903R93023

CBP/TRS 74/93
June 1993

Comparison of Mid-Bay and Lateral Station Water Quality Data in the Chesapeake Bay Mainstem

Chesapeake Bay Program

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Produced under contract to the U.S. Environmental Protection Agency
Contract No. 68-WO-0043

Printed by the U.S. Environmental Protection Agency for the Chesapeake Bay Program

ENDORSEMENT

The Chesapeake Bay Program Monitoring Subcommittee has reviewed the assumptions and methods of data analysis used in this report and finds them appropriate for the analysis conducted. The findings of this report are consistent with and supported by the analytical techniques employed.

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EXECUTIVE SUMMARY

Seasonal median water quality values were compared between stations in mid-Bay and lateral regions in seven east-west transects in the mainstem Chesapeake Bay. Comparisons were made over seven years, 1985-1991, for April-October surface layer medians of total phosphorus, total nitrogen, dissolved orthophosphate, dissolved inorganic nitrogen, total suspended solids, chlorophyll a, Secchi depth, and salinity. Comparisons were also made using spring (March-May) and summer (June-September) medians of surface and bottom salinity and dissolved oxygen. Comparisons were made using difference plots of raw data, scatter plots of annual seasonal medians, and the Wilcoxon matched-pairs test on annual seasonal medians. The graphical and statistical analyses confirmed each other. Correlation coefficients were also calculated between mid-Bay and lateral data series to estimate their degree of similarity over time, but could not be tested for statistical significance.

The results of the median comparisons show that in most cases, mid-Bay data can be used to characterize median water quality in nearby lateral areas. There were three categories of results for the nine parameters analyzed.

In the first category, one parameter, dissolved inorganic nitrogen, had no statistically significant differences between mid-Bay and lateral station medians.

In the second category, five parameters, total phosphorus, orthophosphate, total nitrogen, total suspended solids, and chlorophyll a, had statistically significant differences between mid-Bay and lateral station medians. However, the differences were smaller than the analytical uncertainty for that parameter, as estimated by the method detection limit. Thus, the differences were small enough to permit the application of mid-Bay median water quality to lateral areas. Almost all of the differences found for these five parameters were between mid-Bay and western stations, which were located farther from the mid-Bay station than eastern stations.

In the third category, three parameters (Secchi depth, salinity, and dissolved oxygen) had statistically significant differences that were usually larger than the uncertainty level for those parameters. All of the significant differences in Secchi depth were between central and western stations, and for salinity and dissolved oxygen, the differences were largest when comparing summer medians from 1 meter above the bottom. In most cases, mid-Bay data for these three parameters should not be used to characterize seasonally averaged water quality in nearby lateral areas. However, salinity and dissolved oxygen medians were quite similar at mid-Bay and lateral stations at the surface, and for bottom comparisons at the same depth.

INTRODUCTION

One of the main goals of the Chesapeake Bay Program is the restoration of the Bay's living resources, primarily by improving the water quality in the Bay. To do this effectively, scientists and managers need water quality monitoring data from living resource habitats. However, many living resources are most common in shallow water nearshore habitats, where it is difficult to collect water samples via ship-based monitoring. Also, the three-dimensional computer model that is being used to project water quality responses to nutrient reductions produces estimates for mid-Bay areas only (Nutrient Reevaluation Workgroup 1992). Thus, scientists and managers need information on the comparability of water quality in mid-channel and mid-Bay areas to water quality in shallower nearshore areas. Previous analyses assessed this comparability for mid-channel and nearshore stations in selected tributaries of the Chesapeake Bay (Ellett et al. 1989, Batiuk et al. 1993), but not for areas in the mainstem of the Bay.

The primary purpose of this analysis is to determine whether selected lateral and mid-Bay stations in the Chesapeake Bay mainstem have the same overall levels of certain water quality parameters. For several transects in the Chesapeake Bay mainstem, sampling has occurred at a mid-Bay location and at corresponding eastern and/or western lateral locations with similar latitude. Although these lateral stations are too deep to support all of the living resources that live near the shore, they are closer to many living resource habitats than the mid-Bay stations. The question of whether or not the center and lateral stations behave similarly throughout the period of record is also examined through time series plots and cross-correlation coefficients. The advantages of developing actual predictive models that relate the mid-Bay and lateral station data are discussed. Such predictive models would be particularly useful when one location is not sampled (e.g. lateral stations during the winter) or when data is missing for any reason.

METHODS

A. SELECTION OF TRANSECTS, PARAMETERS, TIME PERIODS, AND SAMPLING DEPTHS

The data used for this analysis were collected under the Chesapeake Bay Mainstem Monitoring Program and the Maryland Tributary Monitoring Program. When the current monitoring program was established in 1984, eastern and western lateral stations were added near historical mid-Bay stations that had been monitored by the Chesapeake Bay Institute. The lateral stations were added primarily to assess the extent that wind and tidal events moved oxygen-poor mid-Bay waters into shallower lateral areas (CBP 1985).

The lateral and mid-Bay data which were selected for analysis consisted of all available cruises from March 1985 through October 1991 for the following transects: CB3.3 (CB3.3C, CB3.3E and CB3.3W); CB4.1 (CB4.1C, CB4.1E, CB4.1W); CB4.2 (CB4.2C, CB4.2E, CB4.2W); CB4.3 (CB4.3C, CB4.3E, CB4.3W); CB5.1 (CB5.1, CB5.1W); CB5.4 (CB5.4, CB5.4W); and CB7.2 (CB7.2, CB7.2E, and CB6.3). Data for the months November through February were not available for transects CB3.3 through CB4.3 after 1988, because the lateral stations were not sampled during these months. Data from 1984 were not available for all months used, because sampling started in June.

The three criteria for selecting transects were:

1. Stations at approximately the same latitude.

2. At least one of the lateral stations in relatively shallow water (8-12 meters median bottom depth to approximate "nearshore" habitat) with the mid-Bay station in deeper water (16-31 meters median bottom depth).

3. All stations in each transect usually sampled on the same day, to reduce variability due to sampling time.

Transect locations, bottom sampling depths, and the percentage of cruises in which the stations were sampled on the same day is provided for each transect in Table 1. A summary map of all the transects and detailed maps of each transect are also provided, including 1990 Submerged Aquatic Vegetation (SAV) beds (Figures 1-7). SAV beds are included because several of the parameters analyzed are important to SAV growth, and have been used to develop water quality habitat requirements for SAV growth (Batiuk et al. 1993). Note that transects were not selected for their proximity to SAV beds; some transects, such as CB3.3, are not close to any current SAV beds. In transects CB4.1 through CB4.3, the western stations are not near any potential SAV habitat, due to high wave action in nearby shallows (Batiuk et al. 1993).

The parameters examined included surface concentrations (layer = 'S') of total phosphorus (TP), total nitrogen (TN), dissolved orthophosphate (PO4F), dissolved inorganic nitrogen (DIN), total suspended solids (TSS), chlorophyll a (CHLA), Secchi depth (SECCHI), and salinity (SALIN). These parameters include all five Submerged Aquatic Vegetation (SAV) habitat requirements (Batiuk et al. 1993), plus total nitrogen, total phosphorus, and salinity. The surface layer is at 0.5 m depth in Maryland and 1.0 m in Virginia. The time period used for these parameters was the same April-October time period used for SAV habitat requirements (Batiuk et al. 1993). The data used had all current data corrections, including an adjustment to early total nitrogen data for stations sampled by Maryland Department of the Environment (MDE) (Bergstrom 1992). In all cases, data from stations in the same transect came from the same laboratory, with the same analytical methods and detection limits.

Surface and near bottom concentrations of dissolved oxygen (DISOXY) and salinity (SALIN) were compared over the spring (March-May) and summer (June-September) periods used for the three-dimensional computer model of Chesapeake Bay water quality. Surface dissolved oxygen (S_DISOXY) and salinity (S_SALIN) used the samples with layer = 'S' at each station. In all cases, the mid-Bay stations were in deeper water than the lateral stations, so bottom dissolved oxygen and salinity were each compared two different ways. The first compared mid-Bay and lateral bottom layer (layer = 'B') samples (B1_DISOXY and B1_SALIN), which had greater sampling depth at the mid-Bay station. The bottom layer sample is taken 1 m above the bottom. The second compared dissolved oxygen and salinity values from the same depth (B2_DISOXY and B2_SALIN), usually at the minimum bottom sampling depth for the lateral station (Table 1). This sampling depth was always above the bottom at the central station, and could be above the pycnocline.

B. SUMMARY STATISTICS AND GRAPHICAL ANALYSES

Because the habitat restoration goals for Submerged Aquatic Vegetation (SAV) and three-dimensional model output are stated in terms of seasonal averages, annual seasonal median concentrations are provided for all parameters. Medians are less sensitive than means to the distribution of the data, and the Wilcoxon matched-pairs test compares medians (see next section). The medians were graphed in scatter plots with lateral station data on the vertical axis and central station data on the horizontal axis. In these plots, differences between lateral and central station data appear as deviations from the diagonal line of equality. To show the magnitudes of differences between the raw data, time series plots of differences between the raw concentration data from mid-Bay and both lateral stations were produced for each transect/variable combination that had statistically significant differences.

C. CHOICE OF STATISTICAL TEST: WILCOXON MATCHED-PAIRS TEST

A nonparametric test was chosen for two reasons. First, nonparametric tests are less sensitive to the distribution of the data, and second, they are less affected by below detection limit data when compared to a parametric test (Gilbert 1987). The Wilcoxon matched-pairs test was used because it assumes positively correlated (paired) samples (Siegel 1956, Marascuilo and McSweeney 1977). Stations within a transect were paired in space, since all were at similar latitudes and within 7-9 km or less of each other (Figures 1-7). Stations were also paired in time of sampling. In almost all cases stations within a transect were sampled on the same day (Table 1).

The Wilcoxon matched-pairs test was performed on annual seasonal median values for two reasons. In statistical terms, the main management question of interest was whether the seasonal medians differed between central and lateral stations, not whether the median of the central-lateral differences on each sampling date was zero. Also, using annual seasonal medians reduced the serial correlation in the data. The Wilcoxon test assumes that sequential data points at the same station are independent, which is not true of semimonthly or monthly nutrient concentrations in the Chesapeake Bay.

Calculations were done using a custom SAS program (SAS Institute 1990) using the formulas in Siegel (1956) and a two-tailed alpha level of 0.05. Because annual seasonal medians were used, tests could not be done on a year-by-year basis, but the consistency and magnitude of the annual differences were assessed graphically (see previous section).

For each variable, the proportion of observations below the detection limit was examined to ensure that there were sufficient uncensored observations for analysis. Comparisons were not made if more than 50% of the observations were censored at either station.

For those pairs of stations exhibiting statistically significant differences with the Wilcoxon matched-pairs test, stem and leaf and box plots were examined to ensure that the observed differences were in fact due to location shifts rather than distributional differences. Also, median differences and 95% confidence intervals were calculated for those pairs of stations with a custom SAS program, using the methods in Conover (1980, p. 288).

D. CORRELATION COEFFICIENTS

An issue which remains unanswered in the comparison of medians is how reliably we can predict the lateral station observations from the mid-Bay station observations when data are missing or lateral areas are not sampled. In order to examine this question in detail, the time series should be carefully modeled to account for serial correlation and other factors. Whereas the Wilcoxon matched-pairs test provides only a coarse comparison, developing a predictive model would enable us to define systematic differences and to extrapolate individual values as well as means or medians. The correlation coefficients described below are intended to provide a rough indication of how good our predictions might be if we carried out this modeling effort. They are called cross-correlation coefficients because they involve parallel time series.

The cross-correlation coefficients between the parallel time series (west and center; east and center) were computed to obtain an estimate of the strength of the relationship between the mid-Bay and corresponding lateral station data for each parameter. Raw concentration data from the same seasons used for the Wilcoxon matched-pairs tests, March 1985 through October 1991, were used to calculate the coefficients. Any pairs of data which were identical because they were both below the detection limit were deleted before the coefficients were calculated. These cross-correlation coefficients are identical to the Pearson product moment correlations, and thus are constrained between -1 and +1. For those stations and parameters exhibiting higher cross-correlations, we would expect to be better able to predict the lateral station levels from the mid-Bay station levels. Nonparametric correlation was not used because it only indicates how closely the ranks of the two data series corresponded. Since the time series are serially correlated, probability estimates for the cross-correlation coefficients are not readily obtainable.

RESULTS AND DISCUSSION

A. ANNUAL SEASONAL MEDIANS AND PLOTS OF MID-BAY AND LATERAL STATION DATA

1. Medians and scatter plots

The annual seasonal medians for all transect/parameter combinations, using the same seasons used for the Wilcoxon matched-pairs tests, are shown in Appendix 1, Table A1-1. The same medians for each year, season and parameter are shown in scatter plots of mid-Bay and lateral station data (Figures 8-47). If mid-Bay and lateral station medians were identical they would fall on the diagonal in each graph; symbols above the diagonal indicate higher medians at lateral stations, while those below indicate higher medians at mid-Bay stations. An examination of these graphs shows the same general differences found with the Wilcoxon matched-pairs tests (next section), with relatively consistent differences from year to year.

2. Time plots of differences

Time plots of differences between central and lateral station data are also shown for all parameters and pairs of stations with statistically significant differences (Figures 48-105). Note that there were no winter data after 1988 from the lateral stations in transects CB3.3 through CB4.3, because winter sampling was discontinued at those stations.

These difference plots show a seasonal pattern in many of the differences, since they include winter data that were not included in the other analyses. For example, total phosphorus, orthophosphate, total nitrogen, chlorophyll *a*, and bottom salinity (B1_SALIN) and dissolved oxygen (B1_DISOXY) differences tended to be larger in the summer (April-October) than in the winter. Other parameters, such as total suspended solids, Secchi depth, and surface salinity and dissolved oxygen, had central-lateral differences of similar magnitudes in the summer and winter. Most of the differences shown were relatively consistent in magnitude and direction from year to year. There were four exceptions to this consistency in 1989: summer bottom salinity (B1_SALIN) differences in transect CB7.2 were smaller than usual in 1989, and summer bottom dissolved oxygen (B1_DISOXY) differences in transects CB4.1 through CB4.3 were smaller than usual in 1989. These departures from the normal pattern of differences in 1989 may be due to the relatively high rainfall during the late spring of that year.

B. STATISTICAL COMPARISONS BETWEEN ANNUAL SEASONAL MEDIANS OF MID-BAY AND LATERAL STATION DATA

In general, there were more significant differences between central and western stations than between central and eastern stations. This was probably because central and western stations were usually located farther apart than central and eastern stations.

1. Central-western differences

The results of the Wilcoxon matched-pairs tests for mid-Bay and western stations are shown in Table 2 over all seven years. There were several parameters and transects with statistically significant differences over this period. Secchi depth medians were significantly greater at the mid-Bay station than at the western station in all transects except CB3.3. Surface total suspended solids medians were significantly higher at the western station in all transects except CB5.1, and surface total phosphorus were significantly higher at the western station in all transects except CB5.1 and CB7.2. Surface total nitrogen and chlorophyll *a* medians were significantly higher at the western station in transects CB4.1, CB4.2, CB4.3, and CB7.2. Surface orthophosphate medians were significantly higher at the western station in transects CB4.1, CB4.2, and CB4.3. Dissolved inorganic nitrogen had no significant differences. In all cases of significant differences, water quality was lower at the western stations. Secchi depth was less at western stations (more turbidity), and the median concentrations of total phosphorus, orthophosphate, total nitrogen, total suspended solids, and chlorophyll *a* were higher for the western (lateral) station than the corresponding mid-Bay station (shown by negative differences).

Median April-October surface salinity was significantly higher at the central station in transects CB4.1 and CB7.2, although the difference was small in transect CB4.1. Median spring surface salinity showed significant differences between mid-Bay and western stations in one transect, CB7.2, and summer surface salinity had significant differences in three transects: CB4.1, CB5.4, and CB7.2 (Table 2). Surface salinity was always higher at the central station (positive differences) except in transect CB5.4, where the summer difference was very small (0.16 ppt). The lower surface salinity at western stations was presumably due to flow from western shore tributaries. Nearby rivers include the South, Rhode and West rivers for CB4.1W, and the Piankatank River for CB5.4W. The western station in transect CB7.2, station CB6.3, is over 20 km south of the mouth of the Rappahannock River (Figure 1), so the surface salinity differences there may reflect the general east-west surface salinity differences found in the lower Bay (EPA 1989). There were no surface salinity differences in the CB5.1 transect, near the mouth of the Patuxent River, possibly because the CB5.1W station is farther from the mouth of the river (Figure 5) compared to station CB5.4W (Figure 6).

Spring and summer bottom salinity at the same layer (B1_SALIN) was significantly higher at the mid-Bay station in spring and summer in all transects, with some differences exceeding 6 ppt. This reflects normal estuarine stratification, with denser, more saline water in deeper areas (EPA 1989). Bottom salinity at the same sampling depth (B2_SALIN) showed far fewer and smaller significant differences, in three transects in the spring and one in the summer, all with higher salinity at the central station.

Surface dissolved oxygen medians showed a small but statistically significant central-western differences in one transect, CB4.2, in the spring. Bottom dissolved oxygen medians at the same layer (B1_DISOXY) were significantly lower at the mid-Bay station in both seasons in all transects, by 2.6 to 4.7 mg/l, except for CB7.2. The median differences were always larger in the summer than in the spring (Table 2). These differences in B1_DISOXY reflect the tendency for sub-pycnocline areas of the Bay, especially deeper mid-Bay areas north of the Rappahannock River, to undergo oxygen depletion in the summer (CSC 1991, Nutrient Reevaluation Workgroup 1992). In transect CB7.2, B1_DISOXY was slightly but significantly higher at the mid-Bay station in the summer, but an examination of the annual seasonal medians (Appendix 1 and Figure 41) shows that low dissolved oxygen levels are not a problem in this transect.

As with salinity, bottom dissolved oxygen at the same sampling depth (B2_DISOXY) showed far fewer significant differences: it was significantly higher at the central station in transects CB4.2 and CB4.3 in the spring, and in transects CB5.4 and CB7.2 in the summer, although the differences were small (1.1 mg/l or less). The slightly higher median levels of B2_DISOXY at the central station may be due to occasional sampling above the pycnocline at the central station in these same-depth comparisons. Dissolved oxygen levels tend to be higher above the pycnocline than below the pycnocline.

2. Central-eastern differences

The results of the Wilcoxon matched-pairs tests for mid-Bay and eastern stations are shown in Table 3 over all seven years. The only statistically significant differences between medians from mid-Bay and the corresponding eastern stations were for chlorophyll *a*, salinity and dissolved oxygen.

Chlorophyll *a* medians were slightly but significantly higher at station CB3.3C compared to CB3.3E. Since these two stations are less than 2 km apart and are a similar distance from shore (Figure 2), reasons for these consistent differences in median chlorophyll *a* levels are unclear.

Surface salinity medians were significantly higher at the eastern stations in transects CB4.1 and CB7.2 over all seasons, and in transect CB4.3 in the spring, but the magnitude of the differences was very small (0.2-0.6 ppt) in the CB4.1 and CB4.3 transects (Table 3). The larger surface salinity differences in transect CB7.2 (1.2-1.6 ppt) are presumably due to the tendency for east-west salinity differences in the lower Bay (EPA 1989). Bottom salinity at the same layer (B1_SALIN) was significantly higher in both spring and summer at the mid-Bay stations in all transects. This same pattern was found in central-western comparisons, and here the difference is presumably also due to the greater sampling depth at mid-Bay stations. The two transects with relatively deep eastern stations, CB4.1 and CB4.3, generally had the smallest median differences in B1_SALIN (Table 3). "Bottom" salinity at the same sampling depth (B2_SALIN) was usually higher at the mid-Bay station (positive differences), but there were fewer significant differences, and smaller median differences, compared to results for B1_SALIN.

Surface dissolved oxygen medians were slightly but statistically significantly lower at the eastern station in transect CB7.2 in both spring and summer (Table 3). Reasons for these differences are unclear. Bottom dissolved oxygen at the same layer (B1_DISOXY) was significantly lower at the mid-Bay station for both seasons for all transects but CB4.1 and CB4.3. Transect CB4.1 had a significant summer median difference, but the magnitude was very small (0.05 mg/l). "Bottom" dissolved oxygen at the same sampling depth (B2_DISOXY) had only one statistically significant difference, with slightly higher (0.24 mg/l) summer median levels at the eastern station in the CB7.2 transect.

The lack of significant differences between bottom dissolved oxygen at the same layer (B1_DISOXY) at mid-Bay and eastern stations in transects CB4.1 and CB4.3 (Table 3) is probably due to the depth of the eastern stations in those transects. Stations CB3.3E and CB4.2E, which had significant differences in bottom dissolved oxygen, were much shallower than stations CB4.1E and CB4.3E, which did not (Table 1). The deep eastern stations CB4.1E and CB4.3E had B1_DISOXY medians as low or lower than medians at the corresponding mid-Bay station (Appendix 1 and Figure 43). In contrast, the western stations were all relatively shallow (Table 1), and all western stations had significantly higher summer median bottom dissolved oxygen (B1_DISOXY) than the corresponding mid-Bay stations (Table 2).

3. Synthesis of results from different analyses

Comparison of the annual seasonal medians (Appendix 1, Table A1-1, and Figures 8-47) to the results over seven years in Tables 2 and 3 shows that all of the differences that were statistically significant over seven years also showed consistent differences in the same direction on an annual basis. Thus, although the concentration levels often varied from year to year, the differences between stations were consistent over the seven years studied. This same consistency of differences is evident in plots of the raw differences (Figures 48-105), although most of the differences were less consistent when using raw data rather than medians.

However, for nutrients and most other SAV-related parameters, these significant differences were smaller than or similar in magnitude to estimates of analytical uncertainty and the habitat requirements for SAV growth (Batiuk et al. 1993). The magnitudes are compared in Table 4, using the method detection limits at the laboratories involved to estimate analytical uncertainty. All of the significant differences were smaller than or similar to the maximum MDL and the SAV habitat requirement (if available), except for Secchi depth, salinity, and dissolved oxygen. Thus, the differences in total phosphorus, orthophosphate, total nitrogen, total suspended solids, and chlorophyll *a*, although statistically significant, were small enough to permit the application of mid-Bay data to lateral areas, given the uncertainty in the data. However, the significant differences in Secchi depth, salinity, and dissolved oxygen were consistently larger than the detection limit for those parameters (Table 4). Thus, mid-Bay data for these three parameters should not be used to characterize seasonally averaged water quality in nearby lateral areas for those transects and seasons with significant differences. Note that when "bottom" salinity and dissolved oxygen are compared at the same sampling depth (B2_SALIN and B2_DISOXY) there are few significant differences with relatively small magnitudes, but there are consistent and large differences in most transects when comparing bottom layer salinity and dissolved oxygen at different depths (B1 parameters).

The differences that were significant showed generally reduced surface water quality at the western station compared to the mid-Bay station. This was shown by higher nutrients, total suspended solids, and chlorophyll *a*, and lower Secchi depths at the western stations. This could be due either to localized effects such as bottom re-suspension or shoreline erosion, or to more distant effects such as flow from western shore tributaries. The same tendency for lower Secchi depths (and correspondingly higher light attenuation) at nearshore sites was also found in two comparisons of tributary nearshore and mid-channel data (Ellett et al. 1989, Batiuk et al. 1993). One of these studies also found significantly higher total suspended solids medians at several nearshore sites (Batiuk et al. 1992).

C. CORRELATIONS BETWEEN MID-BAY AND LATERAL STATION DATA

Correlations between mid-Bay and lateral station data were calculated to estimate how well water quality at lateral stations could be predicted from mid-Bay water quality. The cross-correlation coefficients between data from central and lateral stations for all parameters analyzed are shown in Table 5. Not surprisingly, the cross-correlation coefficients are larger for those stations which are physically closer together. For all the three-station transects examined, the eastern stations are closer to the central station than are the western stations (Figures 1-7), and this is reflected in the generally larger coefficients for the center and east than the center and west. This may be a result of differences in time as well as distance, since intervals between sampling times are greater when the stations are farther apart.

Even after considering the time/distance issue, certain parameters appear to be more readily extrapolated from the central stations to the lateral stations than others. The cross-correlations for nitrogen (total nitrogen and dissolved inorganic nitrogen) and surface dissolved oxygen and salinity (S_DISOXY and S_SALIN) are frequently larger for all transects than cross-correlations for phosphorus (total phosphorus and orthophosphate), chlorophyll *a*, total suspended solids or bottom dissolved oxygen and salinity. Bottom salinity and dissolved oxygen at the same layer (B1_SALIN and B1_DISOXY) tended to have smaller correlations than the same parameters compared near the bottom with the same depth (B2_SALIN and B2_DISOXY), although the pattern was occasionally reversed. Spring salinity correlations were usually smaller than those in the summer, but spring dissolved oxygen correlations were usually larger than those in the summer. For salinity, this may reflect higher flow levels in the spring, which would tend to make salinities less similar at different stations. The occurrence of low dissolved oxygen values in the summer, which tend to be somewhat localized, probably led to smaller dissolved oxygen correlations in the summer.

D. ATTAINMENT OF SUBMERGED AQUATIC VEGETATION (SAV) HABITAT REQUIREMENTS

The frequency of attainment of Submerged Aquatic Vegetation (SAV) habitat requirements was compared for mid-Bay and lateral stations, and the number of years and pairs of stations for which attainment was the same or different was tabulated (Table 6). This was done to show how accurately mid-Bay data could be used to predict habitat requirement attainment in lateral areas. The medians used are in Appendix 1, and the habitat requirements are in Table 4. The attainment was the same in most comparisons, with 88-100% of the pairs of stations (central-western and central-eastern pairs) with the same attainment of habitat requirements.

This frequency of identical attainment was higher than the corresponding values for tributary nearshore to mid-channel comparisons in four tributary study areas, which ranged from 66-88% of pairs and years with the same attainment (Batiuk et al. 1993). Those lower frequencies of similarity were probably due to two factors: the use of true "nearshore" stations in 1-2 m of water, as well as to station location relative to water quality gradients. The nearshore stations analyzed in the SAV study were chosen to include gradients of SAV growth, so many of the median water quality values for nearshore stations were near the habitat requirements for SAV. This made it more likely to find differences in habitat requirement attainment between nearshore and mid-channel stations. The mid-Bay and lateral stations in the mainstem were not located with respect to SAV gradients, and their water quality medians were usually both above or both below the SAV habitat requirements.

CONCLUSIONS

In summary, some aspects of the mid-Bay to lateral station comparisons are site-specific, but median water quality at the lateral station can often be characterized by the median at the mid-Bay station. In this analysis, sets of two different lateral stations were compared to the same mid-Bay station and it is evident that water quality at some lateral stations is nearly identical to water quality at the mid-Bay station, while other pairs of stations show differences in water quality. Central and western stations, which are located farther apart, showed many more differences than central and eastern stations. Also, some parameters showed more differences than others, and many of the significant differences were small. There were no significant differences for one parameter, dissolved inorganic nitrogen. The statistically significant differences in total phosphorus, orthophosphate, total nitrogen, total suspended solids, and chlorophyll *a*, although consistent over 7 years, were small enough to permit the use of mid-Bay data to characterize median water quality in lateral areas, given the uncertainty in the data. However, the significant differences in Secchi depth, bottom layer salinity, and bottom layer dissolved oxygen were consistently larger than the detection limit for those parameters and (for Secchi depth) the habitat requirement for SAV growth. Thus, in most cases mid-Bay data for these parameters should not be used to characterize median water quality in nearby lateral areas. However, salinity and dissolved oxygen medians for the surface layer, and for "bottom" comparisons at the same depth (B2_SALIN and B2_DISOXY), were quite similar at mid-Bay and lateral stations.

Clearly, factors such as distance between sites, difference in sampling depth, and proximity of a lateral station to the shore influence the relationship between mid-Bay and lateral water quality. There is evidence that additional physical variations may influence trends in some parameters, such as total phosphorus (Nagaraj and Brunenmeister 1991).

It should be noted that all the mainstem lateral stations except CB5.4W are in fairly deep water (7 to 23 m bottom sampling depth, Table 1), so it is uncertain how mid-channel data might relate to "very nearshore" data which is of particular interest in terms of living resources. For example, most SAV species growing in the Chesapeake Bay are limited to areas 2 m deep or less, with the largest populations found in water 1 m deep or less (Batiuk et al. 1993). Analyses underway using Citizen Monitoring data from the Patuxent River, which is usually measured from water samples collected from a dock or pier in 1-2 m of water, will provide more information about how well mid-channel data can reflect conditions in true nearshore areas in the tributaries.

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TABLE 1. Median bottom sampling depths for the seven transects studied, with the percentage of cruises in which the transect was sampled on the same day.

TRANSECT	LOCATION	FIELD	LAB	Median bottom sampling depth, m (min-max,B2) WEST	CENTER	EAST	% sampled on same day
CB3.3	North of Bay Bridge	MDE	CRL/CBL	8.0 (7-10,7)	22.0 (19-25)	7.0 (5-9,5)	97.8
CB4.1	Horseshoe Pt. - Kent Pt.	MDE	CRL/CBL	8.0 (7-9,7)	31.0 (25-33)	22.0 (17-24,21)	95.7
CB4.2	Plum Pt. - Sharps Isl.	MDE	CRL/CBL	8.0 (7-9,7)	26.0 (23-28)	8.0 (6-10,7)	96.7
CB4.3	Dares Beach - mouth of Little Choptank	MDE	CRL/CBL	8.0 (7-9,7)	25.0 (23-27)	21.0 (19-23,21)	95.7
CB5.1	Mouth of Patuxent	MDE	MDHMH/ CBL	8.5 (7.5-9.1,6)	16.1 (14-18)	-	95.0
CB5.4	Mouth of Wicomico (VA)	VIMS	VIMS	4.0 (3-6,3)	31.0 (24-34)	-	95.6
CB7.2	Winter Harbor - Hungars Creek	VIMS	VIMS	12.0 (9-14,9)	21.0 (16-23)	13.0 (10-14,11)	84.1

Note: Field and lab are field collection agency and analysis laboratory. The lab changed from CRL to CBL on 5/15/85, and from MDHMH to CBL on 7/1/90. B2 depth is the sampling depth used for B2_DISOXY and B2_SALIN. % sampled on same day is the % of cruises in which all stations in the transect were sampled on the same calendar day. Transects CB5.1 and CB5.4 have no eastern stations.

TABLE 2. Statistically significant median differences ($p < 0.05$) between 1985-1991 Central and Western station medians. Exact p in parentheses, 95% confidence interval is below the difference, differences are Central – Western.

	CB3.3C & CB3.3W	CB4.1C & CB4.1W	CB4.2C & CB4.2W	CB4.3C & CB4.3W	CB5.1 & CB5.1W	CB5.4 & CB5.4W	CB7.2 & CB6.3
NUTRIENTS, OTHER SAV PARAMETERS, AND SALINITY, SURFACE, APRIL–OCTOBER							
TP	**-0.0057** (.018) (-0.011,-0.003)	**-0.011** (.018) (-0.014,-0.006)	**-0.011** (.018) (-0.018,-0.008)	**-0.0073** (.018) (-0.019,-0.005)	NS	**-0.0041** (.018) (-0.009,-0.002)	NS
PO4F	NS	**-0.0019** (.026) (-0.0035,-0.0006)	**-0.0017** (.018) (-0.0024,-0.0014)	**-0.0013** (.018) (-0.0022,-0.0004)	NS	MDL	MDL
TN	NS	**-0.115** (.026) (-0.24,-0.021)	**-0.130** (.018) (-0.16,-0.068)	**-0.130** (.018) (-0.23,-0.034)	NS	MDL	**-0.035** (.026) (-0.054,-0.010)
DIN	NS	NS	NS	NS	MDL	MDL	MDL
TSS	**-1.0** (.018) (-1.6,-0.2)	**-1.6** (.018) (-3.3,-0.8)	**-1.6** (.018) (-2.6,-0.8)	**-1.2** (.018) (-1.7,-0.8)	NS	**-1.7** (.018) (-5.0,-0.8)	**-2.5** (.026) (-5.0,-0.9)
CHLA	NS	**-3.6** (.018) (-5.3,-1.9)	**-3.6** (.018) (-4.7,-2.7)	**-3.5** (.018) (-4.7,-2.3)	NS	NS	**-1.9** (.018) (-2.0,-0.7)
SECCHI	NS	**0.41** (.018) (0.30,0.58)	**0.51** (.018) (0.20,0.78)	**0.44** (.018) (0.30,0.53)	**0.21** (.026) (0.10,0.35)	**0.50** (.018) (0.40,0.70)	**0.43** (.026) (0.20,0.53)
SALIN	NS	**0.28** (.018) (0.08,0.50)	NS	NS	NS	NS	**0.93** (.026) (0.31,1.39)
SALINITY AND DISSOLVED OXYGEN, SURFACE AND BOTTOM , SPRING AND SUMMER							
SPRING (MARCH–MAY)							
S_SALIN	NS	NS	NS	NS	NS	NS	**0.82** (.026) (0.22,1.61)
B1_SALIN	**4.29** (.018) (2.58,6.07)	**5.92** (.018) (5.40,6.70)	**5.94** (.018) (4.58,8.24)	**5.92** (.018) (4.95,8.06)	**3.70** (.018) (2.54,5.04)	**5.99** (.018) (4.69,7.34)	**3.87** (.018) (2.38,4.85)
B2_SALIN	NS	**1.08** (.018) (0.43,1.70)	NS	NS	**0.40** (.042) (0.005,0.72)	NS	**1.79** (.018) (0.80,2.41)
S_DISOXY	NS	NS	**0.54** (.026) (0.20,1.16)	NS	NS	NS	NS

TABLE 2. (Continued) Statistically significant median differences ($p < 0.05$) between 1985-1991 Central and Western station medians. Exact p in parentheses, 95% confidence interval is below the difference, differences are Central – Western.

	CB3.3C & CB3.3W	CB4.1C & CB4.1W	CB4.2C & CB4.2W	CB4.3C & CB4.3W	CB5.1 & CB5.1W	CB5.4 & CB5.4W	CB7.2 & CB6.3
SALINITY AND DISSOLVED OXYGEN, SURFACE AND BOTTOM , SPRING AND SUMMER (CONTINUED)							
SPRING (MARCH–MAY)							
B1_DISOXY	**-2.59** (.026) (-4.01,-0.96)	**-2.80** (.018) (-4.04,-1.63)	**-2.85** (.026) (-4.20,-0.79)	**-2.86** (.018) (-4.10,-1.38)	**-2.63** (.018) (-4.73,-0.75)	**-2.63** (.018) (-4 42,-1.30)	NS
B2_DISOXY	NS	NS	**1.00** (.026) (0.40,2.74)	**1.07** (.018) (0.59,1.50)	NS	NS	NS
SUMMER (JUNE–SEPTEMBER)							
S_SALIN	NS	**0.36** (.026) (0.14,0.71)	NS	NS	NS	**-0.16** (.026) (-0.38,-0.06)	**0.77** (.018) (0.38,1.11)
B1_SALIN	**3.73** (.018) (3.37,4.28)	**5.56** (.018) (4.99,6.14)	**6.26** (.018) (5.63,7.01)	**5.97** (.018) (5.36,7.02)	**4.44** (.018) (3.84,5.71)	**6.02** (.018) (4.81,7.16)	**1.85** (.018) (1.07,3.01)
B2_SALIN	NS	NS	NS	NS	NS	NS	**0.96** (.018) (0.38,1.51)
S_DISOXY	NS	NS	NS	NS	NS	NS	NS
B1_DISOXY	**-2.62** (.018) (-3.96,-1.62)	**-3.38** (.018) (-4.25,-2.30)	**-4.00** (.018) (-5.20,-2.67)	**-3.38** (.018) (-4.77,-1.72)	**-4.70** (.018) (-5.00,-4.33)	**-3.82** (.018) (-5.10,-2.56)	**0.57** (.018) (0.37,0.87)
B2_DISOXY	NS	NS	NS	NS	NS	**0.43** (.018) (0.14,0.97)	**0.86** (.018) (0.57,1.31)

NS Not statistically Significant, two tailed alpha > 0.05, Wilcoxon matched-pairs test on annual seasonal medians.
MDL Too many observations below Method Detection Limit to make a comparison
S_ Surface layer at both stations, same sample depth
B1_ Bottom layer at both stations, central station has deeper sample depth
B2_ Same sample depth at both stations, near bottom at lateral station , above bottom at central (see Table 1 for depths)
n Sample size per station ranged from 4 to 7 for all parameters, using annual seasonal medians for 1985-1991.
Parameters: TP (Total Phosphorus), PO4F (Dissolved Orthophosphate), TN (Total Nitrogen), DIN (Dissolved Inorganic Nitrogen), TSS (Total Suspended Solids), CHLA (Chlorophyll *a*), SECCHI (Secchi depth), SALIN (Salinity), and DISOXY (Dissolved Oxygen). Units are mg/l except: CHLA is ug/l, SECCHI is m., SALIN is ppt.

TABLE 3. Statistically significant median differences ($p < 0.05$) between 1985-1991 Central and Eastern station medians. Exact p in parentheses, 95% confidence interval is below the difference, differences are Central – Eastern.

	CB3.3C & CB3.3E	CB4.1C & CB4.1E	CB4.2C & CB4.2E	CB4.3C & CB4.3E	CB7.2 & CB7.2E
NUTRIENTS, OTHER SAV PARAMETERS, AND SALINITY, SURFACE, APRIL–OCTOBER					
TP	NS	NS	NS	NS	NS
PO4F	NS	NS	NS	NS	MDL
TN	NS	NS	NS	NS	NS
DIN	NS	NS	NS	NS	MDL
TSS	NS	NS	NS	NS	NS
CHLA	**2.5** (.042) (0.2,4.9)	NS	NS	NS	NS
SECCHI	NS	NS	NS	NS	NS
SALIN	NS	**–0.26** (.042) (-0.89,-0.02)	NS	NS	**–1.46** (.018) (-2.36,-0.97)
SALINITY AND DISSOLVED OXYGEN, SURFACE AND BOTTOM , SPRING AND SUMMER					
SPRING (MARCH–MAY)					
S_SALIN	NS	**–0.63** (.018) (-1.11,-0.15)	NS	**–0.47** (.018) (-0.93,-0.19)	**–1.64** (.018) (-2.85,-0.45)
B1_SALIN	**4.64** (.018) (3.26,6.62)	**1.34** (.018) (0.88,1.50)	**5.87** (.018) (4.84,6.88)	**0.85** (.018) (0.53,1.13)	**3.00** (.018) (1.95,4.34)
B2_SALIN	NS	**0.91** (.026) (0.25,1.06)	**–0.58** (.042) (-1.63,-0.04)	**0.79** (.018) (0.42,1.15)	**1.09** (.018) (0.51,1.98)
S_DISOXY	NS	NS	NS	NS	**0.54** (.042) (0.03,1.17)
B1_DISOXY	**–3.41** (.018) (-4.29,-1.92)	NS	**–3.19** (.018) (-4.21,-2.35)	NS	**–0.88** (.026) (-1.35,-0.11)
B2_DISOXY	NS	NS	NS	NS	NS

TABLE 3. (Continued). Statistically significant median differences ($p < 0.05$) between 1985-1991 Central and Eastern station medians. Exact p in parentheses, 95% confidence interval is below the difference, differences are Central – Eastern.

	CB3.3C & CB3.3E	CB4.1C & CB4.1E	CB4.2C & CB4.2E	CB4.3C & CB4.3E	CB7.2 & CB7.2E
SUMMER (JUNE–SEPTEMBER)					
S_SALIN	NS	**-0.22** (.035) (-1.58,-0.03)	NS	NS	**-1.17** (.018) (-1.74,-0.62)
B1_SALIN	**5.00** (.018) (4.23,6.14)	**2.00** (.018) (1.70,2.31)	**4.95** (.018) (4.41,5.77)	**0.71** (.018) (0.62,1.09)	**1.73** (.018) (1.08,2.39)
B2_SALIN	NS	**1.39** (.018) (0.81,1.77)	NS	**0.85** (.026) (0.20,1.29)	**0.84** (.018) (0.65,1.62)
S_DISOXY	NS	NS	NS	NS	**0.43** (.026) (0.07,0.72)
B1_DISOXY	**-3.62** (.018) (-4.86,-2.74)	**-0.048** (.026) (-0.15,-0.005)	**-3.91** (.018) (-5.6,-2.3)	NS	**-0.50** (.018) (-0.81,-0.16)
B2_DISOXY	NS	NS	NS	NS	**-0.24** (.026) (-0.49,-0.09)

NS Not statistically Significant, two tailed alpha > 0.05, Wilcoxon matched-pairs test on annual seasonal medians.
MDL Too many observations below Method Detection Limit to make a comparison
S_ Surface layer at both stations, same sample depth
B1_ Bottom layer at both stations, central station has deeper sample depth
B2_ Same sample depth at both stations, near bottom at lateral station , above bottom at central (see Table 1 for depths)
n Sample size per station ranged from 4 to 7 for all parameters, using annual seasonal medians for 1985-1991.
Parameters: TP (Total Phosphorus), PO4F (Dissolved Orthophosphate), TN (Total Nitrogen), DIN (Dissolved Inorganic Nitrogen), TSS (Total Suspended Solids), CHLA (Chlorophyll *a*), SECCHI (Secchi depth), SALIN (Salinity), and DISOXY (Dissolved Oxygen). Units are mg/l except: CHLA is ug/l, SECCHI is m., SALIN is ppt.

