RECORD OF ESTUARINE AND SALT MARSH METABOLISM AT CRYSTAL RIVER, FLORIDA, 1977–1981

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CHAPTER 1

CHAPTER SUMMARIES

Inner Discharge Bay

1. The inner discharge bay system gross productivity in 1980 approximated 33% of the control bay system gross productivity. This was a decline from the 46% relative system gross productivity measured in 1978 and 1979.
2. Plankton gross productivity accounted for approximately 87% of the discharge system gross productivity and 26% of the control system gross productivity.
3. Unit 3 was off line 50% of the year. This was reflected in lower spring and summer temperatures in the discharge bay.
4. System gross productivity, system net productivity, and ecological efficiencies all exhibited a decline from spring to fall in 1980. There were no substantial changes in the independent variables such as salinity and temperature to explain this decline.

Outer Discharge Bay

1. The outer discharge bay's system gross productivity averaged 34% higher or approximately 1.20 g $O_2 \cdot m^{-2} \cdot d^{-1}$ greater than the control bay on an annual basis.
2. Mean seasonal temperatures for the outer discharge bay were significantly higher during 1980 with respect to its control bay. Temperature in the discharge bay averaged 3.7°C greater than those in the control bay.
3. An apparent trend towards increased productivity in the outer discharge bay was accompanied by a decrease in productivity of its control bay.

4. Operation of Unit 3 in conjunction with Units 1 and 2 at the Crystal River power plant caused no measureable decrease of system metabolism in the outer discharge bay ecosystem.

Bays OB and C

1. System gross productivity was 1.4 g $O_2 \cdot m^{-2} \cdot d^{-1}$ (39%) higher in the outermost discharge bay compared to its control in 1980.
2. Temperatures of the discharge bay were approximately 2–4°C higher than in the corresponding control bay during 1977–1980.
3. Both the discharge and control bays were plankton dominated in terms of gross productivity.
4. Postoperational (1977–1980) trends in the discharge bay suggest that adaptation to thermal effluent is taking place while long-term trends in the control bay appear to indicate possible impacts of plant operation on the non-thermally affected estuary at Crystal River.

Marsh Metabolism

1. As in previous years, both *Juncus* and *Spartina* marshes in the thermally affected areas were characterized by shorter, lower specific weight, and more numerous plants per unit area than the control marshes. Higher dead *Juncus* biomass was measured in the thermal marsh. Marsh productivies were similar in thermal and control marshes.
2. Seasonal mean *Littorina* biomass was consistently higher in both *Juncus* and *Spartina* thermal marshes than in their control marshes.
3. *Uca* burrow densities in the *Spartina* marsh were greater in the discharge area than in the intake area in the cooler seasons (winter and spring). This suggests stimulation of invertebrate activity in response to thermal loading.

4. Differences in *Spartina* specific weight, stalk heights, and stalk density that were observed between 1980 and previous years' measurements on the intake suggest either structurally different communities have been sampled or that the control marsh is undergoing long-term biomass fluctuations.

CHAPTER 2

INTRODUCTION

When conditions of temperature and circulation of an estuary are changed, a self-organization process may cause a new kind of estuarine ecosystem to develop, one capable of using the new conditions as resources rather than as stresses. On the west coast of Florida at Crystal River, successive construction of three power plants using once-through cooling starting in 1967 have provided opportunity to observe these changes and determine how the developing ecosystems compare with those that develop nearby without the influences of power plants.

This is a report on measurements of estuarine metabolism after a nuclear plant (Unit 3) came on line in 1977 and the changes observed. In part the power plants have provided pump-driven circulation that replaces the natural circulation interrupted by long canal spoil jetties. The estuarine temperatures at Crystal River have been increased approximately 4°C. High productivity is well known in hot springs where high temperatures are regular, with high photosynthetic efficiencies found at 50°C. Turbidity is one stress factor of particular importance following recent dredging activity, in construction, and where barges operate in supplying fuel. Highly productive turbid waters are known. Because the plants have been on and off the temperature and current regimes to which the organisms have been adapting have been variable.

If environmental systems in contact with technology can develop productive interfaces, a pattern of man and nature can evolve that helps the economy of nature and that of man symbiotically. The alternatives of high technology waste treatment, cooling towers, etc. may unnecessarily divert potential resources from the estuary and also divert economic resources of the economy. The relative magnitudes of these alternatives can be evaluated with energy analysis as done for Crystal River earlier (Odum 1974; Kemp et al. 1977). The data for such evaluations comes from monitoring the success of the estuary in self-organizing a productive metabolism to go with the new and variable conditions.

It is the purpose of this study to report data on total ecosystem functioning of the estuarine systems receiving discharge waters compared to control locations in 1980, to preoperational (1973) data and to data after the nuclear unit went into operation (1977–1980). Comparisons are made between measurements reported here and in earlier reports and dissertations (Lehman 1974; Young 1974; McKellar 1975; Homer 1976, 1977; Kemp 1976; Smith 1976; Hornbeck 1979; Odum et al. 1978; Caldwell et al. 1979, 1980).

In order to analyze the overall effect of additional thermal discharge from the nuclear unit on the Crystal River estuary and adjacent salt marsh ecosystem, system-level parameters were monitored including total system metabolism (production and respiration) and plankton metabolism monitored in light and dark bottles. In addition, environmental factors that affect system functioning have been determined. These include solar radiation (insolation), water temperature, air temperature, salinity, turbidity, wind speed, depth, and current.

System metabolism, as estimated by system gross production (productivity) and respiration, is an integrated measure of the functioning of the entire biological system. System gross production is the sum of all photosynthetic processes and system respiration sums all respiration processes. In this manner, the functioning of all populations may be measured in different areas for comparison.

The theory of maximum power selection (Boltzman 1886; Lotka 1922; Odum 1971) suggests that environmental systems and those of humanity self-organize by trial, error, and selection so as to maximize their energy inflow and use that energy to meet all other needs so as to prevail in competition. Total productivity and total respiratory metabolism are measures of total energy conversion and utilization. These measures of total metabolism monitor the success of the ecosystems in developing a pattern that is as good as others in use of the available energies. Thus system metabolism may be the single most important variable to appraise conditions in an estuary.

Study Site and Sampling Plan

The Florida Power Corporation has constructed three electric-power generating units and is in the process of building two additional units on the Gulf of Mexico near Crystal River, Florida. Two coal-fired units, Units 1 and 2, with a combined capacity of 897 megawatts, came on line in 1966 and 1969, respectively. These two units require approximately 2410 $m^3 \cdot min^{-1}$ of cooling water. This water is drawn from off shore via a long intake canal and is discharged in shore via a short discharge canal. Average thermal elevation of the effluent water relative to the intake (ΔT) was reported as 5–6°C by McKellar (1975). The first studies of metabolism were made in 1973 when these plants were operating.

A third nuclear-powered unit, with 855-megawatt capacity, came on line in 1977 using once-through cooling via the same intake and discharge canals. This unit pumps an additional 2366 $m^3 \cdot min^{-1}$ and increases overall ΔT of the power station to approximately 8–9°C.

The Crystal River power plants are located on the Gulf of Mexico coastline in Citrus County approximately 5 km north of the Crystal River and about 5 km south of the Cross Florida Barge Canal and the Withlacoochee River (Fig. II-1). The coastline in this area is characterized by low wave energies and the drowned karst topography typical of this part of Florida's west coast. Tidal marshes are dominated by the black rush *Juncus roemarianus* with a narrow band of *Spartina alterniflora* fronting the *Juncus* on the seaward side. Numerous oyster bars occur roughly parallel to the coastline extending 3 to 4 km seaward.

Located among these oyster bars are the bays currently under study. Figure II-2 shows the location of these sampling stations. Stations A, B, C, and D were the initial primary bay stations and have been sampled from the beginning of the project. It was discovered during the spring of the first year's research effort that only stations B and D (McKellar's former outer discharge and control bays, respectively) and station A (Smith's former discharge bay) were directly comparable with areas previously studied. As a result of these inadequacies in the initial phases of this study, several stations were added to complement those of the original sampling design. After comparability studies were run during the summer of 1977 between Smith's former inner discharge control area (located at Fort Island) and the most inshore area to the south of the intake canal, the decision was made to add station E as a control for the bay in area A. Station OB was added in the summer 1977 as a comparable discharge bay for intake control area C.

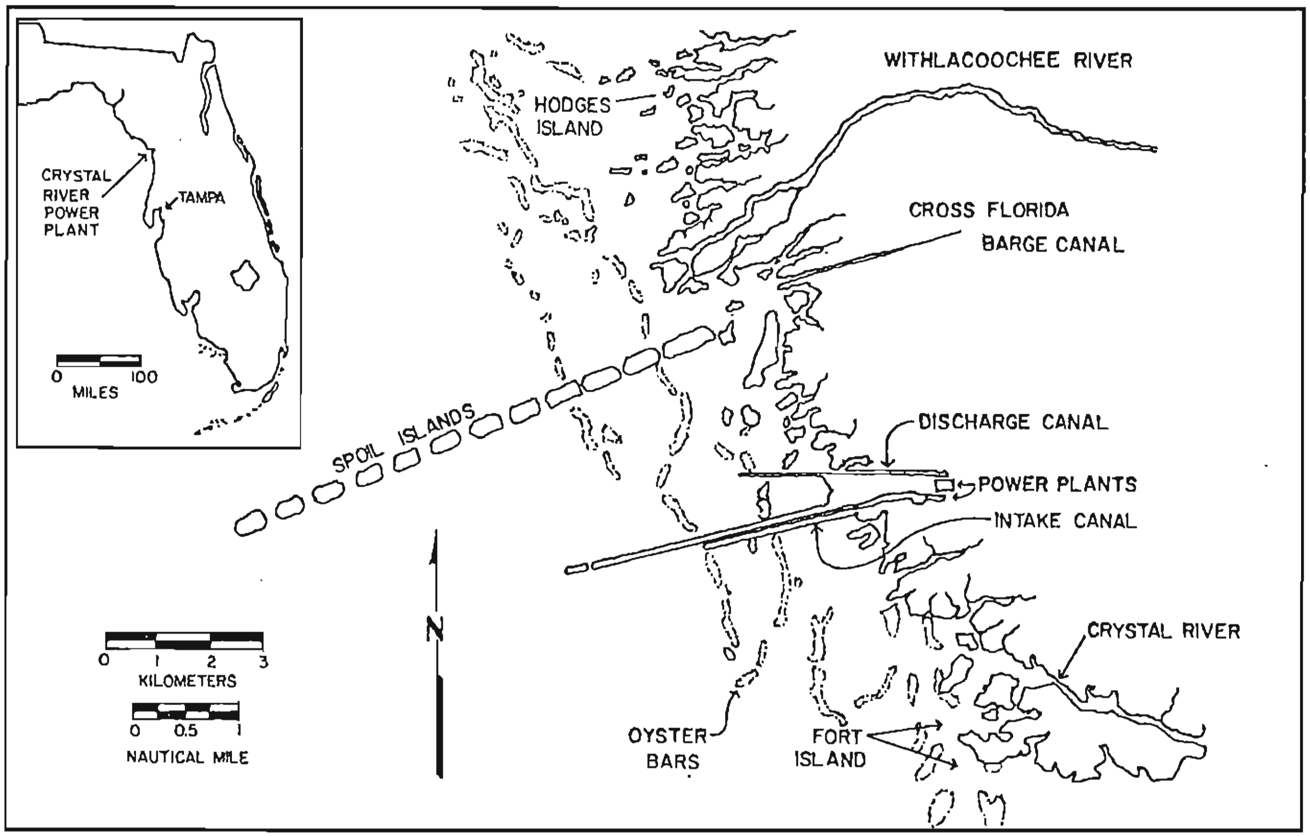


Figure II-1. The Crystal River power plants in relation to the major features of the regional coastline.

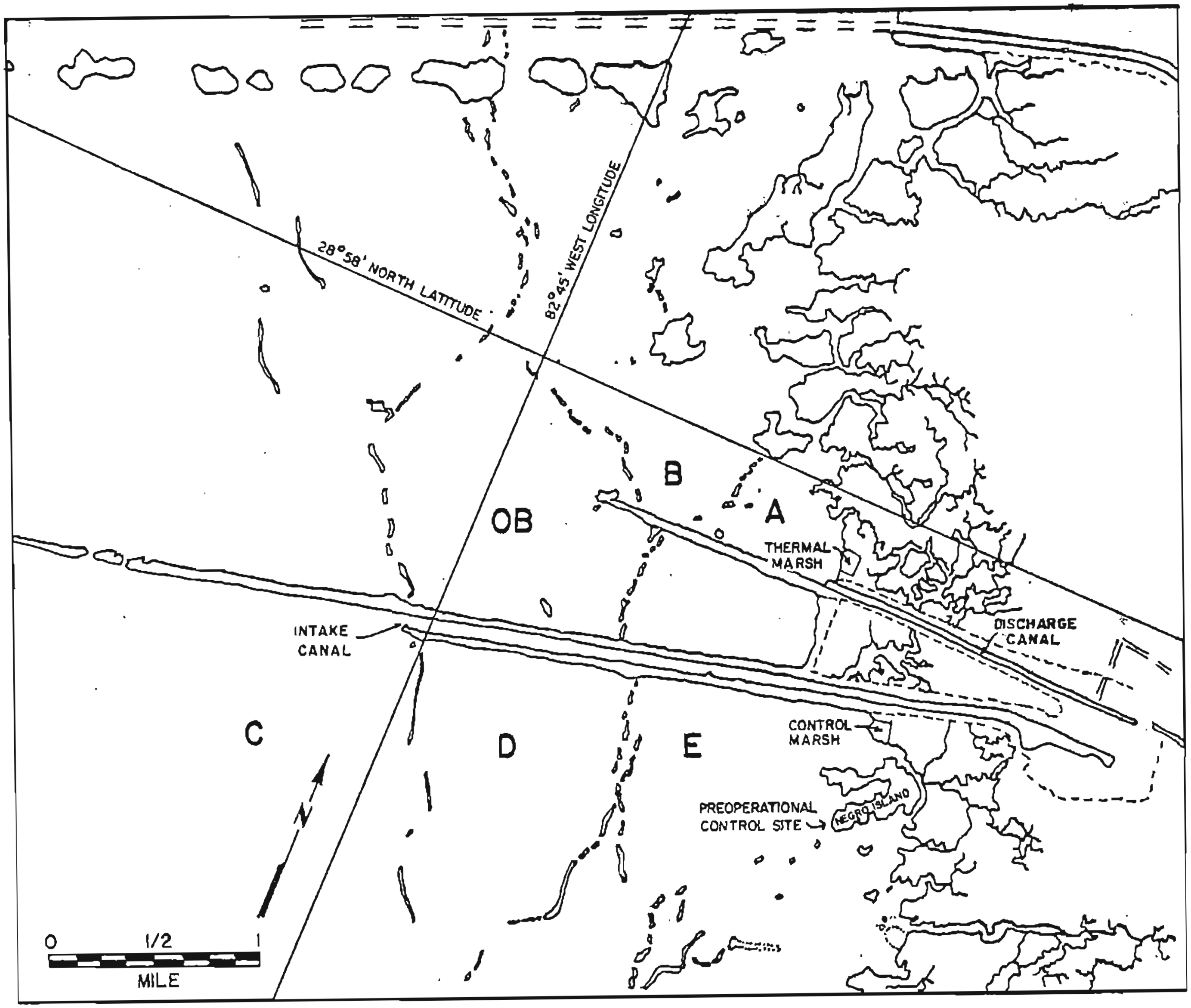


Figure II-2. Locations of the inner discharge bay (A) and its control bay (E); outer discharge bay (B) and its control bay (D); and the outermost discharge bay (OB) and its control bay (C) at the Crystal River Power Plant site.

The marsh metabolism and harvest areas are also shown in Fig. II-2. Since the barge formerly used by Don Young was no longer available, it was decided (after a personal site visit by Young) to develop a land-based operation. The study area in the discharge marsh is included in the area previously studied by Young. Since Young's intake marsh site on Negro Island was no longer accessible, close inspection of the area revealed an apparent comparable site on the south side of the intake canal.

In all cases, efforts were made to duplicate sampling methods used in the previous studies to insure comparability. Sampling and calculation methods are described in greater detail in chapter 3 of this report.

CHAPTER 3

COMMUNITY METABOLISM OF THE INNER DISCHARGE BAY (A) AND ITS CONTROL BAY (E)

Kathryn A. Benkert

Introduction

This chapter includes the results of the 1980 metabolic measurements for the inner discharge bay (A) and its control bay (E). The 1980 data are compared to both the 1972–1974 preoperational data (Smith 1976) and the 1977–1979 postoperational data (Odum et al. 1978; Caldwell et al. 1979, 1980).

Study Site

The locations of the inner discharge bay and its control bay are shown in Fig. II-1b. The inner discharge bay is bounded on the landward side by a *Spartina*–*Juncus* salt marsh. A series of oyster reefs separates the inner bay from the outer discharge bay (B).

The control bay, adjoining the south side of the power plant intake canal, approximates the conditions that would exist in the inner discharge bay if the power plant and canal structures were absent. Like the inner discharge bay, the control bay is bordered on the landward side by a *Spartina*–*Juncus* marsh and on the seaward side by oyster reefs. In the past, the control bay was used as a control station for the inner discharge bay by other researchers monitoring fish, invertebrates, and macrophyte stocks (Smith 1976).

Materials and Methods

Community metabolism was measured using methods as nearly identical as possible to those used during the preoperational studies at the Crystal River Power Plant (McKellar 1975; Smith 1976; Kemp 1977). The methods for the diurnal sampling of community metabolism were based on techniques developed by Odum and Hoskins (1958), Odum and Wilson (1962), and Odum (1967). The three-point abbreviated diurnal, or dawn-dusk-dawn, sampling was based on methods used by McConnell (1962) and McKellar (1975). Plankton metabolism was measured by the light and dark bottle incubation technique (American Public Health Association [APHA] 1975).

Two consecutive 24-hour diurnal sampling programs were accomplished each quarter. Each bay was sampled once approximately every 4 hours at three different stations randomly selected in that bay. Duplicate water samples were collected at each station for dissolved oxygen analysis.

The dawn-dusk-dawn measurements were made approximately every 2 weeks for a 3-day period. This method is an abbreviation of the diurnal method and involved measuring the minimum (dawn) and maximum (dusk) levels of oxygen in the water column. Duplicate water samples were collected at one station in each bay for dissolved oxygen analysis.

Dissolved Oxygen Analysis

The dissolved oxygen content of the water was determined by the sodium azide modification of the Winkler method (APHA 1975). The Winkler method was adapted for use with 125-ml flat-topped glass reagent bottles instead of the standard 300-ml BOD bottles. McKellar (1975) and Smith (1976) discussed the advantages, disadvantages, and errors inherent to the usage of the 125-ml bottles.

The water samples were collected by allowing surface water to flow into a bucket while avoiding unnecessary agitation. Water was siphoned from the bottom of the bucket into the collection bottle. The bottle was allowed to flush at least twice, filling from the bottom of the bottle. The siphon was then slowly removed, and the cap was replaced on the bottle to dispel excess water. Removing the cap, reagents were then added to fix the oxygen as follows: 1. 0.5 ml of $MnSO_4$ was added below the water's surface; and 2. 0.5 ml of alkali-iodide-azide was added below the water's surface. After carefully replacing the cap to avoid air bubble entrapment, the bottle was inverted 15+ times to insure proper mixing of the reagents. The precipitate was allowed to settle and the bottle was shaken again.

Each of the dissolved oxygen water samples collected at a station was filled from a different seawater bucket sample. The amount of time needed to fill a bottle allowed two potentially different water masses to be sampled by bucket collection at a station.

Upon returning to the laboratory and the second settling of precipitate, 0.5 ml of concentrated sulfuric acid (H_2SO_4) was added to each bottle. The bottles were then shaken until the precipitate had completely dissolved. Titration followed within 8 hours. Smith (1976) presented the results of an experiment testing the effects of a time delay of samples with and without acidification prior to titration for the final dissolved oxygen measurement. The differences found between immediate and delayed titration were considered too small to have a significant effect on the overall data. Titration of the samples was sometimes delayed up to 8 hours, depending on field operation difficulties.

For titration, a 101-ml portion of each sample was measured and titrated with 0.012 N sodium thiosulfate solution. Paragon starch was used as an end point indicator. The use of 0.012 N sodium thiosulfate allowed direct reading of the titrant as dissolved oxygen: 1 ml thiosulfate = 1 $g \cdot m^{-3}$ dissolved oxygen.

The above procedure was used for oxygen determinations in both the 24-hour diurnal series and the dawn-dusk-dawn methods for metabolism measurements of the total water column.

Plankton Metabolism

To measure the plankton component of the community metabolism, the light-dark bottle method was employed. For this procedure, 300-ml BOD bottles were used. The dark bottles were taped to exclude light, and the tops were capped with black plastic and secured by rubber bands. The light bottles were used unmodified.

One set, consisting of two light bottles and two dark bottles, was anchored in each of the bays after the dawn sampling run. The light bottles were suspended approximately 0.5 m from the surface by cords attached to a length of PVC pipe buoyed at each end by a plastic milk bottle. The dark bottles were attached below the light bottles. The set of bottles was incubated up to 24 hours.

In addition to the light and dark bottles, two 125-ml subsamples were collected to determine the initial amount of dissolved oxygen present at each station. In all cases (light, dark, or initial) each bottle was filled with water from a single surface bucket collection made at the station.

Plankton respiration was calculated as the decrease in oxygen in the dark bottle as compared to the initial concentration of oxygen. Net productivity was calculated as the increase in oxygen in the light bottle as compared to the initial concentration. Corrections were made to adjust for variations in the incubation time.

With the use of the 300-ml BOD bottles for plankton metabolism, fixation and acidification were done using 2.0-ml volumes of the appropriate reagents. Sample volumes of 101 ml were used for titration with 0.012 N sodium thiosulfate.

Water Depth

Water depth was measured at each station by a plumb line marked at 0.2-m intervals. For the inner discharge bay a reference stake, which represented a minimum of 50 measurements conducted in transects, was available to determine the average water depth.

Light Penetration

Secchi disk measurements were taken at all stations under all sampling regimes. Extinction coefficients from the Secchi disk readings were calculated as follows:

$$K = 1.7/d$$

where, d = depth in meters at which the Secchi disk was no longer visible (Atkins and Poole 1930). Higher values indicate greater turbidity.

Additional measurements of light extinction were made with a Montedoro-Whitney photometer in the inner discharge bay and its control bay. These measurements were converted to extinction coefficients by the following equation:

$$K = \frac{\ln(S_1/S_2)}{Z_2 - Z_1}$$

where, S_1 = percent of light transmitted at depth Z_1,

S_2 = percent of light transmitted at depth Z_2,

Z_1 = surface or a near surface depth, and

Z_2 = lower depth.

Photometer measurements in the bays A and E were made during high tides at midday. Z_1 was always 0.2 m below the surface. The lower depth, Z_2, was at least 0.2 m above the bottom to avoid interference from sediments resuspended by the probe. For given pairs of data between bays A and E on a given date, the lower depth, Z_2, was always the same value to insure cross comparison between the bays on a relative basis.

Insolation

Insolation was recorded with a Weathermeasure pyroheliometer.

Wind

Wind speed was measured with a hand-held Dwyer wind meter. In the absence of an operating meter, an estimate of wind speed was made.

Current Velocity

Current velocity was measured by either of two methods: 1. a glass flotation device secured to a 5-m length of cord was released, and the time for full extension of the cord was recorded, or 2. a General Oceanics flowmeter was submerged to approximately 0.5 m for 1 minute, and the counts per minute were recorded.

Salinity

Salinity was measured by use of either a Beckman induction salinometer or a Hydrolab conductivity probe with subsequent conversion to salinity. The readings were taken at approximately 0.5 m below the surface.

Temperature

Temperature was measured with either a Hydrolab temperature probe or the temperature probe of the Beckman salinometer. Temperature measurements were made at the same depth and time as the salinity measurements.

Community Metabolism Calculations

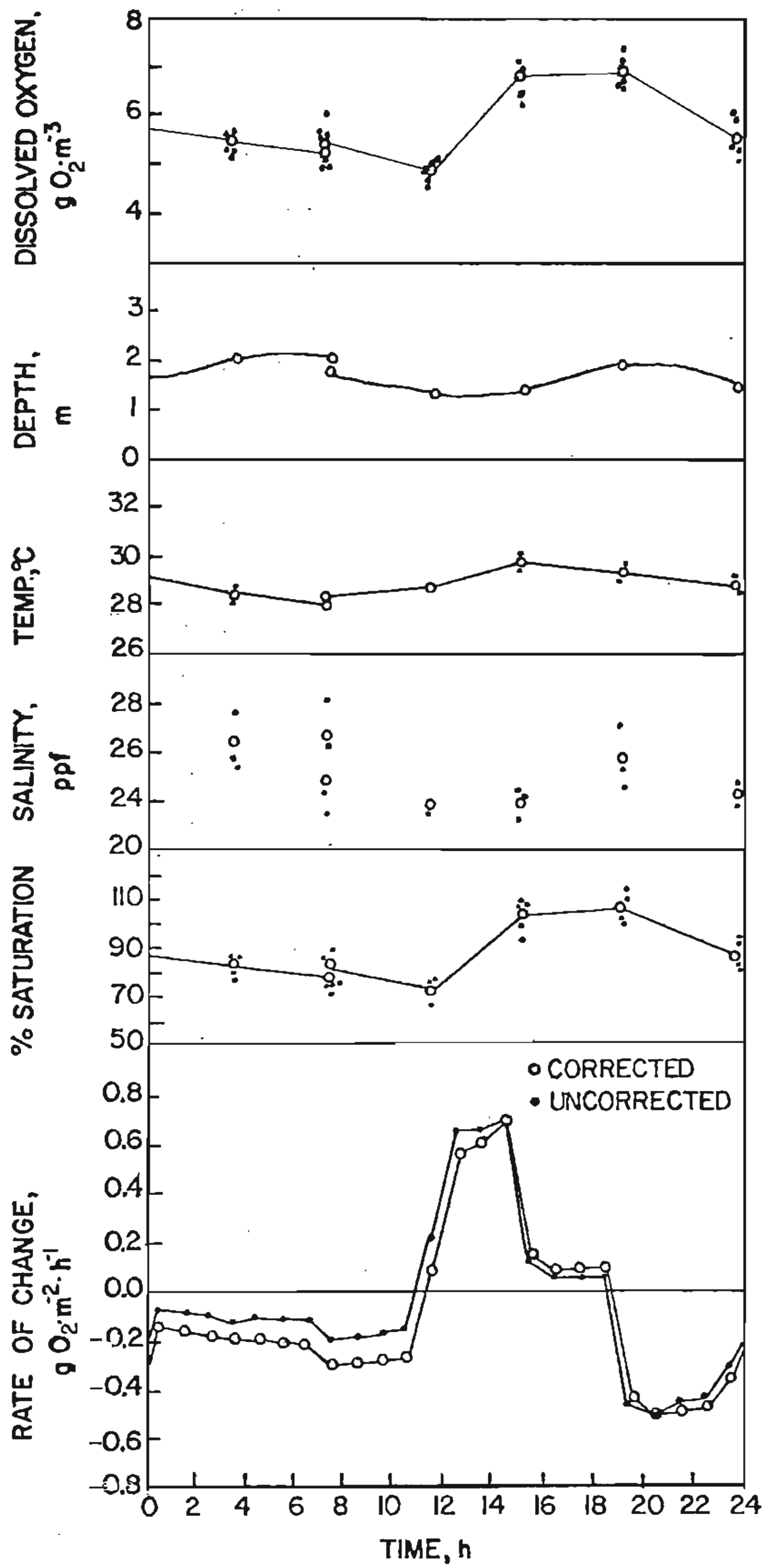
Community metabolism was determined by two methods: 1. 24-hour diurnal sampling, and 2. dawn-dusk-dawn sampling. The metabolism of the 24-hour diurnal sampling method was determined using graphical analysis. The dawn-dusk-dawn metabolism value was determined through the use of equations.

Figure II-3 illustrates the graphical analysis method for diurnal metabolism with actual data from the inner control bay. To calculate the metabolism, the number of grams of oxygen per cubic meter was plotted in Fig. II-3a. Six measurements were taken per sampling period, and the averages of these measurements were plotted and connected. Using tide tables (U.S. Department of Commerce 1976–1979) and the reference stake readings, the depth was plotted in Fig. II-3b. By multiplying the number of grams of oxygen per cubic meter by the depth (meters), the uncorrected oxygen rate of change, on an area basis, was calculated and plotted in Fig. II-3f as grams of oxygen per square meter per hour (•——•).

The average temperatures were plotted in Fig. II-3c as well as the salinites in Fig. II-3d. The salinity values were not connected by lines due to the nonlinearity of the variation in daily salinity patterns. The salinity and temperature values were used in conjunction with the oxygen solubility in tables (Truesdale et al. 1955) to determine the 100% saturation value of oxygen for a given temperature and salinity.

Figure II-3. Example of graphical format for calculation of community metabolism from diurnal measurements in the inner discharge bay (A), October 1, 1977, and its control bay (E), October 2, 1977. Open circles represent averages.

a) oxygen concentration, g $O_2 \cdot m^{-3}$;
b) depth, m;
c) temperature, °C;
d) salinity, ‰;
e) percent saturation of oxygen;
f) rate of change of oxygen, g $O_2 \cdot m^{-2} \cdot hr^{-1}$. Solid lines connecting solid dots (•——•) represent the rate of change uncorrected for diffusion. Solid lines connected with open circles (∘——∘) represent the rate of change corrected for diffusion.


DISSOLVED OXYGEN, g O2·m-3
DEPTH, m
TEMP,°C
SALINITY, ppt
% SATURATION
RATE OF CHANGE, g O2·m-2·h-1
o CORRECTED
• UNCORRECTED
TIME, h

The measured oxygen concentration values in Fig. II-3a were converted to percent saturation values and plotted in Fig. II-3e. To correct the rate curve (Fig. II-3f) for diffusion, the plotted values in Fig. II-3e were subtracted from 100%, then divided by 100, and multiplied by the appropriate diffusion coefficient (see below). This new figure was then added to the uncorrected rate of change value in Fig. II-3f, giving the diffusion corrected oxygen rate of change curve (o——o).

The net productivity and respiration were calculated using the corrected rate of change curve. The time period from sunrise to sunset represents daytime net productivity. The area under/above the curve was measured using a digital planimeter. The negative values below zero on the rate of change curve represent negative net productivity and were added to the positive values to arrive at the final net productivity, for example:

$$(2.3\ g \cdot m^{-2} \cdot d^{-1}) + (-1.0\ g \cdot m^{-2} \cdot d^{-1}) = 1.3\ g \cdot m^{-2} \cdot d^{-1}$$

$$(+P_N) \quad + \quad (-P_N) \quad = P_N \text{ final.}$$

Night respiration is that process occurring between sunset and sunrise and was measured in the same fashion as the net productivity. Although respiration was a negative value, its absolute value was recorded on subsequent tables in this report. The absolute respiration value added to the net productivity yielded the 24-hour gross productivity.

The dawn-dusk-dawn measurements were an abbreviated form of the diurnal measurements. McKellar (1975) and Smith (1976) found the dawn-dusk-dawn method to underestimate gross production from less than 10% to as much as 33% of a full diurnal curve analysis. This study's dawn-dusk-dawn results were not adjusted to compensate for this underestimation and thus must be taken as conservative estimates.

To determine the metabolism from the dawn-dusk-dawn method, the following equations, which yield results comparable to the graphical method, were used (see McKellar 1975).

$$P_{net} = [(O_{2dusk} - O_{2dawn})\cdot\overline{Z} - D)]$$

where, O_2 = dissolved oxygen concentration at dawn and dusk,

$\overline{Z}$ = average daytime water depth, and

D = daytime diffusion.

The total diffusion (D) was determined from the following relationship:

$$D = K\cdot\overline{S}\cdot T$$

where, K = diffusion rate coefficient (g $O_2\cdot m^{-2}\cdot hr^{-1}$ at 100% saturation deficit) (see below),

$\overline{S}$ = average saturation deficit $(S_{dawn} + S_{dusk})/2$,

S = saturation deficit (100 - PS)/100,

PS = percent saturation $(O_2/O_2 \text{ sat})\cdot 100$,

O_2 sat = oxygen concentration at saturation for given water temperature and salinity, and

T = time in hours between dawn and dusk measurements.

Nighttime respiration (R) was calculated in an identical manner for oxygen changes between dusk and dawn.

Diffusion Rate Coefficients

Diffusion coefficients were measured using the methods of Copeland and Duffer (1964) and Smith (1976). A floating dome was placed on the surface and filled with nitrogen gas. An oxygen probe placed in the dome recorded the rate of reaeration. Current and wind speed, depth, water temperature, and air temperature in the dome were also recorded. Diffusion measurements were made in each bay and an average coefficient was calculated. The inner discharge bay coefficient, 0.35 g $O_2 \cdot m^{-2} \cdot hr^{-1}$ at 100% saturation deficit, was from Smith's (1976) preoperational data (n = 5). The control bay coefficient, 0.48 g $O_2 \cdot m^{-2} \cdot hr^{-1}$ at 100% saturation deficit, was determined from measurements (n = 2) in the fall of 1977 in the postoperational study.

P/R Ratios

P/R ratios were calculated using the ratio of gross productivity (P_G) to 2 times nighttime respiration ($2 \cdot R$). This method assumes that night respiration equals daytime respiration. A P/R ratio >1.0 indicates an autotrophic community, while a P/R ratio <1.0 indicates heterotrophy.

Ecological Efficiency

Ecological efficiency was calculated as the ratio of gross productivity (converted to Calories [Cal], 1 g O_2 = 4.0 Cal), to total insolation, multiplied by 100 to give percentage value.

Comparability of Plankton and System Metabolism Data

Estuarine system metabolism may be considered to consist of two dominant parts—benthos metabolism and plankton metabolism. In this study, system metabolism parameters (gross productivity, net productivity, and respiration) are measured by the open water method in which the ecosystem receives very little disturbance in the measurement process. Plankton metabolism is estimated in an altered environment, i.e., a 300-ml bottle over a 12- or 24-hour time period. In this bottle, a circulation-adapted plankton community is cut off from the effect of circulation and thus gross and net productivity may be lowered compared to in situ populations. In addition, surface area to volume ratio is greatly increased in the bottles and thus respiration by attached microbial communites may be higher at long incubation times. Thus, there is considerable reason for doubt concerning the comparability of bottle and open water metabolism measurements and the use of the difference between the two for reporting benthos metabolism. However, considerable evidence has been gained in obvious plankton-dominated systems (deep, with little light penetration to the bottom, e.g., see section on bays OB and C in this report) that the measurements are comparable, and can be used for making tenative conclusions about relative importance of plankton and benthos productivity in clearer or more shallow systems. Comparisons such as these are made in this section and in the rest of the report and must be judged conservatively.

Results

1980 Data

A summary of the 1980 data is presented in Appendix A. The data were analyzed using a two-tailed t-test. Seasons for the inner discharge bay and its control bay are defined as follows:

Winter:	January—March
Spring:	April—June
Summer:	July—September
Fall:	October—December.

These designations are consistent with those used by Smith (1976) for the preoperational study but different from those in other sections of this report.

Table II-1 presents the outage data for Crystal River Units 1, 2, and 3. Unit 3 was off line from February 26 to August 10, 1980. Additional

Table II-1. Crystal River power plant units service record (X = operating unit; Out = unit not operating) and the differences in temperature (ΔT) between the inner discharge bay (A) and its control bay (E).

1980 Sampling Date	ΔT, °C	Unit 1	Unit 2	Unit 3
1/04*	6.8	X	X	X
1/05*	5.4	X	X	Out
1/18–19	5.5	X	X	X
2/01–02	9.6	X	X	X
2/22–23	5.7	X	Out	X
3/08–09	1.3	X	X	Out
3/21–22	3.0	Out	X	Out
4/04–05*	2.3	Out	X	Out
4/18–19	2.8	X	X	Out
5/03–04	2.5	X	X	Out
5/16–17	2.9	X	X	Out
5/31–6/01	3.1	Out	X	Out
6/17–18	3.1	X	X	Out
6/30–7/01*	2.1	Out	X	Out
7/17–18	3.3	X	X	Out
8/03–04	2.7	X	X	Out
8/16–17	4.8	X	X	X
8/29	4.8	X	X	Out
8/30	5.6	X	X	X
9/12	4.1	X	X	Out
9/13	5.9	X	X	X
9/26–27*	5.4	X	X	X
10/15–16	7.3	X	Out	X
10/31–11/01	7.7	Out	X	X
11/14–15	6.3	Out	X	X
11/29–30	8.9	X	X	X
12/15–17	7.9	X	X	X

*Indicates diurnal sampling period.

1–2-day outages of Unit 3 during the rest of the year resulted in a total outage time of 6 months, or 50% of the year. The lowest temperature differences (ΔT) between the inner discharge bay and its control bay occurred when Unit 3 was off line. In addition, there is clearly a seasonal pattern evident for ΔT with higher values in the colder months and lower values during the warmer months. This pattern of plant operation is evident in spite of Unit 3 outages.

Mean seasonal temperatures are presented in Table II-2 and Fig. II-4. The discharge bay temperatures were significantly greater in all seasons, with an average temperature difference of 4.8°C (Table II-3) for the year. Temperature differences were lowest in the spring and summer when Unit 3 was off line.

Salinity was significantly greater in the discharge bay for all seasons (Table II-2, Fig. II-5). The higher salinities in the discharge bay were in part due to the release of the high-salinity offshore water used for cooling purposes. The control bay also received fresh water flows from the Crystal River, which empties into the Gulf approximately 5 km south of the power plant site.

Extinction coefficients (from Secchi disk readings) are reported in Table II-2. The inner discharge bay was generally found to have greater turbidities than the control bay. The data for both bays though is biased towards high extinction coefficients because of the shallowness of the bays. It was usually necessary to have a high tide with moderately turbid waters to get extinction of the Secchi disk in these bays.

To avoid this bias, a series of photometer readings were made throughout the year in the inner discharge and control bays. Extinction coefficients derived from the photometer readings were also significantly

Table II-2. Results of statistical t-tests between the inner discharge bay (A) and its control bay (E): 1980 seasonal averages for temperature (°C), salinity (‰), and extinction coefficient (m^{-1}). The standard error is listed after the value; the number of observations follows in parentheses.

Season	Temperature, °C	Salinity, ‰	Extinction Coefficient, m^{-1}
Winter			
Discharge	21.1 ± 0.7(12)*	26.5 ± 0.4(12)*	2.25 ± 0.25(9)
Control	15.9 ± 1.1(12)*	23.0 ± 0.9(12)*	1.70 ± 0.26(8)
Spring			
Discharge	28.0 ± 0.9(12)*	23.5 ± 0.5(12)*	2.42 ± 0.19(10)*
Control	25.2 ± 0.9(12)*	20.3 ± 0.5(12)*	1.48 ± 0.06(12)*
Summer			
Discharge	33.6 ± 0.4(12)*	23.8 ± 1.0(12)*	1.84 ± 0.10(12)
Control	29.7 ± 0.3(12)*	20.0 ± 1.0(12)*	1.54 ± 0.19(12)
Fall			
Discharge	28.4 ± 1.3(12)*	27.0 ± 0.4(12)*	1.84 ± 0.23(8)*
Control	21.2 ± 1.6(12)*	24.6 ± 0.3(12)*	1.22 ± 0.08(8)*

*Means for control and discharge are significant at the 95% confidence level (two-sample t-tests).

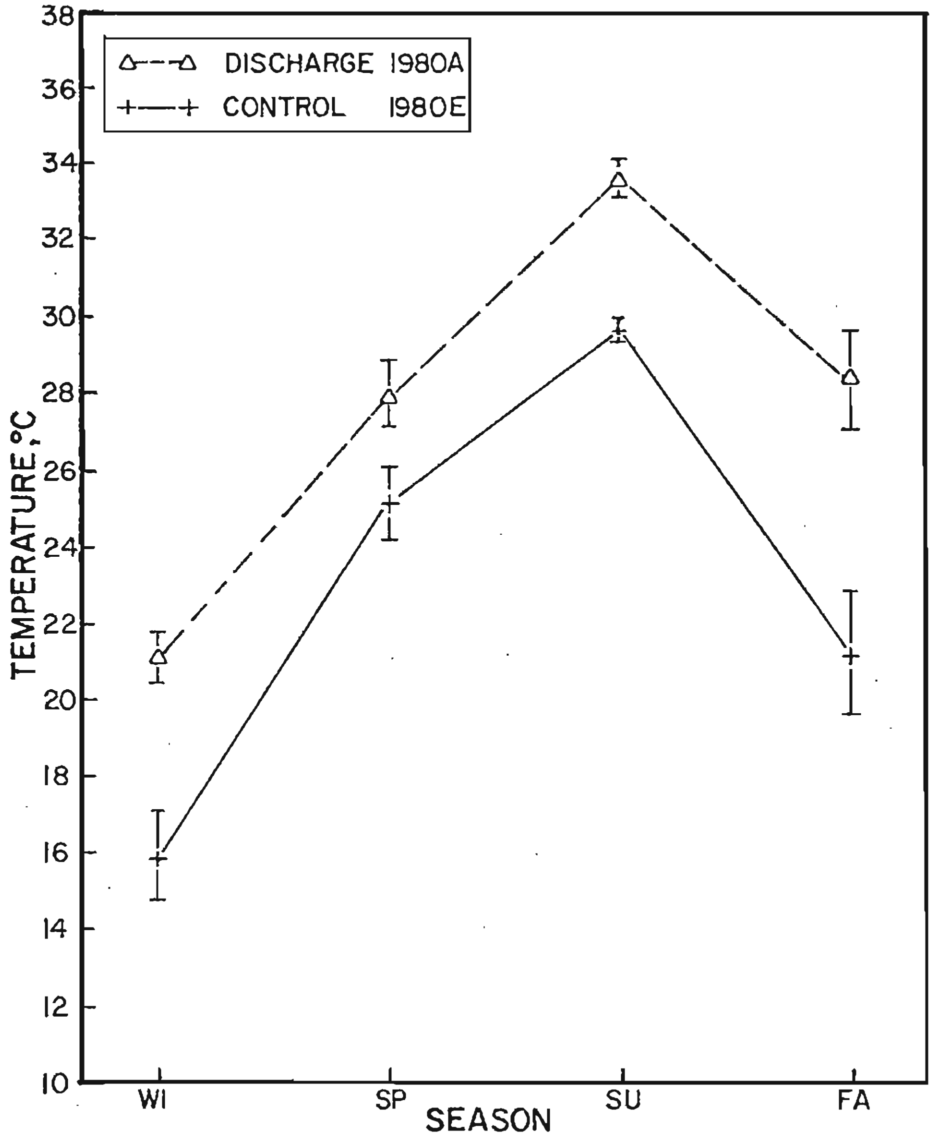


Figure II-4. Comparison of 1980 mean seasonal temperatures for the inner discharge bay (A) and its control bay (E). Bars represent ± one standard error.

Table II-3. Differences in mean temperature (ΔT) between the inner discharge bay (A) and its control bay (E) by seasons for 1980.

Season	Control Bay (E), °C	Discharge Bay (A), °C	ΔT, °C
Winter	15.9	21.1	5.2
Spring	25.2	28.0	2.8
Summer	29.7	33.6	3.9
Fall	21.2	28.4	7.2
Mean			4.8
Standard Error			0.9

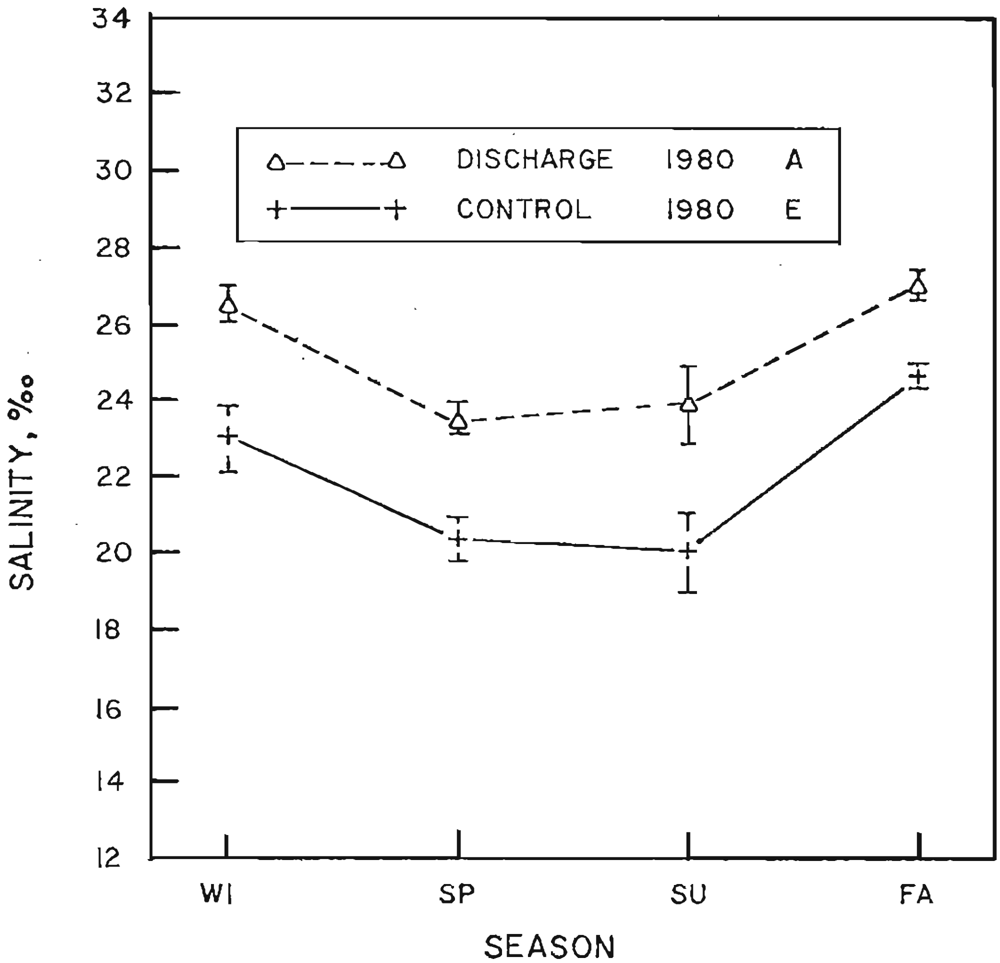


Figure II-5. Mean seasonal salinities for the inner discharge bay (A) and its control bay (E) for 1980. Bars represent ± one standard error.

higher in the discharge bay compared to its control bay (95% confidence level) (Table II-4).

System productivity data for 1980 (Table II-5, Figs. II-6 and II-7) indicated significantly lower productivity in the discharge bay for all seasons. System gross productivity (P_G) peaked in the spring in the inner discharge bay and in the summer in the control bay.

Plankton productivity (Table II-6, Figs. II-8 and II-9) followed the same pattern as the system productivity. The discharge bay plankton productivity peaked in the spring while the control bay plankton productivity peaked in the summer. During the spring quarter, plankton gross productivity was significantly higher in the discharge bay, while during the summer quarter the intake bay's gross productivity was significantly higher.

As in the past 3 years of this study, plankton productivity was the dominant factor in the total system productivity of the inner discharge bay accounting for approximately 84% of the total system productivity (Table II-7). In sharp contrast to the discharge bay, plankton productivity in the control bay averaged only 25% of the total system productivity.

Ecological efficiency in the inner discharge bay was significantly lower than the control bay for all seasons except winter (Table II-8).

The P/R ratios (Table II-8) were consistently higher in the discharge bay compared to its control, with significant differences (P = 0.10) measured during the spring and fall. The range of the P/R ratios was quite large, especially in the inner discharge bay. This was a result of the low respiration values found in the discharge bay (Table II-5).

Table II-4. Photometer-derived extinction coefficients for the inner discharge bay (A) and its control (E) for 1980.

	Light Extinction Coefficient, m^{-1}	
	Discharge Bay (A)	Control Bay (E)
Mean	1.21	1.00
Standard Deviation	0.29	0.17
Range	0.84–2.11	0.81–1.34
N	18	17

Table II-5. Results of statistical t-tests between the inner discharge bay (A) and its control bay (E): 1980 seasonal averages for total system gross productivity ($P_G = P_N + R$), net productivity (P_N), and night respiration (R). The standard error is listed after the value; the number of observations follows in parentheses.

Season	P_G, $g\ O_2 \cdot m^{-2} \cdot d^{-1}$	P_N, $g\ O_2 \cdot m^{-2} \cdot d^{-1}$	R, $g\ O_2 \cdot m^{-2} \cdot d^{-1}$
Winter			
Discharge	1.11 ± 0.23(12)*	0.71 ± 0.08(12)†	0.40 ± 0.17(12)*
Control	2.17 ± 0.34(12)*	1.14 ± 0.20(12)†	1.03 ± 0.17(12)*
Spring			
Discharge	2.32 ± 0.25(12)*	1.48 ± 0.17(12)*	0.84 ± 0.13(12)*
Control	4.80 ± 0.62(12)*	2.74 ± 0.35(12)*	2.06 ± 0.33(12)*
Summer			
Discharge	1.64 ± 0.26(12)*	0.81 ± 0.18(12)*	0.83 ± 0.14(12)*
Control	7.67 ± 0.68(12)*	4.04 ± 0.39(12)*	3.64 ± 0.34(12)*
Fall			
Discharge	0.70 ± 0.23(12)*	0.51 ± 0.15(12)*	0.19 ± 0.11(12)*
Control	6.04 ± 0.82(12)*	3.47 ± 0.47(12)*	2.57 ± 0.42(12)*

*Means for control and discharge are significant at the 95% confidence level (two-sample t-tests).
†Means for control and discharge are significant at the 90% confidence level (two-sample t-tests).

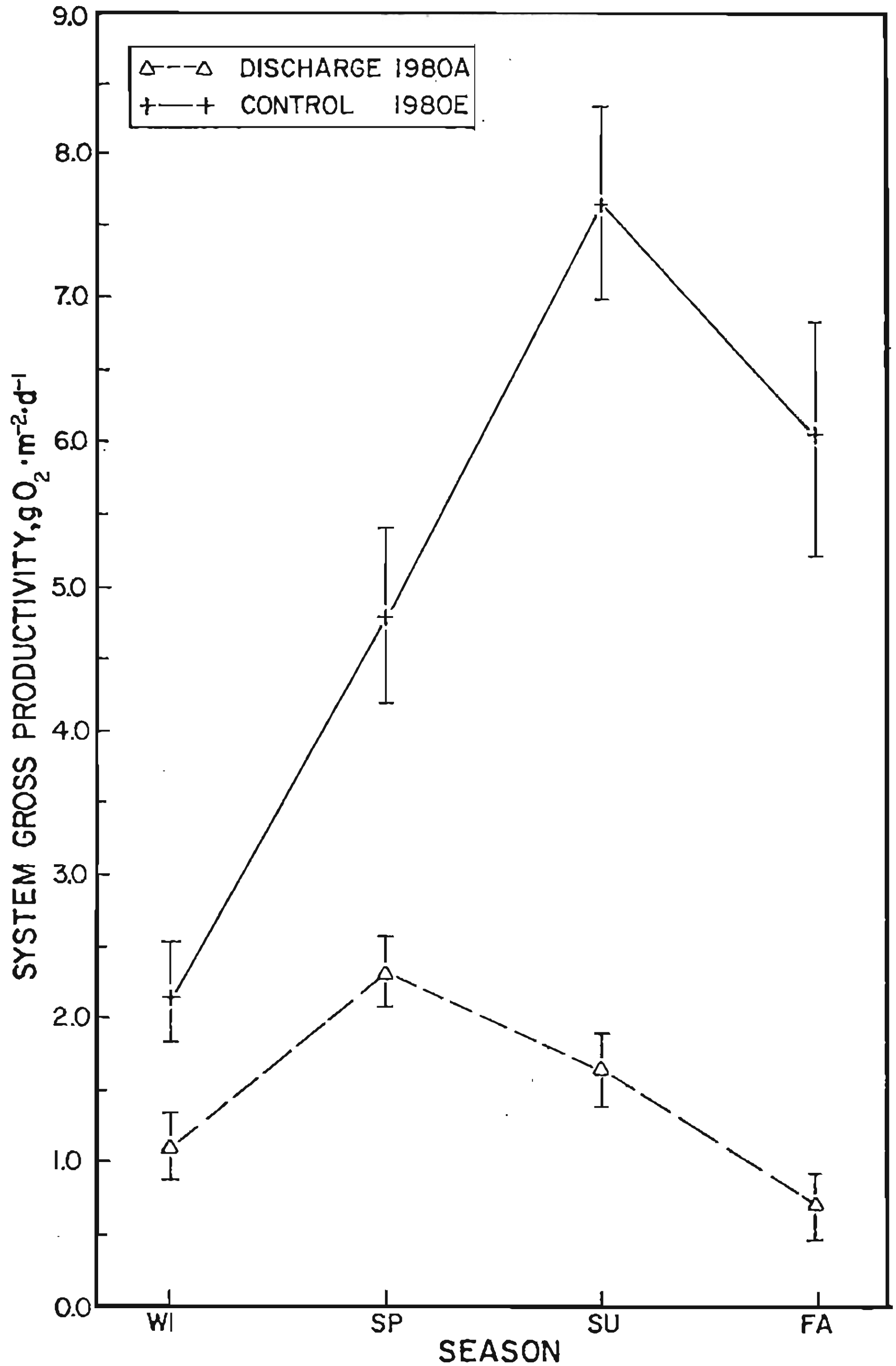


Figure II-6. Mean seasonal system gross productivity of the inner discharge bay (A) and its control bay (E) for 1980. Bars represent ± one standard error.

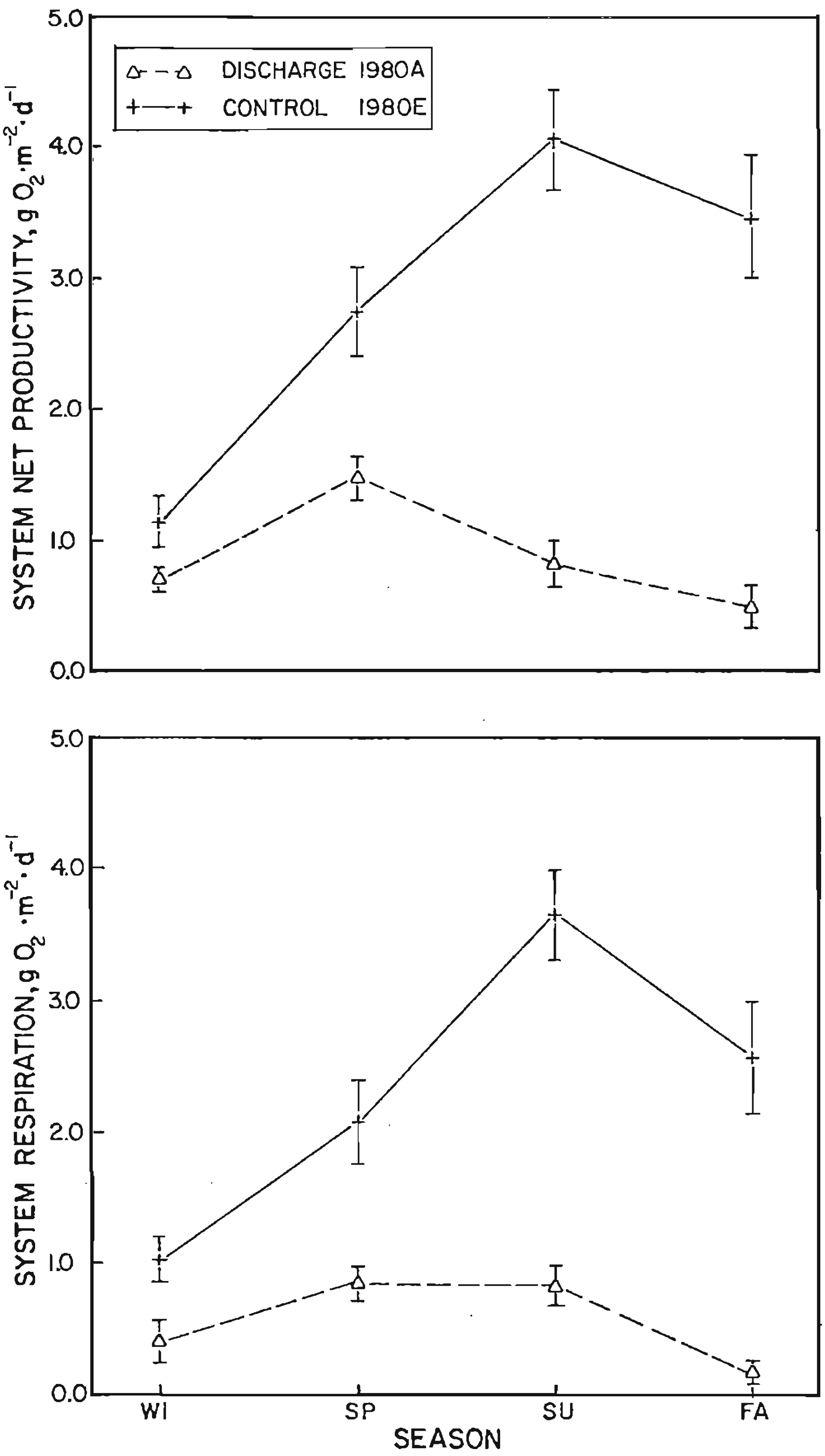


Figure II-7. Mean seasonal system net productivity and system respiration of the inner discharge bay (A) and its control bay (E) for 1980. Bars represent ± one standard error.

Table II-6. Results of statistical t-tests between the inner discharge bay (A) and its control bay (E): 1980 seasonal averages for plankton gross productivity ($P_G = P_N + R$), plankton net productivity (P_N), and plankton respiration (R). The standard error is listed after the value; the number of observations follows in parentheses.

Season	Plankton P_G, $g\ O_2 \cdot m^{-2} \cdot d^{-1}$	Plankton P_N, $g\ O_2 \cdot m^{-2} \cdot d^{-1}$	Plankton R, $g\ O_2 \cdot m^{-2} \cdot d^{-1}$
Winter			
Discharge	0.30 ± 0.08(9)	0.18 ± 0.07(9)	0.13 ± 0.04(8)
Control	0.55 ± 0.16(10)	0.34 ± 0.13(10)	0.27 ± 0.09(8)
Spring			
Discharge	2.02 ± 0.35(12)*	1.89 ± 0.33(12)*	0.13 ± 0.04(12)†
Control	1.10 ± 0.13(12)*	0.84 ± 0.12(12)*	0.26 ± 0.06(12)†
Summer			
Discharge	1.57 ± 0.30(12)*	1.33 ± 0.32(12)	0.24 ± 0.04(12)*
Control	2.45 ± 0.23(12)*	1.90 ± 0.21(12)	0.55 ± 0.06(12)*
Fall			
Discharge	0.89 ± 0.10(12)	0.59 ± 0.08(12)	0.30 ± 0.06(12)
Control	1.30 ± 0.30(12)	0.94 ± 0.22(12)	0.37 ± 0.11(12)

*Means for control and discharge are significant at the 95% confidence level (two-sample t-tests).
†Means for control and discharge are significant at the 90% confidence level (two-sample t-tests).

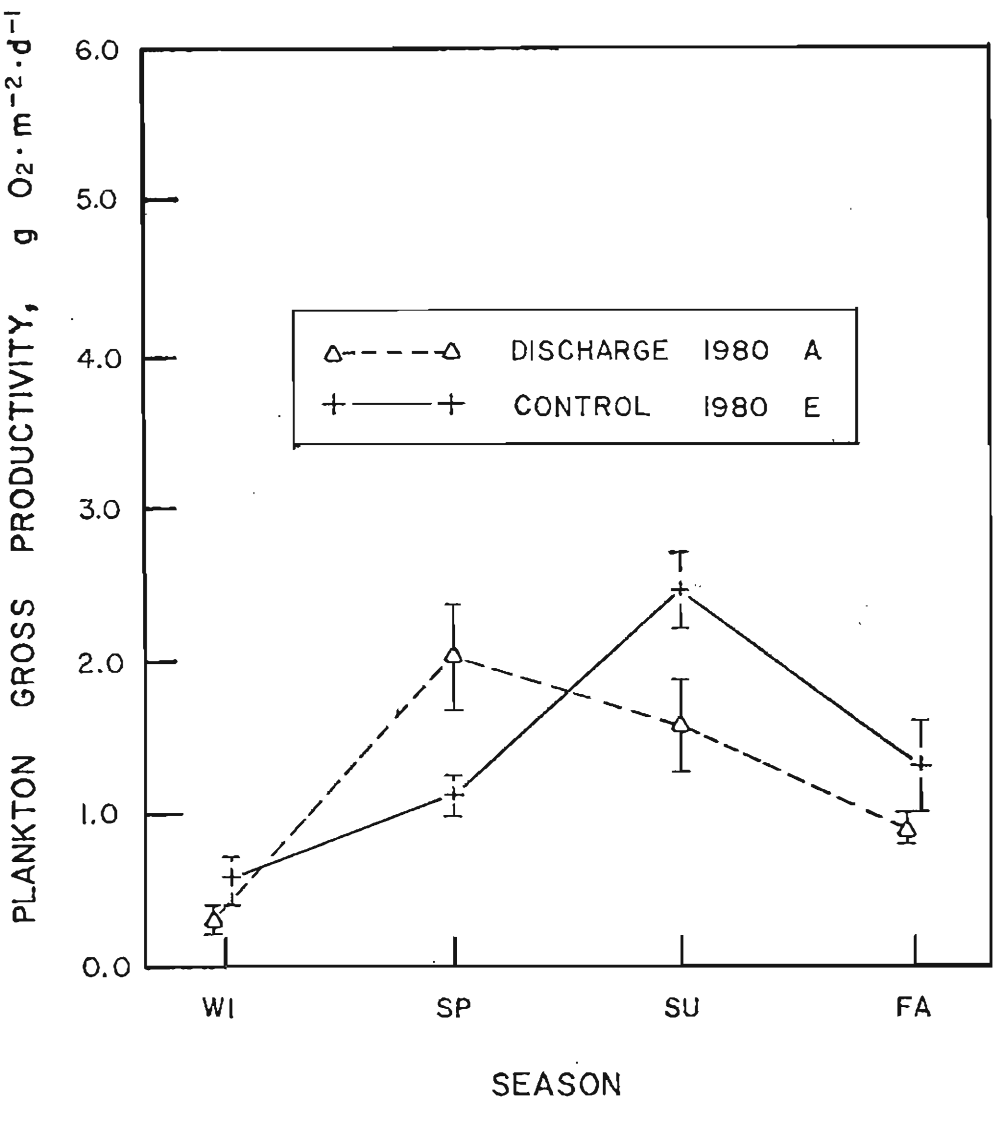


Figure II-8. Mean seasonal plankton gross productivity of the inner discharge bay (A) and its control bay (E) for 1980. Bars represent ± one standard error.

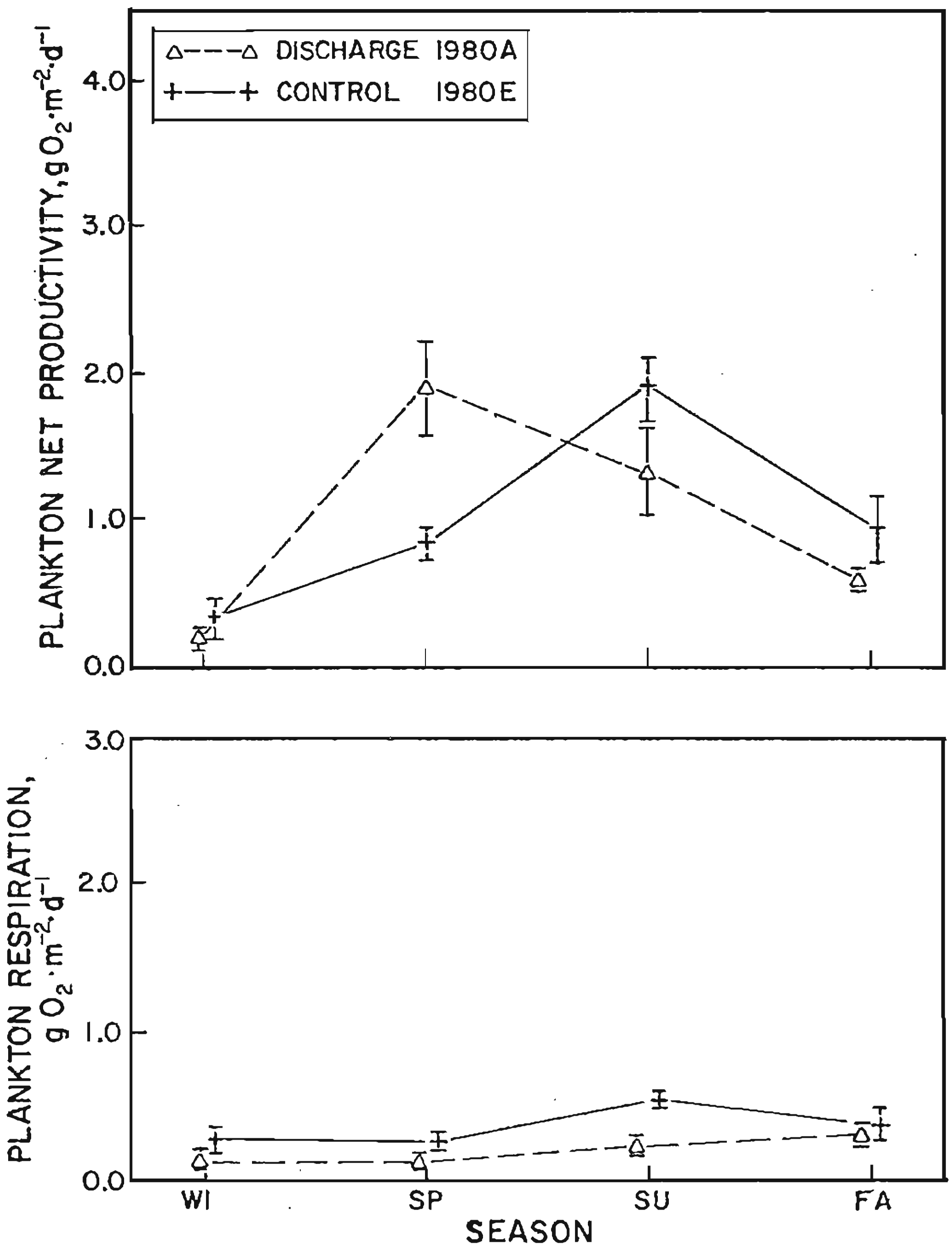


Figure II-9. Mean seasonal plankton net productivity and plankton respiration of the inner discharge bay (A) and its control bay (E) for 1980. Bars represent ± one standard error.

Table II-7. Percent of the seasonal average total system gross productivity (P_G) due to plankton gross productivity (P_G) in the control bay (E) and the inner discharge bay (A) for 1980.

	Control (E)			Inner Discharge Bay (A)		
Season	Total P_G, $g\ O_2 \cdot m^{-2} \cdot d^{-1}$	Plankton P_G, $g\ O_2 \cdot m^{-2} \cdot d^{-1}$	% Plankton P_G	Total P_G, $g\ O_2 \cdot m^{-2} \cdot d^{-1}$	Plankton P_G, $g\ O_2 \cdot m^{-2} \cdot d^{-1}$	% Plankton P_G
Winter	2.17	0.55	25.3	1.11	0.30	27.0
Spring	4.80	1.10	22.9	2.32	2.02	87.1
Summer	7.67	2.45	31.9	1.64	1.57	95.7
Fall	6.04	1.30	21.5	0.70	0.89	127.1
Mean			25.4			84.2
Standard Deviation			4.6			41.8

Table II-8. Results of statistical t-tests for evaluation of mean ecological efficiencies and P/R ratios ($P_G/2R$) between the inner discharge bay (A) and its control bay (E) for 1980. Standard error follows the value; number of observations in parentheses.

Season	Ecological Efficiency	Range	P/R Ratio	Range
Winter				
Discharge	0.21 ± 0.06(12)	0.04–0.66	1.95 ± 0.58(8)	0.74–5.83
Control	0.32 ± 0.06(12)	0.11–0.69	1.20 ± 0.20(12)	0.52–3.19
Spring				
Discharge	0.21 ± 0.02(12)*	0.12–0.37	1.59 ± 0.19(12)†	0.70–2.73
Control	0.44 ± 0.05(12)*	0.11–0.68	1.19 ± 0.11(11)†	0.76–2.12
Summer				
Discharge	0.16 ± 0.02(12)*	0.07–0.30	1.20 ± 0.19(12)	0.59–3.09
Control	0.72 ± 0.05(12)*	0.42–0.96	1.08 ± 0.06(12)	0.85–1.66
Fall				
Discharge	0.09 ± 0.03(11)*	-0.04–0.32	7.76 ± 5.50(5)†	1.02–29.50
Control	0.90 ± 0.11(11)*	0.24–1.60	1.58 ± 0.36(12)†	0.80–5.34

*Means for control and discharge are significant at the 95% confidence level (two-sample t-tests).
†Means for control and discharge are significant at the 90% confidence level (two-sample t-tests).

1973 Preoperational and 1980 Post-operational Data Comparisons

Prior to the operation of Unit 3, a study of the system metabolism of the inner discharge bay and a control station at Fort Island was conducted by Smith (1976). A record of Smith's data can be found in Appendix II-B of Caldwell et al. (1979). The 1973 preoperational data is grouped data from 1972 to 1974. The productivity measurements reflected the energy flows and structure of the inner discharge bay at a time when it had been receiving thermal effluent for several years from two electrical generating units.

In spring 1977 when this postoperational study began, the control station at Fort Island was dropped for logistics reasons. Diurnal measurements were made in the inner control bay and at the Fort Island station to compare productivities (Odum et al. 1978). The two sites were found to be similar in productivity, and the inner control bay was chosen as the control site for the inner discharge bay. Due to this switch in control stations, comparisons between the preoperational and postoperational control station data were not made.

Water temperatures in the inner discharge bay in 1980 were significantly different from those in 1973 in all seasons except winter (Table II-9, Fig. II-10). During spring 1980, when Unit 3 was off line, the temperatures were significantly lower. In summer and fall 1980, when Unit 3 was on line for all or part of those seasons, temperatures were significantly higher than those in 1973. Salinities (Table II-9, Fig. II-10) were significantly lower in spring and summer 1980. In both 1973 and 1980 though, the mean annual salinity was approximately 25.5‰.

Table II-9. Results of statistical t-test for comparison of temperature (°C) and salinity (‰) in the inner discharge bay (A) between the 1973 (preoperational) and 1980. Standard error follows the value; number of observations in parentheses.

	Inner Discharge Bay (A)	
Season	Temperature, °C	Salinity, ‰
Winter		
1973	20.6 ± 2.8(3)	23.8 ± 3.8(3)
1980	21.1 ± 0.7(12)	26.5 ± 0.4(12)
Spring		
1973	31.8 ± 0.5(14)*	25.9 ± 0.6(14)*
1980	28.0 ± 0.9(12)*	23.5 ± 0.5(12)*
Summer		
1973	32.3 ± 0.4(10)*	26.6 ± 0.6(10)*
1980	33.6 ± 0.4(12)*	23.8 ± 1.0(12)*
Fall		
1973	22.4 ± 0.9(4)*	27.1 ± 0.2(4)
1980	28.4 ± 1.3(12)*	27.0 ± 0.4(12)

*Means significant at 95% confidence level.

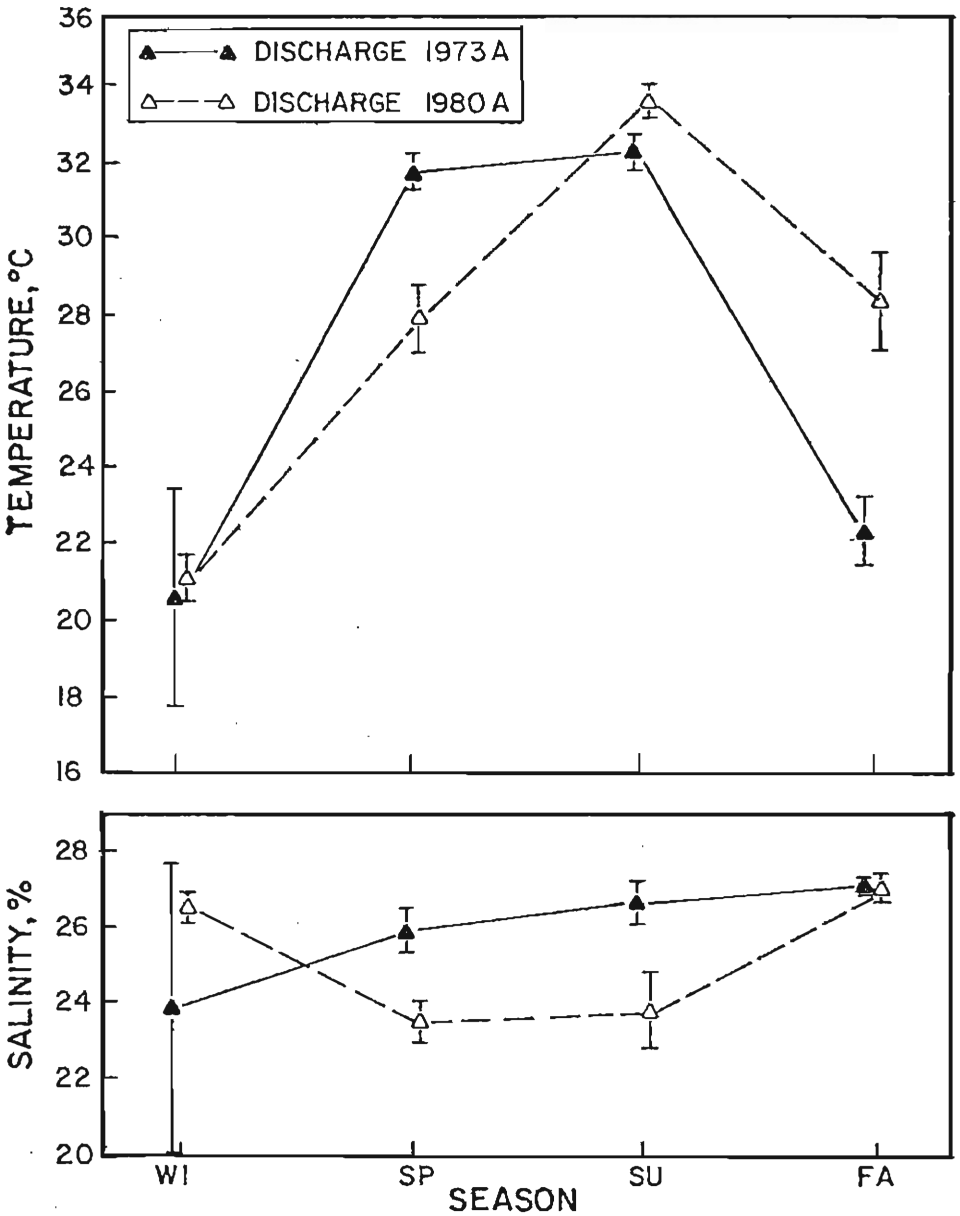


Figure II-10. Comparison of the mean seasonal temperature and salinity of the inner discharge bay (A) in 1973 and 1980. Bars represent ± one standard error.

Total system productivity data are presented in Table II-10 and Figs. II-11 and II-12. System gross productivity (P_G) was significantly lower during 1980 for all seasons. The mean annual system gross productivity in 1980 was approximately 30% of that measured in 1973. In 1980, system net productivity (P_N) was approximately 50% of that measured in 1973 while system respiration (R) was approximately 27% of that found in 1973.

Plankton gross productivities (P_G) did not differ significantly between 1973 and 1980 (Table II-11 and Fig. II-13). Plankton respiration in spring 1980 was significantly less than that in 1973 although only two measurements were made in 1973.

Preoperational and Postoperational Trends: 1973, 1977–1980

Temperatures exhibited a cyclical pattern, which peaked in the summer (Fig. II-14). The highest seasonal temperature was in summer 1977, the only summer in which Unit 3 was on line. All matched seasonal discharge-intake temperature pairs were significantly different except for winter 1978, which included only three measurements. Table II-12 presents a seasonal comparison of ΔTs between the discharge and control bays. Except for the winter 1973 data, the higher ΔTs were found in seasons during which Unit 3 was operational all or part of the time.

Postoperational salinity fluctuations (Fig. II-15) in the control and discharge bays tracked each other closely. The discharge bay averaged approximately 3‰ greater than the control bay (Table II-13). This was due in part to the discharge of the higher salinity offshore water used for cooling. Preoperational salinities did not demonstrate this close relationship, possibly because Fort Island, the preoperational control

Table II-10. Results of statistical t-tests for comparison of total system gross productivity ($P_G = P_N + R$), net productivity (P_N), and night respiration (R) in the inner discharge bay (A) between 1973 (preoperational) and 1980. Standard error follows the value; number of observations follows in parentheses.

	Inner Discharge Bay (A)		
Season	P_G, g $O_2 \cdot m^{-2} \cdot d^{-1}$	P_N, g $O_2 \cdot m^{-2} \cdot d^{-1}$	R, g $O_2 \cdot m^{-2} \cdot d^{-1}$
Winter			
1973	3.25 ± 1.17(3)*	1.40 ± 0.40(3)*	1.85 ± 0.93(3)*
1980	1.11 ± 0.23(12)*	0.71 ± 0.08(12)*	0.40 ± 0.17(12)*
Spring			
1973	4.05 ± 0.52(14)*	2.13 ± 0.31(14)†	1.92 ± 0.26(14)*
1980	2.32 ± 0.25(12)*	1.48 ± 0.17(12)†	0.84 ± 0.13(12)*
Summer			
1973	4.40 ± 0.85(10)*	2.10 ± 0.50(10)*	2.30 ± 0.44(10)*
1980	1.64 ± 0.26(12)*	0.81 ± 0.18(12)*	0.83 ± 0.14(12)*
Fall			
1973	3.27 ± 0.28(3)*	1.20 ± 0.06(3)*	2.07 ± 0.24(3)*
1980	0.70 ± 0.23(12)*	0.51 ± 0.15(12)*	0.19 ± 0.11(12)*

*Means significant at 95% confidence level.
†Means significant at 90% confidence level.

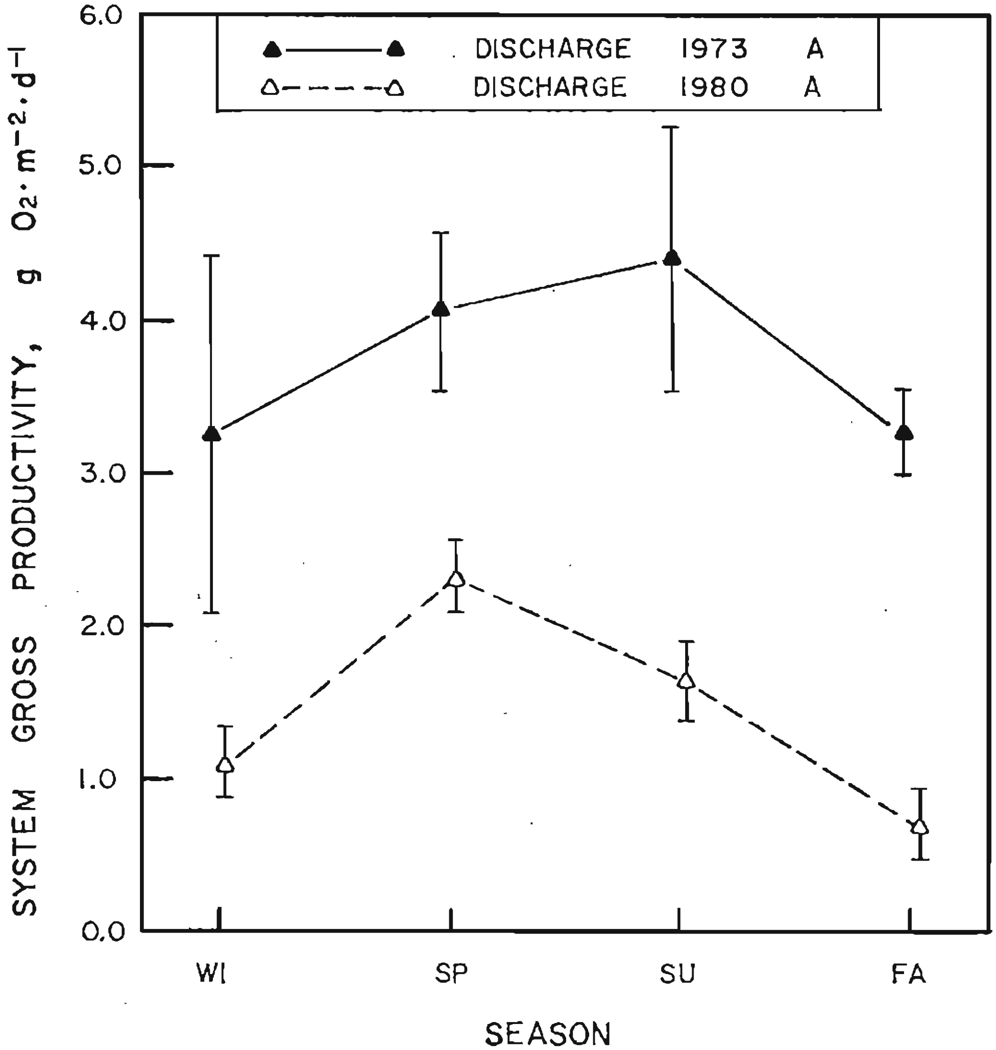


Figure II-11. Mean seasonal system gross productivity of the inner discharge bay (A) in 1973 and 1980. Bars represent ± one standard error.

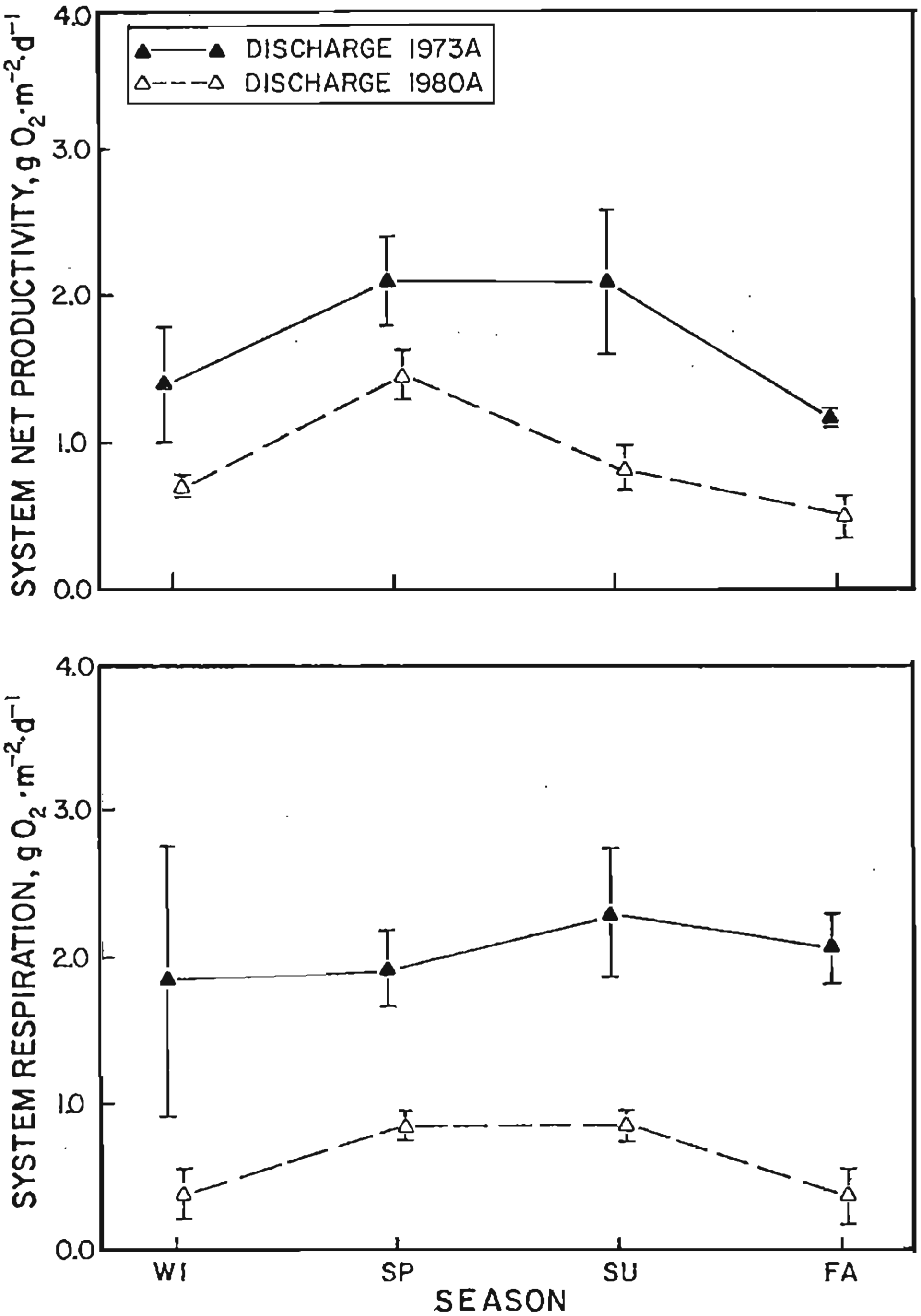


Figure II-12. Mean seasonal system net productivity and system respiration of the inner discharge bay (A) in 1973 and 1980. Bars represent ± one standard error.

Table II-11. Results of statistical t-tests for comparison of plankton gross productivity ($P_G = P_N + R$), plankton net productivity (P_N), and plankton respiration (R) in the inner discharge bay (A) between 1973 (preoperational) and 1980. Standard error follows the value; number of observations follows in parentheses.

	Inner Discharge Bay (A)		
Season	Plankton P_G, $g\ O_2 \cdot m^{-2} \cdot d^{-1}$	Plankton P_N, $g\ O_2 \cdot m^{-2} \cdot d^{-1}$	Plankton R, $g\ O_2 \cdot m^{-2} \cdot d^{-1}$
Winter			
1973	No data for 1973		
1980	0.30 ± 0.08(9)	0.18 ± 0.07(9)	0.13 ± 0.04(8)
Spring			
1973	3.15 ± 1.55(2)	1.85 ± 0.65(2)	1.30 ± 0.90(2)*
1980	2.02 ± 0.35(12)	1.89 ± 0.33(12)	0.13 ± 0.04(12)*
Summer			
1973	0.97 ± 0.20(3)	0.70 ± 0.12(3)†	0.27 ± 0.09(3)
1980	1.57 ± 0.30(12)	1.33 ± 0.32(12)†	0.24 ± 0.04(12)
Fall			
1973	0.83 ± 0.08(4)	0.58 ± 0.05(4)	0.25 ± 0.05(4)
1980	0.89 ± 0.10(12)	0.59 ± 0.08(12)	0.30 ± 0.06(12)

*Means significant at 95% confidence level.
†Means significant at 90% confidence level.

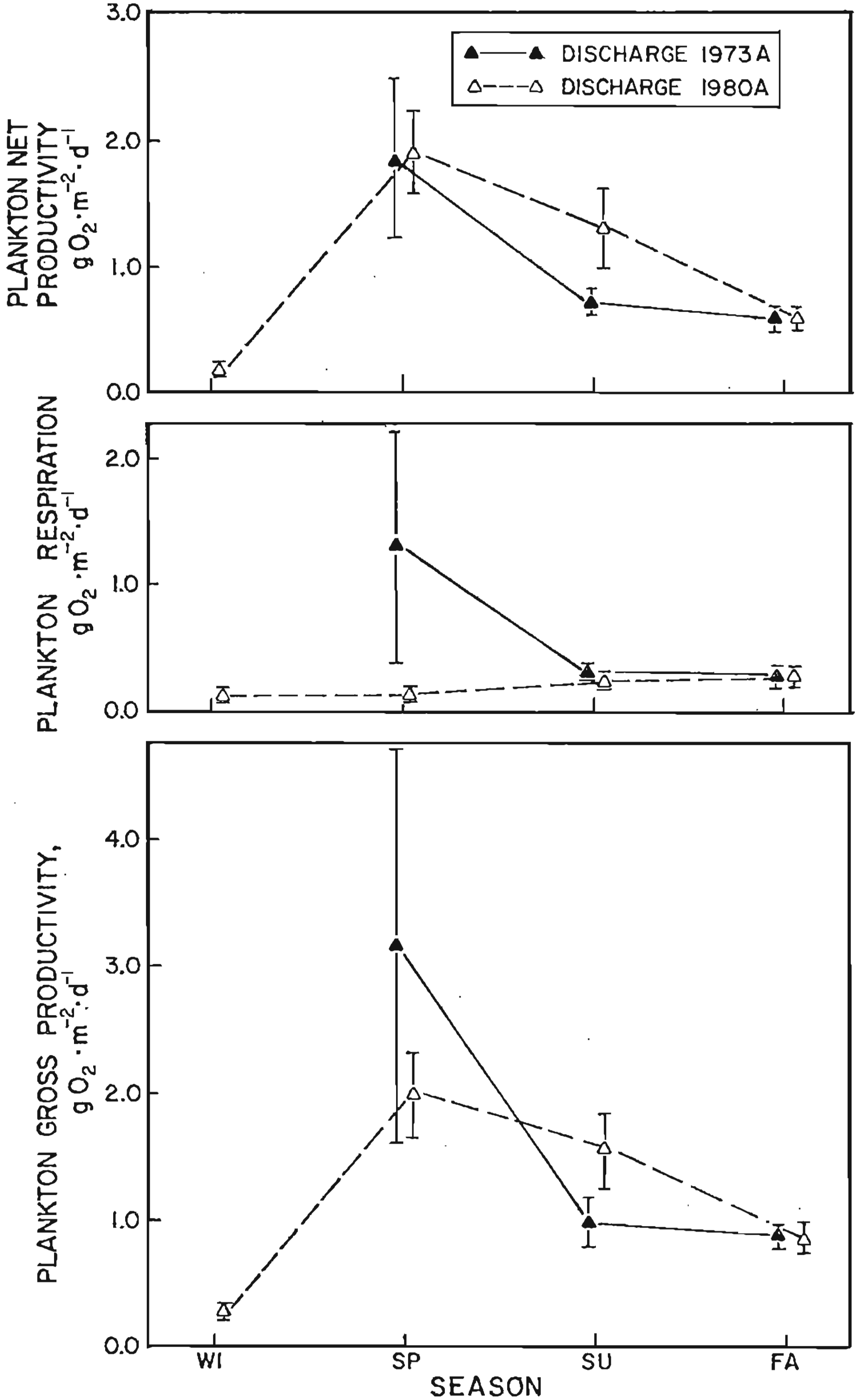


Figure II-13. Mean seasonal plankton gross productivity, net productivity, and respiration of the inner discharge bay (A) in 1973 and 1980. Bars represent ± one standard error.

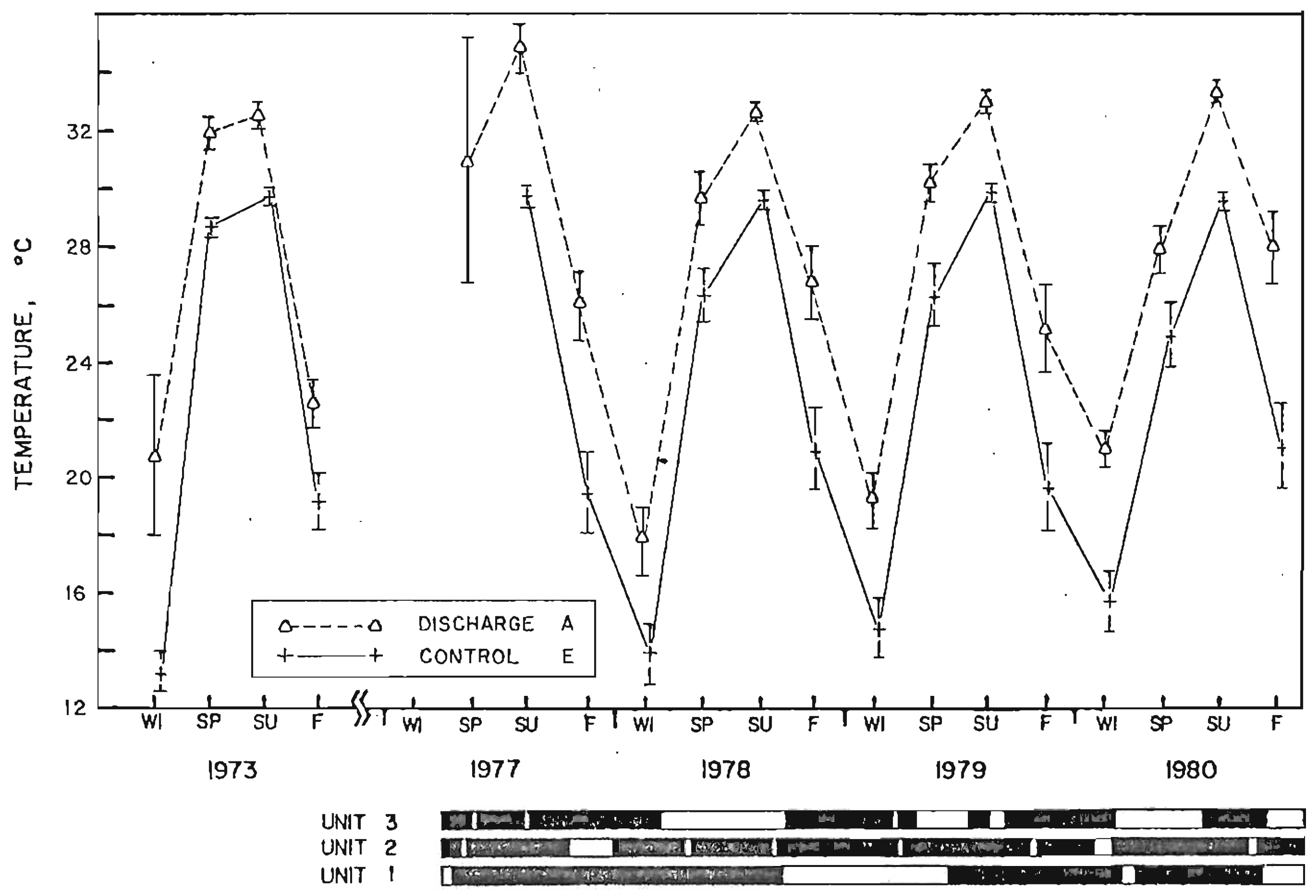


Figure II-14. Mean seasonal temperatures of the inner discharge bay (A) and its control bay (E) for 1973, 1977–1980. Bars represent ± one standard error.

Table II-12. Seasonal ΔT's between inner discharge bay (A) and its control bay (E) for 1973, 1977–1980.

Season	ΔT, °C 1973	1977	1978	1979	1980
Winter	(7.3)	No data	3.8*	4.5*	5.2*
Spring	3.2	No data	3.2	3.8	2.8
Summer	2.8	4.9*	3.0	3.6	3.9*
Fall	3.3	6.3*	5.7*	5.6*	7.2*
Mean	4.1	5.6	3.9	4.4	4.8
Standard deviation	2.1	1.0	1.2	0.9	1.9

*Unit 3 operational for all or part of that season.

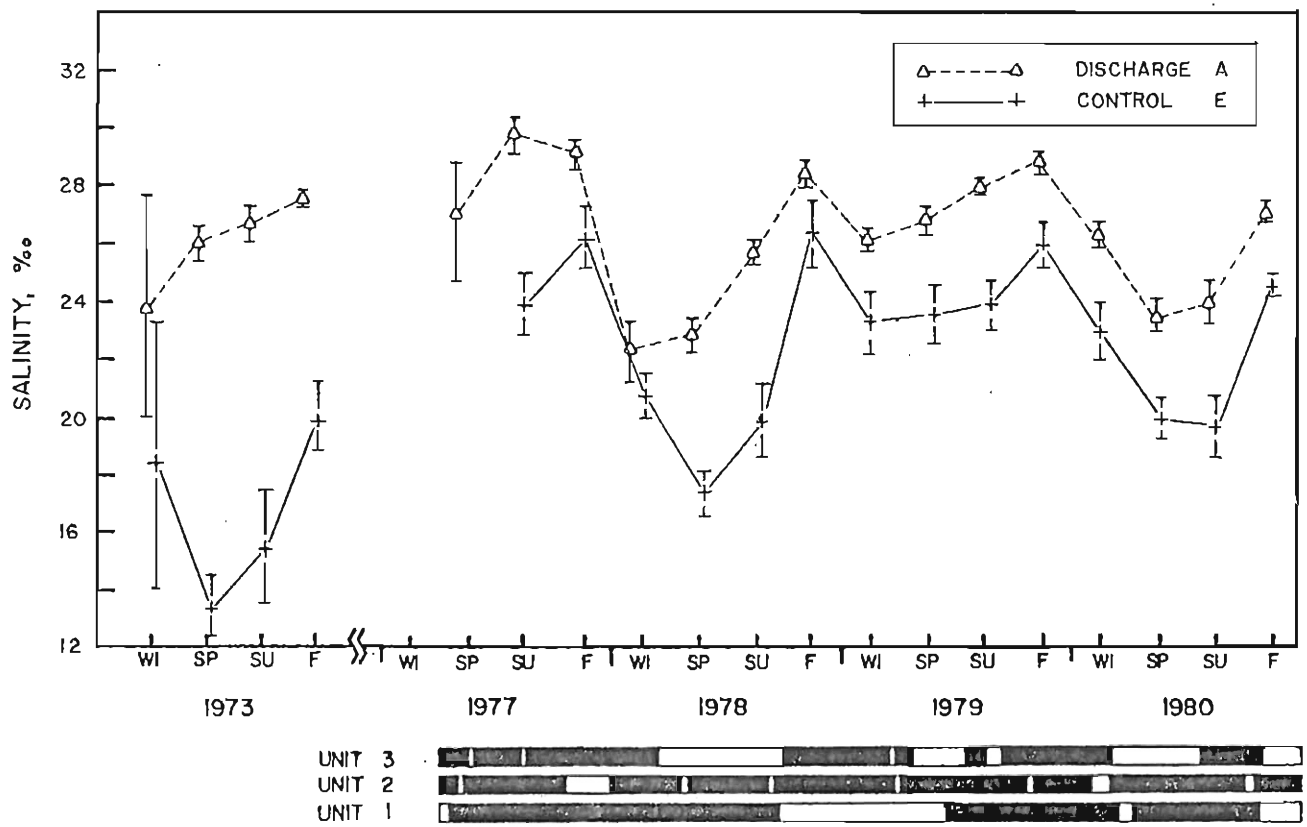


Figure II-15. Mean seasonal salinities of the inner discharge bay (A) and its control bay (E) for 1973, 1977–1980. Bars represent ± one standard error.

Table II-13. Mean annual salinity (‰) for the inner discharge bay (A) and its control bay (E) for 1973, 1978–1980.

	Year			
	1973	1978	1979	1980
Control				
Mean	16.9	21.1	24.0	22.0
Standard deviation	2.9	3.8	1.3	2.2
Discharge				
Mean	25.8	24.6	27.2	25.2
Standard deviation	1.5	2.9	1.2	1.8

site, was located near the mouth of the Crystal River where it was influenced by the freshwater discharge.

