F.5.6 Results

- Sediments at Stations 3,4,7,10,11 and 12 were classified as clayey silts, whereas that at Station 2 was classified as sand-silt clay (Fig. F.5-2). Bivariate plots of % organics vs % silts showed relatively lower organics and silts at Station 2 than at other stations (Fig. F.5-3).

- Straight-hinge and umbone larval abundances were tabulated (Tables F.5-5 and F.5-6). No significant station differences were detected with ANOVA for straight-hinge larval abundance, but significant date and date-station interaction effects were found (Table F.5-7). Significant date, station, and date-station interaction effects were also seen for umbone larval abundances (Table F.5-8). Specific orthogonal contrasts showed no differences between affected and unaffected stations. Partially affected Station 4 was different from partially affected Station 7 (Table F.5-8).

- Spat densities are tabulated in Table F.5-9. Significant date, station, and date-station interactions were detected using ANOVA (Table F.5-10). Orthogonal contrasts of affected and unaffected stations were not conducted because of sampler losses.

- Juvenile *Rangia* densities (retention on 223-µm mesh) are shown in Table F.5-11. No statistical testing of this data was done. Juvenile/adult *Rangia* densities and biomasses (retention on 505-µm mesh) are shown in Tables F.5-12 and F.5-13, respectively. Significant date and station effects were detected on *Rangia* density (Table F.5-14). Orthogonal comparisons showed significant differences between affected and unaffected stations (Table F.5-14). Adjustment for variability due to percent sand (ANCOVA) did not alter the results of the ANOVA (Tables F.5-15 and F.5-16). No ANOVAS were done using biomass data.

- Length-frequency histograms of the composite 1980 *Rangia* samples (lengths > 0.5mm) are given in Fig. F.5-4 and month-specific distributions are given by station in Figs. F.5-5 through F.5-11.

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- ANCOVA testing showed that a reduced linear model, assuming equal slopes at all station-substrate combinations, was appropriate for the seven growth parameters (Table F.5-17). Assuming equal slopes at all station-substrate combinations, ANCOVA showed substrate effects on growth (final length-initial length) and on final length. No significant station effects were noted for any of the growth parameters (Table F.5-18).

- In the summer growth studies, mean increase in length generally was linear regardless of substrate type (Fig. F.5-12). Growth measured by increase in tissue dry weight was higher at sand stations than at mud stations (Figure F.5-13), but not significantly so. Length and weight increases were not different among stations regardless of substrate type (Figs. F.5-14 through Fig. F.5-17).

- In the winter growth study, percent survival was significantly higher at Station 3 (discharge) than at Station 12 (reference) regardless of initial clam size (Table F.5-19). Changes in length frequency distributions for the winter growth study are shown in Figs. F.5-18 and F.5-19.

- A length-weight regression assuming station-specific coefficients showed significant station, length, and station-length interaction effects on condition (weight) of clams collected for abundance studies regardless of size (Table F.5-20). Direct station comparisons of least squares mean weight estimates for Rangia < 5mm in length showed differences between Stations 2 and 12 (both reference, but substrates somewhat different), Stations 2 and 4 (reference vs. partially affected), and Stations 12 and 3 (reference vs affected) (Table F.5-21). For clams > 5mm in length, all station comparisons were significantly different except Stations 3 and 4 (affected vs partially affected) (Table F.5-21). Estimation of the station-specific coefficients showed that only Stations 3, 4, and 12 showed positive incremental effects on the overall mean size for clams < 5mm, whereas only Stations 7, 10, and 12 showed positive incremental effects on the overall mean size for clams > 5mm (Table F.5-22). Calculated instantaneous growth rates by age (G) are shown in Table F.5-23 for clams < 30mm.

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- Instantaneous mortality rates for Stations 3, 4, and 12 are 0.381, 0.356, and 0.190, respectively, based on integrated size density distributions (Figs. F.5-20 and F.5-21).

- Annual productivity rates for Rangia populations at Stations 3, 4, and 12 are 1.43, 1.90, and 145.21 g/m^2, respectively. Annual turnover rates at these stations are 0.27, 0.41, and 9.34 g/m^2, respectively.

- Predation studies using caging experiments in summer 1980 showed Rangia was significantly preyed upon in uncaged situations. Correcting for natural mortality (assumed total mortality in caged situations is natural) showed that predation mortality was highest at Station 3, intermediate at Station 4, and lowest at Station 12 (Table F.5-24). Thus, the observed predation mortality gradient corresponds to the temperature gradient resulting from the power plant.

F.5-7 Significance and Critique of Findings

- From the data presented, there does appear to be a relationship between plant discharge and Rangia mortality, with increased winter survival in the discharge region due to a protective plant influence and decreased spat and juvenile survival in summer months due to increased predation.

- Although the plant is affecting the Rangia population dynamics in the Saltpeter and Dundee Creek system, results of this study and other PPSP studies (Appendices F.1 and F.2) suggest that effects are spatially limited. Nearby Chesapeake Bay waters support large populations of Rangia which could be used to restock affected Rangia populations in the plant vicinity.

- Sampling methods could have affected the strength of some conclusions, particularly those relating to size frequency distributions. The integrated densities used to evaluate population mortality rates may have been biased toward higher rates because although the sampling gear (Ponar grab) collected small (< 20 mm) clams well, it did less well with larger clams.

- Conclusions were often drawn from analyses which incorporated large numbers of missing cells, small samples, or physical-chemical stations differences. For example, 50% of the observations

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in the spat abundance ANOVA were missing for the affected stations (i.e., Stations 3 and 10). Therefore, firm conclusions drawn from these types of data sets should not be made.

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Table F.5-1. Two-way analysis of variance model used for *Rangia* spot abundance data (from Ref. 5)

$$Y = \mu + \alpha_i + \beta_j + E_{ijk}$$

where

Y	=	$\log_e$(organism abundance + 1.0)
μ	=	parameter representing overall mean $\log_e$ (abundance + 1.0)
α_i	=	effect due to station i
β_i	=	effect due to sampling date j
$\alpha_i\beta_j$	=	interaction effect of the ith station and jth date above and beyond the effect of each separately
E_{ijk}	=	experimental error assumed to be normally distributed with a mean of zero and a variance of σ^2

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Table F.5-2. ANCOVA designs used to analyze summer 1980 Rangia growth studies (from Ref. 5)

For analysis assuming equal slopes (B_1) at all stations:

$$Y = \mu + \alpha_1 + \beta_j + (\alpha\beta)_{ij} = \gamma_{k(cij)} + B_1 X + E_{1(cijk)}$$

where

Y = growth parameter

μ = overall mean growth paramater

α_i = effect at Station i

β_j = effect of substrate j

$(\alpha\beta)_{ij}$ = effect of station-substrate

$\gamma_{k(ij)}$ = effect of trays rested in a station-substrate combination

β_1 = slope parameter for covariate term

X = (covariate term) time trap spent in water

$E_{1(ijk)}$ = experimental error assured to be normally distributed with a mean of zero and a variance of σ^2.

For analysis assuming station specific slopes:

$$Y = \mu + \alpha_i + B_j + (\alpha\beta)_{ij} + \alpha_k + B_i (\alpha\beta)_{ij} X + E_{ijk}$$

where

$B_i(\alpha\beta)_{ij}$ = slope for each station-substrate combination.

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Table F.5-3. ANCOVA designs used to analyze condition (weight in relation to length) of Rangia (from Ref. 5)

For analysis assuming equal slopes (β_1) at all stations:

$$Y = \mu + \alpha_i + \beta_1 + E_{ij}$$

where

Y = log-transformed weight

μ = log-transformed overall mean weight

α_i = effect of station i

βi = slope parameter for covariate term

X = log-transformed length (covariate)

E_{ij} = experimental error assumed to be normally distributed with a mean of zero and a variance of σ^2.

For analysis assuming station-specific slopes:

$$Y = \mu + \alpha_i + \beta_1 + \alpha_i \beta_i + E_{ij}$$

where

$\alpha_i \beta_i$ = station-dependent slope parameter

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Table F.5-4. ANCOVA design to evaluate station differences in length-weight relationships assuming station-specific slopes (from Ref. 5)

$$Y = \mu + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_5 X_5 + \alpha_6 X_6 + \alpha_7 X_7 + B_i X + \alpha_1 B_1 X + \alpha_2 B_1 X + \alpha_3 B_1 X + \alpha_4 B_1 X + \alpha_5 B_1 X + \alpha_6 B_1 X + \alpha_7 B_1 X + E_{ij}$$

where Y = log-10 transformed weight

μ = overall mean weight

$\alpha_1 X_1$ = station effect of Station 2

$\alpha_2 X_2$ = station effect of Station 3

$\alpha_3 X_3$ = station effect of Station 4

$\alpha_4 X_4$ = station effect of Station 7

$\alpha_5 X_5$ = station effect of Station 10

$\alpha_6 X_6$ = station effect of Station 11

$\alpha_7 X_7$ = station effect of Station 12

B = slope for length (covariate)

X = $\log_{10}$ length

$\alpha_1 B_1$ = Station-dependent slope parameter for Station 2

$\alpha_2 B_1$ = Station-dependent slope parameter for Station 3

$\alpha_3 B_1$ = Station-dependent slope parameter for Station 4

$\alpha_4 B_1$ = Station-dependent slope parameter for Station 7

$\alpha_5 B_1$ = Station-dependent slope parameter for Station 10

$\alpha_6 B_1$ = Station-dependent slope parameter for Station 11

$\alpha_7 B_1$ = Station-dependent slope parameter for Station 12.

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Table F.5-5. Density (no./100 liters) of Pelecypod straight-hinge larvae at stations in the vicinity of C.P. Crane power plant, January-November 1980 (from Ref. 5)

	STATION							
DATE	ST 2	ST 3	ST 4	ST 7	ST10	ST11	ST12	MEAN
9 JAN 80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28 FEB 80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19 MAR 80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17 APR 80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14 MAY 80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11 JUN 80	7.1	3.7	0.0	0.0	1.5	0.0	3.2	2.2
9 JUL 80	50.0	38.6	50.2	32.3	280.1	49.8	15.7	75.7
6 AUG 80	61.5	29.2	372.1	148.3	95.0	49.5	27.5	111.9
10 SEP 80	46.0	4.0	0.0	5.2	0.0	101.5	5.9	23.2
8 OCT 80	16.3	0.0	0.0	4.2	0.0	0.5	0.0	3.0
13 NOV 80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MEAN	16.4	6.8	38.4	17.3	34.2	16.8	4.8	19.3

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Table F.5-6. Density (no./100 liters) of Pelecypod umbone larvae at stations in the vicinity of C.P. Crane power plant, January-November 1980 (from Ref. 5)

	STATION							
DATE	ST 2	ST 3	ST 4	ST 7	ST10	ST11	ST12	MEAN
9 JAN 80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20 FEB 80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19 MAR 80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17 APR 80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14 MAY 80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11 JUN 80	6.7	3.2	0.0	0.0	0.0	5.9	0.0	2.3
9 JUL 80	210.5	157.2	213.5	42.7	605.5	273.8	330.4	261.0
6 AUG 80	285.9	78.8	561.7	144.3	72.7	155.8	48.5	192.5
10 SEP 80	23.0	10.5	18.5	40.1	9.3	114.2	0.0	30.8
8 OCT 80	13.4	0.0	14.1	0.0	7.9	0.9	6.6	6.1
13 NOV 80	0.0	0.0	0.0	0.0	0.0	0.0	7.3	1.0
MEAN	49.0	22.7	73.4	20.6	63.2	39.4	35.7	43.5

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Table F.5-7. Pelecypoda straight-hinge larvae analysis of variance[a] results with a priori orthogonal polynomial linear contrast, C.P. Crane power plant, 1980 (from Ref. 5)

Source	DF	Type IV SS	F*	P(F*>F)	Power
Dates	2	41.53	19.91	0.0001	
Stations	6	13.60	2.17	0.0893	0.38
Dates x Stations	12	49.02	3.92	0.0035	
Error	20	20.86			
Total	40				

Orthogonal Linear Contrast of Station Means	Contrast Estimate	T*	P(T*>T)	Standard Error of Estimate
Plume vs. Reference	0.19	0.13	0.8964	1.44
Plume vs. Partial	0.55	0.66	0.5173	0.83
Between 3 and 10	0.71	1.20	0.2431	0.59
Between 4 and 7	-0.04	-0.06	0.9520	0.59
Between 2 and 12	-1.55	-2.63	0.0160	0.59

(a) Performed on LOG_e (Density + 1).

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Table F.5-8. Pelecypoda umbone larvae analysis of variance[a] results with a priori orthogonal polynomial linear contrast and Duncan's multiple range test, C.P. Crane power plant, 1980 (from Ref. 5)

Source	DF	Type IV SS	F*	P(F*>F)	Power
Dates	3	142.62	109.75	0.0001	
Stations	6	18.05	6.94	0.0002	0.975
Dates x Stations	18	43.25	5.55	0.0001	
Error	27	11.70			
Total	54				

Orthogonal Linear Contrast of Station Means	Contrast Estimate	T*	P(T*>T)	Standard Error of Estimate
Plume vs. Reference	-0.15	-0.19	0.8522	0.81
Plume vs. Partial	0.89	1.91	0.0673	0.47
Between 3 and 10	0.59	1.79	0.0849	0.33
Between 4 and 7	-1.17	-3.55	0.0014	0.33
Between 2 and 12	-1.42	-4.30	0.0002	0.33

DUNCAN'S MULTIPLE RANGE TEST

Stations	4	2	11	10	7	3	12
Means	4.28	4.15	3.76	3.55	3.11	2.96	2.73

(a) Performed on LOG_e (Density + 1).

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Table F.5-9. Density (no./m^2) of *Rangia cuneata* spat at stations in the vicinity of C.P. Crane power plant, January-November 1980 (from Ref. 5)

	STATION							
DATE	ST 2	ST 3	ST 4	ST 7	ST10	ST11	ST12	MEAN
30 APR 80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14 MAY 80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28 MAY 80	0.0	0.0	0.0	0.0	0.0	1986.9	0.0	283.8
10 JUN 80	0.0	0.0	0.0	0.0	0.0	1986.9	1986.9	567.7
10 JUL 80	3973.8	0.0	0.0	0.0	0.0	0.0	0.0	611.4
24 JUL 80	15895.1	5960.6	25829.4	5960.6	0.0	5960.6	13908.2	10502.1
7 AUG 80	69540.6	--	47685.1	5960.6	0.0	7947.5	3973.8	22517.9
20 AUG 80	1986.9	--	49671.9	13908.2	--	1986.9	0.0	13510.8
2 SEP 80	3973.8	--	0.0	3973.8	--	0.0	1986.9	1986.9
17 SEP 80	23842.5	63580.0	0.0	5960.6	7947.5	1986.9	5960.6	12914.7
30 SEP 80	3973.8	1986.9	--	0.0	0.0	0.0	3973.8	1655.7
13 OCT 80	0.0	23842.5	3973.8	0.0	0.0	0.0	0.0	2445.4
27 OCT 80	0.0	0.0	0.0	1986.9	0.0	0.0	0.0	283.8
MEAN	9475.9	5739.9	11057.4	3020.1	722.5	1681.2	2445.4	4835.5

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Table F.5-10. *Rangia cuneata* spat analysis of variance[a] results with a priori orthogonal polynomial linear contrast and Duncan's multiple range test, C.P. Crane power plant, 1980 (from Ref. 5)

Source	DF	Type IV SS	F*	P(F*>F)	Power
Dates	4	245.02	7.58	0.0003	
Stations	6	230.58	4.75	0.0019	--
Dates x Stations	19	473.07	3.08	0.0035	
Error	28	226.33			
Total	57				

Orthogonal Linear Contrast of Station Means	Contrast Estimate	T*	P(T*>T)	Standard Error of Estimate
Plume vs. Reference	No est.			
Plume vs. Partial	No est.			
Between 3 and 10	No est.			
Between 4 and 7	1.64	1.23	0.2302	1.33
Between 2 and 12	-1.73	-1.36	0.1854	1.27

DUNCAN'S MULTIPLE RANGE TEST

Stations	3	7	2	4	12	11	10
Means	9.44	7.96	7.83	7.02	6.10	5.18	2.95

(a) Performed on LOG_e (Density + 1).

