

US EPA ARCHIVE DOCUMENT

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

Data Requirement::

EPA DP Barcode	D288775
EPA MRID	458677-06
EPA Guideline	70-1(Special Study)

Test material:

Purity: {.....}

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: 05/31/2003

CITATION: Sepulveda, M. S. and T. S. Gross. 2003. Characterization of Atrazine Exposures and Potential Effects in Florida Ecosystems Dominated by Sugarcane Agriculture: A Reconnaissance Survey of Amphibians in South Florida for the Assessment of Potential Atrazine Effects. Department of Physiological Sciences, University of Florida, Caribbean Science Center, Gainesville, Florida. Sponsor: Syngenta Crop Protection, Inc. Study ID: ECORISK Number UFL-02.

EXECUTIVE SUMMARY:

A reconnaissance survey for cane toads (*Bufo marinus*) in south Florida sugarcane-dominated agricultural sites (Belle Glade and Canal Point) and nonagricultural sites (University of Miami) indicated increased incidence of intersex (ovarian tissue in Bidder's organ) in frogs identified as having testes. *B. marinus* is typically a sexually dimorphic amphibian; however, 100% of the cane toads collected at Belle Glade and roughly 55% of the male/intersex frogs collected at Canal Point exhibited female coloration. Additionally, males typically exhibit nuptial pads; however 71% and 0% of the of the intersex frogs collected from Canal Point and Belle Glade, respectively, had nuptial pads. Vitellogenin, a female-specific protein, is not typically expressed in males; however, intersex frogs had vitellogenin levels ($774 \pm 29 \text{ PO}_4/\text{mg protein}$) similar to the females ($853 \pm 34 \text{ PO}_4/\text{mg protein}$) and was roughly double that of male toads ($375 \pm 34 \text{ PO}_4/\text{mg protein}$). Plasma sex steroids (17- β estradiol and testosterone) were relatively gender-specific; however, testosterone levels in intersex males exhibited roughly twice the amount of variability as similar estimates for males. Although agricultural sites had atrazine concentrations ranging from <0.01 to $24.45 \mu\text{g/L}$ over the six-month sampling period, no atrazine levels were measured at the University of Miami (nonagricultural) site.

The study authors clearly recognized the potential for other chemicals to confound the interpretation of this study, but they failed to monitor for any other chemicals. The study authors also failed to characterize atrazine levels in nonagricultural sites and water quality parameters that could have impacted the development of frogs.

In this study, the southern toad (*B. terrestris*) was also examined and found to have an increased incidence of intersex (Bidder's organ containing ovarian tissue) in both agricultural and nonagricultural sites. The study authors speculate that the presence of a Bidder's organ may have rendered the animals more sensitive to developmental effects. Bidder's organ is characterized as a nonfunctional, rudimentary ovary; however, no information is available on whether the organ has an endocrine function at any time during the development of the animal. Additionally, while bufonids typically exhibit Bidder's organs at the anterior of each testis, oogenesis is normally abortive because the oocytes fail to reach vitellogenesis and undergo a degenerative process. However, the one slide depicting an intersex male in this study suggested that the oocytes possessed yolk and were therefore vitellogenic.

This study was useful in identifying the incidence of hermaphroditism in field-collected toads. As with the previous studies, toads with testes also appeared to have ovarian tissue, but unlike previous studies the ovarian tissue was associated with the Bidder's organ rather than the testes. While toads collected in agricultural sites may have been exposed to atrazine during development, it is unknown whether atrazine was present at the nonagricultural sites. Other problems with the the study design include exposure to other agrochemicals and environmental conditions relevant to development of toads, *e.g.*, water quality characteristics. These factors limit an interpretation of the findings and make it difficult to establish causality. Based on these data, it is difficult to conclude that atrazine exposure was associated with an increased incidence of intersex. Also, the study does not provide insights on the ecological relevance of the data. If toads depend on coloration to attract mates, though, toads from agricultural sites may have an impaired ability to attract mates because of their distinctly female appearance.

I. MATERIALS AND METHODS

GUIDELINE FOLLOWED:
COMPLIANCE:

Nonguideline Study
Not conducted under GLP; however, most practices as defined by 40CFR Part 160, August 19, 1989, were established for this study, including but not limited to:

1. Written, authorized preliminary protocol
2. Written, authorized Standard Operating Procedures for all key procedures.
3. Organization and personnel were sufficient in terms of number, education, training and experience.
4. Independent QA inspections were conducted
5. Final Report was written
6. Raw data, documentation, records, protocols, and final report were archived

A. MATERIALS:

1. Test Material

[Complete this subsection using the information provided in the methodology section of the study report. Name of test material as cited in the study report.]

Description: Atrazine

Lot No./Batch No. :

Purity: NA

Stability of compound under test conditions:

Storage conditions of test chemicals: NA

2. Test organism:

Species: Cane toad (*Bufo marinus*); Southern toad (*B. terrestris*); Green Treefrog (*Hyla cinera*); Cuban Treefrog (*Osteopilus septentrionalis*)

Age at test initiation: Field collected animals; age not determined

Weight at study initiation: (mean and range)

Male:	125.1 ± 8.3 g
Female:	133.9 ± 10.3 g
Intersex:	123.0 ± 14.5 g

Length at study initiation: (mean and range)

Male:	100.6 ± 2.5 mm
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Female: 104.9 ± 2.4 mm
 Intersex: 99.9 ± 6.7 mm

Source: Field-collected at Belle Glade and Canal Point (sugar cane sites); University of Miami (nonagricultural site)

B. STUDY DESIGN:

Objective:

- 1) To determine whether exposure of frogs to sugarcane agricultural areas in South Florida would result in a higher incidence of intersex and/or other gonadal/developmental anomalies
- 2) to examine amphibian populations exposed to a complex mixture of several pesticides and assorted agrichemicals.

1. Experimental Conditions

a) Range-finding Study: Preliminary

b) Definitive Study

Table 1 . Experimental Parameters

Parameter	Details
Acclimation: period: Conditions: (same as test or not) Feeding: Health: (any mortality observed)	NA
Duration of the test	NA
Test condition static/flow- through Type of dilution system for flow- through method. Renewal rate for static renewal	NA
Aeration, if any	NA
Test vessel	NA

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

Parameter	Details
Source of dilution water Quality:	NA
Water parameters: Hardness pH Dissolved oxygen Total Organic carbon Particulate Matter Metals Pesticides Chlorine Temperature {Salinity for marine or estuarine species} Intervals of water quality measurement	NA
Number of replicates/groups: control: solvent control: treated ones:	NA
Number of organisms per replicate /groups: control: solvent control: treated ones:	NA
Biomass loading rate	NA
Test concentrations: nominal: measured:	NA
Solvent (type, percentage, if used)	NA
Lighting	NA
Feeding	NA

US EPA ARCHIVE DOCUMENT

Parameter	Details
Recovery of chemical Level of Quantitation Level of Detection	NA
Positive control {if used, indicate the chemical and concentrations}	NA
Other parameters, if any	NA

Reconnaissance survey was conducted in the field:

Initially, distribution and concentration of atrazine at south Florida sites (Belle Glade and Canal Point) was measured by collecting multiple water samples from several canals/ditches every 2 weeks from February through June with an additional sample in mid-July. A scoping survey of atrazine did not include University of Miami site. No chemicals other than atrazine were screened.

A scoping survey of amphibians for *Bufo marinus* was conducted; however, only the University of Miami site was identified as nonagricultural and having *B. marinus*.

Although *B. terrestris* was located at Belle Glade, it was not located at Canal Point. Two nonagricultural sites (Archibald Biological Station and Fisheater Creek) did have the Southern Toad.

2. Observations:

Table 2: Observations

Criteria	Details
Parameters measured including the sublethal effects/toxicity symptoms	
Observation intervals	
Were raw data included?	
Other observations, if any	

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 appeared to differ in any substantive way, the difference was reported in the text below.]

