C, *X. laevis* tadpoles take 58 days to complete metamorphosis (Nieuwkoop and Faber 1967) and under natural conditions where water temperatures may fluctuate widely, metamorphosis may take from 56 to 63 days, still a shorter period of time than the minimal 70 days required in the current study.

Because the test animals were added in two stages, exposure times differed. Animals (600) added to the tank first were exposed for roughly a week longer than the second complement (200) of animals added to bring the total number of tadpoles per microcosm to 800.

Although the first metamorphs reached stage 66 by 70 days, the majority of study animals did not reach stage 66 until 126 to 133 days, which implies that the study conditions delayed development and may have rendered the animals less sensitive to any developmental effects of atrazine should they exist.

Although raw water quality data were not provided, a series of figures depicted water temperature, pH, dissolved oxygen (DO) and conductivity over the study period. It appears from these graphs that something (perhaps a high rain event) happened around Day 90 to 100 that caused conductivity, temperature and pH to drop substantially. Conductivity in all but three of the exposure tanks tended to steadily increase from days 0 to 90; however, tanks 2,4, 6 and 9 had very erratic conductivity with steep declines. In tanks 4 and 6, conductivity plummeted Day 40 and in tank 2 conductivity plummeted by day 60.

By Day 100, dissolved oxygen in some replicates of the reference, 10 and 25 $\mu\text{g/L}$ treatments dropped below 2 mg/L. Dissolved oxygen and conductivity in the 25 $\mu\text{g/L}$ treatment were unusually variable relative to the other treatments. It is possible that the supplemental feeding resulted in food residues that increased conductivity during days 0 through 90 and that a high rain event may have resulted in a rapid influx of water that lowered conductivity and dissolved oxygen. The low oxygen content of the water is difficult to explain because water samples were collected mid-day when photosynthesis by phytoplankton should supplement dissolved oxygen levels. Heavy rain charged with carbon dioxide could have lowered DO; however, it should have also altered pH which does not appear to have occurred. However, given that the report states that very little rain fell during the study, it is uncertain why water quality changed so dramatically.

The study was intentionally designed to keep the loading rate below 1 tadpole per liter. Because the reference was from 1999, it suggests that the authors were aware that higher loading rates would have compromised the development of tadpoles.

Total time to metamorphosis cannot be determined from this study because an unknown number of animals were sacrificed by Day 133. It is likely that tadpoles could have died and not been accounted for during the course of the study. What is apparent, though, is that metamorphosis was considerably delayed for the majority of animals in this study.

Although no intersex gonads were observed, the current analysis is based on gross morphology alone and does not represent an analysis based on histology.

Although the stated objectives were to analyze snout-vent length (SVL) and mass, the report did not present an analysis of these data. In the table below, the mean SVL and mean mass for each treatment replicate were extracted from the appendix. No statistical analysis was done on this data set, but it appears as if there may be significant reductions in SVL and mass associated with atrazine exposure. EFED's analysis (see attached output) revealed that on average, male and female frogs not exposed to atrazine were longer 21.17 mm and 22.07 mm, respectively, than frogs from atrazine-treated groups (**Table 4**); non-exposed males and females also tended to weigh more, i.e., 1.08 and 1.20 g, respectively, than frogs treated with atrazine. Analysis of variance (see attached printout) revealed that both males and females were significantly larger in terms of weight ($p < 0.02$) and length ($p < 0.03$) than atrazine treated males and females. It is unclear whether the difference in size is due to the direct effects of atrazine on growth or whether it is due to reduced phytoplankton caused by atrazine treatment. At each treatment though, there was no difference in weight or length of males versus females.

Table 4. Summary of average male and female *Xenopus laevis* lengths and weights with associated standard deviations by atrazine concentration.

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Atrazine Concentration	Sex	Length	Standard Deviation	Weight	Standard Deviation
0	Female	21.17	3.80	1.08	0.75
0	Male	22.07	3.97	1.20	0.78
1	Female	18.55	2.70	0.70	0.32
1	Male	18.78	2.36	0.71	0.28
10	Female	18.82	3.36	0.73	0.51
10	Male	18.84	3.17	0.75	0.61
25	Female	17.50	3.11	0.59	0.40
25	Male	18.17	2.79	0.64	0.34

Similarly, there was no analysis on time to metamorphosis, as originally stated in the objective section of the study. However, given the method by which metamorphs were removed, and given the confounding effects of the differential exposure during the first week of the study, this analysis may not be possible. Individual treatment data for each tank is needed for Figure 2. Clearly, the data were collected for each tank, but for some reason they were not presented in this study. Also, some very large organisms were collected that were up to 4 to 6 times the mean weight of the entire sample, suggesting that these organisms were not collected at completion of metamorphosis, but some time much later.

In terms of the gonadal analysis, only the gonads of the first 150 stage 66 organisms in each treatment were evaluated. This sampling would bias the evaluation toward the faster developing organisms, which is not representative of the population being tested. Only 150 organisms were sampled, representing 6.25% of the original organisms in a treatment.

H. REFERENCES:

Hayes, T. B., A. Collins, M. Lee, M. Mendoza, N. Noriega, A. S. Stuart, and A. Vonk. 2002a. Hermaphroditic, demasculinized frogs after exposure to the herbicide atrazine at low ecologically relevant doses. *Proceedings of the National Academy of Sciences of the United States of America* 99(8): 5476 - 5480

Nieuwkoop, P. D. and J. Faber. 1967. Normal table of *Xenopus laevis* (Daudin). North-Holland Publishing Company, Amsterdam.

Smith, E. E., L. Du Preez, and K. Solomon. 2003. Gonadal and laryngeal responses to field exposure of *Xenopus laevis* to atrazine in areas of corn production in South Africa. The Institute of Environmental and Human Health, Texas Tech University, Lubbock, TX and School of Environmental Sciences and Development, Potchefstroom University for CHE, Potchefstroom, South Africa. Sponsor: Syngenta Crop Protection, Inc., Laboratory Study ID: ECORISK Number SA-01C.

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Weldon, C. 1999. The sustainable utilization of the African clawed frog *Xenopus laevis* (Daudin). M.Sc. Thesis. Department of Zoology and Entomology, University of the Orange Free State, Bloemfontein, South Africa.

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MEAN LENGTH AND WEIGHT FOR ALL FROGS COLLECTED AT EACH SITE

621

Obs	ATRAZINE	SITE	_TYPE_	_FREQ_	LENGTH	WEIGHT	L_SD	W_SD
1	0	12	0	61	21.3213	1.09951	4.09761	0.76949
2	0	3	0	67	21.5955	1.10149	3.49729	0.67835
3	0	7	0	22	22.2409	1.34364	4.50816	0.96341
4	1	11	0	75	17.5907	0.57760	1.82380	0.18347
5	1	4	0	75	19.7347	0.83400	2.70368	0.34261
6	10	10	0	75	18.1227	0.61533	1.63381	0.20565
7	10	5	0	75	19.5400	0.86227	4.22665	0.73003
8	25	2	0	75	18.4040	0.66387	2.59393	0.37961
9	25	6	0	47	17.5574	0.60936	3.52807	0.39261
10	25	9	0	28	16.5679	0.48536	2.52866	0.28908

MEAN LENGTH AND WEIGHT FOR MALE AND FEMALE FROGS COLLECTED AT EACH SITE

622

Obs	ATRAZINE	SITE	Sex	_TYPE_	_FREQ_	LENGTH	WEIGHT	L_SD	W_SD
1	0	12	F	0	29	20.5931	1.03276	4.17312	0.81263
2	0	12	M	0	32	21.9813	1.16000	3.97772	0.73595
3	0	3	F	0	41	21.5585	1.07951	3.24700	0.59480
4	0	3	M	0	26	21.6538	1.13615	3.92624	0.80419
5	0	7	F	0	12	21.2417	1.19250	4.70483	1.07726
6	0	7	M	0	10	23.4400	1.52500	4.17591	0.82481
7	1	11	F	0	39	17.4103	0.56821	1.99272	0.18953
8	1	11	M	0	36	17.7861	0.58778	1.62659	0.17879
9	1	4	F	0	39	19.6974	0.84026	2.85671	0.36757
10	1	4	M	0	36	19.7750	0.82722	2.56742	0.31844
11	10	10	F	0	47	18.0426	0.61362	1.66417	0.21999
12	10	10	M	0	28	18.2571	0.61821	1.60241	0.18286
13	10	5	F	0	43	19.6791	0.86488	4.40317	0.68274
14	10	5	M	0	32	19.3531	0.85875	4.03908	0.80039
15	25	2	F	0	41	18.4561	0.68610	2.88037	0.44866
16	25	2	M	0	34	18.3412	0.63706	2.24150	0.27891
17	25	6	F	0	21	17.1619	0.57143	3.59256	0.39082
18	25	6	M	0	26	17.8769	0.64000	3.51287	0.39905
19	25	9	F	0	19	15.8316	0.41368	2.22862	0.18860
20	25	9	M	0	9	18.1222	0.63667	2.52971	0.40503

MEAN LENGTH AND WEIGHT FOR MALE AND FEMALE FROGS BY ATRAZINE CONC

623

Obs	ATRAZINE	Sex	_TYPE_	_FREQ_	LENGTH	WEIGHT	L_SD	W_SD
1	0	F	0	82	21.1707	1.07951	3.79852	0.75050
2	0	M	0	68	22.0706	1.20456	3.97068	0.77549
3	1	F	0	78	18.5538	0.70423	2.70405	0.32116
4	1	M	0	72	18.7806	0.70750	2.35723	0.28334
5	10	F	0	90	18.8244	0.73367	3.35507	0.51080
6	10	M	0	60	18.8417	0.74650	3.17032	0.60543
7	25	F	0	81	17.5049	0.59247	3.10676	0.39879
8	25	M	0	69	18.1377	0.63812	2.78832	0.34000

