Wen Lee

TR/85-005

INTERIM DATA STATUS REPORT

AUGUST 1985

STUDIES OF FRESHWATER INFLOW EFFECTS ON THE LAVACA RIVER DELTA AND LAVACA BAY, TEXAS

by

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Texas Water Development Board
P. O. Box 13087 Capitol Station
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OPERATIONS

A total of eight sampling trips were made over a ten month period from November, 1984 through August, 1985 to study the effects of freshwater inflow on selected sites in the upper portion of the Lavaca-Tres Palacios Estuary. A complete seasonal cycle of data will have been collected following the October 1985 sampling trip in contract year two.

Data were collected from the following seven sampling sites: 45,65 (river sites), 85 (river delta), 603,613,623 (lake sites), and 623 (upper bay). Two additional stations, 1505 and 1905, in the lower bay were sampled for primary production, nutrient dynamics, hydrography, and water chemistry.

Although we have no stream-flow data at this time, conductivity/ salinity data shown in Table 1 indicates periodic inflow of freshwater into the study area during the first year. Salinities in November, 1984 were lower than those measured during a reconnaissance trip in September, 1984 when salinities of 25‰ in Lavaca Bay and 20 ‰ in Redfish Lake were measured. During the period from January through May, 1985 salinities decreased and remained low at most stations. Although still lower than the salinities measured in September, 1984, increasing salinity has occurred from June through August.

PRIMARY PRODUCTION NUTRIENT DYNAMICS

Water Quality Parameters and Phytoplankton. (J. Cullen). Most of the samples from the study have been analysed and results tabulated. A working copy of the files is included (Tables 2-4 and Figures 1-14). Note that all values will be carefully checked and that a few changes and additions are anticipated. Conductivity values for 1905 and 1505 will be included after cross-calibration problems are resolved. Nutrient samples from August and total P from June-August have yet to be analyzed. Phytoplankton counts continue, but results have not yet been tabulated. Large amounts of sediment slow the counting procedure considerably.

Mean values are reported. Variation between replicates was in most cases not qualitatively important in comparison to the larger-scale patterns. A statistical analysis will be performed for the final report.

Nutrient samples were filtered prior to freezing for later analysis. This methodology limits changes in water chemistry after sampling and may be a consideration in interpreting the rather low (but in my opinion reliable) ammonium values.

In general, trends are as expected, indicative of nutrient input associated with freshwater inflow and a strong biotic demand for the nutrients. The picture in January seems relatively clear: fresh water high in nutrients upstream, grading into saltier water downstream, depleted in nutrients but high in chlorophyll. Perhaps the cold temperatures and recent freshwater influx enabled us to observe the strong gradients before the biota was able to deplete the nutrients and begin to obliterate the pattern. Results from January can be contrasted with November, when the temperature was milder. A gradient of conductivity is present, but dissolved inorganic nitrogen is very low throughout the study area. Chlorophyll shows a pronounced gradient, high upstream to low in the bay. It is likely that the nutrient input associated with freshwater had already been assimilated, perhaps being reflected in chlorophyll. Data on upstream water quality in the two months would help clarify the picture.

Temperature alone certainly does not explain the differences between months. Conductivity and temperature are similar in November and March, but nutrient levels (at least nitrogen) are very high in March. High chlorophyll values indicate algal blooms in the tertiary lakes. Some of the differences between November and March may be associated with different nutrient loads in runoff. It is notable that dissolved phosphate is low in March, indicating that the source of nutrients was relatively high in nitrogen.

A more complete discussion will follow. At this early stage of analysis, it appears to me likely that a major determinant of the patterns of water quality parameters is timing--how soon after a rainfall sampling occurs. The nutrient pulses associated with sporadic runoff are obviously transient, and we observe unknown stages in the assimilation of the nutrient pulse by the biota.

Table 1. Conductivity and Salinity on the day of Nutrient Sampling
LaVaca Bay 1984-85

Note: values from 1905 and 1505 are forthcoming

mmho/cm	Nov 27/28	Jan 22/23	Mar 5/6	April 2/3	May 7/8	June 4/5	July 16/17	August 13/14
45	4.78	0.60	2.50	6.10	0.50	1.50	1.30	6.00
603	5.78	0.15	1.20	1.10	0.65	2.00	2.70	9.00
65	6.48	1.75	1.20	1.10	1.50	4.80	4.40	17.00
613	13.12	7.50	5.50	1.80	4.80	3.70	13.00	23.00
623	14.94	20.00	8.40	2.80	2.80	10.00	14.00	23.00
633			12.50	2.20	1.60	13.50	11.00	22.00
85	12.50	21.50	10.00	3.60	6.80	16.00	15.00	26.00
1905								
1505								

Salinity algorithm: S(ppt)= a*(C^b) where C is conductivity

	a	b
Up to March	0.3708	1.129
After March	0.4321	1.119

Salinity ppt	Nov 27/28	Jan 22/23	Mar 5/6	April 2/3	May 7/8	June 4/5	July 16/17	August 13/14
45	2.17	0.21	1.04	3.27	0.20	0.68	0.58	3.21
603	2.69	0.04	0.46	0.48	0.27	0.94	1.31	5.05
65	3.06	0.70	0.46	0.48	0.68	2.50	2.27	10.29
613	6.78	3.61	2.54	0.83	2.50	1.87	7.62	14.43
623	7.85	10.91	4.10	1.37	1.37	5.68	8.28	14.43
633			6.42	1.04	0.73	7.95	6.32	13.73
85	6.42	11.84	4.99	1.81	3.69	9.62	8.95	16.56
1905								
1505								

1905 and 1505 data await recalibration of KATY Hydrolab

File C and S Summary 9/9/85 version

Table 2.

Conductivity on the day of Nutrient Sampling
LaVaca Bay 1984-85

Note: values need quite a bit of rechecking

mmho/cm	Nov 27/28	Jan 22/23	Mar 5/6	April 2/3	May 7/8	June 4/5	July 16/17	August 13/14
45	4.78	0.60	2.50	6.10	0.50	1.50	1.30	6.00
603	5.78	0.15	1.20	1.10	0.65	2.00	2.70	9.00
65	6.48	1.75	1.20	1.10	1.50	4.80	4.40	17.00
613	13.12	7.50	5.50	1.80	4.80	3.70	13.00	23.00
623	14.94	20.00	8.40	2.80	2.80	10.00	14.00	23.00
633			12.50	2.20	1.60	13.50	11.00	22.00
85	12.50	21.50	10.00	3.60	6.80	16.00	15.00	26.00

File Conductivity Summary 8/29/85 version

Table 3. Temperature at the Time of Nutrient Sampling
LaVaca Bay 1984-85

Note: assumes that nutrients were done on day 1

degrees C	Nov 27/28	Jan 22/23	Mar 5/6	April 2/3	May 7/8	June 4/5	July 16/17	August 13/14
45	14.9	6.8	15.2	24.8	26.3	26.5	32.3	31.3
603	14.7	5.5	16.1	24.8	27.0	27.0	32.0	31.0
65	15.5	5.2	16.1	22.5	26.0	27.3	31.8	30.3
613	16.3	6.0	17.8	24.3	26.3	27.5	30.5	30.5
623	14.6	6.5	16.5	17.5	27.0	30.0	28.8	30.0
633			17.0	21.0	25.8	28.0	28.3	28.5
85	14.9	6.3	16.3	20.3	25.0	28.0	28.8	29.8
1905	15.1		16.4	22.7				
1505			16.5	20.8				

File Temp Summary 8/29/85 version

Table 4.

Mean Oxygen
LaVaca Bay 1984-1985

	Nov 27/28	Jan 22/23	Mar 5/6	April 2/3	May 7/8	June 4/5	July 16/17	August 13/14
mg per liter								
45	9.05	13.35	9.20	9.20	7.45	7.55	14.20	8.80
603	9.00	14.20	10.20	9.95	8.50	8.15	11.10	8.50
65	9.25	13.70	9.20	9.55	8.00	7.60	11.10	8.90
613	9.15	15.30	10.20	10.20	9.00	8.95	8.70	9.30
623	9.65	16.60	12.40	7.95	7.90	9.05	6.50	7.30
633			10.80	8.60	7.30	8.63	6.90	7.30
85	9.45	16.20	10.10	9.20	8.00	8.10	6.80	7.35
1905	10.20		8.50	8.50				
1505			8.20	8.40				
ml per liter								
45	6.34	9.35	6.44	6.44	5.22	5.29	9.94	6.16
603	6.30	9.94	7.14	6.97	5.95	5.71	7.77	5.95
65	6.48	9.59	6.44	6.69	5.60	5.32	7.77	6.23
613	6.41	10.71	7.14	7.14	6.30	6.27	6.09	6.51
623	6.76	11.62	8.68	5.57	5.53	6.34	4.55	5.11
633			7.56	6.02	5.11	6.04	4.83	5.11
85	6.62	11.34	7.07	6.44	5.60	5.67	4.76	5.15
1905	7.14		5.95	5.95				
1505			5.74	5.88				

File Mean O2 8/29/85 version

Table 5.

pH on the day of Nutrient Sampling
LaVaca Bay 1984-85

pH	Nov 27/28	Jan 22/23	Mar 5/6	April 2/3	May 7/8	June 4/5	July 16/17	August 13/14
45	8.25	8.28	7.95	7.95	7.60	7.90		8.10
603	8.60	8.35	8.45	8.15	6.90	7.90		8.10
65	8.40	8.45	8.10	7.90	7.33	7.90		8.05
613	8.30	8.35	8.23	8.45	8.35	7.90		8.10
623	8.35	7.20	8.85	7.40	8.00	7.90		8.10
633			8.75	7.95	7.65	7.95		8.10
85	8.15	9.00	8.35	8.10	8.20	7.95		8.10
1905	8.30		8.00	8.30				
1505			7.90	8.40				

File pH Summary 8/29/85 version

Table 6.

Secchi Depth on the day of Nutrient Sampling
LaVaca Bay 1984-85

Note: assumes nutrients were done on day 1

cm	Nov 27/28	Jan 22/23	Mar 5/6	April 2/3	May 7/8	June 4/5	July 16/17	August
45	60	20	23	23	19	36	17	34
603	30	20	30	18	16	31	23	31
65	41	20	18	18	25	42	31	35
613	18	45	22	13	27	31	23	30
623	52	50	39	15	16	13	24	28
633			30	14	10	13	25	27
85	45	90	36	13	27	16	47	47
1905								
1505								

File Secchi Summary 8/29/85 version

Table 7.

Mean Ammonium
LaVaca Bay 1984-1985

	Nov 27/28	Jan 22/23	Mar 5/6	April 2/3	May 7/8	June 4/5	July 16/17	August 13/14
µg-at/l								
45	0.59	5.26	2.47	0.09	0.28	0.58	0.41	0.16
603	0.72	2.98	0.79	0.04	0.17	0.12	0.19	0.14
65	0.55	6.01	1.18	0.03	0.16	0.09	0.19	0.16
613	0.62	0.90	0.45	0.02	0.03	0.00	0.17	0.29
623	1.38	0.42	0.39	0.01	0.17	1.33	0.27	0.21
633			0.19	0.02	0.67	0.81	0.25	0.36
85	0.71	0.42	0.36	0.10	0.83	3.37	0.31	0.85
1905	0.26			0.04	0.97	2.99	3.55	5.38
1505				0.02	0.09	1.06	1.38	2.26
mg/l								
45	0.008	0.074	0.035	0.001	0.004	0.008	0.006	0.002
603	0.010	0.042	0.011	0.001	0.002	0.002	0.003	0.002
65	0.008	0.084	0.017	0.000	0.002	0.001	0.003	0.002
613	0.009	0.013	0.006	0.000	0.000	0.000	0.002	0.004
623	0.019	0.006	0.005	0.000	0.002	0.019	0.004	0.003
633			0.003	0.000	0.009	0.011	0.004	0.005
85	0.010	0.006	0.005	0.001	0.012	0.047	0.004	0.012
1905	0.004			0.001	0.014	0.042	0.050	0.075
1505				0.000	0.001	0.015	0.019	0.032

File Mean NH4 prepared 9/5/85

Table 8.

Mean Nitrite
LaVaca Bay 1984-1985

	Nov 27/28	Jan 22/23	Mar 5/6	April 2/3	May 7/8	June 4/5	July 16/17	August 13/14
µg-at/l								
45	0.00	0.31	0.40	0.61	0.85	0.12	0.26	0.06
603	0.03	0.41	0.37	0.37	0.21	0.08	0.07	0.06
65	0.01	0.53	0.39	0.59	0.12	0.05	0.02	0.05
613	0.03	0.37	0.29	0.44	0.03	0.05	0.06	0.04
623	0.07	0.39	2.05	0.45	0.07	0.12	0.06	0.04
633			0.53	0.74	0.08	0.10	0.02	0.04
85	0.05	0.11	0.63	0.48	0.09	0.22	0.02	0.04
1905	0.04			0.71	0.00	0.02	0.02	0.02
1505				1.08	0.00	0.06	0.02	0.02
mg/l								
45	0.000	0.004	0.006	0.009	0.012	0.002	0.004	0.001
603	0.000	0.006	0.005	0.005	0.003	0.001	0.001	0.001
65	0.000	0.007	0.005	0.008	0.002	0.001	0.000	0.001
613	0.000	0.005	0.004	0.006	0.000	0.001	0.001	0.001
623	0.001	0.005	0.029	0.006	0.001	0.002	0.001	0.001
633			0.007	0.010	0.001	0.001	0.000	0.001
85	0.001	0.002	0.009	0.007	0.001	0.003	0.000	0.001
1905	0.001			0.010	0.000	0.000	0.000	0.000
1505				0.015	0.000	0.001	0.000	0.000

File Mean NO2 prepared 9/5/85

Table 9.

Mean Nitrate
LaVaca Bay 1984-1985

	Nov 27/28	Jan 22/23	Mar 5/6	April 2/3	May 7/8	June 4/5	July 16/17	August 13/14
µg-at/l								
45	0.19	34.97	44.17	32.87	21.69	1.43	11.94	0.10
603	0.13	34.61	35.86	14.67	10.12	0.06	0.06	0.02
65	0.14	41.47	34.47	23.10	9.53	0.28	0.06	0.16
613	0.00	24.98	9.65	10.35	0.80	0.03	0.00	0.14
623	0.00	3.45	30.91	21.89	13.23	1.05	0.04	0.00
633			17.14	16.35	36.05	0.90	0.06	0.00
85	0.08	4.00	21.27	24.73	17.08	3.30	0.03	0.00
1905	0.04			15.59	0.46	0.35	0.11	0.02
1505				7.11	0.41	0.35	0.11	0.13
mg/l								
45	0.003	0.490	0.618	0.460	0.304	0.020	0.167	0.001
603	0.002	0.485	0.502	0.205	0.142	0.001	0.001	0.000
65	0.002	0.581	0.483	0.323	0.133	0.004	0.001	0.002
613	0.000	0.350	0.135	0.145	0.011	0.000	0.000	0.002
623	0.000	0.048	0.433	0.306	0.185	0.015	0.001	0.000
633			0.240	0.229	0.505	0.013	0.001	0.000
85	0.001	0.056	0.298	0.346	0.239	0.046	0.000	0.000
1905	0.001			0.218	0.006	0.005	0.002	0.000
1505				0.100	0.006	0.005	0.002	0.002

File Mean NO3 prepared 9/5/85

Table 10.

