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United States
Environmental Protection
Agency

Region 10
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Surveillance & Analysis Division

A Field Study of the Dissolved Oxygen Resources In Grays Harbor During Summer Low Flow

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A FIELD STUDY OF THE DISSOLVED OXYGEN RESOURCES OF GRAYS HARBOR DURING SUMMER LOW FLOW

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FINDINGS

As part of a region-wide program to examine the impact of low river flows upon sensitive bodies of water, the U.S. Environmental Protection Agency (EPA), Region 10 conducted an intensive water quality survey of Grays Harbor, during the period July 25-29, 1977. Measurements of temperature, dissolved oxygen, conductivity and important nutrients were made in the receiving waters and the point sources discharging to the estuary. Measurements of primary productivity were made in the receiving waters only. The intensive water quality survey was supplemented with a long-term monitoring program to measure temperature, dissolved oxygen, salinity and pH at the ocean and upstream boundaries of the estuary. This long-term program consisted of samples taken once a week at the two boundaries during high slack and was conducted by the Grays Harbor Community College.

The freshwater discharge from the Chehalis River varied from an estimated 1,160 cfs on July 25, 1977 to 1,120 cfs on July 29, 1977. This was not the period of lowest flow in Grays Harbor during 1977, but it was sufficiently low to cause deterioration of water quality, particularly in the Inner Harbor. The minimum dissolved oxygen levels in Grays Harbor were found in the vicinity of Cow Point. Several violations of the State of Washington's water quality standard for dissolved oxygen were recorded. The minimum dissolved oxygen concentration was 4.9 mg/l. All of the standard violations for dissolved oxygen occurred at, or near, the bottom of the receiving waters.

Maximum water temperatures of 20.0°C were recorded in the Chehalis River near Montesano. At the ocean entrance water temperatures did not exceed 16.0°C. Temperature measurements in the North Bay of Grays Harbor indicated that the warm mud flats increased the water temperature 1.6°C.

Nutrient measurements showed that ocean is a major source for nitrate and orthophosphate in Grays Harbor. The major source of ammonia-nitrogen was in the inner portions of Grays Harbor, in the vicinity of the major waste discharges. The major sources for biological oxygen demand are the two industrial discharges. However, order of magnitude discrepancies between loadings reported by the EPA Region 10 laboratory and the industrial laboratories were noted. Of the rivers discharging to Grays Harbor, the Chehalis River contributed the largest organic loading. The deoxygenation rates were found to be lower in the inner Harbor compared to the rates measured near the ocean boundary of Grays Harbor.

Serious foaming problems were observed near the ITT/Rayonier discharge on several occasions.

Primary productivity per unit of surface area by phytoplankton was highest at the sampling station nearest the ocean, and decreased monotonically, upstream as far as Aberdeen, the location of the most landward sampling station. Changes in water clarity appeared to be the major reason for this decrease.

The long-term monitoring program by Grays Harbor Community College recorded what appeared to be an upwelling event during mid-August. In addition, the data showed that water quality conditions at the ocean and up-stream boundaries were more closely coupled when the freshwater discharge was high.

INTRODUCTION

During the period October 1976 through August 1977, the Pacific Northwest received abnormally low amounts of precipitation. As a result, stream flows in many parts of the region were at, or near, historic low values. In order to determine the impact of these low flow conditions upon water quality, the Environmental Protection Agency (EPA) Region 10 initiated, with support from EPA Headquarters, a number of water quality studies. One of the river basins chosen was the Grays Harbor - Chehalis River in southwestern Washington (Figure 1).

The Chehalis River's base flow is maintained by a large aquifer in the foothills of the Cascade Mountains, fifty miles to the east of Grays Harbor. As a result, the summer low flows do not vary substantially from year to year, unless there are extended periods of drought. Despite this relative constancy, summer low flows in the Chehalis River do reach levels at which water quality becomes affected by waste discharges. The National Pollution Discharge Elimination System (NPDES) permits for the two largest waste dischargers, the ITT/Rayonier pulp mill at Hoquiam and the Weyerhaeuser Company pulp mill at Cosmopolis, both contain limitations which are functions of the flow in the Chehalis River. Since low flow has an important influence on water quality in the Chehalis River and Grays Harbor, we felt that a low flow survey in this system would be very useful. Such a survey would provide data for evaluating available mathematical models for dissolved oxygen (Yearsley and Houck (1973)) and Lorenzen, et al (1973), as well as providing additional data for waste load allocations in Grays Harbor.

History of Water Quality Problems

Water quality in the Chehalis River and Grays Harbor began to deteriorate soon after the installation of the first domestic sewer systems in the latter part of the 19th century. Principal problems with the discharge of these domestic wastes were associated with bacterial populations hazardous to public health and localized impacts of untreated organic wastes. The principal impact of the domestic waste was upon the shellfishing industry. According to Orlob et al. (1951), approximately 9000 acres of tidelands, potentially available for the culture of the Pacific oyster in Grays Harbor, were unsatisfactory for the cultivation of commercial shellfish because of bacterial contamination.

In 1928, Rayonier, Inc., commenced the operation of calcium based sulfite pulp mill at Hoquiam. The untreated wastes, with pH ranging from 1.6 to 2.5, had sulfite waste liquor (SWL) concentrations as high as 44,000 mg/l (Orlob, et al. (1951) and an estimated 245,000 pounds per day of ultimate biological oxygen demand (BOD_u). These wastes, besides having a substantial impact on the dissolved oxygen resources of Grays Harbor, created conditions which inhibited the passage of migrating anadromous fish and resulted in numerous incidents of distressed and dead fish, shrimp and crabs (Eriksen and Townsend (1940)).

Studies conducted by the Washington Pollution Control Commission (Orlob, Jones, and Peterson (1951); Peterson (1953); Peterson, Wagner, and Livingston (1957); and Pollution Control Commission (1958)) during the 1950's showed that there were still severe water quality problems in the Grays Harbor/Chehalis River system. The construction of primary treatment facilities at Aberdeen, Hoquiam, and Cosmopolis in the 1960's, as well as a program of waste impoundment and waste treatment did have some beneficial effects on water quality. These improvements were to a degree counterbalanced by increases in population and paper production as well by the operation of a new pulp mill at Cosmopolis in 1958 by the Weyerhaeuser Company.

For example, studies by the Washington State Department of Fisheries in 1969 and 1970 (Deschamps and Phinney (1971)) showed that receiving water in the vicinity of the ITT/Rayonier pulp mill at Hoquiam resulted in 100% mortality to juvenile chinook salmon kept in live boxes after only 10 hours. These toxic conditions occurred despite the fact that ITT/Rayonier had improved their treatment efficiency by changing from a calcium based sulfite process to a sodium based sulfite process in 1966. Water quality studies conducted by both ITT/Rayonier and the Weyerhaeuser Company from 1971 to 1976, showed that water quality standards for dissolved oxygen were violated during this period.

At the present time, the treatment facilities for the municipal discharges to Grays Harbor are very similar to the facilities as they existed in the late 1950's. According to the Water Quality Management Plan drafted by the State of Washington's Department of Ecology (1975), all three municipal dischargers and Grays Harbor, Hoquiam, Aberdeen and Cosmopolis, operate primary treatment plants. The City of Aberdeen operates a primary anaerobic digester plant with a chlorine contact chamber. Hoquiam is served by a sewage lagoon, and Cosmopolis operates a combined primary clarifier and sludge digester. The permitted loadings of 5-day BOD (BOD_5) for these facilities are shown in Table 1.

Table 1. Permitted loadings of BOD_5 for the major municipal discharges to Grays Harbor.

Source	BOD_5 Loading Weekly Average (lbs/day)	Monthly Average (lbs/day)
Aberdeen STP	9,458	6,305
Cosmopolis STP	2,252	2,027
Hoquiam STP	2,802	1,851

The ITT/Rayonier pulp mill has an aerated lagoon which reduces the organic loading of their waste discharge substantially.

The Weyerhaeuser Company pulp mill at Cosmopolis presently operates a similar treatment facility. The permitted loadings of BOD_5 for these two discharges are shown in Table 2.

Table 2. Permitted loadings of BOD_5 for the major industrial discharges to Grays Harbor.

	BOD_5 Loading	
	Chehalis River flow 2,000 cfs (lbs/day)	Chehalis River flow 2,000 cfs (lbs/day)
ITT/Rayonier	28,000 (daily average)	28,000 (daily average)
	36,000 (daily maximum)	53,000 (daily maximum)
Weyerhaeuser	26,000 (daily average)	32,400 (daily average)
	32,400 (daily maximum)	49,000 (daily maximum)

DESCRIPTION OF THE STUDY AREA

Hydrology

Grays Harbor is a large coastal plain estuary on the coast of Washington (Figure 1). The six rivers which discharge to Grays Harbor have a combined drainage area of approximately 2500 square miles. The Chehalis River, upstream from Aberdeen, drains nearly 80% of the area. The estimated average annual discharge of the Chehalis River near Hoquiam, Washington, is approximately 7600 cfs. Rainfall in the Grays Harbor/Chehalis River system is high, and the hydrographs of the river's tributary to Grays Harbor are strongly influenced by rainfall.

Tidal exchange also plays an important part in the flushing of Grays Harbor. Tides in Grays Harbor are of the mixed type with two unequal high tides and two unequal low tides each lunar day (24 hours, 50 minutes). Mean and diurnal tidal ranges and mean tide level for Point Chehalis and Aberdeen, as determined by the United States Department of Commerce (1977), are given in Table 3.

Table 3. Mean and diurnal tide ranges and mean tide level for selected locations in Grays Harbor (U.S. Department of Commerce (1977)).

Location	Mean Tide Range (ft)	Diurnal Tide Range (ft)	Mean Tide* Level (ft)
Point Chehalis	6.9	9.0	4.8
North Channel	7.6	9.7	5.2
Aberdeen	7.9	10.1	5.4
Montesano, Chehalis River	6.7	8.1	4.1

* Relative to Mean Lower Low Water

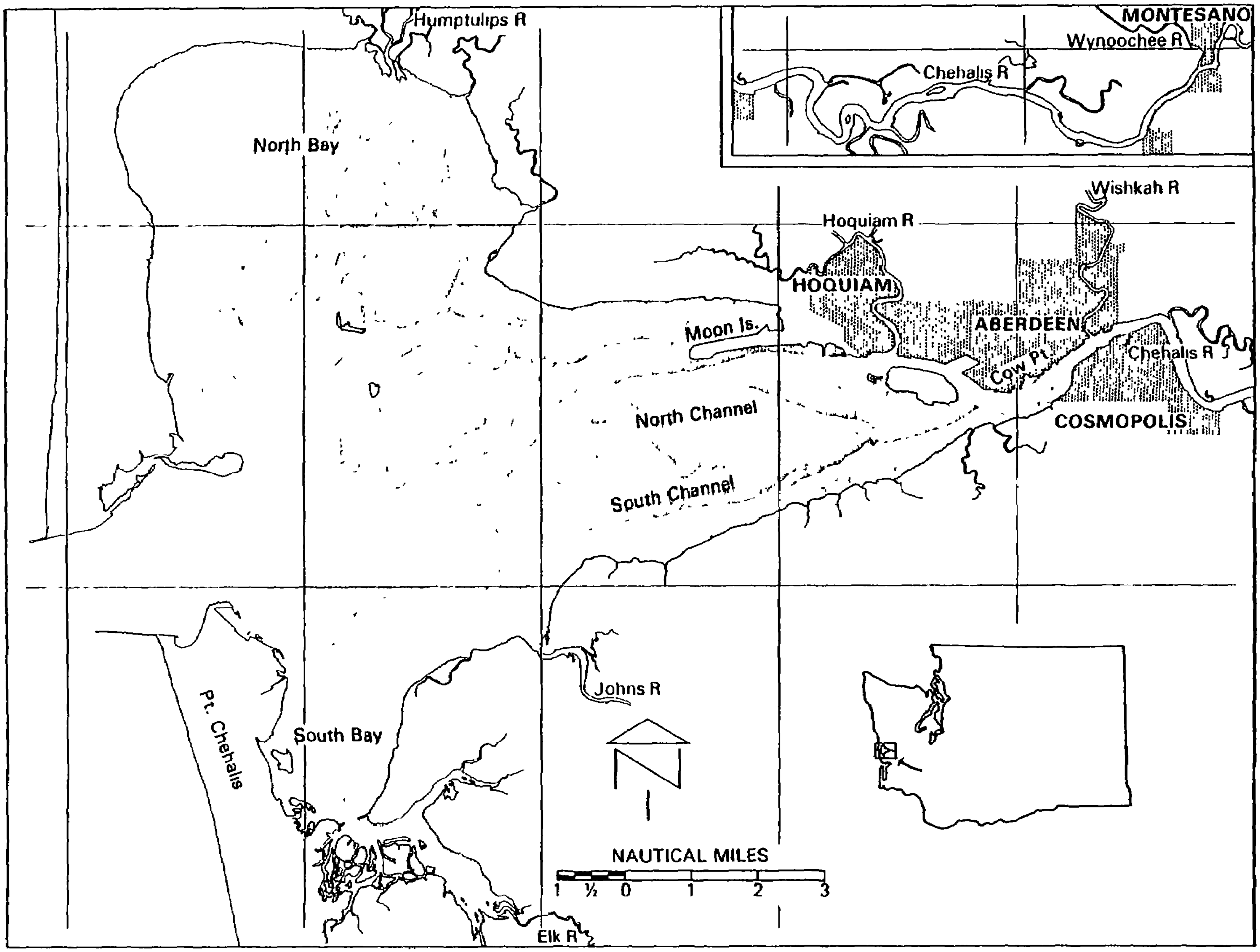


Figure 1. Grays Harbor and fresh water tributaries.

Yearsley and Cleland (1979) have used a numerical hydrodynamic model to determine the volume of water which enters Grays Harbor between mean low water (MLW) and mean high water (MHW). The intertidal volume or tidal prism, computed using this model are shown in Table 4.

The modified tidal prism method, developed by Ketchum (1951), provides a means for comparing the relative importance of river discharge and tidal exchange. Figure 2 shows the exchange times predicted by the modified tidal prism method at various river flows for an average and a high tidal range. The average tidal range corresponds to a change in height at Aberdeen, relative to MLLW, from 1.4 feet (MLW) to 9.20 feet (MHW). The maximum tidal range corresponds to a change in height from 0.0 feet (MLLW) to 9.90 feet (MHHW). When the freshwater discharge of the Chehalis River, as estimated at Hoquiam, is greater than 8,000 c.f.s. the exchange time is not strongly influenced by increasing flow. However, below 8,000 c.f.s., the exchange time increases rapidly as the river discharge decreases. The effect of a change in the tidal amplitude is relatively constant on the other hand. In the case examined, a 20% decrease in tidal prism causes a 20% increase in the exchange time throughout the range of freshwater flows.

FIGURE 2 . RESIDENCE TIMES IN GRAYS HARBOR AS A FUNCTION OF RIVER FLOW AND TIDAL RANGE - MODIFIED TIDAL PRISM METHOD.

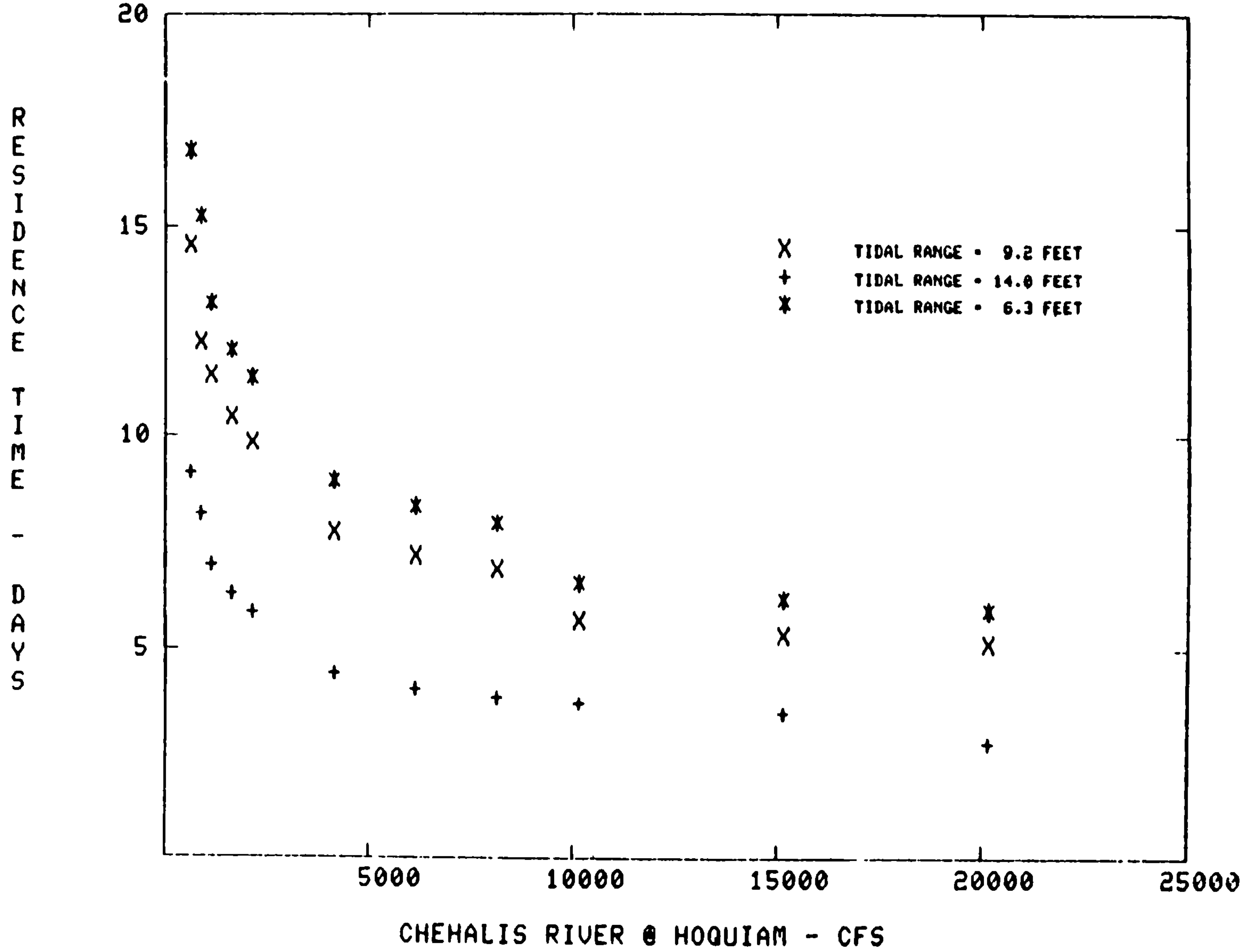


Table 4. Intertidal volumes in Grays Harbor for the maximum tidal range, July 25-29, 1977.

Distance from Montesano (nautical miles)	Intertidal Volume (millions of cubic feet)
1	12.6
2	18.2
3	19.6
4	26.0
5	32.6
6	40.7
7	48.8
8	48.8
9	58.2
10	67.0
11	74.0
12	79.0
13	153.0
14	276.0
15	427.0
16	642.0
17	731.0
18	842.0
19	1000.0
20	1430.0
21	2050.0
22	2370.0
23	2840.0
24	3120.0
25	1970.0
26	670.0
27	550.0

The quality of the ocean water at the entrance to Grays Harbor can also have an influence on the water quality within Grays Harbor. Pearson and Holt (1961) have documented numerous instances of low dissolved oxygen at the entrance to Grays Harbor. There is strong evidence to indicate that this low dissolved oxygen is associated with upwelling conditions in the ocean off the coast of Washington. The data reported by Pearson and Holt (1961) was not adequate to quantify the impact of upwelled ocean water upon the inner portions of Grays Harbor. However, subsequent mathematical modeling studies (Yearsley and Hess (1979)) indicate that a decrease of

4.0 mg/l in dissolved oxygen at the entrance results in less than a 1.0 mg/l decrease in the dissolved oxygen at its minimum point in the Inner Harbor.

A potentially significant impact upon the dissolved oxygen of the Inner Harbor is that of land use practices in the watershed drained by the Chehalis, Satsop, Wynoochee, Wishkah, and Hoquiam Rivers. Of particular importance are those practices which result in increases in the organic sediment load of these rivers. Logging and farming are the principal industries in this watershed and both can have significant impact upon the sediment load of the river. Studies by Beverage and Swecker (1969) and the results of several mathematical modeling exercises indicate that the organic sediments accumulate in the Inner Harbor and do have a significant impact upon dissolved oxygen.

Water Chemistry

The ocean water at the entrance of Grays Harbor is influenced by processes both in the deep ocean and near shore. Hydrographic measurements off the coast of Washington, as described by Stefansson and Richards (1964), show that the winter density structure in the near shore area results from dilution of oceanic water by the Columbia and other coastal rivers. The surface 30 meters is essentially isothermal during the winter, with temperatures varying from $8^{\circ}C$ to $10^{\circ}C$. Salinities vary from 29o/oo* to 32o/oo. During the summer, surface salinities increase as freshwater discharge decreases and as upwelling supplies high salinity water from

* o/oo - parts per thousand

depth. Salinities vary from 32 o/oo to 33.5 o/oo in the summer, while temperatures vary from 8°C at 30 meters to 14°C at the surface.

Dissolved oxygen in the surface 10 meters varies between 9.0 and 10.0 mg/l throughout the year. According to Stefansson and Richards (1964), maximum values occur in the summer when primary productivity is highest. At 30 meters, the variation in dissolved oxygen is from 4.0 mg/l to 8.5 mg/l, with the minimum values being associated with summer upwelling incidents.

Inorganic phosphorus and nitrogen are influenced primarily by upwelling. Dissolved orthophosphorus varies between 0.015 mg/l and 0.030 mg/l in the surface 10 meters and between 0.022 mg/l and 0.075 mg/l at 30 meters. Peak values occur during the summer. NO_3-N has seasonal characteristics similar to the dissolved orthophosphorus. In the surface 10 meters, NO_3-N varies between 0.0 mg/l and 0.070 mg/l, and between 0.070 mg/l and 0.210 mg/l at 80 meters.

Within Grays Harbor, longitudinal and vertical variations of temperatures, salinity and dissolved oxygen are related to the freshwater discharge. During the winter, when the freshwater discharge is large, vertical variations are small in all parameters. As an example, for data collected by ITT/Rayonier, Inc., between sample stations MC05 (7.8 nautical miles downstream from Montesano) and MC10 (15.3 nautical miles from Montesano) on March 24, 1976, the maximum longitudinal variation in temperature was from 6.9°C to 7.8°C, the maximum longitudinal salinity variation was from 0.0% to 4.0% and dissolved oxygen from 11.3 mg/l to 9.5 mg/l. Maximum vertical difference in temperature was 0.2°C, 3% salinity and 1.7 mg/l of dissolved oxygen. The freshwater discharge on this date was estimated as 24,800 cfs at Hoquiam.

During the summer low, longitudinal variations increase but vertical variations remain about the same. Data collected by ITT/Rayonier on August 19, 1977, provides an example of low flow condition. On this date, the temperature varied longitudinally from 20.0°C to 17.5°C, the salinity varied longitudinally from 15% to 27%, and the dissolved oxygen varied longitudinally from 3.4 mg/l to 5.8 mg/l. Maximum vertical differences observed were 0.6°C in temperature, 3.6% in salinity, and 1.2 mg/l in dissolved oxygen. The freshwater discharge at Hoquiam, as estimated by the U.S. Geological Survey, was 804 cfs.

FIELD STUDIES

Sampling Program

The field studies conducted by the Surveillance and Analysis Division, EPA Region 10, consisted of a reconnaissance during the period July 11-13, 1977, and comprehensive survey of receiving water quality and point sources during the period July 25-29, 1977. Locations of receiving water stations and point sources sampled are shown in Figure 3. Temperature, salinity, pH, and dissolved oxygen were measured at all stations, both in receiving waters and in the point source effluent streams. These measurements were made with mercury thermometers or calibrated thermistor, conductivity bridge, pH probe and dissolved oxygen probe or titration by the Winkler method, respectively.

