GROWTH OF *SYRINGODIUM FILIFORME* IN THERMALLY STRESSED AND UNSTRESSED AREAS OF THE ANCLOTE RIVER ESTUARY, TARPON SPRINGS, FLORIDA

by

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A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in the Department of Marine Science
in
The University of South Florida

March, 1976

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DESCRIPTION OF STUDY AREAS

Experimental Station

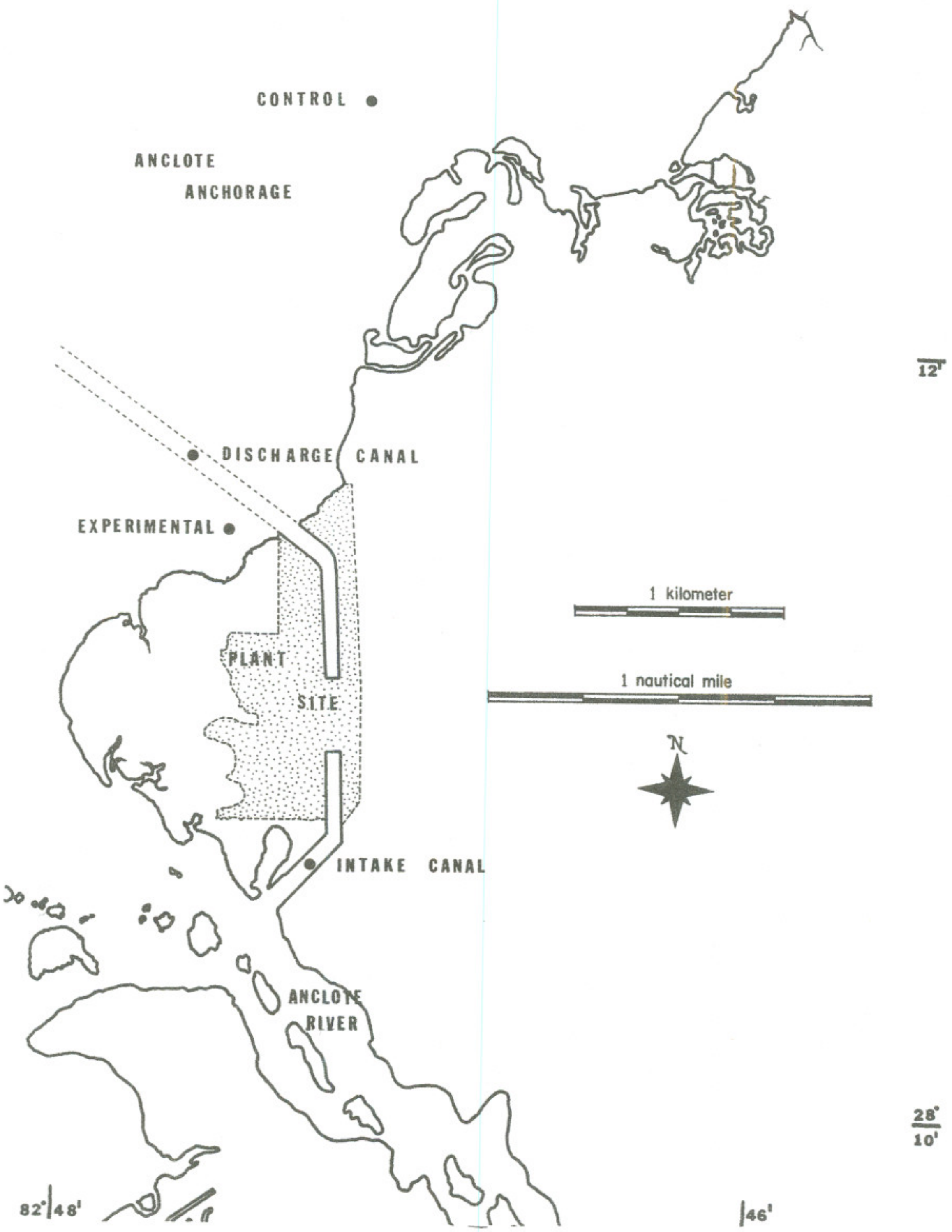
The experimental station (Figure 1) is a seagrass area about 100 meters west of the Anclote radar station and 50 meters south of the discharge canal from the power plant. The area is under the direct influence of the thermal plume from the discharge canal. All three of the most abundant species of seagrasses were present in pure and mixed stands. Bottom sediments at this station were firm and sandy at the beginning of the study. As time progressed a soft silty layer was deposited on top of the sand. Water clarity was generally poor. Water depth was 0.75 meters at mean low water.

