1-EEB-02A

10/06/95

DP Barcode D209355 MRID No.: 432505-01

DATA EVALUATION RECORD
ESTUARINE FISH EARLY LIFE-STAGE TEST
GUIDELINE 72-4(A)

1. **CHEMICAL:** Carbofuran. Shaughnessey #: 090601

2. **TEST MATERIAL:** Carbofuran Technical. Purity: 98%

3. **CITATION:**

Authors: Boeri, R.L. and T.J. Ward
Title: Early Life-Stage Toxicity of Carbofuran Technical to the Sheepshead Minnow, *Cyprinodon variegatus*
Study Completion Date: May 25, 1994
Laboratory: T.R. Wilbury Laboratories, Inc., Marblehead, Massachusetts
Laboratory Report ID: 212-FM
Sponsor: FMC Corporation, Princeton, New Jersey
MRID No.: 432505-01
DP Barcode: D209355

4. **REVIEWED BY:** Rosemary Graham Mora, M.S.
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Signature: P. Kosalwat Date: 10/3/95

5. **APPROVED BY:**

Ann Stavola, Section Chief EEB, EFED, U.S.EPA

Signature: C.E.T. Ann Stavola Date: 5-7-97 5/8/97

6. **CONCLUSIONS:** This study is scientifically sound and fulfills the guideline requirements for an estuarine fish early life-stage test. The NOEL and LOEL of carbofuran technical for sheepshead minnow are 2.6 and 6.0 µg/L, respectively. The MATC is 3.9 µg/L.

7. **ADEQUACY OF THE STUDY:**

A. Classification: Core.

B. Rationale: N/A.

C. Reparability: N/A.

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8. MAJOR GUIDELINE DEVIATIONS:

1. The test consisted of only two replicates; four replicates are required.

2. The test water was natural seawater diluted with dechlorinated tap water to adjust the salinity to 15-17 ppt. The use of dechlorinated tap water is discouraged. However, the growth and survival of control organisms in this test were acceptable.

3. The size of the embryo exposure chambers was not reported.

9. MATERIALS AND METHODS:

A. Biological System:

Guideline Criteria	Reported Information
Species: An estuarine fish species, preferably a silversides species or sheepshead minnow (*Cyprinodon variegatus*).	*Cyprinodon variegatus*
Source	Multi Aquaculture System, Inc., Ammagansett, New York
Age at beginning of test: Embryos 2 to 24 hours old.	Embryos less than 24 hours.
Replicates: Minimum of 20 embryos per replicate cup, 4 replicates per concentration. Minimum of 30 fish per treatment for post-hatch exposure.	20 embryos per cage; 2 cages per replicate vessel; 2 replicate vessels per treatment. Post hatch exposure: 20 fish per replicate vessel; 2 replicate vessels per treatment.
Post Hatch: % of embryos that produce live fry must be ≥ 50% in each control; % hatch in any control embryo cup must be no more than 1.6 times that in another control cup.	100% of embryos in each control produced live fry. 1 time

Guideline Criteria	Reported Information
Feeding: Fish should be fed at least twice daily. Fish should not be fed for at least 24 hr prior to termination on day 32.	Fish were fed *Artemia salina* nauplii 2-3 times daily except during final 24 hours prior to test termination.
Counts: At a minimum, live fish should be counted 11, 18, 25, and 32 days after hatching.	Number of live fish were counted daily during the 32 days post-hatch.
Controls: Avg. survival at end of test must be ≥ 80%. Survival in any control chamber must not be < 70%.	100% survival in the controls at test termination.
Controls: Negative control and carrier control (when applicable) are required.	A dilution water control and a solvent control (0.1 ml DMF/L) were included in this study.

Comments: None.

B. Physical System:

Guideline Criteria	Reported Information
Test Water: 1) May be natural (sterilized and filtered) or a commercial mixture; 2) Natural seawater should have weekly range of salinity less than 6%, monthly pH range less than 0.8 pH units; 3) Salinity should be ≥ 15 parts per thousand; 4) Water must be free of pollutants.	1. Natural seawater with salinity adjusted to 15-17 parts per thousand (ppt) using dechlorinated tapwater. The test water was aerated, particle and activated-carbon filtered, and U.V. sterilized. 2. Not reported. 3. Salinity was 15-17 ppt and pH was 7.8-8.1 during the study. 4. Boron was 3.3 mg/l in a sample of test water. No other pollutants were detected.
Test Temperature: Depends upon test species; should not deviate by more than 2°C from appropriate temperature. For sheepshead minnow, either 25°C or 30°C is recommended.	29.9 ±0.3°C (range 29.3-32°C).

Guideline Criteria	Reported Information
Photoperiod: Recommend 16L/8D.	16 hours light/8 hours dark.
Dosing Apparatus: Intermittent flow proportional diluters or continuous flow serial diluters should be used. A minimum of 5 toxicant concentrations with a dilution factor not greater than 0.5 and controls should be used.	An intermittent flow proportional diluter was used. The test was consisted of a dilution water control, a solvent control, and 5 concentrations with a dilution factor of approximately 0.5.
Toxicant Mixing: 1) Mixing chamber is recommended but not required; 2) Aeration should not be used for mixing; 3) It must be demonstrated that the test solution is completely mixed before intro. into the test system; 4) Flow splitting accuracy must be within 10%.	1. The system was not clearly described; it appeared that no mixing chamber was used. 2. Not reported. 3. Not reported. 4. Not reported.
Test Vessels: All glass or glass with stainless steel frame.	Embryo cages were suspended in 20-L glass aquaria.
Embryo Cups: 120 ml glass jars with bottoms replaced with 40 mesh stainless steel or nylon screen.	Embryo cages were constructed of glass cylinders with Nitex® screen bottoms. The size of the cylinders was not reported.
Flow Rate: Flow rates to larval cups should provide 90% replacement in 8-12 hours. Flow rate must maintain DO at above 75% of saturation and maintain the toxicant level.	6.8 volume exchanges per 24 hours.
Aeration: Dilution water should be aerated to insure DO concentration at or near 100% saturation. Test tanks and embryo cups should not be aerated.	Aeration in test vessels was initiated at 24 hours to maintain D.O. concentrations $\geq$82% of saturation.

Comments: The report indicates that aeration of the test vessels was initiated at 24 hours; however, a comment in the GLP Statement indicates that D.O. levels fell slightly below 75% saturation on day 6 of the test, "prior to the initiation of aeration." This is a discrepancy in the report. Raw data for water quality were not presented in the report; only weekly ranges were reported.

C. **Chemical System:**

Guideline Criteria	Reported Information
Concentrations: Minimum of 5 concentrations and a control, all replicated, plus solvent control if appropriate. - Toxicant conc. must be measured in one tank at each toxicant level every week. - One concentration must adversely affect a life stage and one concentration must not affect any life stage.	- Dilution water control, solvent control (0.1 ml DMF/L), and five nominal concentrations (3.8, 7.7, 16, 32, and 64 µg/L). - Toxicant concentrations were measured in each replicate vessel of the controls and treatments every week. - Yes.
Other Variables: 1) DO must be measured at each conc. at least once a week; 2) Natural seawater must maintain a constant salinity and not fluctuate more than 6% weekly; monthly pH range < 0.8 pH units.	1. D.O. was measured daily in each test chamber that contained live organisms. 2. Test water was of consistent water quality.
Solvents: Should not exceed 0.1 ml/L in a flow-through system. Following solvents are acceptable: dimethylformamide, triethylene glycol, methanol, acetone, ethanol.	0.1 ml/L DMF.

Comments: Toxicant concentration was maintained at 61-113% of nominal concentrations.

10. REPORTED RESULTS:

Guideline Criteria	Reported Information
Data Endpoints must include: - Number of embryos hatched; - Time to hatch; - Mortality of embryos, larvae, and juveniles; - Time to swim-up (if approp.); - Measurement of growth; - Incidence of pathological or histological effects; - Observations of other effects or clinical signs.	All appropriate data endpoints listed at left were reported.
Raw data included? (Y/N)	Yes.

Effects Data:

Toxicant Conc. (µg/L)		Percent Hatch		Time to Hatch		Survival (35 days)		Total Length (mm)		Wet weight (mg)	
Nom.	Meas.	A	B	A	B	A	B	A	B	A	B
Ctrl	ND	100	100	3	3	100	100	26	26	340	320
Solv	ND	100	100	3	3	100	100	27	26	370	360
3.8	2.6	100	100	3	3	100	100	26	26	350	350
7.7	6.0	95	87.5	5	5	100	95	26	26	340	340
16	16	30	17.5	8	8	20	17.5	26	26	360	350
32	26	12.5	15	8	8	7.5	10	26	25	330	300
64	51	0	0	-	-	0	0	-	-	-	-

ND = Not detected (detection limit = 0.80 µg/L).

COMMENTS: The percentage hatched was calculated by the reviewer as the number of embryos that hatched by the day reported by the authors as time to hatch. The authors reported the percentage hatch as hatched fish on day 3 for the control and 2.6 µg/L groups, and unhatched live embryos plus hatched fish on day 3 for the four highest test levels.