Mean Phosphate
LaVaca Bay 1984-1985

	Nov 27/28	Jan 22/23	Mar 5/6	April 2/3	May 7/8	June 4/5	July 16/17	August 13/
µg-at/l								
45	1.09	5.90	1.07	2.26	2.35	1.21	1.65	0.47
603	0.76	5.52	0.80	1.27	1.37	2.10	0.50	0.66
65	0.95	5.85	0.73	1.20	0.75	1.21	0.31	1.33
613	1.44	4.39	0.28	0.65	0.16	0.92	0.42	1.25
623	1.15	1.44	0.09	1.45	0.75	1.84	0.54	0.74
633			0.25	1.49	1.57	1.14	0.54	1.21
85	1.35	0.82	0.71	1.64	0.59	1.25	0.35	2.23
1905				0.10	0.24	0.51	0.08	0.78
1505				0.39	0.00	0.51	0.31	0.94
mg/l								
45	0.034	0.183	0.033	0.070	0.073	0.038	0.051	0.015
603	0.024	0.171	0.025	0.039	0.042	0.065	0.016	0.020
65	0.029	0.181	0.023	0.037	0.023	0.038	0.010	0.041
613	0.045	0.136	0.009	0.020	0.005	0.029	0.013	0.039
623	0.036	0.045	0.003	0.045	0.023	0.057	0.017	0.023
633			0.008	0.046	0.049	0.035	0.017	0.038
85	0.042	0.025	0.022	0.051	0.018	0.039	0.011	0.069
1905				0.003	0.007	0.016	0.002	0.024
1505				0.012	0.000	0.016	0.010	0.029

File Mean PO4 prepared 9/5/85

Table 11.

Mean Chlorophyll a
LaVaca Bay 1984-1985

Some minor corrections still to be made

µg/liter	Nov 27/28	Jan 22/23	Mar 5/6	April 2/3	May 7/8	June 4/5	July 16/17	August 13/14
45	16.76	2.69	1.57	7.94	0.21	13.24	18.89	17.16
603	9.64	0.72	9.45	14.25	0.92	12.78	30.88	18.01
65	10.32	7.41	14.25	17.11	0.8	11.97	10.73	30.04
613	7.65	6.71	35.68	29.23	1.55	14.71	12.93	8.93
623		11.95	76.48	10.86	1.41	8.57	3.04	1.06
633			28.19	11.76	0.40	7.02	7.94	3.98
85	5.68	9.73	5.41	18.33	0.35	6.31	3.21	4.61
1905	3.05			12.73	0.65	5.36	3.06	3.25
1505				11.12	0.99	6.16	3.14	3.65

File Mean CHL 8/30/85 version

Table 12.

Mean Pheopigment Concentration
LaVaca Bay 1984-1985

Some minor corrections still to be made

µg/liter	Nov 27/28	Jan 22/23	Mar 5/6	April 2/3	May 7/8	June 4/5	July 16/17	August 13/14
45	4.19	4.3	2.15	4.48	2.45	5.76	9.69	4.11
603	5.94	4.43	6.04	7.56	4.07	3.42	8.76	5.09
65	4.58	6.61	5.99	8.5	3.09	4.33	5.51	11.83
613	6.43	2.18	8.15	10.18	2.79	3.06	4.55	3.14
623		2.36	8.40	1.13	4.71	8.75	2.89	1.44
633			6.03	6.01	4.36	9.04	2.78	2.44
85	3.68	2.19	2.18	6.54	3.14	8.81	1.57	1.83
1905	0.85			3.77	1.70	2.19	0.59	0.77
1505				2.92	1.86	2.68	0.70	0.72

File Mean Pheo 8/30/85 version

Table 13.

Mean Total Kjeldahl Nitrogen
LaVaca Bay 1984-1985

mg N / liter	Nov 27/28	Jan 22/23	Mar 5/6	April 2/3	May 7/8	June 4/5	July 16/17
45	0.26	0.13	0.29	0.39	0.17	0.17	0.58
603	0.26	0.18	0.30	0.76	0.25	0.41	0.65
65	0.24	0.17	0.13	0.49	0.15	0.47	0.68
613	0.32	0.19	0.38	0.63	0.25	0.64	0.93
623	0.14	0.25	0.48	0.43	0.23	0.81	0.80
633			0.69	0.73	0.37	0.89	1.00
85	0.24	0.86	0.41	0.43	0.20	0.73	0.86
1905	0.12		0.33	0.40	0.18	0.85	0.76
1505			0.31	0.32	0.50	0.67	0.93

File Mean TKN 8/30/85 version

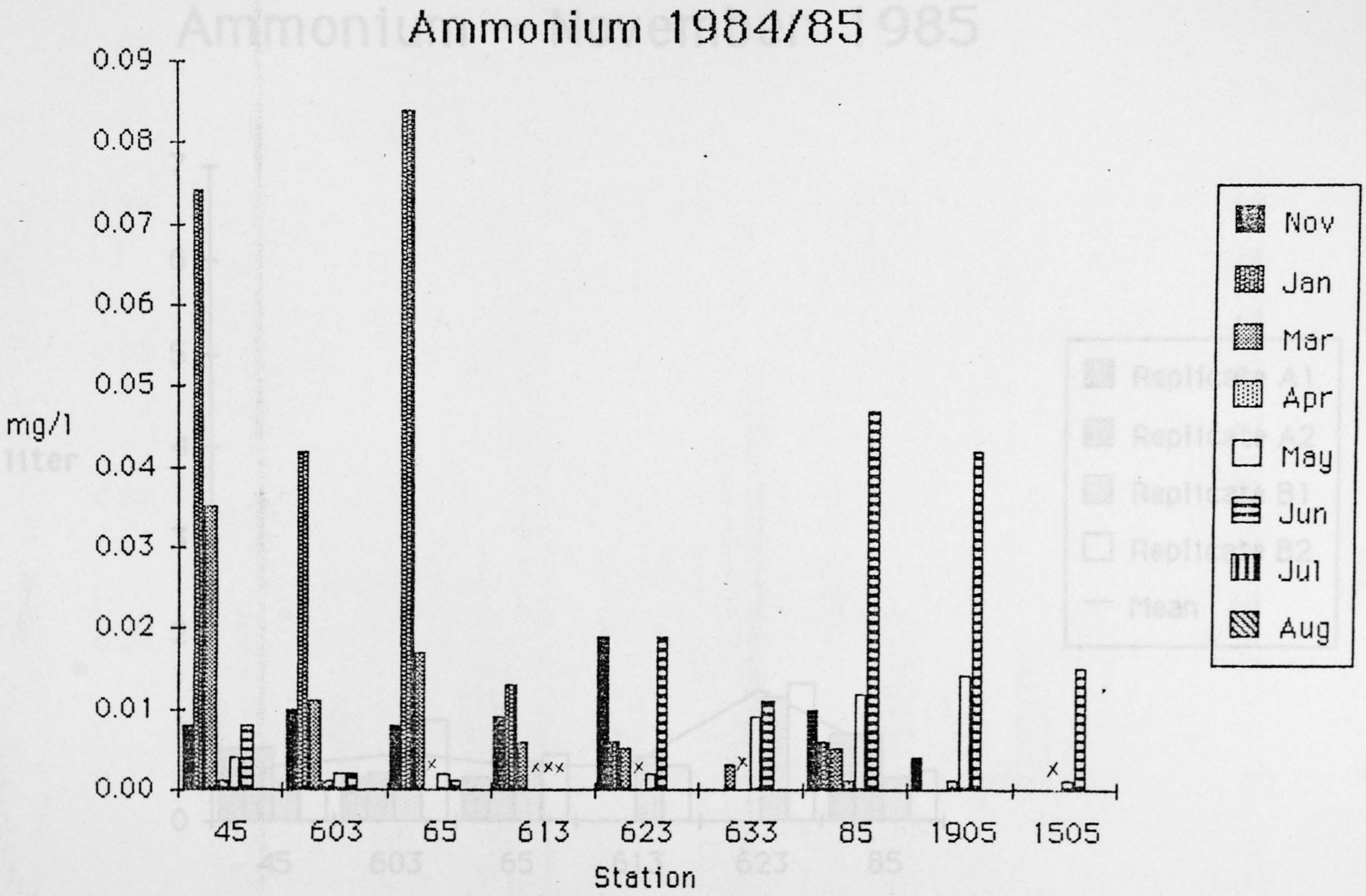
Table 14.

Mean Total Phosphorus
LaVaca Bay 1984-1985

	Nov 27/28	Jan 22/23	Mar 5/6	April 2/3	May 7/8
µg-at/l					
45	6.78		11.83	8.18	9.43
603	7.88		11.46	9.66	8.98
65	1.00		9.83	7.93	8.50
613	6.75		8.38	10.40	6.98
623			5.53	11.53	9.99
633			2.95	10.48	14.00
85	5.05		2.78	9.70	6.88
1905			1.60		2.55
1505			3.50		2.15
mg/l					
45	0.210		0.367	0.254	0.292
603	0.244		0.355	0.299	0.278
65	0.031		0.305	0.246	0.264
613	0.209		0.260	0.322	0.216
623	0.000		0.171	0.357	0.310
633			0.091	0.325	0.434
85	0.157		0.086	0.301	0.213
1905				0.000	0.079
1505				0.000	0.067

File Mean Total P 8/30/85 version

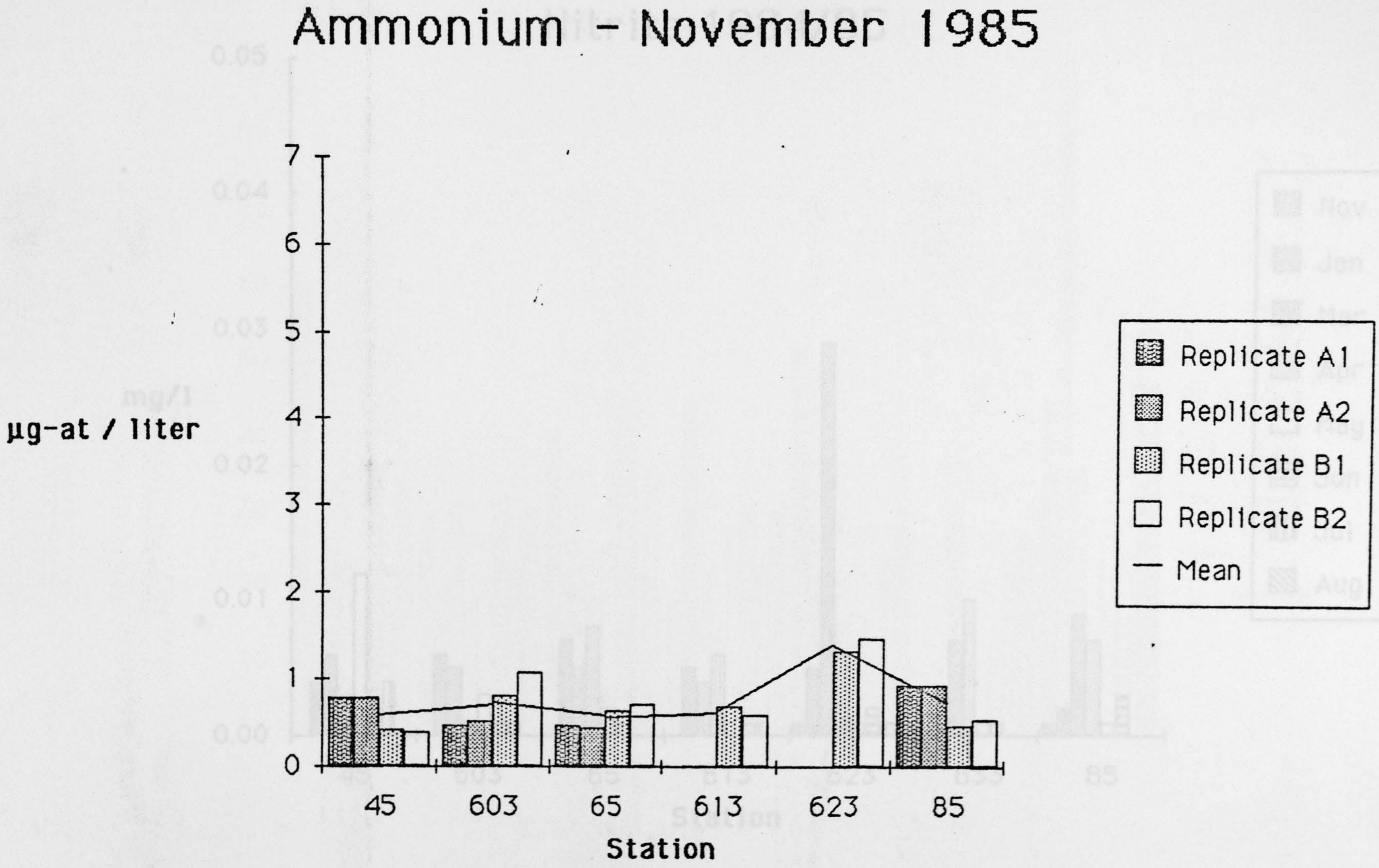
Figure 1.



File Ammonium. This version 8/29/85

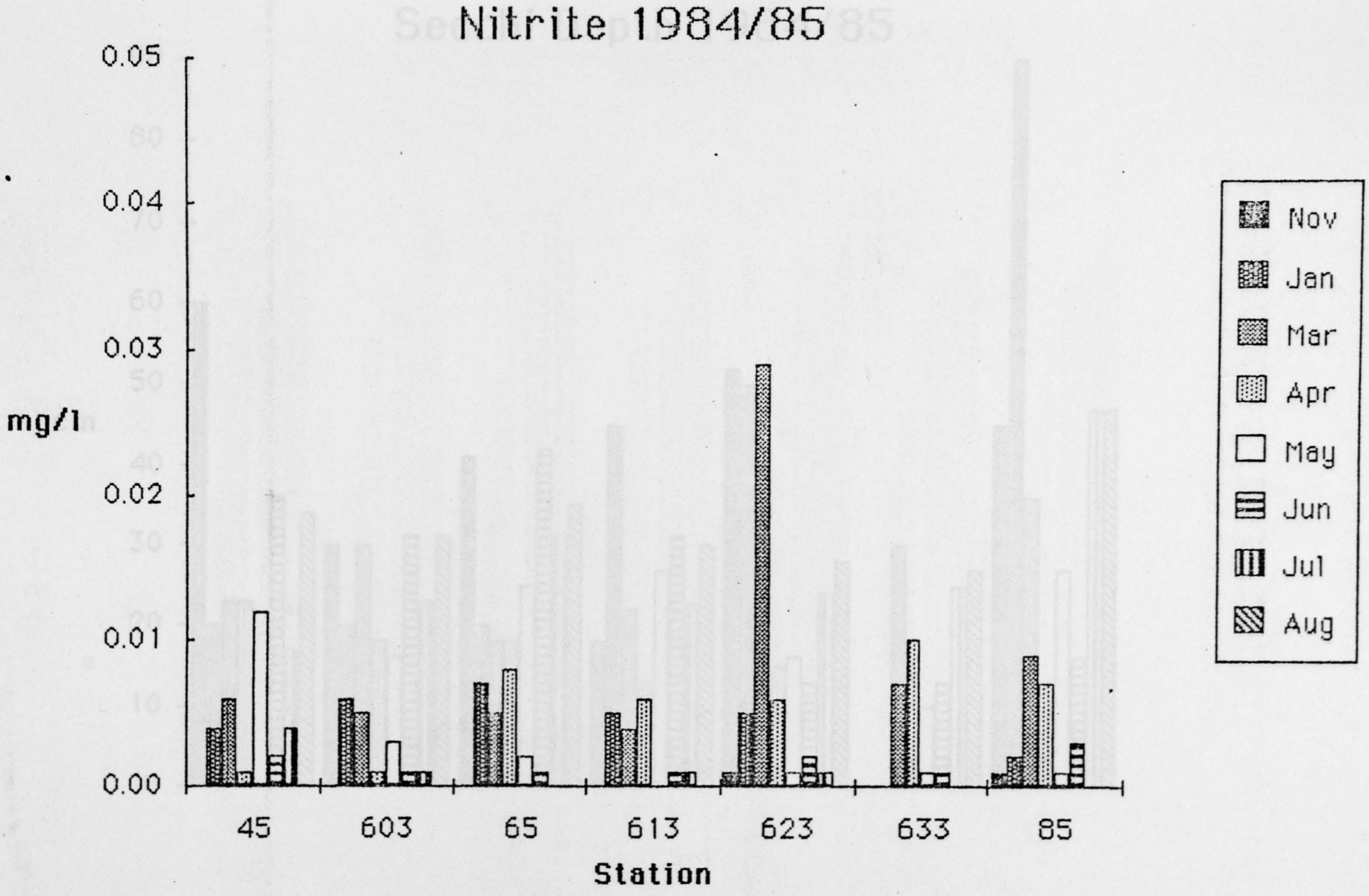
X measured value very close to zero.