Canals and ditches were sampled for atrazine at both of the agricultural sites. Atrazine levels ranged from < 0.10 to 24.45 ppb at Belle Glade and from < 0.10 to 19.54 ppb at Canal Point. Atrazine concentration at Belle Glade (consisting of 8 sampling sites) peaked in early February (February 10) and then rapidly declined to a more or less steady state for the remainder of the sampling period. At Canal Point (consisting of 8 sampling sites), atrazine concentrations peaked on March 16 and again on April 14, but remained sporadic.

Distribution of Amphibians

Bufo marinus was located in two sugarcane areas (Belle Glade and Canal Point) and only one nonagricultural area, *i.e.*, University of Miami. *Bufo terrestris* was located in one sugarcane area (Belle Glade) and two nonagricultural sites, *i.e.*, Archibald Biological Station and Fisheater Creek. *Hyla cinera* was present at Belle Glade and Archibald. *O. septentrionalis* was present at Belle Glade and Fisheating Creek.

Body weight, length and coloration were recorded; blood was collected by cardiac puncture.

Gender defined by:

- female: present of ovarian tissue and absence of testicular tissue
- male: presence of testes and absence of developing eggs and/or ovarian tissue
- intersex: presence of testes and developing eggs and/or ovarian tissue.

Gonadal Deformities:

- segmented testes: testes with clear demarcations or splits
- highly segmented: testes with demarcations making testes appear multiple
- abnormal shaped: twisted or curled
- multiple testes: not defined in text

intersex: not defined in text but likely refers to mix of ovarian and testicular tissue in same organism

Only testes were examined histologically; sections were fixed in formalin and then embedded in parafin. Approximately 29% of the males collected from Belle Glade and 39% of the males collected from Canal Point were intersexed based on ovarian tissue located in the Bidder's organ of males.

For *B. terrestris*, 6 of 18 (33%) were intersex from Archibaold (nonagricultural site); 3 of 21 (14%) were intersex from Belle Glade; and 5 of 23 (22%) were intersex from Fisheater Creek (cattle/citrus site).

Plasma was analyzed for 17-β estradiol and testosterone using radioimmunoassay and for alkali-labile phosphate as in indirect measure of vitellogenin.

Table 3 . Distribution of amphibians in both agricultural (sugarcane) and nonagricultural sites.

Species	Agricultural (Sugarcane Site)		Nonagricultural Site		
	Belle Glade	Canal Point	Univ. of Miami	Archibald	Fisheater
Cane Toad (<i>B. marinus</i>)	X	X	X		
Southern Toad (<i>B. terrestris</i>)	X			X	X
Green Treefrog (<i>Hyla cinera</i>)	X			X	
Cuban Treefrog (<i>Ostropilus septentrionalis</i>)	X				X

C. VERIFICATION OF STATISTICAL RESULTS: Basic statistics run using SAS® (Statistical Analysis System, Release 8.01, Cary, North Carolina). (See attached printout).

D. STUDY DEFICIENCIES: The study failed to measure atrazine in nonagricultural sites and to collect any information on other chemicals present at the sites. The study also failed to characterize water quality at any of the collection sites.

The University of Miami nonagricultural site was added late in the study and was therefore not included in any

of the atrazine sampling efforts.

According to the protocol, animals collected will include: tadpoles at early, mid, and late metamorphosis (>30 per site), metamorphs (>30 per site), and adults (10 males and 10 females per site) as available for each species. Each site will contain 3 replicates/location. Blood will be collected for subsequent endocrine biomarker analysis (E, T, P and DHT). Gonadal tissue from adults will be fixed for subsequent evaluation of gonadal tissues and laryngeal development and subsequent atrazine analysis. The protocol was amended to show that only adults were collected because tadpoles were “difficult to collect.” Does this mean that tadpoles were too few in number to collect?

No effort was made to characterize the larynxes because the technique for doing so had not been validated for *B. marinus*.

No P or DHT analysis was performed for *B. marinus* because validated procedures were not available for this species.

Proposed experimental start date on UFL-02 protocol (April 1, 2001) does not agree with proposed experimental start and termination date, i.e., March 1, 2002, and October 1, 2003, respectively also reported in the protocol

E. REVIEWER’S COMMENTS:

Although the study objective states that a range of chemicals are used on sugarcane and implies a recognition that other chemicals would potentially confound any effort to link anomalies to atrazine, the study failed to measure any chemicals in the nonagricultural (University of Miami) site and only measured atrazine in each of the agricultural sites (Belle Glade and Canal Point). Atrazine concentrations in agricultural sites ranged over three orders of magnitude. While some sampling sites exhibited relatively high atrazine concentrations during a sampling date, others samples collected from different areas of the same site exhibited low atrazine concentrations. Although no intersex animals were detected in the nonagricultural site, the authors suggested that the incidence of intersex in agricultural sites may be reflective of “background”. The authors also suggested that Bidder’s organ may potentially render Bufonidae more susceptible to gonad effects. It is unclear whether the characterization of Bidder’s organ as being a “nonfunctional, rudimentary ovary” is entirely correct because literature suggests that if normal males are castrated, the Bidder’s organ will differentiate into an ovary. If the theory that atrazine up-regulates is correct and testosterone is transformed into estrogen, is there sufficiently low testosterone or sufficiently high estrogen to result in differentiation of the Bidder’s organ?

Across treatment sites, estradiol in intersex animals was only slightly (302 ± 33 pg/mL) above levels found in normal males (293 ± 23 pg/mL); serum testosterone in intersex males was slightly lower (503 ± 307 pg/mL) than normal males (552 ± 174 pg/mL). It is clear, though, that the variability in testosterone levels for intersex males (CV= 61%) was roughly double that of normal males (31.5%). Additionally, labile phosphate as an indirect measure of plasma vitellogenin levels in intersex males (774 ± 29 PO₄/mg protein) was roughly double the level in normal males (375 ± 34 PO₄/mg protein) and was similar to the levels contained in females (853 ± 34 PO₄/mg protein). If the labile phosphate (ALP) is indicative of vitellogenin, then vitellogenesis in intersex animals has been up-regulated by exposure to either an endogenous and/or exogenous estrogen.

It is unclear why the Bidder's organ makes the toad a generally more sensitive species to the effects of atrazine or other endocrine disrupting chemicals. It could be argued that this natural hermaphroditic condition is a confounding characteristic since the ovarian tissue of Bidder's organ is presumably capable of estrogen synthesis and therefore capable of inducing vitellogenin synthesis in the absence of an exogenous estrogen. This study seems to indicate that vitellogenin levels in the intersex organisms approximates the normal female condition in the absence of elevated plasma estrogen. But, the lack of a strong vitellogenic response of the normal males from the same site suggests that they have not been exposed to an estrogenic chemical. This presumes that the ALP-measurement is a good surrogate for vitellogenin and that the male levels at the reference site represents baseline vitellogenin concentrations. This issue clearly needs more research.

Furthermore, although *Bufo marinus* is typically a sexually dimorphic species with gender-specific coloration being detected in the nonagricultural site collected animals, female coloration pattern was detected in 100% of the frogs (male, female and intersex) collected at Belle Glade and 57%, 54% and 100% of the intersex, male and female frogs collected from Canal Point, respectively.

Nuptial pads were not identified for females from any of the sites. In males collected from nonagricultural sites, 90% had nuptial pads, while 82% and 32% of the males had nuptial pads from Canal Point and Belle Glade, respectively. For males identified as intersex from Canal Point and Belle Glade, 71% and 0% had nuptial pads, respectively.

Testicular abnormalities other than intersex were somewhat similar across collection sites with 44% for Canal Point, 61% for Belle Glade and 45% for University of Miami.