The authors noted: "No fish survived to hatch at 51 µg/L carbofuran Technical."

Toxicity Observations: "The only sublethal effect noted during the study was the relative size of test organisms as visually observed (several treatment fish in the highest 3 concentrations were observed to be smaller than the controls)." See Table 5 (attached).

Statistical Results:

Statistical Method: Dunnett's Test

NOEL: 6.0 µg/L LOEL: 16.0 µg/L MATC: 9.8 µg/L

Most sensitive endpoint: Survival and visually observed size.

Comments: Although very few embryos in the four highest test concentrations hatched by day 3, the authors calculated the percentage survival at hatch for these four test concentrations based on the number of unhatched live embryos plus hatched fish on day 3 (see Table A.1, attached). This practice led to much higher percentages survival at hatch for the four highest concentrations and yielded a less conservative NOEL.

11. Reviewer's Statistical Results:

Statistical Method: Williams' Test

NOEL: 2.6 µg/L LOEL: 6.0 µg/L MATC: 3.9 µg/L

Most sensitive endpoint: Percentage Survival at Hatch

Comments: This study is scientifically sound and fulfills the guideline requirements for an estuarine fish early life-stage test. The NOEL and LOEL of carbofuran technical for sheepshead minnow are 2.6 and 6.0 µg/L, respectively. The MATC is 3.9 µg/L.

Table 5. Sublethal effects of sheepshead minnows, *Cyprinodon variegatus*, at 48 hours, at hatch (day 3), and at 7, 14, 21, 28, and 32 days post hatch, during the toxicity test with Carbofuran Technical.

Mean Measured Concentration of Carbofuran Technical (µg/L)	Rep.	Percent Normal at 48 Hours	Percent Normal at Hatch	Percent Normal (days post hatch)				
			day 3	7	14	21	28	32
ND (control)	1	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	Mean	100.0	100.0	100.0	100.0	100.0	100.0	100.0
ND (sol con)	1	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	Mean	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2.6	1	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	Mean	100.0	100.0	100.0	100.0	100.0	100.0	100.0
6.0	1	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2	100.0	100.0	100.0	95.0	95.0	95.0	95.0
	Mean	100.0	100.0	100.0	97.5	97.5	97.5	97.5
16	1	100.0	87.5	30.0	20.0	20.0	20.0	20.0
	2	100.0	92.5	17.5	17.5	17.5	17.5	17.5
	Mean	100.0	90.0*	23.8*	18.8*	18.8*	18.8*	18.8*
26	1	92.5	85.0	10.0	7.5	7.5	7.5	7.5
	2	90.0	90.0	15.0	5.0	5.0	5.0	5.0
	Mean	91.3*	87.5*	12.5*	6.3*	6.3*	6.3*	6.3*
51	1	82.5	82.5	0.0	0.0	0.0	0.0	0.0
	2	90.0	87.5	0.0	0.0	0.0	0.0	0.0
	Mean	86.3*	85.0*	0.0*	0.0*	0.0*	0.0*	0.0*

Notes:
1. ND = not detected at or above 0.80 µg/L
2. Rep. = replicate.
3. Concentrations with no normal fish were not included in statistical analyses.
4. Percent normal data different than the control and solvent controls at the 95% confidence level are marked with an asterisk (zeros are assumed to be different).
5. Day 3 numbers are for hatched fish in control, solvent control, and 2.6 µg/L, and for unhatched live embryos and hatched fish in 6.0, 16, 26, and 51 µg/L test vessels.

Table A.1. Survival and hatching data from the first three days of the toxicity test with sheepshead minnows, *Cyprinodon variegatus*, and Carbofuran Technical.

	Number of Live Organisms													
	Mean Measured Concentration of Carbofuran Technical (µg/L)													
Day of Exposure	ND (con)		ND (sol con)		2.6		6.0		16		26		51	
	r1	r2	r1	r2	r1	r2	r1	r2	r1	r2	r1	r2	r1	r2
Day 0														
live embryos	40	40	40	40	40	40	40	40	40	40	40	40	40	40
dead embryos	0	0	0	0	0	0	0	0	0	0	0	0	0	0
live fish	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dead fish	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Day 1														
live embryos	40	40	40	40	40	40	40	40	40	40	40	40	40	40
dead embryos	0	0	0	0	0	0	0	0	0	0	0	0	0	0
live fish	0	0	0	0	0	0	0	0	0	0	0	0	0	0
dead fish	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Day 2														
live embryos	32	32	29	27	30	32	35	37	40	40	37	36	33	36
dead embryos	0	0	0	0	0	0	0	0	0	0	3	4	7	4
live fish	8	8	11	13	10	8	5	3	0	0	0	0	0	0
dead fish	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Day 3														
live embryos	0	0	0	0	0	0	26	29	35	37	34	36	33	35
dead embryos	0	0	0	0	0	0	0	0	1	0	0	0	0	0
live fish	40	40	40	40	40	40	14	11	4	3	3	0	0	1
dead fish	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: 1. ND = not detected at or above the analytical detection limit of 0.80 µg/L
2. con = control, sol con = solvent control.
3. r1 = replicate 1, r2 = replicate 2.

Table A.2 Survival data from the fourth day of exposure to the conclusion of the toxicity test with sheepshead minnows, *Cyprinodon variegatus*, and Carbofuran Technical.

	Number of Live Organisms													
	Mean Measured Concentration of Carbofuran Technical (µg/L)													
Day of Exposure	ND (con)		ND (sol con)		2.6		6.0		16		26		51	
	r1	r2	r1	r2	r1	r2	r1	r2	r1	r2	r1	r2	r1	r2
4	20	20	20	20	20	20	38	35	39	40	37	36	33	36
5	20	20	20	20	20	20	20	20	39	40	37	36	0	0
6	20	20	20	20	20	20	20	20	35	35	24	29	0	0
7	20	20	20	20	20	20	20	20	14	16	10	17	0	0
8	20	20	20	20	20	20	20	20	12	7	5	6	0	0
9	20	20	20	20	20	20	20	20	12	7	5	6	0	0
10	20	20	20	20	20	20	20	20	12	7	5	6	0	0
11	20	20	20	20	20	20	20	19	12	7	5	6	0	0
12	20	20	20	20	20	20	20	19	12	7	5	6	0	0
13	20	20	20	20	20	20	20	19	12	7	5	6	0	0
14	20	20	20	20	20	20	20	19	11	7	4	5	0	0
15	20	20	20	20	20	20	20	19	11	7	4	5	0	0
16	20	20	20	20	20	20	20	19	11	7	4	5	0	0
17	20	20	20	20	20	20	20	19	10	7	4	5	0	0
18	20	20	20	20	20	20	20	19	10	7	4	5	0	0
19	20	20	20	20	20	20	20	19	10	7	4	5	0	0
20	20	20	20	20	20	20	20	19	9	7	3	5	0	0
21	20	20	20	20	20	20	20	19	9	7	3	5	0	0
22	20	20	20	20	20	20	20	19	8	7	3	4	0	0
23	20	20	20	20	20	20	20	19	8	7	3	4	0	0
24	20	20	20	20	20	20	20	19	8	7	3	4	0	0
25	20	20	20	20	20	20	20	19	8	7	3	4	0	0
26	20	20	20	20	20	20	20	19	8	7	3	4	0	0
27	20	20	20	20	20	20	20	19	8	7	3	4	0	0
28	20	20	20	20	20	20	20	19	8	7	3	4	0	0
29	20	20	20	20	20	20	20	19	8	7	3	4	0	0
30	20	20	20	20	20	20	20	19	8	7	3	4	0	0
31	20	20	20	20	20	20	20	19	8	7	3	4	0	0
32	20	20	20	20	20	20	20	19	8	7	3	4	0	0
33	20	20	20	20	20	20	20	19	8	7	3	4	0	0
34	20	20	20	20	20	20	20	19	8	7	3	4	0	0
35	20	20	20	20	20	20	20	19	8	7	3	4	0	0

Notes: 1. ND = not detected at or above 0.80 µg/L
2. con = control, sol con = solvent control.
3. r1 = replicate 1, r2 = replicate 2.
4. Size differences were visually noted during the test at concentrations above 6.0 µg/L Carbofuran Technical (weight data are presented in Table 6).