Chemical analyses for 2-, 5-, 10-, 15-, and 20-day biological oxygen demand (BOD), ammonia and nitrite + nitrate-nitrogen, dissolved orthophosphate and total phosphorus, and total organic carbon (TOC) were performed at selected receiving water stations.

With the exception of the 2-, 10-, 15-, and 20-day BOD, similar analyses were performed upon samples collected from the point sources. Samples were collected daily, or twice daily depending upon location, and placed in polyethylene containers. The samples were preserved in ice and shipped to the EPA Regional Laboratory within six hours of the time they were collected. Table 5 gives the method used to analyze each parameter.

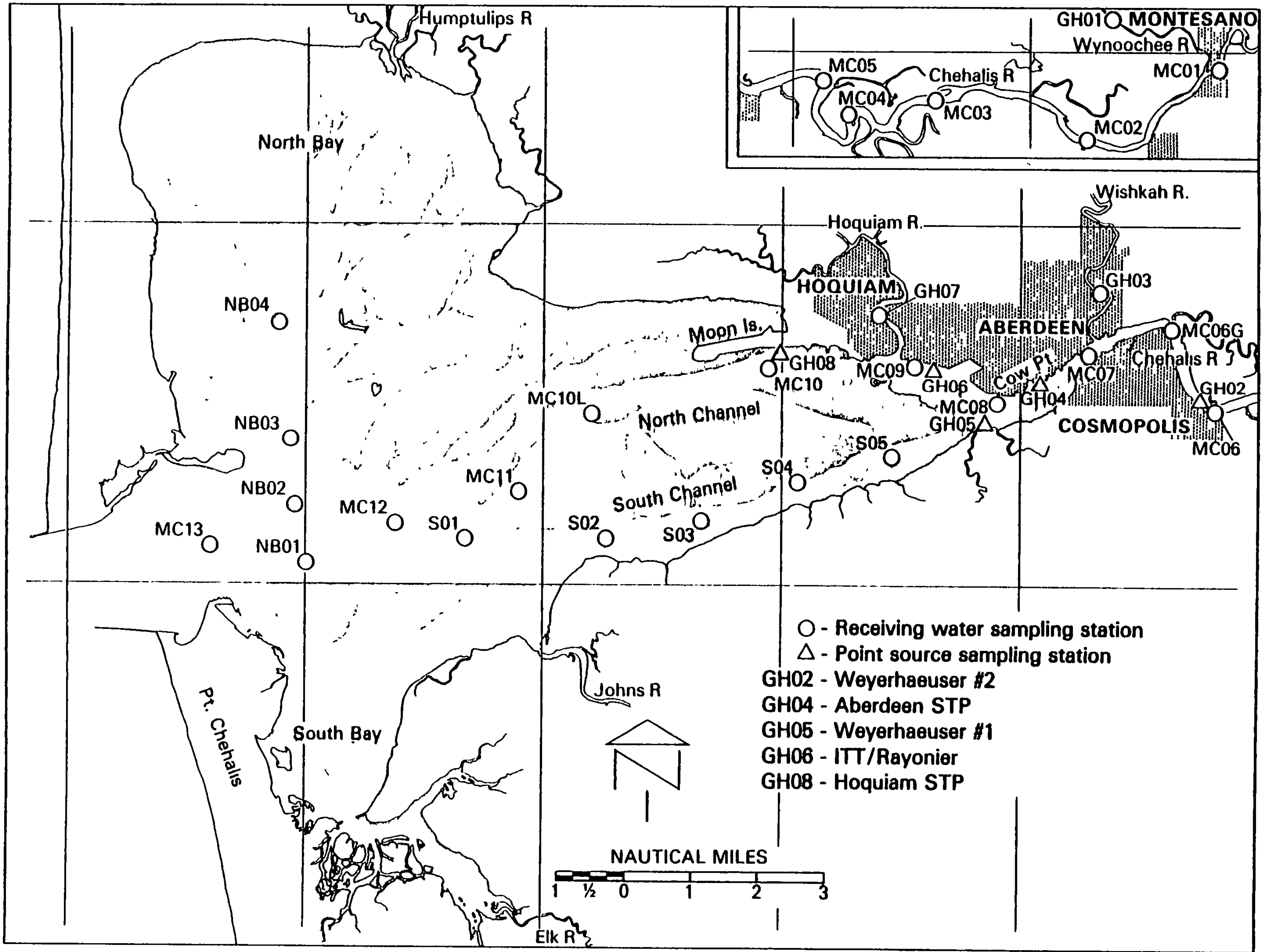


Figure 3. Location of receiving water and point source sampling stations in Grays Harbor during the EPA Region 10 field study, July 25-27, 1977.

Table 5. References for methods used to analyze various water quality parameters during the July 25-29, 1977, Grays Harbor field study.

STORET Parameter Code	Parameter	Method of Analysis
00304	2-day BOD	Standard Methods
00310	5-day BOD	Standard Methods
00322	10-day BOD	Standard Methods
00323	15-day BOD	Standard Methods
00324	20-day BOD	Standard Methods
00610	$N-NH_3$	EPA Manual
00625	TKN	Standard Methods
00630	$N-NO_3+NO_2$	EPA Manual
00665	P-Total	EPA Manual
00671	P-Diss. Ortho	EPA Manual
00680	TOC	EPA Manual

The University of Washington's Department of Oceanography, under contract to EPA, Region 10, measured primary productivity, chlorophyll a and phaeo pigments at four stations in Grays Harbor.

An additional part of the field study program was the measurement of temperature, salinity, pH and dissolved oxygen once a week in Grays Harbor at Point Chehalis and in the Chehalis River near Montesano, Washington. EPA, Region 10, provided contract funds to the Grays Harbor Community College to perform this study. Dr. John M. Smith was the project leader. The period of sampling was from August 4, 1977 through September 29, 1977. The purpose of this study was to provide complementary data for that collected by the two mills, Weyerhaeuser and ITT/Rayonier. The data collected by the mills is from the inner portions of the estuary only. It does not, therefore, provide data for the river and ocean boundaries. The data collected by Grays Harbor Community College provided boundary conditions, at least for temperature, salinity, pH and dissolved oxygen, during the months of August and September 1977.

Quality Control

Temperature, conductivity, pH and dissolved oxygen probes were calibrated at the beginning of each day using, respectively, standard mercury thermometer, two conductivity reference samples, standard pH buffers, and the Winkler method for dissolved oxygen. In addition, periodic checks of these parameters were made throughout each day as a means of monitoring drift and to determine whether or not the instruments were functioning properly.

The effect of field handling and storage time upon the chemical analyses was determined by analyzing autoclaved blanks which had been subjected to the same treatment as the receiving water and point source samples. The measured levels of various nutrients in these blanks are given in Table 6. In addition, a known quantity of PO_4, NH_3 and NO_3 was added to a small number of water samples in the field. These "spiked" samples, along with unspiked replicates were handled and analyzed in the same manner as the other samples. Recovery efficiencies and sample differences are shown in Table 7.

Table 6. Measured levels of various nutrients in autoclaved blanks. The blanks were subjected to the same handling procedures as water samples, during the field study of Grays Harbor July 25-29, 1977.

Lab Number	NH-3-N (mg/l)	NO_3-N (mg/l)	TKN (mg/l)	P.DisOrtho (mg/l)	P-Total (mg/l)	TOC (mg/l)
30467	.006	.002	0.40	.002	.004	1.0
30468	.006	.002	0.03	.002	.002	2.0
30566	.002	.002	****	.002	.004	2.0
30567	.002	.002	****	.002	.002	1.0

Tidal and Hydrologic Condition

Estimated time and heights of slack tide the water surface levels are given in Table 8 for various locations throughout Grays Harbor and the Chehalis River. These estimates were obtained from the tidal tables published by the U.S. Department of Commerce (1977). Estimates of the freshwater flow for the Chehalis River at Hoquiam during the survey are shown in Table 9. The flow of the Chehalis River at Hoquiam was estimated by the U.S. Geological Survey from:

$$Q_1 = 1.4 * (Q_2 + Q_3 + Q_4) \quad (1)$$

Where,

Q_1 = the estimated freshwater flow of the Chehalis River at Hoquiam,

Q_2 = the gaged flow of the Chehalis River at Grand Mound,

Q_3 = the gaged flow of the Satsop River at Satsop,

Q_4 = the gaged flow of the Wynoochee River at Black Creek.

Table 7. Recovery efficiencies of field spiked samples collected during the field study of Grays Harbor, July 25-29, 1977.

Lab Number	NH_3-N (mg/1) Spike	NH_3-N (mg/1) Replicate	NO_3-N (mg/1) Spike	NO_3-N (mg/1) Replicate	P.DisOrtho (mg/1) Spike	P.DisOrtho (mg/1) Replicate
30626	0.056		0.049		0.050	
30627		0.004		0.002		0.002
30628		0.006		0.002		0.004
Recovery Efficiency	102%		94%		94%	
30481	0.098		0.090		0.046	
30482		0.054		0.046		0.004
30483		0.042		0.044		0.002
Recovery Efficiency	100%		90%		86%	
30464	0.028		0.052		0.030	
30465		0.002		0.002		0.002
30466		0.002		0.002		0.002
Recovery Efficiency	52%		100%		56%	

Table 8. Estimated time and height of slack tide at selected locations in Grays Harbor during July 25-29, 1977. Tidal heights are relative to mean lower low water. Times are Pacific daylight time.

Tide	Pt. Chehalis Time (ft)	Pt. Chehalis Height	Aberdeen Time (ft)	Aberdeen Height	Montesano Time (ft)	Montesano Height
First low 7/25	0240	0.3	0323	0.4	0511	0.2
First high 7/25	0849	5.9	0921	7.0	1042	5.6
Second low 7/25	1435	2.6	1518	2.7	1706	1.4
Second high 7/25	2052	9.0	2124	10.1	2245	8.1
First low 7/26	0344	-0.4	0427	-0.3	0615	-0.2
First High 7/26	1000	6.1	1032	7.2	1153	5.8
Second low 7/26	1544	2.7	1627	2.8	1815	1.5
Second high 7/26	2154	9.3	2226	10.4	2347	8.3
First low 7/27	0445	-1.0	0528	-0.9	0716	-0.5
First high 7/27	1110	6.5	1142	7.6	1303	6.1
Second low 7/27	1550	2.5	1733	2.6	1921	1.4
Second high 7/27	2253	9.5	2325	10.6	0046(7/28)	8.5
First low 7/28	0543	-1.7	0626	-1.6	0814	-0.8
First high 7/28	1210	7.0	1242	8.1	1403	6.5
Second low 7/28	1751	2.1	1834	2.2	2022	1.2
First low 7/29	2351(7/28)	9.7	0023	10.8	0144	8.6
First high 7/29	0634	-2.1	0717	-2.0	0905	1.1
Second high 7/29	1306	7.6	1338	8.7	1459	7.0
Second low 7/29	1845	1.7	1928	1.8	2116	1.0

Table 9. Estimates of the discharge of the Chehalis River at Hoquiam for the period July 25-29, 1977.

Date	Freshwater Discharge of the Chehalis River at Hoquiam (cfs)
July 25, 1977	1,160
July 26, 1977	1,140
July 27, 1978	1,140
July 28, 1977	1,140
July 29, 1977	1,120

RESULTS

The results of all field measurements are presented in Appendices I (EPA receiving water studies), II (EPA point source studies), III (University of Washington primary productivity studies), and IV (Grays Harbor Community College studies).

In addition, the averages of all temperature, dissolved oxygen, and salinity measurements made at each sampling station in the Main Channel are shown in Figures 4 through 6. Average values of these parameters at high and low slack tides, for the same stations, are shown in Figures 7 through 33. Time of slack tide varies more than two hours between the entrance to Grays Harbor and Montesano. Data from the time periods shown in Table 10 were used to characterize conditions at the various tide stages.

Table 10. Time interval used to characterize various periods of slack tide in Grays Harbor, July 25-29, 1977. Data from these time intervals was used to develop figures 8 through 34.

Tide (Port Dock-Aberdeen)	Date	Time Interval (Pacific Daylight Time)
Second low	July 25, 1977	1330-1800
First high	July 26, 1977	0900-1300
Second low	July 26, 1977	1400-1900
First high	July 27, 1977	1000-1400
Second low	July 27, 1977	1600-2000
First low	July 28, 1977	0500-1000
First high	July 28, 1977	1100-1500
Second low	July 28, 1977	1700-2100
First low	July 29, 1977	0530-1000

FIGURE 4 . AVERAGE, MAXIMUM AND MINIMUM TEMPERATURE IN GRAYS HARBOR. EPA REGION 10 FIELD STUDY, JULY 25-29, 1977.

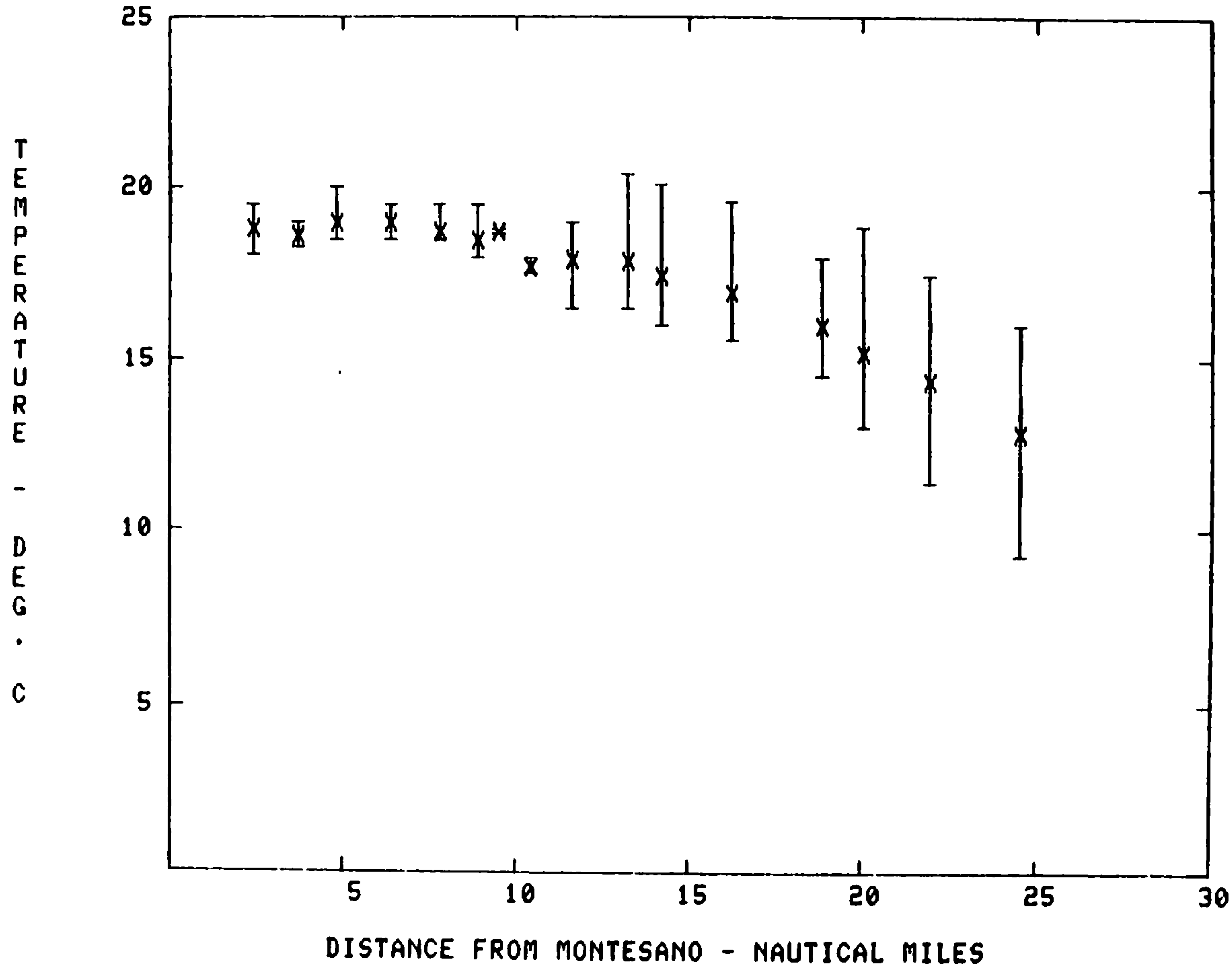


FIGURE 51. AVERAGE, MAXIMUM AND MINIMUM DISSOLVED OXYGEN IN GRAYS HARBOR. EPA REGION 10 FIELD STUDY, JULY 25-29, 1977.

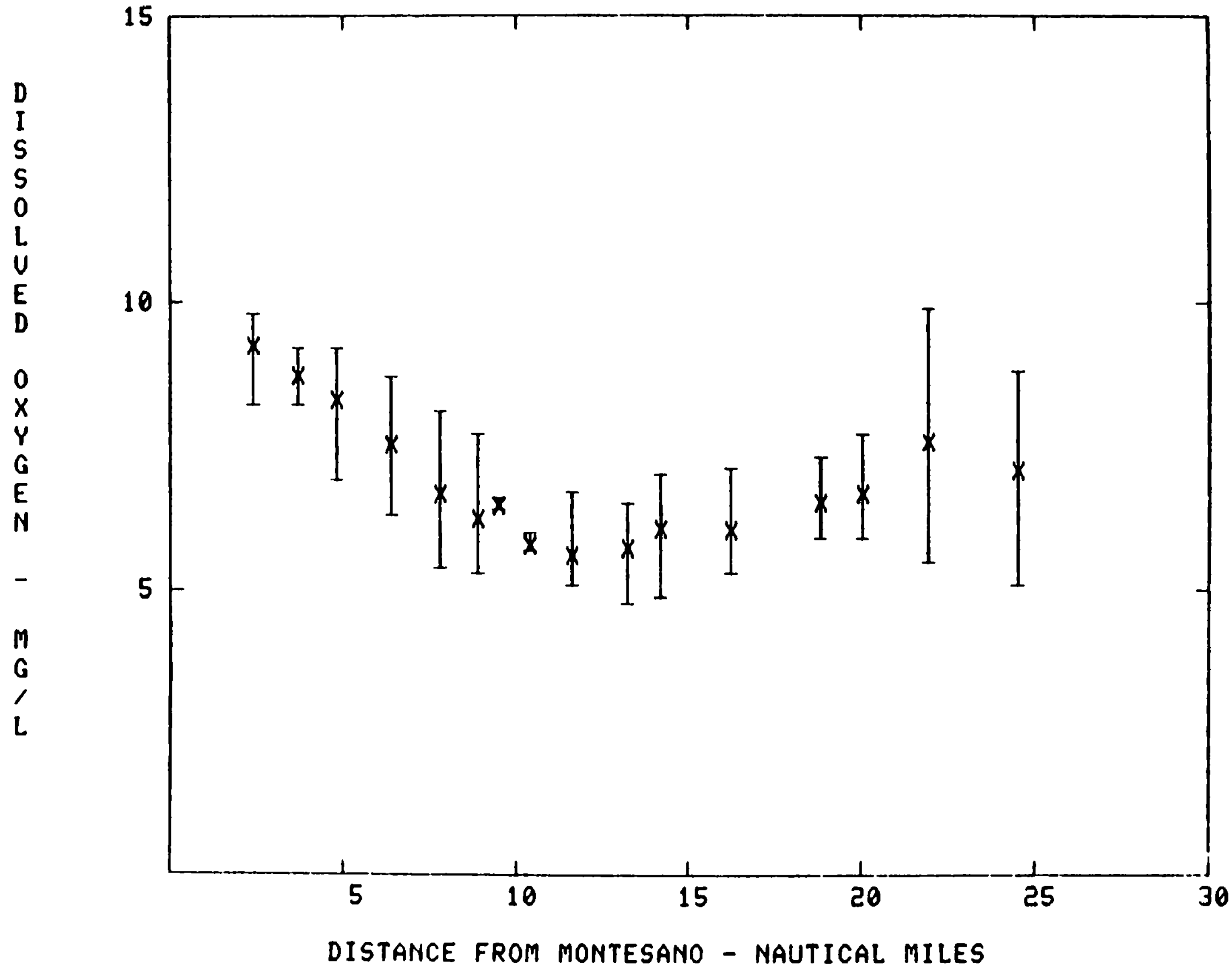


FIGURE 6 1. AVERAGE, MAXIMUM AND MINIMUM SALINITY IN GRAYS HARBOR. EPA REGION 10 FIELD STUDY, JULY 25-29, 1977.

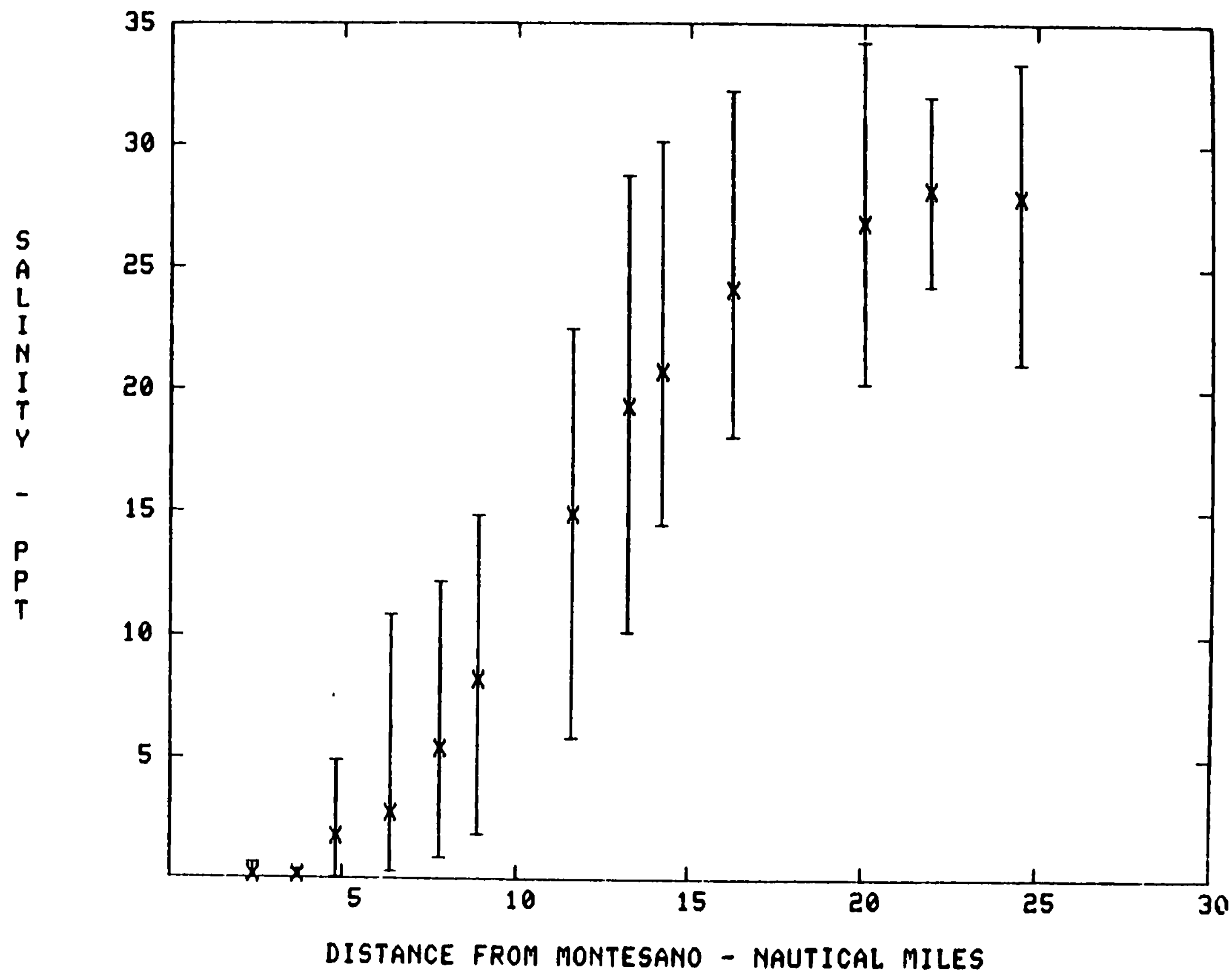


FIGURE 71 . DEPTH-AVERAGED TEMPERATURE IN THE NORTH CHANNEL OF GRAYS HARBOR AT SECOND LOW SLACK, JULY 25, 1977.

