

US EPA ARCHIVE DOCUMENT

DATA EVALUATION RECORD

- 1. **CHEMICAL:** Benefin (or Benfluralin).  
Shaughnessey Number: 084301.
- 2. **TEST MATERIAL:** <sup>72-4(a)</sup> Benefin (Compound 054521); N-(n-butyl)-N-ethyl-2,6-dinitro- $\alpha,\alpha,\alpha$ -trifluoro- $p$ -toluidine; Lot No. 231EF4; 96.62% active ingredient; 0.1 mg/l aqueous solubility.
- 3. **STUDY TYPE:** Freshwater Fish Early Life-Stage Test.  
Species Tested: Rainbow Trout (*Salmo gairdneri*).
- 4. **CITATION:** Cocke, P.J., M.D. Gunnoe, and G.R. Koenig. 1990. The Toxicity of Benefin to Rainbow Trout (*Salmo gairdneri*) in a 49-Day Early Life-Stage Study. Study No. F00690. Performed by Lilly Research Laboratories, Greenfield, IN. Submitted by DowElanco. EPA MRID No. 416138-05.

5. **REVIEWED BY:**

Kimberly Rhodes, M.S.  
Associate Scientist  
KBN Engineering and  
Applied Sciences, Inc.

Signature: *Louis M. Rifici for KR*  
Date: *6/26/92*

6. **APPROVED BY:**

Louis M. Rifici, M.S.  
Associate Scientist  
KBN Engineering and  
Applied Sciences, Inc.

Signature: *Louis M. Rifici*  
Date: *6/26/92*

Henry T. Craven, M.S.  
Supervisor, EEB/EFED  
USEPA

Signature: *H.T. Craven* SR 2-2-94  
Date:

7. **CONCLUSIONS:** This study is scientifically sound and meets the guideline requirements for a fish early life-stage test. Based on mean measured concentrations, the MATC of benefin for *Salmo gairdneri* was  $>1.9$  and  $<5.0$   $\mu\text{g a.i./l}$  mean measured concentrations (geometric mean MATC =  $3.1$   $\mu\text{g a.i./l}$ ).

8. **RECOMMENDATIONS:** N/A.

9. **BACKGROUND:**

10. DISCUSSION OF INDIVIDUAL TESTS: N/A.

11. MATERIALS AND METHODS:

- A. Test Animals: Rainbow trout (*Salmo gairdneri*) early-eyed eggs were obtained from Trout Lodge, McMillian, Washington, in one shipment lot. The eggs were held in an incubator (13.6°C) for 3 days prior to test initiation. The holding water was from the same source as the dilution water and had a total hardness of 103 mg/l as CaCO<sub>3</sub>, a total alkalinity of 120 mg/l as CaCO<sub>3</sub>, and conductivity of 222 μS/cm. The photoperiod during the acclimation period provided 16 hours of light and 8 hours of darkness with a light intensity below 22 μE/m<sup>2</sup>/sec.
- B. Test System: A proportional diluter system was used to mix and deliver test solutions to four replicate 10-gal glass aquaria per treatment level. The flow rate provided approximately 4.4 volume replacements per day. Exposure vessels for the larvae were 10-gal aquaria containing 18 l of test solution at a solution depth of 15 cm. The eggs were exposed in glass-embryo cups. Each cup was suspended in a glass vessel equipped with a self-starting siphon and was designed to fill and partially empty with each diluter cycle. The test vessels were arranged in a random-block design. The photoperiod provided 16 hours of light and 8 hours of darkness with a light intensity below 22 μE/m<sup>2</sup>/sec.

The dilution water was treated well water. The treatment process consisted of passing the water through birm filters (to remove iron), an electro dialysis unit, (to remove approximately 50% of the minerals), and a degasser (to remove excess CO<sub>2</sub>) in order to adjust the pH. The water was stored in underground tanks before it was pumped to the laboratory for use. A flow-through refrigeration system was used to obtain dilution water at a temperature below 13°C. The dilution water had a pH of 8.0 and a dissolved oxygen concentration of 10.3 mg/l at test initiation. The solvent control had a total hardness of 154 mg/l as CaCO<sub>3</sub>, an alkalinity of 180 mg/l as CaCO<sub>3</sub>, and a specific conductivity of 242 μS/cm at test initiation.

Stock solutions (100 μg/l) were prepared each day of the study by adding 20 ml of an acetone solution containing 20.48 mg benefin to 205 l of dilution water. This solution was diluted to provide the remaining four

concentrations. An injector was used to automatically deliver acetone to the solvent control at a concentration of 0.1 ml/l.

- C. **Dosage:** Forty-nine-day flow-through test. Nominal test concentrations selected, based on preliminary testing were 1.2, 3.7, 11, 33, and 100  $\mu\text{g/l}$ . A dilution water control and a solvent control were also included. The solvent control (0.1 ml/l) contained the amount of acetone present in the highest test concentration.
- D. **Design:** Twenty embryos were impartially selected and distributed to each egg cup (one cup per replicate; four replicates per concentration). The embryos used were visually inspected and judged to be in good condition. During the egg incubation period, each replicate was observed daily for the number of live and dead embryos. Dead embryos were discarded.

After hatching was complete, the larvae were transferred to the appropriate growth tanks. Observations of mortality and abnormal effects were made daily and dead individuals were removed. After swim-up, the larvae were fed salmon starter mash two to three times daily. Excess food and fecal material were removed from the aquaria at least three times each week after the fish began active feeding. The larvae were not fed 24 hours prior to test termination. The biomass loading rate did not exceed 0.2 g/l/day.

At test termination (30 days post swim-up), larval growth (total length and wet weight) was determined. Fish were transferred to a water filled container which was fitted with a millimeter grid bottom. One 8 x 10 inch photograph was taken of the larvae in each replicate and total length was determined. The fish were then sacrificed and blotted wet weight of each fish was measured to the nearest 0.0001 g with an analytical balance.