Control Station

The control station (Figure 1) is a seagrass area similar to the experimental but not under the influence of the thermal discharge. It is located about 500 meters northwest of Bailey's Bluff. Bottom sediments were not as firm as the experimental, but there was no distinct silty layer on the top and no change in the bottom sediments during the course of the study. Water clarity was generally good. Water depth was 1.5 meters at mean low water. Tidal amplitude was about 1 meter at both stations.

Figure 1

Locations of control and experimental stations in the Anclote estuary, Tarpon Springs, Florida.


CONTROL
ANCLOTE
ANCHORAGE
DISCHARGE CANAL
EXPERIMENTAL
PLANT
SITE
INTAKE CANAL
ANCLOTE
RIVER
1 kilometer
1 nautical mile
N
12'
28°
10'
82°|48'
|46'

RESULTS

Physical and Chemical Factors

Salinity

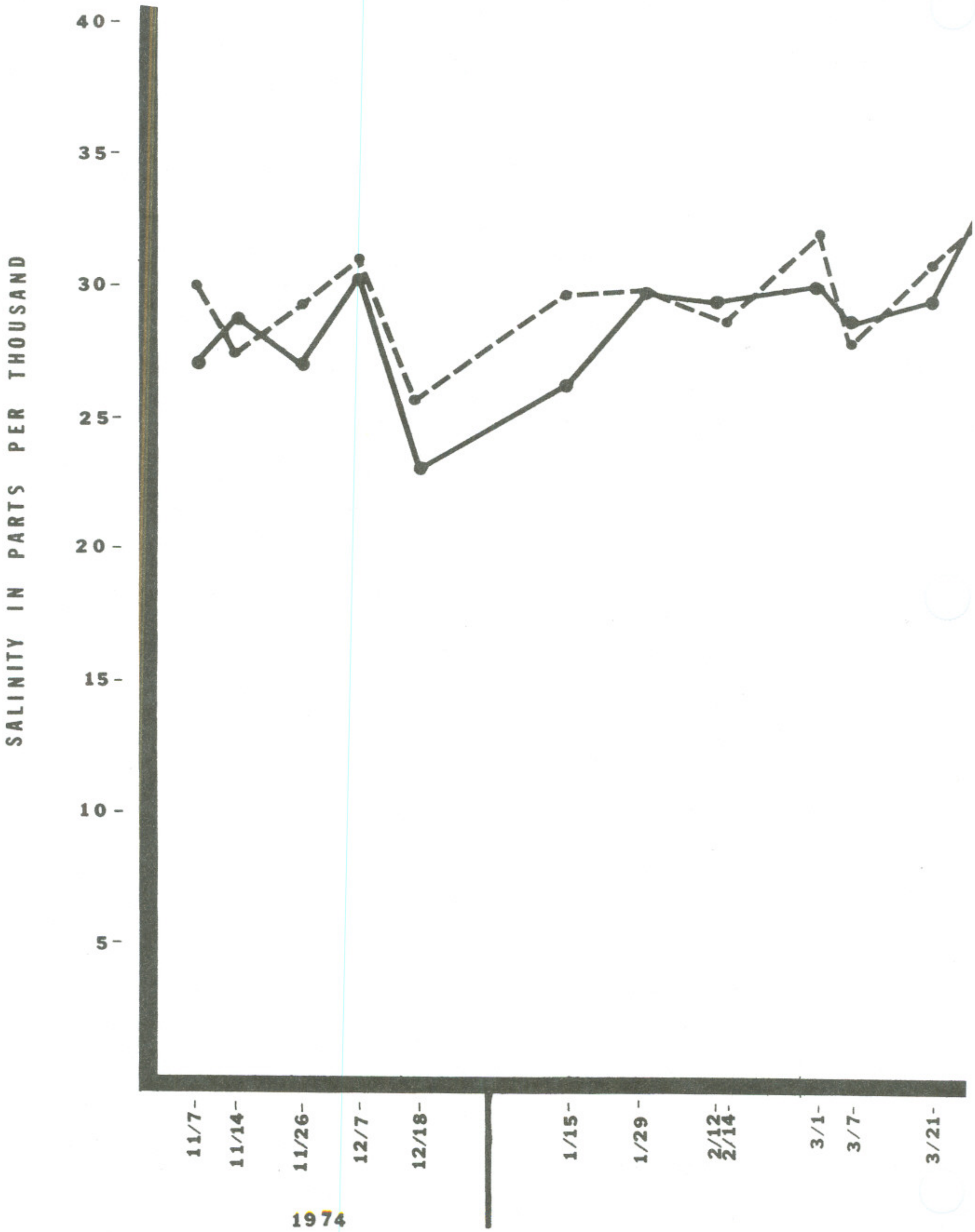
Salinities at the control and experimental stations generally show little difference (Figure 5). The average salinity was 30.74 ‰ at the control station and 31.06‰ at the experimental station. The range of salinities at the control station was 23.20 to 35.40 ‰ and at the experimental station was 25.70 to 35.20 ‰. The lowest salinities occurred at both stations in December followed by a progressive increase with highest salinities in May and June. After June a gradual decline in salinities began, coincidental with the start of the rainy season and increase in flow of the Anclote River.