System gross productivity in the control bay followed a seasonal pattern that peaked in the summer (Fig. II-16). In the discharge bay, the system gross productivity appeared to vary with the operation of Unit 3. In 1977, when Unit 3 was on line for most of the year, gross productivity was uniformly low in the inner discharge bay. In spring 1978, when Unit 3 was off line, gross productivity rebounded to levels measured in the pre-operational study. Previous to 1980, it appeared that if Unit 3 was off line during spring and summer that the full productivities were not depressed to the low levels recorded in 1977. In 1980 though, when Unit 3 came on line in the fall, gross productivity dropped to the levels measured in 1977. The 1980 fall temperatures (Fig. II-14) were greater and the salinities (Fig. II-15) were slightly less than those recorded in 1977—1979 although none of the differences were statistically significant ($P = 0.05$).

System net productivity and respiration (Fig. II-17) exhibited the same patterns: the discharge bay appeared to vary with the operation of Unit 3 while the control bay demonstrated a strong seasonal pattern.

To investigate the relationship between discharge and control productivities, the percent of discharge productivity relative to the control productivity (control productivity = 100%) was calculated for each year (Table II-14). The relative inner discharge bay productivities of 1978 and 1979 were nearly identical: 46.5% and 46.2%, respectively. In 1980 the relative discharge productivity dropped to 33.1%. During the same period, 1977—1980, the control bay system gross productivity remained statistically constant except for spring 1978, which was significantly

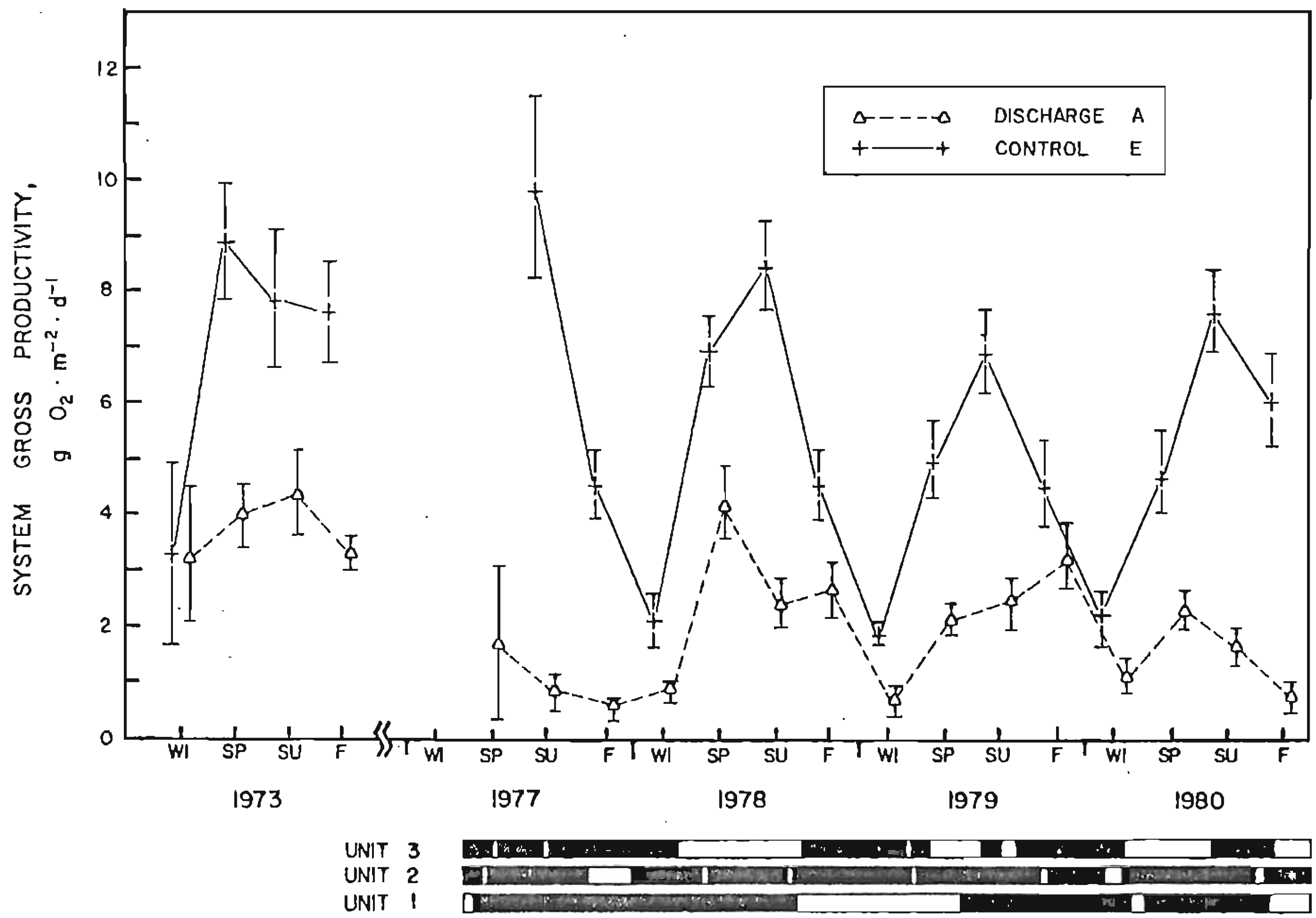


Figure II-16. Mean seasonal system gross productivity of the inner discharge bay (A) and its control bay (E) for 1973, 1977–1980. Bars represent ± one standard error.

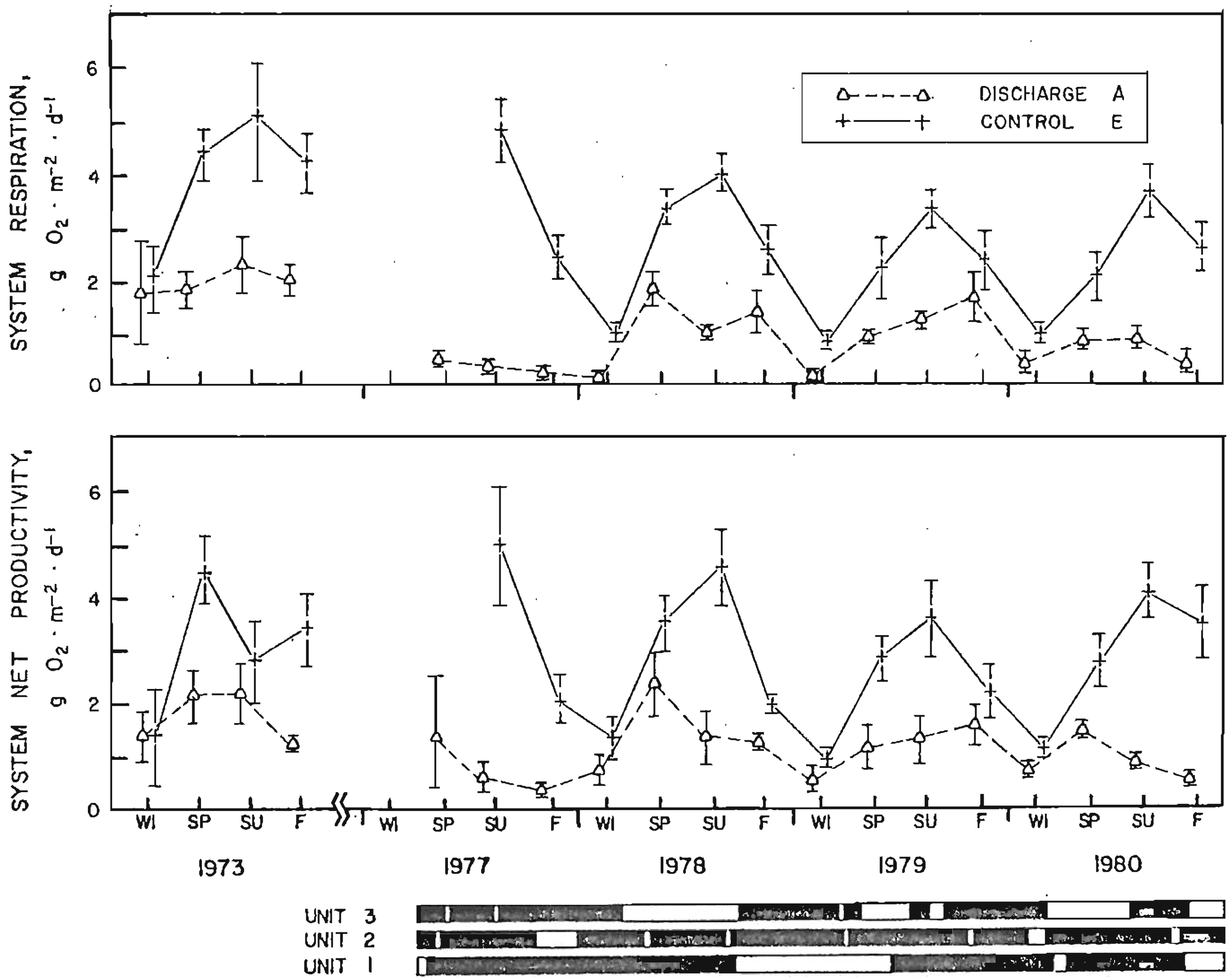


Figure II-17. Mean seasonal system net productivity and respiration of the inner discharge bay (A) and its control bay (E) for 1973, 1977–1980. Bars represent ± one standard error.

Table II-14. The seasonal average percent system gross productivity of the inner discharge bay (A) relative to the system gross productivity of its control bay (E) for 1973, 1977–1980. Number in parentheses indicates number of observations.

	% Total Gross Productivity				
Season	1973	1977	1978	1979	1980
Winter	97.0(2)	No data	37.6(8)	36.9(8)	51.3(12)
Spring	45.5(7)	No data	61.3(11)	41.7(12)	48.3(12)
Summer	55.3(6)	8.3(7)	28.2(10)	35.3(10)	21.4(12)
Fall	42.4(4)	12.1(11)	58.8(11)	70.8(12)	11.5(12)
Mean	60.0	10.2	46.5	46.2	33.1
Standard deviation	25.2	2.7	16.2	16.6	19.7

higher than spring 1979 and 1980 (Fig. II-16). Whether these postoperational relative productivities can be directly compared to the preoperational data (from Table II-14 percent relative discharge productivity = 60.0) is difficult to ascertain given the small sample sizes in some seasons and the use of a different control station. The relative productivities of summer and fall 1977 represented the only data with Unit 3 operating in the summer and are markedly lower than any other relative percent productivities.

The pattern of postoperational plankton gross productivity was very similar to that of the system gross productivity (Fig. II-18). The control bay plankton productivity had a seasonal pattern that peaked in the summer. There was also some seasonal pattern found in the inner discharge bay with spring and summer productivities highest with similar values. The preoperational plankton gross productivity indicates a spring peak and this was seen again in 1978 and 1980 data. Again, the depressed levels of productivity were evident in the inner discharge bay in 1977. The same trends shown by the plankton gross productivities were found in the plankton net productivities (Fig. II-19). The plankton respiration (Fig. II-19) did not exhibit as pronounced a seasonal variation as did the plankton net productivity.

Table II-15 summarizes seasonal and annual means of percent plankton gross productivity of the inner discharge bay relative to its control bay. Preoperational data (1973) indicated higher plankton gross productivity in the discharge bay. During Unit 3's first year of operation, this relative productivity was severely reduced relative to the control bay; while during the following 3 years plankton productivities were similar between the discharge and control bays. This trend may be indicative of greater

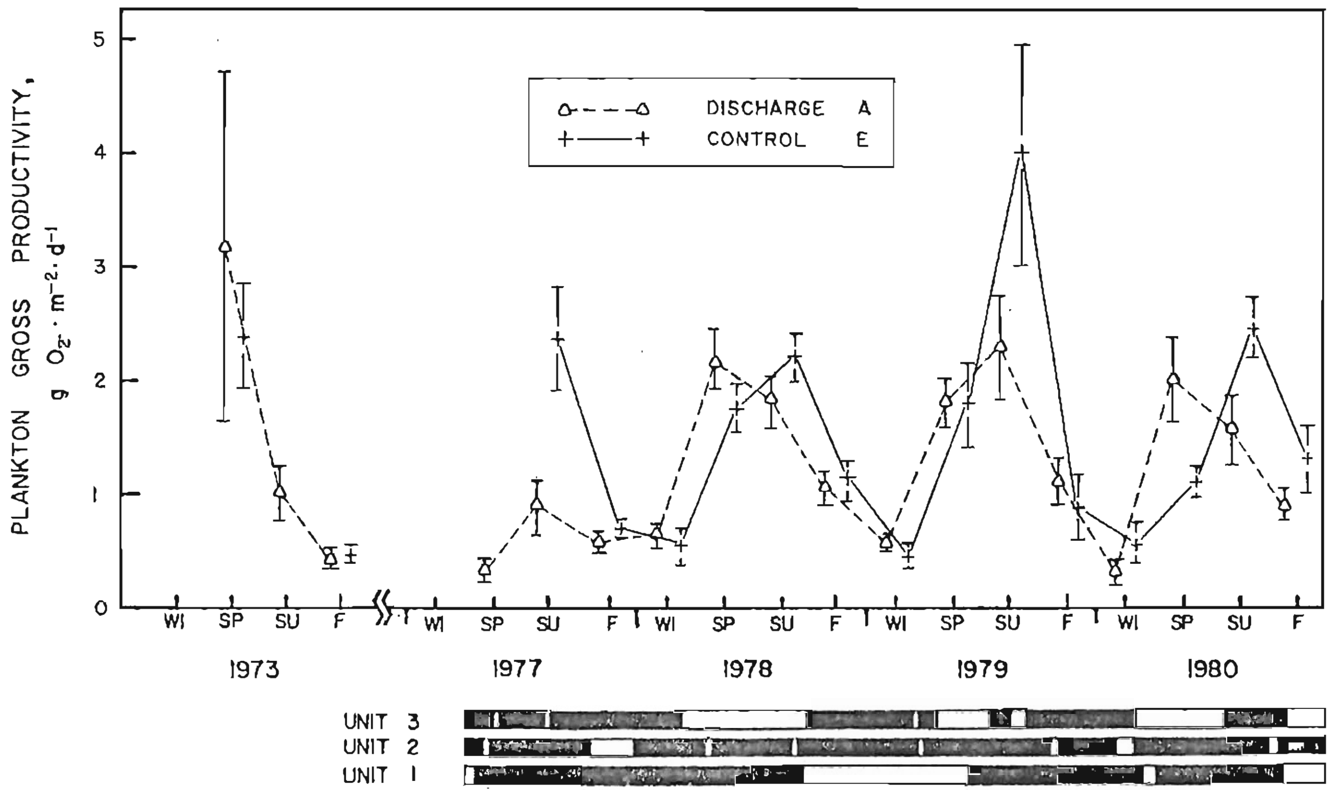


Figure II-18. Mean seasonal plankton gross productivity of the inner discharge bay (A) and its control bay (E) for 1973, 1977–1980. Bars represent ± one standard error.

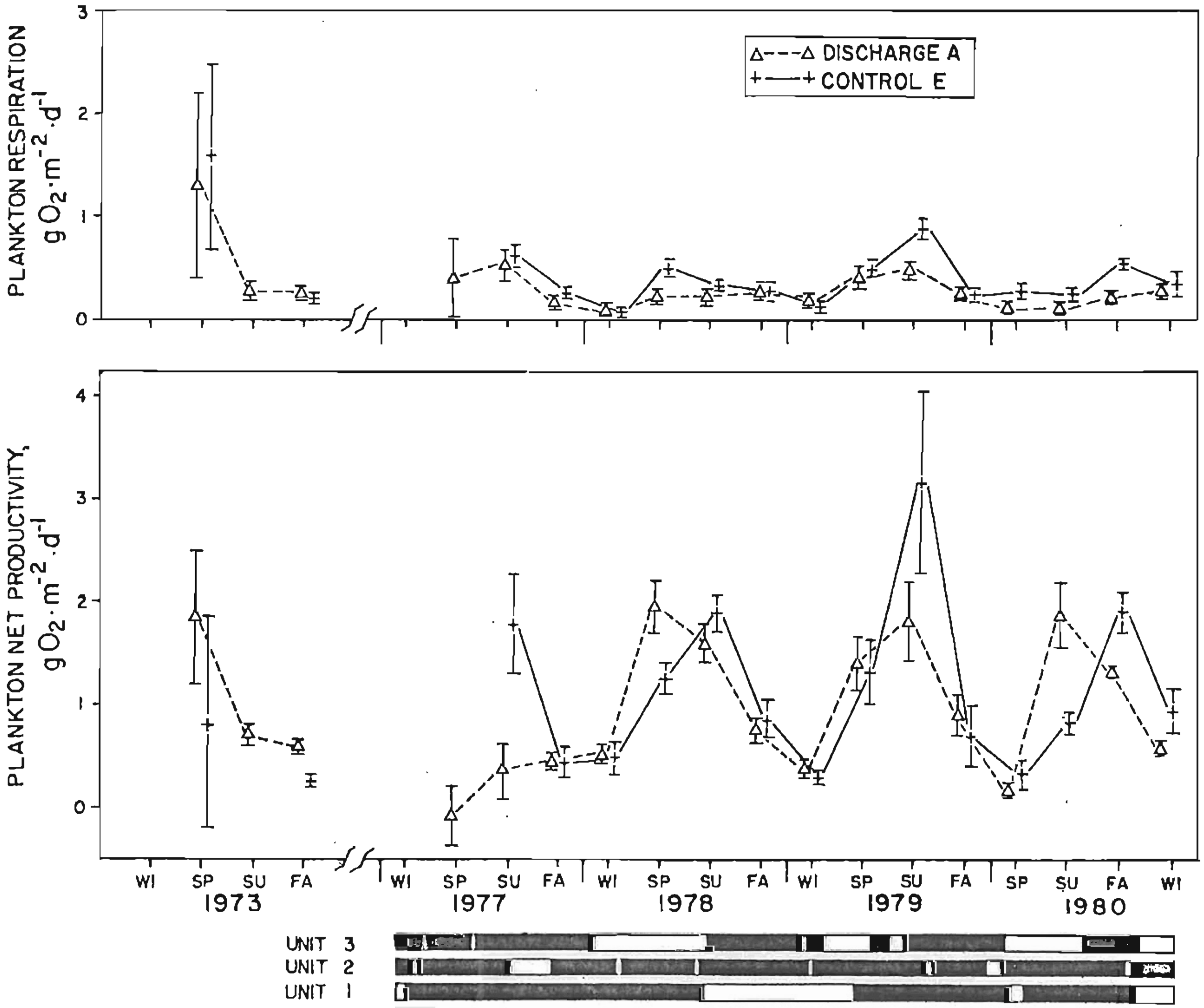


Figure II-19. Mean seasonal plankton net productivity and respiration of the inner discharge bay (A) and its control bay (E) for 1973, 1977–1980. Bars represent ± one standard error.

Table II-15. The seasonal average percent plankton gross productivity of the inner discharge bay (A) relative to the plankton gross productivity of its control bay (E) for 1973, 1977–1980. Number in parentheses indicates number of observations.

	% Plankton Gross Productivity				
Season	1973	1977	1978	1979	1980
Winter	No data	No data	111.1(6)	128.9(9)	54.5(12)
Spring	131.2(2)	No data	124.0(12)	100.5(11)	183.0(12)
Summer	No data	36.3(5)	81.5(10)	56.6(9)	64.2(12)
Fall	184.4(4)	82.1(10)	90.3(11)	118.5(10)	68.5(12)
Mean	157.8	59.2	101.7	101.1	92.6
Standard deviation	37.6	32.4	19.4	31.9	60.6

thermal loading during 1977 or to selection of plankton populations adapted to the new, more variable thermal regime.

The percent of the system gross productivity (P_G) produced by the plankton is presented in Table II-16. Assuming the comparable nature of these measurements as discussed earlier, it appears that the system productivity in the inner discharge bay was plankton dominated in the postoperational years. In 1977, when Unit 3 was operational for the year, the system gross productivity was 100% plankton productivity. In 1978–1980 when Unit 3 was operational only 50–60% of the year, benthos productivity contributed to the system metabolism of the inner discharge bay. It is interesting to note that since 1978 the relative amount of plankton productivity in the inner discharge bay has been increasing. The question arises whether a plankton-dominated system can be as productive as a benthos-dominated system. In 1977 and fall 1980, when plankton accounted for all the system productivity, the lowest levels of system gross productivity were measured.

The postoperational control is a benthos-dominated system (Table II-16). The relative amount of plankton gross productivity has remained fairly constant throughout this study.

The ecological efficiency (Fig. II-20) of the inner discharge bay has been significantly less than that of its control bay for all seasons except winter 1980. In 1980 the ecological efficiencies of the inner discharge bay follow a general downward trend throughout the year. Since this trend began near the time of the start up of Unit 3 in August, this lowered efficiency may be directly related to plant operation.

Table II-16. Plankton gross productivity as a percentage of total gross productivity for the inner discharge bay (A) and its control bay (E) for preoperational and postoperational years.

	Control					Discharge				
Season	1973	1977	1978	1979	1980	1973	1977	1978	1979	1980
Winter	No data		25.7	24.1	25.3	No data		75.9	82.6	27.0
Spring	26.7		25.5	35.9	22.9	80.8		51.5	86.6	87.1
Summer	No data	24.0	25.9	58.2	31.9	22.7	104.9	75.4	93.0	95.7
Fall	5.8	15.8	25.3	20.2	21.5	24.2	105.3	38.8	33.8	129.0
Mean	16.2	19.9	25.6	34.6	25.4	42.3	105.1	60.4	74.0	84.7
Standard deviation	14.8	5.8	0.3	17.1	4.6	32.6	0.3	18.4	27.1	42.5

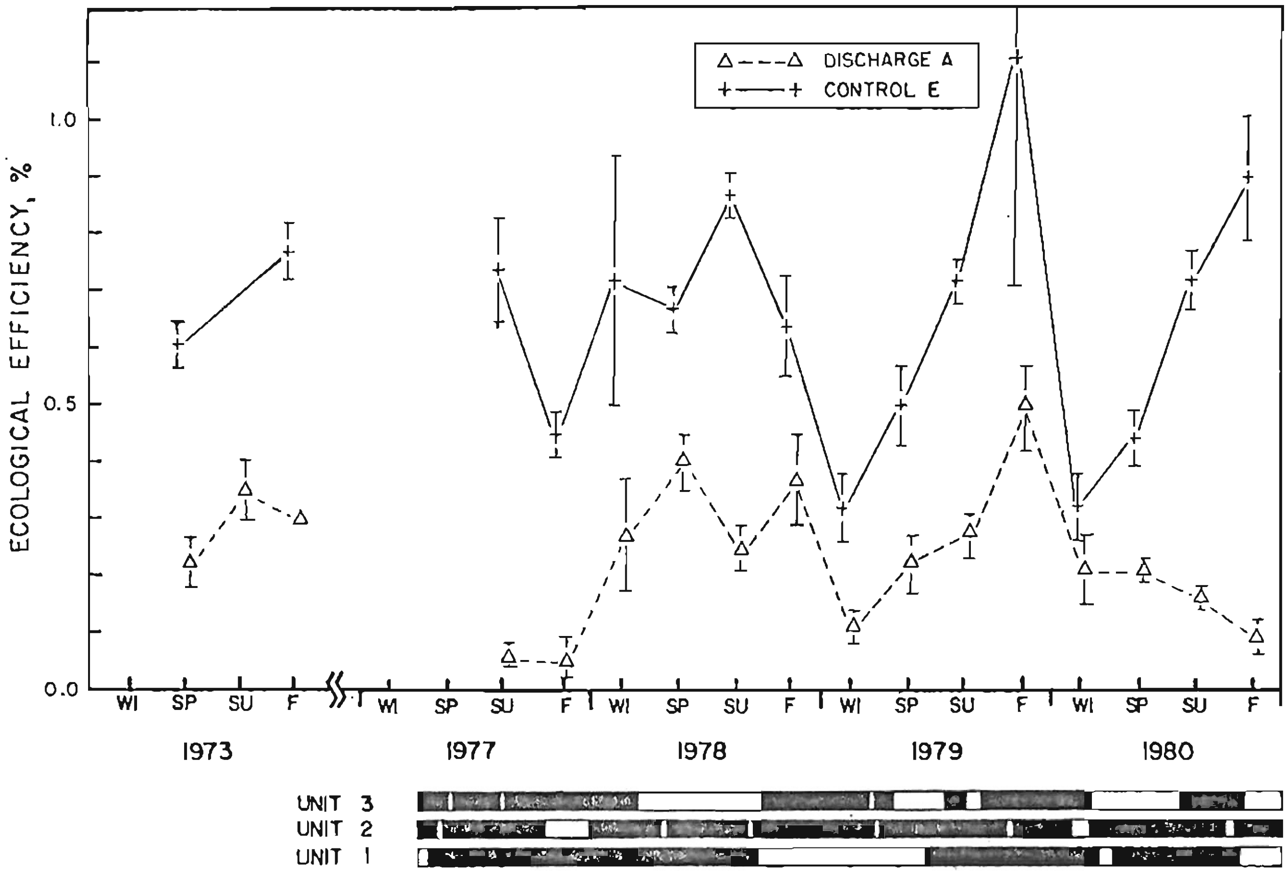


Figure II-20. Mean seasonal ecological efficiencies of the inner discharge bay (A) and its control bay (E) for 1973, 1977–1980. Bars represent ± one standard error.

Discussion

When an ecosystem is disturbed an initial lowering of productivity is expected (Odum et al. 1978; Caldwell et al. 1979). This is followed by an increasing productivity as the ecosystem adapts to the disturbance. When Unit 3 went on line in 1977, productivity in the inner discharge bay dropped to very low levels. In 1978, Unit 3 was off line more than 50% of the year and productivity in the inner discharge bay rebounded to levels measured in the preoperational study. This pattern was repeated in 1979. In 1980, Unit 3 was again off line 50% of the year, predominately in the spring and summer. Unlike 1978 and 1979, the levels of productivity declined from spring through fall. The fall 1980 productivity was similar to that measured in 1977.

The independent variables measured in this study gave no obvious insights into this decline. Given the theory of ecosystem adaptation and the maximization of power (Caldwell et al. 1979), one might expect that the productivity of the inner discharge bay would have increased or remained at the same level in 1980. Apparently either other independent factors, such as nutrients, may be affecting the inner discharge bay, causing a decline in productivity; or the question of ecosystem adaptation and resiliency must be examined. It is possible that the cumulative effects of an interaction of temperature, turbidity, and other unknown factors may have exceeded the capabilities of the discharge bay system to adapt to even the varying operation of Unit 3 during the past 3 years.

Summary

1. The inner discharge bay system gross productivity in 1980 approximated 33% of the control bay system gross productivity. This was a decline

from the 46% relative system gross productivity measured in 1978 and 1979.

2. Plankton gross productivity accounted for approximately 87% of the discharge system gross productivity and 26% of the control system gross productivity.

3. Unit 3 was off line 50% of the year. This was reflected in lower spring and summer temperatures in the discharge bay.

4. System gross productivity, system net productivity, and ecological efficiencies all exhibited a decline from spring to fall in 1980. There were no substantial changes in the independent variables such as salinity and temperature to explain this decline.

CHAPTER 4

COMMUNITY METABOLISM OF THE OUTER DISCHARGE BAY (B) AND ITS CONTROL BAY (D)

Arthur M. Watson

Introduction

The results of the 1980 community metabolism measurements for the thermally affected outer discharge bay (B) and its control bay (D) (see Fig. II-2) are presented in this section. McKellar (1975) conducted a study (during 1972–1973) to determine the effects of thermal effluent on the outer discharge bay ecosystem. At that time it was discovered that although the bays are of similar depth, the outer discharge bay was plankton dominated while its control bay was dominated by benthic macrophytes. Results from 1980 measurements are compared with McKellar's (1975) preoperational study and with the 1977–1979 postoperational study (Odum et al. 1978; Caldwell et al. 1979, 1980).

Study Site

The outer discharge bay is adjacent to and due west of the inner discharge bay (A). It is bordered on the seaward and landward sides by oyster bars that run north and south. The outer control bay is located on the intake side of the canal and is morphologically similar to the outer discharge bay, with oyster bars lining the landward (eastern) side and a sandbar lining the seaward (western) side.

Methods

The methods and materials that were used in determining the community metabolism for the outer discharge bay and the outer control bay were the same as those used for the inner discharge bay and its control bay. These methods and necessary definitions are presented in chapter 3. The diffusion coefficient (K) used for the outer discharge and control bays, 0.35 g $O_2 \cdot m^{-2} \cdot hr^{-1}$, at 100% saturation deficit, was from McKellar's (1975) preoperational study (n = 5).

Results

Bimonthly data collected during 1980 are summarized in Appendix B. Seasons for the outer discharge bay and its control bay are defined as follows:

Spring:	February—April
Summer:	May—July
Fall:	August—October
Winter:	November—January.

These season designations are consistent with those used by McKellar (1975) in his preoperational study. Note that they differ from those used for the inner bays in chapter 3.

Temperature, Salinity, and Light Extinction for 1980

Mean seasonal water temperatures for the outer discharge bay were all significantly higher than those of the control bay (Table II-17 and Fig. II-21). Seasonal temperature differences (ΔT) ranged from 6.2°C in the winter to 1.8°C in the summer.

Mean seasonal salinities were not significantly different for the outer discharge and control bays except during the winter (Table II-17 and

Table II-17. Results of statistical t-tests between the outer discharge bay (B) and its control bay (D): 1980 seasonal averages for temperature (°C), salinity (‰), and extinction coefficients (m^{-1}). The standard error is listed after the value; the number of observations follows in parentheses.

Season	Temperature, °C	Salinity, ‰	Extinction Coefficient, m^{-1}
Spring			
Discharge	21.4 ± 0.7(12)*	24.8 ± 0.5(12)	1.75 ± 0.16(12)
Control	18.3 ± 1.1(12)*	24.1 ± 0.5(12)	1.89 ± 0.21(12)
Summer			
Discharge	29.6 ± 0.6(12)*	21.1 ± 0.7(12)	2.18 ± 0.16(12)
Control	27.8 ± 0.7(12)*	22.5 ± 0.4(12)	2.30 ± 0.15(12)
Fall			
Discharge	32.6 ± 0.5(12)*	25.5 ± 1.1(12)	1.60 ± 0.09(12)†
Control	29.0 ± 0.6(12)*	24.7 ± 0.9(12)	1.31 ± 0.13(12)†
Winter			
Discharge	23.2 ± 1.1(12)*	26.7 ± 0.3(12)†	1.67 ± 0.26(12)†
Control	17.0 ± 1.0(12)*	25.9 ± 0.3(12)†	1.19 ± 0.09(12)†

*Means for control and discharge are significant at the 95% confidence level (two-sample t-tests).
†Means for control and discharge are significant at the 90% confidence level (two-sample t-tests).

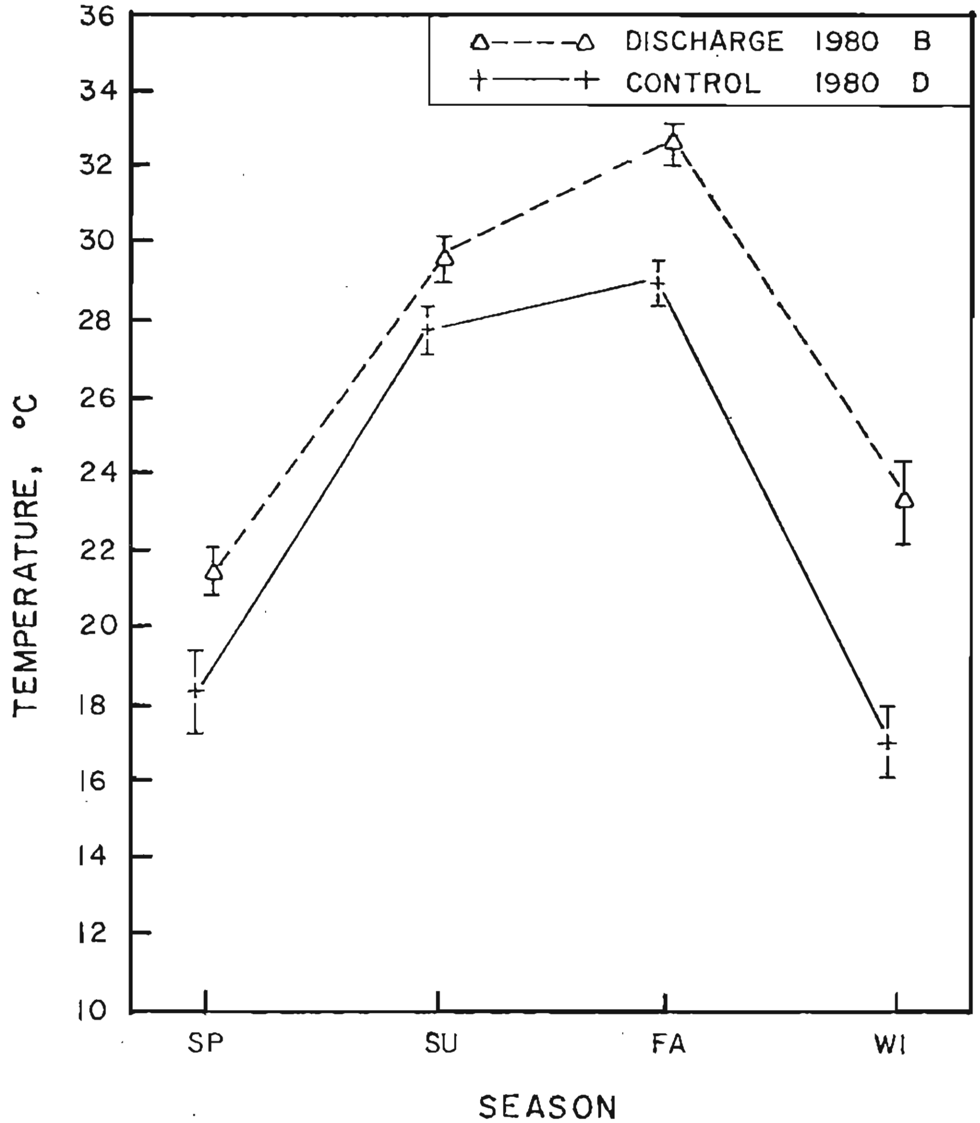


Figure II-21. Seasonal mean temperature in the outer discharge and control bays for 1980. Bars represent ± one standard error.

Fig. II-22). The higher discharge salinity was significant at the 90% confidence level.

Mean seasonal light extinction coefficients estimated from Secchi disk readings were significantly higher (90% confidence level) for the outer discharge bay compared to its control bay during the fall and winter (Table II-17 and Fig. II-23). Annual means of photometer light extinction measurements (Table II-18) indicated no significant difference between control and discharge bays.

System Gross Productivity, Net Productivity, and Night Respiration for 1980

System gross productivity for the outer discharge bay compared to its control bay was significantly higher (95% confidence level) during the spring, summer, and fall 1980 (Table II-19 and Fig. II-24). No significant difference in gross productivity between the outer discharge and control bays occurred during the winter. Outer discharge bay system gross productivity peaked in the summer with a seasonal mean of 6.42 g $O_2 \cdot m^{-2} \cdot d^{-1}$. System gross productivity in the control bay peaked during the fall with a mean seasonal value of 4.63 g $O_2 \cdot m^{-2} \cdot d^{-1}$. Mean seasonal net productivity in the outer discharge bay was significantly higher (95% confidence level) than the control bay during the spring, summer, and fall (Table II-19 and Fig. II-25). During the summer and fall, nighttime respiration was significantly higher (95% confidence level) in the outer discharge bay than in the control bay (Table II-19 and Fig. II-25).

Plankton Gross Productivity, Net Productivity, and Night Respiration for 1980

Mean seasonal plankton gross productivity in the control bay was significantly higher than the outer discharge bay only during the spring 1980

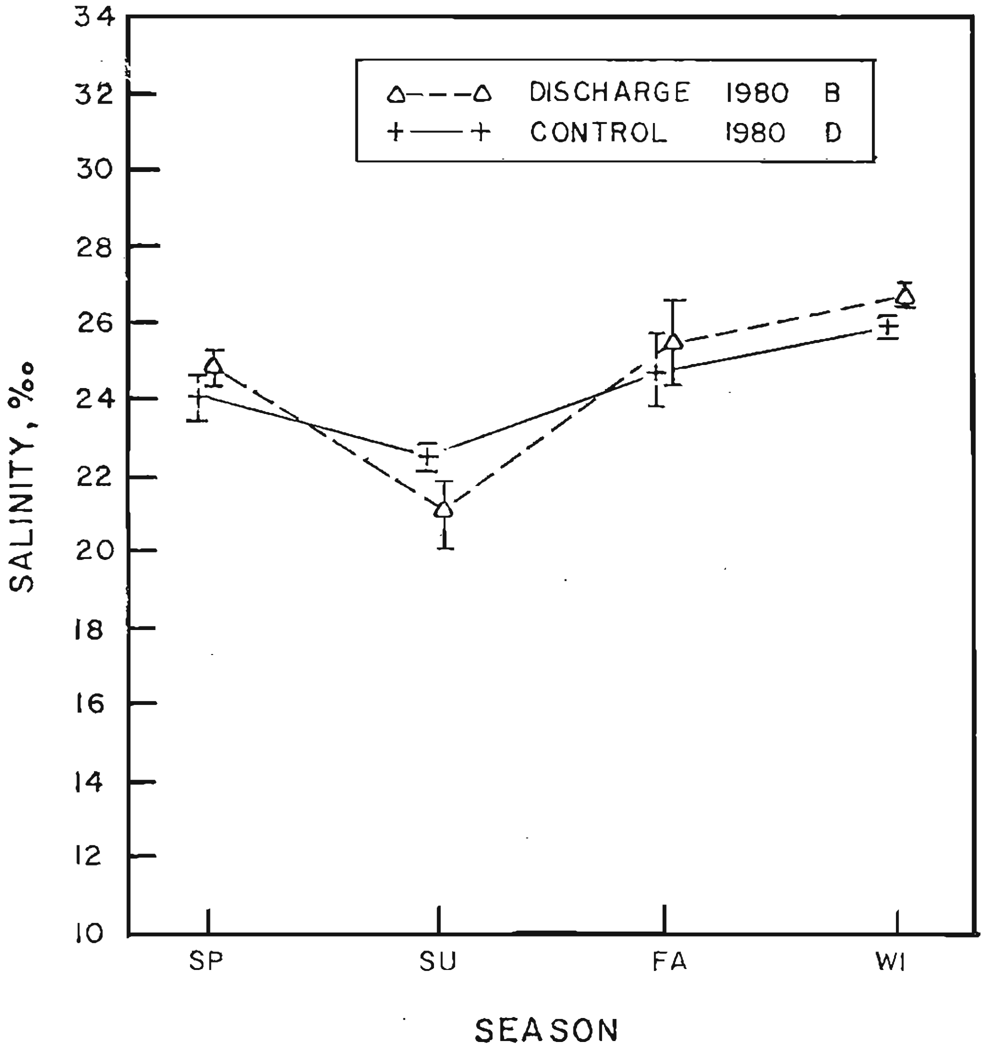


Figure II-22. Seasonal mean salinity in the outer discharge and control bays for 1980. Bars represent ± one standard error.

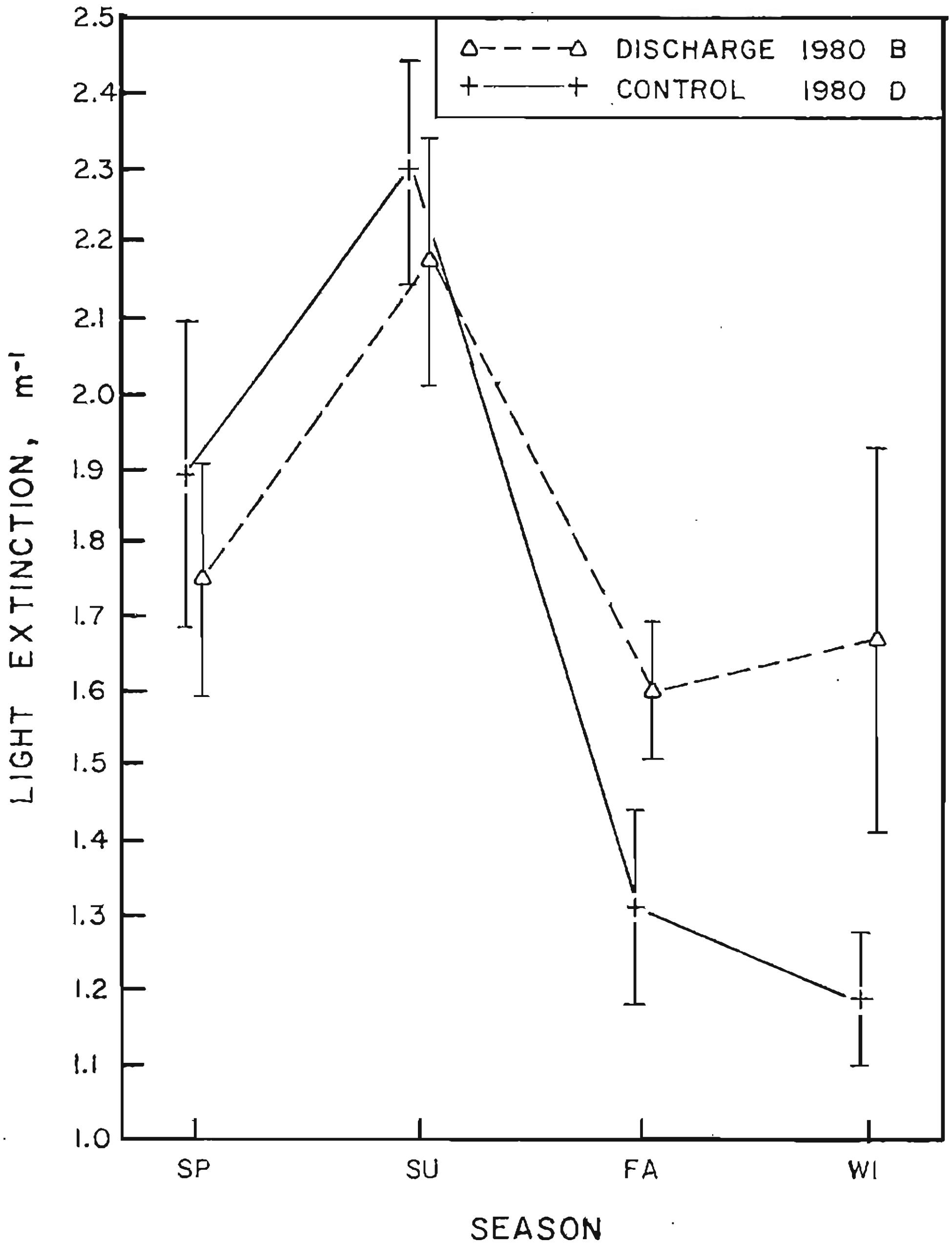


Figure II-23. Seasonal average light extinction coefficients for the outer discharge and control bays for 1980. Bars represent ± one standard error.

Table II-18. Photometer-derived extinction coefficients for the outer discharge bay (B) and its control bay (D) for 1980.

	Light Extinction, m^{-1}	
	Discharge Bay (B)	Control Bay (D)
Mean	1.17	1.16
Standard deviation	0.09	0.37
Range	1.03—1.34	0.70—1.84
N	17	16

Table II-19. Results of statistical t-tests between the outer discharge bay (B) and its control bay (D): 1980 seasonal averages for gross productivity ($P_G = P_N + R$), net productivity (P_N), and night respiration (R). The standard error is listed after the value; the number of observations follows in parentheses.

Season	P_G, $g\ O_2 \cdot m^{-2} \cdot d^{-1}$	P_N, $g\ O_2 \cdot m^{-2} \cdot d^{-1}$	R, $g\ O_2 \cdot m^{-2} \cdot d^{-1}$
Spring			
Discharge	3.17 ± 0.33(12)*	1.99 ± 0.20(12)*	1.18 ± 0.15(12)
Control	1.98 ± 0.27(12)*	1.11 ± 0.15(12)*	0.87 ± 0.17(12)
Summer			
Discharge	6.42 ± 0.50(12)*	3.61 ± 0.31(12)*	2.81 ± 0.25(12)*
Control	3.94 ± 0.30(12)*	2.10 ± 0.18(12)*	1.84 ± 0.12(12)*
Fall			
Discharge	6.33 ± 0.20(12)*	3.34 ± 0.20(12)*	2.99 ± 0.09(12)*
Control	4.63 ± 0.41(12)*	2.31 ± 0.25(12)*	2.32 ± 0.19(12)*
Winter			
Discharge	1.72 ± 0.38(12)	1.05 ± 0.20(12)	0.67 ± 0.21(12)
Control	2.29 ± 0.54(12)	1.40 ± 0.36(12)	0.97 ± 0.21(12)

*Means for control and discharge are significant at the 95% confidence level (two-sample t-tests).

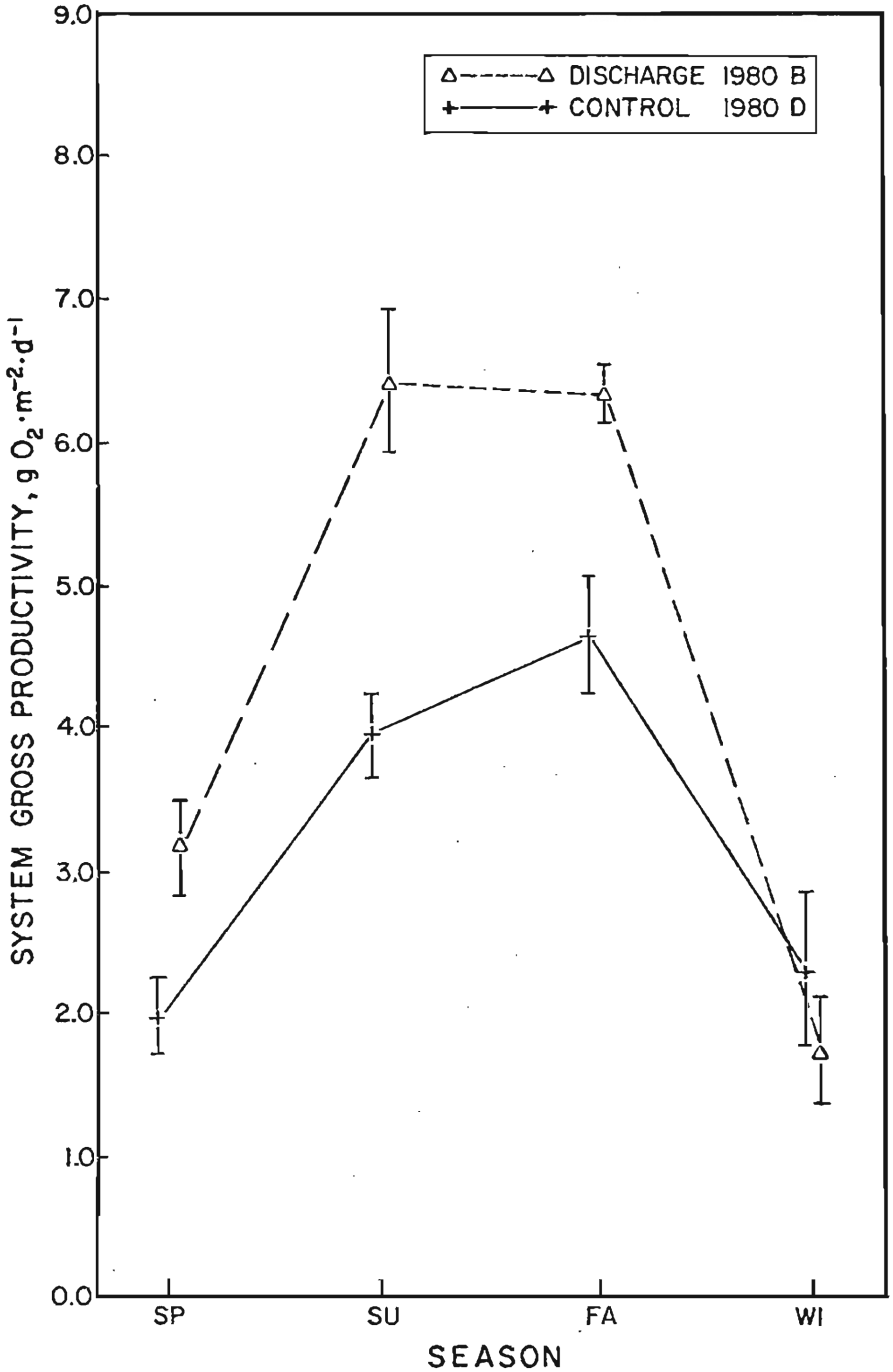


Figure II-24. Seasonal mean system gross productivity for the outer discharge and control bays for 1980. Bars represent ± one standard error.

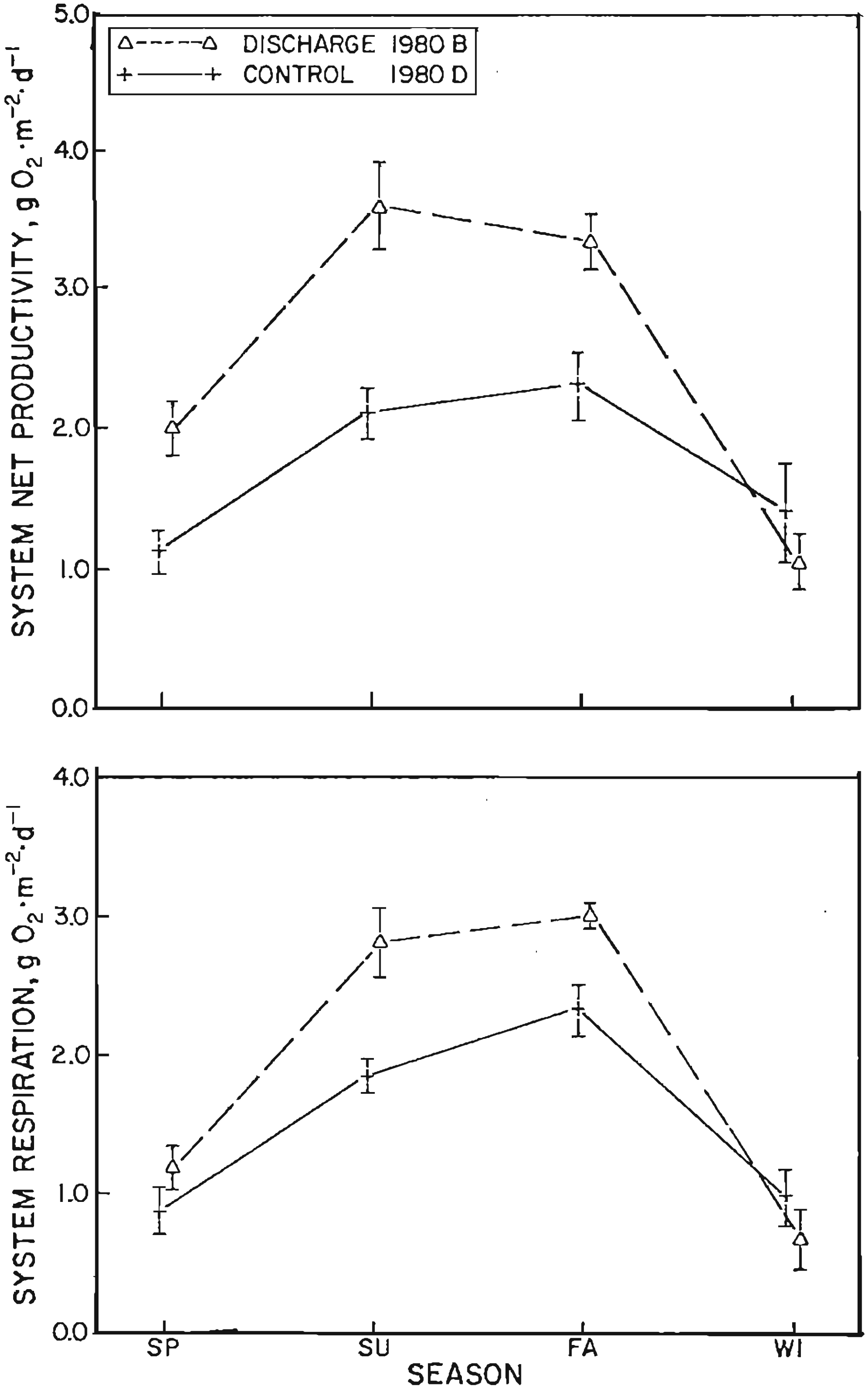


Figure II-25. Seasonal mean system net productivity and respiration for the outer discharge and control bays for 1980. Bars represent ± one standard error.

(Table II-20 and Fig. II-26). Plankton net productivity was not significantly different between the two bays during 1980 (Table II-20 and Fig. II-27). Mean seasonal plankton respiration was significantly higher (90% confidence level) in the control bay during the summer (Table II-20 and Fig. II-27). No other significant differences in plankton respiration between the outer discharge and control bays were detected.

Ecological Indices for 1980

Mean ecological efficiencies for the outer discharge bay and its control bay are given in Table II-21. During the spring (90% confidence level), summer, and fall (95% confidence level) means seasonal ecological efficiency was higher in the outer discharge bay than its control bay.

The P/R ratios are also presented in Table II-21. Mean values indicated greatest autotrophy during the spring and winter, with mean values >1.0 throughout the year. There was a significant difference (90% confidence level) between the outer discharge and control bays only during the summer 1980.

Comparison of 1973 Preoperational and 1980 Postoperational Data

Temperature, Salinity, and Light Extinction

Environmental parameters for the 1973 preoperational and 1980 postoperational studies are given in Figs. II-28 and II-29. The fall 1980 seasonal temperature was significantly higher (95% confidence level) than that of the fall 1973 value. Mean seasonal salinity during the summer was significantly lower in the 1980 study. Light extinction coefficients in summer 1980 were significantly higher than those recorded in 1973.

Table II-20. Results of statistical t-tests between the outer discharge bay (B) and its control bay (D): 1980 seasonal averages for gross plankton productivity ($P_G = P_N + R$), plankton net productivity (P_N), and plankton respiration (R). The standard error is listed after the value; the number of observations follows in parentheses.

Season	Plankton P_G, g $O_2 \cdot m^{-2} \cdot d^{-1}$	Plankton P_N, g $O_2 \cdot m^{-2} \cdot d^{-1}$	Plankton R, g $O_2 \cdot m^{-2} \cdot d^{-1}$
Spring			
Discharge	0.98 ± 0.16(12)*	0.74 ± 0.17(12)	0.24 ± 0.04(12)
Control	1.51 ± 0.23(11)*	0.95 ± 0.31(11)	0.56 ± 0.23(11)
Summer			
Discharge	4.50 ± 0.57(12)	4.14 ± 0.55(12)	0.36 ± 0.07(12)*
Control	3.63 ± 0.36(12)	3.08 ± 0.39(12)	0.56 ± 0.07(12)*
Fall			
Discharge	3.42 ± 0.36(12)	2.74 ± 0.35(12)	0.68 ± 0.13(12)
Control	3.36 ± 0.39(12)	2.62 ± 0.36(12)	0.74 ± 0.07(12)
Winter			
Discharge	1.06 ± 0.25(11)	0.81 ± 0.20(11)	0.25 ± 0.08(11)
Control	1.34 ± 0.34(12)	0.87 ± 0.25(12)	0.47 ± 0.12(12)

*Means for control and discharge are significant at the 90% confidence level (two-sample t-tests).

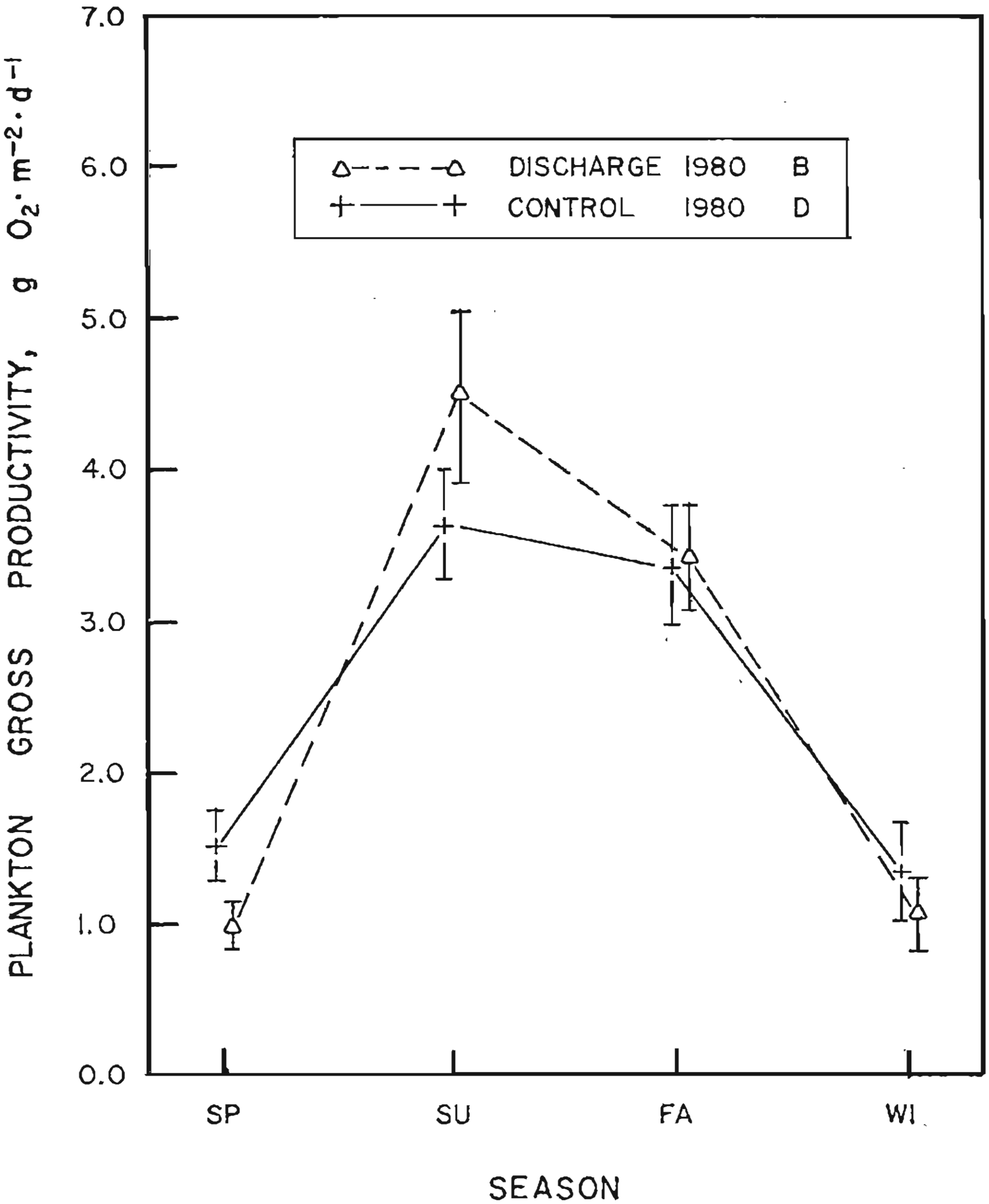


Figure II-26. Seasonal mean plankton gross productivity for the outer discharge and control bays for 1980. Bars represent $\pm$ one standard error.

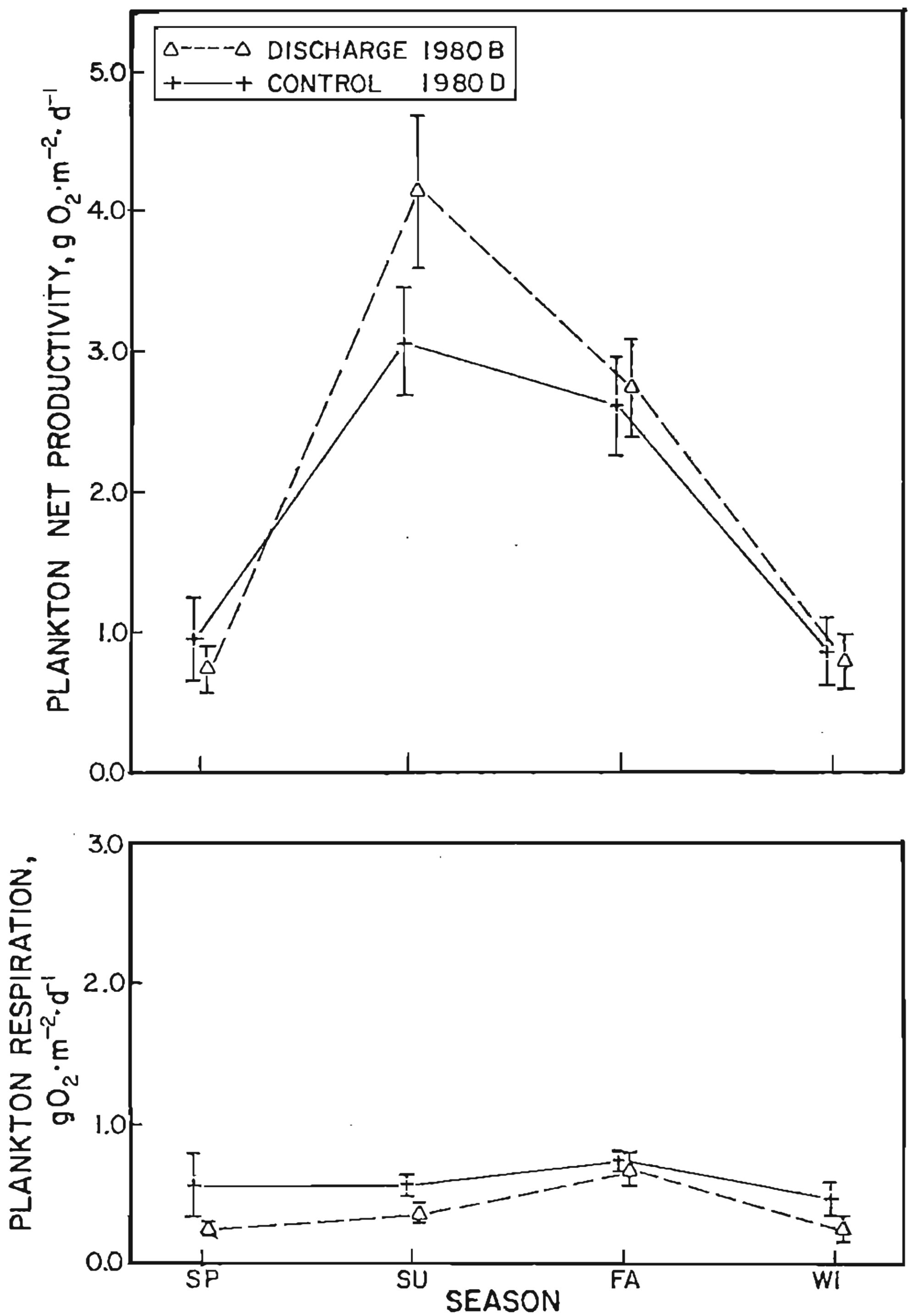


Figure II-27. Seasonal mean plankton net productivity and respiration for the outer discharge and control bays for 1980. Bars represent ± one standard error.

Table II-21. Results of statistical t-tests for evaluation of mean ecological efficiencies and P/R ratios ($P_G/2R$) between the outer discharge bay (B) and its control bay (D) for 1980. Standard error follows the value; number of observations in parentheses.

Season	Ecological Efficiency	Range	P/R Ratio	Range
Spring				
Discharge	0.38 ± 0.06(12)†	0.19–0.85	1.43 ± 0.09(12)	0.95–2.04
Control	0.23 ± 0.03(12)†	0.03–0.43	3.93 ± 2.41(12)	0.71–30.25
Summer				
Discharge	0.58 ± 0.04(12)*	0.25–0.80	1.17 ± 0.05(12)†	0.92–1.55
Control	0.36 ± 0.03(12)*	0.21–0.62	1.07 ± 0.02(12)†	0.92–1.20
Fall				
Discharge	0.64 ± 0.03(12)*	0.44–0.91	1.07 ± 0.04(12)	0.84–1.37
Control	0.48 ± 0.06(12)*	0.27–0.99	1.00 ± 0.04(12)	0.82–1.27
Winter				
Discharge	0.34 ± 0.09(11)	0.08–0.94	1.24 ± 0.13(9)	0.80–2.10
Control	0.33 ± 0.07(11)	0.00–0.67	1.67 ± 0.26(12)	0.00–2.90

*Means for control and discharge are significant at the 95% confidence level (two-sample t-tests).
†Means for control and discharge are significant at the 90% confidence level (two-sample t-tests).

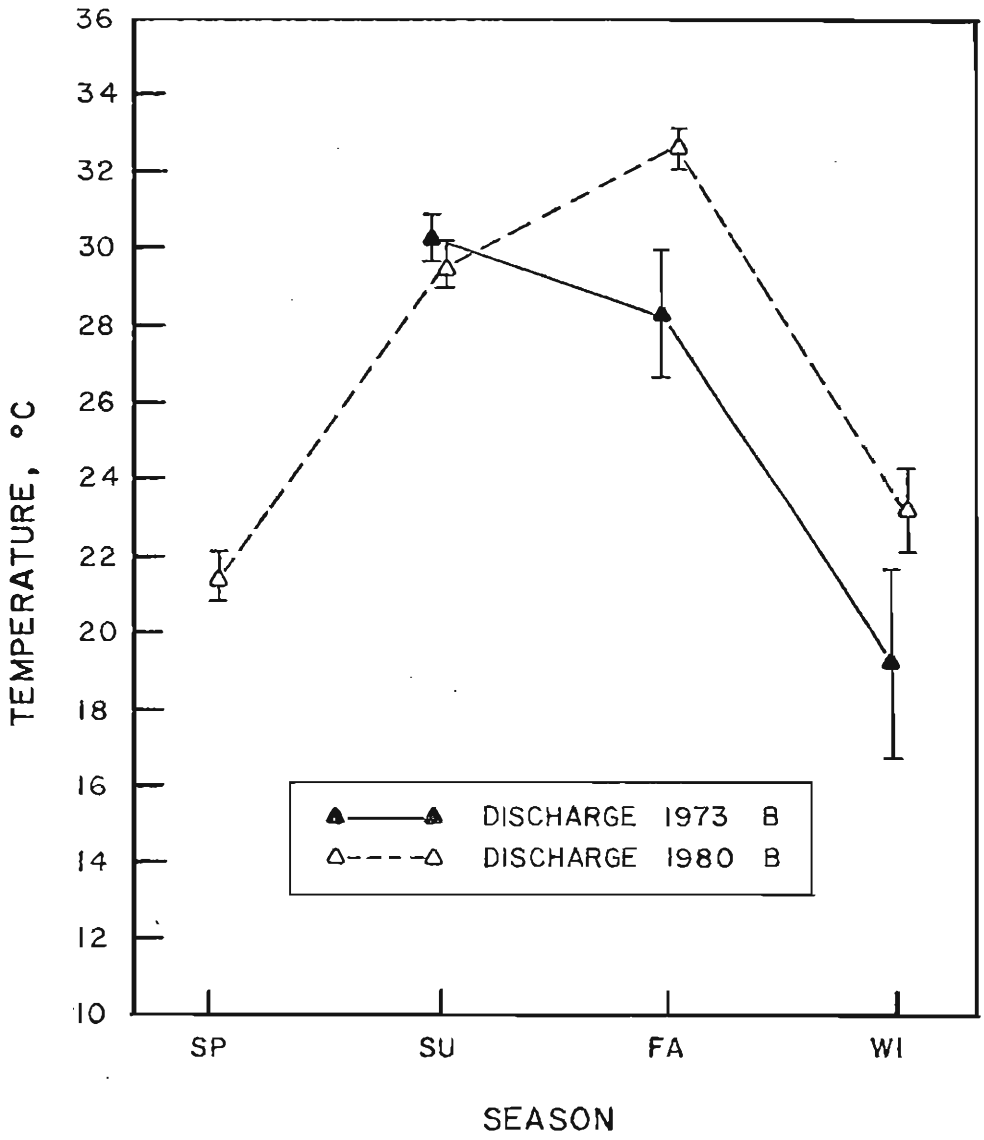


Figure II-28. Comparison of 1973 and 1980 values for mean seasonal temperatures for the outer discharge bay. Bars represent ± one standard error.

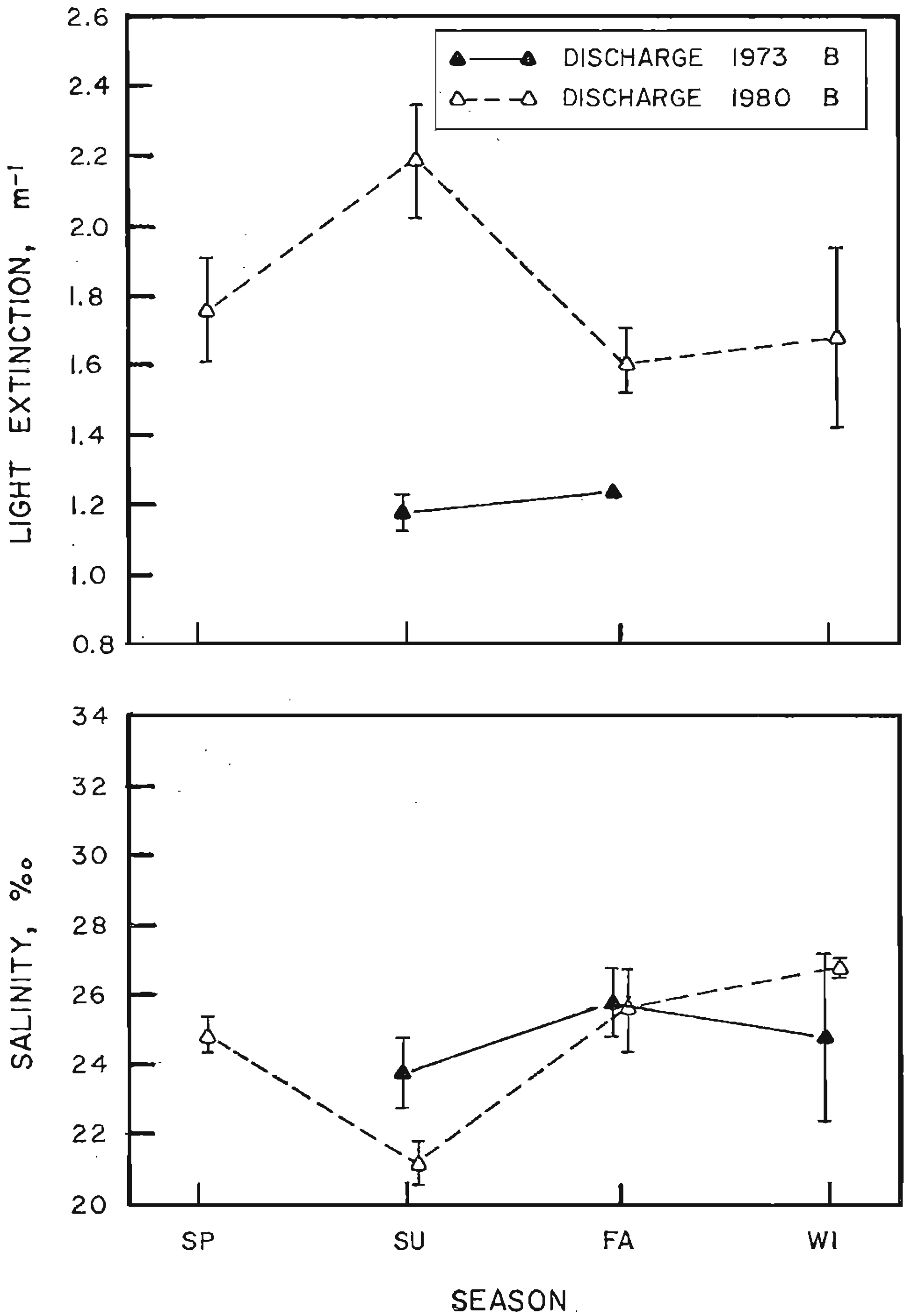


Figure II-29. Comparison of 1973 and 1980 values for mean seasonal salinity and light extinction coefficients for the outer discharge bay. Bars represent ± one standard error.

System Gross Productivity, Net Productivity, and Night Respiration

A significant decrease in system gross productivity occurred in winter 1980 with respect to the 1973 value (Fig. II-30). There were no significant differences in system net productivity between the 1973 and 1980 seasonal means (Fig. II-31). System night respiration was significantly lower in winter 1980.

Plankton Gross Productivity, Net Productivity, and Night Respiration

There were no significant differences between the plankton gross productivity in any season (Fig. II-32). Plankton net productivity was significantly higher in winter 1980 (Fig. II-33). There was a significant (95% confidence level) decrease in plankton respiration during fall and winter 1980.

Preoperational and Postoperational Trends: 1973, and 1977–1980

Temperature, Salinity, and Light Extinction

All mean seasonal temperatures were significantly higher in the outer discharge bay than the control bay during the postoperational period except for spring 1978 (Fig. II-34). Seasonal temperatures for both the preoperational and postoperational periods peak in either summer or fall of each year. Lowest temperatures for the control bay were recorded in the winter of each year. This also occurred in the outer discharge bay during 1973, 1977, and 1979; however, in 1978 and 1980, lowest temperatures were recorded in the spring season. A mean ΔT of $\sim 4°C$ between the outer discharge and control bays during the postoperational period has been attributed to the thermal effluent from the three power plants.

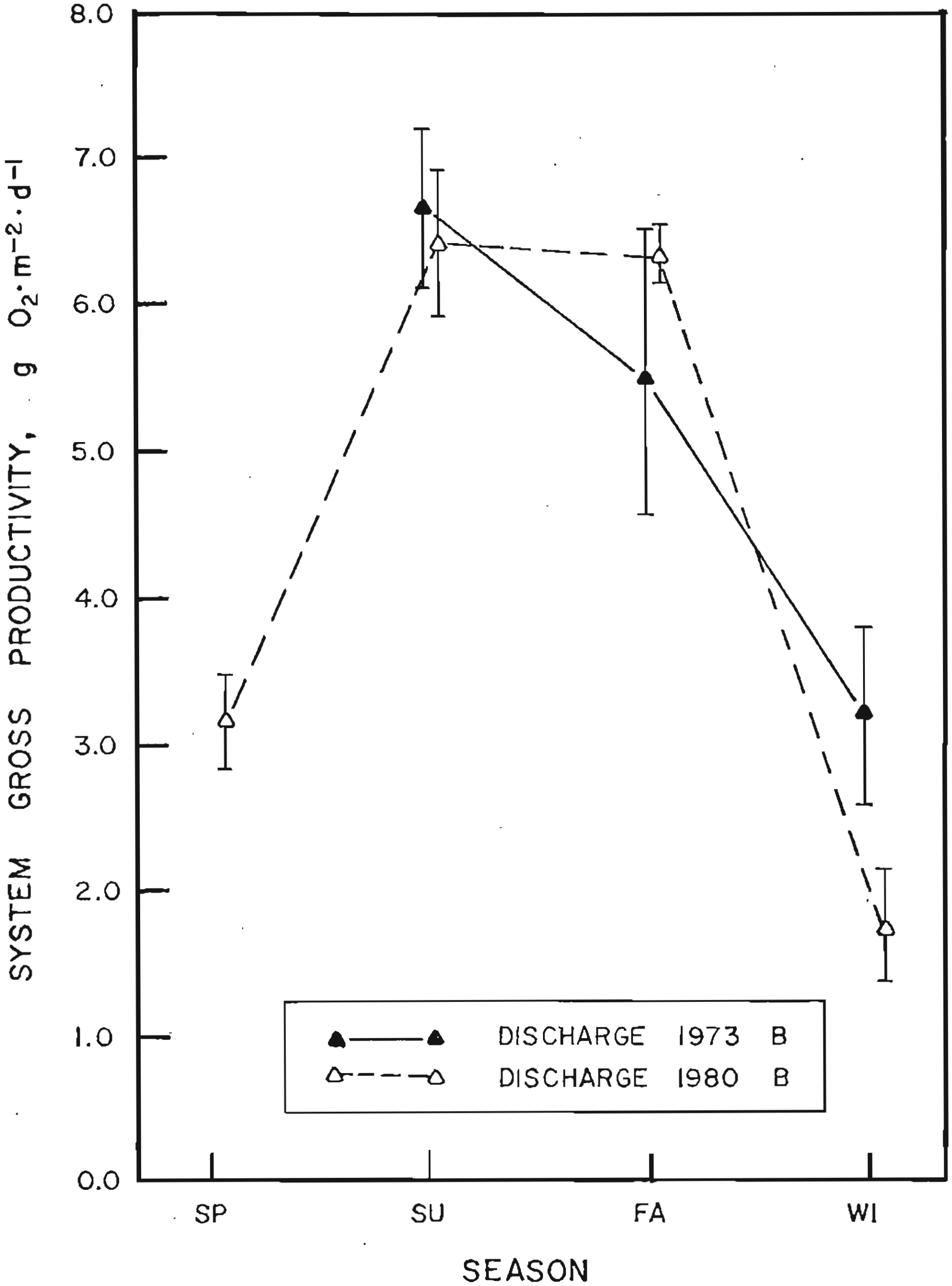


Figure II-30. Comparison of 1973 and 1980 values for mean seasonal system gross productivity for the outer discharge bay. Bars represent ± one standard error.

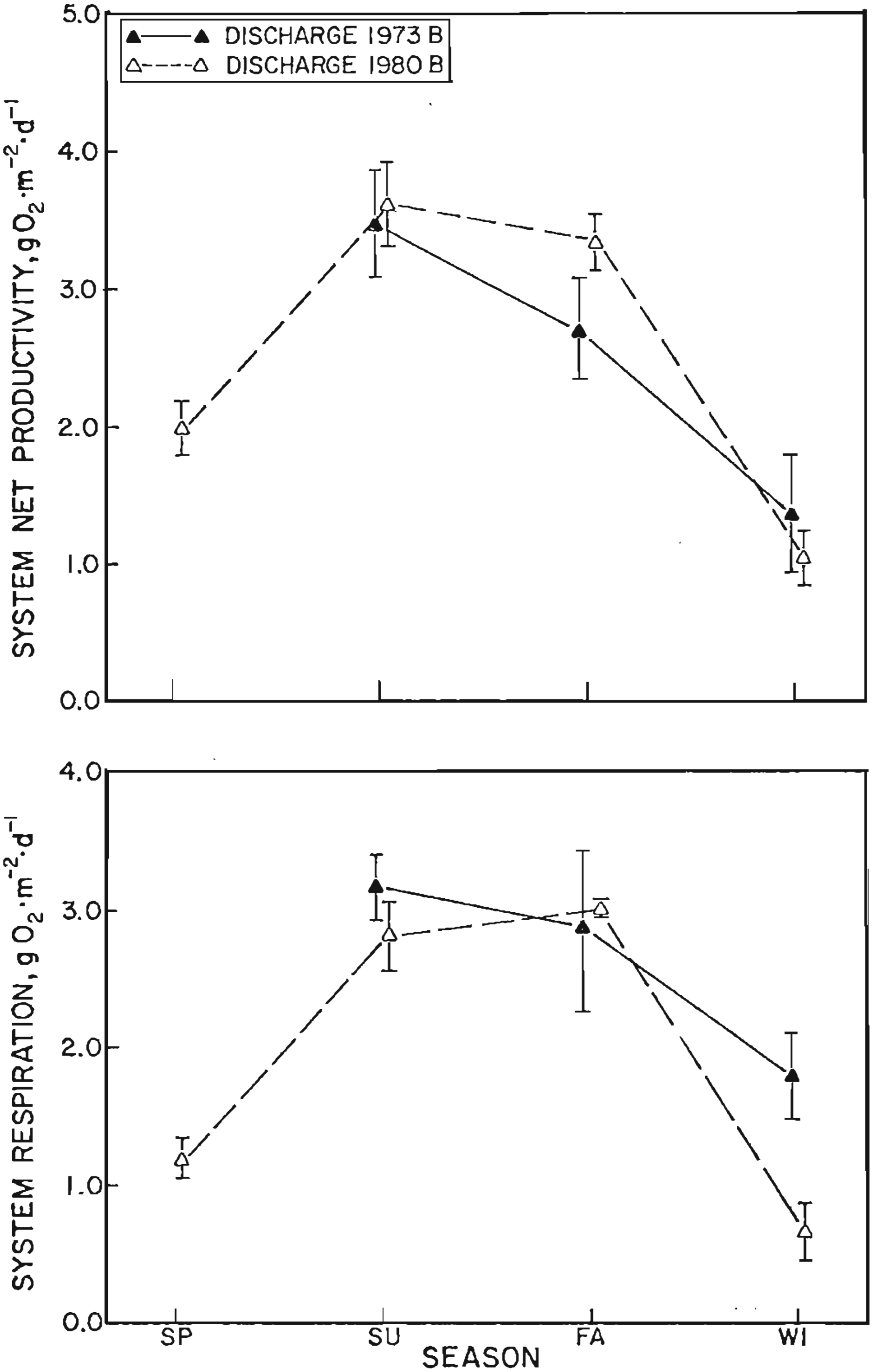


Figure II-31. Comparison of 1973 and 1980 values for mean seasonal system net productivity and respiration for the outer discharge bay. Bars represent ± one standard error.

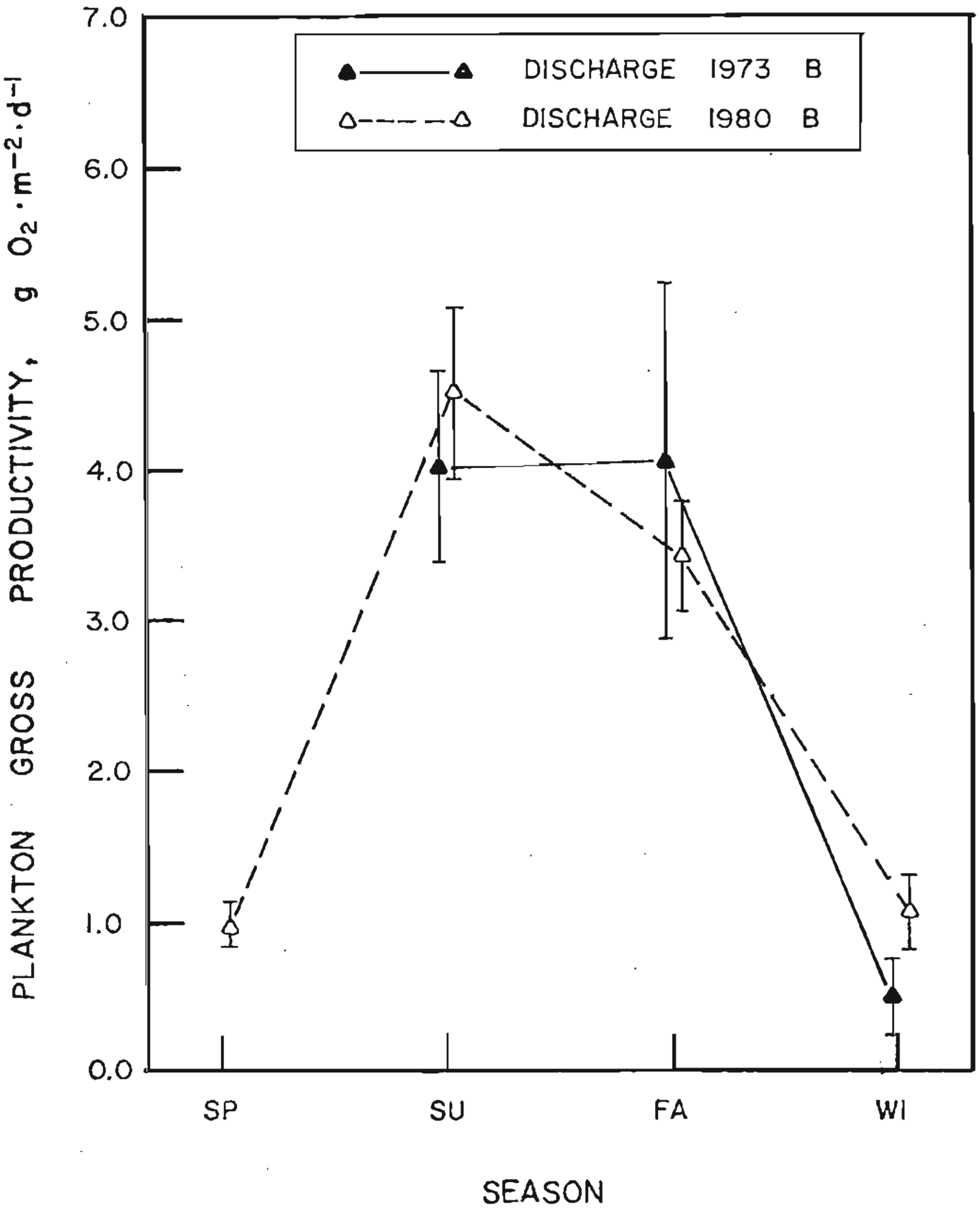


Figure II-32. Comparison of 1973 and 1980 values for mean seasonal plankton gross productivity for the outer discharge bay. Bars represent ± one standard error.

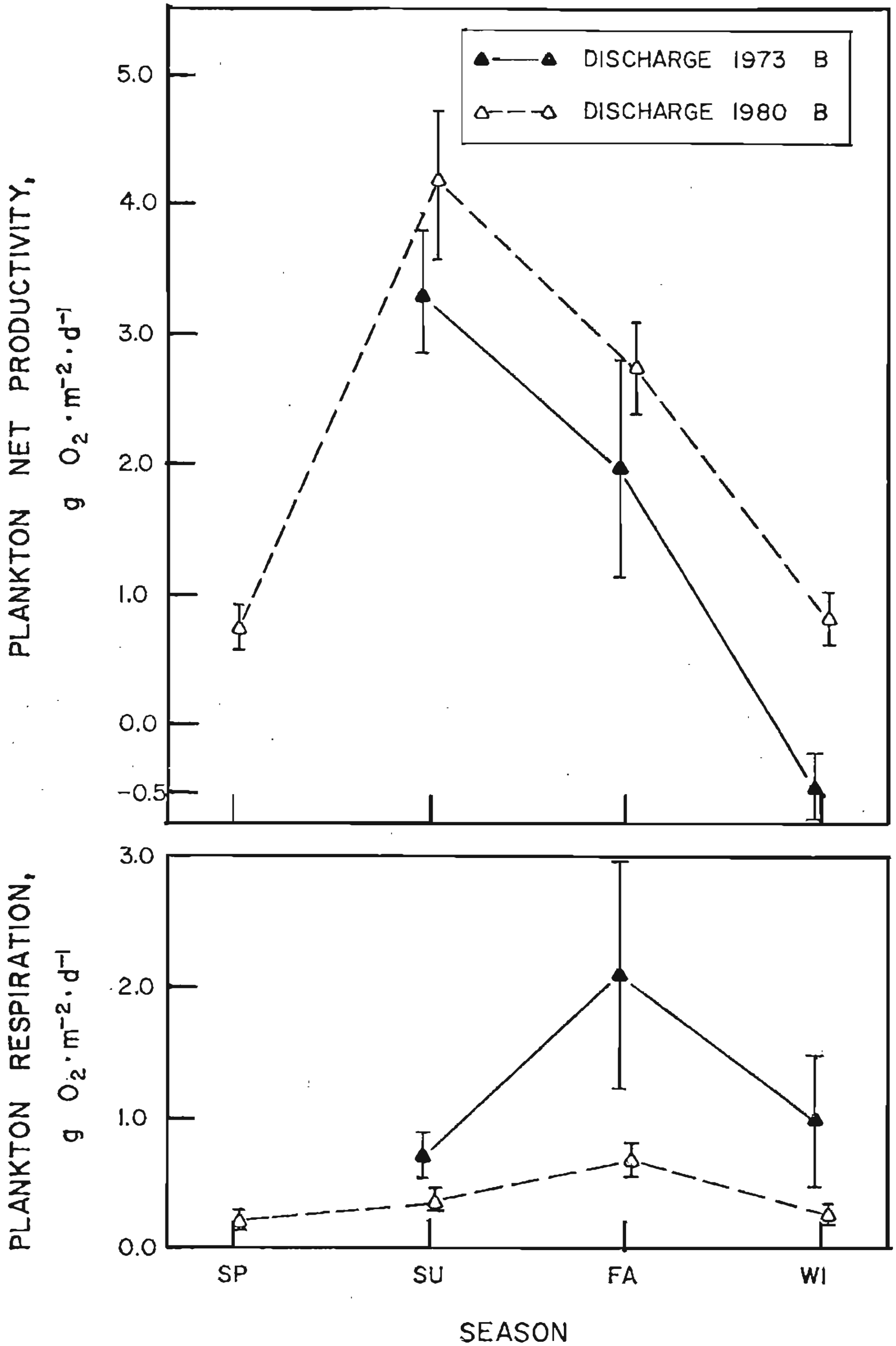


Figure II-33. Comparison of 1973 and 1980 values for mean seasonal plankton net productivity and respiration for the outer discharge bay. Bars represent ± one standard error.

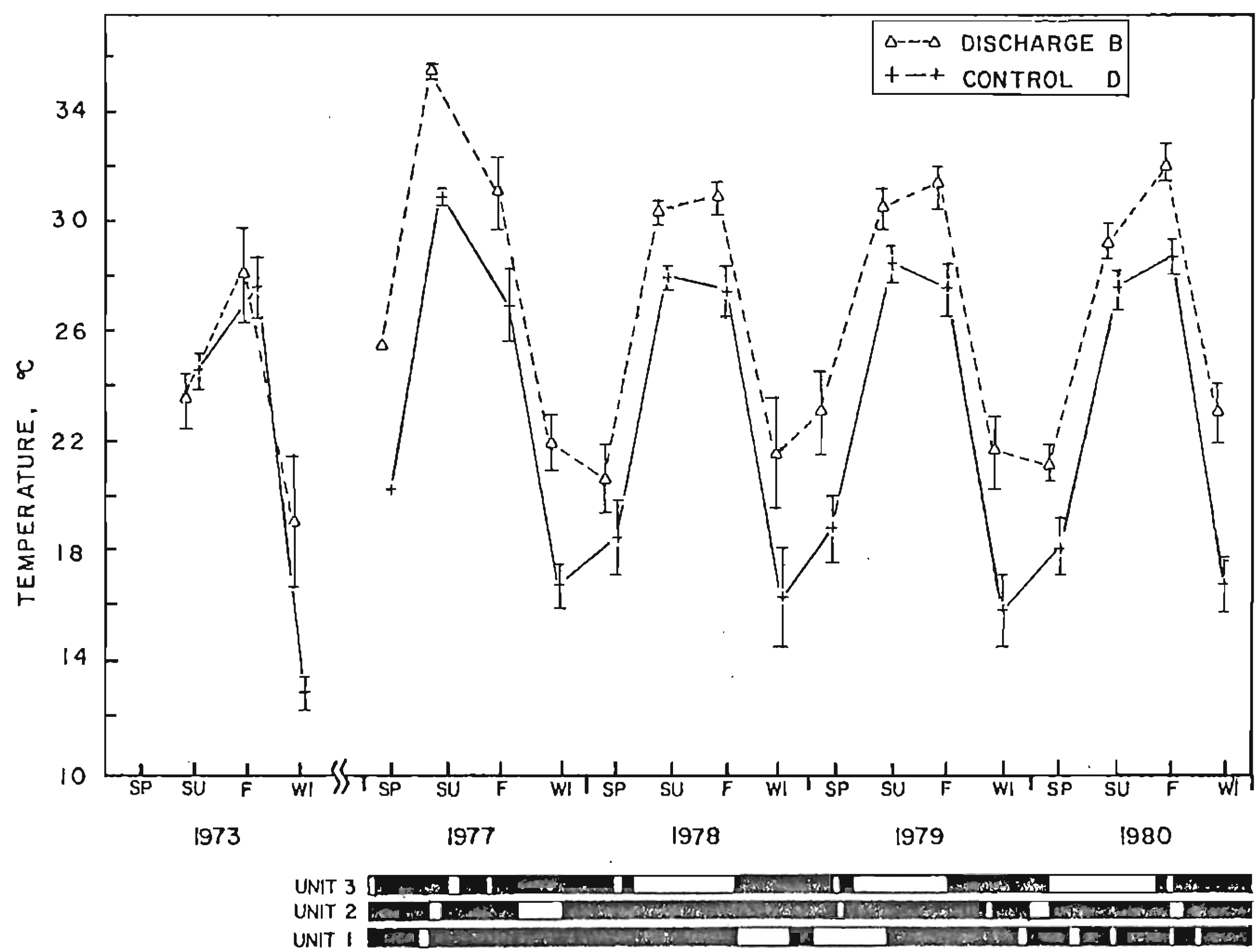


Figure II-34. Seasonal mean temperature for the outer discharge and control bays along with the schedule of power plant operation from 1973–1980. Darkened areas indicate Unit was on line. Bars represent $\pm$ one standard error.

Mean seasonal salinities during the preoperational and postoperational periods were significantly different between the outer discharge and control bays for spring 1977 and 1978, summer 1978, and winter 1979 and 1980 (Fig. II-35). Generally, salinity was slightly higher in the discharge bay than its control bay.

Mean seasonal light extinction coefficients were significantly higher in the outer discharge bay relative to the control bay in fall and winter 1977, spring and summer 1978, fall 1979, and fall and winter 1980 (Fig. II-36). All observed differences were significant at the 90% confidence level except for winter 1977, which was significant at the 95% confidence level.

System Gross Productivity, Net Productivity, and Night Respiration

Comparisons of system gross productivity in the outer discharge and control bays for 1973–1980 are presented in Fig. II-37. During the postoperational period, there was a trend for higher system gross productivity in the outer discharge bay relative to its control bay. Significantly higher productivity values from the outer discharge bay were recorded for spring 1978 and 1979 and spring, summer, and fall 1980.

System net productivity and respiration were consistently higher in the outer discharge bay than its control bay during the last three postoperational years (Fig. II-38). While outer discharge bay productivity has been relatively consistent during this period, the gross and net productivity of its control bay have shown a significant decrease. The long-term graph of ecological efficiency (Fig. II-39) indicates that high productivity values recorded in 1977 may have been due to higher than

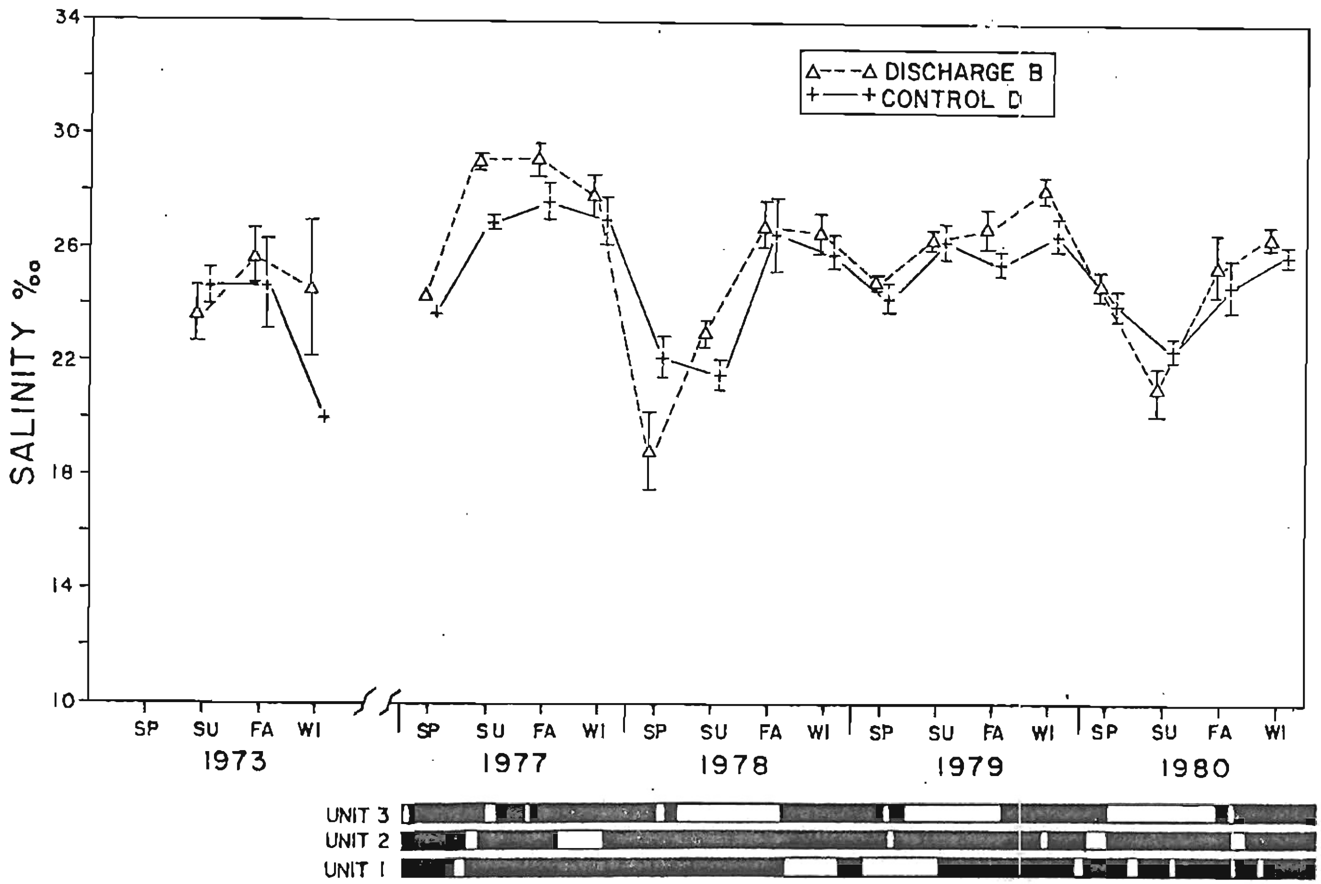


Figure II-35. Seasonal mean salinity for the outer discharge and control bays along with the schedule of power plant operation from 1973—1980. Darkened areas indicate Unit was on line. Bars represent ± one standard error.