Dissolved oxygen concentration, pH, and temperature were measured and recorded daily in one replicate of the controls and each treatment level. Temperature in one control aquarium was also monitored continuously. Total hardness, total alkalinity, conductivity, and total ammonia were measured weekly in one replicate of the solvent control and the highest treatment level (100  $\mu\text{g/l}$ ) through day 27. Because of mortality in the highest treatment level, these water quality parameters

were measured weekly in one replicate from the solvent control and the 33  $\mu\text{g}/\text{l}$  nominal test concentration after day 27.

A composite 500-ml sample of test solution was collected on test days 6, 13, 20, 27, 34, 41, and 49. At test initiation, a 500-ml sample of test solution was collected from only one replicate at each treatment level and the controls. Water samples were analyzed for benfenin using gas chromatography.

- E. **Statistics:** The dilution water control and solvent control responses were pooled since no significant differences were detected using a one-tailed Dunnett's t-test (hatch and survival data) or a weighted ANOVA test (growth data).

Hatchability and survival treatment means were analyzed using a one-tailed Dunnett's t-test. The data were analyzed as proportional hatch and survival and arcsine square root transformed.

Growth data were analyzed using a weighted ANOVA test. This procedure ensured that the weight of each larva made an equivalent contribution to the mean length and weight for the treatment. The significance level of all statistical analyses was at  $p \leq 0.05$ .

12. **REPORTED RESULTS:** The mean measured concentrations were 0.8, 1.9, 5.0, 14.8, and 45.5  $\mu\text{g a.i.}/\text{l}$  (Table 1, attached). These values represent 45-67% of the nominal exposure concentrations. No benfenin was detected in the control solutions.

Time to hatch (5 to 8 days) was similar in the controls and the treatment replicates (Table 3, attached). Hatchability of eggs and larval survival at complete hatch ranged from 95 to 100% in each treatment replicate and the controls (Table 3, attached).

All larvae in the highest mean measured concentration (45.5  $\mu\text{g a.i.}/\text{l}$ ) died by day 33 post-hatch. At test termination, larval survival in the 14.8  $\mu\text{g a.i.}/\text{l}$  mean measured test concentration was significantly lower than the pooled controls (Table 4, attached). Abnormal effects (hyperactivity and prostrate position) were observed at the 14.8 and 45.5  $\mu\text{g a.i.}/\text{l}$  treatment levels. No treatment-related deformities were observed.

At test termination, mean standard length was significantly

reduced at 5.0, and 14.8  $\mu\text{g a.i./l}$  mean measured concentrations when compared to the pooled control (Table 4, attached). Mean blotted wet weight was significantly reduced at 14.8  $\mu\text{g a.i./l}$  (Table 4, attached).

During the study, the pH ranged from 7.0 to 8.3, the dissolved oxygen concentration ranged from 6.7 to 11.2 mg/l (63 to 105% of saturation) and the daily temperature ranged from 11.5 to 13.1°C. The total hardness, total alkalinity, conductivity, and un-ionized ammonia in the solvent control and the highest treatment level containing live organisms ranged from 103 to 171 mg/l as  $\text{CaCO}_3$ , 140 to 190 mg/l as  $\text{CaCO}_3$ , 182 to 251  $\mu\text{S/cm}$ , and <0.001 to 0.001 mg/l, respectively.

13. **STUDY AUTHOR'S CONCLUSIONS/QUALITY ASSURANCE MEASURES:** "No significant reduction in rainbow trout larval survival, behavior, or growth relative to controls was observed during the test at analyzed benefin concentrations  $\leq 1.9 \mu\text{g/l}$ . At the end of the 49-day testing period, larval body weight was significantly reduced at a benefin concentration of 14.8  $\mu\text{g/l}$ , and total length of larvae was significantly reduced at test concentrations  $\geq 5.0 \mu\text{g/l}$ . At benefin concentrations  $\geq 14.8 \mu\text{g/l}$ , larval survival was significantly less than the survival of control animals. Based on the results of this study, the chronic no-observed-effect concentration (NOEC) for benefin in rainbow trout was 1.9  $\mu\text{g/l}$ ."

Good Laboratory Practice and Quality Assurance Statements were included in the report, indicating that the study was conducted in accordance with U.S. EPA Good Laboratory Practice Standards (40 CFR Part 160). In addition, several GLP quality assurance inspections were performed throughout the study and the final report was reviewed by the Quality Assurance Unit of the performing laboratory.

14. **REVIEWER'S DISCUSSION AND INTERPRETATION OF STUDY RESULTS:**

- A. **Test Procedure:** The test procedure is generally in accordance with the SEP and ASTM guidelines, except for the following deviations:

Impartial selection was used for embryo selection and distribution to test chambers; random selection is required.

For this study, the light intensity was 1315.3  $\pm 222.8$  lux (reported as 122.2  $\pm 20.7$  footcandles); guidelines recommend 400-800 lux.

The physical state of the test material (i.e., form, color) was not reported.

The SEP and ASTM recommend nominal concentrations which are at least 50% of the next highest concentration. The nominal concentrations in this test were approximately 30% of the next highest.

Continuous temperature monitoring results were not reported.

- B. **Statistical Analysis:** The homogeneity and normality of the survival (49-day post hatch) and hatchability data were analyzed (printouts 1 and 2, attached) Arcsine square-root transformation did not correct the heteroscedasticity of survival and hatchability data or the normality of the hatchability data. Therefore, the survival and hatchability data were analyzed using Steels Many-One Rank test (Toxstat version 3.3), a non-parametric test. No significant reduction in hatchability was detected for any test level when compared to the solvent control (printout 3, attached). Survival at concentrations  $\geq 14.8 \mu\text{g a.i./l}$  were significantly lower than the solvent control (printout 4, attached).