Figure 1A.



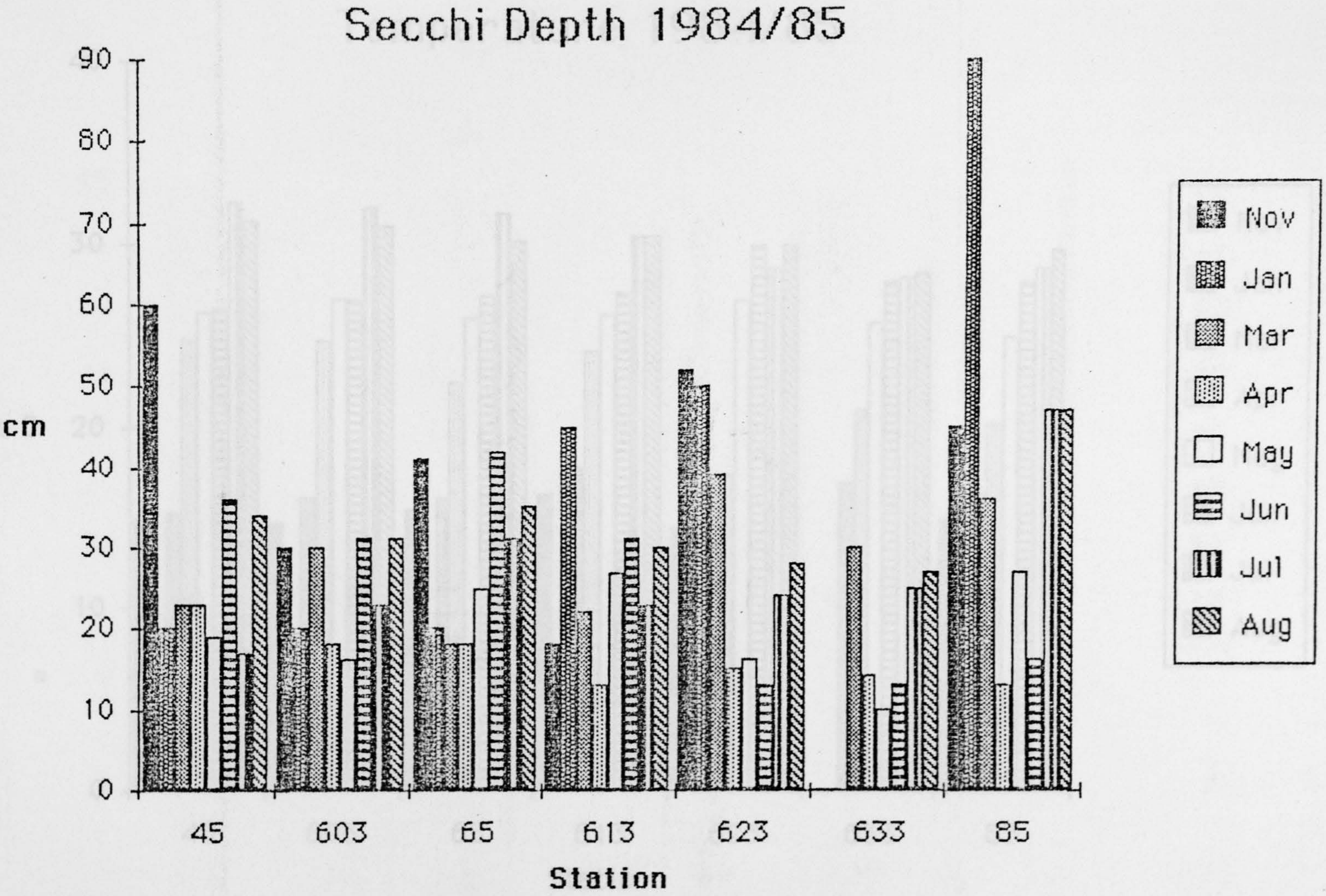
File November NH4 prepared 9/9/85

Figure 2.



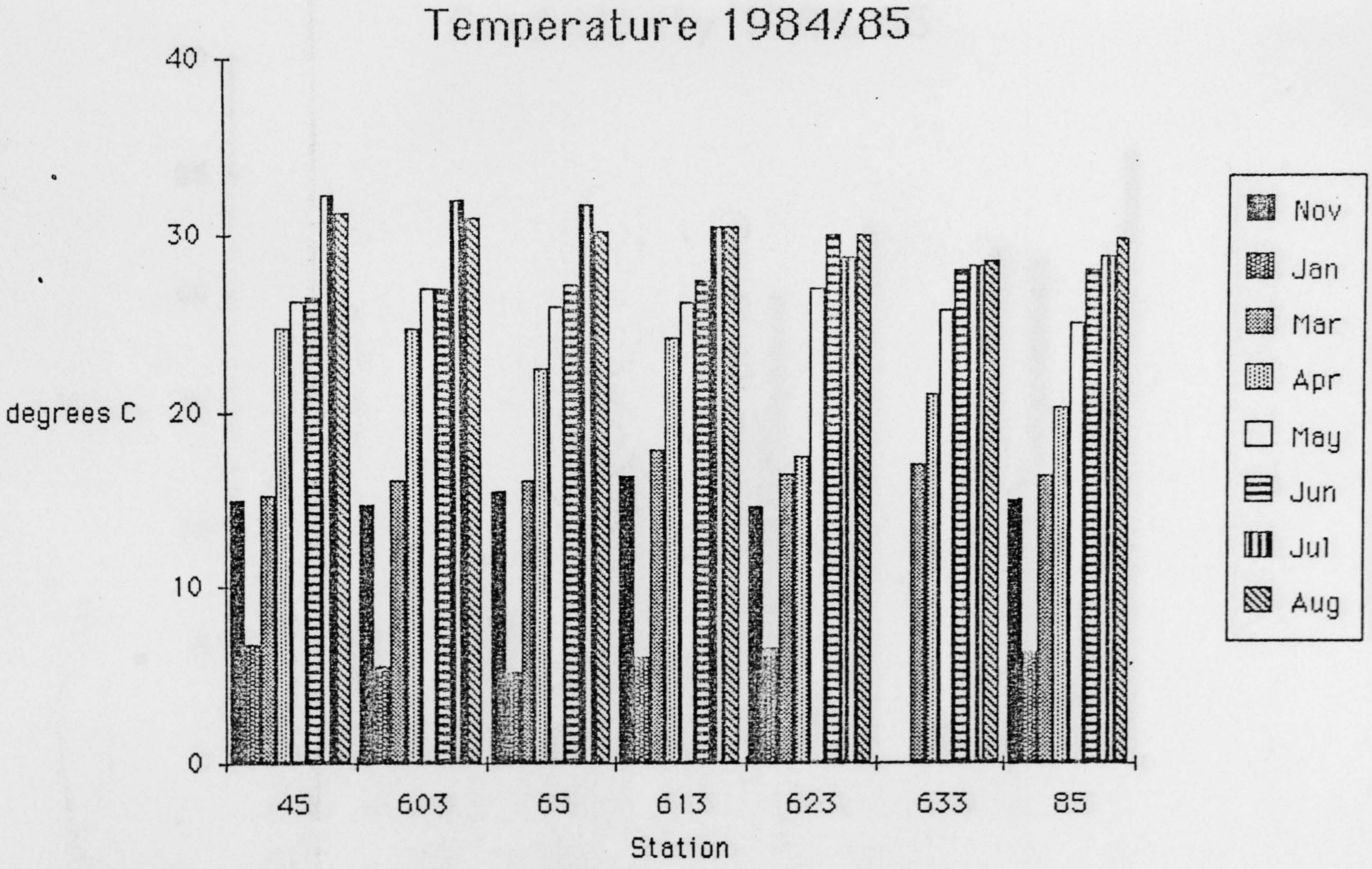
File Nitrite. This version 8/29/85

Figure 3.



File Secchi

Figure 4.



File Temperature

Figure 5.

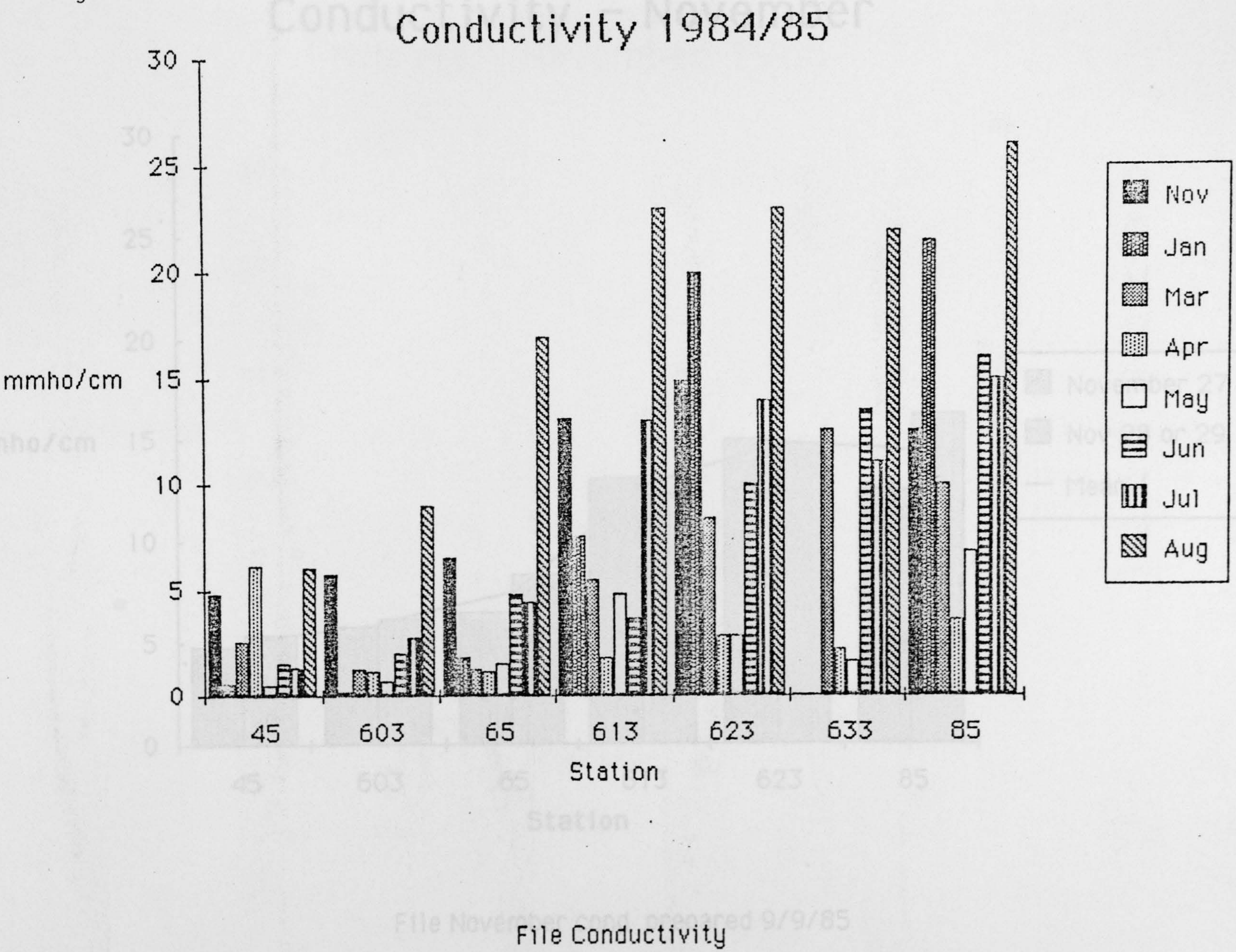

Conductivity 1984/85
30
25
20
15
10
5
0
mmho/cm
45
603
65
613
623
633
85
Station
Nov
Jan
Mar
Apr
May
Jun
Jul
Aug
File Conductivity

Figure 6.