F. CONCLUSIONS: It is not clear why the authors concluded that *Bufo marinus* may be more sensitive to factors that influence gonadal development and sexual differentiation because it possesses a nonfunctional rudimentary ovary (Bidder's organ). For that reason, the species may be a useful sentinel for factors influencing gonadal development. Additionally, while bufonids typically exhibit Bidder's organs at the anterior of each testis, oogenesis is normally abortive because the oocytes fail to reach vitellogenesis and undergo a degenerative process (Petrini and Zaccanti 1998)¹. However, the one slide (Figure 3F) depicting an intersex male in this study suggests that the oocytes possessed yolk and were therefore vitellogenic. Although the authors state that previous studies have hypothesized a potential developmental mechanism of action for atrazine and that the current study was indirectly designed to evaluate a similar mechanism of action in amphibians, the current study's focus on adults does not permit direct evaluation of this effect. Also, it is difficult to test the hypothesis that atrazine exposure resulted in developmental effects in amphibians because atrazine was not measured in nonagricultural sites, other chemicals were not measured at any of the sites, and no water quality data were collected to characterize the study sites. While it may have been possible to derive some correlation between the incidence of intersex in males and atrazine patterns within particular areas of the sample sites, these data are not provided.

Since intersex, *i.e.*, ovarian tissue in the Bidder's organ, did not appear to involve the testes *per se*, it is unclear

¹Petrini, S. and F. Zaccanti. 1998. The effects of Aromatase and 5 α -reductase inhibitors, antiandrogen, and sex steroids on Bidder's organs development and gonadal differentiation in *Bufo bufo* tadpoles. The Journal of Experimental Zoology 280: 245 - 259.

whether the reproductive capacity of the adult frogs was diminished due to this effect. However, the intersex frogs appear to be responding to an environmental estrogen given their elevated vitellogenin levels and a distinctly female appearance. If these frogs rely heavily of coloration to attract mate, their ability to reproduce may be impaired

The incidence of intersex in *Bufo terrestris* also appeared to be elevated; however this was true for both agricultural and nonagricultural sites. The authors speculate that this increased incidence may be indicative of the variability in the background occurrence of intersex among amphibians with a Bidder's organ. Since atrazine levels at the nonagricultural sites were not characterized, it is difficult to speculate on the relevancy of the proposition of "background".

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

MEAN LENGTH WEIGHT GONAD AND GONADOSOMATIC INDEX BY SITE AND SEX

1

Obs	site	Sex	_TYPE_	_FREQ_	LENGTH	WEIGHT	GONAD	GSE	SD_LT	SD_WT	SD_GONAD	SD_GSI
1	BG	F	0	19	92.979	94.005	2.22374	1.11278	19.0811	67.773	4.3402	1.16438
2	BG	I	0	9	96.332	94.639	0.21622	0.23778	10.6652	40.275	0.0927	0.08913
3	BG	M	0	22	90.763	79.609	0.23955	0.31182	7.4531	21.577	0.2006	0.29333
4	CP	F	0	37	109.067	143.762	6.29178	3.35892	15.8198	65.904	10.8004	5.11631
5	CP	I	0	7	104.639	159.486	0.53771	0.37286	39.9476	59.198	0.1515	0.18901
6	CP	M	0	11	106.042	128.105	0.41200	0.32727	10.1743	47.890	0.1693	0.11934
7	UM	F	0	4	122.835	232.685	9.56100	4.33500	13.9482	136.862	5.1713	1.41630
8	UM	M	0	20	108.400	174.345	0.40530	0.23050	24.0066	57.599	0.1495	0.05375

ANOVA FOR LENGTH BETWEEN SITES

2

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

The ANOVA Procedure

Class Level Information

Class	Levels	Values
site	3	BG CP UM
Number of observations		60

Dependent Variable: SVL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	4629.32548	2314.66274	8.17	0.0008
Error	57	16146.86161	283.27827		
Corrected Total	59	20776.18709			

R-Square	Coeff Var	Root MSE	SVL Mean
0.222819	16.04614	16.83087	104.8905

Source	DF	Anova SS	Mean Square	F Value	Pr > F
site	2	4629.325476	2314.662738	8.17	0.0008

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

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
site	2	194186	97093.2	0.56	0.5751
Error	57	9906646	173801		

Bartlett's Test for Homogeneity of SVL Variance

Source	DF	Chi-Square	Pr > ChiSq
site	2	1.0035	0.6055

Dunnett's t Tests for SVL

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

Alpha	0.05
Error Degrees of Freedom	57
Error Mean Square	283.2783
Critical Value of Dunnett's t	2.28365

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

site Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
UM - BG	29.856	8.712 51.000 ***
CP - BG	16.088	5.240 26.936 ***

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

ANOVA FOR LENGTH BETWEEN SITES

6

----- Sex=I -----

The ANOVA Procedure

Class Level Information

Class	Levels	Values
site	2	BG CP

Number of observations 16

Dependent Variable: SVL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	271.66953	271.66953	0.36	0.5566
Error	14	10484.85064	748.91790		
Corrected Total	15	10756.52018			

R-Square	Coeff Var	Root MSE	SVL Mean
0.025256	27.37560	27.36636	99.96625

Source	DF	Anova SS	Mean Square	F Value	Pr > F
site	1	271.6695337	271.6695337	0.36	0.5566

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

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
site	1	6318154	6318154	1.83	0.1976
Error	14	48349862	3453562		

Bartlett's Test for Homogeneity of SVL Variance

Source	DF	Chi-Square	Pr > ChiSq
site	1	9.8175	0.0017

Dunnett's t Tests for SVL

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

Alpha	0.05
Error Degrees of Freedom	14
Error Mean Square	748.9179
Critical Value of Dunnett's t	2.14485

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

site Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
CP - BG	8.306	-21.274 37.887

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

ANOVA FOR LENGTH BETWEEN SITES

10

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

The ANOVA Procedure

Class Level Information

Class	Levels	Values
site	3	BG CP UM

Number of observations 53

Dependent Variable: SVL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	3671.52388	1835.76194	6.98	0.0021
Error	50	13151.65680	263.03314		
Corrected Total	52	16823.18068			

R-Square	Coeff Var	Root MSE	SVL Mean
0.218242	16.12326	16.21830	100.5894

Source	DF	Anova SS	Mean Square	F Value	Pr > F
site	2	3671.523883	1835.761942	6.98	0.0021

12

ANOVA FOR LENGTH BETWEEN SITES
Levene's Test for Homogeneity of SVL Variance
ANOVA of Squared Deviations from Group Means

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
site	2	2890854	1445427	0.89	0.4168
Error	50	81136179	1622724		

Bartlett's Test for Homogeneity of SVL Variance

Source	DF	Chi-Square	Pr > ChiSq
site	2	26.2881	<.0001

Dunnett's t Tests for SVL

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

Alpha	0.05
Error Degrees of Freedom	50
Error Mean Square	263.0331
Critical Value of Dunnett's t	2.28707

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

site Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
UM - BG	17.637	6.177 29.097 ***
CP - BG	15.279	1.582 28.976 ***

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

NONPARAMETRIC COMPARISON OF LENGTH BETWEEN SITES

14

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

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable SVL
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	19	363.0	579.50	62.927869	19.105263
CP	37	1276.0	1128.50	65.771701	34.486486
UM	4	191.0	122.00	33.744135	47.750000

Kruskal-Wallis Test

Chi-Square 13.9187
DF 2
Pr > Chi-Square 0.0009

Median Scores (Number of Points Above Median) for Variable SVL
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	19	4.0	9.50	1.816823	0.210526
CP	37	22.0	18.50	1.898929	0.594595
UM	4	4.0	2.00	0.974245	1.000000

Median One-Way Analysis

Chi-Square 11.4979
DF 2
Pr > Chi-Square 0.0032

US EPA ARCHIVE DOCUMENT

NONPARAMETRIC COMPARISON OF LENGTH BETWEEN SITES

16

----- Sex=I -----

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable SVL
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	9	56.0	76.50	9.447222	6.222222
CP	7	80.0	59.50	9.447222	11.428571

Wilcoxon Two-Sample Test

Statistic 80.0000
Normal Approximation
Z 2.1170
One-Sided Pr > Z 0.0171
Two-Sided Pr > |Z| 0.0343

t Approximation
One-Sided Pr > Z 0.0257
Two-Sided Pr > |Z| 0.0514

Z includes a continuity correction of 0.5.