The reviewer used two-way analysis of variance and Bonferroni's test (Crunch Version 3) to analyze the length and wet weight data. At test termination (49-days post hatch), fish length at concentrations  $\geq 5.0 \mu\text{g a.i./l}$  were significantly lower than the dilution water and solvent control (printouts 5 and 6, attached). Fish weight at concentrations  $\geq 14.8 \mu\text{g a.i./l}$  were significantly lower than the controls (printouts 7 and 8, attached).

- C. **Discussion/Results:** This study is scientifically sound and meets the guideline requirements for a fish early life-stage test. Based on mean measured concentrations, the MATC of benefin for rainbow trout was  $>1.9$  and  $<5.0 \mu\text{g a.i./l}$  mean measured concentrations (geometric mean MATC =  $3.1 \mu\text{g a.i./l}$ ).

- D. **Adequacy of the Study:**

- (1) **Classification:** Core.
- (2) **Rationale:** N/A.
- (3) **Repairability:** N/A.

15. COMPLETION OF ONE-LINER: Yes, June 25, 1992.



416138-05 Rainbow trout - Survival

File: 41613805.sur Transform: ARC SINE(SQUARE ROOT(Y))

Chi-square test for normality: actual and expected frequencies

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INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	1.876	6.776	10.696	6.776	1.876
OBSERVED	0	10	9	9	0

---

Calculated Chi-Square goodness of fit test statistic = 6.2848  
 Table Chi-Square value ( $\alpha = 0.01$ ) = 13.277

Data PASS normality test. Continue analysis.

416138-05 Rainbow trout - Survival

File: 41613805.sur Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro Wilks test for normality

D = 0.159

W = 0.923

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

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

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

416138-05 Rainbow trout - Survival

File: 41613805.sur Transform: ARC SINE(SQUARE ROOT(Y))

Hartley 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.

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416138-05 Rainbow trout Hatchability  
 File: 41613805.hat Transform: ARC SINE(SQUARE ROOT(Y))

Chi-square test for normality: actual and expected frequencies

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INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	1.876	6.776	10.696	6.776	1.876
OBSERVED	0	1	27	0	0

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Calculated Chi-Square goodness of fit test statistic = 40.3039  
 Table Chi-Square value (alpha = 0.01) = 13.277

Data FAIL normality test. Try another transformation.

Warning - The two homogeneity tests are sensitive to non-normal data and should not be performed.

416138-05 Rainbow trout Hatchability  
 File: 41613805.hat Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro Wilks test for normality

D = 0.000

W = 0.434

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

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

Data FAIL normality test. Try another transformation.

Warning - The two homogeneity tests are sensitive to non-normal data and should not be performed.

416138-05 Rainbow trout Hatchability  
 File: 41613805.hat Transform: ARC SINE(SQUARE ROOT(Y))

Hartley 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.

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416138-05 Rainbow trout Hatchability

File: 41613805.hat

Transform: ARC SINE(SQUARE ROOT(Y))

STEELS MANY-ONE RANK TEST

Ho: Control < Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	Solvent Control	1.345				
2	Control	1.345	18.00	10.00	4.00	
3	0.8	1.345	18.00	10.00	4.00	
4	1.9	1.345	18.00	10.00	4.00	
5	5.0	1.345	18.00	10.00	4.00	
6	14.8	1.345	16.00	10.00	4.00	
7	45.5	1.345	18.00	10.00	4.00	

Critical values use  $k = 6$ , are 1 tailed, and  $\alpha = 0.05$

416138-05 Rainbow trout - Survival

File: 41613805.sur

Transform: ARC SINE(SQUARE ROOT(Y))

STEELS MANY-ONE RANK TEST

Ho: Control < Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	Solvent Control	1.259				
2	Control	1.271	20.50	10.00	4.00	
3	0.8	1.297	21.00	10.00	4.00	
4	1.9	1.238	17.50	10.00	4.00	
5	5.0	1.297	19.00	10.00	4.00	
6	14.8	0.675	10.00	10.00	4.00	*
7	45.5	0.226	10.00	10.00	4.00	*

Critical values use  $k = 6$ , are 1 tailed, and  $\alpha = 0.05$



FILTER: None

Post-hoc tests for factor C (CONC)

Level	Mean	Level	Mean
1	40.960	6	26.290
2	40.904		
3	41.079		
4	39.778		
5	38.081		

Comparison	Tukey-A*	Bon- ferroni	Dunnnett
1 > 2			
1 < 3			
1 > 4			
1 > 5	0.0100	0.0000	0.0100
1 > 6	0.0100	0.0000	0.0100
2 < 3			N.A.
2 > 4			N.A.
* 2 > 5	0.0100	0.0000	N.A.
* 2 > 6	0.0100	0.0000	N.A.
3 > 4			N.A.
3 > 5	0.0100	0.0000	N.A.
3 > 6	0.0100	0.0000	N.A.
4 > 5		0.0457	N.A.
4 > 6	0.0100	0.0000	N.A.
5 > 6	0.0100	0.0000	N.A.

\* The only possible P-values are .01, .05 or .10 (up to 0.0500).  
A blank means the P-value is greater than 0.0500.

For Dunnnett's test only the P-values .05 and .01 are possible  
and only for comparisons with the control mean (level 1).

Post-hoc tests for factor R (REP)

Level	Mean
1	38.649
2	39.224
3	39.705
4	38.810

Comparison	Tukey-A*	Bon- ferroni	Dunnnett
1 < 2			
1 < 3			
1 < 4			
2 < 3			N.A.
2 > 4			N.A.
3 > 4			N.A.

\* The only possible P-values are .01, .05 or .10 (up to 0.0500).  
A blank means the P-value is greater than 0.0500.

For Dunnnett's test only the P-values .05 and .01 are possible  
and only for comparisons with the control mean (level 1).