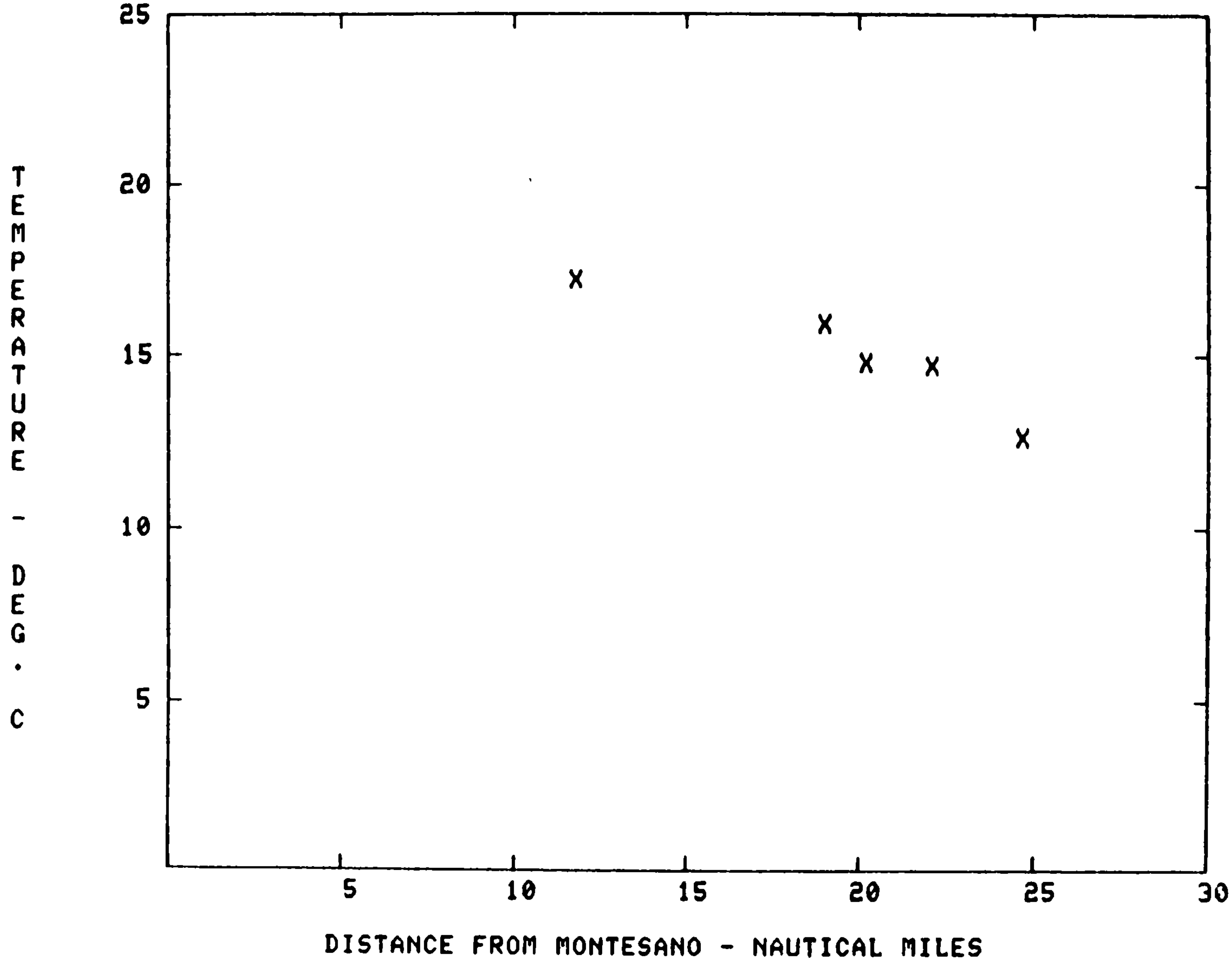


FIGURE 8. DEPTH-AVERAGED TEMPERATURE IN THE NORTH CHANNEL OF GRAYS HARBOR AT FIRST HIGH SLACK, JULY 26, 1977.

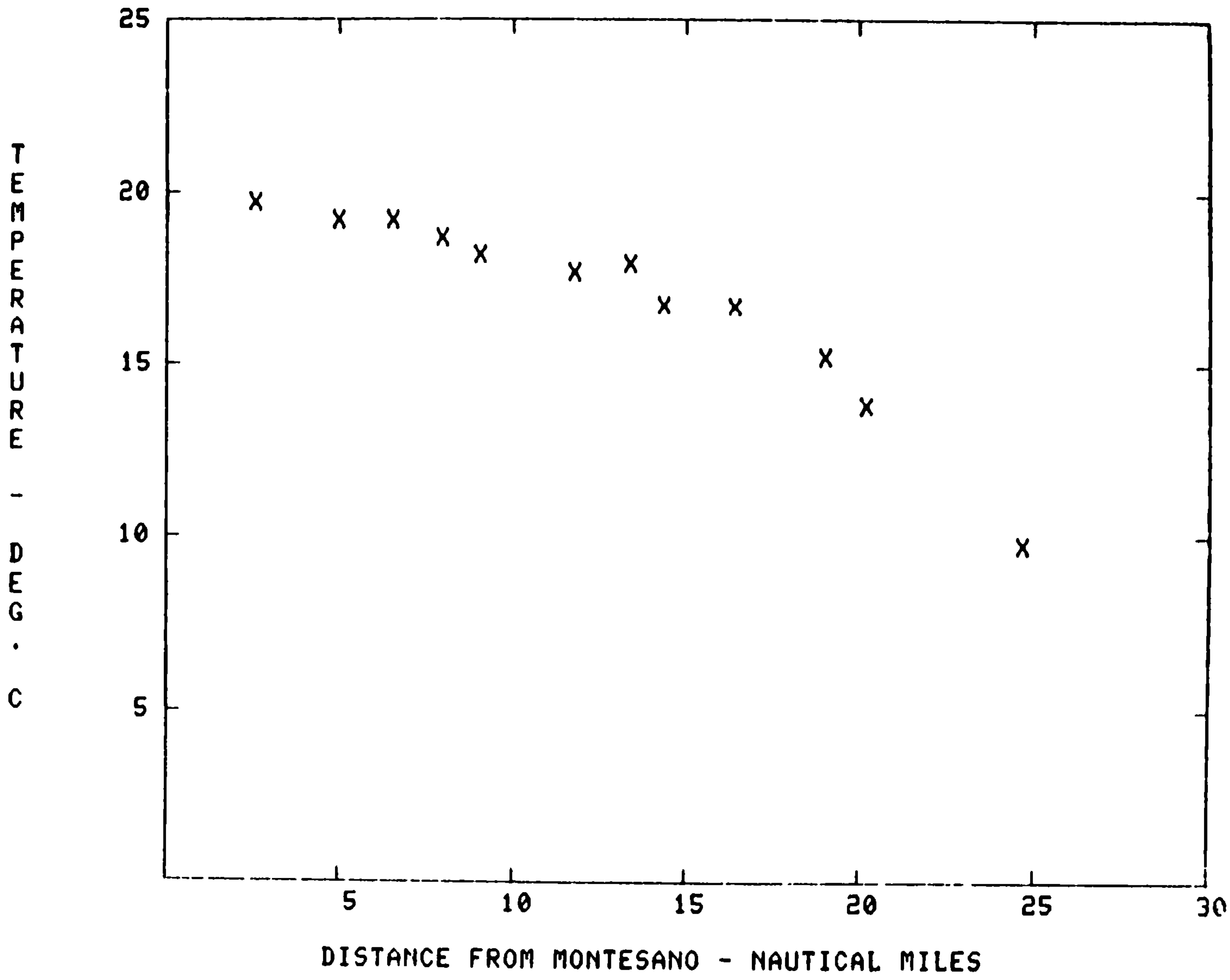


FIGURE 9. DEPTH-AVERAGED TEMPERATURE IN THE NORTH CHANNEL OF GRAYS HARBOR AT SECOND LOW SLACK, JULY 26, 1977.

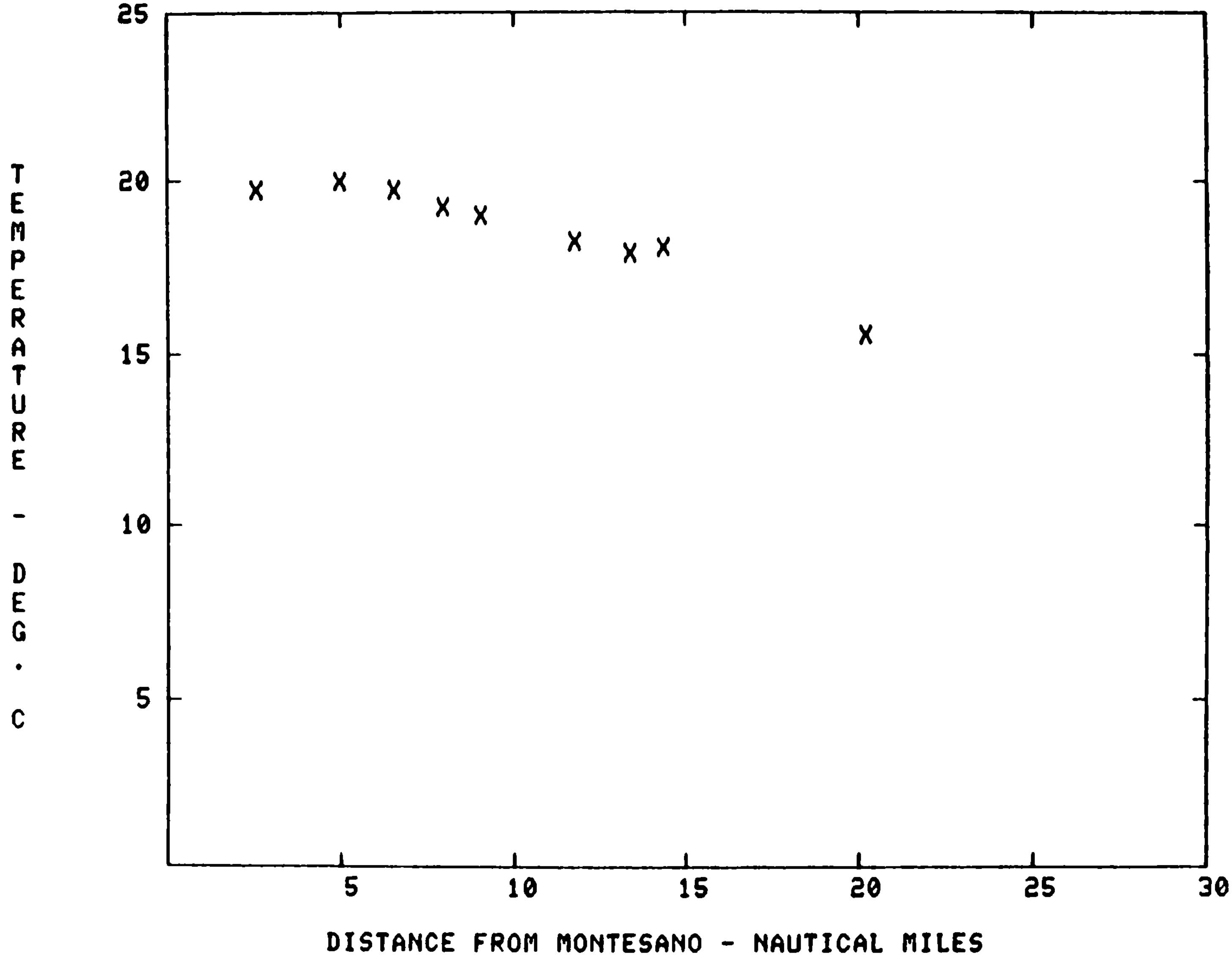


FIGURE 10. DEPTH-AVERAGED TEMPERATURE IN THE NORTH CHANNEL OF GRAYS HARBOR AT FIRST HIGH SLACK, JULY 27, 1977.

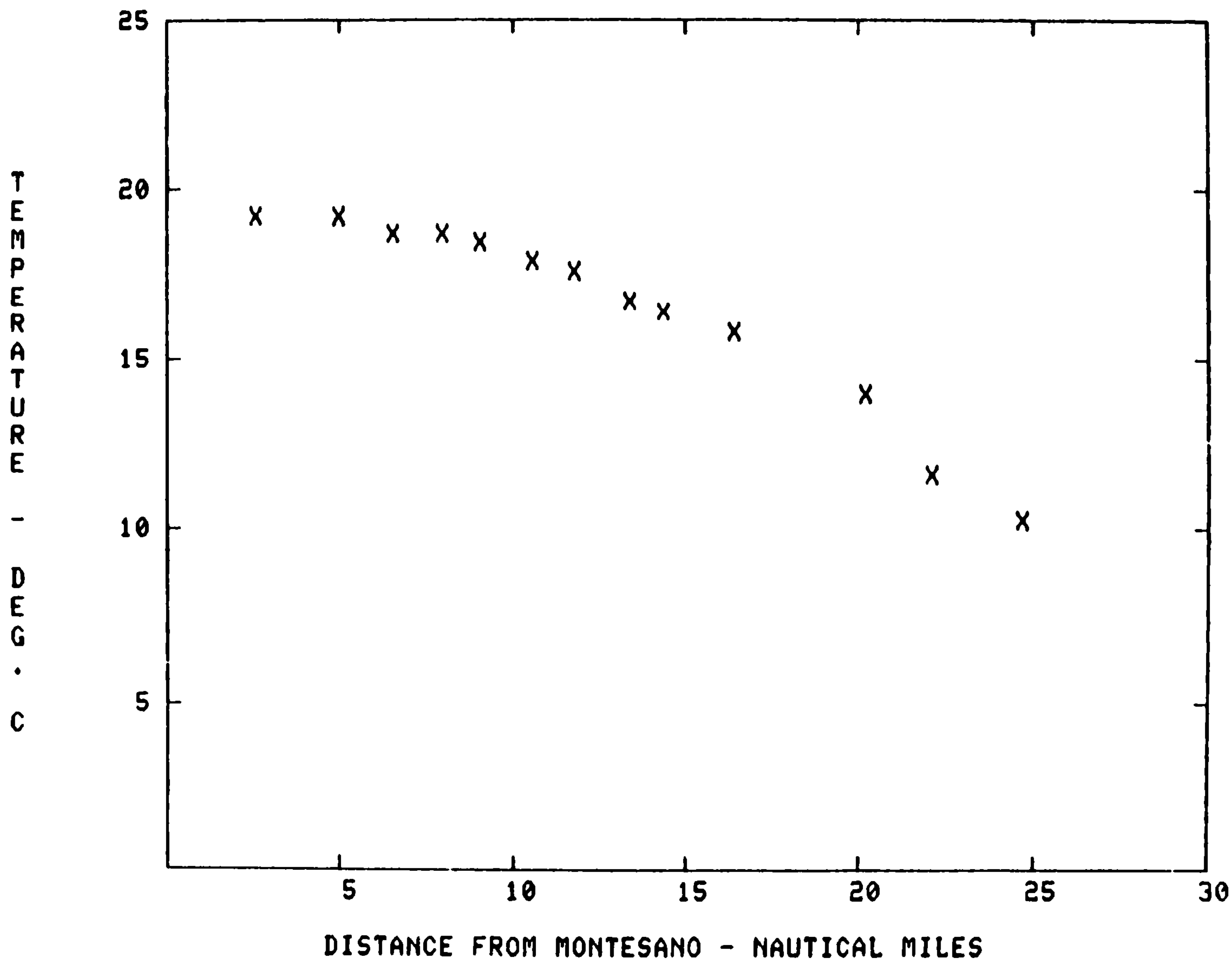


FIGURE 11. DEPTH-AVERAGED TEMPERATURE IN THE NORTH CHANNEL OF GRAYS HARBOR AT SECOND LOW SLACK, JULY 27, 1977.

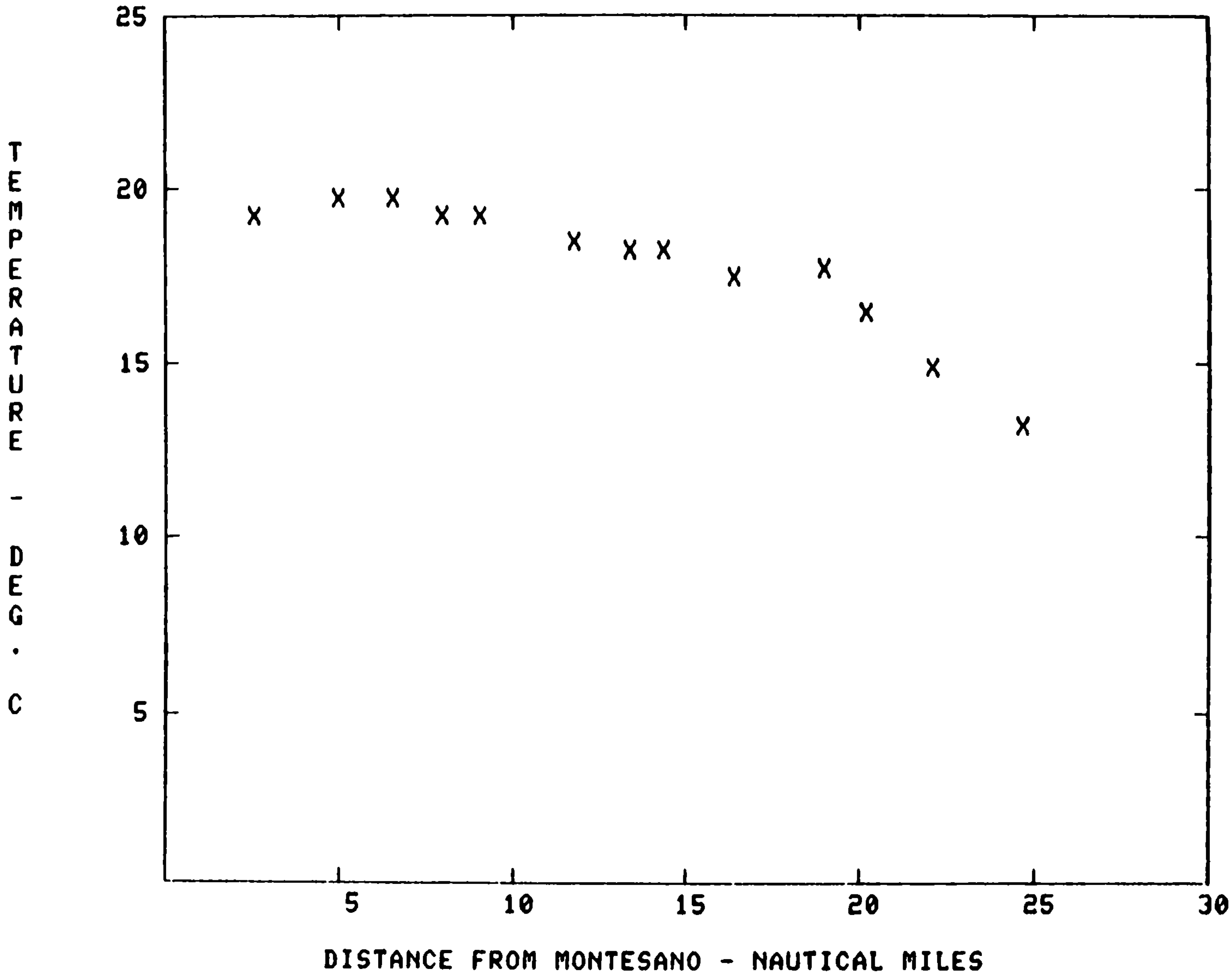


FIGURE 12 . DEPTH-AVERAGED TEMPERATURE IN THE NORTH CHANNEL OF GRAYS HARBOR AT FIRST LOW SLACK, JULY 28, 1977.

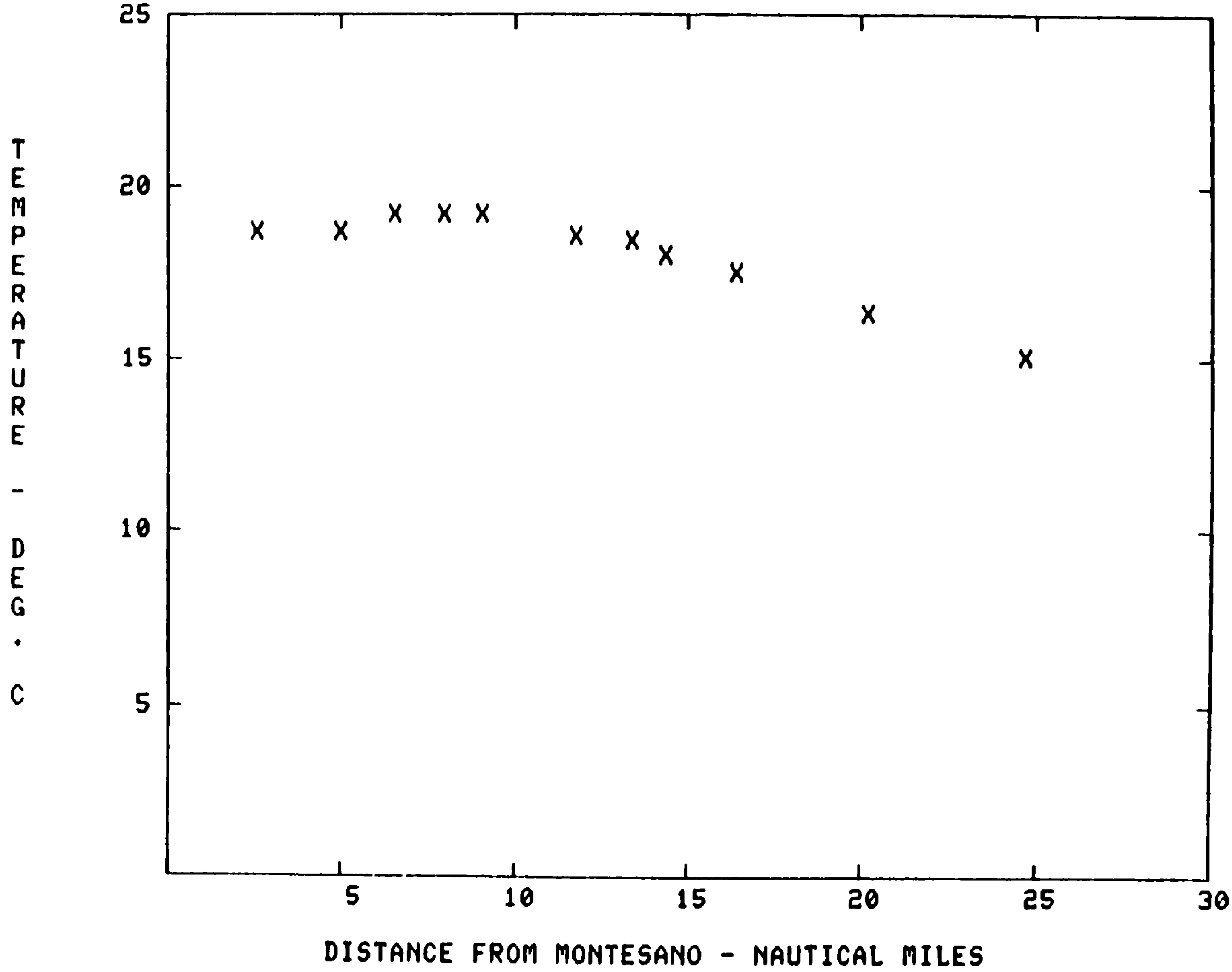


FIGURE 13. DEPTH-AVERAGED TEMPERATURE IN THE NORTH CHANNEL OF GRAYS HARBOR AT FIRST HIGH SLACK, JULY 28, 1977.