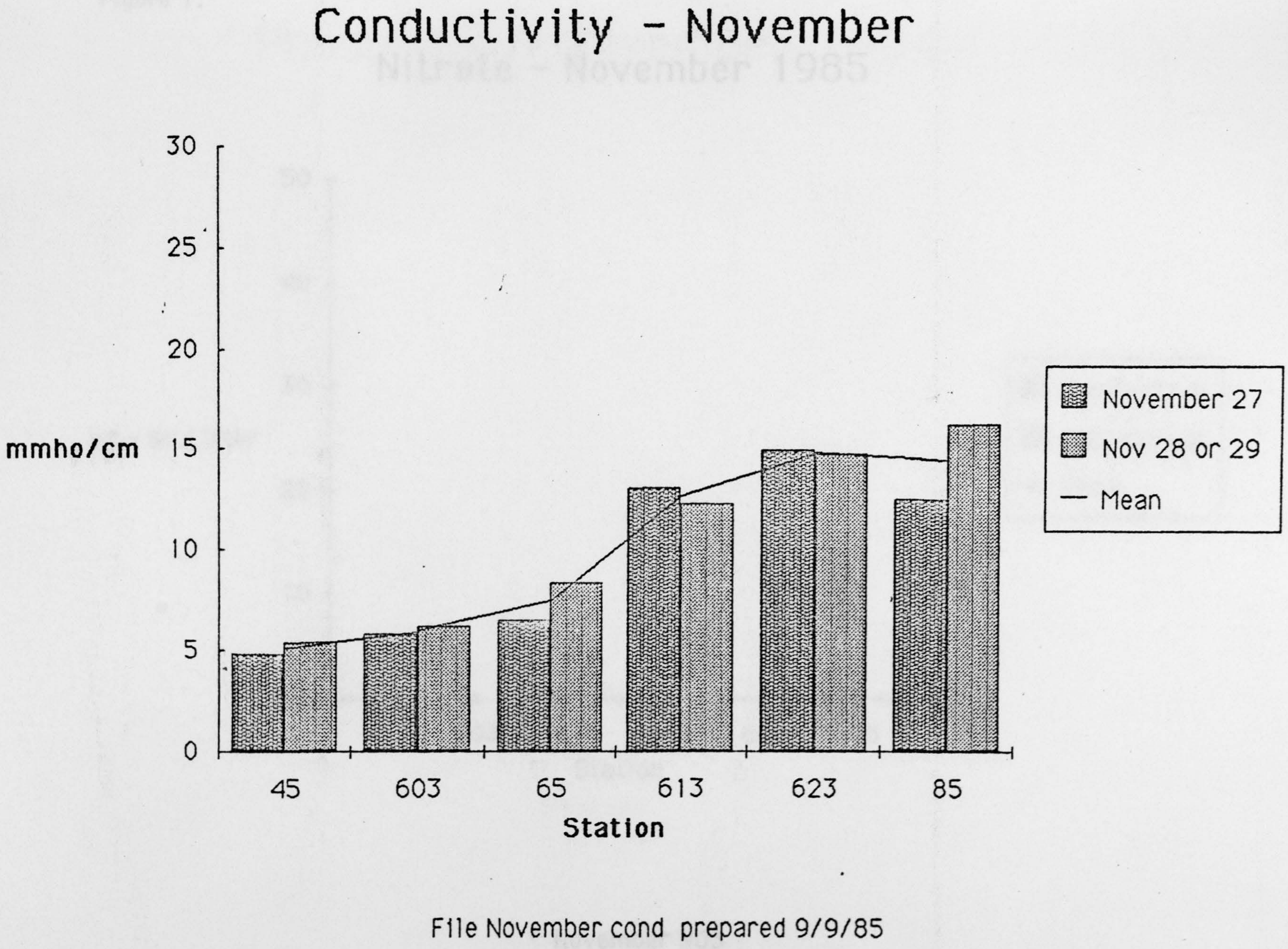
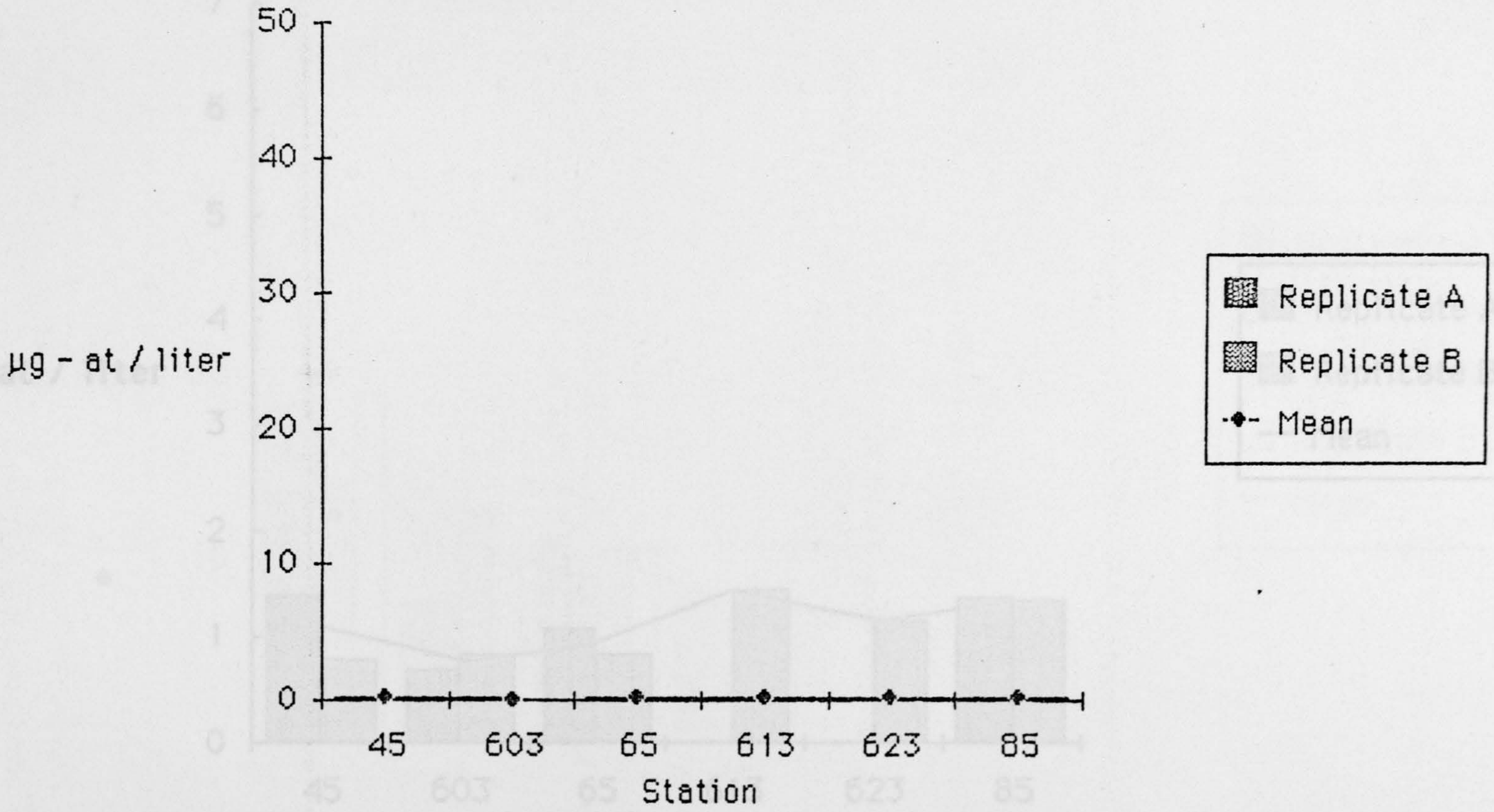

Conductivity - November
30
25
20
15
10
5
0
mmho/cm
45
603
65
613
623
85
Station
November 27
Nov 28 or 29
Mean
File November cond prepared 9/9/85

Figure 7.

Nitrate - November 1985



November NO3

Figure 8.

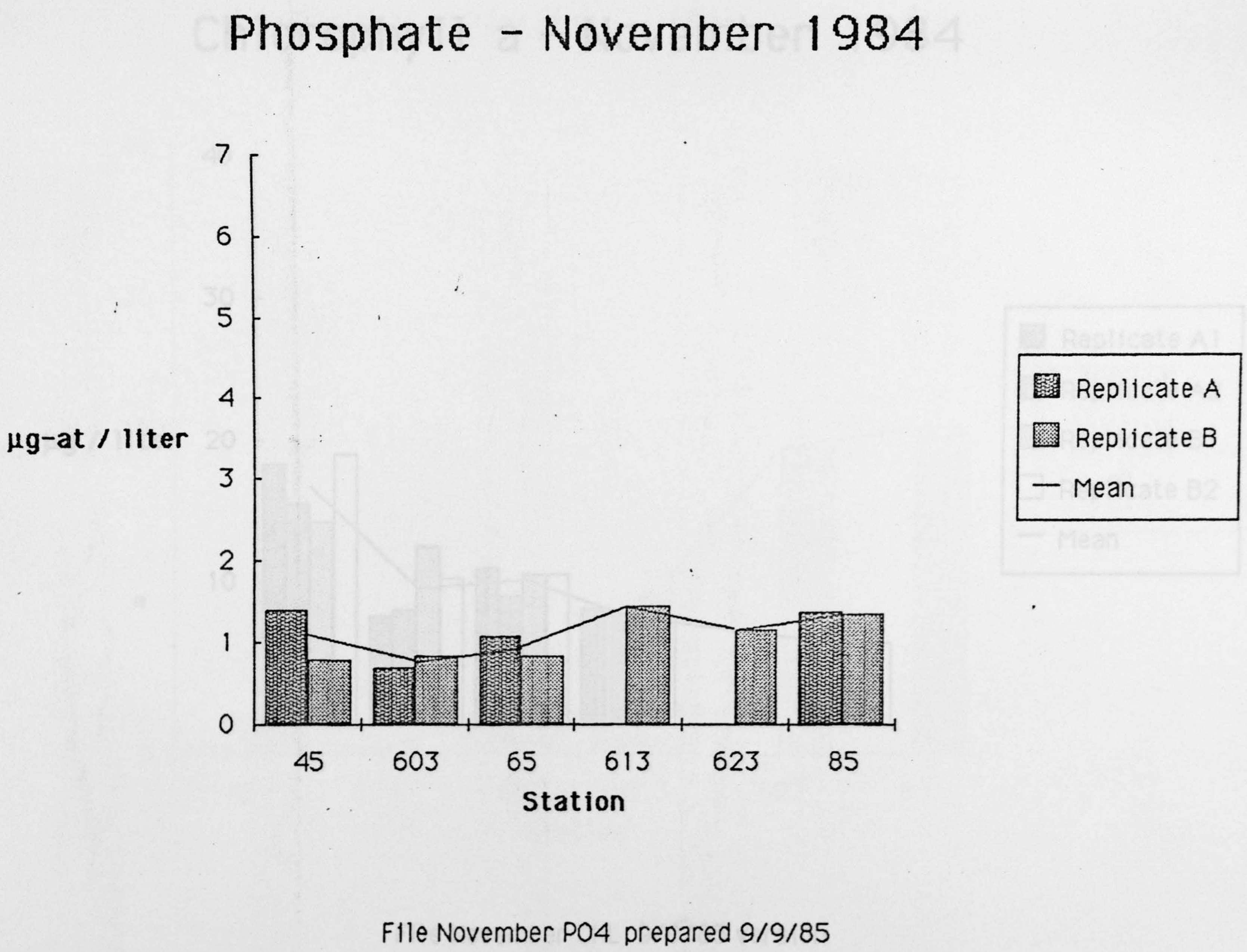
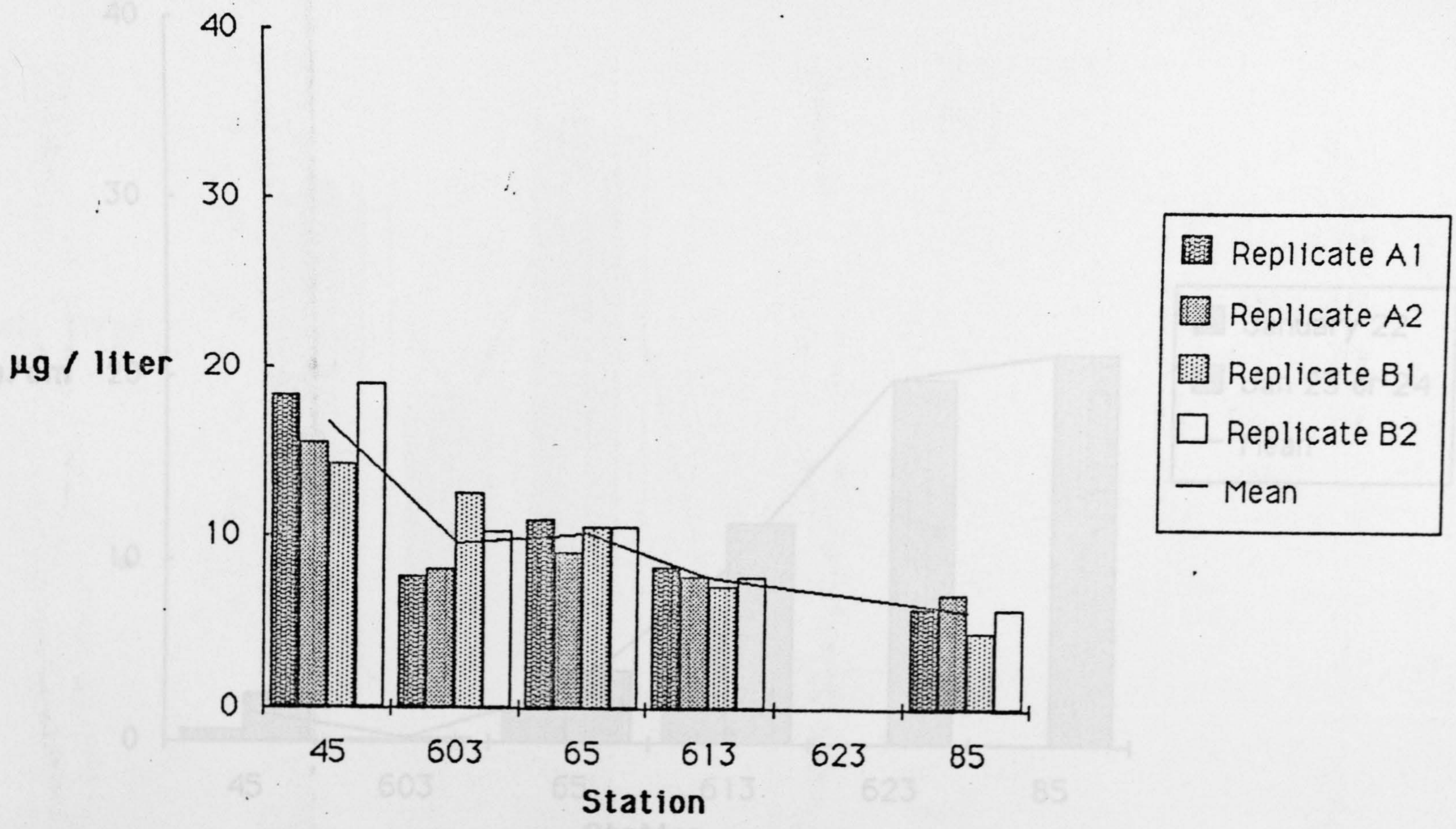

Phosphate - November 1984
7
6
5
4
3
2
1
0
µg-at / liter
45
603
65
613
623
85
Station
Replicate A
Replicate B
Mean
File November PO4 prepared 9/9/85

Figure 9.

Chlorophyll a - November 1984



File November CHL 9/9/85 version

Figure 10.