Kruskal-Wallis Test

Chi-Square 4.7087
DF 1
Pr > Chi-Square 0.0300

The NPAR1WAY Procedure

Median Scores (Number of Points Above Median) for Variable SVL
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	9	2.0	4.50	1.024695	0.222222
CP	7	6.0	3.50	1.024695	0.857143

Median Two-Sample Test

Statistic 6.0000
Z 2.4398
One-Sided Pr > Z 0.0073
Two-Sided Pr > |Z| 0.0147

Median One-Way Analysis

Chi-Square 5.9524
DF 1
Pr > Chi-Square 0.0147

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

NONPARAMETRIC COMPARISON OF LENGTH BETWEEN SITES

18

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

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable SVL
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	22	313.0	594.0	55.398556	14.227273
CP	11	348.0	297.0	45.596052	31.636364
UM	20	770.0	540.0	54.497706	38.500000

Kruskal-Wallis Test

Chi-Square 27.1304
DF 2
Pr > Chi-Square <.0001

The NPAR1WAY Procedure

Median Scores (Number of Points Above Median) for Variable SVL
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	22	1.0	10.792453	1.810436	0.045455
CP	11	7.0	5.396226	1.490088	0.636364
UM	20	18.0	9.811321	1.780996	0.900000

Median One-Way Analysis

Chi-Square 31.1926
DF 2
Pr > Chi-Square <.0001

US EPA ARCHIVE DOCUMENT

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

ANOVA FOR WEIGHT BETWEEN SITES

20

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

The ANOVA Procedure

Class Level Information

Class	Levels	Values
site	3	BG CP UM

Number of observations 60

Dependent Variable: wt

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	72873.3117	36436.6559	7.03	0.0019
Error	57	295228.9890	5179.4559		
Corrected Total	59	368102.3007			

R-Square	Coeff Var	Root MSE	wt Mean
0.197970	53.73440	71.96844	133.9336

Source	DF	Anova SS	Mean Square	F Value	Pr > F
site	2	72873.31174	36436.65587	7.03	0.0019

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

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
site	2	3.5729E8	1.7864E8	2.91	0.0624
Error	57	3.4941E9	61300449		

Bartlett's Test for Homogeneity of wt Variance

Source	DF	Chi-Square	Pr > ChiSq
site	2	4.3547	0.1133

Dunnnett's t Tests for wt

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

Alpha	0.05
Error Degrees of Freedom	57
Error Mean Square	5179.456
Critical Value of Dunnnett's t	2.28365

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

site Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
UM - BG	138.68	48.27 229.09 ***
CP - BG	49.76	3.37 96.14 ***

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

ANOVA FOR WEIGHT BETWEEN SITES

24

----- Sex=I -----

The ANOVA Procedure

Class Level Information

Class	Levels	Values
site	2	BG CP

Number of observations 16

Dependent Variable: wt

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	16557.62363	16557.62363	6.82	0.0205
Error	14	34003.16446	2428.79746		
Corrected Total	15	50560.78809			

R-Square	Coeff Var	Root MSE	wt Mean
0.327480	40.06429	49.28283	123.0094

Source	DF	Anova SS	Mean Square	F Value	Pr > F
site	1	16557.62363	16557.62363	6.82	0.0205

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

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
site	1	9605650	9605650	1.11	0.3100
Error	14	1.2117E8	8654926		

Bartlett's Test for Homogeneity of wt Variance

Source	DF	Chi-Square	Pr > ChiSq
site	1	0.9592	0.3274

Dunnett's t Tests for wt

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

Alpha	0.05
Error Degrees of Freedom	14
Error Mean Square	2428.797
Critical Value of Dunnett's t	2.14485

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

site Comparison	Difference Between Means	Simultaneous 95% Confidence Limits	
CP - BG	64.85	11.58 118.12	***

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

ANOVA FOR WEIGHT BETWEEN SITES

28

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

The ANOVA Procedure

Class Level Information

Class	Levels	Values
site	3	BG CP UM

Number of observations 53

Dependent Variable: wt

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	94122.4446	47061.2223	24.58	<.0001
Error	50	95747.7804	1914.9556		
Corrected Total	52	189870.2250			

R-Square	Coeff Var	Root MSE	wt Mean
0.495720	34.88999	43.76021	125.4234

Source	DF	Anova SS	Mean Square	F Value	Pr > F
site	2	94122.44456	47061.22228	24.58	<.0001

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

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
site	2	77865494	38932747	3.38	0.0420
Error	50	5.7584E8	11516787		

Bartlett's Test for Homogeneity of wt Variance

Source	DF	Chi-Square	Pr > ChiSq
site	2	16.9429	0.0002

Dunnett's t Tests for wt

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

Alpha	0.05
Error Degrees of Freedom	50
Error Mean Square	1914.956
Critical Value of Dunnett's t	2.28707

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

site Comparison	Difference Between Means	Simultaneous 95% Confidence Limits	
UM - BG	94.74	63.81 125.66	***
CP - BG	48.50	11.54 85.45	***

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

NONPARAMETRIC COMPARISON OF WEIGHT BETWEEN SITES

32

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

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable wt
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	19	371.0	579.50	62.926995	19.526316
CP	37	1270.0	1128.50	65.770787	34.324324
UM	4	189.0	122.00	33.743666	47.250000

Average scores were used for ties.

Kruskal-Wallis Test

Chi-Square	12.9558
DF	2
Pr > Chi-Square	0.0015

Median Scores (Number of Points Above Median) for Variable wt
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	19	3.0	9.50	1.816823	0.157895
CP	37	23.0	18.50	1.898929	0.621622
UM	4	4.0	2.00	0.974245	1.000000

Average scores were used for ties.

Median One-Way Analysis

Chi-Square	14.8325
DF	2
Pr > Chi-Square	0.0006

US EPA ARCHIVE DOCUMENT

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

NONPARAMETRIC COMPARISON OF WEIGHT BETWEEN SITES

34

----- Sex=I -----

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable wt
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	9	59.0	76.50	9.447222	6.555556
CP	7	77.0	59.50	9.447222	11.000000

Wilcoxon Two-Sample Test

Statistic 77.0000

Normal Approximation

Z 1.7995
One-Sided Pr > Z 0.0360
Two-Sided Pr > |Z| 0.0719

t Approximation

One-Sided Pr > Z 0.0460
Two-Sided Pr > |Z| 0.0921

Z includes a continuity correction of 0.5.

Kruskal-Wallis Test

Chi-Square 3.4314
DF 1
Pr > Chi-Square 0.0640

Median Scores (Number of Points Above Median) for Variable wt
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	9	3.0	4.50	1.024695	0.333333
CP	7	5.0	3.50	1.024695	0.714286

Median Two-Sample Test

Statistic 5.0000
Z 1.4639
One-Sided Pr > Z 0.0716
Two-Sided Pr > |Z| 0.1432

Median One-Way Analysis

Chi-Square 2.1429
DF 1
Pr > Chi-Square 0.1432

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

NONPARAMETRIC COMPARISON OF WEIGHT BETWEEN SITES

36

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

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable wt
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	22	331.0	594.0	55.397439	15.045455
CP	11	313.0	297.0	45.595133	28.454545
UM	20	787.0	540.0	54.496608	39.350000

Average scores were used for ties.

Kruskal-Wallis Test

Chi-Square	26.0714
DF	2
Pr > Chi-Square	<.0001

Median Scores (Number of Points Above Median) for Variable wt
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	22	1.0	10.792453	1.810436	0.045455
CP	11	7.0	5.396226	1.490088	0.636364
UM	20	18.0	9.811321	1.780996	0.900000

Average scores were used for ties.