TABLE 4. Comparison of the magnitudes of statistically significant median differences, uncertainty estimates (MDLs), and SAV habitat requirements.

Parameter	Units	Range of significant median differences	Range of MDLs used	SAV Habitat Requirements
TP	mg/l	0.004 - 0.011	0.002 - 0.022	none
PO4F	mg/l	0.0013 - 0.0019	0.0005 - 0.013	0.01 (mesohaline) 0.02 (polyhaline)
TN	mg/l	0.035 - 0.13	0.03 - 0.20	none
DIN	mg/l	none significant	0.003 - 0.080	0.15
TSS	mg/l	1.0 - 2.5	1 - 5	15
CHLA	ug/l	1.9 - 3.6	0.2 - 3.2	15
Secchi	m	0.2 - 0.5	0.1	0.97
Salinity	ppt	0.2 - 6.3	0.1 - 0.7	none
Dissolved Oxygen	mg/l	0.05 - 4.7	0.1 - 0.2	none

Notes: MDL = Method Detection Limit, which estimates analytical uncertainty because it is usually computed as three times the standard deviation of seven low-level replicate samples. SAV = Submerged Aquatic Vegetation; seasonal medians should be below these levels (or above for Secchi) to promote SAV growth. All transects studied are in the mesohaline region of the Bay (5-18 ppt salinity) except transect CB7.2, which is polyhaline (> 18 ppt).

TABLE 5. Pearson crosscorrelation coefficients for Chesapeake Bay mainstem data, center and lateral Stations, using raw concentration data from 1985-1991 for the seasons shown.

	CB3.3C & CB3.3W	CB3.3C & CB3.3E	CB4.1C & CB4.1W	CB4.1C & CB4.1E	CB4.2C & CB4.2W	CB4.2C & CB4.2E
NUTRIENTS, OTHER SAV PARAMETERS, AND SALINITY, SURFACE, APRIL-OCTOBER						
TP	.52 (101)	.68 (102)	.25 (101)	.49 (98)	.52 (101)	.69 (99)
PO4F	.56 (100)	.71 (97)	.35 (96)	.53 (98)	.46 (96)	.74 (94)
TN	.77 (101)	.86 (101)	.30 (101)	.89 (101)	.67 (99)	.93 (98)
DIN	.97 (102)	.99 (102)	.94 (102)	.98 (100)	.95 (100)	.99 (98)
TSS	.67 (97)	.61 (97)	.25 (97)	.59 (93)	.34 (93)	.70 (90)
CHLA	.19 (99)	.76 (98)	.14 (96)	.70 (94)	.50 (97)	.79 (96)
SECCHI	.56 (99)	.71 (102)	.56 (99)	.78 (101)	.64 (100)	.81 (101)
SALIN	.97 (103)	.99 (103)	.94 (103)	.96 (102)	.96 (103)	.99 (102)
SALINITY AND DISSOLVED OXYGEN, SURFACE AND BOTTOM, SPRING AND SUMMER						
SPRING (MARCH-MAY)						
S_SALIN	.93 (39)	.99 (39)	.78 (39)	.95 (38)	.87 (39)	.99 (38)
B1_SALIN	.30 (39)	.24 (39)	.49 (39)	.90 (38)	.61 (39)	.32 (38)
B2_SALIN	.78 (36)	.88 (32)	.81 (35)	.87 (35)	.70 (34)	.93 (32)
S_DISOXY	.80 (38)	.87 (38)	.94 (38)	.91 (37)	.86 (38)	.96 (37)
B1_DISOXY	.80 (38)	.80 (38)	.72 (38)	.99 (37)	.73 (38)	.70 (37)
B2_DISOXY	.87 (35)	.82 (31)	.65 (34)	.99 (34)	.71 (33)	.91 (31)
SUMMER (JUNE-SEPTEMBER)						
S_SALIN	.97 (61)	.99 (61)	.98 (61)	.95 (61)	.99 (61)	.99 (61)
B1_SALIN	.69 (55)	.69 (54)	.65 (55)	.93 (55)	.59 (55)	.78 (55)
B2_SALIN	.88 (52)	.97 (50)	.85 (51)	.92 (42)	.83 (51)	.94 (51)
S_DISOXY	.74 (61)	.84 (61)	.66 (61)	.68 (61)	.61 (61)	.90 (61)
B1_DISOXY	.17 (55)	.27 (54)	-.05 (55)	.46 (55)	.24 (55)	-.06 (55)
B2_DISOXY	.59 (52)	.80 (50)	.43 (51)	.69 (42)	.26 (51)	.78 (51)

S_ surface, B1_ bottom same layer (both bottom layer), B2_ bottom same depth (see Table 1 for depths).
TP (Total Phosphorus), TN (Total Nitrogen), PO4F (Dissolved Orthophosphate), DIN (Dissolved Inorganic Nitrogen), TSS (Total Suspended Solids), CHLA (Chlorophyll a), SECCHI (Secchi depth), SALIN (Salinity), and DISOXY (Dissolved Oxygen).
Pearson correlation coefficient (sample size in parentheses); probability estimates are not given since they were inaccurate due to serial correlation of the data. Data were excluded when both samples were below detection (see text).

TABLE 5. (Continued). Pearson crosscorrelation coefficients for Chesapeake Bay mainstem data, center and lateral Stations, using raw concentration data from 1985-1991 for the seasons shown.

	4.3C & 4.3W	4.3C & 4.3E	5.1C & 5.1W	5.4C & 5.4W	7.2C & 6.3W	7.2C & 7.2E
NUTRIENTS, OTHER SAV PARAMETERS, AND SALINITY, SURFACE, APRIL-OCTOBER						
TP	.51 (99)	.62 (100)	.31 (91)	.65 (97)	.73 (99)	.74 (95)
PO4F	.63 (93)	.25 (95)	.49 (71)	.61 (53)	.65 (47)	.72 (45)
TN	.63 (99)	.88 (101)	.75 (68)	.18 (98)	.67 (101)	.58 (100)
DIN	.97 (101)	.98 (102)	.97 (92)	.76 (83)	84 (68)	.80 (69)
TSS	.53 (91)	.34 (86)	.08 (90)	.53 (94)	.32 (99)	.53 (98)
CHLA	.17 (97)	.86 (96)	.86 (87)	.74 (99)	.86 (96)	.89 (98)
SECCHI	.72 (102)	.64 (101)	.73 (92)	.44 (95)	.69 (97)	.81 (98)
SALIN	.98 (103)	.99 (103)	.98 (93)	.92 (96)	.88 (97)	.90 (97)
SALINITY AND DISSOLVED OXYGEN, SURFACE AND BOTTOM, SPRING AND SUMMER						
SPRING (MARCH-MAY)						
S_SALIN	.94 (39)	.96 (39)	.95 (40)	.86 (36)	.80 (37)	.80 (37)
B1_SALIN	.52 (39)	.88 (38)	.19 (38)	-.11 (36)	.71 (36)	.72 (36)
B2_SALIN	.87 (35)	.83 (33)	.85 (40)	.80 (36)	.72 (36)	.72 (36)
S_DISOXY	.93 (38)	.97 (38)	.89 (40)	.84 (35)	.95 (36)	.92 (37)
B1_DISOXY	.69 (38)	.99 (37)	.86 (38)	.78 (35)	.94 (34)	.95 (36)
B2_DISOXY	.56 (35)	.99 (32)	.80 (40)	.83 (34)	.96 (36)	.97 (36)
SUMMER (JUNE-SEPTEMBER)						
S_SALIN	.99 (61)	.99 (61)	.98 (53)	.92 (57)	.90 (56)	.90 (55)
B1_SALIN	.59 (55)	.94 (55)	.64 (49)	.47 (59)	.87 (53)	.96 (53)
B2_SALIN	.89 (51)	.93 (39)	.92 (53)	.92 (53)	.72 (52)	.86 (51)
S_DISOXY	.60 (61)	.88 (61)	.79 (53)	.55 (55)	.72 (56)	.80 (54)
B1_DISOXY	00 (55)	.55 (55)	.33 (48)	.38 (57)	.82 (55)	.67 (55)
B2_DISOXY	.50 (51)	.53 (39)	.06 (53)	.48 (51)	.76 (53)	.77 (52)

S_ surface, B1_ bottom same layer (both bottom layer), B2_ bottom same depth (see Table 1 for depths).
TP (Total Phosphorus), TN (Total Nitrogen), PO4F (Dissolved Orthophosphate), DIN (Dissolved Inorganic Nitrogen), TSS (Total Suspended Solids), CHLA (Chlorophyll_a), SECCHI (Secchi depth), SALIN (Salinity), and DISOXY (Dissolved Oxygen).
Pearson correlation coefficient (sample size in parentheses); probability estimates are not given since they were inaccurate due to serial correlation of the data. Data were excluded when both samples were below detection (see text).

TABLE 6. Correspondence of attainment rates for SAV habitat requirements for pairs of central and lateral stations, using annual growing season medians from all seven transects, 1985-1991.

Parameter	Stations	Attainment of SAV habitat requirement			Total
		Lateral only	Same	Central only	
DIP (PO4F)	Center-West	0	49 (100%)	0	49
	Center-East	0	35 (100%)	0	35
DIN	Center-West	1 (2%)	44 (90%)	4 (8%)	49
	Center-East	2 (6%)	31 (88%)	2 (6%)	35
TSS	Center-West	0	47 (96%)	2 (4%)	49
	Center-East	0	35 (100%)	0	35
CHLA	Center-West	1 (2%)	45 (92%)	3 (6%)	49
	Center-East	1 (3%)	33 (94%)	1 (3%)	35
Secchi	Center-West	0	47 (96%)	2 (4%)	49
	Center-East	0	35 (100%)	0	35

Notes: Number of years and stations, and percentage of total, are shown. "Same" means the requirement was either met or not met at both stations. Medians used are in Appendix 1, habitat requirements are in Table 4.

Figure 1. Locator map showing the seven transects studied.

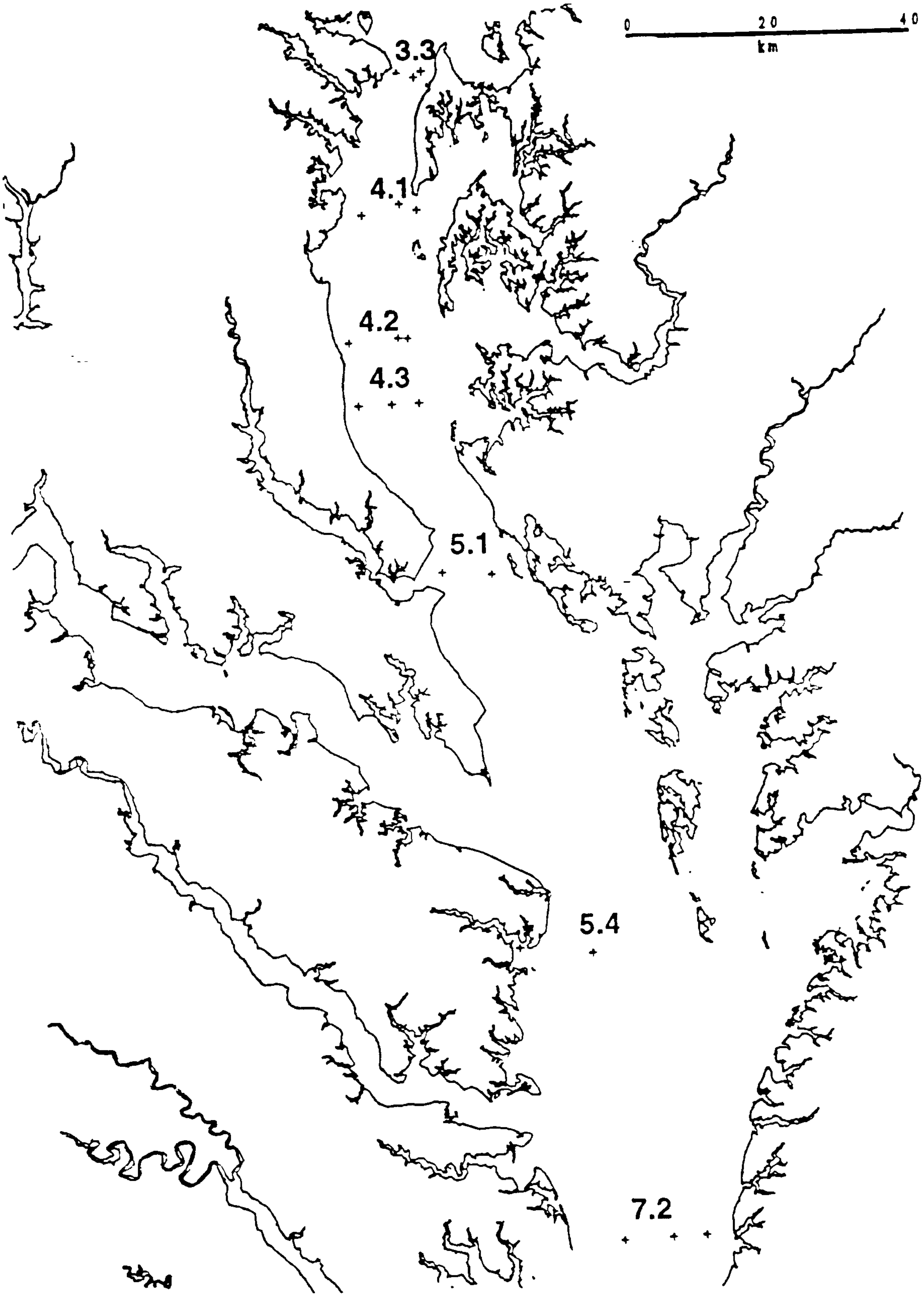


Figure 2. Detail map of transect CB3.3. Hatched areas are 1990 SAV coverage.

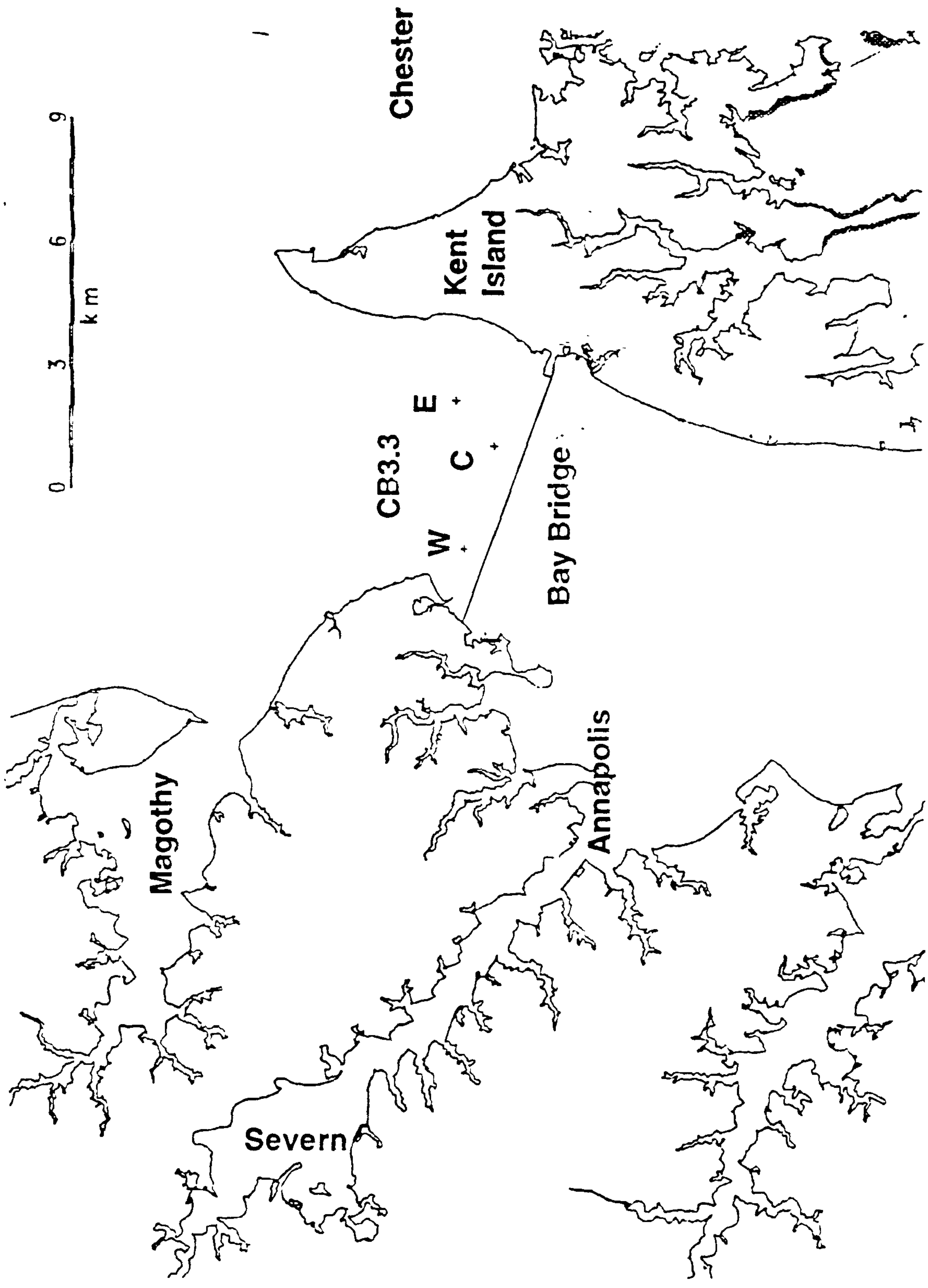


Figure 3. Detail map of transect CB4.1. Hatched areas are 1990 SAV coverage.

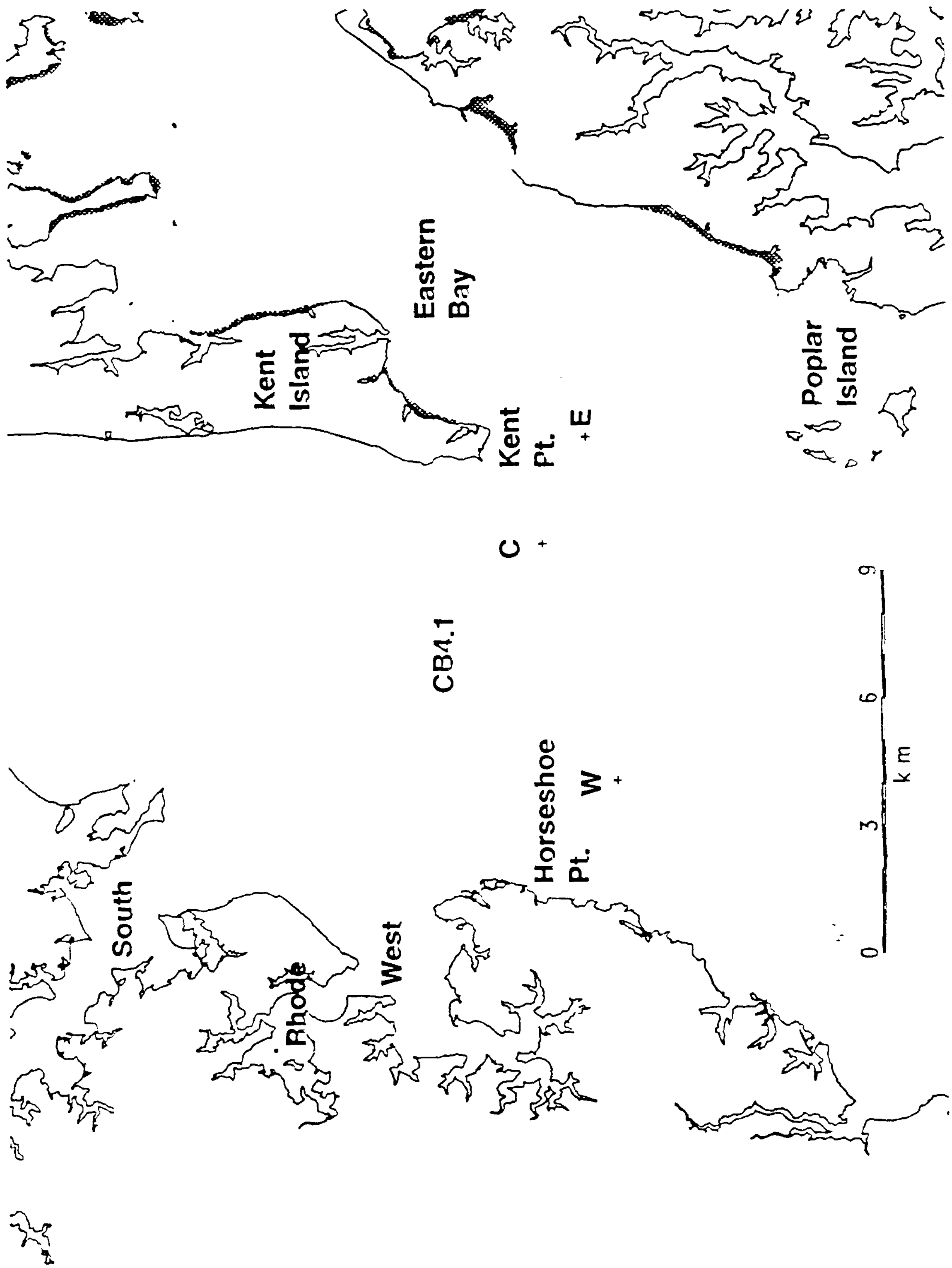


Figure 4. Detail map of transects CB4.2 and 4.3. Hatched areas are 1990 SAV coverage.

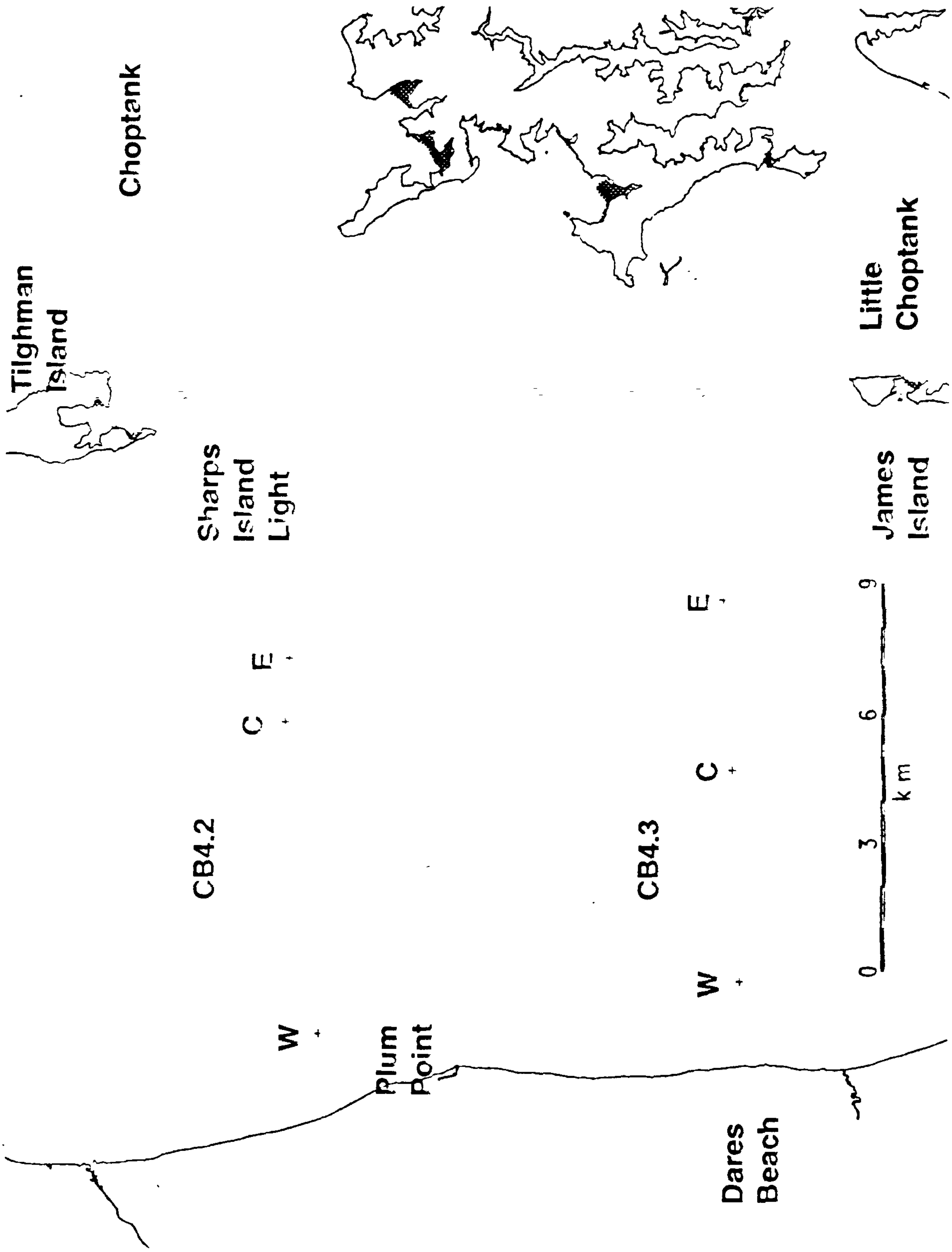


Figure 5. Detail map of transect CB5.1. Hatched areas are 1990 SAV coverage.

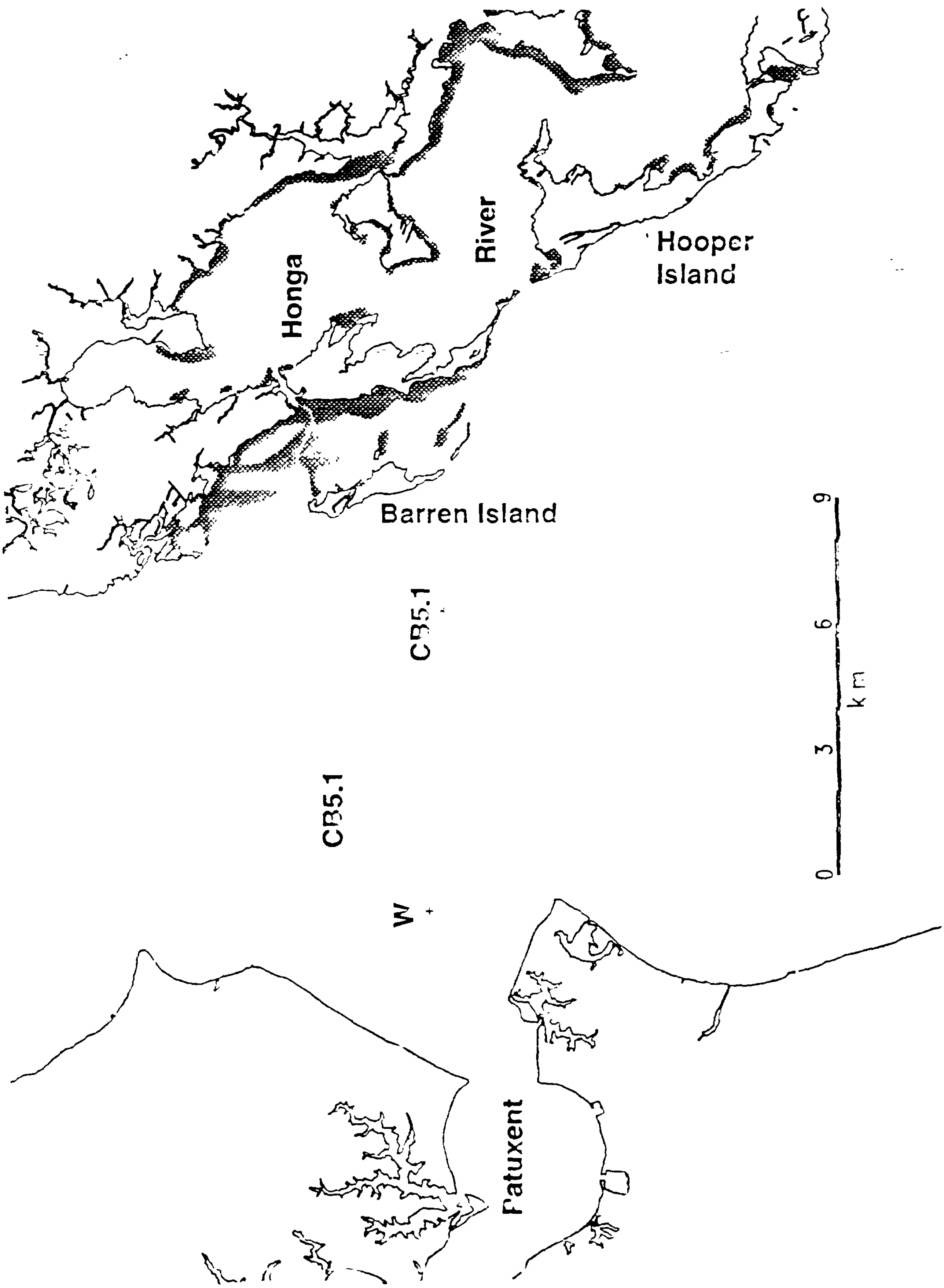
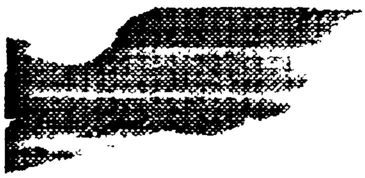


Figure 6. Detail map of transect CB5.4. Hatched areas are 1990 SAV coverage.



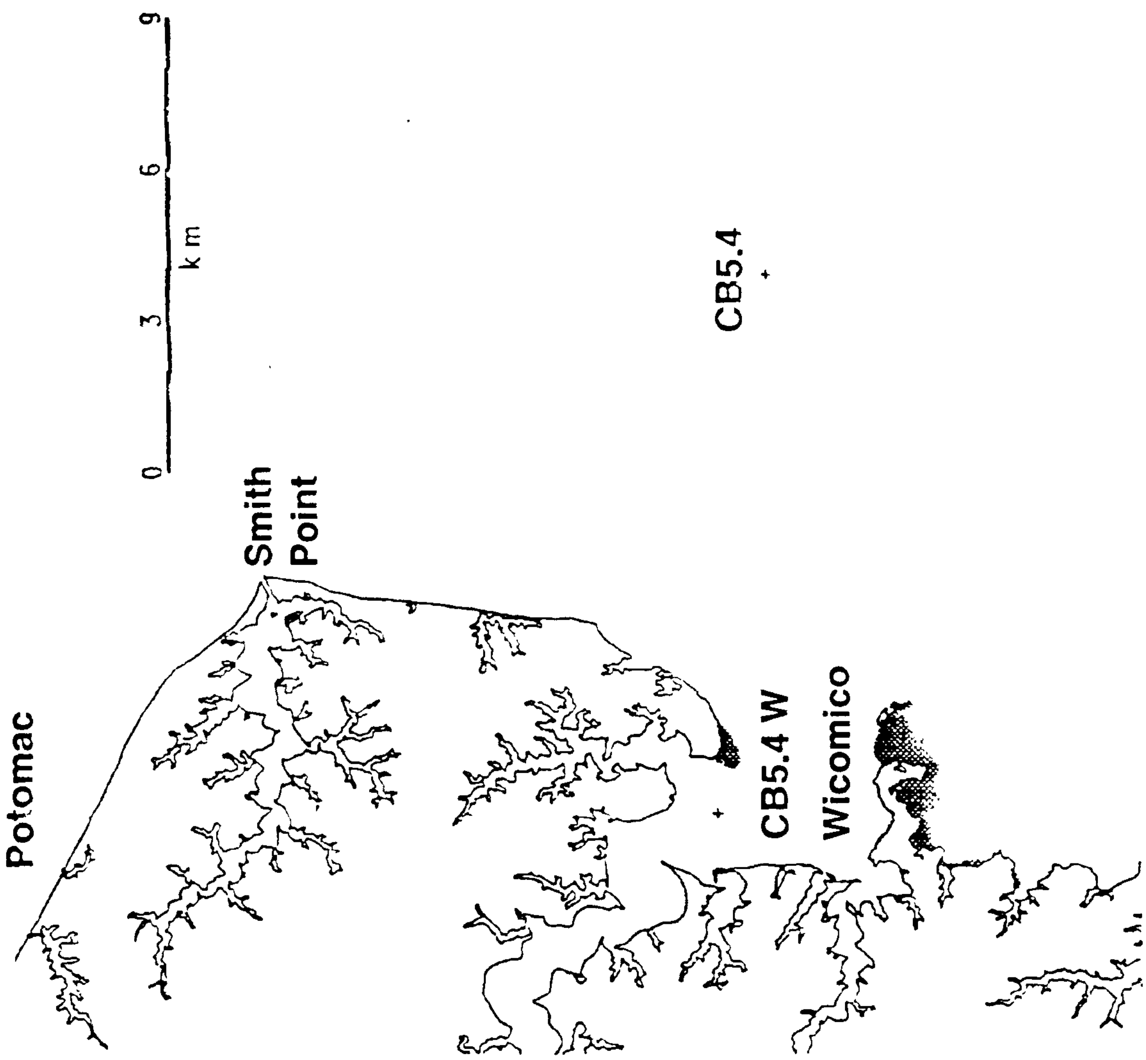
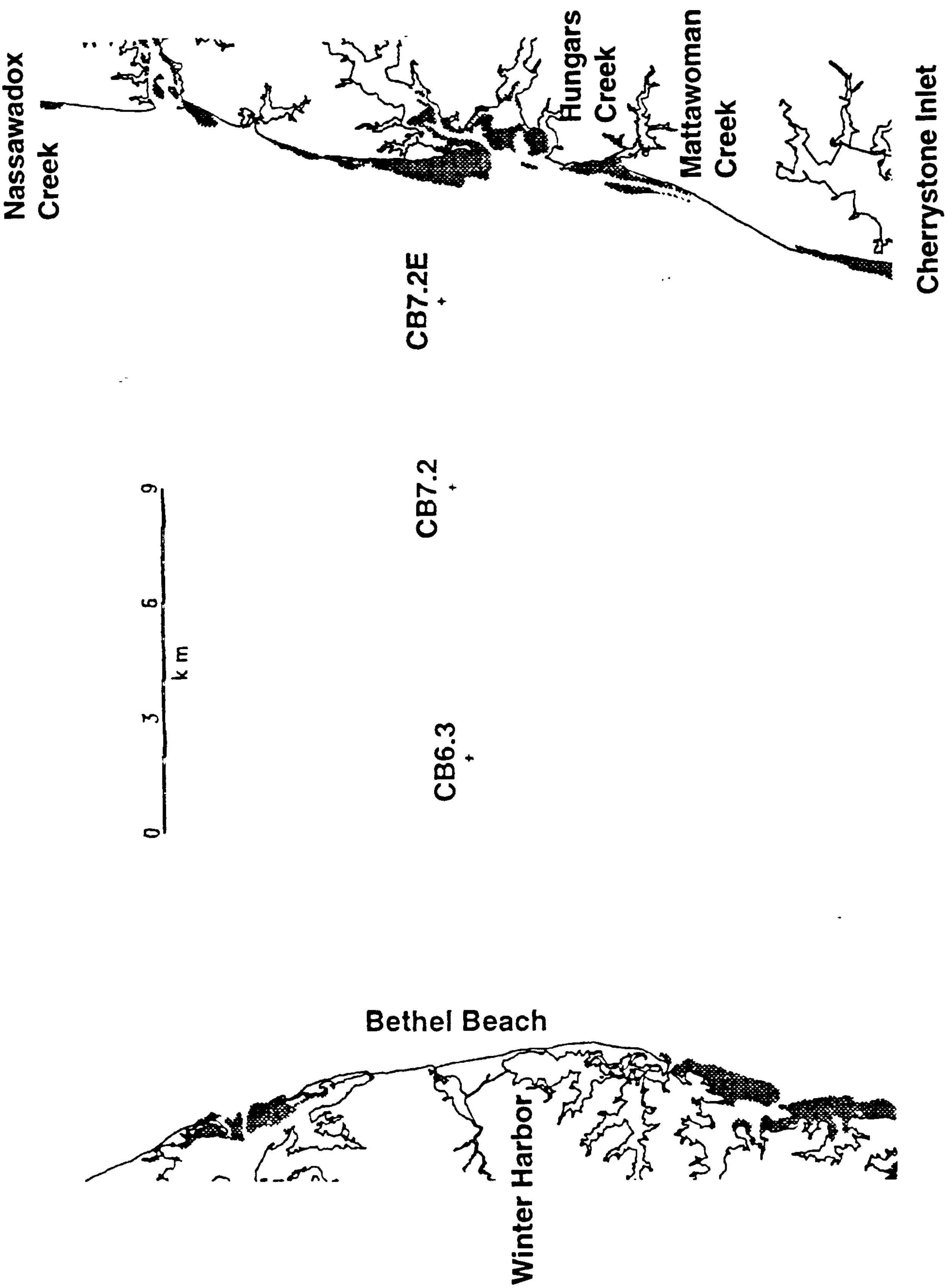


Figure 7. Detail map of transect CB7.2. Hatched areas are 1990 SAV coverage.



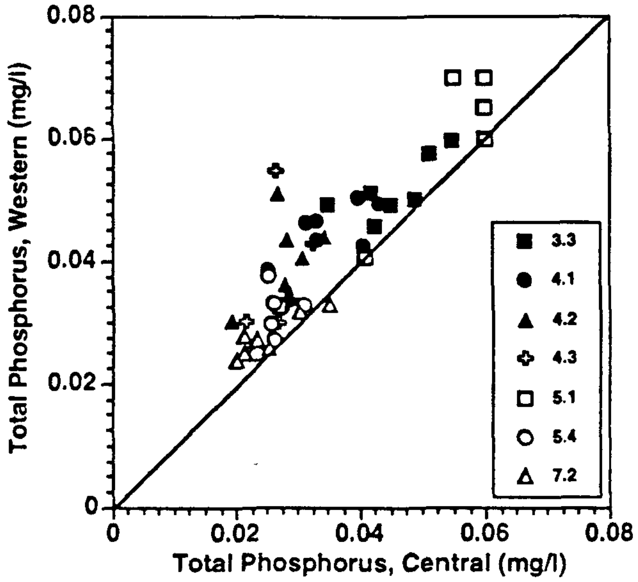


Figure 8. Scatter plot of annual seasonal medians of Total Phosphorus, 1985-1991, for western and central stations.

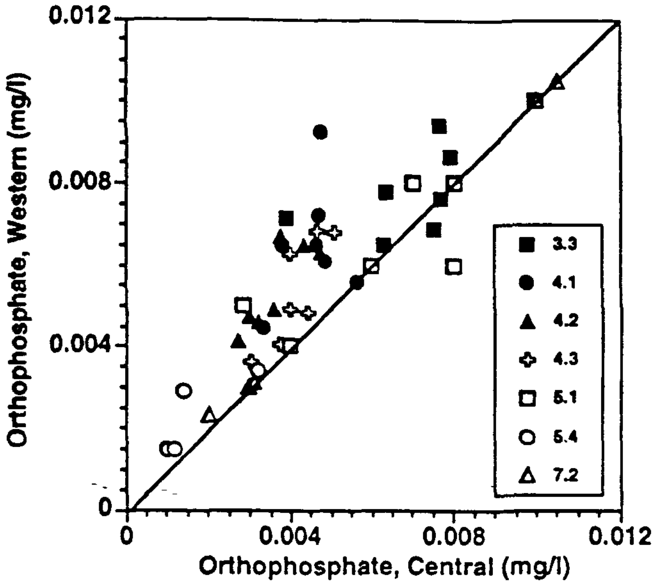


Figure 10. Scatter plot of annual seasonal medians of Orthophosphate, 1985-1991, for western and central stations.

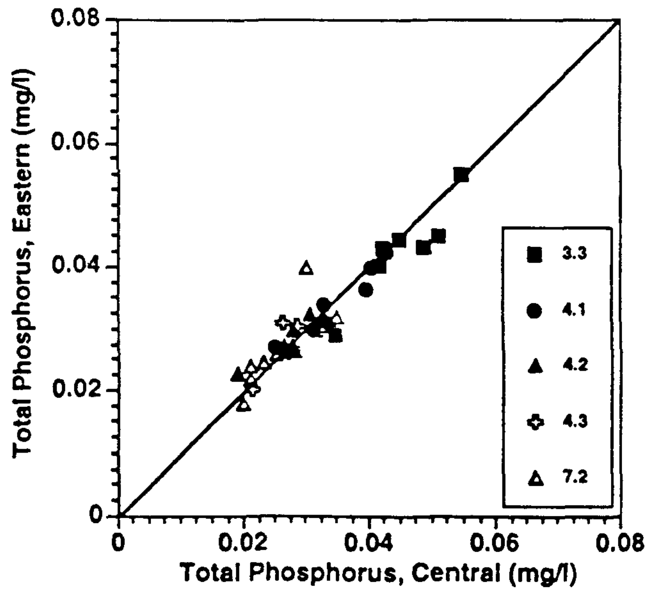


Figure 9. Scatter plot of annual seasonal medians of Total Phosphorus, 1985-1991, for eastern and central stations.