(b) Because of cells of missing data, many possible contrasts of non-zero cell means are possible, resulting in different sums of squares values. This value represents one contrast within the family of contrast possibilities (Searle and Henderson 1978, p. 42).

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Table F.5-11. Density (no./m^2) of *Rangia cuneata* collected by Ponar and retained on 223-µm-mesh screen at stations in the vicinity of C.P. Crane power plant, April-November 1980 (from Ref. 5)

	STATION							
DATE	ST 2	ST 3	ST 4	ST 7	ST10	ST11	ST12	MEAN
3 APR 80	0.0	322.5	0.0	0.0	0.0	268.8	537.5	161.3
22 MAY 80	397.8	0.0	0.0	0.0	0.0	0.0	537.5	133.6
18 JUN 80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10 JUL 80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7 AUG 80	0.0	268.8	0.0	0.0	0.0	0.0	0.0	38.4
9 SEP 80	0.0	0.0	537.5	268.8	0.0	0.0	0.0	115.2
9 OCT 80	0.0	0.0	1612.5	0.0	0.0	0.0	268.8	268.8
17 NOV 80	0.0	0.0	806.3	0.0	0.0	0.0	0.0	115.2
MEAN	49.7	73.9	369.5	33.6	0.0	33.6	168.0	106.3

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Table F.5-12. Density (no./m^2) of Rangia cuneata collected by Ponar and retained by 505-µm-mesh screen at stations in the vicinity of C.P. Crane power plant, January-November 1980 (from Ref. 5)

DATE	STATION ST 2	ST 3	ST 4	ST 7	ST10	ST11	ST12	MEAN
9 JAN 80	419.3	32.3	53.8	10.8	10.8	10.8	0.0	76.8
27 FEB 80	107.5	21.5	43.0	0.0	0.0	0.0	0.0	24.6
20 MAR 80	21.5	43.0	0.0	10.8	0.0	10.8	0.0	12.3
3 APR 80	139.8	43.0	86.0	0.0	0.0	0.0	0.0	38.4
22 MAY 80	1214.8	150.5	387.0	161.3	43.0	129.0	559.0	377.8
18 JUN 80	2537.0	1634.0	1032.0	107.5	129.0	795.5	1515.8	1107.3
10 JUL 80	4031.3	279.5	698.8	21.5	53.8	215.0	3128.3	1204.0
7 AUG 80	2762.8	75.3	150.5	32.3	32.3	75.3	2418.8	792.4
9 SEP 80	1806.0	53.8	10.8	0.0	10.8	0.0	1451.3	476.1
9 OCT 80	3547.5	43.0	32.3	0.0	10.8	10.8	2150.0	827.8
17 NOV 80	3450.8	32.3	0.0	0.0	10.8	0.0	1924.3	774.0
MEAN	1821.6	218.9	226.7	31.3	27.4	113.4	1195.2	519.2

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Table F.5-13. Biomass (mg/m^2) of Rangia cuneata collected by Ponar and retained on 505-µm-mesh screen at stations in the vicinity of C.P. Crane power plant, January-November 1980 (from Ref. 5)

	STATION							
DATE	ST 2	ST 3	ST 4	ST 7	ST10	ST11	ST12	MEAN
9 JAN 80	83075.36	32468.87	8782.53	0.11	2.90	0.22	0.00	17761.43
27 FEB 80	25745.93	32954.13	40415.91	0.00	0.00	0.00	0.00	14159.42
20 MAR 80	2562.05	36.55	0.00	8.39	0.00	2.58	0.00	372.79
3 APR 80	49116.75	47000.72	87494.68	0.00	0.00	0.00	0.00	26230.31
22 MAY 80	46662.00	39933.24	75.57	89.55	21.72	25.91	289.18	12442.45
18 JUN 80	41211.74	1031.68	628.77	235.43	127.17	1410.94	1741.93	6626.81
10 JUL 80	42176.87	1496.61	2853.70	158.13	130.40	1498.01	24948.28	10466.00
7 AUG 80	31869.67	40218.23	14031.44	276.17	188.88	440.75	8772.97	13685.44
9 SEP 80	26580.02	17908.11	5179.35	0.00	121.26	0.00	12247.69	8862.35
9 OCT 80	65678.20	24963.11	30532.15	0.00	102.77	15671.35	28817.96	23680.79
17 NOV 80	92272.30	28527.71	0.00	0.00	89.76	0.00	25968.56	20979.77
MEAN	46086.45	24230.81	17272.19	69.80	71.35	1731.80	9344.23	14115.24

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Table F.5-14. *Rangia cuneata* (505-μm Ponar collections) analysis of variance[a] results with a priori orthogonal polynomial linear contrast and Duncan's multiple range test, C.P. Crane power plant, 1980 (from Ref. 5)

Source	DF	Type IV SS	F*	P(F*>F)	Power
Dates	3	63.27	6.87	0.0003	
Stations	6	287.58	15.62	0.0001	>0.99
Dates x Stations	18	91.93	1.66	0.0581	
Error	103	316.06			
Total	130				

Orthogonal Linear Contrast of Station Means	Contrast Estimate	T*	P(T*>T)	Standard Error of Estimate
Plume vs. Reference	10.08	7.46	0.0001	1.35
Plume vs. Partial	0.56	0.65	0.5177	0.87
Between 3 and 10	-2.03	-3.32	0.0012	0.61
Between 4 and 7	-2.80	-4.51	0.0001	0.62
Between 2 and 12	-0.51	-0.98	0.3291	0.52

DUNCAN'S MULTIPLE RANGE TEST

Stations	2	12	4	3	11	10	7
Means	7.01	6.66	5.74	5.18	4.21	3.05	2.95

(a) Performed on LOG_e (Density + 1).

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Table F.5-15. *Rangia cuneata* (505-μm Ponar collections) analysis of covariance[a] results with percent sand as covariate, C.P. Crane power plant, 1979 (from Ref. 8)

Source	df	SS	F*	P(F*>F)
Covariate	1	0.6324	----	----
Station	6	90.5876	7.07	0.0001
Date	3	58.2536	9.09	0.0001
Station * Date	18	117.2199	3.05	0.0003
Error	83	177.3138		
Total	111	670.8532		

[a] Performed on $\log_e$ (Density + 1)

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Table F.5-16. *Rangia cuneata* (505-μm-Ponar collections) analysis of covariance[a] results with percent sand as covariate, C.P. Crane power plant, 1980 (from Ref. 8)

Source	df	SS(Type IV)	F*	P(F*>F)
Covariate	1	5.7580	----	----
Station	6	260.7377	11.06	0.0001
Date	2	6.2280	0.79	0.4574
Station*Date	12	102.2288	2.17	0.0246
Error	62	243.7008		
Total	83	764.8081		

[a] Performed on $\log_e$ (Density + 1)

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Table F.5-17. Results of analysis of covariance testing the equality of slopes of a linear model of growth of *Rangia cuneata* at Stations 3, 4, and 12 in the vicinity of C.P. Crane power plant, 11 June - 13 October (from Ref. 5)

		Growth[a]	Final Length	Shell Weight	Total Clam Weight	Tissue Dry Weight	Tissue Wet Weight	Final Width
Reduced model (equal slopes)	SS(E)	1,099.919	1,161.610	151,320,552.6	356,977,480	292,740.33	13,718,417	541.278
	d.f.	272	272	272	270	268	269	271
Full model (unequal slopes)	SS(E)	1,097.798	1,142.298	150,053,519.8	354,113,664	285,116	13,515,303	533.814
	d.f.	270	270	270	268	266	267	269
F*		0.261	2.271	1.140	1.084	3.533	2.006	1.881
d.f.		2,270	2,270	2,270	2,268	2,270	2,267	2,271
Result[b]		Accept H_0	Accept H_0	Accept H_0	Accept H_0	Accept H_0	Accept H_0	Accept H_0

(a) Growth = final length-initial length.
(b) Compared to a conservative F critical value ($F_{.05,2,120}$) = 19.49.

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Table F.5-18. Results of nested factorial analysis of covariance, assuming equal slopes between stations, testing for differences in growth of *Rangia cuneata* between stations and substrate types, independently for several growth parameters measured. C.P. Crane power plant, 11 June - 13 October 1980 (from Ref. 5)

	SS	MS	E	F*	d.f.	P(F*>F)
Growth[a]						
Station x substrate	50.628	25.314	16.438	1.540	2, 32	0.2299
Station	44.848	22.424	12.641	1.774	2, 39	0.1831
Substrate	68.896	68.896	13.023	5.290	1, 38	0.0270[b]
Final Length						
Station x substrate	10.9466	5.4733	16.7289	0.3272	2, 32	0.7233
Station	3.9496	1.9748	12.9217	0.1528	2, 39	0.8588
Substrate	101.4423	101.4423	13.2962	7.6294	1, 38	0.0088[b]
Shell Weight						
Station x substrate	2.3089×10^6	1.1545×10^6	3.2733×10^6	0.3527	2, 29	0.7246
Station	1.1042×10^7	5.5209×10^6	2.4432×10^6	2.2557	2, 34	0.1203
Substrate	6.4466×10^6	6.4466×10^6	2.5247×10^6	2.5534	1, 33	0.1196

(a) Growth = final length-initial length.
(b) Significant.

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Table F.5-18. Continued

	SS	MS	E	F*	d.f.	P(F*>F)
Total Clam Weight						
Station x substrate	3.1259×10^6	1.5629×10^6	1.5410×10^8	0.0101	2, 25	0.9900
Station	1.9669×10^7	9.8345×10^6	1.0748×10^8	0.0915	2, 25	0.9129
Substrate	1.4298×10^7	1.4298×10^7	1.1205×10^8	0.1276	1, 25	0.7239
Tissue Dry Weight						
Station x substrate	9,040.23	4,530.11	$6,7176 \times 10^4$	0.0674	2, 26	0.9350
Station	36,869.99	18,434.99	4.7070×10^4	0.3916	2, 26	0.6799
Substrate	2,688.08	2,688.08	4.9026×10^4	0.0548	1, 26	0.8167
Tissue Wet Weight						
Station x substrate	2.0484×10^5	1.0242×10^5	2.4728×10^5	0.4142	2, 30	0.6646
Station	1.0695×10^6	5.3475×10^5	1.8784×10^5	2.8468	2, 36	0.0712
Substrate	2.9321×10^5	2.9321×10^5	1.9341×10^5	1.5160	1, 35	0.2262
Final Width						
Station x substrate	6.9191	3.4595	9.9723	0.3469	2, 30	0.7097
Station	1.4452	0.7226	7.5361	0.0959	2, 36	0.9088
Substrate	23.6019	23.6019	7.7813	3.0332	1, 35	0.0904

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Table F.5-19. Percent survival of two size classes of *Rangia cuneata* studied at two stations in the vicinity of C.P. Crane power plant, 29 October-8 April 1981 (from Ref. 5)

	Size Class	
	1	2
Station 3	50%	75%
Station 12	0	5%

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Table F.5-20. Analysis of covariance testing differences in weight/length relationships between stations, assuming unequal slopes for the linear model, C.P. Crane power plant, January-November 1980 (from Ref. 5)

	SS	d.f.	F*	P(F*>F)
Clams <5 mm long				
Station	1.7956	6	12.97	0.0001
Log_{10} length	169.0278	1	7,326.10	0.0001
Station x length interaction	0.9111	6	6.58	0.0001
Clams >5 mm long				
Stations	2.9048	6	48.93	0.0001
Log_{10} length	0.6836	1	62.11	0.0001
Station x length interaction	5.5603	6	84.20	0.0001

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Table F.5-21. Prediction of least squares mean weight (log_{10} transformed) of *Rangia cuneata* at each station for overall average log_{10} length of clams collected by size group, with comparisons of the predictions between selected stations, linear model with unequal slopes assumed, C.P. Crane power plant, January-November 1980 (from Ref. 5)

Station	LS Mean[a] Log_{10} Weight	Station Comparisons	DLS Mean[b]	P(T*>T)	
Clams <5 mm long					
2	0.1204	- 2/12	0.0541	0.0001	*(c)
3	0.1306	2/3	0.0102	0.4860	
4	0.1709	- 2/4	0.0505	0.0002	*
7	-0.0155	- 12/3	-0.0439	0.0051	*
10	0.1042	12/4	-0.0036	0.8040	
12	0.1745	3/4	0.0403	0.0248	
Clams >5 mm long					
2	0.9737				
3	1.1991	2/12	-0.0545	0.0001	*
4	1.2471	2/3	0.2254	0.0001	*
7	0.9469	2/4	0.2734	0.0001	*
10	1.0234	12/3	-0.2799	0.0001	*
12	0.9192	3/4	0.0480	0.1520	

(a) Predicted at $\bar{X}_{log10}$ length for all stations.
(b) Difference in predicted least squares mean weight.
(c) Significant at $\alpha = 0.01$.

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Table F.5-22. Estimate of the station-effects term (a_i) of the linear model relating $\log_{10}$ weight to $\log_{10}$ length of Rangia cuneata for clams < 5 mm and > 5 mm long, unequal slopes assumes, C.P. Crane power plant, January-November 1980 (from Ref. 5)

Station	Term	Estimate	
		Clams<5 mm	Clams >5 mm
2	α_1	-0.0442	-0.0585
3	α_2	0.0330	-0.3148
4	α_3	0.0729	-0.2503
7	α_4	-0.1232	0.3857
10	α_5	-0.0136	0.1079
11	α_6	-0.0003	-0.2554
12	α_7	0.0753	0.3854

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Table F.5-23. Calculation of instantaneous growth rate (G) for size classes of *Rangia cuneata* <30 mm long at C.P. Crane power plant, January-November 1980 (from Ref. 5)

L (mm)	W (mg)[a]	Age[b] (days)	Δt (days)	G[c] ($days^{-1}$)
0.5	0.00077	2.53		
			12.68	0.423566
3	0.16558	15.21		
			15.21	0.136518
6	1.32067	30.42		
			15.21	0.079858
9	4.44942	45.63		
			15.21	0.056672
12	10.53559	60.84		
			15.21	0.043936
15	20.55348	76.05		
			15.21	0.035909
18	35.48829	91.26		
			15.21	0.030360
21	56.31636	106.47		
			15.21	0.026299
24	84.01530	121.68		
			15.21	0.023198
27	119.56215	136.89		
			15.21	0.020751
30	163.93337	152.10		

(a) Calculated from weight/length equation.
(b) Determined from growth rate.
(c) Instantaneous growth.

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Table F.5-24. Results of two in situ predation experiments conducted for *Rangia cuneata* at stations in the vicinity of C.P. Crane power plant, 11 June–1 July and 24 July–15 August 1980 (from Ref. 5)

		Experiment 1			Experiment 2			
		% Retrieval		% Survival	% Retrieval		% Survival	Mean No. Unmarked
Station	Cage[a]	Range	Mean	From Predation	Range	Mean	From Predation	Clams Per Tray
3	C	5-40	20.8		4.4-17.4	10.9		15.0
	N	0-10	2.5	12.0	NA[d]	0	0	2.5
4	C	30-90	57.9[b]		26.1-30.4	28.3		45.0
	N	10-35	18.8	32.5	NA	0	0	0
12	C	0-75	46.3[c]		73.9-78.3	76.1		797.5
	N	10-50	27.5	59.4	NA	33.3	43.8	401.0

(a) C = caged.
N = no cage.
(b) Includes two trays with crabs, no live clams found.
(c) Includes four trays with crabs, no live clams found.
(d) NA = range of percents not applicable.