Median One-Way Analysis

Chi-Square	31.1926
DF	2
Pr > Chi-Square	<.0001

US EPA ARCHIVE DOCUMENT

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

ANOVA FOR GONAD WEIGHT BETWEEN SITES

38

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

The ANOVA Procedure

Class Level Information

Class	Levels	Values
site	3	BG CP UM

Number of observations 60

Dependent Variable: gonad

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	288.453909	144.226955	1.78	0.1779
Error	57	4618.623706	81.028486		
Corrected Total	59	4907.077615			

R-Square	Coeff Var	Root MSE	gonad Mean
0.058783	172.3940	9.001582	5.221517

Source	DF	Anova SS	Mean Square	F Value	Pr > F
site	2	288.4539090	144.2269545	1.78	0.1779

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

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
site	2	128737	64368.3	1.67	0.1977
Error	57	2199727	38591.7		

Bartlett's Test for Homogeneity of gonad Variance

Source	DF	Chi-Square	Pr > ChiSq
site	2	15.4430	0.0004

Dunnett's t Tests for gonad

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

Alpha	0.05
Error Degrees of Freedom	57
Error Mean Square	81.02849
Critical Value of Dunnett's t	2.28365

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

site Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
UM - BG	7.337	-3.971 18.646
CP - BG	4.068	-1.734 9.870

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

ANOVA FOR GONAD WEIGHT BETWEEN SITES

42

----- Sex=I -----

The ANOVA Procedure

Class Level Information

Class	Levels	Values
site	2	BG CP

Number of observations 16

Dependent Variable: gonad

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	0.40696877	0.40696877	27.59	0.0001
Error	14	0.20647098	0.01474793		
Corrected Total	15	0.61343975			

R-Square	Coeff Var	Root MSE	gonad Mean
0.663421	34.02901	0.121441	0.356875

Source	DF	Anova SS	Mean Square	F Value	Pr > F
site	1	0.40696877	0.40696877	27.59	0.0001

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

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
site	1	0.000571	0.000571	0.92	0.3534
Error	14	0.00868	0.000620		

Bartlett's Test for Homogeneity of gonad Variance

Source	DF	Chi-Square	Pr > ChiSq
site	1	1.5542	0.2125

Dunnett's t Tests for gonad

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

Alpha	0.05
Error Degrees of Freedom	14
Error Mean Square	0.014748
Critical Value of Dunnett's t	2.14485

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

site Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
CP - BG	0.32149	0.19023 0.45276 ***

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

ANOVA FOR GONAD WEIGHT BETWEEN SITES

46

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

The ANOVA Procedure

Class Level Information

Class	Levels	Values
site	3	BG CP UM

Number of observations 53

Dependent Variable: gonad

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	0.36407367	0.18203683	5.85	0.0052
Error	50	1.55651365	0.03113027		
Corrected Total	52	1.92058732			

R-Square	Coeff Var	Root MSE	gonad Mean
0.189564	52.21800	0.176438	0.337887

Source	DF	Anova SS	Mean Square	F Value	Pr > F
site	2	0.36407367	0.18203683	5.85	0.0052

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

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
site	2	0.00324	0.00162	0.27	0.7670
Error	50	0.3041	0.00608		

Bartlett's Test for Homogeneity of gonad Variance

Source	DF	Chi-Square	Pr > ChiSq
site	2	1.6748	0.4328

Dunnett's t Tests for gonad

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

Alpha	0.05
Error Degrees of Freedom	50
Error Mean Square	0.03113
Critical Value of Dunnett's t	2.28707

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

site Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
CP - BG	0.17245	0.02344 0.32147 ***
UM - BG	0.16575	0.04108 0.29043 ***

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

NONPARAMETRIC COMPARISON OF GONAD WEIGHT BETWEEN SITES

50

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

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable gonad
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	19	346.0	579.50	62.926995	18.210526
CP	37	1282.0	1128.50	65.770787	34.648649
UM	4	202.0	122.00	33.743666	50.500000

Average scores were used for ties.

Kruskal-Wallis Test

Chi-Square	16.7428
DF	2
Pr > Chi-Square	0.0002

Median Scores (Number of Points Above Median) for Variable gonad
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	19	4.0	9.50	1.816823	0.210526
CP	37	22.0	18.50	1.898929	0.594595
UM	4	4.0	2.00	0.974245	1.000000

Average scores were used for ties.

Median One-Way Analysis

Chi-Square	11.4979
DF	2
Pr > Chi-Square	0.0032

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NONPARAMETRIC COMPARISON OF GONAD WEIGHT BETWEEN SITES

52

----- Sex=I -----

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable gonad
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	9	48.0	76.50	9.433319	5.333333
CP	7	88.0	59.50	9.433319	12.571429

Average scores were used for ties.

Wilcoxon Two-Sample Test

Statistic 88.0000

Normal Approximation

Z 2.9682
One-Sided Pr > Z 0.0015
Two-Sided Pr > |Z| 0.0030

t Approximation

One-Sided Pr > Z 0.0048
Two-Sided Pr > |Z| 0.0096

Z includes a continuity correction of 0.5.

Kruskal-Wallis Test

Chi-Square 9.1277
DF 1
Pr > Chi-Square 0.0025

Median Scores (Number of Points Above Median) for Variable gonad
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	9	2.0	4.50	1.024695	0.222222
CP	7	6.0	3.50	1.024695	0.857143

Average scores were used for ties.

Median Two-Sample Test

Statistic 6.0000
Z 2.4398
One-Sided Pr > Z 0.0073
Two-Sided Pr > |Z| 0.0147

Median One-Way Analysis

Chi-Square 5.9524
DF 1
Pr > Chi-Square 0.0147

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

NONPARAMETRIC COMPARISON OF GONAD WEIGHT BETWEEN SITES

54

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

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable gonad
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	22	382.50	594.0	55.386271	17.386364
CP	11	377.50	297.0	45.585941	34.318182
UM	20	671.00	540.0	54.485621	33.550000

Average scores were used for ties.

Kruskal-Wallis Test

Chi-Square	14.5995
DF	2
Pr > Chi-Square	0.0007

Median Scores (Number of Points Above Median) for Variable gonad
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	22	4.0	10.792453	1.810436	0.181818
CP	11	8.0	5.396226	1.490088	0.727273
UM	20	14.0	9.811321	1.780996	0.700000

Average scores were used for ties.

Median One-Way Analysis

Chi-Square	14.0970
DF	2
Pr > Chi-Square	0.0009

US EPA ARCHIVE DOCUMENT

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

ANOVA FOR GONADOSOMATIC INDEX BETWEEN SITES

56

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

The ANOVA Procedure

Class Level Information

Class	Levels	Values
site	3	BG CP UM
Number of observations		60

NOTE: Due to missing values, only 59 observations can be used in this analysis.

Dependent Variable: GSI

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	72.010680	36.005340	2.08	0.1350
Error	56	971.423418	17.346847		
Corrected Total	58	1043.434098			

R-Square	Coeff Var	Root MSE	GSI Mean
0.069013	152.0150	4.164955	2.739831

Source	DF	Anova SS	Mean Square	F Value	Pr > F
site	2	72.01068044	36.00534022	2.08	0.1350

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

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
site	2	8045.3	4022.6	1.28	0.2865
Error	56	176236	3147.1		

Bartlett's Test for Homogeneity of GSI Variance

Source	DF	Chi-Square	Pr > ChiSq
site	2	32.7955	<.0001

Dunnett's t Tests for GSI

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

Alpha	0.05
Error Degrees of Freedom	56
Error Mean Square	17.34685
Critical Value of Dunnett's t	2.28391

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

site Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
UM - BG	3.2222	-2.0359 8.4804
CP - BG	2.2461	-0.4875 4.9797

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

ANOVA FOR GONADOSOMATIC INDEX BETWEEN SITES

60

----- Sex=I -----

The ANOVA Procedure

Class Level Information

Class	Levels	Values
site	2	BG CP

Number of observations 16

Dependent Variable: GSI

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	0.07184534	0.07184534	3.62	0.0779
Error	14	0.27789841	0.01984989		
Corrected Total	15	0.34974375			

R-Square	Coeff Var	Root MSE	GSI Mean
0.205423	47.45756	0.140890	0.296875

Source	DF	Anova SS	Mean Square	F Value	Pr > F
site	1	0.07184534	0.07184534	3.62	0.0779

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

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
site	1	0.00219	0.00219	1.21	0.2896
Error	14	0.0253	0.00180		