Carbofuran Tech: Percent Survival at Hatch
7
2
2
2
2
2
2
2
Solvent Control
1
1
Control
1.00000000
1.00000000
2.6
1.00000000
1.00000000
6.0
1
0.95
16
0.20
0.175
26
0.075
0.1
51
0.00000000
0.00000000

CASE	64	2.0000	2.0000	24.4000	315.0000
CASE	65	2.0000	2.0000	25.2000	214.0000
CASE	66	2.0000	2.0000	25.3000	299.0000
CASE	67	2.0000	2.0000	27.5000	259.0000
CASE	68	2.0000	2.0000	26.3000	327.0000
CASE	69	2.0000	2.0000	26.9000	385.0000
CASE	70	2.0000	2.0000	24.2000	290.0000
CASE	71	2.0000	2.0000	27.8000	294.0000
CASE	72	2.0000	2.0000	27.5000	393.0000
CASE	73	2.0000	2.0000	25.3000	404.0000
CASE	74	2.0000	2.0000	28.2000	342.0000
CASE	75	2.0000	2.0000	26.6000	362.0000
CASE	76	2.0000	2.0000	26.4000	291.0000
CASE	77	2.0000	2.0000	24.1000	308.0000
CASE	78	2.0000	2.0000	26.7000	297.0000
CASE	79	2.0000	2.0000	24.4000	312.0000
CASE	80	2.0000	2.0000	26.9000	336.0000
CASE	81	3.0000	1.0000	28.2000	432.0000
CASE	82	3.0000	1.0000	25.3000	292.0000
CASE	83	3.0000	1.0000	27.5000	347.0000
CASE	84	3.0000	1.0000	25.0000	301.0000
CASE	85	3.0000	1.0000	27.5000	366.0000
CASE	86	3.0000	1.0000	25.0000	313.0000
CASE	87	3.0000	1.0000	25.3000	390.0000
CASE	88	3.0000	1.0000	28.1000	301.0000
CASE	89	3.0000	1.0000	26.4000	312.0000
CASE	90	3.0000	1.0000	26.5000	422.0000
CASE	91	3.0000	1.0000	26.4000	396.0000
CASE	92	3.0000	1.0000	26.3000	296.0000
CASE	93	3.0000	1.0000	25.5000	311.0000
CASE	94	3.0000	1.0000	25.7000	322.0000
CASE	95	3.0000	1.0000	27.3000	401.0000
CASE	96	3.0000	1.0000	24.5000	375.0000
CASE	97	3.0000	1.0000	26.8000	362.0000
CASE	98	3.0000	1.0000	27.4000	322.0000
CASE	99	3.0000	1.0000	25.2000	418.0000
CASE	100	3.0000	1.0000	24.0000	292.0000
CASE	101	3.0000	2.0000	27.8000	361.0000
CASE	102	3.0000	2.0000	25.3000	302.0000
CASE	103	3.0000	2.0000	24.3000	313.0000
CASE	104	3.0000	2.0000	24.8000	322.0000
CASE	105	3.0000	2.0000	28.4000	461.0000
CASE	106	3.0000	2.0000	24.7000	336.0000
CASE	107	3.0000	2.0000	26.5000	375.0000
CASE	108	3.0000	2.0000	26.4000	465.0000
CASE	109	3.0000	2.0000	24.8000	296.0000
CASE	110	3.0000	2.0000	27.3000	289.0000
CASE	111	3.0000	2.0000	28.3000	436.0000
CASE	112	3.0000	2.0000	27.1000	381.0000
CASE	113	3.0000	2.0000	26.8000	322.0000
CASE	114	3.0000	2.0000	26.4000	294.0000
CASE	115	3.0000	2.0000	24.5000	370.0000
CASE	116	3.0000	2.0000	25.2000	356.0000
CASE	117	3.0000	2.0000	28.9000	365.0000
CASE	118	3.0000	2.0000	24.1000	287.0000
CASE	119	3.0000	2.0000	25.6000	370.0000
CASE	120	3.0000	2.0000	27.6000	359.0000
CASE	121	4.0000	1.0000	27.6000	301.0000
CASE	122	4.0000	1.0000	24.2000	312.0000
CASE	123	4.0000	1.0000	24.1000	326.0000
CASE	124	4.0000	1.0000	26.8000	363.0000
CASE	125	4.0000	1.0000	24.5000	482.0000
CASE	126	4.0000	1.0000	28.1000	461.0000
CASE	127	4.0000	1.0000	24.3000	316.0000
CASE	128	4.0000	1.0000	28.8000	421.0000
CASE	129	4.0000	1.0000	27.3000	302.0000
CASE	130	4.0000	1.0000	23.8000	281.0000
CASE	131	4.0000	1.0000	23.9000	289.0000
CASE	132	4.0000	1.0000	28.0000	289.0000
CASE	133	4.0000	1.0000	25.5000	299.0000
CASE	134	4.0000	1.0000	27.2000	299.0000
CASE	135	4.0000	1.0000	25.0000	313.0000
CASE	136	4.0000	1.0000	25.3000	393.0000
CASE	137	4.0000	1.0000	28.6000	291.0000
CASE	138	4.0000	1.0000	25.6000	393.0000
CASE	139	4.0000	1.0000	28.3000	371.0000

CASE	140	4.0000	1.0000	26.2000	346.0000
CASE	141	4.0000	2.0000	26.8000	406.0000
CASE	142	4.0000	2.0000	26.8000	385.0000
CASE	143	4.0000	2.0000	23.6000	292.0000
CASE	144	4.0000	2.0000	24.3000	302.0000
CASE	145	4.0000	2.0000	23.2000	279.0000
CASE	146	4.0000	2.0000	26.9000	373.0000
CASE	147	4.0000	2.0000	25.8000	339.0000
CASE	148	4.0000	2.0000	25.7000	362.0000
CASE	149	4.0000	2.0000	24.9000	313.0000
CASE	150	4.0000	2.0000	26.9000	449.0000
CASE	151	4.0000	2.0000	24.0000	268.0000
CASE	152	4.0000	2.0000	26.1000	367.0000
CASE	153	4.0000	2.0000	26.9000	401.0000
CASE	154	4.0000	2.0000	23.6000	264.0000
CASE	155	4.0000	2.0000	26.9000	460.0000
CASE	156	4.0000	2.0000	26.5000	310.0000
CASE	157	4.0000	2.0000	23.2000	267.0000
CASE	158	4.0000	2.0000	26.0000	309.0000
CASE	159	4.0000	2.0000	26.5000	394.0000
CASE	160	5.0000	1.0000	28.2000	422.0000
CASE	161	5.0000	1.0000	23.6000	449.0000
CASE	162	5.0000	1.0000	24.8000	261.0000
CASE	163	5.0000	1.0000	26.4000	283.0000
CASE	164	5.0000	1.0000	24.5000	344.0000
CASE	165	5.0000	1.0000	26.5000	316.0000
CASE	166	5.0000	1.0000	25.5000	441.0000
CASE	167	5.0000	1.0000	25.1000	375.0000
CASE	168	5.0000	2.0000	26.2000	369.0000
CASE	169	5.0000	2.0000	26.8000	342.0000
CASE	170	5.0000	2.0000	25.5000	390.0000
CASE	171	5.0000	2.0000	24.6000	397.0000
CASE	172	5.0000	2.0000	25.5000	342.0000
CASE	173	5.0000	2.0000	26.2000	316.0000
CASE	174	5.0000	2.0000	24.8000	291.0000
CASE	175	6.0000	1.0000	25.4000	332.0000
CASE	176	6.0000	1.0000	24.9000	362.0000
CASE	177	6.0000	1.0000	26.6000	287.0000
CASE	178	6.0000	2.0000	21.2000	198.0000
CASE	179	6.0000	2.0000	26.6000	358.0000
CASE	180	6.0000	2.0000	25.4000	341.0000
CASE	181	6.0000	2.0000	26.9000	291.0000

ANOVA on Weights

LEVELS ENCOUNTERED DURING PROCESSING ARE:
TRT
1.0000 2.0000 3.0000 4.0000 5.0000 6.0000
REP
1.0000 2.0000

DEP VAR: WEIGHT N: 181 MULTIPLE R: 0.288 SQUARED MULTIPLE R: 0.083

ANALYSIS OF VARIANCE

SOURCE	SUM-OF-SQUARES	DF	MEAN-SQUARE	F-RATIO	P
TRT	34822.3609	5	6964.4722	2.4294	0.0371
REP	2884.9280	1	2884.9280	1.0064	0.3172
TRT*REP	5244.1426	5	1048.8285	0.3659	0.8714
ERROR	484473.4528	169	2866.7068		

DURBIN-WATSON D STATISTIC 1.968
FIRST ORDER AUTOCORRELATION .016

Post-hoc pairwise comparison of weight/Bonferroni.
COL/
ROW TRT
1 1.0000
2 2.0000
3 3.0000
4 4.0000
5 5.0000
6 6.0000

USING LEAST SQUARES MEANS.

POST HOC TEST OF WEIGHT

MATRIX OF PAIRWISE MEAN DIFFERENCES:

	1	2	3	4	5
1	0.0000				
2	-34.7898	0.0000			
3	-14.5750	20.2148	0.0000		
4	-22.0447	12.7451	-7.4697	0.0000	
5	-9.8768	24.9131	4.6982	12.1680	0.0000
6	-53.3500	-18.5602	-38.7750	-31.3053	-43.4732

	6
6	0.0000

BONFERRONI ADJUSTMENT.
MATRIX OF PAIRWISE COMPARISON PROBABILITIES:

	1	2	3	4	5
1	1.0000				
2	0.0626	1.0000			
3	1.0000	1.0000	1.0000		
4	1.0000	1.0000	1.0000	1.0000	
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	0.2549	1.0000	1.0000	1.0000	1.0000

	6
6	1.0000

ANOVA on Lengths

LEVELS ENCOUNTERED DURING PROCESSING ARE:

TRT	1.0000	2.0000	3.0000	4.0000	5.0000	6.0000
REP	1.0000	2.0000				

DEP VAR: LENGTH N: 181 MULTIPLE R: 0.272 SQUARED MULTIPLE R: 0.074

ANALYSIS OF VARIANCE

SOURCE	SUM-OF-SQUARES	DF	MEAN-SQUARE	F-RATIO	P
TRT	16.7081	5	3.3416	1.7849	0.1185
REP	2.1185	1	2.1185	1.1315	0.2890
TRT*REP	5.5675	5	1.1135	0.5948	0.7040
ERROR	316.4021	169	1.8722		
DURBIN-WATSON D STATISTIC	2.403				
FIRST ORDER AUTOCORRELATION	-.213				

Post-hoc pairwise comparison of length/Bonferroni.