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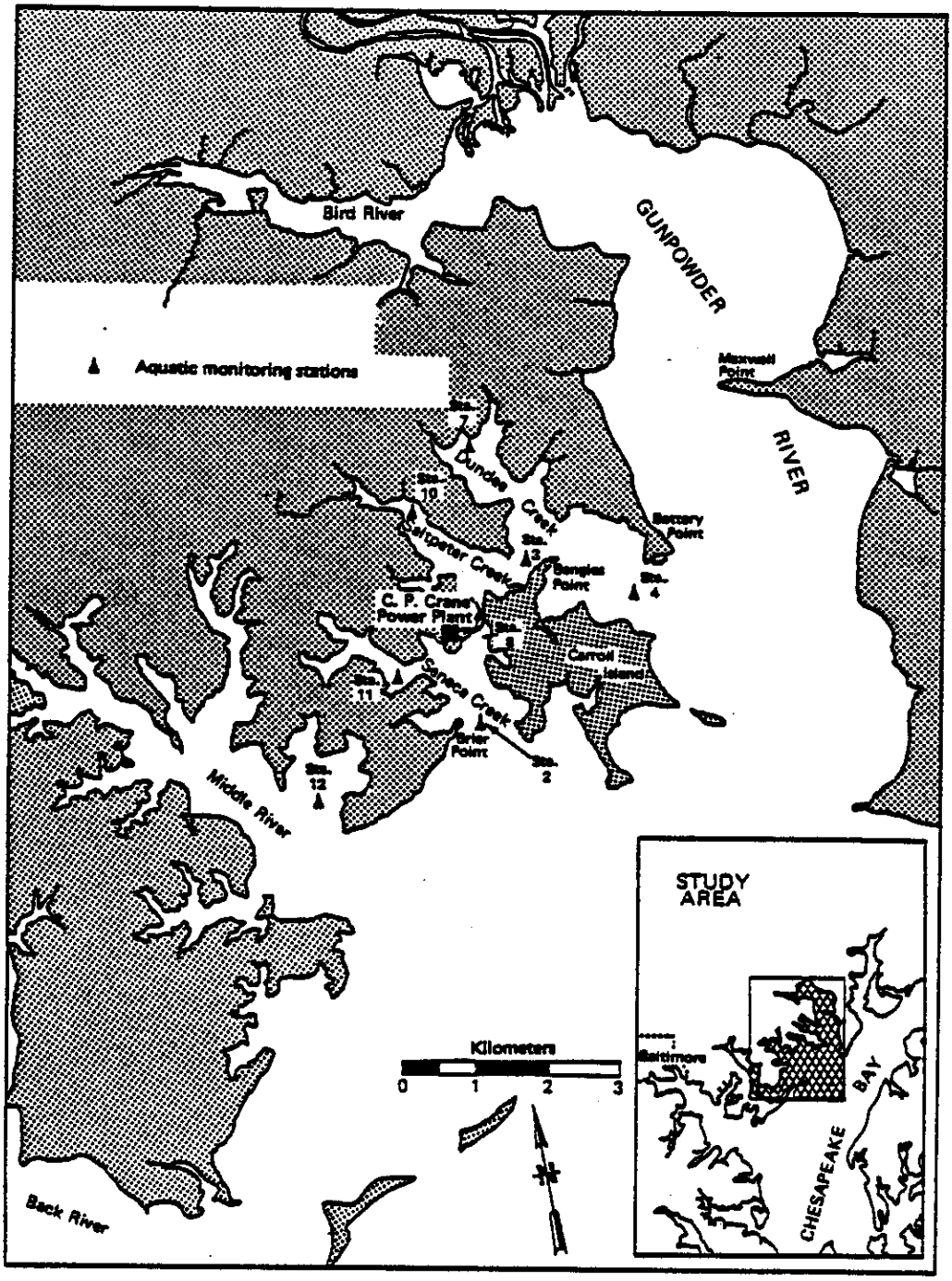

Figure F.5-1. 1980 sampling stations for Rangia cuneata near the C.P. Crane power plant (from Ref. 5)

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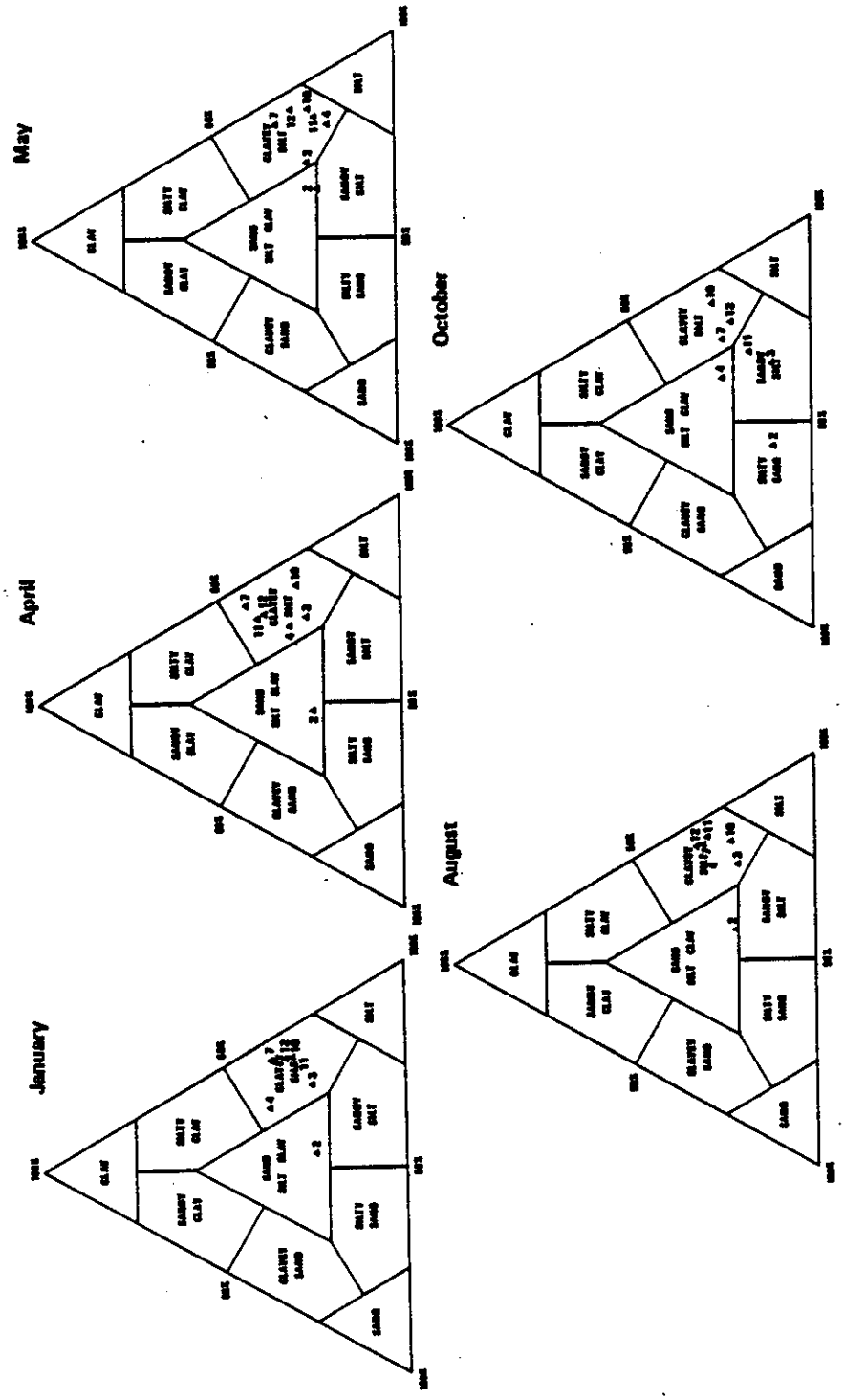

Figure F.5-2. Seasonal substrate characterization of benthic stations located near the C.P. Crane power plant, 1980 (from Ref. 5)

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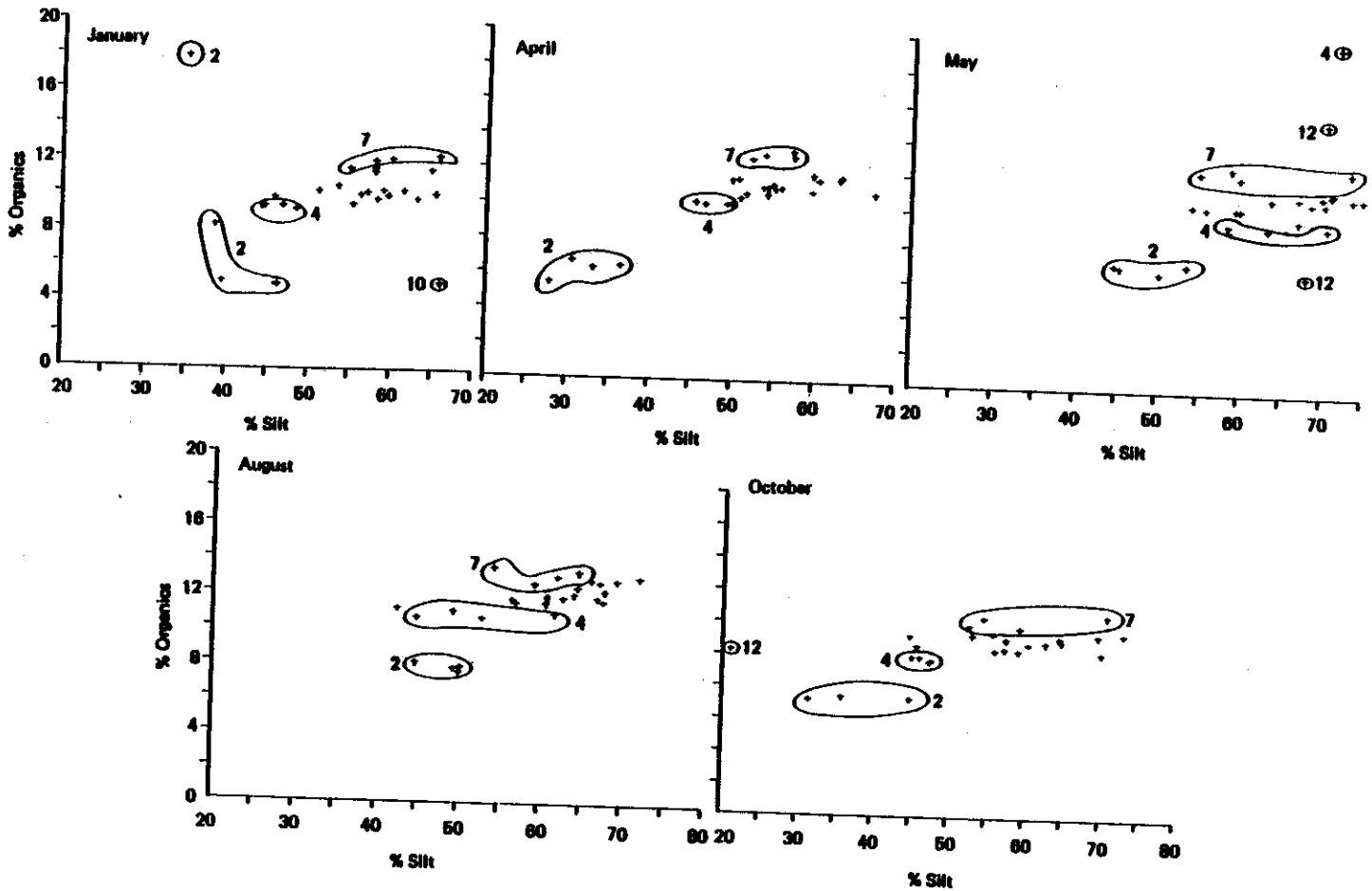

Figure F.5-3. Bivariate scatter plots of percentages of organics and silt in the sediment at benthic locations near the C.P. Crane power plant, January-October 1980 (from Ref. 5)

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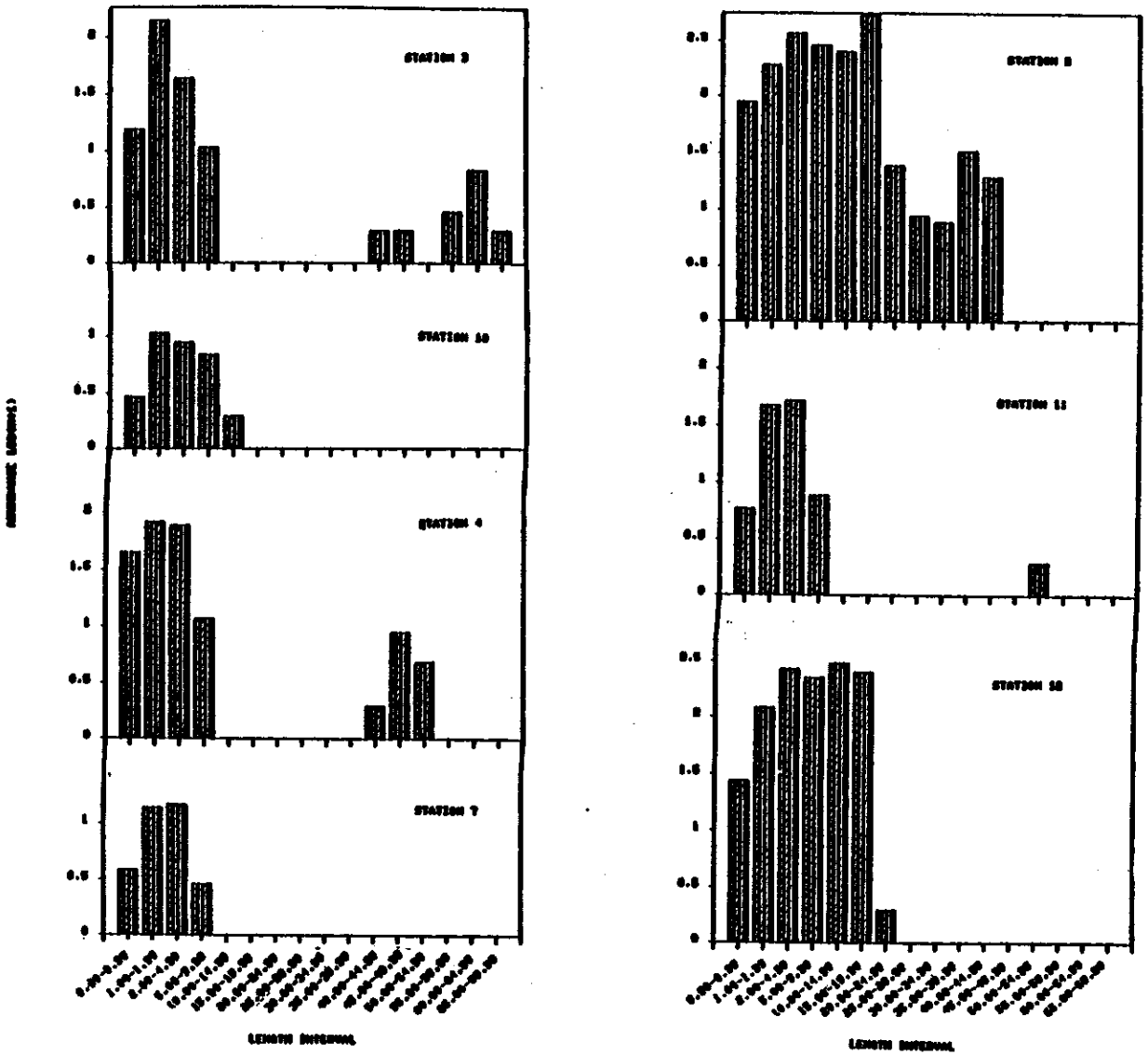

Figure F.5-4. Length (mm) frequency of Rangia cuneata, log (N + 1) of abundance (no./m^2) averaged over dates by station in the vicinity of the C.P. Crane power plant, January-December 1980 (from Ref. 5)