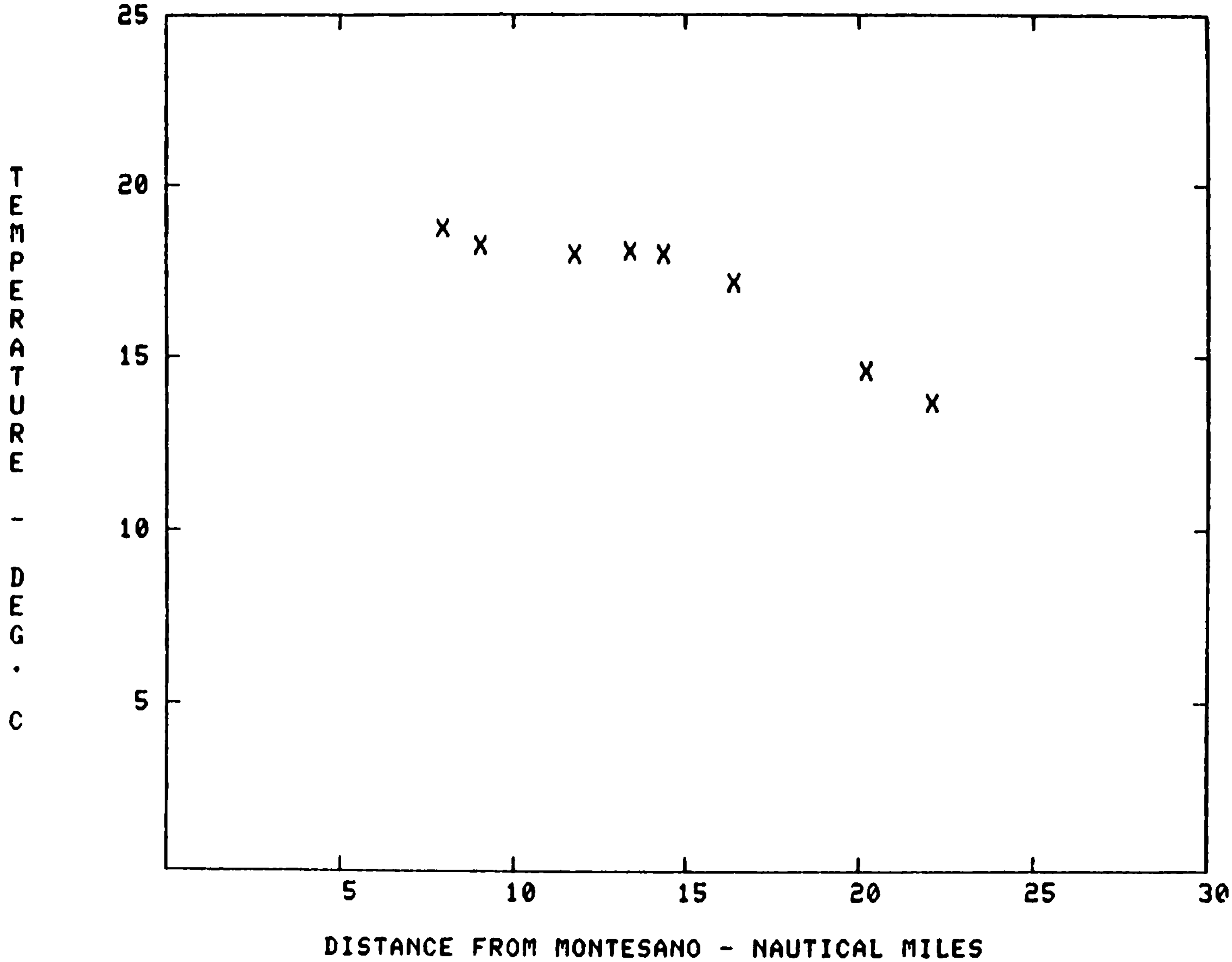


FIGURE 14 DEPTH-AVERAGED TEMPERATURE IN THE NORTH CHANNEL OF GRAYS HARBOR AT SECOND LOW SLACK, JULY 28, 1977.

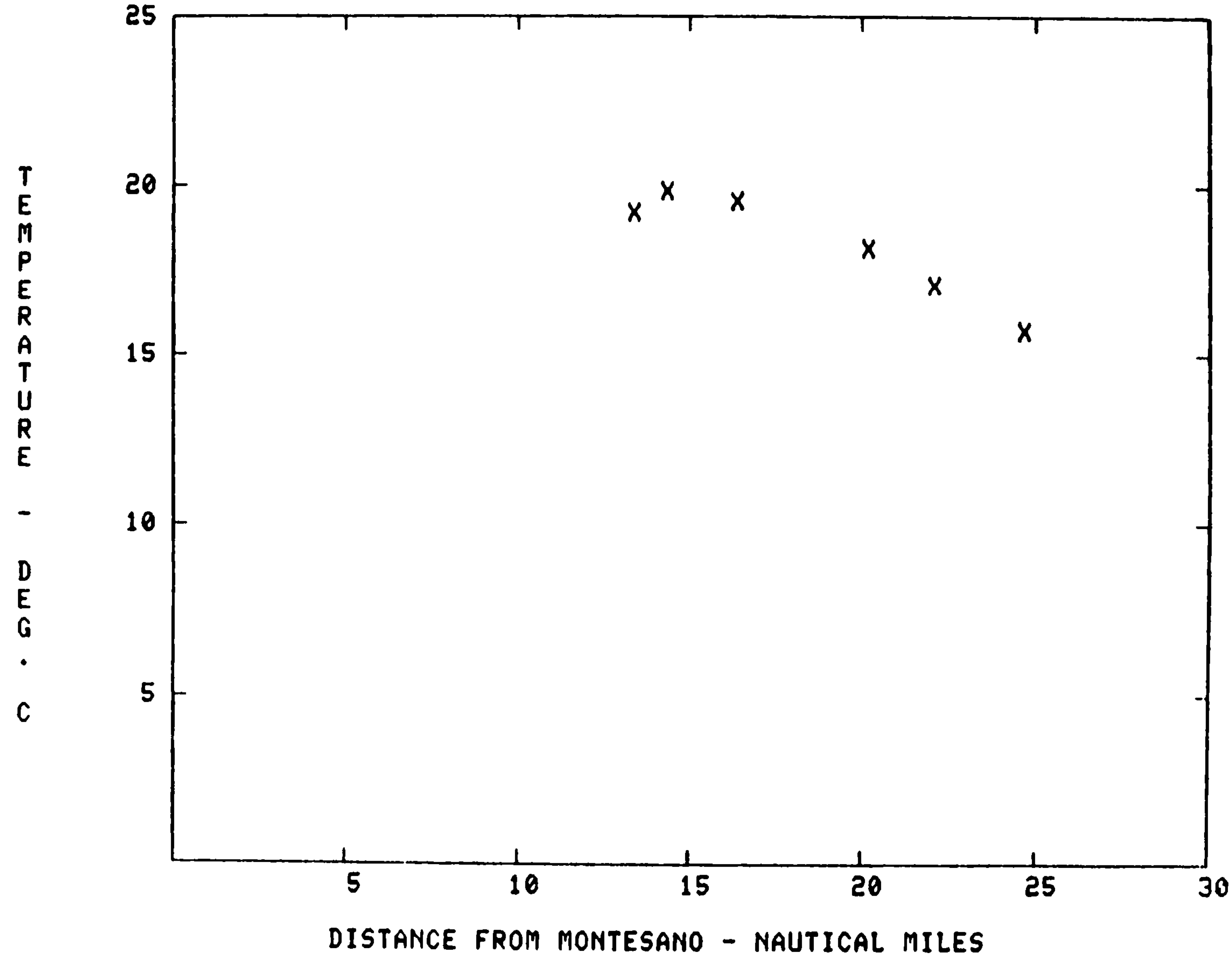


FIGURE 15. DEPTH-AVERAGED TEMPERATURE IN THE NORTH CHANNEL OF GRAYS HARBOR AT FIRST LOW SLACK, JULY 29, 1977.

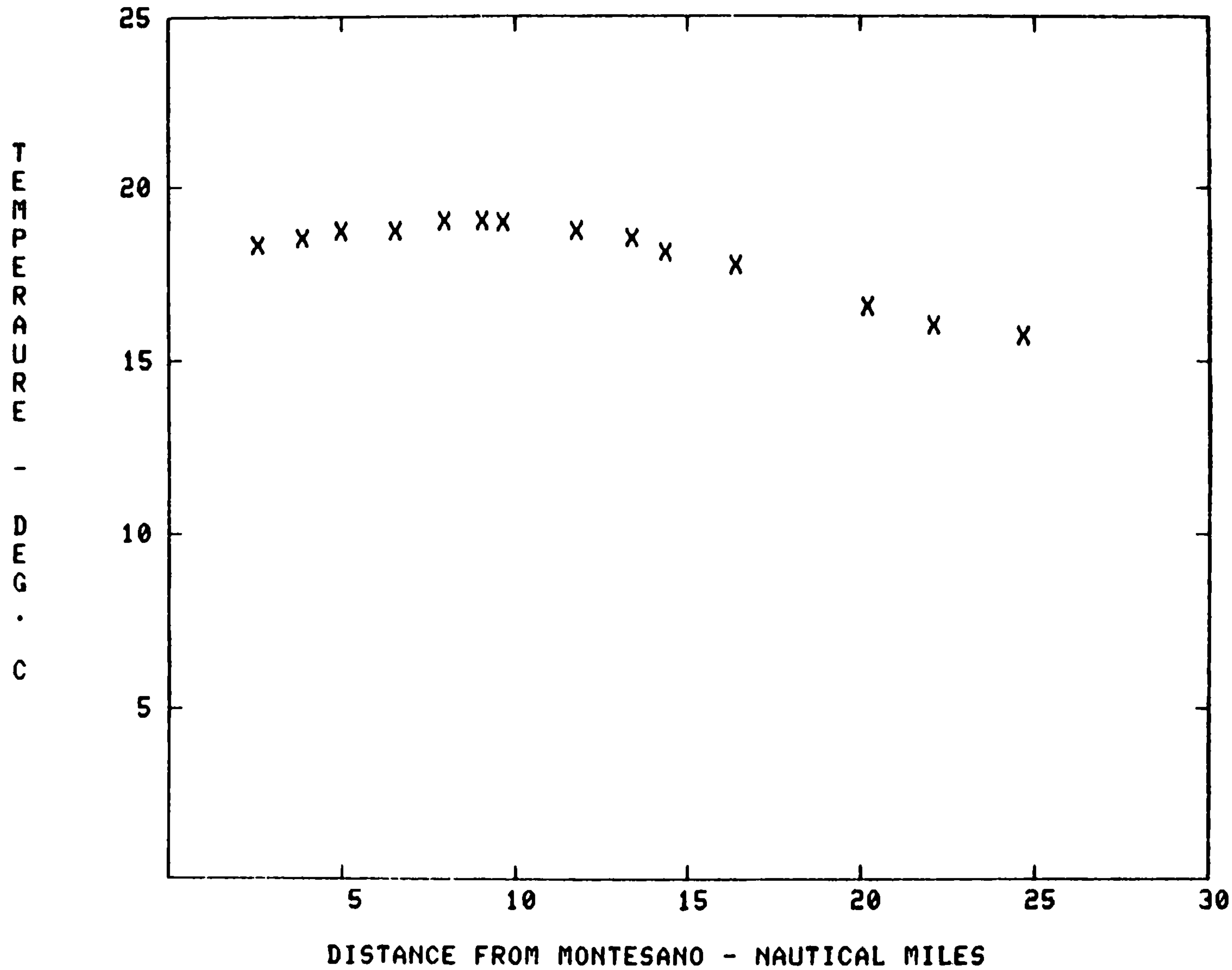


FIGURE 16. DEPTH-AVERAGED DISSOLVED OXYGEN IN THE NORTH CHANNEL OF GRAYS HARBOR AT SECOND LOW SLACK, JULY 25, 1977.

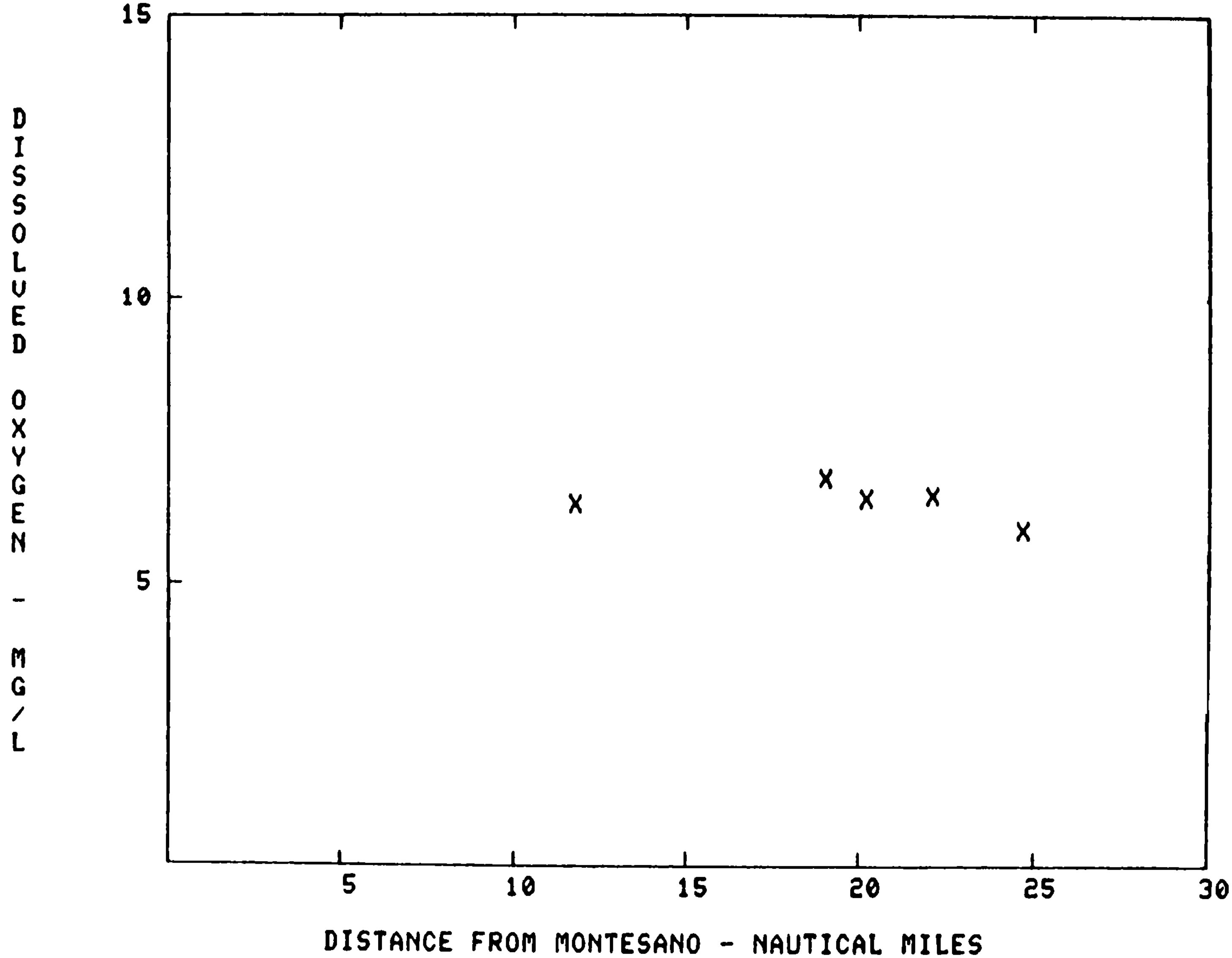


FIGURE 17. DEPTH-AVERAGED DISSOLVED OXYGEN IN THE NORTH CHANNEL OF GRAYS HARBOR AT FIRST HIGH SLACK, JULY 26, 1977.

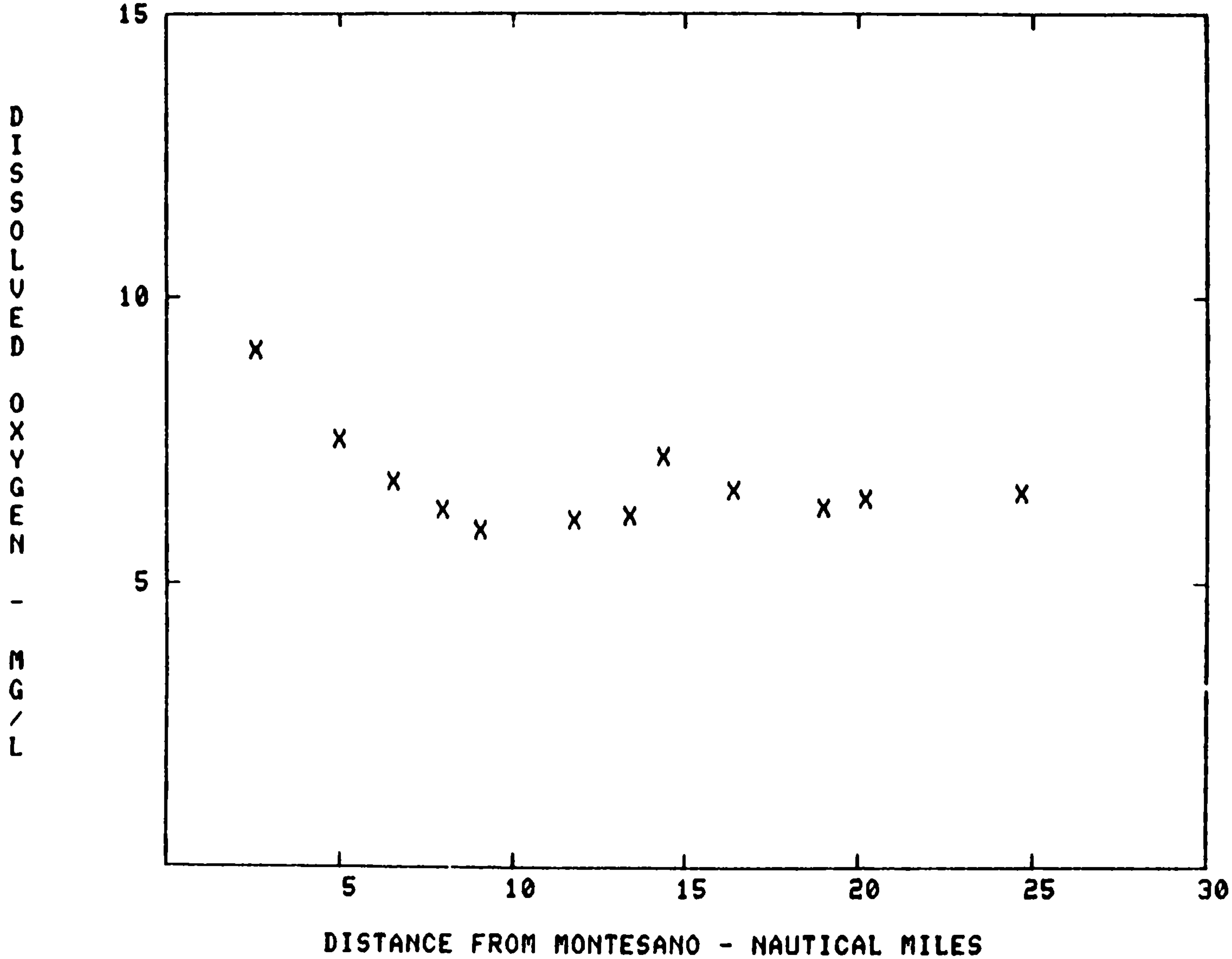


FIGURE 18. DEPTH-AVERAGED DISSOLVED OXYGEN IN THE NORTH CHANNEL OF GRAYS HARBOR AT SECOND LOW SLACK, JULY 26, 1977.

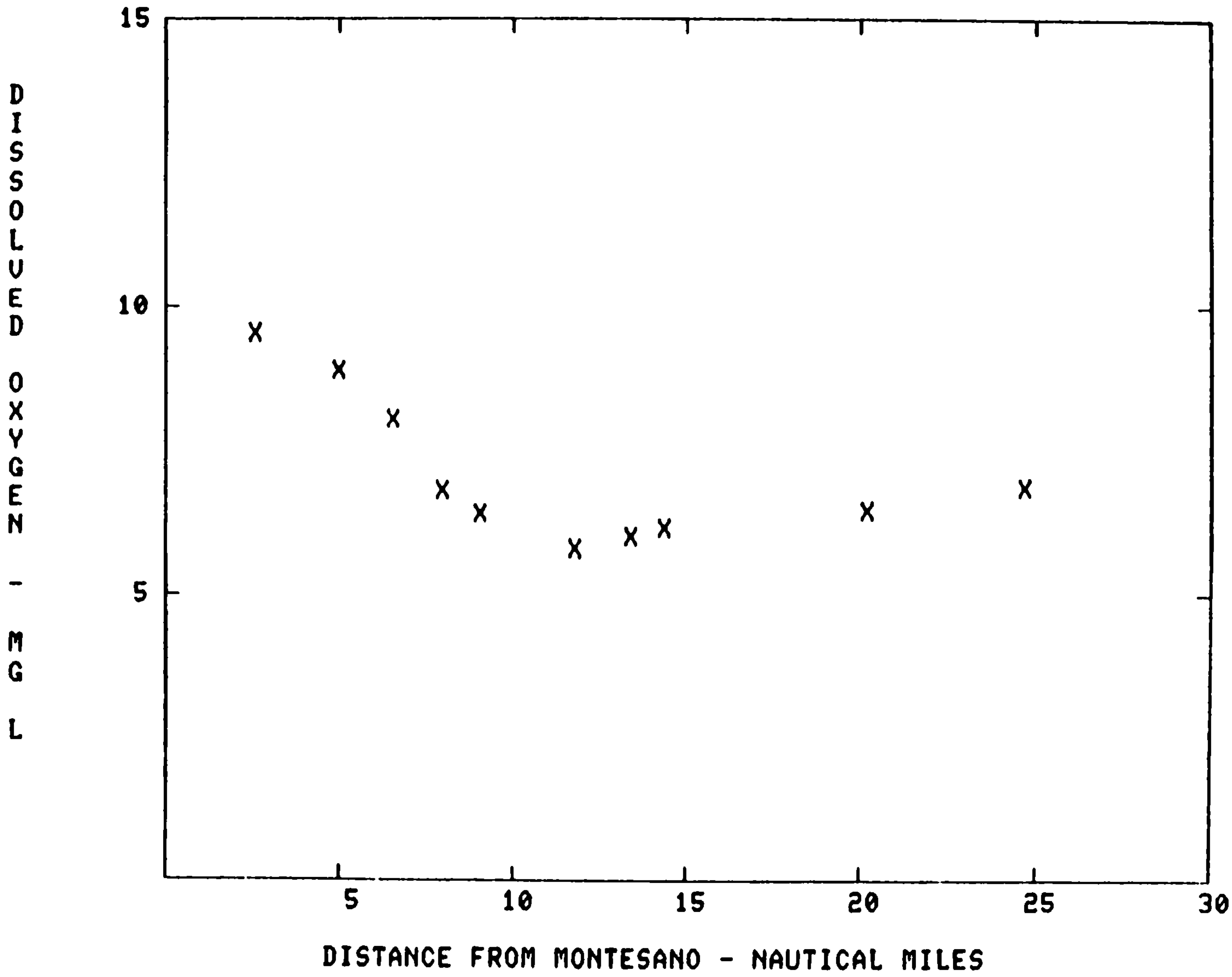


FIGURE 19. DEPTH-AVERAGED DISSOLVED OXYGEN IN THE NORTH CHANNEL OF GRAYS HARBOR AT FIRST HIGH SLACK, JULY 27, 1977.