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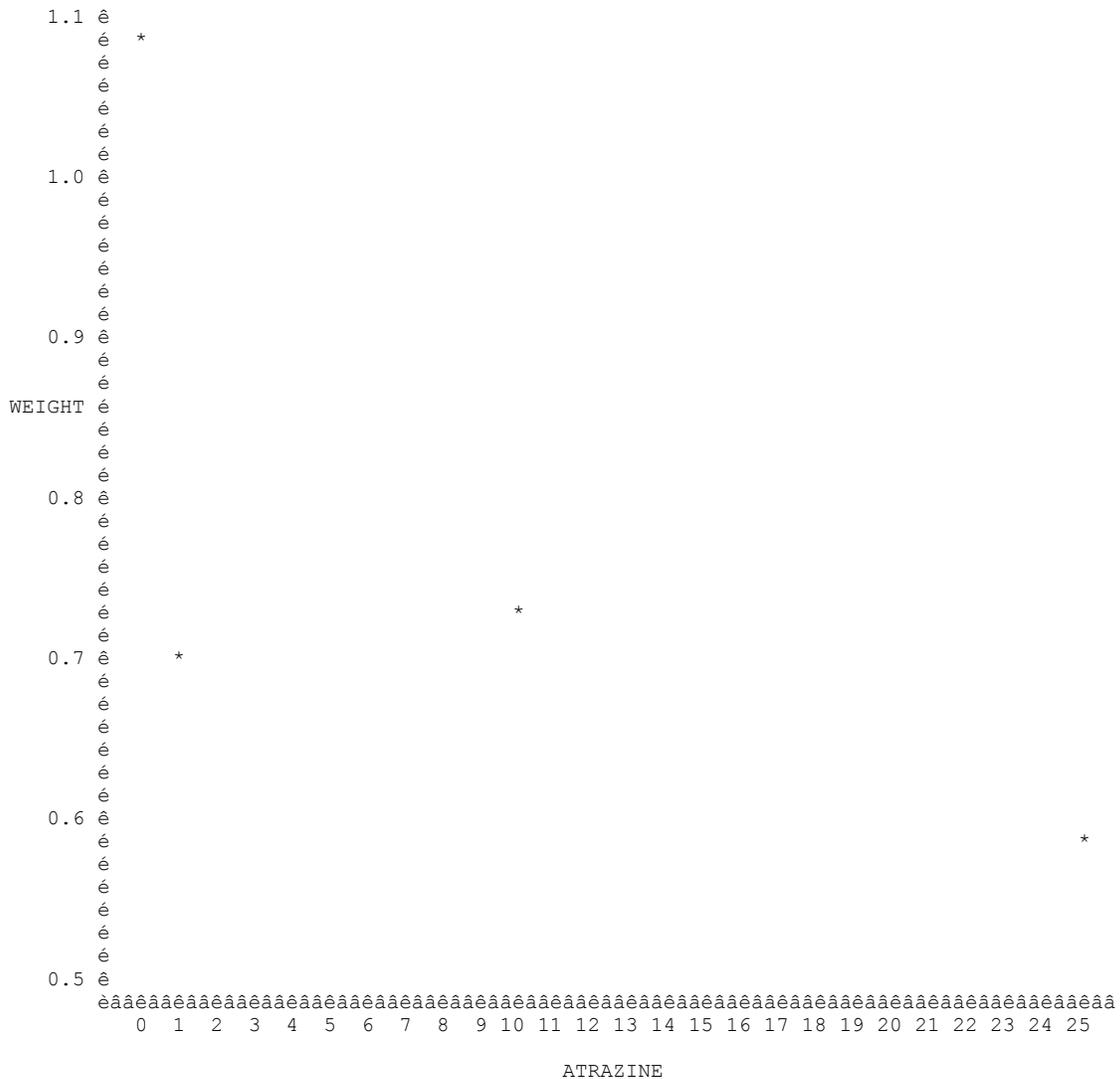
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PLOT OF FROG WEIGHT OVER ATRAZINE CONCENTRATION FOR MALE AND FEMALE FROGS

624

----- Sex=F -----

Plot of WEIGHT*ATRAZINE. Symbol used is '*'.



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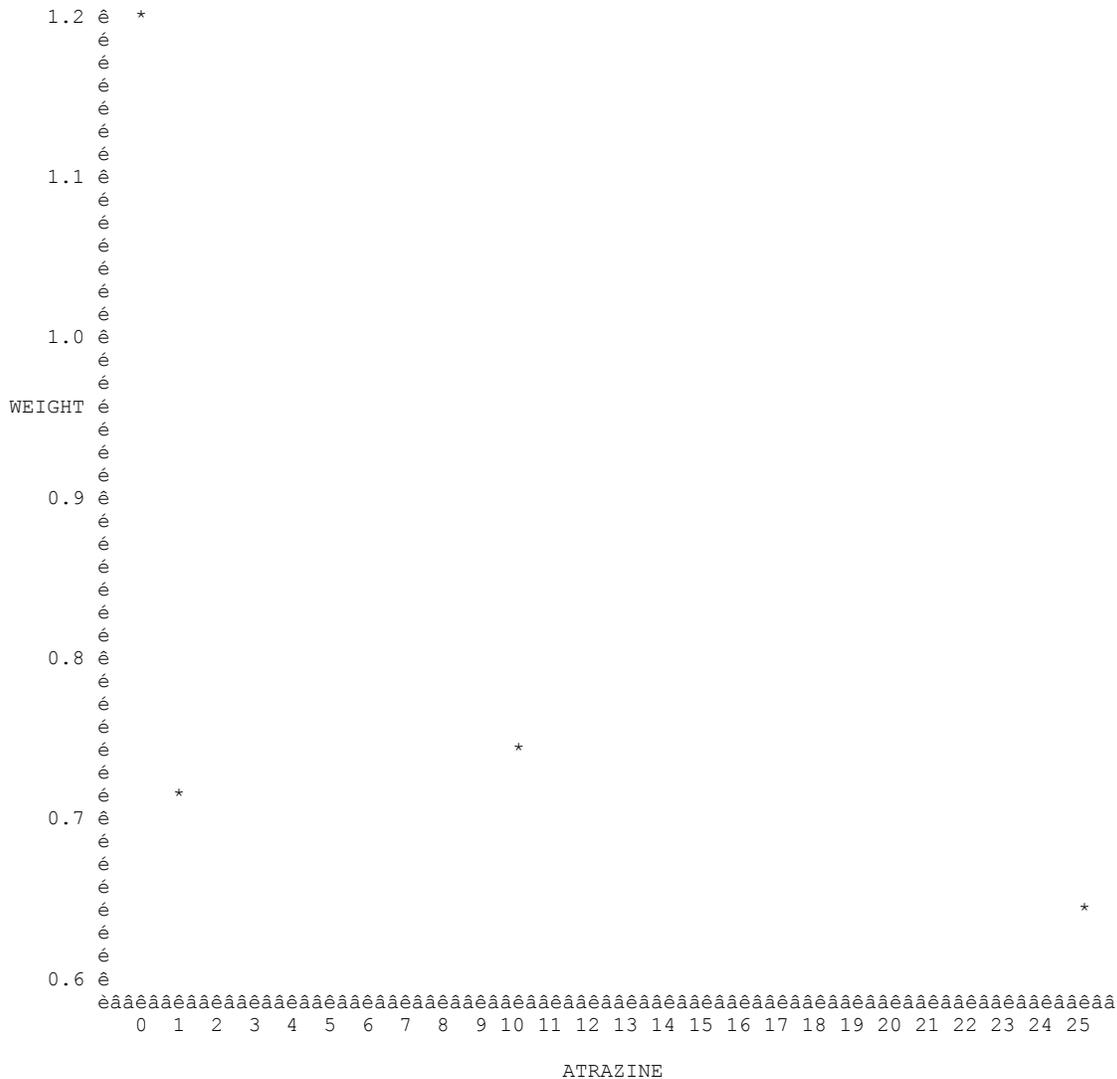
EPA MRID Number 458677-11

PLOT OF FROG WEIGHT OVER ATRAZINE CONCENTRATION FOR MALE AND FEMALE FROGS

625

----- Sex=M -----

Plot of WEIGHT*ATRAZINE. Symbol used is '*'.



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ANALYSIS OF VARIANCE FOR FROG WEIGHT BETWEEN TREATMENT GROUPS BY SEX

626

----- Sex=F -----

The GLM Procedure

Class Level Information

Class	Levels	Values
ATRAZINE	4	0 1 10 25

Number of observations 331

Dependent Variable: MASS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	10.8440965	3.6146988	13.21	<.0001
Error	327	89.5108805	0.2737336		
Corrected Total	330	100.3549770			

R-Square	Coeff Var	Root MSE	MASS Mean
0.108057	67.26132	0.523196	0.777855

Source	DF	Type I SS	Mean Square	F Value	Pr > F
ATRAZINE	3	10.84409653	3.61469884	13.21	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
ATRAZINE	3	10.84409653	3.61469884	13.21	<.0001

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ANALYSIS OF VARIANCE FOR FROG WEIGHT BETWEEN TREATMENT GROUPS BY SEX

628

----- Sex=M -----

The GLM Procedure

Class Level Information

Class	Levels	Values
ATRAZINE	4	0 1 10 25

Number of observations 269

Dependent Variable: MASS

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	13.56982643	4.52327548	15.88	<.0001
Error	265	75.47985684	0.28482965		
Corrected Total	268	89.04968327			

R-Square	Coeff Var	Root MSE	MASS Mean
0.152385	64.76464	0.533694	0.824052

Source	DF	Type I SS	Mean Square	F Value	Pr > F
ATRAZINE	3	13.56982643	4.52327548	15.88	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
ATRAZINE	3	13.56982643	4.52327548	15.88	<.0001

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Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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PROC UNIVARIATE OUTPUT FOR RESIDUALS FROM GLM PROCEDURE USING FROG WEIGHT BY SEX 630

----- Sex=F -----

The UNIVARIATE Procedure
Variable: Resid

Moments

N	331	Sum Weights	331
Mean	0	Sum Observations	0
Std Deviation	0.52081195	Variance	0.27124509
Skewness	3.47817499	Kurtosis	16.8585986
Uncorrected SS	89.5108805	Corrected SS	89.5108805
Coeff Variation	.	Std Error Mean	0.02862641

Basic Statistical Measures

Location		Variability	
Mean	0.00000	Std Deviation	0.52081
Median	-0.12423	Variance	0.27125
Mode	-0.24951	Range	4.39000
		Interquartile Range	0.29944

Tests for Location: Mu0=0

Test	-Statistic-	-----p Value-----		
Student's t	t 0	Pr > t	1.0000	
Sign	M -60.5	Pr >= M	<.0001	
Signed Rank	S -9276	Pr >= S	<.0001	

Tests for Normality

Test	--Statistic--	-----p Value-----	
Shapiro-Wilk	W 0.670492	Pr < W	<0.0001
Kolmogorov-Smirnov	D 0.218809	Pr > D	<0.0100
Cramer-von Mises	W-Sq 5.537051	Pr > W-Sq	<0.0050
Anderson-Darling	A-Sq 29.21036	Pr > A-Sq	<0.0050

Quantiles (Definition 5)

Quantile	Estimate
100% Max	3.6004878
99%	2.4504878
95%	0.9657692
90%	0.4175309
75% Q3	0.0557692
50% Median	-0.1242308
25% Q1	-0.2436667
10%	-0.3495122
5%	-0.4436667
1%	-0.7195122
0% Min	-0.7895122