From November, 1974, to late July, 1975, salinities at the control station were generally a little lower than those at the experimental station. During August and September, 1975, the reverse was true. The salinity data of 1974-1975 is consistent with the records of previous years in the area (Behrens, 1975).

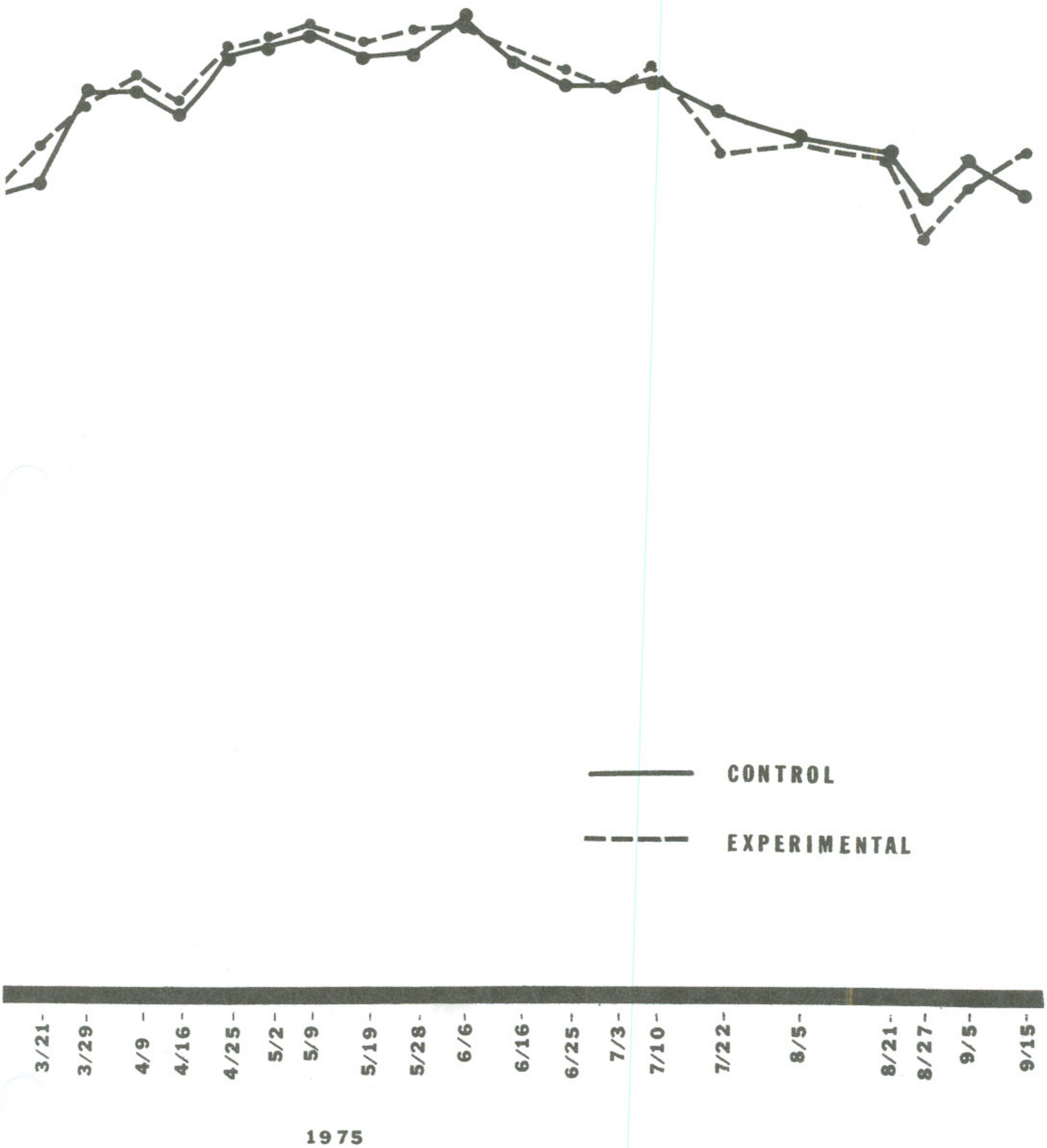
The maximum salinity difference between stations at a given time was 2.9 ‰ and the usual difference was