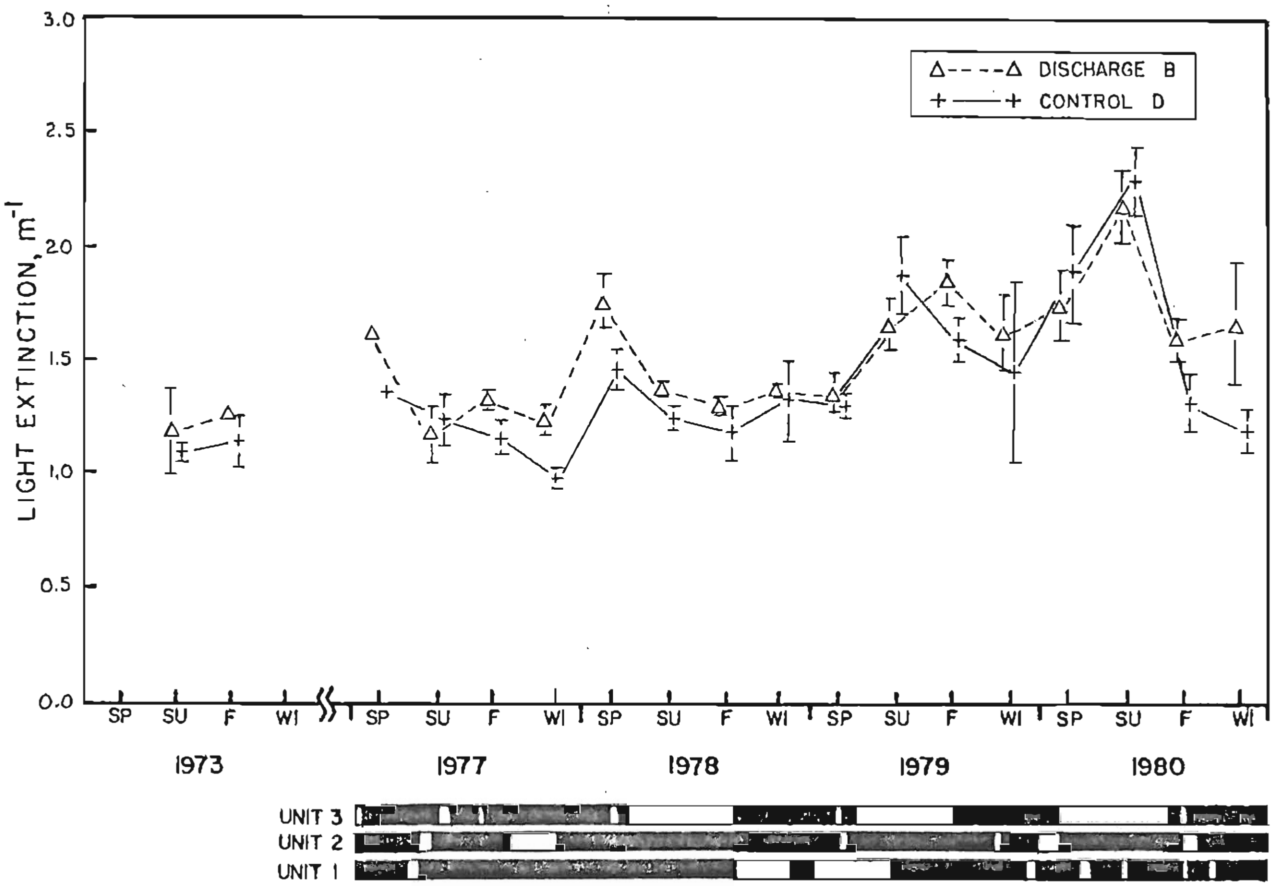


Figure II-36. Seasonal mean light extinction coefficients for the outer discharge and control bays along with the schedule of power plant operation from 1973–1980. Darkened areas indicate Unit was on line. Bars represent ± one standard error.

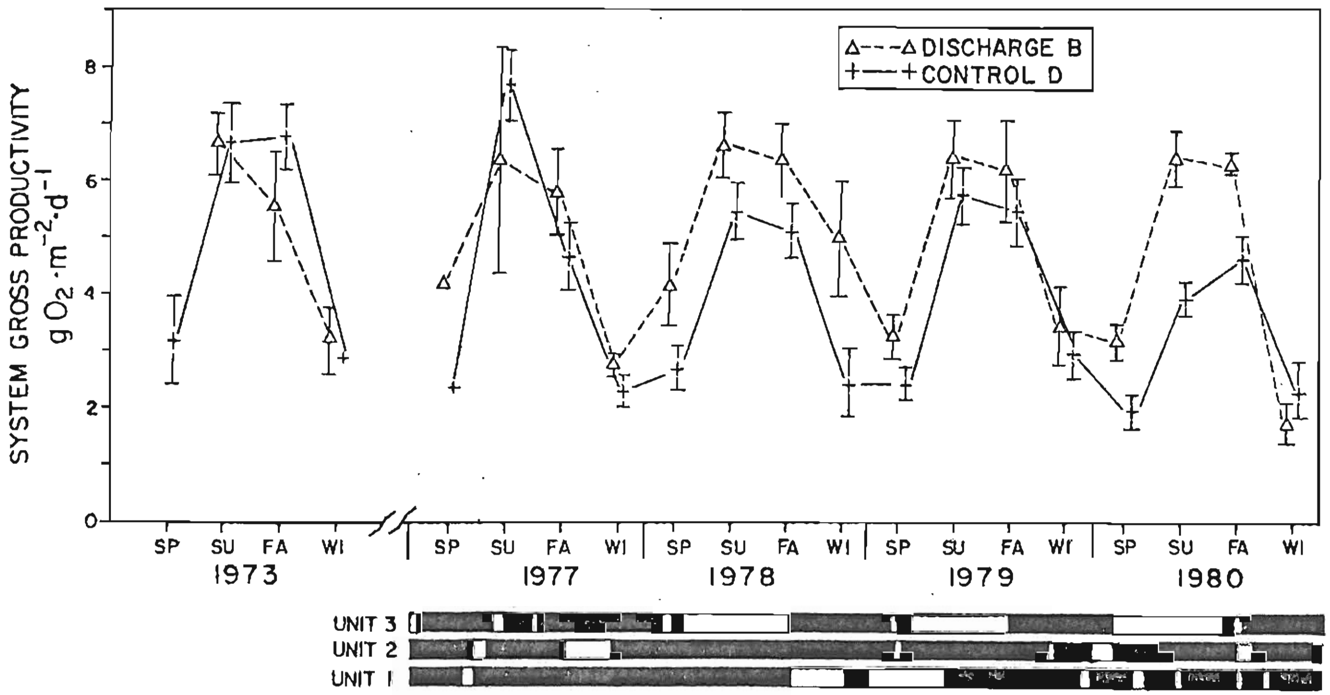


Figure II-37. Seasonal mean system gross productivyt for the outer discharge and control bays along with the schedule of power plant operation from 1973—1980. Darkened areas indicate Unit was on line. Bars represent ± one standard error.

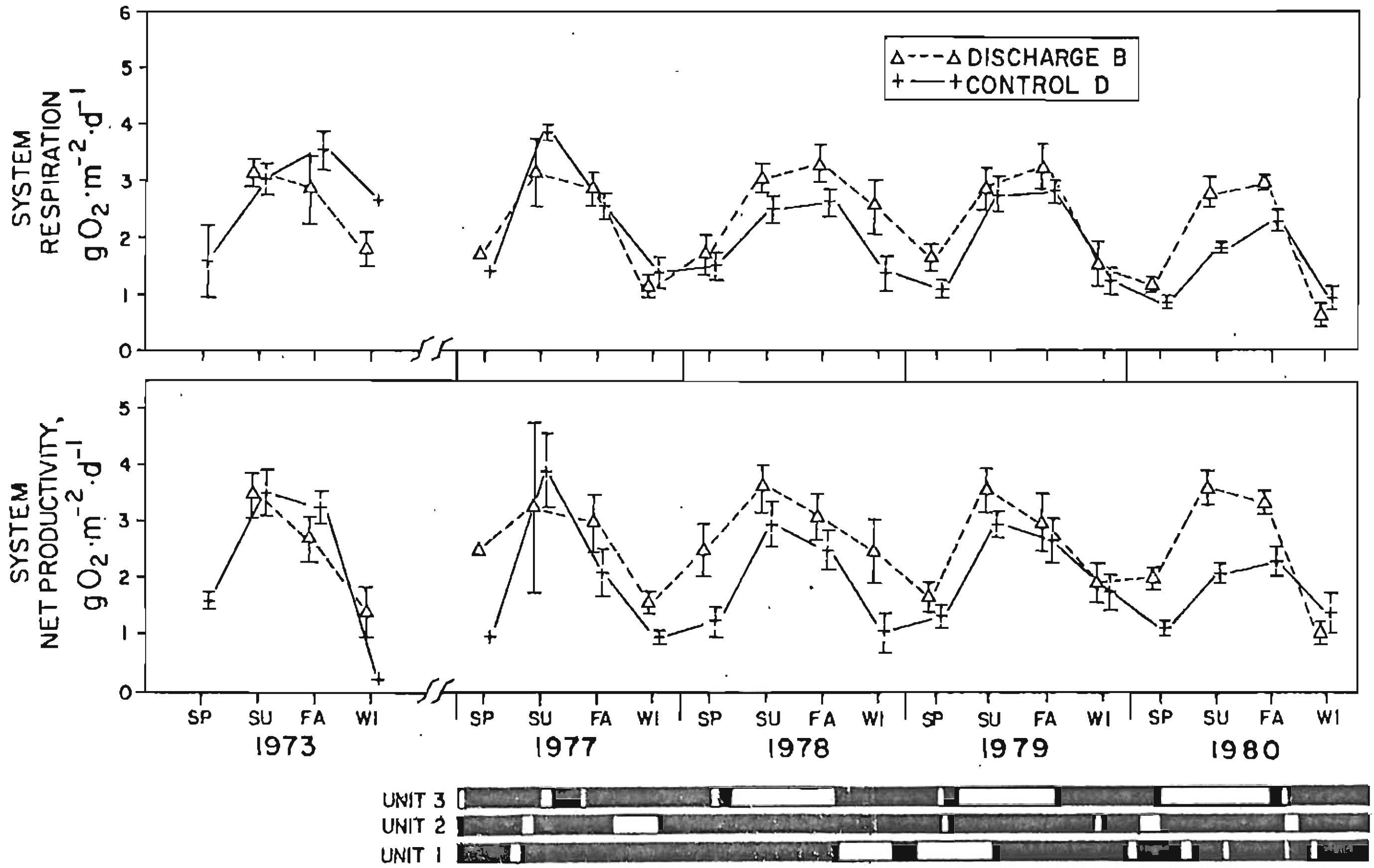


Figure II-38. Seasonal mean system net productivity and respiration for the outer discharge and control bays along with the schedule of power plant operation from 1973–1980. Darkened areas indicate Unit was on line. Bars represent ± one standard error.

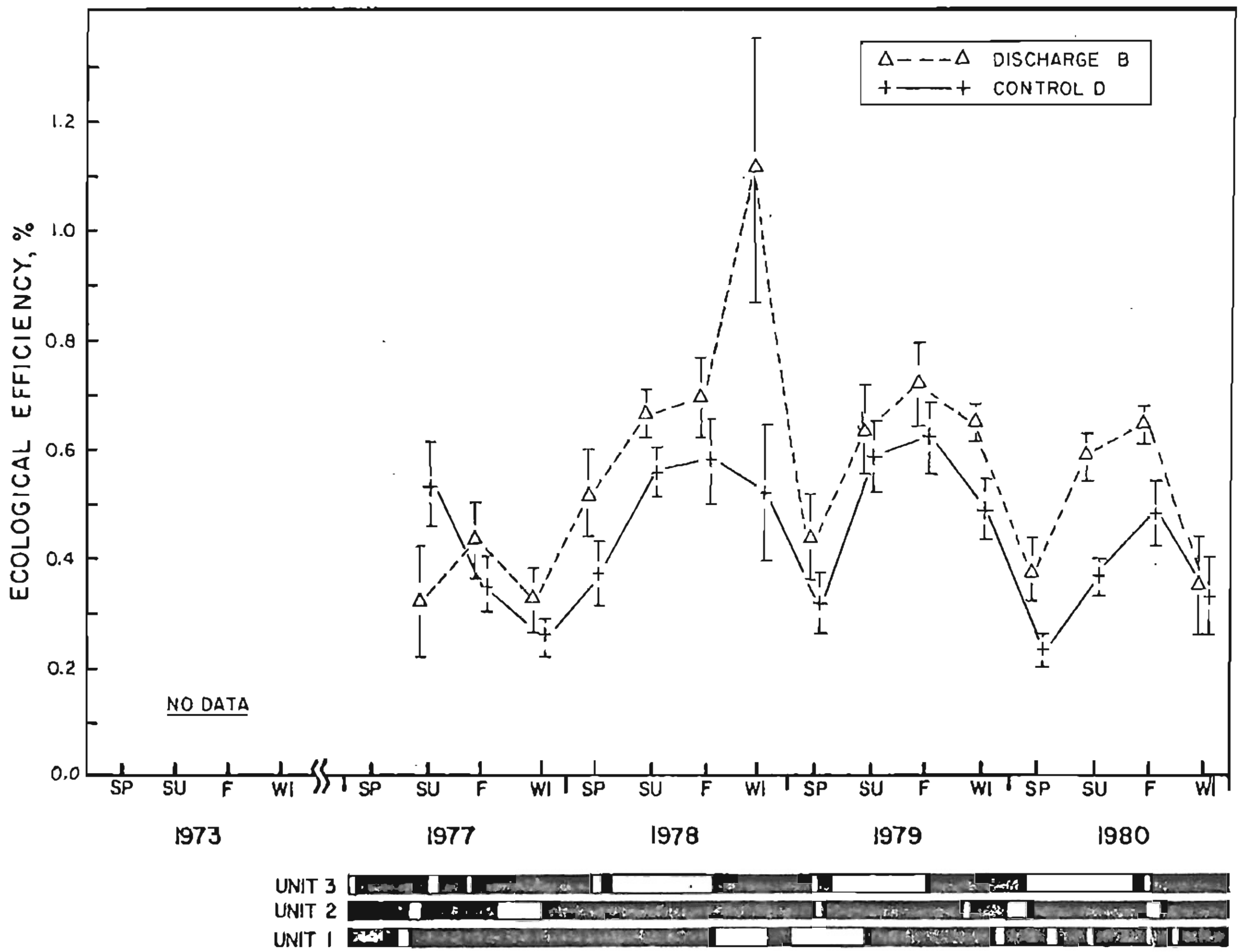


Figure II-39. Seasonal mean plankton gross productivity for the outer discharge and control bays along with the schedule of power plant operation from 1973–1980. Darkened areas indicate Unit was on line. Bars represent ± one standard error.

did show a significant decrease in the control bay between 1979 and 1980.

Plankton Gross Productivity, Net Productivity, and Night Respiration

A comparison of plankton gross productivity between the outer discharge and control bays for 1973–1980 is presented in Fig. II-40. The only significant difference in mean seasonal plankton gross productivity occurred during summer 1977. The decrease of plankton gross productivity in the outer discharge bay during the first postoperational year could have been the response of an unadapted plankton community.

Mean seasonal plankton net productivity was significantly different between the outer discharge and control bays in summer 1977 and spring 1979 (Fig. II-41). Mean seasonal respiration was significantly higher in the control bay during summer 1978.

Discussion

Overview of 1980 Data

System gross productivity in the outer discharge bay responsed positively to the addition of thermal effluent throughout the sampling year except for the winter (Fig. II-24). The lack of stimulation during the winter may be accounted for by a significant increase in turbidity for the discharge bay relative to the control bay (Fig. II-23). Increased ΔT values between the outer discharge and control bays during the fall and winter (Fig. II-21) coincide with the nuclear unit coming on line. During the fall and winter additional discharge from the nuclear unit may have contributed to the increased turbidity in the outer discharge bay (Fig. II-36).

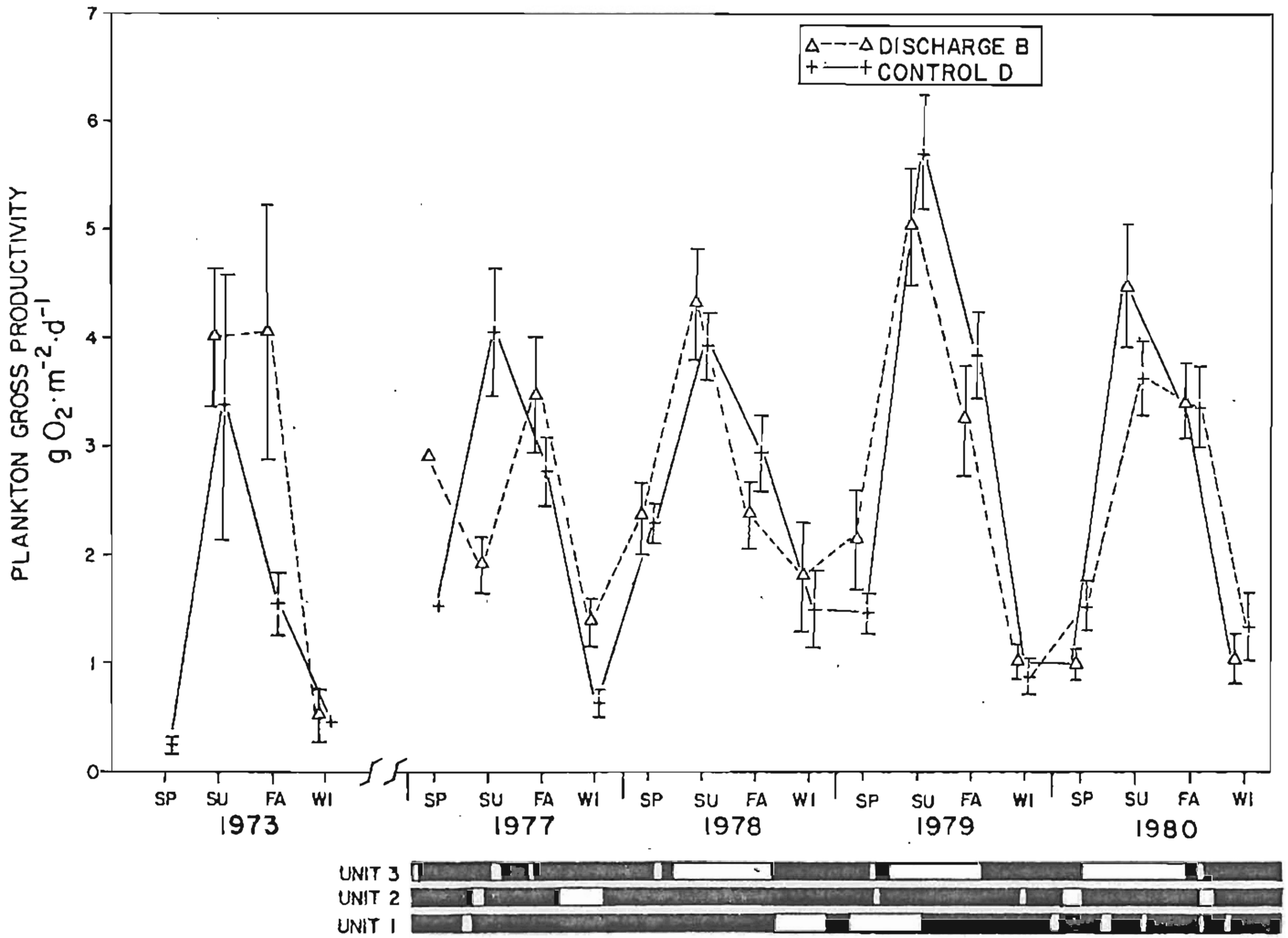


Figure II-40. Seasonal mean plankton net productivity and respiration for the outer discharge and control bays along with the schedule of power plant operation from 1973–1980. Darkened areas indicate Unit was on line. Bars represent ± one standard error.

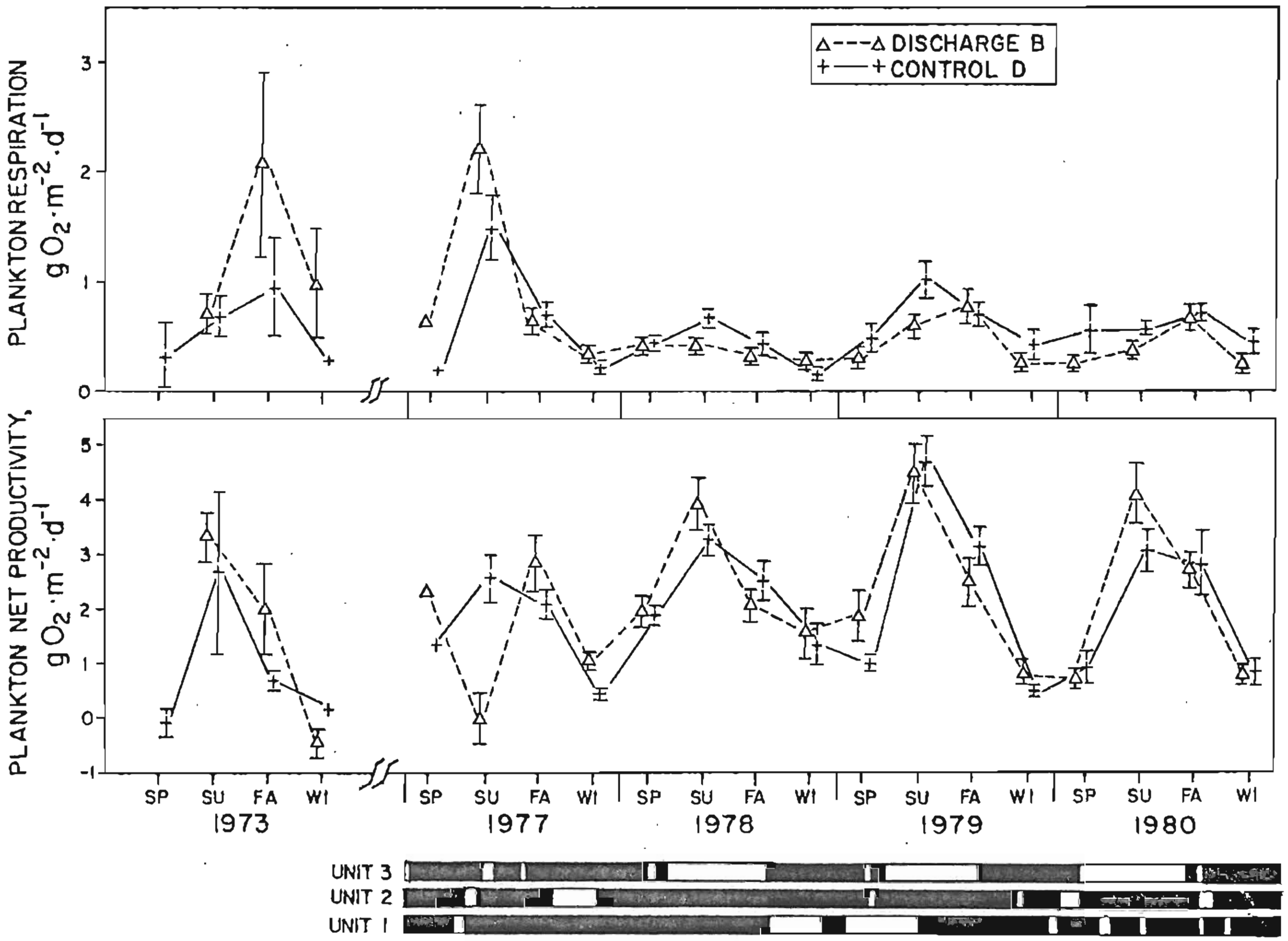


Figure II-41. Seasonal mean ecological efficiencies for the outer discharge and control bays along with the schedule of power plant operation from 1973–1980. Darkened areas indicate Unit was on line. Bars represent ± one standard error.

Plankton productivity of the outer discharge bay showed little or no stimulation compared to the control bay during the seasons when gross productivity was greatly enhanced (Figs. II-24 and II-26). If the assumption discussed earlier is made, that the difference between those parameters is a measure of benthos productivity, it would appear that it is this benthos community that is responding positively to the power plants at Crystal River.

Referring to the annual means of percent plankton metabolism presented in Table II-22 for the outer discharge bay, a consistent and even contribution of planktonic and benthic systems to gross productivity in spite of variable seasonal means is seen. On the other hand, the control bay appears to be shifting from benthos to plankton domination. It is interesting that once again evidence of major changes in our control systems, which was assumed to be unperturbed by plant operation, is found. These changes may be due to normal temporal variation or it is possible that altered current regimes due to the building of the canal systems is impacting the estuaries on either side of the power plants in different ways.

Comparison of 1973 and 1980 Data

Increased temperatures during fall and winter 1980, with respect to the 1973 data, can be attributed to the operation of Unit 3 in conjunction with Units 1 and 2. Summer values for both years were similar because the nuclear unit was off line at both times.

The significant decrease in system gross productivity for winter 1980 cannot be addressed due to the lack of insolation and turbidity data for 1973.

Table II-22. Plankton gross productivity as a percentage of total gross productivity for the outer discharge bay (B) and its control bay (D) for 1973 (preoperational) and 1977–1980 (postoperational).

	Control (D)					Discharge (B)				
Season	1973	1977	1978	1979	1980	1973	1977	1978	1979	1980
Spring	No data	64.0	84.6	61.0	76.3	No data	69.8	56.4	65.6	31.0
Summer	50.7	52.3	72.2	99.8	92.1	60.4	30.0	65.3	78.9	70.1
Fall	22.8	59.2	49.0	70.5	72.6	73.2	59.9	36.8	52.4	54.0
Winter	15.4	27.3	62.0	29.9	46.5	15.4	49.8	35.8	29.3	61.6
Mean	29.6	50.7	67.0	65.3	71.9	49.7	52.4	48.6	56.6	54.2
Standard deviation	18.6	16.3	15.1	28.8	18.9	30.4	17.0	14.6	21.1	16.8

There was no significant stimulation of plankton gross productivity during the 1980 study, yet the net productivities during 1980 were approximately 62% higher (significantly higher in the winter). This increase may be accounted for in part by increased thermal effluent in 1980. Plankton respiration was reduced in 1980 by approximately 67% for the 1973 measurements and this would explain why we do not see a significant increase in the gross productivity.

Preoperational and Postoperational Trends with Respect to Power Plant Operation: 1973, 1977–1980

During the preoperational period (1973), system metabolism was not significantly different between the outer discharge and its control bay (see Table II-23). Also, during the first year of plant operation with three units on line (1977), gross productivity of the outer discharge bay was not affected in spite of much higher water temperatures (Figs. II-34 and II-37). In subsequent years, the gross productivity of the outer discharge bay has not changed significantly in spite of variable plant effects—apparently plant operation is having no deleterious effect on this discharge bay. In fact, if the outer control bay represents a true control situation, power plant operation is clearly stimulating gross and net production of the outer discharge bay (Table II-23). It appears quite obvious, however, that the control bay is undergoing significant community structure changes. Table II-24 indicates this trend with plankton productivity dominance shifting from the discharge bay in 1973 to the intake bay in 1980. It is not clear if power plant operation (e.g., cooling water intake rate) is affecting this trend on the control side.

Table II-23. The seasonal average percent gross productivity of the outer discharge bay (B) relative to the gross productivity of its control bay (D) for 1973, 1977–1980. Number in parentheses indicates number of observations.

	% Total Gross Productivity				
Season	1973	1977	1978	1979	1980
Spring	No data	175.4(1)	153.1(10)	135.3(9)	159.6(12)
Summer	99.8(9)	82.0(4)	121.7(12)	111.3(12)	162.9(12)
Fall	81.9(5)	124.0(11)	124.7(10)	113.4(10)	136.7(12)
Winter	111.2(1)	118.2(7)	206.6(9)	117.3(11)	75.1(12)
Mean	97.6	124.9	151.5	119.3	133.6
Standard deviation	14.8	38.5	39.3	10.9	40.7

Table II-24. The seasonal average percent plankton gross productivity of the outer discharge bay (B) relative to the plankton gross productivity of its control bay (D) for 1973, 1977–1980. Number in parentheses indicates number of observations.

	% Plankton Gross Productivity				
Season	1973	1977	1978	1979	1980
Spring	No data	191.4(1)	101.7(9)	145.6(9)	64.9(11)
Summer	119.0(2)	46.9(3)	109.9(12)	88.1(11)	124.0(12)
Fall	263.0(3)	125.4(11)	79.6(10)	84.4(10)	101.8(12)
Winter	111.4(1)	219.4(6)	119.3(8)	114.8(11)	79.1(11)
Mean	164.5	145.8	102.6	108.2	92.5
Standard deviation	85.4	76.8	17.0	28.4	25.9

Summary

1. The outer discharge bay's system gross productivity averaged 34% higher or approximately 1.20 g $O_2 \cdot m^{-2} \cdot d^{-1}$ greater than the control bay on an annual basis.
2. Mean seasonal temperatures for the outer discharge bay were significantly higher during 1980 with respect to its control bay. Temperature in the discharge bay averaged 3.7°C greater than those in the control bay
3. An apparent trend towards increased productivity in the outer discharge bay was accompanied by a decrease in productivity of its control bay.
4. Operation of Unit 3 in conjunction with Units 1 and 2 at the Crystal River power plant caused no measureable decrease of system metabolism in the outer discharge bay ecosystem.

CHAPTER 5

COMMUNITY METABOLISM OF THE DISCHARGE BAY (OB) AND THE CONTROL BAY (C)

William F. Coggins

Introduction

This chapter presents community metabolism data obtained from the discharge bay (OB) and its control bay (C) (see Fig. II-2). The discharge bay is located approximately 3 km seaward from the power generating station, has a mean depth of 2.3 m, and is bounded by oyster bars to the west and east and by dredge spoil banks on the north and south. The control bay has a mean depth of 2.6 m and has less obstructed water flow due to the absence of oyster bars to the west and south. Spoil banks and an oyster/sand bar form the remaining boundaries of this bay, to the north and east, respectively.

Total community and plankton metabolism, temperature, salinity, and light extinction data will be examined to assess the possible effects of the thermal effluent on the discharge bay community for both the current study year (1980) and previous study years (1977–1979).

Methods

A detailed discussion of the methods and materials used to measure the parameters (total community metabolism, plankton metabolism, temperature, salinity, and light extinction) can be found in chapter 3 of this report. The diffusion coefficient (K) used for correction of open-water metabolism data for the discharge bay was 1.51 g $O_2 \cdot m^{-2} \cdot hr^{-1}$ at

100% saturation deficit. The value of K used for the control bay was 0.44 g $O_2 \cdot m^{-2} \cdot hr^{-1}$. These coefficients were based on single measured values using the diffusion dome method as discussed in chapter 3. The higher diffusion coefficient measured for the discharge bay can be attributed to the higher current in this bay due to cooling water circulation.

The bimonthly data from which seasonal means were derived are given in Appendix C. Two-sample t-tests were used to compare data collected from the two bays. Seasons for the discharge bay and its control bay are defined as follows:

Spring:	February—April
Summer:	May—July
Fall:	August—October
Winter:	November—January.

Outage data for Crystal River Units 1, 2, and 3 during 1980 are given in Table II-1.

Results

Temperature, Salinity, and Light Extinction Coefficients for 1980

Mean seasonal temperature differences between the discharge bay and the control bay on the days measured ranged between 4.4°C in the winter to 1.7°C in the summer during the 1980 sampling year (Table II-25 and Fig. II-42). All temperature differences (ΔT) between the discharge bay and the control bay were significant at either the 90% or 95% confidence level.

Mean seasonal salinities measured during 1980 for the discharge bay and the control bay are given in Table II-25 and Fig. II-43. Seasonal salinities for the control bay were slightly higher (mean difference of

Table II-25. Results of statistical t-tests between the discharge bay (OB) and its control bay (C): 1980 seasonal averages for temperature (°C), salinity (‰), and extinction coefficients (m^{-1}). The standard error is listed after the value; the number of observations follows in parentheses.

Season	Temperature, °C	Salinity, ‰	Extinction Coefficient, m^{-1}
Spring			
Discharge	20.7 ± 0.7(12)†	24.6 ± 0.5(12)	1.70 ± 0.13(12)
Control	18.2 ± 1.0(12)†	24.9 ± 0.4(12)	1.88 ± 0.21(12)
Summer			
Discharge	29.3 ± 0.6(12)†	21.0 ± 0.6(12)*	2.30 ± 0.17(12)
Control	27.6 ± 0.6(12)†	23.5 ± 0.4(12)*	2.46 ± 0.17(12)
Fall			
Discharge	31.9 ± 0.6(12)*	25.2 ± 1.1(12)	1.79 ± 0.15(12)†
Control	29.0 ± 0.6(12)*	25.9 ± 0.8(12)	1.41 ± 0.15(12)†
Winter			
Discharge	21.5 ± 0.9(12)*	26.0 ± 0.5(12)	1.30 ± 0.07(12)
Control	17.1 ± 0.9(12)*	26.2 ± 0.3(12)	1.18 ± 0.08(12)

*Means for control and discharge are significant at the 95% confidence level (two sample t-tests).
†Means for control and discharge are significant at the 90% confidence level (two sample t-tests).

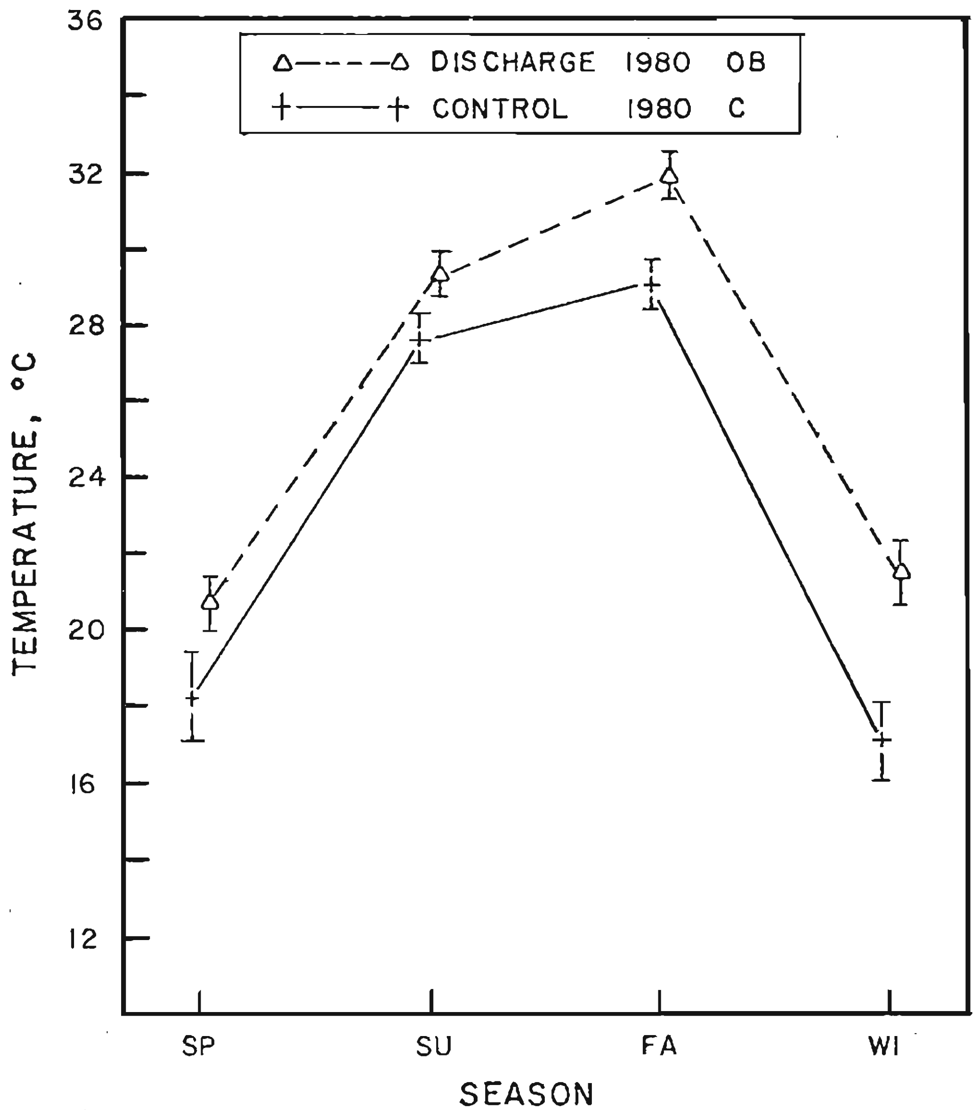


Figure II-42. Seasonal mean temperature in the discharge and control bays for 1980. Bars represent ± one standard error.

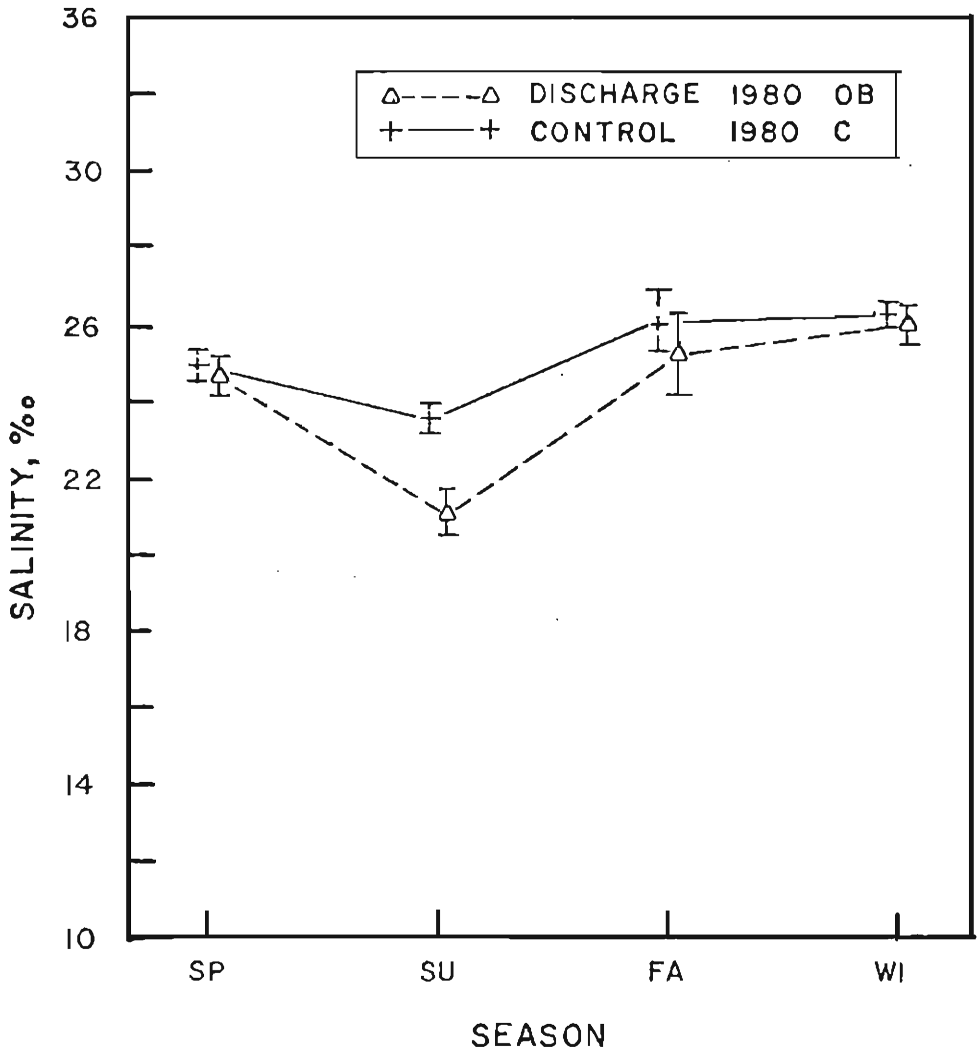


Figure II-43. Seasonal mean salinity in the discharge and control bays for 1980. Bars represent ± one standard error.

0.9‰) than the discharge bay for each season and were only significantly different (2.5‰) for the summer at the 90% confidence level.

Mean seasonal extinction coefficients estimated from Secchi disk readings (Table II-25 and Fig. II-44) were not significantly different between the discharge bay and the control bay, except during the fall (0.4 m^{-2} increase in the control bay). Photometer readings were taken to further verify Secchi disk measurements (Table II-26).

System Gross Productivity, Net Productivity, and Night Respiration for 1980

Mean seasonal system gross productivity, net productivity, and night respiration data for the discharge and control bays are given in Table II-27 and Figs. II-45 and II-46.

System gross productivity, net productivity, and nighttime respiration in the discharge bay were all significantly higher than the control bay during the fall. Net productivity and nighttime respiration were both significantly higher during the spring. No other significant differences between the system metabolism in the control and discharge bays occurred during 1980.

Plankton Gross Productivity, Net Productivity, and Night Respiration for 1980

Mean seasonal plankton gross productivity, net productivity, and respiration data for the discharge and control bays are given in Table II-28 and Figs. II-47, II-48, and II-49. Plankton gross productivity for the discharge bay was significantly higher during the fall as was plankton net productivity and plankton respiration. No other significant differences between the plankton metabolism of the control and discharge bays were detected.

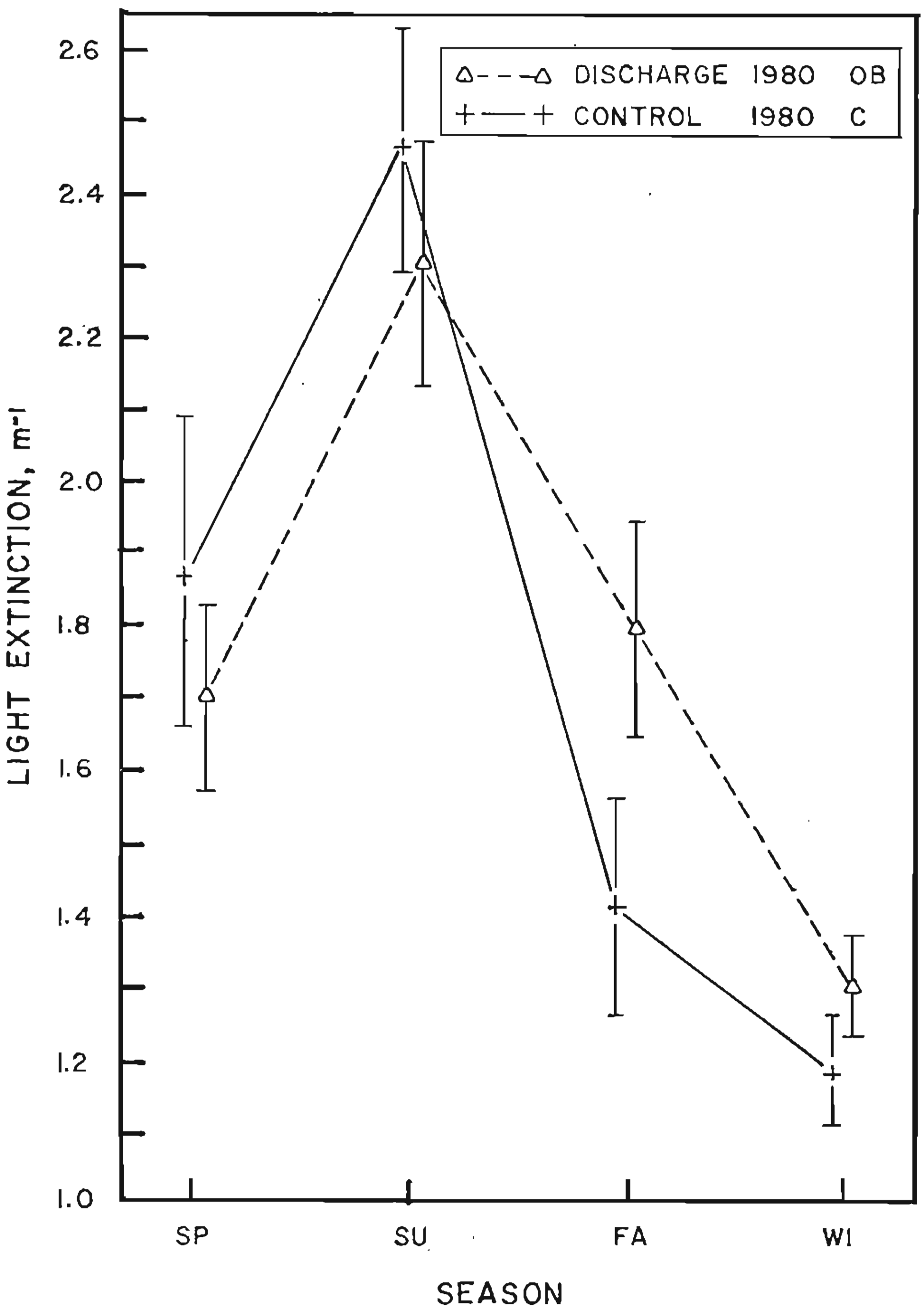


Figure II-44. Seasonal average light extinction coefficients for the control and discharge bays for 1980. Bars represent ± one standard error.

Table II-26. Photometer-derived extinction coefficients for the discharge bay (OB) and its control bay (C) for 1980.

	Light Extinction, m^{-1}	
	Discharge Bay (OB)	Control Bay (C)
Mean	1.09	1.21
Standard deviation	0.24	0.41
Range	0.75–1.70	0.66–1.84
N	17	17

Table II-27. Results of statistical t-tests between the discharge bay (OB) and its control bay (C): 1980 seasonal averages for gross productivity ($P_G = P_N + R$), net productivity (P_N), and night respiration (R). The standard error is listed after the value; the number of observations follows in parentheses.

Season	P_G, $g\ O_2 \cdot m^{-2} \cdot d^{-1}$	P_N, $g\ O_2 \cdot m^{-2} \cdot d^{-1}$	R, $g\ O_2 \cdot m^{-2} \cdot d^{-1}$
Spring			
Discharge	3.14 ± 0.37(12)	2.58 ± 0.36(12)*	0.56 ± 0.12(12)†
Control	2.19 ± 0.42(12)	1.24 ± 0.26(12)*	0.95 ± 0.19(12)†
Summer			
Discharge	5.37 ± 0.98(12)	3.44 ± 0.83(12)	1.93 ± 0.31(12)
Control	4.25 ± 0.34(12)	2.19 ± 0.24(12)	2.06 ± 0.14(12)
Fall			
Discharge	8.07 ± 0.77(12)*	4.80 ± 0.56(12)*	3.27 ± 0.39(12)†
Control	5.10 ± 0.28(12)*	2.68 ± 0.19(11)*	2.41 ± 0.16(12)†
Winter			
Discharge	2.52 ± 0.54(12)	1.79 ± 0.21(12)	0.74 ± 0.39(12)
Control	1.96 ± 0.43(12)	1.27 ± 0.32(12)	0.75 ± 0.20(11)

*Means for control and discharge are significant at the 95% confidence level (two-sample t-tests).

†Means for control and discharge are significant at the 90% confidence level (two-sample t-tests).

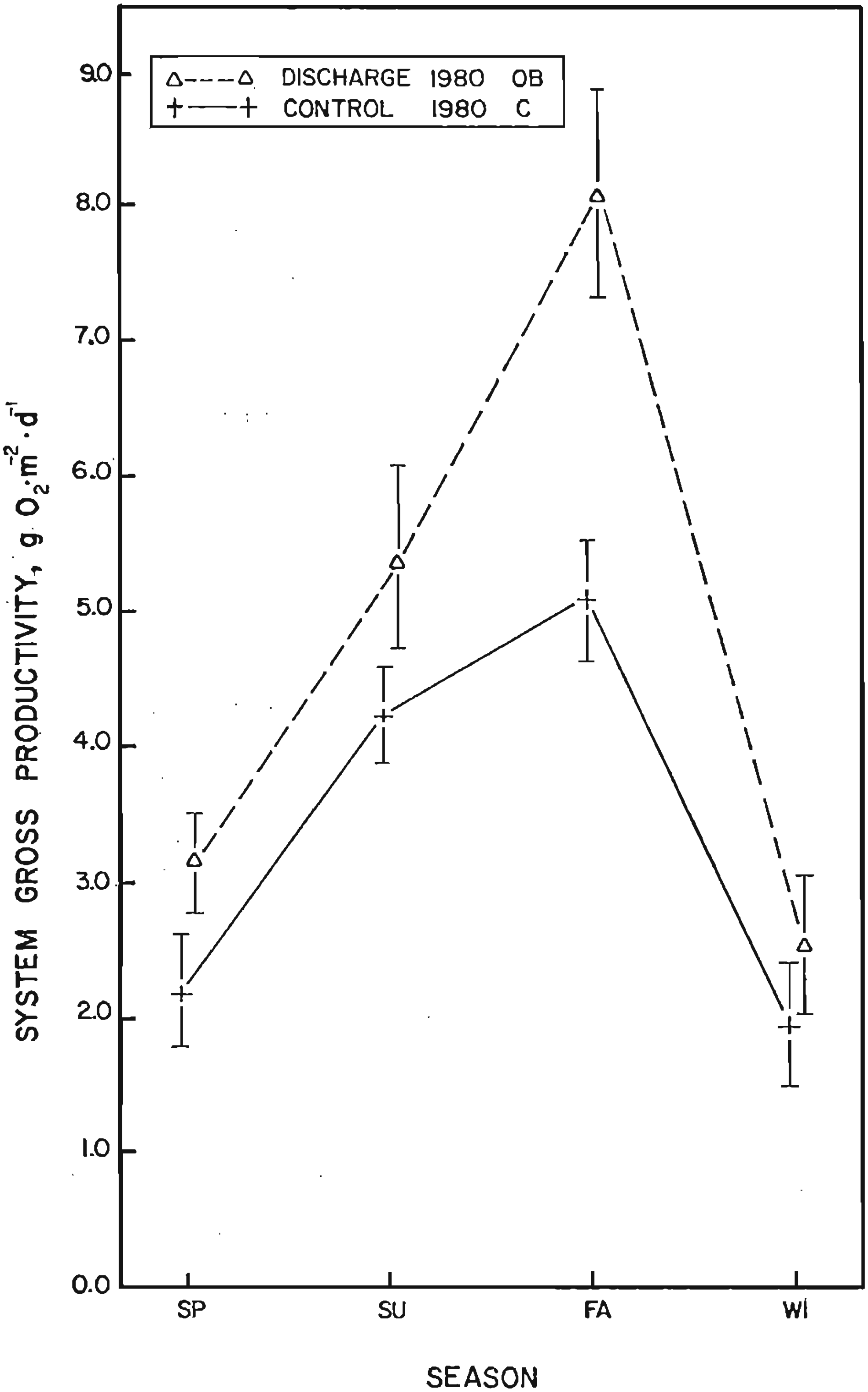


Figure II-45. Seasonal mean system gross productivity for the discharge and control bays for 1980. Bars represent ± one standard error.

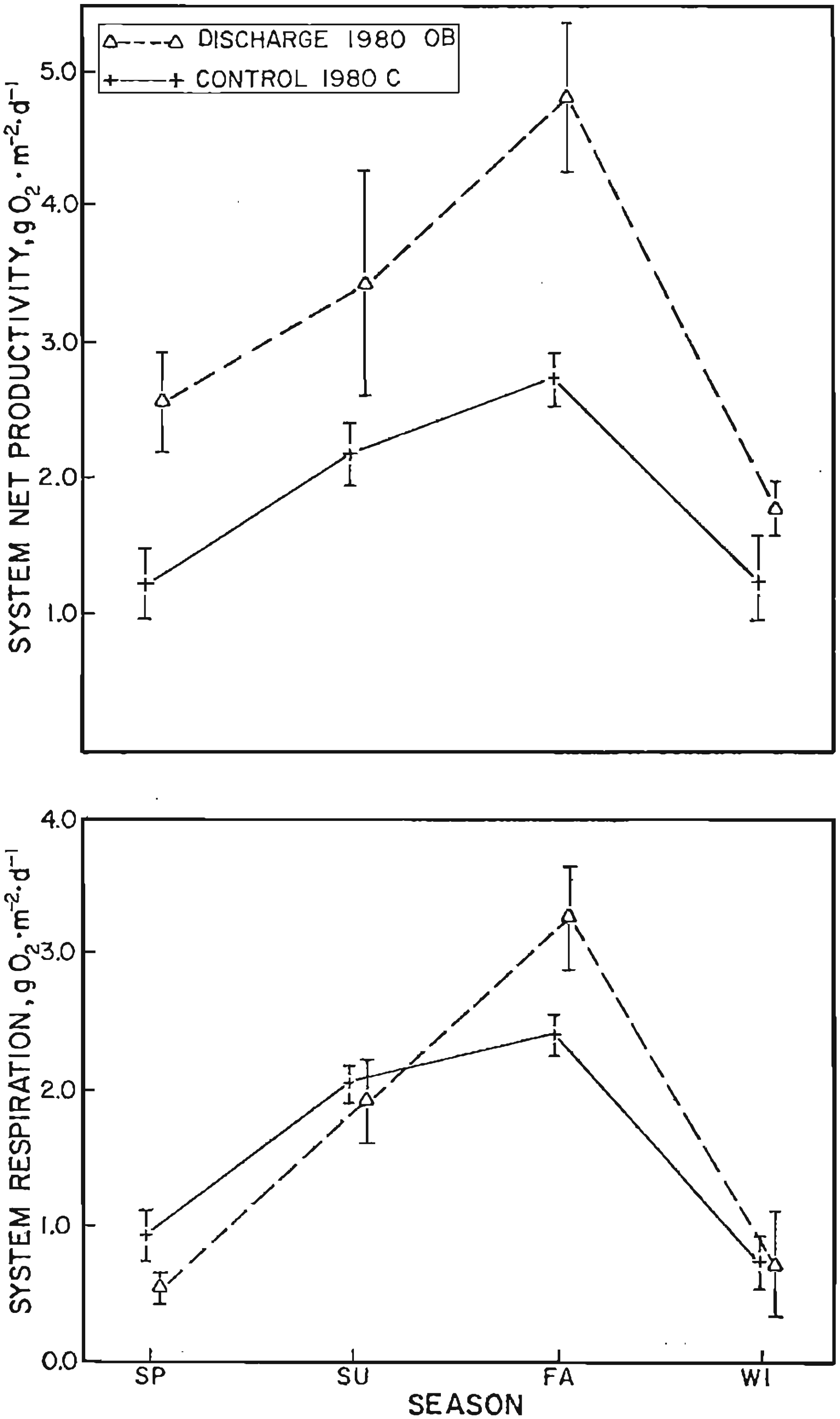


Figure II-46. Seasonal mean system net productivity and respiration for the discharge and control bays for 1980. Bars represent ± one standard error.

Table II-28. Results of statistical t-tests between the discharge bay (OB) and its control bay (C): 1980 seasonal averages for gross plankton productivity ($P_G = P_N + R$), plankton net productivity (P_N), and plankton respiration (R). The standard error is listed after the value; the number of observations follows in parentheses.

Season	Plankton P_G, g $O_2 \cdot m^{-2} \cdot d^{-1}$	Plankton P_N, g $O_2 \cdot m^{-2} \cdot d^{-1}$	Plankton R, g $O_2 \cdot m^{-2} \cdot d^{-1}$
Spring			
Discharge	1.62 ± 0.20(12)	1.21 ± 0.22(12)	0.41 ± 0.10(12)
Control	2.18 ± 0.37(11)	1.74 ± 0.36(11)	0.44 ± 0.09(11)
Summer			
Discharge	6.55 ± 0.73(12)	5.94 ± 0.73(12)	0.62 ± 0.07(12)
Control	5.46 ± 0.54(12)	4.77 ± 0.57(12)	0.69 ± 0.16(12)
Fall			
Discharge	6.42 ± 0.41(12)*	5.66 ± 0.38(12)*	0.76 ± 0.11(12)*
Control	4.39 ± 0.36(12)*	3.19 ± 0.34(12)*	1.20 ± 0.11(12)*
Winter			
Discharge	1.81 ± 0.31(12)	1.10 ± 0.21(12)	0.71 ± 0.15(12)
Control	1.73 ± 0.43(12)	1.14 ± 0.33(12)	0.59 ± 0.13(12)

*Means for control and discharge are significant at the 95% confidence level (two-sample t-tests).

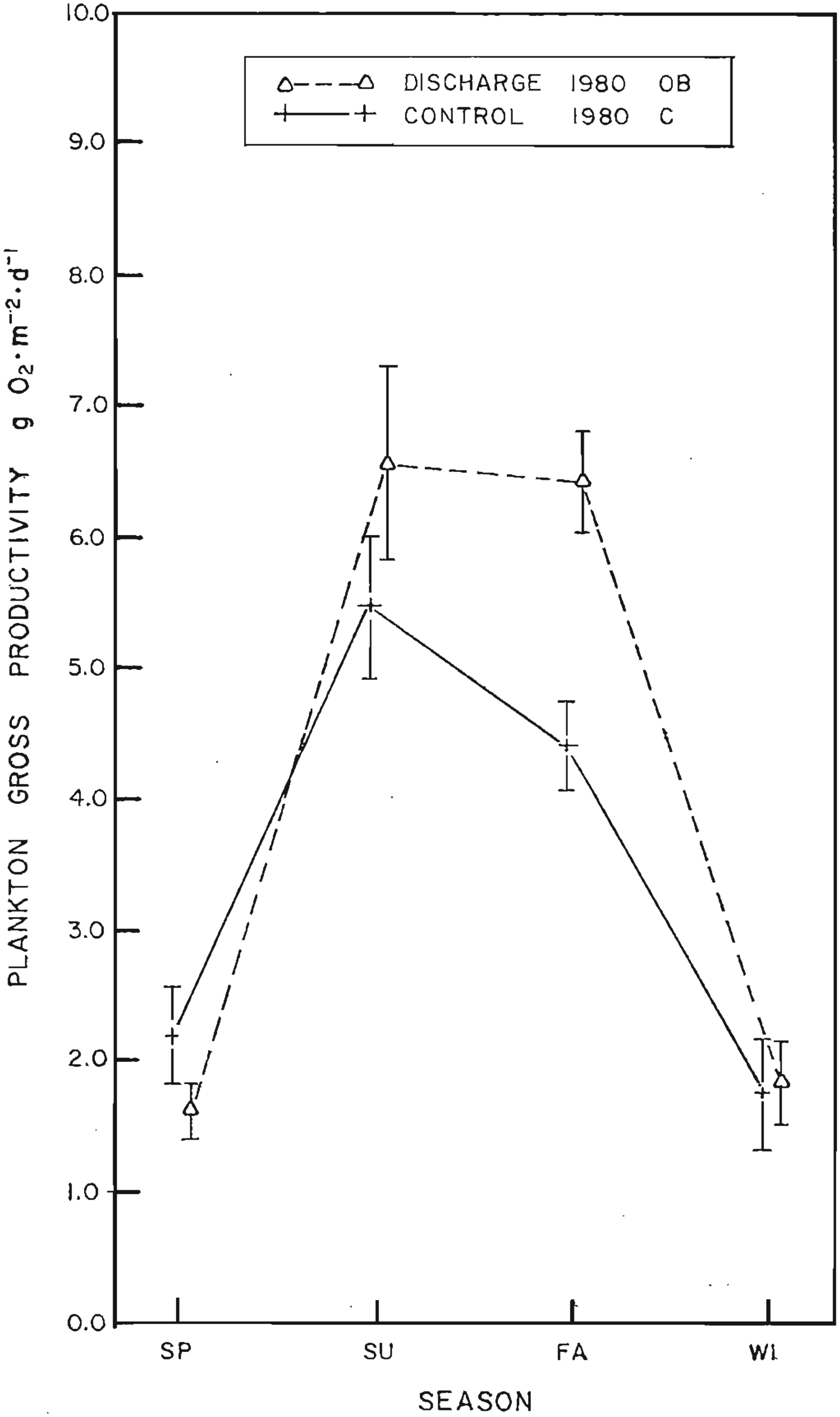


Figure II-47. Seasonal mean plankton gross productivity for the discharge and control bays for 1980. Bars represent ± one standard error.

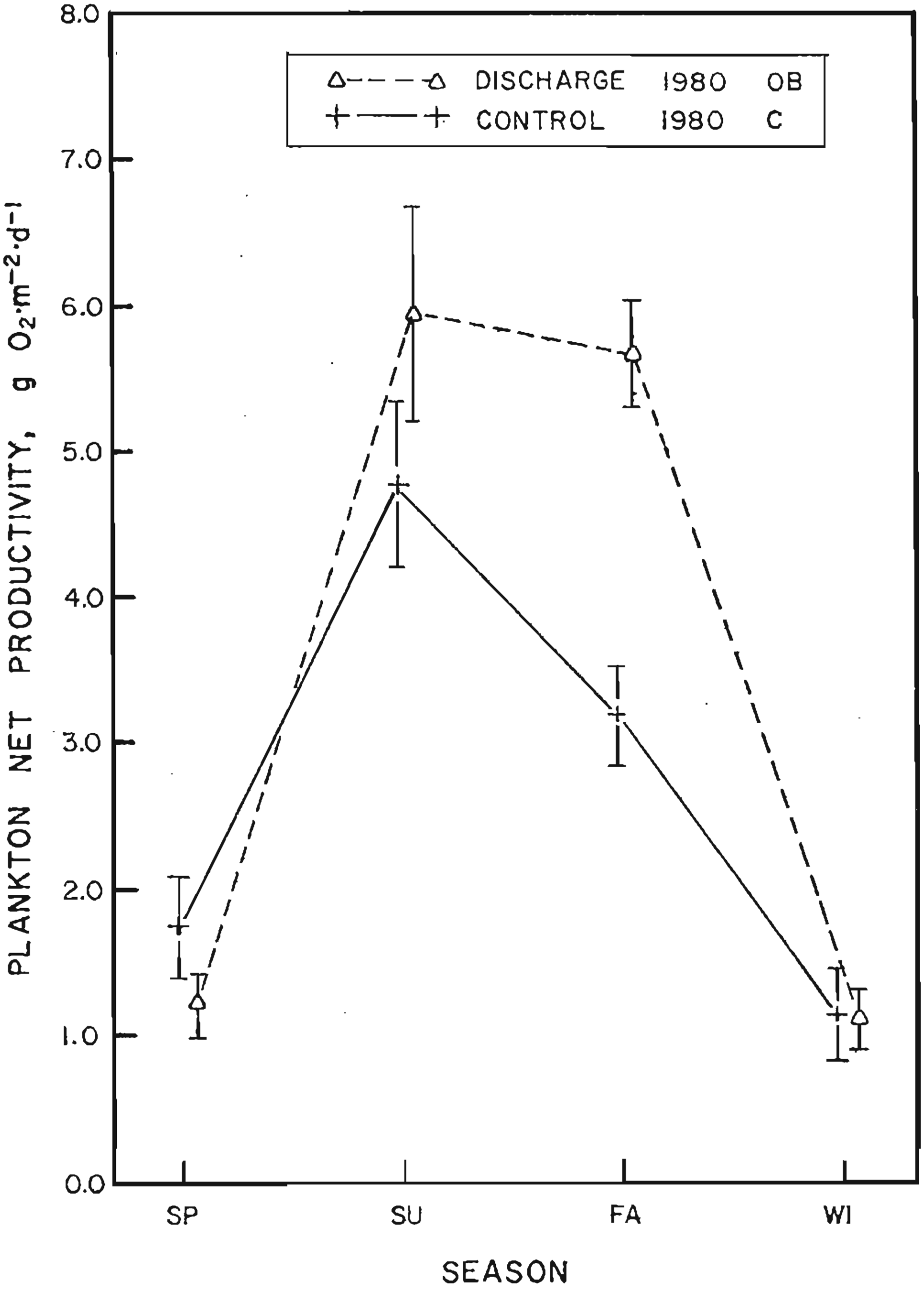


Figure II-48. Seasonal mean plankton net productivity for the discharge and control bays for 1980. Bars represent ± one standard error.

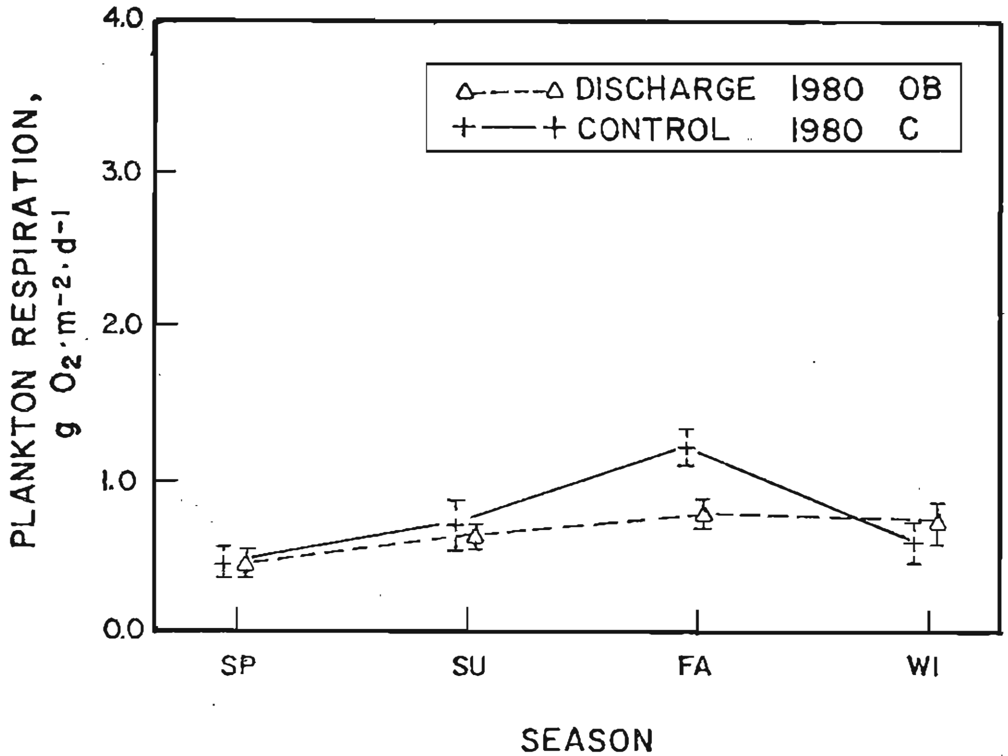


Figure II-49. Seasonal mean plankton respiration for the discharge and control bays for 1980. Bars represent ± one standard error.

Ecological Indices

Ecological efficiencies are presented in Table II-29. The discharge bay mean during the fall was significantly higher than the control bay.

The P/R ratios are also presented in Table II-29. P/R ratios were significantly higher in the discharge bay compared to the control bay during spring and summer 1980 (95% confidence level).

Temperature, Salinity, and Light Extinction Coefficients for 1977–1980

Temperature data throughout the 4-year period from 1977–1980 demonstrated seasonal trends corresponding to insolation, with the highest temperatures recorded in the summer and the lowest during the winter (Fig. II-50). An increase of approximately 3.1°C in the discharge bay water temperature during the postoperational period has been attributed to the thermal effluent from the three power plants. Mean seasonal temperatures for the discharge bay were all significantly higher than the control bay except for spring 1978, winter 1978, and summer 1979.

Salinity measurements for the two bays during the past 4 years were not significantly different except for spring 1978, summer 1979, and summer 1980 (Fig. II-51). The lower salinity values for the discharge bay could be accounted for by a slower exchange rate with offshore waters due to the semienclosed nature of the discharge bay. The control bay may receive greater exchange with higher salinity, offshore water because of the absence of any appreciable seaward boundary (i.e., oyster bars).

Light extinction values for the postoperational study were significantly higher for the discharge bay between fall 1977 and fall 1978 (Fig. II-52). The fall 1980 extinction value from the discharge bay was also significantly higher than from the control bay. The increase in light

Table II-29. Results of statistical t-tests for evaluation of mean ecological efficiencies and P/R ratios ($P_G/2R$) between the discharge bay (OB) and its control bay (C) for 1980. Standard error follows the value; number of observations in parentheses.

Season	Ecological Efficiency	Range	P/R Ratio	Range
Spring				
Discharge	0.37 ± 0.05(12)	0.05–0.73	2.57 ± 0.39(9)*	1.08–4.31
Control	0.26 ± 0.06(12)	0.00–0.70	1.25 ± 0.10(11)*	0.78–1.91
Summer				
Discharge	0.49 ± 0.08(12)	0.10–1.03	1.73 ± 0.31(12)*	0.54–3.77
Control	0.38 ± 0.02(12)	0.22–0.49	1.03 ± 0.05(12)*	0.76–1.31
Fall				
Discharge	0.83 ± 0.09(12)*	0.15–1.32	1.32 ± 0.15(12)	0.74–2.50
Control	0.52 ± 0.04(12)*	0.31–0.71	1.07 ± 0.05(12)	0.88–1.44
Winter				
Discharge	0.49 ± 0.14(11)	0.14–1.78	3.15 ± 1.69(7)	0.82–13.29
Control	0.30 ± 0.06(11)	0.08–0.68	2.66 ± 1.21(10)	0.58–12.81

*Means for control and discharge are significant at the 95% confidence level (two-sample t-tests).

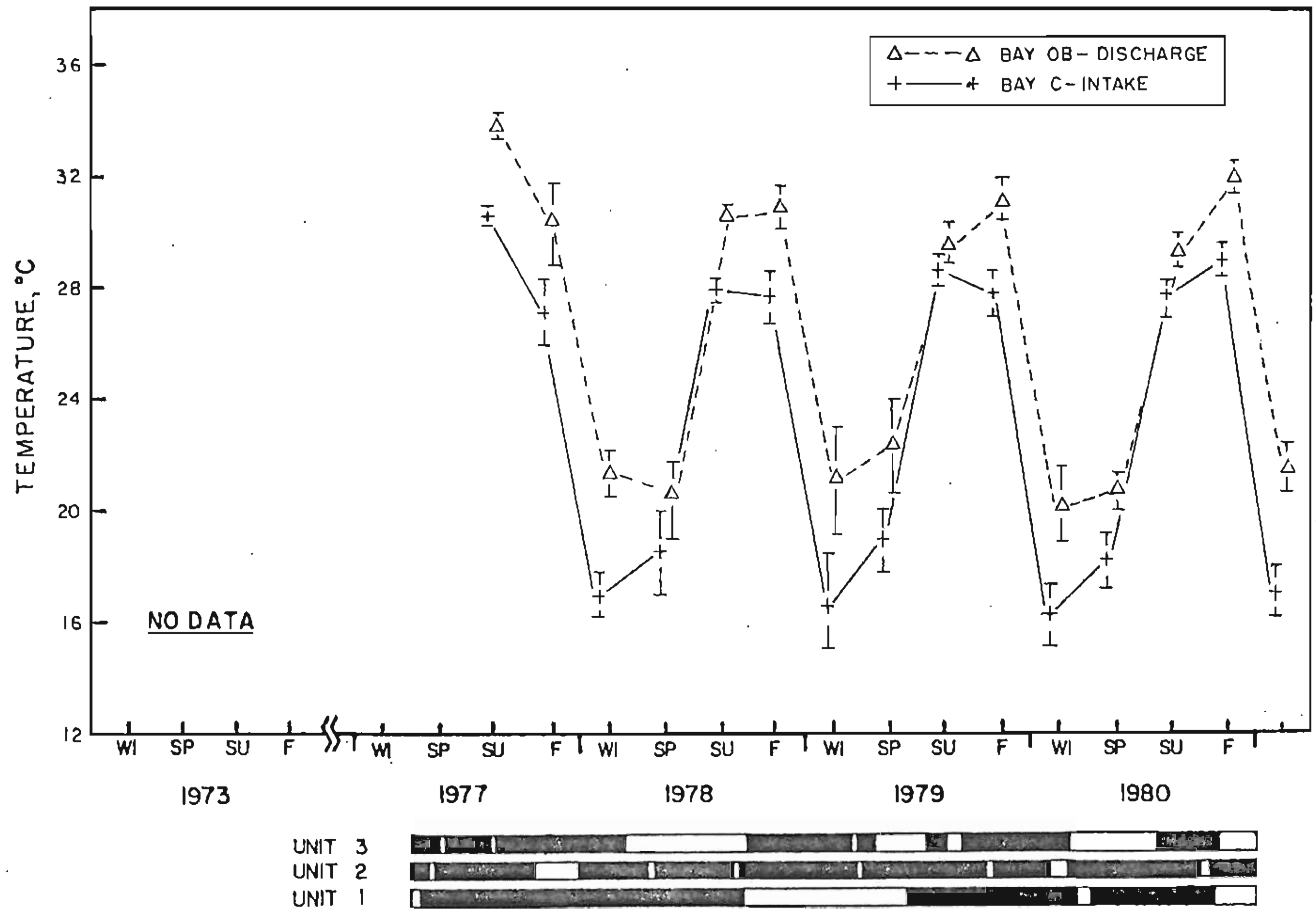


Figure II-50. Seasonal mean temperature for the discharge and control bays along with the schedule of power plant operation from 1977–1980. Darkened areas indicate Unit was on line. Bars represent $\pm$ one standard error.

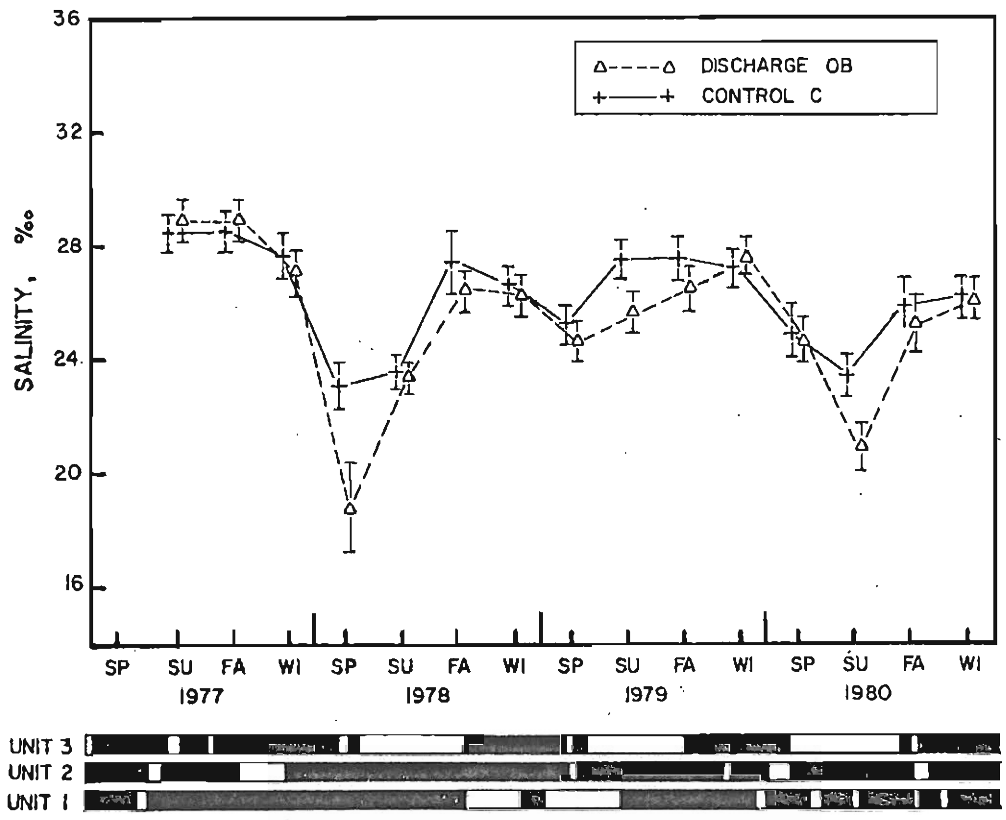


Figure II-51. Seasonal mean salinity for the discharge and control bays along with the schedule of power plant operation from 1977–1980. Darkened areas indicate Unit was on line. Bars represent ± one standard error.

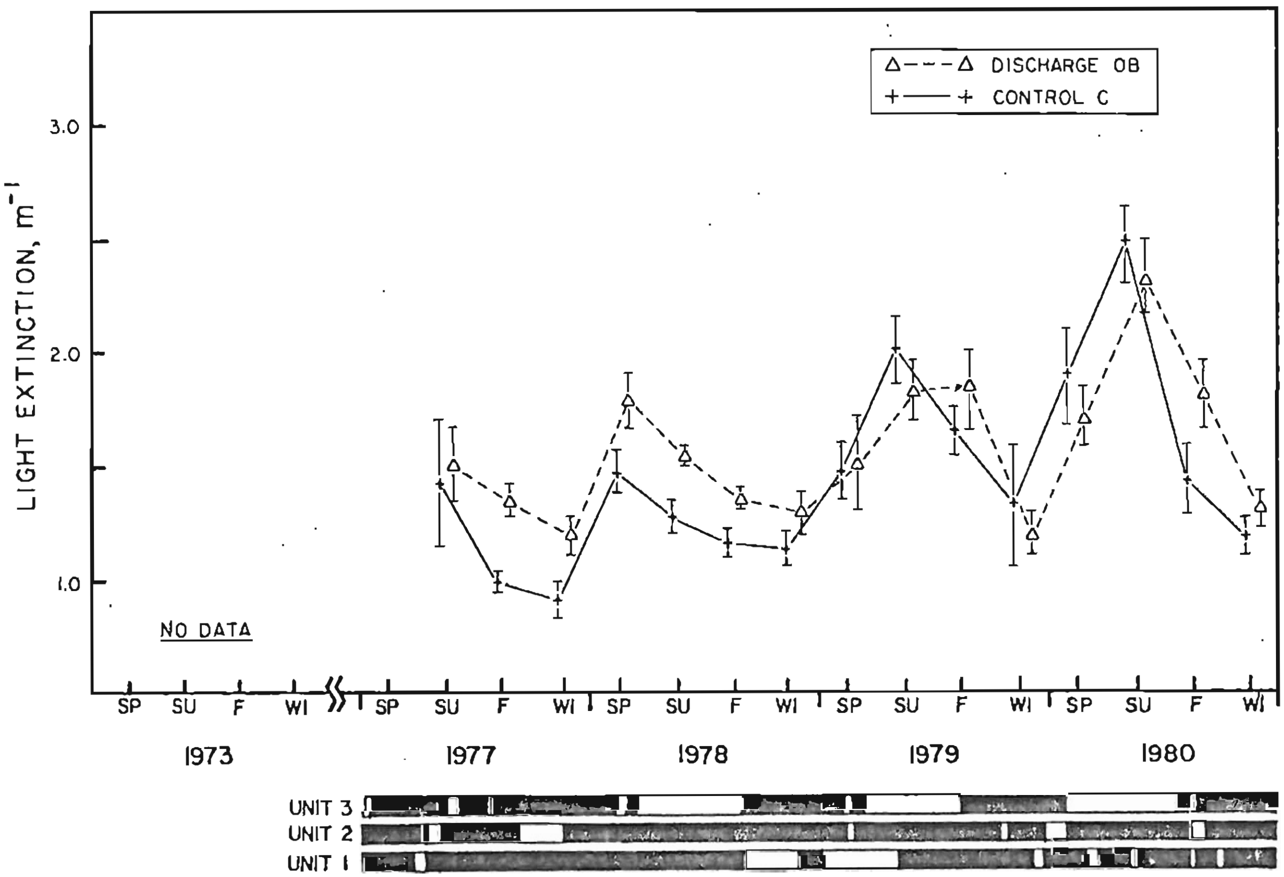


Figure II-52. Seasonal mean light extinction coefficients for the discharge and control bays along with the schedule of power plant operation from 1977–1980. Darkened areas indicate Unit was on line. Bars represent ± one standard error.

attenuation for both bays during the past 2 years could be the result of dredging operations in the intake canal.

System Gross Productivity, Net Productivity, and Night Respiration for 1977–1980

System gross productivity measurements for the discharge and control bays during the postoperational period display clear seasonal trends. Maximum values were recorded in the summer or fall, and minimum values were recorded in the winter (Fig. II-53). Variable depression and stimulation of productivity for the discharge bay relative to the control bay occurred throughout the first 3 years of this study (see Table II-30). Only during the last year (1980) was there a consistently higher productivity in the discharge bay. The trend for increasing maximum system productivity in the discharge bay is confounded by a simultaneous decrease in this parameter in the control bay. The effect on productivity, if any, of plant operation on this control bay is unclear. The trend of increased peak productivity of the discharge bay may indicate adaptation to power plant operation.

System respiration and net productivity (Fig. II-54) follow similar patterns as total gross productivity. Net productivity in the discharge bay increased rapidly during the first part of 1980 from its lowest value recorded (0.49 g $O_2 \cdot m^{-2} \cdot d^{-1}$, fall 1979) to its highest recorded value 4.80 g $O_2 \cdot m^{-2} \cdot d^{-1}$) in fall 1980.

Plankton Gross Productivity, Net Productivity, and Night Respiration for 1977–1980

Mean seasonal plankton gross productivity values between summer 1977 and winter 1980 for the discharge and control bays are given in Fig. II-55. Seasonal trends between this period are clear, with highest values found in the summer and the lowest values in the winter. The plankton

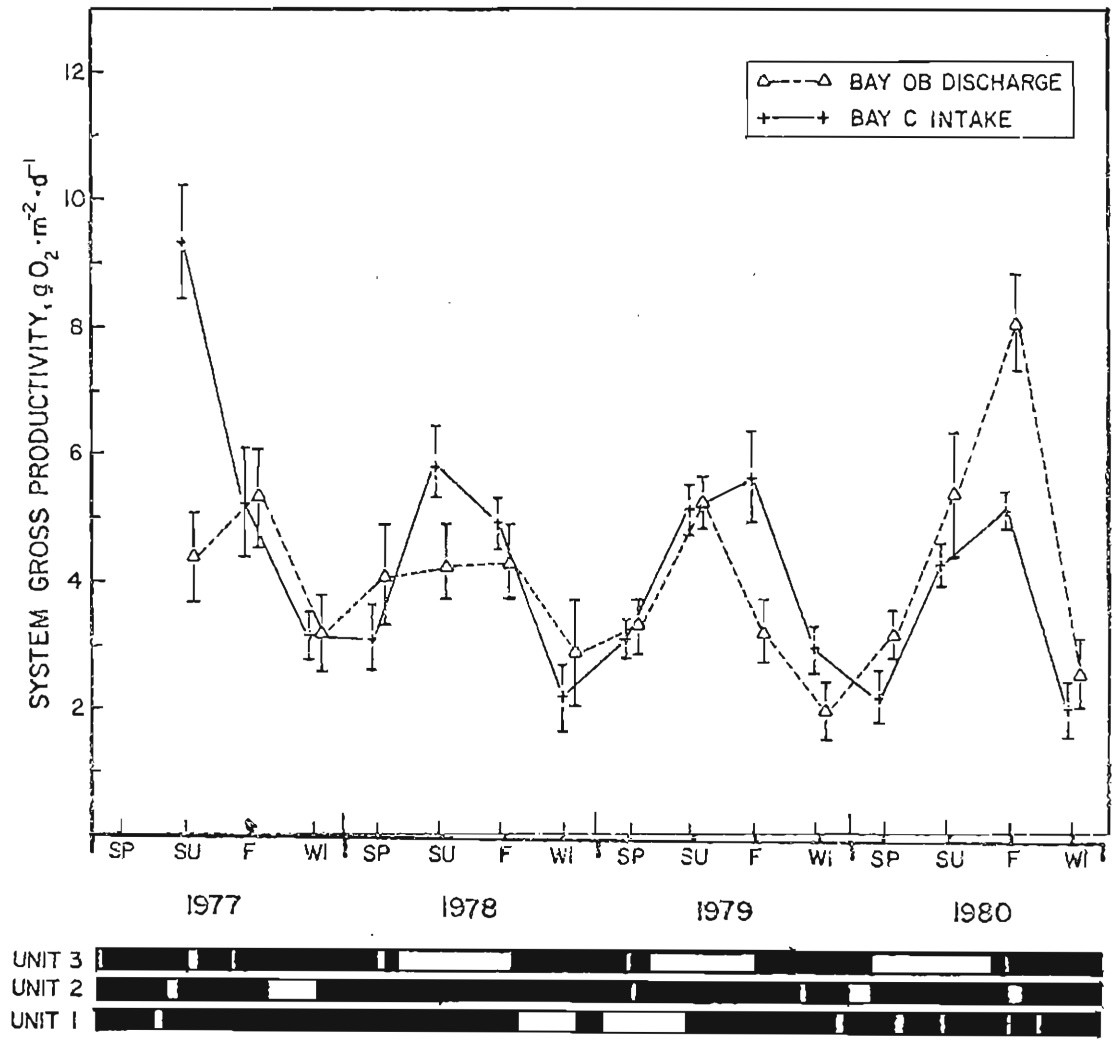


Figure II-53. Seasonal mean system gross productivity for the discharge and control bays along with the schedule of power plant operation from 1977–1980. Darkened areas indicate Unit was on line. Bars represent ± one standard error.

Table II-30. The seasonal average percent gross productivity of the discharge bay (OB) relative to the gross productivity of the control bay (C) for 1977–1980. Number in parentheses indicates number of observations.

	% Total Gross Productivity			
Season	1977	1978	1979	1980
Spring	No data	134.5(10)	107.5(9)	142.7(12)*
Summer	47.0(3)*	73.3(11)*	104.5(12)*	126.4(12)*
Fall	101.1(10)	87.8(10)*	56.1(10)*	158.2(12)
Winter	103.2(7)	132.9(9)	67.1(10)	127.9(12)
Mean	83.8	107.1	83.8	138.8
Standard deviation	31.9	31.2	26.1	14.9

*Crystal River Unit 3 was off line for greater than 50% of the season indicated.

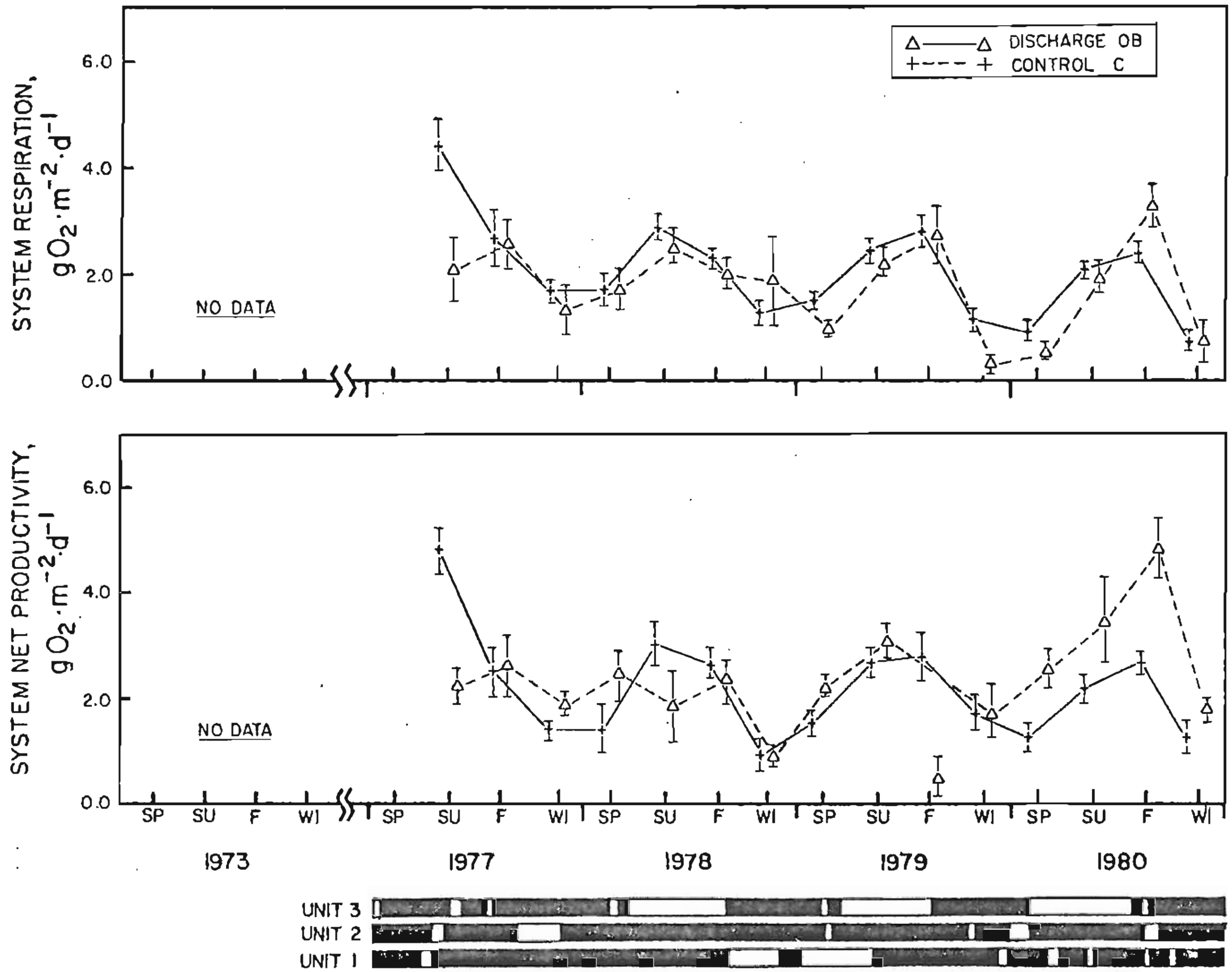


Figure II-54. Seasonal mean system net productivity and respiration for the discharge and control bays along with the schedule of power plant operation from 1977–1980. Darkened areas indicate Unit was on line. Bars represent ± one standard error.

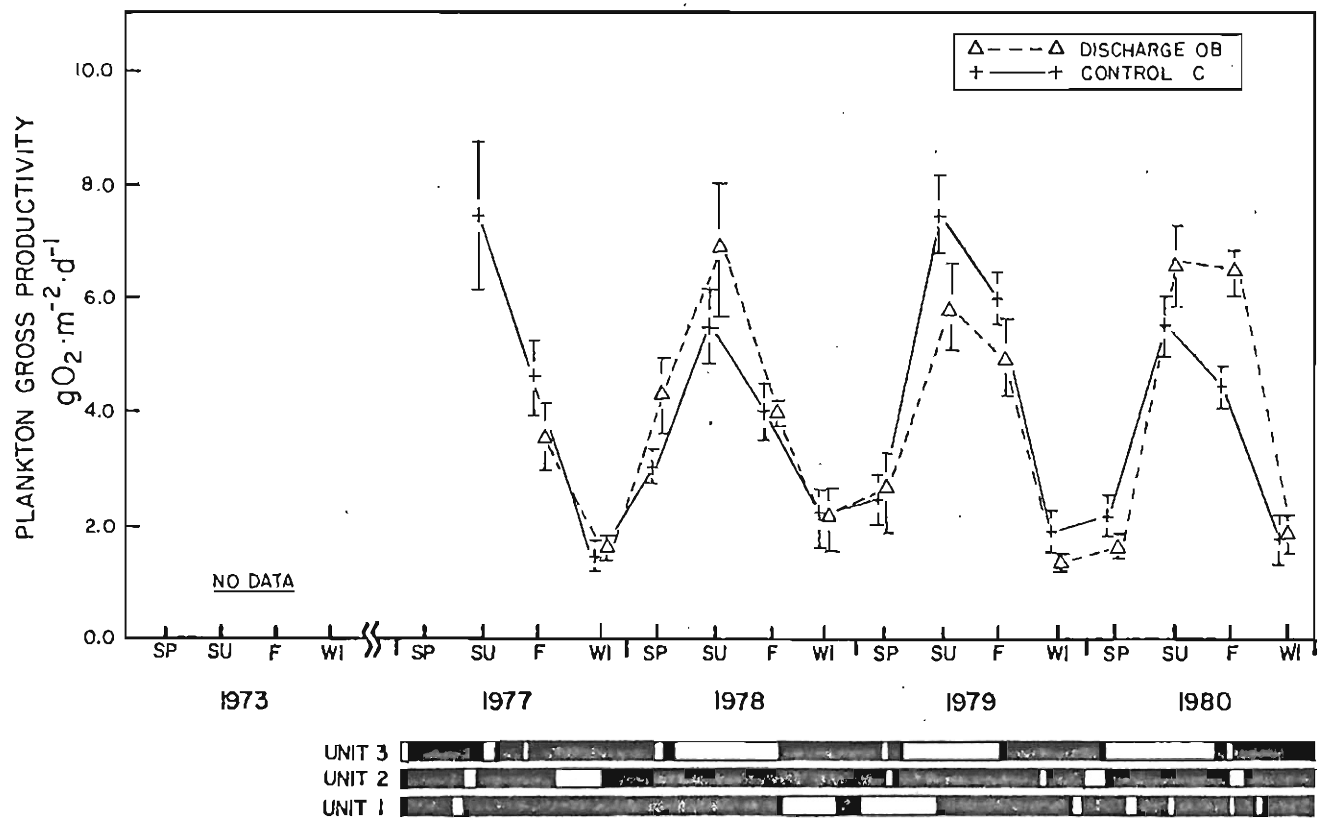


Figure II-55. Seasonal mean plankton gross productivity for the discharge and control bays along with the schedule of power plant operation from 1977–1980. Darkened areas indicate Unit was on line. Bars represent ± one standard error.

productivity was significantly higher in the discharge bay relative to the control bay during fall 1980.

Table II-31 presents the discharge seasonal plankton gross productivity data as a percentage of control values. During the 4-year study, the yearly average values have been variable with no consistent trends between discharge and control.

Plankton respiration and net productivity seasonal means for 1977–1980 are given in Fig. II-56. Seasonal trends are evident, but no consistent, long-term trends were observed. The magnitude of plankton net productivity and respiration have not significantly changed during 4 years of study.

Discussion

Overview of 1980 Data for the Discharge and Control Bays

Overall, gross productivity of the outermost discharge bay was positively correlated with the addition of thermal effluent from the power plants during 1980. Total system gross productivity for the discharge bay peaked during the fall when the bay was under the effect of thermal loading by all three power plants. Total system gross productivity was higher in the discharge bay even when the nuclear unit was off line in the spring and summer. The lowest ΔT between the discharge and control bays occurred during these seasons. An increase in the ΔT values during the fall and winter accompanied higher system productivity in the discharge bay.

In order to approximate the overall effect of plankton in these outermost bays, Table II-32 summarizes plankton gross productivity as a percentage of system gross productivity. Plankton gross productivity consistently accounted for more than 90% of total gross productivity. Plank-

Table II-31. The seasonal average percent plankton gross productivity of the discharge bay (OB) relative to the plankton gross productivity of the control bay (C) for 1977–1980. Number in parentheses indicates number of observations.

Season	% Plankton Gross Productivity 1977	1978	1979	1980
Spring	No data	140.1(9)	106.5(9)	74.1(11)*
Summer	No data	125.9(9)*	78.3(10)*	120.1(12)*
Fall	77.0(9)	100.5(8)*	82.1(10)*	146.1(12)
Winter	107.7(7)	97.7(9)	65.5(11)	104.5(12)
Mean	92.4	116.1	83.1	111.2
Standard deviation	21.7	20.4	17.1	30.1

*Crystal River Unit 3 was off line for greater than 50% of the season indicated.

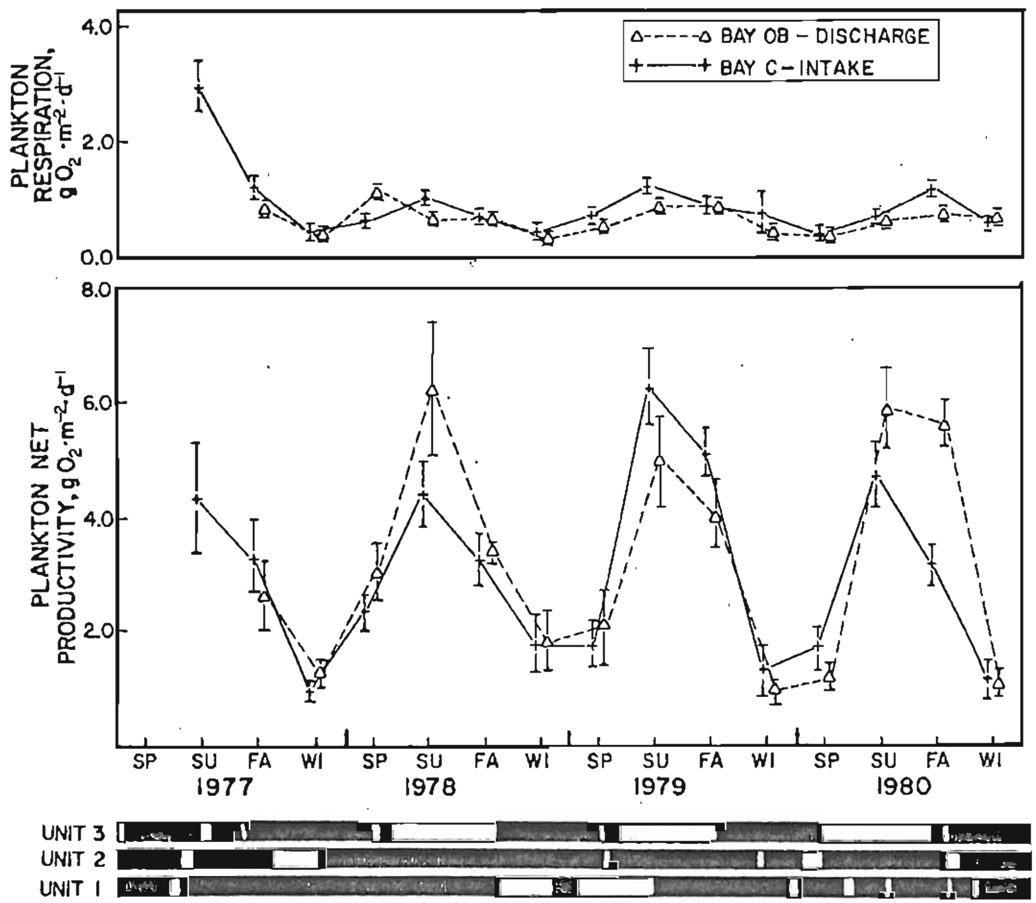


Figure II-56. Seasonal mean plankton net productivity and respiration for the discharge and control bays along with the schedule of power plant operation from 1977–1980. Darkened areas indicate Unit was on line. Bars represent ± one standard error.

Table II-32. Plankton gross productivity as a percentage of total gross productivity for the discharge bay (OB) and control bay (C) for postoperational years (1977—1980).

	Control Bay (C)				Discharge Bay (OB)			
Season	1977	1978	1979	1980	1977	1978	1979	1980
Spring	No data	97.4	80.3	102.7	No data	101.5	92.2	51.6
Summer	79.2	92.7	147.4	107.8	No data	159.2	110.4	122.0
Fall	88.1	81.7	106.9	86.1	67.0	93.5	156.5	79.4
Winter	45.4	100.9	66.1	88.3	47.4	74.2	64.4	71.4
Mean	70.9	93.2	100.2	96.2	57.2	107.1	105.9	81.1
Standard deviation	22.5	8.4	35.7	10.7	13.9	36.6	38.7	29.7

ton gross productivity peaked during the summer season in both bays and was significantly stimulated during the fall in the discharge bay compared to the control bay plankton productivity.

Postoperational Trends with Respect to Power Plant Operation: 1977–1980

Both the outer discharge bay and its control bay appear to be plankton-dominated systems (see Table II-32), which may allow these deeper systems to respond quickly to changes in thermal loading. During the past 4 years system productivity of the outermost discharge bay has shown both increased and decreased response compared to its control. Figure II-53 suggests a decline in gross productivity, however, Fig. II-57, which gives production per unit insolation (efficiency), indicates little change except in the last year. Increased turbidity in the control bay (Fig. II-52) in 1980 may explain the decreased productivity. In the discharge bay system gross productivity increased in 1980.

Summary

1. System gross productivity was 1.4 g $O_2 \cdot m^{-2} \cdot d^{-1}$ (39%) higher in the outermost discharge bay compared to its control in 1980.
2. Temperatures of the discharge bay were approximately 2–4°C higher than in the corresponding control bay during 1977–1980.
3. Both the discharge and control bays were plankton dominated in terms of gross productivity.
4. Postoperational (1977–1980) trends in the discharge bay suggest that adaptation to thermal effluent is taking place while long-term trends in the control bay appear to indicate possible impacts of plant operation on the non-thermally affected estuary at Crystal River.