Extreme Observations

-----Lowest-----		-----Highest-----	
Value	Obs	Value	Obs
-0.789512	1	2.18753	279

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

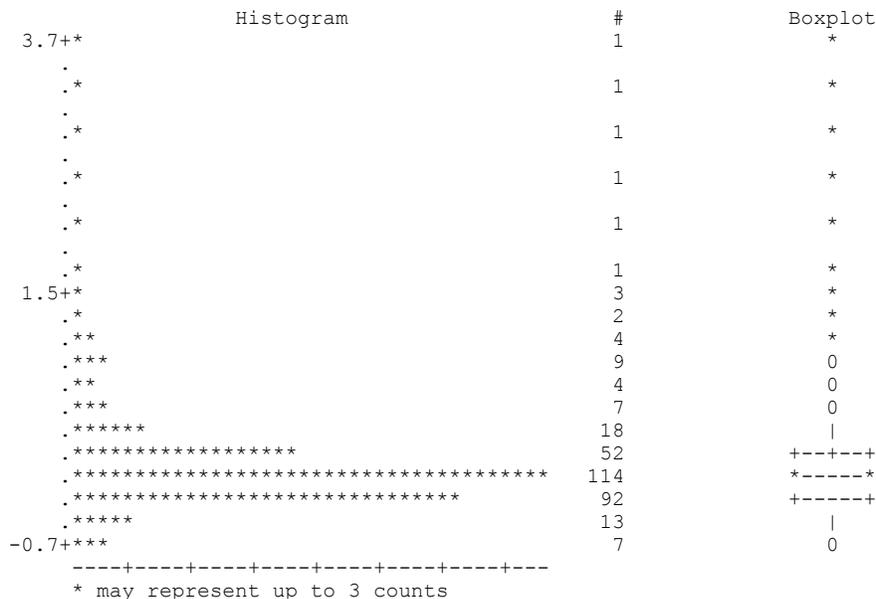
EPA MRID Number 458677-11

-0.739512	38	2.45049	31
-0.739512	6	2.92633	250
-0.719512	42	3.38049	71
-0.669512	7	3.60049	13

PROC UNIVARIATE OUTPUT FOR RESIDUALS FROM GLM PROCEDURE USING FROG WEIGHT BY SEX 632

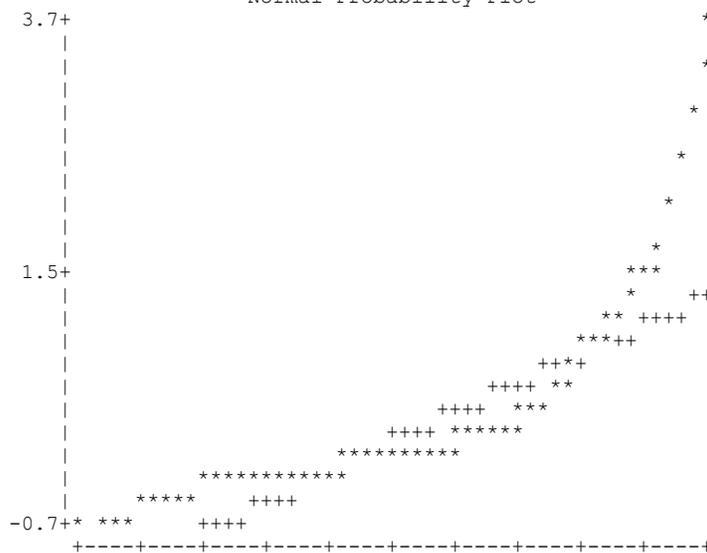
----- Sex=F -----

The UNIVARIATE Procedure
Variable: Resid



The UNIVARIATE Procedure
Variable: Resid

Normal Probability Plot



-2 -1 0 +1 +2

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Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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PROC UNIVARIATE OUTPUT FOR RESIDUALS FROM GLM PROCEDURE USING FROG WEIGHT BY SEX 634

----- Sex=M -----

The UNIVARIATE Procedure
Variable: Resid

Moments

N	269	Sum Weights	269
Mean	0	Sum Observations	0
Std Deviation	0.53069884	Variance	0.28164126
Skewness	3.56627975	Kurtosis	19.3195663
Uncorrected SS	75.4798568	Corrected SS	75.4798568
Coeff Variation	.	Std Error Mean	0.03235728

Basic Statistical Measures

Location		Variability	
Mean	0.00000	Std Deviation	0.53070
Median	-0.12650	Variance	0.28164
Mode	-0.18650	Range	4.69806
		Interquartile Range	0.36900

NOTE: The mode displayed is the smallest of 4 modes with a count of 4.

Tests for Location: Mu0=0

Test	-Statistic-	-----p Value-----
Student's t	t 0	Pr > t 1.0000
Sign	M -40.5	Pr >= M <.0001
Signed Rank	S -4884.5	Pr >= S 0.0001

Tests for Normality

Test	--Statistic--	-----p Value-----
Shapiro-Wilk	W 0.698635	Pr < W <0.0001
Kolmogorov-Smirnov	D 0.177585	Pr > D <0.0100
Cramer-von Mises	W-Sq 3.346828	Pr > W-Sq <0.0050
Anderson-Darling	A-Sq 18.12	Pr > A-Sq <0.0050

Quantiles (Definition 5)

Quantile	Estimate
100% Max	3.863500
99%	3.115441
95%	0.885441
90%	0.491884
75% Q3	0.112500
50% Median	-0.126500
25% Q1	-0.256500
10%	-0.384559
5%	-0.474559
1%	-0.784559
0% Min	-0.834559

Extreme Observations

-----Lowest-----		-----Highest-----	
Value	Obs	Value	Obs
-0.834559	39	1.34544	8
-0.784559	27	2.14544	62

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Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

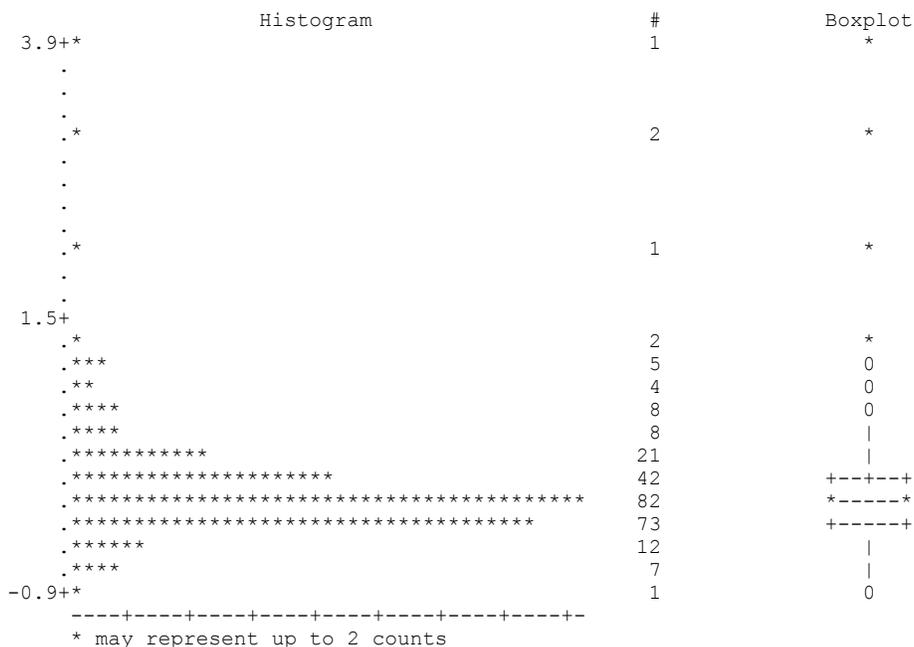
EPA MRID Number 458677-11

-0.784559	24	3.11544	44
-0.774559	63	3.19544	11
-0.764559	5	3.86350	196

PROC UNIVARIATE OUTPUT FOR RESIDUALS FROM GLM PROCEDURE USING FROG WEIGHT BY SEX 636

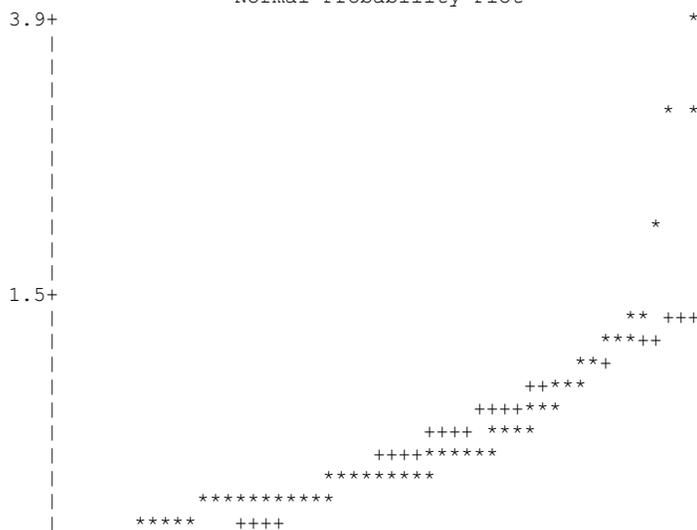
----- Sex=M -----

The UNIVARIATE Procedure
Variable: Resid



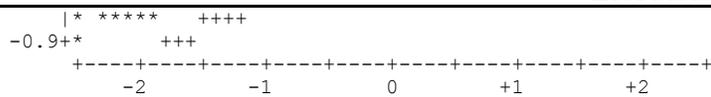
The UNIVARIATE Procedure
Variable: Resid

Normal Probability Plot



Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

EPA MRID Number 458677-11



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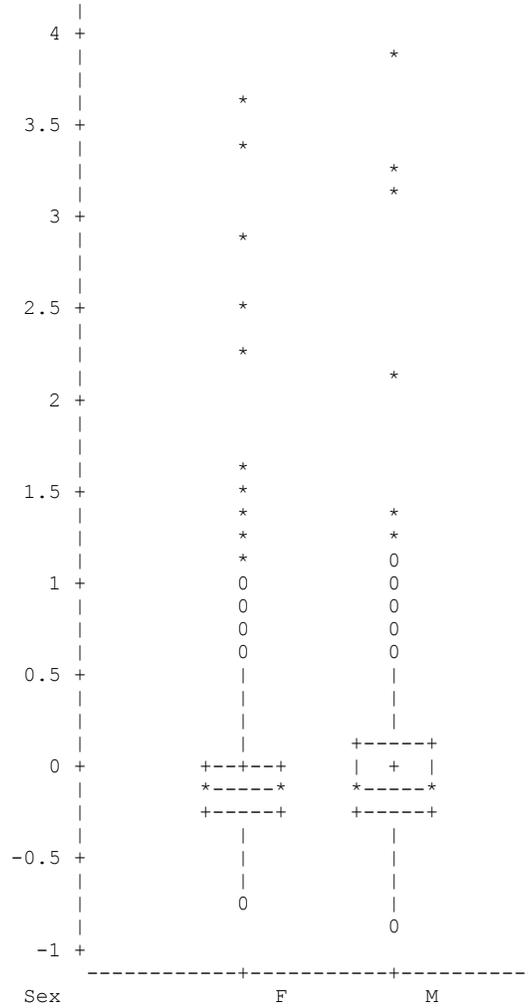
Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