Figure 5

Salinities at the control and experimental stations from November 7, 1974, to September 15, 1975.



SALINITY IN PARTS PER THOUSAND
40
35
30
25
20
15
10
5
11/7
11/14
11/26
12/7
12/18
1/15
1/29
2/12
2/14
3/1
3/7
3/21
1974


CONTROL
EXPERIMENTAL
3/21
3/29
4/9
4/16
4/25
5/2
5/9
5/19
5/28
6/6
6/16
6/25
7/3
7/10
7/22
8/5
8/21
8/27
9/5
9/15
1975

less than 1 ‰. It is unlikely that such small differences in salinity could account for any differences in seagrass behavior. Phillips (1960) reports that the optimum salinity for <u>Syringodium</u> is over 20 ‰. In this study there were no salinities of less than 20 ‰ recorded.

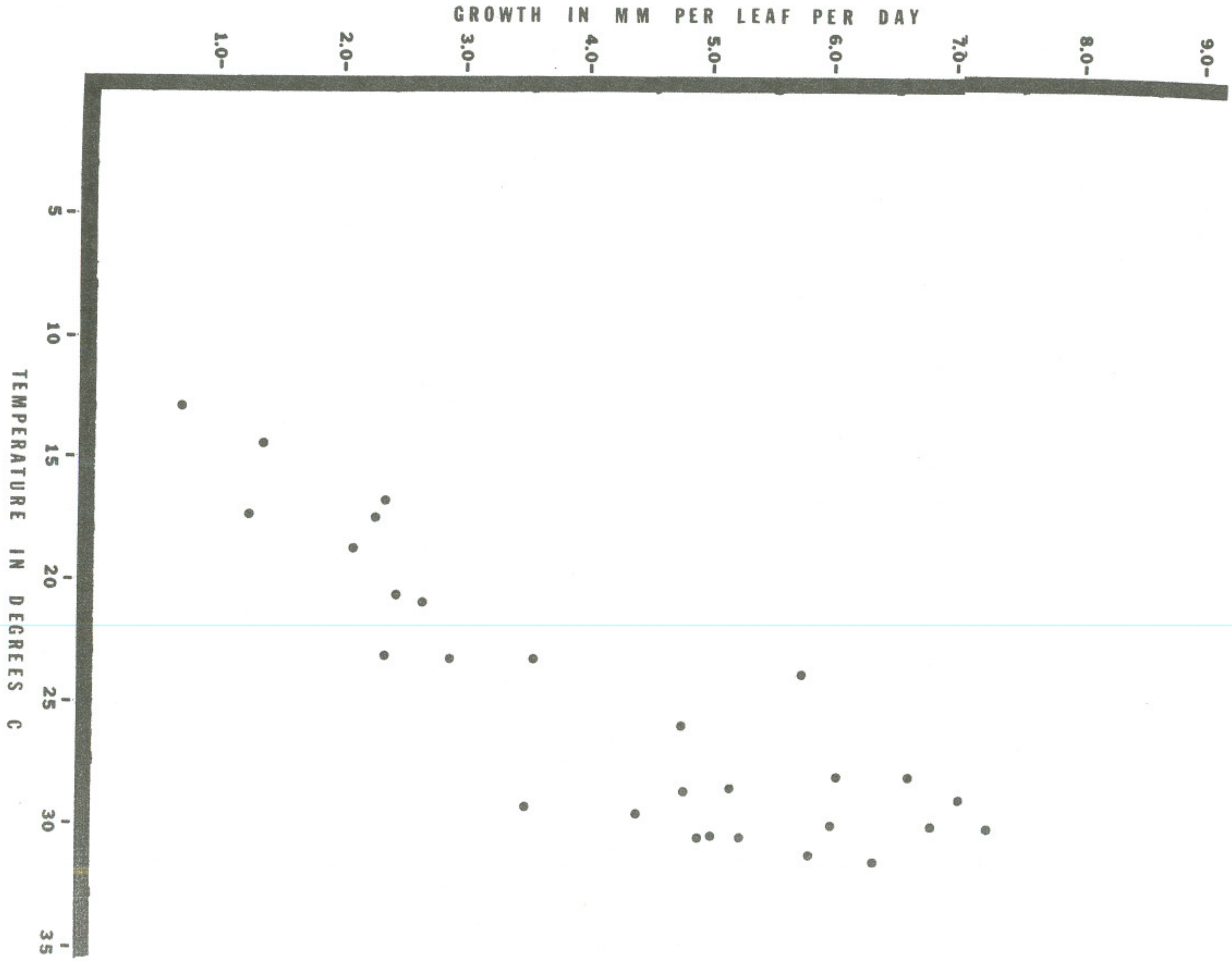
Temperature

Water temperature data from November 7, 1974, to September 15, 1975, is shown graphically in Figure 6. Water temperature at the control station ranged from 10.8° C on January 15 to 31.4° C on June 16. At the experimental station the range was from 15.5°C on January 15 to 34.0° C on June 16. The average temperature for the period October 31, 1974, to September 15, 1975, at the control station was 24.56° C and for the experimental station 27.07° C. Temperatures at the experimental station were 1.0 to 5.0° C higher than those of the control station (Table 1). The average difference of 2.51° C is significant at the 95 per cent level. The average difference of 2.51° C is in agreement with the projected rise of 2.78° C over ambient used in the model devised by Palmer (1975).

During the critical warm months from May through mid-September, the water temperature at the control station ranged between 28.0 and 31.4° C and between 29.0 and 34.0° C at the experimental station. At the experimental station from May 28 to September 15 the water temperature was continuously over 31.0° C.

Figure 10

Scattergram of growth in millimeters per leaf per day at the control station versus the temperature at which the growth took place.



GROWTH IN MM PER LEAF PER DAY
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
TEMPERATURE IN DEGREES C
5
10
15
20
25
30
35

.27, for growth rates and water temperature over the year does not mean that temperature is not important. What has happened is that the erect branches have been damaged by the continually high water temperatures and are responding with lowered growth rates.

Figure 11, a scattergram of growth rates and water temperature, shows that growth rates are highest between 25 and 30°C. When the water temperature rose above 30°C and persisted at this level for a long period of time there was a considerable reduction in growth rates.