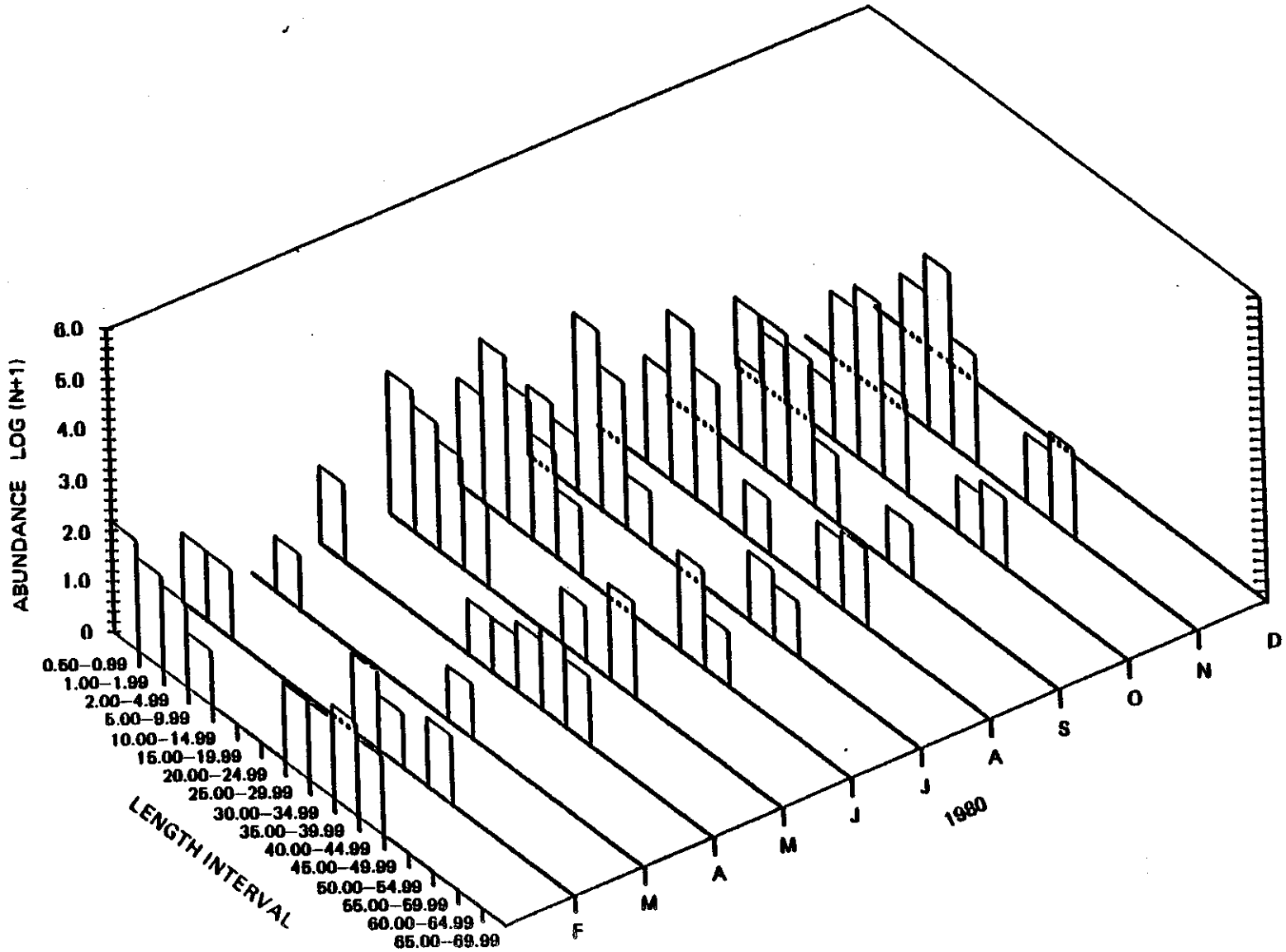

Figure F.5-5. Log (N + 1) abundance (no./m^2) of Rangia cuneata by length interval (mm) at Station 2 in the vicinity of the C.P. Crane power plant, January-November 1980 (from Ref. 5)

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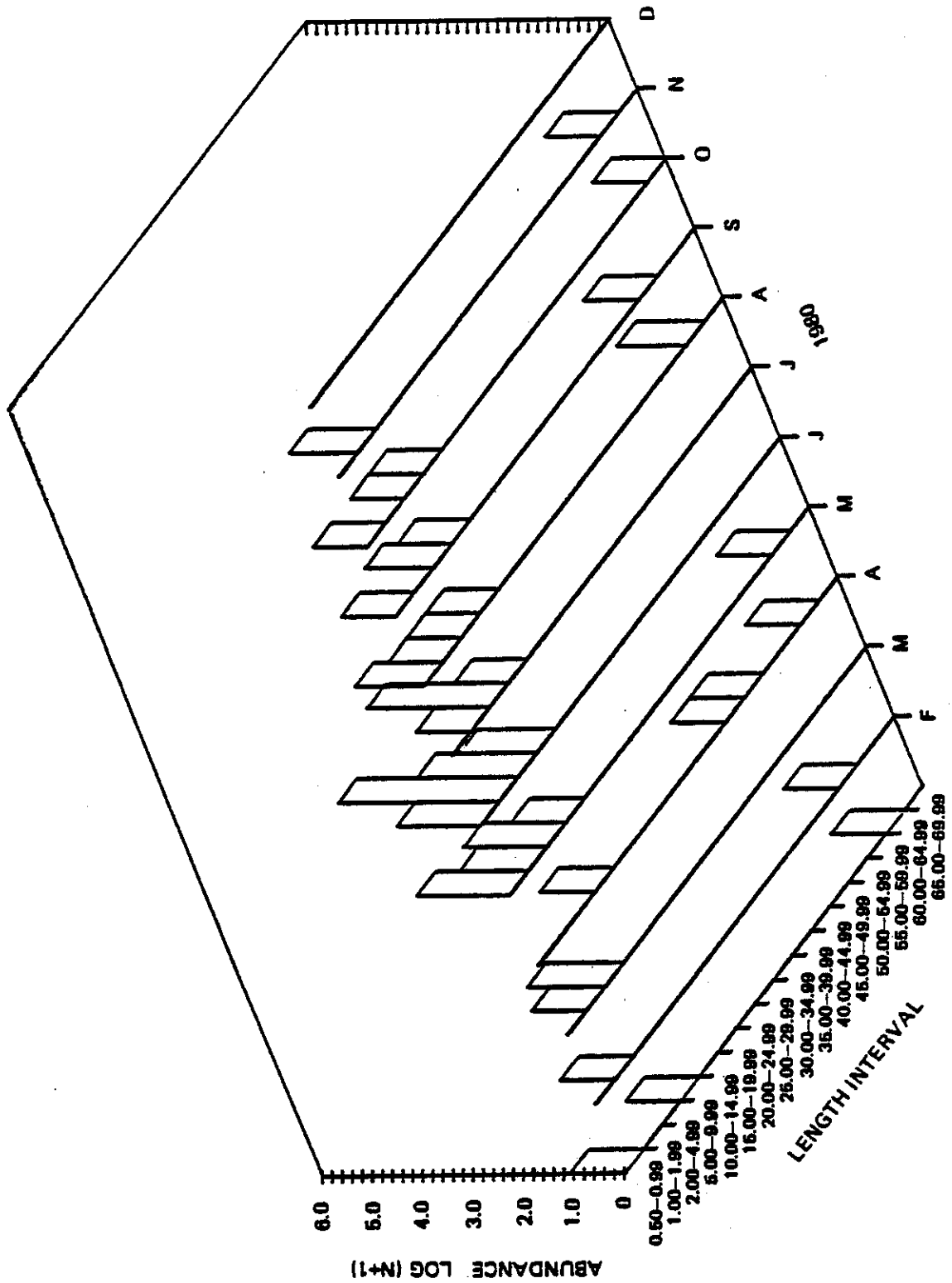

Figure F.5-6. Log (N + 1) of abundance (no./m^2) of Rangia cuneata by length interval (mm) at Station 3 in the vicinity of the C.P. Crane power plant, January-November 1980 (from Ref. 5)

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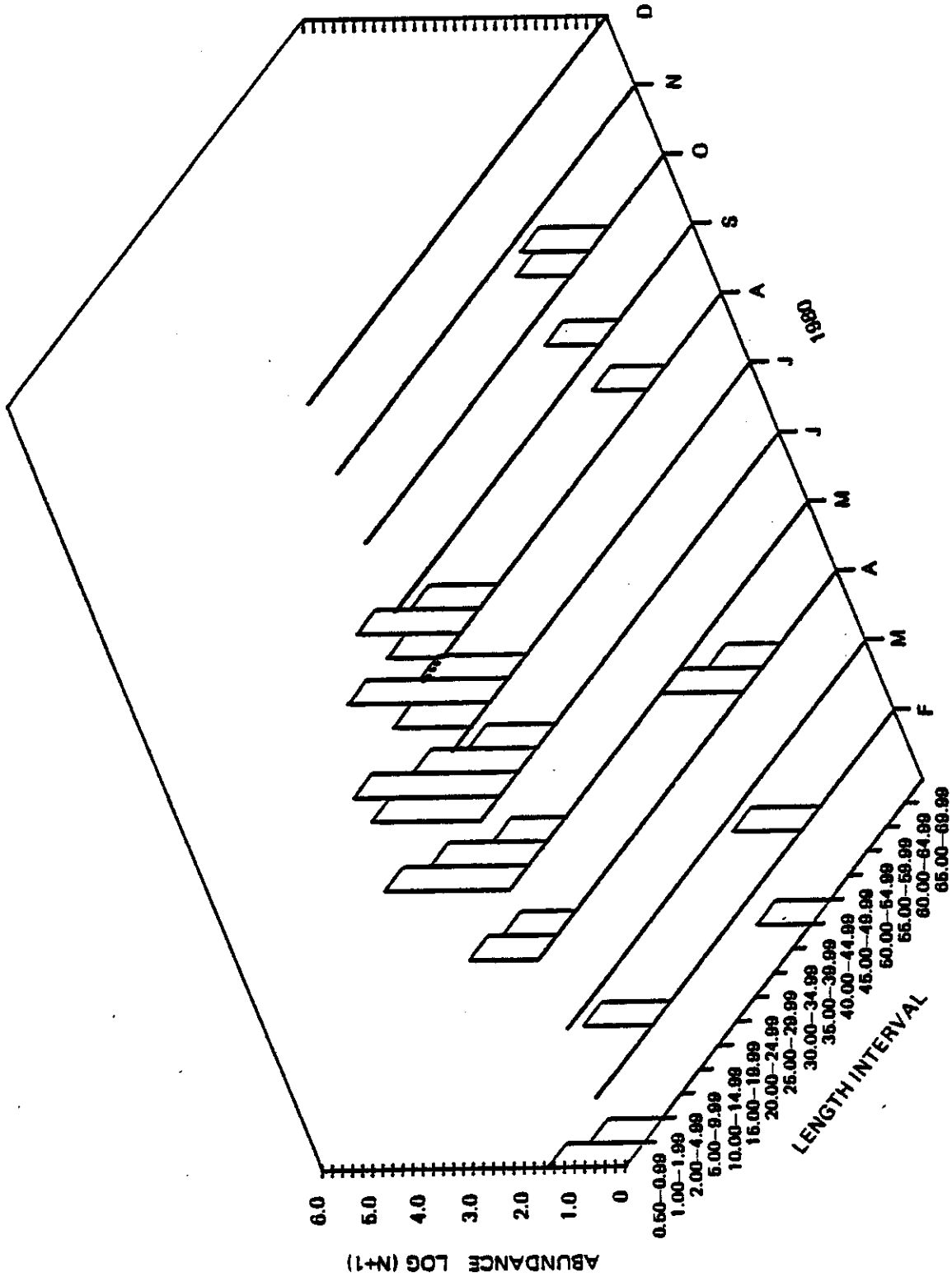

Figure F.5-7. Log (N + 1) of abundance (no./m^2) of Rangia cuneata by length interval (mm) at Station 4 in the vicinity of the C.P. Crane power plant, January-November 1980 (from Ref. 5)

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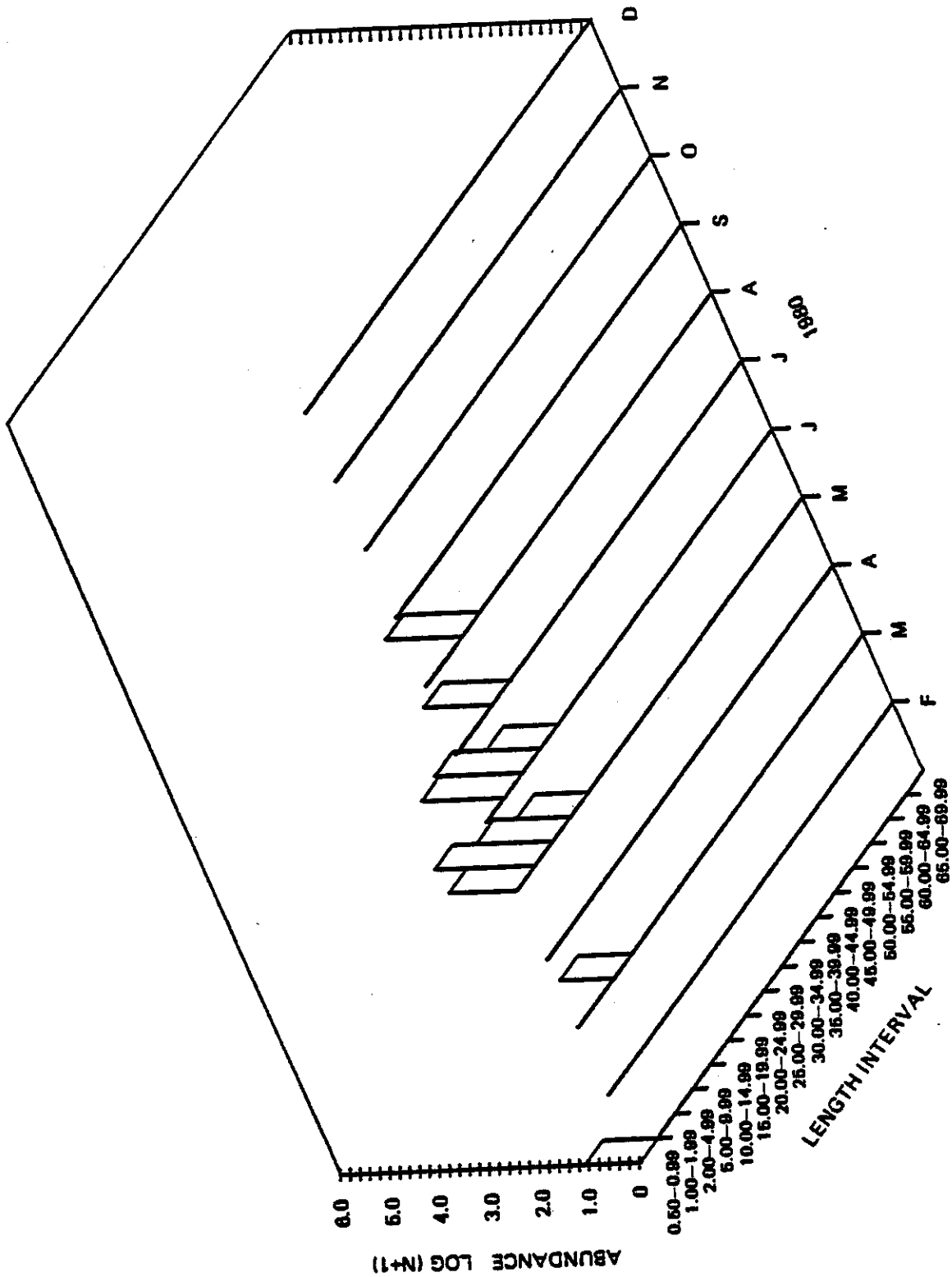

Figure F.5-8. Log (N + 1) of abundance (no./m^2) of Rangia cuneata by length interval (mm) at Station 7 in the vicinity of the C.P. Crane power plant, January-November 1980 (from Ref. 5)