EPA MRID Number 458677-11

PROC UNIVARIATE OUTPUT FOR RESIDUALS FROM GLM PROCEDURE USING FROG WEIGHT BY SEX 638

The UNIVARIATE Procedure
Variable: Resid

Schematic Plots



US EPA ARCHIVE DOCUMENT

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

EPA MRID Number 458677-11

REGRESSION ANALYSIS OF WEIGHT OVER ATRAZINE CONCENTRATION

639

----- Sex=F -----

The REG Procedure
 Model: MODEL1
 Dependent Variable: WEIGHT

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	0.06563	0.06563	1.96	0.2969
Error	2	0.06711	0.03356		
Corrected Total	3	0.13274			

Root MSE	0.18318	R-Square	0.4944
Dependent Mean	0.77747	Adj R-Sq	0.2416
Coeff Var	23.56145		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	1	0.89246	0.12309	7.25	0.0185
ATRAZINE	1	-0.01278	0.00914	-1.40	0.2969

REGRESSION ANALYSIS OF WEIGHT OVER ATRAZINE CONCENTRATION

640

----- Sex=M -----

The REG Procedure
 Model: MODEL1
 Dependent Variable: WEIGHT

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	0.07648	0.07648	1.25	0.3800
Error	2	0.12248	0.06124		
Corrected Total	3	0.19896			

Root MSE	0.24747	R-Square	0.3844
Dependent Mean	0.82417	Adj R-Sq	0.0766
Coeff Var	30.02629		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	1	0.94830	0.16628	5.70	0.0294
ATRAZINE	1	-0.01379	0.01234	-1.12	0.3800

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

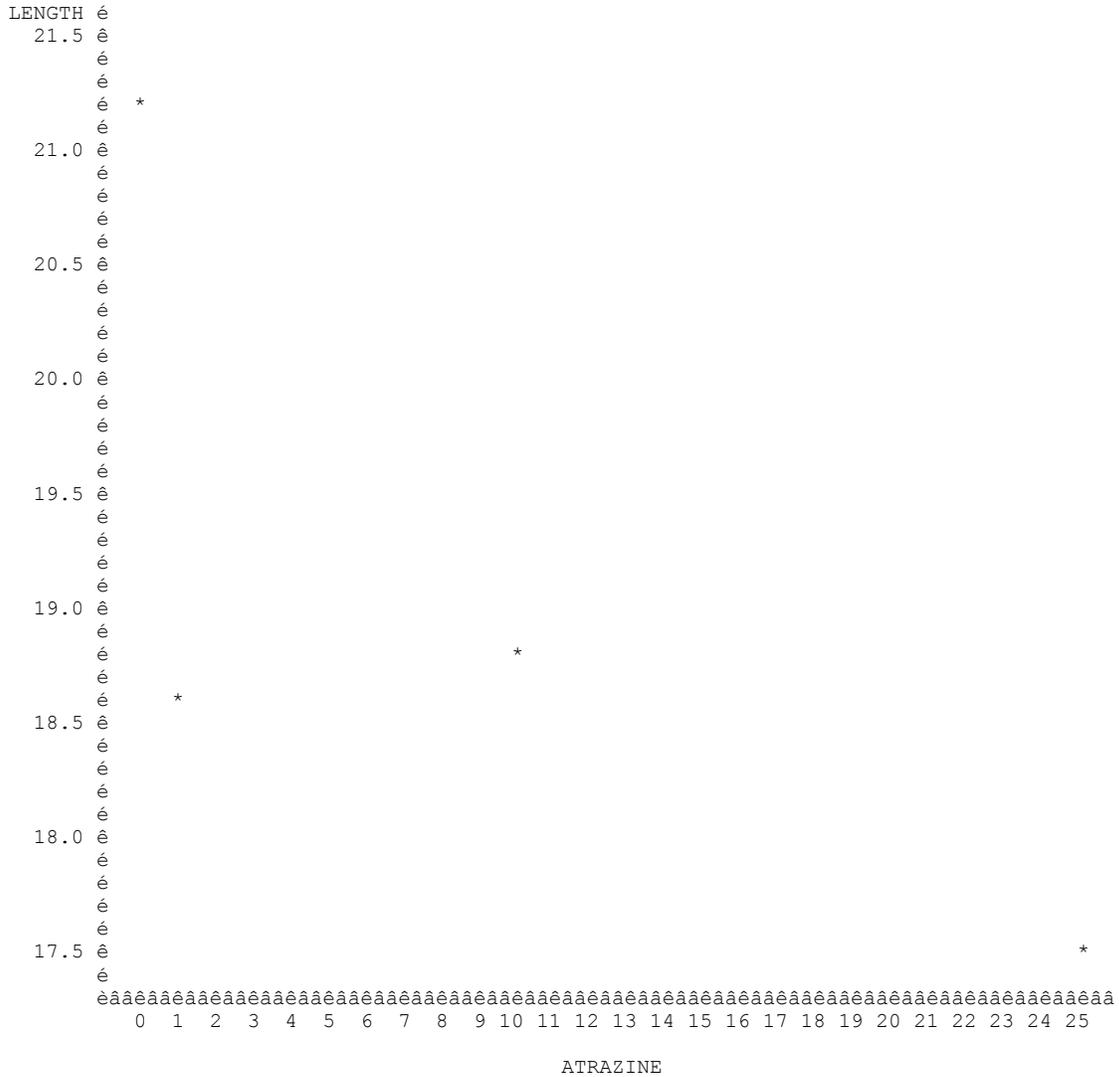
EPA MRID Number 458677-11

PLOT OF FROG LENGTH OVER ATRAZINE CONCENTRATION FOR MALE AND FEMALE FROGS

641

----- Sex=F -----

Plot of LENGTH*ATRAZINE. Symbol used is '*'.



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Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

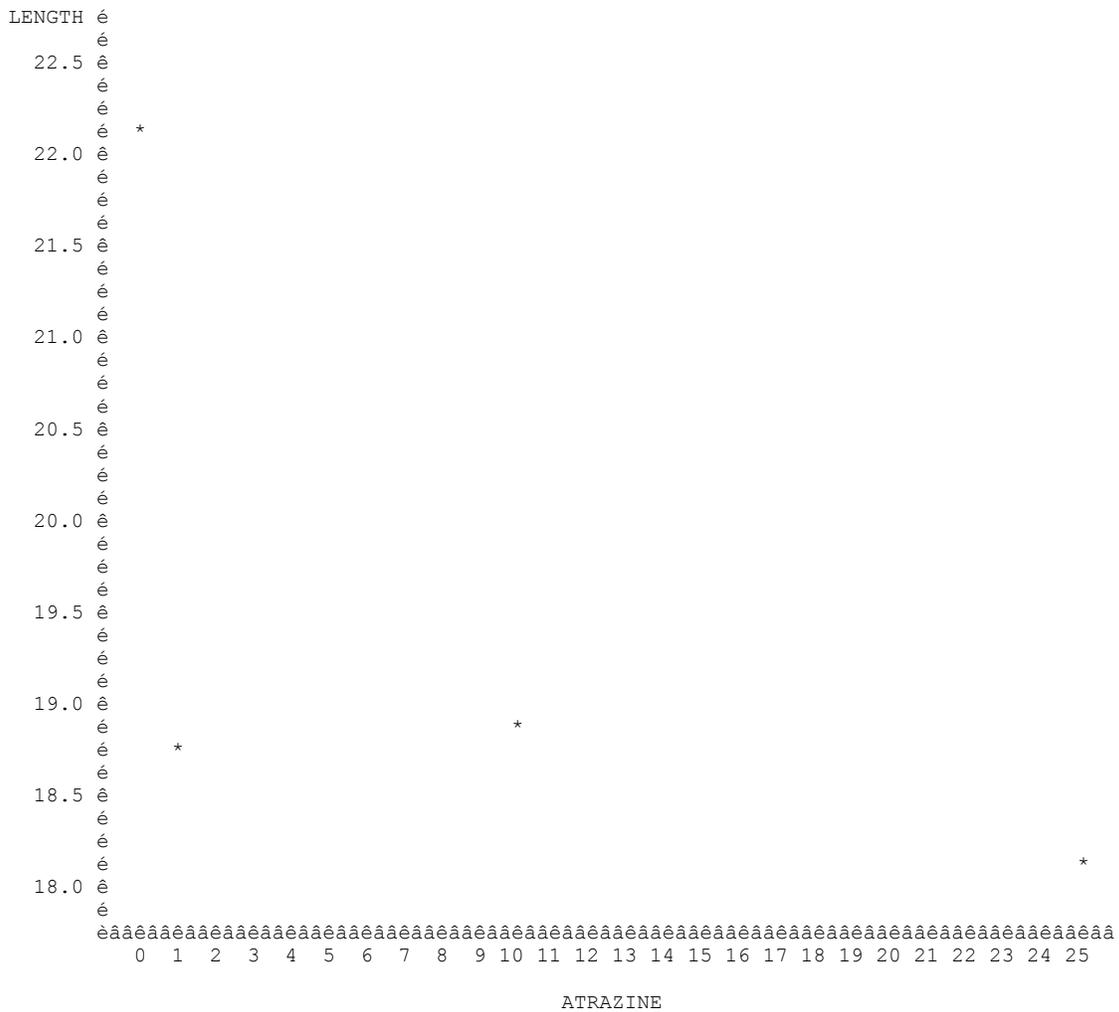
EPA MRID Number 458677-11

PLOT OF FROG LENGTH OVER ATRAZINE CONCENTRATION FOR MALE AND FEMALE FROGS

642

Sex=M

Plot of LENGTH*ATRAZINE. Symbol used is '*'.