Bartlett's Test for Homogeneity of GSI Variance

Source	DF	Chi-Square	Pr > ChiSq
site	1	3.5402	0.0599

Dunnett's t Tests for GSI

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

Alpha	0.05
Error Degrees of Freedom	14
Error Mean Square	0.01985
Critical Value of Dunnett's t	2.14485

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

site Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
CP - BG	0.13508	-0.01721 0.28737

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

ANOVA FOR GONADOSOMATIC INDEX BETWEEN SITES

64

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

The ANOVA Procedure

Class Level Information

Class	Levels	Values
site	3	BG CP UM

Number of observations 53

Dependent Variable: GSI

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	0.09486143	0.04743072	1.18	0.3147
Error	50	2.00424045	0.04008481		
Corrected Total	52	2.09910189			

R-Square	Coeff Var	Root MSE	GSI Mean
0.045191	70.41295	0.200212	0.284340

Source	DF	Anova SS	Mean Square	F Value	Pr > F
site	2	0.09486143	0.04743072	1.18	0.3147

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

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
site	2	0.0746	0.0373	1.60	0.2121
Error	50	1.1661	0.0233		

Bartlett's Test for Homogeneity of GSI Variance

Source	DF	Chi-Square	Pr > ChiSq
site	2	42.9859	<.0001

Dunnett's t Tests for GSI

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

Alpha	0.05
Error Degrees of Freedom	50
Error Mean Square	0.040085
Critical Value of Dunnett's t	2.28707

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

site Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
CP - BG	0.01545	-0.15364 0.18454
UM - BG	-0.08132	-0.22279 0.06015

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

NONPARAMETRIC COMPARISON OF GONADOSOMATIC INDEX (GSI) BETWEEN SITES

68

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

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable GSI
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	18	306.50	540.0	60.741820	17.027778
CP	37	1265.50	1110.0	63.792823	34.202703
UM	4	198.00	120.0	33.164309	49.500000

Average scores were used for ties.

Kruskal-Wallis Test

Chi-Square 17.6412
DF 2
Pr > Chi-Square 0.0001

Median Scores (Number of Points Above Median) for Variable GSI
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	18	4.0	8.847458	1.783289	0.222222
CP	37	21.0	18.186441	1.872862	0.567568
UM	4	4.0	1.966102	0.973655	1.000000

Average scores were used for ties.

Median One-Way Analysis

Chi-Square 10.0440
DF 2
Pr > Chi-Square 0.0066

US EPA ARCHIVE DOCUMENT

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

NONPARAMETRIC COMPARISON OF GONADOSOMATIC INDEX (GSI) BETWEEN SITES

70

----- Sex=I -----

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable GSI
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	9	56.50	76.50	9.440273	6.277778
CP	7	79.50	59.50	9.440273	11.357143

Average scores were used for ties.

Wilcoxon Two-Sample Test

Statistic 79.5000

Normal Approximation

Z 2.0656

One-Sided Pr > Z 0.0194

Two-Sided Pr > |Z| 0.0389

t Approximation

One-Sided Pr > Z 0.0283

Two-Sided Pr > |Z| 0.0566

Z includes a continuity correction of 0.5.

Kruskal-Wallis Test

Chi-Square 4.4884

DF 1

Pr > Chi-Square 0.0341

Median Scores (Number of Points Above Median) for Variable GSI
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	9	2.0	4.50	1.024695	0.222222
CP	7	6.0	3.50	1.024695	0.857143

Average scores were used for ties.

Median Two-Sample Test

Statistic 6.0000

Z 2.4398

One-Sided Pr > Z 0.0073

Two-Sided Pr > |Z| 0.0147

Median One-Way Analysis

Chi-Square 5.9524

DF 1

Pr > Chi-Square 0.0147

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

NONPARAMETRIC COMPARISON OF GONADOSOMATIC INDEX (GSI) BETWEEN SITES

72

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

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable GSI
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	22	524.50	594.0	55.289008	23.840909
CP	11	423.00	297.0	45.505889	38.454545
UM	20	483.50	540.0	54.389940	24.175000

Average scores were used for ties.

Kruskal-Wallis Test

Chi-Square	7.6716
DF	2
Pr > Chi-Square	0.0216

Median Scores (Number of Points Above Median) for Variable GSI
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	22	10.00	10.792453	1.758432	0.454545
CP	11	8.50	5.396226	1.447286	0.772727
UM	20	7.50	9.811321	1.729838	0.375000

Average scores were used for ties.

Median One-Way Analysis

Chi-Square	4.8749
DF	2
Pr > Chi-Square	0.0874

US EPA ARCHIVE DOCUMENT

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

ANOVA FOR CONDITION INDEX BETWEEN SITES

74

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

The ANOVA Procedure

Class Level Information

Class	Levels	Values
site	3	BG CP UM

Number of observations 60

Dependent Variable: CI

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	2.87929138	1.43964569	6.71	0.0024
Error	57	12.22812021	0.21452842		
Corrected Total	59	15.10741159			

R-Square	Coeff Var	Root MSE	CI Mean
0.190588	38.52713	0.463172	1.202197

Source	DF	Anova SS	Mean Square	F Value	Pr > F
site	2	2.87929138	1.43964569	6.71	0.0024

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

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
site	2	0.6135	0.3067	3.66	0.0320
Error	57	4.7813	0.0839		

Bartlett's Test for Homogeneity of CI Variance

Source	DF	Chi-Square	Pr > ChiSq
site	2	4.3397	0.1142

Dunnett's t Tests for CI

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

Alpha	0.05
Error Degrees of Freedom	57
Error Mean Square	0.214528
Critical Value of Dunnett's t	2.28365

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

site Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
UM - BG	0.8712	0.2893 1.4531 ***
CP - BG	0.3133	0.0148 0.6119 ***

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

ANOVA FOR CONDITION INDEX BETWEEN SITES

78

----- Sex=I -----

The ANOVA Procedure

Class Level Information

Class	Levels	Values
site	2	BG CP
Number of observations		16

Dependent Variable: CI

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	8.11930253	8.11930253	2.32	0.1499
Error	14	48.97043484	3.49788820		
Corrected Total	15	57.08973737			

R-Square	Coeff Var	Root MSE	CI Mean
0.142220	118.0374	1.870264	1.584467

Source	DF	Anova SS	Mean Square	F Value	Pr > F
site	1	8.11930253	8.11930253	2.32	0.1499

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

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
site	1	183.9	183.9	1.95	0.1844
Error	14	1320.7	94.3380		

Bartlett's Test for Homogeneity of CI Variance

Source	DF	Chi-Square	Pr > ChiSq
site	1	23.5316	<.0001

Dunnett's t Tests for CI

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

Alpha	0.05
Error Degrees of Freedom	14
Error Mean Square	3.497888
Critical Value of Dunnett's t	2.14485

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

site Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
CP - BG	1.4360	-0.5856 3.4576

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

ANOVA FOR CONDITION INDEX BETWEEN SITES

82

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

The ANOVA Procedure

Class Level Information

Class	Levels	Values
site	3	BG CP UM

Number of observations 53

Dependent Variable: CI

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	22.6025084	11.3012542	2.26	0.1149
Error	50	250.0105867	5.0002117		
Corrected Total	52	272.6130951			

R-Square	Coeff Var	Root MSE	CI Mean
0.082911	151.8343	2.236115	1.472734

Source	DF	Anova SS	Mean Square	F Value	Pr > F
site	2	22.60250839	11.30125420	2.26	0.1149

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

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
site	2	1898.9	949.5	0.93	0.4022
Error	50	51177.9	1023.6		

Bartlett's Test for Homogeneity of CI Variance

Source	DF	Chi-Square	Pr > ChiSq
site	2	122.7	<.0001

Dunnett's t Tests for CI

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

Alpha	0.05
Error Degrees of Freedom	50
Error Mean Square	5.000212
Critical Value of Dunnett's t	2.28707

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

site Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
UM - BG	1.4305	-0.1496 3.0105
CP - BG	0.3156	-1.5730 2.2041