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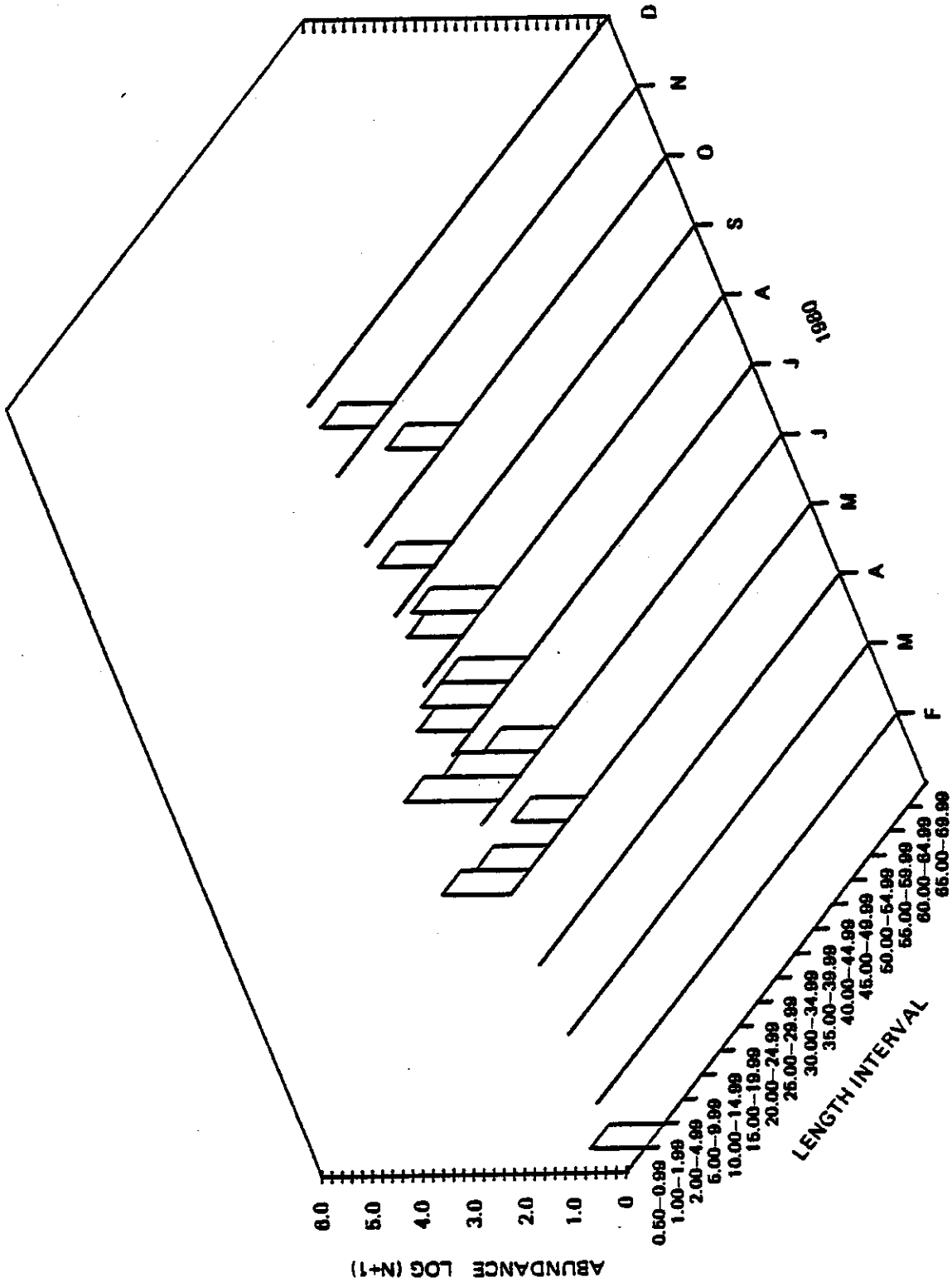

Figure F.5-9. Log (N + 1) of abundance (no./m^2) of Rangia cuneata by length interval (mm) at Station 10 in the vicinity of the C.P. Crane power plant, January-November 1980 (from Ref. 5)

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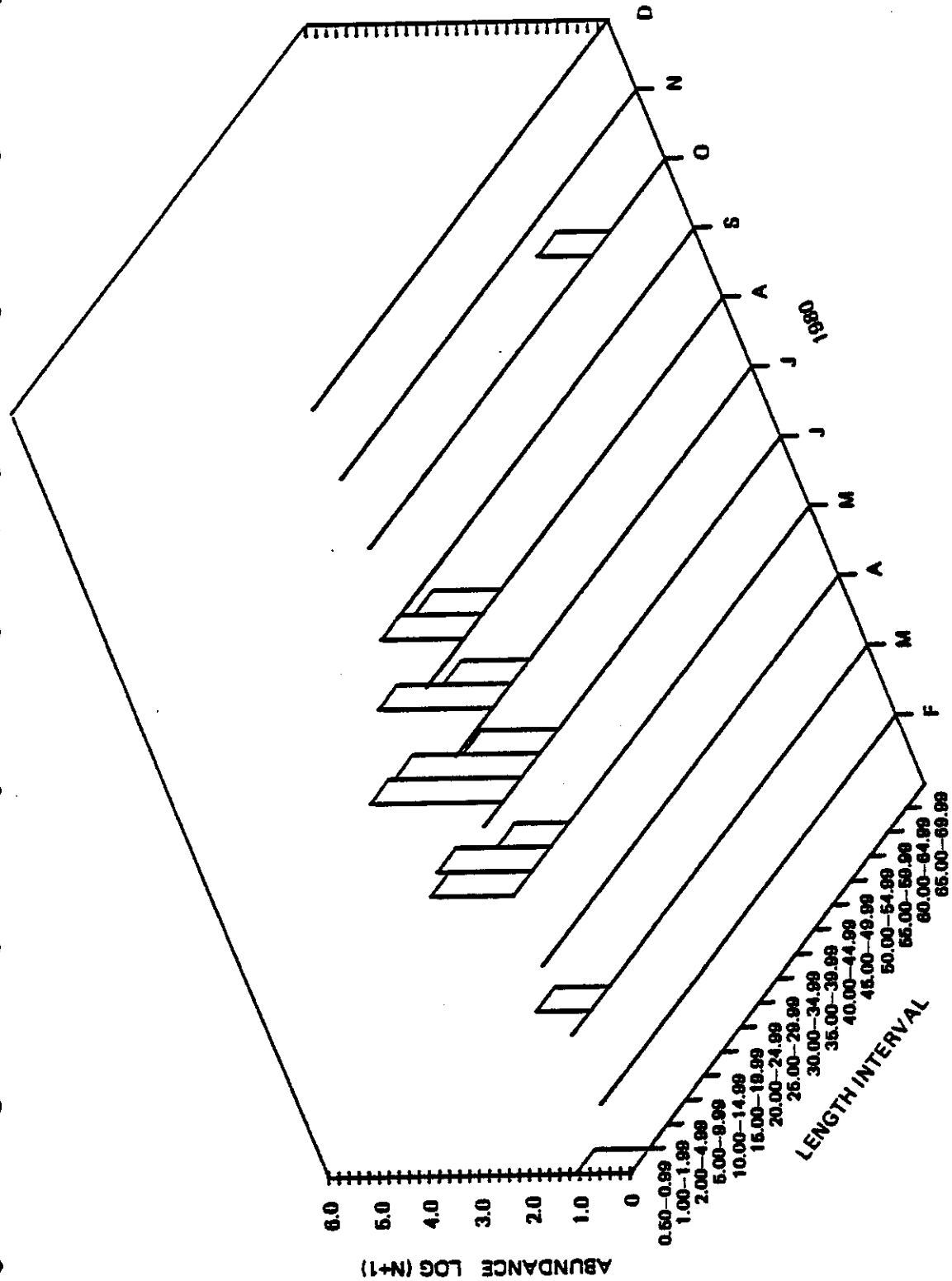

Figure F.5-10. Log (N + 1) of abundance (no./m^2) of *Rangia cuneata* by length interval (mm) at Station 11 in the vicinity of the C.P. Crane power plant, January-November 1980 (from Ref. 5)

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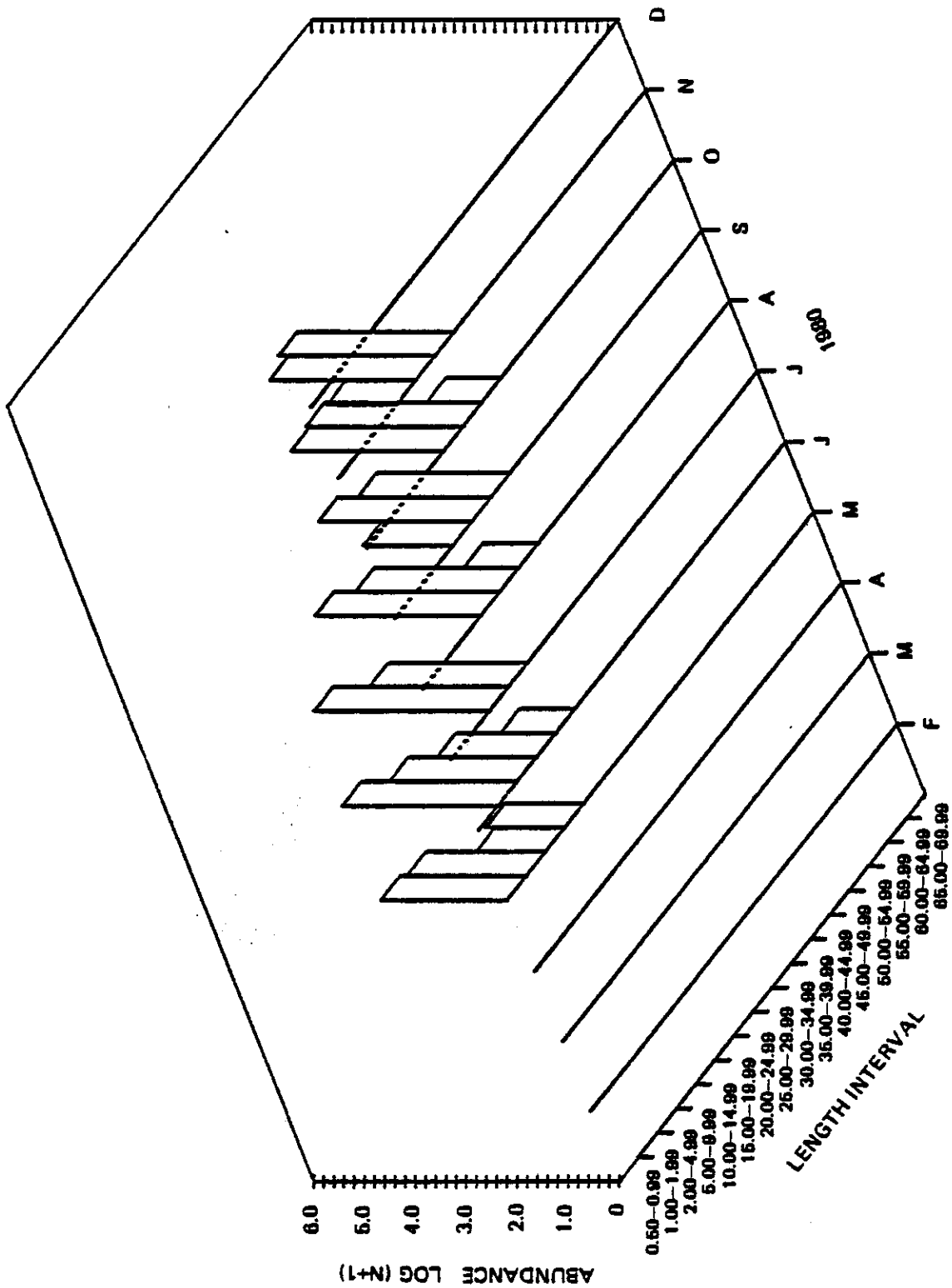

Figure F.5-11. Log (N + 1) of abundance (no./m^2) of Rangia cuneata by length interval (mm) at Station 12 in the vicinity of the C.P. Crane power plant, January-November 1980 (from Ref. 5)

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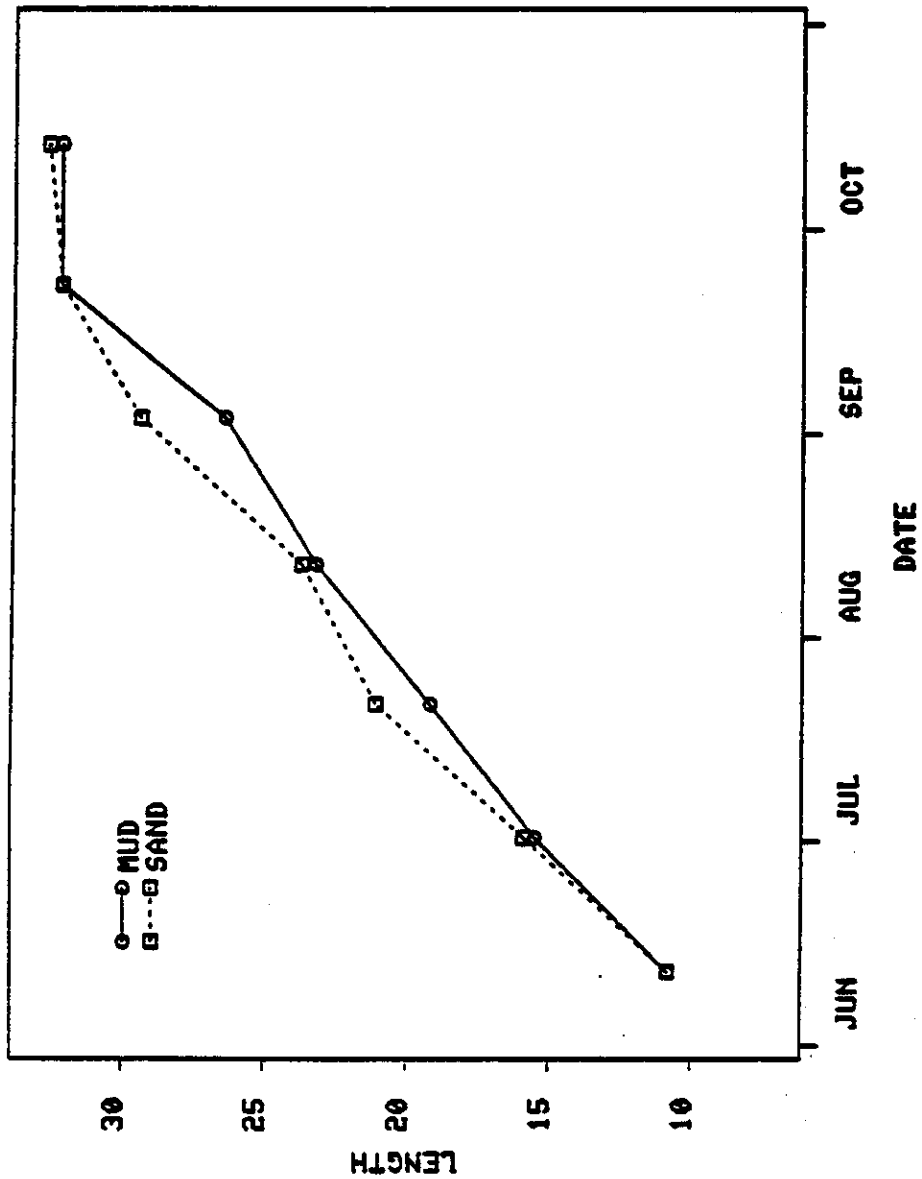

Figure F.5-12. Mean length (mm) of Rangia cuneata from two substrate types, averaged over stations in the vicinity of the C.P. Crane power plant, 11 June-13 October 1980 (from Ref. 5)