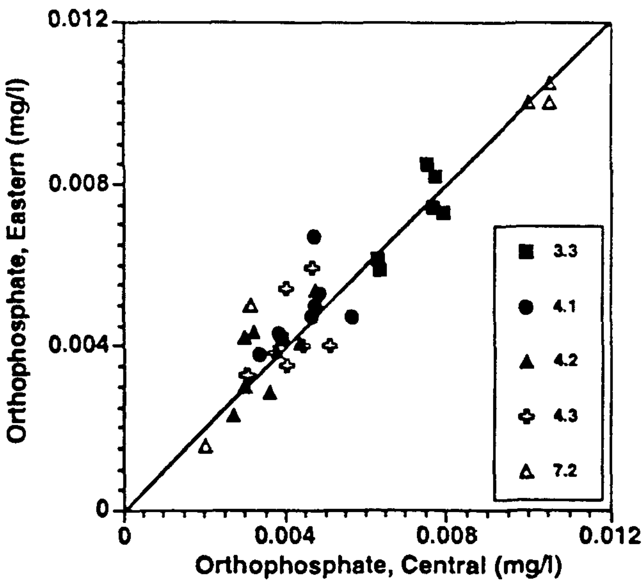


Figure 11. Scatter plot of annual seasonal medians of Orthophosphate, 1985-1991, for eastern and central stations.

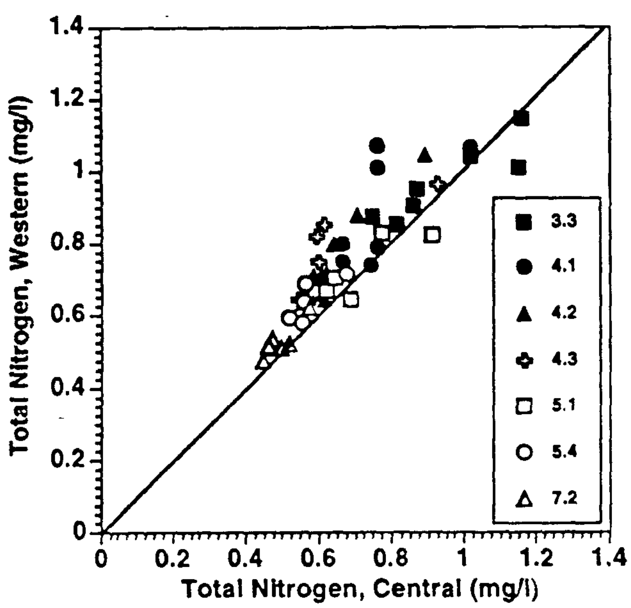


Figure 12. Scatter plot of annual seasonal medians of Total Nitrogen, 1985-1991, for western and central stations.

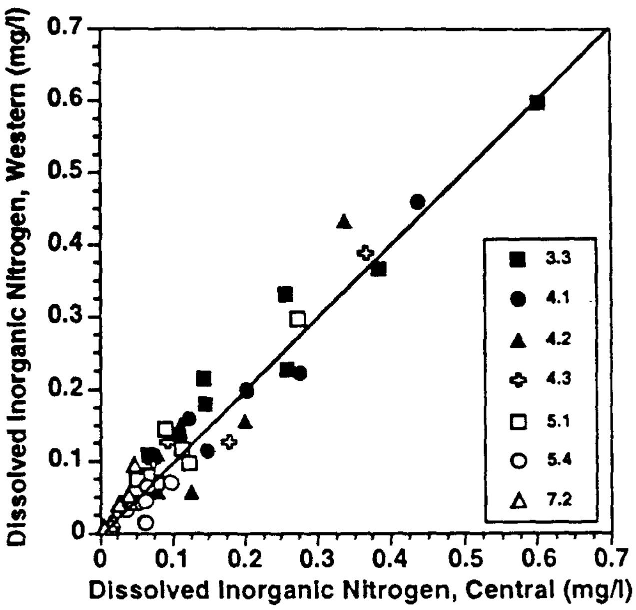


Figure 14. Scatter plot of annual seasonal medians of Dissolved Inorganic Nitrogen, 1985-1991, for western and central stations.

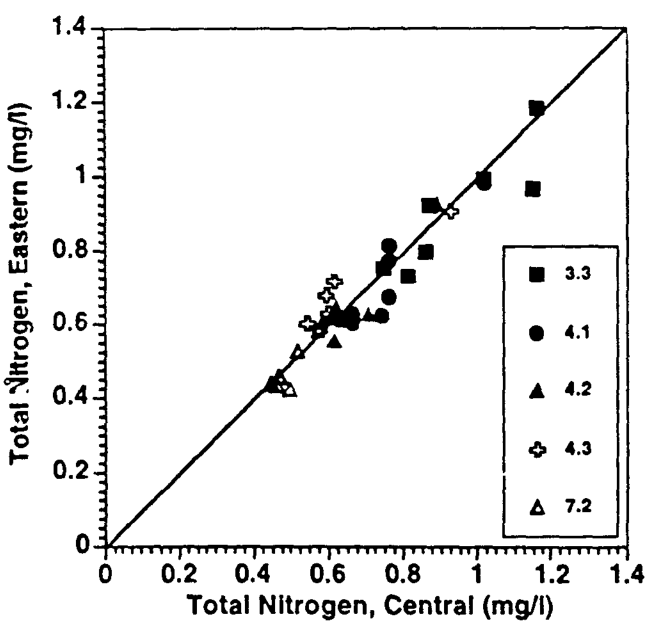


Figure 13. Scatter plot of annual seasonal medians of Total Nitrogen, 1985-1991, for eastern and central stations.

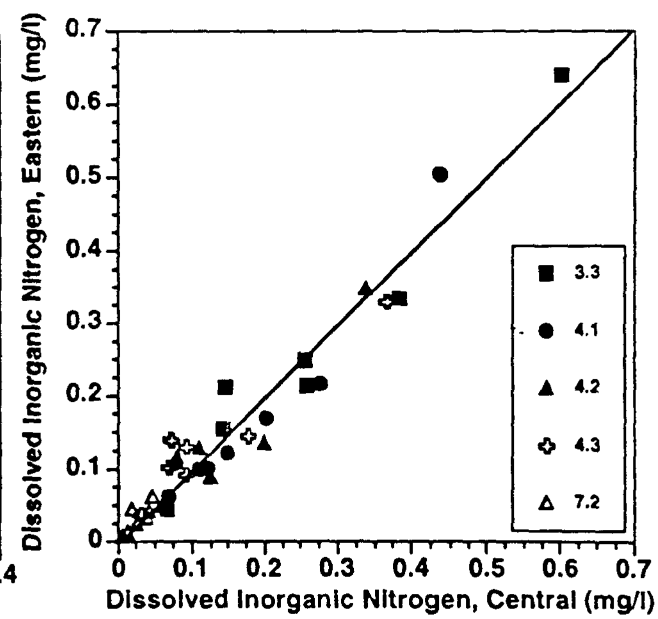


Figure 15. Scatter plot of annual seasonal medians of Dissolved Inorganic Nitrogen, 1985 1991, for eastern and central stations.

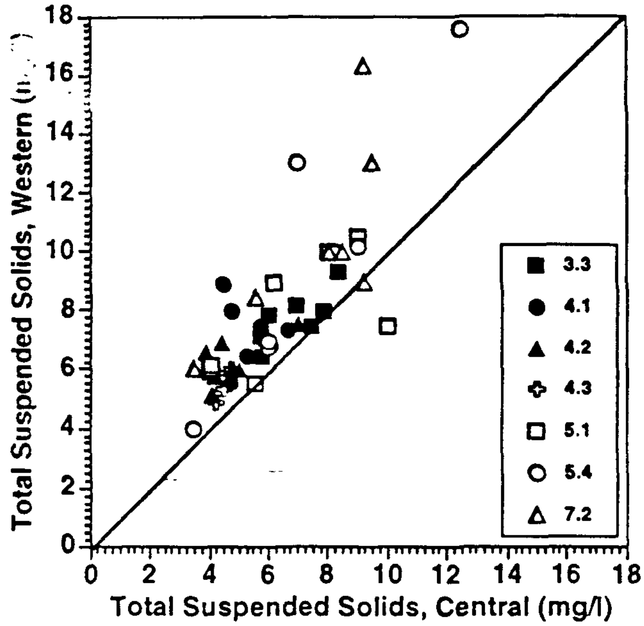


Figure 16. Scatter plot of annual seasonal medians of Total Suspended Solids, 1985-1991, for western and central stations.

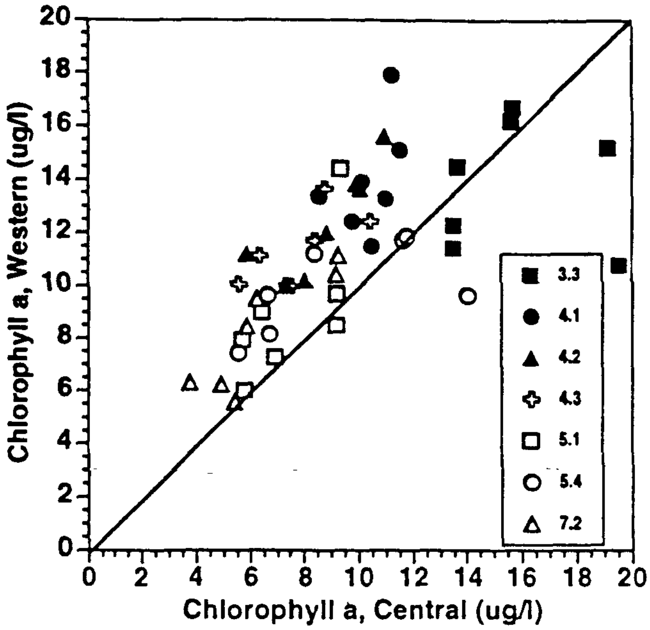


Figure 18. Scatter plot of annual seasonal medians of Chlorophyll *a*, 1985-1991, for western and central stations.

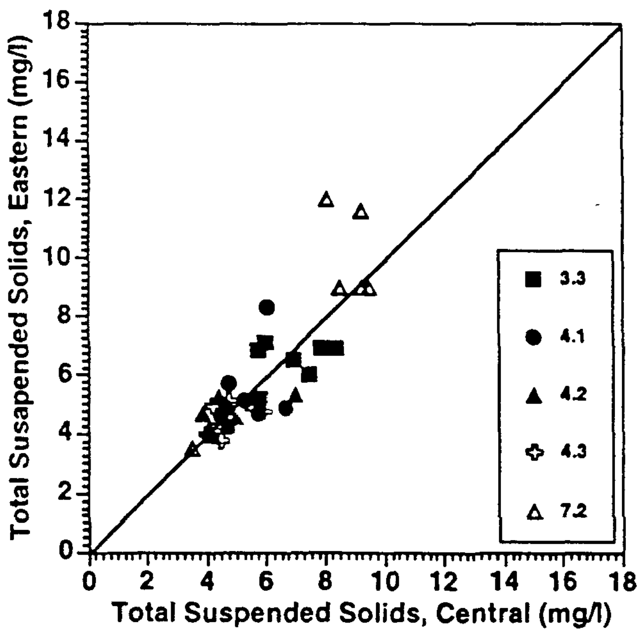


Figure 17. Scatter plot of annual seasonal medians of Total Suspended Solids, 1985-1991, for eastern and central stations.

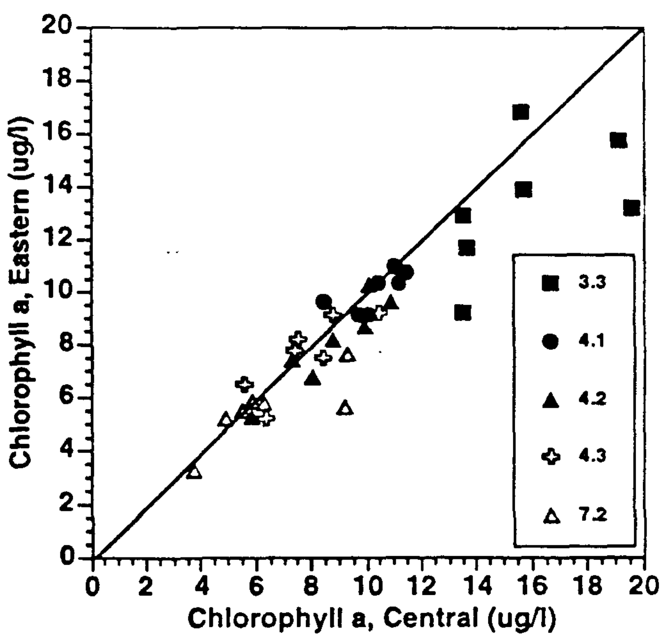


Figure 19. Scatter plot of annual seasonal medians of Chlorophyll *a*, 1985-1991, for eastern and central stations.

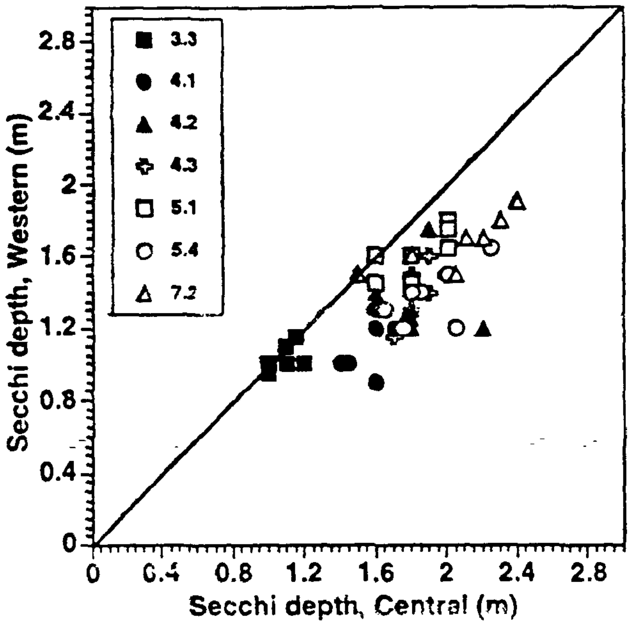


Figure 20. Scatter plot of annual seasonal medians of Secchi depth, 1985-1991, for western and central stations.

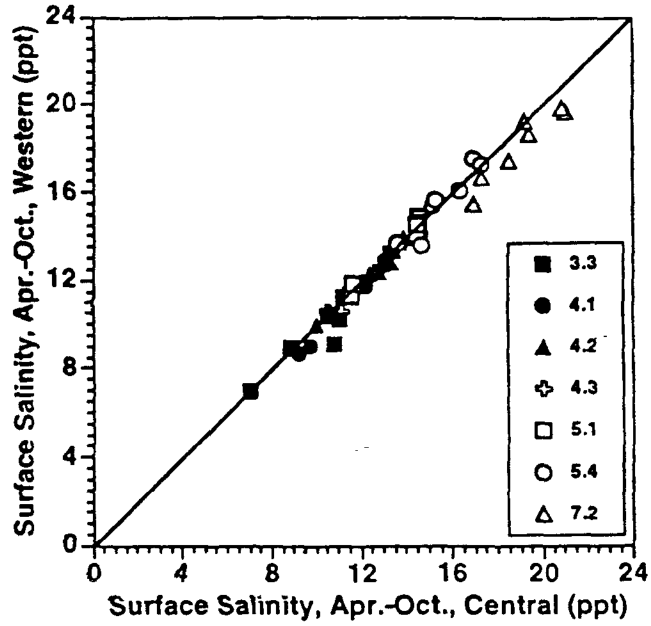


Figure 22. Scatter plot of annual seasonal medians of Surface Salinity, 1985-1991, for western and central stations.

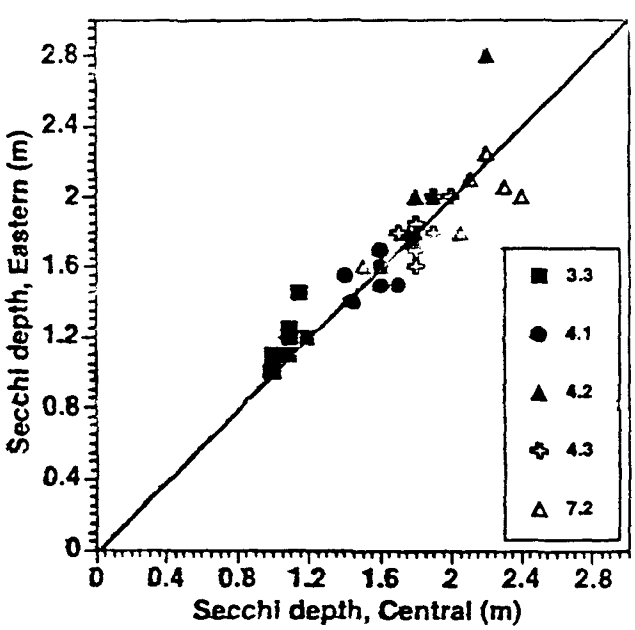


Figure 21. Scatter plot of annual seasonal medians of Secchi depth, 1985-1991, for eastern and central stations.

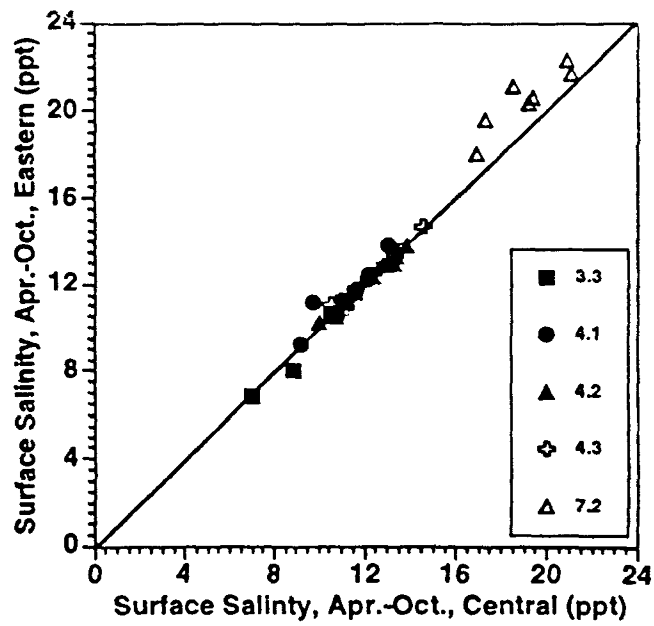


Figure 23. Scatter plot of annual seasonal medians of Surface Salinity, 1985-1991, for eastern and central stations.

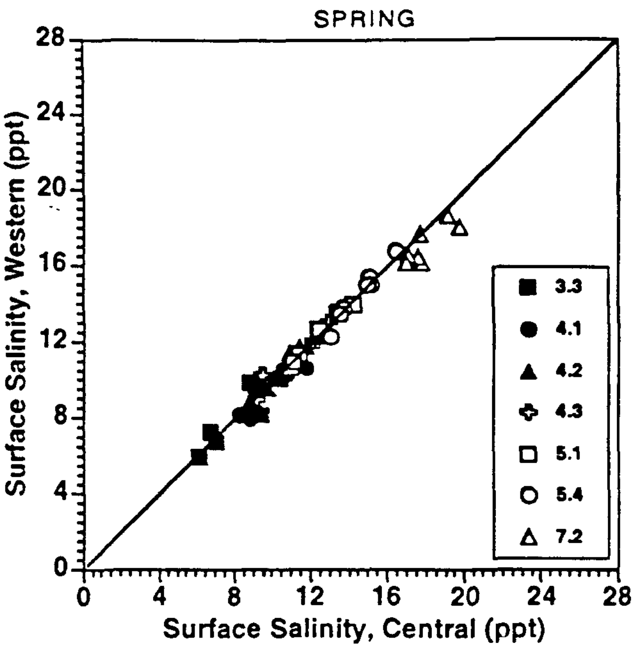


Figure 24. Scatter plot of annual seasonal medians of spring Surface Salinity, 1985-1991, for western and central stations.

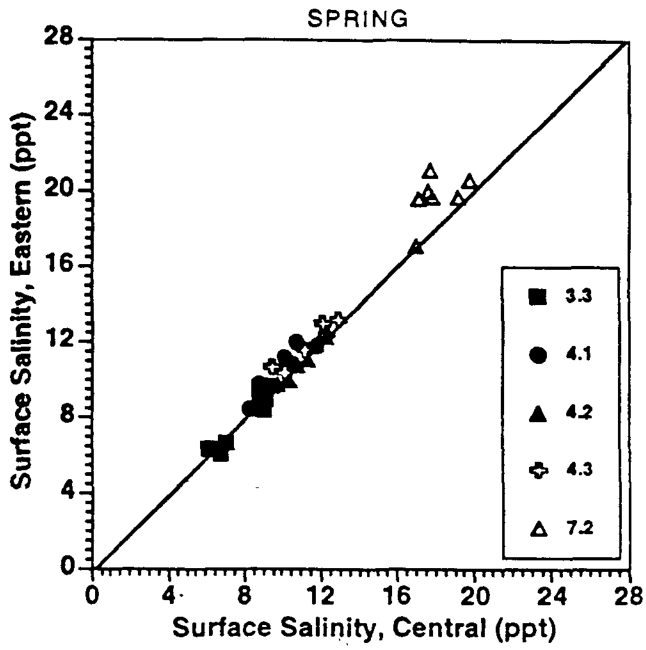


Figure 26. Scatter plot of annual seasonal medians of spring Surface Salinity, 1985-1991, for eastern and central stations.

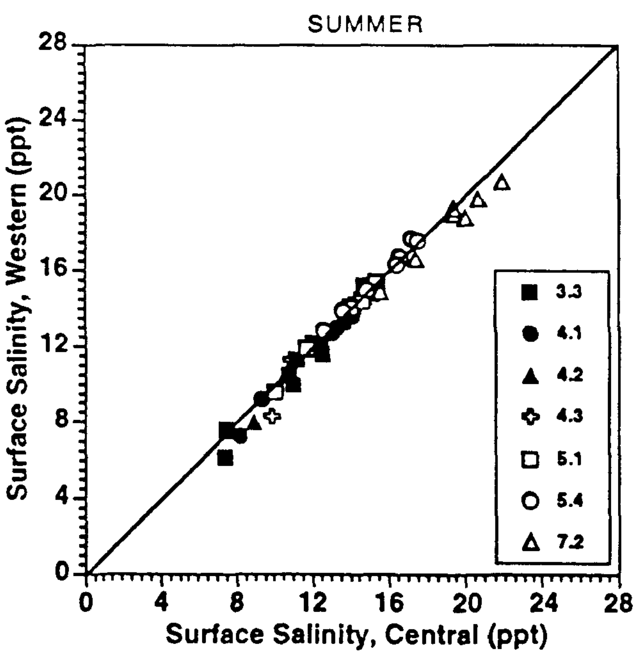


Figure 25. Scatter plot of annual seasonal medians of summer Surface Salinity, 1985-1991, for western and central stations.

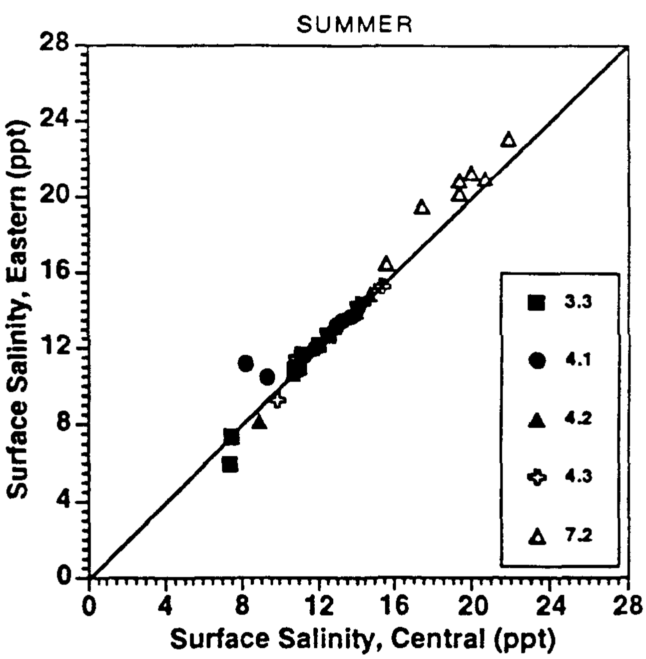


Figure 27. Scatter plot of annual seasonal medians of summer Surface Salinity, 1985-1991, for eastern and central stations.

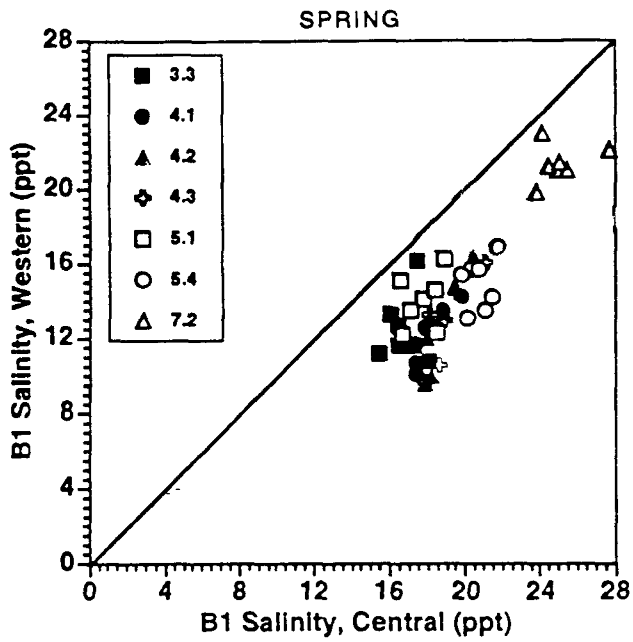


Figure 28. Scatter plot of annual seasonal medians of spring B1 Salinity, 1985-1991, for western and central stations.

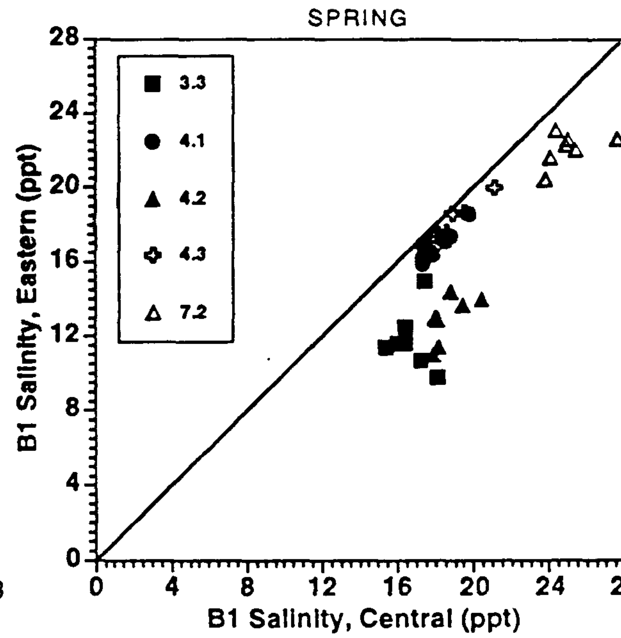


Figure 30. Scatter plot of annual seasonal medians of spring B1 Salinity, 1985-1991, for eastern and central stations.

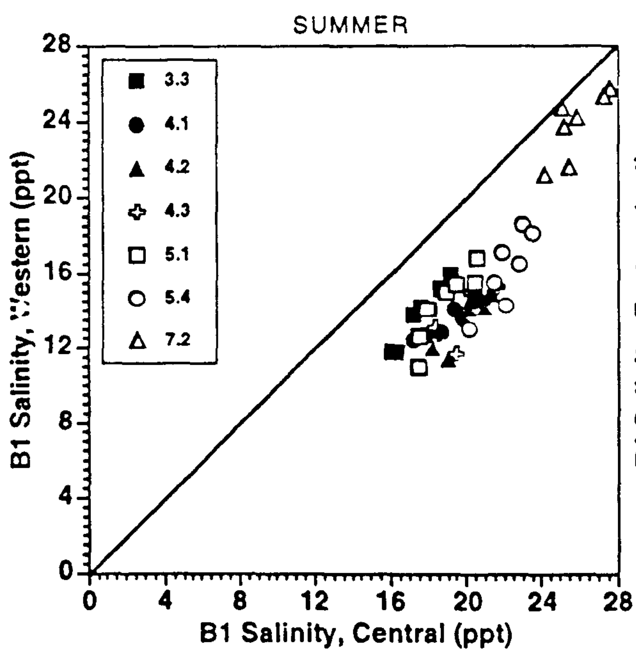


Figure 29. Scatter plot of annual seasonal medians of summer B1 Salinity, 1985-1991, for western and central stations.

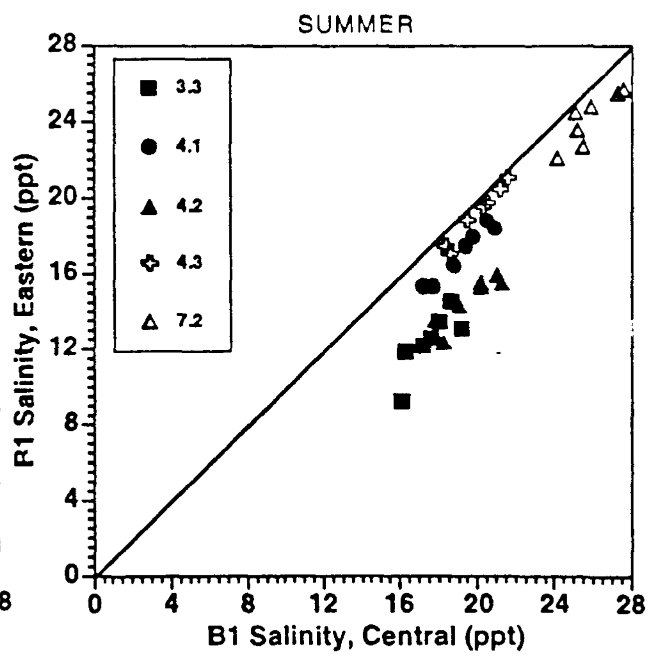


Figure 31. Scatter plot of annual seasonal medians of summer B1 Salinity, 1985-1991, for eastern and central stations.

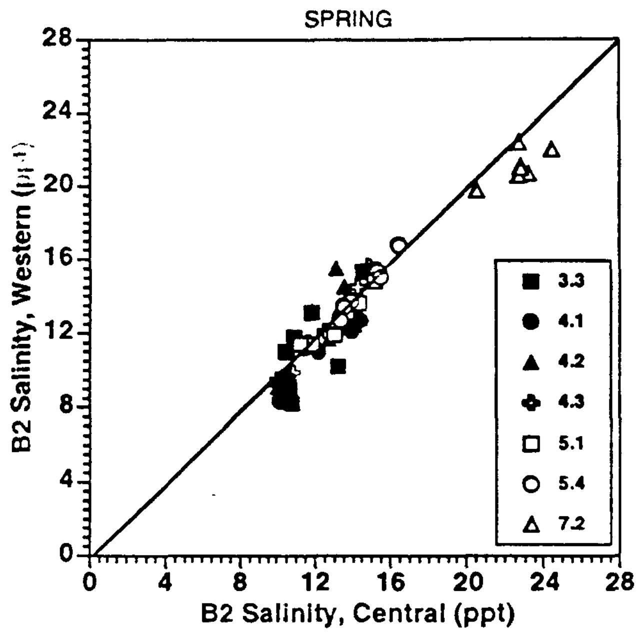


Figure 32. Scatter plot of annual seasonal medians of spring B2 Salinity, 1985-1991, for western and central stations.

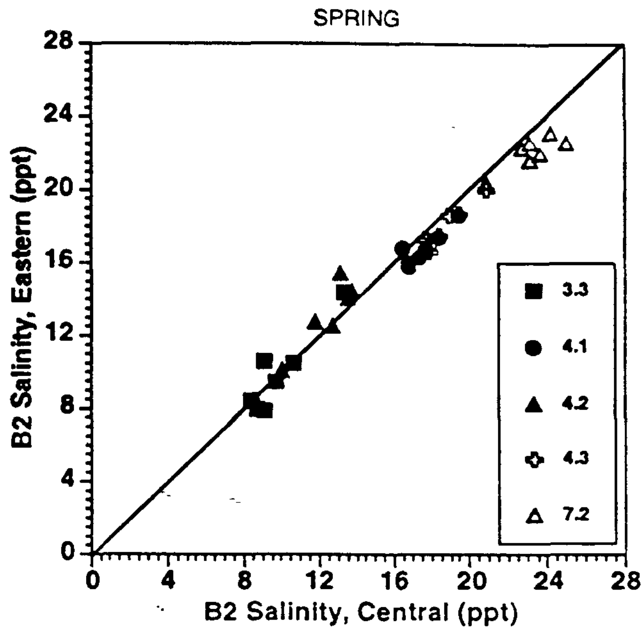


Figure 34. Scatter plot of annual seasonal medians of spring B2 Salinity, 1985-1991, for eastern and central stations.

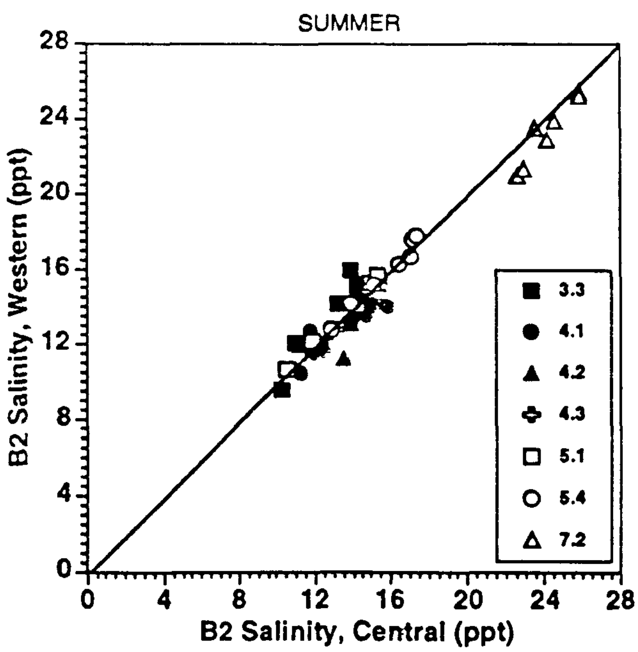


Figure 33. Scatter plot of annual seasonal medians of summer B2 Salinity, 1985-1991, for western and central stations.

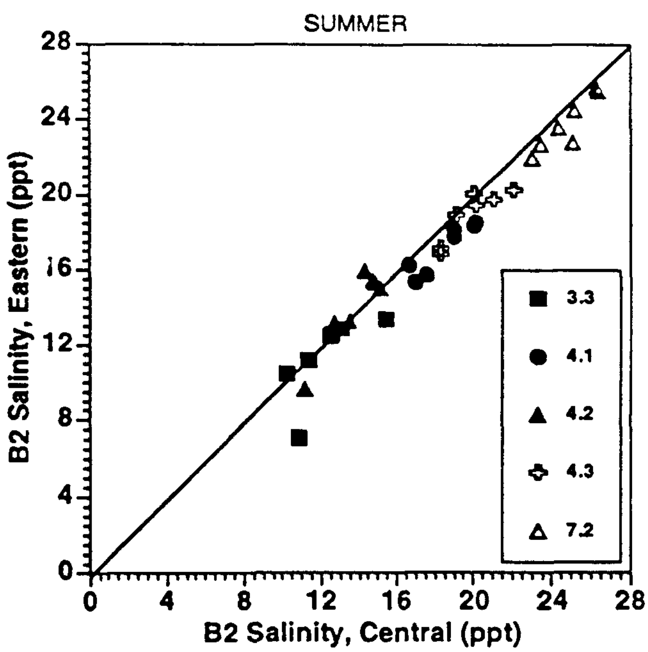


Figure 35. Scatter plot of annual seasonal medians of summer B2 Salinity, 1985-1991, for eastern and central stations.

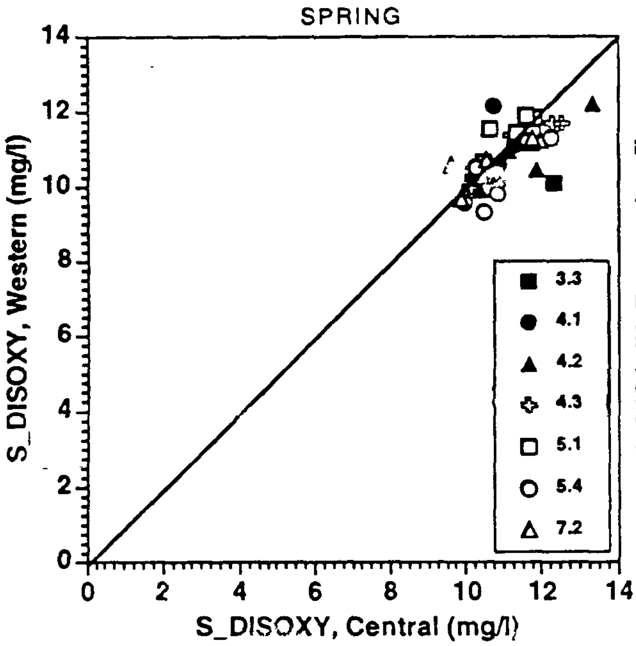


Figure 36. Scatter plot of annual seasonal medians of spring S_Disoxy, 1985-1991, for western and central stations.

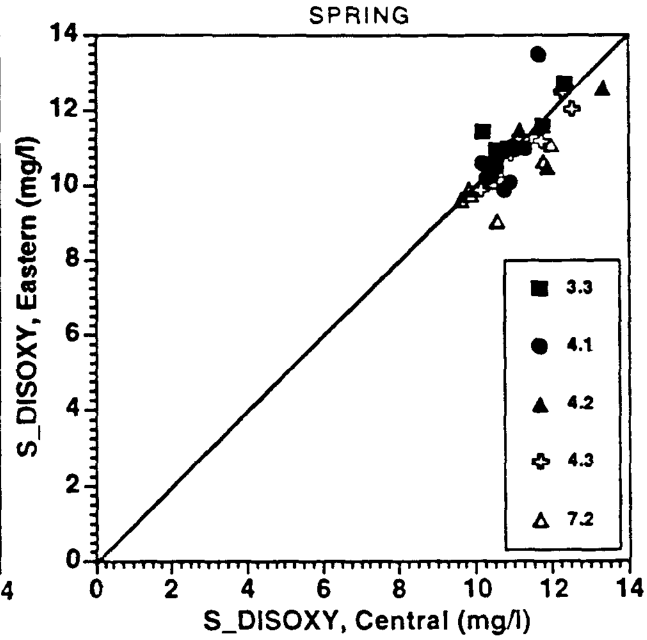


Figure 38. Scatter plot of annual seasonal medians of spring S_Disoxy, 1985-1991, for eastern and central stations.

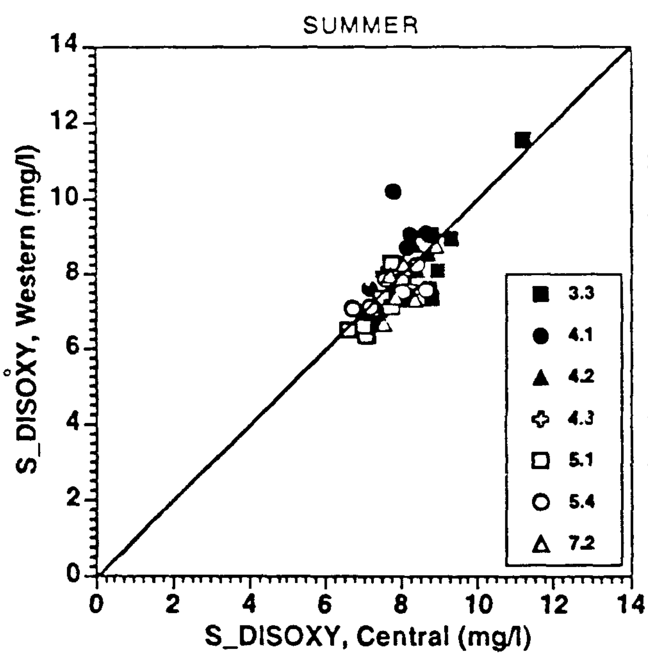


Figure 37. Scatter plot of annual seasonal medians of summer S_Disoxy, 1985-1991, for western and central stations.

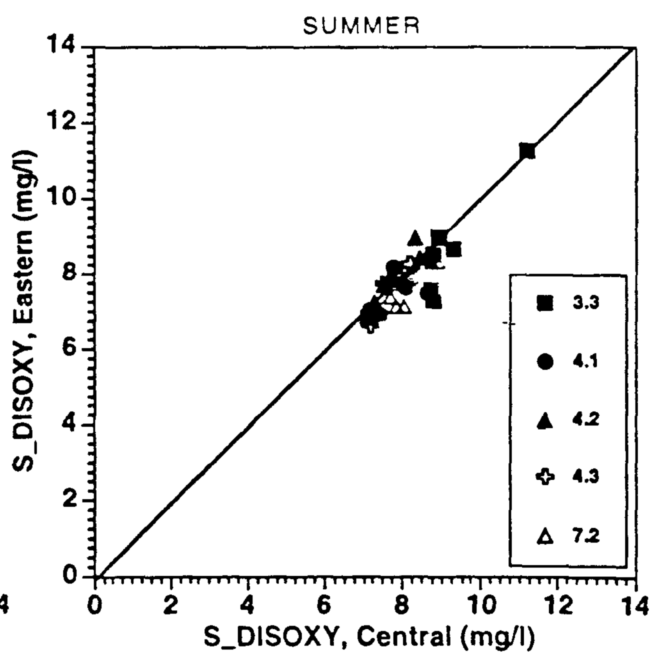


Figure 39. Scatter plot of annual seasonal medians of summer S_Disoxy, 1985-1991, for eastern and central stations.