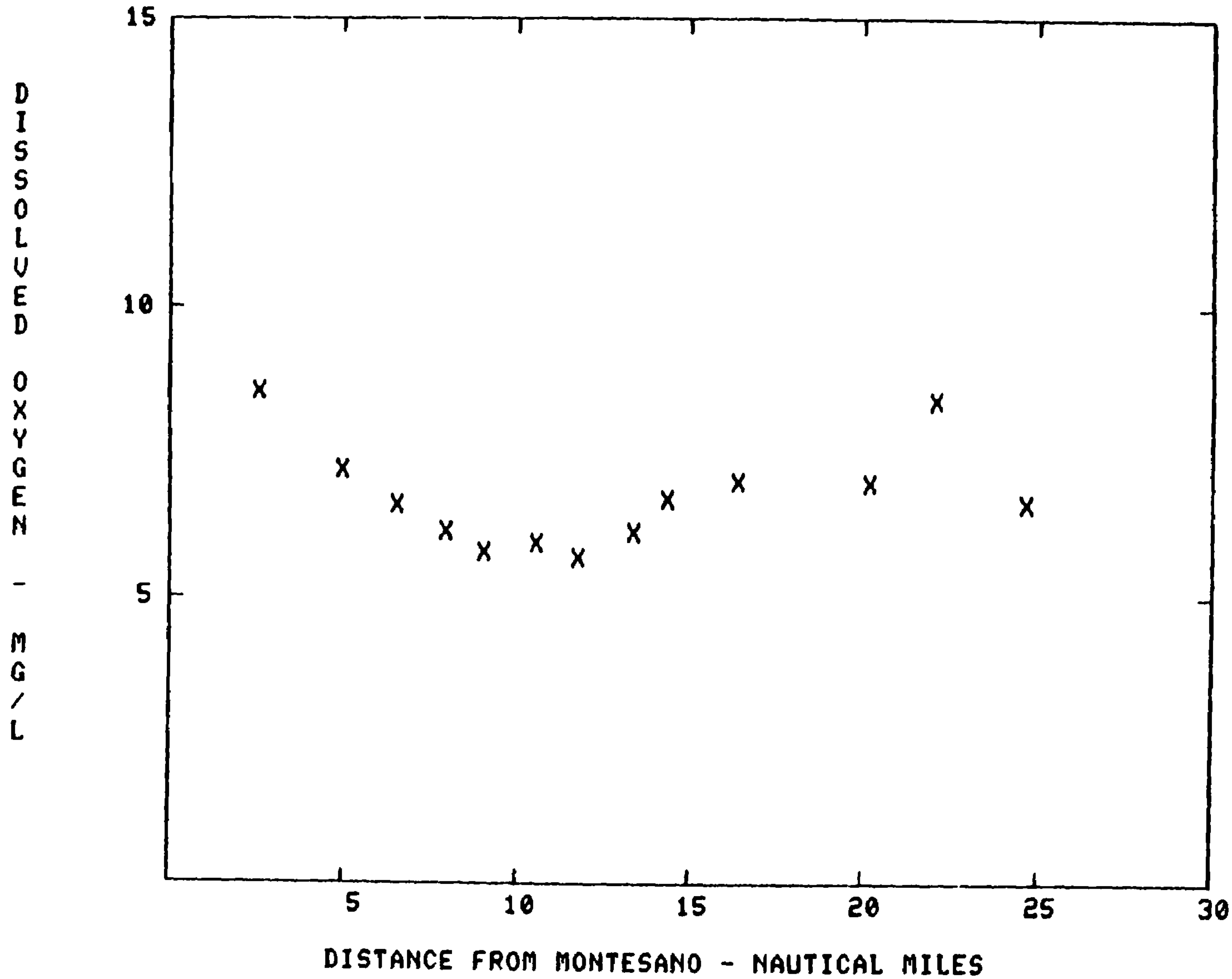


FIGURE 20. DEPTH-AVERAGED DISSOLVED OXYGEN IN THE NORTH CHANNEL OF GRAYS HARBOR AT SECOND LOW SLACK, JULY 27, 1977.

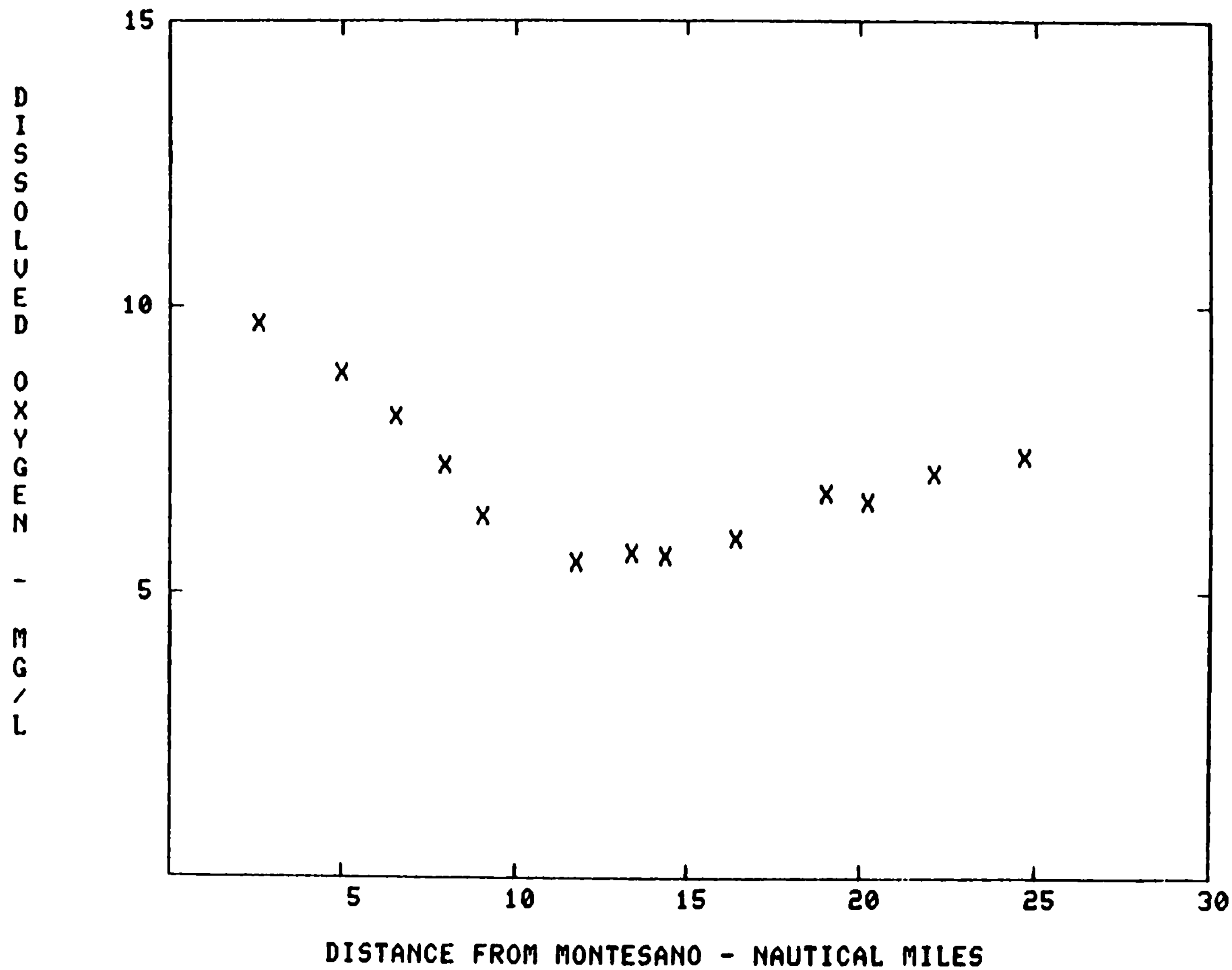


FIGURE 21. DEPTH-AVERAGED DISSOLVED OXYGEN IN THE NORTH CHANNEL OF GRAYS HARBOR AT FIRST LOW SLACK, JULY 28, 1977.

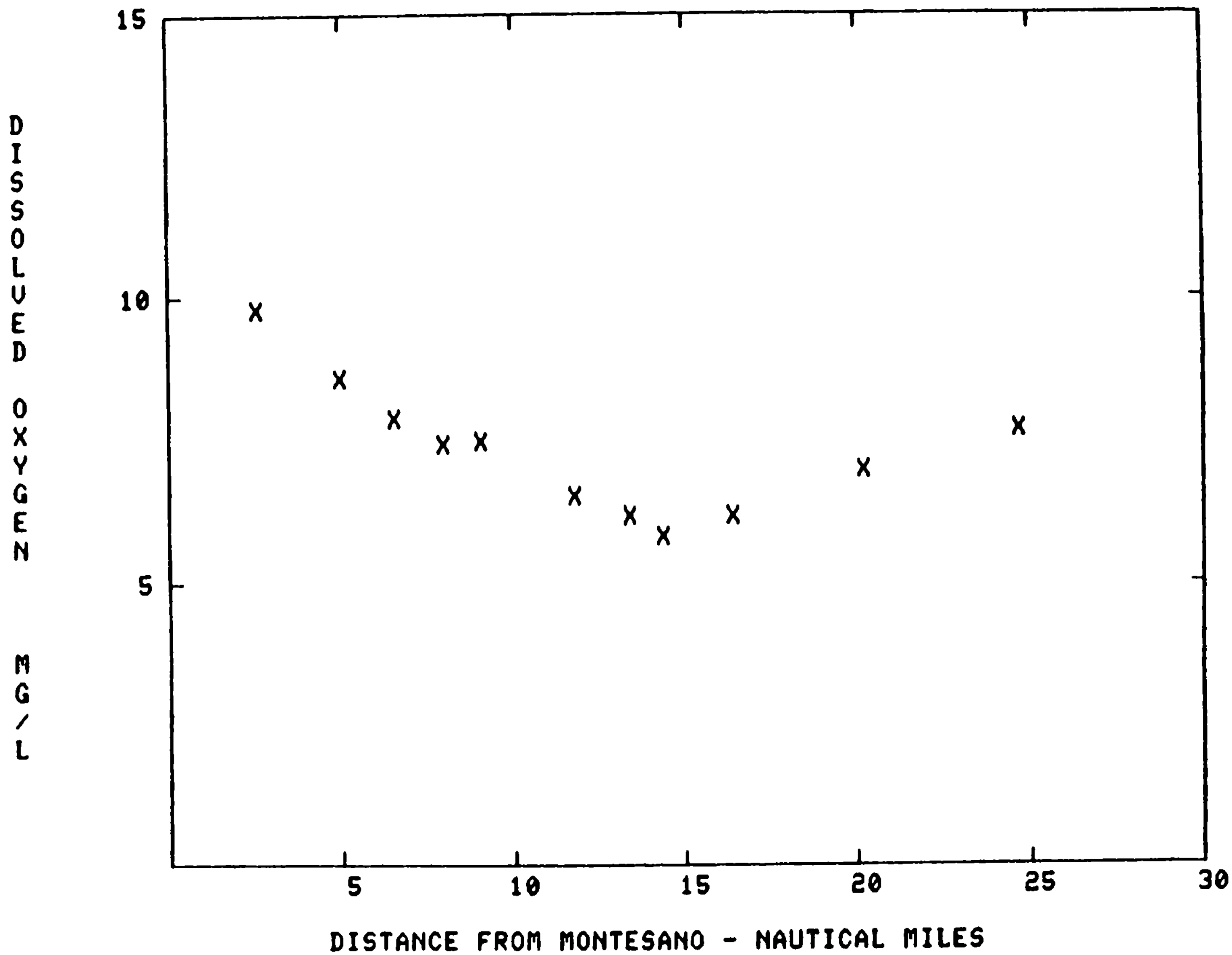


FIGURE 22. DEPTH-AVERAGED DISSOLVED OXYGEN IN THE NORTH CHANNEL OF GRAYS HARBOR AT FIRST HIGH SLACK, JULY 28, 1977.

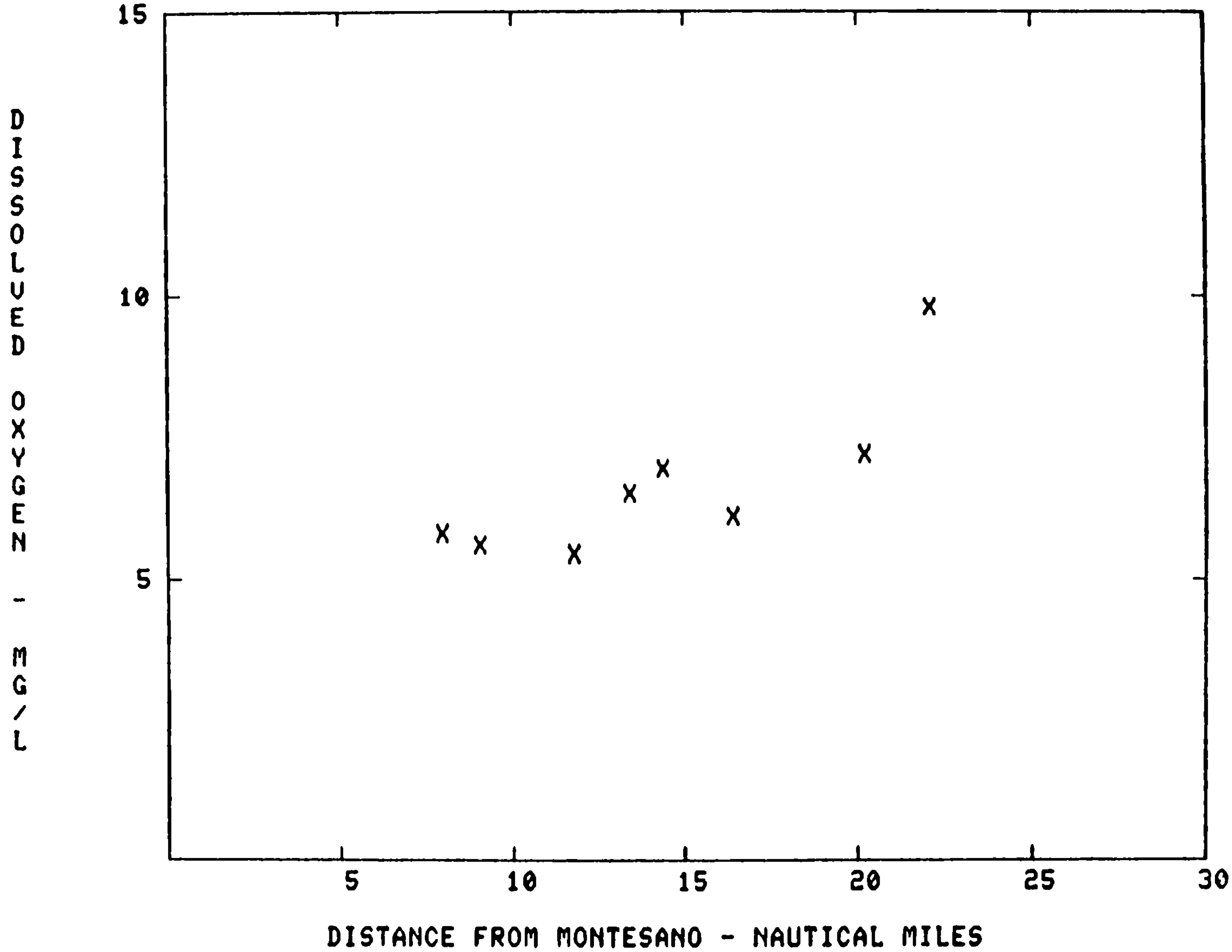


FIGURE 23 . DEPTH-AVERAGED DISSOLVED OXYGEN IN THE NORTH CHANNEL OF GRAYS HARBOR AT SECOND LOW SLACK, JULY 28, 1977.

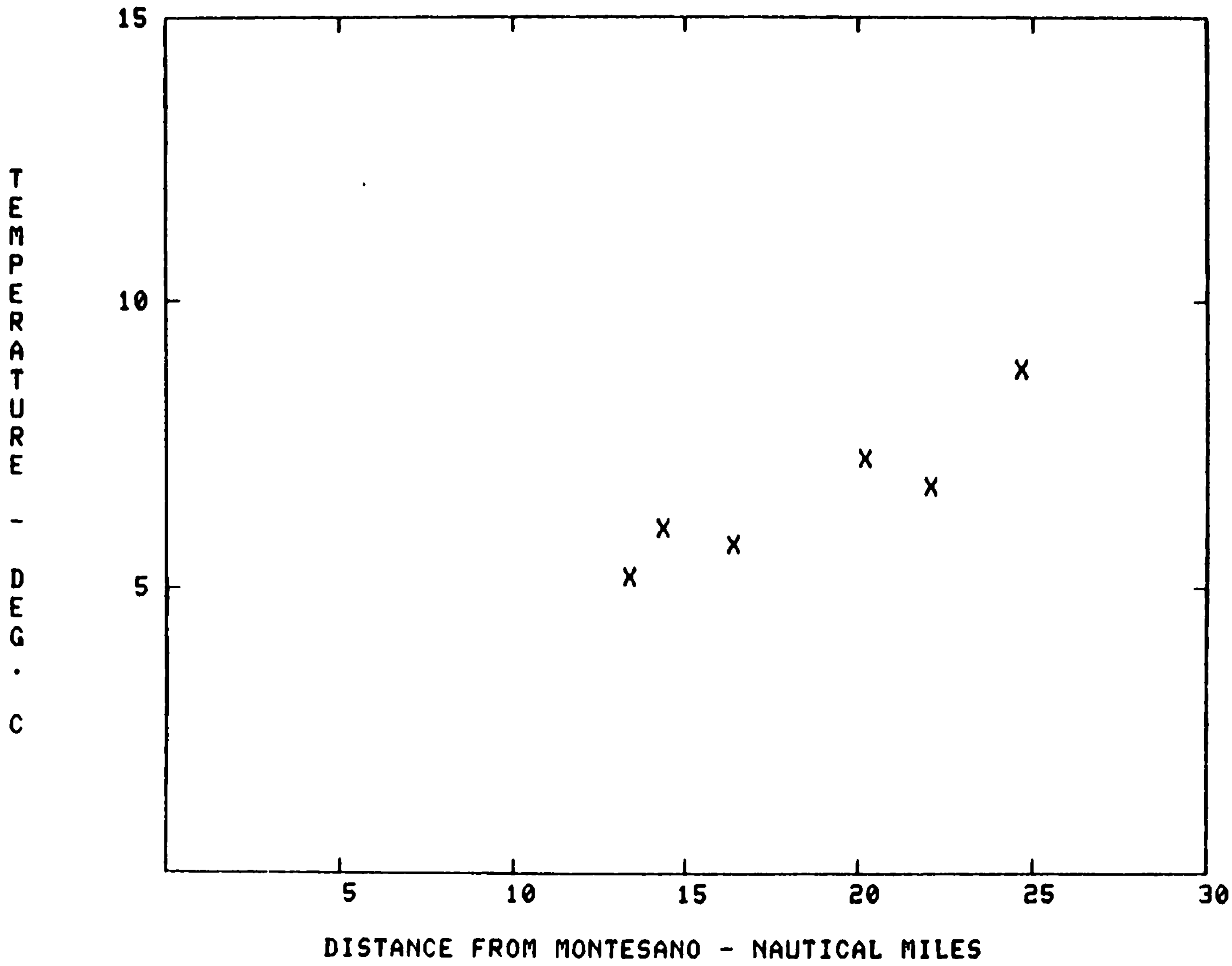


FIGURE 24. DEPTH-AVERAGED DISSOLVED OXYGEN IN THE NORTH CHANNEL OF GRAYS HARBOR AT FIRST LOW SLACK, JULY 29, 1977.

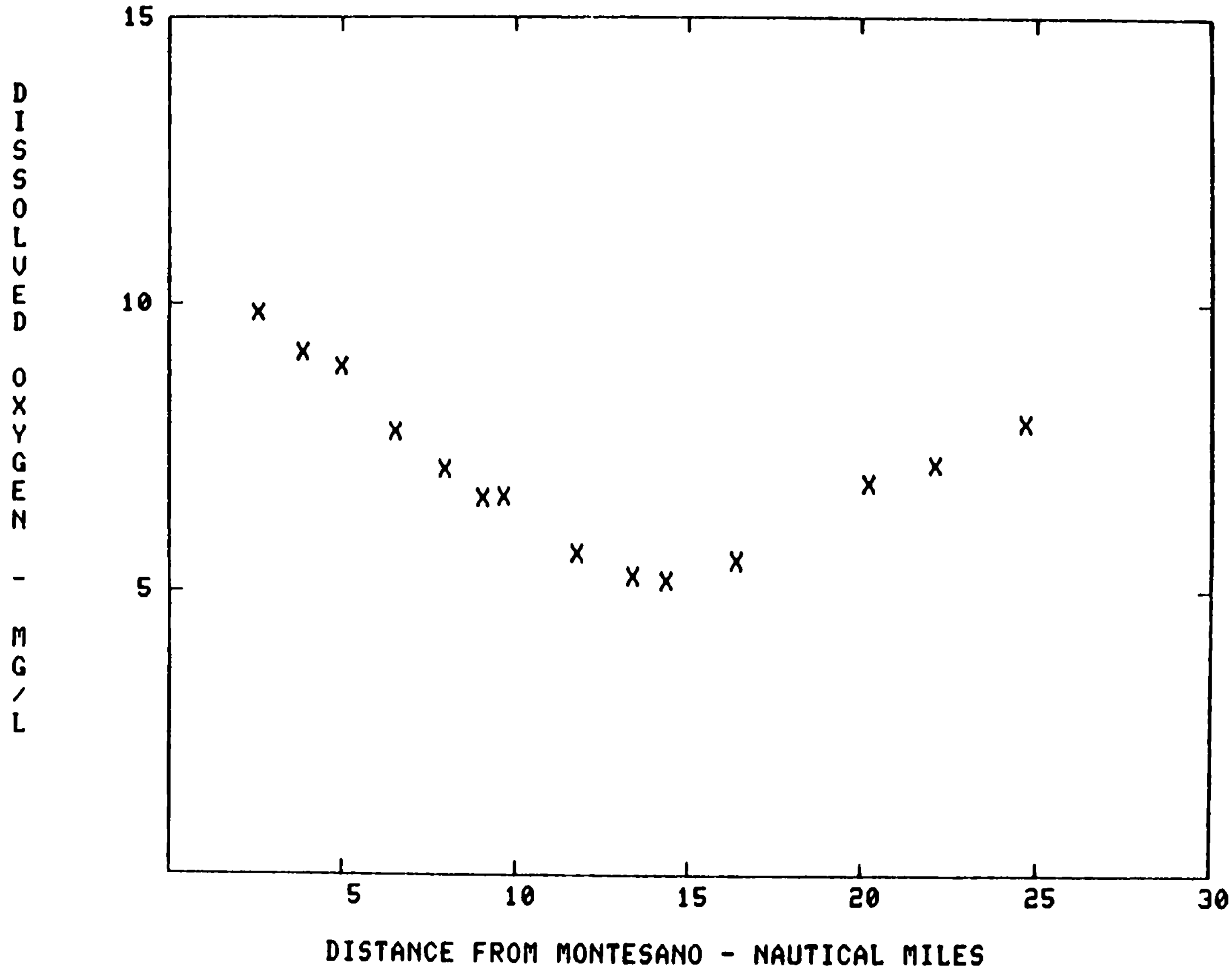


FIGURE 25. DEPTH-AVERAGED SALINITY IN THE NORTH CHANNEL OF GRAYS HARBOR AT SECOND LOW SLACK, JULY 25, 1977.