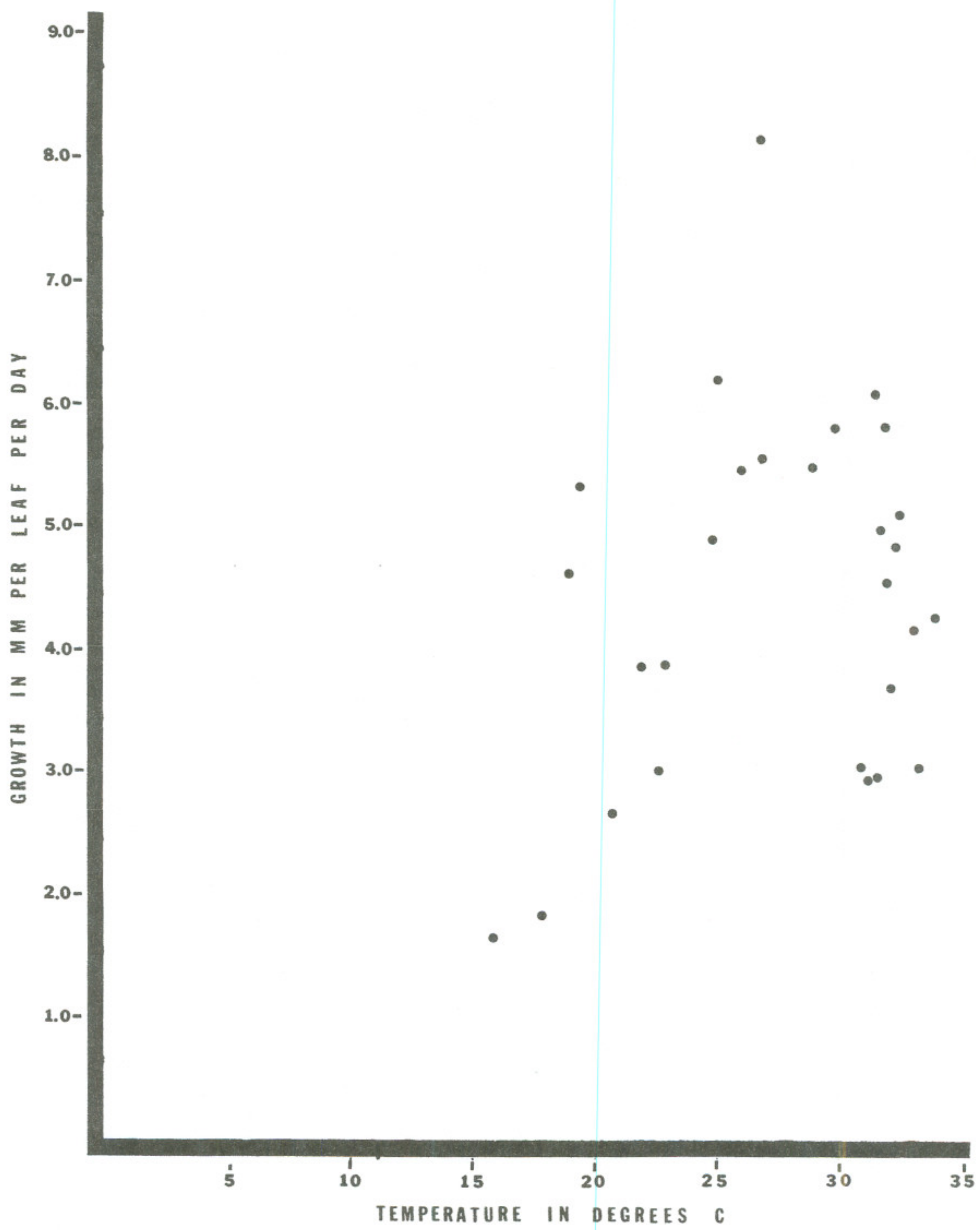
For the period November 7, 1974, to May 2, 1975, Syringodium at the experimental station exhibited a significantly higher growth rate than plants at the control station. During the period May 2 to September 15, 1975, however, growth rates at the control station were significantly higher than those for plants at the experimental station. For the period November 7, 1974 to September 15, 1975, there was no significant difference between the growth rates at the two stations.

Growth as milligrams ash free dry weight per erect branch per day

Syringodium erect branches at the experimental station were of slightly less diameter than the erect branches of Syringodium at the control station. Because of this, growth in millimeters per leaf per day does not give a complete picture of growth patterns. The use of growth in milligrams ash free dry weight per erect branch

Figure 11

Scattergram of growth in millimeters per leaf per day at the experimental station versus the temperature at which the growth took place.