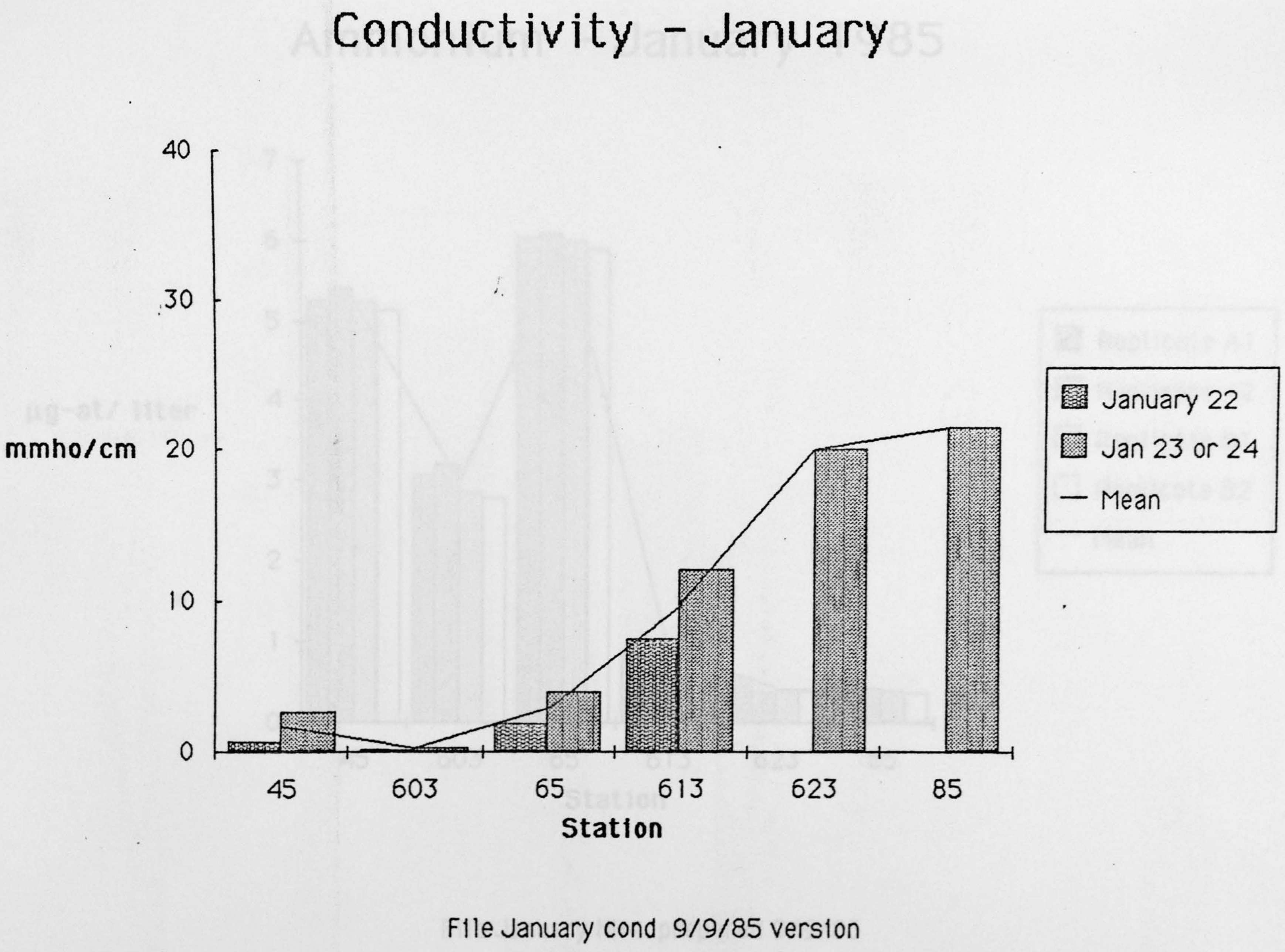
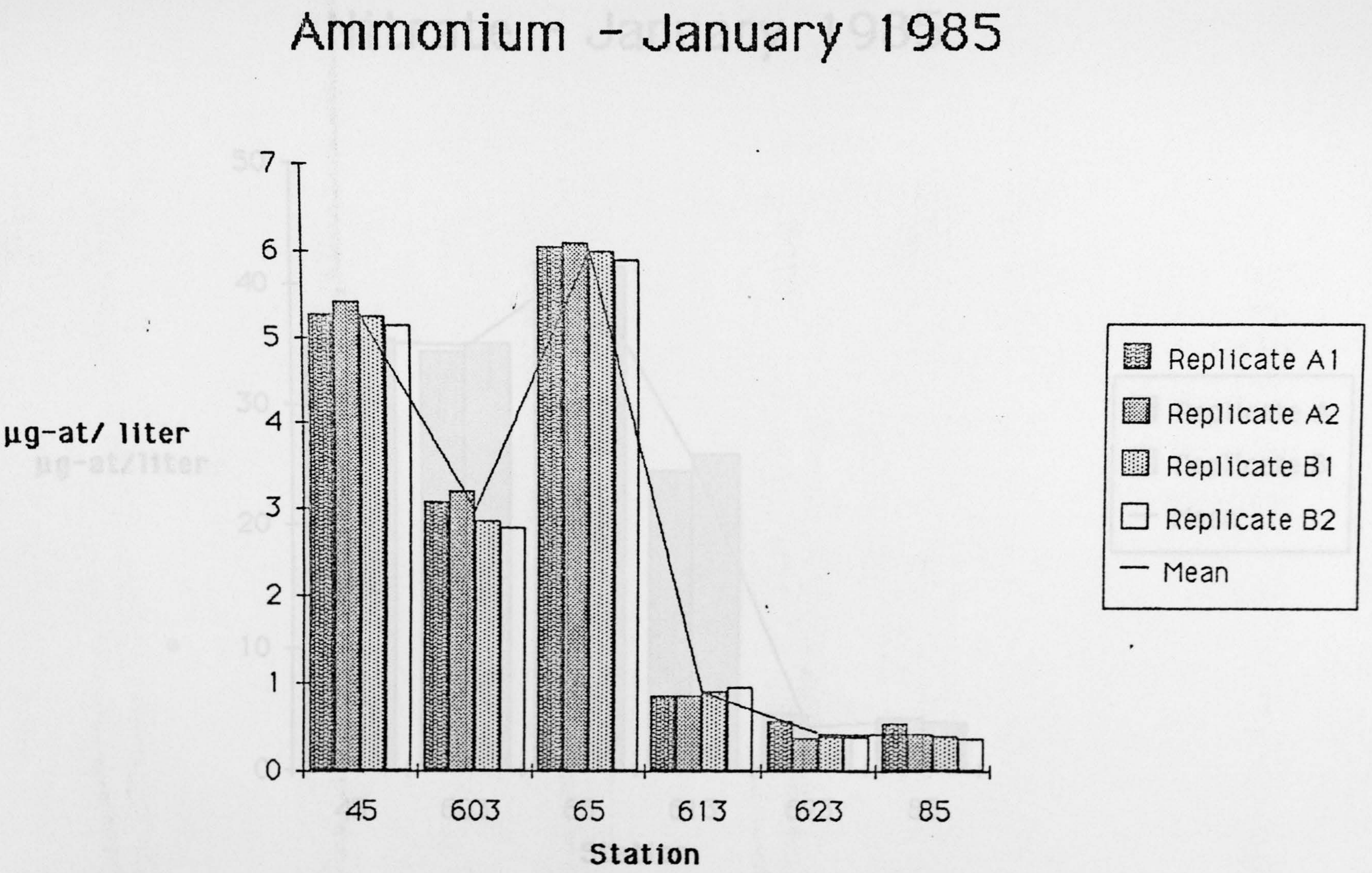
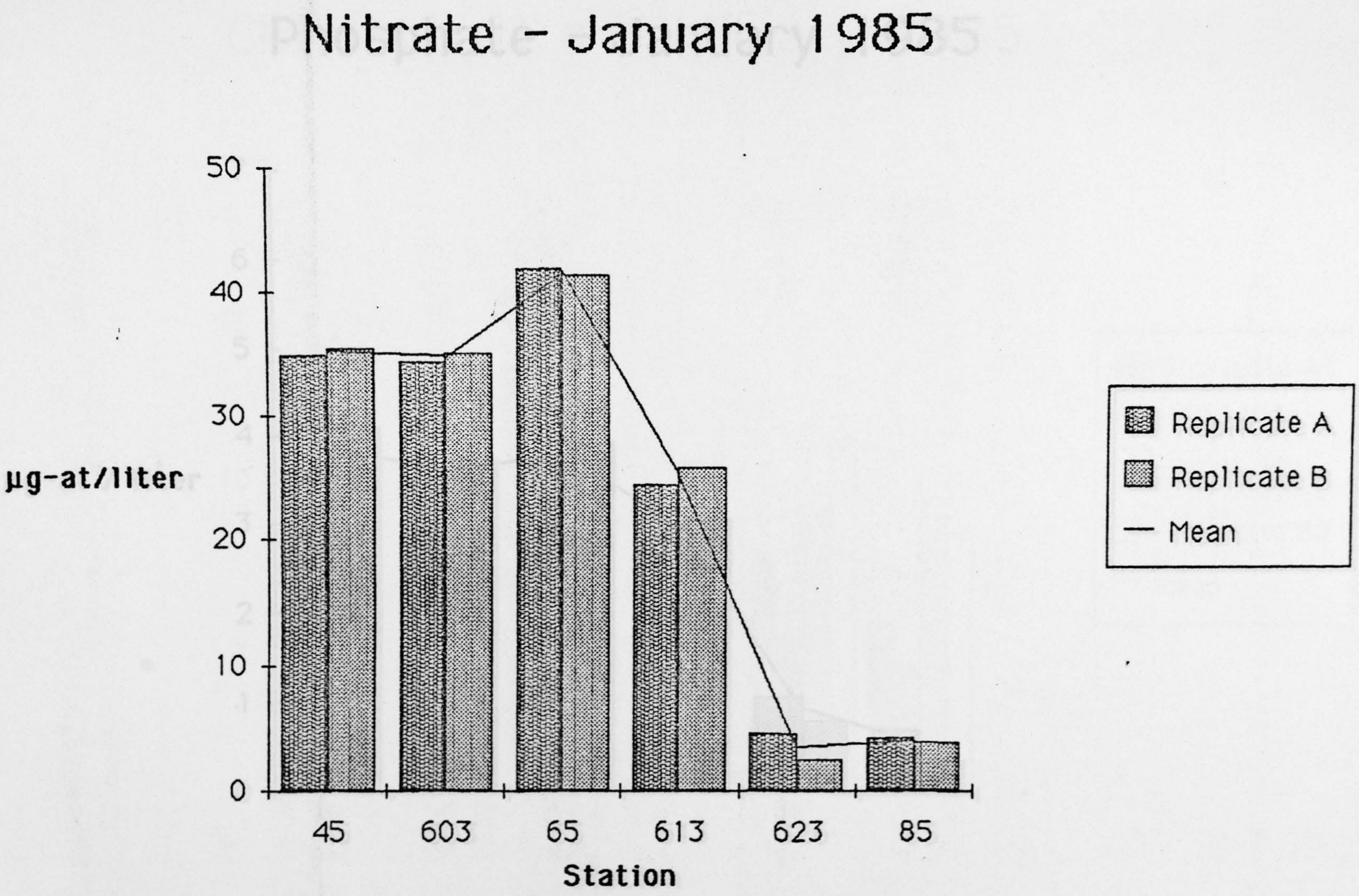

Conductivity - January
40
30
20
10
0
mmho/cm
January 22
Jan 23 or 24
Mean
45
603
65
613
623
85
Station
File January cond 9/9/85 version

Figure 11.



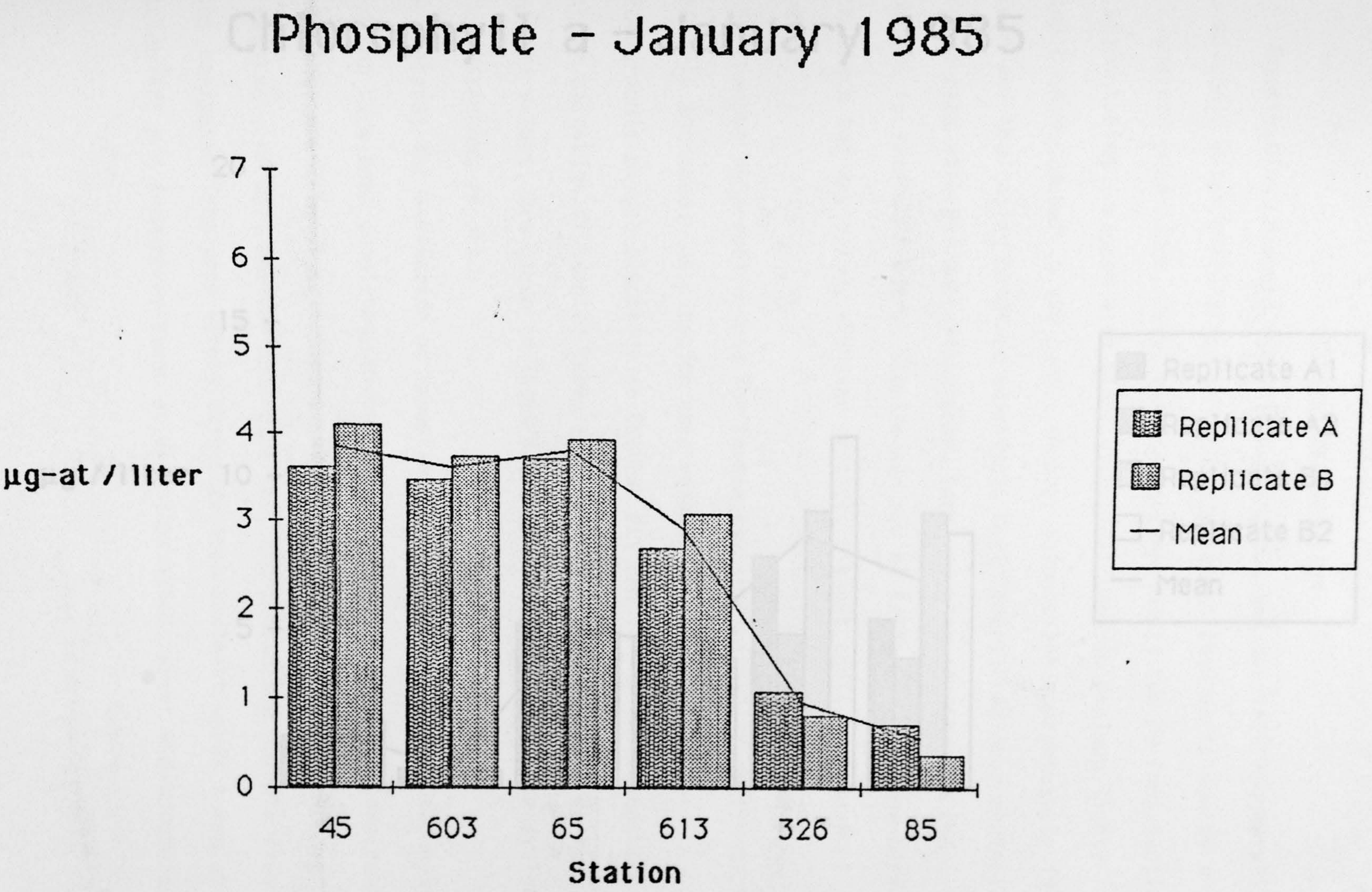
File January NH4 prepared 9/9/85

Figure 12.