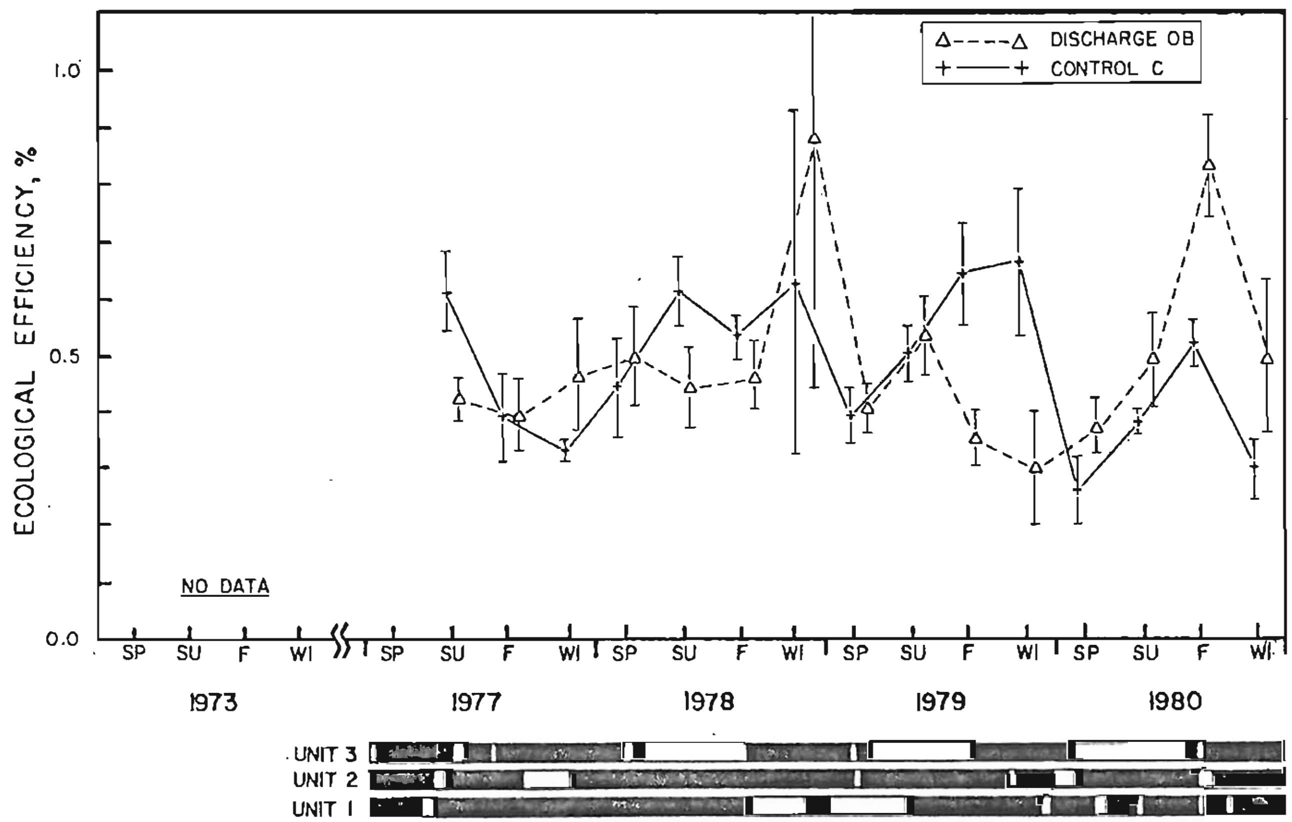


Figure II-57. Seasonal mean ecological efficiencies for the discharge and control bays along with the schedule of power plant operation from 1977–1980. Darkened areas indicate Unit was on line. Bars represent ± one standard error.

CHAPTER 6

COMMUNITY METABOLISM OF THE MARSH ECOSYSTEM

Jeffrey J. Kosik

Introduction

In this chapter salt marsh structure and metabolism measurements are reported, continuing the studies designed to assess any additional impact of the thermal discharge from Unit 3 of the Crystal River Energy Center on the estuarine marsh environment. Biological structure and community metabolism measurements were taken from areas that were affected by the thermal effluent and compared with data from biotically similar areas that were not subjected to the thermal addition. These measurements were then compared with data from previous studies (Young 1974; Hornbeck 1978; Odum et al. 1978; Caldwell et al. 1979, 1980).

Methods previously used were duplicated as closely as practical in order to provide a basis for comparing conditions prior to and subsequent to operation of the nuclear unit. Quarterly measurements of structure included harvest of the dominant grasses for height and weight parameters, counts of the salt marsh periwinkle snail *Littorina irrorata*, and the number of fiddler crab (genus *Uca*) burrows. Metabolism measurements included net photosynthesis and respiration made by analysis of CO_2 fluxes in the marsh community. The physical parameters that were monitored include insolation, air temperature, and water temperature.

Study Sites

The sites chosen for this study are in two areas, one of which received tidal inundation by water of elevated temperature due to its proximity to the discharge canal (Fig. II-58). The control area received no thermal additions from the effluent due to a long jetty that was constructed to avoid recycling previously heated water through the power plant. Preoperational control data were collected on the offshore islands. These are adjacent to the present sites where all postoperational data were collected.

Both the control and thermally impacted marshes received semidiurnal tidal inundation. The floristic composition of these marshes was similar, with two dominating species. Most of the marsh areas surrounding the Crystal River site were covered with patches of Juncus roemarianus, which grows to a height of 2 m. These areas were of higher elevation and received less frequent and less severe tidal inundation than areas with Spartina alterniflora, which was typically found along the fringes of the Juncus marshes. Water flushing the thermally impacted marshes was 1.6–9.6°C higher than the water flooding the control marsh.

Thermal Discharge Conditions

When under normal loading conditions, Crystal River Units 1 and 2 discharge a combined average of 2410 $m^3 \cdot min^{-1}$, and Unit 3 discharges an average of 2366 $m^3 \cdot s^{-1}$ (USAEC 1973). During 1980, Unit 3 was inoperative from March through August; however, heated effluent was released by Units 1 and 2 during this time. The spring and summer samplings were conducted with Unit 3 off line, while the fall sampling took place in November, 3 months after Unit 3 went on line.

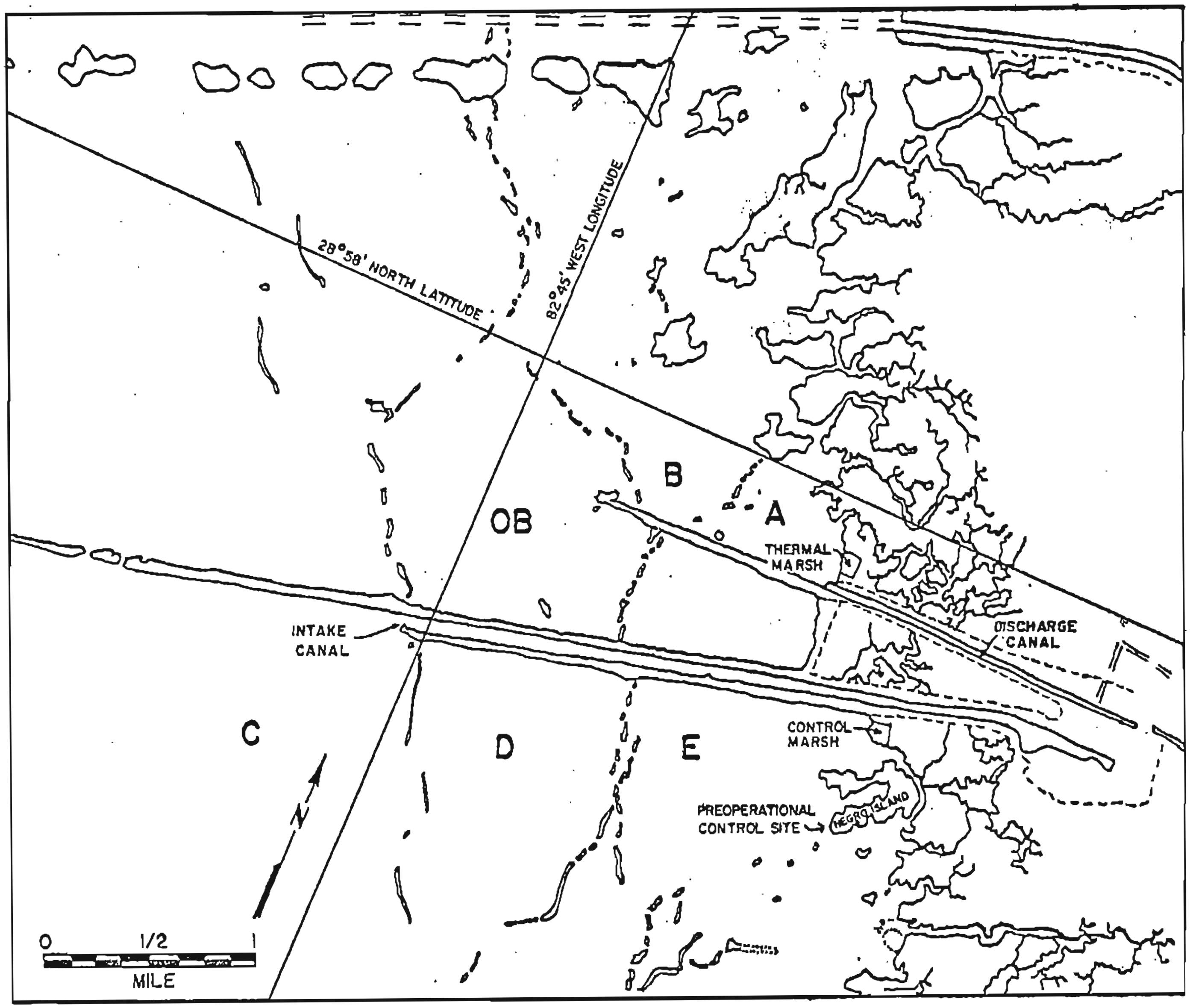


Figure II-58. Map showing locations of preoperational and postoperational sampling sites. Control data for 1973 were collected around Negro Island, and thermal data for 1973 were collected along tidal creeks. Data for 1977–1980 were collected on the exterior edges of marshes as indicated.

Materials and Methods

Biological Structure

Biomass measurements were taken during this portion of the study as a method of estimating the net productivity of the thermally affected and control marshes. To quantify standing crops of *J. roemarianus* and *S. alterniflora*, vegetation harvests were collected quarterly in the intake and discharge areas. Five replicate samples for *Juncus* and nine replicate samples for *Spartina* were collected in both marshes each quarter. Hoops that covered an area of 0.25 m^2 were tossed over the *Spartina* or *Juncus* plants, and community biomass was sampled from the area below the hoops. The number of dead, flowering, and live stems in various length classes was recorded for each quadrat. Wet and dry weights for live and dead material were also determined. After each quadrat was harvested, the number of crab burrows in the marsh substrate was counted as an index of *Uca* activity. During high tide, *Littorina* became visible and numbers were subsequently recorded.

Metabolism

Plant community metabolism measurements were made quarterly on both the thermally affected and the control sites by enclosing an area of marsh plants and substrate with polyethylene chambers. These chambers were continually flushed with ambient air, which was circulated by electric blowers. To quantify the productivity of the plants, gaseous exchange of CO_2 and water between the air and biota was recorded by measuring concentration differences across the individual chambers with an infrared gas analyzer (IRGA). Air and water temperature and insolation were monitored for the duration of the field research. Figure II-59 shows the major components of the metabolism study. The instruments were housed in a

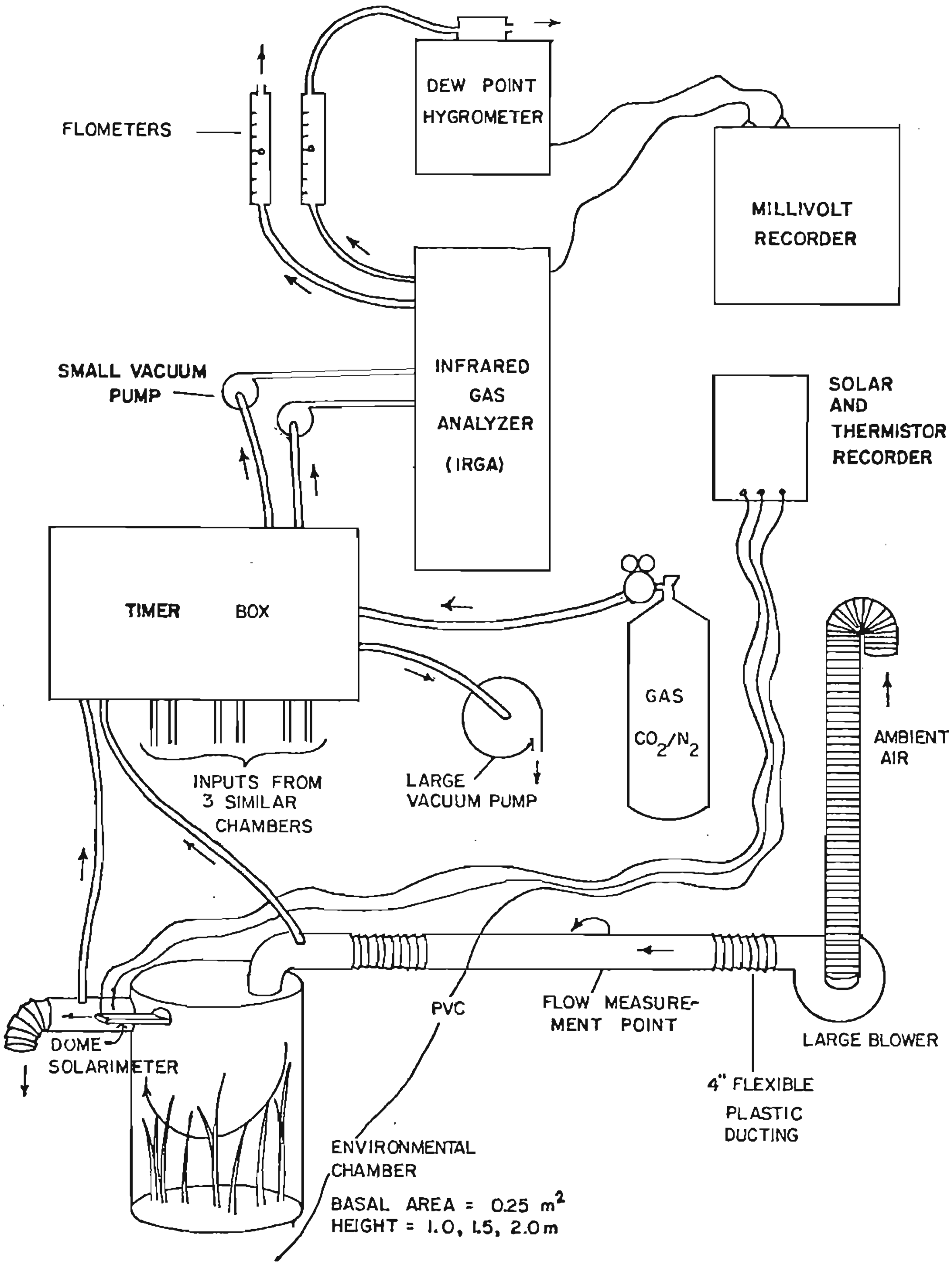


Figure II-59. General schematic of metabolism apparatus. Arrows indicate direction of air flow.

weather-protected mobile lab, and electricity was provided by a portable 6-KW generator.

Field Apparatus for Air Sampling and CO_2 Measurement

At each research site four polyethylene chambers with a base area of 0.25 m^2 were placed over two plots each of *Spartina* and *Juncus*. Air was circulated through the chambers by four constant-delivery centrifugal blowers supplying ambient air through a system of 10-cm diameter PVC pipes and flexible ducting. On the top of each chamber was a 10-cm diameter metal cylinder, which accepted the input of air from the blowers. A similar 10-cm diameter cylinder was employed to direct the air leaving the chamber and was located opposite the intake. Air samples were taken as the air entered the chamber and at the exhaust pipe as it exited. Intake and exhaust air flows were sampled for 15 minutes per chamber per hour for 24–36 hours. A vacuum pump drew the sample air from the chambers through tygon tubing to 1-gallon glass mixing jars. The timer box regulated the distribution of the samples through the IRGA, which measured the concentration of CO_2, and then passed the sample through a dew point hygrometer to determine the water vapor concentration.

Timer Box

The purpose of the timer box was to regulate the air flow through the IRGA. The timer box consisted of a 60-minute-per-revolution timer wheel, four 3 way–valve double solenoids, and one 2 way–valve single solenoid. The timer wheel contained single pole–double throw switches, which controlled the solenoid valves selecting the chamber air streams (ambient from the entrance and exhaust from the exit) to be pumped through the IRGA. Small vacuum pumps supplied the IRGA with the air samples.

IRGA

A Beckman model 215-B IRGA was used in this study. By design, the IRGA allows versatility in application, sensitivity, and a selection of ranges for gas concentrations to be analyzed. Because the detector within the IRGA compares differences in energy absorption between gases in two internal cells, one may compare a reference gas to an unknown or compare two unknowns directly. The differential method of analysis was employed in this study due to the high sensitivity (1.0 ± 0.5 ppm) that is achieved when ambient and exhaust samples are directly compared. The millivolt output of this arrangement represented a change in CO_2 across the chamber. The analyzer response was approximately linear over the range of ambient CO_2 concentrations so that the sensitivity, measured as the change in millivolts per change in ppm, was fairly constant over the sampling ranges. Ambient air was routed to both cells of the IRGA during the first 7 minutes of each 15-minute cycle. For the remainder of the cycle, exhaust air was sent through one cell, and the CO_2 concentration was compared against that of the ambient sample in the other cell. The resulting energy differential yielded a millivolt output, which was recorded on a potentiometric strip chart recorder. The IRGA was calibrated at approximately 12-hour intervals using bottled CO_2 standard gases (305 ppm, 322 ppm, and 350 ppm).

Calculation of Photosynthesis and Respiration

An estimate of carbon fixation/release was calculated from the CO_2 and temperature data, and the equation, which corrects for stochiometry and the gas laws (after Brown and Rosenberg 1968), is as follows:

$$g\ C \cdot hr^{-1} = \frac{F \times K \times \Delta[CO_2]}{T}$$

where, F = flow rate ($m^3 \cdot hr^{-1}$),

$\Delta[CO_2]$ = change in CO_2 concentration across the chamber (ppm),

T = air temperature (°K), and

K = a constant defined as:

$$K = \frac{(12 \text{ g C} \cdot \text{mole}^{-1}) \times (10^3 \text{ l} \cdot \text{m}^{-3}) \times 273°\text{K}}{22.41 \text{ mole}^{-1} \times 10^6 \text{ ppm}}$$

$$= 0.14625 \text{ g C} \cdot \text{m}^{-3} \cdot °\text{K} \cdot \text{ppm}^{-1}.$$

Since the range of atmospheric pressure was generally less than 20 millibars, in effect less than 2%, the atmospheric pressure was assumed to be constant. The rate of carbon fixation or release was plotted for each of the several chambers being measured, along with physical climatic data for the corresponding time period. Usually the graphs for a 24-hour period include parts of two calendar days because chambers were generally set up during the daylight hours and were run for at least 24 hours. On metabolism rate graphs, the areas above the zero line are designated as net photosynthesis (NP). The areas below the zero line during the daylight hours are subtracted from the net photosynthesis values and the difference is designated as net productivity (P_N). The total area below the line during the night is referred to as nighttime respiration (R). The average rate of nighttime respiration was assumed constant throughout the day as an estimate of the 24-hour respiration rate (R_{24}). The sum of net productivity and nighttime respiration is an index of gross productivity (P_G) (for greater detail, see Brown [1978] and Hornbeck [1979]).

To compensate for the amount of biomass in each chamber, gross productivity values were divided by the sample weight to obtain the specific metabolism. This quotient was then multiplied by the seasonal mean value of total biomass to normalize for weight.

A useful parameter in the analysis of metabolism measurements is the P/R ratio, which gives an indication of the daily prevalence of production or consumption in the ecosystem. This ratio was obtained by dividing the gross productivity value by the 24-hour respiration measurement. P/R values greater than unity reflect a net increase of organic matter in the community, while ratios less than one indicate that the community is consuming more organic carbon than is being produced, hence, a decline in the organic storage.

Efficiency of gross production was estimated as the ratio between gross production and total insolation and used a conversion of grams of carbon to kilocalories as is defined below.

$$\text{Efficiency of gross production (\%)} = \frac{\text{gross production } (\text{g C}\cdot\text{m}^{-2}\cdot\text{d}^{-1}) \times (8 \text{ Cal}\cdot\text{g C}^{-1}) \times 100}{\text{insolation } (\text{Cal}\cdot\text{m}^{-2}\cdot\text{d}^{-1}).}$$

Supplementary Equipment

After being pumped through the IRGA, the sample flow passed through the dew point hygrometer, which was used to determine the water vapor concentration. Both the IRGA and dew point hygrometer produced millivolt output, which was recorded by potentiometric recorders.

Insolation was measured inside a chamber with a dome solarimeter and external to a chamber with a pyroheliometer. The air temperature was monitored within a chamber by means of a thermistor probe. The water temperature was monitored at a lower elevation than the chambers to insure a reading whenever tides inundated the marsh. Water temperature was also obtained from the inner discharge (A) and control (E) bays of the bay metabolism study (see Fig. II-58). For further detail on equipment use see Hornbeck (1979).

Statistical Analysis

Biomass data was processed and statistics were performed with the use of the SAS package programs (SAS Institute 1979). Biomass and metabolism values were subjected to t-test comparisons of the discharge and intake means as well as comparisons of 1980 means with previous annual means. Significant differences at a 95% confidence level were noted in the results.

Results

Comparison of Intake and Discharge Water Temperatures for 1980

The Crystal River Power Plant intake and discharge water temperatures are presented in Table II-33 and Fig. II-60. Biweekly mean intake and discharge water temperatures were recorded at stations E and A, respectively. The differences between the two means (ΔT), representing the thermal loading applied to the thermal marsh, are also presented in Table II-33 and Fig. II-60. The mean discharge water temperatures paralleled the mean intake temperature with an average ΔT of 4.6°C. Outage data for the three units are also presented in Fig. II-60.

Biological Structure of *Spartina* Marshes for 1980

Mean *Spartina* stalk density values are presented in Table II-34 and Fig. II-61. The numbers of live *Spartina* stalks were significantly higher in the discharge marsh during the spring, fall, and winter. The dead stalk densities in the *Spartina* marshes followed similar decreasing trends

Table II-33. Mean intake (bay E) and discharge (bay A) water temperatures and temperature differences (T) for 1980.

Date	Bay A Temperature, °C	Bay E Temperature, °C	T, °C
1/11/80	19.0	12.2	6.8
1/18/80	22.3	17.1	5.2
2/02/80	19.7	10.1	9.6
2/25/80	24.4	18.8	5.6
3/08/80	19.8	18.2	1.6
3/21/80	21.8	18.2	3.6
4/05/80	24.0	21.2	2.8
4/18/80	24.2	22.3	1.9
5/11/80	26.8	24.5	2.3
5/30/80	30.5	26.7	3.8
6/17/80	32.1	28.8	3.3
6/30/80	30.5	28.7	1.8
7/17/80	33.4	30.3	3.1
8/03/80	34.0	31.3	2.7
8/28/80	34.5	29.4	5.1
9/12/80	32.1	28.0	4.1
9/28/80	36.4	30.5	5.9
10/15/80	31.1	23.6	7.5
10/30/80	30.1	23.0	7.1
11/15/80	26.0	20.2	5.8
11/29/80	24.1	14.6	9.5
12/17/80	23.6	15.8	7.8

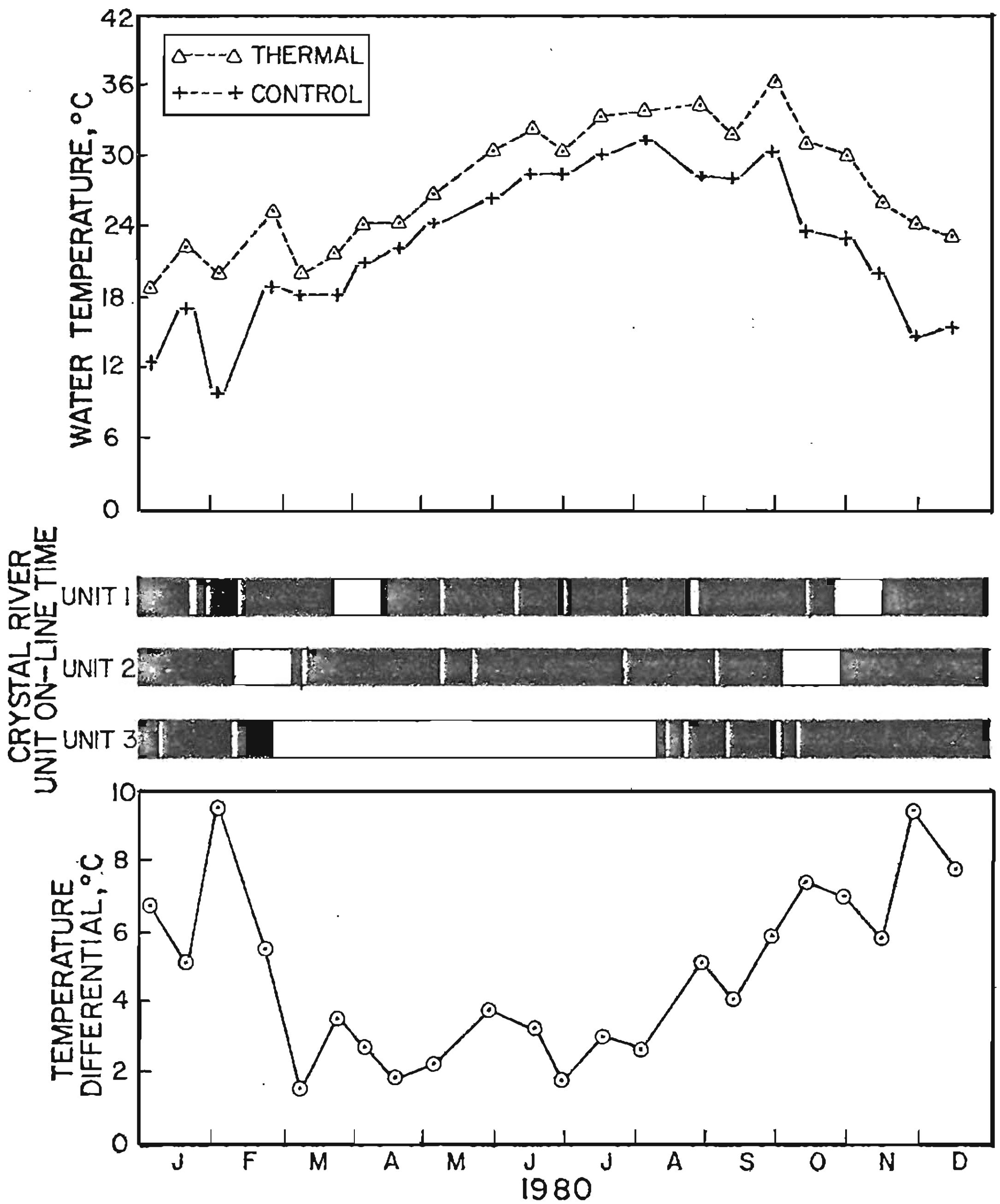


Figure II-60. Intake and discharge water temperatures along with the schedule of power plant operation for 1980. Upper graph represents seasonal averages at monitoring stations A (discharge) and E (intake). The differences between the means (ΔT) are presented on the lower graph. Darkened areas indicate Unit was on line.

Table II-34. Seasonal means (± one standard error) of *Spartina* stalk density for 1980.

Season	Date	Treatment	Live Stalks·m^{-2}	Dead Stalks·m^{-2}	Total Stalks·m^{-2}
Winter	1/06/80	Thermal	258.7 ± 26.8*	98.2 ± 10.5	356.9 ± 24.6*
	1/04/80	Control	134.2 ± 10.9	71.1 ± 10.1	205.3 ± 11.3
Spring	3/26/80	Thermal	214.7 ± 32.1*	135.1 ± 14.2*	349.8 ± 32.0*
	3/28/80	Control	103.6 ± 14.2	82.2 ± 11.9	185.8 ± 13.1
Summer	7/11/80	Thermal	153.2 ± 11.1	66.4 ± 9.18	219.6 ± 17.3
	7/04/80	Control	119.1 ± 12.4	84.0 ± 9.73	203.1 ± 17.6
Fall	10/11/80	Thermal	209.3 ± 11.5*	45.8 ± 7.28	255.1 ± 14.8*
	10/05/80	Control	114.2 ± 10.0	57.8 ± 6.70	172.0 ± 12.6

*Indicates a significant difference at a 95% confidence level was recorded when compared to the 1980 discharge mean.

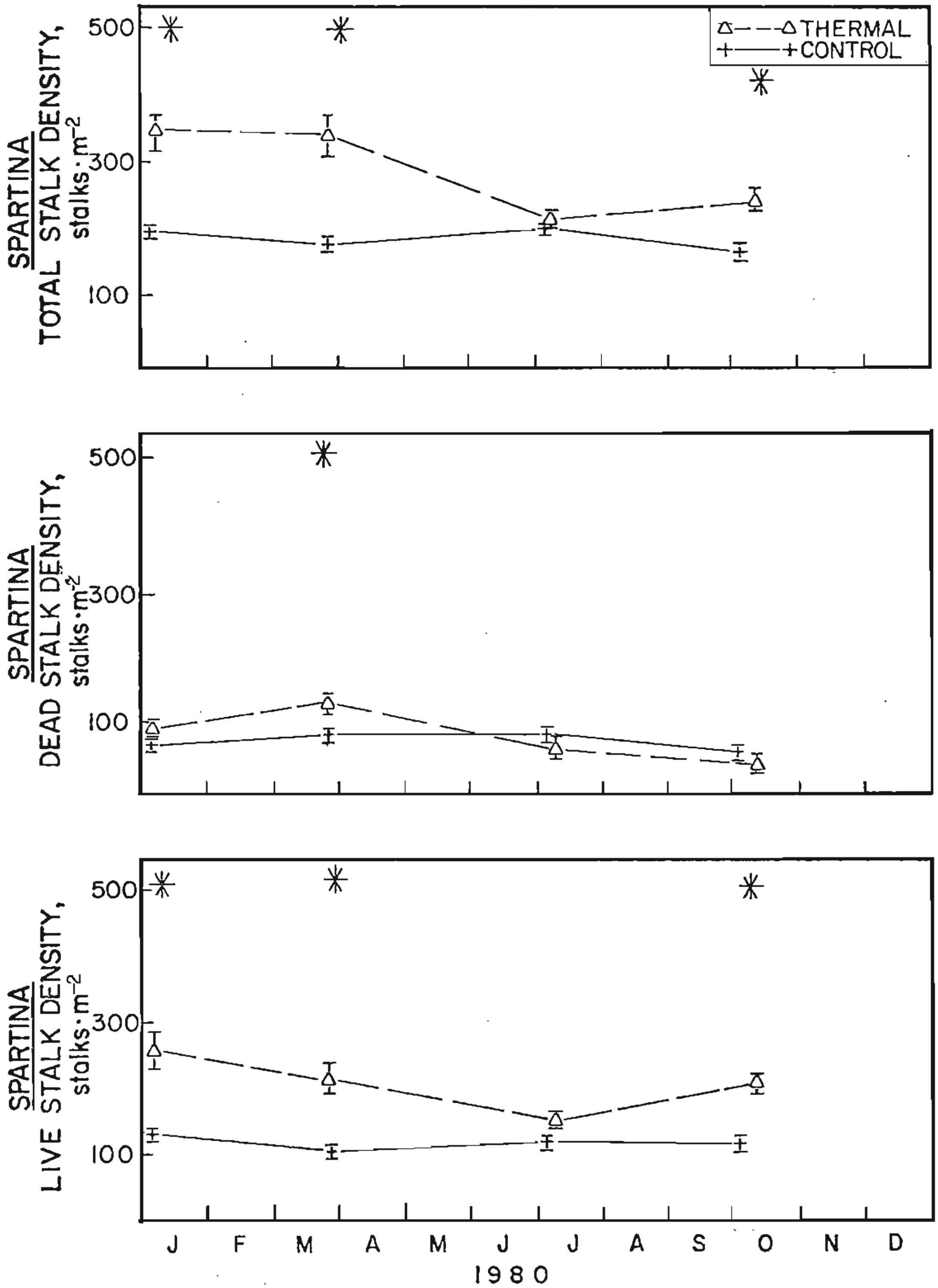


Figure II-61. Seasonal means of Spartina stalk densities for 1980. Bars represent ± one standard error. Asterisks indicate a significant difference between the means at a 95% confidence level. Seasonal harvests had a sample size of nine.

with the only significant difference occurring in the spring. Spartina total stalk density was greater in the thermal marshes throughout the year and was significantly different in all seasons except summer.

Spartina standing crop weights (aboveground biomass) are presented in Table II-35 and Fig. II-62. There was no significant difference for live Spartina weights during any season in 1980. Trends of live weight reached a minimum in the spring and then increased to a maximum in the fall. The dead Spartina weights for 1980 were nearly constant through the year. The control marshes had a significantly higher mean occurring in the winter. The total live weight of Spartina increased throughout the year in both marshes. The control marsh had a slightly higher mean during all sampling seasons with the winter season being significantly different.

Seasonal means of Spartina specific weights are shown in Table II-36 and Fig. II-63. Specific weight was significantly higher in the control marsh for all four seasons in 1980. The control marsh reached a maximum during the fall while the thermal marsh reached its maximum in the summer.

Seasonal means of Spartina stalk heights are given in Table II-37 and Fig. II-64. Mean values of Spartina stalk height were significantly greater (approximately 15 cm) in the control marsh during each season of 1980. The trend of the stalk heights was to increase in the winter and spring and then level off during the summer and fall.

The mean value of Littorina in the thermal Spartina marsh were significantly greater during the first three seasons of 1980 (Table II-38 and Fig. II-65). The differences in the two marshes varied widely but followed similar patterns, reaching minimum values in the summer and maximum values in the fall. These patterns were repeated for the Spartina

Table II-35. Seasonal means (± one standard error) of *Spartina* aboveground biomass (after drying at 70°C) for 1980.

Season	Date	Treatment	Live Biomass $g \cdot m^{-2}$	Dead Biomass $g \cdot m^{-2}$	Total Biomass $g \cdot m^{-2}$
Winter	1/06/80	Thermal	485.2 ± 48.5	178.3 ± 24.9*	663.5 ± 43.3*
	1/04/80	Control	475.9 ± 63.3	376.6 ± 88.6	852.5 ± 71.4
Spring	3/26/80	Thermal	411.6 ± 38.5	322.8 ± 30.0	734.4 ± 44.1
	3/28/80	Control	399.5 ± 60.9	400.4 ± 64.4	799.9 ± 73.9
Summer	7/11/80	Thermal	753.9 ± 57.1	322.5 ± 34.0	1076 ± 71.8
	7/04/80	Control	868.0 ± 90.3	347.3 ± 47.2	1215 ± 89.6
Fall	10/11/80	Thermal	970.2 ± 65.8	289.8 ± 42.1	1260 ± 64.7
	10/05/80	Control	1063 ± 118	409.8 ± 39.7	1472 ± 123

*Indicates a significant difference at a 95% confidence level was recorded when compared to the 1980 discharge mean.

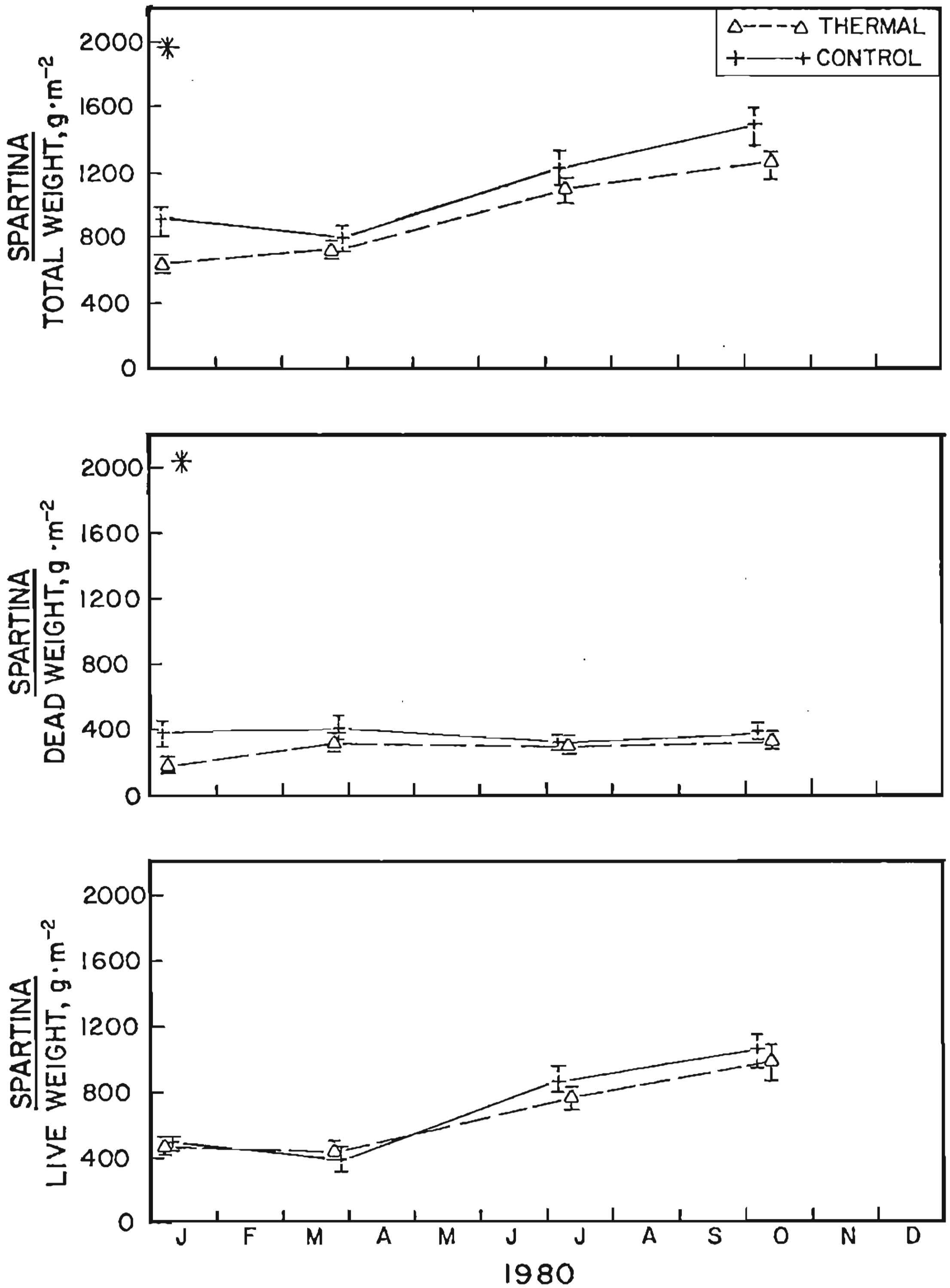


Figure II-62. Seasonal means of Spartina aboveground biomass weight per square meter (after drying at 70°C) for 1980. Bars represent ± one standard error. Asterisks indicate a significant difference between the means at a 95% confidence level. Seasonal harvests had a sample size of nine.

Table II-36. Seasonal means (± one standard error) of specific weight of *Spartina* for 1980.

Season	Date	Treatment	$g \cdot stalk^{-1}$
Winter	1/06/80	Thermal	1.9 ± 0.06*
	1/04/80	Control	3.4 ± 0.21
Spring	3/26/80	Thermal	2.0 ± 0.23*
	3/28/80	Control	3.9 ± 0.32
Summer	7/11/80	Thermal	5.0 ± 0.38*
	7/04/80	Control	7.6 ± 1.0
Fall	10/11/80	Thermal	4.7 ± 0.37*
	10/05/80	Control	9.5 ± 0.89

*Indicates a significant difference at a 95% confidence level was recorded when compared to the 1980 discharge mean.

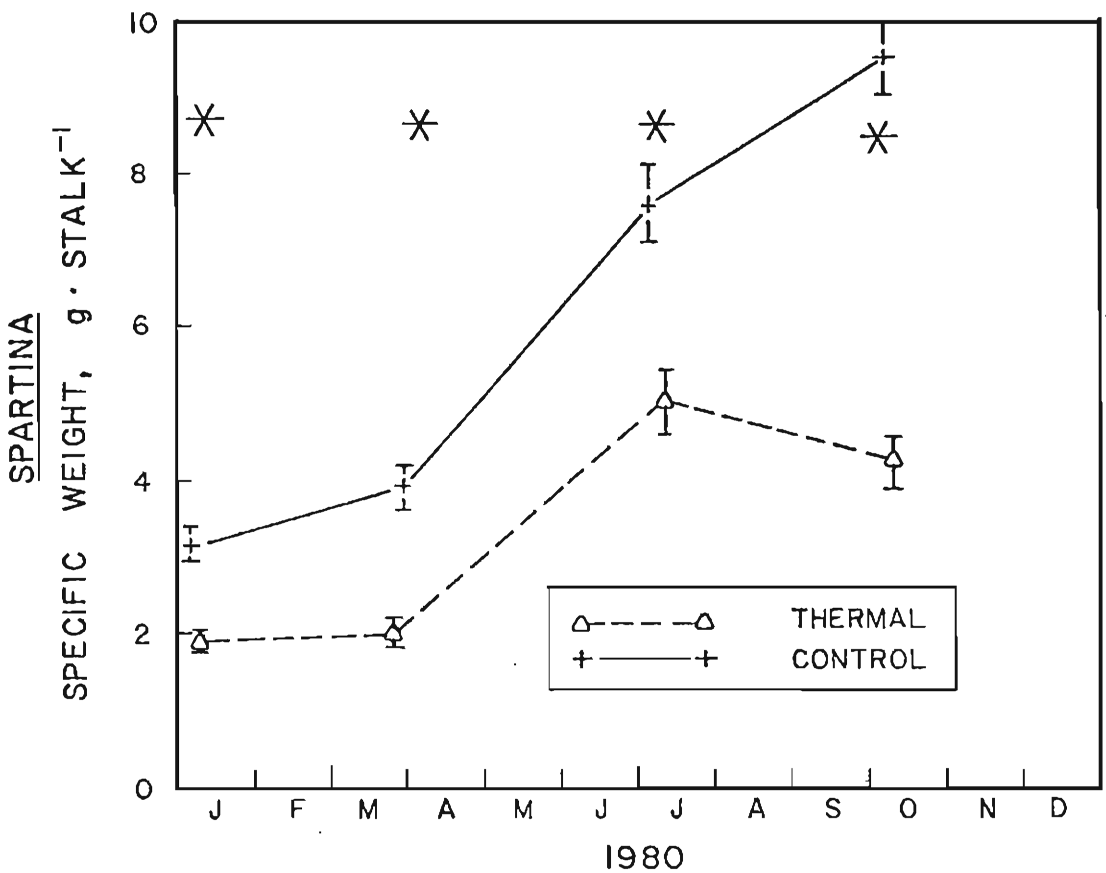


Figure II-63. Seasonal means of Spartina specific weight (weight per stalk) for 1980. Bars represent ± one standard error. Asterisks indicate a significant difference between the means at a 95% confidence level. Seasonal harvests had a sample size of nine.

Table II-37. Seasonal means (± one standard error) of *Spartina* stalk height for 1980.

Season	Date	Treatment	Stalk Heights, cm
Winter	1/06/80	Thermal	42.64 ± 1.13*
	1/04/80	Control	55.72 ± 2.04
Spring	3/26/80	Thermal	46.23 ± 0.86*
	3/28/80	Control	61.90 ± 1.64
Summer	7/11/80	Thermal	62.78 ± 1.50*
	7/04/80	Control	70.68 ± 2.20
Fall	10/11/80	Thermal	59.06 ± 1.63*
	10/05/80	Control	77.14 ± 2.38

*Indicates a significant difference at a 95% confidence level was recorded when compared to the 1980 discharge mean.

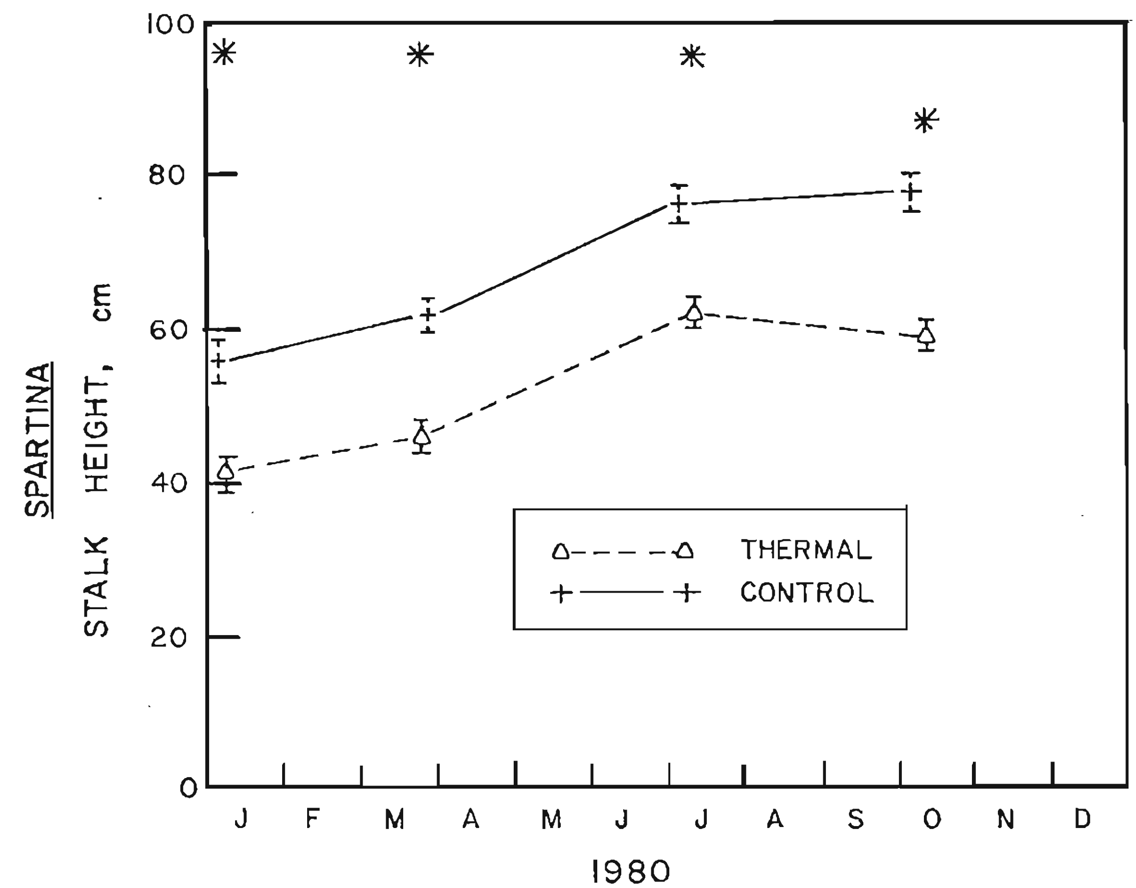


Figure II-64. Seasonal means of Spartina stalk height for 1980. Bars represent ± one standard error. Asterisks indicate a significant difference between the means at a 95% confidence level. Seasonal harvests had a sample size of nine.

Table II-38. Seasonal means (± one standard error) of *Littorina* and *Uca* burrow density in *Spartina* marshes for 1980.

Season	Date	Treatment	*Littorina*·m^{-2}	*Uca* Burrows·m^{-2}
Winter	1/06/80	Thermal	20.9 ± 2.56*	116.4 ± 26.42
	1/04/80	Control	1.78 ± 1.35	132.4 ± 26.18
Spring	3/26/80	Thermal	15.6 ± 4.69*	234.2 ± 20.99*
	3/28/80	Control	3.11 ± 1.30	152.0 ± 19.83
Summer	7/11/80	Thermal	10.0 ± 2.40*	148.0 ± 20.02
	7/04/80	Control	1.78 ± 0.97	152.0 ± 18.15
Fall	10/11/80	Thermal	24.0 ± 4.32	156.4 ± 23.76
	10/05/80	Control	12.9 ± 4.84	197.3 ± 14.77

*Indicates a significant difference at a 95% confidence level was recorded when compared to the 1980 discharge mean.

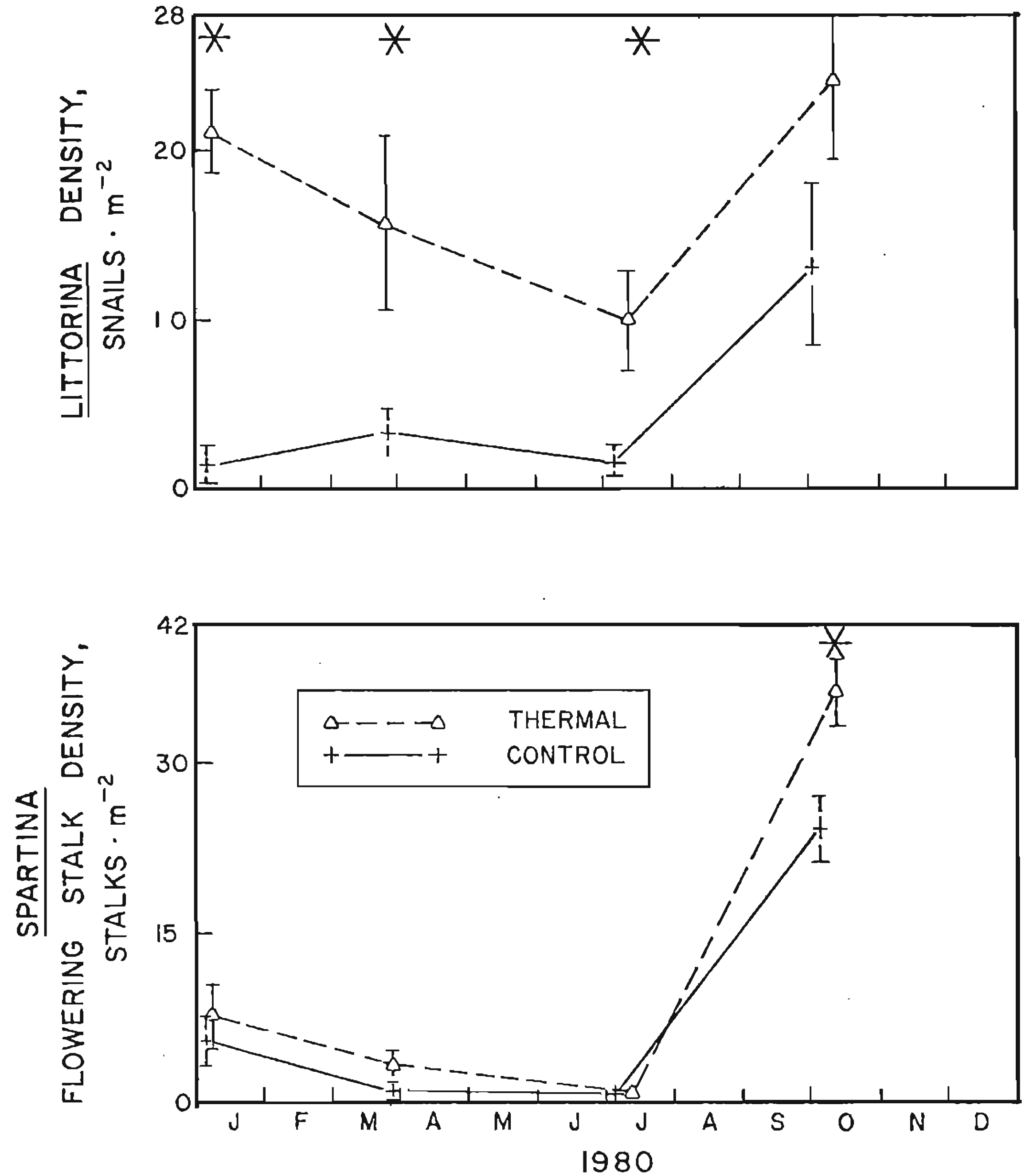


Figure II-65. Seasonal means of Spartina flowers and Littorina per square meter for 1980. Bars represent ± one standard error. Asterisks indicate a significant difference between the means at a 95% confidence level. Seasonal harvests had a sample size of nine.

flowering stalks presented in Table II-39 and Fig. II-65. The only difference was that the significant difference occurred in the winter. The *Spartina* flowers recorded in the winter and spring were reported as drying and decaying flowers from the previous year.

Uca burrow densities are presented in Table II-38 and Fig. II-66. Trends for mean values of *Uca* burrows per square meter were similar in both marshes. Significantly greater numbers were reported in the thermal marsh during the spring.

Spartina Metabolism Results

Productivity results from the CO_2 chambers are presented in Table II-40 and Figs. II-67 and II-68. Mean *Spartina* net productivity for the thermal marsh reached a maximum value in the summer and steadily decreased through the rest of the year. The control followed a similar pattern with peak productivity in the summer. Significant differences were recorded during the first three quarters of the year. Net productivity followed the same pattern as gross productivity with significant differences recorded in the winter and spring. *Spartina* nighttime respiration values remained relatively constant in both marshes with the thermal values slightly higher all year. Significant differences were recorded during the spring and summer. During the spring, values for all three parameters were significantly higher in the thermal marsh than in the control area. This observation is identical with that of the 1978 and 1979 data.

Seasonal means of *Spartina* P/R ratios are presented in Table II-41 and Fig. II-69. Control marsh P/R was higher throughout the year except during the spring when the thermal marsh value was significantly higher.

Table II-39. Seasonal means (± one standard error) of flowering *Spartina* stalks for 1980.

Season	Date	Treatment	Flowering *Spartina* Stalks·m^{-2}
Winter	1/06/80	Thermal	7.56 ± 3.09
	1/04/80	Control	5.33 ± 2.40
Spring	3/26/80	Thermal	3.11 ± 1.74
	3/28/80	Control	1.33 ± 0.94
Summer	7/11/80	Thermal	0.0 ± 0.0
	7/04/80	Control	0.0 ± 0.0
Fall	10/11/80	Thermal	36.0 ± 2.91*
	10/05/80	Control	24.4 ± 3.01

*Indicates a significant difference at a 95% confidence level was recorded when compared to the 1980 discharge mean.

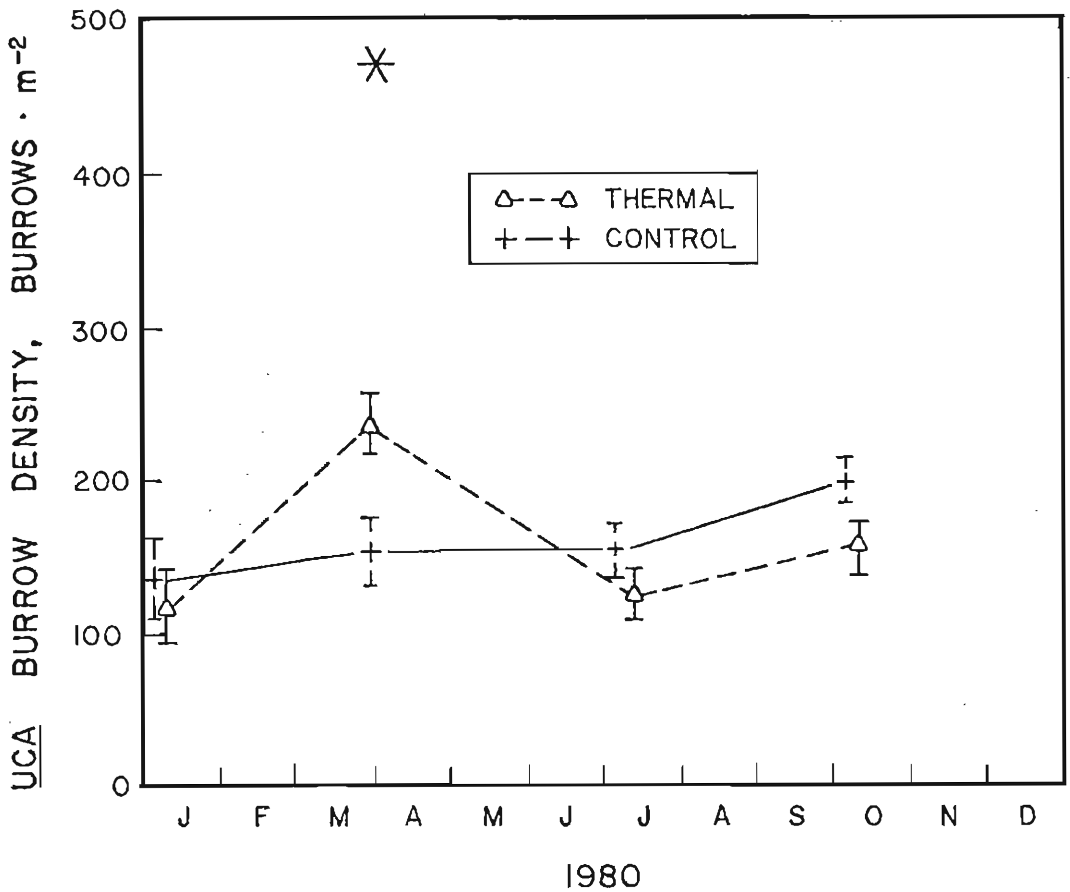


Figure II-66. Seasonal means of *Uca* burrows per square meter in *Spartina* marshes for 1980. Bars represent ± one standard error. Asterisks indicate a significant difference between the means at a 95% confidence level. Seasonal harvests had a sample size of nine.

Table II-40. Seasonal means (± one standard error) of *Spartina* metabolism for 1980, normalized for weight.

Season	Date	Treatment	Insolation, $kcal \cdot m^{-2} \cdot d^{-1}$	Weight Correction Factor	Net Production, $g\ C \cdot m^{-2} \cdot d^{-1}$	Nighttime Respiration, $g\ C \cdot m^{-2} \cdot d^{-1}$	Gross Productivity, $g\ C \cdot m^{-2} \cdot d^{-1}$
Winter	1/05/80	Thermal	2116	1.738	- 0.643	2.173	1.529
	1/05/80	Thermal	2116	1.216	- 0.314	1.289	0.975
	1/06/80	Thermal	2275	1.234	- 0.387	1.033	0.645
	1/06/80	Thermal	2275	1.325	- 0.231	0.767	0.537
					- 0.394 ± 0.08*	1.316 ± 0.26	0.922 ± 0.19*
	1/03/80	Control	2315	1.992	1.811	1.460	3.271
	1/03/80	Control	2315	1.688	1.723	0.905	2.628
	1/04/80	Control	No data	0.643	0.031	0.944	0.978
	1/04/80	Control	No data	1.550	0.042	2.012	2.829
					0.902 ± 0.43	1.330 ± 0.23	2.427 ± 0.43
Spring	3/26/80	Thermal	3014	0.880	2.963	1.456	4.418
	3/26/80	Thermal	3014	0.904	3.612	2.054	5.666
	3/27/80	Thermal	2351	1.073	3.664	2.487	6.152
	3/27/80	Thermal	2351	1.387	3.791	3.253	7.043
					3.508 ± 0.16*	2.313 ± 0.21	5.820 ± 0.47*
	3/28/80	Control	3098	0.557	1.371	1.382	2.753
	3/28/80	Control	3098	0.935	1.012	1.651	2.663
					1.192 ± 0.13	1.517 ± 0.10	2.708 ± 0.03
Summer	7/11/80	Thermal	2867	1.040	2.476	2.225	4.701
	7/11/80	Thermal	2867	1.401	2.724	1.947	4.671
					2.600 ± 0.09*	2.086 ± 0.10*	4.686 ± 0.01

Table II-40 (Cont'd).

Season	Date	Treatment	Insolation, kcal·m^{-2}·d^{-1}	Weight Correction Factor	Net Production, g C·m^{-2}·d^{-1}	Nighttime Respiration, g C·m^{-2}·d^{-1}	Gross Productivity, g C·m^{-2}·d^{-1}
Summer	7/04/80	Control	3657	0.899	2.986	1.848	4.834
	7/04/80	Control	3657	0.707	5.068	1.369	6.437
	7/05/80	Control	3725	0.839	4.261	1.333	5.594
	7/05/80	Control	3725	0.753	3.872	1.404	5.276
					4.047 ± 0.28	1.489 ± 0.10	5.535 ± 0.29
Fall	10/11/80	Thermal	2621	1.340	1.931	1.761	3.692
	10/11/80	Thermal	2621	1.256	0.973	1.383	2.356
	10/12/80	Thermal	3009	0.908	2.803	2.068	4.871
	10/12/80	Thermal	3009	0.926	3.419	1.852	5.271
					2.282 ± 0.92	1.766 ± 0.25	4.048 ± 1.14
	10/05/80	Control	2003	0.545	2.381	8.893	3.274
	10/05/80	Control	2003	1.241	3.601	1.807	5.408
	10/06/80	Control	2951	1.000	5.975	1.840	7.815
	10/06/80	Control	2951	1.000	2.787	1.816	4.603
					3.686 ± 1.39	1.589 ± 0.40	5.275 ± 1.65

*Indicates a significant difference between the means at a 95% confidence level.

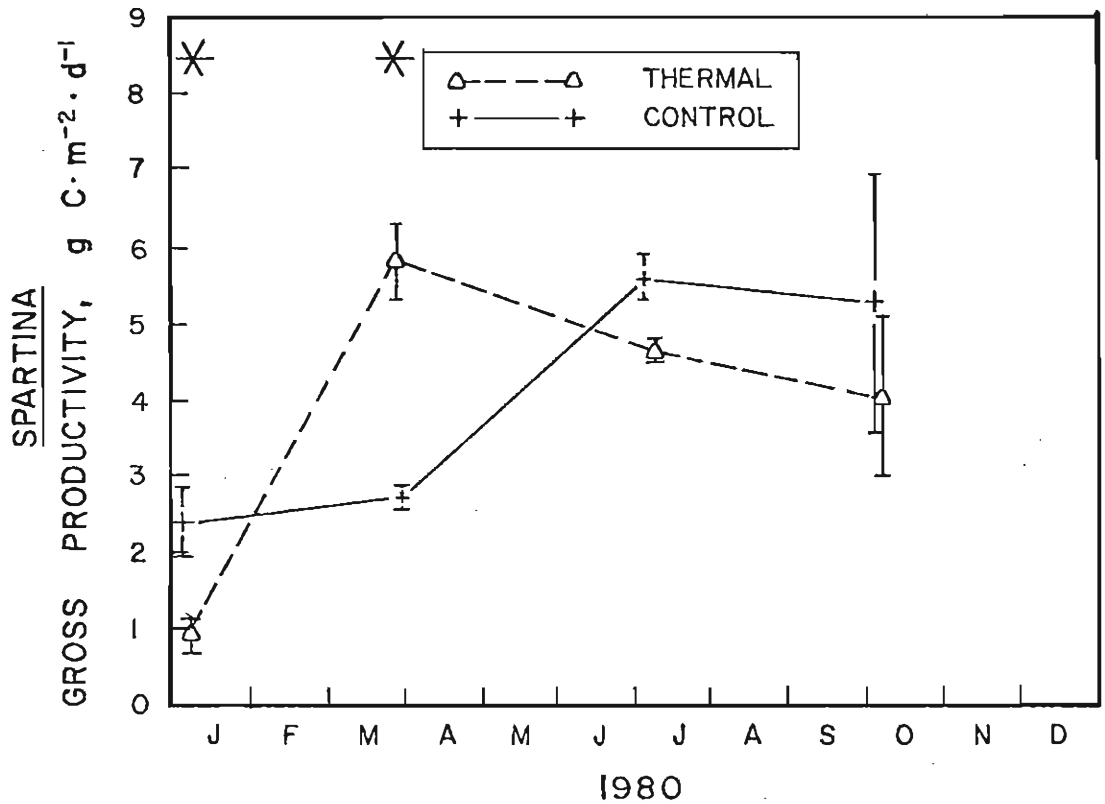


Figure II-67. Seasonal means for Spartina gross productivity for 1980. Bars represent ± one standard error. Asterisks indicate a significant difference between the means at a 95% confidence level. Seasonal harvests had a sample size of three.

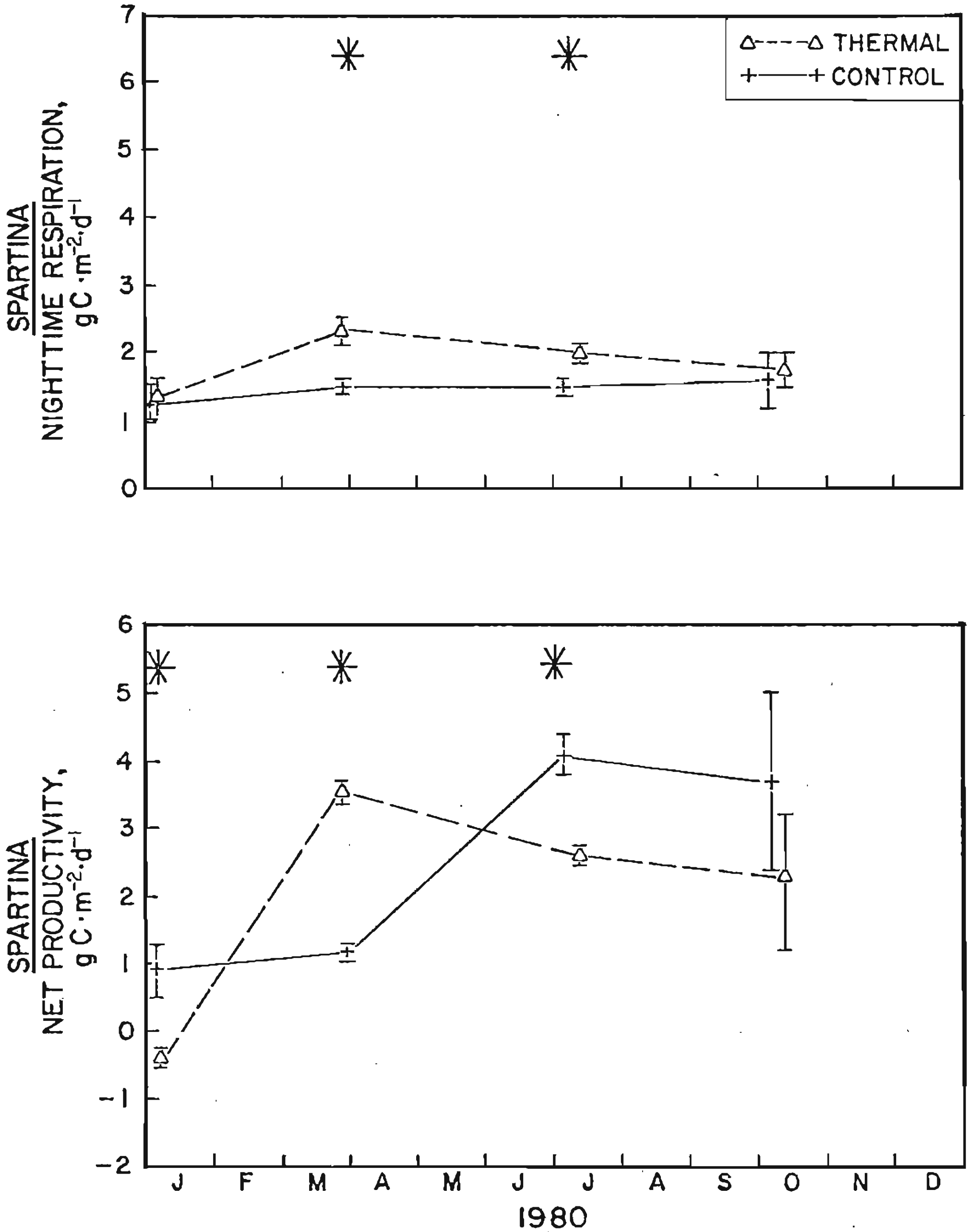


Figure II-68. Seasonal means for Spartina net productivity and nighttime respiration for 1980. Bars represent ± one standard error. Asterisks indicate a significant difference between the means at a 95% confidence level. Seasonal harvests had a sample size of three.

Table II-41. Seasonal means (± one standard error) of *Spartina* P/R ratios for 1980.

Season	Date	Treatment	P/R Ratio
Winter	1/06/80	Thermal	0.406 ± 0.03
	1/04/80	Control	1.117 ± 0.43
Spring	3/26/80	Thermal	1.304 ± 0.16*
	3/28/80	Control	0.901 ± 0.10
Summer	7/11/80	Thermal	0.940 ± 0.06
	7/04/80	Control	1.591 ± 0.32
Fall	10/11/80	Thermal	1.125 ± 0.21
	10/05/80	Control	1.680 ± 0.33

*Indicates a significant difference between the means at a 95% confidence level.

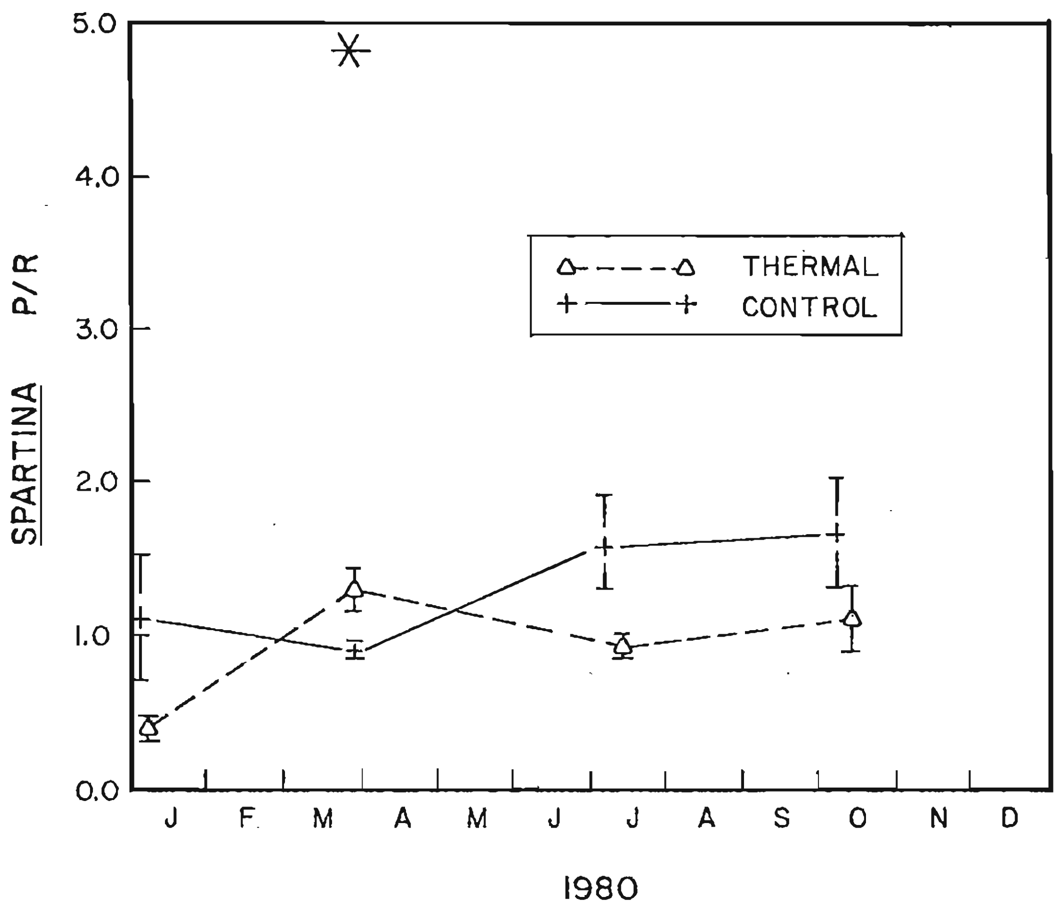


Figure II-69. Seasonal means for Spartina P/R ratios for 1980. Bars represent ± one standard error. Asterisks indicate a significant difference between the means at a 95% confidence level. Seasonal harvests had a sample size of three.

Biological Structure of *Juncus* Marshes

Mean values of *Juncus* shoot densities are given in Table II-42 and Fig. II-70. As in the *Spartina* marsh, mean values for *Juncus* live shoot densities were greater in the thermally affected marsh than in the control marsh. Significant differences were recorded during the winter quarter. The dead shoot densities for both marshes remained relatively constant with the thermal marsh value significantly higher for the first three seasons of the year. Mean total shoot densities were greater in the thermally affected marsh for every season of 1980 with significant differences reported during the winter and summer.

As shown in Table II-43 and Fig. II-71, mean values of *Juncus* live biomass weights were nearly constant throughout the year. The dead and total *Juncus* weights also remained nearly constant throughout the year. Higher weights in the thermal marsh were reported in the spring and summer for dead *Juncus* and summer for the total *Juncus* weights.

Mean specific weights for *Juncus* were significantly higher in the control marsh during the winter and fall while the thermal marsh values had slightly higher means during the remaining seasons (Table II-44 and Fig. II-72).

Seasonal means of *Juncus* shoot heights were significantly higher in the control marsh compared to the thermal marsh during spring, summer, and fall (Table II-45 and Fig. II-73). Minimum values occurred for both marshes in the spring and maximum values in the fall. Flowering *Juncus* shoots were observed during the spring in both marshes with a mean value of about 1 flower$\cdot m^{-2}$ (Table II-46 and Fig. II-74).

As shown in Table II-47 and Fig. II-74, *Littorina* density in the thermal marsh fluctuated seasonally while the control marsh density

Table II-42. Seasonal means (± one standard error) of *Juncus* shoot densities for 1980.

Season	Date	Treatment	Live Shoots·m^{-2}	Dead Shoots·m^{-2}	Total Shoots·m^{-2}
Winter	1/06/80	Thermal	769.6 ± 90.1*	580.0 ± 51.6*	1350 ± 123*
	1/04/80	Control	495.2 ± 42.7	304.0 ± 57.7	799.2 ± 85.5
Spring	3/26/80	Thermal	765.6 ± 151	624.0 ± 70.1*	1390 ± 176
	3/28/80	Control	688.0 ± 101	270.4 ± 49.6	958.4 ± 125
Summer	7/11/80	Thermal	560.6 ± 49.5	587.4 ± 26.1*	1148 ± 28.7*
	7/04/80	Control	508.8 ± 45.1	272.0 ± 39.9	780.8 ± 72.5
Fall	10/11/80	Thermal	585.6 ± 35.3	530.4 ± 67.9	1116 ± 93.2
	10/05/80	Control	625.6 ± 79.3	487.2 ± 66.9	1113 ± 137

*Indicates a significant difference at a 95% confidence level was recorded when compared to the 1980 discharge mean.

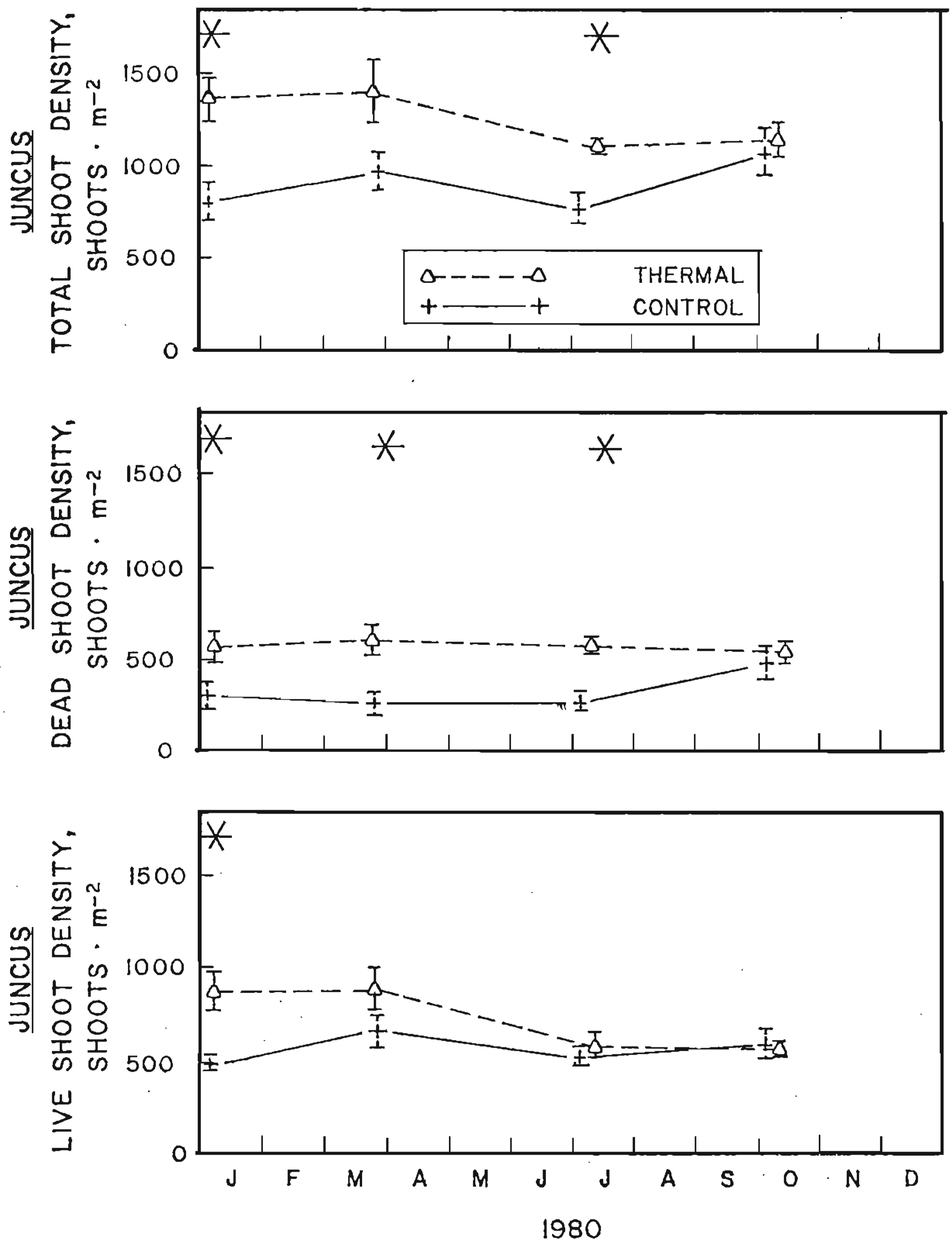


Figure II-70. Seasonal means for Juncus shoot densities for 1980. Bars represent ± one standard error. Asterisks indicate a significant difference between the means at a 95% confidence level. Seasonal harvests had a sample size of five.

Table II-43. Seasonal means (± one standard error) of *Juncus* aboveground biomass (after drying at 70°C) for 1980.

Season	Date	Treatment	Live Biomass $g \cdot m^{-2}$	Dead Biomass $g \cdot m^{-2}$	Total Biomass $g \cdot m^{-2}$
Winter	1/06/80	Thermal	1281.9 ± 178.3	1291.4 ± 165.0	2573.3 ± 331.6
	1/04/80	Control	1069.0 ± 92.4	1212.8 ± 134.6	2281.8 ± 217.1
Spring	3/26/80	Thermal	1099.0 ± 135.2	1432.8 ± 157.5*	2531.8 ± 271.1
	3/28/80	Control	945.6 ± 215.7	758.5 ± 117.7	1704.1 ± 327.7
Summer	7/11/80	Thermal	1164.0 ± 152.7	1519.0 ± 82.2*	2683.0 ± 230.5*
	7/04/80	Control	1022.0 ± 69.9	808.0 ± 115.3	1831.0 ± 174.0
Fall	10/11/80	Thermal	1130.0 ± 140.4	1094.0 ± 170.3	2224.0 ± 280.9
	10/05/80	Control	1569.0 ± 207.6	1369.0 ± 229.3	2938.0 ± 414.9

*Indicates a significant difference at a 95% confidence level was recorded when compared to the 1980 discharge mean.

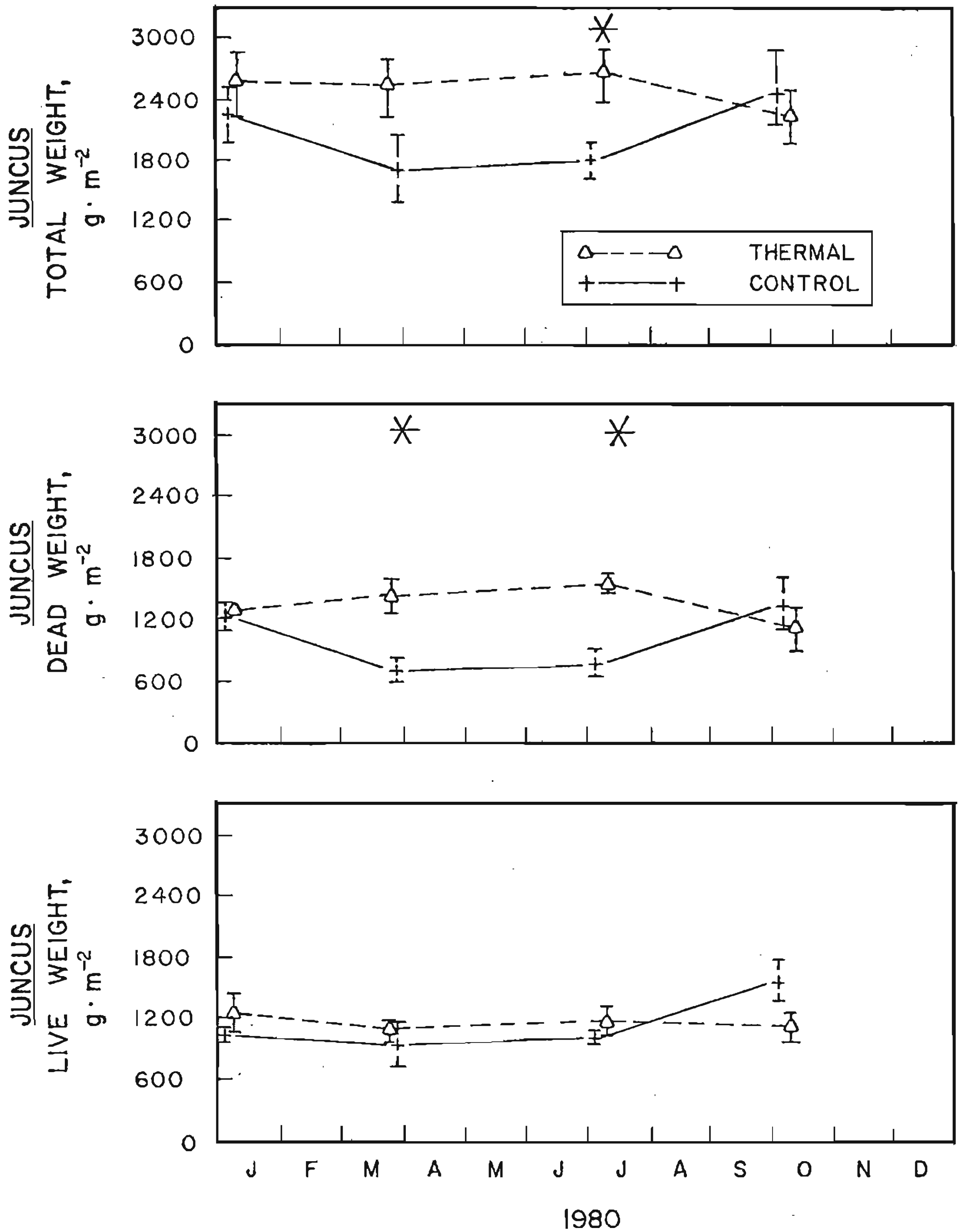


Figure II-71. Seasonal means for Juncus aboveground biomass weight per square meter (after drying at 70°C) for 1980. Bars represent ± one standard error. Asterisks indicate a significant difference between the means at a 95% confidence level. Seasonal harvests had a sample size of five.

Table II-44. Seasonal means (± one standard error) of specific weights of *Juncus* for 1980.

Season	Date	Treatment	$g \cdot stalk^{-1}$
Winter	1/06/80	Thermal	1.7 ± 0.08*
	1/04/80	Control	2.2 ± 0.11
Spring	3/26/80	Thermal	1.9 ± 0.68
	3/28/80	Control	1.4 ± 0.27
Summer	7/11/80	Thermal	2.2 ± 0.41
	7/04/80	Control	2.0 ± 0.08
Fall	10/11/80	Thermal	1.9 ± 0.17*
	10/05/80	Control	2.5 ± 0.03

*Indicates a significant difference at a 95% confidence level was recorded when compared to the 1980 discharge mean.

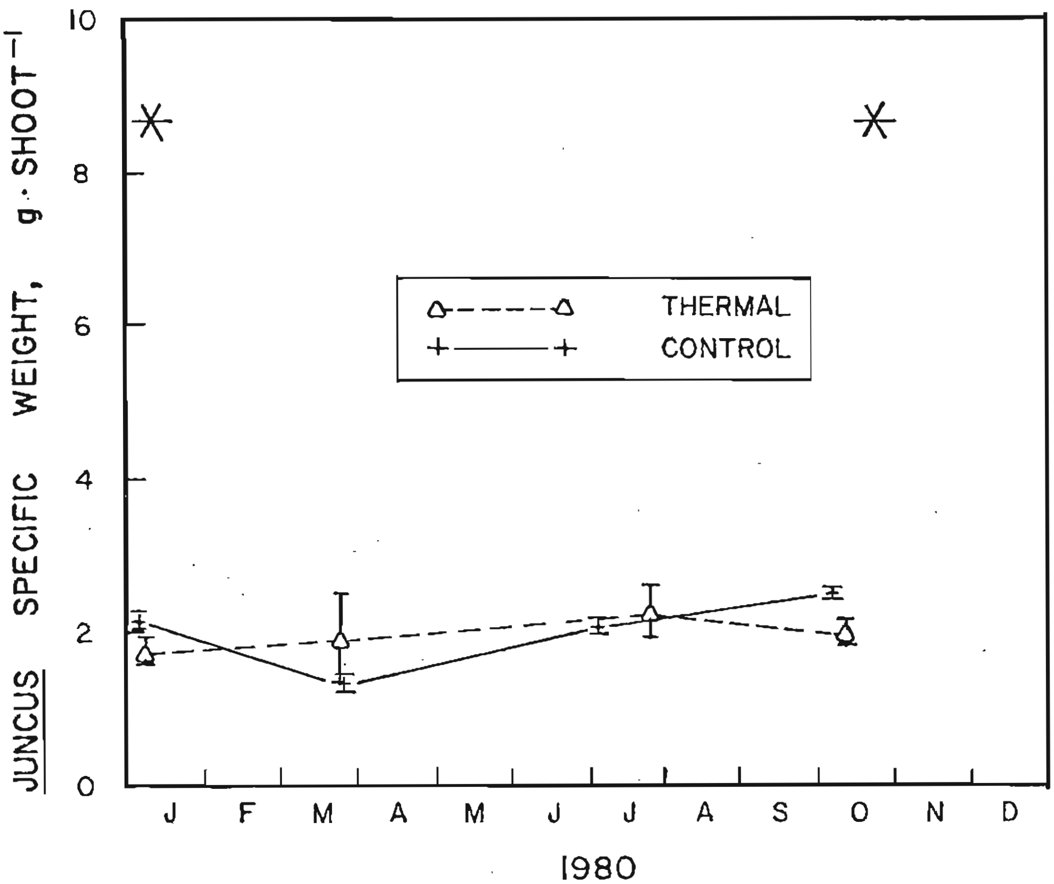


Figure II-72. Seasonal means for Juncus specific weight (weight per shoot) for 1980. Bars represent ± one standard error. Asterisks indicate a significant difference between the means at a 95% confidence level. Seasonal harvests had a sample size of five.

Table II-45. Seasonal means (± one standard error) of *Juncus* shoot heights for 1980.

Season	Date	Treatment	Shoot Heights, cm
Winter	1/06/80	Thermal	94.90 ± 1.55
	1/04/80	Control	97.69 ± 1.91
Spring	3/26/80	Thermal	78.77 ± 1.25*
	3/28/80	Control	84.27 ± 1.74
Summer	7/11/80	Thermal	94.64 ± 1.32*
	7/04/80	Control	103.3 ± 1.61
Fall	10/11/80	Thermal	98.72 ± 1.52*
	10/05/80	Control	116.2 ± 1.73

*Indicates a significant difference at a 95% confidence level was recorded when compared to the 1980 discharge mean.

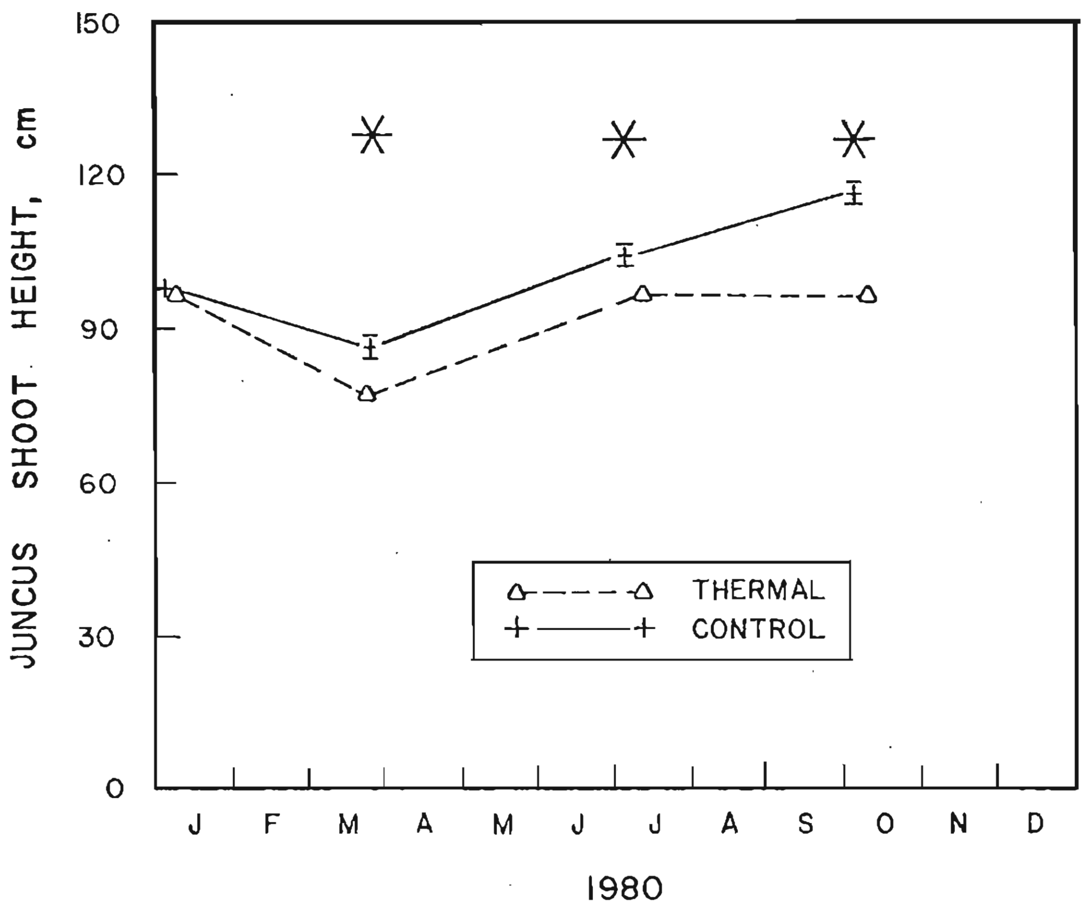


Figure II-73. Seasonal means of Juncus shoot heights for 1980. Bars represent ± one standard error. Asterisks indicate a significant difference between the means at a 95% confidence level. Seasonal harvests had a sample size of five.

Table II-46. Seasonal means (± one standard error) of flowering *Juncus* plants for 1980.

Season	Date	Treatment	Flowering *Juncus* Plants$\cdot m^{-2}$
Winter	1/06/80	Thermal	0.0 ± 0.0
	1/04/80	Control	0.0 ± 0.0
Spring	3/26/80	Thermal	0.8 ± 0.8
	3/28/80	Control	1.6 ± 1.0
Summer	7/11/80	Thermal	0.0 ± 0.0
	7/04/80	Control	0.0 ± 0.0
Fall	10/11/80	Thermal	0.0 ± 0.0
	10/05/80	Control	0.0 ± 0.0

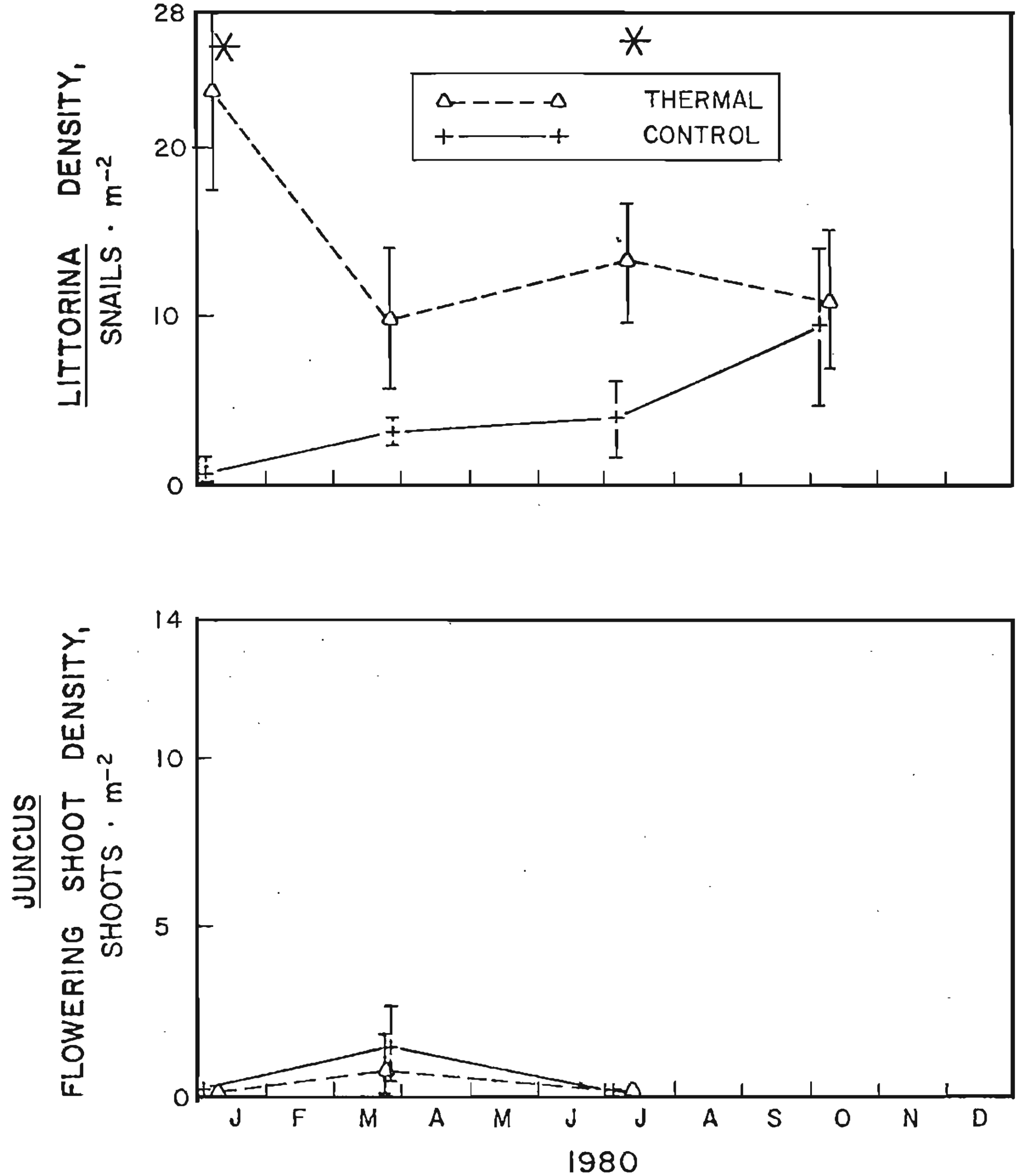


Figure II-74. Seasonal means of Juncus flowers and Littorina per square meter for 1980. Bars represent ± one standard error. Asterisks indicate a significant difference between the means at a 95% confidence level. Seasonal harvests had a sample size of five.

Table II-47. Seasonal means (± one standard error) of *Littorina* and *Uca* burrow density in *Juncus* marshes for 1980.

Season	Date	Treatment	*Littorina*·m^{-2}	*Uca* Burrows·m^{-2}
Winter	1/06/80	Thermal	23 ± 7.9*	191.2 ± 28.4*
	1/04/80	Control	0.8 ± 0.8	88.0 ± 18.6
Spring	3/26/80	Thermal	9.6 ± 4.5	232.8 ± 21.4
	3/28/80	Control	3.2 ± 0.8	222.4 ± 10.2
Summer	7/11/80	Thermal	13 ± 2.1*	449.7 ± 65.6*
	7/04/80	Control	4.0 ± 2.2	252.0 ± 46.7
Fall	10/11/80	Thermal	8.8 ± 2.7	182.4 ± 53.6
	10/05/80	Control	7.6 ± 5.0	137.6 ± 19.1

*Indicates a significant difference at a 95% confidence level was recorded when compared to the 1980 discharge mean.

gradually increased. Littorina densities in the thermal marsh were significantly higher during the winter and summer seasons.

Mean values of Uca burrow densities are shown in Table II-47 and Fig. II-75. Both thermal and control marshes had their greatest numbers of Uca burrows during the summer. The thermal marsh densities were consistently higher throughout the year and significantly higher during the winter and summer seasons.

Juncus Metabolism Results

Results of the Juncus metabolism analysis are presented in Table II-48 and Figs. II-76 and II-77. Mean values of net productivity in the control marsh were higher than those of the discharge marsh during the three warmer seasons of the year. Nighttime respiration values remained fairly uniform with minimum values during the winter. Gross productivity values fluctuated seasonally in both marshes, with highest values recorded during the fall in the control marsh and during the spring in the discharge marsh. There were no significant differences reported between the discharge and intake means for the three metabolism parameters during 1980.

Mean values of Juncus P/R ratios are presented in Table II-49 and Fig. II-78. The mean values were greater than unity throughout the year, with the control marsh having a slightly higher mean for the latter three seasons of 1980. Significant differences were recorded during the winter and summer.

Comparisons of 1980 Data with Previous Years

A major energy inflow to the discharge marshes is the thermal effluent. The observed seasonal means of the intake and discharge water

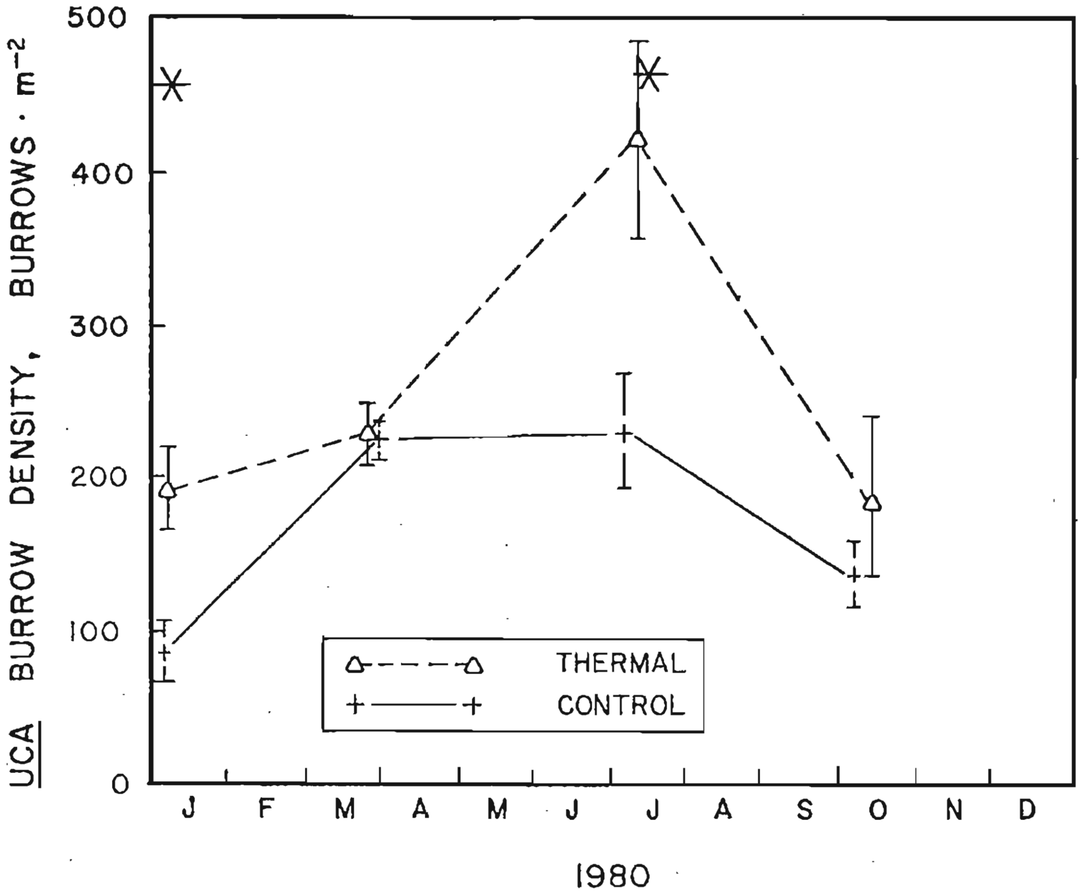


Figure II-75. Seasonal means of Uca burrows per square meter in Juncus marshes for 1980. Bars represent ± one standard error. Asterisks indicate a significant difference between the means at a 95% confidence level. Seasonal harvests had a sample size of five.