Weight

Printout 8

Analysis of Variance

File: benlngth

Date: 05-21-1992

FILTER: None

Post-hoc tests for factor C (CONC)

Level	Mean	Level	Mean
1	0.699	6	0.204
2	0.687		
3	0.732		
4	0.666		
5	0.650		

Comparison	Tukey-A*	Bon- ferroni	Dunnnett
1 > 2			
1 < 3			
1 > 4			
1 > 5			
1 > 6	0.0100	0.0000	0.0100
2 < 3			N.A.
2 > 4			N.A.
2 > 5			N.A.
2 > 6	0.0100	0.0000	N.A.
3 > 4			N.A.
3 > 5		0.0380	N.A.
3 > 6	0.0100	0.0000	N.A.
4 > 5			N.A.
4 > 6	0.0100	0.0000	N.A.
5 > 6	0.0100	0.0000	N.A.

\* The only possible P-values are .01, .05 or .10 (up to 0.0500). A blank means the P-value is greater than 0.0500.

- For Dunnnett's test only the P-values .05 and .01 are possible and only for comparisons with the control mean (level 1).

Post-hoc tests for factor R (REP)

Level	Mean
1	0.624
2	0.665
3	0.661
4	0.648

Comparison	Tukey-A*	Bon- ferroni	Dunnnett
1 < 2			
1 < 3			
1 < 4			
2 > 3			N.A.
2 > 4			N.A.
3 > 4			N.A.

\* The only possible P-values are .01, .05 or .10 (up to 0.0500). A blank means the P-value is greater than 0.0500.

For Dunnnett's test only the P-values .05 and .01 are possible and only for comparisons with the control mean (level 1).



Study/Species/Lab/ MRID # \_\_\_\_\_ Chemical % a.i. \_\_\_\_\_ Results \_\_\_\_\_ Reviewer/ Validation Date \_\_\_\_\_ Status \_\_\_\_\_

Chronic Fish \_\_\_\_\_ Concentrations Tested (pp<sub>b</sub>) - 0.8, 1.9, 5.0, 14.8, 45.5

Species: Salmo gairdneri MATC - > 1.9 < 5.0 pp<sub>b</sub> 1\*

Lab: Lilly Research Lab. Effected Parameters - standard length, survival  
wet weight

MRID # 416138-05 Control Mortality (%) - 99.8 Solvent Control Mortality (%) - 8.75  
Comments: \* mean measured concentrations

KR/LAK-Coe  
6/25/98

Chronic Invertebrate \_\_\_\_\_ Concentrations Tested (pp) - \_\_\_\_\_

Species: \_\_\_\_\_ MATC - > \_\_\_\_\_ < \_\_\_\_\_ pp \_\_\_\_\_

Lab: \_\_\_\_\_ Effected Parameters - \_\_\_\_\_

MRID # \_\_\_\_\_ Control Mortality (%) - \_\_\_\_\_ Solvent Control Mortality (%) - \_\_\_\_\_

Comments:

TITLE: 416138-05 Rainbow trout - Survival  
FILE: 41613805.sur  
TRANSFORM: ARC SINE(SQUARE ROOT(Y))

NUMBER OF GROUPS: 7

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GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Solvent Control	1	0.8500	1.1731
1	Solvent Control	2	1.0000	1.3453
1	Solvent Control	3	0.8500	1.1731
1	Solvent Control	4	0.9500	1.3453
2	Control	1	0.7500	1.0472
2	Control	2	1.0000	1.3453
2	Control	3	1.0000	1.3453
2	Control	4	1.0000	1.3453
3	0.8	1	0.9000	1.2490
3	0.8	2	1.0000	1.3453
3	0.8	3	0.9000	1.2490
3	0.8	4	1.0000	1.3453
4	1.9	1	0.9000	1.2490
4	1.9	2	1.0000	1.3453
4	1.9	3	0.8000	1.1071
4	1.9	4	0.9000	1.2490
5	5.0	1	0.9500	1.3453
5	5.0	2	0.9000	1.2490
5	5.0	3	0.9000	1.2490
5	5.0	4	0.9500	1.3453
6	14.8	1	0.3500	0.6331
6	14.8	2	0.4500	0.7353
6	14.8	3	0.3160	0.5970
6	14.8	4	0.4500	0.7353
7	45.5	1	0.0000	0.2255
7	45.5	2	0.0000	0.2255
7	45.5	3	0.0000	0.2255
7	45.5	4	0.0000	0.2255

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TITLE: 416138-05 Rainbow trout Hatchability  
FILE: 41613805.hat  
TRANSFORM: ARC SINE(SQUARE ROOT(Y))

NUMBER OF GROUPS: 7

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GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Solvent Control	1	1.0000	1.3453
1	Solvent Control	2	1.0000	1.3453
1	Solvent Control	3	1.0000	1.3453
1	Solvent Control	4	1.0000	1.3453
2	Control	1	1.0000	1.3453
2	Control	2	1.0000	1.3453
2	Control	3	1.0000	1.3453
2	Control	4	1.0000	1.3453
3	0.8	1	1.0000	1.3453
3	0.8	2	1.0000	1.3453
3	0.8	3	1.0000	1.3453
3	0.8	4	1.0000	1.3453
4	1.9	1	1.0000	1.3453
4	1.9	2	1.0000	1.3453
4	1.9	3	1.0000	1.3453
4	1.9	4	1.0000	1.3453
5	5.0	1	1.0000	1.3453
5	5.0	2	1.0000	1.3453
5	5.0	3	1.0000	1.3453
5	5.0	4	1.0000	1.3453
6	14.8	1	1.0000	1.3453
6	14.8	2	1.0000	1.3453
6	14.8	3	0.9500	1.3453
6	14.8	4	1.0000	1.3453
7	45.5	1	1.0000	1.3453
7	45.5	2	1.0000	1.3453
7	45.5	3	1.0000	1.3453
7	45.5	4	1.0000	1.3453