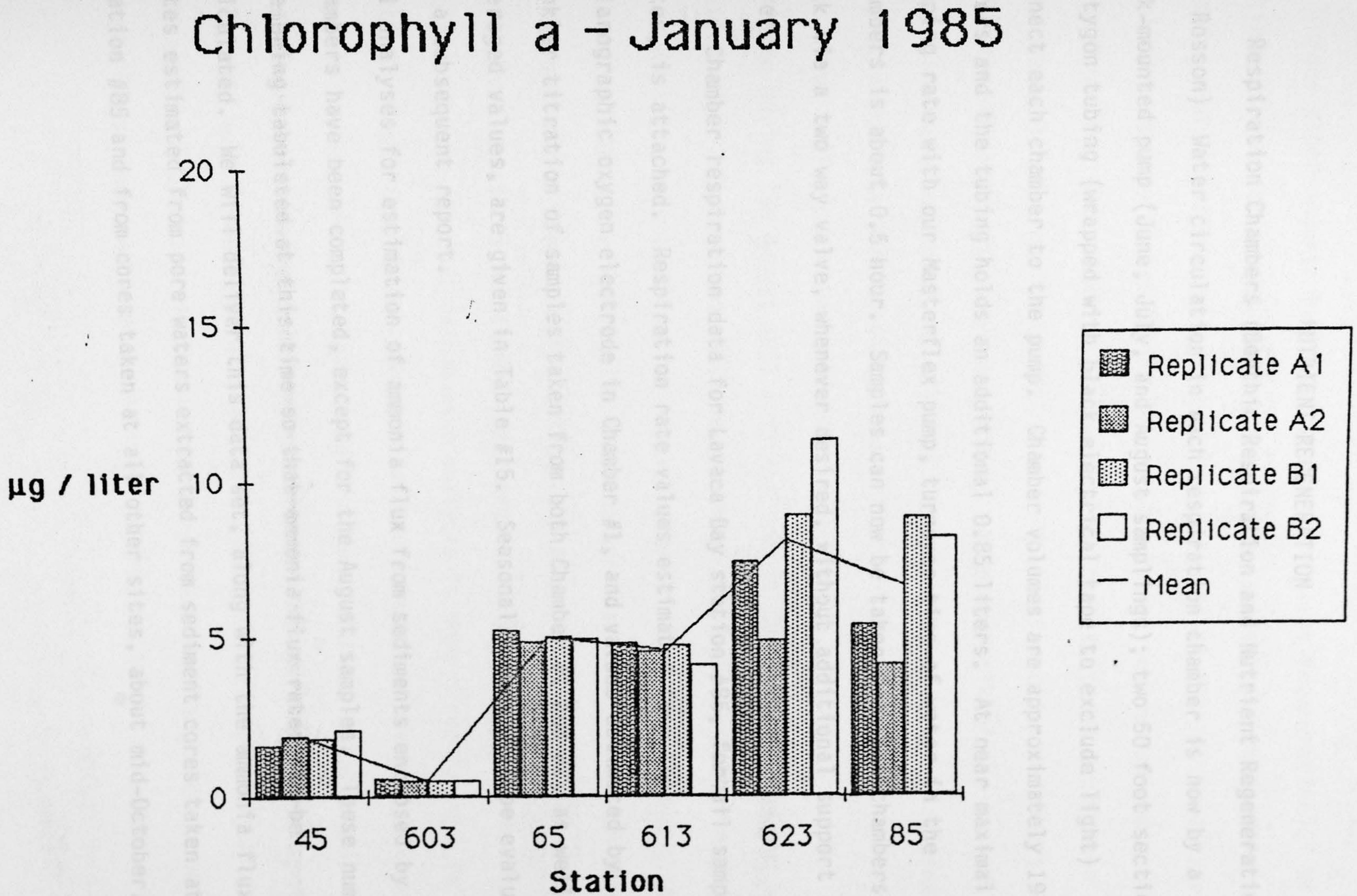
January NO3 prepared 9/9/85

Figure 13.



File January PO4 prepared 9/9/85

Figure 14.



File January CHL prepared 9/9/85

NUTRIENT REGENERATION

Respiration Chambers (Benthic Respiration and Nutrient Regeneration). (R. Rosson) Water circulation in each respiration chamber is now by a deck-mounted pump (June, July, and August samplings); two 50 foot sections of tygon tubing (wrapped with black electrical tape to exclude light) connect each chamber to the pump. Chamber volumes are approximately 19 liters and the tubing holds an additional 0.85 liters. At near maximal pumping rate with our Masterflex pump, turnover time of water in the chambers is about 0.5 hour. Samples can now be taken from the chambers on deck via a two way valve, whenever desired, without additional support of a diver.

Chamber respiration data for Lavaca Bay station #85, for all sampling dates, is attached. Respiration rate values estimated from the polarographic oxygen electrode in Chamber #1, and values estimated by Winkler titration of samples taken from both Chamber #1 and #2, as well as averaged values, are given in Table #15. Seasonal trends will be evaluated in a subsequent report.

All analyses for estimation of ammonia flux from sediments enclosed by the chambers have been completed, except for the August samples. These numbers are being tabulated at this time so that ammonia flux rates can be calculated. We will deliver this data set, along with the ammonia flux rates estimated from pore waters extracted from sediment cores taken at Station #85 and from cores taken at all other sites, about mid-October.

Pore Water Ammonia Analysis (Sediment Nutrient Regeneration). We continue to collect sediment cores from all sample sites. Cores were fractionated into 1 cm sections, and frozen in the field. At this time in the laboratory, we are still extracting pore waters from these sediments by centrifugation; the extracted pore waters are then filtered and frozen for later analysis of ammonium concentration. Most extracted pore waters are still frozen and await ammonium analyses. When the bulk of the pore water extractions are completed, we will run the ammonium analyses. I estimate completion of this work by early or mid October 1985.

Four diffusion probes (see attached schematic, Figure 15) were emplaced during the August 1985 sampling; two at Station #85, and two at Station #613. These probes will be recovered mid-September after a minimum of 30 days in place to allow for complete equilibration with sediment pore waters. Standard cores will also be taken and fractionated at that time for comparison of ammonium gradients in the pore waters from these sites. If comparable results are found, these probes can replace the core sampling procedures used now. Since ammonium analysis is done directly on 1 cm sections of gel from these probes, a considerable amount of time will be saved in the processing of these samples. Because of a lack of equipment (1 centrifuge instead of 2 or more) and due to lack of adequate man-power for timely extraction of pore waters from cores, we are hopeful that the probes will be a viable alternative to the present sampling technique (should these same measurements be required in year two of the contract).

Turbidity Measurements. We have been taking replicate water samples since January 1985 for relative turbidity measurements. Samples were sealed in serum bottles, stored at 4°C, and retuned to the laboratory for analysis. All turbidity measurements were made on a Hatch Model 2100A Turbidometer. This device measures light scattering; data is reported as relative turbidity units (FTU). No attempt has been made to relate these values to total suspended solids or the fraction of organic and inorganic particulates. For your information, the turbidity data for each site is summarized in the attached Table 16 and Figure 16.

TABLE 15

Sample Date	Temp (°C)	Salinity (ppt)	Turbidity (FTU)	DO (mg/l)	Respiration Rate (mg O2 per l per h) Ch#1 electrode	Ch#1 winkler	Ch#2 winkler	mean rate AVE	mean rate ±STD	(mg O2 per m2 per h) mean rate AVE	±STD
11/28/84	14.9	6.5	—	10.7	1.07	?0.00	0.34	0.71	0.52	198.4	145.3
1/23/85	6.3	10.9	3.6	12.0	1.28	?-0.12	0.93	1.11	0.25	311.0	69.7
3/6/85	16.3	6.7	6.1	9.8	0.82	0.64	0.69	0.72	0.09	201.7	26.1
4/3/85	20.3	2.0	68.3	11.0	0.81	0.65	0.33	0.60	0.24	167.5	68.2
5/8/85	25.0	4.3	21.4	8.9	0.71	0.28	0.33	0.44	0.24	123.8	66.2
6/5/85	32.5	9.5	78.4	7.2	0.40	0.20	0.53	0.38	0.17	106.0	46.8
7/17/85	29.0	9.8	0	6.8	0.70	0.62	0.29	0.53	0.22	150.1	61.7
8/14/85	29.5	17.5	7.3	7.1	1.24	1.17	0.98	1.13	0.14	317.1	38.4

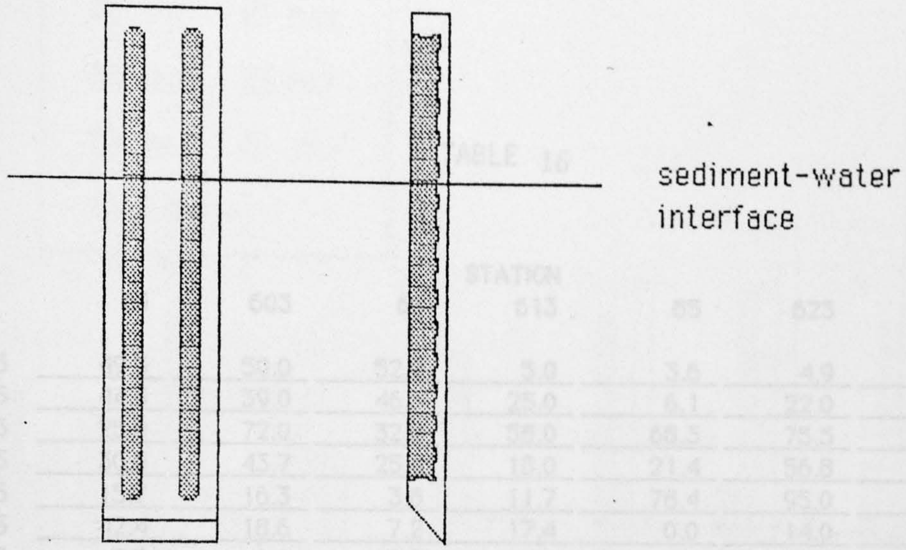
Chambers were either mixed or not mixed as follows: 1. [Nov, Jan, and Mar] mixed by an "automobile windshield wiper pump" mounted in a water tight housing attached to respiration chambers; 2. [Apr and May] no mixing; and 3. [Jun, Jul, and August] mixed by a Masterflex pump mounted on the deck of R/V Katy.

Hydrographic data from Hydrolab data set.

Values with "?" are unreliable and are not included in further calculations.

Figure 15.

DIFFUSION PROBES



probe material: plexiglass

well length: 145.0 cm
width: 2.5 cm
depth: 7.0 mm

The well's of each probe are filled with a 10% polyacrylamide gel made up in distilled water. This gel is stiff enough to withstand tearing when the probes are placed in sandy or muddy sediments. After about 30 days in place, the pore water in the gel is equilibrated with the pore water of the surrounding sediments. The gel ensures that there is no loss of natural gradients downcore in the pore waters during the recovery process. One centimeter sections of gel will be removed from each well, starting at the sediment water interface, immediately after the probe is removed from the sediment. These gel sections are put into acid cleaned scintillation vials, and frozen for later analysis. It should be possible to add reagents for ammonium analysis directly to these gel sections.

Port Lavaca - 1985

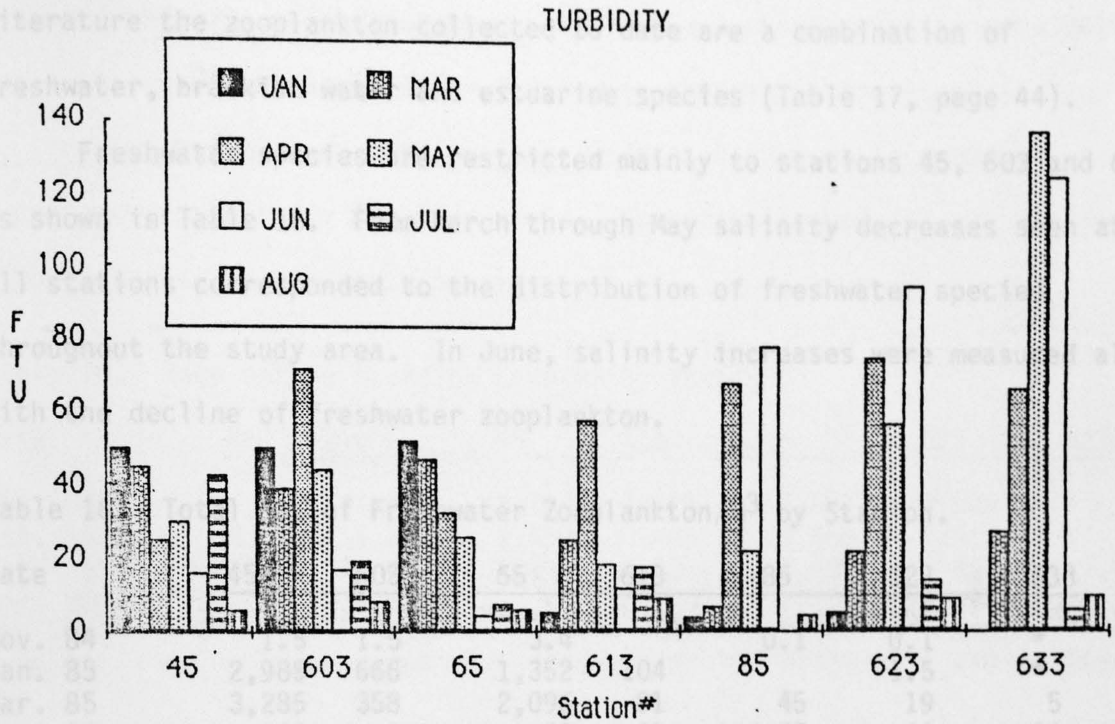
TABLE 16

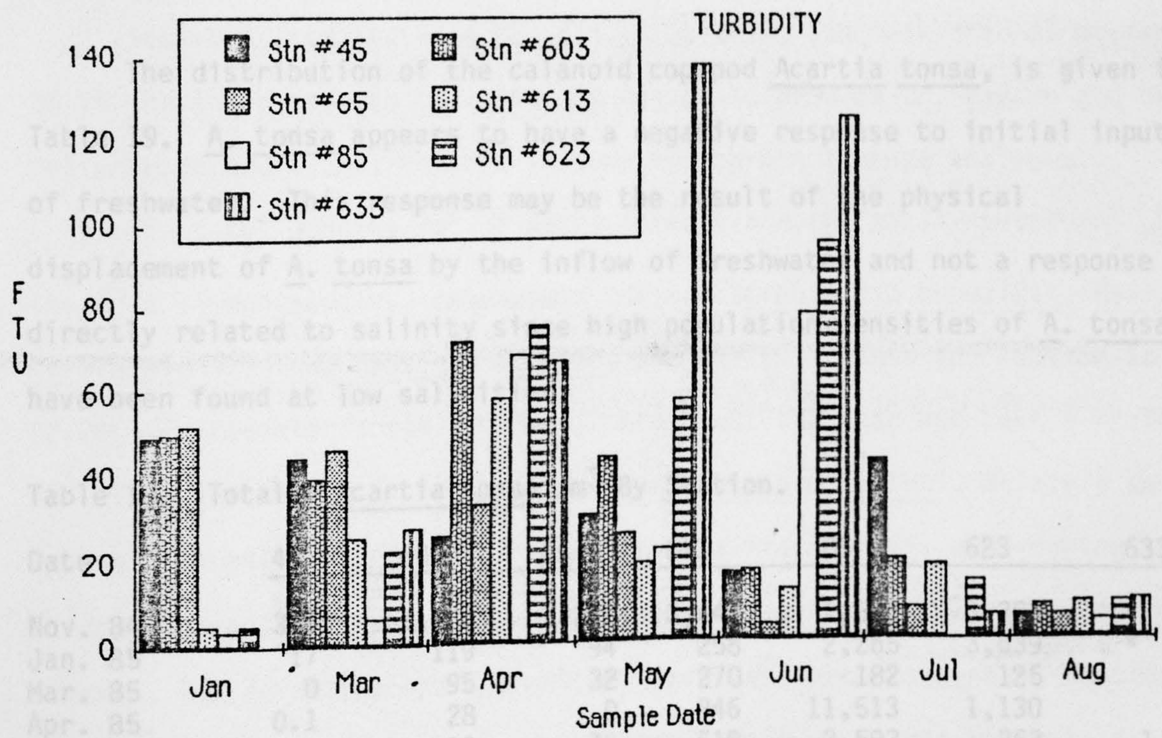
Date	STATION 45	603	65	613	85	623	633
1/23/85	49.5	50.0	52.0	5.0	3.6	4.9	0.0
3/06/85	44.5	39.0	46.5	25.0	6.1	22.0	27.0
4/03/85	25.0	72.0	32.0	58.0	68.3	75.5	66.5
5/08/85	30.0	43.7	25.4	18.0	21.4	56.8	138.0
6/05/85	15.7	16.3	3.8	11.7	78.4	95.0	125.3
7/17/85	42.4	18.6	7.2	17.4	0.0	14.0	5.5
8/14/85	5.3	8.0	5.6	8.5	4.4	8.9	9.3

[a]All values are relative turbidity units (FTU).