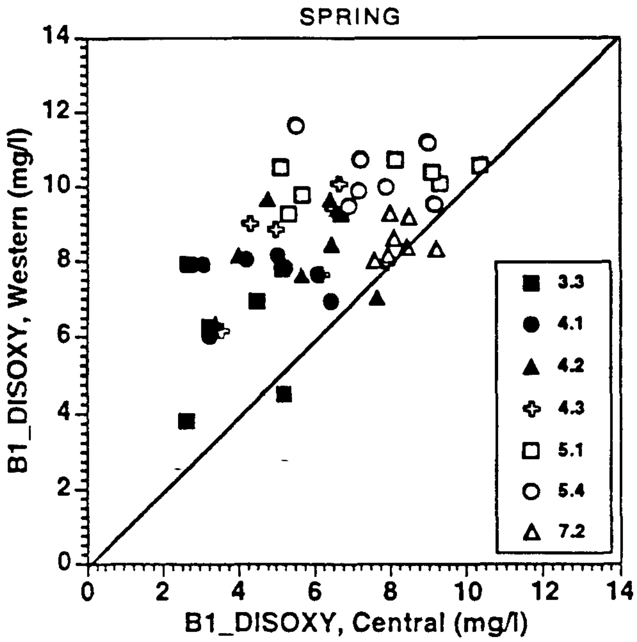


Figure 40. Scatter plot of annual seasonal medians of spring B1_Disoxy, 1985-1991, for western and central stations.

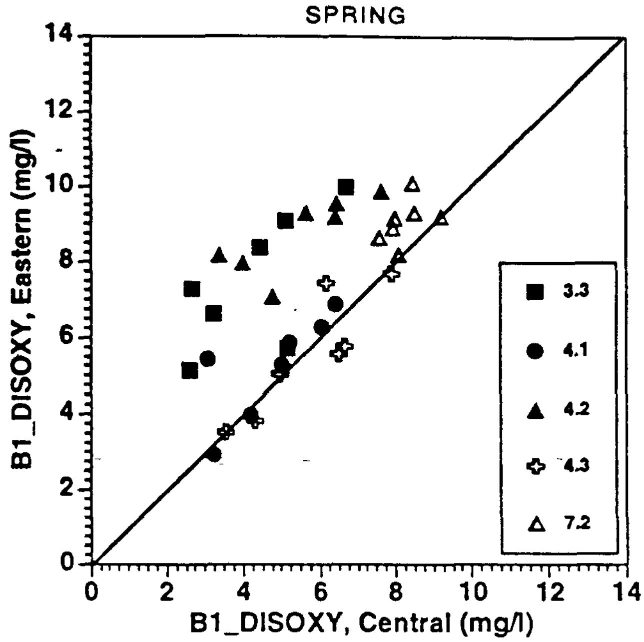


Figure 42. Scatter plot of annual seasonal medians of spring B1_Disoxy, 1985-1991, for eastern and central stations.

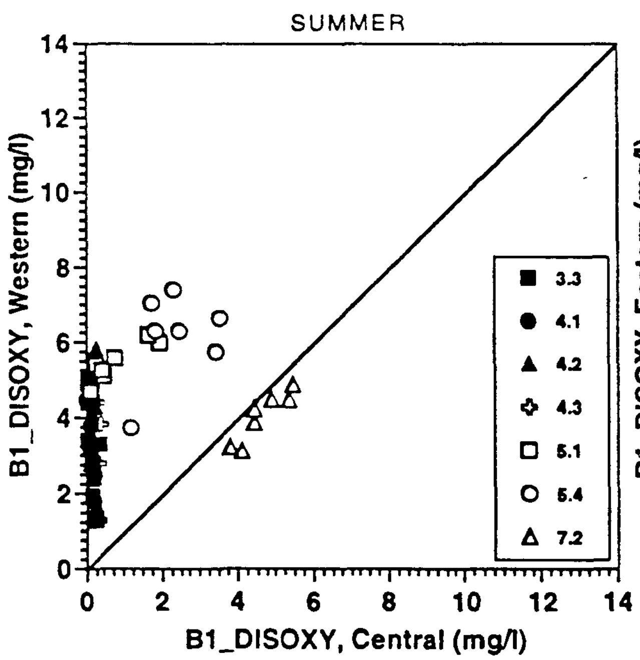


Figure 41. Scatter plot of annual seasonal medians of summer B1_Disoxy, 1985-1991, for western and central stations.

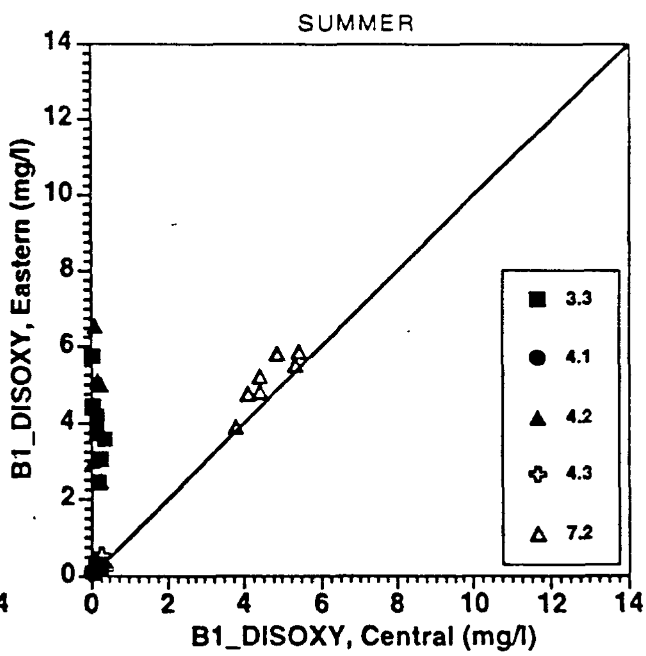


Figure 43. Scatter plot of annual seasonal medians of summer B1_Disoxy, 1985-1991, for eastern and central stations.

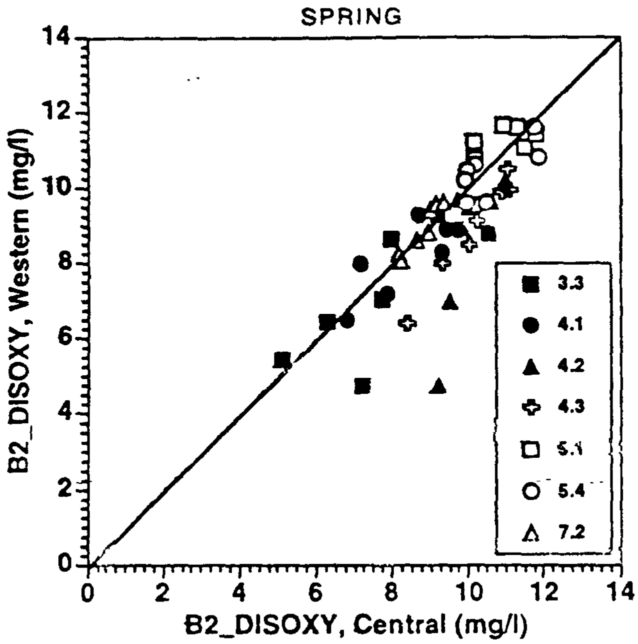


Figure 44. Scatter plot of annual seasonal medians of spring B2_Disoxy, 1985-1991, for western and central stations.

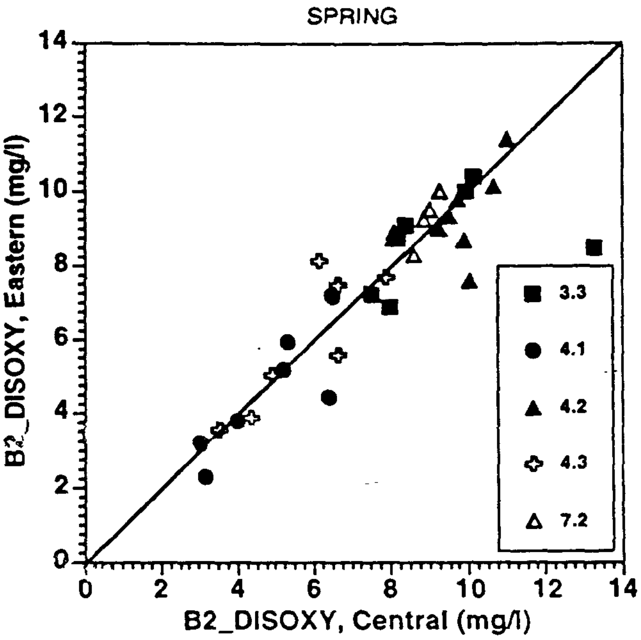


Figure 46. Scatter plot of annual seasonal medians of spring B2_Disoxy, 1985-1991, for eastern and central stations.

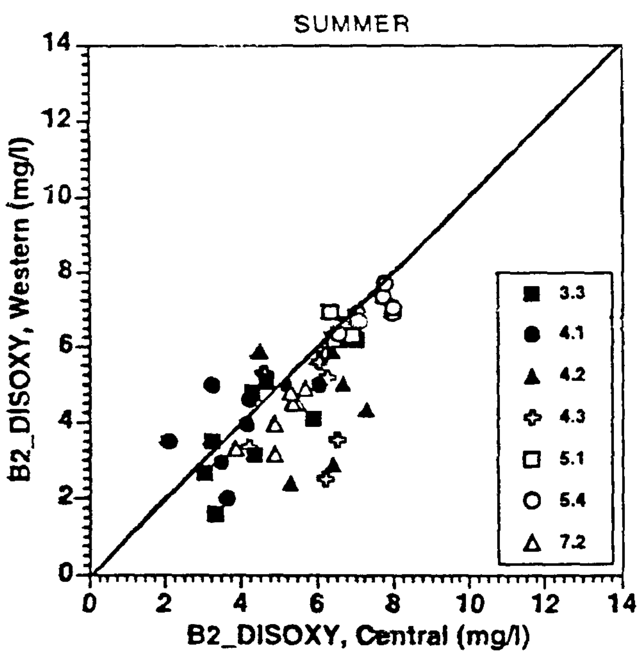


Figure 45. Scatter plot of annual seasonal medians of summer B2_Disoxy, 1985-1991, for western and central stations.

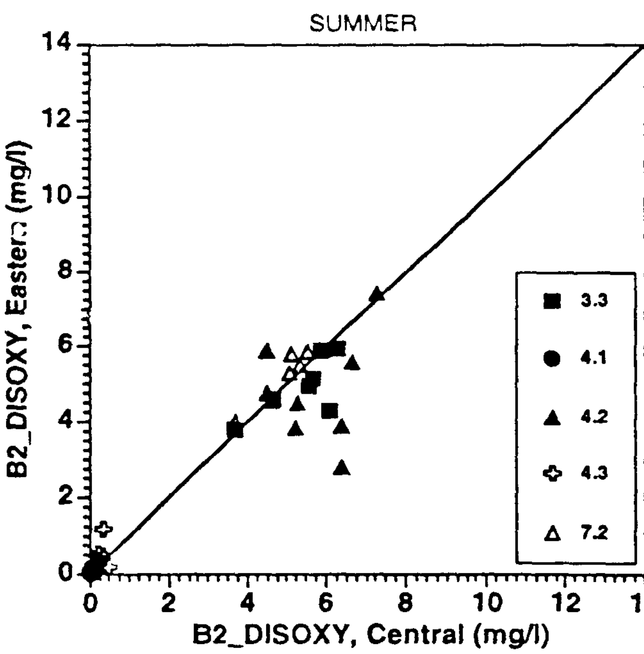


Figure 47. Scatter plot of annual seasonal medians of summer B2_Disoxy, 1985-1991, for eastern and central stations.

Figure 48. Time plot of differences between central and lateral stations for Total Phosphorus in CB3.3, 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

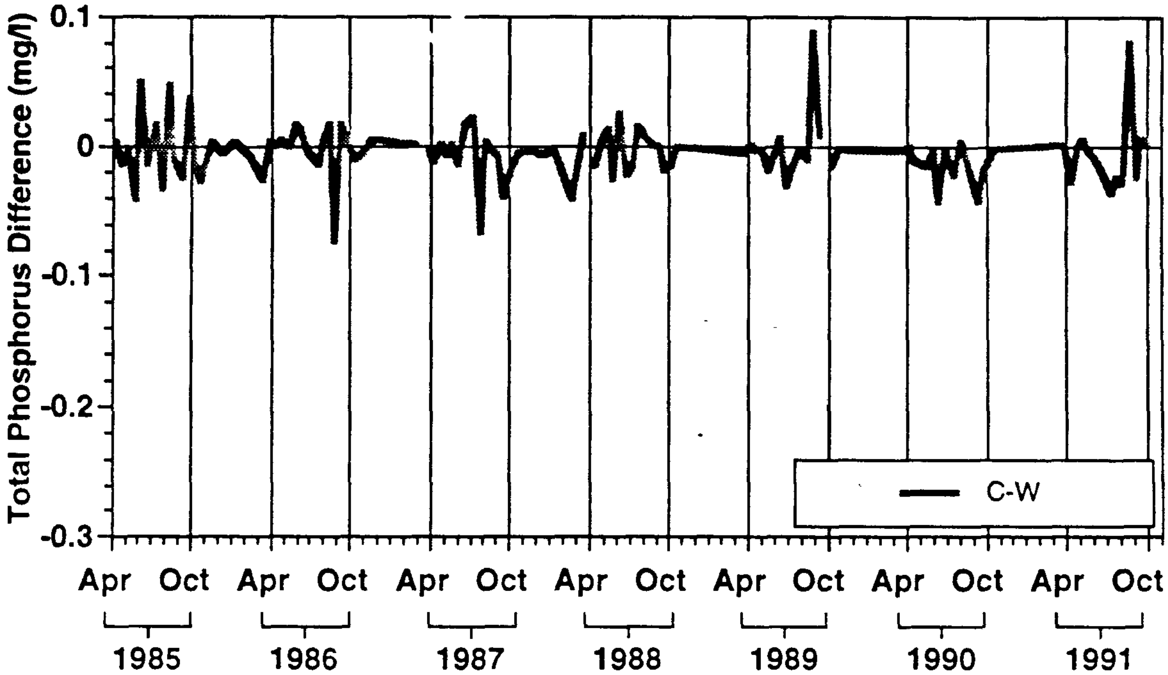


Figure 49. Time plot of differences between central and lateral stations for Total Phosphorus in CB4.1, 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

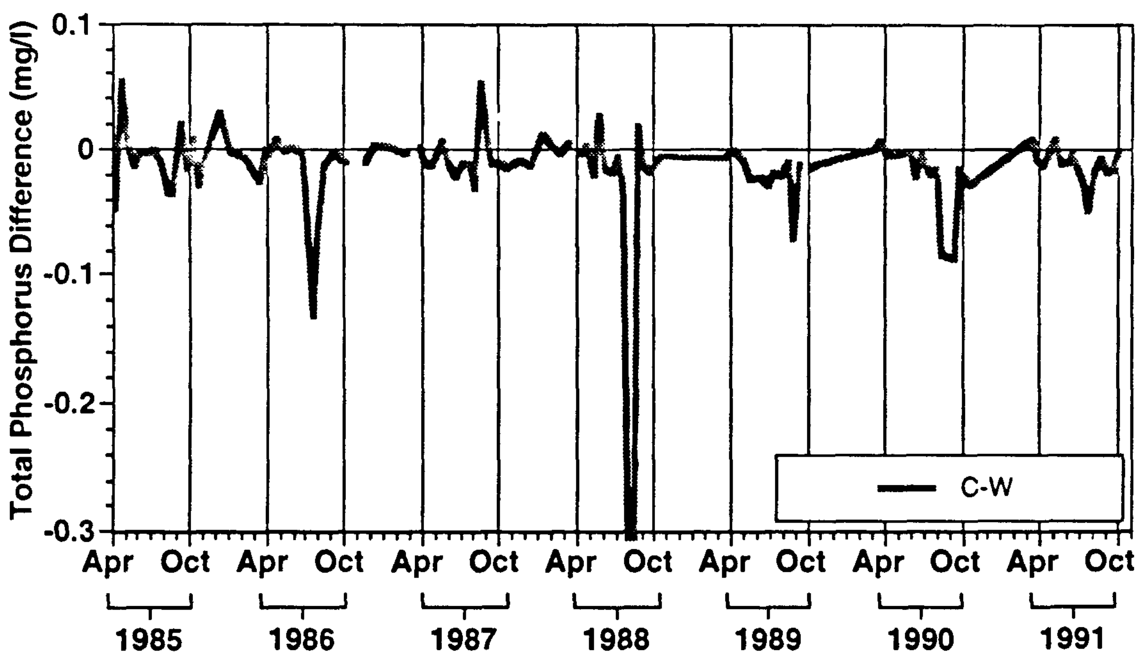


Figure 50. Time plot of differences between central and lateral stations for Total Phosphorus in CB4.2, 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

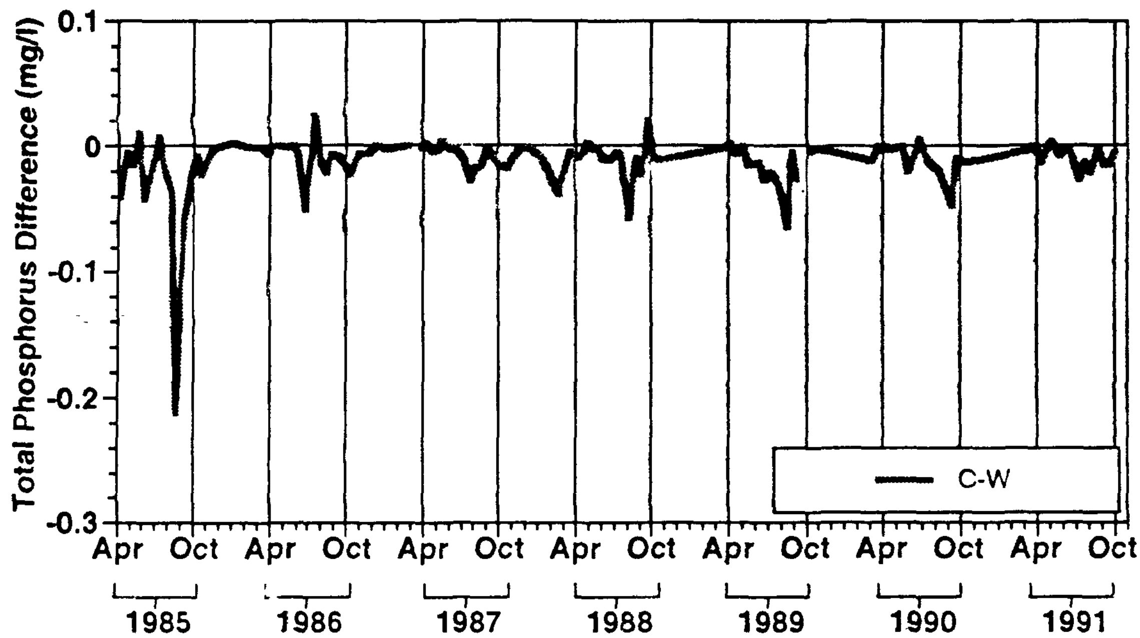


Figure 51. Time plot of differences between central and lateral stations for Total Phosphorus in CB4.3, 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

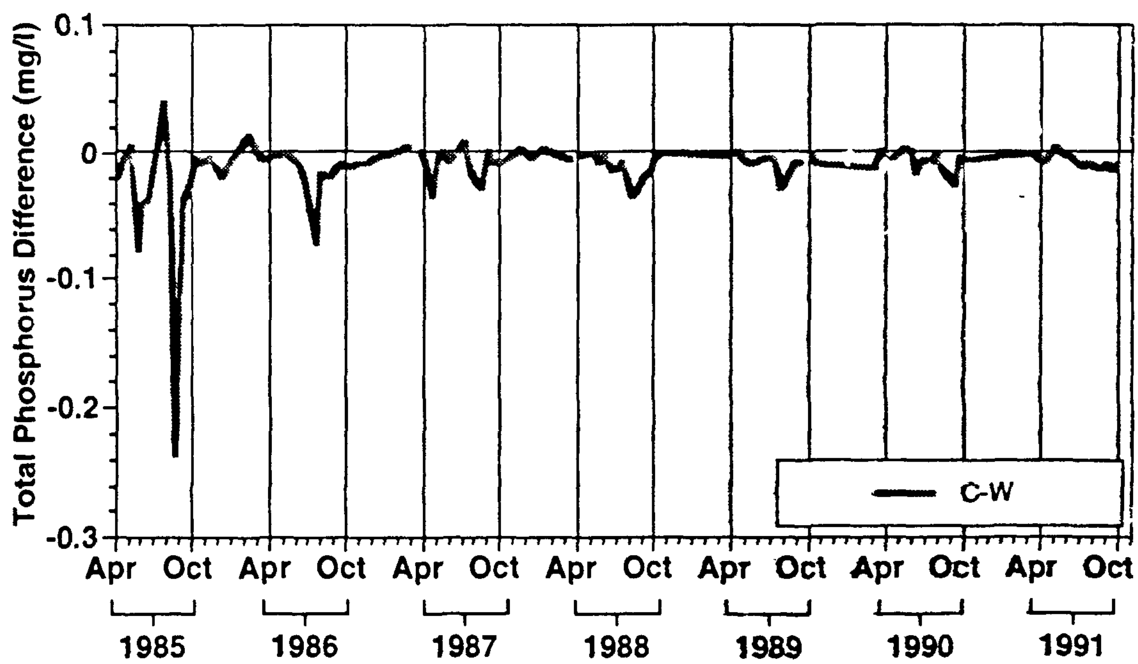


Figure 52. Time plot of differences between central and lateral stations for Total Phosphorus in CB5.4, 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

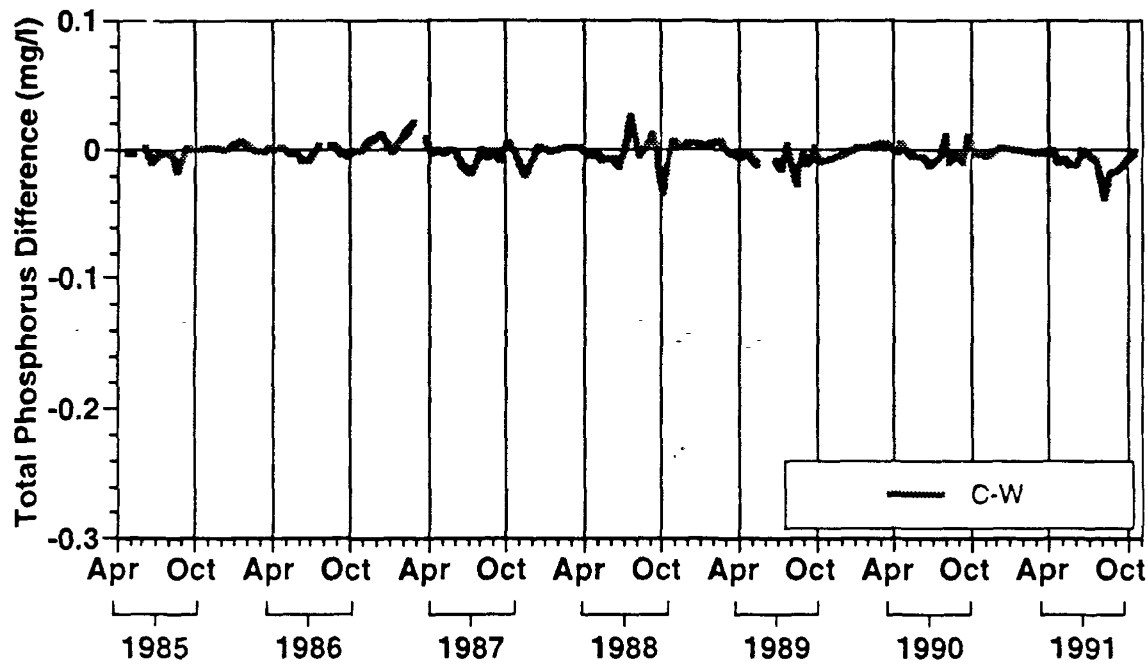


Figure 53. Time plot of differences between central and lateral stations for Orthophosphate in CB4.1, 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

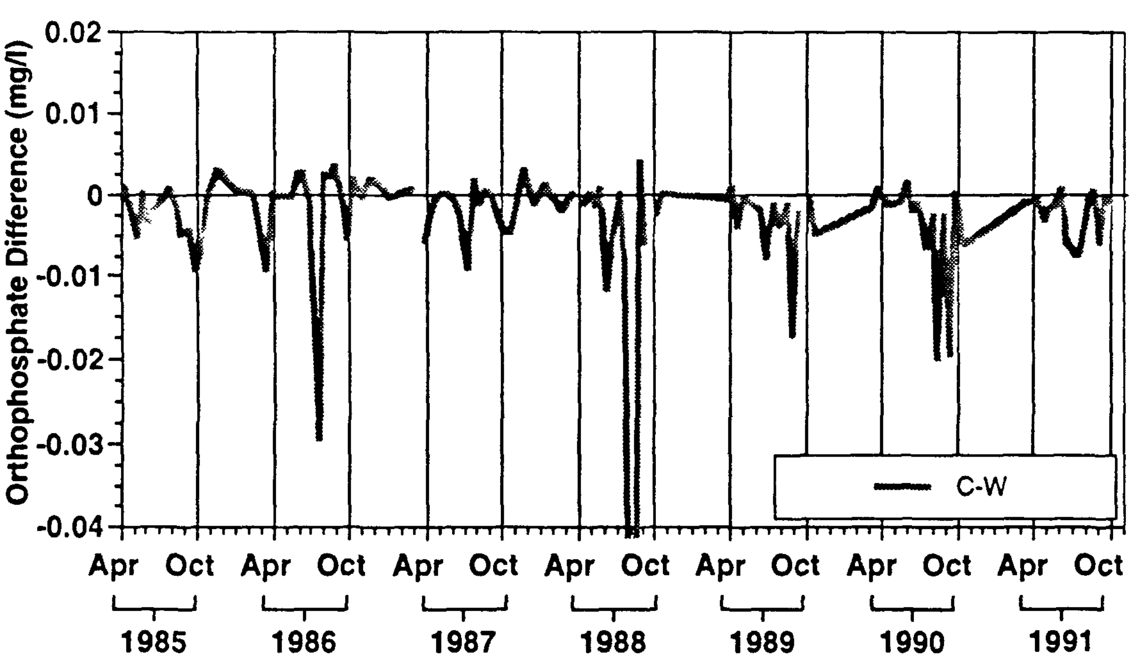


Figure 54. Time plot of differences between central and lateral stations for Orthophosphate in CB4.2 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

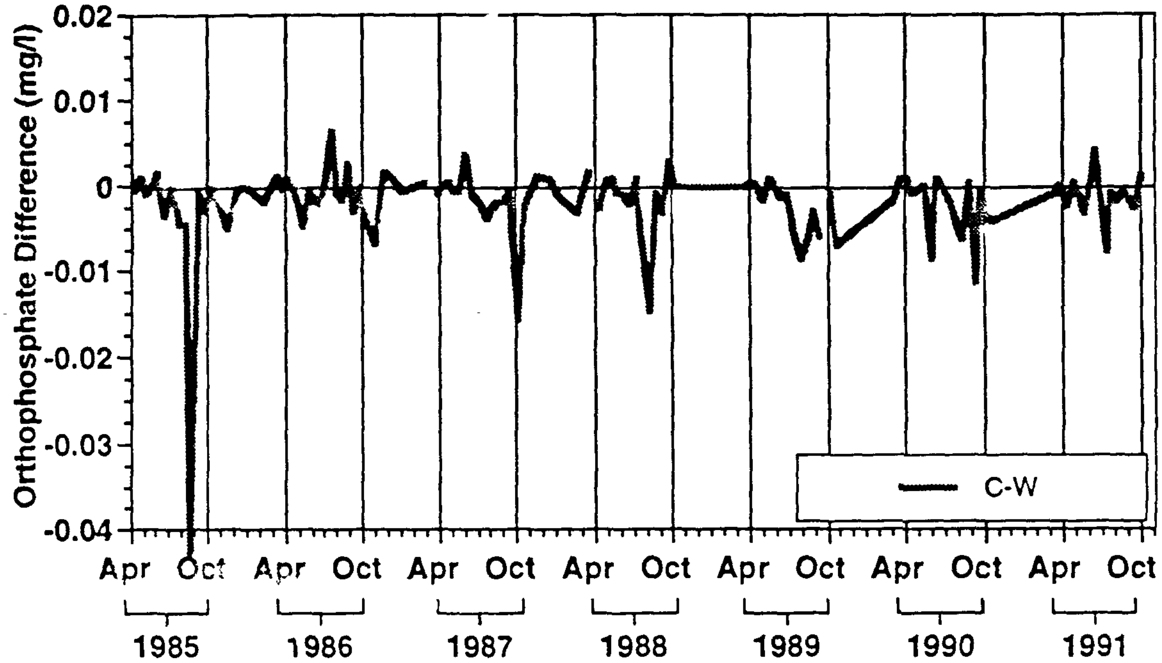


Figure 55. Time plot of differences between central and lateral stations for Orthophosphate in CB4.3, 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

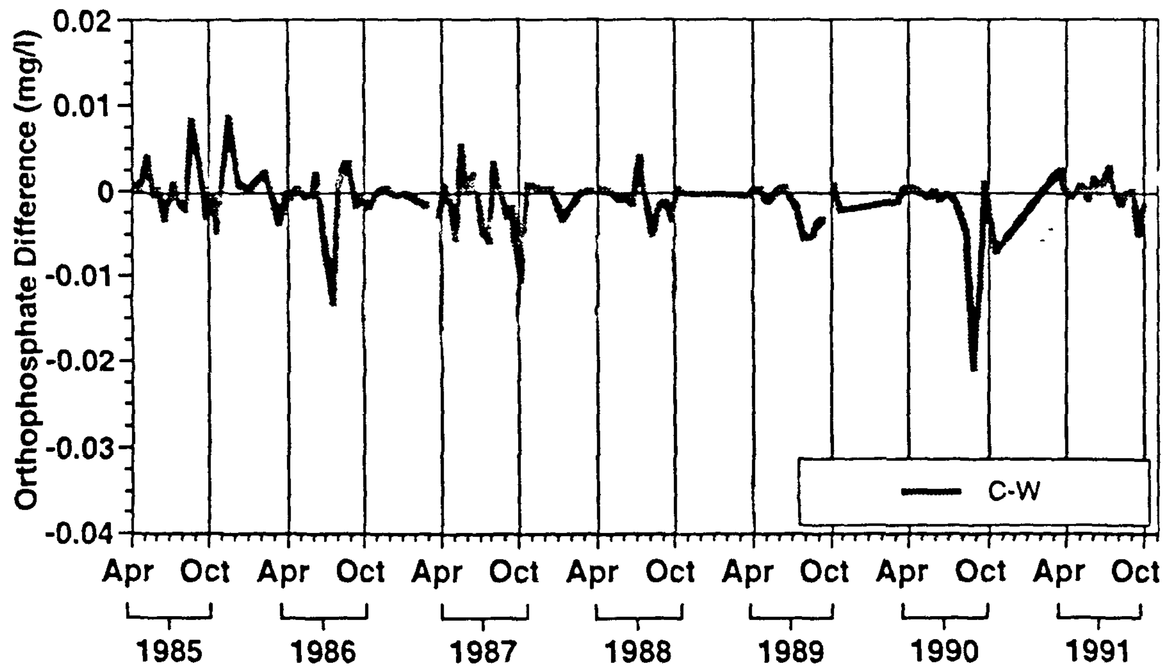


Figure 56. Time plot of differences between central and lateral stations for Total Nitrogen in CB4.1 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

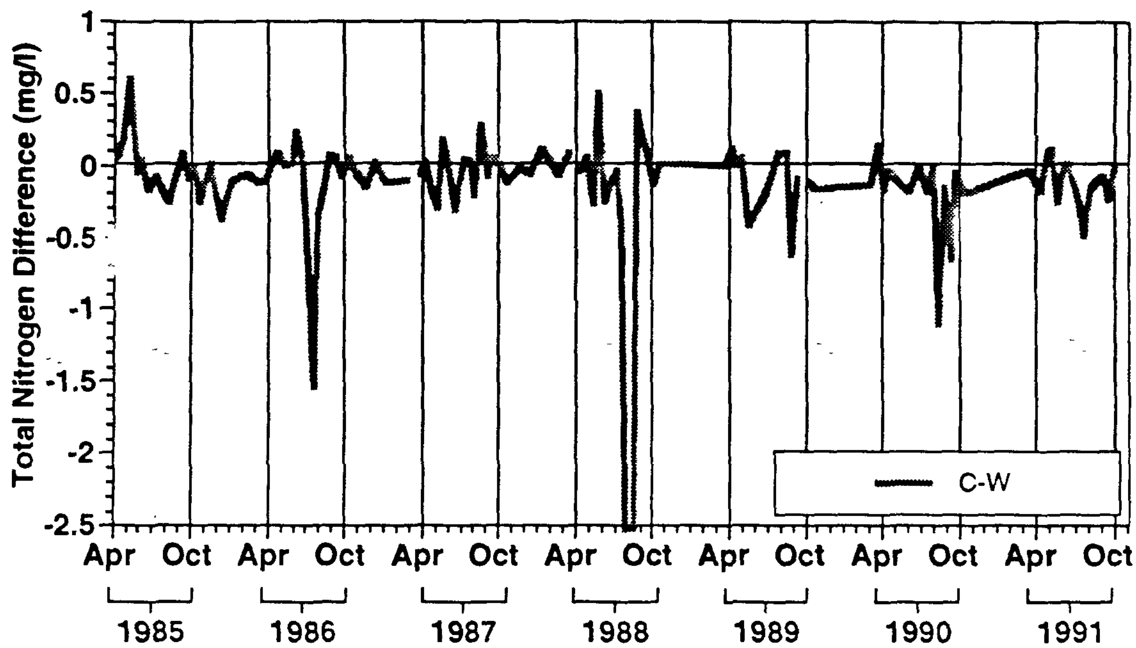


Figure 57. Time plot of differences between central and lateral stations for Total Nitrogen in CB4.2 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

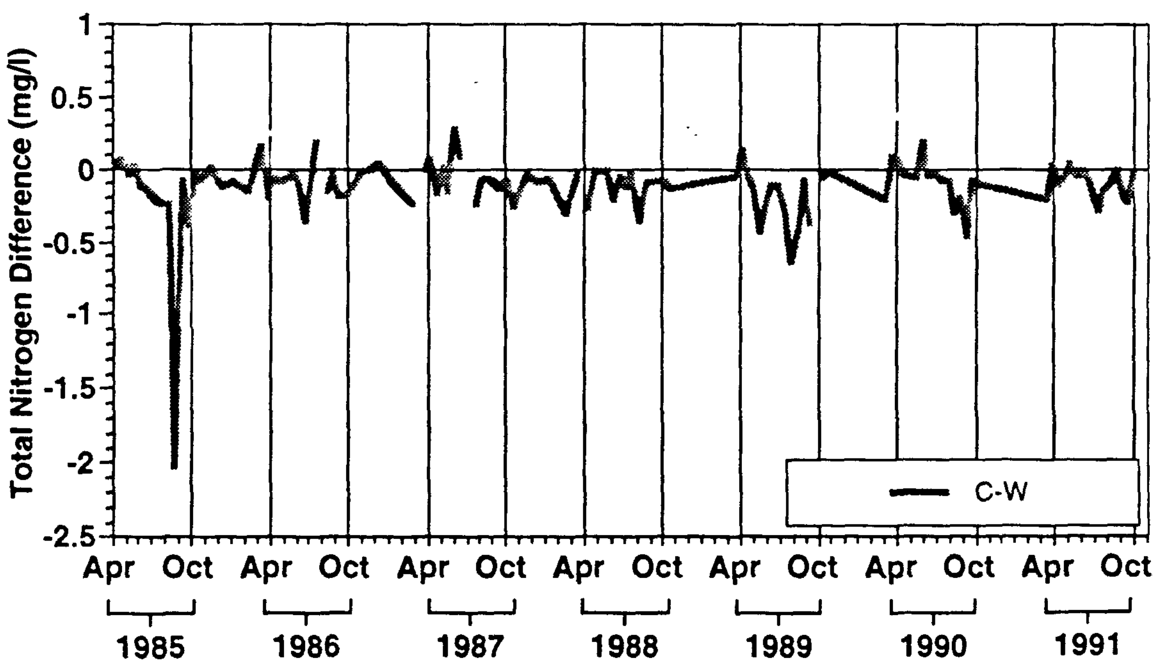


Figure 58. Time plot of differences between central and lateral stations for Total Nitrogen in CB4.3 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

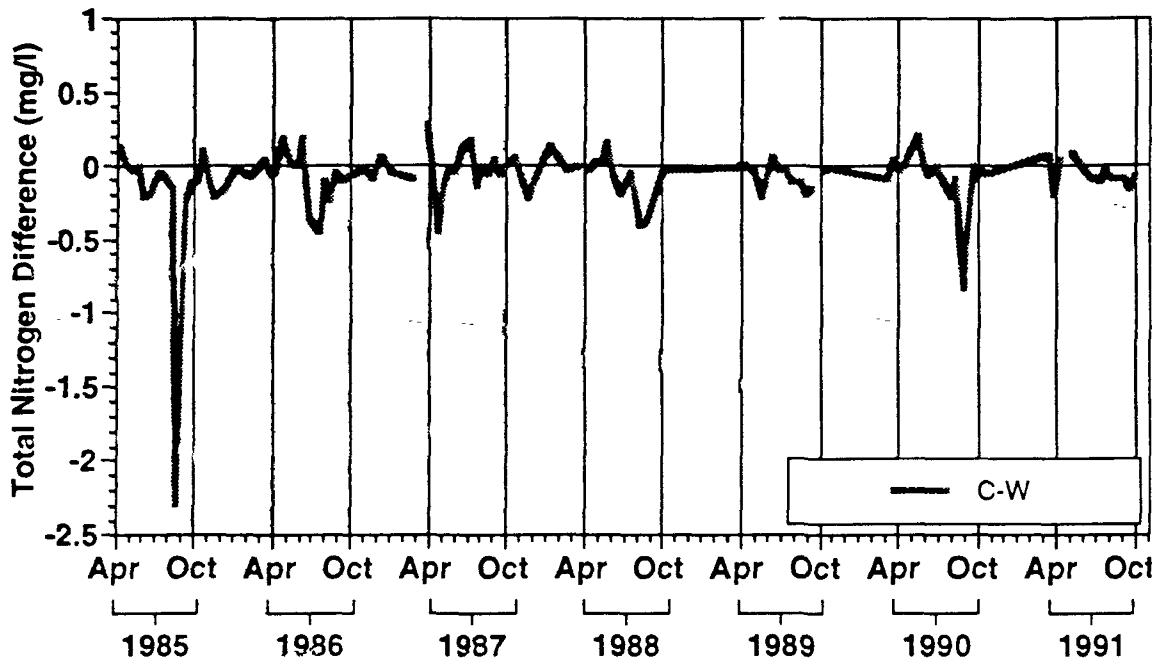


Figure 59. Time plot of differences between central and lateral stations for Total Nitrogen in CB7.2 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

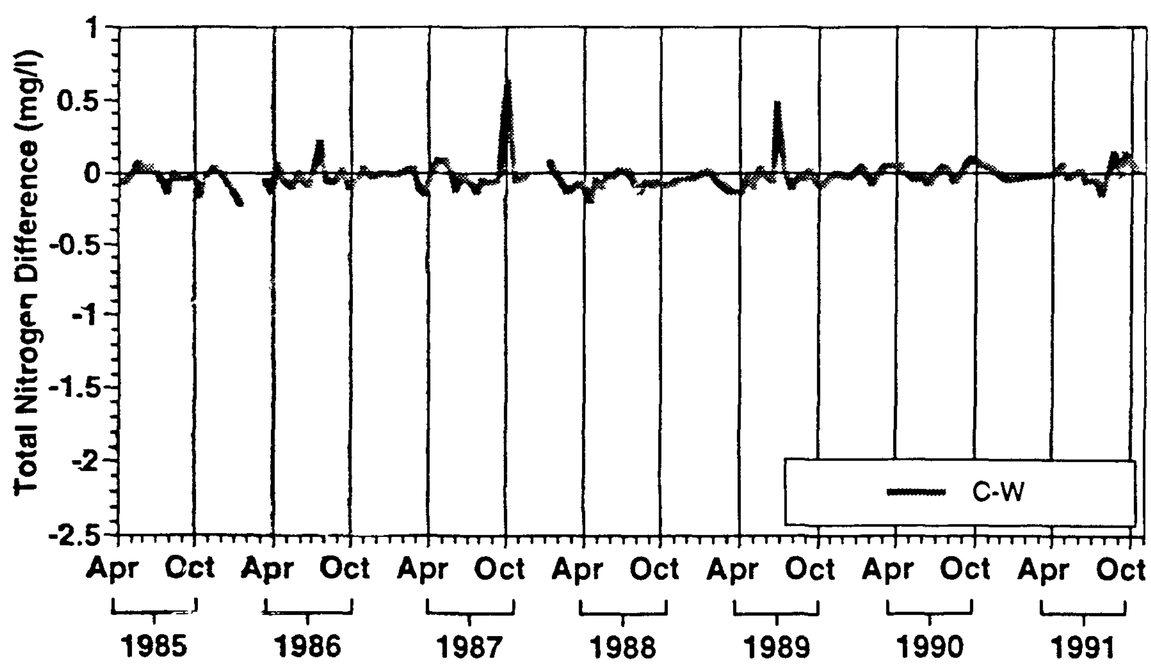


Figure 60. Time plot of differences between central and lateral stations for Total Suspended Solids in CB3.3 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