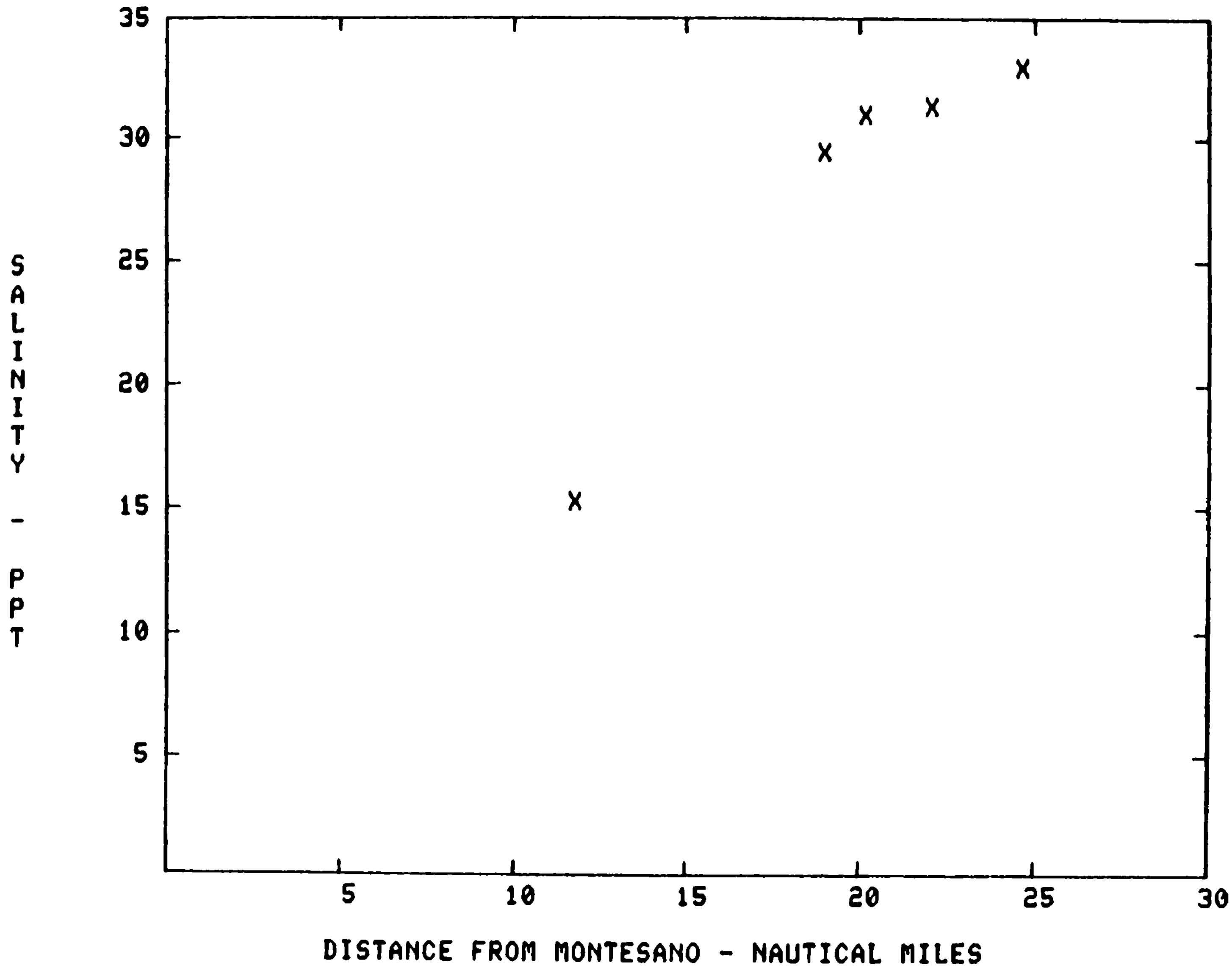


FIGURE 26. DEPTH-AVERAGED SALINITY IN THE NORTH CHANNEL OF GRAYS HARBOR AT FIRST HIGH SLACK, JULY 26, 1977.

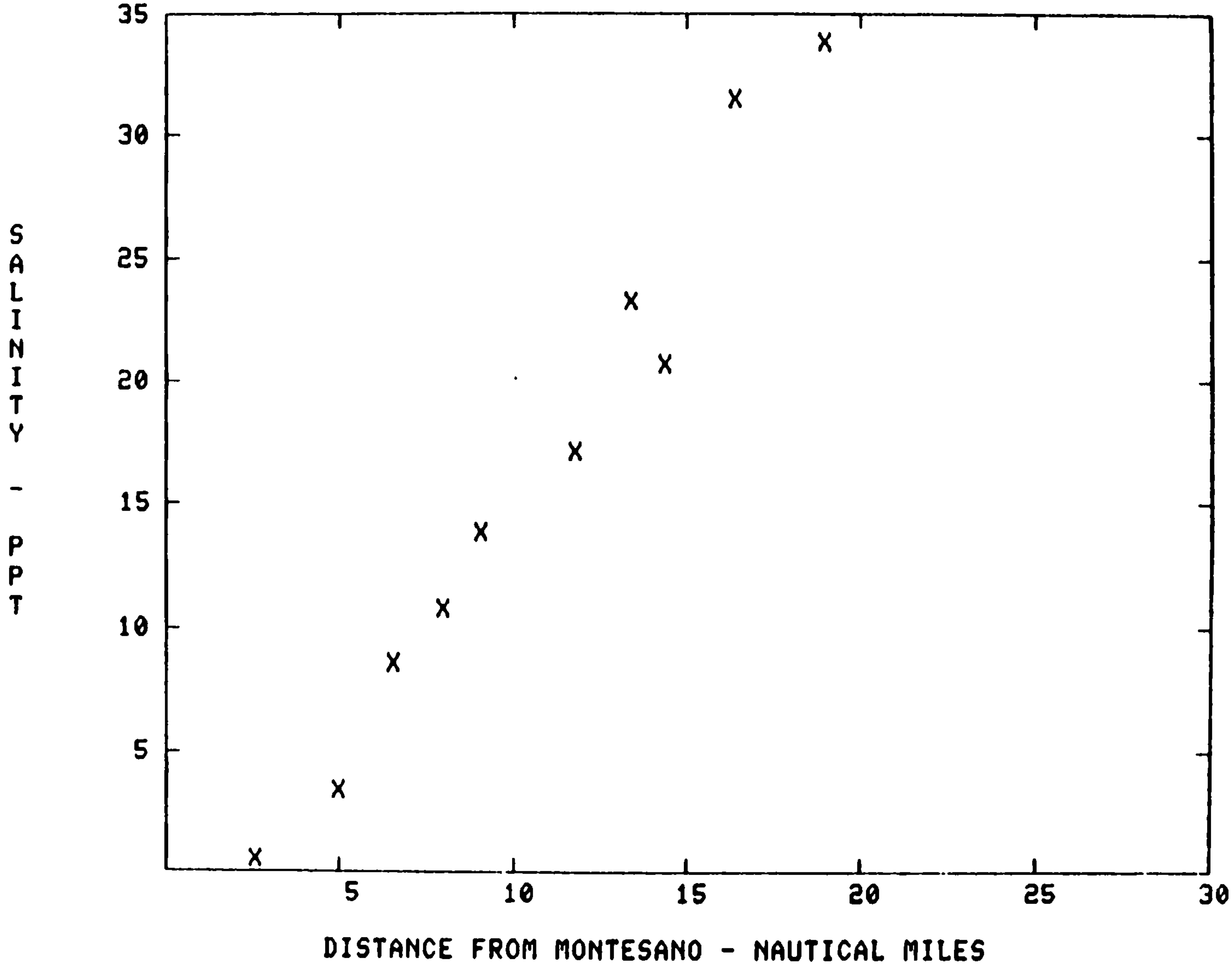


FIGURE 27. DEPTH-AVERAGED SALINITY IN THE NORTH CHANNEL OF GRAYS HARBOR AT SECOND LOW SLACK, JULY 26, 1977.

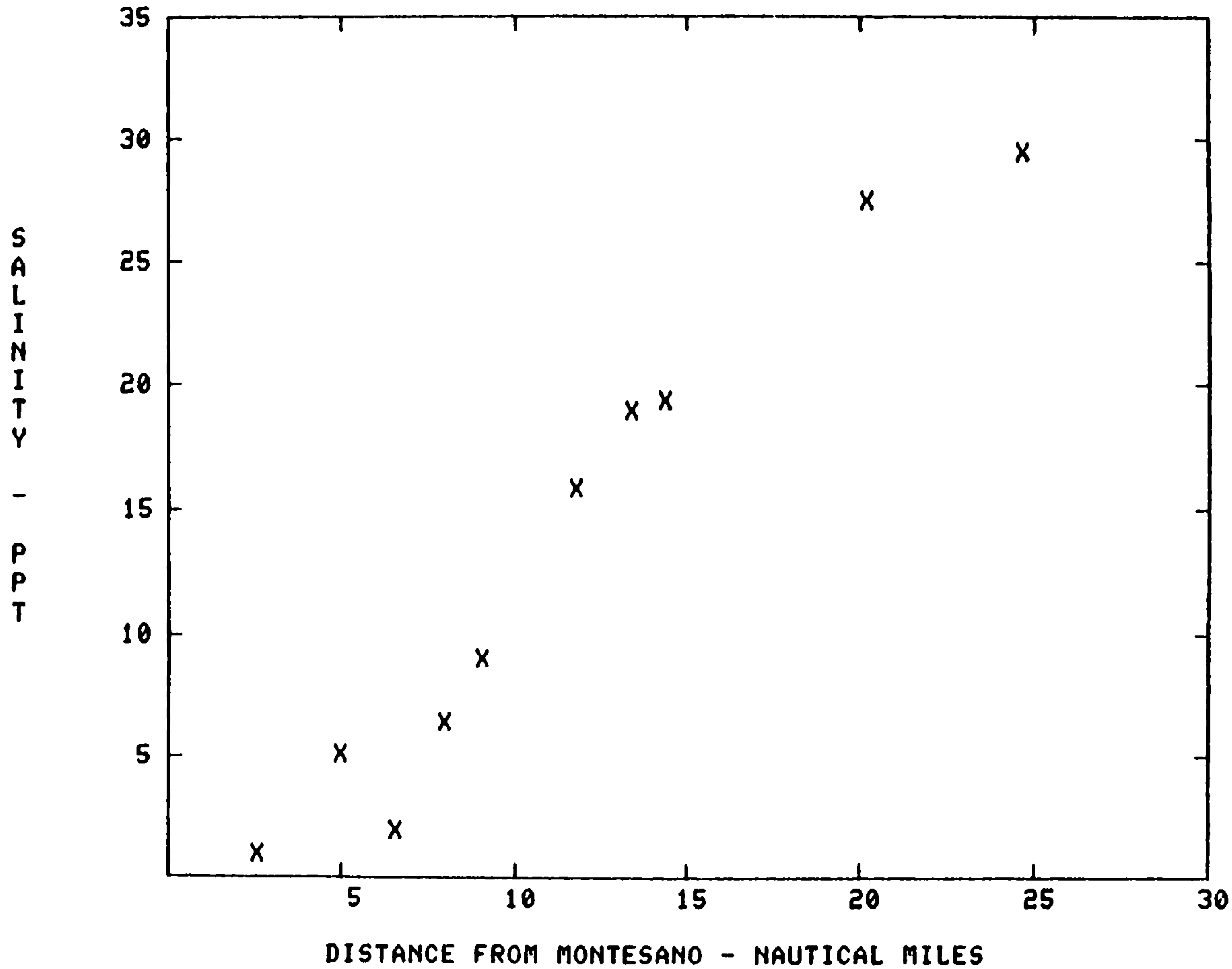


FIGURE 28. DEPTH-AVERAGED SALINITY IN THE NORTH CHANNEL OF GRAYS HARBOR AT FIRST HIGH SLACK, JULY 27, 1977.

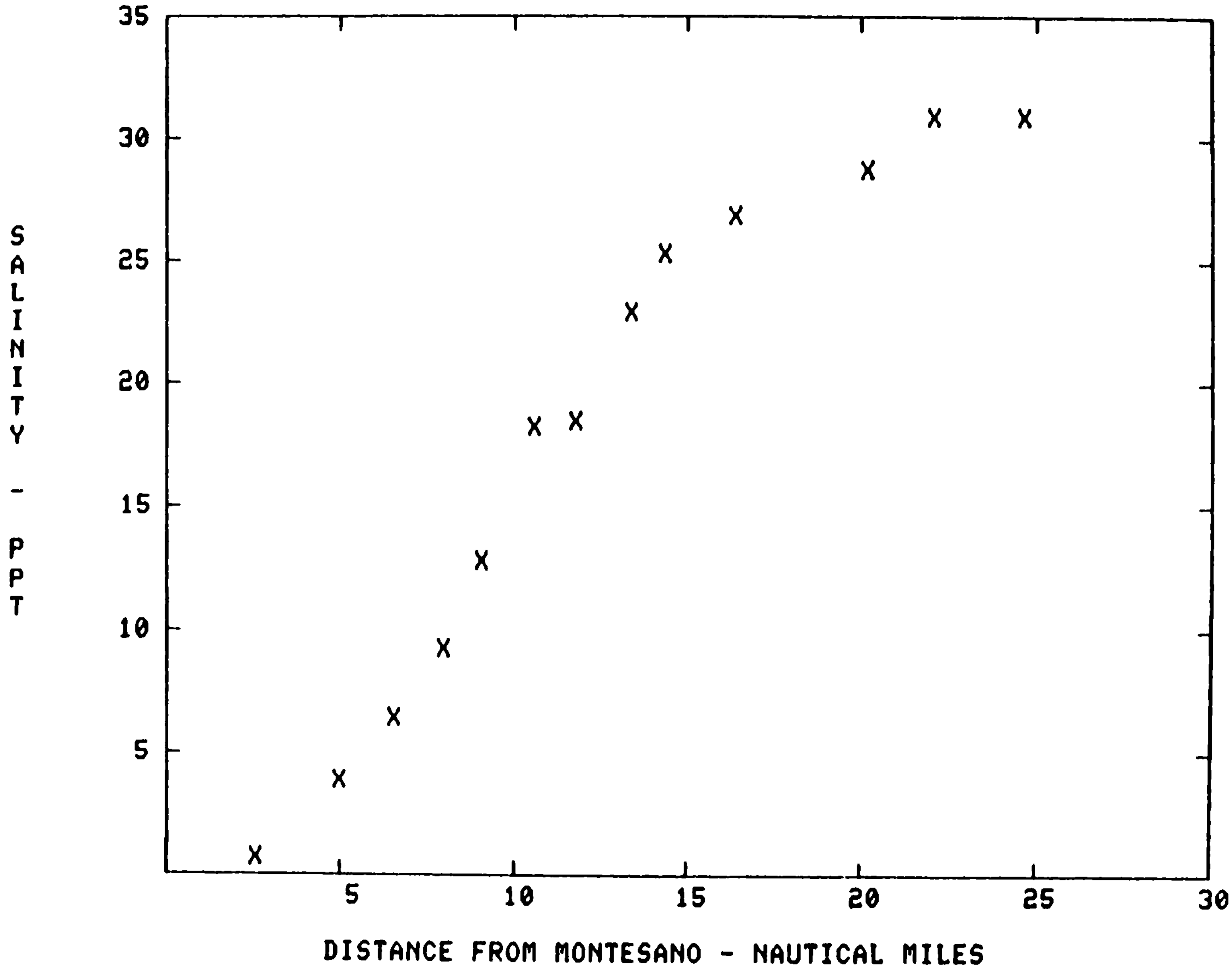


FIGURE 29. DEPTH-AVERAGED SALINITY IN THE NORTH CHANNEL OF GRAYS HARBOR AT SECOND LOW SLACK, JULY 27, 1977.

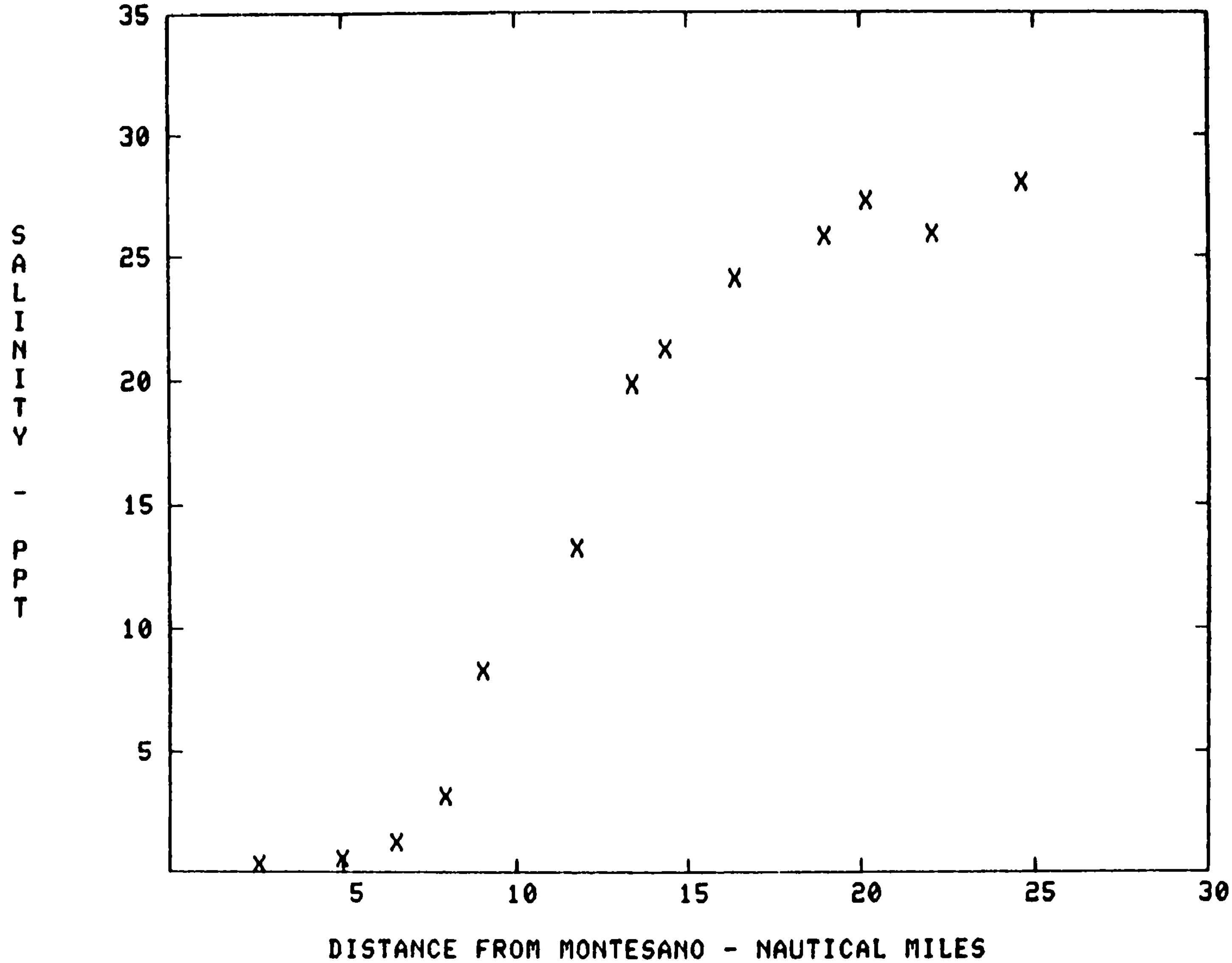


FIGURE 30. DEPTH-AVERAGED SALINITY IN THE NORTH CHANNEL OF GRAYS HARBOR AT FIRST LOW SLACK, JULY 28, 1977.

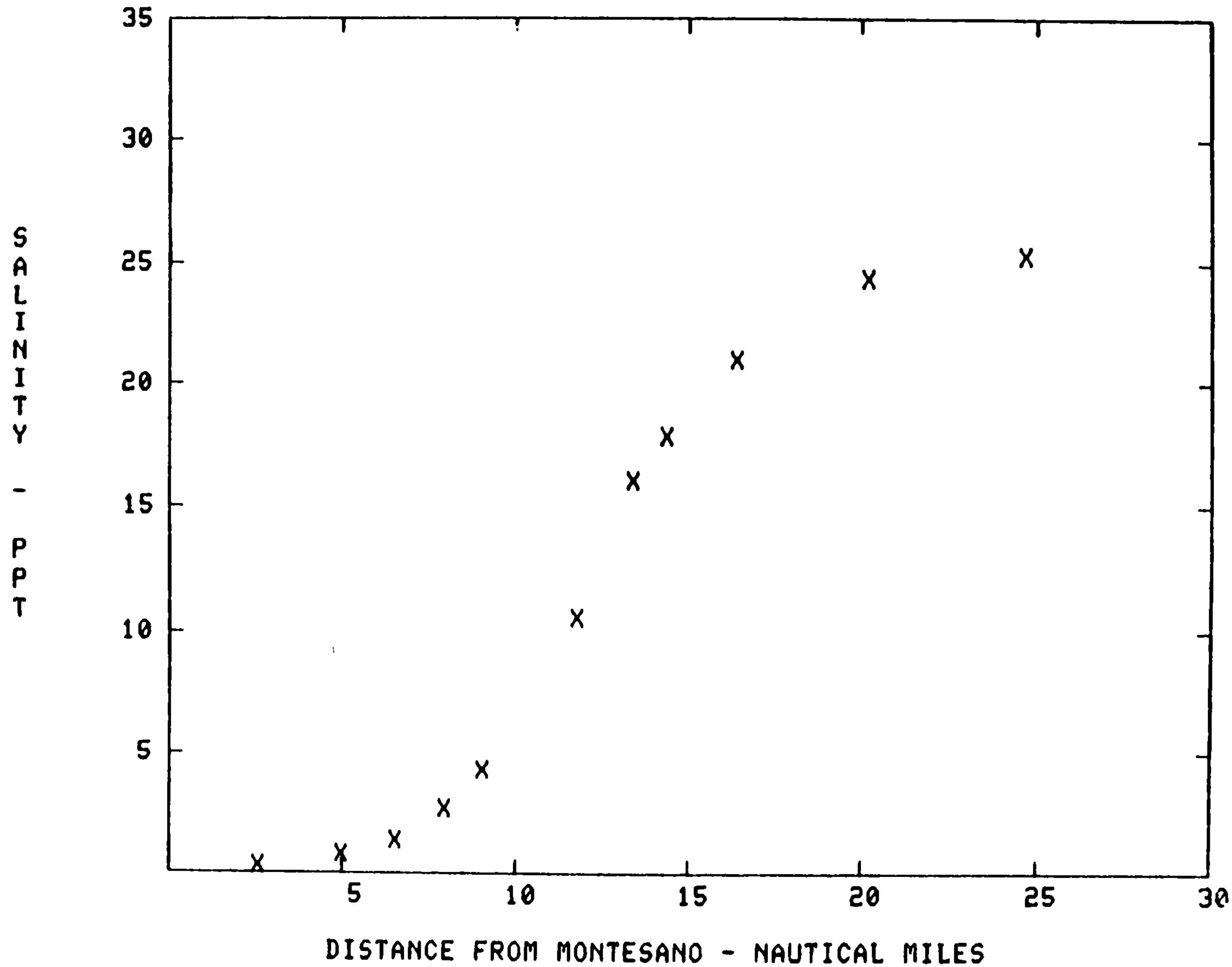


FIGURE 31. DEPTH-AVERAGED SALINITY IN THE NORTH CHANNEL OF GRAYS HARBOR AT FIRST HIGH SLACK, JULY 28, 1977.