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Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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ANALYSIS OF VARIANCE FOR FROG LENGTH BETWEEN TREATMENT GROUPS BY SEX

643

----- Sex=F -----

The GLM Procedure

Class Level Information

Class	Levels	Values
ATRAZINE	4	0 1 10 25

Number of observations 331

Dependent Variable: SVL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	585.622241	195.207414	18.21	<.0001
Error	327	3505.727849	10.720880		
Corrected Total	330	4091.350091			

R-Square	Coeff Var	Root MSE	SVL Mean
0.143137	17.21578	3.274276	19.01903

Source	DF	Type I SS	Mean Square	F Value	Pr > F
ATRAZINE	3	585.6222415	195.2074138	18.21	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
ATRAZINE	3	585.6222415	195.2074138	18.21	<.0001

ANALYSIS OF VARIANCE FOR FROG LENGTH BETWEEN TREATMENT GROUPS BY SEX

645

----- Sex=M -----

The GLM Procedure

Class Level Information

Class	Levels	Values
ATRAZINE	4	0 1 10 25

Number of observations 269

Dependent Variable: SVL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	640.258332	213.419444	21.98	<.0001
Error	265	2572.541817	9.707705		
Corrected Total	268	3212.800149			

R-Square	Coeff Var	Root MSE	SVL Mean
0.199284	16.01009	3.115719	19.46097

Source	DF	Type I SS	Mean Square	F Value	Pr > F
ATRAZINE	3	640.2583321	213.4194440	21.98	<.0001

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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Source	DF	Type III SS	Mean Square	F Value	Pr > F
ATRAZINE	3	640.2583321	213.4194440	21.98	<.0001

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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PROC UNIVARIATE OUTPUT FOR RESIDUALS FROM GLM PROCEDURE USING FROG LENGTH BY SEX 647

----- Sex=F -----

The UNIVARIATE Procedure
Variable: Resid

Moments

N	331	Sum Weights	331
Mean	0	Sum Observations	0
Std Deviation	3.25935848	Variance	10.6234177
Skewness	1.6487435	Kurtosis	4.17321286
Uncorrected SS	3505.72785	Corrected SS	3505.72785
Coeff Variation	.	Std Error Mean	0.17915054

Basic Statistical Measures

Location		Variability	
Mean	0.00000	Std Deviation	3.25936
Median	-0.62444	Variance	10.62342
Mode	-1.42444	Range	22.72940
		Interquartile Range	2.77060

NOTE: The mode displayed is the smallest of 2 modes with a count of 6.

Tests for Location: Mu0=0

Test	-Statistic-	-----p Value-----	
Student's t	t 0	Pr > t	1.0000
Sign	M -36.5	Pr >= M	<.0001
Signed Rank	S -5490	Pr >= S	0.0015

Tests for Normality

Test	--Statistic--	-----p Value-----	
Shapiro-Wilk	W 0.871872	Pr < W	<0.0001
Kolmogorov-Smirnov	D 0.1515	Pr > D	<0.0100
Cramer-von Mises	W-Sq 2.170587	Pr > W-Sq	<0.0050
Anderson-Darling	A-Sq 12.12968	Pr > A-Sq	<0.0050

Quantiles (Definition 5)

Quantile	Estimate
100% Max	15.775556
99%	11.395062
95%	6.729268
90%	3.646154
75% Q3	0.946154
50% Median	-0.624444
25% Q1	-1.824444
10%	-3.004938
5%	-4.104938
1%	-5.670732
0% Min	-6.953846

Extreme Observations

-----Lowest-----		-----Highest-----	
Value	Obs	Value	Obs
-6.95385	83	10.4756	248

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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-6.17073	1	11.3951	279
-5.87073	6	13.5293	71
-5.67073	38	13.9293	13
-5.57073	5	15.7756	250

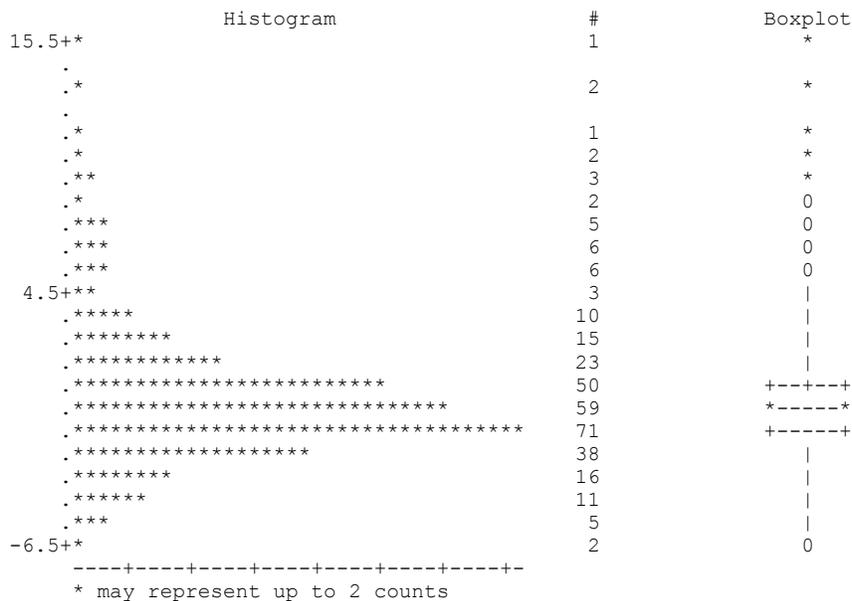
Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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PROC UNIVARIATE OUTPUT FOR RESIDUALS FROM GLM PROCEDURE USING FROG LENGTH BY SEX 649

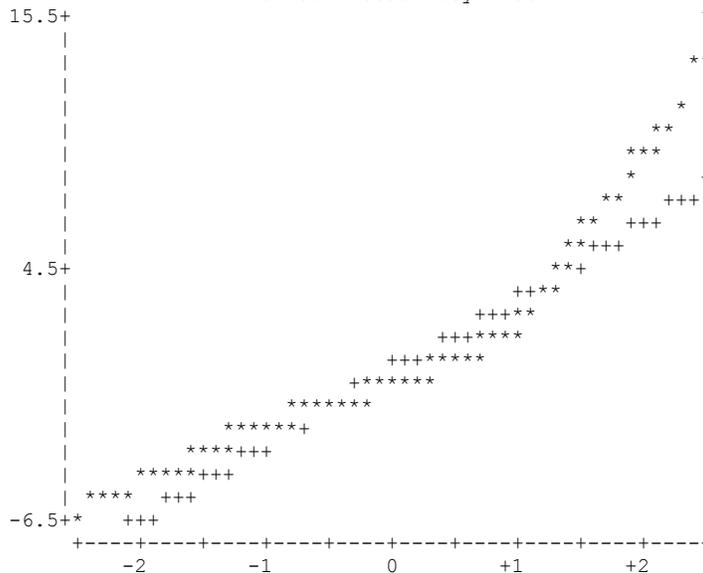
----- Sex=F -----

The UNIVARIATE Procedure
Variable: Resid



The UNIVARIATE Procedure
Variable: Resid

Normal Probability Plot



Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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PROC UNIVARIATE OUTPUT FOR RESIDUALS FROM GLM PROCEDURE USING FROG LENGTH BY SEX 651

----- Sex=M -----

The UNIVARIATE Procedure
Variable: Resid

Moments

N	269	Sum Weights	269
Mean	0	Sum Observations	0
Std Deviation	3.09823121	Variance	9.59903663
Skewness	1.47756279	Kurtosis	4.18236889
Uncorrected SS	2572.54182	Corrected SS	2572.54182
Coeff Variation	.	Std Error Mean	0.18890249

Basic Statistical Measures

Location		Variability	
Mean	0.00000	Std Deviation	3.09823
Median	-0.57059	Variance	9.59904
Mode	-1.68056	Range	22.72892
		Interquartile Range	2.85713

Tests for Location: Mu0=0

Test	-Statistic-	-----p Value-----	
Student's t	t 0	Pr > t	1.0000
Sign	M -29.5	Pr >= M	0.0004
Signed Rank	S -2839.5	Pr >= S	0.0259

Tests for Normality

Test	--Statistic--	-----p Value-----	
Shapiro-Wilk	W 0.903548	Pr < W	<0.0001
Kolmogorov-Smirnov	D 0.137053	Pr > D	<0.0100
Cramer-von Mises	W-Sq 1.231739	Pr > W-Sq	<0.0050
Anderson-Darling	A-Sq 6.644115	Pr > A-Sq	<0.0050

Quantiles (Definition 5)

Quantile	Estimate
100% Max	15.858333
99%	12.229412
95%	6.029412
90%	4.162319
75% Q3	1.119444
50% Median	-0.570588
25% Q1	-1.737681
10%	-3.080556
5%	-3.880556
1%	-5.870588
0% Min	-6.870588

Extreme Observations

-----Lowest-----		-----Highest-----	
Value	Obs	Value	Obs
-6.87059	27	8.45833	183

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-6.27059	63	8.52941	62
-5.87059	24	12.22941	44
-5.77059	39	13.32941	11
-5.37059	5	15.85833	196

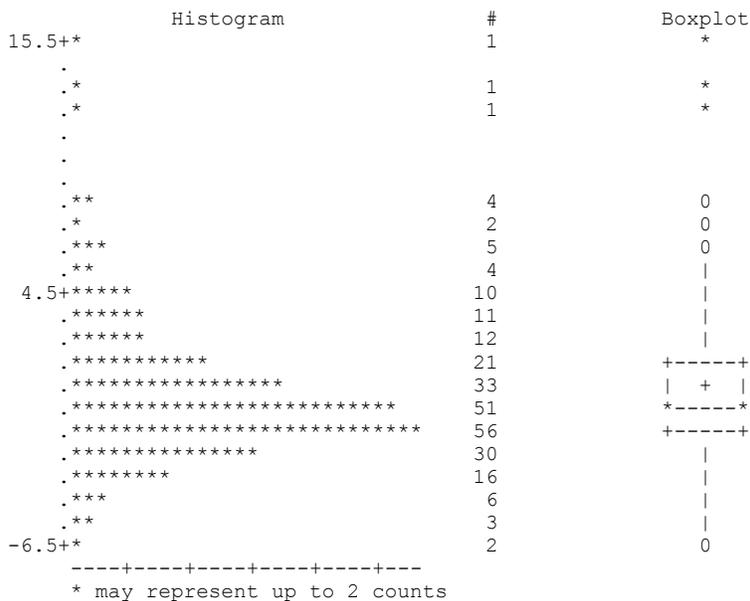
Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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PROC UNIVARIATE OUTPUT FOR RESIDUALS FROM GLM PROCEDURE USING FROG LENGTH BY SEX 653