COL/ ROW	TRT
1	1.0000
2	2.0000
3	3.0000
4	4.0000
5	5.0000
6	6.0000

USING LEAST SQUARES MEANS.

POST HOC TEST OF LENGTH

MATRIX OF PAIRWISE MEAN DIFFERENCES:

	1	2	3	4	5
1	0.0000				
2	0.5776	0.0000			
3	0.3550	-0.2226	0.0000		
4	-0.0324	-0.6100	-0.3874	0.0000	
5	-0.2464	-0.8240	-0.6014	-0.2141	0.0000
6	-0.5333	-1.1109	-0.8883	-0.5010	-0.2869

	6
6	0.0000

BONFERRONI ADJUSTMENT.
MATRIX OF PAIRWISE COMPARISON PROBABILITIES:

	1	2	3	4	5
1	1.0000				
2	0.9138	1.0000			
3	1.0000	1.0000	1.0000		
4	1.0000	0.7409	1.0000	1.0000	
5	1.0000	0.7311	1.0000	1.0000	1.0000
6	1.0000	0.7675	1.0000	1.0000	1.0000

	6
6	1.0000

Carbofuran Technical: Effects to the Early Life Stage of Sheepshead Minnow

THE FOLLOWING RESULTS ARE FOR:
TRT = 1.0000

TOTAL OBSERVATIONS: 40

	WEIGHT	LENGTH
N OF CASES	40	40
MINIMUM	280.0000	24.2000
MAXIMUM	466.0000	28.1000
MEAN	365.3500	25.8625
STANDARD DEV	51.4311	1.0180

THE FOLLOWING RESULTS ARE FOR:
TRT = 2.0000

TOTAL OBSERVATIONS: 40

	WEIGHT	LENGTH
N OF CASES	40	40
MINIMUM	214.0000	23.8000
MAXIMUM	471.0000	29.5000
MEAN	330.0250	26.4250
STANDARD DEV	47.3847	1.3887

THE FOLLOWING RESULTS ARE FOR:
TRT = 3.0000

TOTAL OBSERVATIONS: 40

	WEIGHT	LENGTH
N OF CASES	40	40
MINIMUM	287.0000	24.0000
MAXIMUM	465.0000	28.9000
MEAN	350.7750	26.2175
STANDARD DEV	50.4282	1.3492

THE FOLLOWING RESULTS ARE FOR:
TRT = 4.0000

TOTAL OBSERVATIONS: 39

	WEIGHT	LENGTH
N OF CASES	39	39
MINIMUM	264.0000	23.2000
MAXIMUM	482.0000	28.8000
MEAN	343.2821	25.8385
STANDARD DEV	59.7662	1.5998

THE FOLLOWING RESULTS ARE FOR:
TRT = 5.0000

TOTAL OBSERVATIONS: 15

	WEIGHT	LENGTH
N OF CASES	15	15
MINIMUM	261.0000	23.6000
MAXIMUM	449.0000	28.2000
MEAN	355.8667	25.6133
STANDARD DEV	57.2661	1.1382

THE FOLLOWING RESULTS ARE FOR:
TRT = 6.0000

TOTAL OBSERVATIONS: 7

	WEIGHT	LENGTH
N OF CASES	7	7
MINIMUM	198.0000	21.2000
MAXIMUM	362.0000	26.9000
MEAN	309.8571	25.2857
STANDARD DEV	57.5715	1.9548

SUMMARY STATISTICS FOR WEIGHT

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 2.5619 DF= 5 PROBABILITY = 0.7672

ANALYSIS OF VARIANCE

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROBABILITY
BETWEEN GROUPS	36916.3958	5	7383.2792	2.6292	0.0255
WITHIN GROUPS	491439.5379	175	2808.2259		

SUMMARY STATISTICS FOR LENGTH

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 10.3252 DF= 5 PROBABILITY = 0.0665

ANALYSIS OF VARIANCE

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROBABILITY
BETWEEN GROUPS	16.6522	5	3.3304	1.7936	0.1165
WITHIN GROUPS	324.9447	175	1.8568		

THE FOLLOWING RESULTS ARE FOR:
TRT = 1.0000
REP = 1.0000
TOTAL OBSERVATIONS: 20

	WEIGHT	LENGTH
N OF CASES	20	20
MINIMUM	280.0000	24.3000
MAXIMUM	466.0000	27.8000
MEAN	366.9500	25.8100
STANDARD DEV	54.1329	0.9037

THE FOLLOWING RESULTS ARE FOR:
TRT = 1.0000
REP = 2.0000
TOTAL OBSERVATIONS: 20

	WEIGHT	LENGTH
N OF CASES	20	20
MINIMUM	298.0000	24.2000
MAXIMUM	465.0000	28.1000
MEAN	363.7500	25.9150
STANDARD DEV	49.9377	1.1421

THE FOLLOWING RESULTS ARE FOR:
TRT = 2.0000
REP = 1.0000
TOTAL OBSERVATIONS: 19

	WEIGHT	LENGTH
N OF CASES	19	19
MINIMUM	292.0000	24.6000
MAXIMUM	471.0000	29.5000
MEAN	341.2632	26.7421
STANDARD DEV	48.2388	1.2993

THE FOLLOWING RESULTS ARE FOR:
TRT = 2.0000
REP = 2.0000
TOTAL OBSERVATIONS: 21

	WEIGHT	LENGTH
N OF CASES	21	21
MINIMUM	214.0000	23.8000
MAXIMUM	404.0000	28.2000
MEAN	319.8571	26.1381
STANDARD DEV	45.3379	1.4351

THE FOLLOWING RESULTS ARE FOR:
TRT = 3.0000
REP = 1.0000

TOTAL OBSERVATIONS: 20

	WEIGHT	LENGTH
N OF CASES	20	20
MINIMUM	292.0000	24.0000
MAXIMUM	432.0000	28.2000
MEAN	348.5500	26.1950
STANDARD DEV	48.2259	1.2172

Carbofuran Technical: Effects to the Early Life Stage of Sheepshead Minnow

THE FOLLOWING RESULTS ARE FOR:
TRT = 3.0000
REP = 2.0000
TOTAL OBSERVATIONS: 20

	WEIGHT	LENGTH
N OF CASES	20	20
MINIMUM	287.0000	24.1000
MAXIMUM	465.0000	28.9000
MEAN	353.0000	26.2400
STANDARD DEV	53.6999	1.5014

THE FOLLOWING RESULTS ARE FOR:
TRT = 4.0000
REP = 1.0000
TOTAL OBSERVATIONS: 20

	WEIGHT	LENGTH
N OF CASES	20	20
MINIMUM	281.0000	23.8000
MAXIMUM	482.0000	28.8000
MEAN	342.4000	26.1550
STANDARD DEV	59.8642	1.7370

THE FOLLOWING RESULTS ARE FOR:
TRT = 4.0000
REP = 2.0000
TOTAL OBSERVATIONS: 19

	WEIGHT	LENGTH
N OF CASES	19	19
MINIMUM	264.0000	23.2000
MAXIMUM	460.0000	26.9000
MEAN	344.2105	25.5053
STANDARD DEV	61.2886	1.4105

THE FOLLOWING RESULTS ARE FOR:
TRT = 5.0000
REP = 1.0000
TOTAL OBSERVATIONS: 8

	WEIGHT	LENGTH
N OF CASES	8	8
MINIMUM	261.0000	23.6000
STANDARD DEV	72.1683	1.4300
MAXIMUM	449.0000	28.2000
MEAN	361.3750	25.5750

THE FOLLOWING RESULTS ARE FOR:
TRT = 5.0000
REP = 2.0000
TOTAL OBSERVATIONS: 7

	WEIGHT	LENGTH
N OF CASES	7	7
MINIMUM	291.0000	24.6000
MAXIMUM	397.0000	26.8000
MEAN	349.5714	25.6571
STANDARD DEV	38.5869	0.7955

THE FOLLOWING RESULTS ARE FOR:
TRT = 6.0000
REP = 1.0000
TOTAL OBSERVATIONS: 3

	WEIGHT	LENGTH
N OF CASES	3	3
MINIMUM	287.0000	24.9000
MAXIMUM	362.0000	26.6000
MEAN	327.0000	25.6333
STANDARD DEV	37.7492	0.8737