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FILTER: None

Obs.	CONC	REP	LENGTH
1	1	1	44.0000
2	1	1	46.0000
3	1	1	46.0000
4	1	1	45.0000
5	1	1	41.0000
6	1	1	41.0000
7	1	1	45.0000
8	1	1	42.0000
9	1	1	40.0000
10	1	1	39.0000
11	1	1	45.0000
12	1	1	43.0000
13	1	1	48.0000
14	1	1	43.0000
15	1	1	43.0000
16	1	2	34.0000
17	1	2	42.0000
18	1	2	44.0000
19	1	2	45.0000
20	1	2	44.0000
21	1	2	43.0000
22	1	2	41.0000
23	1	2	41.0000
24	1	2	42.0000
25	1	2	38.0000
26	1	2	40.0000
27	1	2	41.0000
28	1	2	42.0000
29	1	2	36.0000
30	1	2	38.0000
31	1	2	41.0000
32	1	2	42.0000
33	1	2	35.0000
34	1	2	40.0000
35	1	2	47.0000
36	1	3	40.0000
37	1	3	42.0000
38	1	3	44.0000
39	1	3	40.0000
40	1	3	40.0000
41	1	3	39.0000
42	1	3	40.0000
43	1	3	37.0000
44	1	3	38.0000
45	1	3	40.0000
46	1	3	37.0000
47	1	3	41.0000
48	1	3	40.0000
49	1	3	41.0000
50	1	3	42.0000
51	1	3	41.0000
52	1	3	37.0000
53	1	3	44.0000
54	1	3	37.0000
55	1	3	40.0000

FILTER: None

Obs.	CONC	REP	LENGTH
56	1	4	30.0000
57	1	4	42.0000
58	1	4	39.0000
59	1	4	44.0000
60	1	4	36.0000
61	1	4	42.0000
62	1	4	42.0000
63	1	4	38.0000
64	1	4	38.0000
65	1	4	43.0000
66	1	4	43.0000
67	1	4	40.0000
68	1	4	45.0000
69	1	4	45.0000
70	1	4	41.0000
71	1	4	35.0000
72	1	4	36.0000
73	1	4	42.0000
74	1	4	40.0000
75	1	4	44.0000
76	2	1	40.0000
77	2	1	41.0000
78	2	1	36.0000
79	2	1	35.0000
80	2	1	36.0000
81	2	1	39.0000
82	2	1	37.0000
83	2	1	32.0000
84	2	1	37.0000
85	2	1	41.0000
86	2	1	40.0000
87	2	1	41.0000
88	2	1	44.0000
89	2	1	44.0000
90	2	1	41.0000
91	2	1	41.0000
92	2	1	39.0000
93	2	2	40.0000
94	2	2	39.0000
95	2	2	39.0000
96	2	2	41.0000
97	2	2	44.0000
98	2	2	36.0000
99	2	2	45.0000
100	2	2	40.0000
101	2	2	30.0000
102	2	2	40.0000
103	2	2	43.0000
104	2	2	39.0000
105	2	2	42.0000
106	2	2	37.0000
107	2	2	39.0000
108	2	2	42.0000
109	2	2	37.0000
110	2	2	36.0000

FILTER: None

Obs.	CONC	REP	LENGTH
111	2	2	45.0000
112	2	2	41.0000
113	2	3	43.0000
114	2	3	42.0000
115	2	3	40.0000
116	2	3	45.0000
117	2	3	44.0000
118	2	3	40.0000
119	2	3	42.0000
120	2	3	45.0000
121	2	3	44.0000
122	2	3	44.0000
123	2	3	42.0000
124	2	3	44.0000
125	2	3	43.0000
126	2	3	43.0000
127	2	3	47.0000
128	2	3	42.0000
129	2	3	42.0000
130	2	4	43.0000
131	2	4	47.0000
132	2	4	44.0000
133	2	4	38.0000
134	2	4	43.0000
135	2	4	40.0000
136	2	4	40.0000
137	2	4	44.0000
138	2	4	40.0000
139	2	4	44.0000
140	2	4	41.0000
141	2	4	41.0000
142	2	4	40.0000
143	2	4	41.0000
144	2	4	40.0000
145	2	4	41.0000
146	2	4	45.0000
147	2	4	43.0000
148	2	4	40.0000
149	3	1	47.0000
150	3	1	46.0000
151	3	1	41.0000
152	3	1	37.0000
153	3	1	40.0000
154	3	1	42.0000
155	3	1	44.0000
156	3	1	42.0000
157	3	1	38.0000
158	3	1	42.0000
159	3	1	45.0000
160	3	1	39.0000
161	3	1	39.0000
162	3	1	43.0000
163	3	1	40.0000
164	3	1	40.0000
165	3	1	37.0000

FILTER: None

Obs.	CONC	REP	LENGTH
166	3	1	44.0000
167	3	2	38.0000
168	3	2	42.0000
169	3	2	37.0000
170	3	2	37.0000
171	3	2	42.0000
172	3	2	42.0000
173	3	2	40.0000
174	3	2	37.0000
175	3	2	40.0000
176	3	2	43.0000
177	3	2	38.0000
178	3	2	40.0000
179	3	2	46.0000
180	3	2	43.0000
181	3	2	41.0000
182	3	2	41.0000
183	3	2	40.0000
184	3	2	39.0000
185	3	2	45.0000
186	3	2	42.0000
187	3	3	39.0000
188	3	3	43.0000
189	3	3	36.0000
190	3	3	36.0000
191	3	3	38.0000
192	3	3	40.0000
193	3	3	40.0000
194	3	3	46.0000
195	3	3	41.0000
196	3	3	38.0000
197	3	3	41.0000
198	3	3	43.0000
199	3	3	42.0000
200	3	3	38.0000
201	3	3	40.0000
202	3	3	45.0000
203	3	3	45.0000
204	3	3	41.0000
205	3	4	45.0000
206	3	4	44.0000
207	3	4	39.0000
208	3	4	45.0000
209	3	4	42.0000
210	3	4	36.0000
211	3	4	39.0000
212	3	4	40.0000
213	3	4	44.0000
214	3	4	42.0000
215	3	4	42.0000
216	3	4	43.0000
217	3	4	45.0000
218	3	4	37.0000
219	3	4	37.0000
220	3	4	40.0000