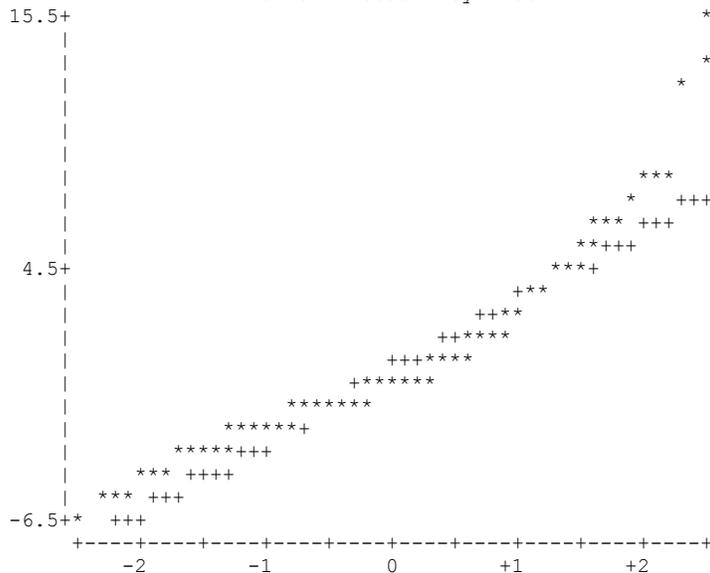
----- Sex=M -----

The UNIVARIATE Procedure
Variable: Resid



The UNIVARIATE Procedure
Variable: Resid

Normal Probability Plot



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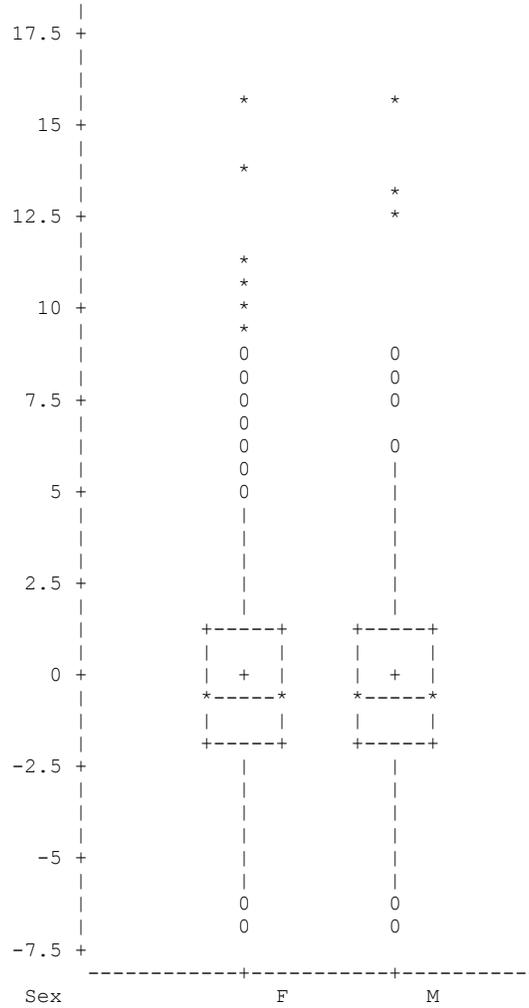
Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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PROC UNIVARIATE OUTPUT FOR RESIDUALS FROM GLM PROCEDURE USING FROG LENGTH BY SEX 655

The UNIVARIATE Procedure
Variable: Resid

Schematic Plots



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Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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REGRESSION ANALYSIS OF LENGTH OVER ATRAZINE CONCENTRATION

656

----- Sex=F -----

The REG Procedure
Model: MODEL1
Dependent Variable: LENGTH

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	3.99283	3.99283	2.51	0.2541
Error	2	3.18361	1.59180		
Corrected Total	3	7.17643			

Root MSE	1.26167	R-Square	0.5564
Dependent Mean	19.01349	Adj R-Sq	0.3346
Coeff Var	6.63564		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	1	19.91044	0.84775	23.49	0.0018
ATRAZINE	1	-0.09966	0.06293	-1.58	0.2541

REGRESSION ANALYSIS OF LENGTH OVER ATRAZINE CONCENTRATION

657

----- Sex=M -----

The REG Procedure
Model: MODEL1
Dependent Variable: LENGTH

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	3.94737	3.94737	1.45	0.3522
Error	2	5.46029	2.73015		
Corrected Total	3	9.40766			

Root MSE	1.65232	R-Square	0.4196
Dependent Mean	19.45762	Adj R-Sq	0.1294
Coeff Var	8.49187		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	1	20.34946	1.11024	18.33	0.0030
ATRAZINE	1	-0.09909	0.08241	-1.20	0.3522

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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ANOVA FOR FROG LENGTH BETWEEN TREATMENTS

658

----- Sex=F -----

The ANOVA Procedure

Class Level Information

Class	Levels	Values
ATRAZINE	4	0 1 10 25

Number of observations 10

Dependent Variable: LENGTH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	24.31994787	8.10664929	6.17	0.0290
Error	6	7.88332214	1.31388702		
Corrected Total	9	32.20327001			

R-Square	Coeff Var	Root MSE	LENGTH Mean
0.755201	6.043316	1.146249	18.96722

Source	DF	Anova SS	Mean Square	F Value	Pr > F
ATRAZINE	3	24.31994787	8.10664929	6.17	0.0290

Levene's Test for Homogeneity of LENGTH Variance
ANOVA of Squared Deviations from Group Means

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
ATRAZINE	1	1.4602	1.4602	2.90	0.1640
Error	4	2.0163	0.5041		

Bartlett's Test for Homogeneity of LENGTH Variance

Source	DF	Chi-Square	Pr > ChiSq
ATRAZINE	3	1.6226	0.6543

Dunnnett's t Tests for LENGTH

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

Alpha	0.05
Error Degrees of Freedom	6
Error Mean Square	1.313887
Critical Value of Dunnnett's t	3.12383

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

ATRAZINE Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
10 - 0	-2.2703	-5.5390 0.9984
1 - 0	-2.5773	-5.8460 0.6915

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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25 - 0 -3.9812 -6.9049 -1.0576 ***

US EPA ARCHIVE DOCUMENT

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

EPA MRID Number 458677-11

ANOVA FOR FROG LENGTH BETWEEN TREATMENTS

662

----- Sex=M -----

The ANOVA Procedure

Class Level Information

Class	Levels	Values
ATRAZINE	4	0 1 10 25

Number of observations 10

Dependent Variable: LENGTH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	32.02748490	10.67582830	14.25	0.0039
Error	6	4.49480602	0.74913434		
Corrected Total	9	36.52229092			

R-Square	Coeff Var	Root MSE	LENGTH Mean
0.876930	4.402765	0.865525	19.65868

Source	DF	Anova SS	Mean Square	F Value	Pr > F
ATRAZINE	3	32.02748490	10.67582830	14.25	0.0039

Levene's Test for Homogeneity of LENGTH Variance
ANOVA of Squared Deviations from Group Means

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
ATRAZINE	1	0.4820	0.4820	3.52	0.1337
Error	4	0.5470	0.1368		

Bartlett's Test for Homogeneity of LENGTH Variance

Source	DF	Chi-Square	Pr > ChiSq
ATRAZINE	3	3.1456	0.3697

Dunnett's t Tests for LENGTH

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

Alpha	0.05
Error Degrees of Freedom	6
Error Mean Square	0.749134
Critical Value of Dunnett's t	3.12383

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

ATRAZINE Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
10 - 0	-3.5532	-6.0214 -1.0851 ***

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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1	- 0	-3.5778	-6.0460	-1.1096	***
25	- 0	-4.2449	-6.4525	-2.0373	***

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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NONPARAMETRIC COMPARISON OF FROG LENGTH ACROSS TREATMENTS

666

----- Sex=F -----

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable LENGTH
Classified by Variable ATRAZINE

ATRAZINE	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
0	3	27.0	16.50	4.387482	9.000000
1	2	10.0	11.00	3.829708	5.000000
10	2	10.0	11.00	3.829708	5.000000
25	3	8.0	16.50	4.387482	2.666667

Kruskal-Wallis Test

Chi-Square 6.7455
DF 3
Pr > Chi-Square 0.0805

Median Scores (Number of Points Above Median) for Variable LENGTH
Classified by Variable ATRAZINE

ATRAZINE	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
0	3	3.0	1.50	0.763763	1.00
1	2	1.0	1.00	0.666667	0.50
10	2	1.0	1.00	0.666667	0.50
25	3	0.0	1.50	0.763763	0.00

Median One-Way Analysis

Chi-Square 5.4000
DF 3
Pr > Chi-Square 0.1447

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NONPARAMETRIC COMPARISON OF FROG LENGTH ACROSS TREATMENTS

668

----- Sex=M -----

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable LENGTH
Classified by Variable ATRAZINE

ATRAZINE	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
0	3	27.0	16.50	4.387482	9.000000
1	2	8.0	11.00	3.829708	4.000000
10	2	10.0	11.00	3.829708	5.000000
25	3	10.0	16.50	4.387482	3.333333

Kruskal-Wallis Test

Chi-Square 6.0909
DF 3
Pr > Chi-Square 0.1073

Median Scores (Number of Points Above Median) for Variable LENGTH
Classified by Variable ATRAZINE

ATRAZINE	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
0	3	3.0	1.50	0.763763	1.00
1	2	1.0	1.00	0.666667	0.50
10	2	1.0	1.00	0.666667	0.50
25	3	0.0	1.50	0.763763	0.00

Median One-Way Analysis

Chi-Square 5.4000
DF 3
Pr > Chi-Square 0.1447

US EPA ARCHIVE DOCUMENT

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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ANOVA FOR FROG WEIGHT BETWEEN TREATMENTS

670

----- Sex=F -----

The ANOVA Procedure

Class Level Information

Class	Levels	Values
ATRAZINE	4	0 1 10 25

Number of observations 10

Dependent Variable: WEIGHT

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	0.47376094	0.15792031	7.93	0.0165
Error	6	0.11947701	0.01991283		
Corrected Total	9	0.59323795			

R-Square	Coeff Var	Root MSE	WEIGHT Mean
0.798602	17.94657	0.141113	0.786294

Source	DF	Anova SS	Mean Square	F Value	Pr > F
ATRAZINE	3	0.47376094	0.15792031	7.93	0.0165

Levene's Test for Homogeneity of WEIGHT Variance
ANOVA of Squared Deviations from Group Means

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
ATRAZINE	1	0.000095	0.000095	1.45	0.2953
Error	4	0.000264	0.000066		

Bartlett's Test for Homogeneity of WEIGHT Variance

Source	DF	Chi-Square	Pr > ChiSq
ATRAZINE	3	0.9200	0.8206

Dunnnett's t Tests for WEIGHT

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

Alpha	0.05
Error Degrees of Freedom	6
Error Mean Square	0.019913
Critical Value of Dunnnett's t	3.12383

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

ATRAZINE Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
10 - 0	-0.3623	-0.7647 0.0401
1 - 0	-0.3974	-0.7998 0.0050

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25 - 0 -0.5445 -0.9044 -0.1846 ***

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ANOVA FOR FROG WEIGHT BETWEEN TREATMENTS

674

----- Sex=M -----

The ANOVA Procedure

Class Level Information

Class	Levels	Values
ATRAZINE	4	0 1 10 25

Number of observations 10

Dependent Variable: WEIGHT

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	0.73743515	0.24581172	9.66	0.0103
Error	6	0.15260050	0.02543342		
Corrected Total	9	0.89003565			