THE FOLLOWING RESULTS ARE FOR:
TRT = 6.0000

REP = 2.0000

TOTAL OBSERVATIONS: 4

	WEIGHT	LENGTH
N OF CASES	4	4
MINIMUM	198.0000	21.2000
MAXIMUM	358.0000	26.9000
MEAN	297.0000	25.0250
STANDARD DEV	71.8656	2.6311

SUMMARY STATISTICS FOR WEIGHT

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 6.4696 DF= 11 PROBABILITY = 0.8403

ANALYSIS OF VARIANCE

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROBABILITY
BETWEEN GROUPS	43882.4809	11	3989.3164	1.3916	0.1807
WITHIN GROUPS	484473.4528	169	2866.7068		

SUMMARY STATISTICS FOR LENGTH

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 16.3292 DF= 11 PROBABILITY = 0.1293

ANALYSIS OF VARIANCE

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROBABILITY
BETWEEN GROUPS	25.1948	11	2.2904	1.2234	0.2749
WITHIN GROUPS	316.4021	169	1.8722		

KOLMOGOROV-SMIRNOV ONE SAMPLE TEST USING STANDARD NORMAL DISTRIBUTION

VARIABLE	N-OF-CASES	MAXDIF	PROBABILITY (2-TAIL)
LENGTH	181.0000	1.0000	0.0000
WEIGHT	181.0000	1.0000	0.0000

FMC Corporation

Agricultural Chemical Group
1735 Market Street
Philadelphia Pennsylvania 19103
215 299 6000

Sent to KBN 8/18/95

432505-00

FMC

Mr. Dennis McNeilly
Reregistration Branch
Special Review and Reregistration Division
Office of Pesticide Programs, U.S. EPA
Document Processing Desk (DCI-Carbofuran)
Room 266A, Crystal Mall 2
1921 Jefferson Davis Highway
Arlington, VA 22202

Dear Mr. McNeilly:

Subject: Carbofuran Data Call-In
Company No. 000279, Chemical No. 090601
Data Requirement-EPA Guideline No. 72-4

On March 12, 1993 FMC submitted a study to fulfill the Subject Data Requirement. We noted that a NOEC for growth effects, a requirement for study acceptability, had not been established. Accordingly we committed to a repeat of the test.

Enclosed herewith are four (4) copies of a report entitled:

Early Life-Stage Toxicity of Carbofuran Technical to the Sheepshead Minnow 43250501

FMC Report No.A93-3785

This submission is made to fulfill this data requirement per Lois Rossi's letter of 8/8/91, and our 5/12/93 commitment as noted above. For your, and the reviewer's convenience, I am attaching a summary of the study to this letter. The NOEC was determined to be 6.0 ug/L and LOEC 15 ug/L.

Should you, or the reviewer, have any questions relative to this study please contact me (215-299-6436).

Sincerely,

Don Carlson

Don Carlson, PhD
Product Development and
Registrations Manager-Carbofuran

cc: M. Palmieri, FMC

FMC Corporation
Chemical Research and Development Center
Box 8
Princeton, New Jersey 08543
(609) 951-3000

TYPE OF STUDY:	EARLY LIFE STAGE
COMPOUND:	CARBOFURAN
FORMULATION:	TECHNICAL
REFERENCE NUMBER:	PL91-313
LABORATORY:	T. R. WILBURY
STUDY NUMBER:	A93-3785
SPECIES:	SHEEPSHEAD MINNOW
DOSAGE:	2.6, 6.0, 15, 26, 51 µg/L (measured)
CONCLUSION:	NOEL = 6.0 µg/L LOEL = 15 µg/L MATC = 9.5 µg/L

SUMMARY:

A 35-day fish early life-stage study of carbofuran technical was conducted in the sheepshead minnow, *Cyprinodon variegatus*. Eighty embryos (40 per replicate, 20 per embryo cage) were exposed to carbofuran at each of the above mean measured concentrations. Identical solvent (dimethylformamide, 0.1 mL/L) and dilution water control groups were included. The test was conducted under flow-through conditions with approximately 6.8 volume exchanges delivered every day. Observations for mortality, morbidity, behavior and other overt signs of toxicity were made daily. Water quality parameters such as temperature, pH, and dissolved oxygen were determined at prescribed intervals. The concentrations of the test material in the exposure solutions was determined weekly using a validated HPLC method.

Mean measured concentrations of carbofuran were 68 to 94% of nominal and were stable throughout the test. Salinity ranged from 15 to 17 g/L, pH from 7.7 to 8.1, dissolved oxygen 5.6 to 7.3 mg/L and the temperature ranged from 29.3 to 31.0 C. Percent embryo survival at 48 hours, percent hatch and post-hatch survival were significantly ($\alpha = 0.05$) reduced at exposure concentrations of 26 and 51 µg/L. Post-hatch survival was also significantly reduced among the fish exposed at 15 µg/L. Mean survival at 6.0 and 2.6 µg/L was 97.5% and 100%, respectively. Neither control group showed any effects. No statistically detectable effect of carbofuran exposure on length or weight of surviving fish was found. Based on these results the no-observed-effect concentration (NOEC) was determined to be 6 µg/L, the lowest-observed-effect concentration (LOEC) 15 µg/L and the maximum acceptable toxicant concentration (MATC), calculated as the geometric mean of the NOEC and LOEC was 9.5 ug/L.

FMC Corporation

Agricultural Chemical Group
1735 Market Street
Philadelphia Pennsylvania 19103
215 299 6000

432505-00

Mr. Dennis McNeilly
Reregistration Branch
Special Review and Reregistration Division
Office of Pesticide Programs, U.S. EPA
Document Processing Desk (DCI-Carbofuran)
Room 266A, Crystal Mall 2
1921 Jefferson Davis Highway
Arlington, VA 22202

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Company No. 000279/Chemical No. 090601
Data Requirement-EPA Guideline No. 72-4

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Early Life-Stage Toxicity of Carbofuran Technical to the Sheepshead Minnow 43250501

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This submission is made to fulfill this data requirement per Lois Rossi's letter of 8/8/91, and our 5/12/93 commitment as noted above. For your, and the reviewer's convenience, I am attaching a summary of the study to this letter. The NOEC was determined to be 6.0 ug/L and LOEC 15 ug/L.

Should you, or the reviewer, have any questions relative to this study please contact me (215-299-6436).

Sincerely,

Don Carlson

Don Carlson, PhD
Product Development and
Registrations Manager-Carbofuran

cc: M. Palmieri, FMC

FMC Corporation
Chemical Research and Development Center
Box 8
Princeton, New Jersey 08543
(609) 951-3000

TYPE OF STUDY:	EARLY LIFE STAGE
COMPOUND:	CARBOFURAN
FORMULATION:	TECHNICAL
REFERENCE NUMBER:	PL91-313
LABORATORY:	T. R. WILBURY
STUDY NUMBER:	A93-3785
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DOSAGE:	2.6, 6.0, 15, 26, 51 µg/L (measured)
CONCLUSION:	NOEL = 6.0 µg/L LOEL = 15 µg/L MATC = 9.5 µg/L

SUMMARY:

A 35-day fish early life-stage study of carbofuran technical was conducted in the sheepshead minnow, *Cyprinodon variegatus*. Eighty embryos (40 per replicate, 20 per embryo cage) were exposed to carbofuran at each of the above mean measured concentrations. Identical solvent (dimethylformamide, 0.1 mL/L) and dilution water control groups were included. The test was conducted under flow-through conditions with approximately 6.8 volume exchanges delivered every day. Observations for mortality, morbidity, behavior and other overt signs of toxicity were made daily. Water quality parameters such as temperature, pH, and dissolved oxygen were determined at prescribed intervals. The concentrations of the test material in the exposure solutions was determined weekly using a validated HPLC method.

Mean measured concentrations of carbofuran were 68 to 94% of nominal and were stable throughout the test. Salinity ranged from 15 to 17 g/L, pH from 7.7 to 8.1, dissolved oxygen 5.6 to 7.3 mg/L and the temperature ranged from 29.3 to 31.0 C. Percent embryo survival at 48 hours, percent hatch and post-hatch survival were significantly ($\alpha = 0.05$) reduced at exposure concentrations of 26 and 51 µg/L. Post-hatch survival was also significantly reduced among the fish exposed at 15 µg/L. Mean survival at 6.0 and 2.6 µg/L was 97.5% and 100%, respectively. Neither control group showed any effects. No statistically detectable effect of carbofuran exposure on length or weight of surviving fish was found. Based on these results the no-observed-effect concentration (NOEC) was determined to be 6 µg/L, the lowest-observed-effect concentration (LOEC) 15 µg/L and the maximum acceptable toxicant concentration (MATC), calculated as the geometric mean of the NOEC and LOEC was 9.5 ug/L.

Carbofuran Tech: Percent Survival at Hatch
File: C:\TOXSTAT\43250501.HAT Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	0.938	3.388	5.348	3.388	0.938
OBSERVED	0	3	8	3	0

Calculated Chi-Square goodness of fit test statistic = 3.2800
Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

Carbofuran Tech: Percent Survival at Hatch
File: C:\TOXSTAT\43250501.HAT Transform: NO TRANSFORMATION

Hartley's test for homogeneity of variance
Bartlett's test for homogeneity of variance

These two tests can not be performed because at least one group has zero variance.