FILTER: None

Obs.	CONC	REP	LENGTH
221	3	4	44.0000
222	3	4	48.0000
223	3	4	35.0000
224	3	4	44.0000
225	4	1	41.0000
226	4	1	45.0000
227	4	1	42.0000
228	4	1	47.0000
229	4	1	41.0000
230	4	1	34.0000
231	4	1	44.0000
232	4	1	36.0000
233	4	1	38.0000
234	4	1	35.0000
235	4	1	33.0000
236	4	1	26.0000
237	4	1	37.0000
238	4	1	36.0000
239	4	1	43.0000
240	4	1	40.0000
241	4	1	39.0000
242	4	1	39.0000
243	4	2	37.0000
244	4	2	35.0000
245	4	2	43.0000
246	4	2	36.0000
247	4	2	46.0000
248	4	2	42.0000
249	4	2	39.0000
250	4	2	41.0000
251	4	2	42.0000
252	4	2	40.0000
253	4	2	39.0000
254	4	2	44.0000
255	4	2	42.0000
256	4	2	43.0000
257	4	2	45.0000
258	4	2	47.0000
259	4	2	43.0000
260	4	2	49.0000
261	4	2	45.0000
262	4	2	40.0000
263	4	3	41.0000
264	4	3	44.0000
265	4	3	47.0000
266	4	3	32.0000
267	4	3	38.0000
268	4	3	37.0000
269	4	3	40.0000
270	4	3	40.0000
271	4	3	45.0000
272	4	3	38.0000
273	4	3	40.0000
274	4	3	35.0000
275	4	3	42.0000



FILTER: None

Obs.	CONC	REP	LENGTH
276	4	3	41.0000
277	4	3	43.0000
278	4	3	38.0000
279	4	4	37.0000
280	4	4	38.0000
281	4	4	40.0000
282	4	4	42.0000
283	4	4	30.0000
284	4	4	40.0000
285	4	4	36.0000
286	4	4	42.0000
287	4	4	40.0000
288	4	4	40.0000
289	4	4	40.0000
290	4	4	34.0000
291	4	4	40.0000
292	4	4	40.0000
293	4	4	41.0000
294	4	4	35.0000
295	4	4	32.0000
296	4	4	42.0000
297	5	1	40.0000
298	5	1	33.0000
299	5	1	44.0000
300	5	1	26.0000
301	5	1	32.0000
302	5	1	39.0000
303	5	1	37.0000
304	5	1	39.0000
305	5	1	41.0000
306	5	1	39.0000
307	5	1	35.0000
308	5	1	38.0000
309	5	1	28.0000
310	5	1	39.0000
311	5	1	37.0000
312	5	1	38.0000
313	5	1	40.0000
314	5	1	35.0000
315	5	1	36.0000
316	5	2	37.0000
317	5	2	40.0000
318	5	2	34.0000
319	5	2	37.0000
320	5	2	42.0000
321	5	2	34.0000
322	5	2	42.0000
323	5	2	42.0000
324	5	2	42.0000
325	5	2	39.0000
326	5	2	41.0000
327	5	2	38.0000
328	5	2	40.0000
329	5	2	36.0000
330	5	2	39.0000

FILTER: None

Obs.	CONC	REP	LENGTH
331	5	2	36.0000
332	5	2	45.0000
333	5	2	38.0000
334	5	3	42.0000
335	5	3	40.0000
336	5	3	47.0000
337	5	3	38.0000
338	5	3	37.0000
339	5	3	33.0000
340	5	3	39.0000
341	5	3	40.0000
342	5	3	38.0000
343	5	3	42.0000
344	5	3	39.0000
345	5	3	36.0000
346	5	3	33.0000
347	5	3	33.0000
348	5	3	40.0000
349	5	3	33.0000
350	5	3	38.0000
351	5	3	43.0000
352	5	4	44.0000
353	5	4	38.0000
354	5	4	30.0000
355	5	4	40.0000
356	5	4	40.0000
357	5	4	40.0000
358	5	4	40.0000
359	5	4	43.0000
360	5	4	40.0000
361	5	4	40.0000
362	5	4	39.0000
363	5	4	43.0000
364	5	4	27.0000
365	5	4	37.0000
366	5	4	42.0000
367	5	4	42.0000
368	5	4	36.0000
369	5	4	30.0000
370	5	4	38.0000
371	6	1	22.0000
372	6	1	23.0000
373	6	1	30.0000
374	6	1	30.0000
375	6	1	24.0000
376	6	1	27.0000
377	6	1	24.0000
378	6	2	23.0000
379	6	2	26.0000
380	6	2	26.0000
381	6	2	21.0000
382	6	2	32.0000
383	6	2	27.0000
384	6	2	23.0000
385	6	2	24.0000

FILTER: None

Obs.	CONC	REP	LENGTH
386	6	2	31.0000
387	6	3	30.0000
388	6	3	34.0000
389	6	3	27.0000
390	6	3	26.0000
391	6	3	26.0000
392	6	3	33.0000
393	6	4	27.0000
394	6	4	30.0000
395	6	4	24.0000
396	6	4	25.0000
397	6	4	20.0000
398	6	4	25.0000
399	6	4	29.0000
400	6	4	21.0000
401	6	4	25.0000