R-Square	Coeff Var	Root MSE	WEIGHT Mean
0.828546	18.48632	0.159479	0.862684

Source	DF	Anova SS	Mean Square	F Value	Pr > F
ATRAZINE	3	0.73743515	0.24581172	9.66	0.0103

Levene's Test for Homogeneity of WEIGHT Variance
ANOVA of Squared Deviations from Group Means

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
ATRAZINE	1	0.00150	0.00150	4.00	0.1161
Error	4	0.00150	0.000376		

Bartlett's Test for Homogeneity of WEIGHT Variance

Source	DF	Chi-Square	Pr > ChiSq
ATRAZINE	3	12.4660	0.0059

Dunnnett's t Tests for WEIGHT

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

Alpha	0.05
Error Degrees of Freedom	6
Error Mean Square	0.025433
Critical Value of Dunnnett's t	3.12383

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

ATRAZINE Comparison	Difference Between Means	Simultaneous 95% Confidence Limits

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10	-	0	-0.5352	-0.9900	-0.0805	***
1	-	0	-0.5662	-1.0210	-0.1114	***
25	-	0	-0.6358	-1.0426	-0.2290	***

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NONPARAMETRIC COMPARISON OF FROG WEIGHT ACROSS TREATMENTS BY SEX

678

----- Sex=F -----

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable WEIGHT
Classified by Variable ATRAZINE

ATRAZINE	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
0	3	27.0	16.50	4.387482	9.00
1	2	8.0	11.00	3.829708	4.00
10	2	11.0	11.00	3.829708	5.50
25	3	9.0	16.50	4.387482	3.00

Kruskal-Wallis Test

Chi-Square 6.5455
DF 3
Pr > Chi-Square 0.0879

Median Scores (Number of Points Above Median) for Variable WEIGHT
Classified by Variable ATRAZINE

ATRAZINE	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
0	3	3.0	1.50	0.763763	1.00
1	2	1.0	1.00	0.666667	0.50
10	2	1.0	1.00	0.666667	0.50
25	3	0.0	1.50	0.763763	0.00

Median One-Way Analysis

Chi-Square 5.4000
DF 3
Pr > Chi-Square 0.1447

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NONPARAMETRIC COMPARISON OF FROG WEIGHT ACROSS TREATMENTS BY SEX

680

----- Sex=M -----

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable WEIGHT
Classified by Variable ATRAZINE

ATRAZINE	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
0	3	27.0	16.50	4.387482	9.00
1	2	7.0	11.00	3.829708	3.50
10	2	9.0	11.00	3.829708	4.50
25	3	12.0	16.50	4.387482	4.00

Kruskal-Wallis Test

Chi-Square 5.8364
DF 3
Pr > Chi-Square 0.1198

Median Scores (Number of Points Above Median) for Variable WEIGHT
Classified by Variable ATRAZINE

ATRAZINE	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
0	3	3.0	1.50	0.763763	1.00
1	2	1.0	1.00	0.666667	0.50
10	2	1.0	1.00	0.666667	0.50
25	3	0.0	1.50	0.763763	0.00

Median One-Way Analysis

Chi-Square 5.4000
DF 3
Pr > Chi-Square 0.1447

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Comparison	Means	Limits
M - F	0.1721	-0.2012 0.5454

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ANOVA FOR WEIGHT BETWEEN SEXES

686

----- ATRAZINE=1 -----

The ANOVA Procedure

Class Level Information

Class	Levels	Values
Sex	2	F M

Number of observations 4

Dependent Variable: WEIGHT

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	0.00001069	0.00001069	0.00	0.9872
Error	2	0.06567277	0.03283639		
Corrected Total	3	0.06568346			

R-Square	Coeff Var	Root MSE	WEIGHT Mean
0.000163	25.67177	0.181208	0.705865

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Sex	1	0.00001069	0.00001069	0.00	0.9872

Levene's Test for Homogeneity of WEIGHT Variance
ANOVA of Squared Deviations from Group Means

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Sex	0	0	.	.	.
Error	0	0	.	.	.

Bartlett's Test for Homogeneity of WEIGHT Variance

Source	DF	Chi-Square	Pr > ChiSq
Sex	1	0.0108	0.9171

Dunnett's t Tests for WEIGHT

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

Alpha	0.05
Error Degrees of Freedom	2
Error Mean Square	0.032836
Critical Value of Dunnett's t	4.30263
Minimum Significant Difference	0.7797

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

Difference

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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Sex Comparison	Between Means	Simultaneous 95% Confidence Limits
M - F	0.003269	-0.776402 0.782940

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ANOVA FOR WEIGHT BETWEEN SEXES

690

----- ATRAZINE=10 -----

The ANOVA Procedure

Class Level Information

Class	Levels	Values
Sex	2	F M

Number of observations 4

Dependent Variable: WEIGHT

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	0.00000059	0.00000059	0.00	0.9969
Error	2	0.06049619	0.03024810		
Corrected Total	3	0.06049678			

R-Square	Coeff Var	Root MSE	WEIGHT Mean
0.000010	23.53874	0.173920	0.738866

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Sex	1	5.9017464E-7	5.9017464E-7	0.00	0.9969

Levene's Test for Homogeneity of WEIGHT Variance
ANOVA of Squared Deviations from Group Means

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Sex	0	0	.	.	.
Error	0	0	.	.	.

Bartlett's Test for Homogeneity of WEIGHT Variance

Source	DF	Chi-Square	Pr > ChiSq
Sex	1	0.00127	0.9716

Dunnett's t Tests for WEIGHT

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

Alpha	0.05
Error Degrees of Freedom	2
Error Mean Square	0.030248
Critical Value of Dunnett's t	4.30263
Minimum Significant Difference	0.7483

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

Difference

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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Sex Comparison	Between Means	Simultaneous 95% Confidence Limits
M - F	-0.0007682	-0.7490802 0.7475438

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ANOVA FOR WEIGHT BETWEEN SEXES

694

----- ATRAZINE=25 -----

The ANOVA Procedure

Class Level Information

Class	Levels	Values
Sex	2	F M

Number of observations 6

Dependent Variable: WEIGHT

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	0.00980227	0.00980227	1.05	0.3639
Error	4	0.03742040	0.00935510		
Corrected Total	5	0.04722267			

R-Square	Coeff Var	Root MSE	WEIGHT Mean
0.207575	16.18803	0.096722	0.597489

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Sex	1	0.00980227	0.00980227	1.05	0.3639

Levene's Test for Homogeneity of WEIGHT Variance
ANOVA of Squared Deviations from Group Means

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Sex	1	0.000233	0.000233	4.00	0.1162
Error	4	0.000233	0.000058		

Bartlett's Test for Homogeneity of WEIGHT Variance

Source	DF	Chi-Square	Pr > ChiSq
Sex	1	11.6016	0.0007

Dunnett's t Tests for WEIGHT

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

Alpha	0.05
Error Degrees of Freedom	4
Error Mean Square	0.009355
Critical Value of Dunnett's t	2.77630
Minimum Significant Difference	0.2193

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

Difference

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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Sex Comparison	Between Means	Simultaneous 95% Confidence Limits
M - F	0.08084	-0.13841 0.30009

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NONPARAMETRIC COMPARISON OF FROG WEIGHT BETWEEN SEXES FOR EACH EXPOSURE GROUP 698
 ----- ATRAZINE=0 -----

The NPARIWAY Procedure

Wilcoxon Scores (Rank Sums) for Variable WEIGHT
 Classified by Variable Sex

Sex	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
F	3	8.0	10.50	2.291288	2.666667
M	3	13.0	10.50	2.291288	4.333333

Wilcoxon Two-Sample Test

Statistic 8.0000

Normal Approximation

Z -0.8729
 One-Sided Pr < Z 0.1914
 Two-Sided Pr > |Z| 0.3827

t Approximation

One-Sided Pr < Z 0.2113
 Two-Sided Pr > |Z| 0.4227

Z includes a continuity correction of 0.5.

Kruskal-Wallis Test

Chi-Square 1.1905
 DF 1
 Pr > Chi-Square 0.2752

Median Scores (Number of Points Above Median) for Variable WEIGHT
 Classified by Variable Sex

Sex	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
F	3	1.0	1.50	0.670820	0.333333
M	3	2.0	1.50	0.670820	0.666667

Median Two-Sample Test

Statistic 1.0000
 Z -0.7454
 One-Sided Pr < Z 0.2280
 Two-Sided Pr > |Z| 0.4561

Median One-Way Analysis

Chi-Square 0.5556
 DF 1
 Pr > Chi-Square 0.4561

US EPA ARCHIVE DOCUMENT

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NONPARAMETRIC COMPARISON OF FROG WEIGHT BETWEEN SEXES FOR EACH EXPOSURE GROUP 700

----- ATRAZINE=1 -----

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable WEIGHT
Classified by Variable Sex

Sex	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
F	2	5.0	5.0	1.290994	2.50
M	2	5.0	5.0	1.290994	2.50

Wilcoxon Two-Sample Test

Statistic 5.0000

Normal Approximation

Z 0.0000
One-Sided Pr < Z 0.5000
Two-Sided Pr > |Z| 1.0000

t Approximation

One-Sided Pr < Z 0.5000
Two-Sided Pr > |Z| 1.0000

Z includes a continuity correction of 0.5.

Kruskal-Wallis Test

Chi-Square 0.0000
DF 1
Pr > Chi-Square 1.0000

Median Scores (Number of Points Above Median) for Variable WEIGHT
Classified by Variable Sex

Sex	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
F	2	1.0	1.0	0.577350	0.50
M	2	1.0	1.0	0.577350	0.50

Median Two-Sample Test

Statistic 1.0000
Z 0.0000
One-Sided Pr < Z 0.5000
Two-Sided Pr > |Z| 1.0000

Median One-Way Analysis

Chi-Square 0.0000
DF 1
Pr > Chi-Square 1.0000

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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NONPARAMETRIC COMPARISON OF FROG WEIGHT BETWEEN SEXES FOR EACH EXPOSURE GROUP 702

----- ATRAZINE=10 -----

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable WEIGHT
Classified by Variable Sex

Sex	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
F	2	5.0	5.0	1.290994	2.50
M	2	5.0	5.0	1.290994	2.50

Wilcoxon Two-Sample Test

Statistic 5.0000

Normal Approximation

Z 0.0000

One-Sided Pr < Z 0.5000

Two-Sided Pr > |Z| 1.0000

t Approximation

One-Sided Pr < Z 0.5000

Two-Sided Pr > |Z| 1.0000

Z includes a continuity correction of 0.5.