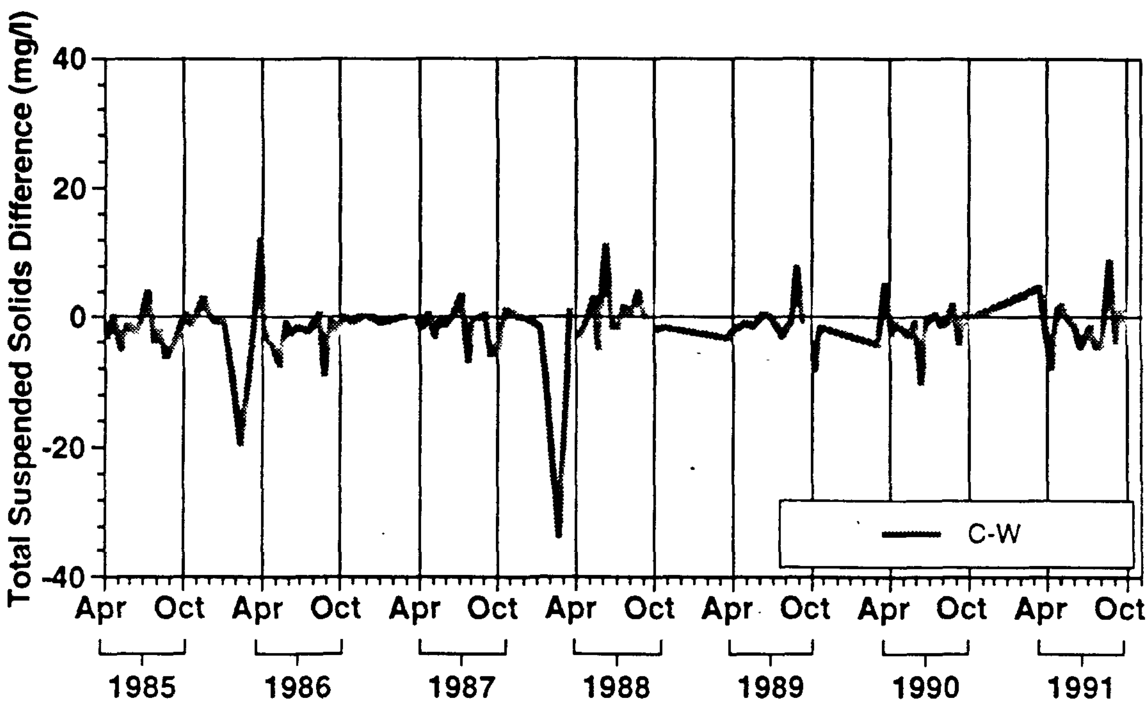


Figure 61. Time plot of differences between central and lateral stations for Total Suspended Solids in CB4.1 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

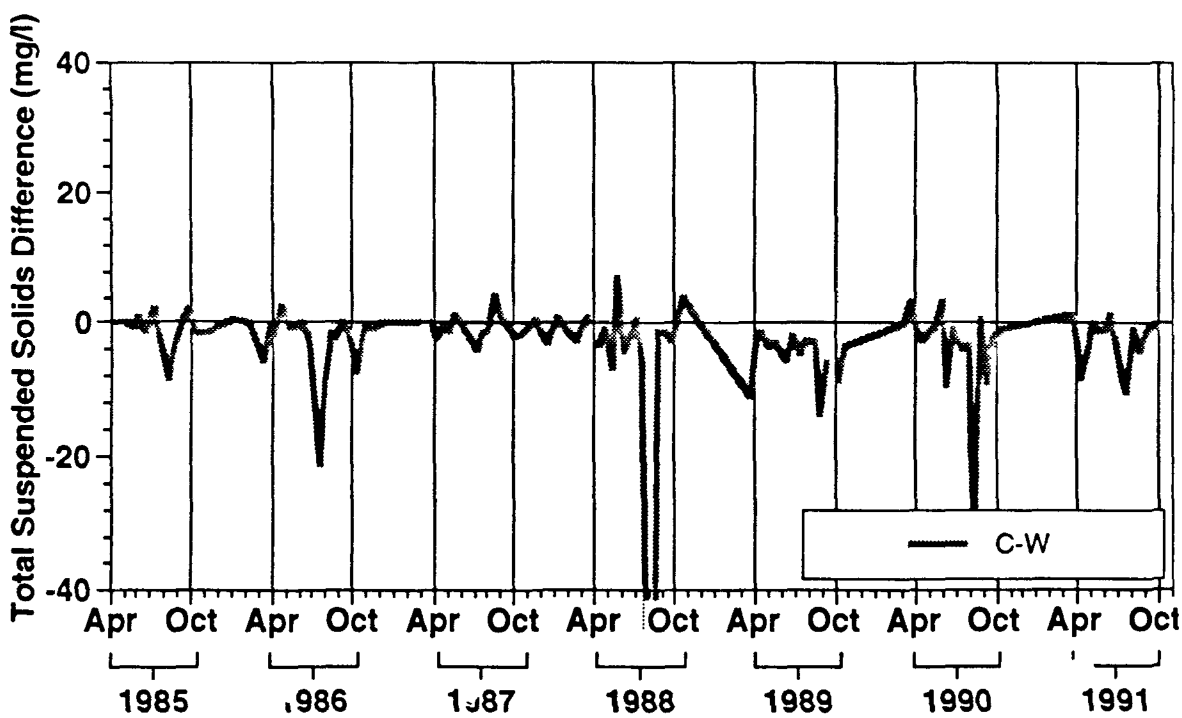


Figure 62. Time plot of differences between central and lateral stations for Total Suspended Solids in CB4.2 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

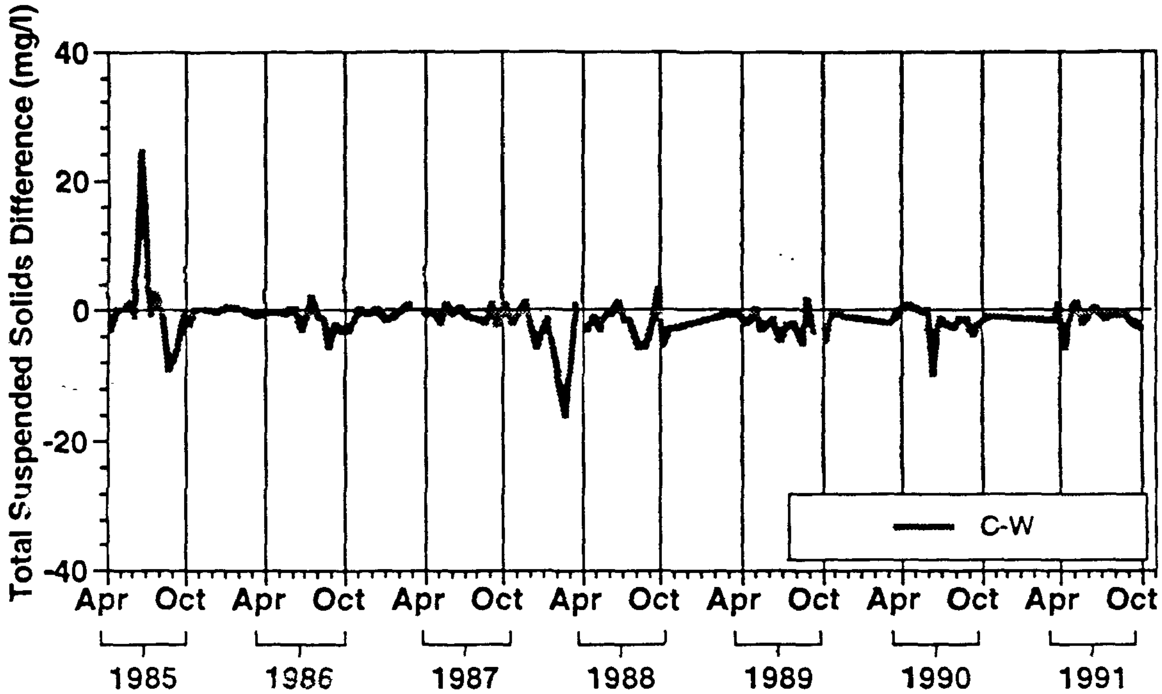


Figure 63. Time plot of differences between central and lateral stations for Total Suspended Solids in CB4.3 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

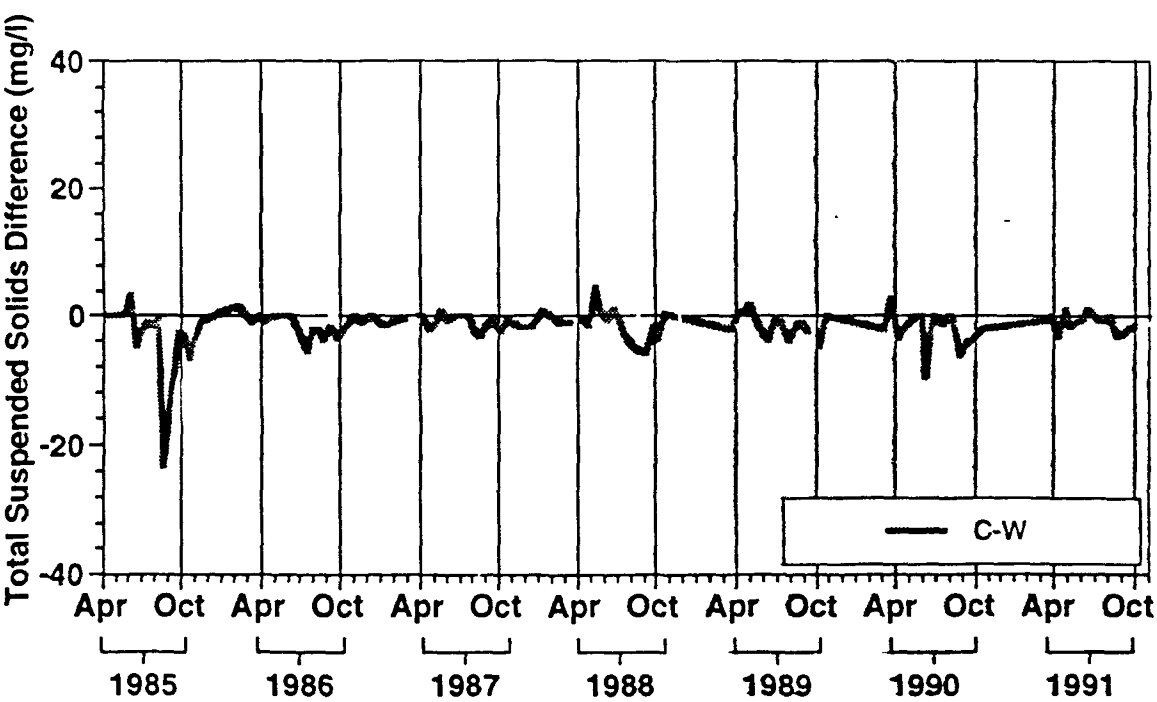


Figure 64. Time plot of differences between central and lateral stations for Total Suspended Solids in CB5.4 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

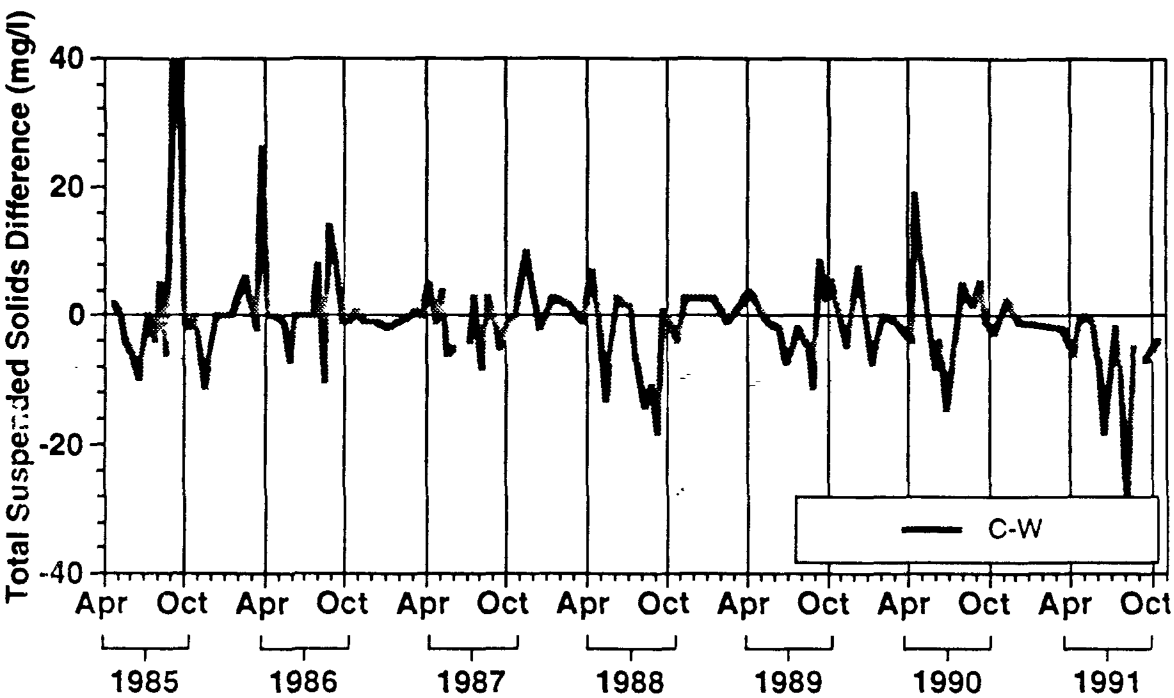


Figure 65. Time plot of differences between central and lateral stations for Total Suspended Solids in CB7.2 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

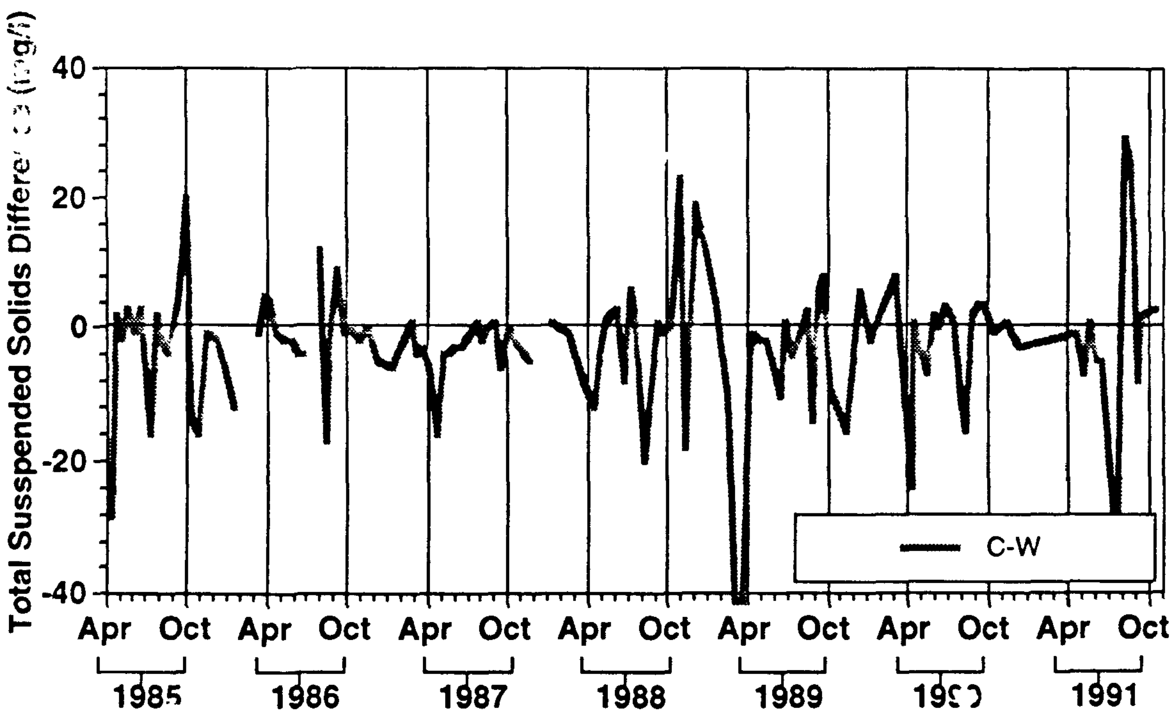


Figure 66. Time plot of differences between central and lateral stations for Chlorophyll *a* in CB3.3 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

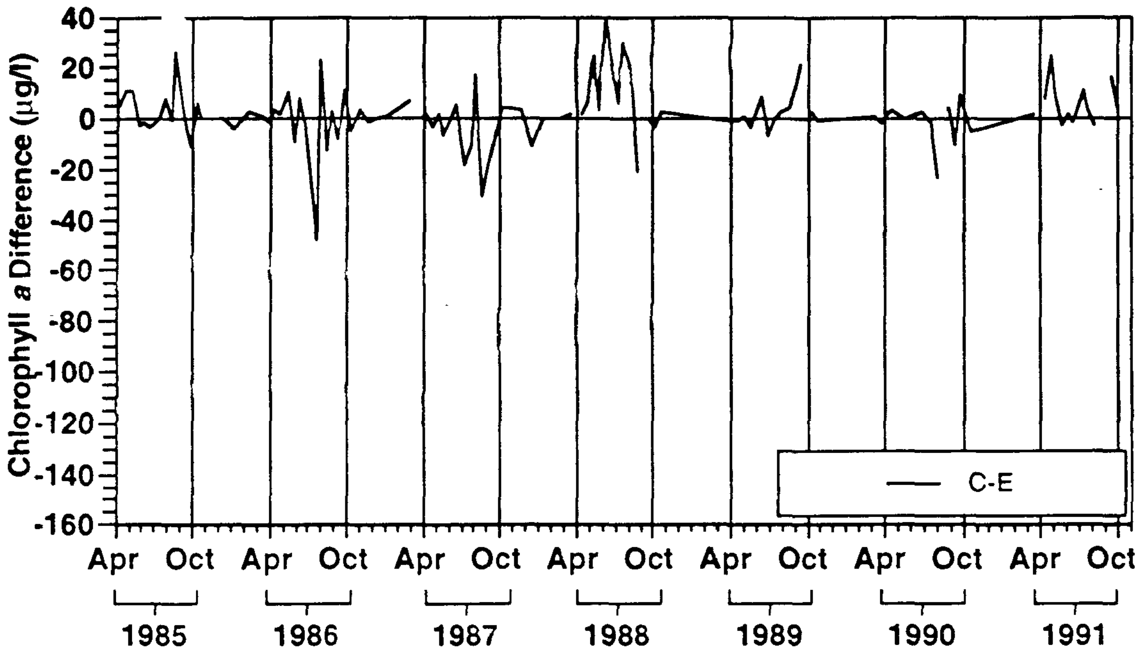


Figure 67. Time plot of differences between central and lateral stations for Chlorophyll *a* in CB4.1 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

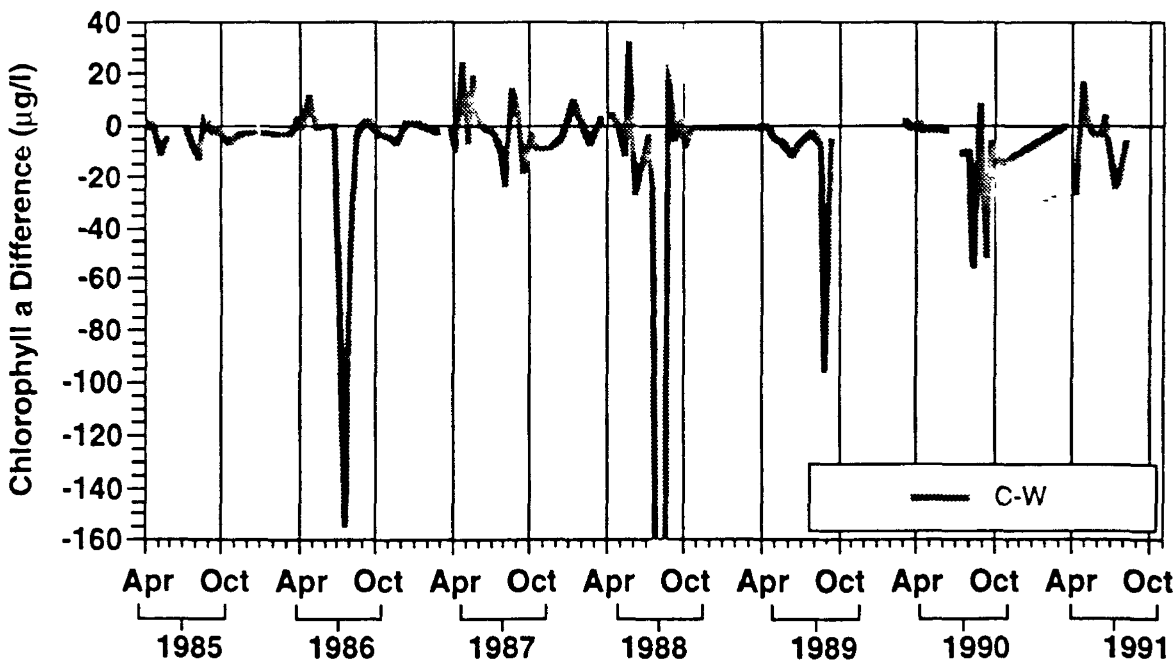


Figure 68. Time plot of differences between central and lateral stations for Chlorophyll *a* in CB4.2 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

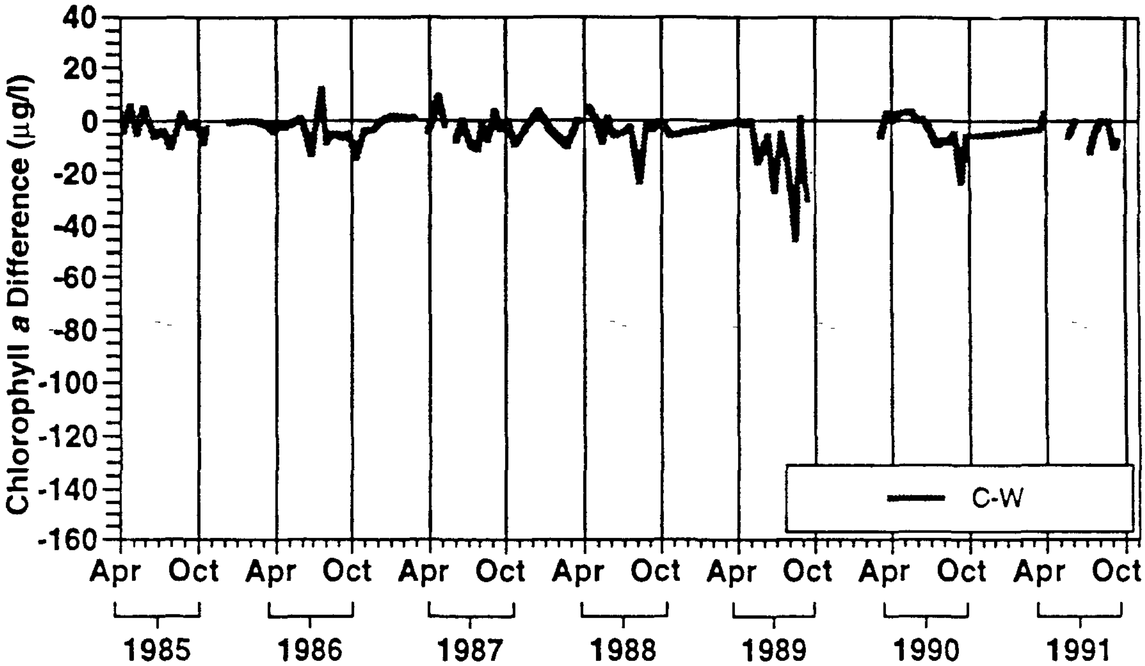


Figure 69. Time plot of differences between central and lateral stations for Chlorophyll *a* in CB4.3 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

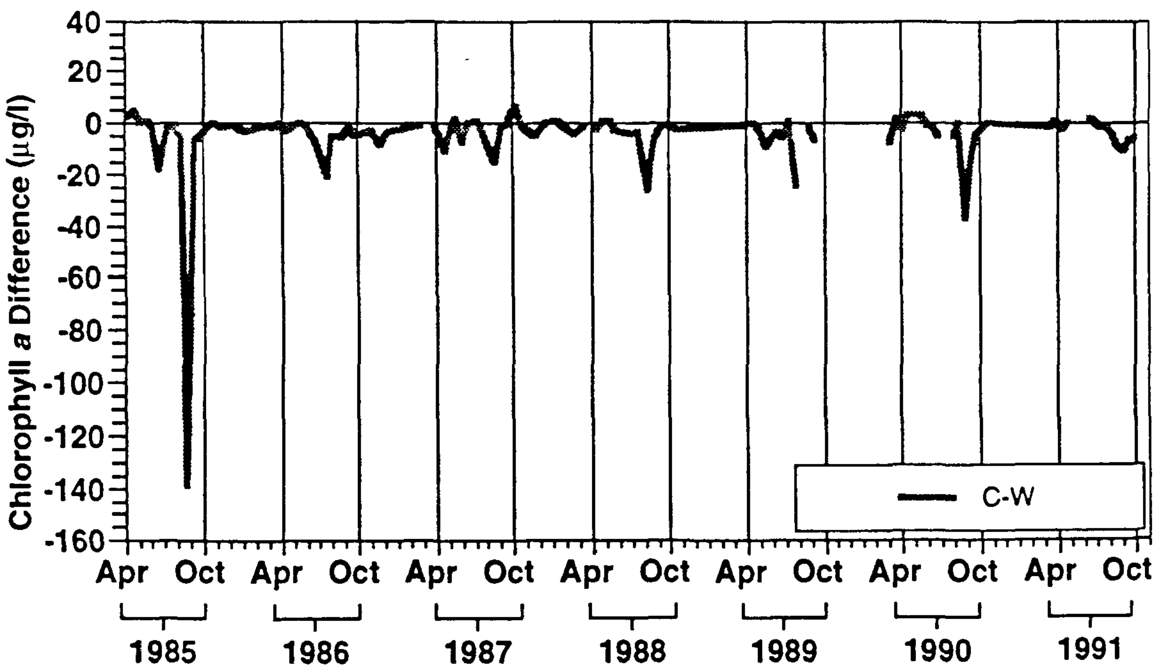


Figure 70. Time plot of differences between central and lateral stations for Chlorophyll *a* in CB7.2 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

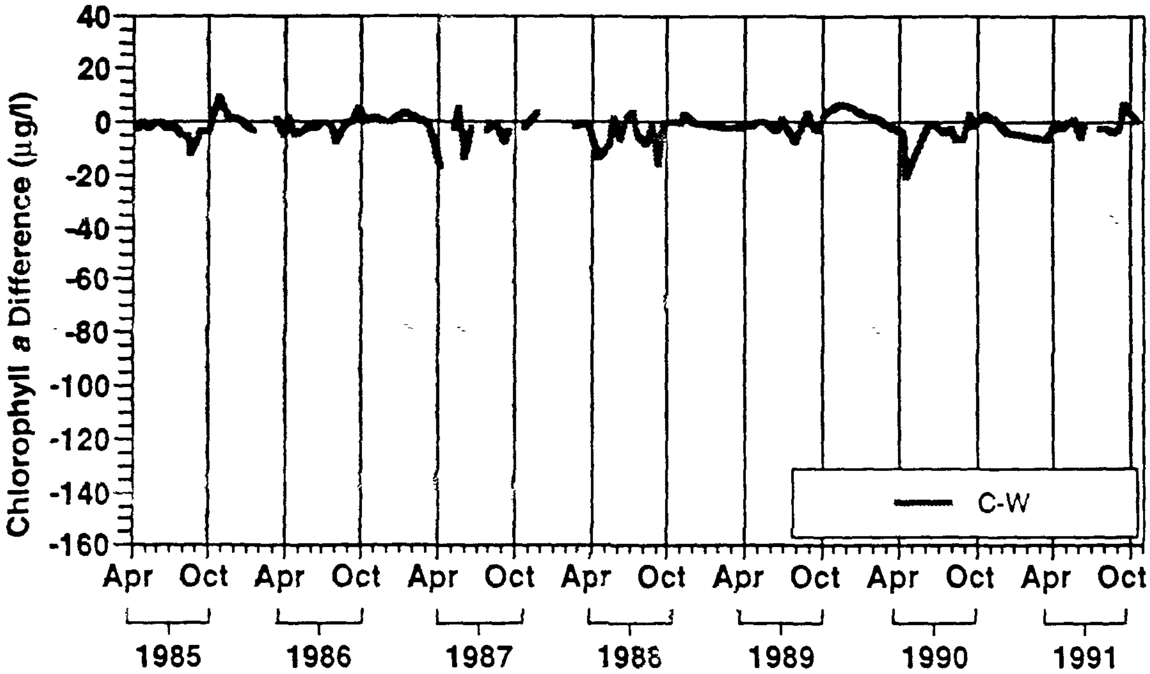


Figure 71. Time plot of differences between central and lateral stations for Secchi in CB4.1 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

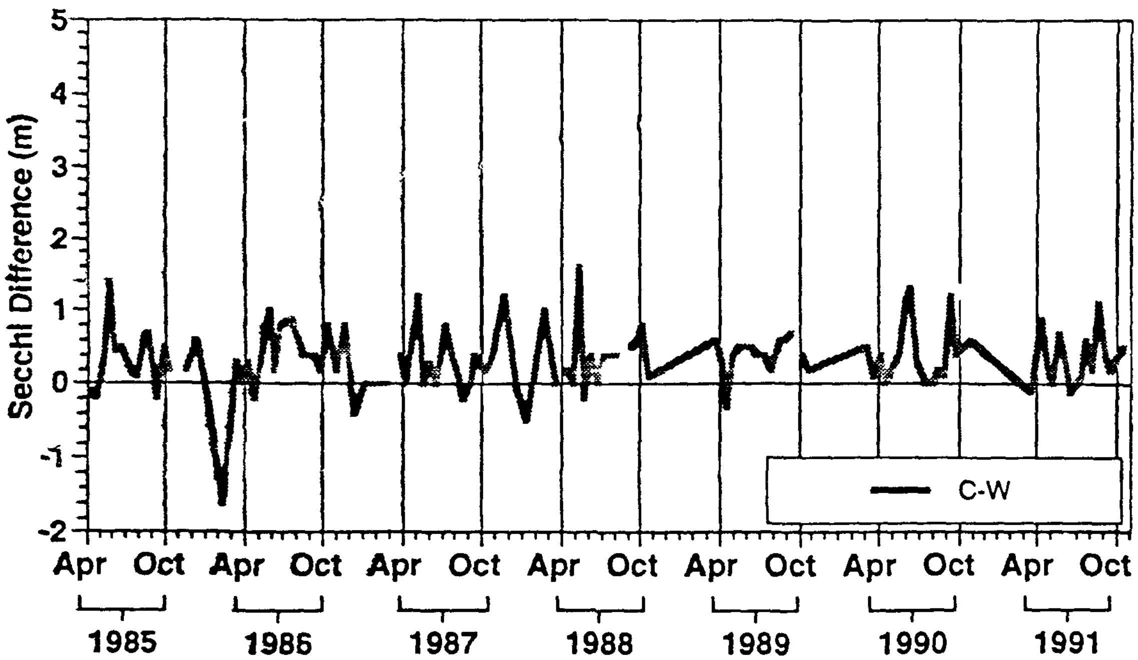


Figure 72. Time plot of differences between central and lateral stations for Secchi in CB4.2 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

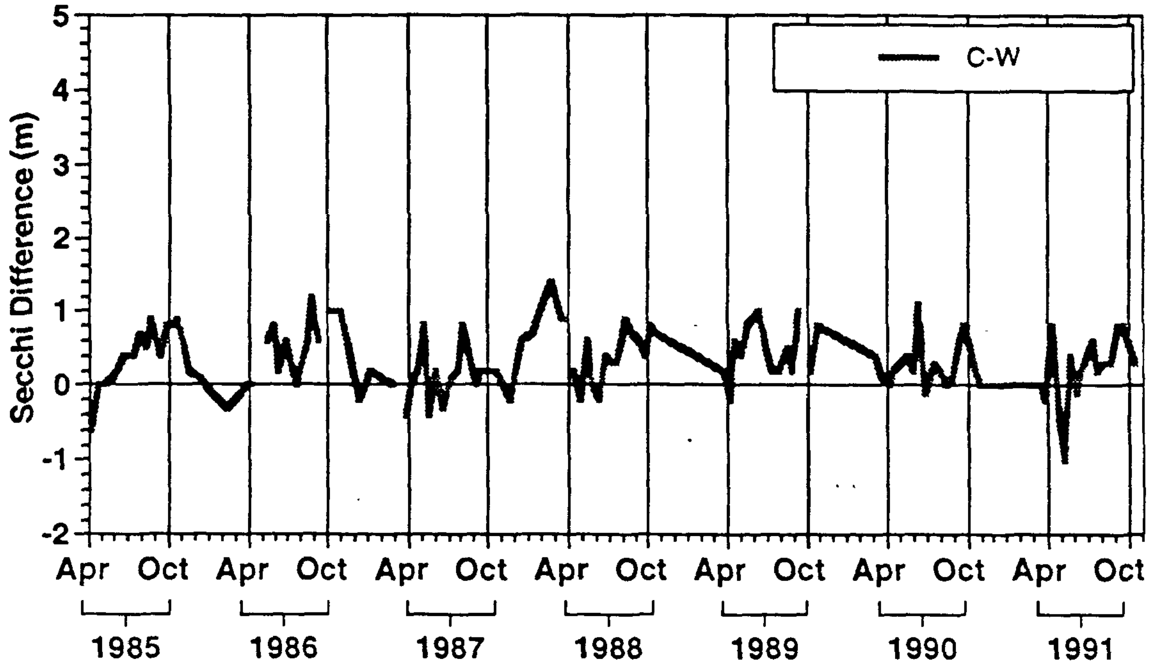


Figure 73. Time plot of differences between central and lateral stations for Secchi in CB4.3 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

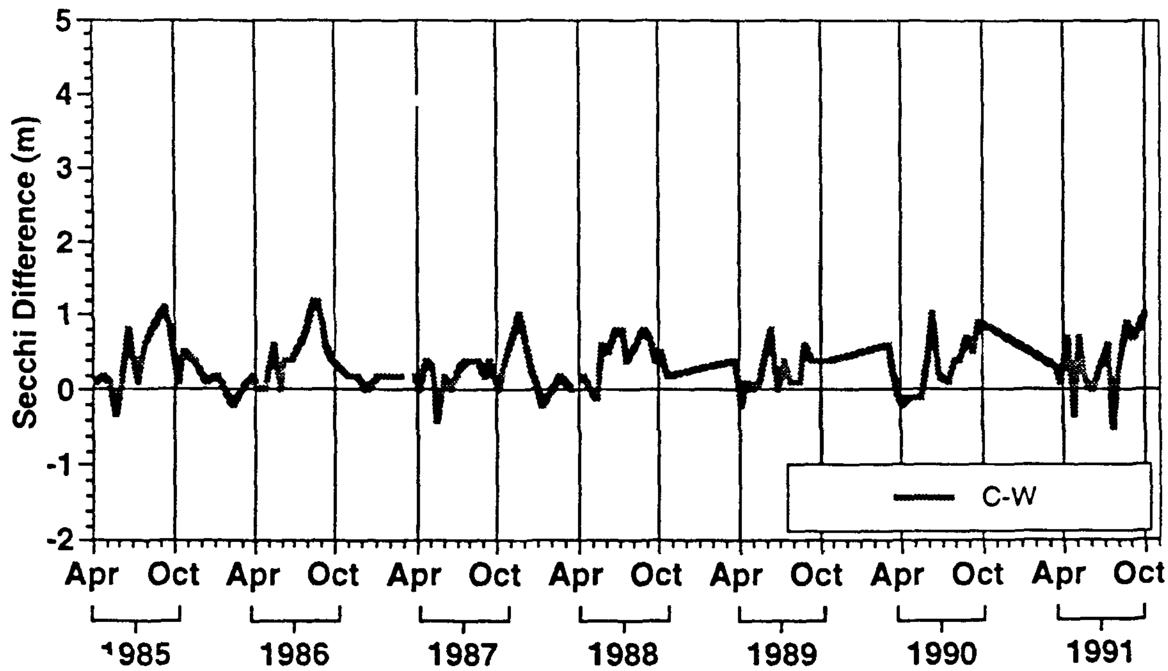


Figure 74. Time plot of differences between central and lateral stations for Secchi in CB5.1 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

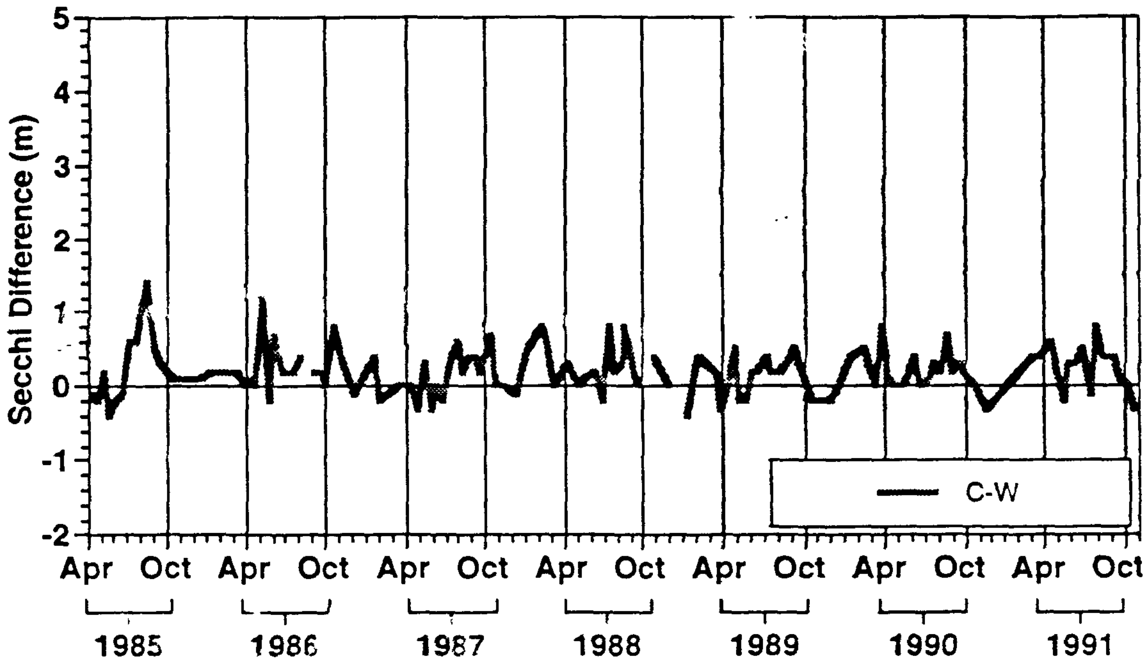


Figure 75. Time plot of differences between central and lateral stations for Secchi in CB5.4 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

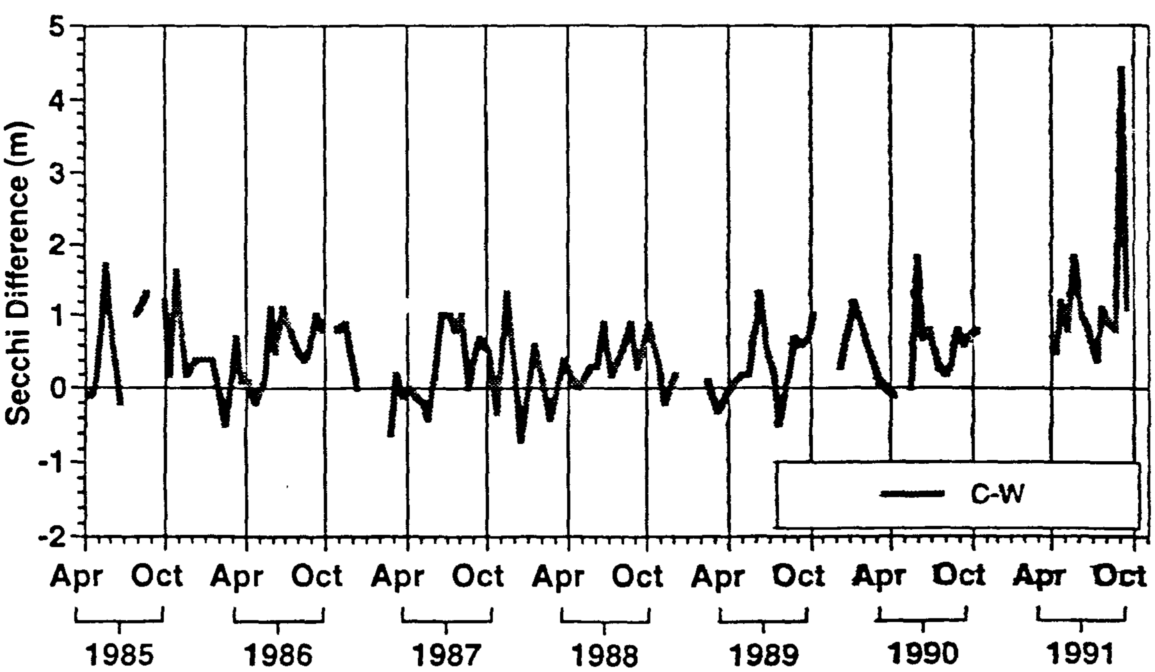


Figure 76. Time plot of differences between central and lateral stations for Secchi in CB7.2 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