*Weight*

Data listing

File: benlngth

Date: 05-21-1992

FILTER: None

Obs.	CONC	REF	<i>Weight</i> LENGTR
1	1	1	0.7065
2	1	1	0.7309
3	1	1	0.5923
4	1	1	0.7825
5	1	1	0.8222
6	1	1	0.5513
7	1	1	0.9716
8	1	1	0.8615
9	1	1	0.7716
10	1	1	0.8608
11	1	1	0.7980
12	1	1	0.8769
13	1	1	0.5204
14	1	1	0.9340
15	1	1	0.6578
16	1	2	0.6670
17	1	2	0.8113
18	1	2	0.7152
19	1	2	0.8404
20	1	2	0.8495
21	1	2	0.8744
22	1	2	0.4928
23	1	2	0.7724
24	1	2	0.7630
25	1	2	0.7694
26	1	2	0.7065
27	1	2	0.8533
28	1	2	0.9283
29	1	2	0.4275
30	1	2	0.6329
31	1	2	0.5882
32	1	2	0.7517
33	1	2	0.7648
34	1	2	0.4808
35	1	2	1.0282
36	1	3	0.6306
37	1	3	0.7177
38	1	3	0.5056
39	1	3	0.7605
40	1	3	0.7005
41	1	3	0.6016
42	1	3	0.6583
43	1	3	0.5796
44	1	3	0.5406
45	1	3	0.6441
46	1	3	0.7574
47	1	3	0.5663
48	1	3	0.6669
49	1	3	0.5332
50	1	3	0.6003
51	1	3	0.5468
52	1	3	0.5624
53	1	3	0.6904
54	1	3	0.7505
55	1	3	0.5788

FILTER: None

*weight*

Obs.	CONC	REP	LENGTH
56	1	4	0.6640
57	1	4	0.9395
58	1	4	0.6471
59	1	4	0.5143
60	1	4	0.4510
61	1	4	0.7905
62	1	4	0.8401
63	1	4	0.7250
64	1	4	0.7648
65	1	4	0.6174
66	1	4	0.6938
67	1	4	0.8743
68	1	4	1.2094
69	1	4	0.5290
70	1	4	0.5930
71	1	4	0.4566
72	1	4	0.8538
73	1	4	0.2662
74	1	4	0.4577
75	1	4	0.7529
76	2	1	0.5159
77	2	1	0.7538
78	2	1	0.5169
79	2	1	0.4910
80	2	1	0.6036
81	2	1	0.4893
82	2	1	0.6150
83	2	1	0.6296
84	2	1	0.6619
85	2	1	0.7819
86	2	1	0.6354
87	2	1	0.5767
88	2	1	0.5428
89	2	1	0.6797
90	2	1	0.3335
91	2	1	0.4711
92	2	1	0.9693
93	2	2	0.5588
94	2	2	0.6215
95	2	2	0.8160
96	2	2	0.6244
97	2	2	0.8839
98	2	2	0.4824
99	2	2	0.2651
100	2	2	0.5883
101	2	2	0.4571
102	2	2	0.5057
103	2	2	0.5169
104	2	2	0.7568
105	2	2	0.4959
106	2	2	0.5212
107	2	2	0.7033
108	2	2	0.6261
109	2	2	0.6124
110	2	2	0.5116

FILTER: None

Obs.	CONC	REP	<i>Weight</i> LENGTH
111	2	2	0.4671
112	2	2	0.9263
113	2	3	0.6628
114	2	3	0.9713
115	2	3	0.6905
116	2	3	0.6890
117	2	3	0.7406
118	2	3	0.7456
119	2	3	0.5922
120	2	3	0.7751
121	2	3	0.9955
122	2	3	0.7547
123	2	3	0.9392
124	2	3	0.6815
125	2	3	0.7113
126	2	3	0.6798
127	2	3	0.7831
128	2	3	0.7627
129	2	3	0.9418
130	2	4	0.6563
131	2	4	0.6068
132	2	4	0.5743
133	2	4	0.8196
134	2	4	0.6848
135	2	4	0.8644
136	2	4	0.7663
137	2	4	0.6382
138	2	4	1.1465
139	2	4	1.0019
140	2	4	0.6979
141	2	4	0.8658
142	2	4	0.6264
143	2	4	0.6290
144	2	4	0.8868
145	2	4	1.0876
146	2	4	1.0492
147	2	4	0.6657
148	2	4	0.5604
149	3	1	0.6211
150	3	1	0.7495
151	3	1	0.5998
152	3	1	0.7171
153	3	1	0.8005
154	3	1	0.7697
155	3	1	0.8553
156	3	1	0.9966
157	3	1	0.6772
158	3	1	1.1183
159	3	1	0.7131
160	3	1	1.0593
161	3	1	0.7398
162	3	1	0.4517
163	3	1	0.7444
164	3	1	0.7376
165	3	1	0.6399

*weight*

Data listing

File: benlength

Date: 05-21-1992

FILTER: None

Obs.	CONC	REP	<i>weight</i> LENGTH
166	3	1	0.8846
167	3	2	0.5497
168	3	2	0.7271
169	3	2	0.7080
170	3	2	0.8424
171	3	2	0.8677
172	3	2	0.7046
173	3	2	0.5465
174	3	2	0.8876
175	3	2	0.5569
176	3	2	0.6456
177	3	2	0.6807
178	3	2	0.5285
179	3	2	0.7096
180	3	2	0.6149
181	3	2	0.6089
182	3	2	0.8487
183	3	2	0.5800
184	3	2	0.8034
185	3	2	0.6999
186	3	2	0.8866
187	3	3	0.9381
188	3	3	0.7851
189	3	3	0.8679
190	3	3	0.6903
191	3	3	0.5862
192	3	3	0.9140
193	3	3	0.6614
194	3	3	0.7342
195	3	3	0.4670
196	3	3	1.1074
197	3	3	0.4594
198	3	3	0.6971
199	3	3	0.6709
200	3	3	0.8568
201	3	3	0.9852
202	3	3	0.7942
203	3	3	0.6524
204	3	3	0.7110
205	3	4	0.8594
206	3	4	0.7709
207	3	4	0.7384
208	3	4	0.4407
209	3	4	0.7946
210	3	4	0.8597
211	3	4	0.8158
212	3	4	0.8876
213	3	4	0.9140
214	3	4	0.7413
215	3	4	0.7075
216	3	4	0.4390
217	3	4	0.6895
218	3	4	0.6661
219	3	4	0.6152
220	3	4	0.4662