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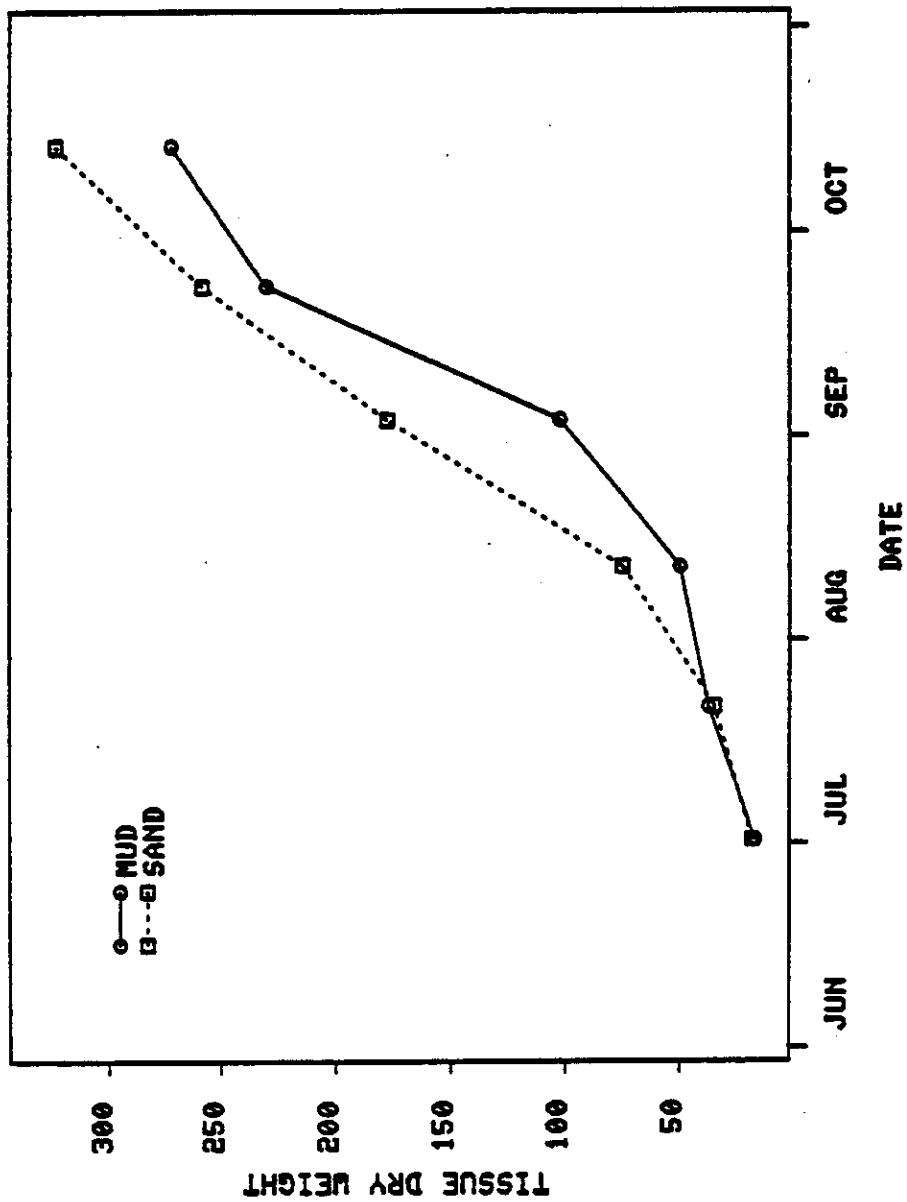

Figure F.5-13. Mean tissue dry weight (mg) of Rangia cuneata from two substrate types, averaged over stations in the vicinity of the C.P. Crane power plant, 11 June-13 October 1980 (from Ref. 5)

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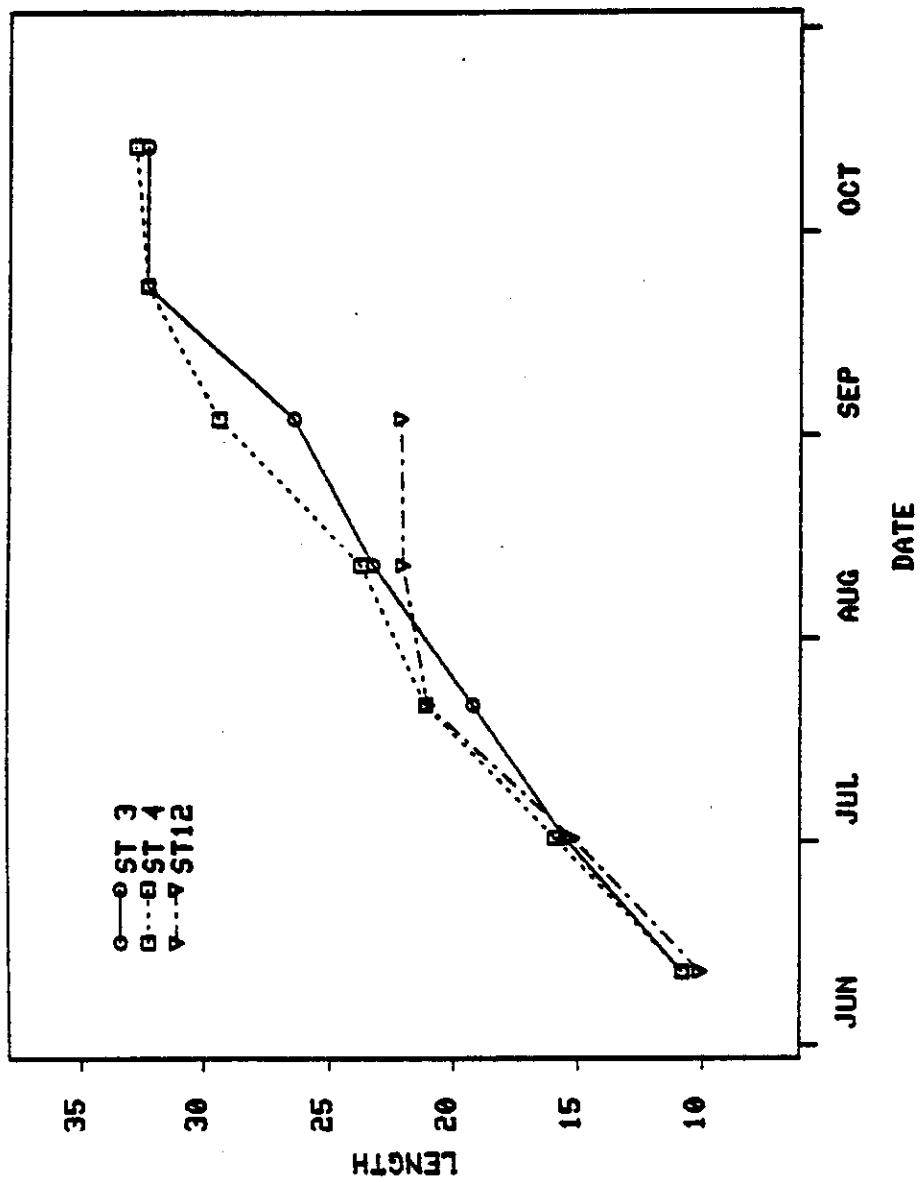

Figure F.5-14. Mean length (mm) of Rangia cuneata grown in mud substrate at three stations in the vicinity of the C.P. Crane power plant, 11 June-13 October 1980 (from Ref. 5)

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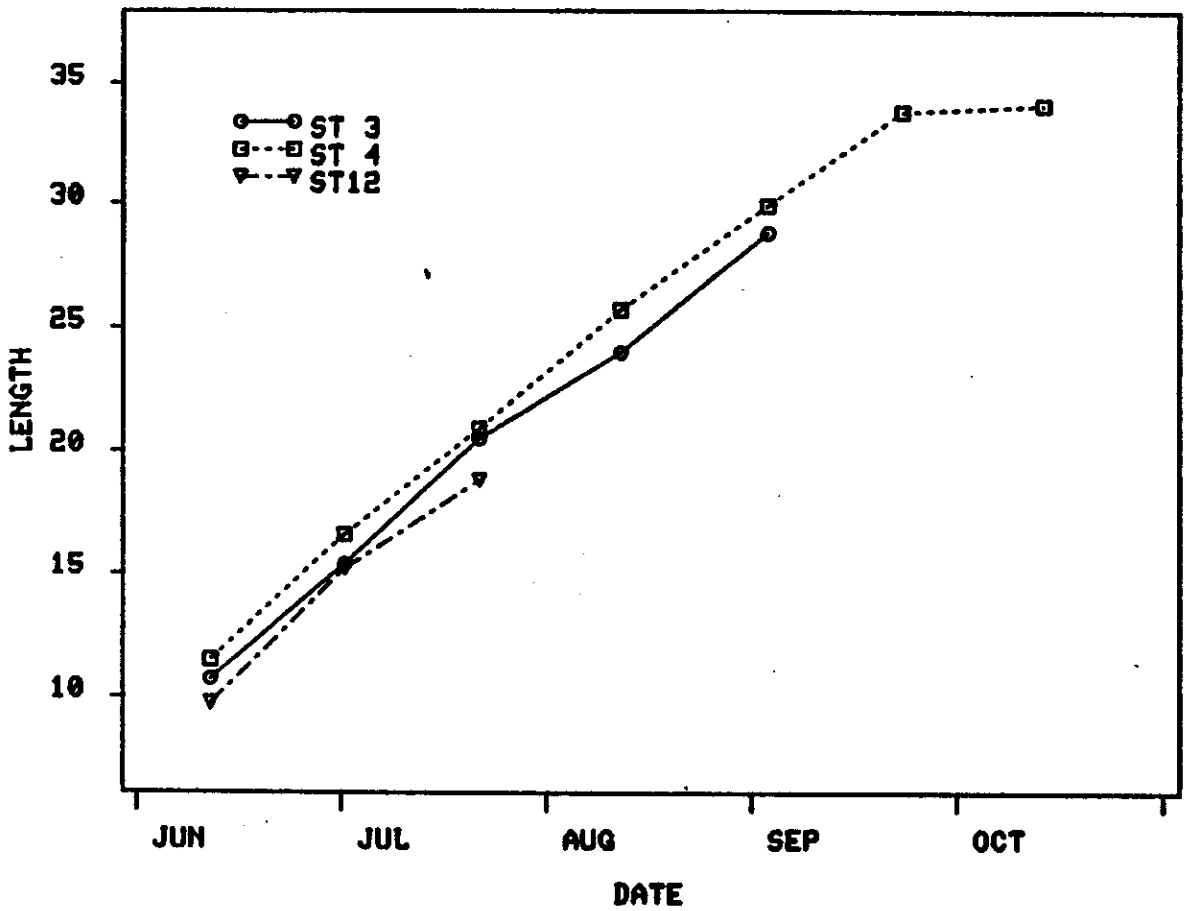

Figure F.5-15. Mean length (mm) of Rangia cuneata grown in sand substrate at three stations in the vicinity of the C.P. Crane power plant 11 June-13 October 1980 (from Ref. 5)

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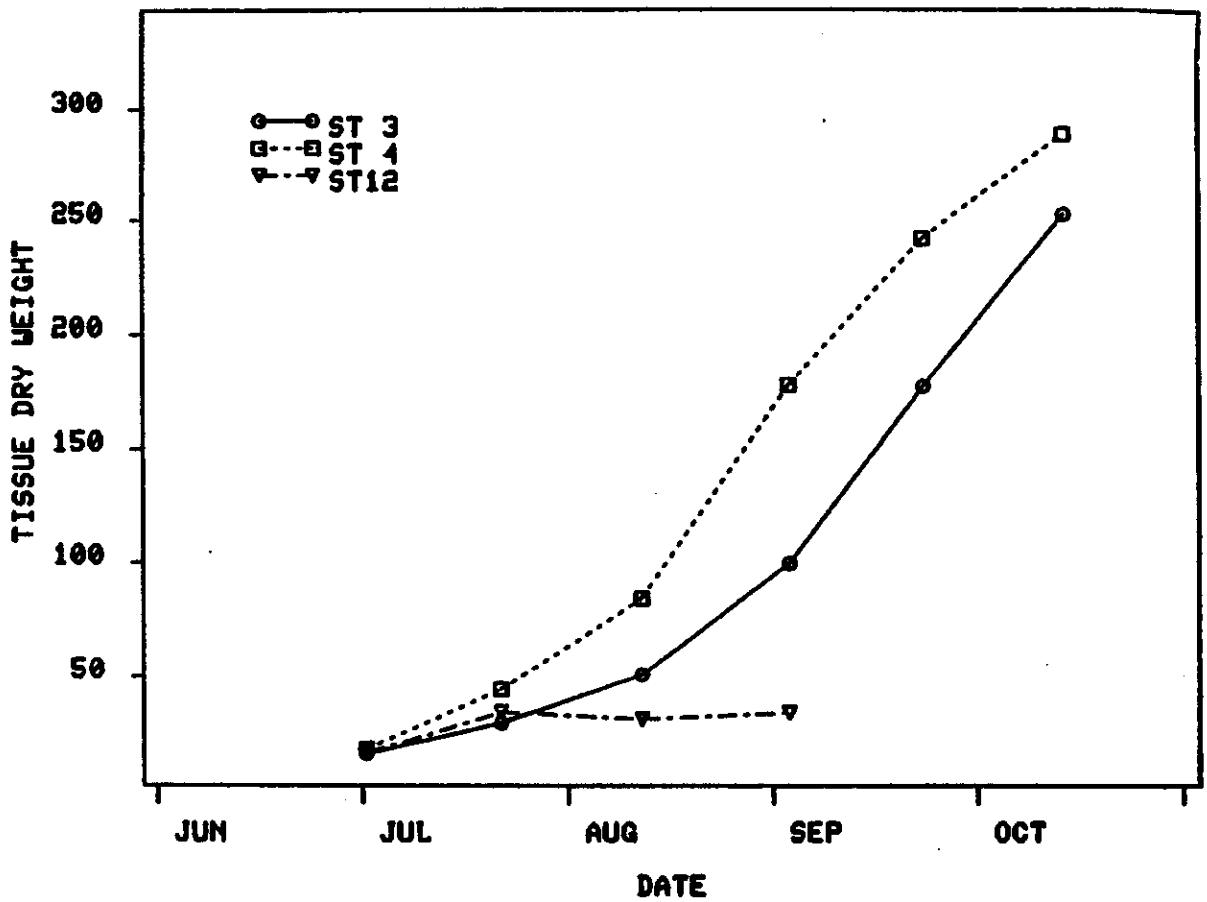

Figure F.5-16. Mean tissue dry weight (mg) of Rangia cuneata grown in mud substrate at three stations in the vicinity of the C.P. Crane power plant, 11 June-13 October 1980 (from Ref. 5)