Table II-48. Seasonal means (± one standard error) for *Juncus* metabolism values for 1980, normalized for weight.

Season	Date	Treatment	Insolation, $kcal \cdot m^{-2} \cdot d^{-1}$	Weight Correction Factor	Net Production, $g\ C \cdot m^{-2} \cdot d^{-1}$	Nighttime Respiration, $g\ C \cdot m^{-2} \cdot d^{-1}$	Gross Productivity, $g\ C \cdot m^{-2} \cdot d^{-1}$
Winter	1/05/80	Thermal	2116	0.828	6.135	0.917	7.053
	1/05/80	Thermal	2116	0.968	6.040	1.375	7.415
	1/06/80	Thermal	2275	0.723	4.517	1.102	5.619
	1/06/80	Thermal	2275	1.505	7.027	1.451	8.478
					5.930 ± 0.90	1.211 ± 0.21	7.141 ± 1.02
	1/03/80	Control	2315	0.868	3.197	1.394	4.591
	1/03/80	Control	2315	1.279	6.027	2.023	8.050
	1/04/80	Control	No data	0.968	1.019	1.652	2.672
	1/04/80	Control	No data	1.220	1.031	1.967	2.998
					2.819 ± 2.05	1.759 ± 0.25	4.578 ± 2.13
Spring	3/26/80	Thermal	3014	1.501	5.210	3.395	8.605
	3/26/80	Thermal	3014	1.065	5.860	2.309	8.062
	3/27/80	Thermal	2351	1.290	7.171	4.630	11.801
	3/27/80	Thermal	2351	0.749	5.012	2.170	7.182
					5.813 ± 0.84	3.126 ± 0.99	8.913 ± 1.74
	3/28/80	Control	3098	0.906	7.147	2.566	9.712
	3/28/80	Control	3098	0.571	6.055	1.900	7.956
					6.601 ± 0.55	2.233 ± 0.33	8.834 ± 0.88
Summer	7/11/80	Thermal	2867	0.836	3.005	2.498	5.503
	7/11/80	Thermal	2867	0.744	3.890	1.986	5.875
	7/12/80	Thermal	2418	1.271	3.871	3.355	7.227
					3.589 ± 0.41	2.613 ± 0.57	6.202 ± 0.74

Table II-48 (Cont'd).

Season	Date	Treatment	Insolation, kcal $\cdot m^{-2} \cdot d^{-1}$	Weight Correction Factor	Net Production, g $C \cdot m^{-2} \cdot d^{-1}$	Nighttime Respiration, g $C \cdot m^{-2} \cdot d^{-1}$	Gross Productivity, g $C \cdot m^{-2} \cdot d^{-1}$
Summer	7/04/80	Control	3657	1.014	4.668	1.749	6.418
	7/04/80	Control	3657	1.211	6.340	2.705	9.045
	7/05/80	Control	3725	0.809	5.440	1.540	7.032
	7/05/80	Control	3725	0.971	6.970	2.441	9.411
					5.855 ± 0.88	2.109 ± 0.48	7.977 ± 1.28
Fall	10/11/80	Thermal	2621	1.261	5.517	3.004	8.521
	10/11/80	Thermal	2621	0.759	3.220	1.548	4.768
	10/12/80	Thermal	3009	1.503	5.092	3.011	8.103
	10/12/80	Thermal	3009	0.812	0.362	2.416	2.779
					3.548 ± 2.03	2.495 ± 0.60	6.043 ± 2.38
	10/05/80	Control	2003	1.526	14.376	3.936	18.312
	10/05/80	Control	2003	0.945	4.337	1.952	6.289
	10/06/80	Control	2951	1.000	10.468	2.382	12.850
	10/06/80	Control	2951	1.000	8.487	3.083	11.570
					9.417 ± 3.62	2.838 ± 0.75	12.255 ± 4.28

*Indicates a significant difference between the means at a 95% confidence level.

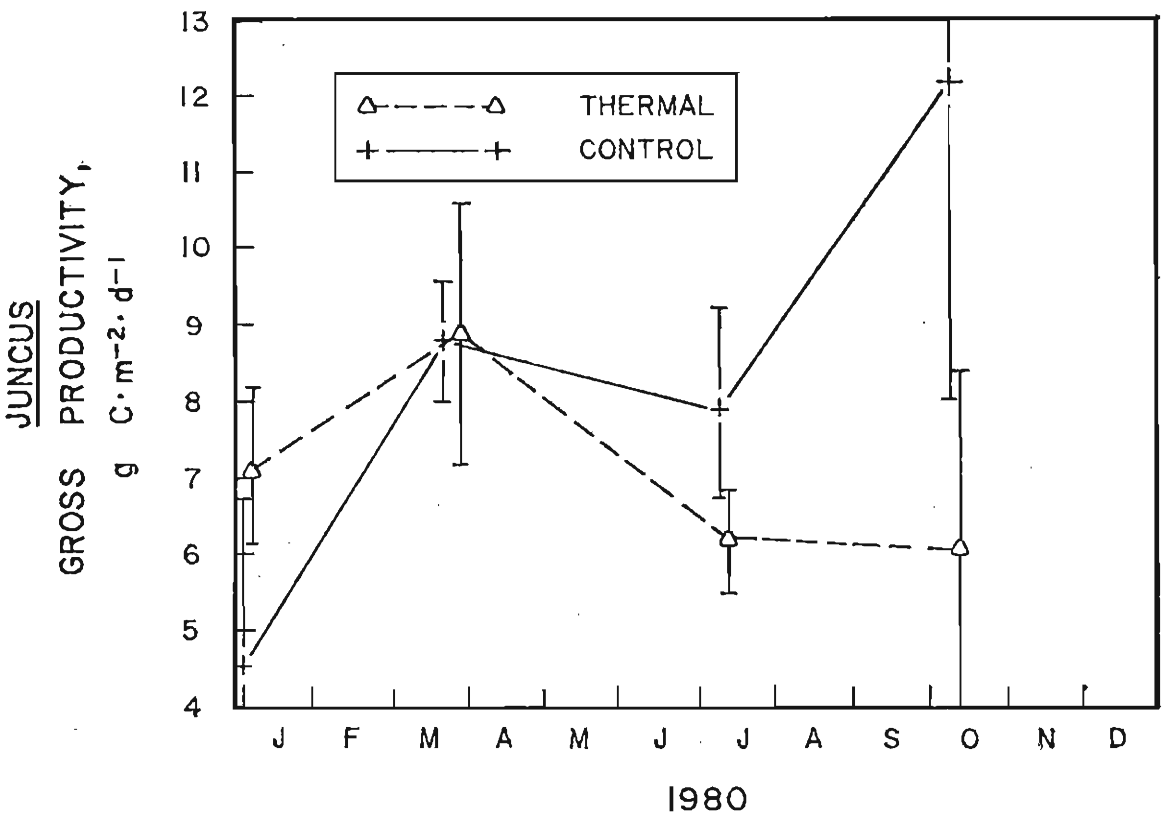


Figure II-76. Seasonal means of *Juncus* gross productivity for 1980. Bars represent ± one standard error. Asterisks indicate a significant difference between the means at a 95% confidence level. Seasonal harvests had a sample size of five.

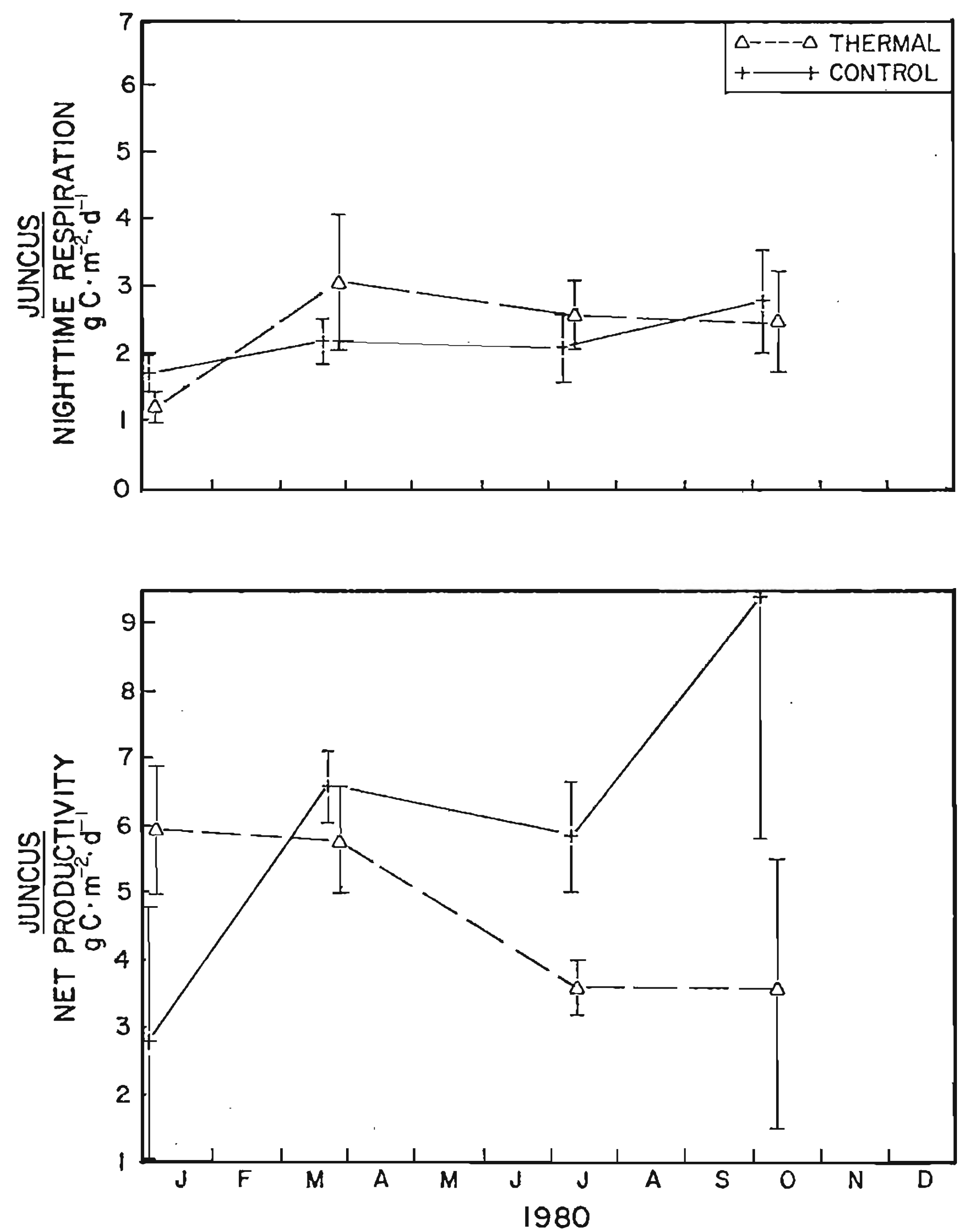


Figure II-77. Seasonal means of Juncus net productivity and nighttime respiration for 1980. Bars represent ± one standard error. Asterisks indicate a significant difference between the means at a 95% confidence level. Seasonal harvests had a sample size of three.

Table II-49. Seasonal means (± one standard error) of *Juncus* P/R ratios for 1980.

Season	Date	Treatment	P/R Ratio
Winter	1/06/80	Thermal	3.499 ± 0.59*
	1/04/80	Control	1.519 ± 0.62
Spring	3/26/80	Thermal	1.839 ± 0.74
	3/28/80	Control	1.993 ± 0.10
Summer	7/11/80	Thermal	1.016 ± 0.15*
	7/04/80	Control	1.608 ± 0.19
Fall	10/11/80	Thermal	1.220 ± 0.38
	10/05/80	Control	2.128 ± 0.42

*Indicates a significant difference between the means at a 95% confidence level.

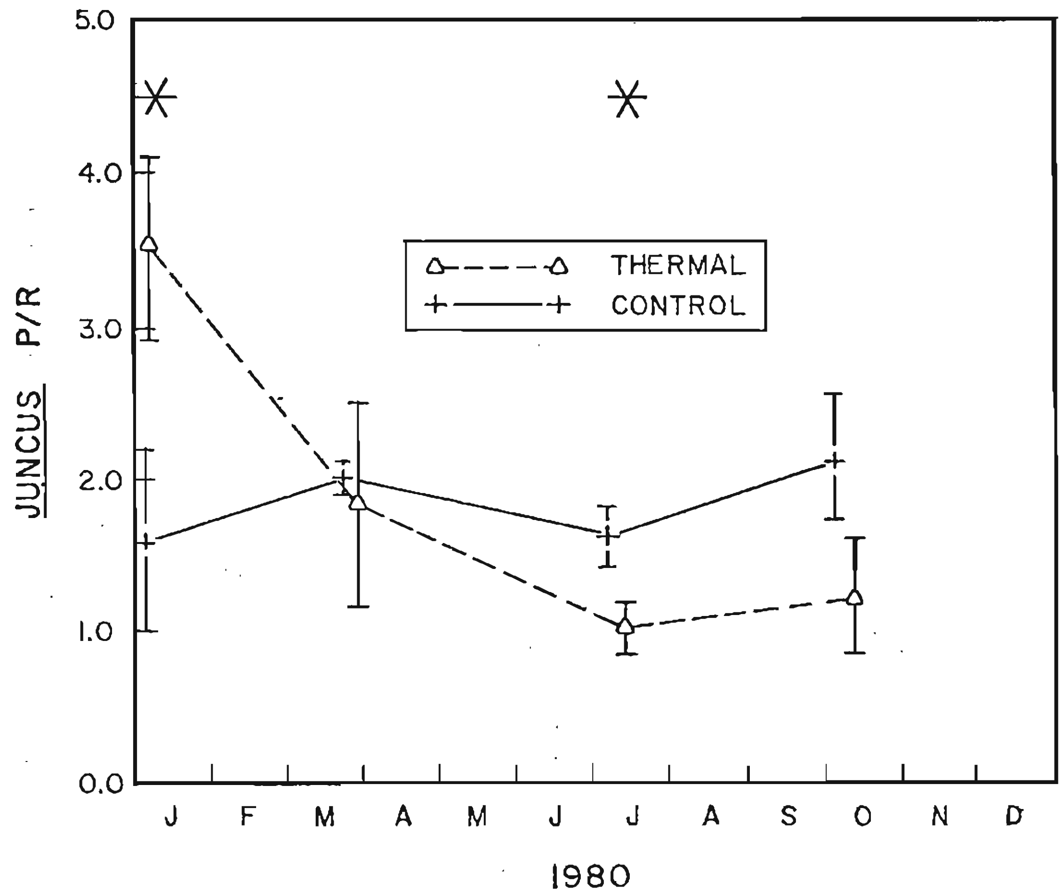


Figure II-78. Seasonal means of Juncus P/R ratios for 1980. Bars represent ± one standard error. Asterisks indicate a significant difference between the means at a 95% confidence level. Seasonal harvests had a sample size of three.

temperatures during the preoperational and postoperational years are presented in Table II-50 and Fig. II-79. The ΔT values and the on-line times of Units 1, 2, and 3 are also presented. Plant outage data were not available prior to 1977. ΔT was 4°C or greater during the time when all three units are on line.

Spartina Comparisons

Comparisons of 1980 *Spartina* biomass parameters with previous years results are presented in this section. The lack of a sufficient data base for 1973 (no standard errors on mean values for certain parameters) precludes a complete comparison.

1980 Data Compared with Preoperational Data

Comparisons between 1973 and 1980 means of live *Spartina* stalk densities are presented in Table II-51 and Fig. II-80. The 1973 control *Spartina* stalk densities were approximately 70% greater than 1980 values, while 1980 thermal values remained almost equal to those of the preoperational data. This is also seen in Fig. II-81, where 1980 thermal and control dead stalk densities are compared to 1973 data. *Spartina* live and dead weight values are shown in Table II-52 and Figs. II-82 and II-83. Live weights for 1980 are significantly higher than those of 1973 (thermal and control) during all seasons except spring (thermal). Dead weight values of *Spartina* show significant differences in the thermal marsh during the winter, summer, and fall. Although no standard errors were available to perform necessary statistics, 1973 mean values of specific weight (Table II-53 and Fig. II-84) and stalk heights (Table II-54 and Fig. II-85) for the control marsh suggest that both sets of values were significantly lower than the 1980 values. These differences observed in the control areas contrast with the similar values recorded in the

Table II-50. Mean seasonal discharge and intake water temperatures and the change in temperature (ΔT) for 1973–1980.

	Winter			Spring			Summer			Fall		
	Discharge	Intake	ΔT	Discharge	Intake	ΔT	Discharge	Intake	ΔT	Discharge	Intake	ΔT
1973	20.5	13.6	6.5	32.5	29.0	3.5	33.0	29.5	3.5	22.0	19.0	3.0
1977	No data			31.0	No data		34.0	29.0	5.0	27.0	22.0	5.0
T 1973/1977				- 1.5			+ 1.0	- 0.5	+ 1.5	+ 5.0	- 3.0	+ 2.0
1978	18.0	14.0	4.0	30.0	26.0	4.0	32.0	29.0	3.0	27.0	21.0	6.0
T 1973/1978	- 2.5	+ 0.4	- 2.5	- 2.5	- 3.0	+ 0.5	- 1.0	- 0.5	- 0.5	+ 5.0	+ 2.0	+ 3.0
1979	19.5	13.0	6.5	26.0	20.0	6.0	32.5	30.0	2.5	27.0	22.0	5.0
T 1973/1979	- 1.0	- 0.6	0.0	- 6.5	- 0.0	+ 2.5	- 0.5	+ 0.5	- 1.0	+ 5.0	+ 3.0	+ 2.0
1980	19.0	12.2	6.8	21.8	18.2	3.6	33.4	30.3	3.1	30.1	23.0	7.1
T 1973/1980	- 1.5	- 1.4	+ 0.3	- 10.7	- 10.8	+ 0.1	+ 0.4	+ 0.8	- 0.4	+ 8.1	+ 4.0	+ 4.1

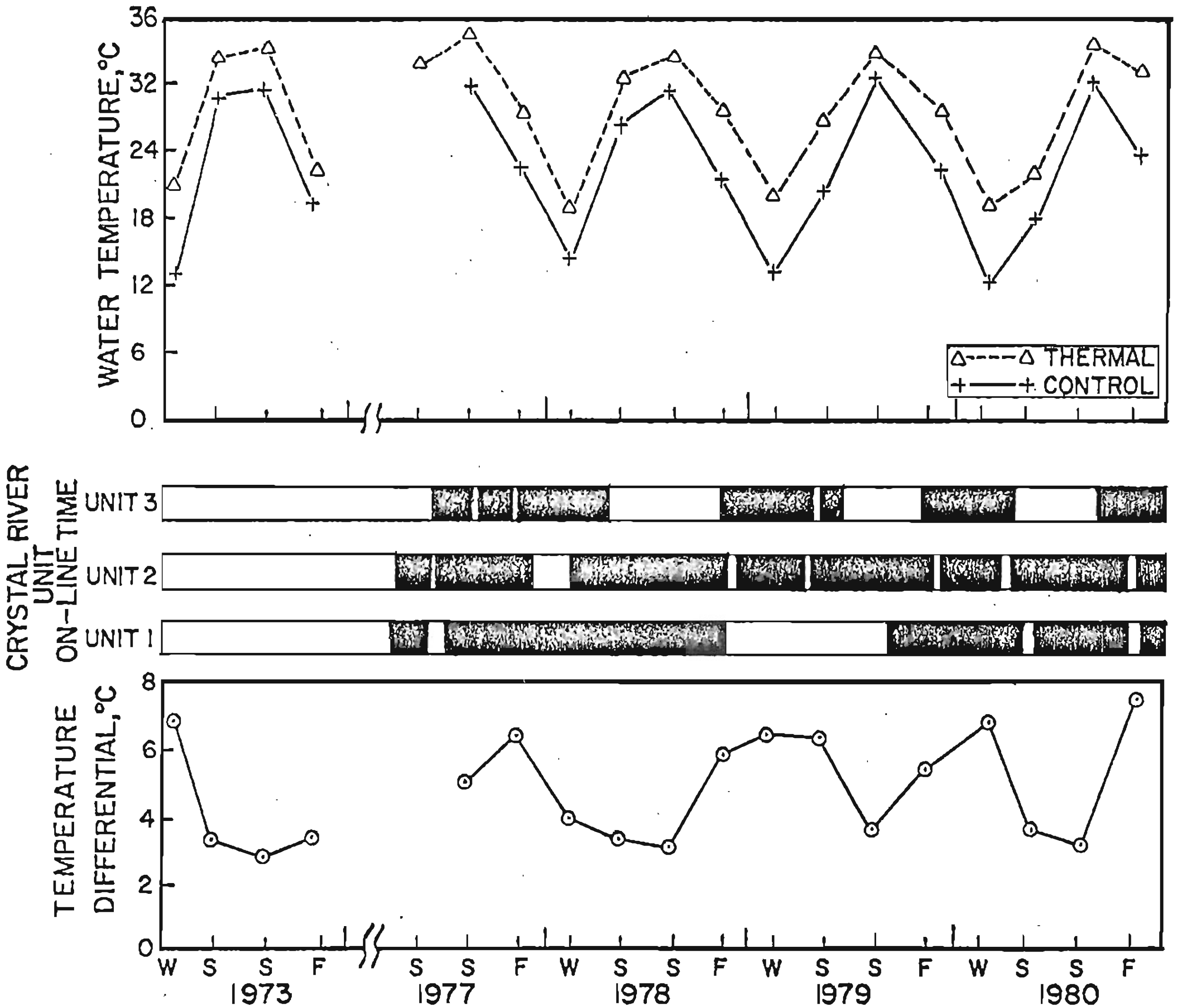


Figure II-79. Intake and discharge water temperatures along with the schedule of power plant operation (when available) for 1973–1980. Upper graph represents seasonal averages at monitoring stations A (discharge) and E (intake). The differences between the means (ΔT) are presented on the lower graph. Striped areas indicate Unit was on line.

Table II-51. Comparison of *Spartina* stalk densities for 1980 with previous year's seasonal means (± one standard error).

Season	Year	Treatment	Live Stalks·m^{-2}	Dead Stalks·m^{-2}
Winter	1973	Thermal	185 ± 25	140 ± 15*
	1977	Thermal	No data	No data
	1978	Thermal	230 ± 24.4	85 ± 5.1
	1979	Thermal	229 ± 15.3	101 ± 12.6
	1980	Thermal	259 ± 26.8	98.2 ± 10.5
	1973	Control	145 ± 15	100 ± 10
	1977	Control	No data	No data
	1978	Control	77 ± 13.8*	46 ± 5.7
	1979	Control	115 ± 8.96	70.7 ± 10.7
	1980	Control	134 ± 10.9	71.1 ± 10.1
Spring	1973	Thermal	195 ± 20	110 ± 15
	1977	Thermal	146 ± 8.27	166 ± 9.55
	1978	Thermal	190 ± 18.3	115 ± 9.5
	1979	Thermal	239 ± 20.7	165 ± 18.4
	1980	Thermal	215 ± 32.1	135 ± 14.2
	1973	Control	165 ± 15*	85 ± 8
	1977	Control	71.1 ± 9.86	101 ± 12.3
	1978	Control	75 ± 10	96 ± 8.7
	1979	Control	92.0 ± 11.9	125 ± 14.5*
	1980	Control	103 ± 14.2	82.2 ± 11.9
Summer	1973	Thermal	200 ± 18*	120 ± 7*
	1977	Thermal	126 ± 5.5*	74.7 ± 11.9
	1978	Thermal	144 ± 11	102 ± 6.1*
	1979	Thermal	157 ± 13.3	53.3 ± 6.43
	1980	Thermal	153 ± 11.1	66.4 ± 9.18
	1973	Control	190 ± 20*	85 ± 25
	1977	Control	62.5 ± 4.65*	27.1 ± 6.03*
	1978	Control	67 ± 4.5*	69 ± 11.3
	1979	Control	73.8 ± 5.08*	70.2 ± 6.64
	1980	Control	119 ± 12.4	84.0 ± 9.73
Fall	1973	Thermal	175 ± 15	165 ± 18*
	1977	Thermal	97.5 ± 7.17*	9.60 ± 2.04*
	1978	Thermal	154 ± 10.6*	100 ± 12.1*
	1979	Thermal	179 ± 24.7	52.9 ± 8.58
	1980	Thermal	209 ± 11.5	45.8 ± 7.28
	1973	Control	190 ± 10*	78 ± 20
	1977	Control	95.1 ± 8.45	14.0 ± 7.65*
	1978	Control	120 ± 9	63 ± 10.4
	1979	Control	121 ± 13.1	89.8 ± 12.0*
	1980	Control	114 ± 10.0	57.8 ± 6.70

*Indicates a significant difference at a 95% confidence level was recorded when compared with the 1980 seasonal mean.

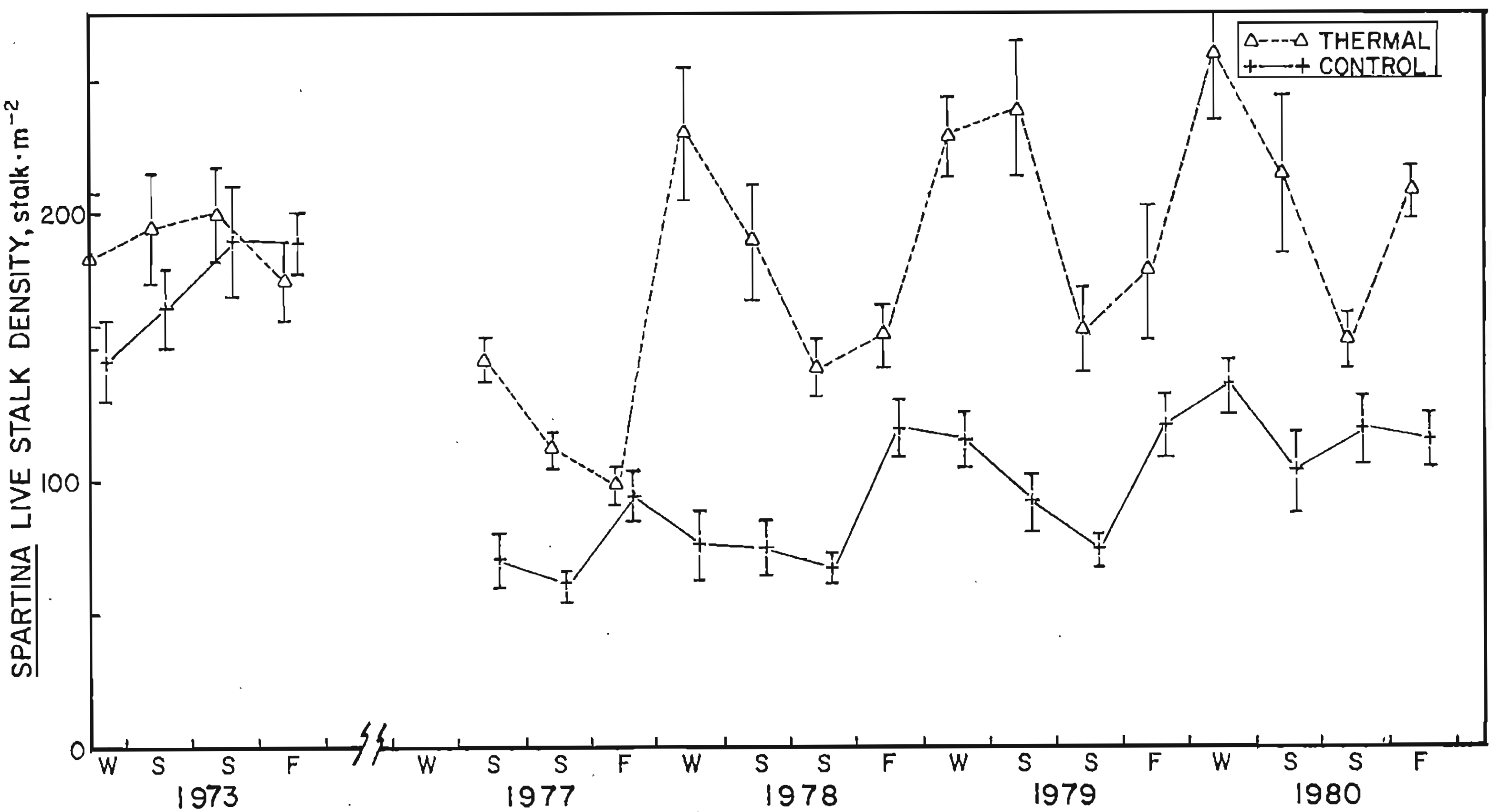


Figure II-80. Comparison of preoperational (1973) with 1977–1980 seasonal means for Spartina live stalk densities. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

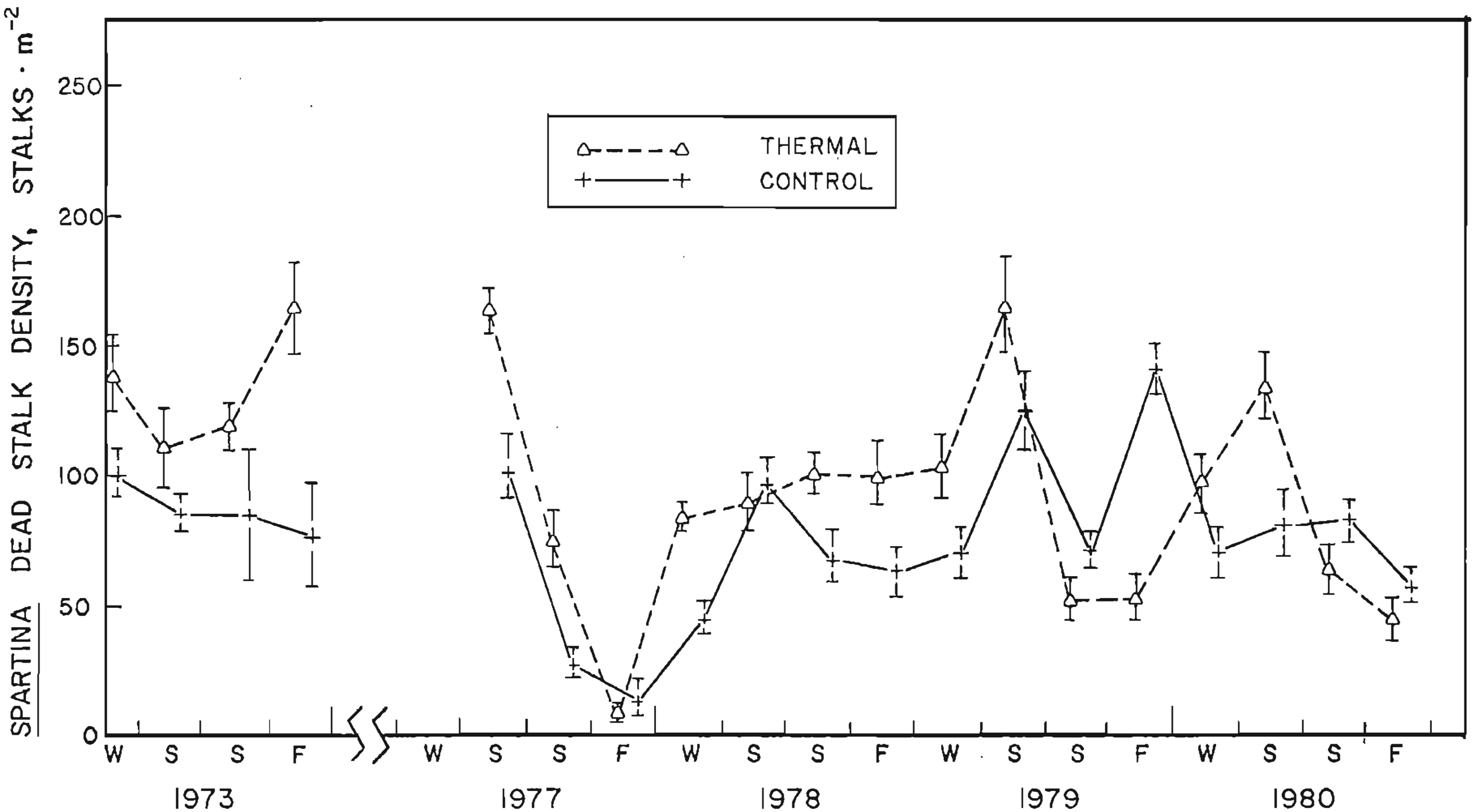


Figure II-81. Comparison of preoperational (1973) with 1977–1980 seasonal means for Spartina dead stalk densities. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

Table II-52. Comparison of Spartina biomass weights for 1980 with previous year's seasonal means (± one standard error).

Season	Year	Treatment	Live Biomass $g \cdot m^{-2}$	Dead Biomass $g \cdot m^{-2}$
Winter	1973	Thermal	150 ± 20*	335 ± 25*
	1977	Thermal	No data	No data
	1978	Thermal	322 ± 30.3*	283 ± 15.3*
	1979	Thermal	329 ± 45.0*	357 ± 41.9*
	1980	Thermal	485 ± 48.5	178 ± 24.9
	1973	Control	135 ± 15*	225 ± 20
	1977	Control	No data	No data
	1978	Control	250 ± 55.2*	321 ± 38.3
	1979	Control	413 ± 74.9	871 ± 178*
	1980	Control	476 ± 63.3	377 ± 88.6
Spring	1973	Thermal	225 ± 10	350 ± 40
	1977	Thermal	395 ± 31	369 ± 25.9
	1978	Thermal	312 ± 24.8	326 ± 23.4
	1979	Thermal	272 ± 23.0*	471 ± 24.5*
	1980	Thermal	412 ± 38.5	323 ± 30.0
	1973	Control	225 ± 25*	250 ± 50
	1977	Control	388 ± 35.3	484 ± 38.0
	1978	Control	224 ± 48*	478 ± 60.5
	1979	Control	184 ± 22.3*	542 ± 55.7
	1980	Control	400 ± 60.9	400 ± 64.4
Summer	1973	Thermal	420 ± 25*	450 ± 24*
	1977	Thermal	609 ± 41.9	290 ± 29
	1978	Thermal	424 ± 32.3*	704 ± 45.3*
	1979	Thermal	472 ± 37.9*	586 ± 67.3*
	1980	Thermal	754 ± 57.1	323 ± 34.0
	1973	Control	530 ± 35*	257 ± 33
	1977	Control	510 ± 32.1*	187 ± 39.6*
	1978	Control	453 ± 46.8*	555 ± 80.1*
	1979	Control	374 ± 46.2*	959 ± 77.5*
	1980	Control	868 ± 90.3	347 ± 47.2
Fall	1973	Thermal	560 ± 40*	465 ± 45*
	1977	Thermal	564 ± 42.8*	182 ± 21.4*
	1978	Thermal	695 ± 47.8*	345 ± 37.9
	1979	Thermal	720 ± 72.3*	199 ± 38.5
	1980	Thermal	970 ± 65.8	290 ± 42.1
	1973	Control	460 ± 60*	275 ± 30*
	1977	Control	786 ± 76.8	245 ± 26.4*
	1978	Control	1140 ± 149	518 ± 76.1
	1979	Control	626 ± 65.8*	500 ± 80.6
	1980	Control	1060 ± 118	410 ± 39.7

*Indicates a significant difference at a 95% confidence level was recorded when compared with the 1980 seasonal mean.

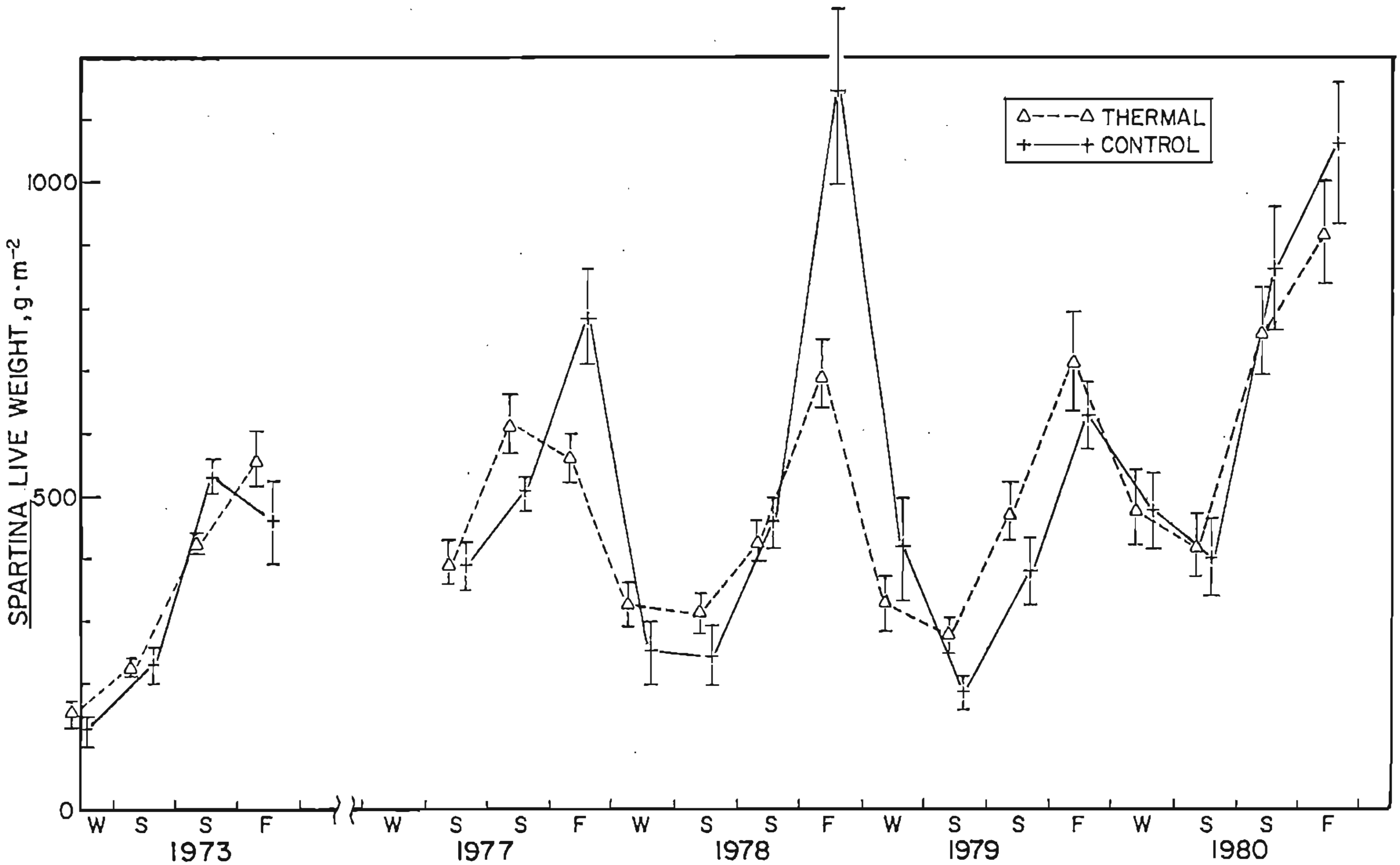


Figure II-82. Comparison of preoperational (1973) with 1977–1980 seasonal means for *Spartina* aboveground live biomass weights. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

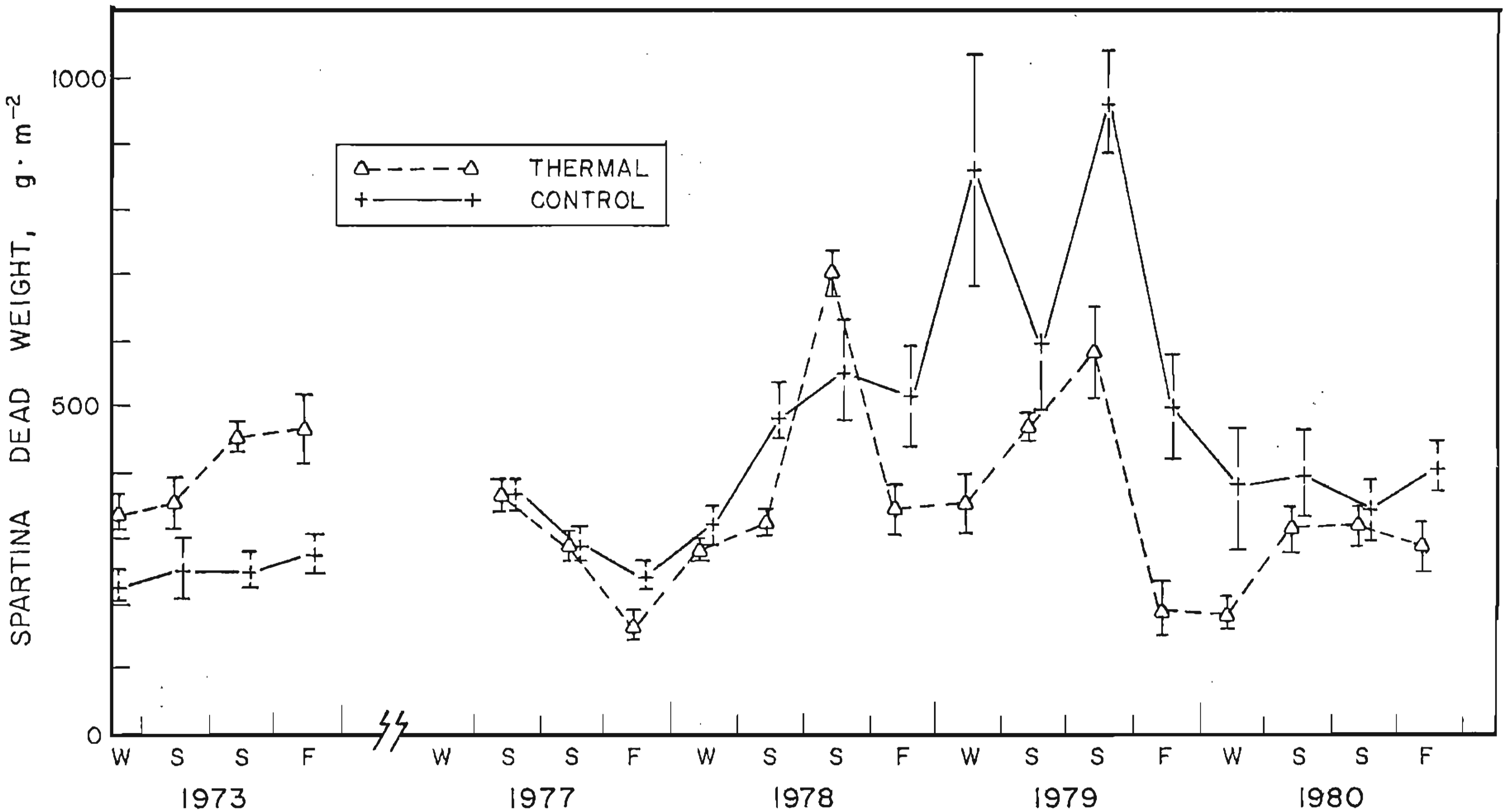


Figure II-83. Comparison of preoperational (1973) with 1977–1980 seasonal means for <u>Spartina</u> aboveground dead biomass weights. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

Table II-53. Comparison of <u>Spartina</u> specific weights for 1980 with previous year's seasonal means (± one standard error).

Season	Year	Treatment	Specific Weight $g \cdot stalk^{-1}$
Winter	1973	Thermal	1.5
	1977	Thermal	No data
	1978	Thermal	1.4 ± 0.07*
	1979	Thermal	1.4 ± 0.17*
	1980	Thermal	1.9 ± 0.06
	1973	Control	1.5
	1977	Control	No data
	1978	Control	3.8 ± 0.90
	1979	Control	3.5 ± 0.45
	1980	Control	3.4 ± 0.21
Spring	1973	Thermal	2.0
	1977	Thermal	2.8 ± 0.10*
	1978	Thermal	1.8 ± 0.18
	1979	Thermal	1.1 ± 0.04*
	1980	Thermal	2.0 ± 0.23
	1973	Control	1.9
	1977	Control	6.0 ± 0.7*
	1978	Control	2.8 ± 0.32*
	1979	Control	2.0 ± 0.17*
	1980	Control	3.9 ± 0.32
Summer	1973	Thermal	2.7
	1977	Thermal	4.9 ± 0.2
	1978	Thermal	3.0 ± 0.19*
	1979	Thermal	3.0 ± 0.14*
	1980	Thermal	5.0 ± 0.38
	1973	Control	2.9
	1977	Control	8.4 ± 0.40
	1978	Control	6.8 ± 0.51
	1979	Control	5.4 ± 0.89
	1980	Control	7.6 ± 1.00
Fall	1973	Thermal	3.0
	1977	Thermal	5.6 ± 0.2*
	1978	Thermal	4.8 ± 0.58
	1979	Thermal	4.4 ± 0.47
	1980	Thermal	4.7 ± 0.37
	1973	Control	2.7
	1977	Control	8.4 ± 0.60
	1978	Control	9.4 ± 0.78
	1979	Control	5.6 ± 0.76*
	1980	Control	9.5 ± 0.89

*Indicates a significant difference at a 95% confidence level was recorded when compared with the 1980 seasonal mean.

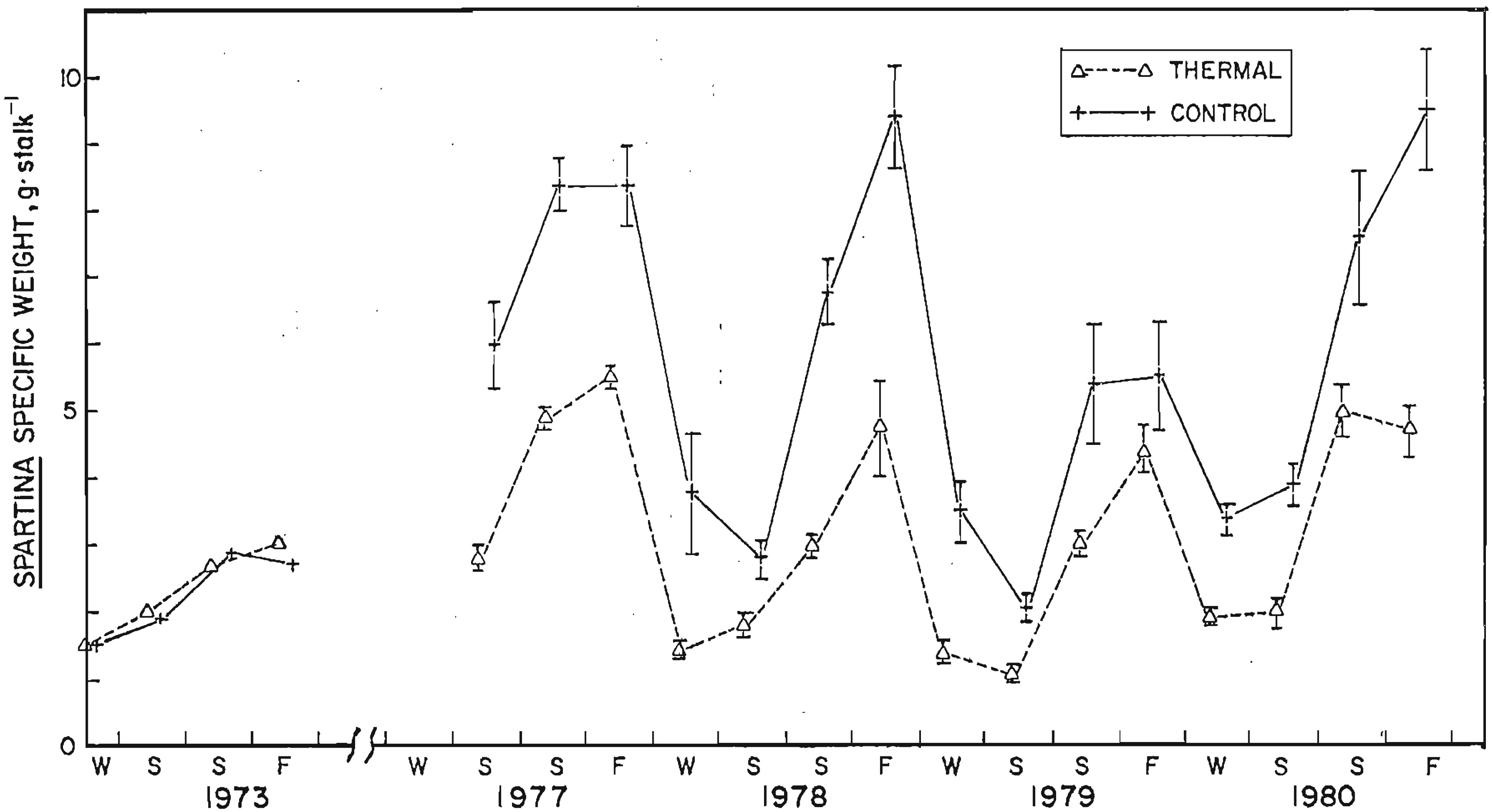


Figure II-84. Comparison of preoperational (1973) with 1977–1980 seasonal means for Spartina specific weights. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

Table II-54. Comparison of Spartina stalk heights for 1980 with previous year's seasonal means (± one standard error).

Season	Year	Treatment	Stalk Heights, cm
Winter	1973	Thermal	36
	1977	Thermal	No data
	1978	Thermal	42.0 ± 1.05
	1979	Thermal	36.4 ± 1.14*
	1980	Thermal	42.6 ± 1.13
	1973	Control	37
	1977	Control	No data
	1978	Control	59.0 ± 2.63
	1979	Control	55.7 ± 1.78
	1980	Control	55.7 ± 2.04
Spring	1973	Thermal	53
	1977	Thermal	60.0 ± 0.9*
	1978	Thermal	51.5 ± 0.69*
	1979	Thermal	41.6 ± 0.62*
	1980	Thermal	46.2 ± 0.86
	1973	Control	48
	1977	Control	86.0 ± 1.5*
	1978	Control	70.1 ± 1.60*
	1979	Control	55.9 ± 1.29*
	1980	Control	61.9 ± 1.64
Summer	1973	Thermal	57
	1977	Thermal	73.0 ± 1.8*
	1978	Thermal	71.4 ± 0.82*
	1979	Thermal	57.2 ± 0.86*
	1980	Thermal	62.8 ± 1.50
	1973	Control	55
	1977	Control	83.0 ± 2.8*
	1978	Control	84.7 ± 2.67*
	1979	Control	70.0 ± 2.03
	1980	Control	70.7 ± 2.20
Fall	1973	Thermal	45
	1977	Thermal	80.0 ± 1.7*
	1978	Thermal	63.0 ± 1.53
	1979	Thermal	50.0 ± 1.49*
	1980	Thermal	59.1 ± 1.63
	1973	Control	44
	1977	Control	92.0 ± 1.4*
	1978	Control	80.0 ± 2.49
	1979	Control	60.1 ± 1.95*
	1980	Control	77.1 ± 2.38

*Indicates a significant difference at a 95% confidence level was recorded when compared with the 1980 seasonal mean.

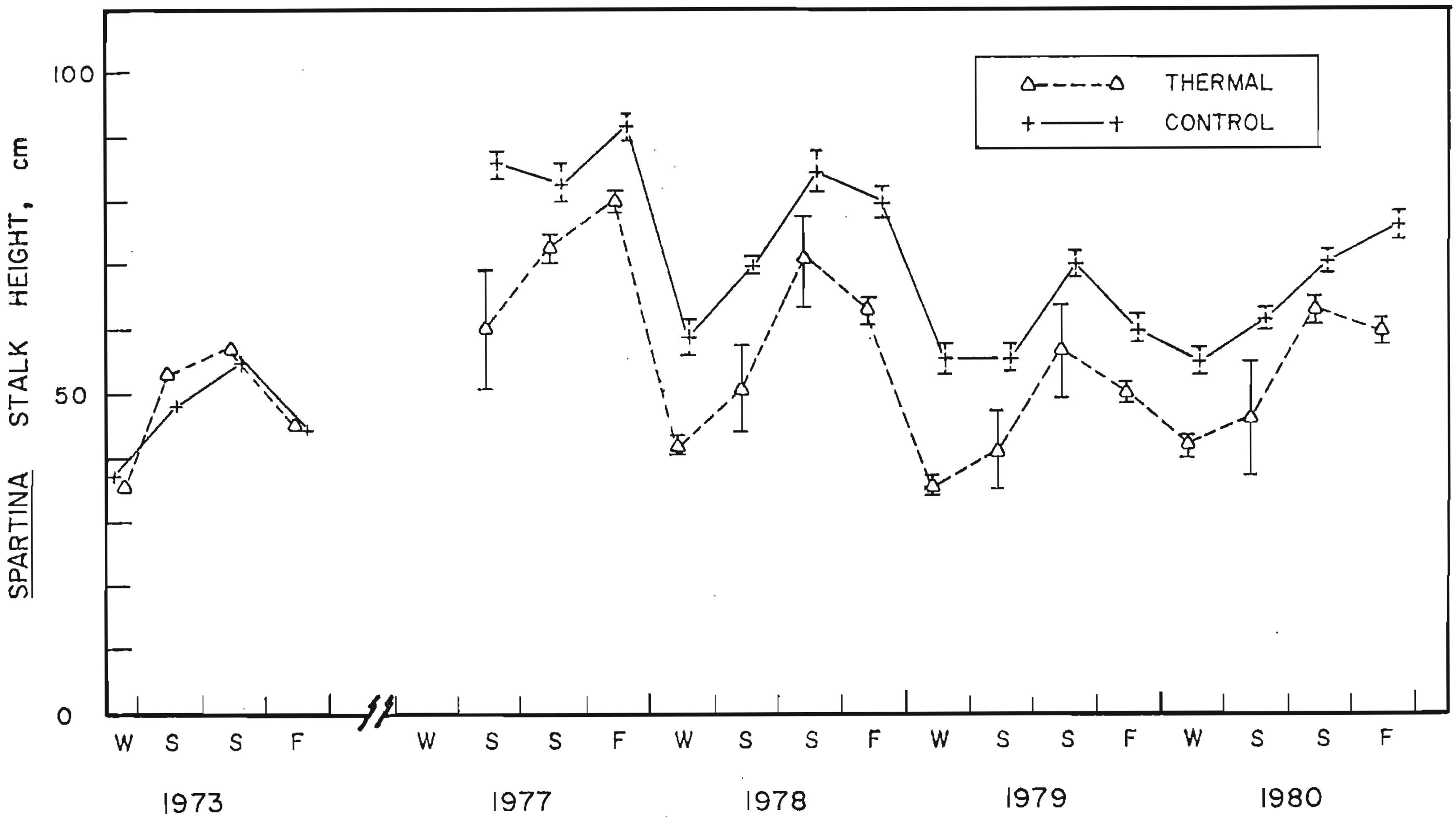


Figure II-85. Comparison of preoperational (1973) with 1977–1980 seasonal means for *Spartina* stalk heights. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

thermally affected area. Of the remaining biomass parameters, only the 1980 thermal Littorina mean (Table II-55 and Fig. II-86) appears to be higher than that of 1973. On the other hand, the number of Uca burrows in 1980 was lower than in 1973 (Table II-56 and Fig. II-87).

1980 Data Compared with 1977–1979 Data

Compared with 1980 data, 1977, 1978, and 1979 means for live weights were significantly different for the winter, summer, and fall thermal marsh and for the summer control marsh (Table II-52 and Fig. II-82). Dead weights and live and dead densities showed a large number of significant differences during the summer and fall (thermal and control) as seen on Tables II-51 and II-52. Specific weights were significantly different during the spring in both thermal and control marshes and during summer and winter in the thermal area (Table II-53). Stalk heights were significantly different in all seasons except winter (thermal and control) when compared with 1980 data (Table II-54). Flowering stalks were significantly different during the winter at both marshes (Table II-57 and Fig. II-88). This is due to the fact that the number of flowers was never recorded during the winter prior to 1980. This was also accompanied by significantly higher flower values during the fall in the remaining fauna parameters. Uca values showed significant differences during the summer (control) and fall (thermal) (Table II-55) while Littorina densities showed significant differences during the winter (thermal) and fall (thermal and control) (Table II-56).

Spartina live stalk density (Fig. II-80) in the thermal marsh remained relatively unchanged while the control values dropped considerably from their preoperational levels. The mean Spartina live weight for both thermal and control marshes appeared to gradually increase with

Table II-55. Comparison of *Littorina* densities in *Spartina* marshes for 1980 with previous year's seasonal means (± one standard error).

Season	Year	Treatment	*Littorina*·m^{-2}
Winter	1973	Thermal	3.6
	1977	Thermal	No data
	1978	Thermal	1.1 ± 0.74*
	1979	Thermal	8.9 ± 2.81*
	1980	Thermal	20.9 ± 2.56
	1973	Control	5.0
	1977	Control	No data
	1978	Control	0.6 ± 0.57
	1979	Control	5.7 ± 1.92
	1980	Control	1.8 ± 1.35
Spring	1973	Thermal	4.0
	1977	Thermal	2.0 ± 0.8*
	1978	Thermal	8.0 ± 3.00
	1979	Thermal	6.7 ± 2.75
	1980	Thermal	15.6 ± 4.69
	1973	Control	1.7
	1977	Control	0.0 ± 0.0*
	1978	Control	0.4 ± 0.36
	1979	Control	4.4 ± 1.41
	1980	Control	3.11 ± 1.30
Summer	1973	Thermal	2.2
	1977	Thermal	8.0 ± 4.2
	1978	Thermal	1.6 ± 0.88*
	1979	Thermal	12.4 ± 4.34
	1980	Thermal	10.0 ± 2.40
	1973	Control	6.4
	1977	Control	0.0 ± 0
	1978	Control	0.0 ± 0
	1979	Control	3.1 ± 1.30
	1980	Control	1.8 ± 0.97
Fall	1973	Thermal	4.9
	1977	Thermal	10.6 ± 3.8*
	1978	Thermal	9.3 ± 3.06*
	1979	Thermal	10.2 ± 1.78*
	1980	Thermal	24.0 ± 4.32
	1973	Control	2.0
	1977	Control	0.4 ± 0.4*
	1978	Control	0.9 ± 0.59*
	1979	Control	1.3 ± 0.67*
	1980	Control	12.9 ± 4.84

*Indicates a significant difference at a 95% confidence level was recorded when compared with the 1980 seasonal mean.

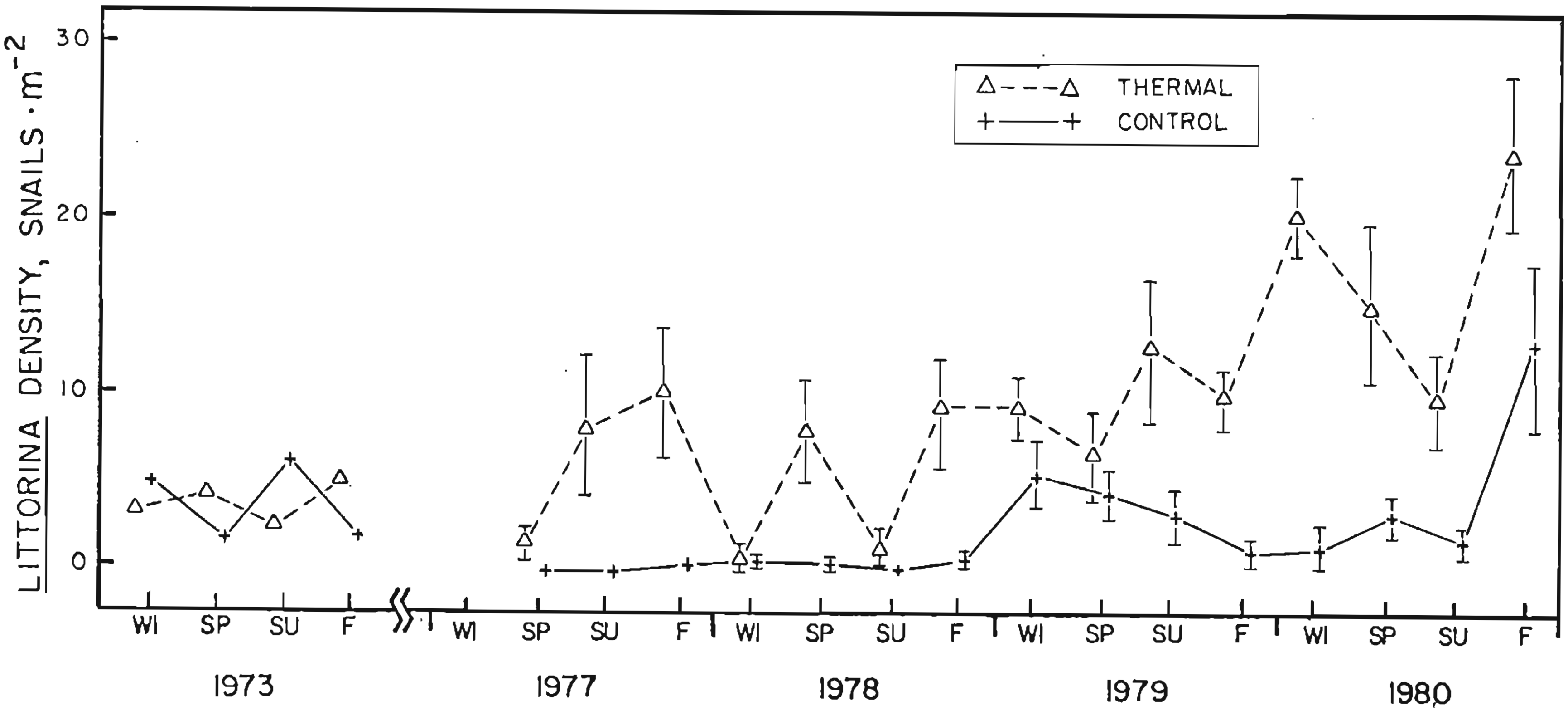


Figure II-86. Comparison of preoperational (1973) with 1977–1980 seasonal means of *Littorina* densities in the *Spartina* marshes. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

Table II-56. Comparison of *Uca* burrow densities in *Spartina* marshes for 1980 with previous year's seasonal means (± one standard error).

Season	Year	Treatment	*Uca* Burrows·m^{-2}
Winter	1973	Thermal	278
	1977	Thermal	No data
	1978	Thermal	90 ± 13.5
	1979	Thermal	220 ± 16.7*
	1980	Thermal	116 ± 26.4
	1973	Control	413
	1977	Control	No data
	1978	Control	101 ± 10.9
	1979	Control	104 ± 15.4
	1980	Control	132 ± 26.2
Spring	1973	Thermal	332
	1977	Thermal	97.5 ± 16.1*
	1978	Thermal	303 ± 41.7
	1979	Thermal	301 ± 27.1
	1980	Thermal	234 ± 21.0
	1973	Control	363
	1977	Control	84.4 ± 9.3*
	1978	Control	205 ± 26.1
	1979	Control	213 ± 27.0
	1980	Control	152 ± 19.8
Summer	1973	Thermal	No data
	1977	Thermal	No data
	1978	Thermal	267 ± 29.3*
	1979	Thermal	167 ± 21.6
	1980	Thermal	148 ± 20.0
	1973	Control	327 ± 75.5*
	1977	Control	237 ± 18*
	1978	Control	357 ± 39.1*
	1979	Control	175 ± 20.4
	1980	Control	152 ± 18.2
Fall	1973	Thermal	369
	1977	Thermal	134 ± 32
	1978	Thermal	316 ± 25.3*
	1979	Thermal	248 ± 20.6*
	1980	Thermal	156 ± 23.8
	1973	Control	634
	1977	Control	207 ± 22
	1978	Control	278 ± 18.9*
	1979	Control	212 ± 32.7
	1980	Control	197 ± 14.8

*Indicates a significant difference at a 95% confidence level was recorded when compared with the 1980 seasonal mean.

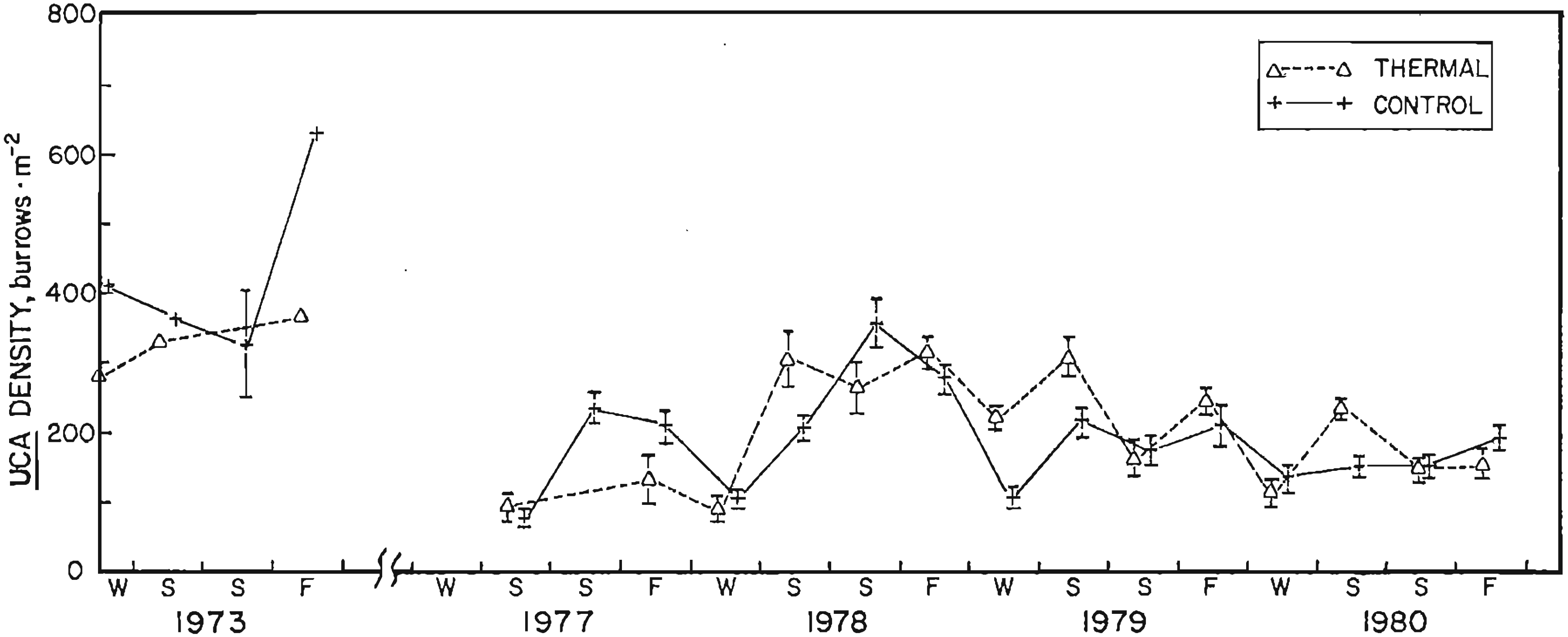


Figure II-87. Comparison of preoperational (1973) with 1977–1980 seasonal means of *Uca* burrow densities in the *Spartina* marshes. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

Table II-57. Comparison of *Spartina* flowering stalk densities for 1980 with previous year's seasonal means (± one standard error).

Season	Year	Treatment	Flowering *Spartina* Stalks·m^{-2}
Winter	1973	Thermal	No data
	1977	Thermal	No data
	1978	Thermal	0*
	1979	Thermal	0*
	1980	Thermal	7.56 ± 3.09
	1973	Control	No data
	1977	Control	No data
	1978	Control	0*
	1979	Control	0*
	1980	Control	5.33 ± 2.40
Spring	1973	Thermal	No data
	1977	Thermal	0
	1978	Thermal	0
	1979	Thermal	0
	1980	Thermal	3.11 ± 1.74
	1973	Control	No data
	1977	Control	0
	1978	Control	0
	1979	Control	0
	1980	Control	1.33 ± 0.94
Summer	1973	Thermal	No data
	1977	Thermal	0
	1978	Thermal	0
	1979	Thermal	0
	1980	Thermal	0
	1973	Control	No data
	1977	Control	0
	1978	Control	0
	1979	Control	0
	1980	Control	0
Fall	1973	Thermal	No data
	1977	Thermal	7.1 ± 2.1*
	1978	Thermal	2.2 ± 1.78*
	1979	Thermal	7.11 ± 2.81*
	1980	Thermal	36.0 ± 2.91
	1973	Control	No data
	1977	Control	11.1 ± 2.9*
	1978	Control	13.8 ± 4.01
	1979	Control	4.88 ± 2.19*
	1980	Control	24.4 ± 3.01

*Indicates a significant difference at a 95% confidence level was recorded when compared with the 1980 seasonal mean.

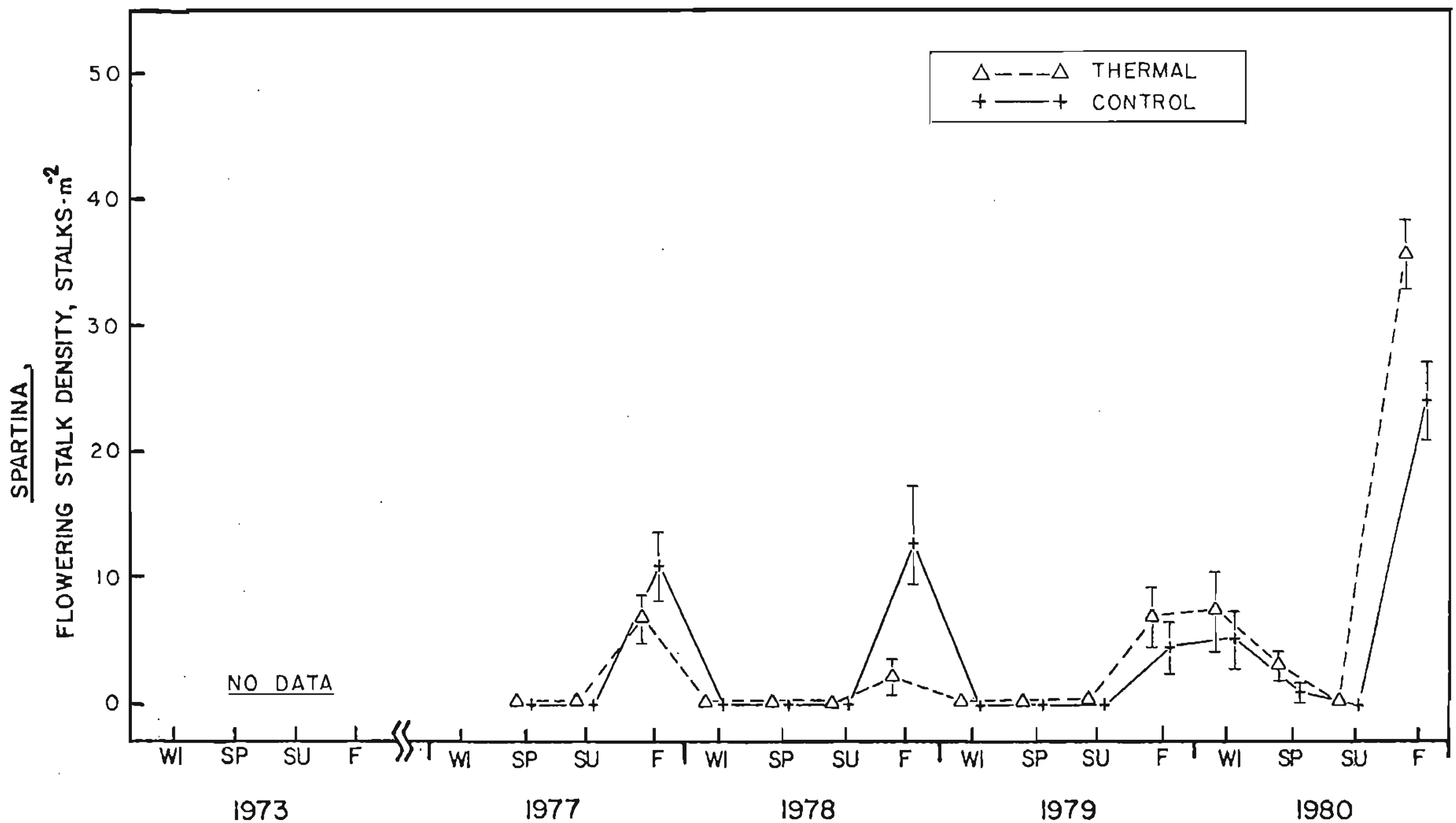


Figure II-88. Comparison of preoperational (1973) with 1977–1980 seasonal means of *Spartina* flowering stalk densities. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

time and showed few significant differences between the two marshes (Fig. II-82). Mean specific weight (Fig. II-84) and stalk height (Fig. II-85) values in the thermal marsh appeared to be relatively constant, but the control values were higher than those of the thermal marsh.

Spartina Metabolism Comparisons

The comparisons of 1980 *Spartina* metabolism values with previous years data are presented in Table II-58 and Figs. II-89, II-90, and II-91. Net productivity values were found to be significantly different in both thermal and control marshes during the spring of 1973 when compared to 1980. Due to an unusually low net productivity value during winter 1980 in the thermal marsh (-0.39 g $C \cdot m^{-2} \cdot d^{-1}$), 1978 and 1979 means compared to that value were found to be significantly higher. Winter and summer nighttime respiration values of 1978 were found to be significantly lower and significantly higher, respectively, in the control marsh when compared to 1980. Spring gross productivity values for 1973 were significantly lower than 1980 means in the discharge marsh and significantly higher in the control marsh. With all three metabolism parameters, no significant differences were recorded during the fall season between 1980 and previous years. As presented in Table II-59 and Fig. II-92, 1980 P/R means for both marshes remained relatively similar with those of previous years. The significant differences recorded were during the spring control and summer thermal seasons for both 1977 and 1979 along with the 1979 winter thermal mean.

Juncus Comparisons

The only biomass parameters available from 1973 for comparison purposes were live and dead weights from the thermally affected marsh

Table II-58. Comparison of *Spartina* metabolism for 1980 with previous year's seasonal means (± one standard error).

Season	Date	Treatment	Sample Size	Insolation, kcal·m^{-2}·d^{-1}	Air Temperature, °C	Net Productivity, g C·m^{-2}·d^{-1}	Nighttime Respiration, g C·m^{-2}·d^{-1}	Gross Productivity, g C·m^{-2}·d^{-1}
Winter	1/31/78	Thermal	2	905	11.8	1.18 ± 0.08*	0.56 ± 0.03	0.73 ± 0.05
	1/13/79	Thermal	2	2664	9.8	1.17 ± 0.21*	0.49 ± 0.14	1.65 ± 0.35
	1/05/80	Thermal	4	2196	8.9	- 0.39 ± 0.08	1.32 ± 0.26	0.92 ± 0.19
	2/02/78	Control	2	453	15.9	0.19 ± 0.03	0.18 ± 0.02*	0.37 ± 0.01*
	1/06/79	Control	2	2119	13.2	2.79 ± 0.48	1.07 ± 0.08	3.86 ± 0.56
	1/03/80	Control	4	2315	13.4	0.90 ± 0.43	1.33 ± 0.23	2.43 ± 0.43
Spring	3/07/73	Thermal	4	4590	23.0	1.41 ± 0.15*	1.78 ± 0.43	3.18 ± 0.33*
	5/01/77	Thermal	4	4322	22.2	2.86 ± 0.32	2.91 ± 0.72	5.77 ± 1.00
	4/11/78	Thermal	2	5960	26.5	2.95 ± 0.13	2.73 ± 0.09	5.68 ± 0.21
	3/31/79	Thermal	4	3353	23.5	3.52 ± 0.27	1.57 ± 0.06	5.09 ± 0.24
	3/26/80	Thermal	4	2683	19.6	3.51 ± 0.16	2.31 ± 0.21	5.82 ± 0.47
	3/12/73	Control	2	4604	23.4	3.47 ± 0.24*	1.80 ± 0.26	5.27 ± 0.37*
	5/08/77	Control	3	3440	24.5	1.94 ± 0.11	1.42 ± 0.05	3.36 ± 0.20
	4/08/78	Control	4	6761	27.2	1.03 ± 0.25	2.04 ± 0.13	3.07 ± 0.12
	4/06/79	Control	2	3679	26.7	1.98 ± 0.41	0.65 ± 0.06*	2.63 ± 0.47
	3/28/80	Control	2	3098	21.1	1.19 ± 0.13	1.52 ± 0.1	2.71 ± 0.03
Summer	7/28/73	Thermal	4	5000	29.7	5.83 ± 0.94	1.22 ± 0.31	7.50 ± 1.39
	7/24/77	Thermal	5	4468	30.0	3.32 ± 0.37	1.20 ± 0.06*	4.52 ± 0.42
	7/06/78	Thermal	2	No data	30.4	1.79 ± 0.02	2.39 ± 0.18	4.38 ± 0.39
	6/15/79	Thermal	2	4337	25.4	6.06 ± 0.76*	1.62 ± 0.14	7.66 ± 0.92
	7/11/80	Thermal	2	2643	31.0	2.60 ± 0.09	2.09 ± 0.10	4.69 ± 0.01
	8/03/73	Control	2	3500	28.3	6.30 ± 1.15	1.22 ± 0.31	7.52 ± 1.39
	7/16/77	Control	2	2038	26.1	2.50 ± 1.5	1.69 ± 0.20	4.19 ± 1.7
	7/01/78	Control	4	2407	30.8	2.82 ± 0.40	2.90 ± 0.11*	5.72 ± 0.44
	6/14/79	Control	1	5370	25.4	3.72	1.03	4.69
	7/04/80	Control	4	3691	34.5	4.05 ± 0.28	1.49 ± 0.10	5.54 ± 0.29

Table II-58 (Cont'd).

Season	Date	Treatment	Sample Size	Insolation, kcal $\cdot m^{-2} \cdot d^{-1}$	Air Temperature, °C	Net Productivity, g $C \cdot m^{-2} \cdot d^{-1}$	Nighttime Respiration, g $C \cdot m^{-2} \cdot d^{-1}$	Gross Productivity, g $C \cdot m^{-2} \cdot d^{-1}$
Fall	73†	Thermal	†	No data	No data	No data	No data	No data
	10/06/77	Thermal	4	4141	23.9	0.81 ± 0.43	1.14 ± 0.14	1.95 ± 0.34
	9/28/78	Thermal	3	955	25.3	2.19 ± 0.43	1.09 ± 0.17	3.28 ± 0.58
	9/14/79	Thermal	4	3100	27.5	1.70 ± 0.49	1.23 ± 0.20	2.93 ± 0.67
	10/11/80	Thermal	4	2815	28.0	2.28 ± 0.92	1.77 ± 0.25	4.05 ± 1.14
	73†	Control	†	No data	No data	No data	No data	No data
	10/10/77	Control	4	3561	25.4	1.51 ± 0.28	1.38 ± 0.38	2.89 ± 0.60
	9/24/78	Control	2	2679	28.3	2.50 ± 1.12	1.19 ± 0.18	3.69 ± 0.04
	9/12/79	Control	2	2401	28.8	4.62 ± 0.88	1.34 ± 0.07	5.96 ± 0.81
	10/05/80	Control	4	2477	23.0	3.69 ± 1.39	1.59 ± 0.40	5.28 ± 1.65

*Indicates a significant difference at a 95% confidence level was recorded when compared with the 1980 seasonal mean.
†Not available.

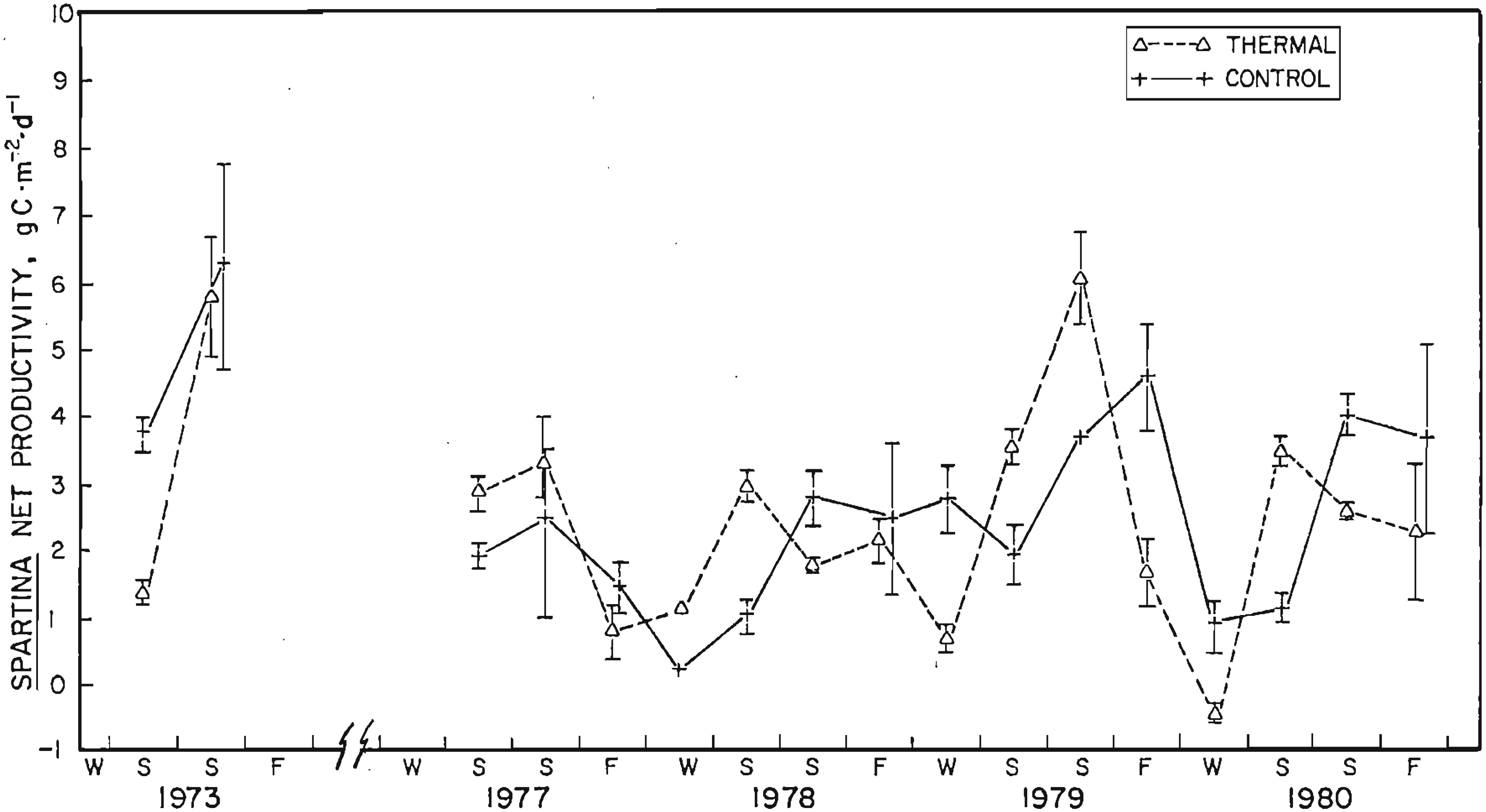


Figure II-89. Comparison of preoperational (1973) with 1977–1980 seasonal means of Spartina net productivity. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

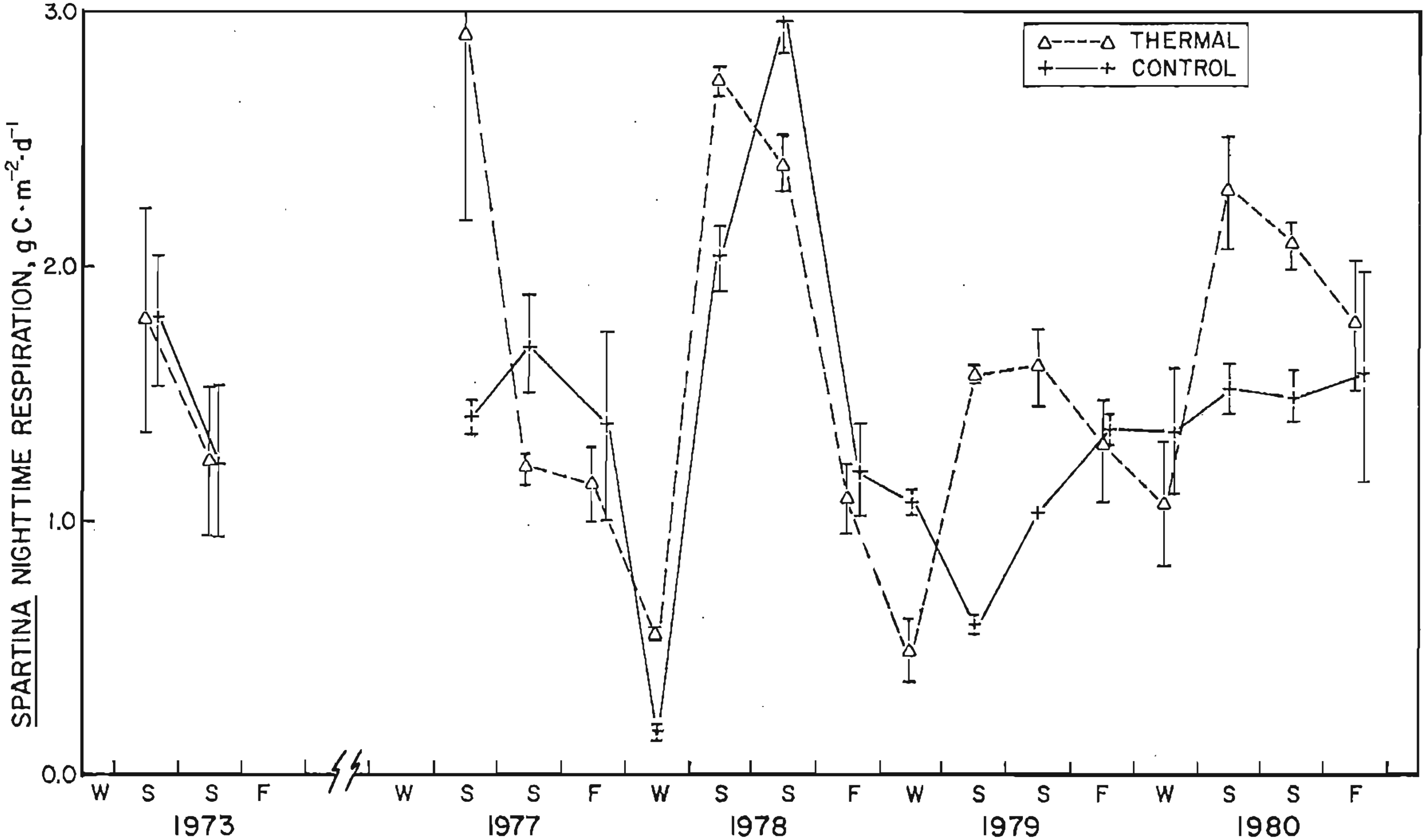


Figure II-90. Comparison of preoperational (1973) with 1977–1980 seasonal means of Spartina nighttime respiration. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

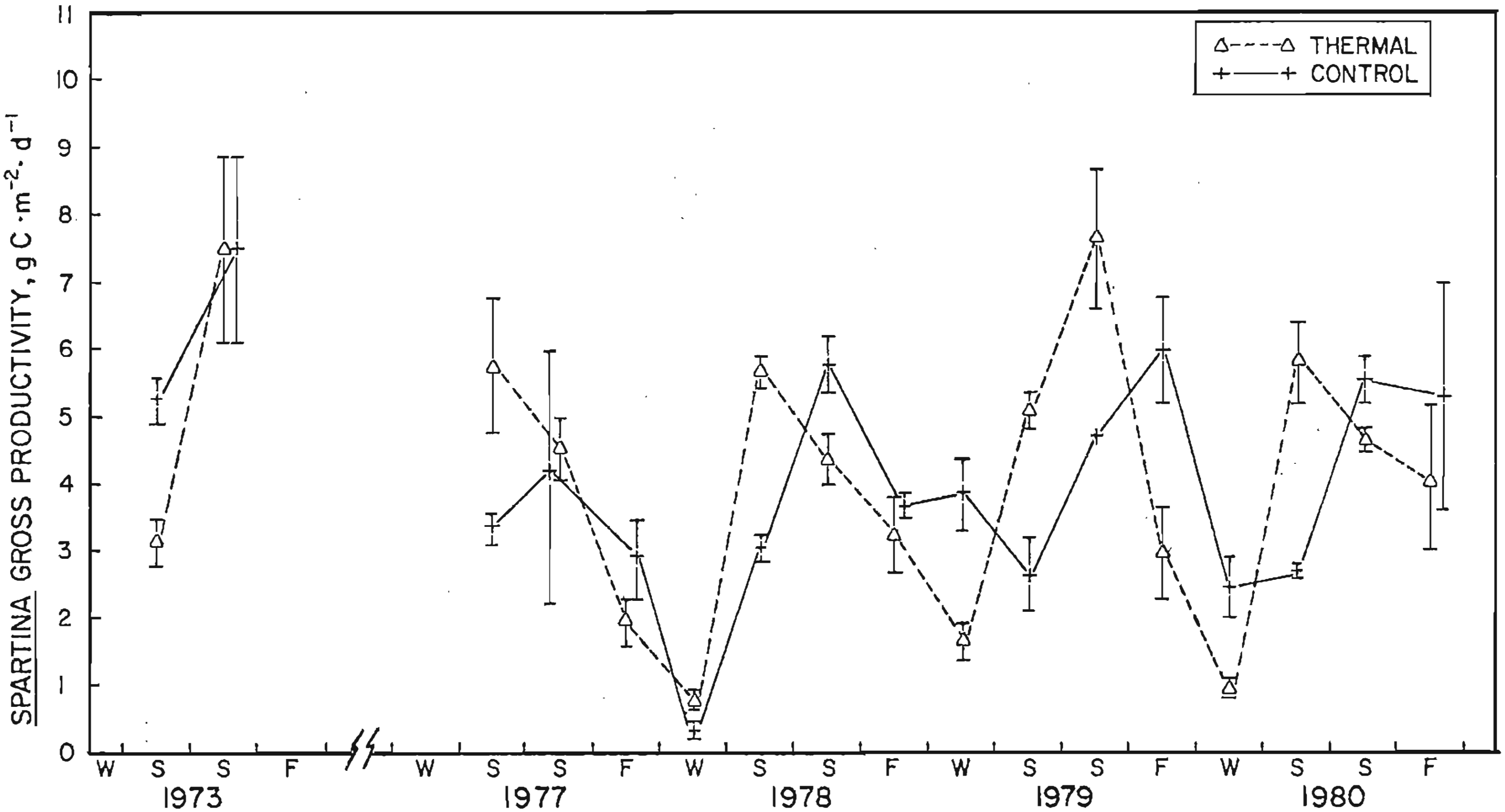


Figure II-91. Comparison of preoperational (1973) with 1977–1980 seasonal means of Spartina gross productivity. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

Table II-59. Comparison of *Spartina* P/R ratios for 1980 with previous year's seasonal means (± one standard error).

Season	Year	Treatment	P/R Ratio
Winter	1973	Thermal	No data
	1977	Thermal	No data
	1978	Thermal	0.51 ± 0.10
	1979	Thermal	2.03 ± 0.17*
	1980	Thermal	0.41 ± 0.03
	1973	Control	No data
	1977	Control	No data
	1978	Control	0.99 ± 0.12
	1979	Control	2.04 ± 0.14
	1980	Control	1.12 ± 0.43
Spring	1973	Thermal	0.89
	1977	Thermal	1.07 ± 0.10
	1978	Thermal	1.06 ± 0.01
	1979	Thermal	1.60 ± 0.12
	1980	Thermal	1.30 ± 0.16
	1973	Control	0.75
	1977	Control	1.19 ± 0.04*
	1978	Control	0.67 ± 0.12
	1979	Control	1.93 ± 0.18*
	1980	Control	0.90 ± 0.10
Summer	1973	Thermal	3.07
	1977	Thermal	1.82 ± 0.19*
	1978	Thermal	0.84 ± 0.03
	1979	Thermal	1.94 ± 0.06*
	1980	Thermal	0.94 ± 0.06
	1973	Control	0.99
	1977	Control	1.22 ± 0.27
	1978	Control	0.91 ± 0.05
	1979	Control	1.91
	1980	Control	1.59 ± 0.32
Fall	1973	Thermal	No data
	1977	Thermal	0.86 ± 0.25
	1978	Thermal	1.85 ± 0.54
	1979	Thermal	1.12 ± 0.29
	1980	Thermal	1.13 ± 0.21
	1973	Control	No data
	1977	Control	1.13 ± 0.09
	1978	Control	1.75 ± 0.55
	1979	Control	2.18 ± 0.40
	1980	Control	1.68 ± 0.33

*Indicates a significant difference at a 95% confidence level was recorded when compared with the 1980 seasonal mean.

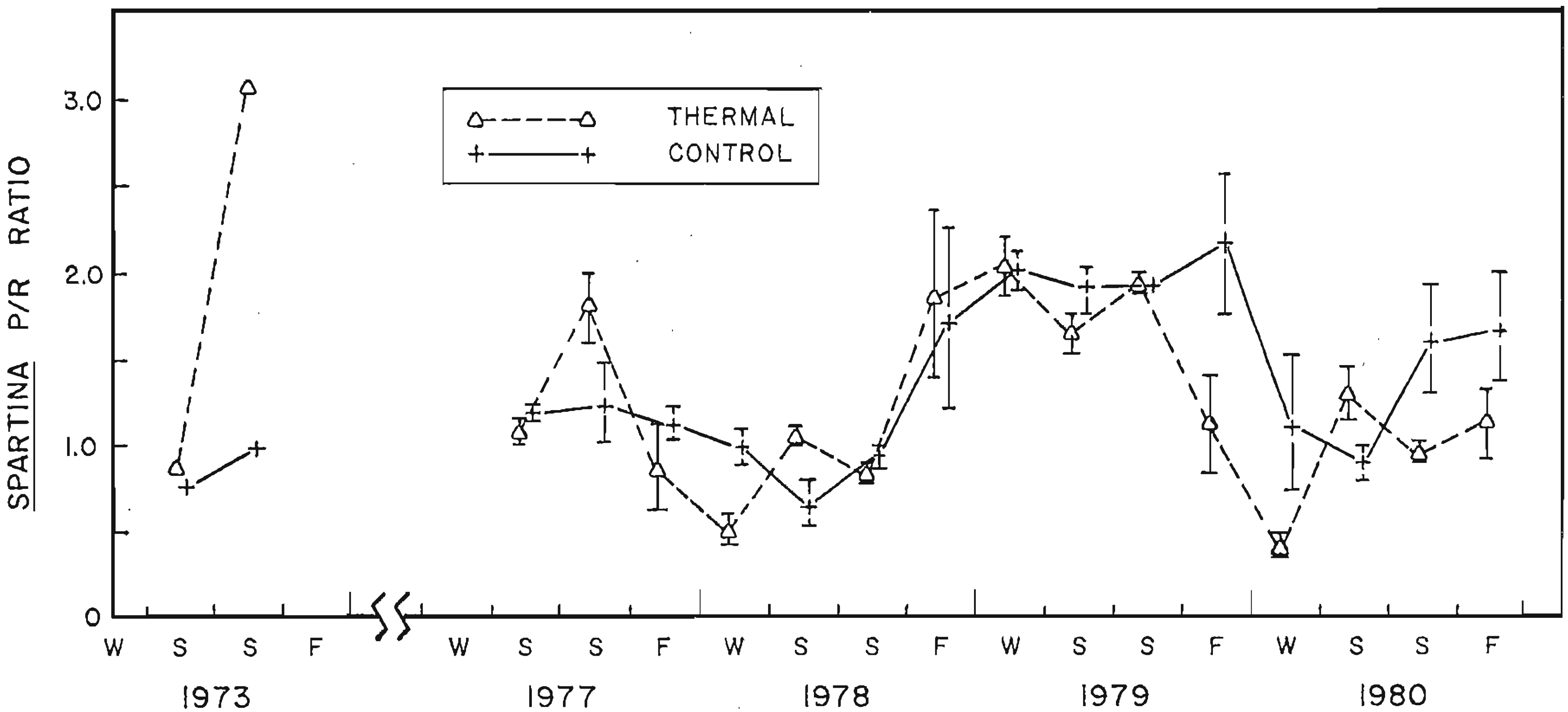


Figure II-92. Comparison of preoperational (1973) with 1977–1980 seasonal means of Spartina P/R ratios. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

(Table II-60 and Figs. II-93 and II-94). Both sets of preoperational data means were significantly lower than 1980 values, with the exception of the fall thermal marsh dead weight mean.

1980 Data Compared with 1977–1979 Data

When compared with 1980 means, 1977, 1978, and 1979 postoperational data showed few significant differences with the exception of *Juncus* shoot heights (Table II-61 and Fig. II-95), which were significantly different for every year during the spring and summer seasons (both thermal and control). Other *Juncus* parameters showing significant differences were live shoot density (spring control 1978–1979, fall control 1978–1979) (Table II-62 and Fig. II-96), and live and dead *Juncus* weights (both reporting significant differences during the winter thermal and control and spring thermal) (Table II-60 and Figs. II-93 and II-94). Specific weights (Table II-63 and Fig. II-97), *Littorina* (Table II-64 and Fig. II-98), and *Uca* burrows (Table II-65 and Fig. II-99) each reported a few scattered significant differences with 1980 means. *Juncus* flowering shoots showed no significant differences for postoperational data although unusually high means were reported (Table II-66 and Fig. II-100).

A few noticeable trends can be seen in *Juncus* shoot heights (Fig. II-95). The shoot height values are consistently higher in the control marsh. This is also evident in the postoperational means in the *Spartina* marsh (Fig. II-85). On the other hand, mean values of live and dead shoot density in the thermal marsh are consistently greater than those in the control marsh (Figs. II-96 and II-101). Flowering *Juncus* shoot densities decreased in annual means (Table II-66 and Fig. II-100) while *Littorina* density increased slightly over the 4-year postoperational record (Table II-64 and Fig. II-98).

Table II-60. Comparison of *Juncus* biomass weights for 1980 with previous year's seasonal means (± one standard error).