*Weight*

Data listing

File: benlength

Date: 05-21-1992

FILTER: None

Obs.	CONC	REP	<i>Weight</i> LENGTH
221	3	4	0.8319
222	3	4	0.4272
223	3	4	0.8995
224	3	4	0.6353
225	4	1	0.8213
226	4	1	0.4214
227	4	1	0.9435
228	4	1	0.5985
229	4	1	0.7178
230	4	1	0.4837
231	4	1	0.9268
232	4	1	0.1573
233	4	1	0.5779
234	4	1	0.8614
235	4	1	1.0351
236	4	1	0.4545
237	4	1	0.8456
238	4	1	0.4817
239	4	1	0.3964
240	4	1	0.7395
241	4	1	0.7226
242	4	1	0.9420
243	4	2	0.7518
244	4	2	0.8687
245	4	2	0.9236
246	4	2	0.8980
247	4	2	0.6305
248	4	2	1.2811
249	4	2	1.2000
250	4	2	0.5335
251	4	2	0.6326
252	4	2	0.8315
253	4	2	0.9141
254	4	2	0.4451
255	4	2	0.4987
256	4	2	0.9770
257	4	2	0.9170
258	4	2	0.8531
259	4	2	0.6595
260	4	2	0.7979
261	4	2	0.7134
262	4	2	0.8800
263	4	3	0.8960
264	4	3	0.5174
265	4	3	0.6970
266	4	3	0.7322
267	4	3	0.5883
268	4	3	0.5801
269	4	3	0.4158
270	4	3	0.5896
271	4	3	0.7854
272	4	3	0.5640
273	4	3	0.6278
274	4	3	0.4536
275	4	3	0.5925



Data listing

File: benlngth

Date: 05-21-1992

FILTER: None

*weight*

Obs.	CONC	REP	LENGTH
276	4	3	0.3649
277	4	3	0.5270
278	4	3	0.8006
279	4	4	0.5885
280	4	4	0.3347
281	4	4	0.6636
282	4	4	0.6770
283	4	4	0.3030
284	4	4	0.5993
285	4	4	0.5935
286	4	4	0.6870
287	4	4	0.2422
288	4	4	0.7714
289	4	4	0.7453
290	4	4	0.3670
291	4	4	0.6330
292	4	4	0.4655
293	4	4	0.4750
294	4	4	0.3624
295	4	4	0.6713
296	4	4	0.7067
297	5	1	0.7454
298	5	1	0.4764
299	5	1	0.5420
300	5	1	0.6004
301	5	1	0.5336
302	5	1	0.6897
303	5	1	0.6715
304	5	1	0.5560
305	5	1	0.5792
306	5	1	0.4629
307	5	1	0.5818
308	5	1	0.5437
309	5	1	0.5192
310	5	1	0.3320
311	5	1	0.2120
312	5	1	0.2355
313	5	1	0.9397
314	5	1	0.5002
315	5	1	0.1590
316	5	2	0.6210
317	5	2	0.5872
318	5	2	0.5522
319	5	2	0.8593
320	5	2	0.8152
321	5	2	0.6040
322	5	2	0.5002
323	5	2	0.9435
324	5	2	0.6963
325	5	2	0.4885
326	5	2	0.8520
327	5	2	0.7100
328	5	2	0.7205
329	5	2	0.5983
330	5	2	0.5847

FILTER: None

Obs.	CONC	REP	<i>Weight</i> LENGTH
331	5	2	0.7125
332	5	2	0.8137
333	5	2	0.7718
334	5	3	0.7032
335	5	3	0.8163
336	5	3	0.5799
337	5	3	0.6420
338	5	3	0.7923
339	5	3	0.4598
340	5	3	0.7297
341	5	3	0.9597
342	5	3	0.4796
343	5	3	0.7966
344	5	3	0.6670
345	5	3	0.9966
346	5	3	0.3557
347	5	3	0.3753
348	5	3	0.6401
349	5	3	0.6831
350	5	3	0.7162
351	5	3	0.5833
352	5	4	0.7288
353	5	4	0.7577
354	5	4	1.1045
355	5	4	0.7888
356	5	4	0.6580
357	5	4	0.7560
358	5	4	0.9455
359	5	4	0.7000
360	5	4	0.9990
361	5	4	0.8752
362	5	4	0.3566
363	5	4	0.5278
364	5	4	0.7284
365	5	4	0.2762
366	5	4	0.8404
367	5	4	0.7230
368	5	4	0.7965
369	5	4	0.9712
370	5	4	0.2794
371	6	1	0.1110
372	6	1	0.2672
373	6	1	0.2530
374	6	1	0.1407
375	6	1	0.0851
376	6	1	0.0807
377	6	1	0.1733
378	6	2	0.1827
379	6	2	0.2110
380	6	2	0.1424
381	6	2	0.2172
382	6	2	0.0866
383	6	2	0.1567
384	6	2	0.3110
385	6	2	0.4266

Data listing

File: benlngth

Date: 05-21-1992

FILTER: None

Obs.	CONC	REP	<i>Weight</i> LENGTH
386	6	2	0.0859
387	6	3	0.2580
388	6	3	0.3879
389	6	3	0.2092
390	6	3	0.3702
391	6	3	0.2790
392	6	3	0.2493
393	6	4	0.1011
394	6	4	0.2040
395	6	4	0.2222
396	6	4	0.1292
397	6	4	0.3660
398	6	4	0.1805
399	6	4	0.2526
400	6	4	0.0789
401	6	4	0.1177