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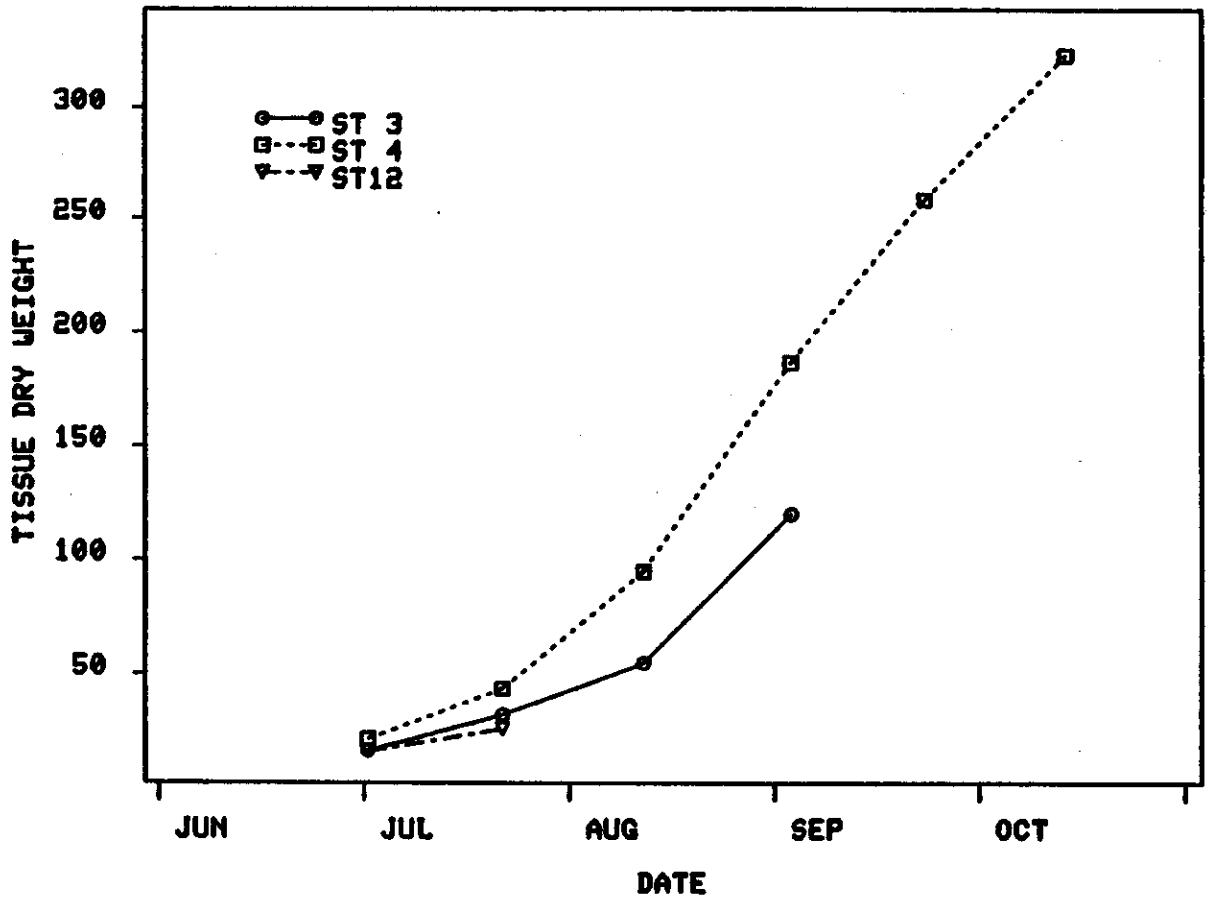

Figure F.5-17. Mean tissue dry weight (mg) of Rangia cuneata grown in sand substrate at three stations in the vicinity of the C.P.Crane power plant, 11 June-13 October 1980 (from Ref. 5)

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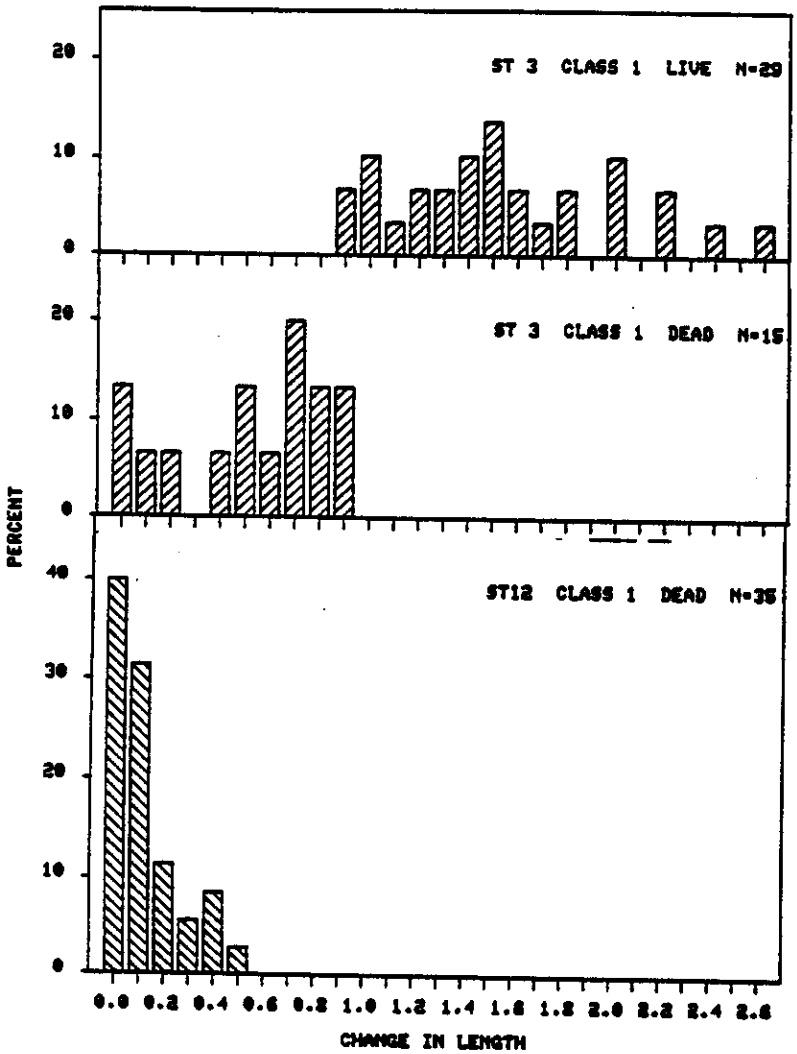

Figure F.5-18. Size class (initially < 20 mm long) frequency distribution of live and dead marked Rangia cuneata, winter growth study at two stations in the vicinity of the C.P. Crane power plant, 29 October 1980-8 April 1980 (from Ref. 5)

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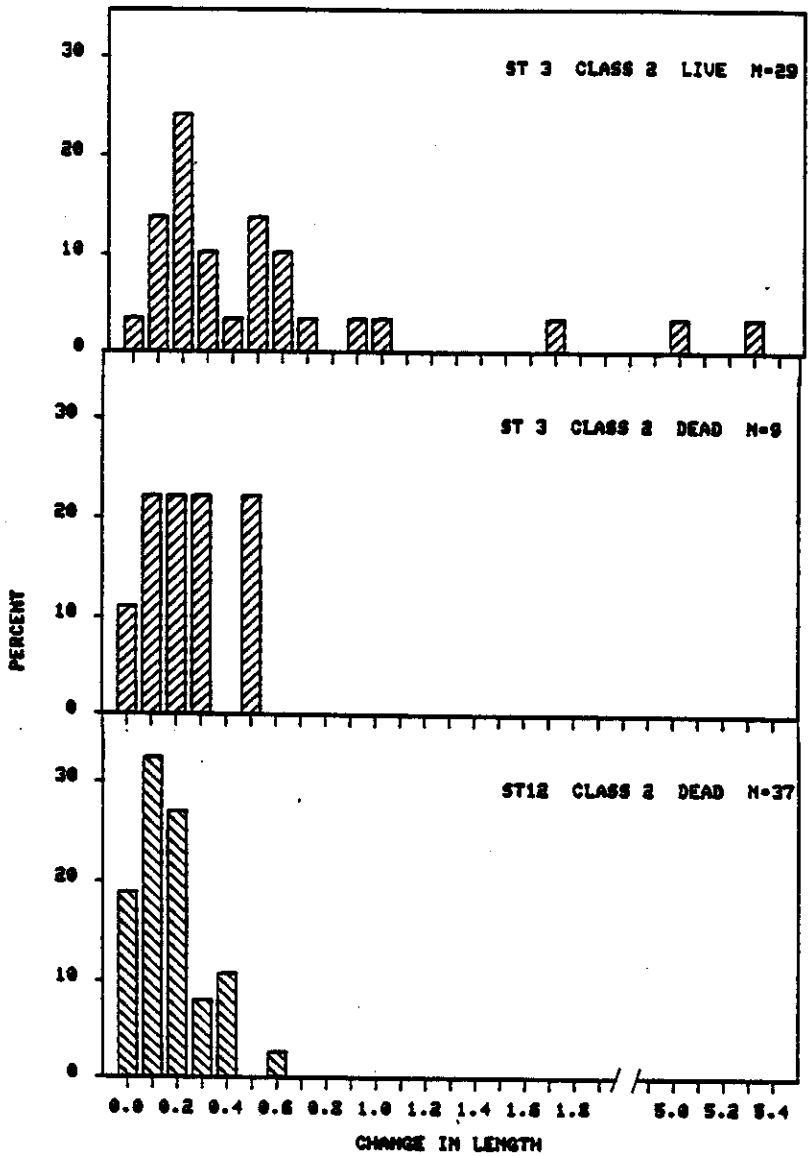

Figure F.5-19. Size class (initially < 25 mm long) frequency distribution of live and dead marked Rangia cuneata, winter growth study at two stations in the vicinity of the C.P. Crane power plant, 29 October 1980-8 April 1981 (from Ref. 5)

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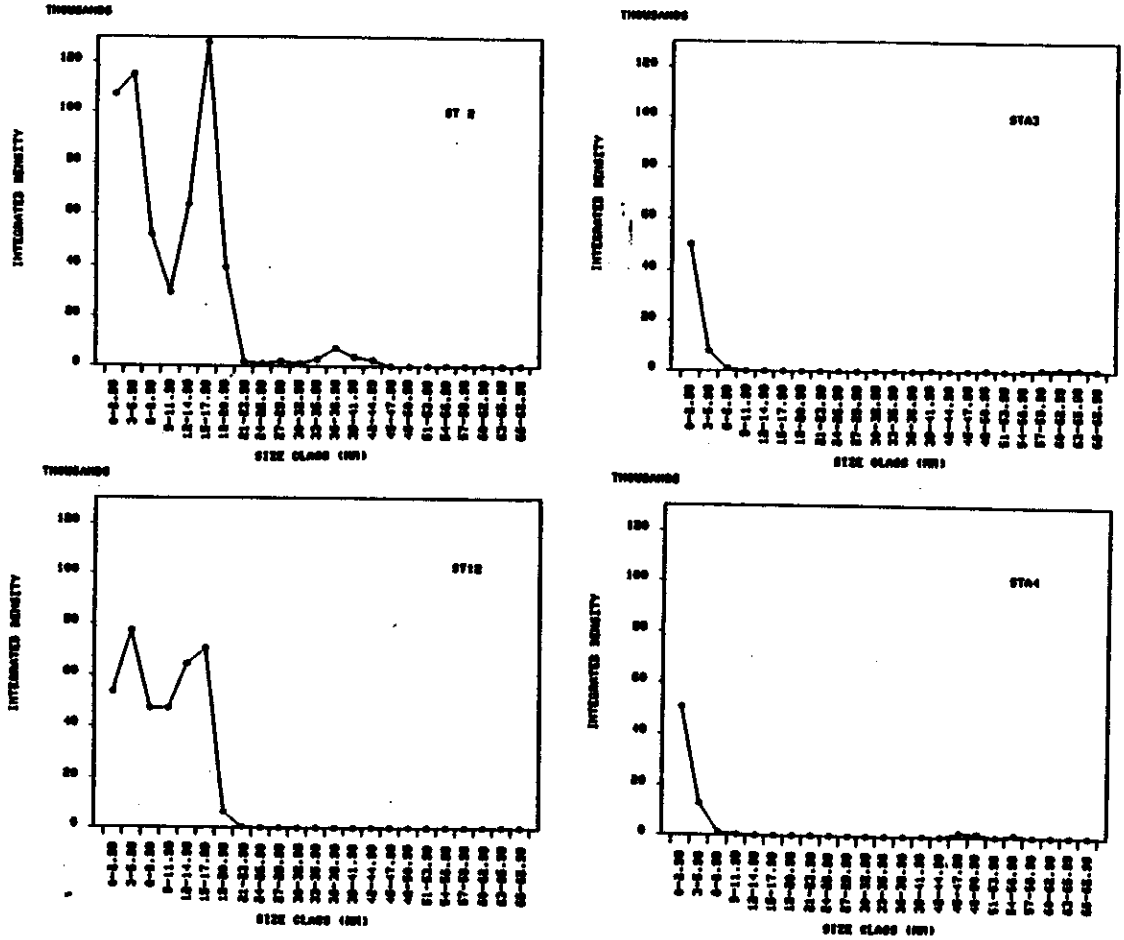

Figure F.5-20. Integrated density (no./m^2 x 10^3) of Rangia cuneata in each length class, plotted by length class for selected stations in the vicinity of the C.P. Crane power plant, January-November 1980 (from Ref. 5)

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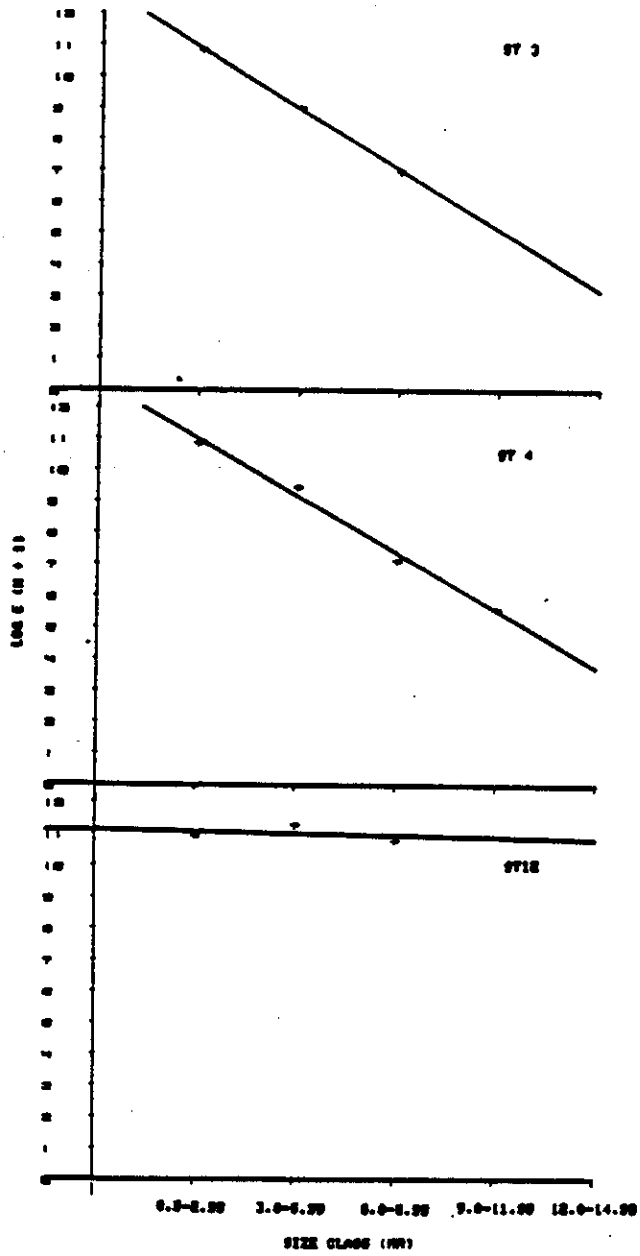

Figure F.5-21. Natural logarithm of the integrated density (no./m^2) for each size class, plotted by size class for selected stations in the vicinity of the C.P. Crane power plant, January-November 1980 (from Ref. 5)

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APPENDIX G

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APPENDIX G.1. WATERFOWL SURVEY

(Ecological Analysts, Inc.)

G.1.1 Objectives

- To determine to what extent the nearfield region of the C.P. Crane power plant is used as a brooding and foraging area for waterfowl, especially American black ducks.
- To determine whether plant operations affect American black duck abundance and distribution.

G.1.2 Data Source

Ref. 25.

G.1.3 Study History

Field census began in the winter 1978-1979 (11-19 December 1978, 4 January 1979, and 11-17 January 1979) and continued into the spring nesting (2nd and 3rd weeks in April and May 1979) and summer nurturing seasons (2nd and 4th weeks in June and July 1979).

G.1.4 Study Methods

- Data from past censuses were reviewed to establish historical distributional and abundance trends for waterfowl in the Atlantic flyway as well as in the State of Maryland.
- The winter field census was carried out every other day from 11-19 December 1978 and from 11-17 January 1979. A one-day census was done on 4 January to coincide with an aerial survey by the Patuxent Wildlife Center. Pairing and nesting of the American black ducks was censused during the second and third weeks in April. Hatching success was censused during the second and third weeks in May. Brood success was determined in the second and fourth weeks of June and July 1979.
- The nearfield area around the plant was partitioned into 3 study areas (Dundee Creek, Upper Saltpeter Creek, and Carroll Island) which were further divided into three observation or census sites (Fig. G.1-1). Counts were conducted at

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each site for 30 minutes in the winter and for 15 minutes in the spring and summer. Area and station order were randomly chosen during the census. One observer did the winter census. Two observers independently censused the three study areas in the spring and summer.