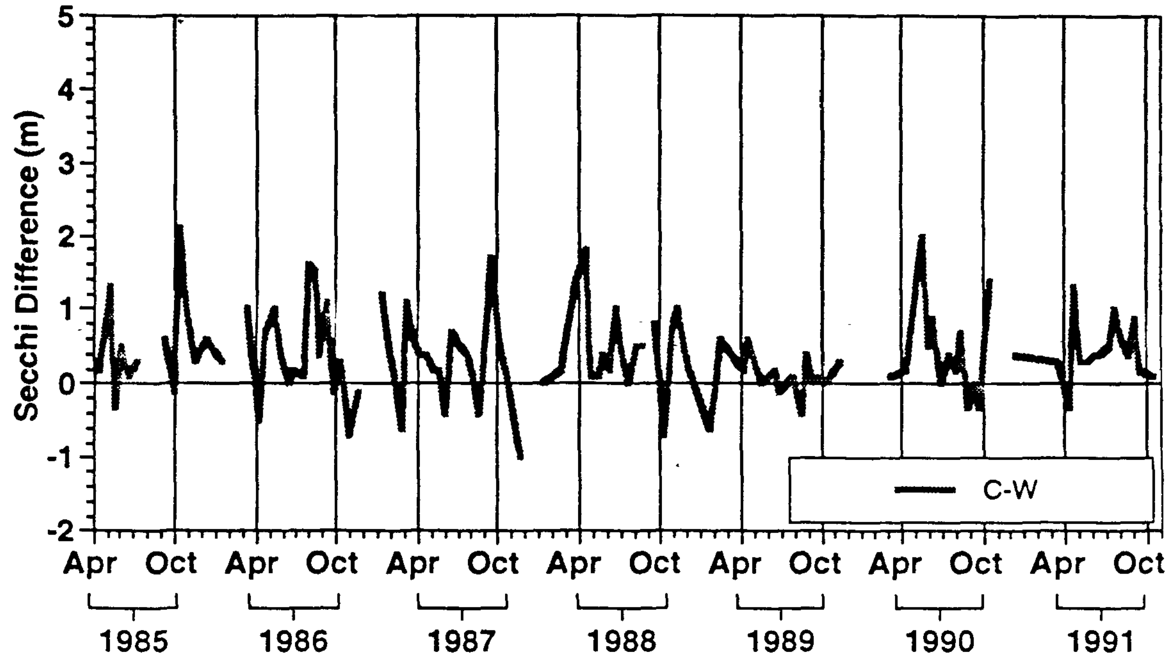


Figure 77. Time plot of differences between central and lateral stations for Surface Salinity in CB4.1 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

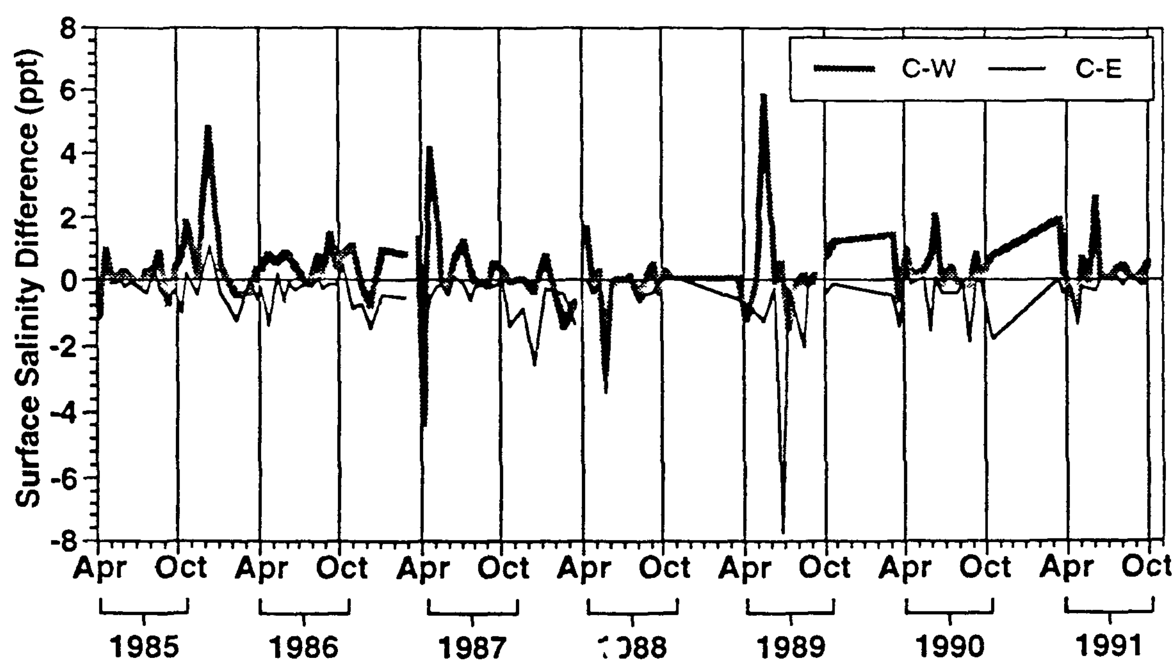


Figure 78. Time plot of differences between central and lateral stations for Surface Salinity in CB4.3 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

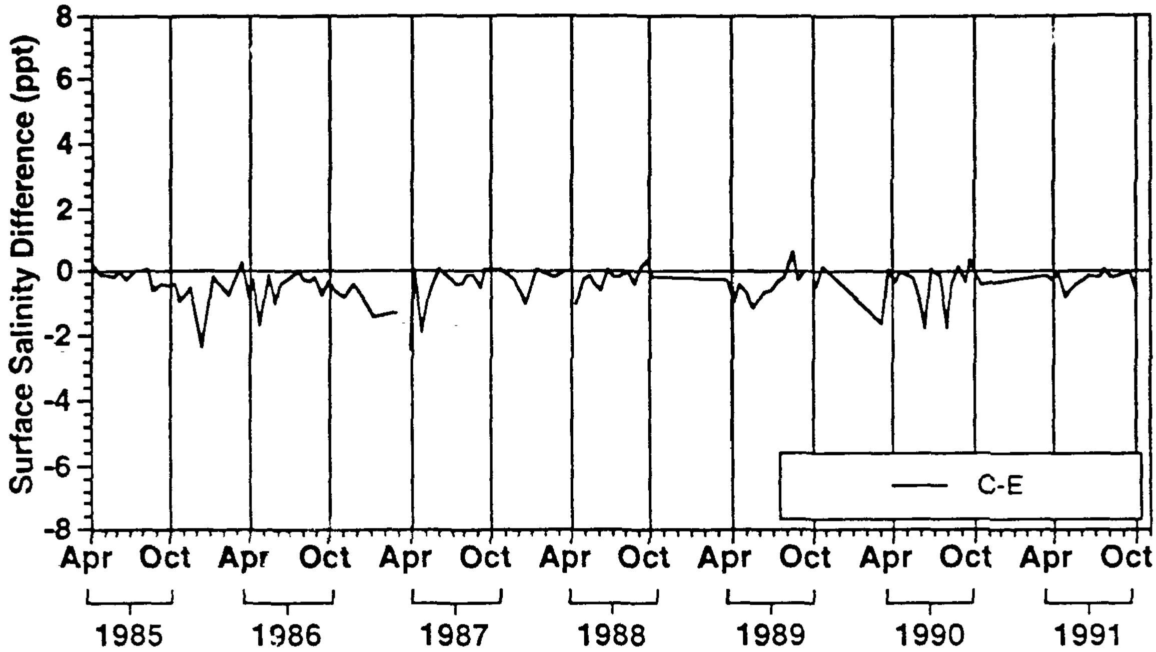


Figure 79. Time plot of differences between central and lateral stations for Surface Salinity in CB5.4 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

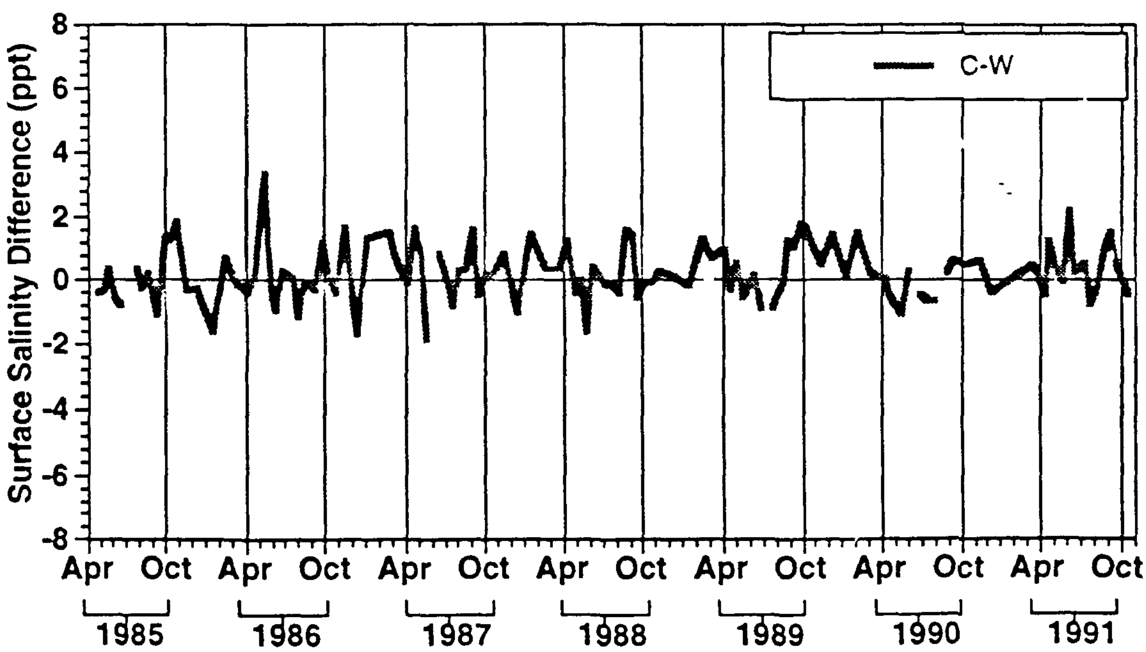


Figure 80. Time plot of differences between central and lateral stations for Surface Salinity in CB7.2 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

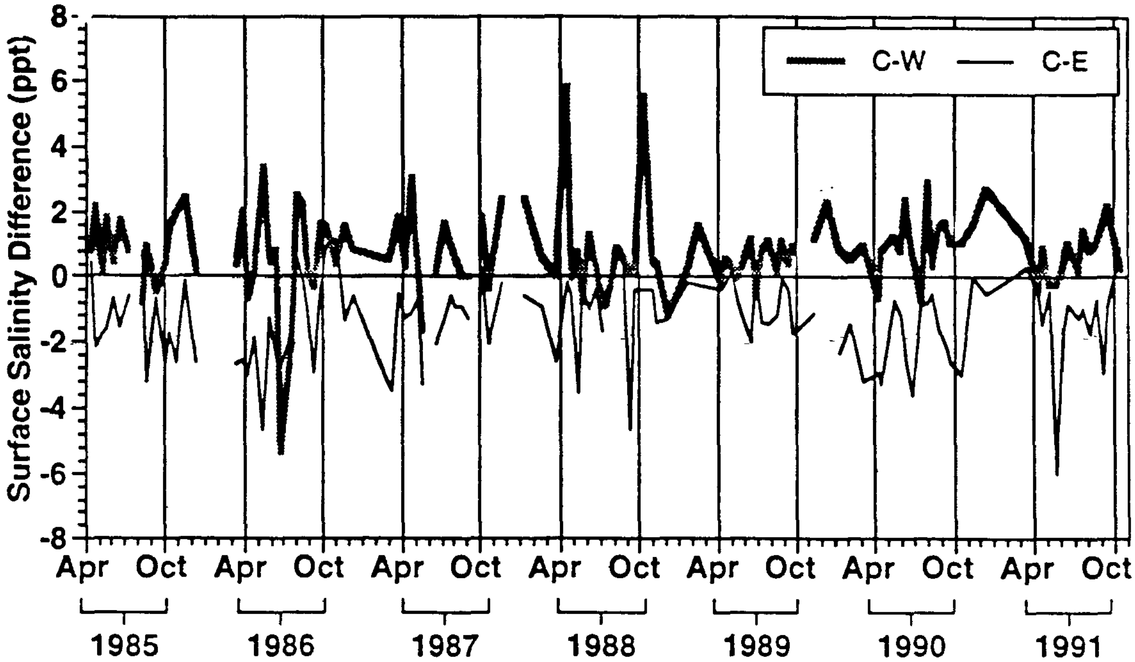


Figure 81. Time plot of differences between central and lateral stations for Bottom Layer Salinity in CB3.3 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

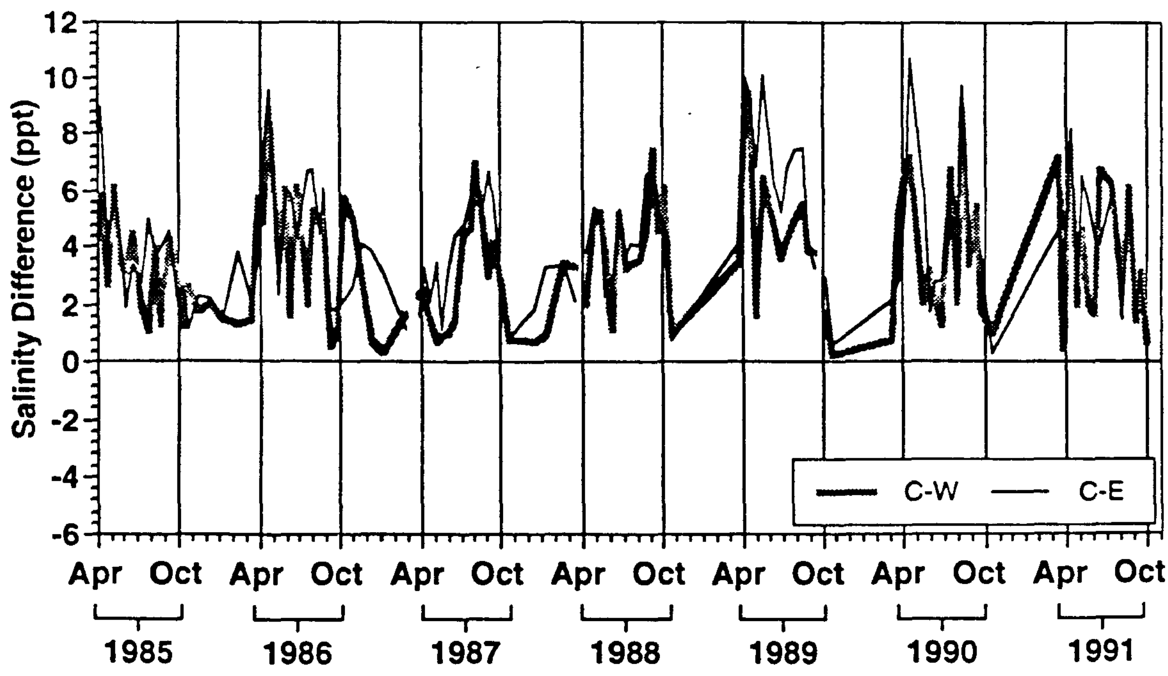


Figure 82. Time plot of differences between central and lateral stations for Bottom Layer Salinity in CB4.1 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

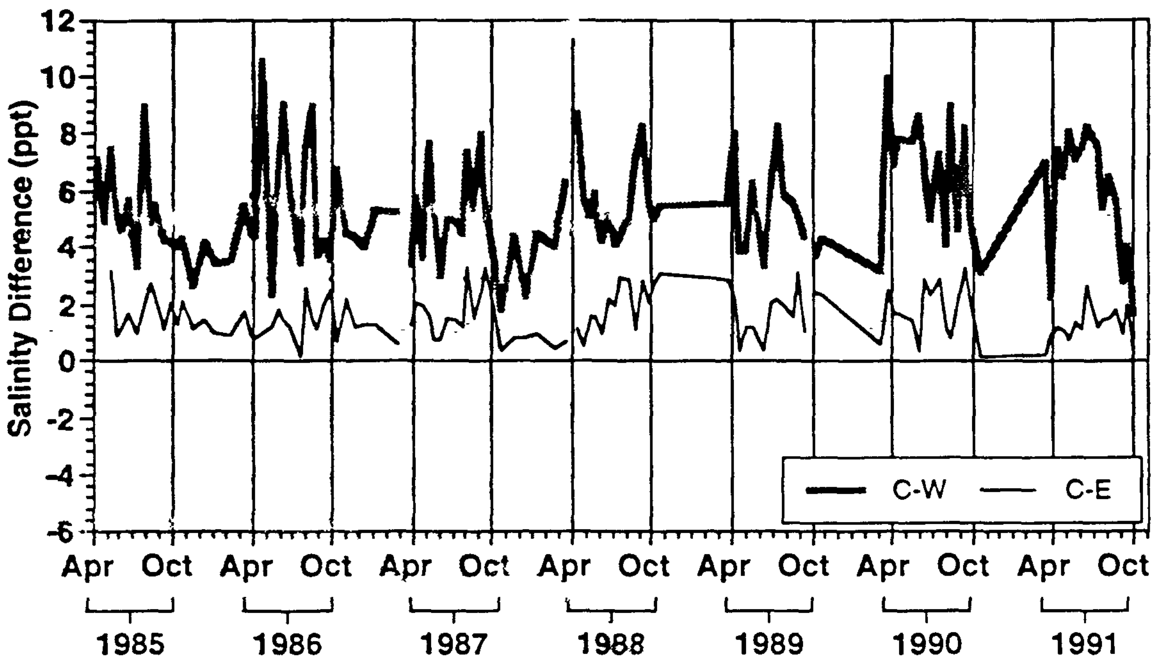


Figure 83. Time plot of differences between central and lateral stations for Bottom Layer Salinity in CB4.2 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

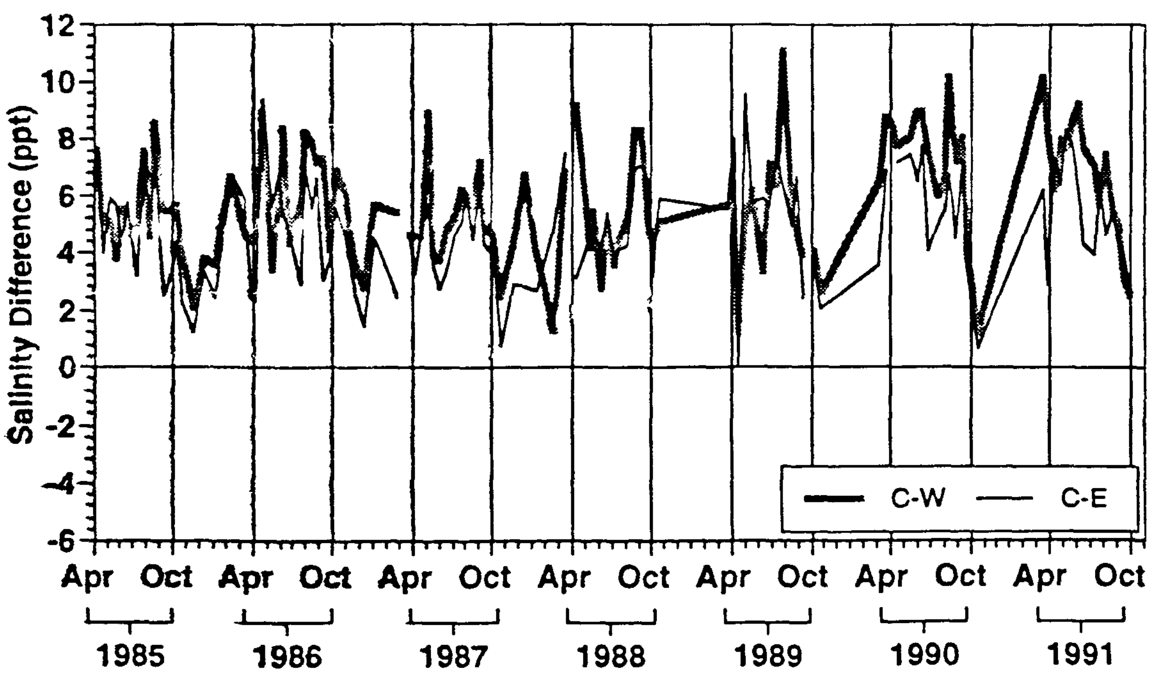


Figure 84. Time plot of differences between central and lateral stations for Bottom Layer Salinity in CB4.3 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

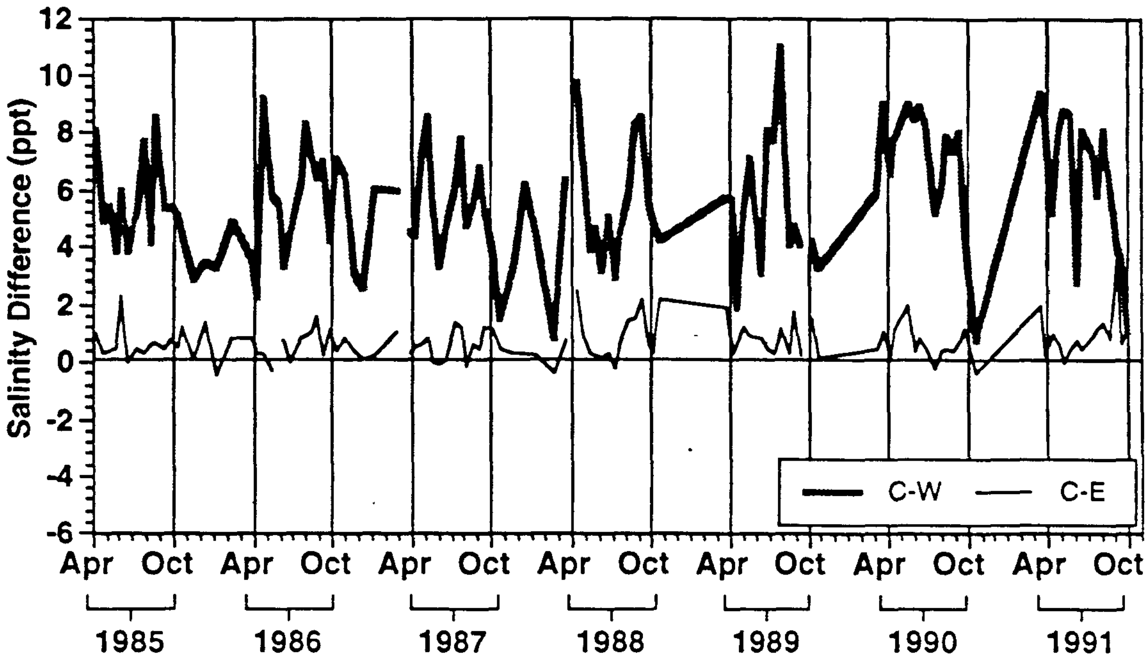


Figure 85. Time plot of differences between central and lateral stations for Bottom Layer Salinity in CB5.1 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

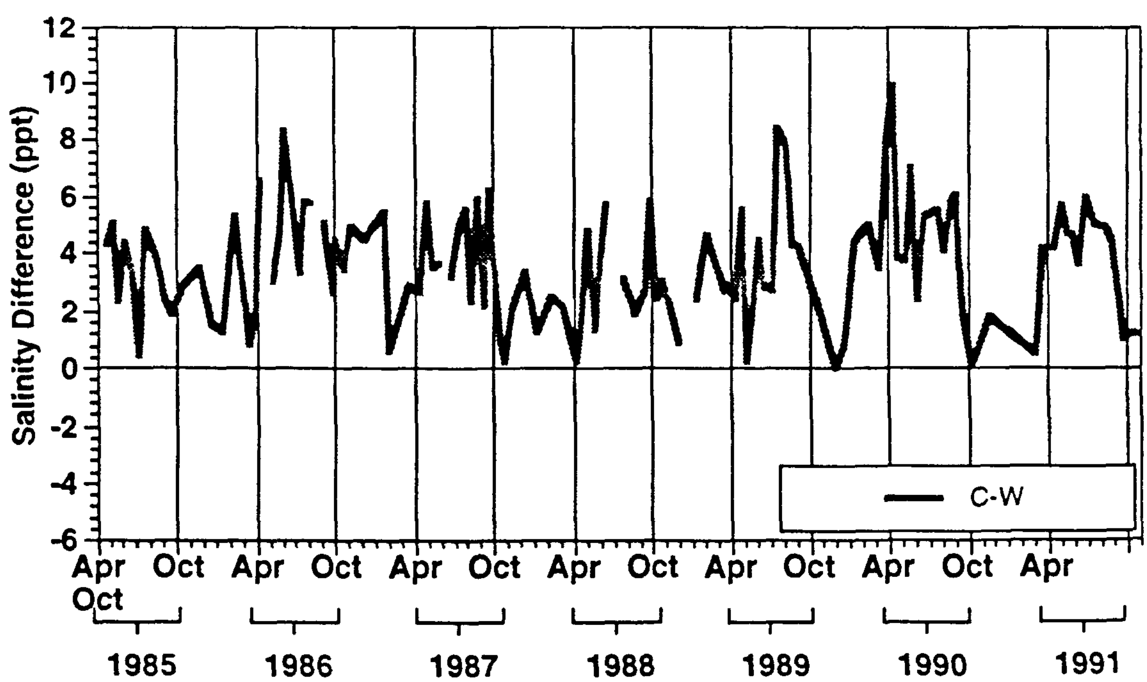


Figure 86. Time plot of differences between central and lateral stations for Bottom Layer Salinity in CB5.4 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

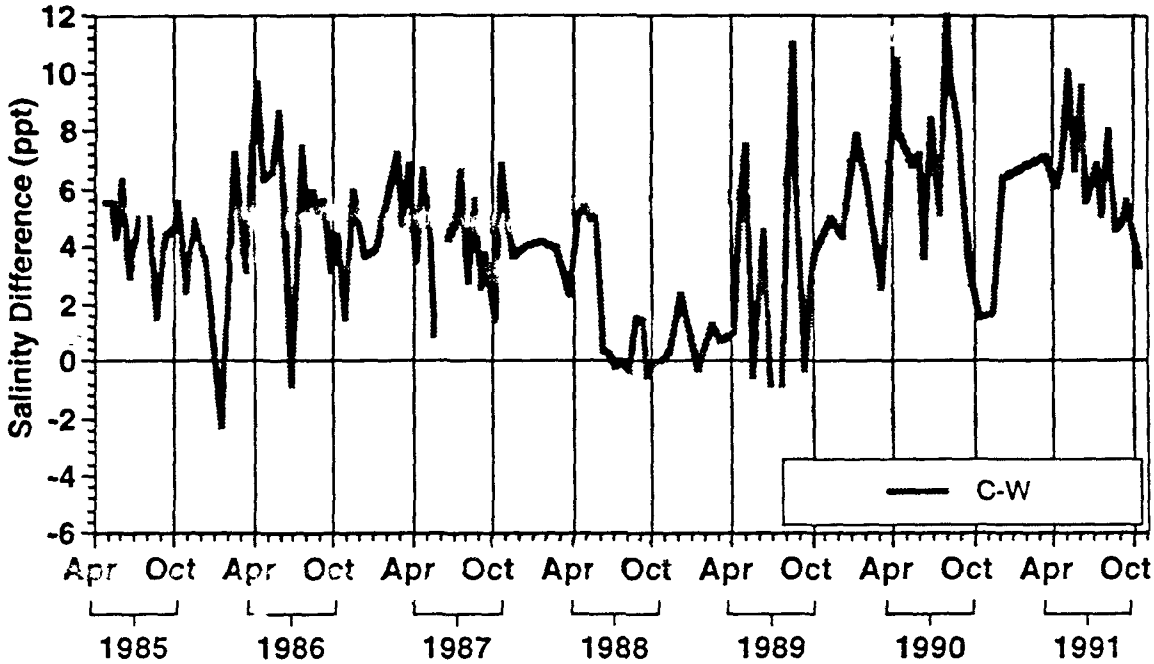


Figure 87. Time plot of differences between central and lateral stations for Bottom Layer Salinity in CB7.2 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

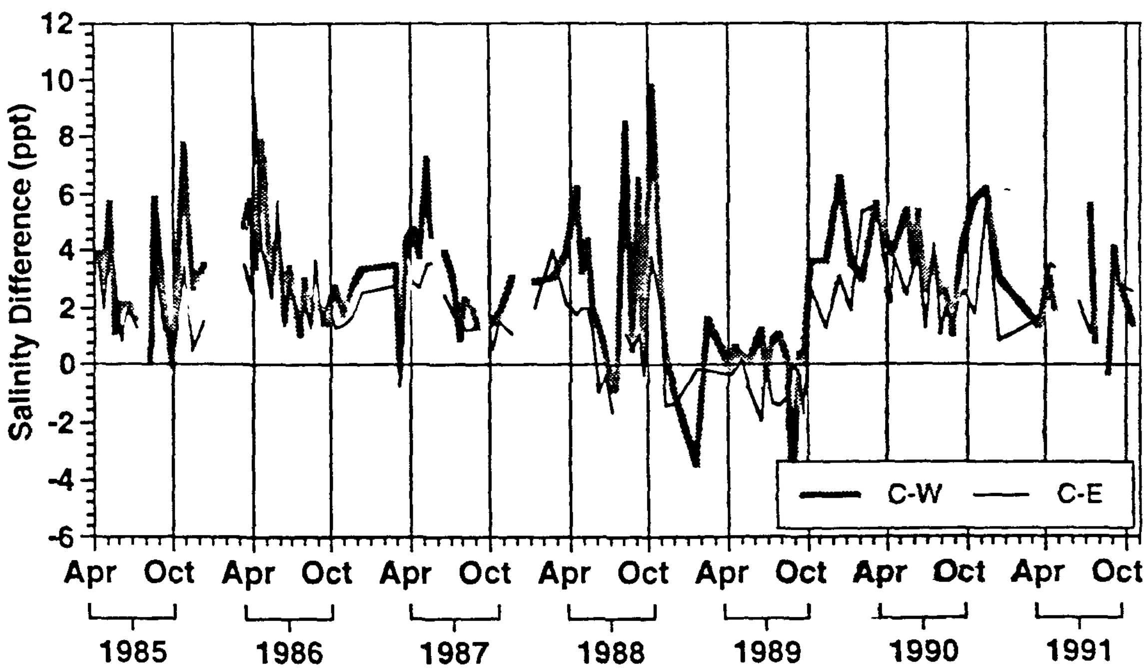


Figure 88. Time plot of differences between central and lateral stations for Bottom same-depth Salinity in CB4.1 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

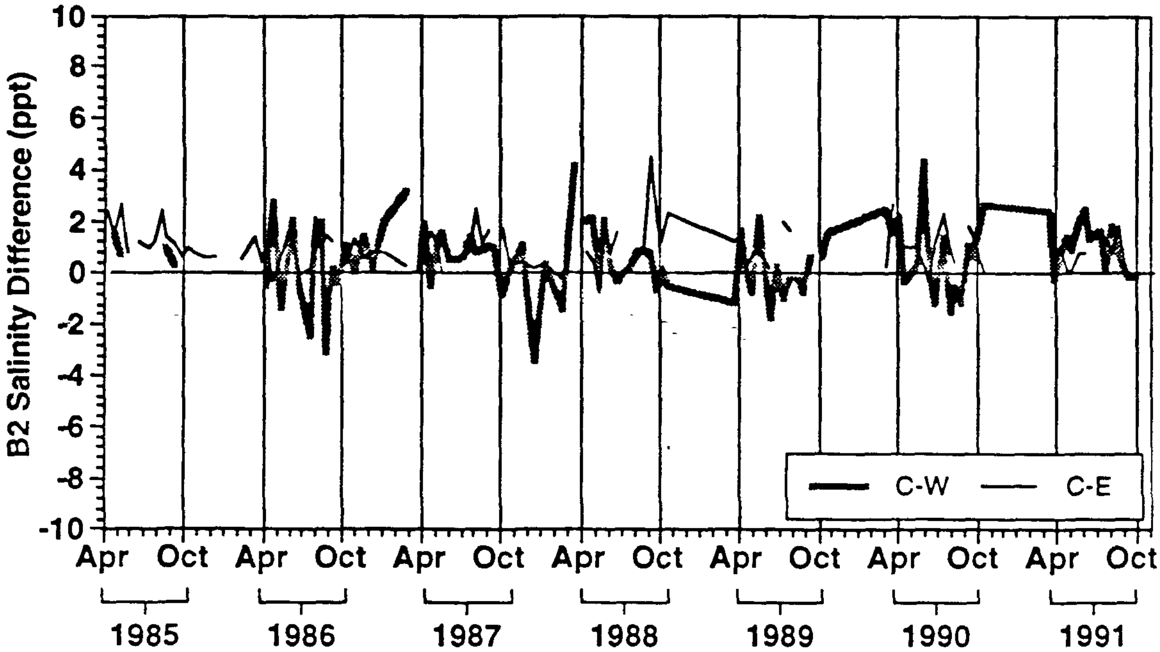


Figure 89. Time plot of differences between central and lateral stations for Bottom same-depth Salinity in CB4.2 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

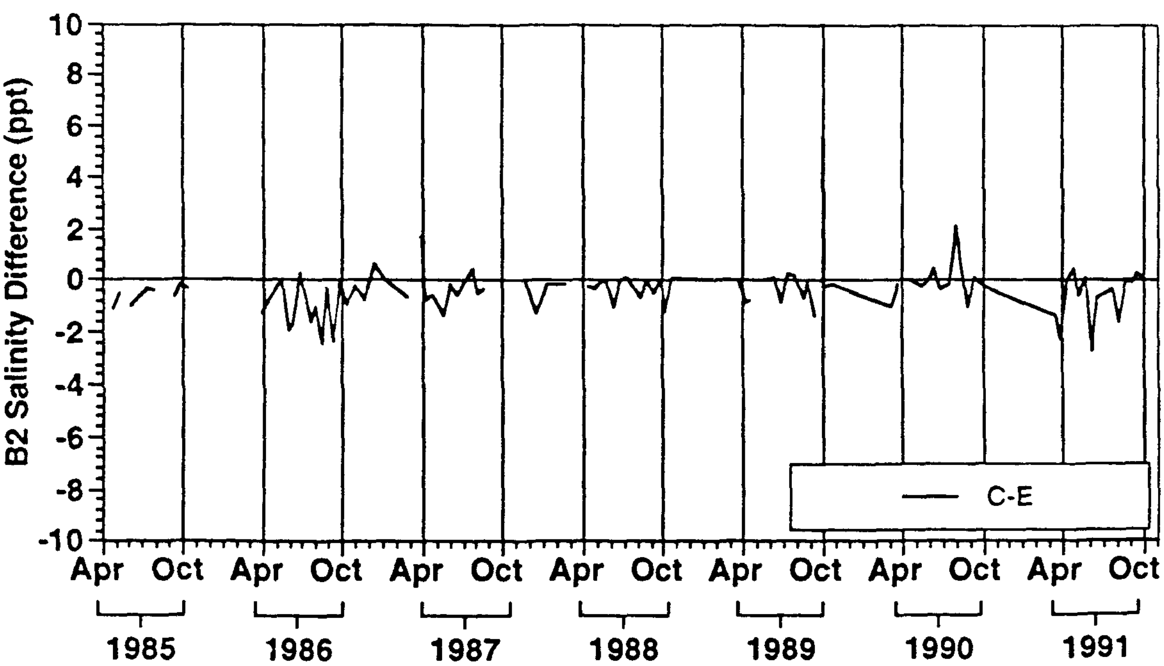


Figure 90. Time plot of differences between central and lateral stations for Bottom same-depth Salinity in CB4.3 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

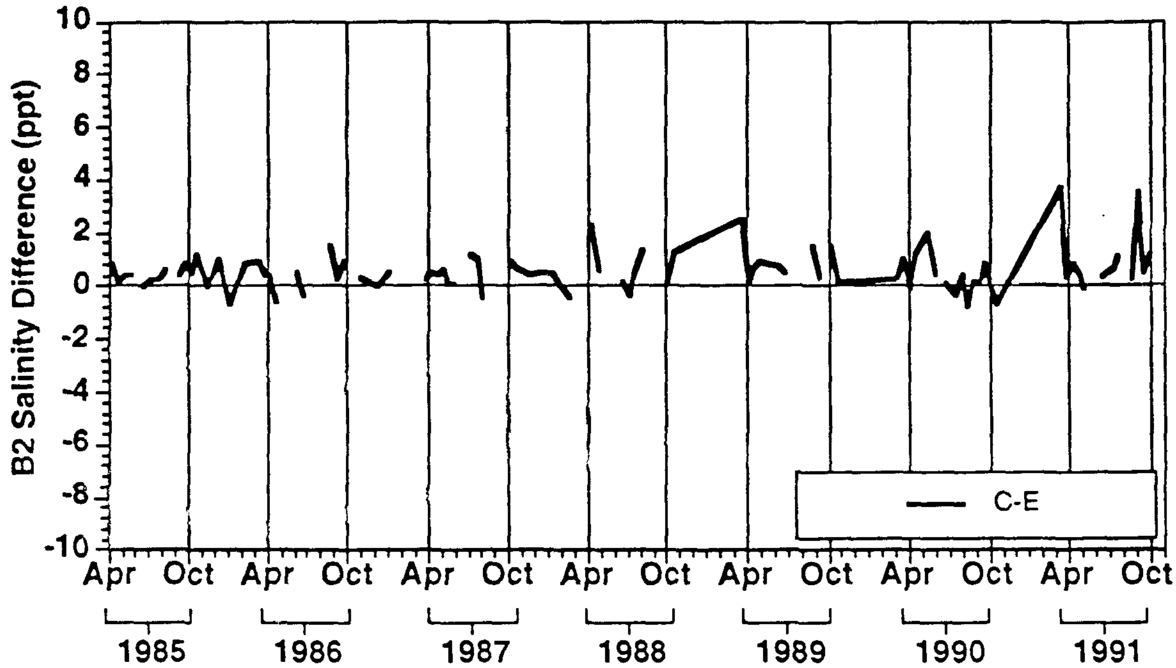


Figure 91. Time plot of differences between central and lateral stations for Bottom same-depth Salinity in CB5.1 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

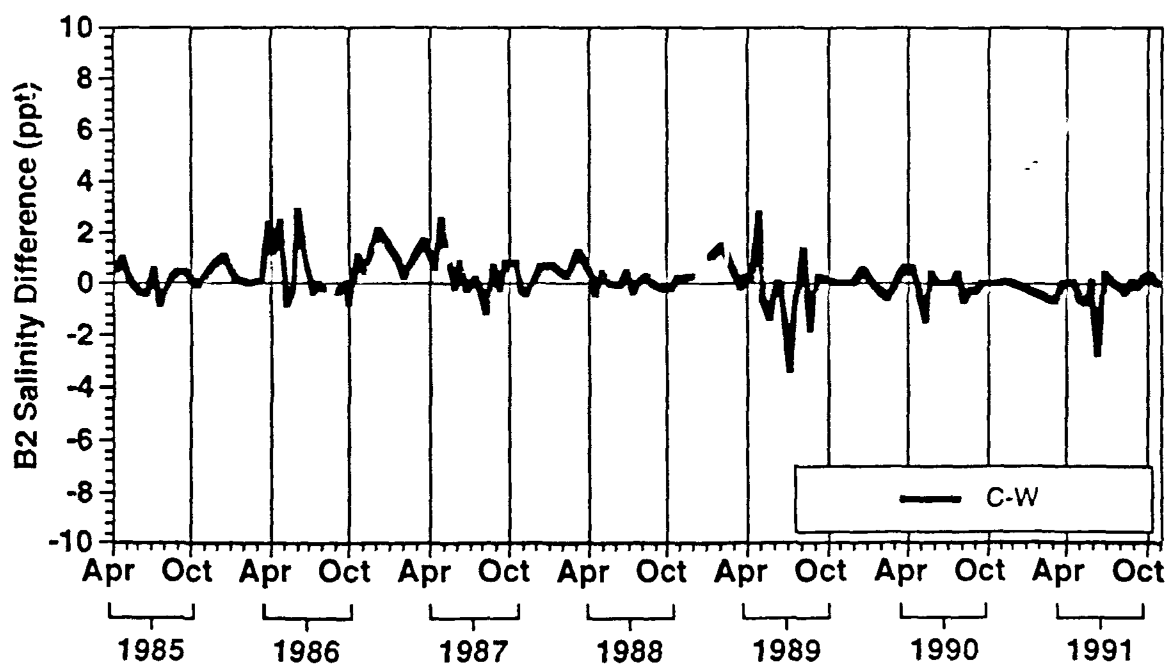


Figure 92. Time plot of differences between central and lateral stations for Bottom same-depth Salinity in CB7.2 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