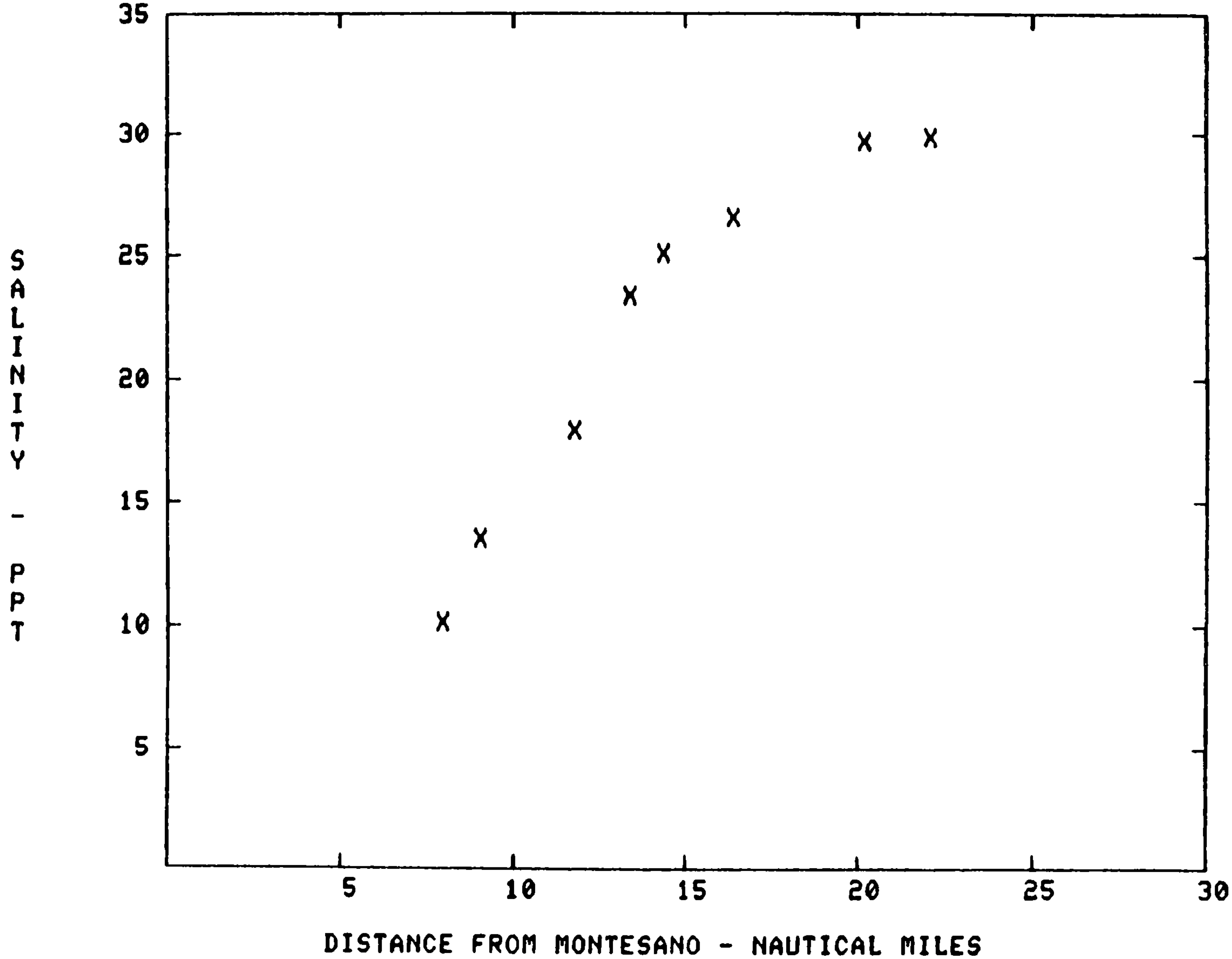


FIGURE 32 . DEPTH-AVERAGED SALINITY IN THE NORTH CHANNEL OF GRAYS HARBOR AT SECOND LOW SLACK, JULY 28, 1977.

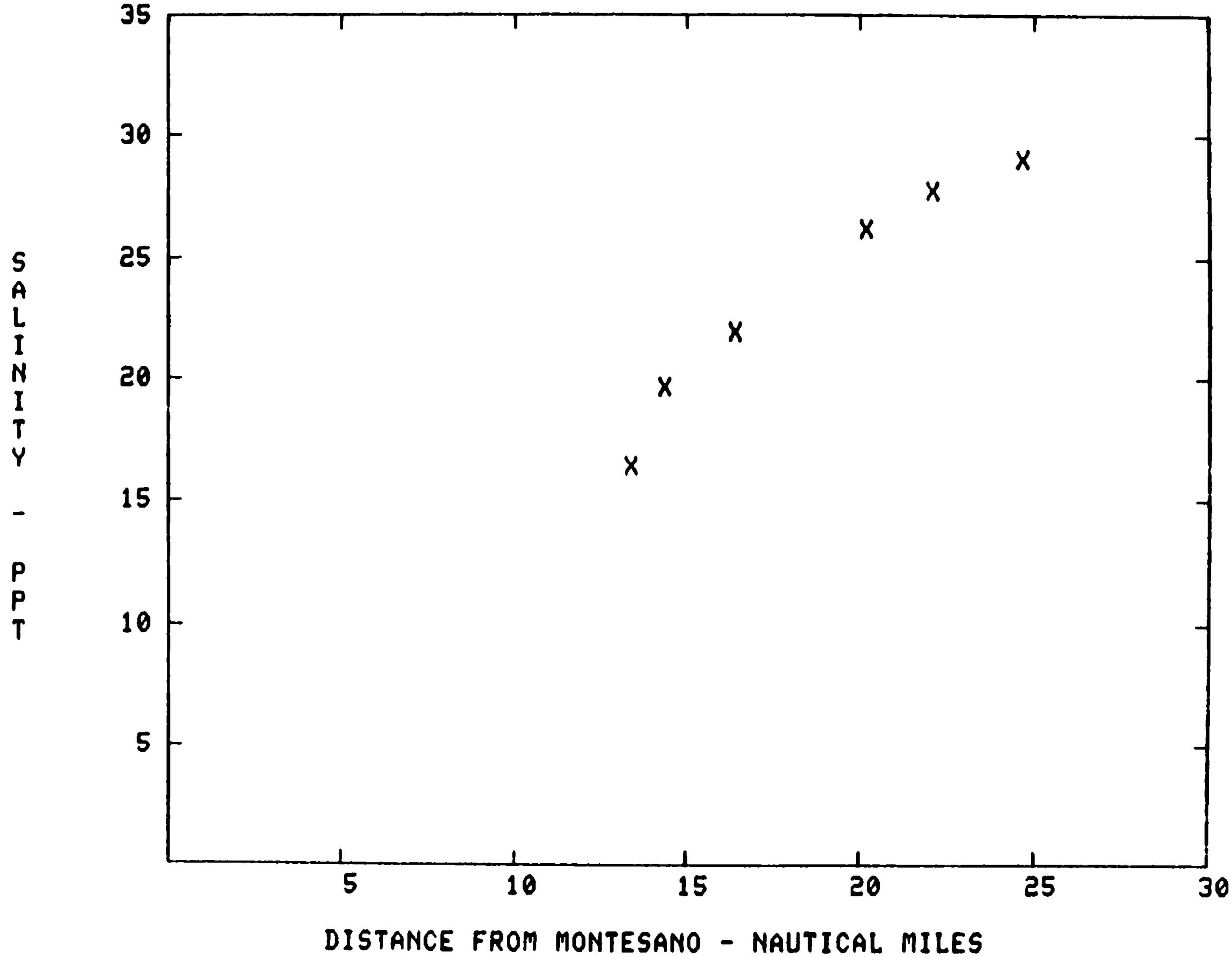
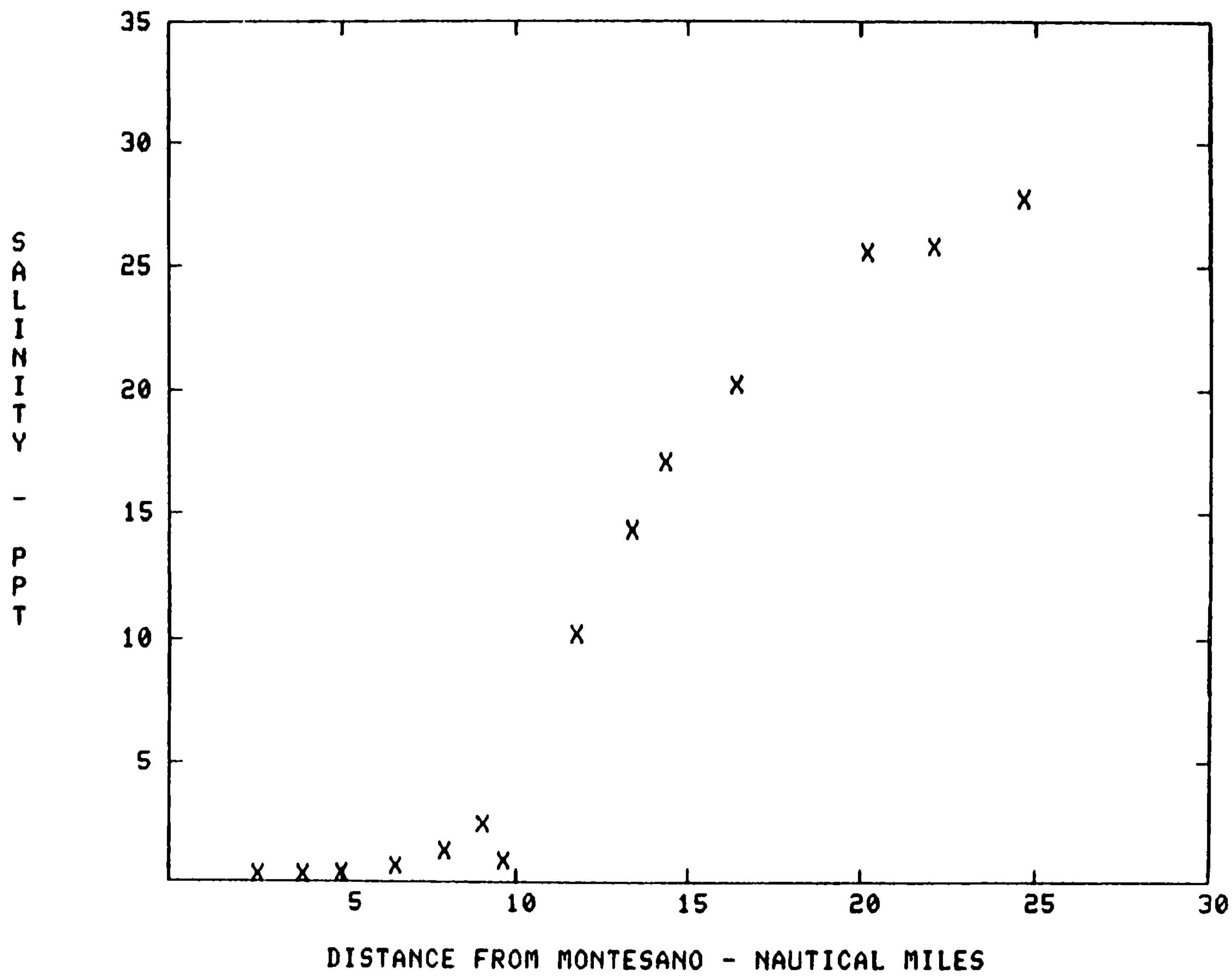


FIGURE 33. DEPTH-AVERAGED SALINITY IN THE NORTH CHANNEL OF GRAYS HARBOR AT FIRST LOW SLACK, JULY 29, 1977.



Nutrient measurements were made in the receiving water at the first high slack only. The averages of all values measured at each station for ammonia-nitrogen, nitrate-nitrogen, total phosphorus, dissolved orthophosphorus, and total organic carbon are shown in Figures 34 through 38.

For those receiving water stations at which long-term biological oxygen demand (BOD) measurements were made, it was possible to determine ultimate BOD, as well as the deoxygenation rate. The method described by Moore, et al. (1950) was used to determine the ultimate BOD and the deoxygenation rate from the data. Estimated ultimate BOD and deoxygenation rates for each station are shown in Table 11. In Figures 39 through 47, observed values for each station are compared to the values computed from:

$$L = Lo\ e^{-K\ t} \qquad (2)$$

where

L = the BOD, mg/l
Lo = the ultimate BOD, mg/l

K_1 = the deoxygenation rate, seconds^{-1}
t = the time, seconds

Table 11. Deoxygenation rate, K_1, and ultimate biological oxygen demand at various locations in Grays Harbor, July 25-29, 1977. Computed from observed data using the method of moments (Moore et al (1950)).

Station No.	Deoxygenation Rate, K_1 (days -1)	Ultimate BOD (mg/l)
MC02	0.14	2.66
MC05	0.14	1.64
MC07	0.11	2.45
MC08	0.17	2.26
MC09	0.13	2.25
MC10	0.21	2.15
MC102	0.25	3.88
MC11	0.22	1.94
MC13	0.24	1.42

FIGURE 34|. AVERAGE, MAXIMUM AND MINIMUM AMMONIA-NITROGEN IN GRAYS HARBOR. EPA REGION 10 FIELD STUDY, JULY 25-29, 1977.

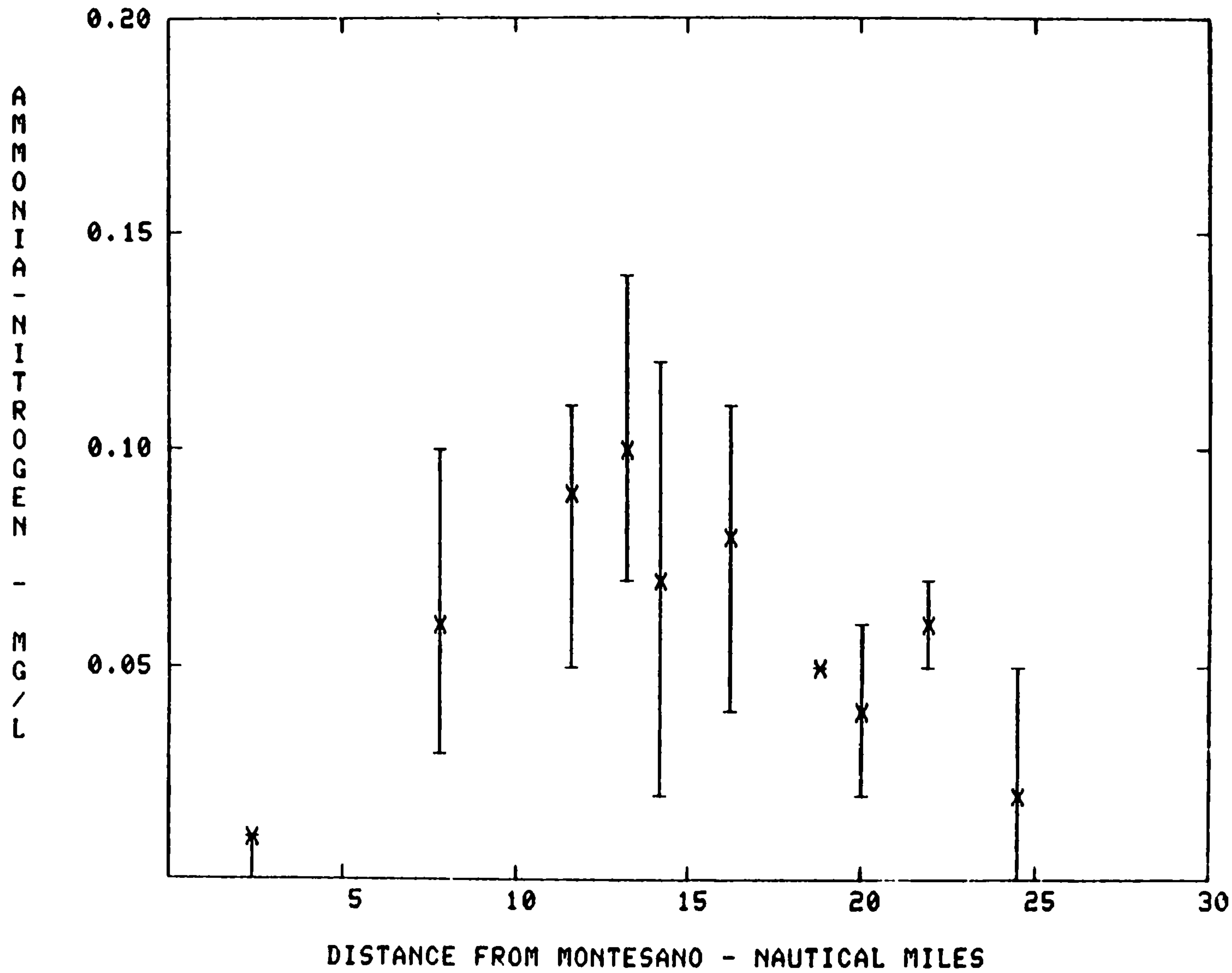


FIGURE 35. AVERAGE, MAXIMUM AND MINIMUM NITRATE-NITROGEN IN GRAYS HARBOR. EPA REGION 10 FIELD STUDY, JULY 25-29, 1977.

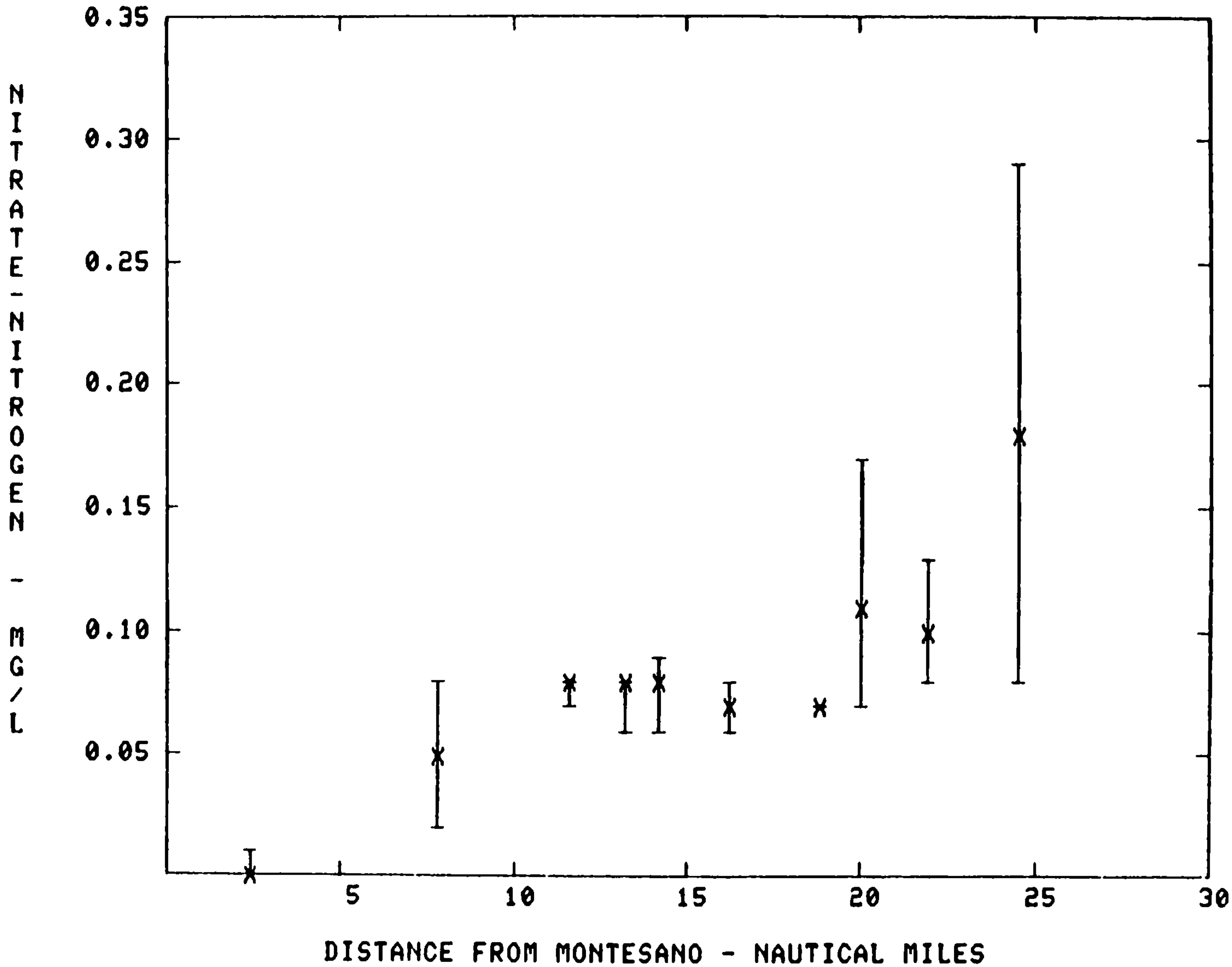


FIGURE 36/. AVERAGE, MAXIMUM AND MINIMUM ORTHOPHOSPHORUS IN GRAYS HARBOR. EPA REGION 10 FIELD STUDY, JULY 25-29, 1977.

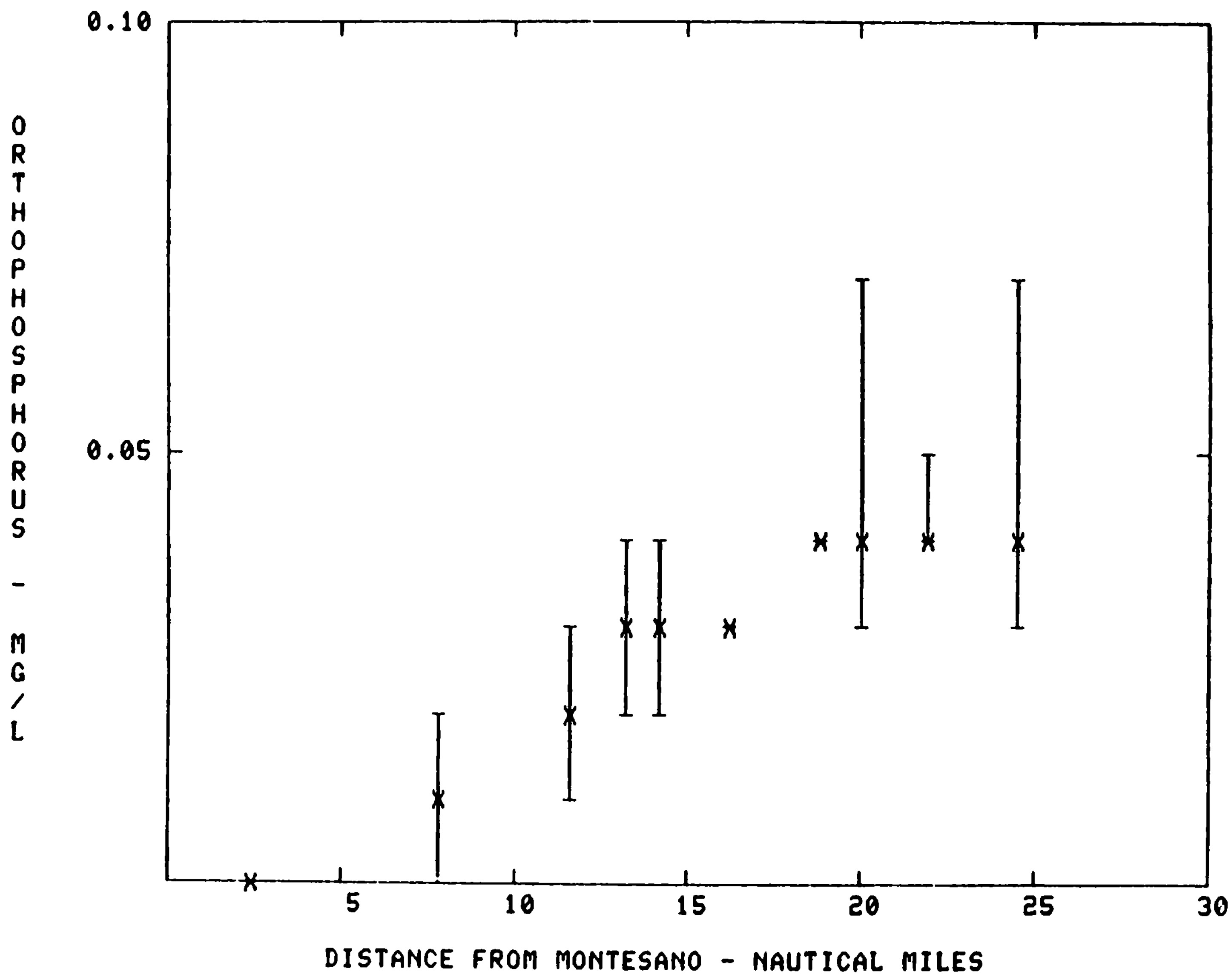


FIGURE 37. AVERAGE, MAXIMUM AND MINIMUM TOTAL PHOSPHORUS IN GRAYS HARBOR. EPA REGION 10 FIELD STUDY, JULY 25-29, 1977.