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

NONPARAMETRIC COMPARISON OF CONDITION INDEX (CI) BETWEEN SITES

86

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

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable CI
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	19	393.0	579.50	62.927869	20.684211
CP	37	1253.0	1128.50	65.771701	33.864865
UM	4	184.0	122.00	33.744135	46.000000

Kruskal-Wallis Test

Chi-Square 10.5265
DF 2
Pr > Chi-Square 0.0052

Median Scores (Number of Points Above Median) for Variable CI
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	19	4.0	9.50	1.816823	0.210526
CP	37	23.0	18.50	1.898929	0.621622
UM	4	3.0	2.00	0.974245	0.750000

Median One-Way Analysis

Chi-Square 9.3983
DF 2
Pr > Chi-Square 0.0091

US EPA ARCHIVE DOCUMENT

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

NONPARAMETRIC COMPARISON OF CONDITION INDEX (CI) BETWEEN SITES

88

----- Sex=I -----

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable CI
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	9	60.0	76.50	9.447222	6.666667
CP	7	76.0	59.50	9.447222	10.857143

Wilcoxon Two-Sample Test

Statistic 76.0000

Normal Approximation

Z 1.6936
One-Sided Pr > Z 0.0452
Two-Sided Pr > |Z| 0.0903

t Approximation

One-Sided Pr > Z 0.0555
Two-Sided Pr > |Z| 0.1110

Z includes a continuity correction of 0.5.

Kruskal-Wallis Test

Chi-Square 3.0504
DF 1
Pr > Chi-Square 0.0807

Median Scores (Number of Points Above Median) for Variable CI
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	9	3.0	4.50	1.024695	0.333333
CP	7	5.0	3.50	1.024695	0.714286

Median Two-Sample Test

Statistic 5.0000
Z 1.4639
One-Sided Pr > Z 0.0716
Two-Sided Pr > |Z| 0.1432

Median One-Way Analysis

Chi-Square 2.1429
DF 1
Pr > Chi-Square 0.1432

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

NONPARAMETRIC COMPARISON OF CONDITION INDEX (CI) BETWEEN SITES

90

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

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable CI
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	22	349.0	594.0	55.398556	15.863636
CP	11	305.0	297.0	45.596052	27.727273
UM	20	777.0	540.0	54.497706	38.850000

Kruskal-Wallis Test

Chi-Square 23.2397
DF 2
Pr > Chi-Square <.0001

Median Scores (Number of Points Above Median) for Variable CI
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	22	1.0	10.792453	1.810436	0.045455
CP	11	7.0	5.396226	1.490088	0.636364
UM	20	18.0	9.811321	1.780996	0.900000

Median One-Way Analysis

Chi-Square 31.1926
DF 2
Pr > Chi-Square <.0001

US EPA ARCHIVE DOCUMENT

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

ANOVA FOR E2/T RATIO BETWEEN SITES

92

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

The ANOVA Procedure

Class Level Information

Class	Levels	Values
site	3	BG CP UM
Number of observations		60

NOTE: Due to missing values, only 42 observations can be used in this analysis.

Dependent Variable: RATIO

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	21.055872	21.055872	0.15	0.6999
Error	40	5587.442993	139.686075		
Corrected Total	41	5608.498865			

R-Square	Coeff Var	Root MSE	RATIO Mean
0.003754	161.1670	11.81889	7.333315

Source	DF	Anova SS	Mean Square	F Value	Pr > F
site	1	21.05587231	21.05587231	0.15	0.6999

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

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
site	1	53436.8	53436.8	0.32	0.5745
Error	40	6670870	166772		

Bartlett's Test for Homogeneity of RATIO Variance

Source	DF	Chi-Square	Pr > ChiSq
site	1	1.4679	0.2257

Dunnett's t Tests for RATIO

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

Alpha	0.05
Error Degrees of Freedom	40
Error Mean Square	139.6861
Critical Value of Dunnett's t	2.02111

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

site Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
CP - BG	1.478	-6.215 9.170

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

ANOVA FOR E2/T RATIO BETWEEN SITES

96

----- Sex=I -----

The ANOVA Procedure

Class Level Information

Class	Levels	Values
site	2	BG CP
Number of observations		16

NOTE: Due to missing values, only 15 observations can be used in this analysis.

Dependent Variable: RATIO

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	3.54538874	3.54538874	0.57	0.4636
Error	13	80.81750386	6.21673107		
Corrected Total	14	84.36289260			

R-Square	Coeff Var	Root MSE	RATIO Mean
0.042025	100.0048	2.493337	2.493217

Source	DF	Anova SS	Mean Square	F Value	Pr > F
site	1	3.54538874	3.54538874	0.57	0.4636

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

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
site	1	7.8877	7.8877	0.13	0.7221
Error	13	776.1	59.6964		

Bartlett's Test for Homogeneity of RATIO Variance

Source	DF	Chi-Square	Pr > ChiSq
site	1	0.0674	0.7951

Dunnett's t Tests for RATIO

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

Alpha	0.05
Error Degrees of Freedom	13
Error Mean Square	6.216731
Critical Value of Dunnett's t	2.16042

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

site Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
CP - BG	-0.9924	-3.8314 1.8466

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

ANOVA FOR E2/T RATIO BETWEEN SITES 100

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

The ANOVA Procedure

Class Level Information

Class	Levels	Values
site	3	BG CP UM
Number of observations		53

NOTE: Due to missing values, only 42 observations can be used in this analysis.

Dependent Variable: RATIO

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	6.0121986	3.0060993	0.88	0.4222
Error	39	132.9691436	3.4094652		
Corrected Total	41	138.9813422			

R-Square	0.043259	Coeff Var	132.2498	Root MSE	1.846474	RATIO Mean	1.396201
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Source	DF	Anova SS	Mean Square	F Value	Pr > F
site	2	6.01219864	3.00609932	0.88	0.4222

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

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
site	2	148.8	74.3982	0.47	0.6311
Error	39	6230.2	159.7		

Bartlett's Test for Homogeneity of RATIO Variance

Source	DF	Chi-Square	Pr > ChiSq
site	2	9.7484	0.0076

Dunnnett's t Tests for RATIO

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

Alpha	0.05
Error Degrees of Freedom	39
Error Mean Square	3.409465
Critical Value of Dunnnett's t	2.31338

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

site Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
CP - BG	-0.3223	-2.0859 1.4413
UM - BG	-0.8799	-2.4128 0.6531

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

NONPARAMETRIC COMPARISON OF E2/T RATIO BETWEEN SITES

104

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

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable RATIO
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	15	269.0	322.50	38.095275	17.933333
CP	27	634.0	580.50	38.095275	23.481481

Wilcoxon Two-Sample Test

Statistic 269.0000

Normal Approximation

Z -1.3912
One-Sided Pr < Z 0.0821
Two-Sided Pr > |Z| 0.1642

t Approximation

One-Sided Pr < Z 0.0858
Two-Sided Pr > |Z| 0.1717

Z includes a continuity correction of 0.5.

Kruskal-Wallis Test

Chi-Square 1.9723
DF 1
Pr > Chi-Square 0.1602

Median Scores (Number of Points Above Median) for Variable RATIO
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	15	5.0	7.50	1.571468	0.333333
CP	27	16.0	13.50	1.571468	0.592593

Median Two-Sample Test

Statistic 5.0000
Z -1.5909
One-Sided Pr < Z 0.0558
Two-Sided Pr > |Z| 0.1116

Median One-Way Analysis

Chi-Square 2.5309
DF 1
Pr > Chi-Square 0.1116

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

NONPARAMETRIC COMPARISON OF E2/T RATIO BETWEEN SITES

106

----- Sex=I -----

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable RATIO
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	9	83.0	72.0	8.485281	9.222222
CP	6	37.0	48.0	8.485281	6.166667

Wilcoxon Two-Sample Test

Statistic 37.0000

Normal Approximation

Z -1.2374
One-Sided Pr < Z 0.1080
Two-Sided Pr > |Z| 0.2159

t Approximation

One-Sided Pr < Z 0.1181
Two-Sided Pr > |Z| 0.2363

Z includes a continuity correction of 0.5.