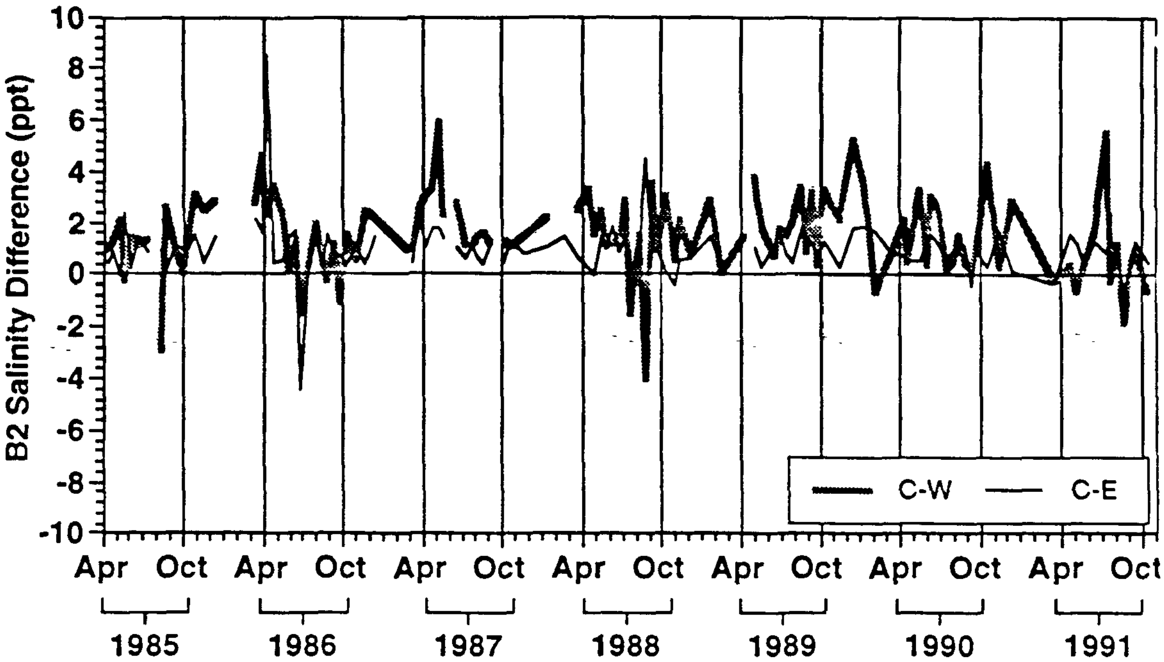


Figure 93. Time plot of differences between central and lateral stations for Surface Dissolved Oxygen in CB4.2 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

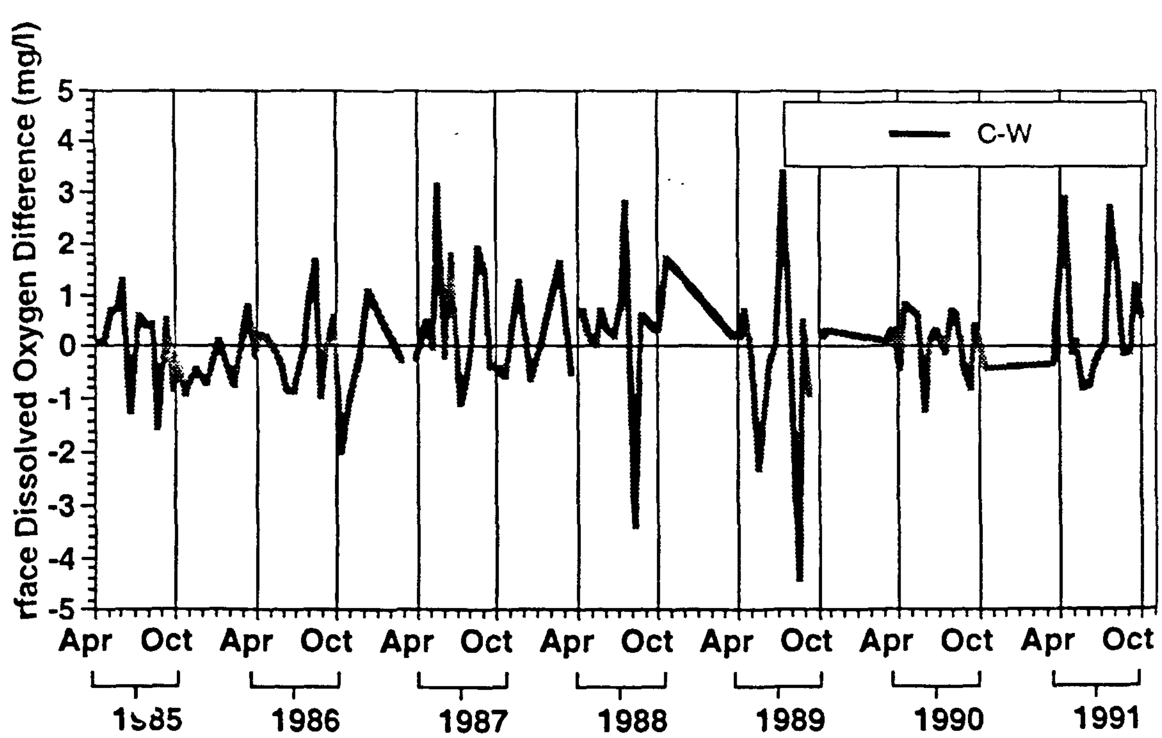


Figure 94. Time plot of differences between central and lateral stations for Surface Dissolved Oxygen in CB7.2 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

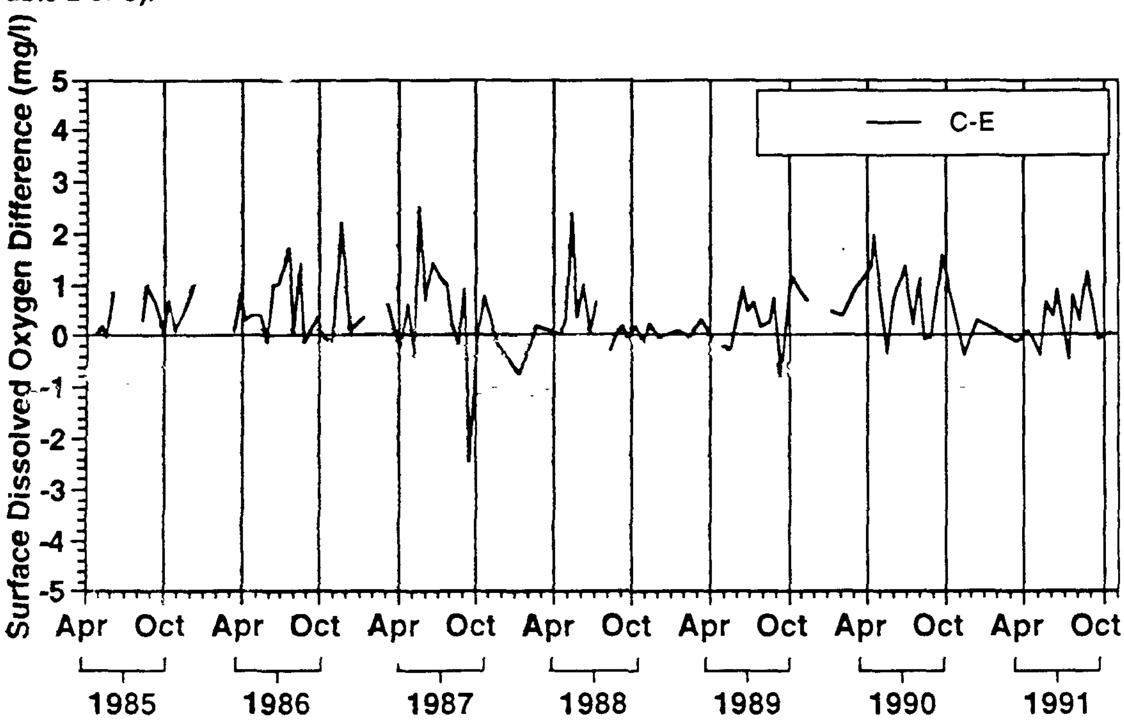


Figure 95. Time plot of differences between central and lateral stations for Bottom Layer Dissolved Oxygen in CB3.3 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

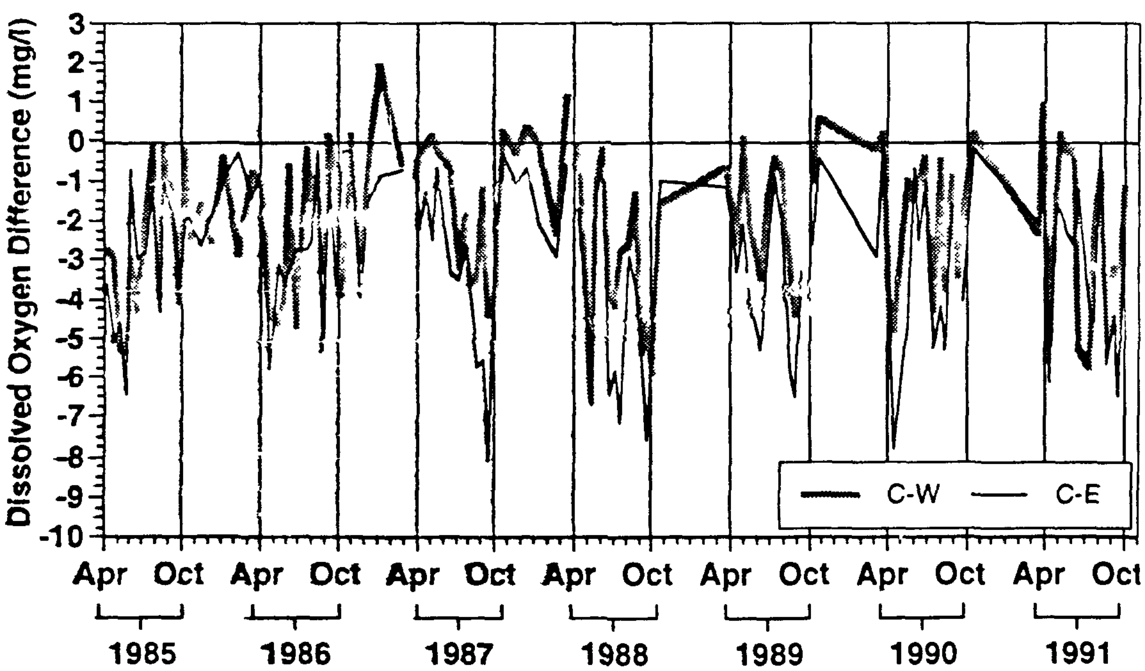


Figure 96. Time plot of differences between central and lateral stations for Bottom Layer Dissolved Oxygen in CB4.1 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

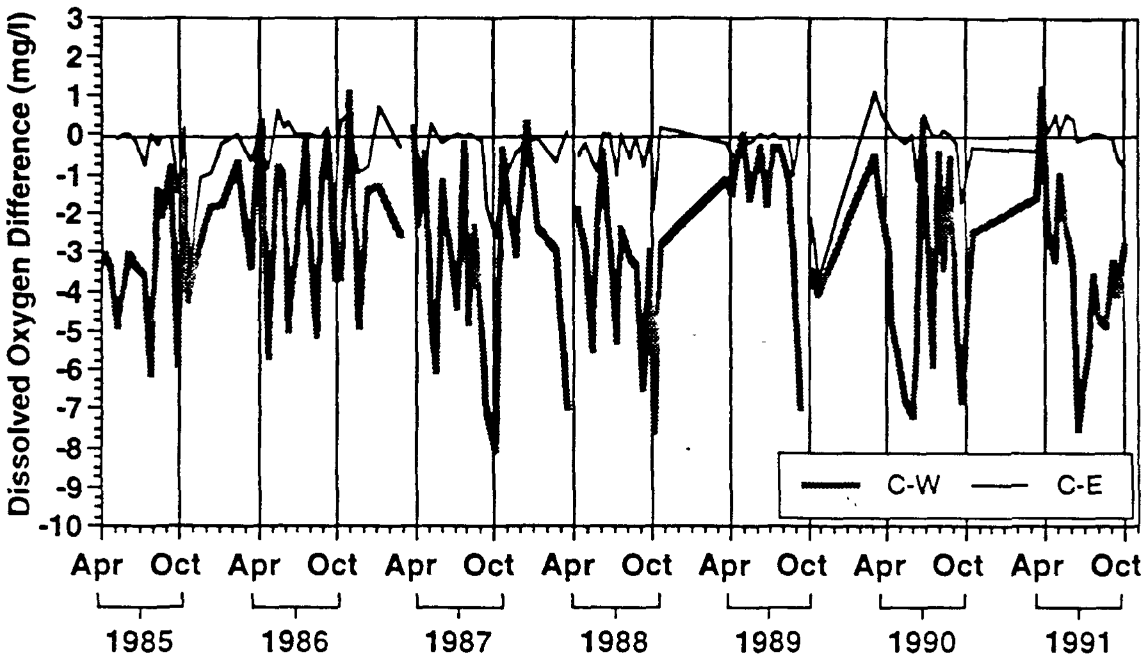


Figure 97. Time plot of differences between central and lateral stations forBottom Layer Dissolved Oxygen in CB4.2 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

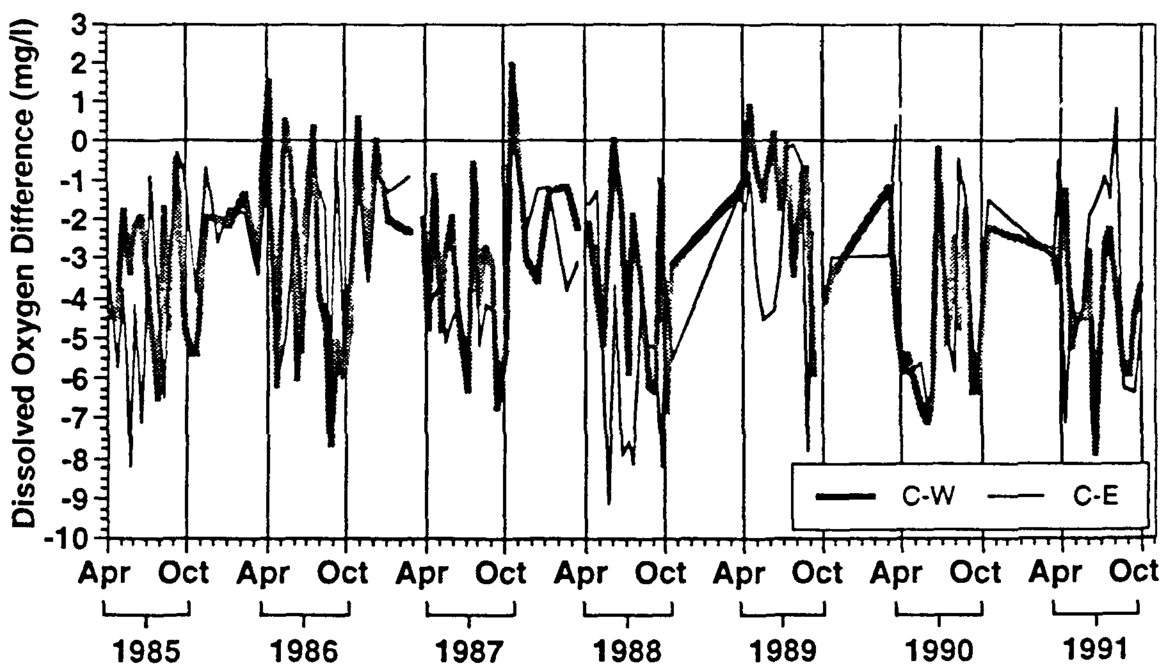


Figure 98. Time plot of differences between central and lateral stations for Bottom Layer Dissolved Oxygen in CB4.3 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

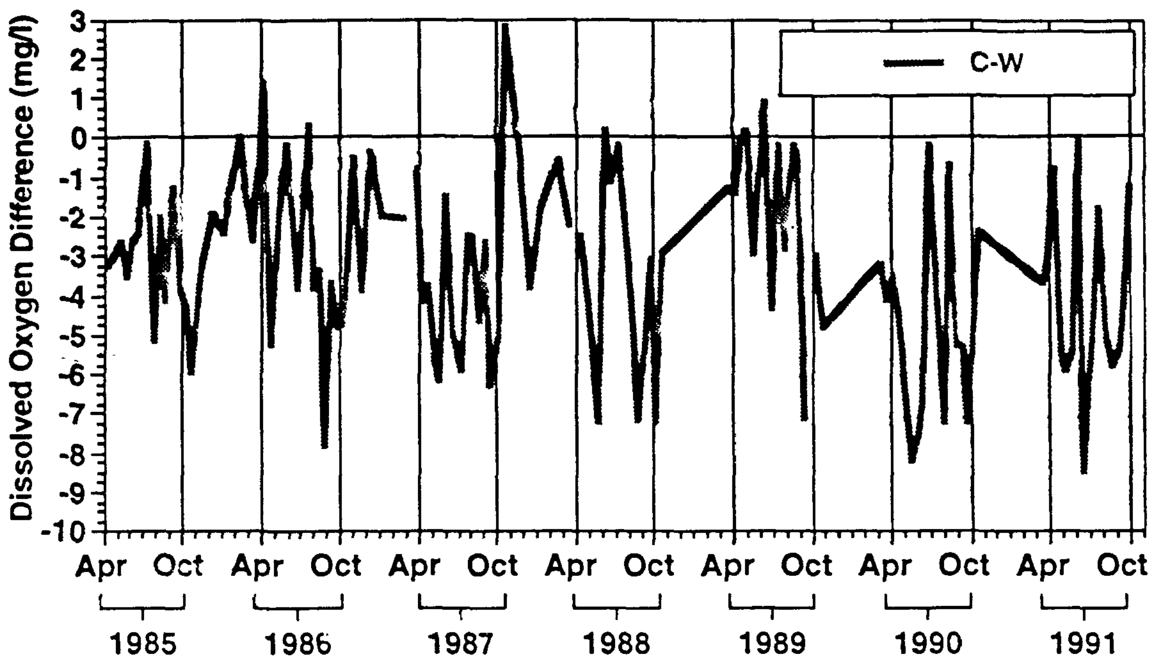


Figure 99. Time plot of differences between central and lateral stations for Bottom Layer Dissolved Oxygen in CB5.1 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

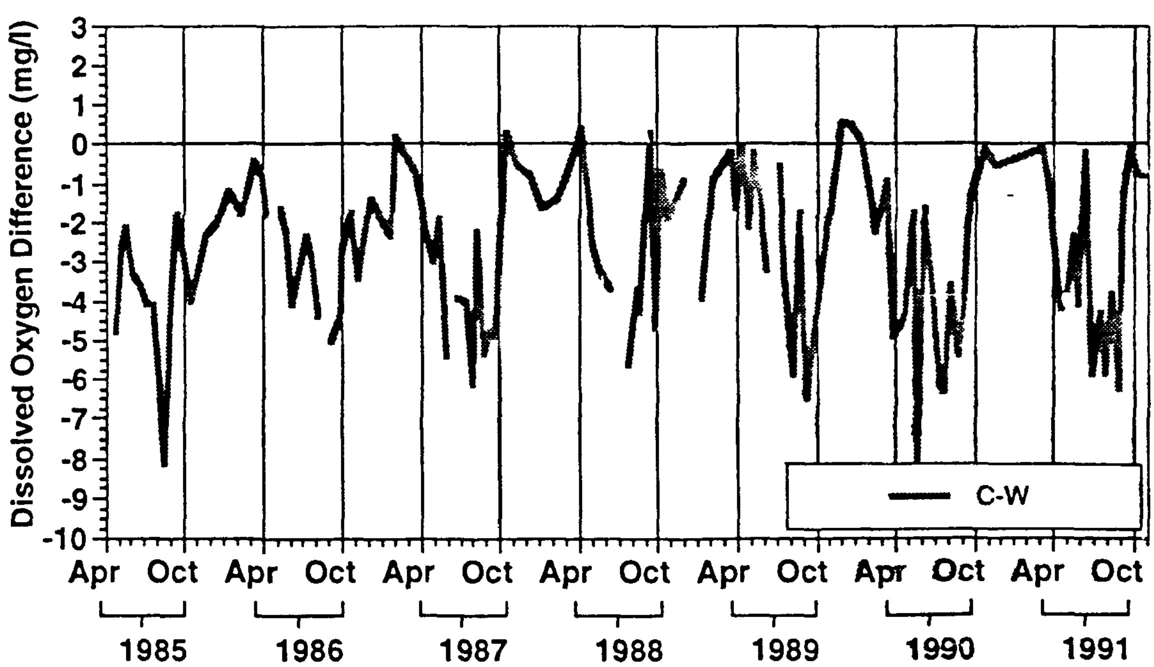


Figure 100. Time plot of differences between central and lateral stations for Bottom Layer Dissolved Oxygen in CB5.4 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

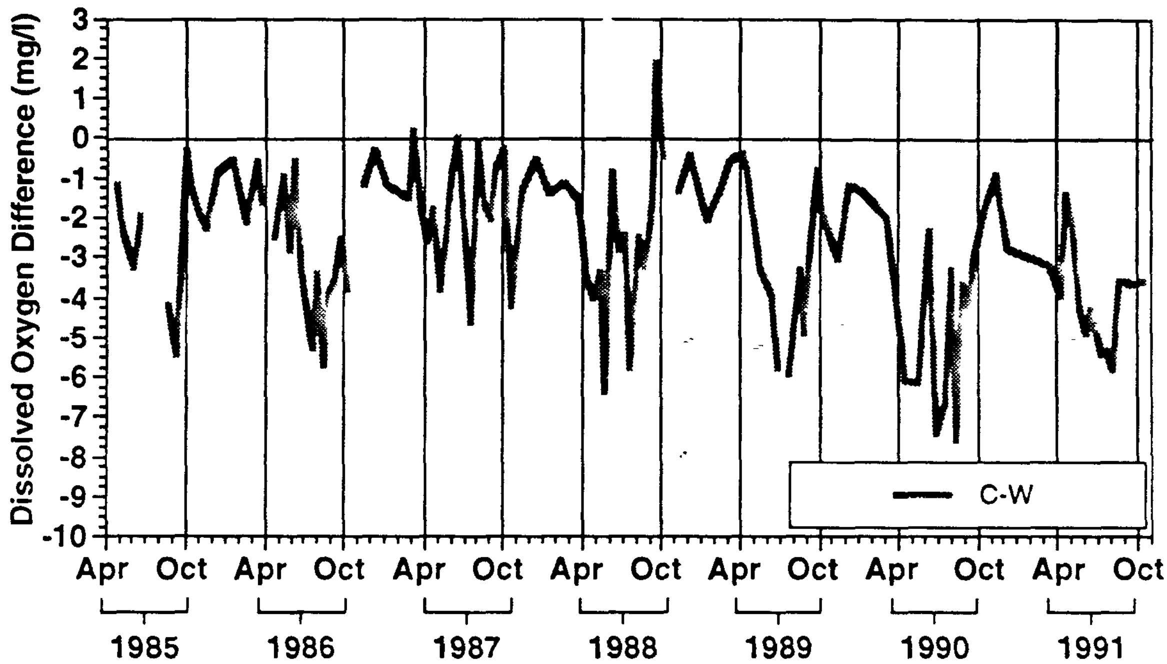


Figure 101. Time plot of differences between central and lateral stations for Bottom Layer Dissolved Oxygen in CB7.2 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

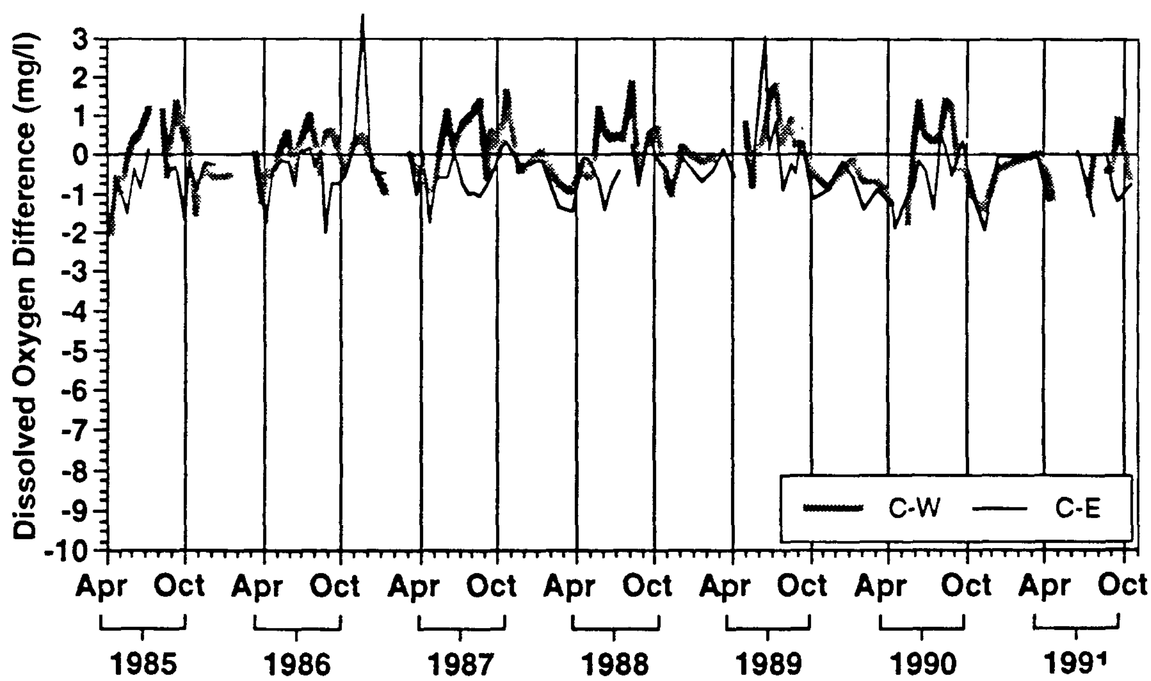


Figure 102. Time plot of differences between central and lateral stations for Bottom same-depth Dissolved Oxygen in CB4.2 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

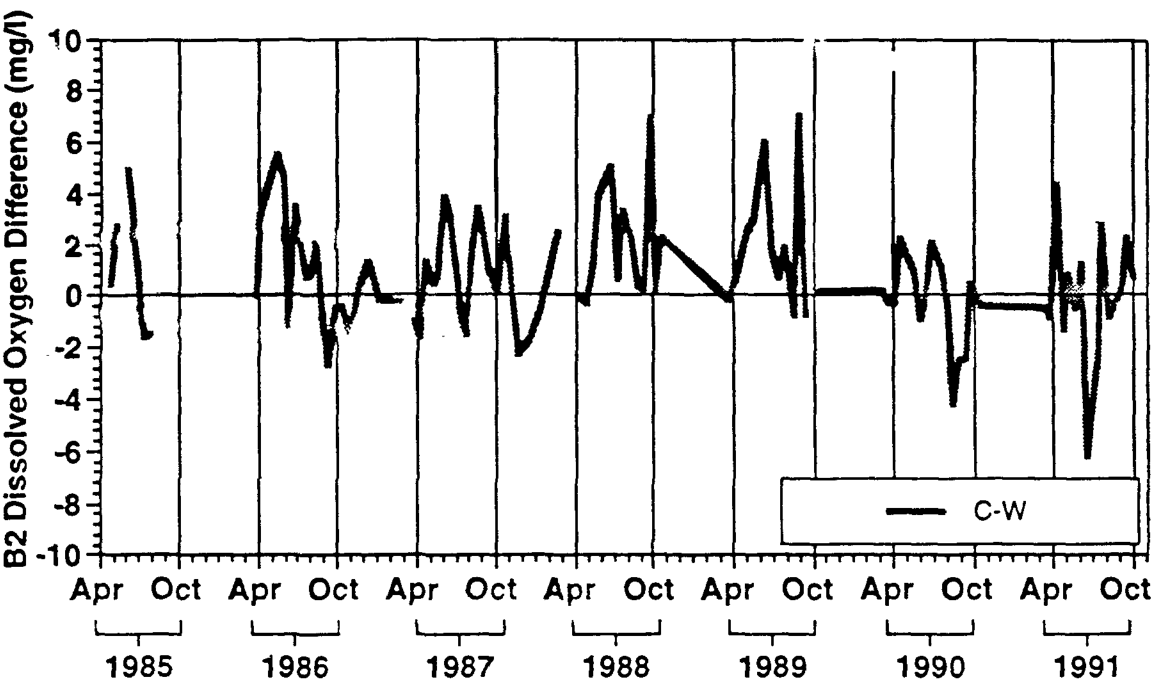


Figure 103. Time plot of differences between central and lateral stations for Bottom same-depth Dissolved Oxygen in CB4.3 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

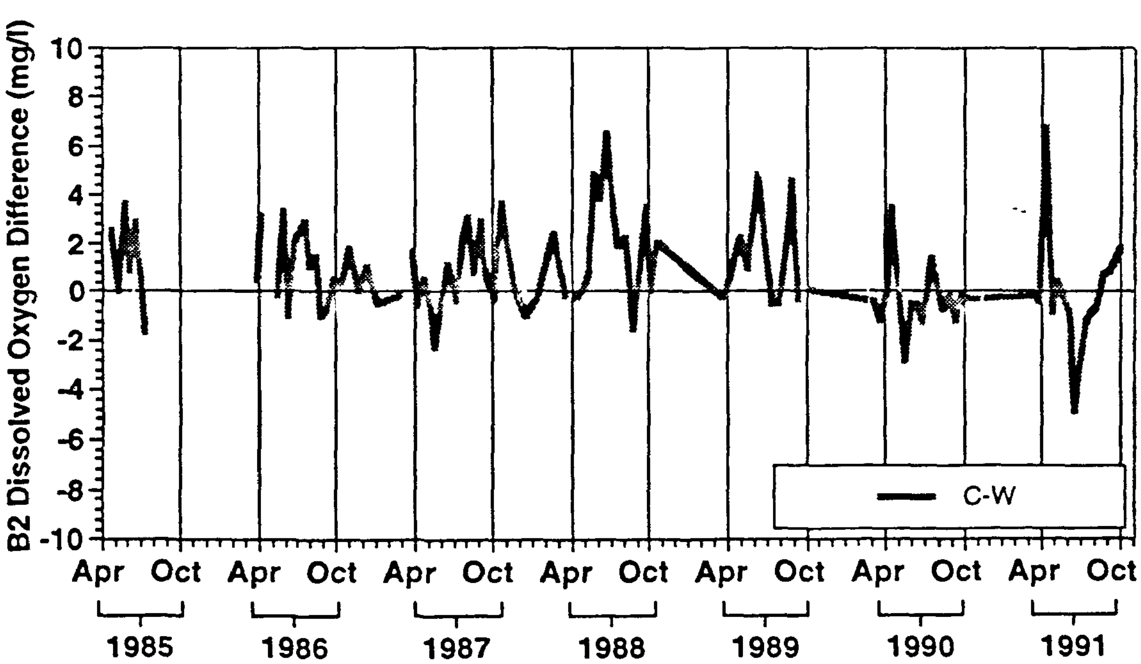


Figure 104. Time plot of differences between central and lateral stations for Bottom same-depth Dissolved Oxygen in CB5.4 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).

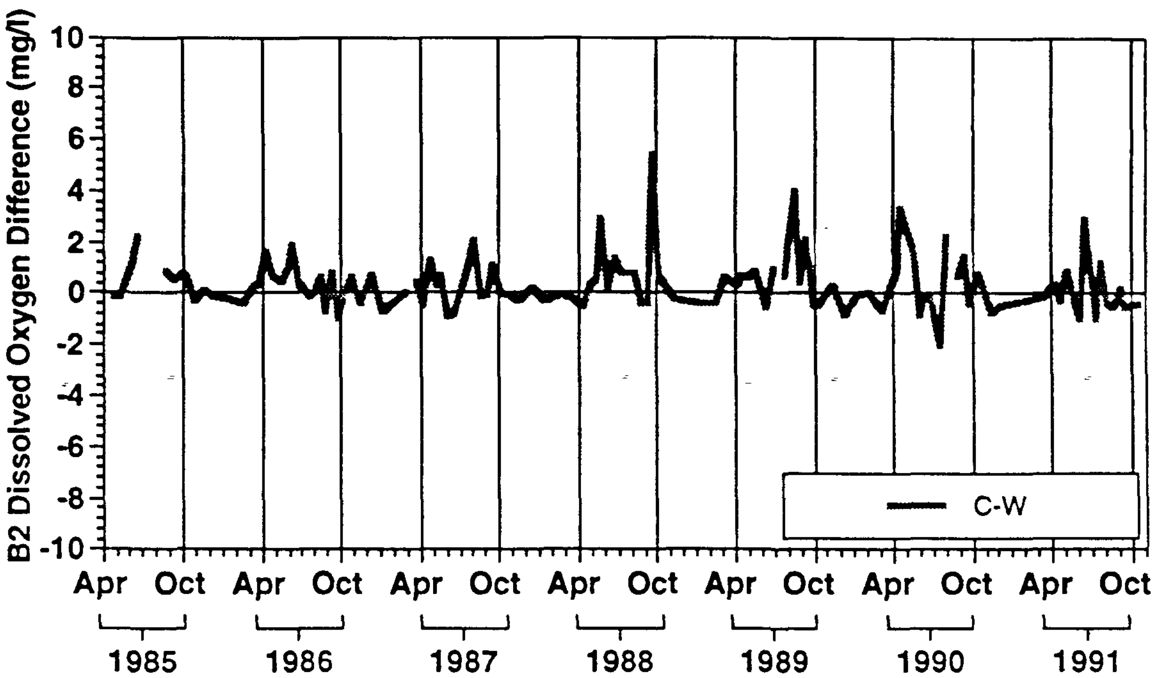
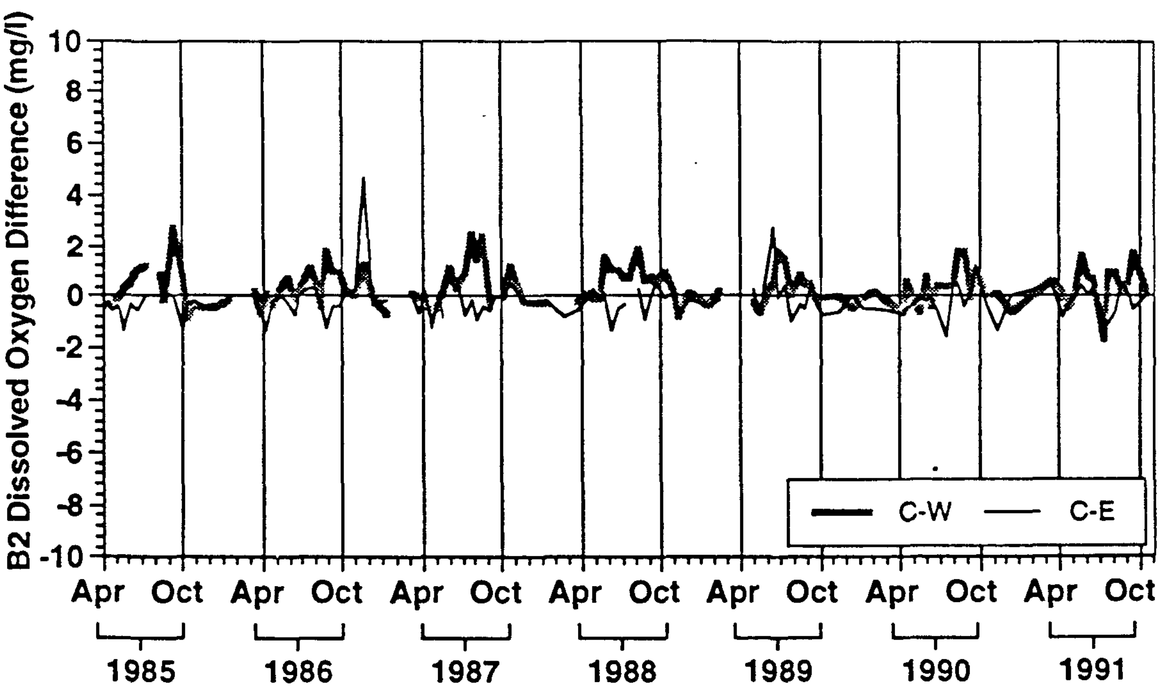


Figure 105. Time plot of differences between central and lateral stations for Bottom same-depth Dissolved Oxygen in CB7.2 1985-1991. All parameters and transects shown had statistically significant differences (see Table 2 or 3).



APPENDIX I

TABLE A1-1. Annual seasonal medians by station for all variables and time periods analyzed.

CENTER-WEST:

SURFACE TOTAL PHOSPHORUS, APRIL-OCTOBER

YEAR	3.3C	3.3W	4.1C	4.1W	4.2C	4.2W	4.3C	4.3W	5.1	5.1W	5.4	5.4W	7.2	6.3 (W)
1985	0.0488	0.0503	0.0405	0.0427	0.0265	0.0511	0.0263	0.0549	0.06	0.06	0.022	0.025	0.021	0.025
1986	0.0545	0.0595	0.043	0.0495	0.028	0.0435	0.0325	0.043	0.055	0.07	0.023	0.025	0.021	0.028
1987	0.051	0.0577	0.0398	0.0505	0.0341	0.0442	0.0286	0.034	0.06	0.065	0.026	0.0275	0.023	0.0275
1988	0.0349	0.0493	0.0252	0.0387	0.0191	0.0306	0.0213	0.0304	0.06	0.07	0.0255	0.03	0.02	0.024
1989	0.0449	0.0493	0.0314	0.0466	0.0285	0.0342	0.0266	0.0303	0.06	0.06	0.026	0.0335	0.035	0.033
1990	0.0423	0.0459	0.033	0.0467	0.0307	0.0407	0.0271	0.0325	0.041	0.0409	0.031	0.033	0.025	0.026
1991	0.0417	0.0514	0.033	0.0436	0.0279	0.0364	0.028	0.0339	0.027	0.0328	0.025	0.038	0.03	0.032

SURFACE ORTHOPHOSPHATE, APRIL-OCTOBER

YEAR	3.3C	3.3W	4.1C	4.1W	4.2C	4.2W	4.3C	4.3W	5.1	5.1W	5.4	5.4W	7.2	6.3 (W)
1985	0.00635	0.0078	0.0047	0.00725	0.00475	0.00635	0.00465	0.00685	0.01	0.01	0.01	0.01	0.01	0.01
1986	0.0063	0.0065	0.00565	0.0056	0.003	0.00475	0.00445	0.00485	0.008	0.008	0.01	0.01	0.0105	0.0105
1987	0.00765	0.0094	0.00465	0.0065	0.0032	0.0046	0.004	0.0063	0.007	0.008	0.01	0.01	0.0105	0.0105
1988	0.00795	0.00865	0.0038	0.0065	0.0036	0.0049	0.00375	0.00405	0.008	0.006	0.001	0.0015	0.002	0.0023
1989	0.00755	0.0069	0.00485	0.0061	0.00435	0.0065	0.0051	0.0068	0.006	0.006	0.0012	0.0015	0.003	0.003
1990	0.0077	0.0076	0.00475	0.00925	0.00375	0.0067	0.004	0.0049	0.004	0.004	0.0014	0.0029	0.003	0.003
1991	0.0039	0.00715	0.00335	0.0045	0.0027	0.00415	0.00305	0.00365	0.00285	0.005	0.0032	0.0034	0.0031	0.0031

SURFACE TOTAL NITROGEN, APRIL-OCTOBER

YEAR	3.3C	3.3W	4.1C	4.1W	4.2C	4.2W	4.3C	4.3W	5.1	5.1W	5.4	5.4W	7.2	6.3 (W)
1985	0.745	0.873	0.664	0.747	0.6035	0.7105	0.6015	0.7505	0.685	0.645	0.5475	0.6	0.472	0.534
1986	0.8614	0.906	0.7419	0.741	0.614	0.643	0.5411	0.6418	0.59	0.67	0.516	0.593	0.4445	0.473
1987	0.868	0.9505	0.7604	0.791	0.6183	0.7204	0.6191	0.6447	0.62	0.67	0.5575	0.6375	0.4665	0.5075
1988	1.15	1.0065	0.7635	1.007	0.6405	0.799	0.592	0.821	0.77	0.83	0.564	0.683	0.4625	0.514
1989	1.163	1.142	1.0195	1.062	0.8905	1.044	0.9285	0.962	0.91	0.825	0.674	0.714	0.575	0.62
1990	1.019	1.039	0.7615	1.0705	0.7045	0.878	0.614	0.8555	0.645	0.705	0.551	0.581	0.498	0.508
1991	0.8145	0.856	0.663	0.7985	0.584	0.709	0.5805	0.651	.		0.563	0.688	0.518	0.517

SURFACE DISSOLVED INORGANIC NITROGEN, APRIL-OCTOBER

YEAR	3.3C	3.3W	4.1C	4.1W	4.2C	4.2W	4.3C	4.3W	5.1	5.1W	5.4	5.4W	7.2	6.3 (W)
1985	0.1463	0.1785	0.111	0.1335	0.0807	0.1089	0.0917	0.1261	0.09	0.145	0.0525	0.041	0.04	0.041
1986	0.1426	0.2155	0.149	0.1156	0.0794	0.0565	0.0706	0.0686	0.076	0.07	0.062	0.044	0.0465	0.0945
1987	0.258	0.226	0.123	0.1599	0.1259	0.056	0.0725	0.0985	0.065	0.08	0.064	0.0655	0.038	0.051
1988	0.2555	0.332	0.201	0.1985	0.1095	0.1525	0.0915	0.1385	0.122	0.098	0.037	0.031	0.0262	0.0404
1989	0.6005	0.597	0.436	0.46	0.3375	0.435	0.365	0.389	0.274	0.296	0.0965	0.0699	0.0172	0.0161
1990	0.3835	0.3665	0.276	0.223	0.1995	0.1575	0.177	0.1265	0.1115	0.118	0.0615	0.0139	0.0121	0.0121
1991	0.0666	0.1105	0.068	0.0611	0.0583	0.0739	0.0319	0.0415	0.05145	0.0741	0.0164	0.0064	0.0064	0.0068

TABLE A1-1 (cont). Annual seasonal medians by station for all variables and time periods analyzed.