Data FAIL to meet homogeneity of variance assumption.
Additional transformations are useless.

TITLE: Carbofuran Tech: Percent Survival at Hatch
FILE: C:\TOXSTAT\43250501.HAT
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 7

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Solvent Control	1	1.0000	1.0000
1	Solvent Control	2	1.0000	1.0000
2	Control	1	1.0000	1.0000
2	Control	2	1.0000	1.0000
3	2.6	1	1.0000	1.0000
3	2.6	2	1.0000	1.0000
4	6.0	1	0.9500	0.9500
4	6.0	2	0.8750	0.8750

4	16	1	0.3000	0.3000
5	16	2	0.1750	0.1750
6	26	1	0.1250	0.1250
6	26	2	0.1500	0.1500
7	51	1	0.0000	0.0000
7	51	2	0.0000	0.0000

Carbofuran Tech: Percent Survival at Hatch
File: C:\TOXSTAT\43250501.HAT Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Solvent Control	2	1.000	1.000	1.000
2	Control	2	1.000	1.000	1.000
3	2.6	2	1.000	1.000	1.000
4	6.0	2	0.875	0.950	0.913
5	16	2	0.175	0.300	0.238
6	26	2	0.125	0.150	0.138
7	51	2	0.000	0.000	0.000

Carbofuran Tech: Percent Survival at Hatch
File: C:\TOXSTAT\43250501.HAT Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Solvent Control	0.000	0.000	0.000	0.00
2	Control	0.000	0.000	0.000	0.00
3	2.6	0.000	0.000	0.000	0.00
4	6.0	0.003	0.053	0.037	5.81
5	16	0.008	0.088	0.063	37.22
6	26	0.000	0.018	0.013	12.86
7	51	0.000	0.000	0.000	N/A

Carbofuran Tech: Percent Survival at Hatch
File: C:\TOXSTAT\43250501.HAT Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Solvent Control	2	1.000	1.000	1.000
2	Control	2	1.000	1.000	1.000
3	2.6	2	1.000	1.000	1.000
4	6.0	2	0.913	0.913	0.913
5	16	2	0.238	0.238	0.238

6	26	2	0.138	0.138	0.138
7	51	2	0.000	0.000	0.000

Carbofuran Tech: Percent Survival at Hatch
File: C:\TOXSTAT\43250501.HAT Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
Solvent Control	1.000				
Control	1.000	0.000		1.89	k= 1, v= 7
2.6	1.000	0.000		2.00	k= 2, v= 7
6.0	0.913	2.215	*	2.04	k= 3, v= 7
16	0.238	19.305	*	2.06	k= 4, v= 7
26	0.138	21.837	*	2.07	k= 5, v= 7
51	0.000	25.318	*	2.08	k= 6, v= 7

s = 0.039
Note: df used for table values are approximate when v > 20.

Carbofuran Technical: Effects to the Early Life Stage of Sheepshead Minnow

TRT 1 = Solvent Control

TRT 2 = Dilution Water Control

TRT 3 = 2.6 ug/l

TRT 4 = 6.0 ug/l

TRT 5 = 16 ug/l

TRT 6 = 26 ug/l

		TRT	REP	LENGTH	WEIGHT
CASE	1	1.0000	1.0000	27.8000	369.0000
CASE	2	1.0000	1.0000	26.2000	466.0000
CASE	3	1.0000	1.0000	26.5000	393.0000
CASE	4	1.0000	1.0000	26.1000	383.0000
CASE	5	1.0000	1.0000	27.2000	442.0000
CASE	6	1.0000	1.0000	26.3000	367.0000
CASE	7	1.0000	1.0000	25.2000	446.0000
CASE	8	1.0000	1.0000	26.6000	363.0000
CASE	9	1.0000	1.0000	25.1000	433.0000
CASE	10	1.0000	1.0000	24.9000	314.0000
CASE	11	1.0000	1.0000	26.1000	280.0000
CASE	12	1.0000	1.0000	26.4000	371.0000
CASE	13	1.0000	1.0000	25.3000	386.0000
CASE	14	1.0000	1.0000	26.1000	340.0000
CASE	15	1.0000	1.0000	24.8000	329.0000
CASE	16	1.0000	1.0000	26.3000	343.0000
CASE	17	1.0000	1.0000	24.9000	287.0000
CASE	18	1.0000	1.0000	24.3000	400.0000
CASE	19	1.0000	1.0000	25.2000	345.0000
CASE	20	1.0000	1.0000	24.9000	282.0000
CASE	21	1.0000	2.0000	26.5000	316.0000
CASE	22	1.0000	2.0000	26.6000	399.0000
CASE	23	1.0000	2.0000	26.5000	391.0000
CASE	24	1.0000	2.0000	27.2000	299.0000
CASE	25	1.0000	2.0000	24.6000	307.0000
CASE	26	1.0000	2.0000	26.4000	330.0000
CASE	27	1.0000	2.0000	25.1000	330.0000
CASE	28	1.0000	2.0000	25.3000	410.0000
CASE	29	1.0000	2.0000	26.4000	298.0000
CASE	30	1.0000	2.0000	24.8000	401.0000
CASE	31	1.0000	2.0000	24.9000	383.0000
CASE	32	1.0000	2.0000	27.9000	465.0000
CASE	33	1.0000	2.0000	28.1000	408.0000
CASE	34	1.0000	2.0000	25.0000	413.0000
CASE	35	1.0000	2.0000	25.9000	396.0000
CASE	36	1.0000	2.0000	24.4000	361.0000
CASE	37	1.0000	2.0000	24.2000	299.0000
CASE	38	1.0000	2.0000	26.0000	380.0000
CASE	39	1.0000	2.0000	25.4000	298.0000
CASE	40	1.0000	2.0000	27.1000	391.0000
CASE	41	2.0000	1.0000	27.8000	373.0000
CASE	42	2.0000	1.0000	28.0000	340.0000
CASE	43	2.0000	1.0000	25.3000	332.0000
CASE	44	2.0000	1.0000	26.9000	315.0000
CASE	45	2.0000	1.0000	27.8000	430.0000
CASE	46	2.0000	1.0000	26.6000	322.0000
CASE	47	2.0000	1.0000	27.0000	307.0000
CASE	48	2.0000	1.0000	26.7000	471.0000
CASE	49	2.0000	1.0000	27.0000	312.0000
CASE	50	2.0000	1.0000	25.2000	306.0000
CASE	51	2.0000	1.0000	25.1000	312.0000
CASE	52	2.0000	1.0000	26.9000	401.0000
CASE	53	2.0000	1.0000	27.7000	351.0000
CASE	54	2.0000	1.0000	25.4000	372.0000
CASE	55	2.0000	1.0000	25.5000	308.0000
CASE	56	2.0000	1.0000	29.5000	324.0000
CASE	57	2.0000	1.0000	24.6000	319.0000
CASE	58	2.0000	1.0000	28.4000	292.0000
CASE	59	2.0000	1.0000	26.7000	297.0000