Port Lavaca - 1985

FIGURE 16





ZOOPLANKTON AND BENTHOS

Zooplankton samples are worked up through June. Based on available literature the zooplankton collected to date are a combination of freshwater, brackish water and estuarine species (Table 17, page 44).

Freshwater species are restricted mainly to stations 45, 603 and 65 as shown in Table 18. From March through May salinity decreases seen at all stations corresponded to the distribution of freshwater species throughout the study area. In June, salinity increases were measured along with the decline of freshwater zooplankton.

Table 18. Total No. of Freshwater Zooplankton/M^3 by Station.

Date	45	603	65	613	85	623	633
Nov. 84	1.5	1.5	3.4		0.1	0.1	*
Jan. 85	2,985	666	1,352	104		1.5	*
Mar. 85	3,285	358	2,096	81	45	19	5
Apr. 85	148	9	33	41	57	56	84
May 85	572	17	73	70	25	69	252
June 85	58	23	0.5				

The distribution of the calanoid copepod *Acartia tonsa*, is given in Table 19. *A. tonsa* appears to have a negative response to initial inputs of freshwater. This response may be the result of the physical displacement of *A. tonsa* by the inflow of freshwater and not a response directly related to salinity since high population densities of *A. tonsa* have been found at low salinities.

Table 19. Total # *Acartia tonsa* /m^3 By Station.

Date	45	603	65	613	85	623	633
Nov. 84	355	1,128	1,123	3,646	2,590	3,283	*
Jan. 85	17	119	94	258	2,265	3,639	*
Mar. 85	0	95	32	270	182	125	424
Apr. 85	0.1	28	0	846	11,513	1,130	849
May 85	0	19	76	518	2,593	263	1,287
June 85	136	886	124	1,291	6,420	11,092	25,608

When densities of A. tonsa are compared with standing crop values it is evident that the A. tonsa is numerically dominant in the Lavaca Bay system (Table 20). Fluctuations in total zooplankton standing crop values are positively correlated ($r^2 = 0.91$) with changes in the standing crop of A. tonsa. The dominance of A. tonsa indicates that it is probably an important component in the food chain. Determination of its use as food by higher trophic levels would be important.

Table 20. Zooplankton Standing Crop/m^3 By Station.

Date	45	603	65	613	85	623	633
Nov. 84	379	1,573	1,742	7,424	3,671	3,938	*
Jan. 85	3,018	1,255	1,468	906	3,656	4,515	*
Mar. 85	3,294	657	2,316	1,801	1,985	983	7,961
Apr. 85	158	66	40	2,328	14,220	1,984	1,218
May 85	608	74	200	833	2,905	400	2,469
June 85	279	1,064	705	1,722	7,781	24,440	34,889

Benthic macrofauna work up is complete through July. A list of species collected is given in Table 21, page 49.

Sediment from stations 85, 623, 633, 1905, and near channel marker #35 and 36 in the lower bay was collected in August to provide Dr. Parker and Dr. Pulich with additional benthic infauna for carbon isotope analyses.

The total density /m^2 of macro-infauna and the total numbers/m^2 of four of the most common species, chironomid larvae, Streblospio benedicti, Mediomastus californiensis, and Hobsonia florida, are listed by date and station in Tables 22-26. Chironomid larvae are found throughout the year and have a preference for sites influenced by freshwater. Streblospio benedicti, mainly a surface deposit/suspension feeder and Mediomastus californiensis, a burrowing, deposit feeder, showed no seasonal trends or direct response to freshwater inflow, however, low densities and sporadic occurrences were observed at station 45. The only polchaete to exhibit any seasonal preferences was Hobsonia florida which was most numerous April through June.

Table 22. Macro-Infauna /m^2 By Station.

Date	45	603	65	613	85	623	633	1905
Nov. 84	3842	17,628	12,656	1,130	25,538	15,368	*	15,368
Jan. 85	30,058	8,362	13,560	3,164	26,894	22,826	*	*
Mar. 85	14,916	10,622	20,566	8,136	23,052	39,550	17,176	*
Apr. 85	18,306	23,278	16,272	4,746	18,306	23,278	15,820	*
May 85	4,294	7,232	23,052	5,424	22,600	32,996	4,746	*
June 85	30,736	16,272	28,024	12,656	24,182	22,600	6,554	*
July 85	18,532	4,068	22,600	14,464	22,374	20,114	3,842	*

Table 23. Total Chironomid Larvae /m^2 By Station.

Date	45	603	65	613	85	623	633	1905
Nov. 84	452	226	678				*	
Jan. 85	17,854	1,582	678	226		226	*	*
Mar. 85	9,452	1,130	3,616	1,808		226		*
Apr. 85	10,170	8,814	2,486		452	452	1,582	*
May 85	2,486	2,938	2,034	678	452	226	226	*
June 85	26,668	5,424	5,650	4,068		226	904	*
July 85	11,300	1,808	2,034	2,712		226		*

Table 24. Total Streblospio benedicti /m^2 By Station.

Date	45	603	65	613	85	623	633	1905
Nov. 84	678	12,430	226	678	4,972	12,430	*	4,294
Jan. 85	2,938	4,520	226	226	8,362	9,266	*	*
Mar. 85		7,006	226		3,390	11,978	5,876	*
Apr. 85	1,130	5,650	678	678	2,712	2,260	1,582	*
May 85		3,842	678	2,034	4,068	7,458	452	*
June 85		3,616	3,390	3,616	7,910	4,294		*
July 85	226	452	11,978	10,848	8,588	4,068	1,582	*

Table 25. Total Mediomastus californiensis /m^2 By Station.

Date	45	603	65	613	85	623	633	1905
Nov. 84	226	1,808	7,006		18,758	2,034	*	4,520
Jan. 85	226		5,876	678	12,204	9,266	*	*
Mar. 85			8,362	452	16,498	13,786	3,390	*
Apr. 85	226		8,362	1,582	12,430	6,102	2,034	*
May 85	1,130	226	7,910	1,356	15,594	15,142	678	*
June 85		226	7,684	1,356	11,526	12,204	2,938	*
July 85		226	4,068	226	12,430	11,300		*

Table 26. Total <u>Hobsonia florida</u> /m^2 By Station.

Date	45	603	65	613	85	623	633	1905
Nov. 84							*	
Jan. 85				452		226	*	*
Mar. 85						678		*
Apr. 85	1,808	1,582	678	226	226	2,712	452	*
May 85		226	452		1,130	3,390	452	*
June 85	1,582		6,554	452	904	678	226	*
July 85	3,164		226					*

* Station not sampled.

Meiofauna samples have been worked up for November, January and March. These data will be useful in determining benthic food availibility for bottom feeding larval and juvenile fish such as the Atlantic croaker.

Sediment from each station was collected in August and is currently being processed for grain size analysis.

Table 17. Lavaca Bay Zooplankton Species List, November 1984 - June 1985.

- PHYLUM COELENTERATA
  - Class Hydrozoa
    - Medusae
  - Class Anthozoa
    - Anemone
- PHYLUM CTENOPHORA
  - Class Tentaculata
    - *Mnemiopsis mccradyi*
- PHYLUM PLATYHELMINTHES
  - Class Turbellaria
    - Order Acoela
      - Flatworm
- PHYLUM NEMERTINEA
  - Nemertean
- PHYLUM ROTIFERA
  - *Brachionus plicatilis*
  - *Platyias quadricornis*
  - *Platyias patulus*
  - Rotifer (unidentified)
- PHYLUM KINORYNCHA
  - Kinorynch
- PHYLUM NEMATODA
  - Nematode
- PHYLUM ANNELIDA
  - Class Polychaeta
    - Polychaete larvae
  - Class Oligochaeta
    - Oligochaetes
  - Class Hirudinea
    - Leech
- PHYLUM MOLLUSCA
  - Class Gastropoda
    - Gastropod larvae
  - Class Pelecypoda
    - Pelecypod larvae
- PHYLUM ARTHROPODA
  - Class Arachnida
    - Order Acarina
      - Hydracarina (water mites)

Class Crustacea

Order Diplostraca

Sididae

Diaphanosoma sp.

Daphnidae

Ceriodaphnia sp.
Daphnia sp.
Moina sp.
Moinodaphnia sp.

Bosminidae

Bosmina sp.

Macrothricidae

Ilyocryptus spinifer
Macrothrix sp.

Chidoridae

Leydigia acanthoceroides

Order Podocopa

Ostracod (unidentified)

Order Calanoida

Paracalanidae

Paracalanus crassirostris

Centropagidae

Centropages hamatus
Centropages velificatus

Diaptomidae

Diaptomus spp.
Pseudodiaptomus coronatus

Temoridae

Eurytemora hirundoides

Pontellidae

Labidocera aestiva

Acartiidae

Acartia tonsa

Tortanidae

Tortanus setacaudatus

Order Harpacticoida
Canuellidae
Scottolana canadensis

Harpacticidae
Harpacticus sp.

Tachiidae
Euterpinna acutifrons

Unidentified
Harpacticoid

Order Cyclopoida
Oithonidae
Oithona colcarva

Cyclopidae
Cyclopoid copepodids
Cyclops sp.
Eucyclops agilis
Eucyclops speratus
Halicyclops sp.
Hemicyclops sp.
Macrocyclops albidus
Mesocyclops edax
Tropocyclops prasinus

Clausidiidae
Saphirella sp. A
Saphirella sp. B

Ergasilidae
Ergasilis sp.

Lichomolgidae
Lichomolgid A

Unidentified
Cyclopoid Copepodids
Copepid Nauplii (Calanoid, Harpacticoid and Cyclopoid combined)

Order Caligoida
Caligidae
Caligus sp. metanauplius
Caligus sp.

Argulidae
Argulus alosae

- Order Thoracica
  - Barnacle nauplii
  - Barnacle cypris larvae
- Order Mysidacea
  - Mysidae
    - *Mysidopsis almyra*
    - *Mysidopsis* sp.
- Order Tanaidacea
  - *Leptochelia rapax*
- Order Isopoda
  - Idoteidae
    - *Edotea triloba*
  - Cymothoidae
    - *Aegathoa oculata*
  - Bopyridae
    - Bopyrid A
  - Munnidae
    - *Munna* sp.
- Order Amphipoda
  - Corophiidae
    - *Corophium louisianum*
  - Gammaridae
    - *Gammarus mucronatus*
  - Oedicerotidae
    - *Monoculodes nyei*
- Order Decapoda
  - Palaemonidae
    - *Macrobrachium* sp. Zoea
    - *Palaemonetes* sp. Zoea
  - Penaeidae
    - *Penaeus aztecus* postlarvae
    - *Penaeus setiferus* postlarvae
  - Ogyrididae
    - *Ogyrides limicola* Zoea
  - Callianassidae
    - *Callianassa* sp. Zoea
  - Portunidae
    - *Callinectes* spp. megalops

Xanthidae

Rithropanopeus harrissi Zoea

Pinnotheridae

Pinnixa sp. Zoea

Ocypodidae

Uca sp. Zoea

Unidentified

Brachyuran Zoea

Brachyuran megalops

Class Insecta

Order Ephemeroptera

Mayfly larvae

Order Chironomidae

Midgefly larave

Midgefly pupae

Class Tardigrada

Tardigrade (water bears)

PHYLUM BRYOZOA

Cyphonautes larvae

PHYLUM CHAETOGNATHA

Saggita sp.

PHYLUM CHORADATA

Class Larvacea

Oikopleura sp.

Miscellaneous

Unidentified (colonial rotifer?)

Table 21 Lavaca Bay Macrobenthos Species List, November 1984 - June 1985

PHYLUM NEMERTINIA (=Rynchocoela)
Nemerteans (unidentified)

Phylum Mollusca
Class Gastropoda
Pyramidellidae
Odostomia laevigata
Odostomia cf. gibbosa

Acteonidae
Acteon punctostriatus

Class Pelicypoda
*Lyonsiidae
*Lyonsia hyalina floridana

Solenidae
Ensis minor

Tellinidae
Macoma mitchilli

Mactridae
Mulinia lateralis

Solecurtidae
Congeria leucophaeta

PHYLUM ANNELIDA
Class Polychaeta
Pilargiidae
Sigambra tentaculata
Ancistrosyllis jonesi
Loandalia americana

Hesionidae
Gyptis vittata

*Syllidae
Syllid (unidentified)

Neriidae
Neriid juvenile
Laeoneris culveri
Nereis succinia

Spionidae
Polydora socialis
Streblospio benedicti

Cossuridae
Cossura delta

Capitellidae
Capitella capitata
Mediomastus californiensis
Heteromastus filiformis

*Maldanidae
Asychis sp.

Ampharetidae
Hobsonia florida

*Serpulidae
Serpulid (unidentified)

Class Oligochaeta
Oligochaetes (unidentified)

Class Hirudinea
Leeches (unidentified)

PHYLUM ARTHROPODA
Subclass Ostracoda
Order Myodocopa
**Sarsilla texana*

Class Crustacea
Subclass Copepoda

Order Cyclopoida
Cyclopidae
Hemicyclops sp.

Lichomolgidae
Cyclopoid copepod (commensal)

Subclass Malacostraca
Order Mysidacea
Mysidopsis sp. juvenile
Mysidopsis almya

Order Cumacea
**Eudorella monodon*

Order Tanaidacea
Tanaidae
Leptochelia rapax

Order Isopoda
Idoteidae
Edotea montosa

Order Amphipoda
Oedicerotidae
Monoculodes nyei

Corophiidae
Corophium louisianum

Order Decapoda
suborder Reptantia
Portunidae
Callinectes sapidus

Class Insecta
Order Diptera
Chironomidae
Chironomid larvae
Chironomid pupa

*Indicates animals collected from station 1905 which was sampled only in November, 1984.

LAVACA BAY FINFISH AND SHELLFISH

All required samples from the finfish-shellfish section of the Lavaca Bay project have been taken and are accounted for in the laboratory. Laboratory workup is complete for all trawl, seine and sled smaples through the June sample period. Icthyoplankton samples have been sorted (i.e. the fish removed from the sample and separated roughly by species) but species identifications have not been completed. The data for trawl, seine and sled samples from November, January, and March have been entered into the computer but these data have not been completely analyzed. Therefore the following discussion is based primarily on a visual perusal of the data and may be subject to revision following an extensive computer-based data analysis.

Finfish and shellfish were collected in the Lavaca Bay delta using four types of collecting equipment. Listed in order of mesh size they were: 0.5 m diameter icthyoplankton net with .505 mm mesh towed at the surface in open water away from the shoreline; a benthic sled with 1.8 mm mesh pulled by hand in shallow water along the shoreline; a 6 m bag seine with 3.2 mm mesh pulled 9.4 m along the shoreline; and a 3.1 m trawl with 15 mm stretched mesh in the bag with a 7 mm mesh liner pulled by boat in the same area as the icthyoplankton net.