GROWTH IN MM PER LEAF PER DAY
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
5
10
15
20
25
30
35
TEMPERATURE IN DEGREES C

Table 7 Correlation coefficients of growth in millimeters per leaf per day at the control station with temperature, salinity and light attenuation.

Date	Growth	Temp.	Coeff.	Salin.	Coeff.	Light	Coeff.
11/7	5.80	23.8		27.1			
11/14	2.29	17.6		28.7			
11/26	2.38	16.8	.99	27.1	-.52		
12/7	1.38	14.5	.99	30.2	-.68		
12/18	.71	13.0	.99	23.2	.15		
2/12	2.39	23.2	.81	29.0	.14		
3/1	2.13	18.8	.80	30.0	.09	.2661	
3/7	1.26	17.4	.79	28.6	.06	.1440	
3/21	2.48	20.6	.78	29.4	.07	.2661	.96
3/29	2.93	23.2	.76	32.8	.13	.3004	.96
4/9	3.60	23.2	.78	32.7	.24	.2847	.85
4/16	2.70	21.0	.78	32.0	.25	.5761	.43
4/25	4.81	26.0	.83	34.0	.40	.2989	.26
5/2	5.22	28.5	.86	34.3	.51	.5502	.53
5/9	6.87	30.0	.90	34.0	.61	.4454	.54
5/19	6.10	28.0	.91	34.0	.65	.5200	.61
5/28	5.31	30.5	.91	34.1	.67	.3974	.61
6/6	7.37	30.2	.92	35.4	.72	.3575	.52
6/16	6.40	31.4	.92	33.8	.73		
6/25	7.09	29.0	.92	33.0	.73	.3436	.46
7/3	6.66	28.0	.92	33.0	.73	.5638	.52
7/10	4.96	30.5	.91	33.3	.73	.3653	.51
7/22	5.88	31.2	.91	32.1	.73	.6849	.52
8/5	3.55	29.3	.88	31.2	.73	.5680	.45
8/21	5.07	30.4	.88	30.8	.72	.4991	.45
8/27	4.47	29.5	.87	28.5	.70	1.0143	.30
9/5	6.04	30.0	.87	30.5	.68		
9/15	4.85	28.6	.87	29.0	.66	.4778	.30

Table 8 Correlation coefficients of growth in millimeters per leaf per day at the experimental station with temperature, salinity and light attenuation.

Date	Growth	Temp.	Coeff.	Salin.	Coeff.	Light	Coeff.
11/7	8.18	27.0		30.0			
11/14	4.61	19.0		27.5			
11/26	5.33	19.5	.99	29.5	.79		
12/7	1.65	16.0	.96	31.0	-.22		
12/18	1.86	18.0	.92	25.7	.29		
2/14	3.88	22.0	.88	28.5	.20		
3/1	3.04	22.8	.78	32.0	.12	.3313	
3/7	2.70	20.8	.75	27.8	.16	.3566	
3/21	3.89	23.0	.73	30.8	.16	.2216	-.99
3/29	4.90	25.0	.73	32.7	.22	.5113	.50
4/9	5.48	26.2	.74	33.2	.30	.3632	.38
4/16	6.21	25.2	.76	32.4	.37	.8370	.71
4/25	5.58	27.0	.77	34.2	.41	.3875	.63
5/2	5.83	30.0	.75	34.4	.45	.9920	.66
5/9	6.09	31.6	.75	35.2	.49	.5427	.63
5/19	5.49	29.0	.75	34.5	.50	1.1670	.57
5/28	5.84	32.0	.74	35.0	.52	.4742	.54
6/6	4.86	32.5	.69	35.1	.50	1.1063	.45
6/16	4.30	34.0	.61				
6/25	5.11	32.5	.59	33.6	.51	.4669	.45
7/3	5.00	31.8	.58	33.0	.51	.8448	.44
7/10	4.57	32.0	.56	33.7	.50	.3775	.45
7/22	4.18	33.2	.52	32.2	.49	.6163	.43
8/5	3.72	32.2	.47	31.0	.50	.6007	.42
8/21	2.97	31.4	.41	30.7	.50	.5510	.40
8/27	3.05	33.3	.35	27.4	.53	.6795	.35
9/5	3.04	31.0	.31	29.5	.55		
9/15	2.99	31.6	.27	28.7	.56	.7165	.30

Table 9 Correlation coefficients of growth as milligrams ash free dry weight per erect branch per day at the control station with temperature, salinity and light attenuation.