Season	Year	Treatment	Live Biomass $g \cdot m^{-2}$	Dead Biomass $g \cdot m^{-2}$
Winter	1973	Thermal	475 ± 50*	880 ± 100*
	1977	Thermal	No data	No data
	1978	Thermal	892 ± 166	850 ± 94*
	1979	Thermal	891 ± 158	1070 ± 203
	1980	Thermal	1280 ± 178	1290 ± 165
	1973	Control	No data	No data
	1977	Control	No data	No data
	1978	Control	575 ± 183*	925 ± 243
	1979	Control	634 ± 134*	615 ± 167*
	1980	Control	1070 ± 92.4	1210 ± 135
Spring	1973	Thermal	515 ± 50*	830 ± 30*
	1977	Thermal	988 ± 157	715 ± 139*
	1978	Thermal	980 ± 135	1040 ± 135
	1979	Thermal	1160 ± 139	1090 ± 84.2
	1980	Thermal	1100 ± 135	1430 ± 158
	1973	Control	No data	No data
	1977	Control	1140 ± 202	634 ± 79.7
	1978	Control	939 ± 95.5	970 ± 79.4
	1979	Control	1130 ± 109	971 ± 81.7
	1980	Control	946 ± 216	759 ± 118
Summer	1973	Thermal	525 ± 75*	980 ± 120*
	1977	Thermal	1350 ± 163	1390 ± 250
	1978	Thermal	1790 ± 291	1140 ± 267
	1979	Thermal	1120 ± 120	1540 ± 131
	1980	Thermal	1160 ± 153	1520 ± 82.2
	1973	Control	No data	No data
	1977	Control	941 ± 108	770 ± 147
	1978	Control	1230 ± 135	1250 ± 191
	1979	Control	968 ± 109	830 ± 149
	1980	Control	1020 ± 69.9	808 ± 115
Fall	1973	Thermal	520 ± 70*	860 ± 80
	1977	Thermal	1510 ± 265	1110 ± 170
	1978	Thermal	1430 ± 157	1280 ± 79.9
	1979	Thermal	807 ± 82.1	1260 ± 119
	1980	Thermal	1130 ± 140	1090 ± 170
	1973	Control	No data	No data
	1977	Control	1530 ± 201	1390 ± 239
	1978	Control	1450 ± 176	920 ± 146
	1979	Control	952 ± 183	1250 ± 115
	1980	Control	1570 ± 208	1370 ± 229

*Indicates a significant difference at a 95% confidence level was recorded when compared with the 1980 seasonal mean.

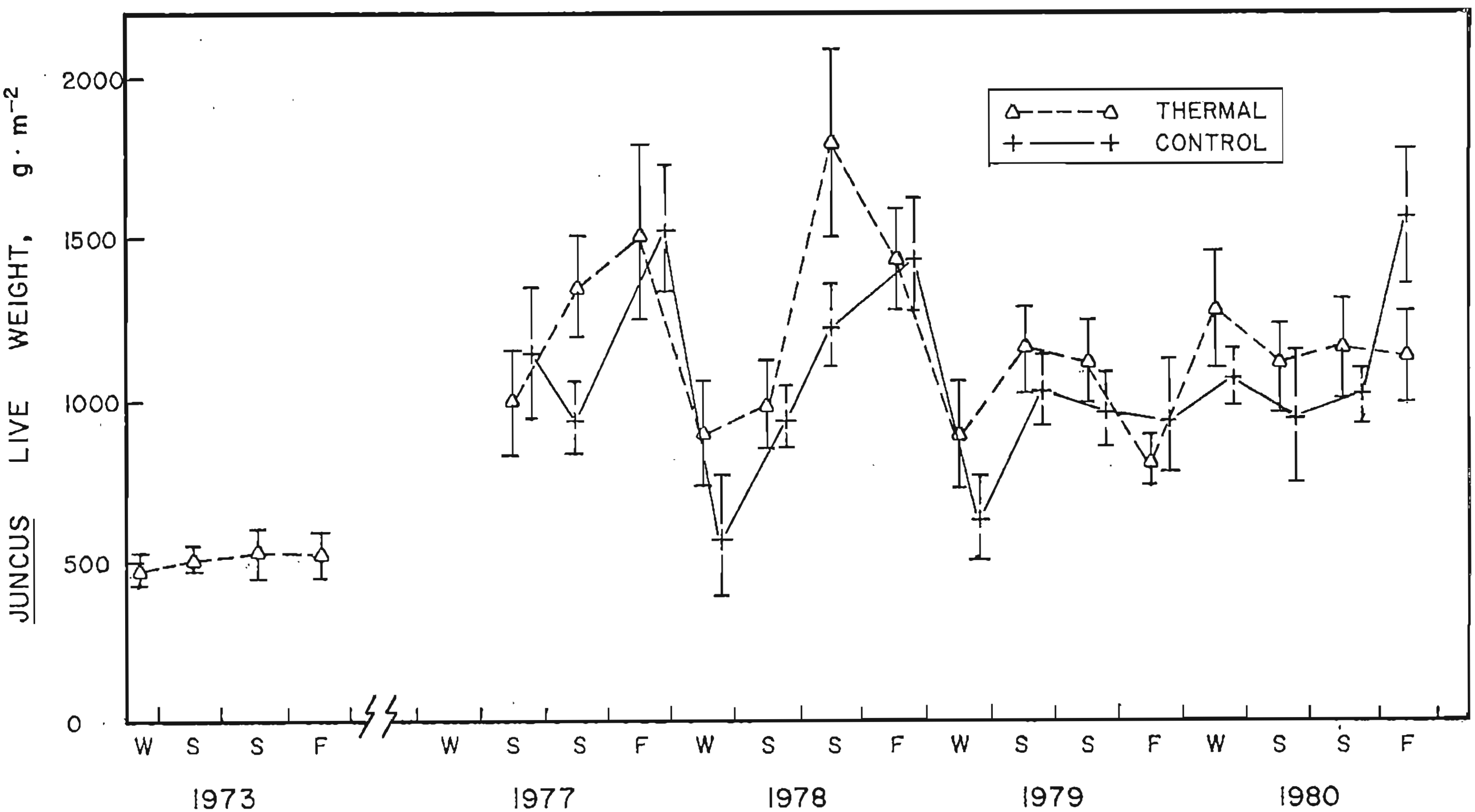


Figure II-93. Comparison of preoperational (1973) with 1977–1980 seasonal means for *Juncus* aboveground live biomass weights. Bars represent $\pm$ one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

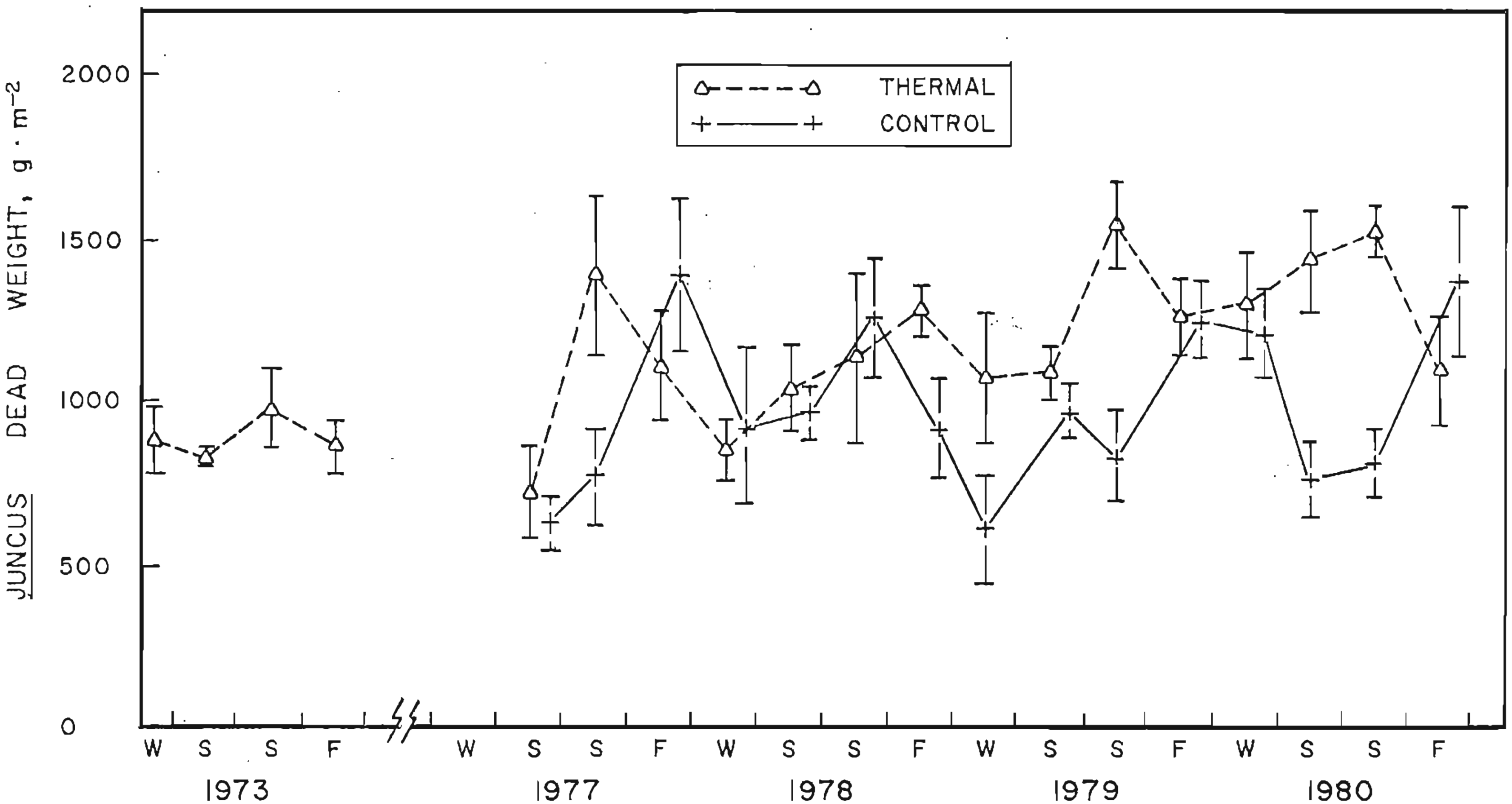


Figure II-94. Comparison of preoperational (1973) with 1977–1980 seasonal means for Juncus aboveground dead biomass weights. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

Table II-61. Comparison of *Juncus* shoot heights for 1980 with previous year's seasonal means (± one standard error).

Season	Year	Treatment	Shoot Heights, cm
Winter	1973	Thermal	No data
	1977	Thermal	No data
	1978	Thermal	90.7 ± 1.52
	1979	Thermal	102 ± 1.88*
	1980	Thermal	94.9 ± 1.55
	1973	Control	No data
	1977	Control	No data
	1978	Control	102 ± 2.12
	1979	Control	108 ± 1.91*
	1980	Control	97.7 ± 1.91
Spring	1973	Thermal	No data
	1977	Thermal	91.0 ± 1.7*
	1978	Thermal	86.7 ± 0.98*
	1979	Thermal	85.7 ± 1.39*
	1980	Thermal	78.8 ± 1.74
	1973	Control	No data
	1977	Control	105 ± 1.8*
	1978	Control	103 ± 1.5*
	1979	Control	90.1 ± 1.76*
	1980	Control	84.3 ± 1.74
Summer	1973	Thermal	No data
	1977	Thermal	100 ± 0.80*
	1978	Thermal	99.4 ± 1.43*
	1979	Thermal	84.9 ± 1.08*
	1980	Thermal	94.6 ± 1.32
	1973	Control	No data
	1977	Control	109 ± 1.43*
	1978	Control	112 ± 1.43*
	1979	Control	94.7 ± 1.44*
	1980	Control	103 ± 1.61
Fall	1973	Thermal	No data
	1977	Thermal	105 ± 1.2*
	1978	Thermal	102 ± 1.19
	1979	Thermal	99.0 ± 1.58
	1980	Thermal	98.7 ± 1.52
	1973	Control	No data
	1977	Control	133 ± 1.1*
	1978	Control	120 ± 2.05
	1979	Control	118 ± 1.77
	1980	Control	116 ± 1.73

*Indicates a significant difference at a 95% confidence level was recorded when compared with the 1980 seasonal mean.

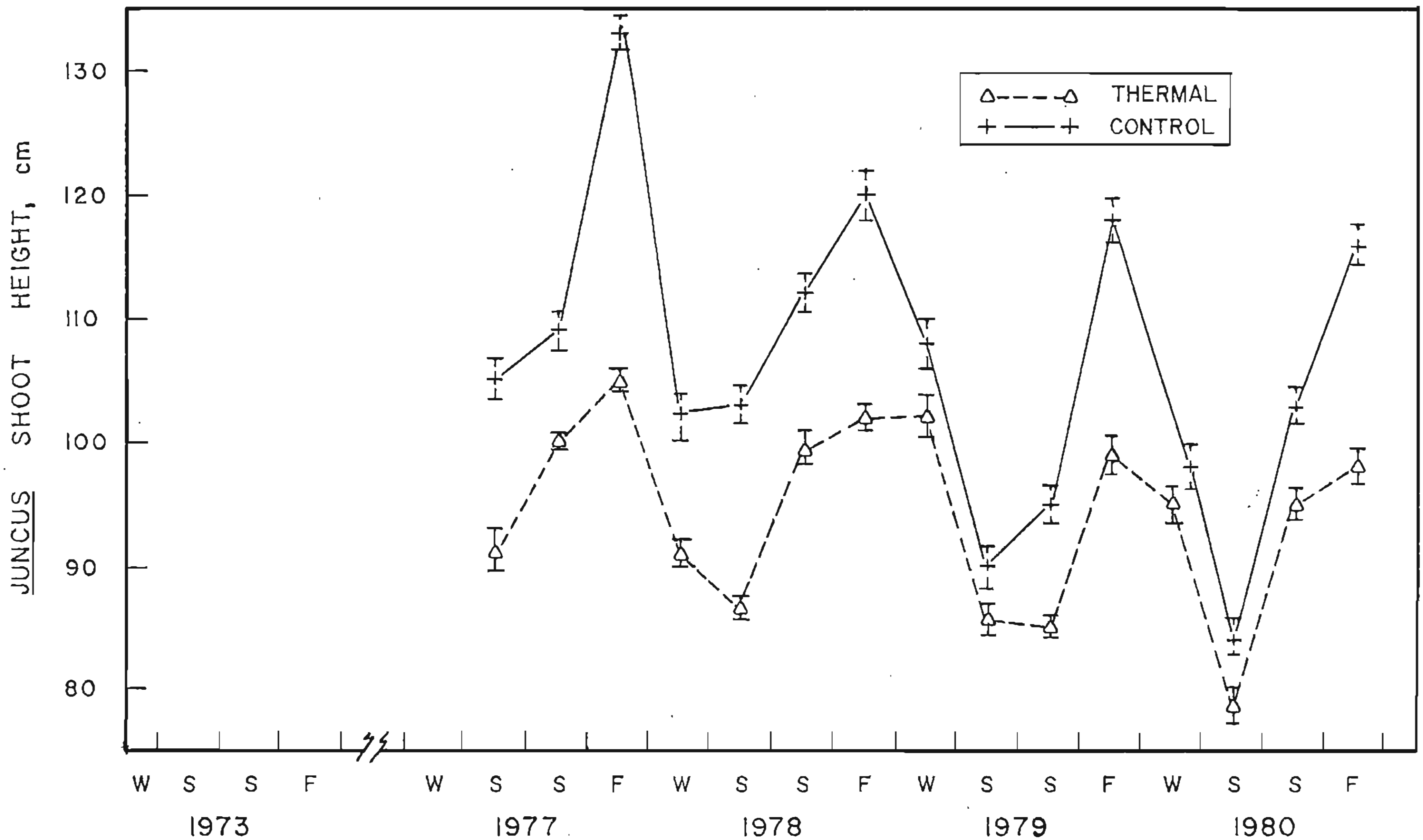


Figure II-95. Comparison of preoperational (1973) with 1977–1980 seasonal means for *Juncus* shoot heights. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

Table II-62. Comparison of *Juncus* shoot densities for 1980 with previous year's seasonal means (± one standard error).

Season	Year	Treatment	Live Shoots·m^{-2}	Dead Shoots·m^{-2}
Winter	1973	Thermal	No data	No data
	1977	Thermal	No data	No data
	1978	Thermal	552 ± 55.6	557 ± 133
	1979	Thermal	467 ± 76.8	415 ± 91.4
	1980	Thermal	770 ± 90.1	580 ± 51.6
	1973	Control	No data	No data
	1977	Control	No data	No data
	1978	Control	438 ± 102	266 ± 860
	1979	Control	298 ± 58.7*	266 ± 67.8
	1980	Control	495 ± 42.7	304 ± 57.7
Spring	1973	Thermal	No data	No data
	1977	Thermal	650 ± 106	222 ± 69.3*
	1978	Thermal	738 ± 95.9	518 ± 62
	1979	Thermal	816 ± 42.8	751 ± 41.7
	1980	Thermal	766 ± 151	624 ± 70.1
	1973	Control	No data	No data
	1977	Control	650 ± 71.8	274 ± 47.4
	1978	Control	290 ± 41.6*	290 ± 41.6
	1979	Control	294 ± 59.2*	394 ± 59.2
	1980	Control	688 ± 101	270 ± 49.6
Summer	1973	Thermal	No data	No data
	1977	Thermal	795 ± 98.9	773 ± 181
	1978	Thermal	487 ± 102	682 ± 69.8
	1979	Thermal	812 ± 87.2	852 ± 165
	1980	Thermal	561 ± 49.5	587 ± 26.1
	1973	Control	No data	No data
	1977	Control	446 ± 40.4	363 ± 61.6
	1978	Control	529 ± 70.5	385 ± 20.9
	1979	Control	561 ± 52.7	532 ± 97.7*
	1980	Control	509 ± 45.1	272 ± 39.9
Fall	1973	Thermal	No data	No data
	1977	Thermal	696 ± 161	173 ± 15.9*
	1978	Thermal	700 ± 39.3	633 ± 57.0
	1979	Thermal	453 ± 53.3	610 ± 55.0
	1980	Thermal	586 ± 35.3	530 ± 67.9
	1973	Control	No data	No data
	1977	Control	569 ± 119	118 ± 11.8*
	1978	Control	341 ± 63.5*	378 ± 76.2
	1979	Control	410 ± 46.7*	506 ± 54.5
	1980	Control	626 ± 79.3	487 ± 66.9

*Indicates a significant difference at a 95% confidence level was recorded when compared with the 1980 seasonal mean.

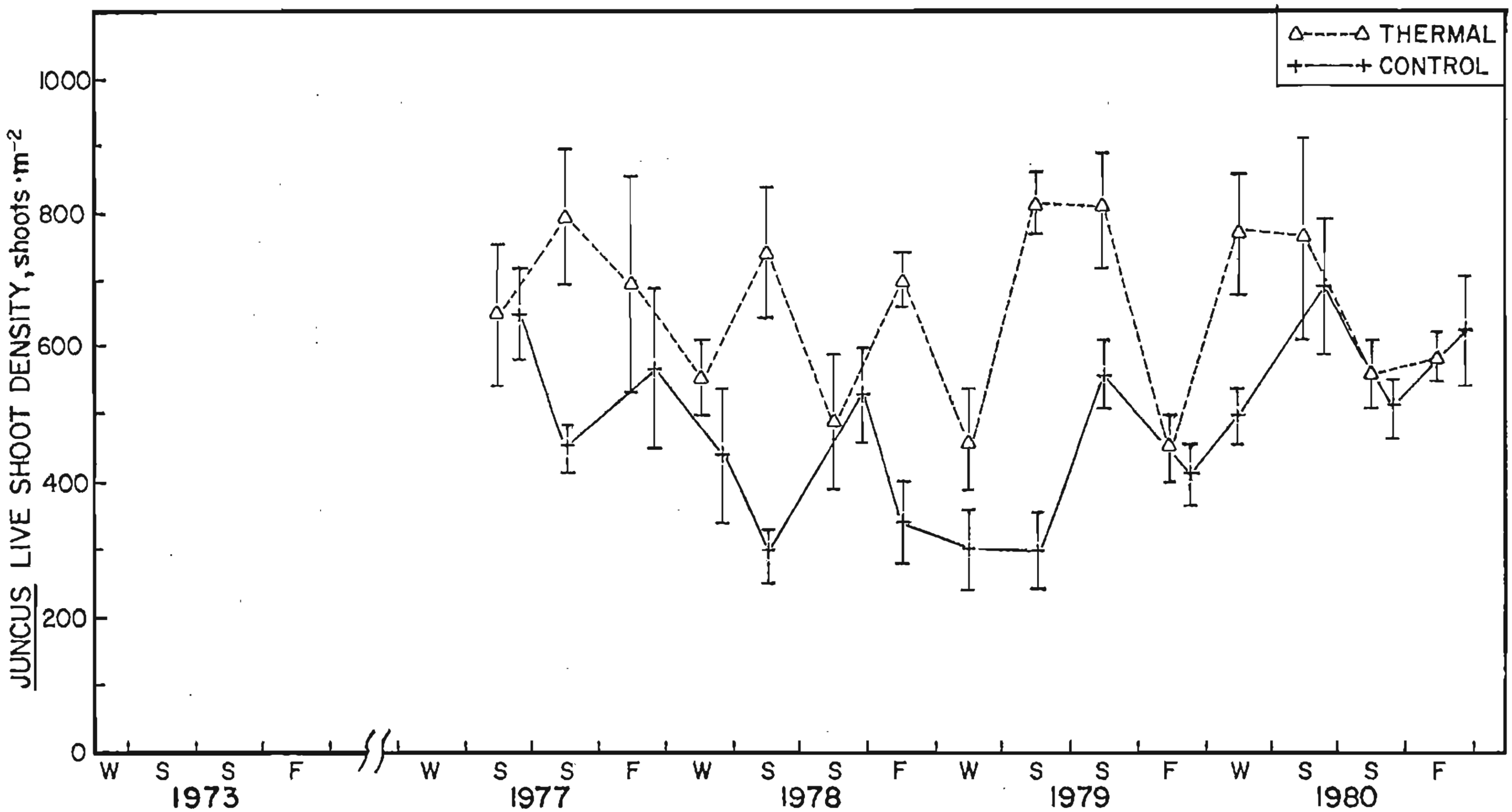


Figure II-96. Comparison of preoperational (1973) with 1977–1980 seasonal means for Juncus live shoot densities. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

Table II-63. Comparison of Juncus specific weights for 1980 with previous year's seasonal means (± one standard error).

Season	Year	Treatment	Specific Weight $g \cdot shoot^{-1}$
Winter	1973	Thermal	1.2
	1977	Thermal	No data
	1978	Thermal	1.6 ± 0.12
	1979	Thermal	1.9 ± 0.09
	1980	Thermal	1.7 ± 0.08
	1973	Control	No data
	1977	Control	No data
	1978	Control	2.1 ± 0.10
	1979	Control	2.1 ± 0.11
	1980	Control	2.2 ± 0.11
Spring	1973	Thermal	1.5
	1977	Thermal	1.5 ± 1.10
	1978	Thermal	1.4 ± 0.04
	1979	Thermal	1.4 ± 0.15
	1980	Thermal	1.9 ± 0.68
	1973	Control	No data
	1977	Control	1.8 ± 0.20
	1978	Control	2.0 ± 0.07
	1979	Control	1.8 ± 0.13
	1980	Control	1.4 ± 0.27
Summer	1973	Thermal	1.0
	1977	Thermal	1.7 ± 0.10
	1978	Thermal	2.5 ± 0.52
	1979	Thermal	1.4 ± 0.06
	1980	Thermal	2.2 ± 0.41
	1973	Control	No data
	1977	Control	2.1 ± 0.10
	1978	Control	2.3 ± 0.08*
	1979	Control	1.7 ± 0.09*
	1980	Control	2.0 ± 0.08
Fall	1973	Thermal	1.6
	1977	Thermal	2.2 ± 0.20
	1978	Thermal	1.8 ± 0.03
	1979	Thermal	1.8 ± 0.05
	1980	Thermal	1.9 ± 0.17
	1973	Control	No data
	1977	Control	2.9 ± 0.30
	1978	Control	3.0 ± 0.51
	1979	Control	2.3 ± 0.33
	1980	Control	2.5 ± 0.03

*Indicates a significant difference at a 95% confidence level was recorded when compared with the 1980 seasonal mean.

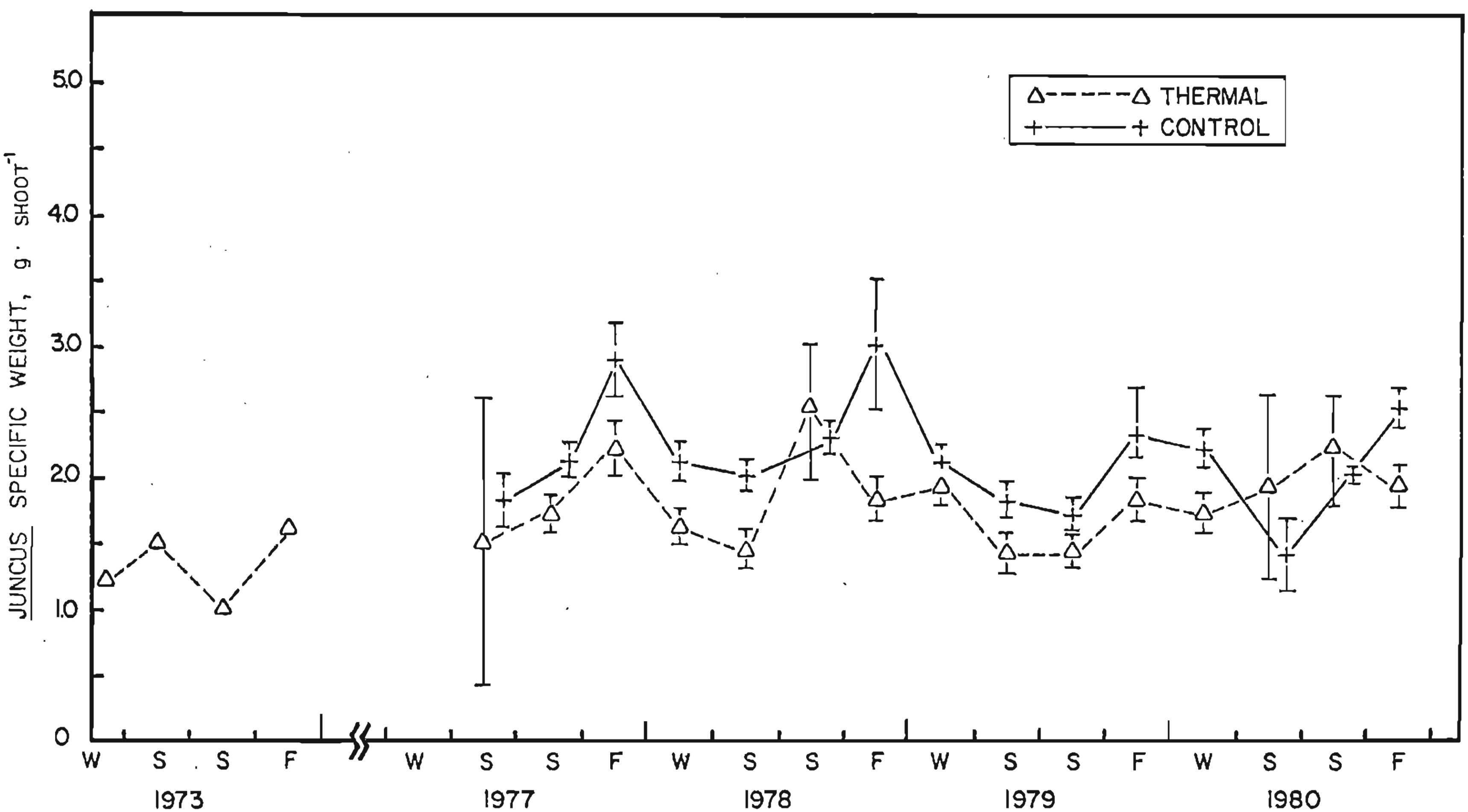


Figure II-97. Comparison of preoperational (1973) with 1977–1980 seasonal means for Juncus specific weights. Bars represent + one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

Table II-64. Comparison of *Littorina* densities in *Juncus* marshes for 1980 with previous year's seasonal means (± one standard error).

Season	Year	Treatment	*Littorina*·m^{-2}
Winter	1973	Thermal	No data
	1977	Thermal	No data
	1978	Thermal	0.0 ± 0
	1979	Thermal	12.8 ± 1.96
	1980	Thermal	23.2 ± 7.94
	1973	Control	No data
	1977	Control	No data
	1978	Control	0.0 ± 0
	1979	Control	1.6 ± 0.98
	1980	Control	0.8 ± 0.80
Spring	1973	Thermal	No data
	1977	Thermal	3.2 ± 0.80
	1978	Thermal	5.7 ± 2.59
	1979	Thermal	6.4 ± 2.99
	1980	Thermal	9.6 ± 4.49
	1973	Control	No data
	1977	Control	0.8 ± 0.80
	1978	Control	0.0 ± 0
	1979	Control	11.2 ± 2.94*
	1980	Control	3.2 ± 0.80
Summer	1973	Thermal	No data
	1977	Thermal	2.0 ± 0.89*
	1978	Thermal	3.3 ± 1.91*
	1979	Thermal	12.8 ± 6.25
	1980	Thermal	13.1 ± 2.09
	1973	Control	No data
	1977	Control	0.0 ± 0
	1978	Control	0.0 ± 0
	1979	Control	0.0 ± 0
	1980	Control	4.0 ± 2.19
Fall	1973	Thermal	No data
	1977	Thermal	5.6 ± 3.0
	1978	Thermal	2.3 ± 1.71
	1979	Thermal	8.8 ± 3.20
	1980	Thermal	8.8 ± 2.65
	1973	Control	No data
	1977	Control	0.0 ± 0
	1978	Control	0.0 ± 0
	1979	Control	4.8 ± 2.33
	1980	Control	7.6 ± 5.00

*Indicates a significant difference at a 95% confidence level was recorded when compared with the 1980 seasonal mean.

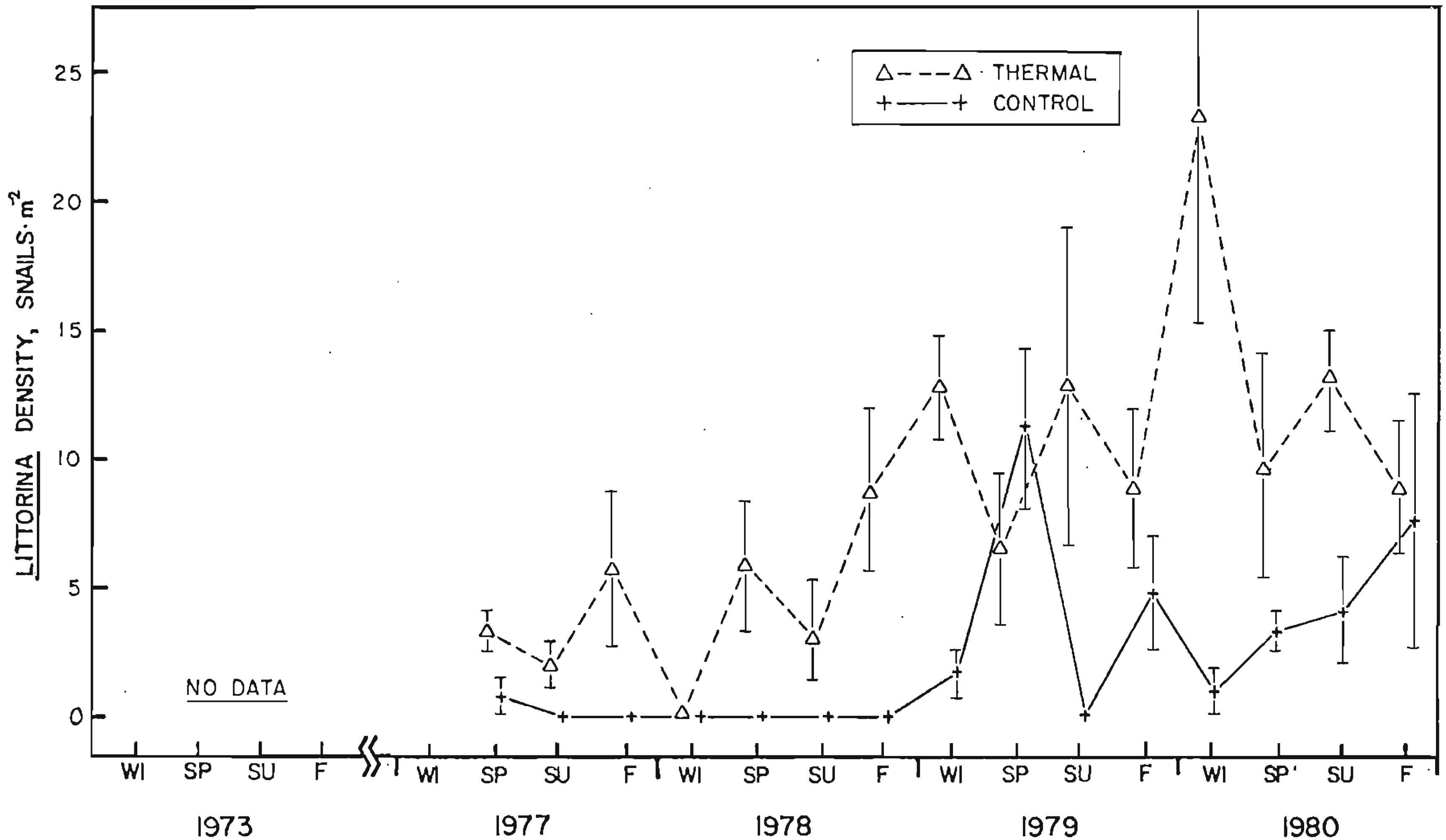


Figure II-98. Comparison of preoperational (1973) with 1977—1980 seasonal means of Littorina densities in the Juncus marshes. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

Table II-65. Comparison of *Uca* burrow densities in *Juncus* marshes for 1980 with previous year's seasonal means (± one standard error).

Season	Year	Treatment	*Uca* Burrows·m^{-2}
Winter	1973	Thermal	No data
	1977	Thermal	No data
	1978	Thermal	88 ± 18
	1979	Thermal	210 ± 55.7
	1980	Thermal	191 ± 28.4
	1973	Control	No data
	1977	Control	No data
	1978	Control	120 ± 9.7
	1979	Control	65 ± 8.27
	1980	Control	88.0 ± 18.6
Spring	1973	Thermal	No data
	1977	Thermal	153 ± 42
	1978	Thermal	277 ± 28.8
	1979	Thermal	139 ± 52.7
	1980	Thermal	233 ± 21.4
	1973	Control	No data
	1977	Control	102 ± 24*
	1978	Control	181 ± 34.9
	1979	Control	152 ± 44.1
	1980	Control	222 ± 10.2
Summer	1973	Thermal	No data
	1977	Thermal	No data
	1978	Thermal	377 ± 38.4
	1979	Thermal	170 ± 26.6*
	1980	Thermal	450 ± 65.6
	1973	Control	No data
	1977	Control	189 ± 20
	1978	Control	293 ± 22.1
	1979	Control	189 ± 32.7
	1980	Control	252 ± 46.7
Fall	1973	Thermal	No data
	1977	Thermal	197 ± 21
	1978	Thermal	276 ± 24.3
	1979	Thermal	242 ± 17.5
	1980	Thermal	182 ± 53.6
	1973	Control	No data
	1977	Control	134 ± 21
	1978	Control	290 ± 16.5*
	1979	Control	205 ± 41.1
	1980	Control	138 ± 19.1

*Indicates a significant difference at a 95% confidence level was recorded when compared with the 1980 seasonal mean.

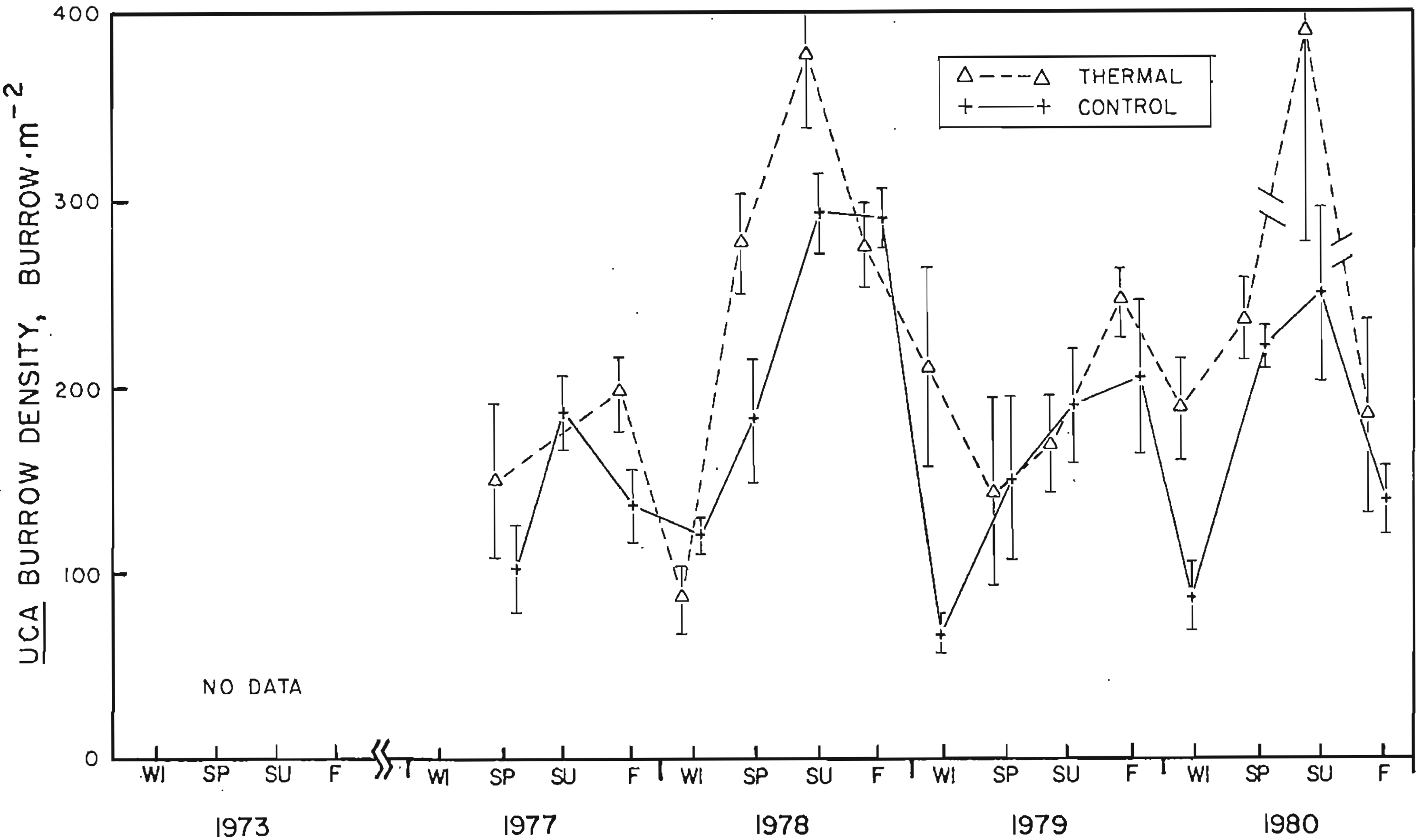


Figure II-99. Comparison of preoperational (1973) with 1977–1980 seasonal means of Uca burrow densities in the Juncus marshes. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

Table II-66. Comparison of *Juncus* flowering shoot densities for 1980 with previous year's seasonal means ($\pm$ one standard error).

Season	Year	Treatment	Flowering *Juncus* Shoots$\cdot m^{-2}$
Winter	1973	Thermal	No data
	1977	Thermal	No data
	1978	Thermal	0
	1979	Thermal	0
	1980	Thermal	0
	1973	Control	No data
	1977	Control	No data
	1978	Control	0
	1979	Control	0
	1980	Control	0
Spring	1973	Thermal	No data
	1977	Thermal	2.4 ± 2.4
	1978	Thermal	6.7 ± 4.37
	1979	Thermal	0
	1980	Thermal	0.8 ± 0.8
	1973	Control	No data
	1977	Control	16.0 ± 6.7
	1978	Control	6.2 ± 3.41
	1979	Control	4.8 ± 3.2
	1980	Control	1.6 ± 1.0
Summer	1973	Thermal	No data
	1977	Thermal	0
	1978	Thermal	0
	1979	Thermal	0
	1980	Thermal	0
	1973	Control	No data
	1977	Control	0
	1978	Control	0
	1979	Control	3.2 ± 3.2
	1980	Control	0
Fall	1973	Thermal	No data
	1977	Thermal	0
	1978	Thermal	0
	1979	Thermal	0
	1980	Thermal	0
	1973	Control	No data
	1977	Control	2.4 ± 1.6
	1978	Control	0
	1979	Control	0
	1980	Control	0

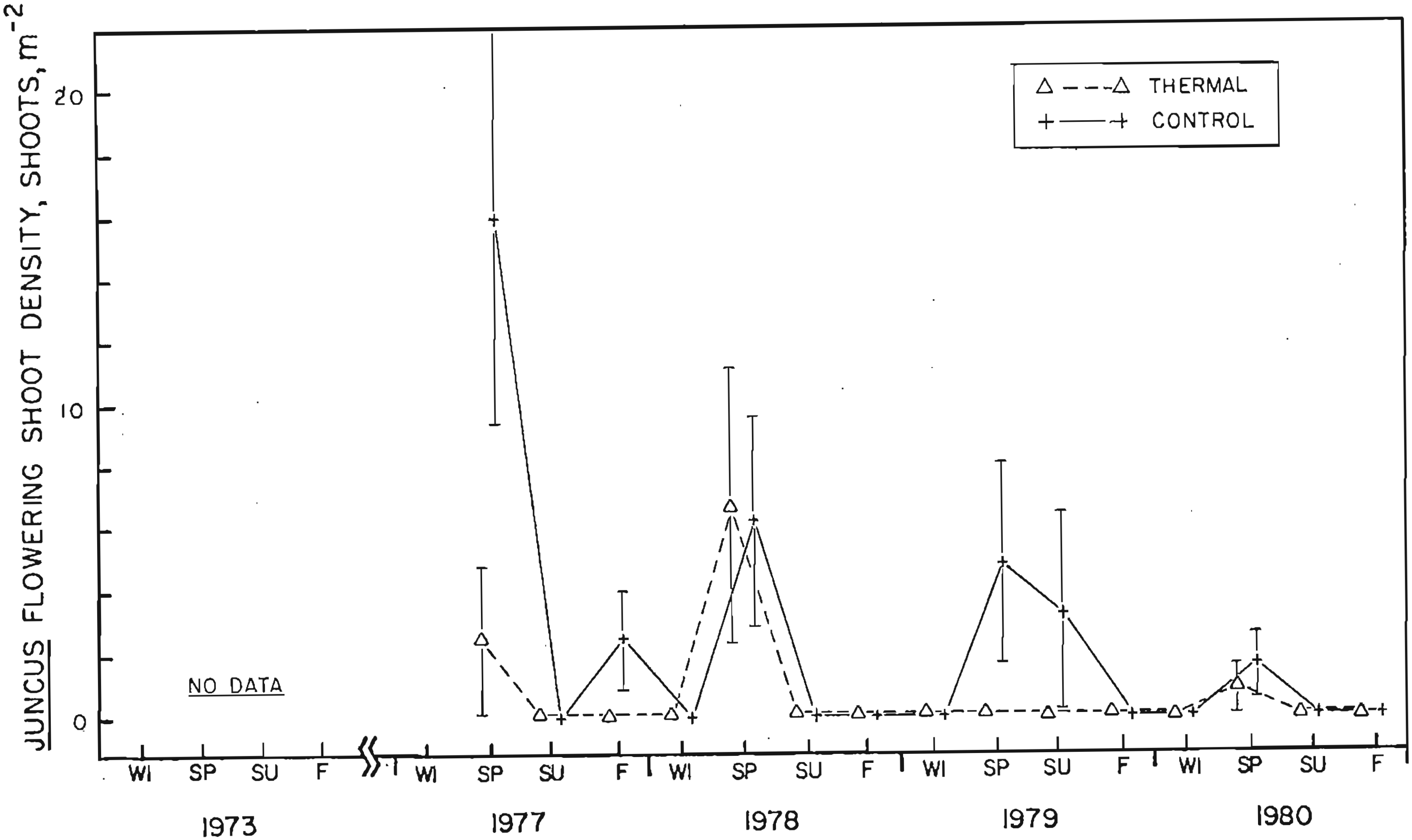


Figure II-100. Comparison of preoperational (1973) with 1977–1980 seasonal means of *Juncus* flowering shoot densities. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

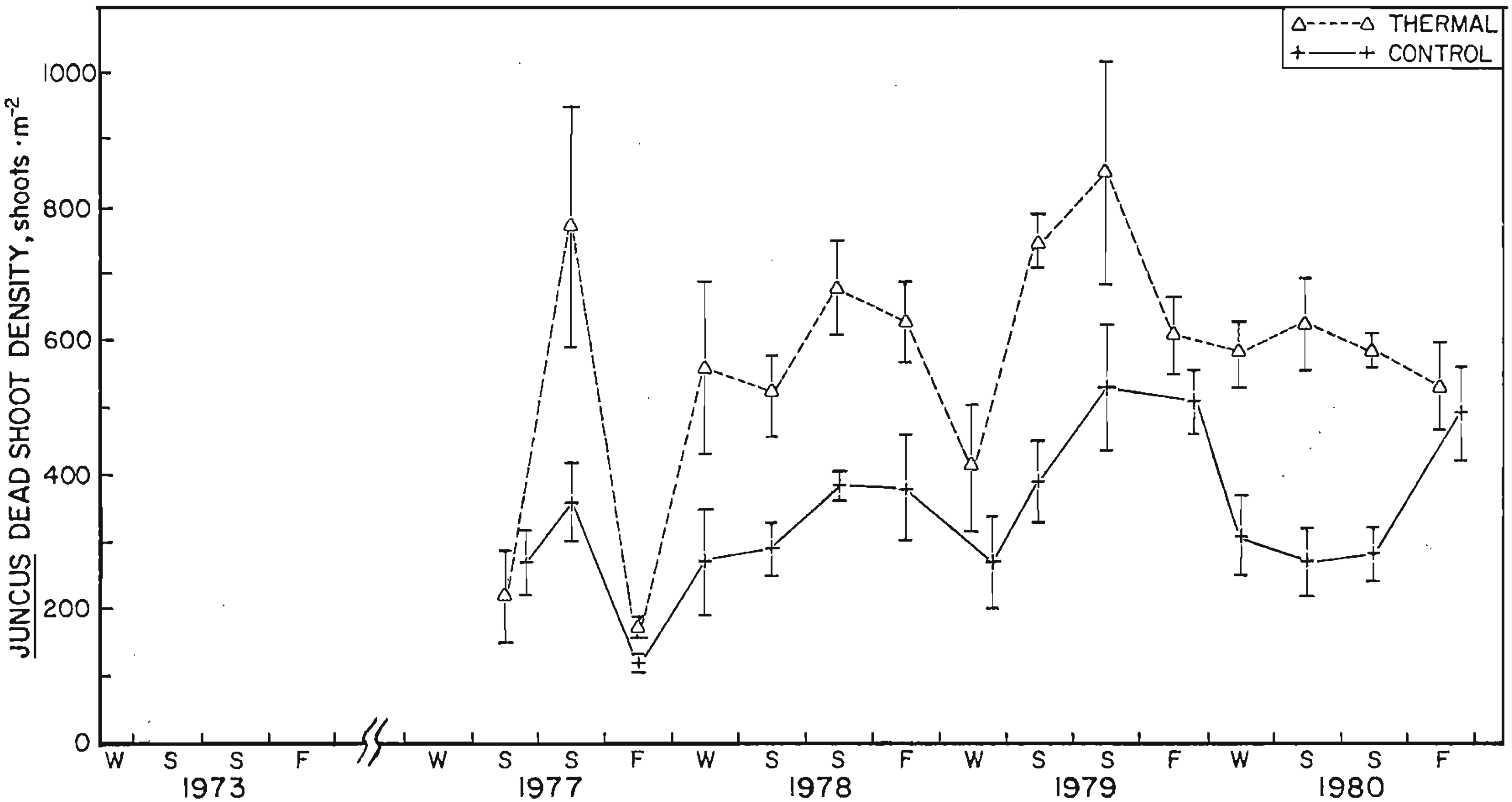


Figure II-101. Comparison of preoperational (1973) with 1977–1980 seasonal means of Juncus dead shoot densities. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

Juncus Metabolism Comparisons

In the thermal marsh, 1980 net productivity means were significantly greater than those of spring 1973 and winter and summer 1978 (Table II-67 and Fig. II-102). Nighttime respiration values were not significantly different during the postoperational years (Fig. II-103). An unusually high 1980 winter gross productivity mean at the control marsh (Fig. II-104), was significantly higher than values recorded during 1977 and 1978.

Comparisons of P/R ratios are given in Table II-68 and Fig. II-105. The 1980 summer mean in the control marsh was significantly higher than in 1978 and significantly lower than in 1979. This parameter was significantly lower during winter 1978 in the thermal marsh.

Discussion

1980 Biomass Values

In the *Spartina* marshes, maximum values of aboveground biomass weights, specific weights, and stalk heights were found at the end of the growing season in the fall. This represented the end of the accumulation of the years productivity. Quantitatively, the *Spartina* control marsh maintained a slightly larger storage of total aboveground biomass (fewer but taller plants) while the thermally affected plots contained a greater number of smaller plants per square meter. This resulted in greater seasonal means of specific weight in the *Spartina* control area.

Data on net production of *Juncus* and the graphs of *Juncus* biomass indicate that the peak of the growing season occurred in the spring and summer. Winter production was less in thermal and control areas suggesting light limitations and/or effect of air temperature. As in the *Spartina* communities there was apparent lengthening of the growing season in

Table II-67. Comparison of _Juncus_ metabolism for 1980 with previous year's seasonal means (± one standard error).

Season	Date	Treatment	Sample Size	Insolation, $kcal \cdot m^{-2} \cdot d^{-1}$	Air Temperature, °C	Net Productivity, $g\ C \cdot m^{-2} \cdot d^{-1}$	Nighttime Respiration, $g\ C \cdot m^{-2} \cdot d^{-1}$	Gross Productivity, $g\ C \cdot m^{-2} \cdot d^{-1}$
Winter	77*	Thermal	*	No data	No data	No data	No data	No data
	1/31/78	Thermal	2	905	11.8	1.14 ± 0.18†	1.01 ± 0.20	2.15 ± 0.02†
	1/13/79	Thermal	2	2664	9.8	2.97 ± 0.05	1.06 ± 0.08	4.02 ± 0.13
	1/05/80	Thermal	4	2196	8.9	5.93 ± 0.90	1.21 ± 0.21	7.14 ± 1.02
	2/02/78	Control	2	453	15.9	1.07 ± 0.37	1.05 ± 0.06	2.12 ± 0.31
	1/06/79	Control	2	2119	13.2	2.59 ± 0.35	0.87 ± 0.03	3.46 ± 0.38
	1/03/80	Control	4	2315	13.4	2.82 ± 2.05	1.76 ± 0.25	4.58 ± 2.13
Spring	3/07/73	Thermal	4	4590	22.0	2.40 ± 0.31†	2.22 ± 0.34	4.62 ± 0.30
	5/01/77	Thermal	3	4369	22.2	3.09 ± 0.89	4.60 ± 1.4	7.69 ± 1.5
	4/11/78	Thermal	3	5960	26.4	3.39 ± 0.63	2.68 ± 0.31	6.57 ± 0.38
	3/31/79	Thermal	4	3353	23.5	4.82 ± 0.55	2.16 ± 0.46	6.98 ± 0.49
	3/26/80	Thermal	4	2683	19.6	5.81 ± 0.84	3.13 ± 0.99	8.91 ± 1.74
	3/12/73	Control	2	4604	23.4	6.33 ± 0.33	3.03 ± 1.13	9.37 ± 0.56
	5/08/77	Control	2	3251	24.5	4.88 ± 0.24	2.88 ± 0.07	7.77 ± 0.25
	4/08/78	Control	4	6761	27.2	5.07 ± 0.41	2.67 ± 0.31	7.74 ± 0.59
	4/06/79	Control	2	3679	26.7	4.94 ± 1.26	1.24 ± 0.25	6.19 ± 1.00
	3/28/80	Control	2	3098	21.1	6.60 ± 0.55	2.33 ± 0.33	8.83 ± 0.88
Summer	7/28/73	Thermal	4	5000	29.7	3.84 ± 0.49	2.30 ± 0.16	6.14 ± 0.47
	7/24/77	Thermal	6	4661	30.2	4.71 ± 0.22	2.09 ± 0.21	6.80 ± 0.32
	7/06/78	Thermal	2	No data	30.4	1.49 ± 0.00†	2.36 ± 0.16	3.85 ± 0.16
	6/15/79	Thermal	2	4337	25.4	5.08 ± 1.07	1.48 ± 0.01	6.56 ± 1.08
	7/11/80	Thermal	3	2643	31.0	3.59 ± 0.41	2.61 ± 0.57	6.20 ± 0.74
	7/28/73	Control	2	3500	28.3	4.52 ± 0.75	3.22 ± 0.46	7.74 ± 0.84
	7/20/77	Control	4	4593	31.2	5.06 ± 0.44	1.73 ± 0.02	6.78 ± 0.46
	7/01/78	Control	4	2407	30.8	3.66 ± 0.52	3.28 ± 0.38	6.93 ± 0.89
	6/14/79	Control	2	5370	25.4	6.94 ± 1.21	1.26 ± 0.23	8.20 ± 1.44
	7/04/80	Control	4	3691	34.5	5.86 ± 0.88	2.11 ± 0.48	7.98 ± 1.28

Table II-67 (Cont'd).

Season	Date	Treatment	Sample Size	Insolation, kcal$\cdot m^{-2}\cdot d^{-1}$	Air Temperature, °C	Net Productivity, g $C\cdot m^{-2}\cdot d^{-1}$	Nighttime Respiration, g $C\cdot m^{-2}\cdot d^{-1}$	Gross Productivity, g $C\cdot m^{-2}\cdot d^{-1}$
Fall	73*	Thermal	*	No data	No data	No data	No data	No data
	10/06/77	Thermal	4	4141	23.9	1.52 ± 0.39	1.48 ± 0.32	3.00 ± 0.15
	9/28/78	Thermal	3	955	25.3	3.90 ± 0.66	1.66 ± 0.18	5.56 ± 0.73
	9/11/79	Thermal	4	3100	27.5	2.41 ± 0.38	1.61 ± 0.07	4.03 ± 0.42
	10/11/80	Thermal	4	2815	28.0	3.55 ± 2.03	2.50 ± 0.60	6.04 ± 2.38
	73*	Control	*	No data	No data	No data	No data	No data
	10/10/77	Control	4	3561	25.4	2.68 ± 0.37	1.47 ± 0.31	4.15 ± 0.53†
	9/24/78	Control	2	2679	28.3	2.48 ± 0.11	1.27 ± 0.26	3.75 ± 0.37†
	9/12/79	Control	4	2401	28.8	3.44 ± 0.47	2.38 ± 0.63	5.82 ± 1.07
	10/05/80	Control	4	2477	23.0	9.42 ± 3.62	2.84 ± 0.75	12.26 ± 4.28

*Not available.

†Indicates a significant difference at a 95% confidence level was recorded when compared with the 1980 seasonal mean.

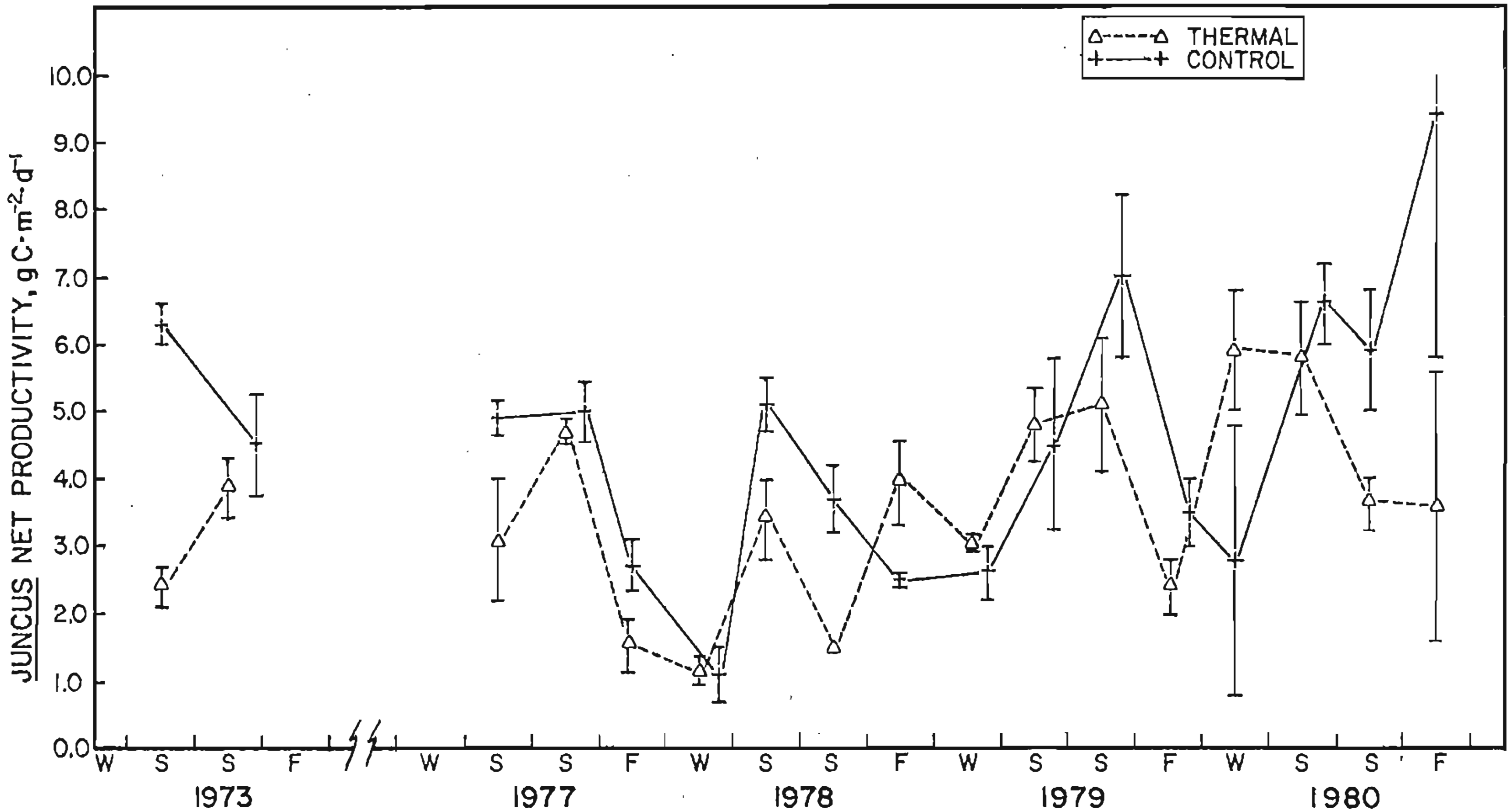


Figure II-102. Comparison of preoperational (1973) with 1977–1980 seasonal means of *Juncus* net productivity. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

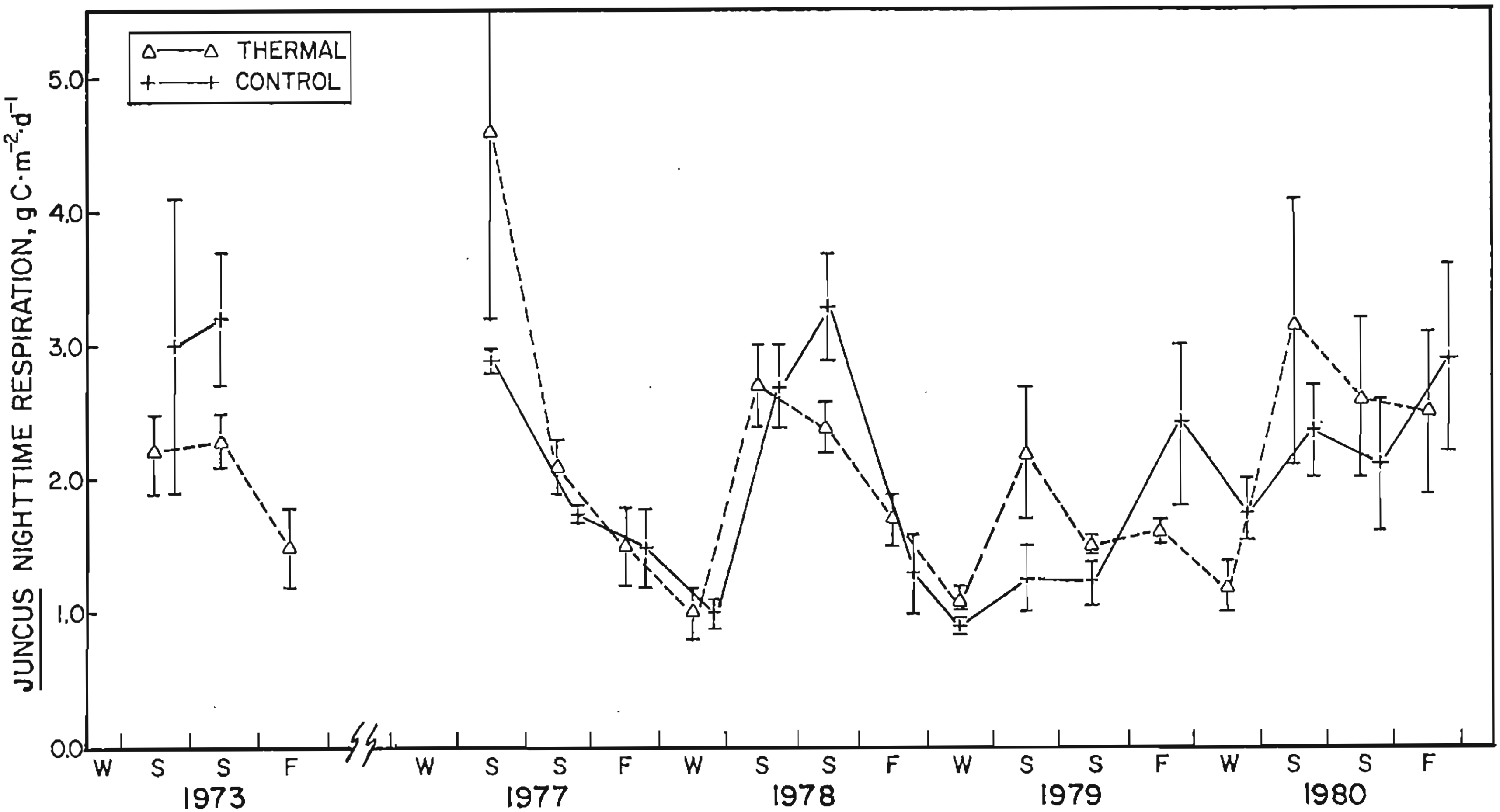


Figure II-103. Comparison of preoperational (1973) with 1977—1980 seasonal means of *Juncus* nighttime respiration. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

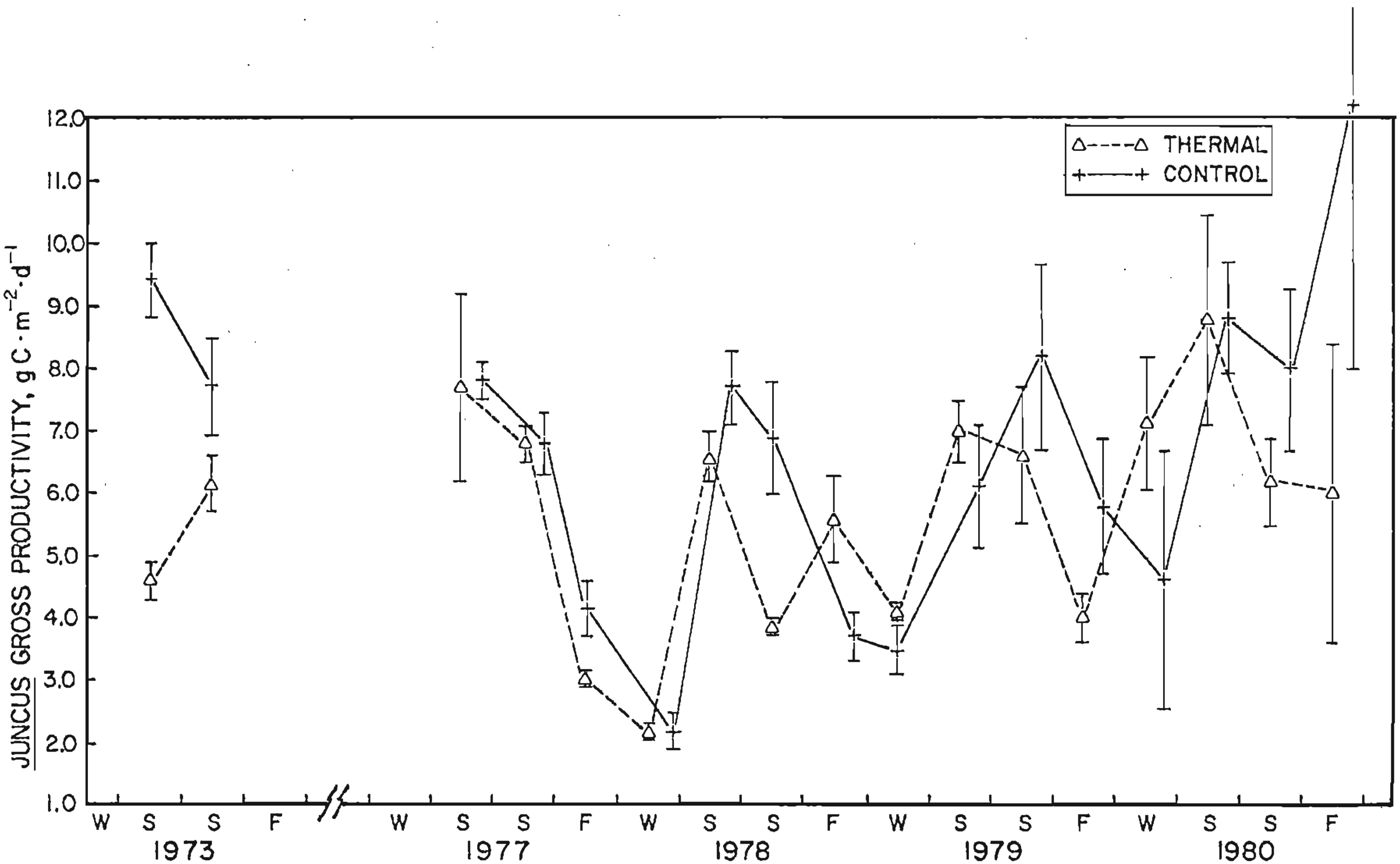


Figure II-104. Comparison of preoperational (1973) with 1977–1980 seasonal means of <u>Juncus</u> gross productivity. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

Table II-68. Comparison of *Juncus* P/R ratios for 1980 with previous year's seasonal means (± one standard error).

Season	Year	Treatment	P/R Ratio
Winter	1973	Thermal	No data
	1977	Thermal	No data
	1978	Thermal	1.17 ± 0.19*
	1979	Thermal	2.17 ± 0.11
	1980	Thermal	3.50 ± 0.59
	1973	Control	No data
	1977	Control	No data
	1978	Control	0.73 ± 0.03
	1979	Control	2.25 ± 0.16
	1980	Control	1.52 ± 0.62
Spring	1973	Thermal	1.04
	1977	Thermal	1.02 ± 0.20
	1978	Thermal	1.28 ± 0.22
	1979	Thermal	1.83 ± 0.35
	1980	Thermal	1.84 ± 0.74
	1973	Control	1.45
	1977	Control	1.37
	1978	Control	1.51 ± 0.14
	1979	Control	2.79 ± 0.95
	1980	Control	1.99 ± 0.10
Summer	1973	Thermal	1.34
	1977	Thermal	1.62 ± 0.08
	1978	Thermal	0.78 ± 0.03
	1979	Thermal	1.83 ± 0.29
	1980	Thermal	1.02 ± 0.15
	1973	Control	1.06
	1977	Control	1.86 ± 0.08
	1978	Control	1.05 ± 0.03*
	1979	Control	2.69 ± 0.02*
	1980	Control	1.61 ± 0.19
Fall	1973	Thermal	No data
	1977	Thermal	1.12 ± 0.26
	1978	Thermal	1.77 ± 0.25
	1979	Thermal	1.19 ± 0.11
	1980	Thermal	1.22 ± 0.38
	1973	Control	No data
	1977	Control	1.66 ± 0.24
	1978	Control	1.58 ± 0.17
	1979	Control	1.25 ± 0.08
	1980	Control	2.13 ± 0.42

*Indicates a significant difference at a 95% confidence level was recorded when compared with the 1980 seasonal mean.

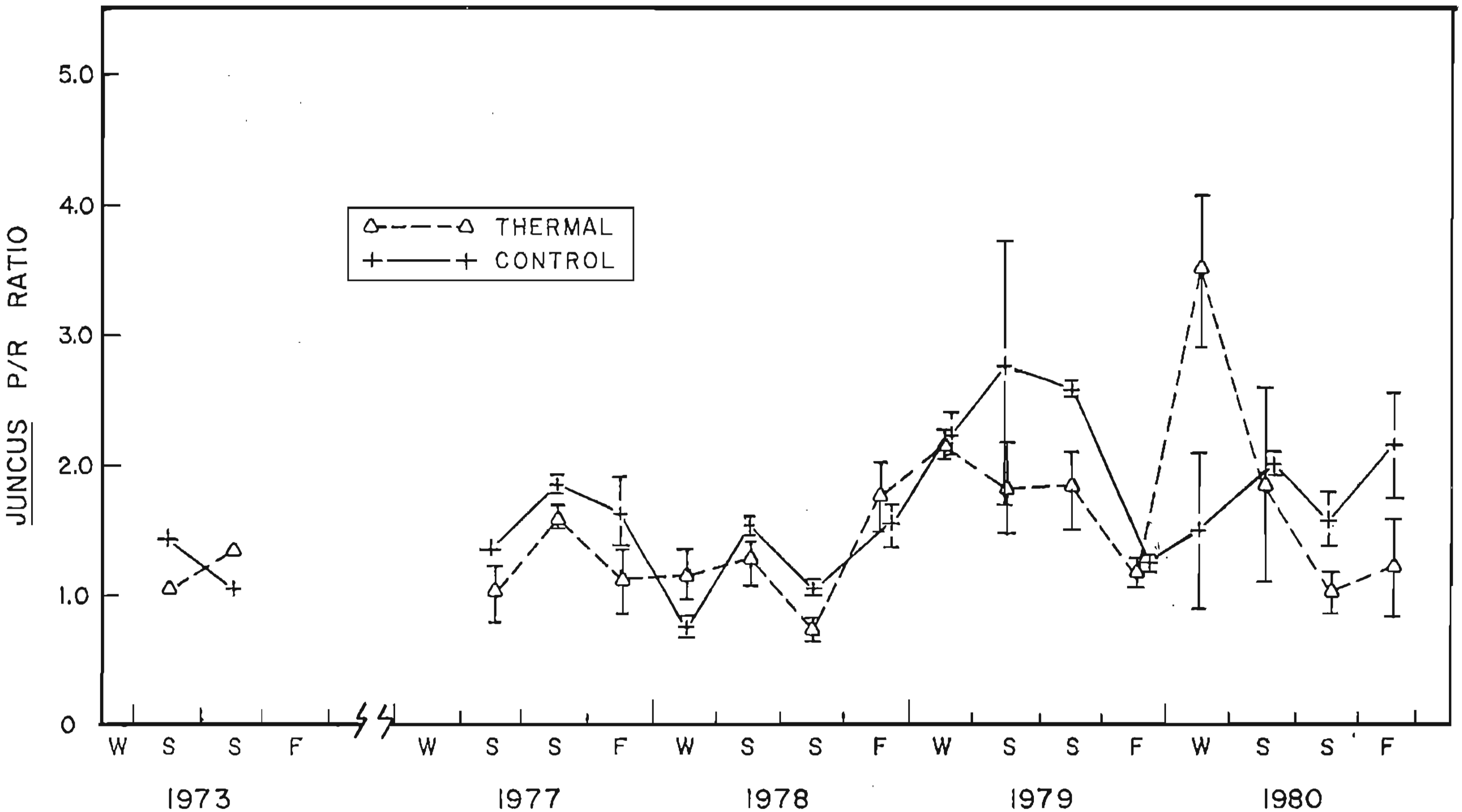


Figure II-105. Comparison of preoperational (1973) with 1977–1980 seasonal means of *Juncus* P/R ratios. Bars represent ± one standard error. Asterisks indicate that a significant difference at a 95% confidence level was recorded when compared to the 1980 seasonal means.

the discharge marsh attributable to the thermal effluent. Unlike the Spartina communities, the Juncus thermally affected area maintained a larger storage of aboveground biomass than the control area. While shoot densities were greater in the thermal marsh, the specific weight (weight per shoot) was approximately the same in both Juncus marshes during the peak growing season and consistantly higher on the control site in the Spartina marsh. Both Juncus and Spartina plants in the thermally affected area were significantly shorter throughout the year than those in the control marsh.

In the Spartina marsh, peak flower production occurred during the fall, which is concurrent with the maximum rate of metabolism and net energy storage as indicated by the P/R ratio.

1980 Invertebrate Activity

The greater stalk density in the thermally affected marsh provided a larger surface area to potentially support greater algal growth and, in turn, greater Littorina populations. The warmer water temperatures apparently did not interfere with maintenance of snail populations in the thermally affected marsh.

The greater density of Uca burrows observed in the thermally affected marsh during the cooler months of the year (winter and spring) could possibly be attributed to the heated effluent, providing a stimulus to Uca activity.

1980 Metabolism

In the Spartina discharge marsh, the thermal loading appeared to be positively correlated with higher rates of both net productivity and nighttime respiration during the spring. This suggests that the heated water was being used by the plants to increase their production. In both

Spartina and *Juncus* marshes there was evidence that the plants maintained productivity at higher temperatures but did so with changes in size, numbers of stalks, and increased metabolism per unit biomass.

1973–1980 Long-Term Trends

The intake marsh served as the control site for comparing the effects of Unit 3's thermal discharge on the marsh. Many preoperational values were significantly different from the mean values of postoperational years. These differences could be the effects of a long-term resiliency of the control marsh from perturbation caused by previous canal dredging, the different location at sampling, stress on the site from continuous monitoring, or other such factors.

Dissimilar *Littorina* sampling techniques in 1977 and 1978 could possibly be responsible for the differences in *Littorina* density. During 1977 and 1978, *Littorina* abundance was estimated in both intake and discharge marshes at low tide as the plots were being harvested. This may have resulted in an under estimation of *Littorina* density because the snails were not readily visible. A new technique was introduced in 1979, whereby the snails were counted during high tide as they were exposed above the water level. This resulted in mean values that were significantly greater than 1977 and 1978 means.

When comparing the thermal marsh with the control, no significant differences in metabolism (gross productivity, net productivity, and respiration) were recorded in the *Juncus* marsh during 1979 and 1980 with a few being reported prior to then. In addition many *Juncus* biomass parameters have shown significant changes in the thermal marsh throughout the postoperational years. These changes include a trend in shortening of shoot heights, increasing the shoot density and increasing the *Littorina* density. These changes are accompanied by no significant differences in aboveground biomass. These changes (metabolism and biomass) are concurrent with those of the *Spartina* marsh. This suggests that the thermal effluent inundating the marsh is changing its morphology but having little affect on the marsh productivity.

Summary

1. As in previous years, both *Juncus* and *Spartina* marshes in the thermally affected areas were characterized by shorter, lower specific weight, and more numerous plants per unit area than the control marshes. Higher dead *Juncus* biomass was measured in the thermal marsh. Marsh productivies were similar in thermal and control marshes.
2. Seasonal mean *Littorina* biomass was consistently higher in both *Juncus* and *Spartina* thermal marshes than in their control marshes.
3. *Uca* burrow densities in the *Spartina* marsh were greater in the discharge area than in the intake area in the cooler seasons (winter and spring). This suggests stimulation of invertebrate activity in response to thermal loading.
4. Differences in specific weight, stalk heights, and stalk density that were observed between *Spartina* 1980 and previous years' measurements on the intake suggest either structurally different communities have been sampled or the control marsh is undergoing long-term biomass fluctuations.

CHAPTER 7

COMPARISON OF SELECTED PREOPERATIONAL AND OPERATIONAL MEASUREMENTS THAT CHANGED BY MORE THAN TWO STANDARD DEVIATIONS

Introduction

This chapter presents a comparison of selected parameters between the preoperational (1973) and operational (1980) discharge areas as required by the CR3 Environmental Technical Specifications (ETS). This necessitates the reporting of "any parameter measured that changes beyond 2σ (two standard deviations) of the value measured in the preoperational monitoring program."

The measured parameters for the inner (A) and outer (B) discharge bays were gross productivity, net productivity, and respiration. In the discharge marsh area, gross productivity, net productivity, respiration, live biomass, and dead biomass of *Juncus roemarianus* and *Spartina alterniflora* were measured. Seasonal means and two standard deviations were calculated for each of the preoperational study parameters. Seasonal means for the operational year that exceeded the two standard deviation limit of the preoperational study are designated by an asterisk.

Results

Seasonal means of the preoperational and operational studies for the inner and outer discharge bay (A and B, respectively) are presented in Table II-69. The parameters used in comparing the preoperational and operational studies in the discharge marsh are given in Table II-70 and II-71.

Table II-69. Seasonal means of the inner discharge bays (A and B) from the 1980 operational and 1973 preoperational studies. Asterisks indicate that the 1980 value exceeded two standard deviations (2σ) of the 1973 preoperational value.

Station	Season	P_G, g $O_2 \cdot m^{-2} \cdot d^{-1}$	P_N, g $O_2 \cdot m^{-2} \cdot d^{-1}$	R, g $O_2 \cdot m^{-2} \cdot d^{-1}$
A	Winter 1973	3.25 ± 4.06	1.40 ± 1.38	1.85 ± 3.22
	1980	1.11	0.71	0.40
	Spring 1973	4.05 ± 3.88	2.13 ± 2.28	1.92 ± 1.94
	1980	2.32	1.48	0.84
	Summer 1973	4.40 ± 5.36	2.10 ± 3.16	2.30 ± 2.76
	1980	1.64	0.81	0.83
	Fall 1973	3.27 ± 0.98	1.20 ± 0.20	2.07 ± 0.84
	1980	0.71*	0.52*	0.19*
B	Winter 1973	3.18 ± 2.46	1.38 ± 1.72	1.80 ± 1.26
	1980	2.82	1.79	1.03
	Spring 1973	No data	No data	No data
	1980	5.35	3.05	2.30
	Summer 1973	6.64 ± 3.78	3.47 ± 2.70	3.16 ± 1.68
	1980	6.35	3.42	2.93
	Fall 1973	5.53 ± 4.32	2.68 ± 1.80	2.85 ± 2.64
	1980	3.10	1.73	1.37

Table II-70. Comparison of preoperational (1973) with operational (1980) seasonal means for *Juncus roemarianus* in the discharge marsh area. Asterisks indicate those means that exceeded two standard deviations (2σ) of preoperational seasonal means.

	Live Weight, $g \cdot m^{-2}$	Dead Weight, $g \cdot m^{-2}$	Net Productivity, $g\ C \cdot m^{-2} \cdot d^{-1}$	Night Respiration, $g\ C \cdot m^{-2} \cdot d^{-1}$	Gross Productivity, $g\ C \cdot m^{-2} \cdot d^{-1}$
Winter 1973	475 ± 210	880 ± 140	No data	No data	No data
1980	1282*	1291*	6.14	1.25	7.40
Spring 1973	515 ± 228	830 ± 150	2.40 ± 1.86	2.22 ± 2.06	4.62 ± 1.82
1980	1099*	1433*	9.25*	3.08	12.33*
Summer 1973	525 ± 320	980 ± 430	3.84 ± 2.58	2.30 ± 0.82	6.14 ± 2.48
1980	1164*	1519*	3.96	2.77	6.72
Fall 1973	520 ± 310	860 ± 360	No data	No data	No data
1980	1130*	1094*	3.55	2.50	6.04

Table II-71. Comparison of preoperational (1973) with operational (1980) seasonal means for *Spartina alterniflora* in the discharge marsh area. Asterisks indicate those means that exceeded two standard deviations (2σ) of preoperational seasonal means.

	Live Weight, $g \cdot m^{-2}$	Dead Weight, $g \cdot m^{-2}$	Net Productivity, $g\ C \cdot m^{-2} \cdot d^{-1}$	Night Respiration, $g\ C \cdot m^{-2} \cdot d^{-1}$	Gross Productivity, $g\ C \cdot m^{-2} \cdot d^{-1}$
Winter 1973	150 ± 220	335 ± 150	No data	No data	No data
1980	485*	178*	- 0.28	0.93	0.65
Spring 1973	225 ± 175	350 ± 170	1.41 ± 1.04	1.78 ± 2.96	3.18 ± 2.30
1980	412*	400	3.38*	2.15	5.53*
Summer 1973	420 ± 200	450 ± 133	5.83 ± 5.00	1.22 ± 0.74	7.50 ± 4.76
1980	754*	323	2.16	1.77	3.93
Fall 1973	560 ± 232	465 ± 266	No data	No data	No data
1980	970*	290	2.28	1.77	4.05

Summary

Discharge Bays

1. The mean system gross productivity, net productivity, and nighttime respiration exceeded the two standard deviation limit for the fall operational (1980) season. It should be noted that the fall preoperational (1973) mean was based on only three samples, whereas the 1980 mean was obtained from twelve samples.
2. All other operational means from the inner and outer discharge bays fell within two standard deviations of the preoperational means.

Discharge Marsh Area

1. Operational (1980) mean live weights of both *Juncus roemarianus* and *Spartina alterniflora* were outside the two standard deviation limit of 1973 means. In all cases, operational means for 1980 were higher than 1973 means.
2. *J. roemarianus* dead weight means for 1980 were outside the two standard deviation limit of 1978 means during the winter, spring, and summer. In each case the 1980 means were higher than the 1973 means.
3. *S. alterniflora* dead weight means for winter 1980 were outside the two standard deviation limit of the 1973 means.
4. Both *J. roemarianus* and *S. alterniflora* gross productivity and night respiration means for 1980 were above the 1973 preoperational two standard deviation limit during the spring season.

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APPENDIX A

SUMMARY OF DATA FROM THE INNER DISCHARGE BAY (A) AND ITS CONTROL BAY (E)

EXPLANATORY KEY OF TABLE CAPTIONS IN APPENDIX A

OBS—Observation #.

STATION—See Figure II-1b.

SEASON—See descriptions in chapter 3.

PG—System gross productivity (g $O_2 \cdot m^{-2} \cdot d^{-1}$).

PN—System daytime net productivity (g $O_2 \cdot m^{-2} \cdot d^{-1}$).

R—System night respiration (g $O_2 \cdot m^{-2} \cdot d^{-1}$).

PLANKPG—Plankton gross productivity (g $O_2 \cdot m^{-2} \cdot d^{-1}$).

PLANKPN—Plankton 24-hour net productivity (g $O_2 \cdot m^{-2} \cdot d^{-1}$).

PLANKR—Plankton 24-hour respiration (g $O_2 \cdot m^{-2} \cdot d^{-1}$).

INSOL—Insolation ($kcal \cdot m^{-2} \cdot d^{-1}$).

TEMP—Temperature (°C).

SAL—Salinity (‰).

EXTINCT—Extinction coefficient (m^{-1}).

MONTH—(Self-explanatory).

DAY—Day (calculated as percentage of 30 or 31 days in the month).

YEAR—(Self-explanatory).

PRRATIO—(calculated as PG/2R).

ECOLEFF—Ecological efficiency (calculated as [4 x PG]/INSOL).

STATION=A

OBS	STATION	SEASON	PG	PN	R	PLANKPG	PLANKPN	PLANKR	INSOL	TEMP	SAL	EXTINCT	MONTH	DAY	YEAR	PRRATIO	ECOLEFF
1	A	FA	3.50	1.30	2.20	1.00	0.60	0.40	4490	25.0	27.5	.	1	0.0	73	0.7955	0.00311804
2	A	WI	5.58	2.04	3.54	.	.	.	.	25.8	27.8	.	1	0.5	73	0.7881	.
3	A	FA	2.70	1.10	1.60	0.70	0.50	0.20	.	22.0	27.0	.	1	0.9	73	0.8438	.
4	A	FA	3.60	1.20	2.40	0.70	0.50	0.20	.	21.5	27.5	.	1	0.9	73	0.7500	.
5	A	FA	.	.	.	0.90	0.70	0.20	3850	21.0	26.5	.	1	0.9	73	.	.
6	A	WI	1.83	1.50	0.33	.	.	.	.	20.0	27.5	.	1	73.0	73	2.7727	.
7	A	WI	2.34	0.67	1.67	.	.	.	.	16.0	16.2	.	2	0.0	73	0.7006	.
8	A	SP	9.10	4.80	4.30	.	.	.	.	28.3	22.5	.	5	33.0	73	1.0581	.
9	A	SP	6.20	2.90	3.30	.	.	.	.	28.4	21.2	.	5	37.0	73	0.9394	.
10	A	SP	3.70	2.60	1.10	.	.	.	6500	32.0	28.0	.	5	80.0	73	1.6818	0.00227692
11	A	SP	2.40	1.70	0.70	.	.	.	6409	33.0	27.7	.	5	83.0	73	1.7143	0.00149789
12	A	SP	4.10	2.30	1.80	1.60	1.20	0.40	5834	30.7	27.7	.	5	87.0	73	1.1389	0.00281111
13	A	SP	3.00	1.50	1.50	.	.	.	.	31.5	22.3	.	6	47.0	73	1.0000	.
14	A	SP	5.70	3.50	2.20	.	.	.	.	33.0	28.0	.	6	57.0	73	1.2955	.
15	A	SP	4.10	1.60	2.50	.	.	.	.	33.0	26.0	.	6	58.0	73	0.8200	.
16	A	SP	3.00	2.10	0.90	.	.	.	.	33.5	27.0	.	6	60.0	73	1.6667	.
17	A	SP	1.30	0.00	1.30	.	.	.	.	33.3	26.5	.	6	63.0	73	0.5000	.
18	A	SP	4.30	2.40	1.90	4.70	2.50	2.20	.	33.0	27.5	.	6	67.0	73	1.1316	.
19	A	SP	3.80	1.70	2.10	.	.	.	.	32.5	27.0	.	6	70.0	73	0.9048	.
20	A	SP	2.20	1.00	1.20	.	.	.	.	32.0	26.0	.	6	73.0	73	0.9167	.
21	A	SP	3.80	1.70	2.10	.	.	.	.	30.3	24.5	.	6	97.0	73	0.9048	.
22	A	SU	10.70	5.90	4.80	.	.	.	.	31.3	22.5	.	7	23.0	73	1.1146	.
23	A	SU	6.10	3.50	2.60	1.00	0.70	0.30	6115	34.0	27.5	.	7	87.0	73	1.1731	0.00399019
24	A	SU	5.70	2.20	3.50	.	.	.	.	34.0	25.0	.	8	7.0	73	0.8143	.
25	A	SU	2.20	0.90	1.30	0.60	0.50	0.10	2869	34.0	26.0	.	8	10.0	73	0.8462	0.00304604
26	A	SU	5.40	1.90	3.50	.	.	.	.	30.5	27.5	.	8	73.0	73	0.7714	.
27	A	SU	2.50	1.20	1.30	1.30	0.90	0.40	.	31.5	27.2	.	8	76.0	73	0.9615	.
28	A	SU	2.90	1.40	1.50	.	.	.	.	31.2	27.5	.	8	80.0	73	0.9667	.
29	A	SU	2.40	2.30	0.10	.	.	.	.	33.0	28.5	.	8	83.0	73	12.0000	.
30	A	SU	2.40	0.60	1.80	.	.	.	.	31.5	27.2	.	8	86.0	73	0.6667	.
31	A	SU	3.70	1.10	2.60	.	.	.	.	32.0	27.5	.	8	90.0	73	0.7115	.
32	A	SP	0.40	0.14	0.26	0.24	0.21	0.03	.	26.3	24.6	1.90	4	23.0	77	0.7692	.
33	A	SP	2.99	2.39	0.60	0.39	-0.39	0.78	.	35.3	28.4	1.80	6	97.0	77	2.4917	.
34	A	SU	0.18	-0.10	0.28	0.29	-0.65	0.94	4200	35.1	28.0	2.00	7	0.0	77	0.3214	0.00017143
35	A	SU	1.80	1.80	0.00	-0.39	-0.92	0.53	7400	37.3	29.3	1.30	7	37.0	77	.	0.00097297
36	A	SU	0.43	0.18	0.25	0.04	-0.45	0.49	5570	37.1	29.8	1.10	7	43.0	77	0.8600	0.00030880
37	A	SU	-0.13	-0.45	0.32	0.14	-0.04	0.18	4780	34.9	30.1	2.30	8	30.0	77	-0.2031	-0.00010879
38	A	SU	-0.28	-0.45	0.17	2.03	0.25	1.78	6030	34.3	30.9	2.30	8	33.0	77	-0.8235	-0.00018574
39	A	SU	1.45	0.44	0.84	1.44	1.16	0.28	3870	30.1	28.1	1.70	8	73.0	77	0.8631	0.00149871
40	A	SU	2.45	1.75	0.70	1.84	1.73	0.11	5230	30.7	26.3	1.40	8	77.0	77	1.7500	0.00187380
41	A	SU	1.70	1.35	0.35	0.73	0.53	0.20	6579	33.8	29.6	1.90	9	27.0	77	2.4286	0.00103359
42	A	SU	0.15	0.15	0.00	1.55	1.15	0.40	6462	35.8	32.5	1.90	9	63.0	77	.	0.00009285
43	A	SU	0.49	0.39	0.10	0.97	0.72	0.25	4896	35.9	32.5	1.70	9	67.0	77	2.4500	0.00040033
44	A	FA	1.92	0.13	1.79	0.66	0.37	0.29	5466	33.8	31.2	1.50	10	3.0	77	0.5363	0.00140505
45	A	FA	0.83	0.16	0.67	0.97	0.78	0.19	5238	33.4	31.1	2.10	10	7.0	77	0.6194	0.00063383
46	A	FA	0.27	0.27	0.00	0.56	0.42	0.14	6462	26.7	28.5	1.30	10	57.0	77	.	0.00016713
47	A	FA	0.48	0.48	0.00	0.66	0.40	0.26	6227	26.1	28.0	1.10	10	60.0	77	.	0.00030833
48	A	FA	0.16	0.06	0.10	0.68	0.56	0.12	2961	27.3	29.7	1.40	11	3.0	77	0.8000	0.00021614
49	A	FA	0.27	0.27	0.00	0.49	0.27	0.22	4441	19.5	29.3	1.40	11	47.0	77	.	0.00024319
50	A	FA	0.39	0.39	0.00	0.61	0.31	0.30	4347	23.3	30.0	1.40	11	50.0	77	.	0.00035887
51	A	FA	0.39	0.37	0.02	0.06	-0.01	0.07	2619	23.8	25.6	1.20	11	97.0	77	9.7500	0.00059565
52	A	FA	0.37	0.29	0.08	.	1.00	.	3416	25.4	25.9	1.10	11	99.0	77	2.3125	0.00043326
53	A	FA	0.63	0.63	0.00	0.54	0.37	0.17	.	22.7	29.0	.	12	63.0	77	.	.
54	A	FA	0.48	0.48	0.00	0.28	0.24	0.04	.	22.9	28.5	.	12	67.0	77	.	.
55	A	WI	0.23	0.13	0.10	0.29	0.20	0.09	159	13.0	23.8	.	2	3.0	78	1.1500	0.00578616
56	A	WI	0.93	0.49	0.44	0.40	0.33	0.07	453	13.1	24.5	.	2	7.0	78	1.0568	0.00821192
57	A	WI	0.51	0.51	0.00	0.79	0.79	0.00	1013	17.4	26.9	.	2	60.0	78	.	0.00201382
58	A	WI	0.49	0.49	0.00	0.51	0.29	0.22	1358	18.0	26.5	0.27	2	63.0	78	.	0.00144330
59	A	WI	0.64	0.64	0.00	0.65	0.54	0.11	2028	18.4	22.7	1.70	3	13.0	78	.	0.00126233
60	A	WI	2.27	2.15	0.12	.	.	.	4221	19.8	19.1	2.27	3	63.0	78	9.4583	0.00215115
61	A	WI	0.45	0.41	0.04	0.68	0.68	0.00	4404	20.8	17.4	3.40	3	97.0	78	5.6250	0.00040872
62	A	WI	0.80	0.44	0.36	0.90	0.73	0.17	4383	21.5	16.7	1.55	3	99.0	78	1.1111	0.00073009
63	A	SP	3.01	1.52	1.49	1.01	0.78	0.23	4201	26.8	20.1	2.83	4	23.0	78	1.0101	0.00286598
64	A	SP	3.78	2.08	1.70	1.40	1.07	0.33	4599	27.5	20.0	2.43	4	27.0	78	1.1118	0.00328767
65	A	SP	5.33	3.00	2.33	1.27	1.07	0.20	5408	25.3	21.6	1.36	4	73.0	78	1.1438	0.00394231
66	A	SP	3.38	1.49	1.89	1.68	1.60	0.08	3551	25.5	22.6	1.55	4	77.0	78	0.8942	0.00380738
67	A	SP	5.35	3.03	2.32	3.83	3.78	0.05	4924	30.5	23.8	1.79	5	27.0	78	1.1530	0.00434606
68	A	SP	2.85	1.88	0.96	3.35	2.75	0.60	2921	31.3	23.7	1.36	5	30.0	78	1.4844	0.00390277
69	A	SP	4.68	1.72	2.96	1.99	1.67	0.32	2664	29.1	20.8	2.83	5	67.0	78	0.7905	0.00702703
70	A	SP	9.58	6.33	3.25	2.25	2.08	0.17	5569	30.5	21.2	1.89	5	70.0	78	1.4738	0.00688095
71	A	SP	2.87	2.02	0.85	1.65	1.42	0.23	4278	33.8	24.0	1.70	6	27.0	78	1.6882	0.00268350
72	A	SP	2.29	1.33	0.96	2.36	2.36	0.00	4036	33.8	23.7	1.36	6	30.0	78	1.1927	0.00226957
73	A	SP	3.15	2.12	1.03	2.85	2.63	0.23	4116	31.1	24.6	1.55	6	77.0	78	1.5291	0.00306122
74	A	SP	.	.	.	2.39	2.20	0.19	3551	.	.	.	6	80.0	78	.	.