Despite the persistent low salinity in the study area, especially during the November to May period, the icthyofaunal community of the Lavaca Bay delta is primarily marine in origin. The only species with freshwater affinities which were even moderately abundant were blue catfish and freshwater shrimp. The dominant species were those typically associated with primary and secondary bays in Gulf coast estuaries. The majority of these species have a "typical" life history for estuarine fishes in that the adults live offshore or in the higher salinity portion of the estuary and the larvae and young juveniles utilize the lower salinity secondary and tertiary bay as nursery areas.

During the winter period (November-March) the most common species were Atlantic croaker, Gulf menhaden, brown shrimp, and white shrimp. These species were taken in all sampling gears and at all stations indicating their wide distribution in the delta. Atlantic croaker averaged 25 to 30 mm (standard length) in the trawl samples and 12 to 18 mm in the sled samples. Gulf menhaden averaged 25 to 45 mm and 15 to 22 mm in the trawl and sled samples respectively. The small size of these individuals (relative to adult sizes of 300 to 500 mm for both species) indicates the importance of the Lavaca River delta as a nursery area for both species. It should be noted that the differences in size range between gear types reflects size selectivity of the samplers and does not necessarily indicate size segregation by habitat for these species. Size data for these species from the icthyoplankton samples was not available as of this writing but both species were taken in the icthyoplankton samples and they will obviously have the smallest size range.

Brown shrimp averaged 50 to 65 mm and 12 to 20 mm (total length) in the trawl and sled samples respectively while white shrimp averaged 50 to 65 mm and 25 to 35 mm. Small (less than 20 mm) white shrimp were not collected during the winter period but postlarvae of that size were quite abundant during the summer months. One thing of interest regarding the shrimp collections was that both species were quite common in the November collections but were essentially absent in the December and March collections. Low water temperatures, which averaged 15°C in November and declined to 6°C in December, may have either killed or driven out the shrimp during this period. Brown shrimp were relatively abundant again in April through June but white shrimp were not abundant until June and July. This problem will be addressed in detail when all the data are available for analysis.

During the "summer" months (April - August) Gulf menhaden and bay anchovy continued to be the dominant fish species while brown shrimp and blue crabs were the dominant shellfish, although grass shrimp were often an important component of the seine and sled samples. Atlantic croaker continued to be one of the dominant species, especially in the trawl collections, but they were much less abundant than during the winter. This decline in catch was due to a combination of growth, which allowed them to avoid the small-mesh sled and seine, and to emigrate into the primary bays which could result in an actual decline in abundance in the delta area.

Other species of interest which were much less abundant in the collections but were regularly encountered include spot, southern flounder, sand seatrout, and spotted seatrout. The latter species was only encountered in the June - August samples. The wide size range (12 - 100 mm) found at the same location at the same time is indicative of the long spawning period of this species and the analysis of the icthyoplankton samples should show whether spotted seatrout spawn in the delta area. it should be emphasized that all collecting gear is size selective and the absence of spotted seatrout greater than 100 mm is a sampling artifact and not representative of the population structue in the delta.

There are no doubt important spatial differences in the ichthyofaunal community structure within the study area and these will be analyzed in detail when all the data are available on the computer.

A very limited stomach content analysis was done by Wen Lee and Mia Tung Li looking at Atantic croaker from the March samples at stations 613, 623, and 633. Meiofauna samples from these sites were analyzed by Rick Kalke. These data will be compared using electivity indices and other appropriate analysis to look at food selectivity by Atlantic croaker. Preliminary data show that the primary foods (ranked in descending order by number of individuals) of Atlantic croaker 21 - 30 mm standard length are: *Sottolana canadensis* (a relatively large harpactacoid copepod), nematodes, unidentified harpactacoids A and B (but not *Scottolana*), and a variety of other crustaceans and polychaetes. In contrast, the meiofauna data indicated that nematodes were by far the most numerous organisms, constituting 65 to 85 percent of the individuals in all samples. *S. canadensis* were only 1.3 to 5.5 percent of the total individuals in the sample and were usually lower in abundance than other harpactacoids and copepod nauplii. Thus it appears that Atlantic croaker are selecting for *S. canadensis* and against other harpactacoids and copepod nauplii. Further analysis of these data will be completed in the coming year.

ISOTOPES AND MARSH PLANT INPUT

Total Kjeldahl nitrogen has been determined for 105 water samples through the July sampling period. These data are listed in the Tables with other water quality parameters. Dissolved/particulate organic carbon samples have been processed through July, but data calculations are not available except for carbon isotope ratios. Table 27 lists $\delta^{13}C$ values for dissolved organic carbon through April.

The 12 bottom sediment samples collected during April (7 Lavaca River and Bay stations + 5 Matagorda Bay sites) have ben processed for total organic carbon and $\delta^{13}C$ analysis; the data will be calculated shortly.

All samples of biota collected on November and January trips have been analyze for $\delta^{13}C$ ratios. This amounts to approximately 140 November samples (Table 28) and 80 January samples (Table 29).

Biota samples collected in net trawls and seine hauls during April have been processed for carbon isotope analysis through the drying stage. This includes approximately 125 fish, shrimp, crab, and oyster samples available for mass spectrometry.

A variety of benthic infauna have been analyzed for $\delta^{13}C$ ratios (Table 30). Additional benthic samples were taken during August from two Matagorda Bay sites; these are currently being analyzed by mass spectrometry. Zooplankton samples were specially collected during April and July for $\delta^{13}C$ analysis; these are currently at the mass spectrometry stage of processing. The zooplankton data should be a direct measurement of the carbon isotope ratio of the phytoplankton part of the food chain in the bay, which is thus far lacking.

Discussion. Since the maximum experimental error in the technique is +0.30‰ all differences between samples greater than this are significant. From two seasons' sampling, the maximum biological variability between individuals of the same species at any one station is at most ca + 1.5 ‰ or a range of 3 ‰. This indicates that average differences between stations for any one species are significant, if greater than 3 ‰.

The terrigenous or marsh plant influence on the Lavaca Bay system is clearly evident in the carbon isotope ratios of some aquatic biota (Tables 28, 29, 30). Estuarine phytoplankton samples would normally have $\delta^{13}C$ values of about -19 ‰ while vascular plants (particularly the dominant marsh plants in this system, Juncus and Iva) had values > -25‰.

From the November data set, it is apparent that penaeid shrimp ranged from ca -21.5 ‰ upriver (stations 45 and 603) to -20.7 at station 85. This suggests essentially the same carbon source was available to all shrimp in the river and upper Lavaca Bay, and this would correspond to considerable input of vascular plant detritus. However, at station 1905 in Matagorda Bay, penaeid shrimp were signifivantly heavier (-17 ‰, indicating a dependence on plant carbon in the range of benthic diatoms or other epiphytic algae. A similar trend is evident for oysters which had ratios of -26 ‰ at Lavaca Bay stations, but were ca 3 ‰ heavier (-23 ‰) in Matagorda Bay, probably reflecting more input from phytoplankton carbon at this site.

Table 27. List of $\delta^{13}C$ values for dissolved organic carbon in water samples from Lavaca and Matagorda Bays during 1985.

Station	January	March	April
45	-22.61	-22.60	-24.06
65	-22.73	-22.41	
603	-22.49	-	-22.57
613	-22.43	-23.94	-23.88
85	-22.77	-	-
623	-18.97	-17.76	-21.52
633	-	-	-19.03
1505	-	-20.01	-22.63
1905	-		

Table 28. List of $\delta^{13}C_{PDB}$ of Lavaca Bay and River Stations for November 1984

Station	Leaf detritus	Zooplankton Tow	Palaemonetes	Penaeid (white) shrimp	Oyster	Rangia or mussel	Blue crab
45	-26.74 (broad leaves mostly)		-19.95(10)	-21.19(8)			-19.86 small -20.53 claw -20.03 body
603	-25.60 (Juncus mostly)	-22.10	-19.00(10 muscle) -19.02 (chitin)	-22.45(4)			-16.81 (7 cm) -17.03 (2 small)
65	-28-24 (elm lvs mostly)	-24.53	-18.55 (2 cm) -19.54 (3 cm)	-21.06 (5 cm) -21.85 (6 cm) -21.23 (7 cm)		Rangia -26.08 whole body	-18.03
613	-25.09 (Juncus & broad leaves)			whites -21.39 (2 cm) -18.98 (2.5 cm) -19.16 (3 cm) -22.32 (3 cm) -18.42 (3 cm) -18.55 (3.5 cm) -19.12 (3.5 cm) -20.43 (6 cm) browns -21.03 (3.5 cm) -21.01 (5 cm) -22.03 (5 cm)		Rangia adductor -24.02 gut -26.27	
623	-24.96		-19.63(8)	-19.51(4)	puree(7) -26.79	mussels(4) -26.38	-24.03 small whole -19.16 large muscle
85	-20.95 (S. patens? mostly)	-28.29	-18.81(10)	-19.71 (large) -21.72 (small) -21.09 (chitin tails)	puree(10) -26.23	mussel puree' -26.71	-21.04 (body-1-large) -23.05 (4 < 2 cm whole)
1905		-25.34		-17.34(4)	puree'(2) -23.42 add.muscle -20.32		-18.42 muscle

Table 28. (Cont.) List of $\delta^{13}C_{PDB}$ of Lavaca Bay and River Stations for November 1984

Station	Menhaden	Anchovy	Croaker	Menidia	Fundulus	Cyprinodon
45	-23.34	-22.35 (10 large) -22.32 (20 small)	-22.83 (10 small) -23.78 (10 large)	-20.41(8)	-16.61 (6 cm) -15.97 (4 cm)	-17.40 (3.5 cm) -17.49 (2.5 cm)
603	-23.09	-20.82 (3 x 2.2 cm)	24.28 (2 cm) -23.25 (3 cm)	-18.90(3.5cm) -20.76(2.5cm)	-20.15 (3cm) -17.43 (4cm) -17.03 (8cm)	-18.20 (3) -17.03 (2
65		-23.13(2)	-24.53 (3 cm) -24.28(3.5cm)	-17.12(8)	-14.95(3.5cm) -16.44 (6cm)	-16.51 (2.5cm) -15.75 (3.5cm)
613	-23.28(6) (wide) -20.42 (young,thin)	-21.24 (2.5 cm)	-19.94 (1 cm) -22.52(1.6cm) -23.51(2.4cm)	-22.32(2 cm)	-16.48(2.5cm) -16.63 (5 cm)	-17.64(8)
623	-24.11(4cm) -24.44(5cm)	-21.64(4)	-22.56(<2.5cm) -21.14(>3 cm)		-14.86(3.5cm) -15.40(9.5cm)	-16.68(10) -17.89 (large)
85		-21.90(3)	-22.46 (2.1cm) -23.24 (2.5cm) -23.18 (2.7cm) -23.13 (3.3a) -22.28 (3.3b) -22.52 (3.8) -22.27 (4.5cm) -20.10 (4.8) -21.93 (open bay-8)	-20.23(3)	-19.13(18)	-18.26(<3.5cm) -19.91(>3.5)
1905			-20.60 (<3 cm) -20.21 (3.5cm)			

Table 29. List of $\delta^{13}C$ values for 1985 January samples from Lavaca Bay and Lavaca River

Station	Leaf detritus	Zooplankton Tow	Palaemonetes	Blue crab	Mullet	Misc.
45	-22.79	-	-20.10±.20 (10)	-	-19.14(10) (whole, 2-3cm) 13cm fish -18.09 backbone -17.96 muscle -14.13 scales -20.42 liver -16.26 skin	Blue catfish tails -24.06 (2) Juncus -25.54±.03 S. patens -12.14 Phragmites-25.48 Iva -27.86
603	-26.51	-24.00	-19.10(6)	-18.90(2) (claw muscle)	-18.80(1)	-31.52 cladophora -24.89 mysid shrimp (9)
65	-24.62	-	-19.95(10) (2.5 cm)	-24.24 (1.8cm whole)	-18.89 (8) (2.5cm)	Iva -29.20
613	-	-24.24	-20.10(6)	-24.72 (1cm,whole)	-	-
623	-25.93	-	-18.49(10)	-	-18.31(10) (2 cm)	-19.02 amphipods (15) -24.55 ectocarpus
85	-26.35	-21.74	-18.83(10) (2.5 cm)	-20.98(1) (claw muscle)	-17.91 (5) (whole) -18.22 (10) (2.2 cm, tails)	-20.39 cladophora -20.54 ctenophore -20.64 amphipods (8)

Table 29. Continued.

Station	Menhaden	Anchovy	Croaker	Menidia	Fundulus	Cyprinodon
45	-22.70 (5) (whole,2cm) -21.84(10) (tails,2cm)	-	-20.97(10) (2-3cm)	-19.41(5) (4.2cm)	-22.19 (2) (> 3cm)	-17.57±.30 (10)(2-3cm)
603	-21.79(10) (2cm thin)	-	-19.34 (5) (1.5-3 cm)	-	-19.52 (4) (2 cm) -17.70 (3) (> 5cm)	-16.44(10) (2-3 cm)
65	-20.88(10) (2-2.5 cm)	-22.50(2) (2.2 cm)	-22.91(12) (1-2 cm) -23.27 (6) (>2.5 cm) -23.61 (6) (whole,1-2cm)	-21.18(6) (3 cm)	-17.88 entire tail -19.44 (2) (whole,1.5cm)	-17.61(5) (3.5 cm)
613	-25.08 (4) (2.5 cm)	-25.87(2) (2.2 cm)	-	-	5.5cm fish -18.30 tail muscle only) -17.57 skin + scales	-17.89 (6) (2.7 cm)
623	-	-	-20.73 (7) (< 1 cm, whole)	-	-16.04 (5) (3.7 cm) -16.20 (2) (6 cm)	-17.41 (7) (2 cm) -15.07±.22 (5)(2.7cm)
85	-22.34 (9) (whole,2.2cm) -22.16(14) (tails,2.2cm)	-	-20.57 (4) (2.2cm)tails	-18.19(3) (tails,5cm)	-17.88 (3) (tails,3cm)	-16.35±.08 (10)(2.5cm)

Table 30. List of $\delta^{13}C$ values for benthic invertebrates collected from Lavaca Bay and Lavaca River during 1985 and month indicated at each station.

Sample	85 (May)	623 (June)	613 (April)	65 (April)	45 (April)	603 (April)
Detritus		-22.26	-24.42	-24.10	-25.24	-25.63
Mediomastis	-22.10		-22.49	-24.24		
Hypaniola	-23.33					-23.46
Nereis	-19.88					
Heteromastis		-19.44				
Loandalia	-21.57					
Laeanereis		-20.67				
Oligochaete			-22.27	-23.75		-21.58
Edotea	-20.50					-22.04
Myrophis					-21.68	
Nemertene					-23.20	
Chironomid Larvae	-22.66				-28.95	-24.06
Chironomid Pupae						-24.05
Streblospio	-21.61					-23.70
Macoma		-21.76				
Mulinia				-27.14		-24.14
Tellina				-23.42		
Average (animals)	-21.66 ± 1.19	-20.62 ± 1.16	-22.38 ± 0.09	-24.63 ± 1.70	-24.61 ± 3.83	-23.69 ± 1.05

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