CASE	60	2.0000	2.0000	23.8000	287.0000
CASE	61	2.0000	2.0000	25.5000	323.0000
CASE	62	2.0000	2.0000	27.9000	367.0000
CASE	63	2.0000	2.0000	28.0000	312.0000
CASE	64	2.0000	2.0000	24.4000	315.0000
CASE	65	2.0000	2.0000	25.2000	214.0000
CASE	66	2.0000	2.0000	25.3000	299.0000
CASE	67	2.0000	2.0000	27.5000	259.0000
CASE	68	2.0000	2.0000	26.3000	327.0000
CASE	69	2.0000	2.0000	26.9000	385.0000
CASE	70	2.0000	2.0000	24.2000	290.0000
CASE	71	2.0000	2.0000	27.8000	294.0000
CASE	72	2.0000	2.0000	27.5000	393.0000
CASE	73	2.0000	2.0000	25.3000	404.0000
CASE	74	2.0000	2.0000	28.2000	342.0000
CASE	75	2.0000	2.0000	26.6000	362.0000
CASE	76	2.0000	2.0000	26.4000	291.0000
CASE	77	2.0000	2.0000	24.1000	308.0000
CASE	78	2.0000	2.0000	26.7000	297.0000
CASE	79	2.0000	2.0000	24.4000	312.0000
CASE	80	2.0000	2.0000	26.9000	336.0000
CASE	81	3.0000	1.0000	28.2000	432.0000
CASE	82	3.0000	1.0000	25.3000	292.0000
CASE	83	3.0000	1.0000	27.5000	347.0000
CASE	84	3.0000	1.0000	25.0000	301.0000
CASE	85	3.0000	1.0000	27.5000	366.0000
CASE	86	3.0000	1.0000	25.0000	313.0000
CASE	87	3.0000	1.0000	25.3000	390.0000
CASE	88	3.0000	1.0000	28.1000	301.0000
CASE	89	3.0000	1.0000	26.4000	312.0000
CASE	90	3.0000	1.0000	26.5000	422.0000
CASE	91	3.0000	1.0000	26.4000	396.0000
CASE	92	3.0000	1.0000	26.3000	296.0000
CASE	93	3.0000	1.0000	25.5000	311.0000
CASE	94	3.0000	1.0000	25.7000	322.0000
CASE	95	3.0000	1.0000	27.3000	401.0000
CASE	96	3.0000	1.0000	24.5000	375.0000
CASE	97	3.0000	1.0000	26.8000	362.0000
CASE	98	3.0000	1.0000	27.4000	322.0000
CASE	99	3.0000	1.0000	25.2000	418.0000
CASE	100	3.0000	1.0000	24.0000	292.0000
CASE	101	3.0000	2.0000	27.8000	361.0000
CASE	102	3.0000	2.0000	25.3000	302.0000
CASE	103	3.0000	2.0000	24.3000	313.0000
CASE	104	3.0000	2.0000	24.8000	322.0000
CASE	105	3.0000	2.0000	28.4000	461.0000
CASE	106	3.0000	2.0000	24.7000	336.0000
CASE	107	3.0000	2.0000	26.5000	375.0000
CASE	108	3.0000	2.0000	26.4000	465.0000
CASE	109	3.0000	2.0000	24.8000	296.0000
CASE	110	3.0000	2.0000	27.3000	289.0000
CASE	111	3.0000	2.0000	28.3000	436.0000
CASE	112	3.0000	2.0000	27.1000	381.0000
CASE	113	3.0000	2.0000	26.8000	322.0000
CASE	114	3.0000	2.0000	26.4000	294.0000
CASE	115	3.0000	2.0000	24.5000	370.0000
CASE	116	3.0000	2.0000	25.2000	356.0000
CASE	117	3.0000	2.0000	28.9000	365.0000
CASE	118	3.0000	2.0000	24.1000	287.0000
CASE	119	3.0000	2.0000	25.6000	370.0000
CASE	120	3.0000	2.0000	27.6000	359.0000
CASE	121	4.0000	1.0000	27.6000	301.0000
CASE	122	4.0000	1.0000	24.2000	312.0000
CASE	123	4.0000	1.0000	24.1000	326.0000
CASE	124	4.0000	1.0000	26.8000	363.0000
CASE	125	4.0000	1.0000	24.5000	482.0000
CASE	126	4.0000	1.0000	28.1000	461.0000
CASE	127	4.0000	1.0000	24.3000	316.0000
CASE	128	4.0000	1.0000	28.8000	421.0000
CASE	129	4.0000	1.0000	27.3000	302.0000
CASE	130	4.0000	1.0000	23.8000	281.0000
CASE	131	4.0000	1.0000	23.9000	289.0000

CASE	132	4.0000	1.0000	28.0000	289.0000
CASE	133	4.0000	1.0000	25.5000	299.0000
CASE	134	4.0000	1.0000	27.2000	299.0000
CASE	135	4.0000	1.0000	25.0000	313.0000
CASE	136	4.0000	1.0000	25.3000	393.0000
CASE	137	4.0000	1.0000	28.6000	291.0000
CASE	138	4.0000	1.0000	25.6000	393.0000
CASE	139	4.0000	1.0000	28.3000	371.0000
CASE	140	4.0000	1.0000	26.2000	346.0000
CASE	141	4.0000	2.0000	26.8000	406.0000
CASE	142	4.0000	2.0000	26.8000	385.0000
CASE	143	4.0000	2.0000	23.6000	292.0000
CASE	144	4.0000	2.0000	24.3000	302.0000
CASE	145	4.0000	2.0000	23.2000	279.0000
CASE	146	4.0000	2.0000	26.9000	373.0000
CASE	147	4.0000	2.0000	25.8000	339.0000
CASE	148	4.0000	2.0000	25.7000	362.0000
CASE	149	4.0000	2.0000	24.9000	313.0000
CASE	150	4.0000	2.0000	26.9000	449.0000
CASE	151	4.0000	2.0000	24.0000	268.0000
CASE	152	4.0000	2.0000	26.1000	367.0000
CASE	153	4.0000	2.0000	26.9000	401.0000
CASE	154	4.0000	2.0000	23.6000	264.0000
CASE	155	4.0000	2.0000	26.9000	460.0000
CASE	156	4.0000	2.0000	26.5000	310.0000
CASE	157	4.0000	2.0000	23.2000	267.0000
CASE	158	4.0000	2.0000	26.0000	309.0000
CASE	159	4.0000	2.0000	26.5000	394.0000
CASE	160	5.0000	1.0000	28.2000	422.0000
CASE	161	5.0000	1.0000	27.6000	449.0000
CASE	162	5.0000	1.0000	24.8000	261.0000
CASE	163	5.0000	1.0000	26.4000	283.0000
CASE	164	5.0000	1.0000	24.5000	344.0000
CASE	165	5.0000	1.0000	26.5000	316.0000
CASE	166	5.0000	1.0000	25.5000	441.0000
CASE	167	5.0000	1.0000	25.1000	375.0000
CASE	168	5.0000	2.0000	26.2000	369.0000
CASE	169	5.0000	2.0000	26.8000	342.0000
CASE	170	5.0000	2.0000	25.5000	390.0000
CASE	171	5.0000	2.0000	24.6000	397.0000
CASE	172	5.0000	2.0000	25.5000	342.0000
CASE	173	5.0000	2.0000	26.2000	316.0000
CASE	174	5.0000	2.0000	24.8000	291.0000
CASE	175	6.0000	1.0000	25.4000	332.0000
CASE	176	6.0000	1.0000	24.9000	362.0000
CASE	177	6.0000	1.0000	26.6000	287.0000
CASE	178	6.0000	2.0000	21.2000	198.0000
CASE	179	6.0000	2.0000	26.6000	358.0000
CASE	180	6.0000	2.0000	25.4000	341.0000
CASE	181	6.0000	2.0000	26.9000	291.0000

ANOVA on Weights

LEVELS ENCOUNTERED DURING PROCESSING ARE:
TRT
1.0000 2.0000 3.0000 4.0000 5.0000 6.0000
REP
1.0000 2.0000

DEP VAR: WEIGHT N: 181 MULTIPLE R: 0.288 SQUARED MULTIPLE R: 0.083

ANALYSIS OF VARIANCE

SOURCE	SUM-OF-SQUARES	DF	MEAN-SQUARE	F-RATIO	P
TRT	34822.3609	5	6964.4722	2.4294	0.0371
REP	2884.9280	1	2884.9280	1.0064	0.3172
TRT*REP	5244.1426	5	1048.8285	0.3659	0.8714
ERROR	484473.4528	169	2866.7068		

DURBIN-WATSON D STATISTIC 1.968
FIRST ORDER AUTOCORRELATION .016

Post-hoc pairwise comparison of weight/Bonferroni.
COL/
ROW TRT
1 1.0000
2 2.0000
3 3.0000
4 4.0000
5 5.0000
6 6.0000

USING LEAST SQUARES MEANS.

POST HOC TEST OF WEIGHT

MATRIX OF PAIRWISE MEAN DIFFERENCES:

	1	2	3	4	5
1	0.0000				
2	-34.7898	0.0000			
3	-14.5750	20.2148	0.0000		
4	-22.0447	12.7451	-7.4697	0.0000	
5	-9.8768	24.9131	4.6982	12.1680	0.0000
6	-53.3500	-18.5602	-38.7750	-31.3053	-43.4732

	6
6	0.0000

BONFERRONI ADJUSTMENT.
MATRIX OF PAIRWISE COMPARISON PROBABILITIES:

	1	2	3	4	5
1	1.0000				
2	0.0626	1.0000			
3	1.0000	1.0000	1.0000		
4	1.0000	1.0000	1.0000	1.0000	
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	0.2549	1.0000	1.0000	1.0000	1.0000

	6
6	1.0000

ANOVA on Lengths

LEVELS ENCOUNTERED DURING PROCESSING ARE:
TRT
1.0000 2.0000 3.0000 4.0000 5.0000 6.0000
REP
1.0000 2.0000

DEP VAR: LENGTH N: 181 MULTIPLE R: 0.272 SQUARED MULTIPLE R: 0.074

ANALYSIS OF VARIANCE

SOURCE	SUM-OF-SQUARES	DF	MEAN-SQUARE	F-RATIO	P
TRT	16.7081	5	3.3416	1.7849	0.1185
REP	2.1185	1	2.1185	1.1315	0.2890
TRT*REP	5.5675	5	1.1135	0.5948	0.7040
ERROR	316.4021	169	1.8722		
DURBIN-WATSON D STATISTIC	2.403				
FIRST ORDER AUTOCORRELATION	-.213				

Post-hoc pairwise comparison of length/Bonferroni.
COL/
ROW TRT
1 1.0000
2 2.0000
3 3.0000
4 4.0000
5 5.0000
6 6.0000

USING LEAST SQUARES MEANS.