STATION=A

OBS	STATION	SEASON	PG	PN	R	PLANKPG	PLANKPN	PLANKR	INSOL	TEMP	SAL	EXTINCT	MONTH	DAY	YEAR	PRRATIO	ECOLEFF
75	A	SU	0.46	-0.49	0.95	1.76	1.74	0.02	3830	32.8	24.5	1.42	7	23	78	0.2421	0.0004804
76	A	SU	0.72	-0.31	1.03	1.44	1.35	0.09	4149	31.8	24.3	1.42	7	27	78	0.3495	0.0006941
77	A	SU	2.02	1.58	0.44	3.06	2.78	0.28	4036	31.8	25.4	1.70	7	70	78	2.2955	0.0020020
78	A	SU	1.17	0.87	0.30	2.32	1.99	0.33	3794	32.3	26.2	1.62	7	73	78	1.9500	0.0012335
79	A	SU	3.56	2.67	0.89	1.83	1.56	0.27	3874	33.0	23.0	.	8	17	78	2.0000	0.0036758
80	A	SU	2.33	0.69	1.64	1.63	1.53	0.10	2502	33.1	24.2	.	8	20	78	0.7104	0.0037250
81	A	SU	3.76	3.00	0.76	0.79	0.52	0.27	4762	33.8	25.7	.	8	93	78	2.4737	0.0031583
82	A	SU	3.85	2.94	0.91	1.32	1.30	0.02	4762	34.4	26.1	.	8	97	78	2.1154	0.0032339
83	A	SU	3.33	1.72	1.61	2.63	1.86	0.77	3511	31.8	27.6	1.42	9	70	78	1.0342	0.0037938
84	A	SU	2.76	0.80	1.96	1.34	1.30	0.04	3936	31.4	27.6	1.31	9	73	78	0.7041	0.0028049
85	A	FA	5.12	2.10	3.02	1.89	1.60	0.29	2972	29.9	30.1	.	10	3	78	0.8477	0.0068910
86	A	FA	3.13	2.25	0.88	1.25	0.50	0.75	3830	31.8	30.3	1.70	10	20	78	1.7784	0.0032689
87	A	FA	0.75	0.39	0.36	1.44	0.66	0.78	4149	29.8	30.8	2.43	10	23	78	1.0417	0.0007231
88	A	FA	1.07	0.46	0.61	1.20	0.82	0.38	3227	29.4	28.7	1.55	10	77	78	0.8770	0.0013263
89	A	FA	2.49	2.14	0.35	1.13	0.96	0.17	.	27.9	28.8	4.25	11	37	78	3.5571	.
90	A	FA	4.24	1.51	2.73	1.19	0.72	0.47	.	27.2	28.8	2.13	11	40	78	0.7766	.
91	A	FA	4.30	1.26	3.04	0.74	0.74	0.00	2582	27.9	27.9	2.00	11	95	78	0.7072	0.0066615
92	A	FA	2.15	0.47	1.68	1.04	1.04	0.00	2340	28.1	27.9	1.31	11	99	78	0.6399	0.0036752
93	A	FA	2.78	1.10	1.68	0.17	0.01	0.16	1775	20.2	26.1	.	12	50	78	0.8274	0.0062648
94	A	FA	1.68	1.25	0.43	0.58	0.56	0.02	2743	21.7	25.1	.	12	53	78	1.9535	0.0024499
95	A	FA	1.22	0.68	0.54	0.62	0.62	0.00	2663	20.5	27.0	1.55	12	57	78	1.1296	0.0018325
96	A	WI	1.87	1.10	0.77	0.50	0.43	0.07	2662	16.3	27.0	.	1	17	79	1.2143	0.0028099
97	A	WI	0.74	0.56	0.18	0.33	-0.16	0.49	1775	14.2	28.2	.	1	20	79	2.0556	0.0016676
98	A	WI	0.39	0.00	0.39	0.53	0.41	0.12	2080	20.0	26.9	.	1	77	79	0.5000	0.0007500
99	A	WI	.	.	.	0.34	0.34	0.00	3224	19.9	26.2	.	1	80	79	.	.
100	A	WI	0.54	0.54	0.00	0.25	0.25	0.00	1750	20.1	24.5	1.42	2	53	79	.	0.0012343
101	A	WI	0.58	0.45	0.13	0.77	0.51	0.26	2022	19.9	24.8	1.89	3	7	79	2.2308	0.0011474
102	A	WI	0.46	0.46	0.00	1.04	0.72	0.32	2980	22.4	25.1	.	3	10	79	.	0.0006174
103	A	WI	0.13	0.07	0.06	0.44	0.29	0.15	3246	20.0	25.5	1.85	3	57	79	1.0833	0.0001602
104	A	WI	0.86	0.61	0.25	0.99	0.55	0.44	4417	20.3	26.1	1.59	3	60	79	1.7200	0.0007788
105	A	SP	2.01	1.42	0.59	1.17	1.13	0.04	4533	27.2	24.6	1.54	3	99	79	1.7034	0.0017737
106	A	SP	1.62	0.77	0.85	1.73	1.34	0.39	4193	28.4	24.7	1.70	4	3	79	0.9529	0.0015454
107	A	SP	0.53	0.29	0.24	1.16	0.80	0.36	3639	30.2	26.0	2.43	4	70	79	1.1042	0.0005826
108	A	SP	-0.41	-0.46	0.05	2.92	2.44	0.48	3536	29.8	26.2	.	4	73	79	-4.1000	-0.0004638
109	A	SP	5.34	3.45	1.89	1.71	1.71	0.00	3410	29.6	26.7	2.62	5	17	79	1.4127	0.0062639
110	A	SP	3.41	1.64	1.77	.	.	.	3410	29.7	25.4	2.62	5	20	79	0.9633	0.0040000
111	A	SP	2.51	1.68	0.83	2.46	2.20	0.26	5260	27.6	25.4	2.43	5	60	79	1.5120	0.0019087
112	A	SP	1.98	1.34	0.64	2.15	1.95	0.20	5470	27.3	25.8	2.13	5	63	79	1.5469	0.0014479
113	A	SP	3.69	1.16	2.53	1.38	1.03	0.35	3406	33.3	26.1	2.83	6	27	79	0.7292	0.0043335
114	A	SP	2.53	1.06	1.47	2.86	2.51	0.35	4334	32.9	26.9	2.27	6	30	79	0.8605	0.0023350
115	A	SP	1.48	1.11	0.37	0.95	0.41	0.54	5303	32.6	28.9	1.89	6	83	79	2.0000	0.0011163
116	A	SP	0.37	0.08	0.29	1.42	-0.13	1.55	4367	32.1	29.5	1.70	6	86	79	0.6379	0.0003389
117	A	SU	2.71	1.94	0.77	2.26	1.67	0.59	4680	34.3	27.9	2.46	7	27	79	1.7597	0.0023162
118	A	SU	2.65	1.96	0.69	2.36	2.02	0.34	4783	34.0	28.0	2.07	7	30	79	1.9203	0.0022162
119	A	SU	1.38	0.66	0.72	3.45	2.92	0.53	3016	31.8	27.4	1.70	7	77	79	0.9583	0.0018302
120	A	SU	1.56	0.87	0.69	5.87	5.01	0.86	3328	31.7	26.9	1.62	7	81	79	1.1304	0.0018750
121	A	SU	3.00	2.18	0.82	0.76	0.55	0.21	3262	34.9	27.4	.	8	19	79	1.8293	0.0036787
122	A	SU	1.11	0.43	0.68	1.37	1.15	0.22	3170	34.6	27.4	.	8	23	79	0.8162	0.0014006
123	A	SU	5.15	3.05	2.10	2.08	1.77	0.31	4265	32.2	27.4	.	8	61	79	1.2262	0.0048300
124	A	SU	4.51	2.38	2.13	2.37	1.92	0.45	4506	33.1	27.8	2.83	8	65	79	1.0587	0.0040036
125	A	SU	1.33	-0.06	1.39	1.80	1.39	0.41	3562	31.9	27.6	1.31	9	27	79	0.4784	0.0014935
126	A	SU	1.18	-0.21	1.39	2.19	1.10	1.09	3343	32.0	28.5	1.70	9	30	79	0.4245	0.0014119
127	A	SU	2.27	0.47	1.80	0.51	0.38	0.13	2005	34.0	28.0	2.27	9	77	79	0.6306	0.0045287
128	A	FA	3.07	1.15	1.92	1.70	1.20	0.50	4263	31.6	26.2	2.68	10	16	79	0.7995	0.0028806
129	A	FA	3.94	1.87	2.07	2.26	1.99	0.27	3781	29.9	26.5	2.27	10	19	79	0.9517	0.0041682
130	A	FA	3.54	1.11	2.43	1.20	1.01	0.19	3008	30.2	28.8	2.83	10	61	79	0.7284	0.0047074
131	A	FA	3.23	1.08	2.15	1.87	1.87	0.00	2812	30.3	29.5	.	10	65	79	0.7512	0.0045946
132	A	FA	3.82	1.05	2.77	0.60	0.36	0.24	2213	28.6	29.4	2.83	11	7	79	0.6895	0.0069047
133	A	FA	3.08	1.83	1.25	.	.	.	2870	26.2	29.7	1.89	11	10	79	1.2320	0.0042927
134	A	FA	5.44	2.92	2.52	1.06	0.76	0.30	2478	22.3	28.8	.	11	53	79	1.0794	0.0087813
135	A	FA	7.26	3.79	3.47	0.98	0.80	0.18	2651	20.6	28.3	.	11	57	79	1.0461	0.0109544
136	A	FA	2.21	1.64	0.57	0.33	0.19	0.14	3077	16.8	28.9	3.40	11	99	79	1.9386	0.0028729
137	A	FA	2.42	1.16	1.26	.	.	.	2328	16.9	28.4	.	12	3	79	0.9603	0.0041581
138	A	FA	0.50	0.38	0.12	0.17	0.05	0.12	980	26.2	29.1	.	12	48	79	2.0833	0.0020408
139	A	FA	0.19	0.19	0.00	0.71	0.71	0.00	231	25.3	29.6	.	12	52	79	.	0.0032900
140	A	WI	0.97	0.55	0.42	0.03	-0.09	0.12	645	19.0	27.3	1.59	1	13	80	1.1548	0.0060155
141	A	WI	0.71	0.46	0.25	0.02	-0.02	.	2351	16.4	27.6	2.24	1	16	80	1.4200	0.0012080
142	A	WI	2.98	0.96	2.02	0.27	0.16	0.11	1810	22.7	28.5	.	1	58	80	0.7376	0.0065856
143	A	WI	2.58	1.42	1.16	0.22	0.04	0.18	2616	22.3	28.8	.	1	61	80	1.1121	0.0039450
144	A	WI	0.41	0.41	0.00	.	.	.	3952	19.6	27.1	3.40	2	4	80	.	0.0004150
145	A	WI	0.55	0.55	0.00	.	.	.	3120	19.7	25.9	3.40	2	7	80	.	0.0007051
146	A	WI	1.03	0.75	0.28	0.44	0.26	0.18	3773	23.2	27.1	1.62	2	79	80	1.8393	0.0010920
147	A	WI	0.70	0.64	0.06	0.08	0.03	0.05	2139	24.4	26.3	.	2	82	80	5.8333	0.0013090
148	A	WI	0.82	0.82	0.00	.	.	.	3818	19.8	24.6	1.62	3	26	80	.	0.0008541

STATION=A

OBS	STATION	SEASON	PG	PN	R	PLANKPG	PLANKPN	PLANKR	INSOL	TEMP	SAL	EXTINCT	MONTH	DAY	YEAR	PRRATIO	ECOLEFF
149	A	WI	0.59	0.59	0.00	0.76	0.40	0.36	2525	21.1	23.7	1.70	3	29	80	.	0.00093465
150	A	WI	0.96	0.60	0.36	0.52	0.48	0.04	4145	23.2	25.3	2.83	3	68	80	1.3333	0.00092642
151	A	WI	1.06	0.82	0.24	0.37	0.37	0.00	5080	21.8	25.5	1.89	3	71	80	2.2083	0.00083465
152	A	SP	0.64	0.18	0.46	0.63	0.53	0.10	2184	24.2	24.2	2.18	4	13	80	0.6957	0.00117216
153	A	SP	1.89	1.31	0.58	0.11	0.11	0.00	5125	24.0	23.8	2.61	4	17	80	1.6293	0.00147512
154	A	SP	2.00	1.62	0.38	0.93	0.85	0.08	4605	24.2	25.1	.	4	60	80	2.6316	0.00173724
155	A	SP	1.09	0.89	0.20	1.30	1.28	0.02	3550	25.0	25.2	2.83	4	63	80	2.7250	0.00122817
156	A	SP	2.43	1.91	0.52	1.46	1.19	0.27	5259	26.2	21.6	2.27	5	10	80	2.3365	0.00184826
157	A	SP	2.75	1.97	0.78	2.77	2.45	0.32	5125	26.8	21.1	.	5	13	80	1.7628	0.00214634
158	A	SP	2.73	1.77	0.96	2.13	2.07	0.06	4189	30.6	22.0	2.83	5	52	80	1.4219	0.00260683
159	A	SP	3.14	1.82	1.32	2.52	2.48	0.04	3387	30.4	22.4	2.83	5	55	80	1.1894	0.00370830
160	A	SP	3.45	1.79	1.66	2.03	1.88	0.15	4546	30.5	22.8	2.27	5	99	80	1.0392	0.00303564
161	A	SP	2.94	1.70	1.24	4.10	3.73	0.37	4902	29.3	23.0	3.40	6	3	80	1.1855	0.00239902
162	A	SP	1.84	0.74	1.10	2.52	2.40	0.12	5140	32.1	25.9	1.36	6	57	80	0.8364	0.00143191
163	A	SP	2.93	2.05	0.88	3.72	3.72	0.00	4768	32.3	25.4	1.62	6	60	80	1.6648	0.00245805
164	A	SU	1.61	0.99	0.62	1.84	1.49	0.35	2303	30.5	19.7	2.13	6	99	80	1.2984	0.00279635
165	A	SU	4.04	2.58	1.46	4.56	4.44	0.12	5467	31.9	20.0	2.22	7	3	80	1.3836	0.00295592
166	A	SU	1.03	0.57	0.46	1.90	1.68	0.22	5006	33.4	22.5	1.79	7	55	80	1.1196	0.00082301
167	A	SU	1.22	0.31	0.91	1.60	1.44	0.16	4019	33.4	22.2	1.62	7	58	80	0.6703	0.00121423
168	A	SU	1.09	0.17	0.92	1.18	0.91	0.27	3758	34.0	21.1	1.62	8	10	80	0.5924	0.00116019
169	A	SU	1.45	0.42	1.03	1.37	0.98	0.39	4724	33.9	21.1	2.27	8	13	80	0.7039	0.00122777
170	A	SU	1.87	1.14	0.73	1.33	1.00	0.33	4442	34.4	23.0	1.31	8	52	80	1.2808	0.00168393
171	A	SU	1.44	0.84	0.60	1.28	1.28	0.00	4709	35.5	23.8	1.31	8	55	80	1.2000	0.00122319
172	A	SU	1.46	0.57	0.89	0.79	0.57	0.22	4575	34.5	26.6	2.27	8	94	80	0.8202	0.00127650
173	A	SU	0.74	0.49	0.25	0.47	0.03	0.44	4397	35.4	27.1	2.00	8	97	80	1.4800	0.00067319
174	A	SU	2.69	0.80	1.89	1.67	1.60	0.07	4075	32.1	29.1	1.55	9	40	80	0.7116	0.00264049
175	A	SU	1.05	0.88	0.17	0.87	0.51	0.36	3692	34.1	29.7	2.00	9	43	80	3.0982	0.00113759
176	A	FA	2.57	1.31	1.26	0.96	0.71	0.25	3207	35.2	29.6	1.40	9	90	80	1.0198	0.00320549
177	A	FA	1.66	1.51	0.15	0.63	0.34	0.29	3663	36.4	30.1	1.28	9	93	80	5.5333	0.00181272
178	A	FA	0.98	0.69	0.29	1.18	0.93	0.25	3678	31.1	27.6	1.89	10	48	80	1.6897	0.00106580
179	A	FA	1.20	0.64	0.56	1.04	0.46	0.58	3354	31.5	27.1	.	10	52	80	1.0714	0.00143113
180	A	FA	0.47	0.47	0.00	0.52	0.45	0.07	2228	30.1	26.4	.	10	99	80	.	0.00084381
181	A	FA	0.15	0.15	0.00	0.73	0.29	0.44	4165	29.4	26.8	.	11	3	80	.	0.00014406
182	A	FA	-0.16	-0.16	0.00	1.63	0.79	0.84	1792	26.2	26.2	1.36	11	47	80	.	-0.00035714
183	A	FA	0.59	0.58	0.01	1.28	1.01	0.27	2663	26.0	26.9	1.55	11	50	80	29.5000	0.00088622
184	A	FA	0.62	0.62	0.00	0.78	0.57	0.21	3607	24.1	26.3	2.83	11	97	80	.	0.00068755
185	A	FA	0.11	0.11	0.00	1.00	0.86	0.14	.	23.1	25.3	2.83	11	99	80	.	.
186	A	FA	0.21	0.21	0.00	0.43	0.36	0.07	1537	24.0	26.3	1.55	12	52	80	.	0.00054652
187	A	FA	-0.04	-0.04	0.00	0.52	0.29	0.23	2249	23.6	25.8	.	12	55	80	.	-0.00007114

STATION=E

OBS	STATION	SEASON	PG	PN	R	PLANKPG	PLANKPN	PLANKR	INSOL	TEMP	SAL	EXTINCT	MONTH	DAY	YEAR	PRRATIO	ECOLEFF
188	E	FA	5.50	2.10	3.40	0.50	0.20	0.30	3100	18.5	22.0	.	1	0.4	73	0.80882	0.0070968
189	E	FA	8.40	4.00	4.40	0.50	0.30	0.20	4140	16.8	21.0	.	1	0.4	73	0.95455	0.0081159
190	E	FA	8.50	4.30	4.20	0.40	0.20	0.20	4280	20.0	19.5	.	1	0.5	73	1.01190	0.0079439
191	E	FA	8.50	3.40	5.10	0.40	0.30	0.10	.	21.2	17.5	.	1	0.5	73	0.83333	.
192	E	WI	4.70	2.10	2.60	.	.	.	.	13.8	13.8	.	2	43.0	73	0.90385	.
193	E	WI	2.00	0.50	1.50	.	.	.	.	12.8	23.3	.	2	73.0	73	0.66667	.
194	E	SP	9.90	5.40	4.50	3.50	2.70	0.80	6409	28.5	17.0	.	5	83.0	73	1.10000	0.0061788
195	E	SP	9.00	4.70	4.30	3.40	2.50	0.90	5834	28.5	16.0	.	5	86.0	73	1.04651	0.0061707
196	E	SP	5.00	1.90	3.10	2.00	-3.20	5.20	3037	29.0	11.0	.	6	83.0	73	0.80645	0.0065854
197	E	SP	10.50	5.10	5.40	1.80	1.10	0.70	6543	28.5	12.5	.	6	86.0	73	0.97222	0.0064191
198	E	SP	6.40	3.50	2.90	.	.	.	6343	29.0	14.3	.	6	87.0	73	1.10345	0.0040359
199	E	SP	11.00	5.20	5.80	.	.	.	6144	28.5	11.0	.	6	90.0	73	0.94828	0.0071615
200	E	SP	10.60	5.60	5.00	1.20	0.90	0.30	6648	28.5	12.5	.	6	93.0	73	1.06000	0.0063779
201	E	SU	6.20	1.80	4.40	.	.	.	.	29.5	13.5	.	8	2.0	73	0.70455	.
202	E	SU	3.70	1.10	2.60	.	.	.	.	30.0	23.5	.	8	33.0	73	0.71154	.
203	E	SU	8.00	4.70	3.30	.	.	.	.	30.5	12.5	.	8	53.0	73	1.21212	.
204	E	SU	10.20	4.00	6.20	.	.	.	.	28.8	13.5	.	8	80.0	73	0.82258	.
205	E	SU	8.50	1.60	6.90	.	.	.	.	29.5	16.0	.	8	86.0	73	0.61594	.
206	E	SU	11.10	3.80	7.30	.	.	.	.	29.0	14.0	.	8	90.0	73	0.76027	.
207	E	SU	8.00	3.68	4.32	.	.	.	5570	30.3	24.4	1.10	7	43.0	77	0.92593	0.0057451
208	E	SU	4.90	1.89	3.01	.	.	.	4780	29.1	25.9	1.20	8	30.0	77	0.81395	0.0041004
209	E	SU	7.52	3.55	3.97	4.05	3.69	0.46	3870	28.0	22.1	1.10	8	73.0	77	0.94710	0.0077726
210	E	SU	15.92	9.39	6.53	1.74	1.27	0.47	5230	28.6	19.8	1.10	8	77.0	77	1.21899	0.0121759
211	E	SU	13.12	7.12	6.00	2.58	1.58	1.00	6579	30.8	23.5	1.10	9	27.0	77	1.09333	0.0079769
212	E	SU	10.94	5.05	5.89	1.63	0.94	0.69	6462	30.1	25.9	1.00	9	63.0	77	0.92869	0.0067719
213	E	SU	8.66	4.16	4.50	1.84	1.42	0.42	4896	30.4	25.4	1.00	9	67.0	77	0.96222	0.0070752
214	E	FA	7.49	4.64	2.85	2.34	1.68	0.66	5466	28.8	25.0	1.10	10	3.0	77	1.31404	0.0054912
215	E	FA	4.74	1.23	3.51	1.38	0.63	0.75	5238	28.9	25.2	1.10	10	7.0	77	0.67521	0.0036197
216	E	FA	6.12	2.88	3.24	0.76	0.52	0.24	6462	18.4	28.3	1.00	10	57.0	77	0.94444	0.0037883

STATION=E

OBS	STATION	SEASON	PG	PN	R	PLANKPG	PLANKPN	PLANKR	INSOL	TEMP	SAL	EXTINCT	MONTH	DAY	YEAR	PRRATIO	ECOLEFF
217	E	FA	5.85	2.66	3.20	0.53	0.29	0.24	6227	18.3	28.4	0.90	10	60	77	0.91406	0.0037578
218	E	FA	4.72	1.44	3.28	0.88	0.51	0.37	2961	20.5	29.5	0.90	11	3	77	0.71951	0.0063762
219	E	FA	3.60	1.74	1.86	0.14	0.14	0.00	4441	14.7	29.3	0.90	11	47	77	0.96774	0.0032425
220	E	FA	2.83	2.08	0.75	0.29	0.26	0.03	4347	15.7	29.4	0.90	11	50	77	1.88667	0.0026041
221	E	FA	3.81	1.71	2.10	0.21	0.20	0.01	2619	17.8	23.8	0.90	11	97	77	0.90714	0.0058190
222	E	FA	4.76	1.46	3.30	0.44	0.26	0.18	3416	19.5	23.0	0.90	11	99	77	0.72121	0.0055738
223	E	FA	3.60	2.48	1.12	0.16	-0.06	0.22	.	15.4	24.0	.	12	63	77	1.60714	.
224	E	FA	3.17	1.15	2.02	0.24	0.24	0.00	.	15.8	21.0	.	12	67	77	0.78465	.
225	E	WI	0.85	0.54	0.31	0.17	0.14	0.03	159	9.0	22.6	1.42	2	3	78	1.37097	0.0213836
226	E	WI	0.72	0.26	0.46	0.40	0.26	0.14	453	10.1	21.0	.	2	7	78	0.78261	0.0063576
227	E	WI	2.28	1.22	1.06	0.79	0.79	0.00	1013	14.1	21.7	.	2	60	78	1.07547	0.0090030
228	E	WI	2.87	1.35	1.52	0.16	0.00	0.16	1358	14.1	22.5	.	2	63	78	0.94408	0.0084536
229	E	WI	3.14	1.85	1.29	1.09	1.09	0.00	2028	15.3	17.8	1.06	3	13	78	1.21705	0.0061933
230	E	WI	2.54	1.46	1.08	.	.	.	4221	13.6	21.0	1.31	3	63	78	1.17593	0.0024070
231	E	WI	2.01	0.67	1.34	0.61	0.57	0.04	4404	17.3	20.0	1.89	3	97	78	0.75000	0.0018256
232	E	WI	2.40	1.34	1.06	.	.	.	4383	18.5	19.2	1.42	3	99	78	1.13208	0.0021903
233	E	SP	7.17	3.83	3.34	0.96	0.63	0.33	4201	24.5	19.2	1.31	4	23	78	1.07335	0.0068269
234	E	SP	7.02	2.34	4.68	0.89	0.72	0.17	4599	24.8	19.2	1.21	4	27	78	0.75000	0.0061057
235	E	SP	8.75	4.31	4.44	0.84	0.73	0.11	5408	22.3	16.9	.	4	74	78	0.98536	0.0064719
236	E	SP	5.97	2.93	3.04	1.09	1.09	0.00	3551	22.2	17.2	1.21	4	77	78	0.98191	0.0067249
237	E	SP	4.46	2.89	1.57	1.28	0.81	0.47	4924	27.0	16.5	1.48	5	27	78	1.42038	0.0036231
238	E	SP	3.99	1.42	2.57	2.61	1.51	1.10	2921	28.0	16.3	1.55	5	30	78	0.77626	0.0054639
239	E	SP	5.21	1.47	3.74	1.79	1.05	0.72	2664	26.3	15.4	1.70	5	67	78	0.69652	0.0078228
240	E	SP	9.04	6.38	2.66	2.46	1.66	0.80	5569	26.1	15.9	1.55	5	70	78	1.69925	0.0064931
241	E	SP	6.65	3.06	3.59	2.42	1.45	0.97	4278	30.0	17.1	1.17	6	27	78	0.92618	0.0062179
242	E	SP	7.02	3.61	3.41	2.64	2.32	0.32	4036	30.1	16.4	1.13	6	30	78	1.02933	0.0069574
243	E	SP	9.00	4.70	4.30	1.98	1.49	0.49	4116	27.4	19.0	0.94	6	77	78	1.04651	0.0087464
244	E	SP	8.15	4.46	3.69	2.00	1.66	0.34	3551	28.0	20.1	0.94	6	80	78	1.10434	0.0091805
245	E	SU	7.95	4.35	3.60	3.30	2.56	0.74	3830	29.2	18.3	1.13	7	23	78	1.10417	0.0083029
246	E	SU	8.28	4.91	3.37	3.52	2.95	0.57	4149	29.2	19.8	1.13	7	27	78	1.22849	0.0079826
247	E	SU	11.29	7.57	3.72	2.32	2.19	0.13	4036	28.3	18.0	.	7	70	78	1.51747	0.0111893
248	E	SU	9.15	5.81	3.34	1.86	1.46	0.40	3794	28.9	18.9	1.06	7	73	78	1.36976	0.0096468
249	E	SU	7.76	4.18	3.58	1.70	1.36	0.34	3874	29.2	14.4	1.13	8	17	78	1.08380	0.0080124
250	E	SU	4.76	2.08	2.68	1.85	1.57	0.28	2502	29.4	16.9	1.00	8	20	78	0.88806	0.0076099
251	E	SU	9.21	5.06	4.15	1.50	1.14	0.36	4762	31.4	21.4	1.90	8	93	78	1.10964	0.0077362
252	E	SU	10.93	6.22	4.71	1.75	1.55	0.20	4762	31.5	21.3	1.90	8	97	78	1.16030	0.0091810
253	E	SU	9.10	2.60	6.50	2.29	2.04	0.25	3511	29.6	24.3	1.31	9	70	78	0.70000	0.0103674
254	E	SU	6.79	2.86	3.93	2.08	2.02	0.06	3936	29.6	25.2	1.13	9	73	78	0.86387	0.0069004
255	E	FA	8.28	3.59	4.69	1.01	0.87	0.14	2972	26.5	27.2	1.15	10	3	78	0.88273	0.0111440
256	E	FA	3.51	1.47	2.04	1.20	0.76	0.44	3830	26.4	28.7	1.31	10	20	78	0.86029	0.0036658
257	E	FA	4.70	1.99	2.71	1.20	1.05	0.15	4149	23.7	29.2	1.55	10	23	78	0.86716	0.0045312
258	E	FA	5.40	2.37	3.03	1.54	1.09	0.45	3227	23.2	28.1	1.31	10	77	78	0.89109	0.0066935
259	E	FA	3.95	1.15	2.80	1.11	0.80	0.31	.	22.1	27.1	.	11	37	78	0.70536	.
260	E	FA	4.44	2.13	2.31	1.58	1.58	0.00	.	21.7	27.6	1.21	11	40	78	0.96104	.
261	E	FA	6.58	2.30	4.28	2.12	2.12	0.00	2582	21.8	24.4	1.13	11	97	78	0.76869	0.0101936
262	E	FA	3.66	1.32	2.34	1.26	-0.03	1.29	2340	23.4	24.3	1.55	11	99	78	0.78205	0.0062564
263	E	FA	3.08	1.90	1.18	0.49	0.33	0.16	1775	14.8	24.6	.	12	50	78	1.30508	0.0069408
264	E	FA	3.04	1.57	1.47	0.58	0.58	0.00	2743	14.6	24.7	.	12	53	78	1.03401	0.0044331
265	E	FA	2.53	1.46	1.07	0.32	0.30	0.02	2663	13.6	25.3	.	12	57	78	1.18224	0.0038002
266	E	WI	1.43	1.35	0.08	0.12	0.12	0.00	2662	10.1	25.8	.	1	17	79	8.93750	0.0021488
267	E	WI	1.51	0.92	0.59	0.30	-0.22	0.52	1775	12.4	24.9	.	1	20	79	1.27966	0.0034028
268	E	WI	2.00	0.86	1.14	0.20	0.09	0.11	2080	11.8	23.0	1.70	1	77	79	0.87719	0.0038462
269	E	WI	.	.	.	0.34	0.34	0.00	3224	12.7	21.6	3.40	1	80	79	.	.
270	E	WI	2.91	1.16	1.75	0.27	0.27	0.00	1750	16.7	19.0	1.21	2	53	79	0.83143	0.0066514
271	E	WI	2.05	0.91	1.14	0.67	0.44	0.23	2022	16.2	23.0	0.91	3	7	79	0.89912	0.0040554
272	E	WI	2.16	0.80	1.36	0.91	0.84	0.07	2980	17.3	22.6	1.62	3	10	79	0.79412	0.0028993
273	E	WI	1.21	0.79	0.42	0.10	-0.22	0.32	3246	17.4	24.1	2.13	3	57	79	1.44048	0.0014911
274	E	WI	1.70	1.13	0.57	1.13	1.13	0.00	4417	17.7	24.4	1.42	3	60	79	1.49123	0.0015345
275	E	SP	3.72	2.40	1.32	0.56	0.30	0.26	4533	21.0	21.0	1.24	3	99	79	1.40909	0.0032826
276	E	SP	3.71	2.55	1.16	0.39	0.10	0.29	4193	22.2	19.7	1.21	4	3	79	1.59914	0.0035392
277	E	SP	2.50	1.49	1.01	0.80	0.37	0.43	3639	24.4	22.6	1.55	4	70	79	1.23762	0.0027480
278	E	SP	4.57	3.20	1.37	1.11	1.11	0.00	3536	24.2	21.2	.	4	73	79	1.66788	0.0051697
279	E	SP	4.68	2.94	1.74	1.91	0.92	0.99	3410	27.2	21.9	1.48	5	17	79	1.34483	0.0054897
280	E	SP	7.91	4.70	3.21	.	.	.	3410	27.3	20.5	.	5	20	79	1.23209	0.0092786
281	E	SP	4.04	2.61	1.43	1.39	1.13	0.26	5260	25.1	25.7	1.70	5	60	79	1.41259	0.0030722
282	E	SP	2.24	1.21	1.03	1.61	1.01	0.60	5470	24.7	25.8	1.62	5	63	79	1.08738	0.0016380
283	E	SP	8.33	2.42	5.91	1.88	1.20	0.68	3406	30.7	24.4	1.70	6	27	79	0.70474	0.0097827
284	E	SP	7.71	3.65	4.06	4.26	3.34	0.92	4334	29.4	25.3	1.55	6	30	79	0.94951	0.0071158
285	E	SP	5.99	3.35	2.64	3.64	2.82	0.82	5303	29.9	25.4	1.26	6	83	79	1.13447	0.0045182
286	E	SP	4.75	2.73	2.02	2.29	2.21	0.08	4367	29.2	26.1	1.89	6	86	79	1.17574	0.0043508
287	E	SU	9.60	6.23	3.37	9.59	8.09	1.50	4680	30.8	25.9	1.77	7	27	79	1.42433	0.0082051
288	E	SU	9.26	5.51	3.75	.	.	1.06	4783	30.3	26.3	1.77	7	30	79	1.23467	0.0077441
289	E	SU	5.53	3.34	2.19	5.01	4.20	0.81	3016	28.9	22.6	1.36	7	77	79	1.26256	0.0073342
290	E	SU	5.05	2.38	2.67	8.02	6.86	1.16	3328	29.0	22.8	1.48	7	81	79	0.94569	0.0060697

STATION=E

OBS	STATION	SEASON	PG	PN	R	PLANKPG	PLANKPN	PLANKR	INSOL	TEMP	SAL	EXTINCT	MONTH	DAY	YEAR	PRRATIO	ECOLEFF
291	E	SU	7.63	3.55	4.08	2.20	1.43	0.77	3262	29.3	22.3	1.13	8	19	79	0.93505	0.0093562
292	E	SU	6.19	3.09	3.10	3.24	2.30	0.94	3170	29.3	23.7	1.48	8	23	79	0.99839	0.0078107
293	E	SU	8.41	4.41	4.00	2.37	1.51	0.86	4265	29.6	23.7	2.43	8	61	79	1.05125	0.0078875
294	E	SU	8.62	4.95	3.67	2.31	1.74	0.57	4506	29.9	23.0	1.55	8	65	79	1.17439	0.0076520
295	E	SU	5.15	1.49	3.66	1.31	0.79	0.52	3562	29.3	22.8	1.13	9	27	79	0.70355	0.0057833
296	E	SU	3.64	0.72	2.92	2.11	1.56	0.55	3343	28.8	25.1	1.62	9	30	79	0.62329	0.0043554
297	E	FA	7.13	3.23	3.90	2.30	2.01	0.29	4263	25.3	22.2	1.98	10	16	79	0.91410	0.0066901
298	E	FA	8.59	5.38	3.21	2.09	2.03	0.06	3781	24.2	22.7	1.40	10	19	79	1.33801	0.0090875
299	E	FA	3.77	1.33	2.44	1.26	0.85	0.41	3008	25.0	26.5	1.89	10	61	79	0.77254	0.0050133
300	E	FA	4.54	2.04	2.50	1.71	1.37	0.34	2812	25.3	26.4	.	10	65	79	0.90800	0.0064580
301	E	FA	7.19	2.28	4.91	0.99	0.92	0.07	2213	23.9	25.3	.	11	7	79	0.73218	0.0129959
302	E	FA	6.04	3.46	2.58	.	.	.	2870	22.0	25.5	1.31	11	10	79	1.17054	0.0084181
303	E	FA	2.95	1.72	1.23	0.34	-0.09	0.43	2478	15.5	28.1	.	11	53	79	1.19919	0.0047619
304	E	FA	4.40	2.69	1.71	0.20	0.03	0.17	2651	16.1	27.7	.	11	57	79	1.28655	0.0066390
305	E	FA	1.98	1.14	0.84	-0.04	-0.04	0.00	3077	10.5	27.5	2.13	11	99	79	1.17857	0.0025739
306	E	FA	1.36	1.17	0.19	.	.	.	2328	11.0	28.9	.	12	3	79	3.57895	0.0023368
307	E	FA	3.67	1.26	2.41	0.08	0.08	0.00	980	20.2	24.8	.	12	48	79	0.76141	0.0149796
308	E	FA	3.04	0.65	2.39	0.26	0.00	0.26	231	18.3	24.8	.	12	52	79	0.63598	0.0526407
309	E	WI	0.45	0.02	0.43	0.54	0.54	.	645	12.2	26.2	1.76	1	13	80	0.52326	0.0027907
310	E	WI	1.01	0.61	0.40	-0.06	-0.06	.	2351	11.0	26.9	1.46	1	16	80	1.26250	0.0017184
311	E	WI	3.09	1.49	1.60	0.11	-0.07	0.18	1810	17.0	24.4	.	1	58	80	0.96563	0.0068287
312	E	WI	4.53	2.50	2.03	0.14	-0.09	0.23	2616	17.1	25.1	.	1	61	80	1.11576	0.0069266
313	E	WI	1.91	1.33	0.58	.	.	.	3952	10.0	25.5	.	2	4	80	1.64655	0.0019332
314	E	WI	1.79	0.70	1.09	.	.	.	3120	10.1	25.9	.	2	7	80	0.82110	0.0022949
315	E	WI	1.89	1.12	0.77	0.44	0.08	0.36	3773	17.5	21.7	1.42	2	79	80	1.22727	0.0020037
316	E	WI	2.27	1.20	1.07	0.22	0.22	0.00	2139	18.8	19.8	1.13	2	82	80	1.06075	0.0042450
317	E	WI	1.53	1.29	0.24	0.83	0.83	0.00	3818	18.2	20.9	1.42	3	26	80	3.18750	0.0016029
318	E	WI	2.78	1.00	1.78	1.23	0.45	0.78	2525	20.2	18.6	1.80	3	29	80	0.78090	0.0044040
319	E	WI	1.10	0.31	0.79	1.43	1.07	0.36	4145	20.7	19.8	3.40	3	68	80	0.69620	0.0010615
320	E	WI	3.70	2.07	1.63	0.64	0.42	0.22	5090	18.2	20.6	1.21	3	71	80	1.13497	0.0029134
321	E	SP	2.09	0.71	1.38	0.89	0.55	0.34	2184	22.3	18.5	1.62	4	13	80	0.75725	0.0038278
322	E	SP	4.57	3.49	1.08	0.63	0.63	0.00	5125	21.2	18.8	1.43	4	17	80	2.11574	0.0035668
323	E	SP	4.00	2.16	1.84	1.77	1.50	0.27	5125	24.5	21.4	1.62	5	13	80	1.08696	0.0031220
324	E	SP	6.89	4.22	2.67	0.83	0.70	0.13	4189	27.8	18.6	1.79	5	52	80	1.29026	0.0065791
325	E	SP	4.65	2.48	2.17	1.75	1.46	0.29	3387	27.5	19.1	1.62	5	55	80	1.07143	0.0054916
326	E	SP	6.05	3.31	2.74	0.84	0.51	0.33	4546	26.7	18.6	1.42	5	99	80	1.10401	0.0053234
327	E	SP	5.37	3.29	2.08	1.85	1.08	0.77	4902	26.8	19.8	1.48	6	3	80	1.29087	0.0043819
328	E	SP	8.69	4.95	3.74	0.90	0.60	0.30	5140	28.8	21.5	0.89	6	57	80	1.16176	0.0067626
329	E	SP	6.94	2.79	4.15	1.49	1.47	0.02	4768	29.4	22.7	1.55	6	60	80	0.83614	0.0058221
330	E	SU	4.07	1.67	2.40	1.74	1.30	0.44	2303	28.7	16.9	2.08	6	99	80	0.84792	0.0070690
331	E	SU	7.31	5.11	2.20	2.36	2.22	0.14	5467	29.6	16.4	1.44	7	3	80	1.66136	0.0053495
332	E	SU	11.30	6.01	5.29	2.04	1.50	0.54	5006	30.3	19.2	1.21	7	55	80	1.06805	0.0090292
333	E	SU	5.76	2.73	3.03	1.65	1.06	0.59	4019	29.9	18.0	3.40	7	58	80	0.95050	0.0057328
334	E	SU	3.94	2.35	1.59	1.70	1.27	0.43	3758	31.3	17.9	1.55	8	10	80	1.23899	0.0041937
335	E	SU	7.20	3.52	3.68	2.06	1.65	0.41	4724	31.1	17.8	1.48	8	13	80	0.97826	0.0060965
336	E	SU	9.60	5.25	4.35	3.70	2.81	0.89	4442	29.7	16.9	0.94	8	52	80	1.10345	0.0086448
337	E	SU	9.76	5.09	4.67	2.63	2.13	0.50	4709	30.6	18.7	1.21	8	55	80	1.04497	0.0082905
338	E	SU	8.36	4.40	3.96	3.89	3.29	0.60	4575	29.4	23.1	1.70	8	94	80	1.05556	0.0073093
339	E	SU	9.76	4.91	4.85	3.48	2.79	0.69	4397	29.8	23.6	1.36	8	97	80	1.00619	0.0088788
340	E	SU	6.16	3.18	2.98	2.15	1.32	0.83	4075	28.0	25.7	1.10	9	40	80	1.03356	0.0060466
341	E	SU	8.87	4.24	4.63	1.96	1.46	0.50	3692	28.2	26.1	1.03	9	43	80	0.95788	0.0096100
342	E	FA	8.49	4.13	4.36	2.99	2.35	0.64	3207	30.3	24.1	1.25	9	90	80	0.97362	0.0105893
343	E	FA	7.92	3.41	4.51	3.09	2.51	0.58	3663	30.5	23.9	1.13	9	93	80	0.87805	0.0086486
344	E	FA	5.15	3.80	1.35	1.08	0.74	0.34	3678	23.6	26.7	.	10	48	80	1.90741	0.0056009
345	E	FA	10.77	6.67	4.10	0.99	0.97	0.02	3354	24.5	26.1	.	10	52	80	1.31341	0.0128444
346	E	FA	8.90	5.16	3.74	0.65	0.64	0.01	2228	23.0	24.1	1.06	10	99	80	1.18984	0.0159785
347	E	FA	8.72	5.35	3.37	0.86	0.64	0.22	4165	21.2	25.2	.	11	3	80	1.29377	0.0083745
348	E	FA	5.47	3.00	2.47	2.19	1.10	1.09	1792	19.4	25.8	1.17	11	47	80	1.10729	0.0122098
349	E	FA	4.01	1.50	2.51	2.14	1.11	1.03	2663	20.2	24.5	1.31	11	50	80	0.79880	0.0060233
350	E	FA	2.14	1.59	0.55	0.40	0.35	0.05	3607	14.6	24.6	1.70	11	97	80	1.94545	0.0023732
351	E	FA	2.99	2.71	0.28	0.38	0.28	0.10	.	14.9	24.3	.	11	99	80	5.33929	.
352	E	FA	2.92	1.54	1.38	0.42	0.42	0.00	1537	16.1	23.3	0.97	12	52	80	1.05797	0.0075992
353	E	FA	5.03	2.76	2.27	0.41	0.11	0.30	2249	15.8	22.7	1.17	12	55	80	1.10793	0.0089462

APPENDIX B

SUMMARY OF DATA FROM THE OUTER DISCHARGE BAY (B) AND ITS CONTROL BAY (D)

EXPLANATORY KEY OF TABLE CAPTIONS IN APPENDIX B

OBS—Observation #.

STATION—See Figure II-1b.

SEASON—See descriptions in chapter 4.

PG—System gross productivity (g $O_2 \cdot m^{-2} \cdot d^{-1}$).

PN—System daytime net productivity (g $O_2 \cdot m^{-2} \cdot d^{-1}$).

R—System night respiration (g $O_2 \cdot m^{-2} \cdot d^{-1}$).

PLANKPG—Plankton gross productivity (g $O_2 \cdot m^{-2} \cdot d^{-1}$).

PLANKPN—Plankton 24-hour net productivity (g $O_2 \cdot m^{-2} \cdot d^{-1}$).

PLANKR—Plankton 24-hour respiration (g $O_2 \cdot m^{-2} \cdot d^{-1}$).

INSOL—Insolation (kcal$\cdot m^{-2} \cdot d^{-1}$).

TEMP—Temperature (°C).

SAL—Salinity (‰).

EXTINCT—Extinction coefficient (m^{-1}).

MONTH—(Self-explanatory).

DAY—Day (calculated as percentage of 30 or 31 days in the month).

YEAR—(Self-explanatory).

PRRATIO—(calculated as PG/2R).

ECOLEFF—Ecological efficiency (calculated as [4 x PG]/INSOL).

STATION=B

OBS	STATION	SEASON	PG	PN	R	PLANKPG	PLANKPN	PLANKR	INSOL	TEMP	SAL	EXTINCT	MONTH	DAY	YEAR	PRRATIO	ECOLEFF
1	B	WI	4.43	2.37	2.06	.	.	.	.	24.4	26.4	.	1	0.4	73	1.07524	.
2	B	WI	3.99	1.75	2.24	.	.	.	.	25.2	27.7	.	1	0.5	73	0.89063	.
3	B	WI	1.85	0.98	0.87	.	.	.	.	13.4	19.9	.	1	0.5	73	1.06322	.
4	B	FA	3.85	1.96	1.89	.	.	.	.	24.4	28.0	.	1	0.6	73	1.01852	.
5	B	FA	4.99	2.06	2.93	.	.	.	.	24.9	25.6	.	1	0.7	73	0.85154	.
6	B	FA	.	.	.	1.78	0.53	1.25	.	24.4	.	.	1	0.7	73	.	.
7	B	WI	2.44	0.41	2.03	0.74	-0.72	1.46	.	18.8	.	.	1	3.0	73	0.60099	.
8	B	WI	.	.	.	0.25	-0.22	0.47	.	14.5	.	.	1	9.0	73	.	.
9	B	SU	3.92	2.19	1.73	.	.	.	.	26.5	22.6	.	5	30.0	73	1.13295	.
10	B	SU	4.81	2.19	2.62	.	.	.	.	26.9	21.2	.	5	33.0	73	0.91794	.
11	B	SU	8.56	5.10	3.46	.	.	.	.	30.2	26.9	1.00	5	80.0	73	1.23699	.
12	B	SU	6.04	3.42	2.62	.	.	.	.	30.0	25.7	1.15	5	83.0	73	1.15267	.
13	B	SU	6.09	3.10	2.99	3.37	2.85	0.52	.	29.7	25.9	.	5	90.0	73	1.01839	.
14	B	SU	.	.	.	.	.	.	.	.	.	0.88	6	33.0	73	.	.
15	B	SU	.	.	.	.	.	.	.	.	.	1.29	6	33.0	73	.	.
16	B	SU	4.54	2.64	1.90	.	.	.	.	30.2	27.7	1.10	6	47.0	73	1.19474	.
17	B	SU	7.10	3.40	3.70	.	.	.	.	30.0	16.0	1.23	6	97.0	73	0.95946	.
18	B	SU	7.93	4.77	3.16	.	.	.	.	31.6	26.3	1.27	7	7.0	73	1.25475	.
19	B	SU	8.48	4.44	4.04	.	.	.	.	30.9	18.3	1.23	7	23.0	73	1.04950	.
20	B	SU	8.56	3.97	4.59	.	.	.	.	33.1	25.3	1.38	7	33.0	73	0.93246	.
21	B	SU	.	.	.	.	.	.	.	.	.	1.11	7	33.0	73	.	.
22	B	SU	9.12	5.50	3.62	4.64	3.77	0.87	.	31.6	24.0	0.94	7	33.0	73	1.25967	.
23	B	SU	4.47	0.95	3.52	.	.	.	.	32.4	24.3	1.42	7	37.0	73	0.63494	.
24	B	FA	8.44	3.99	4.45	.	.	.	.	32.6	23.7	.	8	7.0	73	0.94831	.
25	B	FA	7.03	3.27	3.76	4.58	3.39	1.19	.	33.0	27.9	.	8	33.0	73	0.93484	.
26	B	FA	3.34	2.13	1.21	5.79	2.01	3.78	.	30.8	23.2	1.23	9	67.0	73	1.38017	.
27	B	SP	4.14	2.45	1.69	2.89	2.27	0.63	.	25.7	24.3	1.62	4	23.0	77	1.22485	.
28	B	SU	10.39	6.44	3.95	2.39	0.21	2.20	.	35.6	28.5	1.13	6	7.0	77	1.31519	.
29	B	SU	1.20	-0.30	1.50	.	0.75	.	4200	35.3	28.7	1.50	7	3.0	77	0.40000	0.0011429
30	B	SU	8.57	4.88	3.69	1.53	-1.38	2.91	7400	36.1	29.0	1.10	7	7.0	77	1.16125	0.0046324
31	B	SU	5.20	1.83	3.43	1.78	0.29	1.49	5570	35.9	29.6	0.93	7	43.0	77	0.75802	0.0037343
32	B	FA	0.75	-0.48	1.23	2.68	1.01	1.67	4780	34.5	29.7	1.50	8	.	77	0.30488	0.0006276
33	B	FA	9.02	4.16	4.86	5.82	5.11	0.71	3870	29.7	26.9	1.40	8	3.0	77	0.92798	0.0093230
34	B	FA	5.04	2.65	2.39	1.39	1.14	0.25	6030	34.0	30.9	1.20	8	3.0	77	1.05439	0.0033433
35	B	FA	8.83	5.23	3.60	6.69	6.06	0.63	5230	29.7	25.9	1.10	8	7.0	77	1.22639	0.0067533
36	B	FA	3.98	1.98	2.00	3.44	2.51	0.93	6562	33.9	31.5	1.40	9	3.0	77	0.99500	0.0024261
37	B	FA	8.53	4.67	3.86	2.31	1.81	0.50	6579	34.6	29.7	1.30	9	7.0	77	1.10492	0.0051862
38	B	FA	6.91	4.76	2.15	2.42	2.37	0.05	4896	34.9	31.3	1.30	9	7.0	77	1.60698	0.0056454
39	B	FA	6.19	3.12	3.07	5.55	4.62	0.93	5466	33.1	30.6	1.50	10	3.0	77	1.00814	0.0045298
40	B	FA	5.81	2.64	3.17	3.83	3.20	0.63	5238	32.4	30.0	1.50	10	7.0	77	0.91640	0.0044368
41	B	FA	5.11	2.19	2.92	1.80	1.43	0.37	6462	23.7	27.5	1.20	10	57.0	77	0.87500	0.0031631
42	B	FA	3.44	1.71	1.73	2.12	1.77	0.35	6227	23.1	26.7	1.10	10	60.0	77	0.99422	0.0022097
43	B	WI	3.24	1.44	1.80	2.58	1.88	0.70	2961	26.3	29.7	1.40	11	3.0	77	0.90000	0.0043769
44	B	WI	1.98	1.13	0.85	1.24	0.99	0.25	4441	18.6	29.4	1.20	11	4.0	77	1.16471	0.0017834
45	B	WI	2.41	1.45	0.96	0.96	0.65	0.31	4347	21.6	29.6	1.40	11	5.0	77	1.25521	0.0022176
46	B	WI	3.06	1.38	1.68	1.08	0.84	0.24	2619	23.1	25.5	1.10	11	97.0	77	0.91071	0.0046735
47	B	WI	2.44	1.25	1.19	1.56	1.18	0.38	3416	24.8	25.5	1.10	11	99.0	77	1.02521	0.0028571
48	B	WI	3.28	2.20	1.08	1.11	0.82	0.30	.	19.9	27.8	1.00	12	63.0	77	1.51852	.
49	B	WI	2.68	2.10	0.58	0.96	0.81	0.15	.	21.3	28.0	0.92	12	67.0	77	2.31034	.
50	B	WI	0.93	0.00	0.93	0.57	0.41	0.16	159	12.8	23.3	1.29	2	3.0	78	0.50000	0.0233962
51	B	WI	1.47	0.54	0.93	0.77	0.39	0.38	453	12.9	23.7	.	2	7.0	78	0.79032	0.0129801
52	B	SP	1.62	1.03	0.59	1.82	1.46	0.36	1013	17.6	26.6	1.48	2	60.0	78	1.37288	0.0063968
53	B	SP	3.59	1.81	1.78	0.57	0.57	0.00	1358	16.6	23.8	1.55	2	63.0	78	1.00843	0.0105744
54	B	SP	1.42	1.33	0.09	1.58	1.37	0.21	2028	17.7	20.8	1.62	3	13.0	78	7.88889	0.0028008
55	B	SP	3.63	2.47	1.16	.	.	.	4221	17.1	13.1	1.79	3	63.0	78	1.56466	0.0034399
56	B	SP	2.32	0.93	1.39	1.77	1.57	0.20	4404	18.7	13.5	1.70	3	97.0	78	0.83453	0.0021072
57	B	SP	3.41	1.54	1.87	2.14	1.49	0.65	4383	19.8	13.7	1.70	3	99.0	78	0.91176	0.0031120
58	B	SP	4.52	2.49	2.03	3.24	2.42	0.82	4201	25.9	18.1	2.43	4	23.0	78	1.11330	0.0043037
59	B	SP	6.30	3.24	3.06	3.79	3.11	0.68	4599	26.4	17.9	2.43	4	27.0	78	1.02941	0.0054795
60	B	SP	8.48	4.82	3.66	3.24	2.77	0.47	5408	24.5	20.6	1.42	4	73.0	78	1.15847	0.0062722
61	B	SP	6.26	5.08	1.18	2.87	2.64	0.23	3551	24.3	21.2	1.48	4	77.0	78	2.65254	0.0070515
62	B	SU	8.11	5.34	2.77	6.94	6.57	0.36	4924	28.5	22.9	1.33	5	27.0	78	1.46390	0.0065881
63	B	SU	5.33	1.97	3.36	6.68	5.96	0.72	2921	29.8	23.4	1.36	5	30.0	78	0.79315	0.0072989
64	B	SU	3.38	1.35	2.03	2.46	2.00	0.46	2664	28.1	19.8	1.55	5	67.0	78	0.83251	0.0050751
65	B	SU	8.33	5.34	2.99	2.62	2.22	0.40	5569	28.9	19.6	1.42	5	70.0	78	1.39298	0.0059831
66	B	SU	7.18	4.35	2.83	5.19	4.37	0.82	4278	32.8	22.8	1.48	6	27.0	78	1.26855	0.0067134
67	B	SU	5.80	2.43	3.37	6.38	6.29	0.09	4036	32.8	23.0	1.55	6	30.0	78	0.86053	0.0057483
68	B	SU	10.64	4.95	5.69	2.39	2.02	0.37	4116	30.4	24.2	1.36	6	77.0	78	0.93497	0.0103401
69	B	SU	5.79	3.27	2.52	4.28	4.09	0.19	3551	30.2	24.1	1.13	6	80.0	78	1.14881	0.0065221
70	B	SU	3.78	1.39	2.39	3.68	3.52	0.16	3830	31.7	23.5	1.42	7	23.0	78	0.79079	0.0039478
71	B	SU	5.86	3.29	2.57	1.80	1.38	0.42	4149	31.1	23.5	1.31	7	27.0	78	1.14008	0.0056496
72	B	SU	8.26	5.22	3.04	5.14	4.64	0.50	4036	30.9	24.7	1.31	7	70.0	78	1.35855	0.0081863
73	B	SU	6.97	4.08	2.89	4.24	3.93	0.31	3794	31.0	25.2	1.27	7	73.0	78	1.20588	0.0073484
74	B	FA	6.22	1.88	4.34	2.11	1.81	0.30	3874	31.5	22.7	1.42	8	17.0	78	0.71659	0.0064223

STATION=B

OBS	STATION	SEASON	PG	PN	R	PLANKPG	PLANKPN	PLANKR	INSOL	TEMP	SAL	EXTINCT	MONTH	DAY	YEAR	PRRATIO	ECOLEFF
75	B	FA	3.85	1.47	2.38	1.58	1.46	0.12	2502	31.6	22.8	1.06	8	29	78	0.80882	0.0061551
76	B	FA	8.05	4.05	4.00	3.48	2.98	0.50	4762	34.0	25.4	1.31	8	93	78	1.00625	0.0067619
77	B	FA	6.50	3.97	2.53	4.38	4.13	0.25	4762	33.8	25.1	1.15	8	97	78	1.28458	0.0054599
78	B	FA	6.42	2.63	3.79	2.25	2.14	0.11	3511	31.2	27.1	1.21	9	70	78	0.64697	0.0073142
79	B	FA	3.90	1.73	2.17	1.74	1.49	0.25	3936	30.7	26.5	1.21	9	73	78	0.89862	0.0039634
80	B	FA	9.12	4.59	4.53	1.64	1.50	0.14	2972	30.7	30.1	1.42	10	3	78	1.00662	0.0122746
81	B	FA	7.64	4.03	3.61	2.69	2.04	0.65	3830	30.6	29.9	1.42	10	20	78	1.05817	0.0079791
82	B	FA	8.47	4.65	3.82	1.58	1.29	0.29	4149	27.6	29.7	1.31	10	23	78	1.10864	0.0081658
83	B	FA	3.45	1.65	1.80	1.91	1.45	0.46	3227	28.9	28.7	1.48	10	77	78	0.95833	0.0042764
84	B	WI	9.97	5.54	4.43	3.37	3.08	0.29	.	27.6	28.6	1.48	11	37	78	1.12528	.
85	B	WI	8.65	4.34	4.31	4.03	3.66	0.37	.	27.9	28.7	1.42	11	40	78	1.00348	.
86	B	WI	5.99	2.85	3.14	3.08	2.50	0.58	2582	27.4	28.2	1.48	11	97	78	0.95382	0.0092796
87	B	WI	5.58	2.27	3.31	.	.	.	2340	27.3	27.9	1.55	11	99	78	0.84290	0.0095385
88	B	WI	5.53	2.44	3.09	0.99	0.73	0.26	1775	19.9	25.6	1.21	12	50	78	0.89482	0.0124620
89	B	WI	3.49	2.17	1.32	0.77	0.77	0.00	2743	20.5	26.5	1.06	12	53	78	1.32197	0.0050893
90	B	WI	3.35	1.82	1.53	0.77	0.73	0.04	2663	19.7	26.7	1.31	12	57	78	1.09477	0.0050319
91	B	WI	2.65	1.50	1.15	1.00	0.94	0.06	2662	16.4	27.0	1.35	1	17	79	1.15217	0.0039820
92	B	WI	1.99	1.15	0.84	0.51	-0.41	0.92	1775	14.4	27.5	.	1	20	79	1.18452	0.0044845
93	B	WI	0.37	0.20	0.17	0.95	0.83	0.12	2080	18.5	26.5	1.28	1	77	79	1.08824	0.0007115
94	B	WI	.	.	.	1.59	1.59	0.00	3224	19.8	26.5	1.70	1	80	79	.	.
95	B	SP	4.17	1.89	2.28	1.82	1.25	0.57	1750	20.2	24.3	1.31	2	53	79	0.91447	0.0095314
96	B	SP	2.90	1.31	1.59	1.76	1.27	0.49	2022	19.1	24.1	1.17	3	7	79	0.91195	0.0057369
97	B	SP	2.76	1.11	1.65	2.53	2.53	0.00	2980	21.0	24.6	1.42	3	10	79	0.83636	0.0037047
98	B	SP	2.97	1.37	1.60	0.51	0.51	0.00	3246	19.0	24.4	1.03	3	57	79	0.92813	0.0036599
99	B	SP	2.65	1.62	1.03	0.52	0.52	0.00	4417	19.5	25.2	1.06	3	60	79	1.28641	0.0023998
100	B	SP	3.38	2.22	1.16	1.73	1.22	0.51	4533	26.1	24.4	1.52	3	99	79	1.45690	0.0029826
101	B	SP	5.62	3.17	2.45	1.78	1.22	0.56	4193	26.6	24.4	1.36	4	3	79	1.14694	0.0053613
102	B	SP	3.31	1.57	1.74	4.46	3.99	0.47	3639	29.8	26.2	1.48	4	70	79	0.95115	0.0036384
103	B	SP	1.59	0.46	1.13	4.11	4.11	0.00	3536	28.8	26.0	1.89	4	73	79	0.70354	0.0017986
104	B	SU	7.90	3.99	3.91	4.24	3.62	0.62	3410	28.7	25.7	2.00	5	17	79	1.01023	0.0092669
105	B	SU	9.00	4.41	4.59	.	.	.	3410	28.7	24.5	2.00	5	20	79	0.98039	0.0105572
106	B	SU	4.61	3.07	1.54	4.08	3.64	0.44	5260	26.9	24.9	2.27	5	60	79	1.49675	0.0035057
107	B	SU	4.02	2.03	1.99	4.33	3.73	0.60	5470	26.3	24.7	2.27	5	63	79	1.01005	0.0029397
108	B	SU	7.29	3.36	3.93	3.94	3.68	0.26	3406	33.3	25.1	1.21	6	27	79	0.92748	0.0085614
109	B	SU	8.11	3.97	4.14	5.83	5.83	0.00	4334	32.6	26.1	1.79	6	30	79	0.97947	0.0074850
110	B	SU	8.16	4.46	3.70	2.59	1.92	0.67	5303	31.7	27.4	1.17	6	83	79	1.10270	0.0061550
111	B	SU	2.56	1.40	1.16	3.67	2.81	0.86	4367	31.4	28.1	1.31	6	86	79	1.10345	0.0023449
112	B	SU	9.49	5.97	3.52	5.78	4.78	1.00	4680	33.3	27.5	1.70	7	27	79	1.34801	0.0081111
113	B	SU	7.76	4.62	3.14	7.84	7.00	0.84	4783	33.2	27.6	1.53	7	30	79	1.23567	0.0064897
114	B	SU	2.06	1.51	0.55	4.58	4.02	0.56	3016	31.6	27.5	1.42	7	77	79	1.87273	0.0027321
115	B	SU	5.76	3.68	2.08	8.55	8.09	0.46	3328	31.1	26.9	1.36	7	81	79	1.38462	0.0069231
116	B	FA	3.58	2.21	1.37	2.94	2.39	0.55	3262	34.7	27.7	2.13	8	19	79	1.30657	0.0043899
117	B	FA	6.73	3.79	2.94	4.83	4.37	0.46	3170	35.0	28.0	1.26	8	23	79	1.14456	0.0084921
118	B	FA	11.61	5.82	5.79	7.04	5.15	1.89	4265	32.5	27.7	1.89	8	61	79	1.00259	0.0108886
119	B	FA	11.59	6.09	5.50	4.13	3.37	0.76	4506	33.0	27.9	1.79	8	65	79	1.05364	0.0102885
120	B	FA	3.92	1.03	2.89	3.86	3.25	0.61	3562	31.0	26.3	1.48	9	27	79	0.67820	0.0044020
121	B	FA	3.13	0.74	2.39	3.35	2.10	1.25	3343	30.5	26.5	1.70	9	30	79	0.65481	0.0037451
122	B	FA	4.77	1.98	2.79	2.10	0.47	1.63	2005	32.4	27.3	1.79	9	77	79	0.85484	0.0095162
123	B	FA	5.36	1.95	3.41	0.72	0.25	0.47	4263	28.2	21.4	2.52	10	16	79	0.78592	0.0050293
124	B	FA	7.77	4.59	3.18	1.95	1.76	0.19	3781	28.0	22.7	2.28	10	19	79	1.22170	0.0082200
125	B	FA	4.45	1.86	2.59	2.29	2.12	0.17	3008	31.2	28.9	2.00	10	61	79	0.85907	0.0059176
126	B	FA	5.05	2.23	2.82	2.40	1.95	0.45	2812	31.2	29.6	1.55	10	65	79	0.89539	0.0071835
127	B	WI	5.74	2.56	3.18	1.33	0.66	0.67	2213	29.1	29.6	1.55	11	7	79	0.90252	0.0103751
128	B	WI	4.75	3.20	1.55	.	.	.	2870	27.2	29.3	1.89	11	10	79	1.53226	0.0066202
129	B	WI	3.28	3.09	0.19	0.99	0.74	0.25	2478	21.4	26.9	.	11	53	79	8.63158	0.0052946
130	B	WI	6.13	2.25	3.88	0.83	0.59	0.24	2651	21.9	27.4	.	11	57	79	0.78995	0.0092493
131	B	WI	4.32	2.99	1.33	0.59	0.31	0.28	3077	21.3	29.0	1.21	11	99	79	1.62406	0.0056159
132	B	WI	5.85	2.93	2.92	0.47	0.47	0.00	2328	20.6	28.1	2.43	12	3	79	1.00171	0.0100515
133	B	WI	3.10	1.08	2.02	0.46	0.27	0.19	980	25.8	29.3	.	12	48	79	0.76733	0.0126531
134	B	WI	-0.27	-0.27	0.00	2.40	2.40	0.00	231	25.0	30.1	.	12	52	79	.	-0.0046753
135	B	WI	0.62	0.31	0.31	0.29	0.16	0.13	645	18.5	27.0	1.57	1	13	80	1.00000	0.0038450
136	B	WI	0.71	0.49	0.22	0.14	0.13	0.01	2351	15.3	26.8	2.09	1	16	80	1.61364	0.0012080
137	B	WI	4.27	2.59	1.68	0.58	0.38	0.20	1810	22.5	28.6	0.85	1	58	80	1.27083	0.0094365
138	B	WI	3.35	2.05	1.30	0.49	0.37	0.12	2616	22.8	28.7	0.94	1	61	80	1.28846	0.0051223
139	B	SP	2.56	1.63	0.93	0.26	-0.16	0.42	3952	17.4	27.6	2.83	2	4	80	1.37634	0.0025911
140	B	SP	4.15	2.27	1.88	0.65	0.32	0.33	3120	17.5	26.3	1.42	2	7	80	1.10372	0.0053205
141	B	SP	5.01	3.06	1.95	1.09	0.97	0.12	3773	22.1	27.1	1.42	2	79	80	1.28462	0.0053114
142	B	SP	4.54	2.91	1.63	0.56	0.17	0.39	2139	22.7	26.6	1.17	2	82	80	1.39264	0.0084899
143	B	SP	2.45	1.75	0.70	0.99	0.89	0.10	3818	19.6	24.0	1.06	3	26	80	1.75000	0.0025668
144	B	SP	1.72	1.14	0.58	1.42	1.05	0.37	2525	20.7	24.0	1.26	3	29	80	1.48276	0.0027248
145	B	SP	1.92	1.30	0.62	0.85	0.70	0.15	4145	23.2	25.0	2.43	3	68	80	1.54839	0.0018528
146	B	SP	2.57	1.94	0.63	0.96	0.88	0.08	5080	20.6	25.1	1.55	3	71	80	2.03968	0.0020236
147	B	SP	3.02	1.63	1.39	0.83	0.62	0.21	2184	24.1	24.2	1.88	4	13	80	1.08633	0.0055311
148	B	SP	3.24	2.36	0.88	0.34	0.03	0.31	5125	22.9	22.5	2.21	4	17	80	1.84091	0.0025288

STATION=B

OBS	STATION	SEASON	PG	PN	R	PLANKPG	PLANKPN	PLANKR	INSOL	TEMP	SAL	EXTINCT	MONTH	DAY	YEAR	PRRATIO	ECOLEFF
149	B	SP	4.63	2.85	1.78	2.15	1.74	0.41	4695	23.0	22.6	1.89	4	60	80	1.30056	0.00402172
150	B	SP	2.17	1.03	1.14	1.71	1.71	0.00	3550	23.5	23.1	1.89	4	63	80	0.95175	0.00244507
151	B	SU	3.29	1.85	1.44	2.25	1.79	0.46	5259	25.4	19.3	2.13	5	10	80	1.14236	0.00250238
152	B	SU	4.96	3.26	1.70	2.96	2.65	0.31	5125	26.2	19.8	2.27	5	13	80	1.45882	0.00387122
153	B	SU	8.39	5.06	3.33	2.23	2.08	0.15	4189	29.9	21.2	2.43	5	52	80	1.25976	0.00801146
154	B	SU	5.70	3.02	2.68	2.89	2.80	0.09	3387	29.6	22.0	1.79	5	55	80	1.06343	0.00673162
155	B	SU	7.98	3.94	4.04	3.65	3.56	0.09	4546	29.3	22.3	1.89	5	99	80	0.98762	0.00702156
156	B	SU	6.26	3.76	2.50	5.63	5.16	0.47	4902	28.5	22.7	3.40	6	3	80	1.25200	0.00510812
157	B	SU	8.70	4.95	3.75	4.60	4.15	0.45	5140	31.0	24.8	1.42	6	57	80	1.16000	0.00677043
158	B	SU	5.87	2.86	3.01	5.34	5.34	0.00	4768	30.9	23.8	1.48	6	60	80	0.97508	0.00492450
159	B	SU	4.02	2.37	1.65	4.07	3.23	0.84	2303	29.3	17.5	2.95	6	99	80	1.21818	0.00698220
160	B	SU	7.71	5.22	2.49	9.23	8.63	0.60	5467	30.9	17.5	2.23	7	3	80	1.54819	0.00564112
161	B	SU	7.66	4.08	3.58	5.67	5.40	0.27	5006	32.2	21.2	2.00	7	55	80	1.06983	0.00612066
162	B	SU	6.46	2.96	3.50	5.50	4.86	0.64	4019	32.4	21.7	2.13	7	58	80	0.92286	0.00642946
163	B	FA	6.13	2.94	3.19	5.05	4.68	0.37	3758	32.7	18.5	2.00	8	10	80	0.96082	0.00652475
164	B	FA	6.68	3.90	2.78	5.32	3.53	1.79	4724	32.9	19.0	1.70	8	13	80	1.20144	0.00565622
165	B	FA	6.90	3.73	3.17	4.56	4.01	0.55	4442	33.2	22.6	1.21	8	52	80	1.08833	0.00621342
166	B	FA	5.25	2.14	3.11	3.56	3.40	0.16	4709	34.0	22.8	1.17	8	55	80	0.84405	0.00445955
167	B	FA	6.35	3.31	3.04	3.00	2.16	0.84	4575	32.6	25.6	2.00	8	94	80	1.04441	0.00555191
168	B	FA	5.81	3.08	2.73	4.17	3.33	0.84	4397	33.0	25.9	1.89	8	97	80	1.06410	0.00528542
169	B	FA	6.80	3.96	2.84	3.93	3.51	0.42	4075	32.5	29.1	1.89	9	40	80	1.19718	0.00667495
170	B	FA	6.45	3.36	3.09	1.30	0.78	0.52	3692	32.9	28.9	1.26	9	43	80	1.04369	0.00698808
171	B	FA	7.31	4.64	2.67	2.69	1.74	0.95	3207	34.9	29.9	1.82	9	90	80	1.36891	0.00911756
172	B	FA	5.93	3.31	2.62	1.67	0.76	0.91	3663	34.8	29.7	1.60	9	93	80	1.13168	0.00647557
173	B	FA	7.15	3.37	3.78	2.78	2.51	0.27	3678	28.8	27.1	1.42	10	49	80	0.94577	0.00777597
174	B	FA	5.15	2.32	2.83	2.97	2.49	0.48	3354	29.0	27.0	1.26	10	52	80	0.90989	0.00614192
175	B	WI	1.17	1.17	0.00	1.40	1.34	0.06	2228	29.4	26.3	1.36	10	99	80	.	0.00210054
176	B	WI	0.86	0.86	0.00	.	.	.	4165	29.0	26.7	1.79	11	3	80	.	0.00082593
177	B	WI	3.67	1.39	2.28	2.92	2.08	0.84	1792	24.6	26.1	1.31	11	47	80	0.80482	0.00819196
178	B	WI	1.97	1.10	0.87	2.09	1.78	0.31	2663	24.7	26.3	1.48	11	50	80	1.13218	0.00295907
179	B	WI	0.79	0.79	0.00	0.84	0.75	0.09	3607	23.8	26.4	4.25	11	97	80	.	0.00087607
180	B	WI	1.70	0.92	0.78	1.08	1.05	0.03	.	22.8	25.4	1.62	11	99	80	1.08974	.
181	B	WI	0.71	0.29	0.42	1.21	0.60	0.61	1537	23.1	25.9	1.13	12	52	80	0.84524	0.00184776
182	B	WI	0.84	0.64	0.20	0.62	0.26	0.36	2249	22.5	26.0	1.70	12	55	80	2.10000	0.00149400

STATION=D

OBS	STATION	SEASON	PG	PN	R	PLANKPG	PLANKPN	PLANKR	INSOL	TEMP	SAL	EXTINCT	MONTH	DAY	YEAR	PRRATIO	ECOLEFF
183	D	WI	2.86	0.21	2.65	.	.	.	.	13.6	20.0	.	1	0.6	73	0.53962	.
184	D	FA	4.52	2.49	2.03	2.04	0.56	1.48	.	23.2	30.7	.	1	0.6	73	1.11330	.
185	D	FA	5.49	2.57	2.92	.	.	.	.	23.9	29.2	.	1	0.7	73	0.94007	.
186	D	WI	.	.	.	0.44	0.16	0.28	.	12.4	.	.	2	3.0	73	.	.
187	D	SP	3.96	1.74	2.22	0.30	-0.34	0.63	.	11.8	.	.	2	47.0	73	0.89189	.
188	D	SP	2.42	1.46	0.96	0.18	0.17	0.01	.	12.2	.	.	2	77.0	73	1.26042	.
189	D	SU	3.76	1.74	2.02	.	.	.	.	25.1	22.4	.	5	30.0	73	0.93069	.
190	D	SU	.	.	.	.	.	0.55	.	27.4	.	.	5	33.0	73	.	.
191	D	SU	5.40	3.00	2.40	.	.	.	.	25.9	23.4	.	5	33.0	73	1.12500	.
192	D	SU	5.86	2.92	2.94	4.61	4.14	0.47	.	27.4	25.3	.	5	80.0	73	0.99660	.
193	D	SU	5.56	3.38	2.18	.	.	.	.	27.6	27.1	1.06	5	87.0	73	1.27523	.
194	D	SU	5.18	2.66	2.52	4.61	4.14	0.47	.	27.8	27.4	1.12	5	90.0	73	1.02778	.
195	D	SU	9.21	4.50	3.71	.	.	.	.	29.8	24.9	.	7	7.0	73	1.24124	.
196	D	SU	7.06	3.75	3.31	.	.	.	.	29.8	25.5	.	7	30.0	73	1.06647	.
197	D	SU	10.30	6.36	3.90	.	.	.	.	30.0	24.9	.	7	33.0	73	1.32051	.
198	D	SU	7.56	3.18	4.38	.	.	.	.	26.8	22.0	.	7	37.0	73	0.86301	.
199	D	SU	.	.	.	0.90	-0.31	1.21	.	26.8	.	.	7	40.0	73	.	.
200	D	FA	8.54	3.78	4.76	.	.	.	.	29.5	17.8	.	8	7.0	73	0.89706	.
201	D	FA	7.34	3.72	3.62	.	.	.	.	29.9	23.6	0.88	8	30.0	73	1.01381	.
202	D	FA	7.15	3.70	3.45	1.52	0.39	1.31	.	30.1	23.9	0.83	8	33.0	73	1.03623	.
203	D	FA	8.28	3.86	4.42	.	.	.	.	29.0	21.9	.	8	53.0	73	0.93665	.
204	D	FA	5.90	2.49	3.41	1.05	1.01	0.04	.	29.2	26.0	0.88	9	63.0	73	0.86510	.
205	D	FA	.	.	.	.	.	.	.	.	.	1.13	9	66.0	73	.	.
206	D	FA	.	.	.	.	.	.	.	.	.	1.23	9	66.0	73	.	.
207	D	FA	.	.	.	.	.	.	.	.	.	1.33	9	66.0	73	.	.
208	D	FA	.	.	.	.	.	.	.	.	.	1.87	9	66.0	73	.	.
209	D	FA	.	.	.	.	.	.	.	.	.	0.98	9	66.0	73	.	.
210	D	SP	2.36	0.96	1.40	1.51	1.34	0.17	.	20.4	23.7	1.37	4	23.0	77	0.84286	.
211	D	SU	9.32	5.58	3.74	5.04	3.58	1.46	.	31.3	26.4	1.40	6	7.0	77	1.24599	.
212	D	SU	7.26	3.73	3.53	4.07	2.75	1.32	4200	30.8	26.9	1.50	7	3.0	77	1.02833	0.0069143
213	D	SU	6.34	2.30	4.04	2.35	1.48	0.87	5570	30.7	27.1	1.10	7	3.0	77	0.78465	0.0045530
214	D	SU	8.01	3.93	4.08	4.72	2.40	2.32	7400	31.6	27.2	0.97	7	37.0	77	0.98162	0.0043297
215	D	FA	1.87	-0.42	2.29	3.65	3.02	0.63	4780	29.7	28.2	1.10	8	.	77	0.40830	0.0015649
216	D	FA	4.98	2.65	2.33	3.98	2.60	1.38	3870	27.9	24.9	1.50	8	3.0	77	1.06867	0.0051473

STATION=D

OBS	STATION	SEASON	PG	PN	R	PLANKPG	PLANKPN	PLANKR	INSOL	TEMP	SAL	EXTINCT	MONTH	DAY	YEAR	PRRATIO	ECOLEFF
217	D	FA	6.33	2.88	3.45	2.55	1.50	1.05	6030	29.2	28.4	1.10	8	3	77	0.91739	0.0041990
218	D	FA	8.16	4.13	4.03	3.53	2.88	0.65	5230	28.4	22.5	1.70	8	7	77	1.01241	0.0062409
219	D	FA	4.06	1.95	2.11	2.32	2.02	0.30	6462	29.5	30.9	0.90	9	3	77	0.96209	0.0025132
220	D	FA	5.66	2.79	2.87	2.67	2.35	0.32	4896	29.9	30.0	0.80	9	7	77	0.98606	0.0046242
221	D	FA	6.23	3.83	2.40	2.91	2.00	0.91	6579	30.4	26.7	1.40	9	7	77	1.29792	0.0037878
222	D	FA	4.88	1.73	3.15	4.15	3.07	1.08	5466	28.5	28.3	0.90	10	3	77	0.77460	0.0035712
223	D	FA	3.49	1.12	2.37	2.66	1.86	0.80	5238	28.6	28.5	1.10	10	7	77	0.73629	0.0026651
224	D	FA	2.00	0.36	1.64	0.90	0.77	0.16	6462	18.8	28.0	1.00	10	57	77	0.60976	0.0012380
225	D	FA	3.58	1.91	1.67	1.02	0.62	0.40	6227	18.6	27.6	1.10	10	60	77	1.07186	0.0022997
226	D	WI	2.61	0.85	1.76	0.92	0.67	0.25	2961	20.8	29.3	1.10	11	3	77	0.74148	0.0035258
227	D	WI	2.13	1.06	1.07	0.60	0.31	0.29	4347	15.6	30.0	0.90	11	5	77	0.99533	0.0019600
228	D	WI	2.09	0.51	1.58	.	0.65	.	4441	15.0	29.3	1.10	11	47	77	0.66139	0.0018825
229	D	WI	1.39	0.96	0.43	0.86	0.74	0.12	2619	17.4	24.7	0.90	11	97	77	1.61628	0.0021229
230	D	WI	2.70	0.53	2.17	0.51	0.29	0.22	3416	18.6	24.7	0.90	11	99	77	0.62212	0.0031616
231	D	WI	1.89	1.29	0.60	0.56	0.23	0.33	.	15.2	26.5	.	12	63	77	1.57500	.
232	D	WI	3.39	1.32	2.07	0.30	0.23	0.07	.	15.6	24.5	0.71	12	67	77	0.81884	.
233	D	WI	0.41	0.05	0.36	0.48	0.34	0.14	159	9.1	23.5	1.06	2	3	78	0.56944	0.0103145
234	D	WI	0.85	0.39	0.46	0.76	0.27	0.49	453	9.7	22.7	0.85	2	7	78	0.92391	0.0075055
235	D	SP	1.62	1.23	0.39	1.74	1.43	0.31	1013	13.4	24.8	0.74	2	60	78	2.07692	0.0063968
236	D	SP	1.91	0.38	1.53	1.55	0.99	0.56	1358	13.5	25.7	1.70	2	63	78	0.62418	0.0056259
237	D	SP	3.13	1.26	1.87	2.87	2.50	0.37	2028	15.0	21.5	1.42	3	13	78	0.83690	0.0061736
238	D	SP	0.95	0.95	0.00	.	.	.	4221	14.5	21.4	1.42	3	63	78	.	0.0009003
239	D	SP	1.54	0.58	0.96	2.19	1.69	0.50	4404	17.7	19.4	1.84	3	97	78	0.80208	0.0013587
240	D	SP	2.74	1.12	1.62	2.31	1.67	0.64	4383	18.5	18.6	1.48	3	99	78	0.84568	0.0025006
241	D	SP	3.63	1.65	1.98	2.30	1.91	0.39	4201	24.3	22.2	1.55	4	23	78	0.91667	0.0034563
242	D	SP	3.19	1.54	1.65	3.23	2.61	0.62	4599	24.4	22.2	1.55	4	27	78	0.96667	0.0027745
243	D	SP	5.07	2.88	2.19	2.06	1.62	0.44	5408	22.7	22.0	1.31	4	74	78	1.15753	0.0037500
244	D	SP	3.37	0.54	2.83	2.44	2.44	0.00	3551	22.7	23.8	1.55	4	77	78	0.59541	0.0037961
245	D	SU	6.18	3.30	2.88	4.23	3.87	0.36	4924	26.3	21.2	1.48	5	27	78	1.07292	0.0050203
246	D	SU	5.47	2.54	2.93	4.11	3.03	1.08	2921	27.4	21.1	1.79	5	30	78	0.93345	0.0074906
247	D	SU	4.13	1.49	2.64	1.99	1.43	0.56	2664	26.3	18.1	1.17	5	67	78	0.78220	0.0062012
248	D	SU	8.05	4.64	3.41	2.61	2.45	0.16	5569	26.4	19.5	1.26	5	70	78	1.18035	0.0057820
249	D	SU	5.20	1.35	3.85	4.65	3.65	1.00	4278	29.9	20.4	1.36	6	27	78	0.67532	0.0048621
250	D	SU	5.16	3.01	2.15	5.44	4.80	0.64	4036	30.2	21.8	1.26	6	30	78	1.20000	0.0051140
251	D	SU	5.59	3.26	2.33	3.78	3.30	0.48	4116	27.4	23.6	1.06	6	77	78	1.19957	0.0054325
252	D	SU	3.31	1.34	1.97	2.69	2.19	0.50	3551	27.7	24.5	1.21	6	80	78	0.84010	0.0037285
253	D	SU	4.40	2.52	1.88	4.07	3.28	0.79	3830	29.5	21.5	1.13	7	23	78	1.17021	0.0045953
254	D	SU	2.83	2.01	0.82	4.17	3.09	1.08	4149	29.6	22.9	1.06	7	27	78	1.72561	0.0027284
255	D	SU	8.92	5.96	2.96	3.95	3.52	0.43	4036	28.5	21.9	1.00	7	70	78	1.50676	0.0088404
256	D	SU	6.04	3.76	2.28	5.46	4.59	0.87	3794	29.1	23.2	1.13	7	73	78	1.32456	0.0063679
257	D	FA	6.72	3.88	2.84	2.88	1.96	0.92	4762	29.2	19.4	0.85	8	17	78	1.18310	0.0056447
258	D	FA	4.25	1.49	2.76	1.85	1.36	0.49	4762	29.6	21.4	1.10	8	20	78	0.76993	0.0035699
259	D	FA	6.31	3.00	3.31	3.46	2.80	0.66	3874	30.0	24.0	0.81	8	93	78	0.95317	0.0065152
260	D	FA	7.11	4.32	2.79	5.08	4.90	0.18	2502	30.8	24.5	0.83	8	97	78	1.27419	0.0113669
261	D	FA	4.13	1.36	2.77	3.11	2.72	0.39	3511	29.0	27.6	1.06	9	70	78	0.74549	0.0047052
262	D	FA	4.50	2.60	1.90	3.40	3.40	0.00	3936	29.0	27.7	1.06	9	73	78	1.18421	0.0045732
263	D	FA	6.95	3.00	3.95	1.82	1.82	0.00	2972	26.8	28.8	1.24	10	3	78	0.87975	0.0093540
264	D	FA	3.04	1.78	1.26	1.19	0.87	0.32	3830	26.2	31.2	1.42	10	20	78	1.20635	0.0031749
265	D	FA	4.05	1.88	2.17	2.80	2.38	0.42	4149	24.0	31.8	1.42	10	23	78	0.93318	0.0039046
266	D	FA	3.98	1.66	2.32	3.76	2.80	0.96	3227	22.7	28.2	2.00	10	77	78	0.85776	0.0049334
267	D	WI	4.03	2.39	1.64	1.96	1.59	0.37	.	21.9	28.5	1.21	11	37	78	1.22866	.
268	D	WI	5.46	2.30	3.16	3.25	3.25	0.00	.	21.8	28.5	1.42	11	40	78	0.86392	.
269	D	WI	3.95	1.72	2.23	2.67	2.42	0.25	2582	21.6	26.2	1.36	11	97	78	0.88565	0.0061193
270	D	WI	2.87	1.32	1.55	2.35	2.35	0.00	2340	22.7	26.4	1.48	11	99	78	0.92581	0.0049060
271	D	WI	1.00	0.26	0.74	0.81	0.71	0.10	1775	14.1	25.2	0.85	12	50	78	0.67568	0.0022535
272	D	WI	2.80	1.51	1.29	0.65	0.63	0.02	2743	14.1	25.9	.	12	53	78	1.08527	0.0040831
273	D	WI	0.44	-0.65	1.09	0.53	0.53	0.00	2663	13.8	26.4	2.43	12	57	78	0.20183	0.0006609
274	D	WI	1.27	0.99	0.28	0.34	0.34	0.00	2662	10.2	25.6	1.04	1	17	79	2.26786	0.0019083
275	D	WI	2.80	1.58	1.22	0.45	-0.35	0.80	1775	11.8	25.8	0.75	1	20	79	1.14754	0.0063099
276	D	WI	0.55	0.16	0.39	1.23	0.23	1.00	2080	12.0	23.4	1.28	1	77	79	0.70513	0.0010577
277	D	WI	.	.	.	.	.	.	3224	12.8	22.6	4.25	1	80	79	.	.
278	D	SP	2.93	1.38	1.55	0.87	0.87	0.00	1750	14.8	23.3	1.10	2	53	79	0.94516	0.0066971
279	D	SP	1.49	0.86	0.63	1.33	0.95	0.38	2022	15.3	24.6	1.48	3	7	79	1.18254	0.0029476
280	D	SP	1.45	0.62	0.83	1.40	1.07	0.33	2980	16.1	24.8	0.95	3	10	79	0.87349	0.0019463
281	D	SP	1.11	0.43	0.68	1.16	0.56	0.60	3246	17.3	25.8	1.36	3	57	79	0.81618	0.0013678
282	D	SP	1.73	1.31	0.42	1.68	1.53	0.15	4417	17.4	27.0	1.36	3	60	79	2.05952	0.0015667
283	D	SP	2.89	1.63	1.26	0.97	0.46	0.51	4533	20.3	23.0	1.35	3	99	79	1.14683	0.0025502
284	D	SP	2.71	1.45	1.26	1.16	0.70	0.46	4193	21.5	21.7	1.24	4	3	79	1.07540	0.0025853
285	D	SP	3.68	1.89	1.79	2.11	1.63	0.48	3639	24.4	24.8	1.62	4	70	79	1.02793	0.0040451
286	D	SP	3.69	2.34	1.35	2.55	1.17	1.38	3536	24.0	24.0	1.36	4	73	79	1.36667	0.0041742
287	D	SU	5.30	2.31	2.99	3.52	2.16	1.36	3410	26.9	24.2	1.89	5	17	79	0.88629	0.0062170
288	D	SU	5.45	3.31	2.14	.	.	.	3410	27.3	22.2	1.55	5	20	79	1.27336	0.0063930
289	D	SU	3.07	2.04	1.03	6.58	6.58	0.00	5260	25.6	26.8	3.09	5	60	79	1.49029	0.0023346
290	D	SU	3.34	1.80	1.54	6.71	5.60	.	5470	24.9	26.2	2.83	5	63	79	1.08442	0.0024424

STATION=D

OBS	STATION	SEASON	PG	PN	R	PLANKPG	PLANKPN	PLANKR	INSOL	TEMP	SAL	EXTINCT	MONTH	DAY	YEAR	PRRATIO	ECOLEFF
291	D	SU	4.95	2.00	2.95	2.55	2.15	0.40	3406	30.5	26.3	1.10	6	27	79	0.8390	0.0058133
292	D	SU	5.09	2.74	2.35	4.51	3.75	0.76	4334	29.7	26.8	2.27	6	30	79	1.0830	0.0046977
293	D	SU	5.69	3.19	2.50	5.24	4.41	0.83	5303	30.1	28.0	1.55	6	83	79	1.1380	0.0042919
294	D	SU	5.56	3.27	2.29	5.63	4.30	1.33	4367	29.8	28.8	1.70	6	89	79	1.2140	0.0050927
295	D	SU	7.38	3.55	3.83	8.64	7.03	1.61	4680	31.0	27.9	1.80	7	27	79	0.9634	0.0063077
296	D	SU	8.02	3.55	4.47	5.58	4.48	1.10	4783	30.7	28.6	2.02	7	30	79	0.8971	0.0067071
297	D	SU	7.81	4.39	3.42	6.13	5.15	0.98	3016	29.2	24.7	1.48	7	77	79	1.1418	0.0103581
298	D	SU	7.16	3.39	3.77	7.86	6.05	1.81	3328	29.1	25.4	1.26	7	81	79	0.9496	0.0086058
299	D	FA	5.09	2.35	2.74	3.02	2.26	0.76	3262	30.1	24.6	1.13	8	19	79	0.9288	0.0062416
300	D	FA	6.16	2.85	3.31	5.09	4.11	0.98	3170	29.8	25.4	1.55	8	23	79	0.9305	0.0077729
301	D	FA	7.71	3.71	4.00	5.62	4.57	1.05	4245	29.9	26.5	2.00	8	61	79	0.9637	0.0072309
302	D	FA	7.83	4.17	3.66	6.02	5.13	0.89	4506	30.2	26.0	1.79	8	65	79	1.0697	0.0069507
303	D	FA	2.86	0.50	2.36	2.78	2.15	0.63	3562	29.2	26.9	1.36	9	27	79	0.6059	0.0032117
304	D	FA	2.21	0.38	1.83	3.39	2.82	0.57	3343	28.8	27.9	1.79	9	30	79	0.6038	0.0026443
305	D	FA	4.87	2.77	2.10	3.85	3.43	0.42	4263	25.9	27.0	1.98	10	16	79	1.1595	0.0045696
306	D	FA	5.92	3.25	2.67	2.34	2.10	0.24	3781	24.5	26.2	1.47	10	19	79	1.1086	0.0062629
307	D	FA	5.53	2.74	2.79	2.81	2.60	0.21	3008	24.8	27.1	1.48	10	61	79	0.9910	0.0073537
308	D	FA	6.30	3.62	2.68	3.46	2.23	1.23	2812	25.1	27.8	1.31	10	65	79	1.1754	0.0089616
309	D	WI	3.40	1.22	2.18	1.00	1.00	0.00	2213	23.8	26.4	1.00	11	7	79	0.7798	0.0061455
310	D	WI	3.34	2.21	1.13	1.09	1.09	0.00	2870	22.4	26.7	1.13	11	10	79	1.4779	0.0046551
311	D	WI	5.05	3.37	1.68	1.40	0.70	0.70	2478	16.9	28.4	.	11	53	79	1.5030	0.0081517
312	D	WI	5.57	3.39	2.18	1.03	0.75	0.28	2651	17.0	28.1	.	11	57	79	1.2775	0.0084044
313	D	WI	3.05	2.06	0.99	0.19	-0.06	0.25	3077	13.8	29.1	1.13	11	99	79	1.5404	0.0039649
314	D	WI	1.92	1.80	0.12	2.07	0.60	1.47	2326	13.2	27.9	1.13	12	3	79	8.0000	0.0032990
315	D	WI	3.06	1.39	1.67	0.30	0.26	0.04	980	19.6	26.9	.	12	48	79	0.9162	0.0124898
316	D	WI	2.33	0.65	1.68	0.56	0.56	0.00	231	18.2	27.4	.	12	52	79	0.6935	0.0403463
317	D	WI	-0.21	-0.36	0.15	0.28	0.11	0.17	645	12.5	27.1	1.42	1	13	80	-0.7000	-0.0013023
318	D	WI	0.85	0.39	0.46	0.15	0.05	0.10	2351	11.4	27.6	1.32	1	16	80	0.9239	0.0014462
319	D	WI	1.41	0.65	0.76	0.44	0.26	0.18	1810	16.4	26.3	0.68	1	58	80	0.9276	0.0031160
320	D	WI	1.98	0.98	1.00	0.28	0.06	0.22	2616	16.6	26.5	0.68	1	61	80	0.9900	0.0030275
321	D	SP	1.21	1.19	0.02	0.13	0.06	0.07	3952	11.9	27.1	1.31	2	4	80	30.2500	0.0012247
322	D	SP	2.10	1.21	0.89	1.09	1.09	0.00	3120	10.9	25.1	1.42	2	7	80	1.1798	0.0026923
323	D	SP	0.25	0.20	0.05	0.80	0.40	0.40	3773	16.1	25.7	1.42	2	79	80	2.5000	0.0002650
324	D	SP	1.70	0.73	0.97	1.24	1.00	0.24	2139	17.8	23.3	1.00	2	82	80	0.8763	0.0031791
325	D	SP	3.33	1.97	1.36	.	.	.	3818	16.7	23.0	1.62	3	26	80	1.2243	0.0034887
326	D	SP	2.77	1.12	1.65	1.45	-1.31	2.76	2525	18.8	20.9	2.00	3	29	80	0.8394	0.0043881
327	D	SP	1.54	1.09	0.45	2.00	1.28	0.72	4145	21.3	24.6	3.78	3	68	80	1.7111	0.0014861
328	D	SP	2.71	1.56	1.15	1.85	1.56	0.29	5080	19.2	25.6	1.70	3	71	80	1.1783	0.0021339
329	D	SP	1.43	0.43	1.00	1.70	1.08	0.62	2184	22.4	21.7	1.86	4	13	80	0.7150	0.0026190
330	D	SP	3.33	1.80	1.53	3.14	2.67	0.47	5125	21.5	22.5	2.01	4	17	80	1.0882	0.0025990
331	D	SP	1.43	1.28	0.15	1.32	0.72	0.60	4605	21.3	24.9	2.43	4	60	80	4.7667	0.0012421
332	D	SP	2.00	0.78	1.22	1.86	1.86	0.00	3550	21.7	24.7	2.13	4	63	80	0.8197	0.0022535
333	D	SU	2.71	1.39	1.32	2.30	1.59	0.71	5259	23.3	23.1	2.43	5	10	80	1.0265	0.0020612
334	D	SU	3.73	2.00	1.73	4.02	3.16	0.86	5125	24.1	22.8	2.62	5	13	80	1.0780	0.0029112
335	D	SU	3.48	1.85	1.63	3.34	3.02	0.32	4189	27.6	21.6	2.62	5	52	80	1.0675	0.0033230
336	D	SU	5.23	2.86	2.37	5.17	4.69	0.48	3387	27.3	22.5	2.43	5	55	80	1.1034	0.0061766
337	D	SU	2.57	1.29	1.28	1.93	1.56	0.37	4546	26.8	21.8	2.43	5	99	80	1.0039	0.0022613
338	D	SU	3.13	1.67	1.46	3.31	2.79	0.52	4902	26.8	22.5	2.62	6	3	80	1.0719	0.0025541
339	D	SU	5.36	3.06	2.30	3.42	3.01	0.41	5140	28.7	25.1	1.21	6	57	80	1.1652	0.0041712
340	D	SU	4.62	2.27	2.35	5.21	4.58	0.63	4768	29.2	25.4	1.89	6	60	80	0.9830	0.0038758
341	D	SU	2.81	1.45	1.36	4.28	3.85	0.43	2303	29.0	20.9	3.03	6	99	80	1.0331	0.0048806
342	D	SU	5.27	3.03	2.24	5.70	5.50	0.20	5467	29.7	20.8	2.02	7	3	80	1.1763	0.0038559
343	D	SU	4.06	1.85	2.21	2.56	1.80	0.76	5006	30.4	22.0	1.62	7	55	80	0.9186	0.0032441
344	D	SU	4.28	2.49	1.79	2.37	1.36	1.01	4019	30.1	21.2	2.62	7	58	80	1.1955	0.0042598
345	D	FA	4.98	2.30	2.68	2.41	1.88	0.53	3758	31.0	19.4	1.55	8	10	80	0.9291	0.0053007
346	D	FA	3.23	1.40	1.83	2.81	1.67	1.14	4724	30.9	19.7	1.62	8	13	80	0.8825	0.0027350
347	D	FA	5.09	2.78	2.31	2.20	1.59	0.61	4442	29.5	21.3	1.03	8	52	80	1.1017	0.0045835
348	D	FA	4.39	2.19	2.20	2.76	2.21	0.55	4709	30.2	22.1	1.06	8	55	80	0.9977	0.0037290
349	D	FA	3.21	1.69	1.52	6.34	5.40	0.94	4575	29.5	26.0	2.43	8	94	80	1.0559	0.0028066
350	D	FA	4.38	2.03	2.35	4.51	3.76	0.75	4397	29.6	25.6	1.70	8	97	80	0.9319	0.0039845
351	D	FA	2.89	1.12	1.77	3.47	2.67	0.80	4075	28.4	28.4	1.10	9	40	80	0.8164	0.0028368
352	D	FA	4.25	2.58	1.67	3.04	2.61	0.43	3692	28.5	29.1	0.97	9	43	80	1.2725	0.0046046
353	D	FA	7.95	4.33	3.62	3.48	2.68	0.80	3207	30.1	26.6	1.04	9	90	80	1.0981	0.0099158
354	D	FA	6.21	2.72	3.49	5.25	4.20	1.05	3663	30.2	27.0	1.04	9	93	80	0.8897	0.0067813
355	D	FA	3.90	1.68	2.22	1.82	1.50	0.32	3678	24.6	25.8	1.13	10	48	80	0.8784	0.0042414
356	D	FA	5.08	2.92	2.16	2.26	1.32	0.94	3354	25.0	25.7	1.06	10	52	80	1.1759	0.0060584
357	D	WI	3.35	1.83	1.52	2.33	1.66	0.67	2228	22.7	25.7	1.31	10	99	80	1.1020	0.0060144
358	D	WI	7.02	4.32	2.70	3.32	2.23	1.09	4165	21.8	26.3	1.31	11	3	80	1.3000	0.0067419
359	D	WI	2.03	1.68	0.35	2.88	1.93	0.95	1792	19.0	25.9	1.31	11	47	80	2.9000	0.0045312
360	D	WI	1.68	1.07	1.61	2.86	1.89	0.97	2663	19.7	25.5	1.42	11	50	80	0.5217	0.0025235
361	D	WI	2.32	1.81	0.51	1.18	1.18	0.00	3607	15.9	25.7	1.62	11	97	80	2.2745	0.0025728
362	D	WI	3.22	2.02	1.20	1.17	0.72	0.45	.	15.9	24.5	1.31	11	99	80	1.3417	.
363	D	WI	0.49	0.03	0.46	0.40	0.40	0.00	1537	16.2	24.9	0.87	12	52	80	0.5326	0.0012752
364	D	WI	3.31	2.43	0.88	0.76	-0.08	0.84	2249	15.9	24.3	1.00	12	55	80	1.8807	0.0058871

APPENDIX C

SUMMARY OF DATA FROM THE DISCHARGE BAY (OB) AND ITS CONTROL BAY (C)

EXPLANATORY KEY OF TABLE CAPTIONS IN APPENDIX C

OBS—Observation #.

STATION—See Figure II-1b.

SEASON—See descriptions in chapter 5.

PG—System gross productivity (g $O_2 \cdot m^{-2} \cdot d^{-1}$).

PN—System daytime net productivity (g $O_2 \cdot m^{-2} \cdot d^{-1}$).

R—System night respiration (g $O_2 \cdot m^{-2} \cdot d^{-1}$).

PLANKPG—Plankton gross productivity (g $O_2 \cdot m^{-2} \cdot d^{-1}$).

PLANKPN—Plankton 24-hour net productivity (g $O_2 \cdot m^{-2} \cdot d^{-1}$).

PLANKR—Plankton 24-hour respiration (g $O_2 \cdot m^{-2} \cdot d^{-1}$).

INSOL—Insolation ($kcal \cdot m^{-2} \cdot d^{-1}$).

TEMP—Temperature (°C).

SAL—Salinity (‰).

EXTINCT—Extinction coefficient (m^{-1}).

MONTH—(Self-explanatory).

DAY—Day (calculated as percentage of 30 or 31 days in the month).

YEAR—(Self-explanatory).

PRRATIO—(calculated as PG/2R).

ECOLEFF—Ecological efficiency (calculated as [4 x PG]/INSOL).