CENTER-WEST:

SURFACE TOTAL SUSPENDED SOLIDS, APRIL-OCTOBER

YEAR	3.3C	3.3W	4.1C	4.1W	4.2C	4.2W	4.3C	4.3W	5.1	5.1W	5.4	5.4W	7.2	6.3 (W)
1985	6	7.9	6.05	6.8	7	7.6	5.9	6.9	10	7.5	6	6.8	8.5	10
1986	6.9	8.2	5.25	6.5	4.2	5.75	4	5.8	4	6	3.5	4	3.5	6
1987	5.75	7.2	4.75	5.6	4.05	5.1	4.2	4 85	5 5	5.5	6	7	5.5	8.5
1988	7.4	7.5	5.75	7.5	4.4	6.95	4 75	6	9	10.5	12.5	17.5	9.5	13
1989	5.8	6.5	4.5	8.9	3.9	6 6	4.65	5.5	8	10	9	10.2	9.2	16.2857
1990	7.85	8.05	4.75	8.05	4.75	6.05	4.2	5.9	6 2	9	8.2	10	9 2	9
1991	8.35	9.35	6.65	7.35	5	6 05	4.45	5.35	4.1	6.15	7	13	8	10

SURFACE CHLOROPHYLL *A*, APRIL-OCTOBER

YEAR	3.3C	3.3W	4.1C	4.1W	4.2C	4.2W	4.3C	4.3W	5.1	5.1W	5.4	5.4W	7.2	6.3 (W)
1985	15.67	16.68	11.49	15.09	7.30	10	7.5111	10	5 8	6	5.5536	7.4493	3.7344	6.2707
1986	19.14	15.22	10.45	11.51	5.84	11.22	5.56	10.053	5.7	7.9	6.7	8.1453	4.9	6.2
1987	15.6	16.2	11	13.25	10.05	13.6	10.45	12.4	6 4	8.95	11.65	11.7	5.85	8.4
1988	13.5	12.3	10.1	13.9	8.8	12	7 4	10	9.3	14 4	14.0	9.6	6.25	9.45
1989	13.5	11.4	11.2	17.9	10.9	15.6	8 75	13.6	9.15	8.5	8.4	11.2	9.2	10.4
1990	13.65	14.45	8.5	13.35	9.9	13.85	8.4	11.7	9.2	9.7	11.7747	11.8548	9.2596	11.1339
1991	19.6	10.8	9.75	12.4	8.05	10.2	6.4	11.1	6.95	7.25	6.6803	9.6547	5.4468	5.5322

SECCHI DEPTH, APRIL-OCTOBER

YEAR	3.3C	3.3W	4.1C	4.1W	4.2C	4.2W	4.3C	4.3W	5.1	5.1W	5.4	5.4W	7.2	6.3 (W)
1985	1.1	1	1.7	1.2	1.8	1.25	1.7	1.15	1.8	1.45	2.25	1.65	2.3	1.8
1986	1	0.95	1.6	1.3	2.2	1.2	2	1.5	1.8	1.6	2	1.5	2.2	1.7
1987	1.1	1	1.6	1.3	1.9	1.75	1.9	1.6	2	1.65	1.85	1.4	2.05	1.5
1988	1.15	1.15	1.4	1	1.75	1.25	1.8	1.3	1.6	1.6	1.65	1.3	2.1	1.7
1989	1.1	1.1	1.45	1	1.8	1.3	1 8	1.5	2	1.8	1.8	1.4	1.5	1.5
1990	1	1	1.6	0.9	1.6	1.4	1.8	1.4	1.6	1.45	1.75	1.2	1.8	1.6
' 91	1.2	1	1.6	1.2	1.8	1 2	1.9	1.4	2	1.75	2.05	1.2	2.4	1.9

SURFACE SALINITY, APRIL-OCTOBER

YEAR	3.3C	3.3W	4.1C	4.1W	4.2C	4.2W	4.3C	4.3W	5.1	5.1W	5.4	5.4W	7.2	6.3 (W)
1985	11.6056	11.3106	13.0266	12.9263	13.86	13.9266	14.5991	14.0943	14.59	14.33	16.9521	17.5385	21.0525	19.6519
1986	10.8208	9.1418	12.1347	12.0014	13.2923	12.7953	13.2943	13.293	14.565	14.93	17.281	17.3214	20.8593	19.8535
1987	11.02	10.27	12.165	11.8	12.825	12.365	13.36	13.46	14.535	14.665	16.265	16.09	19.355	18.6313
1988	10.56	10.4	11.675	11.64	12.365	12.33	12.595	12.365	14.46	14.13	15.19	15.385	19.165	19.275
1989	8.855	8.95	9.72	9.08	10.79	10.56	11.145	10.63	11.54	11.41	14 63	13.63	16.9	15.515
1990	7.025	6.995	9.235	8.76	10.01	10.04	10.5	10.63	11.64	11.865	13.585	13.66	17.25	16.65
1991	11.245	11.315	13.025	12.76	13.395	13.36	13 59	13.56	14.495	14.53	15.29	15.69	18.49	17.48

TABLE A1-1 (continued). Annual seasonal medians by station for all variables and time periods analyzed.

CENTER-WEST:

SURFACE SALINITY, SPRING (MARCH-MAY)

YEAR	3.3C	3.3W	4.1C	4.1W	4.2C	4.2W	4.3C	4.3W	5.1	5.1W	5.4	5.4W	7.2	6.3 (W)
1985	8.85	9.88	10.73	10.27	12.23	12.5	12.86	13.06	13.38	13.43	15.07	15.4	19.78	18.1
1986	6.72	7.27	8.8	7.94	10.47	10.11	9.4	10.3	11.34	11.34	13.74	13.73	17.77	16.16
1987	9.4	8.18	11.73	10.63	11.31	11.8	12.13	12.07	12.33	12.69	15.17	14.93	17.61	16.46
1988	9.01	8.25	10.49	10.56	11.8	11.74	12.26	12.07	13.46	13.56	14.98	14.94	17.66	17.66
1989	9.08	9.65	10.17	10.11	10.82	11.47	11.21	11.21	14.23	13.96	16.45	16.74	19.12	18.69
1990	6.15	6.03	8.75	8.09	9.68	9.59	10.17	10.07	10.92	10.72	13.49	13.47	17.03	16.6
1991	7.08	6.74	8.25	8.18	8.85	8.88	9.14	8.98	11.08	11.02	12.97	12.29	16.94	16.22

BOTTOM (B1) SALINITY, SPRING (MARCH-MAY)

YEAR	3.3C	3.3W	4.1C	4.1W	4.2C	4.2W	4.3C	4.3W	5.1	5.1W	5.4	5.4W	7.2	6.3 (W)
1985	17.25	11.54	18.81	13.46	19.45	14.8	19.52	14.43	17.79	14.09	20.33	15.64	24.97	21.01
1986	15.41	11.18	17.9	12.6	18.1	13.09	18.1	13.31	17.04	13.52	21.46	14.2	27.76	22.11
1987	17.48	16.15	18.48	12.46	18.83	13.39	18.96	12.99	18.45	14.59	20.72	15.68	25.5	20.96
1988	16.43	11.61	17.34	11.67	18.03	11.93	18.1	12.33	16.59	15.03	19.83	15.4	24.41	21.12
1989	18.07	10.76	19.8	14.26	20.5	16.36	21.2	16.09	18.9	16.29	21.79	16.83	25.02	21.4
1990	16.49	12.66	17.42	10.04	18.24	9.94	18.65	10.59	18.48	12.26	21.08	13.49	23.84	19.8
1991	16.05	13.23	17.35	10.66	17.86	9.62	17.93	9.65	16.63	12.19	20.13	13.04	24.11	22.97

BOTTOM (B2) SALINITY, SPRING (MARCH-MAY)

YEAR	3.3C	3.3W	4.1C	4.1W	4.2C	4.2W	4.3C	4.3W	5.1	5.1W	5.4	5.4W	7.2	6.3 (W)
1985	10.46	11.08	13.26	12.99	13.53	14.53	14.19	14.53	14.03	13.59	15.21	15.43	22.8	21.04
1986	10.76	8.25	11.34	11.28	11.77	13.23	11.54	11.57	13	12	13.86	13.79	24.39	21.98
1987	14.56	15.41	13.86	12.2	13.66	12.93	14.06	12.26	13.56	13.13	15.37	15.35	23.24	20.64
1988	11.77	13.13	12.19	11.08	12.73	11.8	12.46	12.13	14.36	13.69	15.42	15.09	22.73	20.61
1989	13.19	10.24	14.4	12.79	13.13	15.61	14.8	15.68	15.17	14.9	16.5	16.8	22.83	20.94
1990	10.82	11.9	10.17	8.38	10.01	9.62	10.76	9.98	11.77	11.47	13.52	13.48	20.59	19.79
1991	10.69	9.08	10.59	9.62	9.98	9.23	10.04	9.56	11.15	11.44	13.29	12.79	22.7	22.33

SURFACE DISSOLVED OXYGEN, SPRING (MARCH-MAY)

YEAR	3.3C	3.3W	4.1C	4.1W	4.2C	4.2W	4.3C	4.3W	5.1	5.1W	5.4	5.4W	7.2	6.3 (W)
1985	12.31	10.08	10.72	12.15	13.36	12.2	12.51	11.67	11.8	11.85	10.82	9.79	9.62	10.52
1986	11.75	11.13	11.32	11.07	11.62	11.13	11.7	11.46	10.65	11.55	10.5	9.3	10.45	10.25
1987	10.16	10.35	11.66	11.33	11.85	10.41	12.27	11.67	11.75	11.45	12.25	11.3	11.95	11.2
1988	10.85	10.2	10.9	10.6	10.4	9.9	10.15	10	11.6	11.9	10.29	10.5	10.53	10.69
1989	10.4	10.4	10.3	10.2	10.4	10.4	10.5	10.4	10.5	10.65	9.95	9.55	9.88	9.65
1990	10.55	10.55	10.2	10.3	11.15	10.95	11.2	11.4	11.35	11.45	11.68	11.19	11.74	11.26
1991	10.55	11.15	11	11.05	11.05	10.5	10.9	10.4	10.35	10	10.07	10.12	9.84	9.69

TABLE A1-1 (continued). Annual seasonal medians by station for all variables and time periods analyzed.

CENTER-WEST:

BOTTOM (B1) DISSOLVED OXYGEN, SPRING (MARCH-MAY)

YEAR	3.3C	3.3W	4.1C	4.1W	4.2C	4.2W	4.3C	4.3W	5.1	5.1W	5.4	5.4W	7.2	6.3 (W)
1985	2.66	7.95	3.07	7.95	3.39	6.4	3.56	6.21	5.1	10.55	7.87	9.98	8	9.3
1986	5.13	7.86	5.24	7.9	5.65	7.7	6.14	7.67	9.3	10.1	6.9	9.5	7.95	8.2
1987	5.18	4.55	6.02	7.7	6.44	8.51	6.51	9.44	8.15	10.75	9	11.2	8.5	9.2
1988	4.45	7	5	8.2	6.4	9.7	6.65	10.1	10.4	10.6	7.22	10.74	8.08	8.63
1989	6.7	9.3	6.4	7	7.6	7.1	7.9	8	9.1	10.4	9.14	9.53	9.22	8.32
1990	3.2	6.3	4.2	8.1	4.75	9.7	4.95	8.9	5.7	9.8	5.54	11.65	8.46	8.41
1991	2.6	3.85	3.25	6.05	4	8.2	4.3	9.05	5.3	9.3	7.14	9.87	7.59	8.06

BOTTOM (B2) DISSOLVED OXYGEN, SPRING (MARCH-MAY)

YEAR	3.3C	3.3W	4.1C	4.1W	4.2C	4.2W	4.3C	4.3W	5.1	5.1W	5.4	5.4W	7.2	6.3 (W)
1985	10.51	8.8	7.16	7.99	10	9.5	8.39	6.4	11.3	11.6	10.15	10.59	9.01	9.39
1986	8	8.65	7.89	7.17	9.21	4.76	10.04	8.47	10.15	10.75	10.5	9.6	8.2	8.25
1987	7.22	4.75	9.69	8.88	10.66	9.63	11.07	10.48	11.5	11.05	11.85	10.8	9.15	9.55
1988	7.7	7.05	9.4	8.9	9.7	9.7	10.9	9.9	11.8	11.4	9.95	10.41	8.96	8.8
1989	9.2	9.3	9.3	8.3	9.5	7	9.3	8	10.15	11.2	9.95	9.58	8.64	8.57
1990	6.3	6.45	8.7	9.3	11	10.2	11.1	9.95	10.95	11.65	11.76	11.56	9.37	9.57
1991	5.1	5.45	6.8	6.5	9.85	8.95	10.25	9.15	10.15	9.55	9.92	10.19	8.21	8.06

SURFACE SALINITY, SUMMER (JUNE-SEPTEMBER)

YEAR	3.3C	3.3W	4.1C	4.1W	4.2C	4.2W	4.3C	4.3W	5.1	5.1W	5.4	5.4W	7.2	6.3 (W)
19[illegible]	12.43	11.54	14.1	13.56	14.73	14.53	15.34	14.8	14.59	14.42	17.14	17.7	20.66	19.78
1986	10.95	9.95	12.99	12.69	13.76	13.63	14.13	13.89	14.73	15.13	17.46	17.54	21.93	20.66
1987	11.18	11.28	13.33	13.02	14.03	14.23	14.29	14.43	15.44	15.17	16.54	16.68	19.36	18.98
1988	10.75	10.49	11.74	11.77	12.53	12.39	12.79	12.63	14.06	14.06	14.86	15.01	19.32	19.27
1989	7.37	6.19	8.22	7.24	8.95	8	9.85	8.31	9.98	9.59	12.55	12.75	15.56	14.86
1990	7.43	7.58	9.33	9.17	10.69	10.69	10.88	11.31	11.64	11.86	13.63	13.85	17.4	16.61
19[illegible]1	11.96	12.16	13.72	13.29	14.06	14.02	14.32	14.26	15.3	15.41	16.33	16.31	19.91	18.8

BOTTOM (B1) SALINITY, SUMMER (JUNE-SEPTEMBER)

YEAR	3.3C	3.3W	4.1C	4.1W	4.2C	4.2W	4.3C	4.3W	5.1	5.1W	5.4	5.4W	7.2	6.3 (W)
1985	18.58	15.17	20.88	14.5	21.31	14.89	21.58	15.32	18.92	15.01	23.05	18.56	27.61	25.66
1986	19.17	15.88	20.46	14.94	20.99	14.13	21.2	14.66	20.46	15.44	23.53	18.09	27.34	25.28
1987	17.59	14.13	19.28	14.09	20.11	14.43	20.43	14.7	19.41	15.41	21.92	17.11	25.15	23.65
1988	16.22	11.8	17.14	12.36	17.82	12.66	18.31	13.12	17.9	14.06	21.51	15.45	25.91	24.19
1989	16.02	11.74	17.69	12.66	18.24	12	18.48	12.66	17.45	11.02	20.17	13.01	24.18	21.17
1990	17.18	13.73	18.69	12.82	19	11.41	19.48	11.7	17.52	12.53	22.07	14.24	25.51	21.61
1991	17.96	14.06	19.73	13.59	20.18	14.09	20.29	14.93	20.53	16.73	22.83	16.51	25.1	24.69

TABLE A1-1 (continued). Annual seasonal medians by station for all variables and time periods analyzed.

CENTER-WEST:

BOTTOM (B2) SALINITY, SUMMER (JUNE-SEPTEMBER)

YEAR	3.3C	3.3W	4.1C	4.1W	4.2C	4.2W	4.3C	4.3W	5.1	5.1W	5.4	5.4W	7.2	6.3 (W)
1985	14.24	15.08	15.81	14.1	14.73	14.26	14.5	15.2	14.8	15.03	17.23	17.62	25.86	25.34
1986	13.89	15.95	14.36	14.84	14.36	13.99	14.8	14.3	14.9	15.24	17.38	17.74	25.84	25.2
1987	13.22	14.13	14.7	13.79	15.1	14.26	15.37	14.8	15.44	15.27	17.09	16.7	24.17	22.83
1988	12	11.74	12.39	11.96	12.73	12.62	13.12	12.76	14.19	14.06	15.12	15.22	23.55	23.44
1989	10.28	9.59	11.25	10.43	11.12	12	11.87	11.61	10.56	10.63	12.84	12.73	22.61	20.98
1990	10.95	12.03	11.74	12.69	13.52	11.31	12.4	11.64	11.83	12.13	13.86	14.13	22.92	21.41
1991	13.96	13.09	14.73	13.56	14.86	14.09	14.73	14.32	15.37	15.68	16.42	16.3	24.57	23.87

SURFACE DISSOLVED OXYGEN, SUMMER (JUNE-SEPTEMBER)

YEAR	3.3C	3.3W	4.1C	4.1W	4.2C	4.2W	4.3C	4.3W	5.1	5.1W	5.4	5.4W	7.2	6.3 (W)
1985	7.1	6.38	7.4	6.91	7.67	7.53	7.7	7.26	7.45	7.35	7.97	7.8	7.82	7.35
1986	8.77	9.05	8.11	8.71	7.24	7.11	7.68	7.46	7.7	7.1	7.55	7.84	7.39	6.64
1987	9.29	8.95	8.24	9.06	8.41	8.12	8.2	7.65	7.05	6.35	6.71	7.03	7.69	7.93
1988	8.8	7.35	8.1	7.3	8.45	8.1	7.85	7.4	7	6.6	8.64	7.56	7.52	6.64
1989	8.95	8.1	8.65	9.1	8.35	8.8	8.05	7.4	7.7	8.3	8.02	7.51	8.9	8.74
1990	11.2	11.55	7.75	10.2	8.75	8.55	7.5	8	7.2	7.05	8.39	8.25	8.31	7.31
1991	8.75	7.6	7.15	7.6	7.1	6.35	7.15	6.65	6.6	6.5	7.17	7.08	8.02	8.24

BOTTOM (B1) DISSOLVED OXYGEN, SUMMER (JUNE-SEPTEMBER)

YEAR	3.3C	3.3W	4.1C	4.1W	4.2C	4.2W	4.3C	4.3W	5.1	5.1W	5.4	5.4W	7.2	6.3 (W)
1985	0.22	2.39	0.13	3.3	0.15	4.04	0.34	2.78	1.95	6	3.53	6.64	5.33	4.46
1986	0.24	1.31	0.08	3.31	0.27	5.82	0.35	3.82	1.65	6.2	2.45	6.3	4.85	4.43
1987	0.14	2.83	0.13	3.79	0.24	4.28	0.27	4.41	0.48	5.1	1.19	3.75	4.1	3.11
1988	0.08	3.4	0.09	3.1	0.1	2.8	0.2	2.5	0.75	5.6	3.43	5.73	5.41	4.85
1989	0.35	3.3	0.2	1.8	0.25	1.7	0.3	1.3	0.1	4.7	1.75	7.06	3.79	3.21
1990	0.15	1.95	0.15	4.4	0.15	5	0.2	5.45	0.25	5.4	2.29	7.39	4.39	3.84
1991	0.08	5.05	0.03	4.45	0.04	5	0.08	4.85	0.39	5.25	1.85	6.27	4.4	4.21

BOTTOM (B2) DISSOLVED OXYGEN, SUMMER (JUNE-SEPTEMBER)

YEAR	3.3C	3.3W	4.1C	4.1W	4.2C	4.2W	4.3C	4.3W	5.1	5.1W	5.4	5.4W	7.2	6.3 (W)
1985	3.03	2.63	2.11	3.47	5.27	2.39	4.18	3.34	6.8	6.6	7.73	7.35	5.47	4.5
1986	3.35	1.61	4.16	3.95	6.4	5.88	6.2	5.77	7	6.8	7.05	6.9	5.34	4.47
1987	3.22	3.49	3.48	2.95	6.66	5.03	6.24	5.17	6.7	6.2	6.55	6.34	4.87	3.15
1988	5.9	4.1	6.05	5	7.25	4.35	6.5	3.55	7	6.2	7.96	6.88	5.69	4.88
1989	4.3	4.8	3.65	2	6.4	2.9	6.2	2.5	6.9	6.3	8	7.03	3.84	3.27
1990	4.35	3.15	4.2	4.6	4.5	5.9	6.05	5.6	6.35	6.95	7.76	7.69	4.84	3.94
1991	4.65	5.1	3.2	5	5.2	5.05	4.6	5.3	6.45	6.2	7.12	6.68	5.26	4.77

TABLE A1-1 (continued). Annual seasonal medians by station for all variables and time periods analyzed.

CENTER-EAST:

SURFACE TOTAL PHOSPHORUS, APRIL-OCTOBER

YEAR	3.3C	3.3E	4.1C	4.1E	4.2C	4.2E	4.3C	4.3E	7.2	7.2E
1985	0.0488	0.0434	0.0405	0.04	0.0265	0.0273	0.0263	0.031	0.021	0.024
1986	0.0545	0.055	0.043	0.0425	0.028	0.03	0.0325	0.03	0.021	0.022
1987	0.051	0.045	0.0398	0.0366	0.0341	0.0311	0.0286	0.0305	0.023	0.0245
1988	0.0349	0.029	0.0252	0.027	0.0191	0.0227	0.0213	0.0202	0.02	0.018
1989	0.0449	0.0444	0.0314	0.0298	0.0285	0.0265	0.0266	0.0264	0.035	0.032
1990	0.0423	0.0432	0.033	0.0339	0.0307	0.0324	0.0271	0.0262	0.025	0.026
1991	0.0417	0.0403	0.033	0.0314	0.0279	0.0274	0.028	0.0267	0.03	0.04

SURFACE ORTHOPHOSPHATE, APRIL-OCTOBER

YEAR	3.3C	3.3E	4.1C	4.1E	4.2C	4.2E	4.3C	4.3E	7.2	7.2E
1985	0.00635	0.0059	0.0047	0.0067	0.00475	0.0054	0.00465	0.00595	0.01	0.01
1986	0.0063	0.00615	0.00565	0.00475	0.003	0.00425	0.00445	0.004	0.0105	0.01
1987	0.00765	0.00745	0.00465	0.00475	0.0032	0.00435	0.004	0.00545	0.0105	0.0105
1988	0.00795	0.0073	0.0038	0.0043	0.0036	0.00285	0.00375	0.00385	0.002	0.0016
1989	0.00755	0.0085	0.00485	0.0053	0.00435	0.0041	0.0051	0.004	0.003	0.003
1990	0.0077	0.0082	0.00475	0.005	0.00375	0.0039	0.004	0.00355	0.003	0.003
1991	0.0039	0.0042	0.00335	0.0038	0.0027	0.0023	0.00305	0.0033	0.0031	0.005

SURFACE TOTAL NITROGEN, APRIL-OCTOBER

YEAR	3.3C	3.3E	4.1C	4.1E	4.2C	4.2E	4.3C	4.3E	7.2	7.2E
1985	0.745	0.752	0.664	0.604	0.6035	0.6175	0.6015	0.631	0.472	0.456
1986	0.8614	0.797	0.7419	0.6238	0.614	0.5565	0.5411	0.6033	0.4445	0.4405
1987	0.868	0.9249	0.7604	0.6726	0.6183	0.6504	0.6191	0.6164	0.4665	0.461
1988	1.15	0.9699	0.7635	0.813	0.6405	0.6135	0.592	0.6765	0.4625	0.436
1989	1.163	1.182	1.0195	0.984	0.8905	0.927	0.9285	0.907	0.575	0.583
1990	1.019	0.993	0.7615	0.7755	0.7045	0.631	0.614	0.7195	0.498	0.426
1991	0.8145	0.7335	0.663	0.628	0.584	0.6085	0.5805	0.584	0.518	0.528

SURFACE DISSOLVED INORGANIC NITROGEN, APRIL-OCTOBER

YEAR	3.3C	3.3E	4.1C	4.1E	4.2C	4.2E	4.3C	4.3E	7.2	7.2E
1985	0.1463	0.2115	0.111	0.0994	0.0807	0.1104	0.0917	0.1284	0.04	0.043
1986	0.1426	0.1535	0.149	0.1231	0.0794	0.1181	0.0706	0.1011	0.0465	0.0625
1987	0.258	0.2155	0.123	0.1016	0.1259	0.0906	0.0725	0.1404	0.038	0.0325
1988	0.2555	0.249	0.201	0.17	0.1095	0.1295	0.0915	0.0925	0.0262	0.0252
1989	0.6005	0.64	0.436	0.504	0.3375	0.349	0.365	0.329	0.0172	0.0447
1990	0.3835	0.335	0.276	0.216	0.1995	0.138	0.177	0.144	0.0121	0.0125
1991	0.0666	0.0453	0.068	0.0611	0.0583	0.05	0.0319	0.0384	0.0064	0.0064

TABLE A1-1 (continued). Annual seasonal medians by station for all variables and time periods analyzed.

CENTER-EAST:

SURFACE TOTAL SUSPENDED SOLIDS, APRIL-OCTOBER

YEAR	3.3C	3.3E	4.1C	4.1E	4.2C	4.2E	4.3C	4.3E	7.2	7.2E
1985	6	7.1	6.05	8.35	7	5.35	5.9	4.75	8.5	9
1986	6.9	6.55	5.25	5.1	4.2	4	4	4	3.5	3.5
1987	5.75	6.85	4.75	4.2	4.05	4.15	4.2	4.1	5.5	5
1988	7.4	6.05	5.75	4.7	4.4	5.25	4.75	5.15	9.5	9
1989	5.8	5.2	4.5	4.6	3.9	4.7	4.65	4.9	9.2	9
1990	7.85	6.9	4.75	5.7	4.75	4.9	4.2	4.95	9.2	11.6
1991	8.35	6.95	6.65	4.9	5	4.55	4.45	3.8	8	12

SURFACE CHLOROPHYLL *A*, APRIL-OCTOBER

YEAR	3.3C	3.3E	4.1C	4.1E	4.2C	4.2E	4.3C	4.3E	7.2	7.2E
1985	15.6675	13.9199	11.4872	10.7455	7.2986	7.4202	7.5111	8.2328	3.7344	3.3092
1986	19.1386	15.737	10.4486	10.3667	5.8437	5.283	5.5696	6.4593	4.9	5.2
1987	15.6	16.85	11	10.95	10.05	10.3	10.45	9.2	5.85	5.85
1988	13.5	9.2	10.1	9.1	8.8	8.2	7.4	7.8	6.25	5.75
1989	13.5	12.9	11.2	10.35	10.9	9.6	8.75	9.1	9.2	5.6
1990	13.65	11.7	8.5	9.6	9.9	8.7	8.4	7.5	9.2596	7.6362
1991	19.6	13.2	9.75	9.1	8.05	6.8	6.4	5.2	5.4468	5.4788

SECCHI DEPTH, APRIL-OCTOBER

YEAR	3.3C	3.3E	4.1C	4.1E	4.2C	4.2E	4.3C	4.3E	7.2	7.2E
1985	1.1	1.1	1.7	1.5	1.8	1.75	1.7	1.8	2.3	2.05
1986	1	1.1	1.6	1.6	2.2	2.8	2	2	2.2	2.25
1987	1.1	1.25	1.6	1.7	1.9	2	1.9	1.8	2.05	1.8
1988	1.15	1.45	1.4	1.55	1.75	1.8	1.8	1.85	2.1	2.1
1989	1.1	1.2	1.45	1.4	1.8	1.8	1.8	1.6	1.5	1.6
1990	1	1	1.6	1.5	1.6	1.6	1.8	1.7	1.8	1.8
1991	1.2	1.2	1.6	1.6	1.8	2	1.9	2	2.4	2

SURFACE SALINITY, APRIL-OCTOBER

YEAR	3.3C	3.3E	4.1C	4.1E	4.2C	4.2E	4.3C	4.3E	7.2	7.2E
1985	11.6056	11.6398	13.0266	13.8594	13.86	13.8605	14.5991	14.7331	21.0525	21.7734
1986	10.8208	10.723	12.1347	12.2672	13.2923	12.9935	13.2943	13.5942	20.8593	22.3725
1987	11.02	11.21	12.165	12.46	12.825	12.96	13.36	13.395	19.355	20.665
1988	10.56	10.625	11.675	11.835	12.365	12.43	12.595	12.725	19.165	20.38
1989	8.855	8	9.72	11.21	10.79	10.56	11.145	10.95	16.9	18.03
1990	7.025	6.865	9.235	9.27	10.01	10.3	10.5	11.15	17.25	19.61
1991	11.245	11.28	13.025	12.925	13.395	13.36	13.59	13.625	18.49	21.14

TABLE A1-1 (continued). Annual seasonal medians by station for all variables and time periods analyzed.

CENTER-EAST:

SURFACE SALINITY, SPRING (MARCH-MAY)

YEAR	3.3C	3.3E	4.1C	4.1E	4.2C	4.2E	4.3C	4.3E	7.2	7.2E
1985	8.85	9.56	10.73	11.93	12.23	12.3	12.86	13.16	19.78	20.56
1986	6.72	6.07	8.8	9.82	10.47	10.01	9.4	10.72	17.77	19.68
1987	9.4	9.65	11.73	11.74	11.31	11.08	12.13	12.99	17.61	19.95
1988	9.01	8.38	10.49	10.89	11.8	11.87	12.26	12.33	17.66	21.02
1989	9.08	8.95	10.17	11.21	10.82	10.82	11.21	11.61	19.12	19.72
1990	6.15	6.43	8.75	9.04	9.68	9.78	10.17	10.37	17.03	19.61
1991	7.08	6.68	8.25	8.47	8.85	8.88	9.14	9.68	16.94	17.06

BOTTOM (B1) SALINITY, SPRING (MARCH-MAY)

YEAR	3.3C	3.3E	4.1C	4.1E	4.2C	4.2E	4.3C	4.3E	7.2	7.2E
1985	17.25	10.63	18.81	17.38	19.45	13.65	19.52	18.66	24.97	22.26
1986	15.41	11.38	17.9	16.39	18.1	12.86	18.1	17.45	27.76	22.59
1987	17.48	15	18.48	17.11	18.83	14.4	18.96	18.55	25.5	21.98
1988	16.43	12.46	17.34	16.84	18.03	12.93	18.1	16.97	24.41	23.09
1989	18.07	9.78	19.8	18.55	20.5	13.93	21.2	20.01	25.02	22.59
1990	16.49	11.54	17.42	15.92	18.24	11.34	18.65	17.58	23.84	20.34
1991	16.05	11.54	17.35	16.18	17.86	10.98	17.93	17.38	24.11	21.53

BOTTOM (B2) SALINITY, SPRING (MARCH-MAY)

YEAR	3.3C	3.3E	4.1C	4.1E	4.2C	4.2E	4.3C	4.3E	7.2	7.2E
1985	9.11	10.56	18.45	17.38	13.53	14.09	19.45	18.69	22.68	22.26
1986	8.74	8.02	17.35	16.29	11.77	12.76	18.07	17.18	24.97	22.58
1987	13.29	14.4	17.65	16.63	13.66	14.46	18.96	18.55	23.62	21.97
1988	10.66	10.43	16.43	16.77	12.73	12.59	17.93	16.56	24.09	23.07
1989	9.72	9.46	19.38	18.55	13.13	15.52	20.92	20.01	23.15	22.52
1990	9.08	7.84	16.73	15.75	10.01	10.11	18.45	17.52	20.85	20.34
1991	8.37	8.53	16.76	16.02	9.98	10.2	17.73	17.31	23.1	21.53

SURFACE DISSOLVED OXYGEN, SPRING (MARCH-MAY)

YEAR	3.3C	3.3E	4.1C	4.1E	4.2C	4.2E	4.3C	4.3E	7.2	7.2E
1985	12.31	12.7	10.72	9.87	13.36	12.59	12.51	12.05	9.62	9.59
1986	11.75	11.56	11.32	11	11.62	11.51	11.7	11.16	10.45	10.1
1987	10.16	11.45	11.66	13.49	11.85	10.49	12.27	12.46	11.95	11.1
1988	10.85	11	10.9	10.1	10.4	10.3	10.15	9.9	10.53	9.04
1989	10.4	10.3	10.3	10.2	10.4	10.5	10.5	10.3	9.88	9.74
1990	10.55	10.55	10.2	10.6	11.15	11.5	11.2	11.25	11.74	10.65
1991	10.55	10.95	11	11.05	11.05	11.05	10.9	10.85	9.84	9.89

TABLE A1-1 (continued). Annual seasonal medians by station for all variables and time periods analyzed.

CENTER-EAST:

BOTTOM (B1) DISSOLVED OXYGEN, SPRING (MARCH-MAY)

YEAR	3.3C	3.3E	4.1C	4.1E	4.2C	4.2E	4.3C	4.3E	7.2	7.2E
1985	2.66	7.29	3.07	5.46	3.39	8.19	3.56	3.55	8	9.13
1986	5.13	9.1	5.24	5.89	5.65	9.27	6.14	7.44	7.95	8.9
1987	5.18	5.72	6.02	6.31	6.44	9.52	6.51	5.6	8.5	9.3
1988	4.45	8.4	5	5.3	6.4	9.2	6.65	5.8	8.08	8.19
1989	6.7	10	6.4	6.9	7.6	9.9	7.9	7.7	9.22	9.21
1990	3.2	6.65	4.2	4	4.75	7.1	4.95	5.05	8.46	10.1
1991	2.6	5.15	3.25	2.95	4	8	4.3	3.85	7.59	8.65

BOTTOM (B2) DISSOLVED OXYGEN, SPRING (MARCH-MAY)

YEAR	3.3C	3.3E	4.1C	4.1E	4.2C	4.2E	4.3C	4.3E	7.2	7.2E
1985	13.3	8.5	3.09	3.2	10	7.6	3.56	3.55	8.87	9.26
1986	10.1	10.39	5.31	5.94	9.21	9	6.16	8.15	8.1	8.9
1987	7.97	6.87	6.4	4.45	10.66	10.11	6.63	5.6	9	9.5
1988	8.4	9.1	5.2	5.2	9.7	9.8	6.65	7.5	8.58	8.31
1989	9.9	10	6.5	7.2	9.5	9.35	7.9	7.7	9.24	8.98
1990	8.2	8.75	4	3.8	11	11.4	4.9	5.05	9.26	10.01
1991	7.5	7.25	3.15	2.3	9.85	8.7	4.35	3.9	8.07	8.72

SURFACE SALINITY, SUMMER (JUNE-SEPTEMBER)

YEAR	3.3C	3.3E	4.1C	4.1E	4.2C	4.2E	4.3C	4.3E	7.2	7.2E
1985	12.43	12.7	14.1	14.13	14.73	14.87	15.34	15.31	20.66	20.99
1986	10.95	10.95	12.99	13.19	13.76	13.86	14.13	14.36	21.93	23.11
1987	11.18	11.64	13.33	13.49	14.03	14.02	14.29	14.39	19.36	20.85
1988	10.75	10.88	11.74	11.96	12.53	12.76	12.79	12.89	19.32	20.16
1989	7.37	6	8.22	11.15	8.95	8.19	9.85	9.27	15.56	16.46
1990	7.43	7.36	9.33	10.43	10.69	10.66	10.88	11.51	17.4	19.5
1991	11.96	12.13	13.72	13.69	14.06	14.02	14.32	14.36	19.91	21.28

BOTTOM (B1) SALINITY, SUMMER (JUNE-SEPTEMBER)

YEAR	3.3C	3.3E	4.1C	4.1E	4.2C	4.2E	4.3C	4.3E	7.2	7.2E
1985	18.58	14.57	20.88	18.49	21.31	15.54	21.58	21.02	27.61	25.67
1986	19.17	13.03	20.46	18.83	20.99	15.98	21.2	20.5	27.34	25.45
1987	17.59	12.59	19.28	17.48	20.11	15.34	20.43	19.76	25.15	23.61
1988	16.22	11.86	17.14	15.37	17.82	13.59	18.31	17.52	25.91	24.79
1989	16.02	9.27	17.69	15.41	18.24	12.33	18.48	17.04	24.18	22.06
1990	17.18	12.2	18.69	16.46	19	14.42	19.48	18.86	25.51	22.67
1991	17.96	13.52	19.73	18	20.18	15.61	20.29	19.55	25.1	24.49

TABLE A1-1 (continued). Annual seasonal medians by station for all variables and time periods analyzed.

CENTER-EAST:

BOTTOM (B2) SALINITY, SUMMER (JUNE-SEPTEMBER)

YEAR	3.3C	3.3E	4.1C	4.1E	4.2C	4.2E	4.3C	4.3E	7.2	7.2E
1985	15.48	13.33	20.08	18.35	14.73	15.18	22.11	20.29	26.27	25.67
1986	12.59	12.56	20.11	18.55	14.36	15.95	21.09	19.8	26.37	25.45
1987	12.46	12.46	19.04	17.79	15.1	15.07	20.08	20.08	24.38	23.59
1988	11.34	11.18	16.66	16.29	12.73	13.16	18.27	17.18	25.1	22.78
1989	10.88	7.05	17	15.34	11.12	9.72	18.31	16.9	23.03	22
1990	10.24	10.49	17.62	15.75	13.52	13.76	19.17	18.97	23.4	22.65
1991	13.12	12.92	19	18.11	14.86	15.1	20.15	19.45	25.11	24.16

SURFACE DISSOLVED OXYGEN, SUMMER (JUNE-SEPTEMBER)

YEAR	3.3C	3.3E	4.1C	4.1E	4.2C	4.2E	4.3C	4.3E	7.2	7.2E
1985	7.1	6.82	7.4	6.95	7.67	7.86	7.7	7.63	7.82	7.12
1986	8.77	8.56	8.11	7.9	7.74	7.71	7.68	7.84	7.39	7.04
1987	9.29	8.68	8.24	7.81	8.41	8.12	8.2	8.31	7.69	7.37
1988	8.8	7.3	8.1	7.65	8.45	8.15	7.85	8	7.59	7.71
1989	8.95	9	8.65	7.5	8.35	9	8.05	8	8.9	8.36
1990	11.2	11.3	7.75	8.2	8.75	8.35	7.5	7.75	8.31	7.98
1991	8.75	7.6	7.15	7.05	7.1	6.95	7.15	6.65	8.02	7.13

BOTTOM (B1) DISSOLVED OXYGEN, SUMMER (JUNE-SEPTEMBER)

YEAR	3.3C	3.3E	4.1C	4.1E	4.2C	4.2E	4.3C	4.3E	7.2	7.2E
1985	0.22	2.45	0.13	0.32	0.15	4.11	0.71	0.3	5.33	5.19
1986	0.24	3.02	0.08	0.09	0.27	2.19	0.35	0.21	4.85	5.78
1987	0.14	3.73	0.13	0.28	0.24	1.99	0.27	0.53	4.1	4.76
1988	0.08	5.75	0.09	0.1	0.1	6.55	0.2	0.15	5.41	5.32
1989	0.35	3.6	0.2	0.2	0.25	2.5	0.3	0.3	3.79	3.91
1990	0.15	4.2	0.15	0.2	0.15	5.1	0.2	0.2	4.39	4.77
1991	0.08	4.45	0.03	0.07	0.04	3	0.08	0.07	4.4	5.21

BOTTOM (B2) DISSOLVED OXYGEN, SUMMER (JUNE-SEPTEMBER)

YEAR	3.3C	3.3E	4.1C	4.1E	4.2C	4.2E	4.3C	4.3E	7.2	7.2E
1985	3.69	3.79	0.22	0.35	5.27	4.48	0.17	0.18	5.33	5.5
1986	6.08	4.3	0.08	0.09	6.4	2.77	0.32	1.2	5.12	5.3
1987	4.68	4.6	0.18	0.14	6.66	5.57	0.31	0.48	4.58	4.56
1988	6.3	5.95	0	0.1	7.25	7.45	0.07	0.1	5.53	5.33
1989	5.9	5.9	0.15	0.15	6.4	3.9	0.2	0.55	3.67	3.97
1990	5.7	5.15	0.07	0.2	4.5	5.9	0.15	0.1	4.51	4.73
1991	5.6	4.95	0.01	0.02	5.2	3.85	0.03	0.03	5.07	5.27