Kruskal-Wallis Test

Chi-Square 0.0000

DF 1

Pr > Chi-Square 1.0000

The NPAR1WAY Procedure

Median Scores (Number of Points Above Median) for Variable WEIGHT
Classified by Variable Sex

Sex	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
F	2	1.0	1.0	0.577350	0.50
M	2	1.0	1.0	0.577350	0.50

Median Two-Sample Test

Statistic 1.0000

Z 0.0000

One-Sided Pr < Z 0.5000

Two-Sided Pr > |Z| 1.0000

Median One-Way Analysis

Chi-Square 0.0000

DF 1

Pr > Chi-Square 1.0000

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NONPARAMETRIC COMPARISON OF FROG WEIGHT BETWEEN SEXES FOR EACH EXPOSURE GROUP 704

----- ATRAZINE=25 -----

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable WEIGHT
Classified by Variable Sex

Sex	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
F	3	9.0	10.50	2.291288	3.0
M	3	12.0	10.50	2.291288	4.0

Wilcoxon Two-Sample Test

Statistic 9.0000

Normal Approximation

Z -0.4364
One-Sided Pr < Z 0.3313
Two-Sided Pr > |Z| 0.6625

t Approximation

One-Sided Pr < Z 0.3404
Two-Sided Pr > |Z| 0.6807

Z includes a continuity correction of 0.5.

Kruskal-Wallis Test

Chi-Square 0.4286
DF 1
Pr > Chi-Square 0.5127

The NPAR1WAY Procedure

Median Scores (Number of Points Above Median) for Variable WEIGHT
Classified by Variable Sex

Sex	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
F	3	1.0	1.50	0.670820	0.333333
M	3	2.0	1.50	0.670820	0.666667

Median Two-Sample Test

Statistic 1.0000
Z -0.7454
One-Sided Pr < Z 0.2280
Two-Sided Pr > |Z| 0.4561

Median One-Way Analysis

Chi-Square 0.5556
DF 1
Pr > Chi-Square 0.4561

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ANOVA FOR LENGTH BETWEEN SEXES

706

----- ATRAZINE=0 -----

The ANOVA Procedure

Class Level Information

Class	Levels	Values
Sex	2	F M

Number of observations 6

Dependent Variable: WEIGHT

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	0.04444191	0.04444191	1.64	0.2697
Error	4	0.10848814	0.02712203		
Corrected Total	5	0.15293005			

R-Square	Coeff Var	Root MSE	WEIGHT Mean
0.290603	13.86664	0.164688	1.187654

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Sex	1	0.04444191	0.04444191	1.64	0.2697

Dunnett's t Tests for WEIGHT

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

Alpha	0.05
Error Degrees of Freedom	4
Error Mean Square	0.027122
Critical Value of Dunnett's t	2.77630
Minimum Significant Difference	0.3733

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

Sex Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
M - F	0.1721	-0.2012 0.5454

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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ANOVA FOR LENGTH BETWEEN SEXES

709

----- ATRAZINE=1 -----

The ANOVA Procedure

Class Level Information

Class	Levels	Values
Sex	2	F M
Number of observations		4

Dependent Variable: WEIGHT

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	0.00001069	0.00001069	0.00	0.9872
Error	2	0.06567277	0.03283639		
Corrected Total	3	0.06568346			

R-Square	Coeff Var	Root MSE	WEIGHT Mean
0.000163	25.67177	0.181208	0.705865

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Sex	1	0.00001069	0.00001069	0.00	0.9872

Dunnett's t Tests for WEIGHT

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

Alpha	0.05
Error Degrees of Freedom	2
Error Mean Square	0.032836
Critical Value of Dunnett's t	4.30263
Minimum Significant Difference	0.7797

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

Sex Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
M - F	0.003269	-0.776402 0.782940

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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ANOVA FOR LENGTH BETWEEN SEXES

712

----- ATRAZINE=10 -----

The ANOVA Procedure

Class Level Information

Class	Levels	Values
Sex	2	F M

Number of observations 4

Dependent Variable: WEIGHT

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	0.00000059	0.00000059	0.00	0.9969
Error	2	0.06049619	0.03024810		
Corrected Total	3	0.06049678			

R-Square	Coeff Var	Root MSE	WEIGHT Mean
0.000010	23.53874	0.173920	0.738866

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Sex	1	5.9017464E-7	5.9017464E-7	0.00	0.9969

Dunnnett's t Tests for WEIGHT

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

Alpha	0.05
Error Degrees of Freedom	2
Error Mean Square	0.030248
Critical Value of Dunnnett's t	4.30263
Minimum Significant Difference	0.7483

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

Sex Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
M - F	-0.0007682	-0.7490802 0.7475438

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ANOVA FOR LENGTH BETWEEN SEXES

715

----- ATRAZINE=25 -----

The ANOVA Procedure

Class Level Information

Class	Levels	Values
Sex	2	F M
Number of observations		6

Dependent Variable: WEIGHT

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	0.00980227	0.00980227	1.05	0.3639
Error	4	0.03742040	0.00935510		
Corrected Total	5	0.04722267			

R-Square	Coeff Var	Root MSE	WEIGHT Mean
0.207575	16.18803	0.096722	0.597489

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Sex	1	0.00980227	0.00980227	1.05	0.3639

Dunnnett's t Tests for WEIGHT

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

Alpha	0.05
Error Degrees of Freedom	4
Error Mean Square	0.009355
Critical Value of Dunnnett's t	2.77630
Minimum Significant Difference	0.2193

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

Sex Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
M - F	0.08084	-0.13841 0.30009

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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NONPARAMETRIC COMPARISON OF FROG LENGTH BETWEEN SEXES FOR EACH EXPOSURE GROUP 718

----- ATRAZINE=0 -----

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable WEIGHT
Classified by Variable Sex

Sex	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
F	3	8.0	10.50	2.291288	2.666667
M	3	13.0	10.50	2.291288	4.333333

Wilcoxon Two-Sample Test

Statistic 8.0000

Normal Approximation

Z -0.8729
One-Sided Pr < Z 0.1914
Two-Sided Pr > |Z| 0.3827

t Approximation

One-Sided Pr < Z 0.2113
Two-Sided Pr > |Z| 0.4227

Z includes a continuity correction of 0.5.

Kruskal-Wallis Test

Chi-Square 1.1905
DF 1
Pr > Chi-Square 0.2752

Median Scores (Number of Points Above Median) for Variable WEIGHT
Classified by Variable Sex

Sex	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
F	3	1.0	1.50	0.670820	0.333333
M	3	2.0	1.50	0.670820	0.666667

Median Two-Sample Test

Statistic 1.0000
Z -0.7454
One-Sided Pr < Z 0.2280
Two-Sided Pr > |Z| 0.4561

Median One-Way Analysis

Chi-Square 0.5556
DF 1
Pr > Chi-Square 0.4561

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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NONPARAMETRIC COMPARISON OF FROG LENGTH BETWEEN SEXES FOR EACH EXPOSURE GROUP 720

----- ATRAZINE=1 -----

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable WEIGHT
Classified by Variable Sex

Sex	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
F	2	5.0	5.0	1.290994	2.50
M	2	5.0	5.0	1.290994	2.50

Wilcoxon Two-Sample Test

Statistic 5.0000

Normal Approximation

Z 0.0000
One-Sided Pr < Z 0.5000
Two-Sided Pr > |Z| 1.0000

t Approximation

One-Sided Pr < Z 0.5000
Two-Sided Pr > |Z| 1.0000

Z includes a continuity correction of 0.5.

Kruskal-Wallis Test

Chi-Square 0.0000
DF 1
Pr > Chi-Square 1.0000

Median Scores (Number of Points Above Median) for Variable WEIGHT
Classified by Variable Sex

Sex	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
F	2	1.0	1.0	0.577350	0.50
M	2	1.0	1.0	0.577350	0.50

Median Two-Sample Test

Statistic 1.0000
Z 0.0000
One-Sided Pr < Z 0.5000
Two-Sided Pr > |Z| 1.0000

Median One-Way Analysis

Chi-Square 0.0000
DF 1
Pr > Chi-Square 1.0000

Data Evaluation Report on Exposure of *Xenopus laevis* larvae to Different Concentrations of Atrazine in Semi-Natural Microcosms

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NONPARAMETRIC COMPARISON OF FROG LENGTH BETWEEN SEXES FOR EACH EXPOSURE GROUP 722

----- ATRAZINE=10 -----

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable WEIGHT
Classified by Variable Sex

Sex	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
F	2	5.0	5.0	1.290994	2.50
M	2	5.0	5.0	1.290994	2.50

Wilcoxon Two-Sample Test

Statistic 5.0000

Normal Approximation

Z 0.0000
One-Sided Pr < Z 0.5000
Two-Sided Pr > |Z| 1.0000

t Approximation

One-Sided Pr < Z 0.5000
Two-Sided Pr > |Z| 1.0000

Z includes a continuity correction of 0.5.

Kruskal-Wallis Test

Chi-Square 0.0000
DF 1
Pr > Chi-Square 1.0000

Median Scores (Number of Points Above Median) for Variable WEIGHT
Classified by Variable Sex

Sex	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
F	2	1.0	1.0	0.577350	0.50
M	2	1.0	1.0	0.577350	0.50

Median Two-Sample Test

Statistic 1.0000
Z 0.0000
One-Sided Pr < Z 0.5000
Two-Sided Pr > |Z| 1.0000

Median One-Way Analysis

Chi-Square 0.0000
DF 1
Pr > Chi-Square 1.0000

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NONPARAMETRIC COMPARISON OF FROG LENGTH BETWEEN SEXES FOR EACH EXPOSURE GROUP 724

----- ATRAZINE=25 -----

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable WEIGHT
Classified by Variable Sex

Sex	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
F	3	9.0	10.50	2.291288	3.0
M	3	12.0	10.50	2.291288	4.0

Wilcoxon Two-Sample Test

Statistic 9.0000

Normal Approximation

Z -0.4364
One-Sided Pr < Z 0.3313
Two-Sided Pr > |Z| 0.6625

t Approximation

One-Sided Pr < Z 0.3404
Two-Sided Pr > |Z| 0.6807

Z includes a continuity correction of 0.5.

Kruskal-Wallis Test

Chi-Square 0.4286
DF 1
Pr > Chi-Square 0.5127

Median Scores (Number of Points Above Median) for Variable WEIGHT
Classified by Variable Sex

Sex	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
F	3	1.0	1.50	0.670820	0.333333
M	3	2.0	1.50	0.670820	0.666667

Median Two-Sample Test

Statistic 1.0000
Z -0.7454
One-Sided Pr < Z 0.2280
Two-Sided Pr > |Z| 0.4561

Median One-Way Analysis

Chi-Square 0.5556
DF 1
Pr > Chi-Square 0.4561

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