STATION=C

OBS	STATION	SEASON	PG	PN	R	PLANKPG	PLANKPN	PLANKR	INSOL	TEMP	SAL	EXTINCT	MONTH	DAY	YEAR	PRRATIO	ECOLEFF
1	C	SU	11.84	6.02	5.82	9.88	6.83	3.05	.	30.34	28.12	2.00	6	99	77	1.0172	.
2	C	SU	7.87	3.81	4.06	7.18	4.80	2.38	4200	30.34	28.12	1.79	7	3	77	0.9692	0.007495
3	C	SU	9.20	4.80	4.40	8.65	4.36	4.29	7400	31.82	28.64	0.93	7	37	77	1.0455	0.004973
4	C	SU	8.35	4.70	3.65	3.76	1.54	2.22	5570	30.97	28.45	0.96	7	43	77	1.1438	0.005996
5	C	FA	0.99	0.69	0.30	6.26	4.05	2.21	4780	29.30	29.54	1.06	8	30	77	1.6500	0.000828
6	C	FA	5.33	2.03	3.30	2.48	0.86	1.62	6030	29.30	29.54	1.26	8	33	77	0.8076	0.003536
7	C	FA	8.40	4.77	3.63	9.85	8.75	1.11	3870	28.04	24.64	1.13	8	73	77	1.1570	0.008682
8	C	FA	11.86	5.84	6.02	4.28	2.47	1.81	5230	28.04	24.64	0.94	8	77	77	0.9850	0.009071
9	C	FA	4.32	1.40	2.92	3.46	1.97	1.49	6579	29.80	28.10	1.13	9	27	77	0.7397	0.002627
10	C	FA	5.32	3.43	1.89	5.34	4.21	1.13	6462	29.64	31.08	1.00	9	63	77	1.4074	0.003293
11	C	FA	2.56	1.67	0.89	5.01	4.16	1.01	4896	29.64	31.08	0.85	9	67	77	1.4382	0.002092
12	C	FA	6.27	2.61	3.66	5.44	4.09	1.35	5466	28.74	29.88	0.82	10	3	77	0.8566	0.004588
13	C	FA	4.54	1.47	3.07	3.52	2.78	0.74	5238	28.74	29.96	0.82	10	7	77	0.7394	0.003467
14	C	FA	4.01	1.70	2.31	2.88	2.66	0.22	6462	19.08	27.48	1.00	10	57	77	0.8680	0.002482
15	C	FA	3.85	2.00	1.85	2.10	1.59	0.51	6227	19.08	27.48	0.94	10	60	77	1.0405	0.002473
16	C	WI	2.64	1.48	1.16	2.60	1.81	0.79	2961	21.17	28.70	1.03	11	3	77	1.1379	0.003566
17	C	WI	3.49	1.32	2.17	2.12	1.92	0.20	4441	15.58	29.98	1.10	11	47	77	0.8041	0.003143
18	C	WI	4.41	2.11	2.30	1.42	1.07	0.35	4347	15.58	29.98	1.10	11	50	77	0.9587	0.004058
19	C	WI	1.74	0.66	1.08	0.73	0.43	0.30	2619	18.14	25.30	0.94	11	97	77	0.8056	0.002658
20	C	WI	2.59	0.73	1.86	1.11	0.86	0.25	3416	18.14	25.30	0.92	11	99	77	0.6962	0.003033
21	C	WI	2.93	1.68	1.25	1.47	0.59	0.88	.	15.40	27.90	0.61	12	63	77	1.1720	.
22	C	WI	4.25	1.95	2.30	0.55	0.18	0.37	.	15.70	26.70	0.64	12	67	77	0.9239	.
23	C	WI	-1.37	-1.47	0.10	0.77	0.57	0.20	159	9.20	23.80	1.08	2	3	78	-6.8500	-0.034465
24	C	WI	2.67	1.08	1.59	1.10	0.63	0.47	453	9.80	23.50	0.90	2	7	78	0.8396	0.023576
25	C	SP	2.69	1.37	1.32	2.58	2.09	0.49	1013	12.90	25.50	0.79	2	60	78	1.0189	0.010622
26	C	SP	1.85	0.38	1.47	1.27	1.21	0.06	1358	13.10	26.60	1.36	2	63	78	0.6293	0.005449
27	C	SP	3.71	1.76	1.95	3.65	3.65	0.00	2028	14.60	23.50	1.70	3	13	78	0.9513	0.007318
28	C	SP	2.26	1.80	0.46	.	.	.	4221	15.00	22.60	1.36	3	63	78	2.4565	0.002142
29	C	SP	2.29	1.25	1.04	2.35	1.94	0.41	4404	17.90	18.50	1.55	3	97	78	1.1010	0.002080
30	C	SP	2.21	0.48	1.73	3.25	2.62	0.63	4383	18.40	18.30	1.42	3	99	78	0.6387	0.002017
31	C	SP	2.13	0.90	1.23	3.86	3.61	0.23	4201	24.20	23.10	1.55	4	23	78	0.8659	0.002028
32	C	SP	1.72	0.05	1.77	3.44	2.61	0.83	4599	24.30	23.00	1.55	4	27	78	0.4859	0.001496
33	C	SP	7.05	5.02	2.03	2.36	1.66	0.70	5408	23.10	24.40	1.70	4	73	78	1.7365	0.005214
34	C	SP	4.78	0.82	3.96	4.17	2.22	1.95	3551	23.00	25.20	1.70	4	77	78	0.6035	0.005384
35	C	SU	5.24	2.63	2.61	5.19	4.64	0.55	4924	26.10	23.10	1.48	5	27	78	1.0038	0.004257
36	C	SU	5.02	2.63	2.39	9.41	8.09	1.32	2921	26.90	23.30	1.89	5	30	78	1.0502	0.006874
37	C	SU	3.05	0.77	2.28	2.84	2.18	0.66	2664	26.60	19.60	1.26	5	67	78	0.6689	0.004580
38	C	SU	4.79	2.45	2.34	3.71	2.62	1.09	5569	26.70	21.20	1.36	5	70	78	1.0235	0.003440
39	C	SU	5.67	2.52	3.15	.	.	.	4278	29.50	24.00	1.36	6	27	78	0.9000	0.005302
40	C	SU	.	.	.	.	.	.	4036	29.30	23.90	1.31	6	30	78	.	.
41	C	SU	7.71	4.42	3.29	6.30	4.73	1.57	4116	27.20	25.90	1.06	6	77	78	1.1717	0.007493
42	C	SU	5.81	2.77	3.04	5.35	4.00	1.35	3551	27.90	26.30	1.21	6	80	78	0.9556	0.006545
43	C	SU	4.42	1.95	2.47	3.74	2 68	1.06	3830	29.60	22.50	1.13	7	23	78	0.8947	0.004616
44	C	SU	5.17	2.57	2.60	4.34	3.74	0.60	4149	29.80	24.30	1.13	7	27	78	0.9942	0.004984
45	C	SU	9.80	5.53	4.27	6.14	6.14	0.00	4036	28.50	23.90	1.00	7	70	78	1.1475	0.009713
46	C	SU	8.47	4.88	3.59	7.87	6.50	1.37	3794	28.80	25.20	1.10	7	73	78	1.1797	0.008930
47	C	FA	4.61	2.46	2.15	3.11	1.96	1.15	3874	29.20	21.50	0.87	8	17	78	1.0721	0.004760
48	C	FA	4.29	1.97	2.32	3.29	2.61	0.68	2502	29.40	23.10	1.03	8	20	78	0.9246	0.006859
49	C	FA	4.72	2.93	1.79	3.67	2.95	0.72	4762	31.10	24.90	0.85	8	93	78	1.3184	0.003965
50	C	FA	7.77	4.77	3.00	6.98	6.41	0.57	4762	30.90	25.00	0.97	8	97	78	1.2950	0.006527
51	C	FA	6.46	2.90	3.56	5.05	4.16	0.89	3511	29.20	28.30	1.10	9	70	78	0.9073	0.007360
52	C	FA	4.46	2.40	2.06	3.61	3.29	0.32	3936	29.40	28.50	1.10	9	73	78	1.0825	0.004533
53	C	FA	4.22	2.26	1.96	2.57	2.57	0.00	2972	26.30	29.70	1.36	10	3	78	1.0765	0.005680
54	C	FA	5.08	3.20	1.88	.	.	.	3830	26.30	32.10	1.21	10	20	78	1.3511	0.005305
55	C	FA	3.35	1.70	1.65	.	.	.	4149	24.40	32.00	1.42	10	23	78	1.0152	0.003230
56	C	FA	4.15	1.50	2.65	3.77	2.71	1.06	3227	22.70	28.50	1.55	10	77	78	0.7830	0.005144
57	C	WI	2.88	1.44	1.44	1.93	1.58	0.35	.	22.00	28.50	1.16	11	37	78	1.0000	.
58	C	WI	2.66	1.41	1.25	5.21	5.21	0.00	.	21.90	28.50	1.03	11	40	78	1.0640	.
59	C	WI	4.72	2.16	2.56	2.74	1.93	0.81	2582	21.70	27.70	1.17	11	97	78	0.9219	0.007312
60	C	WI	3.22	1.26	1.96	4.14	3.14	1.00	2340	22.60	27.80	1.55	11	99	78	0.8214	0.005504
61	C	WI	1.32	0.72	0.60	0.56	0.47	0.09	1775	13.90	26.10	0.89	12	50	78	1.1000	0.002975
62	C	WI	1.90	1.00	0.90	1.02	0.87	0.15	2743	14.00	26.30	0.89	12	53	78	1.0556	0.002771
63	C	WI	1.20	0.51	0.69	1.90	1.90	0.00	2663	14.00	26.90	1.48	12	57	78	0.8696	0.001802
64	C	WI	2.94	1.66	1.28	0.38	0.38	0.00	2662	10.10	25.70	1.12	1	17	79	1.1484	0.004418
65	C	WI	2.40	1.66	0.74	0.81	-0.20	1.01	1775	11.60	26.30	0.81	1	20	79	1.6216	0.005408
66	C	WI	2.95	1.22	1.73	1.70	-0.02	1.72	2080	12.30	24.80	1.36	1	77	79	0.8526	0.005673
67	C	WI	.	.	.	1.39	-0.87	2.26	3224	12.70	24.30	4.25	1	80	79	.	.
68	C	SP	3.12	1.72	1.40	1.07	1.07	0.00	1750	14.30	24.50	1.31	2	53	79	1.1143	0.007131
69	C	SP	2.66	1.21	1.45	2.09	1.30	0.79	2022	15.30	25.20	0.92	3	7	79	0.9172	0.005262
70	C	SP	2.31	1.17	1.14	3.33	2.62	0.71	2980	15.90	25.40	1.48	3	10	79	1.0132	0.003101
71	C	SP	1.99	1.17	0.82	1.72	0.96	0.76	3246	17.20	26.90	1.42	3	57	79	1.2134	0.002452
72	C	SP	3.39	1.99	1.40	2.51	2.31	0.20	4417	17.30	27.20	1.42	3	60	79	1.2107	0.003070
73	C	SP	3.31	1.45	1.86	1.60	0.73	0.87	4533	20.10	23.80	1.35	3	99	79	0.8898	0.002921
74	C	SP	2.35	1.11	1.24	0.92	0.41	0.51	4193	21.00	23.10	1.27	4	3	79	0.9476	0.002242

STATION=C

OBS	STATION	SEASON	PG	PN	R	PLANKPG	PLANKPN	PLANKR	INSOL	TEMP	SAL	EXTINCT	MONTH	DAY	YEAR	PRRATIO	ECOLEFF
75	C	SP	3.80	1.51	2.29	4.39	2.82	1.57	3639	24.5	26.1	1.790	4	70	79	0.82969	0.0041770
76	C	SP	4.52	2.75	1.77	4.39	3.81	0.58	3536	24.1	25.0	2.270	4	73	79	1.27684	0.0051131
77	C	SU	3.15	1.24	1.91	2.68	1.90	0.78	3410	26.6	25.9	1.890	5	17	79	0.82461	0.0036950
78	C	SU	4.66	2.85	1.81	.	.	.	3410	27.0	25.0	2.270	5	20	79	1.28729	0.0054663
79	C	SU	3.91	3.01	0.90	6.58	5.80	0.78	5260	25.6	26.4	2.830	5	60	79	2.17222	0.0029734
80	C	SU	3.61	1.23	2.38	9.16	7.65	1.51	5470	24.8	26.1	2.830	5	63	79	0.75840	0.0026399
81	C	SU	4.29	1.82	2.47	5.47	4.75	0.72	3406	30.3	27.0	2.000	6	27	79	0.86842	0.0050382
82	C	SU	4.70	2.36	2.34	8.60	8.07	0.53	4334	29.6	27.3	2.270	6	30	79	1.00427	0.0043378
83	C	SU	5.63	3.14	2.49	4.93	3.72	1.21	5303	30.0	29.4	1.420	6	83	79	1.13052	0.0042467
84	C	SU	4.52	2.96	1.56	8.08	6.53	1.55	4367	29.8	30.0	1.480	6	86	79	1.44872	0.0041401
85	C	SU	6.43	2.83	3.60	7.80	5.84	1.96	4680	31.1	28.6	1.900	7	27	79	0.89306	0.0054957
86	C	SU	7.12	3.60	3.52	8.91	7.40	1.51	4783	30.8	29.0	2.230	7	30	79	1.01136	0.0059544
87	C	SU	6.27	3.71	2.56	8.98	7.94	1.04	3016	29.3	27.0	1.420	7	77	79	1.22461	0.0083156
88	C	SU	6.62	3.36	3.26	11.17	9.73	1.44	3328	29.3	28.2	1.420	7	81	79	1.01534	0.0079567
89	C	FA	5.54	2.74	2.80	4.57	3.51	1.06	3262	30.4	25.9	1.210	8	19	79	0.98929	0.0067934
90	C	FA	7.02	3.19	3.83	6.79	6.79	0.00	3170	29.8	26.2	1.480	8	23	79	0.91645	0.0088580
91	C	FA	8.82	4.67	4.15	7.19	5.71	1.48	4265	30.0	27.0	1.890	8	61	79	1.06265	0.0082720
92	C	FA	7.97	4.17	3.80	8.20	6.90	1.30	4506	30.3	27.1	1.890	8	65	79	1.04868	0.0070750
93	C	FA	2.35	-0.18	2.53	5.31	4.12	1.19	3562	29.1	28.4	1.360	9	27	79	0.46443	0.0026390
94	C	FA	2.60	0.67	1.93	7.35	6.10	1.25	3343	29.0	29.0	1.890	9	30	79	0.67358	0.0031110
95	C	FA	3.41	1.82	1.59	5.39	4.92	0.47	4263	26.1	28.1	2.350	10	16	79	1.07233	0.0031996
96	C	FA	5.66	3.10	2.56	4.79	4.40	0.39	3781	24.8	27.7	1.720	10	19	79	1.10547	0.0059878
97	C	FA	5.27	2.99	2.28	3.76	3.29	0.47	3008	24.8	27.6	1.360	10	61	79	1.15570	0.0070080
98	C	FA	7.90	5.08	2.82	7.01	5.58	1.43	2812	25.0	28.3	1.360	10	65	79	1.40071	0.0112376
99	C	WI	3.34	1.23	2.14	2.43	2.43	0.00	2213	23.8	28.0	1.100	11	7	79	0.78037	0.0060371
100	C	WI	3.21	2.22	0.99	2.65	2.02	0.63	2870	22.6	28.3	1.210	11	10	79	1.62121	0.0044739
101	C	WI	3.24	3.24	0.00	4.65	4.15	0.50	2478	17.2	28.0	1.000	11	53	79	.	0.0052300
102	C	WI	5.80	3.32	2.48	3.87	2.02	1.85	2651	17.2	27.9	0.850	11	57	79	1.16935	0.0087514
103	C	WI	3.59	2.55	1.04	2.70	2.70	0.00	3077	14.7	28.5	1.310	11	99	79	1.72596	0.0046669
104	C	WI	2.01	1.59	0.42	1.45	1.36	0.09	2328	13.8	27.9	1.420	12	3	79	2.39286	0.0034536
105	C	WI	1.21	0.53	0.68	0.60	0.47	0.13	980	19.0	28.0	0.710	12	48	79	0.88971	0.0049388
106	C	WI	1.11	0.07	1.04	0.24	0.07	0.17	231	18.1	28.5	0.760	12	52	79	0.53365	0.0192208
107	C	WI	3.81	1.73	2.08	4.40	3.26	1.14	2228	22.7	26.1	1.481	0	9	80	0.91587	0.0068402
108	C	WI	4.76	2.99	1.77	4.42	3.47	0.95	4165	22.1	26.0	1.481	1	3	80	1.34463	0.0045714
109	C	WI	0.21	0.21	.	0.35	-0.08	0.43	645	12.6	27.3	0.890	1	13	80	.	0.0013023
110	C	WI	0.45	0.06	0.39	0.68	0.13	0.55	2351	11.9	27.4	1.280	1	16	80	0.57692	0.0007656
111	C	WI	0.43	0.43	0.00	0.77	0.77	0.00	1810	16.1	27.4	0.790	1	58	80	.	0.0009503
112	C	WI	1.03	0.46	0.57	-0.01	-0.01	0.00	2616	16.4	28.1	0.770	1	61	80	0.90351	0.0015749
113	C	SP	0.03	0.03	0.00	0.55	0.28	0.27	3952	13.2	26.9	1.700	2	4	80	.	0.0000304
114	C	SP	5.48	3.43	2.05	1.20	1.20	0.00	3120	11.0	24.5	1.260	2	7	80	1.33659	0.0070256
115	C	SP	1.97	1.11	0.86	1.09	0.64	0.45	3773	15.9	26.7	1.130	2	79	80	1.14535	0.0020885
116	C	SP	2.15	1.33	0.82	0.88	0.29	0.59	2139	17.8	24.5	0.790	2	82	80	1.31098	0.0040206
117	C	SP	2.20	1.27	0.93	.	.	.	3818	15.8	24.2	1.620	3	26	80	1.18280	0.0023049
118	C	SP	2.99	1.07	1.92	2.79	1.98	0.81	2525	17.9	22.4	1.420	3	29	80	0.77865	0.0047366
119	C	SP	0.56	0.40	0.16	3.73	2.97	0.76	4145	20.6	25.8	3.400	3	68	80	1.75000	0.0005404
120	C	SP	2.90	1.67	1.23	3.78	3.25	0.53	5080	19.4	25.7	1.550	3	71	80	1.17886	0.0022835
121	C	SP	1.62	0.59	1.03	1.88	1.66	0.22	2184	22.1	23.4	2.290	4	13	80	0.78641	0.0029670
122	C	SP	3.60	2.08	1.52	3.94	3.81	0.13	5125	21.5	23.4	2.340	4	17	80	1.18421	0.0028098
123	C	SP	1.83	1.35	0.48	2.53	1.68	0.87	4605	21.3	25.6	2.430	4	60	80	1.90625	0.0015896
124	C	SP	1.01	0.57	0.44	1.65	1.41	0.24	3550	21.6	25.4	2.620	4	63	80	1.14773	0.0011380
125	C	SU	2.85	1.28	1.57	2.94	2.10	0.84	5259	23.2	23.2	2.430	5	10	80	0.90764	0.0021677
126	C	SU	3.61	1.25	2.36	4.45	3.09	1.36	5125	23.9	23.3	2.620	5	13	80	0.76483	0.0028176
127	C	SU	4.53	2.77	1.76	5.32	5.32	0.00	4189	27.2	23.0	3.400	5	52	80	1.28693	0.0043256
128	C	SU	3.86	1.90	1.96	5.47	5.47	0.00	3387	27.0	24.1	2.830	5	55	80	0.98469	0.0045586
129	C	SU	3.74	1.88	1.86	3.85	3.71	0.14	4546	26.7	22.8	2.430	5	99	80	1.00538	0.0032908
130	C	SU	4.08	2.19	1.89	8.26	6.60	1.66	4902	26.8	23.4	2.830	6	3	80	1.07937	0.0033293
131	C	SU	6.26	3.73	2.53	4.51	3.47	1.04	5140	28.2	26.5	1.260	6	57	80	1.23715	0.0049716
132	C	SU	5.36	2.44	2.92	8.47	8.23	0.24	4768	28.7	26.4	2.130	6	60	80	0.91781	0.0044966
133	C	SU	2.04	0.96	1.08	5.23	4.29	0.97	2303	29.2	22.7	2.880	6	99	80	0.94444	0.0035432
134	C	SU	5.64	3.48	2.16	8.25	8.02	0.23	5467	29.6	22.1	2.090	7	3	80	1.30556	0.0041266
135	C	SU	4.70	2.10	2.60	4.80	3.90	0.90	5006	30.3	22.6	1.790	7	55	80	0.90385	0.0037555
136	C	SU	4.34	2.31	2.03	3.98	3.04	0.94	4019	30.0	21.5	2.830	7	58	80	1.06897	0.0043195
137	C	FA	5.13	2.24	2.89	3.65	2.98	0.67	3758	31.1	21.1	2.130	8	10	80	0.88754	0.0054604
138	C	FA	4.01	2.11	1.90	4.35	2.98	1.37	4724	31.1	21.0	2.130	8	13	80	1.05526	0.0033954
139	C	FA	4.99	2.73	2.26	4.29	3.30	0.99	4442	29.4	24.2	1.170	8	52	80	1.10398	0.0044935
140	C	FA	5.04	3.10	1.94	4.36	2.48	1.88	4709	30.2	24.4	1.030	8	55	80	1.29897	0.0042812
141	C	FA	6.36	3.22	3.14	6.63	5.18	1.45	4575	29.5	27.0	2.000	8	94	80	1.01274	0.0055607
142	C	FA	6.08	3.46	2.62	5.15	3.98	1.17	4397	29.6	27.0	2.130	8	97	80	1.16031	0.0055310
143	C	FA	3.20	1.38	1.82	4.16	3.35	0.81	4075	28.6	29.1	1.100	9	40	80	0.87912	0.0031411
144	C	FA	4.20	2.37	1.83	3.19	2.22	0.97	3692	28.6	29.6	1.030	9	43	80	1.14754	0.0045504
145	C	FA	5.62	3.67	1.95	5.01	4.19	0.82	3207	30.1	28.4	1.040	9	90	80	1.44103	0.0070097
146	C	FA	6.00	2.62	3.38	6.26	4.74	1.52	3663	30.3	28.8	0.950	9	93	80	0.88757	0.0065520
147	C	FA	4.56	2.09	2.47	2.42	1.45	0.97	3678	24.3	25.3	1.210	10	48	80	0.92308	0.0049592
148	C	FA	5.99	3.22	2.77	3.23	1.46	1.77	3354	24.7	25.5	1.060	10	52	80	1.08123	0.0071437

STATION=C

OBS	STATION	SEASON	PG	PN	R	PLANKPG	PLANKPN	PLANKR	INSOL	TEMP	SAL	EXTINCT	MONTH	DAY	YEAR	PRRATIO	ECOLEFF
149	C	WI	2.07	1.45	0.62	2.43	1.46	0.97	1792	19.0	26.2	1.36	11	47	80	1.6694	0.00462054
150	C	WI	1.79	1.01	0.78	2.37	1.42	0.95	2663	19.7	26.0	1.36	11	50	80	1.1474	0.00268870
151	C	WI	2.05	1.97	0.08	2.09	0.90	1.19	3607	16.2	25.2	1.17	11	97	80	12.8125	0.00227336
152	C	WI	3.82	3.46	0.36	1.52	1.11	0.41	.	15.8	24.4	1.48	11	99	80	5.3056	.
153	C	WI	2.03	0.99	1.04	0.75	0.60	0.15	1537	16.4	25.5	1.06	12	52	80	0.9760	0.00528302
154	C	WI	1.13	0.51	0.62	0.96	0.60	0.36	2249	15.8	25.3	1.03	12	55	80	0.9113	0.00200978

STATION=D

OBS	STATION	SEASON	PG	PN	R	PLANKPG	PLANKPN	PLANKR	INSOL	TEMP	SAL	EXTINCT	MONTH	DAY	YEAR	PRRATIO	ECOLEFF
155	D	SU	2.99	2.08	0.91	.	.	.	.	33.38	27.68	1.79	6	99	77	1.6429	.
156	D	SU	4.85	1.88	2.97	.	.	.	4200	33.38	27.68	1.48	7	3	77	0.8165	0.0046190
157	D	SU	5.30	2.77	2.53	.	.	.	5570	35.00	29.01	1.22	7	43	77	1.0474	0.0038061
158	D	FA	0.15	-2.21	2.36	.	.	.	4780	33.33	30.10	1.62	8	30	77	0.0318	0.0001255
159	D	FA	5.69	2.36	3.33	0.80	-0.14	0.94	3870	29.52	26.74	1.31	8	73	77	0.8544	0.0058811
160	D	FA	4.90	3.40	1.50	7.26	6.23	1.03	5230	29.52	26.74	1.36	8	77	77	1.6333	0.0037476
161	D	FA	4.32	2.82	1.50	5.19	4.17	1.02	6579	34.77	29.70	1.06	9	27	77	1.4400	0.0026265
162	D	FA	7.67	4.54	3.13	2.38	1.14	1.24	6432	33.78	31.48	1.48	9	63	77	1.2252	0.0047478
163	D	FA	5.26	3.68	1.58	3.31	2.84	0.47	4986	33.78	31.48	1.70	9	67	77	1.6646	0.0042198
164	D	FA	9.26	4.41	4.85	3.50	2.34	1.16	5466	32.64	30.17	1.29	10	3	77	0.9546	0.0067764
165	D	FA	7.04	2.50	4.54	4.06	3.51	0.55	5238	32.73	29.98	1.43	10	7	77	0.7753	0.0053761
166	D	FA	5.02	3.14	1.88	2.75	2.12	0.63	6462	22.46	26.38	1.17	10	57	77	1.3351	0.0031074
167	D	FA	3.46	1.66	0.80	2.58	1.93	0.65	6227	22.46	26.38	1.06	10	60	77	2.1625	0.0022226
168	D	WI	6.19	2.54	3.65	2.23	2.00	0.23	2961	24.30	28.37	1.42	11	3	77	0.8479	0.0083620
169	D	WI	3.08	1.91	1.17	2.05	1.08	0.97	4441	19.98	29.30	1.36	11	47	77	1.3162	0.0027741
170	D	WI	4.08	2.73	1.35	1.60	1.29	0.31	4347	19.98	29.30	1.31	11	50	77	1.5111	0.0037543
171	D	WI	2.46	1.37	1.09	0.96	0.89	0.07	2619	23.40	25.16	1.13	11	97	77	1.1284	0.0037572
172	D	WI	3.82	1.57	2.25	1.49	1 16	0.33	3416	23.40	25.16	1.26	11	99	77	0.8489	0.0044731
173	D	WI	1.67	1.67	0.00	1.28	0.96	0.32	.	18.40	25.20	0.89	12	63	77	.	.
174	D	WI	1.44	1.44	0.00	1.19	1.02	0.17	.	20.30	27.50	0.94	12	67	77	.	.
175	D	WI	1.29	1.08	0.21	0.55	0.23	0.32	159	13.00	22.90	1.13	2	3	78	3.0714	0.0324528
176	D	WI	0.95	0.64	0.31	0.76	0.41	0.35	453	12.40	23.40	0.81	2	7	78	1.5323	0.0083885
177	D	SP	2.80	2.74	0.06	2.64	2.02	0.62	1013	16.30	26.90	1.17	2	60	78	23.3333	0.0110563
178	D	SP	1.47	0.99	0.48	0.82	0.49	0.60	1358	16.30	27.00	1.48	2	63	78	1.5312	0.0043299
179	D	SP	0.46	0.46	0.00	2.81	2.81	0.00	2028	17.60	20.80	1.48	3	13	78	.	0.0009073
180	D	SP	5.39	3.94	1.45	.	.	.	4221	16.20	11.40	1.55	3	63	78	1.8586	0.0051078
181	D	SP	2.28	0.56	1.72	3.87	2.64	1.23	4404	18.80	12.80	1.89	3	97	78	0.6628	0.0020708
182	D	SP	6.29	3.72	2.57	4.45	3.29	1.16	4383	20.00	13.00	1.62	3	99	78	1.2237	0.0057404
183	D	SP	3.80	1.41	2.39	5.00	3.04	1.96	4201	25.90	17.90	2.13	4	23	78	0.7950	0.0036182
184	D	SP	5.11	2.49	2.62	4.61	3.59	1.02	4599	25.90	16.90	2.43	4	27	78	0.9752	0.0044444
185	D	SP	8.42	5.76	2.66	6.73	5.88	0.85	5408	24.30	19.80	2.13	4	73	78	1.5827	0.0062278
186	D	SP	5.29	2.07	3.22	6.77	4.73	2.04	3551	24.20	20.10	1.94	4	77	78	0.8214	0.0059589
187	D	SU	5.04	2.00	3.04	12.00	11.57	0.43	4924	29.40	23.70	1.79	5	27	78	0.8289	0.0040942
188	D	SU	6.13	4.68	1.45	13.13	12.15	0.98	2921	30.10	23.90	1.48	5	30	78	2.1138	0.0083944
189	D	SU	1.28	-1.66	2.94	3.54	2.90	0.64	2664	30.50	20.70	1.62	5	67	78	0.2177	0.0019219
190	D	SU	5.10	1.49	3.61	2.93	2.45	0.48	5569	30.20	20.70	1.48	5	70	78	0.7064	0.0036631
191	D	SU	4.50	2.03	2.47	6.08	5.13	0.95	4278	32.90	23.40	1.26	6	27	78	0.9109	0.0042076
192	D	SU	.	.	.	.	.	.	4036	31.20	23.50	1.42	6	30	78	.	.
193	D	SU	7.30	3.24	4.06	9.10	8.23	0.87	4116	30.30	24.10	1.48	6	77	78	0.8990	0.0070943
194	D	SU	5.15	3.24	1.91	.	.	.	3551	30.00	23.70	1.70	6	80	78	1.3482	0.0058012
195	D	SU	2.21	-1.54	3.75	5.05	4.79	0.26	3830	31.70	23.30	1.55	7	23	78	0.2947	0.0023081
196	D	SU	1.31	-0.95	2.26	5.81	5.49	0.32	4149	31.00	23.20	1.42	7	27	78	0.2898	0.0012630
197	D	SU	5.27	4.34	0.93	.	.	.	4036	31.60	25.20	1.42	7	70	78	2.8333	0.0052230
198	D	SU	4.49	2.70	1.79	4.55	3.88	0.67	3794	31.50	24.90	1.70	7	73	78	1.2542	0.0047338
199	D	FA	2.70	1.52	1.18	4.56	4.01	0.55	3874	33.00	23.70	1.30	8	17	78	1.1441	0.0027878
200	D	FA	2.19	1.46	0.73	4.20	4.20	0.00	2502	32.40	23.60	1.42	8	20	78	1.5000	0.0035012
201	D	FA	2.56	1.03	1.53	4.14	3.08	1.06	4762	33.50	24.60	1.13	8	93	78	0.8366	0.0021504
202	D	FA	4.54	3.38	1.16	5.07	4.61	0.46	4762	33.60	25.40	1.17	8	97	78	1.9569	0.0038135
203	D	FA	5.81	2.69	3.12	3.70	3.70	0.00	3511	31.00	25.90	1.42	9	70	78	0.9311	0.0066192
204	D	FA	5.46	3.15	2.31	3.94	3.94	0.00	3936	30.60	25.50	1.26	9	73	78	1.1818	0.0055488
205	D	FA	1.91	0.10	1.81	4.34	3.23	1.11	2972	31.00	30.30	1.58	10	3	78	0.5276	0.0025707
206	D	FA	7.79	4.15	3.64	3.03	2.03	1.00	3830	31.00	29.70	1.42	10	20	78	1.0701	0.0081358
207	D	FA	5.50	2.43	3.07	3.05	2.24	0.81	4149	27.70	28.20	1.42	10	23	78	0.8958	0.0053025
208	D	FA	4.64	3.13	1.51	4.27	3.20	1.07	3227	26.10	27.20	1.31	10	77	78	1.5364	0.0057515
209	D	WI	9.25	1.20	8.05	4.23	3.42	0.81	.	27.30	28.40	1.65	11	37	78	0.5745	.
210	D	WI	2.22	1.67	0.55	4.72	4.72	0.00	.	27.20	28.20	1.59	11	40	78	2.0182	.
211	D	WI	3.46	1.38	2.08	3.61	3.61	0.00	2582	26.30	27.80	1.42	11	97	78	0.8317	0.0053602
212	D	WI	1.45	0.77	0.68	0.19	0.06	0.13	2340	26.80	27.90	1.48	11	99	78	1.0662	0.0024786
213	D	WI	3.76	0.00	3.76	1.09	0.88	0.21	1775	19.40	25.50	1.06	12	50	78	0.5000	0.0084732
214	D	WI	1.68	1.60	0.08	1.80	1.77	0.03	2743	18.80	25.90	1.17	12	53	78	10.5000	0.0024499
215	D	WI	1.40	0.00	1.40	1.91	1.64	0.27	2663	18.40	26.00	1.31	12	57	78	0.5000	0.0021029
216	D	WI	5.28	4.72	0.56	2.02	1.90	0.12	2662	15.30	26.70	1.01	1	17	79	4.7143	0.0079339

STATION=D

OBS	STATION	SEASON	PG	PN	R	PLANKPG	PLANKPN	PLANKR	INSOL	TEMP	SAL	EXTINCT	MONTH	DAY	YEAR	PRRATIO	ECOLEFF
217	D	WI	2.50	2.50	0.00	0.89	-0.48	1.37	1775	14.4	27.3	0.73	1	20	79	.	0.0056338
218	D	WI	1.36	0.50	0.86	1.42	1.29	0.13	2080	15.2	24.2	1.10	1	77	79	0.79070	0.0026154
219	D	WI	.	.	.	1.31	1.31	0.00	3224	17.5	25.8	1.70	1	80	79	.	.
220	D	SP	1.43	1.32	0.11	1.51	1.15	0.36	1750	19.9	24.4	1.79	2	53	79	6.50000	0.0032686
221	D	SP	2.55	2.22	0.33	1.92	1.42	0.50	2022	18.2	24.0	1.21	3	7	79	3.86364	0.0050445
222	D	SP	4.49	3.07	1.42	3 51	3.51	0.00	2980	19.1	24.3	0.83	3	10	79	1.58099	0.0060268
223	D	SP	3.21	2.13	1.08	1.03	0.63	0.40	3246	18.6	23.8	1.10	3	57	79	1.48611	0.0039556
224	D	SP	2.24	2.08	0.16	1.36	1.36	0.00	4417	18.6	24.3	1.15	3	60	79	7.00000	0.0020285
225	D	SP	3.46	2.43	1.03	0.98	0.05	0.93	4533	24.8	24.2	1.23	3	99	79	1.67961	0.0030532
226	D	SP	3.48	2.32	1.16	1.03	-0.09	1.12	4193	25.7	24.4	1.24	4	3	79	1.50000	0.0033198
227	D	SP	4.62	2.64	1.98	4.62	3.81	0.81	3639	29.0	26.1	2.62	4	70	79	1.16667	0.0050783
228	D	SP	4.07	2.49	1.58	7.52	6.56	0.96	3536	27.9	26.1	2.43	4	73	79	1.28797	0.0046041
229	D	SU	5.73	3.28	2.45	.	.	.	3410	28.3	25.7	2.27	5	17	79	1.16939	0.0067214
230	D	SU	3.20	1.99	1.21	.	.	.	3410	28.7	25.6	2.43	5	20	79	1.32231	0.0037537
231	D	SU	4.86	3.52	1.34	4.49	3.79	0.70	5260	25.6	22.9	2.43	5	60	79	1.81343	0.0036958
232	D	SU	4.62	2.48	2.14	4.37	3.48	0.89	5470	25.1	22.7	2.43	5	63	79	1.07944	0.0033784
233	D	SU	2.37	1.24	1.13	2.65	1.93	0.72	3406	31.4	21.6	1.48	6	27	79	1.04867	0.0027833
234	D	SU	4.71	2.51	2.20	7.35	7.07	0.28	4334	30.7	23.6	1.89	6	30	79	1.07045	0.0043470
235	D	SU	5.14	3.74	1.40	3.62	2.78	0.84	5303	31.5	27.4	1.31	6	83	79	1.83571	0.0038771
236	D	SU	5.29	2.95	2.34	3.28	2.47	0.81	4367	30.7	27.3	1.26	6	86	79	1.13034	0.0048454
237	D	SU	5.15	2.78	2.37	6.88	5.10	1.78	4690	33.3	27.2	1.76	7	27	79	1.08650	0.0044017
238	D	SU	6.79	3.68	3.11	8.49	7.46	1.03	4783	32.6	26.9	1.65	7	30	79	1.09164	0.0056784
239	D	SU	8.07	5.16	2.91	7.18	6.17	1.01	3016	29.9	28.1	1.42	7	77	79	1.38660	0.0107029
240	D	SU	7.73	3.89	3.84	10.31	9.52	0.79	3328	29.6	28.1	1.55	7	81	79	1.00651	0.0092909
241	D	FA	1.23	-0.75	1.98	5.19	4.44	0.75	3262	35.5	27.5	1.49	8	19	79	0.31061	0.0015083
242	D	FA	2.19	0.83	1.36	9.40	8.26	1.14	3170	35.1	27.7	1.62	8	23	79	0.80515	0.0027634
243	D	FA	3.94	1.65	2.29	7.03	5.56	1.47	4265	32.1	27.2	2.00	8	61	79	0.86026	0.0036952
244	D	FA	4.52	1.80	2.72	6.43	5.44	0.99	4506	32.8	27.5	2.00	8	65	79	0.83089	0.0040124
245	D	FA	4.54	-1.37	5.91	6.24	5.17	1.07	3562	31.6	27.1	1.48	9	27	79	0.38409	0.0050983
246	D	FA	4.33	-1.25	5.58	4.84	4.01	0.83	3343	30.5	26.6	2.13	9	30	79	0.38799	0.0051810
247	D	FA	3.98	0.62	3.36	2.60	1.58	1.02	4263	27.9	19.7	2.71	10	16	79	0.59226	0.0037345
248	D	FA	6.10	2.20	3.90	4.17	3.65	0.52	3781	27.1	20.8	2.02	10	19	79	0.78205	0.0064533
249	D	FA	1.18	0.10	1.08	2.92	2.62	0.30	3008	30.7	28.2	1.70	10	61	79	0.54630	0.0015691
250	D	FA	1.53	1.39	0.14	4.24	3.23	1.01	2812	29.7	28.3	1.55	10	65	79	5.46429	0.0021764
251	D	FA	1.29	0.13	1.16	1.53	0.97	0.56	2213	29.9	29.5	1.42	11	7	79	0.55603	0.0023317
252	D	WI	0.83	0.06	0.77	1.82	1.72	0.10	2870	28.8	29.9	1.55	11	10	79	0.53896	0.0011568
253	D	WI	1.34	1.34	0.00	1.11	0.64	0.47	2478	23.1	28.2	1.00	11	53	79	.	0.0021630
254	D	WI	3.09	3.09	0.00	2.09	1.43	0.66	2651	21.6	27.0	0.94	11	57	79	.	0.0046624
255	D	WI	2.58	2.58	0.00	0.65	0.29	0.36	3077	18.3	28.0	1.36	11	99	79	.	0.0033539
256	D	WI	1.99	1.99	0.00	0.74	0.48	0.26	2328	18.4	27.3	1.55	12	3	79	.	0.0034192
257	D	WI	0.73	0.73	0.00	0.50	0.47	0.03	980	25.5	28.7	1.13	12	48	79	.	0.0029796
258	D	WI	-0.25	-0.25	0.00	1.18	1.18	0.00	231	24.0	29.2	1.06	12	52	79	.	-0.0043290
259	D	WI	0.30	0.30	0.00	0.31	0.21	0.10	645	18.3	26.8	1.42	1	13	80	.	0.0018605
260	D	WI	2.70	1.84	0.86	0.40	0.36	0.04	2351	15.7	26.4	1.90	1	16	80	1.56977	0.0045938
261	D	WI	2.25	2.25	0.00	0.59	0.52	0.07	1810	21.1	28.2	1.10	1	58	80	.	0.0049724
262	D	WI	2.75	2.75	0.00	0.79	0.36	0.43	2616	21.8	28.5	1.03	1	61	80	.	0.0042049
263	D	SP	0.49	0.49	0.00	0.81	0.42	0.39	3952	18.7	27.1	2.00	2	4	80	.	0.0004960
264	D	SP	3.30	3.30	0.00	0.20	0.10	0.10	3120	15.9	25.6	1.36	2	7	60	.	0.0042308
265	D	SP	5.26	4.22	1.04	1.67	1.63	0.04	3773	20.4	27.1	1.26	2	79	80	2.52885	0.0055765
266	D	SP	3.91	3.17	0.74	0.91	0.35	0.56	2139	21.3	26.9	1.06	2	82	80	2.64189	0.0073118
267	D	SP	4.14	4.14	0.00	1.50	1.08	0.42	3818	18.0	24.5	1.42	3	26	80	.	0.0043373
268	D	SP	2.57	2.16	0.41	2.19	1.03	1.16	2525	19.0	25.1	1.17	3	29	80	3.13415	0.0040713
269	D	SP	1.55	0.83	0.72	2.24	1.85	0.39	4145	22.1	25.5	2.13	3	68	80	1.07639	0.0014958
270	D	SP	4.54	3.95	0.59	2.36	2.01	0.35	5080	19.8	21.8	1.55	3	71	80	3.84746	0.0035748
271	D	SP	2.81	1.51	1.30	1.75	1.36	0.39	2184	24.0	24.3	2.10	4	13	80	1.08077	0.0051465
272	D	SP	3.02	2.67	0.35	1.33	0.35	0.98	5125	23.2	23.0	2.19	4	17	80	4.31429	0.0023571
273	D	SP	3.30	2.78	0.52	2.44	2.28	0.16	4605	22.3	21.8	1.89	4	60	80	3.17308	0.0028664
274	D	SP	2.80	1.78	1.02	2.06	2.06	0.00	3550	23.2	23.0	2.27	4	63	80	1.37255	0.0031549
275	D	SU	2.34	2.03	0.31	2 89	2.22	0.67	5259	24.9	19.0	2.27	5	10	80	3.77419	0.0017798
276	D	SU	2.93	2.40	0.53	4.60	4.29	0.31	5125	25.6	19.4	2.13	5	13	80	2.76415	0.0022868
277	D	SU	7.52	5.29	2.23	6.15	5.63	0.52	4189	29.5	21.1	2.43	5	52	80	1.68610	0.0071807
278	D	SU	4.47	2.34	2.13	7.38	6.63	0.75	3387	29.1	21.7	2.13	5	55	80	1.04930	0.0052790
279	D	SU	3.95	1.47	2.48	6.19	5.42	0.77	4546	28.8	22.1	3.09	5	99	80	0.79637	0.0034756
280	D	SU	4.84	3.06	1.78	7.99	7.34	0.65	4902	28.2	22.5	3.40	6	3	80	1.35955	0.0039494
281	D	SU	1.33	0.09	1.24	4.84	4.17	0.67	5140	30.2	24.3	1.36	6	57	80	0.53629	0.0010350
282	D	SU	4.28	3.61	0.67	7.13	7.13	0.00	4768	30.4	23.6	1.70	6	60	80	3.19403	0.0035906
283	D	SU	3.70	1.24	2.46	4.62	3.64	0.98	2303	30.2	18.2	2.83	6	99	80	0.75203	0.0064264
284	D	SU	14.05	11.32	2.73	13.01	12.29	0.72	5467	30.4	16.8	2.44	7	3	80	2.57326	0.0102799
285	D	SU	7.63	3.83	3.80	7.27	6.60	0.67	5006	31.9	21.1	1.70	7	55	80	1.00395	0.0060967
286	D	SU	7.42	4.57	2.85	6.59	5.88	0.71	4019	32.1	22.0	2.13	7	58	80	1.30175	0.0073849
287	D	FA	11.55	5.74	5.81	7.31	6.18	1.13	3758	32.8	19.2	2.43	8	10	80	0.99398	0.0122938
288	D	FA	1.78	0.57	1.21	7.07	6.06	1.01	4724	32.7	18.8	1.89	8	13	80	0.73554	0.0015072
289	D	FA	7.91	6.33	1.58	5.39	4.83	0.56	4442	32.4	22.5	1.21	8	52	80	2.50316	0.0071229
290	D	FA	6.52	4.30	2.22	8.00	7.94	0.06	4709	33.5	22.8	1.55	8	55	80	1.46847	0.0055383

STATION=D

OBS	STATION	SEASON	PG	PN	R	PLANKPG	PLANKPN	PLANKR	INSOL	TEMP	SAL	EXTINCT	MONTH	DAY	YEAR	PRATIO	ECOLEFF
291	D	FA	8.97	5.03	3.94	7.45	6.80	0.65	4575	32.5	25.3	2.62	8	94	80	1.1383	0.0078426
292	D	FA	7.39	3.81	3.58	7.31	6.16	1.15	4397	32.6	26.1	2.83	8	97	80	1.0321	0.0067228
293	D	FA	8.34	4.07	4.27	6.28	5.63	0.65	4075	31.3	28.8	1.62	9	40	80	0.9766	0.0081865
294	D	FA	10.13	5.83	4.30	5.68	4.78	0.90	3692	31.0	27.5	1.62	9	43	80	1.1779	0.0109751
295	D	FA	10.59	8.15	2.44	5.33	4.43	0.90	3207	34.0	29.5	1.59	9	90	80	2.1701	0.0132086
296	D	FA	10.74	6.51	4.23	8.56	7.28	1.28	3663	34.4	29.6	1.40	9	93	80	1.2695	0.0117281
297	D	FA	6.59	3.12	3.47	4.60	4.01	0.59	3678	27.0	25.6	1.42	10	48	80	0.9496	0.0071669
298	D	FA	6.38	4.13	2.25	4.01	3.78	0.23	3354	28.7	27.0	1.36	10	52	80	1.4178	0.0076088
299	D	WI	1.86	1.79	0.07	2.96	2.09	0.87	2228	26.9	25.5	1.55	10	99	80	13.2857	0.0033393
300	D	WI	1.41	1.41	0.00	2.89	2.08	0.81	4165	25.9	25.4	1.31	11	3	80	.	0.0013541
301	D	WI	7.98	3.13	4.85	3.48	2.23	1.25	1792	22.1	26.1	1.17	11	47	80	0.8227	0.0178125
302	D	WI	3.15	2.00	1.15	2.11	1.05	1.06	2663	22.7	26.5	1.26	11	50	80	1.3696	0.0047315
303	D	WI	2.06	1.30	0.76	1.88	1.50	0.38	3607	19.0	22.6	1.42	11	97	80	1.3553	0.0022844
304	D	WI	1.96	1.36	0.60	1.48	0.60	0.88	.	19.4	23.6	1.06	11	99	80	1.6333	.
305	D	WI	2.30	1.73	0.57	2.72	1.09	1.63	1537	22.8	25.9	1.00	12	52	80	2.0175	0.0059857
306	D	WI	1.56	1.56	0.00	2.05	1.09	0.96	2249	22.7	26.0	1.36	12	55	80	.	0.0027746

APPENDIX D

SUMMARY OF DATA FROM THE DISCHARGE AND CONTROL MARSHES

MARSH COMMUNITY METABOLISM DATA

SEASON WINTER 1980
COLLECTION DATE 1- 3-80
AREA - TREATMENT INTAKE - CONTROL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 12ICJ 3A
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.93	4.4	-0.077	0.
1.90	4.0	-0.103	0.
2.90	3.4	-0.071	0.
3.85	2.2	-0.089	0.
4.86	0.9	-0.110	0.
5.84	1.8	-0.061	0.
6.79	1.0	-0.227	0.
7.80	1.1	-0.070	23.
8.78	4.2	0.255	88.
9.77	13.0	0.749	158.
10.02	18.2	0.215	317.
11.02	22.6	0.759	328.
12.02	22.0	0.837	311.
13.01	23.0	0.489	270.
14.01	21.0	0.360	194.
20.91	8.3	-0.144	0.
21.92	8.0	-0.165	0.
23.91	4.1	-0.086	0.
99.99	4.1	-0.086	0.

MARSH COMMUNITY METABOLISM DATA

SEASON WINTER 1980
COLLECTION DATE 1- 3-80
AREA - TREATMENT INTAKE - CONTROL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 12ICJ 4A
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.16	4.1	-0.087	0.
1.18	4.3	-0.075	0.
2.13	4.1	-0.060	0.
3.14	3.0	-0.125	0.
4.11	2.0	-0.088	0.
5.09	-1.0	-0.122	0.
6.08	2.0	-0.096	0.
7.03	-1.0	-0.206	0.
8.08	1.9	-0.088	41.
9.03	6.0	0.647	106.
10.02	13.1	1.015	176.
11.26	16.0	0.589	293.
12.27	19.7	0.418	323.
13.27	22.8	0.711	328.
14.27	21.9	0.690	299.
15.26	23.0	0.436	258.
16.26	20.0	0.175	176.
21.17	8.1	-0.187	0.
22.15	8.0	-0.155	0.
99.99	8.0	-0.155	0.

MARSH COMMUNITY METABOLISM DATA

SEASON WINTER 1980
COLLECTION DATE 1- 5-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 12DCJ 3A
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.07	3.5	-0.102	0.
1.08	2.5	-0.093	0.
2.10	2.5	-0.060	0.
3.10	2.5	-0.011	0.
4.13	1.2	-0.080	0.
5.11	0.0	-0.058	0.
6.12	-0.2	-0.036	0.
7.09	-0.5	-0.064	0.
8.10	0.0	0.000	53.
9.12	3.7	0.529	94.
10.11	6.4	0.754	264.
11.12	10.0	0.870	311.
12.11	12.5	0.916	334.
13.12	16.2	0.891	328.
14.11	16.0	1.023	311.
15.05	16.0	1.162	229.
16.08	14.4	0.937	164.
17.03	12.4	0.480	47.
18.06	8.0	-0.106	0.
19.08	8.0	-0.113	0.
20.07	7.5	-0.109	0.
21.04	6.8	-0.145	0.
22.08	5.7	-0.096	0.
23.06	4.0	-0.088	0.
99.99	4.0	-0.088	0.

MARSH COMMUNITY METABOLISM DATA

SEASON WINTER 1980
COLLECTION DATE 1- 5-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 12DCJ 4A
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.30	3.0	-0.143	0.
1.32	2.3	-0.064	0.
2.34	2.5	-0.062	0.
3.31	2.0	-0.034	0.
4.35	1.0	-0.069	0.
5.37	0.0	-0.099	0.
6.36	-0.5	-0.034	0.
7.35	-0.5	-0.045	0.
8.34	1.1	0.000	65.
9.37	4.0	0.455	141.
10.37	7.8	0.749	282.
11.37	10.4	0.825	323.
12.37	13.3	0.878	340.
13.37	16.4	0.785	328.
14.32	16.2	1.013	293.
15.33	15.7	0.928	235.
16.31	14.0	0.642	141.
17.31	11.5	0.049	23.
18.31	8.0	-0.159	0.
19.30	8.0	-0.231	0.
20.30	7.2	-0.138	0.
21.31	6.8	-0.168	0.
22.30	5.0	-0.130	0.
23.29	3.8	-0.112	0.
99.99	3.8	-0.112	0.

MARSH COMMUNITY METABOLISM DATA

SEASON WINTER 1980
COLLECTION DATE 1- 6-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES SPARTINA
CHAMBER CODE 12DCS 1B
SUNROSE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.86	1.0	-0.087	0.
1.84	1.0	-0.054	0.
2.81	1.0	-0.011	0.
3.80	2.5	-0.056	0.
4.77	2.8	-0.049	0.
5.75	2.0	-0.045	0.
6.73	1.6	-0.063	0.
7.71	1.6	-0.071	18.
8.71	4.1	0.036	129.
9.82	8.5	0.095	188.
10.77	14.0	-0.242	276.
11.76	16.0	-0.313	370.
12.73	18.4	0.114	346.
13.70	18.0	0.152	340.
14.74	13.8	-0.017	305.
15.74	14.5	0.003	211.
17.09	12.4	-0.059	100.
18.04	6.0	-0.178	0.
19.01	4.0	-0.090	0.
20.01	3.0	-0.079	0.
20.98	2.0	-0.038	0.
21.93	2.0	-0.056	0.
22.92	1.7	-0.011	0.
23.91	1.0	-0.091	0.
99.99	1.0	-0.091	0.

MARSH COMMUNITY METABOLISM DATA

SEASON WINTER 1980
COLLECTION DATE 1- 6-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES SPARTINA
CHAMBER CODE 12DCS 2B
SUNROSE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.13	1.0	-0.059	0.
1.10	1.0	-0.030	0.
2.09	1.0	-0.043	0.
3.06	2.0	-0.019	0.
4.03	2.8	-0.041	0.
5.03	2.8	-0.024	0.
6.00	2.0	-0.019	0.
6.99	1.6	-0.035	0.
7.95	2.0	-0.019	47.
9.02	5.3	0.000	135.
10.05	10.7	0.027	205.
11.03	14.2	-0.292	317.
12.02	17.0	0.053	323.
12.97	18.7	0.148	346.
13.99	18.0	-0.023	317.
14.99	13.8	0.009	282.
15.99	14.4	0.000	188.
17.31	11.6	-0.054	65.
18.29	5.8	-0.077	0.
19.24	3.7	-0.031	0.
20.27	2.8	-0.076	0.
21.21	2.0	-0.043	0.
22.20	1.5	-0.057	0.
23.16	1.0	-0.056	0.
99.99	1.0	-0.056	0.

MARSH COMMUNITY METABOLISM DATA

SEASON WINTER 1980
COLLECTION DATE 1- 6-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 12DCJ 3B
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.37	1.0	-0.100	0.
1.35	1.0	-0.093	0.
2.33	1.0	-0.065	0.
3.31	2.0	-0.142	0.
4.27	3.0	-0.099	0.
5.27	2.8	-0.124	0.
6.24	1.9	-0.140	0.
7.24	1.6	-0.095	0.
8.20	3.1	0.211	70.
9.26	6.4	0.830	135.
10.30	11.5	1.028	229.
11.28	14.8	0.909	346.
12.25	17.5	0.839	352.
14.24	16.0	-0.028	305.
15.24	14.0	0.758	258.
16.24	15.2	0.669	158.
17.54	9.5	0.316	35.
18.52	5.0	-0.118	0.
19.49	3.7	-0.109	0.
20.50	2.4	-0.120	0.
21.44	2.0	-0.142	0.
22.44	1.7	-0.120	0.
23.42	1.0	-0.093	0.
99.99	1.0	-0.093	0.

MARSH COMMUNITY METABOLISM DATA

SEASON WINTER 1980
COLLECTION DATE 1- 6-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 12DCJ 4B
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.62	1.0	-0.038	0.
1.60	1.0	-0.089	0.
2.57	1.0	-0.031	0.
3.55	2.4	-0.099	0.
4.53	2.8	-0.063	0.
5.51	2.4	-0.089	0.
6.49	1.6	-0.074	0.
7.46	1.6	-0.038	0.
8.45	3.8	0.214	100.
9.58	7.7	0.691	158.
10.54	13.7	0.611	246.
11.53	15.8	0.677	358.
12.49	17.4	0.676	346.
13.48	18.0	0.669	340.
14.49	14.3	-0.039	305.
15.49	14.0	0.443	235.
16.49	14.0	0.632	129.
17.80	7.5	-0.017	18.
18.77	4.2	-0.005	0.
19.74	3.5	-0.073	0.
20.71	2.0	-0.102	0.
21.69	2.0	-0.122	0.
22.68	1.7	-0.099	0.
23.68	1.0	-0.046	0.
99.99	1.0	-0.046	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SPRING 1980
COLLECTION DATE 3-26-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES SPARTINA
CHAMBER CODE 13DCS 1A
SUNROSE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.91	17.2	-0.209	0.
1.91	16.8	-0.134	0.
2.92	13.5	-0.142	0.
3.92	13.0	-0.138	0.
4.94	12.1	-0.143	0.
5.94	12.1	-0.108	0.
6.95	13.1	-0.006	53.
7.96	18.0	0.180	153.
8.95	22.1	0.436	287.
9.97	24.2	0.540	364.
10.98	24.3	0.199	387.
11.99	26.8	-0.003	240.
13.00	27.0	0.267	428.
14.00	24.0	0.557	334.
15.02	24.1	0.531	223.
16.02	22.8	0.401	217.
16.84	29.5	0.374	153.
17.85	25.0	0.100	53.
18.86	19.1	-0.174	0.
19.87	19.1	-0.132	0.
20.87	18.9	-0.128	0.
21.88	18.0	-0.126	0.
22.89	18.0	-0.140	0.
23.90	18.0	-0.189	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SPRING 1980
COLLECTION DATE 3-26-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES SPARTINA
CHAMBER CODE 13DCS 2A
SUNROSE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.15	17.9	-0.186	0.
1.15	17.2	-0.160	0.
2.17	16.2	-0.155	0.
3.16	13.5	-0.225	65.
4.19	12.9	-0.318	211.
5.18	12.1	-0.322	299.
6.19	12.1	-0.224	393.
7.20	14.0	0.140	422.
8.21	18.9	0.222	246.
9.22	23.6	0.453	358.
10.23	24.5	0.478	276.
11.24	24.5	0.713	211.
12.24	26.2	0.328	141.
13.25	26.9	0.358	41.
14.26	25.1	0.458	0.
15.26	24.1	0.379	0.
17.09	28.2	0.220	123.
18.10	24.0	-0.124	29.
19.11	19.0	-0.142	0.
20.12	19.0	-0.148	0.
21.13	18.2	-0.172	0.
22.13	18.0	-0.110	0.
23.14	17.9	-0.153	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SPRING 1980
COLLECTION DATE 3-26-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 13DCJ 3A
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.40	17.8	-0.201	0.
1.41	17.0	-0.204	0.
2.41	14.5	-0.161	0.
3.42	13.3	-0.161	0.
4.44	12.9	-0.182	0.
5.44	12.1	-0.178	0.
6.44	12.0	-0.138	94.
7.45	15.0	0.189	246.
8.46	20.1	0.238	328.
9.47	24.1	0.367	440.
10.48	25.0	0.447	440.
11.50	26.0	0.502	399.
12.50	24.0	0.549	311.
13.50	26.3	0.385	287.
14.51	24.0	0.388	158.
15.52	24.0	0.272	106.
17.85	25.0	0.105	100.
18.35	21.5	-0.252	18.
19.36	18.9	-0.259	0.
20.36	18.7	-0.257	0.
21.38	18.3	-0.213	0.
22.39	18.0	-0.074	0.
23.40	17.9	-0.235	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SPRING 1980
COLLECTION DATE 3-26-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 13DCJ 4A
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.65	17.7	-0.216	0.
1.66	17.0	-0.188	0.
2.66	14.0	-0.140	0.
3.68	13.1	-0.186	0.
4.69	12.4	-0.146	0.
5.69	12.0	-0.213	0.
6.69	12.5	-0.000	29.
7.70	16.2	0.700	123.
8.71	21.5	0.591	264.
9.72	24.1	0.544	346.
10.72	25.0	0.558	463.
11.74	26.1	0.594	440.
12.74	25.5	0.554	381.
13.75	25.2	0.564	358.
14.76	25.1	0.658	258.
15.75	22.7	0.468	193.
17.60	26.2	99.990	76.
18.60	19.9	-0.136	0.
19.61	19.1	-0.190	0.
20.61	19.0	-0.190	0.
21.62	18.1	-0.176	0.
22.63	18.0	-0.235	0.
23.65	17.9	-0.256	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SPRING 1980
COLLECTION DATE 3-27-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES SPARTINA
CHAMBER CODE 13DCS 1B
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.66	17.5	-0.270	0.
1.64	16.1	-0.298	0.
2.67	15.1	-0.204	0.
3.69	14.9	-0.170	0.
4.70	14.9	-0.217	0.
5.68	15.0	-0.220	0.
6.66	15.0	-0.189	23.
7.72	17.8	0.097	88.
8.69	20.0	0.267	182.
9.74	20.8	0.300	188.
10.73	25.0	0.417	305.
11.74	24.0	0.464	299.
12.74	25.1	0.764	287.
13.75	27.0	0.727	287.
14.76	26.3	0.409	205.
17.29	21.0	-0.010	100.
18.63	19.8	-0.193	0.
19.60	19.4	-0.192	0.
20.60	19.4	-0.153	0.
21.60	18.5	-0.121	0.
22.61	18.7	-0.169	0.
23.63	18.0	-0.188	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SPRING 1980
COLLECTION DATE 3-27-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES SPARTINA
CHAMBER CODE 13DCS 2B
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.93	16.8	-0.311	0.
1.89	16.0	-0.268	0.
2.94	15.1	-0.278	0.
3.94	14.6	-0.252	0.
4.92	15.0	-0.208	0.
5.95	15.0	-0.184	0.
6.96	15.0	-0.142	59.
7.93	19.0	0.228	147.
8.94	19.9	0.212	117.
9.98	21.1	0.392	258.
10.95	23.8	0.319	428.
12.00	24.7	0.370	299.
12.99	25.4	0.540	346.
14.02	27.5	0.350	199.
15.01	25.5	0.369	182.
18.83	19.7	-0.198	0.
19.87	19.5	-0.193	0.
20.86	19.0	-0.102	0.
21.85	18.8	-0.091	0.
22.87	18.7	-0.178	0.
23.91	18.0	-0.173	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SPRING 1980
COLLECTION DATE 3-27-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 13DCJ 3B
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.15	18.0	-0.337	0.
1.15	17.0	-0.363	0.
2.16	16.0	-0.306	0.
3.16	15.1	-0.311	0.
4.17	14.9	-0.283	0.
5.18	15.0	-0.336	0.
6.17	14.8	-0.283	0.
7.20	15.3	0.262	70.
8.20	18.5	0.524	111.
9.18	19.9	0.656	153.
10.24	22.5	1.183	411.
11.24	25.9	1.068	311.
12.24	24.7	1.081	323.
13.24	26.0	1.042	305.
14.26	26.0	0.822	205.
15.27	24.9	0.652	194.
19.08	19.2	-0.306	0.
20.09	19.5	-0.330	0.
21.09	19.0	-0.245	0.
22.11	18.8	-0.307	0.
23.13	18.4	-0.310	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SPRING 1980
COLLECTION DATE 3-27-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 13DCJ 4B
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.39	17.9	-0.209	0.
1.39	16.3	-0.232	0.
2.40	15.9	-0.230	0.
3.39	15.2	-0.242	0.
4.41	14.9	-0.243	0.
5.42	15.0	-0.243	0.
6.44	14.9	-0.151	0.
7.44	16.0	0.449	94.
8.44	19.5	0.611	158.
9.45	19.5	0.727	194.
10.47	24.9	0.790	323.
11.50	24.0	0.752	299.
12.50	24.0	0.838	299.
13.51	26.5	0.781	311.
14.52	25.1	0.757	246.
15.51	23.9	0.576	199.
19.33	19.4	-0.209	0.
20.33	19.1	-0.293	0.
21.34	19.0	-0.284	0.
22.37	18.7	-0.321	0.
23.37	18.3	-0.318	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SPRING 1980
COLLECTION DATE 3-28-80
AREA - TREATMENT INTAKE - CONTROL
DOMINANT SPECIES SPARTINA
CHAMBER CODE 13ICS 2A
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.98	17.0	-0.071	0.
1.97	17.0	-0.130	0.
2.98	17.0	-0.199	0.
3.97	17.0	-0.194	0.
4.98	17.2	-0.199	0.
5.99	16.7	-0.173	0.
6.97	18.8	-0.083	0.
8.00	23.0	0.193	59.
9.01	25.5	0.370	293.
9.99	28.0	0.318	364.
11.01	27.0	0.232	475.
12.03	28.0	0.057	469.
12.97	27.9	-0.001	452.
14.01	23.7	0.073	164.
14.97	24.5	0.128	217.
15.98	24.0	0.175	194.
16.99	22.8	-0.001	129.
18.03	21.0	-0.295	12.
19.03	19.0	-0.281	0.
20.01	18.1	-0.313	0.
20.96	999.9	-0.048	0.
21.96	999.9	-0.023	0.
22.96	999.9	-0.013	0.
23.97	17.1	-0.082	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SPRING 1980
COLLECTION DATE 3-28-80
AREA - TREATMENT INTAKE - CONTROL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 13ICJ 3A
SUNROSE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.19	17.2	-0.145	0.
1.21	17.2	-0.226	0.
2.22	17.1	-0.285	0.
3.21	17.1	-0.288	0.
4.20	17.0	-0.297	0.
5.21	17.0	-0.280	0.
6.21	16.9	-0.231	0.
7.21	19.0	0.502	0.
8.21	22.0	0.898	129.
9.25	27.0	1.273	305.
10.25	28.0	0.888	393.
11.23	28.0	0.907	481.
12.23	27.7	0.802	463.
13.24	27.0	0.720	428.
14.24	24.9	0.725	211.
15.26	25.1	0.819	211.
16.26	25.2	0.595	399.
17.26	23.0	0.246	158.
18.28	20.0	-0.389	18.
19.26	18.6	-0.435	0.
20.25	18.0	-0.444	0.
21.23	999.9	-0.070	0.
22.19	999.9	-0.048	0.
23.19	17.0	-0.124	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SPRING 1980
COLLECTION DATE 3-28-80
AREA - TREATMENT INTAKE - CONTROL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 13ICJ 4A
SUNROSE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.45	17.2	-0.224	0.
1.46	17.3	-0.350	0.
2.48	17.0	-0.185	0.
3.47	17.1	-0.417	0.
4.46	17.0	-0.450	0.
5.49	17.0	-0.394	0.
6.45	16.9	-0.333	0.
7.47	20.1	0.294	23.
8.50	25.1	1.343	235.
9.51	26.5	1.162	346.
10.50	28.9	1.125	416.
11.50	28.0	1.335	463.
12.51	27.1	1.109	463.
13.46	26.8	0.976	387.
14.49	24.5	1.040	240.
15.48	27.0	1.212	370.
16.49	25.0	1.068	293.
17.49	21.9	99.990	65.
18.49	19.2	-0.317	12.
19.50	18.5	-0.361	0.
20.52	18.0	-0.312	0.
21.47	999.9	-0.051	0.
22.46	999.9	-0.064	0.
23.45	17.0	-0.177	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SUMMER 1980
COLLECTION DATE 7- 4-80
AREA - TREATMENT INTAKE - CONTROL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 14ICJ 3A
SUNROSE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.75	27.0	-0.184	0.
1.77	26.0	-0.184	0.
2.78	26.0	-0.182	0.
3.80	25.0	-0.193	0.
4.82	25.0	-0.179	0.
5.83	24.5	-0.166	0.
6.85	27.0	-0.048	18.
7.11	38.0	0.041	59.
8.13	37.5	99.990	117.
9.14	37.0	99.990	199.
10.16	36.5	99.990	282.
11.17	36.0	0.565	411.
12.19	36.0	0.350	481.
13.20	37.0	0.545	469.
14.22	39.0	0.492	446.
15.73	42.5	0.503	358.
16.25	42.5	0.545	328.
17.27	43.0	0.455	258.
18.28	42.5	0.355	170.
19.30	34.5	0.136	88.
20.31	31.5	-0.117	6.
21.33	30.0	-0.183	0.
22.72	28.5	-0.213	0.
23.74	27.0	-0.214	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SUMMER 1980
COLLECTION DATE 7- 4-80
AREA - TREATMENT INTAKE - CONTROL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 14ICJ 4A
SUNROSE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
1.01	27.0	-0.275	0.
2.02	26.0	-0.239	0.
3.04	26.0	-0.179	0.
4.05	25.0	-0.234	0.
5.07	25.0	-0.145	0.
6.08	25.0	-0.217	0.
7.37	39.0	0.125	82.
8.38	38.5	0.484	70.
9.40	38.0	0.498	223.
10.41	37.0	99.990	317.
11.43	36.0	0.596	422.
12.44	34.0	0.387	434.
13.46	38.0	0.281	458.
14.47	40.0	0.533	411.
15.49	43.0	0.576	370.
16.50	42.0	0.514	299.
17.52	43.0	0.512	246.
18.53	42.5	0.439	147.
19.55	39.0	0.152	53.
20.57	31.5	-0.185	0.
21.58	30.0	-0.259	0.
22.98	28.5	-0.307	0.
23.99	27.0	-0.229	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SUMMER 1980
COLLECTION DATE 7- 5-80
AREA - TREATMENT INTAKE - CONTROL
DOMINANT SPECIES SPARTINA
CHAMBER CODE 14ICS 1B
SUNROSE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.62	40.0	-0.171	0.
1.63	40.0	-0.152	0.
2.65	40.0	-0.185	0.
3.66	34.0	-0.203	0.
4.68	33.0	-0.204	0.
5.69	29.5	-0.128	0.
6.71	29.5	-0.109	6.
7.72	35.0	0.226	59.
8.74	38.0	0.206	194.
9.75	39.0	0.289	311.
10.77	39.0	0.553	411.
12.43	32.0	0.498	458.
13.45	34.0	0.466	475.
14.46	40.0	0.659	434.
15.48	40.0	0.753	411.
16.49	40.0	0.450	346.
17.51	40.0	0.501	264.
18.52	40.0	0.403	47.
19.54	40.0	0.142	53.
20.55	40.0	-0.114	0.
21.57	40.0	-0.105	0.
22.59	40.0	-0.171	0.
23.60	40.0	-0.142	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SUMMER 1980
COLLECTION DATE 7- 5-80
AREA - TREATMENT INTAKE - CONTROL
DOMINANT SPECIES SPARTINA
CHAMBER CODE 14ICS 2B
SUNROSE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.87	40.0	-0.203	0.
1.89	40.0	-0.196	0.
2.90	40.0	-0.213	0.
3.92	33.0	-0.251	0.
4.93	34.0	-0.284	0.
5.95	29.5	-0.224	0.
6.96	29.5	-0.044	18.
7.98	36.0	0.314	70.
8.99	38.0	0.359	246.
10.01	39.0	0.324	328.
11.02	39.0	0.462	411.
12.69	32.0	0.534	387.
13.70	40.0	0.547	481.
14.72	40.0	0.505	434.
15.73	40.0	0.609	399.
16.75	40.0	0.620	334.
17.76	40.0	0.469	147.
18.78	40.0	0.587	47.
19.79	40.0	0.110	29.
20.81	40.0	-0.103	0.
21.82	40.0	-0.101	0.
22.84	40.0	-0.169	0.
23.85	40.0	-0.241	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SUMMER 1980
COLLECTION DATE 7- 5-80
AREA - TREATMENT INTAKE - CONTROL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 14ICJ 3B
SUNROSE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.11	40.0	-0.308	0.
1.12	40.0	-0.187	0.
2.14	40.0	-0.130	0.
3.15	40.0	-0.194	0.
4.17	33.0	-0.177	0.
5.19	30.0	-0.247	0.
6.20	29.5	-0.168	0.
7.22	32.0	0.256	29.
8.23	37.0	0.378	106.
9.25	39.0	0.702	282.
10.26	39.0	0.925	399.
11.92	34.5	0.608	434.
12.94	40.0	0.073	352.
13.95	40.0	0.486	475.
14.97	40.0	0.597	422.
15.99	40.0	0.700	387.
17.00	40.0	0.719	305.
18.02	40.0	0.724	82.
19.03	40.0	0.548	47.
20.05	40.0	-0.123	12.
21.06	40.0	-0.213	0.
22.08	40.0	-0.218	0.
23.09	40.0	-0.284	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SUMMER 1980
COLLECTION DATE 7- 5-80
AREA - TREATMENT INTAKE - CONTROL
DOMINANT SPECIES SPARTINA
CHAMBER CODE 14ICS 4B
SUNROSE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.36	40.0	-0.302	0.
1.38	40.0	-0.286	0.
2.39	40.0	-0.325	0.
3.41	34.0	-0.428	0.
4.42	33.0	-0.352	0.
5.44	29.5	-0.406	0.
6.45	29.5	-0.241	0.
7.47	32.5	0.220	47.
8.49	37.0	0.720	147.
9.50	39.5	1.204	317.
10.52	39.0	0.949	405.
11.53	39.0	99.990	411.
12.18	32.0	0.622	446.
13.19	40.0	0.623	469.
14.21	40.0	0.560	458.
15.22	40.0	0.546	422.
16.24	40.0	0.593	364.
17.25	40.0	0.476	287.
18.27	40.0	0.346	65.
19.29	40.0	0.352	59.
20.30	40.0	-0.170	6.
21.32	40.0	-0.177	0.
22.33	40.0	-0.205	0.
23.35	40.0	-0.388	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SUMMER 1980
COLLECTION DATE 7-11-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES SPARTINA
CHAMBER CODE 14DCS 2A
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.83	29.5	-0.211	0.
1.84	29.5	-0.229	0.
2.85	30.0	-0.159	0.
3.87	30.0	-0.170	0.
4.88	29.0	-0.184	0.
5.89	28.0	-0.229	0.
6.90	28.0	-0.176	12.
7.91	28.0	0.158	88.
8.93	28.0	0.651	188.
9.94	34.0	99.990	340.
10.95	34.0	99.990	352.
11.96	34.0	0.600	270.
12.97	34.0	0.025	305.
13.99	33.0	-0.028	428.
15.00	34.0	-0.022	458.
16.01	32.0	0.289	323.
17.02	30.0	99.990	76.
18.03	28.0	-0.116	18.
19.05	28.0	-0.182	6.
20.06	26.0	-0.188	0.
21.07	29.5	-0.199	0.
22.08	22.0	-0.229	0.
22.81	28.0	-0.326	0.
23.82	29.0	-0.307	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SUMMER 1980
COLLECTION DATE 7-11-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 14DCJ 3A
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.07	29.0	-0.382	0.
1.08	30.0	-0.383	0.
2.09	30.0	-0.230	0.
3.11	30.0	-0.212	0.
4.12	30.0	-0.233	0.
5.13	28.0	-0.330	0.
6.14	28.0	-0.413	0.
7.15	28.0	-0.240	23.
8.17	28.0	0.183	111.
9.18	28.0	0.458	205.
10.19	34.0	0.552	287.
11.20	34.0	0.620	375.
12.22	34.0	0.666	293.
13.23	34.0	0.538	305.
14.24	34.0	0.538	411.
15.25	34.0	0.500	393.
16.26	32.0	0.542	328.
17.28	29.0	99.990	47.
18.29	28.0	-0.283	18.
19.30	27.5	-0.309	6.
20.31	27.0	-0.354	0.
21.32	29.5	-0.235	0.
22.34	22.0	-0.342	0.
23.06	28.5	-0.393	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SUMMER 1980
COLLECTION DATE 7-11-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 14DCJ 4A
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.32	29.0	-0.351	0.
1.34	29.0	-0.259	0.
2.35	30.0	-0.189	0.
3.38	30.0	-0.216	0.
4.37	30.0	-0.270	0.
5.38	28.0	-0.328	0.
6.40	28.0	-0.393	0.
7.41	28.0	-0.092	35.
8.42	27.0	0.379	129.
9.43	32.0	0.720	223.
10.44	34.0	0.835	317.
11.46	34.0	0.870	375.
12.47	34.0	0.848	317.
13.48	34.0	0.679	211.
14.49	34.0	0.641	411.
15.50	34.0	0.667	446.
16.52	31.0	99.990	305.
17.53	28.5	99.990	35.
18.54	28.0	-0.206	12.
19.55	28.0	-0.280	6.
20.56	25.0	-0.286	0.
21.58	24.0	-0.235	0.
22.59	22.5	-0.302	0.
23.31	28.5	-0.351	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SUMMER 1980
COLLECTION DATE 7-12-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES SPARTINA
CHAMBER CODE 14DCS 2B
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.11	26.0	-0.185	0.
1.12	27.5	-0.176	0.
2.13	29.0	-0.166	0.
3.14	29.0	-0.087	0.
4.16	30.0	-0.133	0.
5.17	30.5	-0.155	0.
6.18	30.5	-0.166	0.
7.19	29.0	-0.127	18.
8.20	32.5	0.302	100.
9.22	36.0	99.990	223.
10.22	37.0	99.990	299.
11.24	39.0	0.401	364.
12.25	39.0	0.721	293.
13.26	42.0	0.148	510.
14.28	42.0	-0.031	434.
15.29	42.0	-0.102	458.
16.30	38.5	-0.131	35.
17.31	40.0	0.342	141.
18.32	39.0	-0.034	23.
19.34	39.0	-0.141	12.
20.35	39.0	-0.188	0.
23.09	24.5	-0.043	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SUMMER 1980
COLLECTION DATE 7-12-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 14DCJ 3B
SUNROSE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.36	27.0	-0.317	0.
1.37	28.0	-0.293	0.
2.38	28.5	-0.306	0.
3.40	29.0	-0.206	0.
4.41	30.0	-0.159	0.
5.42	30.5	-0.233	0.
6.43	30.5	-0.363	0.
7.44	30.0	-0.198	29.
8.46	34.0	0.284	141.
9.47	36.0	0.531	246.
10.48	38.0	0.575	340.
11.49	38.0	0.665	352.
12.50	42.0	0.664	469.
13.52	42.0	0.544	147.
14.53	41.0	0.377	340.
15.54	42.0	0.068	35.
16.55	37.0	-0.054	41.
17.57	39.0	0.238	235.
18.58	39.0	-0.149	29.
19.59	39.0	-0.242	12.
23.35	24.5	-0.331	0.

MARSH COMMUNITY METABOLISM DATA

SEASON SUMMER 1980
COLLECTION DATE 7-12-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 14DCJ 4B
SUNROSE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.61	27.0	-0.256	0.
1.63	28.0	-0.257	0.
2.64	29.0	-0.256	0.
3.65	30.0	-0.159	0.
4.66	30.0	-0.205	0.
5.67	30.5	-0.238	0.
6.69	30.5	-0.312	0.
7.70	31.0	-0.001	59.
8.71	35.0	0.462	164.
9.72	37.0	0.573	176.
10.73	38.5	0.720	305.
11.75	40.0	0.766	411.
12.76	41.5	0.942	364.
13.77	41.5	0.388	70.
14.78	42.0	0.434	70.
15.79	39.0	-0.035	35.
16.81	38.0	0.099	70.
17.82	40.0	0.173	82.
18.83	39.0	-0.119	35.
19.84	39.0	-0.226	6.
23.60	25.0	-0.266	0.

MARSH COMMUNITY METABOLISM DATA

SEASON FALL 1980
COLLECTION DATE 10- 5-80
AREA - TREATMENT INTAKE - CONTROL
DOMINANT SPECIES SPARTINA
CHAMBER CODE 15ICS 1A
SUNROSE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.63	16.0	-0.082	0.
1.62	16.0	-0.068	0.
2.57	16.0	-0.082	0.
3.57	16.0	-0.123	0.
4.52	16.0	-0.164	0.
5.53	14.5	-0.137	0.
6.53	13.0	-0.125	0.
8.44	17.5	0.163	76.
9.40	22.0	0.525	164.
10.40	26.0	0.700	299.
11.41	29.0	0.260	381.
12.41	2.9	0.972	434.
13.41	29.0	0.691	428.
14.42	29.5	0.690	364.
15.42	30.0	0.699	264.
16.42	31.0	0.641	217.
12.94	29.5	0.560	153.
18.42	24.0	0.228	59.
19.43	20.5	-0.174	0.
19.73	20.0	-0.214	0.
20.73	20.0	-0.303	0.
21.73	18.0	-0.122	0.
22.94	16.5	-0.165	0.
23.67	16.0	-0.110	0.

MARSH COMMUNITY METABOLISM DATA

SEASON FALL 1980
COLLECTION DATE 10- 5-80
AREA - TREATMENT INTAKE - CONTROL
DOMINANT SPECIES SPARTINA
CHAMBER CODE 15ICS 2A
SUNROSE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.89	16.0	-0.058	0.
1.86	16.0	-0.029	0.
2.81	16.0	-0.115	0.
3.79	16.0	-0.086	0.
4.77	15.5	-0.129	0.
5.78	14.0	-0.130	0.
6.73	13.0	-0.087	0.
7.71	13.5	-0.116	0.
8.67	18.0	0.028	100.
9.65	23.0	0.235	176.
10.65	26.0	0.467	328.
11.63	29.0	0.221	399.
12.64	29.0	0.460	434.
13.65	29.0	0.316	416.
14.65	30.0	0.458	328.
15.65	30.0	99.990	252.
16.69	31.0	0.353	199.
17.69	29.0	0.203	129.
18.67	24.0	-0.106	47.
19.67	20.0	-0.158	0.
19.98	20.0	-0.248	0.
20.98	19.0	-0.257	0.
21.99	17.0	-0.144	0.
22.94	16.5	-0.057	0.
23.90	16.0	-0.029	0.

MARSH COMMUNITY METABOLISM DATA

SEASON FALL 1980
COLLECTION DATE 10- 5-80
AREA - TREATMENT INTAKE - CONTROL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 15ICJ 3A
SUNROSE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.13	16.0	-0.078	0.
1.13	16.0	-0.098	0.
2.09	16.0	-0.118	0.
3.07	16.0	-0.117	0.
4.07	16.0	-0.195	0.
5.03	12.5	-0.197	0.
6.03	14.0	-0.295	0.
7.01	12.5	-0.237	0.
7.94	14.5	-0.079	35.
8.92	19.0	1.160	123.
9.90	24.0	1.200	205.
10.90	28.0	0.735	352.
11.89	29.0	1.096	416.
12.87	29.0	1.014	434.
13.87	29.0	1.095	399.
14.90	30.0	99.990	311.
15.93	31.0	0.946	246.
16.94	31.0	1.218	188.
17.92	28.0	0.648	106.
18.92	24.0	-0.210	35.
19.92	20.0	-0.246	0.
20.18	19.0	-0.387	0.
21.24	19.0	-0.290	0.
22.22	17.0	-0.312	0.
23.15	16.0	-0.156	0.

MARSH COMMUNITY METABOLISM DATA

SEASON FALL 1980
COLLECTION DATE 10- 5-80
AREA - TREATMENT INTAKE - CONTROL
DOMINANT SPECIES SPARTINA
CHAMBER CODE 15ICS 4A
SUNROSE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.38	16.0	-0.153	0.
1.38	16.0	-0.087	0.
2.36	16.0	-0.131	0.
3.27	16.0	-0.198	0.
4.27	16.0	-0.131	0.
5.28	14.5	-0.242	0.
6.28	14.0	-0.044	0.
7.29	13.0	-0.221	0.
8.17	16.0	-0.088	47.
9.17	21.0	1.038	153.
10.15	24.5	1.025	264.
11.16	28.0	0.300	370.
12.16	29.0	0.568	428.
13.16	29.0	0.702	434.
14.15	29.0	0.610	381.
15.18	30.0	-0.508	287.
16.18	31.0	99.990	235.
17.19	30.0	0.752	170.
18.19	27.0	0.590	88.
19.20	21.0	-0.216	6.
20.18	20.0	-0.259	0.
20.43	19.0	-0.348	0.
21.49	18.0	-0.218	0.
22.44	16.0	-0.108	0.
23.45	16.0	-0.175	0.

MARSH COMMUNITY METABOLISM DATA

SEASON FALL 1980
COLLECTION DATE 10- 5-80
AREA - TREATMENT INTAKE - CONTROL
DOMINANT SPECIES SPARTINA
CHAMBER CODE 15ICS 1B
SUNROSE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.33	19.5	-0.081	0.
1.73	18.0	-0.123	0.
2.27	18.0	-0.302	0.
3.27	16.0	-0.249	0.
4.19	16.0	-0.221	0.
5.65	22.0	-0.189	0.
6.03	24.0	-0.188	0.
6.91	21.5	-0.135	0.
7.81	21.0	0.026	47.
8.77	26.5	0.344	199.
9.67	28.0	0.472	276.
10.60	30.0	0.631	352.
11.56	33.0	0.740	422.
12.57	34.0	0.808	434.
13.57	35.5	0.790	387.
14.57	36.0	0.744	334.
15.57	36.0	0.702	252.
16.57	36.0	0.646	188.
17.57	31.5	0.457	106.
20.43	19.0	-0.108	0.
21.41	18.0	-0.136	0.
22.43	18.0	-0.136	0.
23.37	20.0	-0.081	0.

MARSH COMMUNITY METABOLISM DATA

SEASON FALL 1980
COLLECTION DATE 10- 5-80
AREA - TREATMENT INTAKE - CONTROL
DOMINANT SPECIES SPARTINA
CHAMBER CODE 15ICS 2B
SUNROSE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.58	19.0	-0.081	0.
1.59	18.5	-0.137	0.
2.51	17.0	-0.248	0.
3.52	16.0	-0.249	0.
4.40	16.0	-0.208	0.
5.35	22.0	-0.163	0.
6.26	26.0	-0.214	0.
7.11	21.0	-0.190	0.
8.07	22.5	-0.001	76.
8.95	28.0	0.209	205.
9.88	28.5	0.314	299.
10.80	30.0	0.417	364.
11.81	33.0	0.517	422.
12.82	34.0	0.437	422.
13.83	35.5	0.435	375.
14.84	32.5	0.179	235.
15.85	36.0	0.356	229.
16.86	35.0	0.281	164.
17.87	28.5	0.051	88.
20.68	18.0	-0.136	0.
21.69	18.0	-0.109	0.
22.67	18.0	-0.109	0.
23.62	20.0	-0.162	0.

MARSH COMMUNITY METABOLISM DATA

SEASON FALL 1980
COLLECTION DATE 10- 5-80
AREA - TREATMENT INTAKE - CONTROL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 15ICJ 3B
SUNROSE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.85	18.5	-0.208	0.
1.78	18.5	-0.321	0.
2.76	16.5	-0.339	0.
3.77	16.0	-0.226	0.
4.65	20.0	-0.207	0.
5.60	24.0	-0.252	0.
6.46	24.0	-0.220	0.
7.34	21.0	-0.159	29.
8.29	24.0	0.501	117.
9.17	28.0	0.647	235.
10.13	30.0	1.315	317.
11.06	31.0	1.207	387.
12.09	33.0	1.131	434.
13.09	34.0	1.333	416.
14.07	35.5	1.393	352.
15.07	36.0	0.914	223.
16.07	36.0	1.357	217.
17.07	34.0	1.127	147.
18.60	28.0	0.173	59.
20.93	18.0	-0.240	0.
21.94	18.0	-0.192	0.
22.89	18.0	-0.128	0.
23.85	20.5	-0.238	0.

MARSH COMMUNITY METABOLISM DATA

SEASON FALL 1980
COLLECTION DATE 10- 5-80
AREA - TREATMENT INTAKE - CONTROL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 15ICJ 4B
SUNROSE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.12	20.0	-0.254	0.
1.08	18.5	-0.215	0.
2.03	18.0	-0.475	0.
3.01	16.0	-0.347	0.
3.94	16.0	-0.261	0.
4.90	20.0	-0.171	0.
5.80	24.0	-0.211	0.
6.68	22.0	-0.212	0.
7.56	20.5	-0.001	29.
8.54	26.0	1.041	176.
9.42	27.0	1.109	252.
10.35	30.0	1.131	334.
11.31	32.0	1.024	405.
12.31	34.0	0.853	434.
13.32	35.0	0.866	405.
14.32	35.0	0.668	328.
15.32	34.0	0.819	164.
16.32	36.0	0.717	211.
17.32	33.0	0.692	135.
21.16	18.0	-0.300	0.
22.19	18.0	-0.343	0.
23.14	20.0	-0.320	0.

MARSH COMMUNITY METABOLISM DATA

SEASON FALL 1980
COLLECTION DATE 10-11-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES SPARTINA
CHAMBER CODE 15DCS 1A
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.82	21.0	-0.040	0.
1.79	20.0	-0.065	0.
2.71	21.5	0.000	0.
3.65	22.0	-0.040	0.
4.63	22.0	-0.070	0.
5.56	20.0	-0.103	0.
6.55	20.0	-0.117	0.
7.49	20.0	-0.146	117.
8.43	24.0	-0.071	70.
9.44	27.0	0.253	176.
10.49	36.0	-0.012	246.
11.53	36.0	0.290	323.
12.55	32.0	0.316	323.
13.58	32.0	0.331	299.
14.63	33.0	0.302	340.
15.67	34.0	0.129	299.
16.68	29.5	0.023	217.
17.73	28.5	0.037	129.
18.76	25.0	-0.138	23.
19.81	25.0	-0.191	0.
21.73	22.0	-0.161	0.
22.77	20.0	-0.142	0.
23.71	22.0	-0.111	0.
99.99	25.0	-0.191	0.

MARSH COMMUNITY METABOLISM DATA

SEASON FALL 1980
COLLECTION DATE 10-11-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES SPARTINA
CHAMBER CODE 15DCS 2A
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.04	22.0	-0.104	0.
1.03	20.5	-0.028	0.
2.02	20.0	-0.040	0.
2.97	22.0	-0.042	0.
3.87	22.0	-0.009	0.
4.86	22.0	-0.066	0.
5.80	20.0	-0.096	0.
6.80	20.0	-0.115	0.
7.74	22.0	-0.042	117.
8.69	26.0	0.098	94.
9.70	32.0	0.107	199.
10.74	34.5	-0.051	264.
11.78	38.0	0.104	328.
12.82	34.0	0.144	311.
13.84	32.0	0.225	317.
14.89	33.0	0.169	346.
15.93	34.0	0.050	282.
16.95	28.5	0.024	194.
18.00	27.0	-0.002	106.
19.05	25.0	-0.164	12.
20.09	25.0	-0.164	0.
21.99	22.0	-0.127	0.
23.02	19.0	-0.115	0.
99.99	25.0	-0.164	0.

MARSH COMMUNITY METABOLISM DATA

SEASON FALL 1980
COLLECTION DATE 10-11-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 15DCJ 3A
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.30	21.0	-0.069	0.
1.27	20.0	-0.225	0.
2.27	21.0	-0.137	0.
3.14	22.0	-0.120	0.
4.11	22.0	-0.137	0.
5.10	21.5	-0.241	0.
6.06	20.0	-0.242	0.
7.00	20.0	-0.324	0.
7.96	21.0	0.076	35.
8.95	28.0	0.480	135.
9.96	35.0	0.499	217.
10.00	39.0	0.518	293.
12.02	35.5	0.544	328.
13.06	34.0	0.527	299.
14.10	32.0	0.531	334.
15.15	34.0	0.504	328.
16.19	34.0	0.527	270.
17.23	28.5	0.342	176.
18.27	26.0	0.044	76.
19.31	25.0	-0.219	0.
20.33	29.5	-0.236	0.
22.26	21.0	-0.284	0.
23.30	20.0	-0.214	0.
99.99	29.5	-0.236	0.

MARSH COMMUNITY METABOLISM DATA

SEASON FALL 1980
COLLECTION DATE 10-11-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 15DCJ 4A
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.54	22.0	-0.245	0.
1.50	20.0	-0.129	0.
2.49	21.5	-0.062	0.
3.51	22.0	-0.123	0.
4.50	22.0	-0.162	0.
5.30	20.0	-0.191	0.
6.29	20.0	-0.149	0.
7.20	20.0	-0.135	0.
8.19	22.0	0.282	47.
9.18	28.0	0.353	153.
10.22	36.0	0.510	235.
11.27	33.0	0.646	305.
12.28	31.5	0.526	328.
13.32	34.0	0.407	299.
14.37	32.0	0.427	340.
15.42	34.0	0.457	317.
16.45	34.0	0.492	252.
17.49	29.0	0.327	153.
18.53	25.5	-0.054	59.
19.57	25.0	-0.246	0.
20.56	29.0	-0.242	0.
22.51	20.5	-0.189	0.
23.55	27.0	-0.181	0.
99.99	29.0	-0.242	0.

MARSH COMMUNITY METABOLISM DATA

SEASON FALL 1980
COLLECTION DATE 10-12-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES SPARTINA
CHAMBER CODE 15DCS 1B
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.89	27.0	-0.231	0.
1.87	28.0	-0.125	0.
2.88	28.0	-0.182	0.
3.92	24.0	-0.176	0.
4.96	21.0	-0.209	0.
6.00	20.0	-0.219	0.
7.05	22.0	-0.216	0.
8.09	26.0	-0.136	18.
9.59	29.0	0.251	147.
10.65	31.5	0.465	258.
11.69	32.5	0.448	323.
12.71	32.0	0.478	364.
13.78	32.0	0.577	387.
14.76	32.0	0.548	381.
15.83	30.5	0.368	340.
16.91	30.0	99.990	276.
20.79	26.0	-0.136	0.
21.81	26.0	-0.299	0.
22.85	26.0	-0.329	0.
23.90	26.5	-0.270	0.
99.99	30.0	99.990	276.

MARSH COMMUNITY METABOLISM DATA

SEASON FALL 1980
COLLECTION DATE 10-12-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES SPARTINA
CHAMBER CODE 15DCS 2B
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.16	26.5	-0.199	0.
1.19	27.0	-0.153	0.
2.14	28.0	-0.108	0.
3.14	28.0	-0.190	0.
4.17	23.0	-0.285	0.
5.21	20.5	-0.205	0.
6.25	20.0	-0.195	0.
7.29	23.5	-0.155	0.
8.80	27.5	-0.002	76.
9.84	29.0	0.294	176.
10.88	31.0	0.487	276.
11.93	32.0	0.547	340.
12.97	32.0	0.659	375.
14.04	32.0	0.648	387.
15.05	32.0	0.567	375.
16.09	30.0	0.484	328.
17.16	30.0	0.221	258.
21.03	26.0	-0.136	0.
22.07	26.0	-0.200	0.
22.59	26.0	-0.208	0.
99.99	30.0	0.221	258.

MARSH COMMUNITY METABOLISM DATA

SEASON FALL 1980
COLLECTION DATE 10-12-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 15DCJ 3B
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.39	26.5	-0.213	0.
1.41	27.0	-0.203	0.
2.40	28.0	-0.140	0.
3.39	28.0	-0.063	0.
4.43	22.5	-0.159	0.
5.47	19.0	-0.226	0.
6.51	20.0	-0.208	0.
7.55	24.0	-0.189	0.
9.06	28.0	0.372	100.
10.10	28.5	0.473	205.
11.17	29.0	0.451	293.
12.21	32.0	0.302	346.
13.27	32.0	0.386	375.
14.27	32.0	0.386	387.
15.31	31.0	0.367	364.
16.38	30.0	0.493	311.
17.42	30.0	0.326	235.
21.29	26.0	-0.204	0.
22.33	26.0	-0.235	0.
23.35	26.5	-0.219	0.
99.99	30.0	0.326	235.

MARSH COMMUNITY METABOLISM DATA

SEASON FALL 1980
COLLECTION DATE 10-12-80
AREA - TREATMENT DISCHARGE - THERMAL
DOMINANT SPECIES JUNCUS
CHAMBER CODE 15DCJ 4B
SUNRISE AT 7.45 SUNSET AT 17.72

TIME	AIR TEMP DEG C	CORRD PS/RESP GC/M2/H	SOLAR KCAL /M2/H
0.68	26.5	-0.358	0.
1.61	27.0	-0.357	0.
2.63	28.0	-0.210	0.
3.65	26.0	-0.229	0.
4.69	22.0	-0.297	0.
5.73	20.0	-0.416	0.
6.77	20.0	-0.266	0.
7.81	24.5	-0.213	6.
9.32	28.5	0.185	123.
10.39	29.5	0.145	235.
11.41	32.5	0.089	305.
12.45	32.0	-0.002	352.
13.51	32.0	0.071	387.
14.56	32.0	0.128	352.
15.58	30.0	0.182	293.
16.61	30.0	99.990	293.
21.55	26.0	-0.261	0.
22.59	26.0	-0.245	0.
23.64	26.5	-0.228	0.
99.99	30.0	99.990	293.

APPENDIX E

PERCENT SATURATION OF DISSOLVED OXYGEN AT POINT OF DISCHARGE, INTAKE SCREENS, AND OUTER BAY

PERCENT SATURATION OF DISSOLVED OXYGEN AT POINT
OF DISCHARGE, INTAKE SCREENS, AND OUTER BAY

The solubility of oxygen in seawater decreases proportionally with increasing temperature and/or salinity. Table II-72 lists the percent saturation of oxygen in water relative to air for the outer bay, point of discharge, and intake screens stations. Percent saturations generally follow the pattern of elevated saturations at dusk due to daily production, with the lowest saturations at dawn due to night respiration. When large changes in temperature and/or salinity occur between any two successive sampling times, this pattern can be obscured. Most dawn-dusk pairs for all three stations varied by less than 10% saturation.

Table II-72. Mean percent saturation of water with dissolved oxygen at point of discharge, intake screens, and outer bay during dawn-dusk-dawn sampling. The mean percent is based on three water samples.

	Outer Bay		Discharge Canal		Intake Screens	
Date	Time	Mean % Saturation	Time	Mean % Saturation	Time	Mean % Saturation
1/04/80	0732	100.8	0700	115.1	0832	98.6
1/04/80	1735	101.5	1800	112.0	1654	99.3
1/05/80	0800	98.4	0700	111.1	0654	99.7
1/05/80	1709	103.6	1755	104.4	1815	100.8
1/06/80	0740	98.1	0700	109.9	0650	97.7
1/18/80	0712	105.3	0643	117.4	0809	106.7
1/18/80	1655	110.8	1627	121.5	1732	108.8
1/19/80	0720	105.4	0650	119.1	0808	107.7
1/19/80	1717	112.3	1645	118.9	1751	110.7
1/20/80	0715	102.0	0648	115.3	0756	103.1
2/01/80	0740	99.6	0700	112.4	0840	97.3
2/01/80	1753	107.4	1730	114.4	1828	98.0
2/02/80	0740	98.4	0837	115.9	0700	99.6
2/02/80	1730	107.3	1630	115.7	1814	101.1
2/03/80	0735	103.1	0823	117.0	0647	101.9
2/22/80	0725	103.8	0704	111.5	0807	105.7
2/22/80	1735	110.8	1700	119.2	1815	110.1
2/23/80	0705	106.1	0635	111.9	0825	105.2
2/23/80	1725	110.0	1657	117.7	1803	112.2
2/24/80	0710	104.9	0635	110.7	0806	100.0
3/07/80	1729	116.8	1649	117.6	1758	120.1
3/08/80	0657	109.9	0627	110.4	0739	113.3
3/08/80	1702	114.1	1753	119.4	1643	117.8
3/09/80	0710	106.8	0630	105.3	0804	105.3
3/09/80	1711	111.5	1629	111.5	1745	109.1
3/21/80	0645	97.4	0615	99.1	0800	98.7
3/21/80	*	*	1700	108.0	1820	101.8
3/22/80	0633	97.5	0609	87.9	0728	92.6
3/22/80	1723	112.1	1647	101.17	1755	101.9
3/23/80	0636	99.5	0614	94.1	0720	97.5
4/04/80	0655	100.4	0600	95.01	0722	109.5
4/04/80	1732	107.9	1655	105.6	1702	113.2
4/05/80	0626	99.1	0548	97.4	0543	99.7
4/05/80	1800	115.5	1715	104.8	1715	112.0
4/06/80	0703	101.9	0533	93.4	0655	101.9

Table II-72 (cont'd).

Date	Outer Bay		Discharge Canal		Intake Screens	
	Time	Mean % Saturation	Time	Mean % Saturation	Time	Mean % Saturation
4/18/80	0558	100.0	0525	100.7	0643	102.8
4/18/80	1823	110.9	1850	110.3	1747	110.0
4/19/80	0558	100.5	0530	99.5	0643	101.1
4/19/80	1809	108.5	1738	111.1	1845	106.3
4/20/80	0610	99.4	0528	99.8	0658	96.2
5/02/80	1800	110.3	1734	109.9	1840	102.9
5/03/80	0643	100.3	0615	98.0	0728	95.6
5/03/80	1842	108.8	1804	110.2	1923	104.5
5/04/80	0645	98.6	0619	95.1	0729	98.4
5/04/80	1853	110.3	1940	104.5	1748	106.0
5/16/80	0643	95.1	0612	91.3	0734	100.3
5/16/80	1819	114.1	1751	101.9	1856	117.2
5/17/80	0640	94.8	0607	86.82	0736	98.9
5/17/80	1830	111.9	1759	97.3	1910	106.6
5/18/80	0637	94.2	0610	91.3	0716	95.5
5/30/80	1754	103.4	1727	97.8	1830	111.2
5/31/80	0634	91.0	0608	80.1	0725	98.1
5/31/80	1811	104.7	1841	95.3	1738	103.4
6/01/80	0641	92.8	0614	86.5	0721	94.2
6/01/80	1820	109.2	1902	96.2	1736	108.3
6/16/80	1848	113.0	1815	109.9	1930	115.6
6/17/80	0700	96.3	0603	92.9	0752	100.1
6/17/80	1915	111.3	1847	105.5	1950	116.9
6/18/80	0642	96.6	0615	93.0	0727	100.7
6/18/80	1845	108.0	1920	106.7	1920	115.8
7/17/80	0731	93.2	0715	88.0	0807	96.8
7/17/80	1853	108.4	1926	102.2	1816	110.6
7/18/80	0706	95.1	0635	90.9	0807	95.0
7/18/80	1838	110.4	1819	104.4	1855	110.6
7/19/80	0732	92.7	0805	87.9	0635	92.0
8/02/80	1857	109.8	1829	100.0	1929	111.7
8/03/80	0714	94.3	0747	88.7	0620	95.9
8/03/80	1905	111.9	1928	97.2	1835	109.0
8/04/80	0646	98.0	0715	89.1	0616	93.4
8/04/80	1900	117.3	1834	95.3	1911	102.0

Table II-72 (cont'd).

Date	Outer Bay		Discharge Canal		Intake Screens	
	Time	Mean % Saturation	Time	Mean % Saturation	Time	Mean % Saturation
8/15/80	1843	122.0	1809	109.7	1923	113.1
8/16/80	0705	100.7	0732	101.5	0630	103.8
8/16/80	1930	116.8	1815	116.5	1910	114.0
8/17/80	0700	104.6	0633	101.6	0740	102.9
8/17/80	1902	117.9	1930	114.0	1847	110.2
8/29/80	0712	93.0	0645	99.9	0748	97.0
8/29/80	1740	114.9	1713	104.9	1811	117.9
8/30/80	0721	92.2	0753	98.9	0645	93.0
8/30/80	1744	112.8	1817	108.2	1715	113.6
9/01/80	0711	96.2	0644	99.0	0726	93.9
9/12/80	0721	93.6	0651	97.6	0753	97.7
9/12/80	1737	107.4	1707	107.9	1822	107.2
9/13/80	0737	94.6	0816	102.8	0700	96.4
9/13/80	1831	110.1	1656	111.9	1815	108.3
9/14/80	0712	93.5	0651	102.8	0755	97.6
9/26/80	0700	102.7	0647	111.8	0830	104.5
9/26/80	1759	125.4	1720	120.8	1815	113.1
9/27/80	0746	101.8	0655	112.0	0810	103.4
9/27/80	1738	124.3	1755	118.1	1755	116.6
9/28/80	0715	98.0	0648	110.8	0620	98.0
10/14/80	1820	109.65	1755	114.32	1855	103.26
10/15/80	0713	96.80	0650	106.41	0758	94.28
10/15/80	1746	110.83	1709	112.90	1825	105.01
10/16/80	0812	95.99	0900	104.29	0715	94.52
10/16/80	1800	112.19	1728	114.97	1838	105.93
10/31/80	0725	98.98	0650	110.26	0810	100.13
10/31/80	1650	109.32	1625	114.18	1735	105.91
11/01/80	0700	95.69	0630	109.90	0744	96.72
11/01/80	1715	111.92	1750	106.81	1625	108.04
11/02/80	0700	99.67	0634	110.41	0745	97.16
11/13/80	1630	110.11	1600	112.35	1615	102.75
11/14/80	0645	103.13	0612	110.31	0735	101.33
11/14/80	1710	112.31	1740	112.89	1608	109.91
11/15/80	0708	103.23	0640	104.68	0802	101.23
11/15/80	1651	110.18	1620	112.68	1740	108.59

Table II-72 (cont'd).

Date	Outer Bay		Discharge Canal		Intake Screens	
	Time	Mean % Saturation	Time	Mean % Saturation	Time	Mean % Saturation
11/28/80	1625	100.36	1555	111.67	1700	97.38
11/29/80	0654	98.79	0621	109.72	0731	96.19
11/29/80	1645	104.15	1605	112.32	1718	100.35
11/30/80	0726	100.34	0801	109.73	0645	97.08
11/30/80	1705	108.95	1745	111.05	1604	98.84
12/15/80	1643	109.66	1610	117.00	1715	102.70
12/16/80	0715	101.86	0645	110.67	0802	99.33
12/16/80	1710	100.34	1744	111.62	1625	101.10
12/17/80	0720	98.85	0640	108.57	0825	98.25
12/17/80	1600	103.15	1735	106.05	1615	100.58