Kruskal-Wallis Test

Chi-Square 1.6806
DF 1
Pr > Chi-Square 0.1949

Median Scores (Number of Points Above Median) for Variable RATIO
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	9	5.0	4.20	0.979796	0.555556
CP	6	2.0	2.80	0.979796	0.333333

Median Two-Sample Test

Statistic 2.0000
Z -0.8165
One-Sided Pr < Z 0.2071
Two-Sided Pr > |Z| 0.4142

Median One-Way Analysis

Chi-Square 0.6667
DF 1
Pr > Chi-Square 0.4142

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

NONPARAMETRIC COMPARISON OF E2/T RATIO BETWEEN SITES

108

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

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable RATIO
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	22	542.0	473.0	39.707262	24.636364
CP	8	157.0	172.0	31.219652	19.625000
UM	12	204.0	258.0	35.916570	17.000000

Kruskal-Wallis Test

Chi-Square 3.2394
DF 2
Pr > Chi-Square 0.1980

Median Scores (Number of Points Above Median) for Variable RATIO
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	22	14.0	11.0	1.637964	0.636364
CP	8	4.0	4.0	1.287842	0.500000
UM	12	3.0	6.0	1.481594	0.250000

Median One-Way Analysis

Chi-Square 4.5260
DF 2
Pr > Chi-Square 0.1040

US EPA ARCHIVE DOCUMENT

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

ANOVA FOR VITELLOGENIN (P_mg) BETWEEN SITES

110

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

The ANOVA Procedure

Class Level Information

Class	Levels	Values
site	3	BG CP UM

Number of observations 60

NOTE: Due to missing values, only 20 observations can be used in this analysis.

Dependent Variable: P_mg

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	11649.5373	5824.7687	0.32	0.7294
Error	17	308087.4127	18122.7890		
Corrected Total	19	319736.9500			

R-Square	Coeff Var	Root MSE	P_mg Mean
0.036435	15.97021	134.6209	842.9500

Source	DF	Anova SS	Mean Square	F Value	Pr > F
site	2	11649.53730	5824.76865	0.32	0.7294

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

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
site	2	33916350	16958175	0.05	0.9474
Error	17	5.3185E9	3.1285E8		

Bartlett's Test for Homogeneity of P_mg Variance

Source	DF	Chi-Square	Pr > ChiSq
site	2	0.0751	0.9631

Dunnett's t Tests for P_mg

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

Alpha	0.05
Error Degrees of Freedom	17
Error Mean Square	18122.79
Critical Value of Dunnett's t	2.42696

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

site Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
CP - BG	54.37	-110.29 219.02
UM - BG	25.72	-170.61 222.06

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

ANOVA FOR VITELLOGENIN (P_{mg}) BETWEEN SITES

114

----- Sex=I -----

The ANOVA Procedure

Class Level Information

Class	Levels	Values
site	2	BG CP

Number of observations 16

NOTE: Due to missing values, only 14 observations can be used in this analysis.
Dependent Variable: P_{mg}

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	532.1488	532.1488	0.04	0.8535
Error	12	179378.2083	14948.1840		
Corrected Total	13	179910.3571			

R-Square	Coeff Var	Root MSE	P _{mg} Mean
0.002958	15.80060	122.2628	773.7857

Source	DF	Anova SS	Mean Square	F Value	Pr > F
site	1	532.1488095	532.1488095	0.04	0.8535

Levene's Test for Homogeneity of P_{mg} Variance
ANOVA of Squared Deviations from Group Means

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
site	1	75518806	75518806	0.30	0.5920
Error	12	2.9897E9	2.4914E8		

Bartlett's Test for Homogeneity of P_{mg} Variance

Source	DF	Chi-Square	Pr > ChiSq
site	1	0.1445	0.7038

Dunnett's t Tests for P_{mg}

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

Alpha	0.05
Error Degrees of Freedom	12
Error Mean Square	14948.18
Critical Value of Dunnett's t	2.17886

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

site Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
CP - BG	-12.46	-156.33 131.41

Data Evaluation Report on the Reconnaissance Survey of South Florida Amphibians for the Assessment of Potential Atrazine Effects

EPA MRID Number 458677-06

ANOVA FOR VITELLOGENIN (P_{mg}) BETWEEN SITES

118

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

The ANOVA Procedure

Class Level Information

Class	Levels	Values
site	3	BG CP UM

Number of observations 53

NOTE: Due to missing values, only 24 observations can be used in this analysis.

Dependent Variable: P_{mg}

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	182143.0833	91071.5417	8.25	0.0023
Error	21	231848.7500	11040.4167		
Corrected Total	23	413991.8333			

R-Square	Coeff Var	Root MSE	P _{mg} Mean
0.439968	27.98847	105.0734	375.4167

Source	DF	Anova SS	Mean Square	F Value	Pr > F
site	2	182143.0833	91071.5417	8.25	0.0023

Levene's Test for Homogeneity of P_{mg} Variance
ANOVA of Squared Deviations from Group Means

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
site	2	5.3083E8	2.6541E8	0.75	0.4831
Error	21	7.399E9	3.5233E8		

Bartlett's Test for Homogeneity of P_{mg} Variance

Source	DF	Chi-Square	Pr > ChiSq
site	2	2.8489	0.2406

Dunnett's t Tests for P_{mg}

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

Alpha	0.05
Error Degrees of Freedom	21
Error Mean Square	11040.42
Critical Value of Dunnett's t	2.37033
Minimum Significant Difference	124.53

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

site Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
CP - BG	51.63	-72.90 176.15
UM - BG	-153.50	-278.03 -28.97 ***

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NONPARAMETRIC COMPARISON OF VITELLOGENIN (P_mg) BETWEEN SITES

122

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

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable P_mg
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	9	84.0	94.50	13.162447	9.333333
CP	7	81.0	73.50	12.619429	11.571429
UM	4	45.0	42.00	10.583005	11.250000

Kruskal-Wallis Test

Chi-Square 0.6439
DF 2
Pr > Chi-Square 0.7247

Median Scores (Number of Points Above Median) for Variable P_mg
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	9	4.0	4.50	1.141329	0.444444
CP	7	4.0	3.50	1.094243	0.571429
UM	4	2.0	2.00	0.917663	0.500000

Median One-Way Analysis

Chi-Square 0.2413
DF 2
Pr > Chi-Square 0.8864

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NONPARAMETRIC COMPARISON OF VITELLOGENIN (P_mg) BETWEEN SITES

124

----- Sex=I -----

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable P_mg
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	8	61.0	60.0	7.745967	7.625000
CP	6	44.0	45.0	7.745967	7.333333

Wilcoxon Two-Sample Test

Statistic 44.0000

Normal Approximation

Z -0.0645
One-Sided Pr < Z 0.4743
Two-Sided Pr > |Z| 0.9485

t Approximation

One-Sided Pr < Z 0.4748
Two-Sided Pr > |Z| 0.9495

Z includes a continuity correction of 0.5.

Kruskal-Wallis Test

Chi-Square 0.0167
DF 1
Pr > Chi-Square 0.8973

Median Scores (Number of Points Above Median) for Variable P_mg
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	8	4.0	4.0	0.960769	0.50
CP	6	3.0	3.0	0.960769	0.50

Median Two-Sample Test

Statistic 3.0000
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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126

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

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable P_mg
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	8	117.0	100.0	16.329932	14.6250
CP	8	138.0	100.0	16.329932	17.2500
UM	8	45.0	100.0	16.329932	5.6250

Kruskal-Wallis Test

Chi-Square 11.8950
DF 2
Pr > Chi-Square 0.0026

The NPAR1WAY Procedure

Median Scores (Number of Points Above Median) for Variable P_mg
Classified by Variable site

site	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
BG	8	5.0	4.0	1.179536	0.6250
CP	8	7.0	4.0	1.179536	0.8750
UM	8	0.0	4.0	1.179536	0.0000

Median One-Way Analysis

Chi-Square 12.4583
DF 2
Pr > Chi-Square 0.0020

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