- High-altitude infrared pictures taken in April 1977 by the Maryland State Planning Department were used to determine the amount of brood cover in each of the three census areas.

G.1.5 Analysis

- Census data were grouped by subfamily and a two-way Friedman's test was used to determine if significant ($\alpha \leq 0.05$) differences in waterfowl abundance existed among the three study areas. When significant differences were indicated, a Friedman's distribution-free multiple comparison test was used to distinguish differences among stations.

G.1.6 Results

- Historical winter waterfowl population estimates for the Atlantic flyway and Maryland are shown in Table G.1-1. The abundance of mallards and American black ducks appears to be increasing in the Aberdeen-Patapsco River near the plant and along the upper western shore although it is declining statewide. Diving ducks are also believed to be increasing in the Aberdeen-Patapsco River, while declining in the upper western shore and state-wide.

- Results of the 1978-1979 aerial winter waterfowl census of the U.S. Fish and Wildlife Service for the upper western shore of the Chesapeake Bay are summarized in Table G.1-2. The survey showed that 8.4% of the American black ducks, 7.2% of the mallards, 1.0% of the swans, and all of the common pintail (two birds) found on the western shore were present in the study area.

- Past studies suggest that distribution, population size, and feeding habits of some waterfowl species in the upper Chesapeake Bay are related to the availability of traditional food sources, especially submerged aquatic vegetation. Surveys of submerged aquatic vegetation indicate that the C.P. Crane study area may be one of the better feeding places for wintering waterfowl (Refs. 67 and 68).

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- A total of 4,327 waterfowl of approximately 18 species were seen in 46.5 hours of observation on ten mornings from 11 December 1978 through 17 January 1979 (Table G.1-3). Seven species made up 95% of the total count: geese (42.8%); whistling swan (20.4%); gadwell (11.4%); American widgeon (5.9%); mallard (5.8%); American black duck (5.2%); and canvasback (3.9%).

- Friedman's test indicated that swans were observed in significantly lower ($\alpha \leq 0.05$) numbers in Saltpeter Creek than in the other two study areas. No significant differences among study areas were detected in the number of geese, dabble ducks, bay ducks, and mergansers. However, a review of the census data (Table G.1-3) suggests that differences in waterfowl distribution between areas does exist, but this nonparametric statistical test may not have been sensitive enough to detect them.

- Ninety-two percent of the mergansers were observed either near the plant in Area 3 of Saltpeter Creek or just downstream of the plant in Area 1 (Bengies Cove) of Carroll Island. Distribution data strongly suggest that mergansers are attracted to the plant's thermal discharge.

- The majority of overwintering waterfowl in the plant region were observed feeding during the early morning census (Table G.1-4).

- The majority (80%) of the American black ducks seen in the winter census were observed around Carroll Island and for the most part were actively feeding. Thirteen percent of them were feeding in Dundee Creek, whereas 6% were resting in Upper Saltpeter Creek (Table G.1-5). According to spring brooding and summer rearing surveys, there was very little American black duck activity in the area, e.g., only two probable nest sites were found on Carroll Island in April and one adult hen with a brood of two ducklings were seen in June and July.

  In contrast to the limited American black duck nesting activity in the survey area, 24 mallard pairs and 2 wood-duck pairs exhibited nesting behavior. Since American black duck and mallards have similar nesting requirements, an insufficient amount of suitable nesting areas is not believed to be responsible for low spring and summer black duck abundance in the study area.

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- The extent of brood cover was calculated to be 111.1 hectares in Dundee Creek, 80.3 hectares in Saltpeter Creek, and 176.7 hectares at Carroll Island.

G.1.7 Significance and Critique of Findings

- Swans were found in lower numbers in Upper Saltpeter Creek than in the other two study areas. However, they were very abundant at a partially plume-affected area on Carroll Island (Area 1), indicating that avoidance, if it occurs, is limited to Upper Saltpeter Creek.

- The merganser was the only waterfowl attracted to the plant's discharge area during the winter. Since mergansers feed mainly on fish, their presence in the plume area may be related to fish which are known to be attracted to the thermal discharges during the winter.

- Habitat and nesting surveys do indicate that the nearfield region around the Crane power plant is suitable for waterfowl nesting. Several species were observed nesting in the region, including great blue herons, green heron, bittern, plovers, marsh wrens, wood duck, and mallard. However, American black duck tend to underutilize the area even though apparently suitable nesting areas are available.

- Since several factors which are known to strongly influence waterfowl presence in an area (i.e., amount of ice cover and extent of beds of submerged aquatic vegetation) were not considered in the analysis, the information presented in this study only suggests effects, rather than making definitive statements about the impact of plant operations on American black duck or on other waterfowl.

- Failure of the Friedman's test to find significant statistical differences among the three areas may be due to the infrequent occurrence of waterfowl in the study areas, the limited sensitivity of this analysis to distinguish area differences, and/or the poor applicability of this analysis to the sampling design.

- Fishermen, boaters, and poachers frequently use the region around the plant, thereby affecting waterfowl distribution and behavioral patterns in the region. Human recreational activity in the area probably obscures any observable plant impact on waterfowl populations.

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Table G.1-1. Summary of waterfowl population estimates derived from mid-winter inventories in the Atlantic flyway and Maryland [a] (from Ref. 25)

Species	Atlantic Flyway		Maryland		Upper Western Shore		Aberdeen-Patapsco River	
	1974-78	1968-77	1974-78	1968-77	1974-78	1969-73	1974-78	1969-73
Mallard	212,699	199,747	26,460	30,330	7,420	5,620	2,140	660
Black duck	258,758	277,956	25,760	41,230	4,940	3,280	1,320	200
Gadwall	24,038	21,084	260	230				
Widgeon	77,375	76,704	980	2,700				
Blue-winged teal	12,976	9,679	trace					
Green-winged teal	48,851	63,561	680	390				
Shoveler	9,868	14,446	100	50				
Common pintail	86,308	106,989	560	2,230				
Total dabble ducks	730,491	770,804	54,800	77,140	12,380	5,920	4,160	420
Redhead	130,282	116,939	4,700	10,930				
Canvasback	127,684	113,022	51,860	50,650	26,260	40,560	3,720	3,600
Scaup spp.	433,198	501,144	50,620	58,652	32,540	44,940	3,120	1,900
Ring-necked duck	47,059	64,655	140	80				
Common goldeneye	45,172	53,516	7,360	12,640				
Bufflehead	62,571	50,607	11,880	11,930				
Ruddy duck	51,778	48,227	11,140	8,730				
Total diving ducks	897,744	948,110	137,700	161,280	68,820	110,740	6,660	4,920
Canada goose	824,169	744,399	523,200	474,060	23,820[b]		440[b]	
Whistling swan	78,178	62,628	32,020	33,310	6,000	9,440	20	260
Total	3,281,677	3,307,005	776,880	793,860	129,600	178,280	12,760	8,020

(a) Adapted from Hindman (1978).
(b) 1973-1977 data.

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Table G.1-2. Summary of federal Wildlife Service winter aerial census of the Upper Western Shore of the Chesapeake Bay (Perry, 1979, personal communication)

Species	Observation Area				
	Saltpeter Creek	Dundee Creek	Carroll Point	Upper Western Shore	Percent Study Area
			Swans		
Whistling swan	30		42	7,222	1.0
			Geese		
Canada goose	200		30	39,262	0.6
			Dabble Ducks		
Mallard	205		360	7,830	7.2
American black duck	112		325	5,220	8.4
Common pintail	2			2	100.0
Widgeon				10	0.0
Wood duck				7	0.0
			Diving Ducks		
Redhead				75	0.0
Ring-necked duck				2	0.0
Canvasback	5			37,430	>0.1
Scaup				20,668	0.0
Common goldeneye			30	4,535	0.7
Bufflehead				4,346	0.0
			Sea Ducks		
Oldsquaw				4,671	0.0
Scoter				4,345	0.0
			Stiff Tailed Ducks		
Ruddy duck				6,280	0.0
			Mergansers		
Red-breasted merganser				1,917	0.0
Total	554	0	787	143,822	

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Table G.1-3. Waterfowl observations at nine stations during 46.5 hours on ten days from 11 December 1978 through 17 January 1979 relating the species count by area for Dundee and Saltpeter Creeks and three Carroll Island coves (from Ref. 25)

Species	Observation Area: Dundee Creek 1	Dundee Creek 2	Dundee Creek 3	Dundee Creek Total	Saltpeter Creek 1	Saltpeter Creek 2	Saltpeter Creek 3	Saltpeter Creek Total	Carroll Island 1	Carroll Island 2	Carroll Island 3	Carroll Island Total	Total
Swans													
Whistling swan	461/5[a]	75/20	8/4	129/29			4/1	4/1	365/54	215/31	46/10	626/95	759/125
Geese													
Canada goose	62	221	250	533	0	237	53	290	556	424	47	1,027	1,850
Surface Feeding Ducks (Dabble)													
Mallard	8	47	52	107	6	20	0	26	73	43	0	116	249
American black duck	0	4	26	30	0	14	0	14	91	87	2	180	224
Gadwall	240	0	0	240					252	0	0	252	492
Common pintail									8	0	0	8	8
American widgeon	0	48	0	48	0	0	6	6	200	2	0	202	256
European widgeon	0	0	4	4									4
Green-winged teal									6	0	0	6	6
Bay Ducks (Diving)													
Redhead									18	0	0	18	18
Canvasback									170	0	0	170	170
Ring-necked duck									4	0	0	4	4
Scaup spp.									8	7	0	15	15
Common goldeneye									0	2	0	2	2
Bufflehead	0	9	0	9					32	54	2	88	97
Mergansers													
Hooded merganser									12	0	0	12	12
Common merganser					0	0	9	9	7	2	0	9	18
Red-breasted merganser					0	0	16	16	0	2	0	2	18
Total	361	424	344	1,129	6	271	79	354	1,855	869	107	2,832	4,327

(a) Adult/juvenile count.

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Table G.1-4. Percentage of observations for which waterfowl were observed feeding as opposed to other activities (i.e., resting, preening, and moving) during the 10 winter-stratified ground censuses (11 December 1978-17 January 1979)(from Ref. 25)

	Observation Area											
	Saltpeter Creek				Dundee Creek				Carroll Island			
Subfamily	1	2	3	Total	1	2	3	Total	1	2	3	Total
Swans			100	100	100	100	50	90	89	75	100	86
Geese		33	0	25	50	100	100	87	83	40	100	67
Dabble ducks	100	40	100	57	100	100	100	100	73	100	100	53
Bay ducks						100		100	67	100	100	77
Merganser			100	100					100	100		100

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Table G.1-5. Summary of American black duck survey of winter, spring, and summer utilization[a] of the census area (from Ref. 25)

	Observation Area									
	Dundee Creek			Saltpeter Creek			Carroll Island			
Date	1	2	3	1	2	3	1[b]	2[b]	3	Total Count
Winter										
11 DEC 78			5 f				50 f	16 f	0	71
13 DEC 78			4 f							4
15 DEC 78			6 f				20 f	12 f 38 m	0	76
17 DEC 78			2 f				6 m	8 f	2 f	18
19 DEC 78		4 f	6 f				6 f	6 f	0	22
4 JAN 79										
11 JAN 79			3 f		4 r		5 r	0	0	12
13 JAN 79							4 f	0	0	4
15 JAN 79					10 r		0	2 f	0	12
17 JAN 79							0	5 f	0	5
Total		4 f	26 f		14 r		81 f; 11 m,r	49 f; 38 m	2 f	224
Percent feeding		100	100		0		87.9	56.3	100	71.9
		100			0			72.8		

	Observation Area									
	Dundee Creek			Saltpeter Creek			Carroll Island			
Date	1	2	3	1	2	3	1[b]	2[b]	3	Total Count
Spring										
9 APR 79							2 p			2
21 APR 79								2 m		2
Summer										
26 JUL 79							3 m			3

(a) f = feeding; r = resting; m = moving; p = preening.
(b) Moving ducks could have been feeding or resting, and could have been interrupted by an unknown disturbance.

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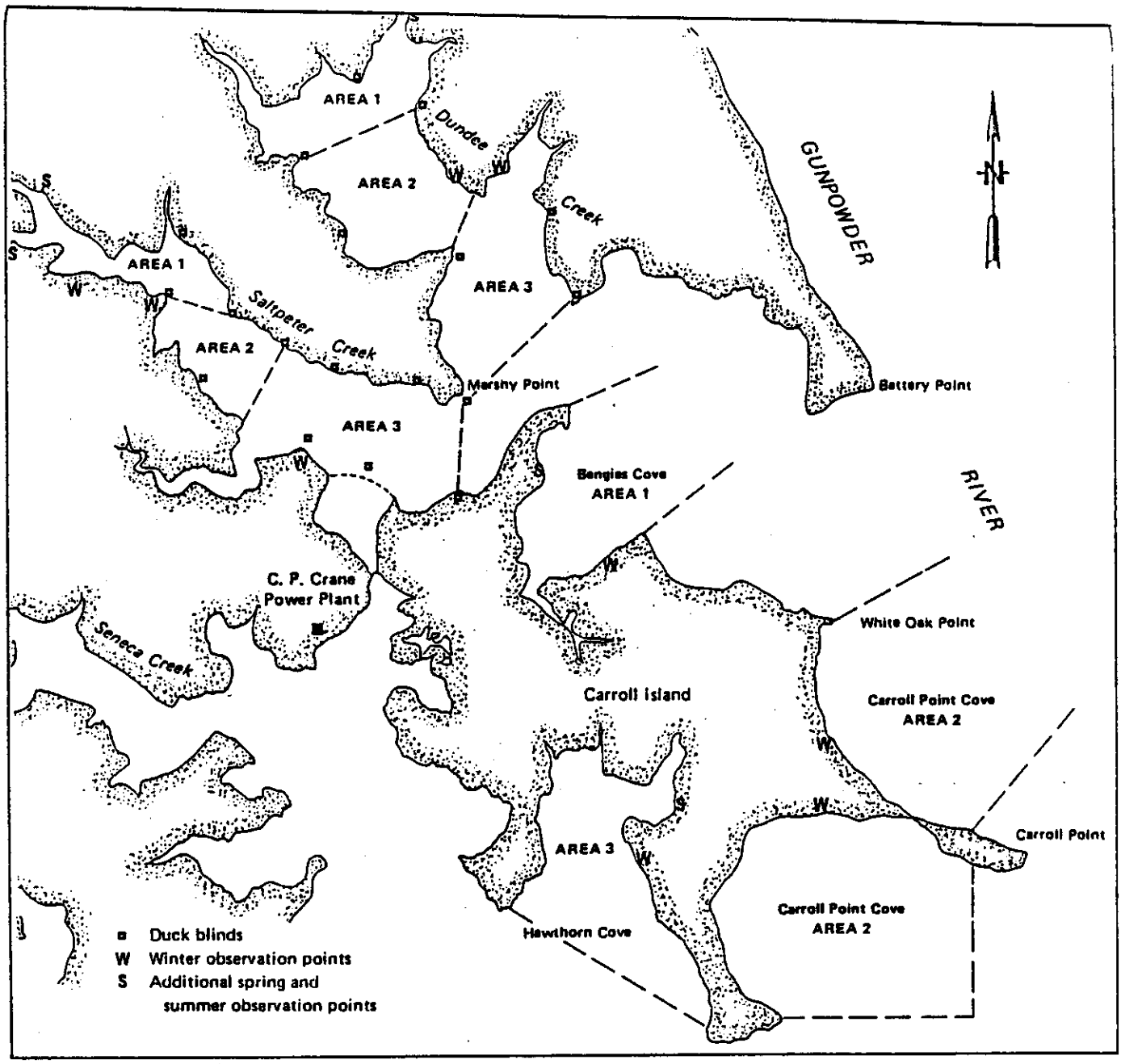

Figure G.1-1. Duck census observation points in the vicinity of the C.P. Crane power plant, 1979 (from Ref. 25)

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