Date	Growth	Temp.	Coeff.	Salin.	Coeff.	Light	Coeff.
11/7	.87	23.8		27.1			
11/14	.51	17.6		28.7			
11/26	.53	16.8	.99	27.1	-.54		
12/7	.32	14.5	.99	30.2	-.79		
12/18	.25	13.0	.99	23.2	.17		
2/12	.68	23.2	.96	29.0	.25		
3/1	.59	18.8	.96	30.0	.28	.2661	
3/7	.26	17.4	.89	28.6	.20	.1440	
3/21	.95	20.6	.83	29.4	.28	.2661	.85
3/29	.86	23.2	.86	32.8	.44	.3004	.87
4/9	1.21	23.2	.85	32.7	.59	.2847	.82
4/16	.76	21.0	.85	32.0	.59	.5761	.30
4/25	1.23	26.0	.88	34.0	.68	.2989	.25
5/2	1.04	28.5	.87	34.3	.71	.5502	.33
5/9	1.41	30.0	.90	34.3	.76	.4454	.40
5/19	1.19	28.0	.91	34.0	.78	.5200	.45
5/28	1.39	30.5	.92	34.1	.80	.3974	.44
6/6	1.39	30.2	.93	35.4	.82	.3575	.41
6/16	1.55	31.4	.94	33.8	.82		
6/25	1.30	29.0	.94	33.0	.82	.3436	.39
7/3	1.13	28.0	.94	33.0	.82	.5638	.38
7/10	.88	30.5	.91	33.3	.81	.3653	.39
7/22	1.25	31.2	.91	32.1	.81	.6849	.41
8/5	.84	29.3	.88	31.2	.81	.5680	.34
8/21	1.10	30.4	.88	30.8	.80	.4991	.47
8/27	.89	29.5	.86	28.5	.79	1.0143	.54
9/5	1.24	30.0	.86	30.5	.77		
9/15	.94	28.6	.86	29.0	.76	.4778	.57

Table 10 Correlation coefficients of growth as milligrams ash free dry weight per erect branch per day at the experimental station with temperature, salinity and light attenuation.

Date	Growth	Temp.	Coeff.	Salin.	Coeff.	Light	Coeff.
11/7	1.59	27.0		30.0			
11/14	.82	19.0		27.5			
11/26	.84	19.5	1.00	29.5	.67		
12/7	.35	16.0	.99	31.0	-.14		
12/18	.44	18.0	.98	25.7	.26		
2/14	.50	22.0	.85	28.5	.26		
3/1	.57	22.8	.76	32.0	.11	.3313	
3/7	.29	20.8	.70	27.8	.19	.3566	-.99
3/21	.73	23.0	.69	30.8	.19	.2216	-.88
3/29	.45	25.0	.55	32.7	.07	.5113	-.61
4/9	.67	26.2	.50	33.2	.06	.3632	.54
4/16	1.50	25.2	.56	32.4	.23	.8370	.75
4/25	1.08	27.0	.59	34.2	.30	.3875	.67
5/2	1.02	30.0	.59	34.7	.35	.9920	.62
5/9	1.09	31.6	.60	35.2	.39	.5427	.61
5/19	1.10	29.0	.62	34.5	.43	1.1670	.60
5/28	1.05	32.0	.62	35.0	.45	.4742	.57
6/6	.69	32.5	.54	35.1	.40	1.1063	.42
6/16	1.06	34.0	.55				
6/25	.76	32.5	.51	33.6	.39	.4669	.43
7/3	.99	31.8	.50	33.0	.39	.8448	.43
7/10	.81	32.0	.49	33.7	.39	.3775	.43
7/22	.86	33.2	.47	32.2	.39	.6163	.43
8/5	.80	32.2	.46	31.0	.39	.6007	.43
8/21	.67	31.4	.43	30.7	.39	.5510	.43
8/27	.49	33.3	.37	27.4	.43	.6795	.39
9/5	.59	31.0	.34	29.5	.44		
9/15	.54	31.6	.31	28.7	.46	.7165	.35

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