POST HOC TEST OF LENGTH

MATRIX OF PAIRWISE MEAN DIFFERENCES:

	1	2	3	4	5
1	0.0000				
2	0.5776	0.0000			
3	0.3550	-0.2226	0.0000		
4	-0.0324	-0.6100	-0.3874	0.0000	
5	-0.2464	-0.8240	-0.6014	-0.2141	0.0000
6	-0.5333	-1.1109	-0.8883	-0.5010	-0.2869

	6
6	0.0000

BONFERRONI ADJUSTMENT.
MATRIX OF PAIRWISE COMPARISON PROBABILITIES:

	1	2	3	4	5
1	1.0000				
2	0.9138	1.0000			
3	1.0000	1.0000	1.0000		
4	1.0000	0.7409	1.0000	1.0000	
5	1.0000	0.7311	1.0000	1.0000	1.0000
6	1.0000	0.7675	1.0000	1.0000	1.0000

	6
6	1.0000

THE FOLLOWING RESULTS ARE FOR:
TRT = 1.0000

TOTAL OBSERVATIONS: 40

	WEIGHT	LENGTH
N OF CASES	40	40
MINIMUM	280.0000	24.2000
MAXIMUM	466.0000	28.1000
MEAN	365.3500	25.8625
STANDARD DEV	51.4311	1.0180

THE FOLLOWING RESULTS ARE FOR:
TRT = 2.0000

TOTAL OBSERVATIONS: 40

	WEIGHT	LENGTH
N OF CASES	40	40
MINIMUM	214.0000	23.8000
MAXIMUM	471.0000	29.5000
MEAN	330.0250	26.4250
STANDARD DEV	47.3847	1.3887

THE FOLLOWING RESULTS ARE FOR:
TRT = 3.0000

TOTAL OBSERVATIONS: 40

	WEIGHT	LENGTH
N OF CASES	40	40
MINIMUM	287.0000	24.0000
MAXIMUM	465.0000	28.9000
MEAN	350.7750	26.2175
STANDARD DEV	50.4282	1.3492

THE FOLLOWING RESULTS ARE FOR:
TRT = 4.0000

TOTAL OBSERVATIONS: 39

	WEIGHT	LENGTH
N OF CASES	39	39
MINIMUM	264.0000	23.2000
MAXIMUM	482.0000	28.8000
MEAN	343.2821	25.8385
STANDARD DEV	59.7662	1.5998

THE FOLLOWING RESULTS ARE FOR:
TRT = 5.0000

TOTAL OBSERVATIONS: 15

	WEIGHT	LENGTH
N OF CASES	15	15
MINIMUM	261.0000	23.6000
MAXIMUM	449.0000	28.2000
MEAN	355.8667	25.6133
STANDARD DEV	57.2661	1.1382

THE FOLLOWING RESULTS ARE FOR:
TRT = 6.0000

TOTAL OBSERVATIONS: 7

	WEIGHT	LENGTH
N OF CASES	7	7
MINIMUM	198.0000	21.2000
MAXIMUM	362.0000	26.9000
MEAN	309.8571	25.2857
STANDARD DEV	57.5715	1.9548

SUMMARY STATISTICS FOR WEIGHT

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 2.5619 DF= 5 PROBABILITY = 0.7672

ANALYSIS OF VARIANCE

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROBABILITY
BETWEEN GROUPS	36916.3958	5	7383.2792	2.6292	0.0255
WITHIN GROUPS	491439.5379	175	2808.2259		

SUMMARY STATISTICS FOR LENGTH

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 10.3252 DF= 5 PROBABILITY = 0.0665

ANALYSIS OF VARIANCE

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROBABILITY
BETWEEN GROUPS	16.6522	5	3.3304	1.7936	0.1165
WITHIN GROUPS	324.9447	175	1.8568		

THE FOLLOWING RESULTS ARE FOR:
TRT = 1.0000
REP = 1.0000
TOTAL OBSERVATIONS: 20

	WEIGHT	LENGTH
N OF CASES	20	20
MINIMUM	280.0000	24.3000
MAXIMUM	466.0000	27.8000
MEAN	366.9500	25.8100
STANDARD DEV	54.1329	0.9037

THE FOLLOWING RESULTS ARE FOR:
TRT = 1.0000
REP = 2.0000
TOTAL OBSERVATIONS: 20

	WEIGHT	LENGTH
N OF CASES	20	20
MINIMUM	298.0000	24.2000
MAXIMUM	465.0000	28.1000
MEAN	363.7500	25.9150
STANDARD DEV	49.9377	1.1421

THE FOLLOWING RESULTS ARE FOR:
TRT = 2.0000
REP = 1.0000
TOTAL OBSERVATIONS: 19

	WEIGHT	LENGTH
N OF CASES	19	19
MINIMUM	292.0000	24.6000
MAXIMUM	471.0000	29.5000
MEAN	341.2632	26.7421
STANDARD DEV	48.2388	1.2993

THE FOLLOWING RESULTS ARE FOR:
TRT = 2.0000
REP = 2.0000
TOTAL OBSERVATIONS: 21

	WEIGHT	LENGTH
N OF CASES	21	21
MINIMUM	214.0000	23.8000
MAXIMUM	404.0000	28.2000
MEAN	319.8571	26.1381
STANDARD DEV	45.3379	1.4351

THE FOLLOWING RESULTS ARE FOR:
TRT = 3.0000
REP = 1.0000

TOTAL OBSERVATIONS: 20

	WEIGHT	LENGTH
N OF CASES	20	20
MINIMUM	292.0000	24.0000
MAXIMUM	432.0000	28.2000
MEAN	348.5500	26.1950
STANDARD DEV	48.2259	1.2172

THE FOLLOWING RESULTS ARE FOR:
TRT = 3.0000
REP = 2.0000
TOTAL OBSERVATIONS: 20

	WEIGHT	LENGTH
N OF CASES	20	20
MINIMUM	287.0000	24.1000
MAXIMUM	465.0000	28.9000
MEAN	353.0000	26.2400
STANDARD DEV	53.6999	1.5014

THE FOLLOWING RESULTS ARE FOR:
TRT = 4.0000
REP = 1.0000
TOTAL OBSERVATIONS: 20

	WEIGHT	LENGTH
N OF CASES	20	20
MINIMUM	281.0000	23.8000
MAXIMUM	482.0000	28.8000
MEAN	342.4000	26.1550
STANDARD DEV	59.8642	1.7370

THE FOLLOWING RESULTS ARE FOR:
TRT = 4.0000
REP = 2.0000
TOTAL OBSERVATIONS: 19

	WEIGHT	LENGTH
N OF CASES	19	19
MINIMUM	264.0000	23.2000
MAXIMUM	460.0000	26.9000
MEAN	344.2105	25.5053
STANDARD DEV	61.2886	1.4105

THE FOLLOWING RESULTS ARE FOR:
TRT = 5.0000
REP = 1.0000
TOTAL OBSERVATIONS: 8

	WEIGHT	LENGTH
N OF CASES	8	8
MINIMUM	261.0000	23.6000
STANDARD DEV	72.1683	1.4300
MAXIMUM	449.0000	28.2000
MEAN	361.3750	25.5750

THE FOLLOWING RESULTS ARE FOR:
TRT = 5.0000
REP = 2.0000
TOTAL OBSERVATIONS: 7

	WEIGHT	LENGTH
N OF CASES	7	7
MINIMUM	291.0000	24.6000
MAXIMUM	397.0000	26.8000
MEAN	349.5714	25.6571
STANDARD DEV	38.5869	0.7955

THE FOLLOWING RESULTS ARE FOR:
TRT = 6.0000
REP = 1.0000
TOTAL OBSERVATIONS: 3

	WEIGHT	LENGTH
N OF CASES	3	3
MINIMUM	287.0000	24.9000
MAXIMUM	362.0000	26.6000
MEAN	327.0000	25.6333
STANDARD DEV	37.7492	0.8737

THE FOLLOWING RESULTS ARE FOR:
TRT = 6.0000
REP = 2.0000

TOTAL OBSERVATIONS: 4

	WEIGHT	LENGTH
N OF CASES	4	4
MINIMUM	198.0000	21.2000
MAXIMUM	358.0000	26.9000
MEAN	297.0000	25.0250
STANDARD DEV	71.8656	2.6311

SUMMARY STATISTICS FOR WEIGHT

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 6.4696 DF= 11 PROBABILITY = 0.8403

ANALYSIS OF VARIANCE

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROBABILITY
BETWEEN GROUPS	43882.4809	11	3989.3164	1.3916	0.1807
WITHIN GROUPS	484473.4528	169	2866.7068		

SUMMARY STATISTICS FOR LENGTH

BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

CHI-SQUARE = 16.3292 DF= 11 PROBABILITY = 0.1293

ANALYSIS OF VARIANCE

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F	PROBABILITY
BETWEEN GROUPS	25.1948	11	2.2904	1.2234	0.2749
WITHIN GROUPS	316.4021	169	1.8722		

KOLMOGOROV-SMIRNOV ONE SAMPLE TEST USING STANDARD NORMAL DISTRIBUTION

VARIABLE	N-OF-CASES	MAXDIF	PROBABILITY (2-TAIL)
LENGTH	181.0000	1.0000	0.0000
WEIGHT	181.0000	1.0000	0.0000