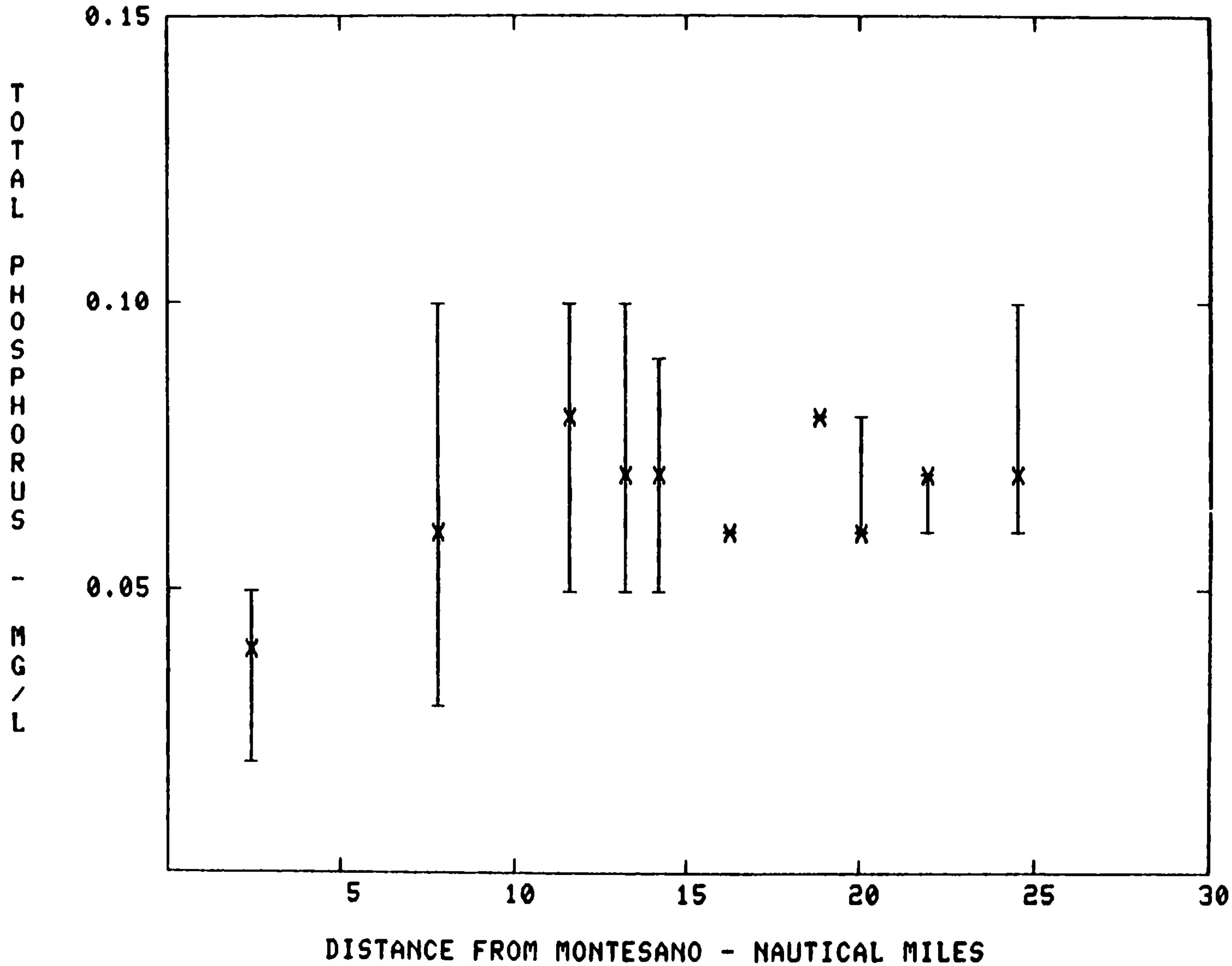


FIGURE 38. AVERAGE, MAXIMUM AND MINIMUM ORGANIC CARBON IN GRAYS HARBOR. EPA REGION 10 FIELD STUDY, JULY 25-29, 1977.

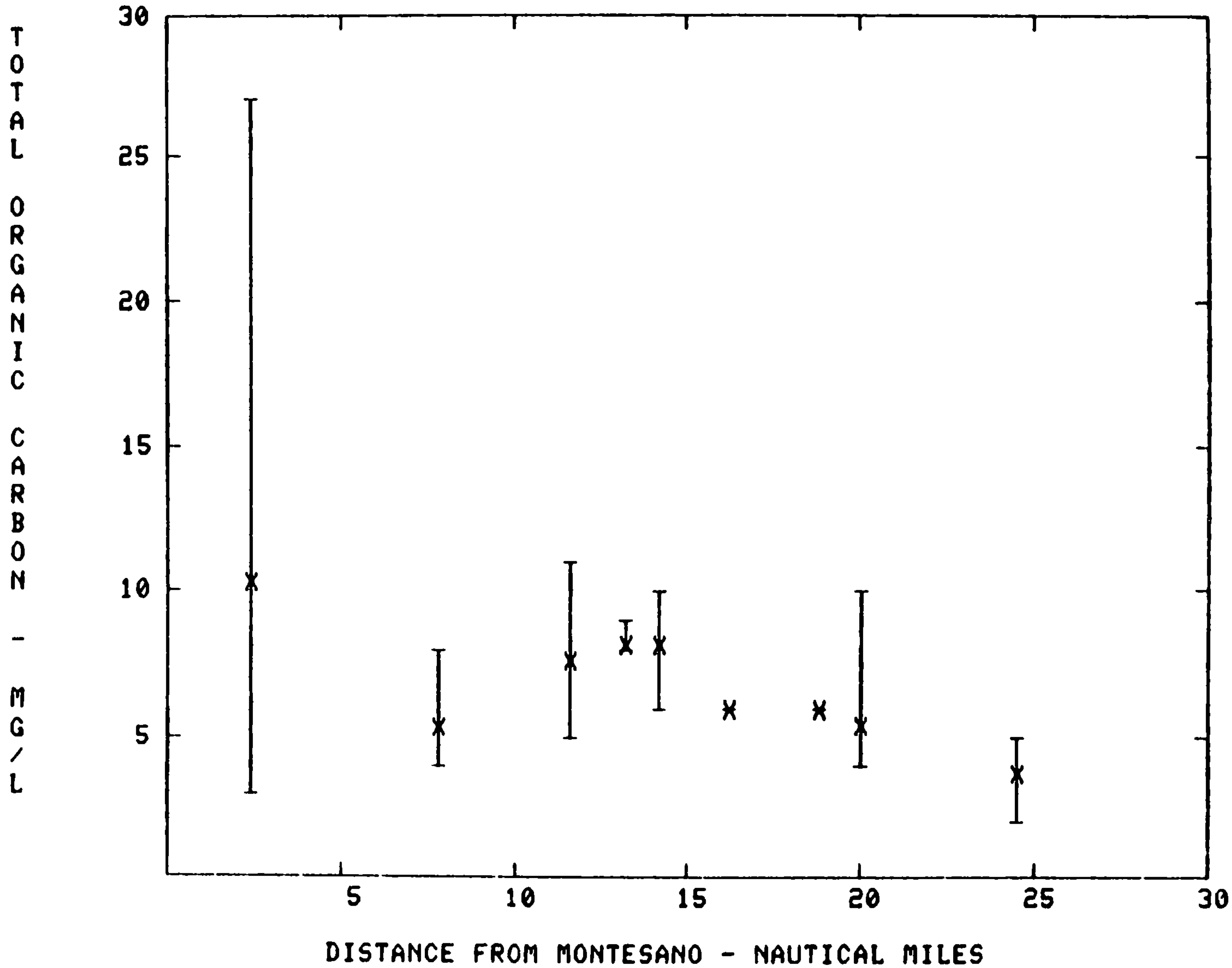


FIGURE 39|. PREDICTED AND OBSERVED BOD AT STATION MC02 IN GRAYS HARBOR. K1=0.14 DAYS^-1 BOD-ULT=2.66 MG/L

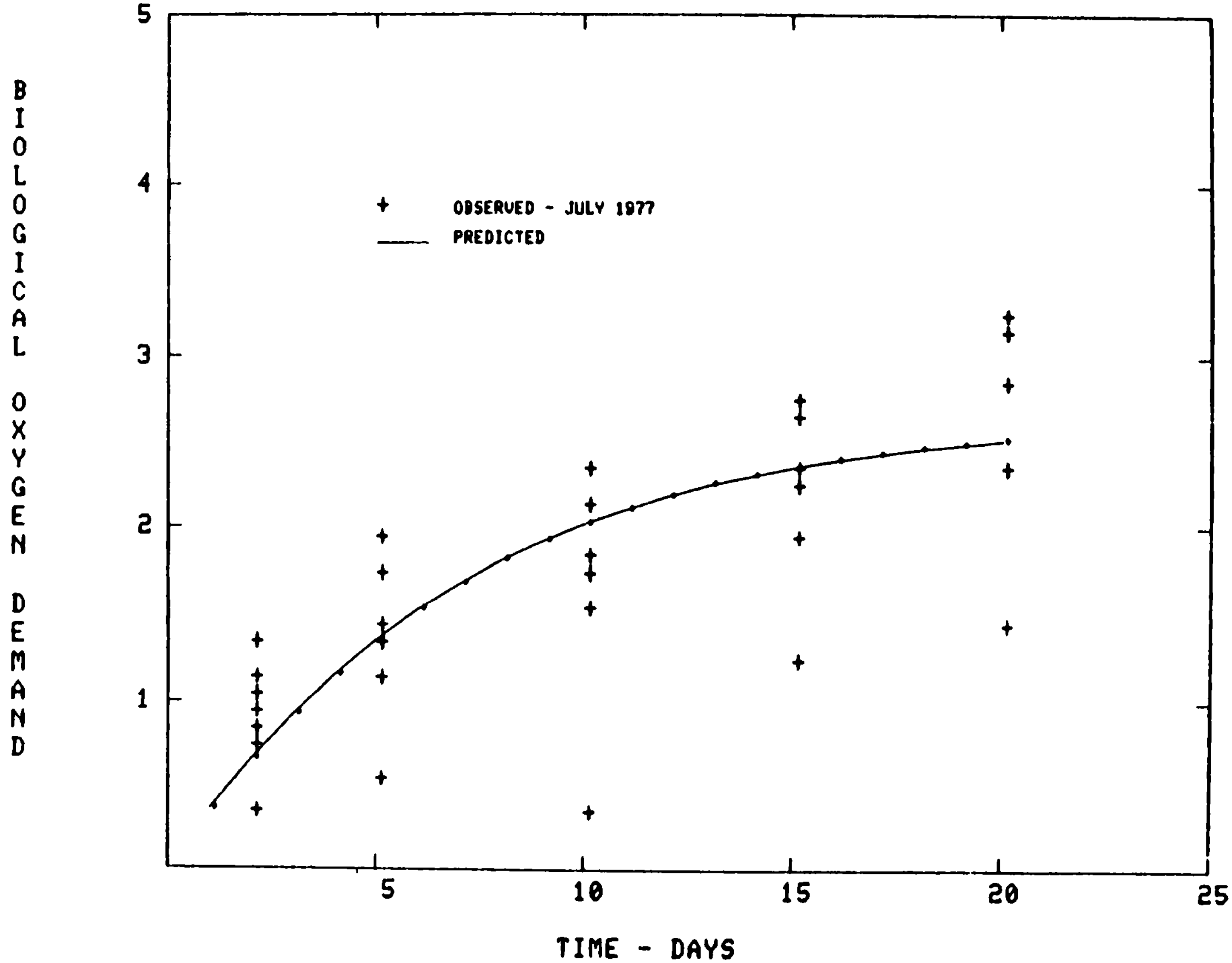


FIGURE 40. PREDICTED AND OBSERVED BOD AT STATION MC05 IN GRAYS HARBOR. K1=0.14 DAYS^-1 BOD-ULT=1.64 MG/L

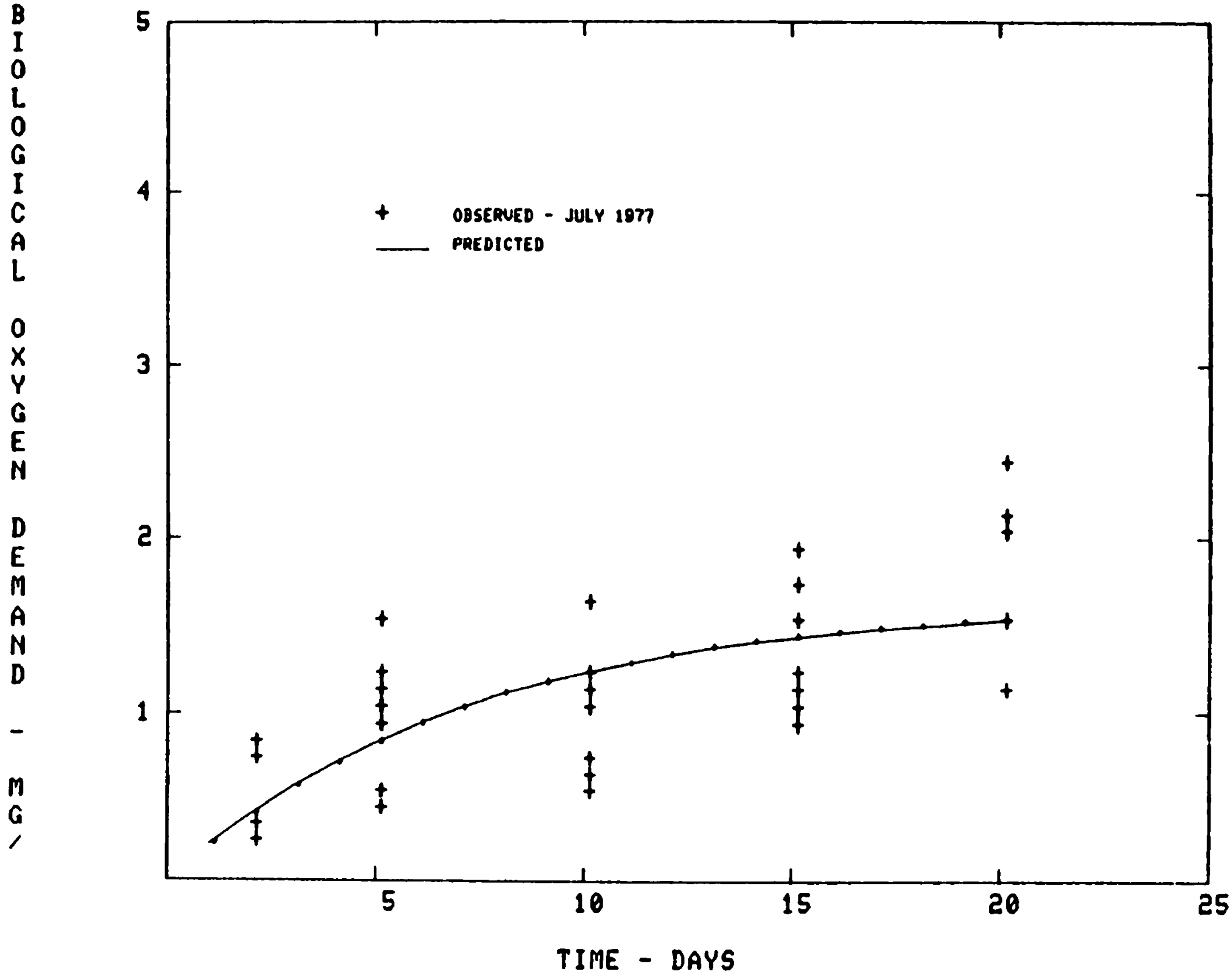


FIGURE 41. PREDICTED AND OBSERVED BOD AT STATION MC07 IN GRAYS HARBOR. K1=0.11 DAYS^-1 BOD-ULT=2.45 MG/L

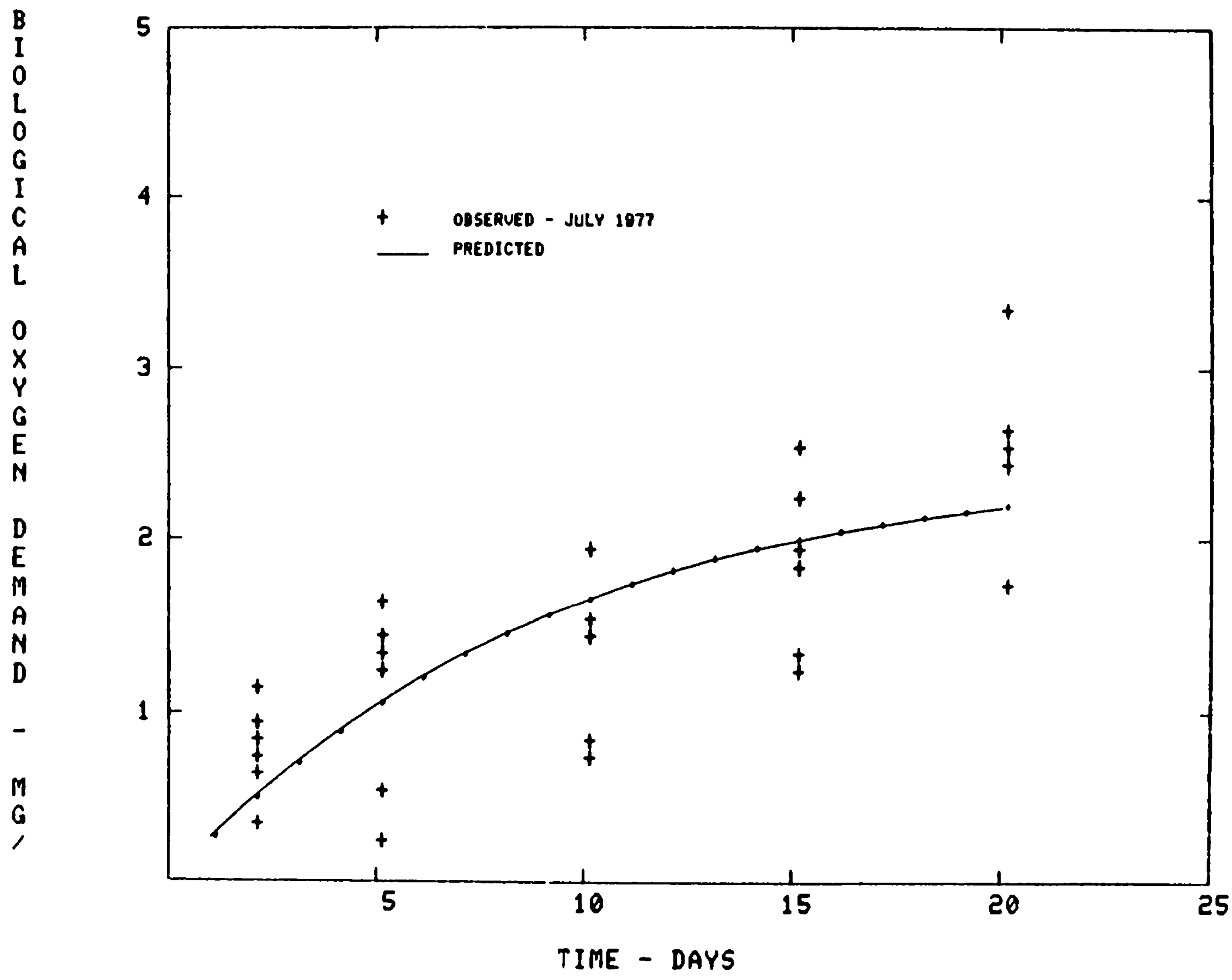


FIGURE 42. PREDICTED AND OBSERVED BOD AT STATION MC08 IN GRAYS HARBOR. K1=0.17 DAYS^-1 BOD-ULT=2.26 MG/L

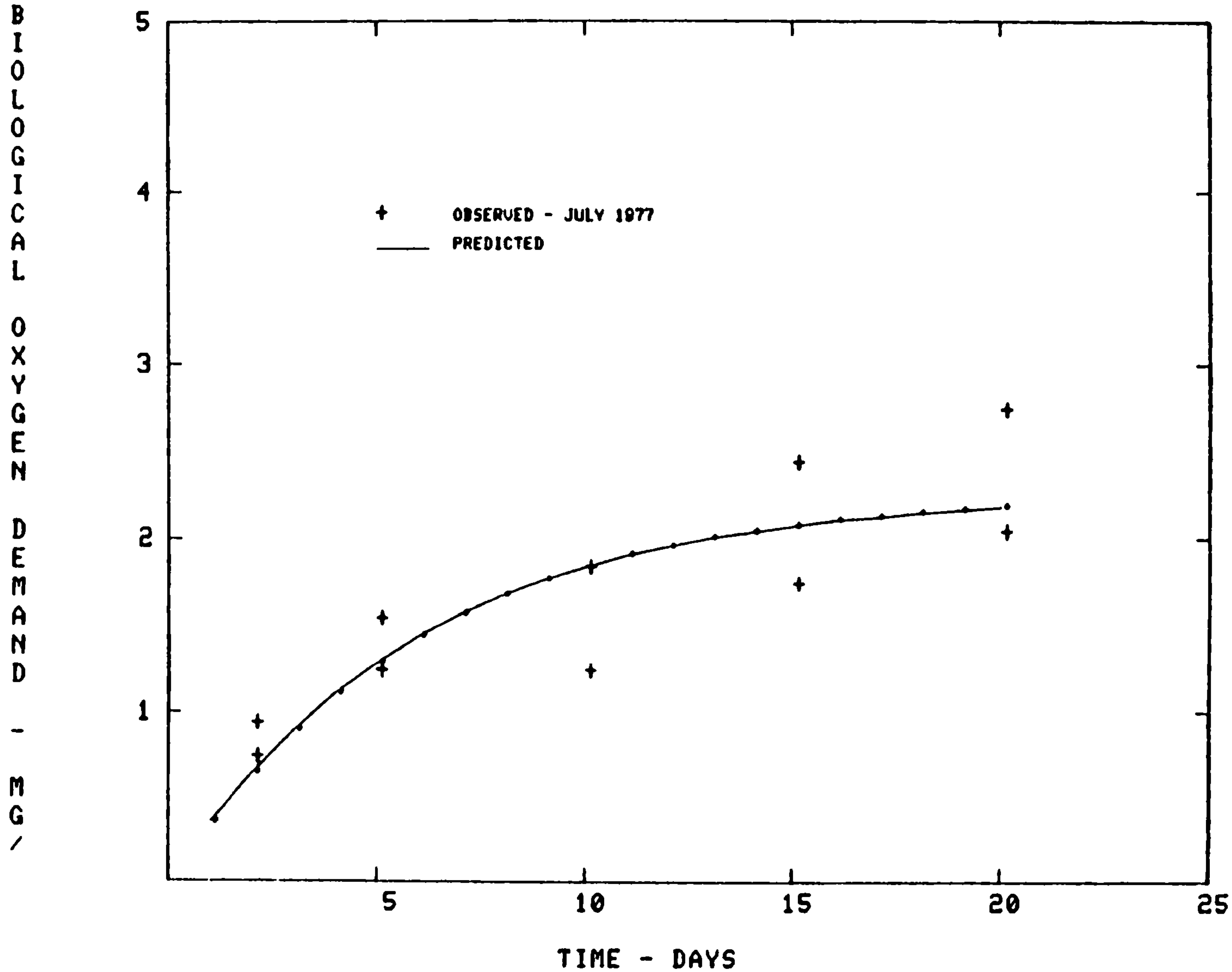


FIGURE 43. PREDICTED AND OBSERVED BOD AT STATION MC09 IN GRAYS HARBOR. K1=0.13 DAYS^-1 BOD-ULT=2.25 MG/L

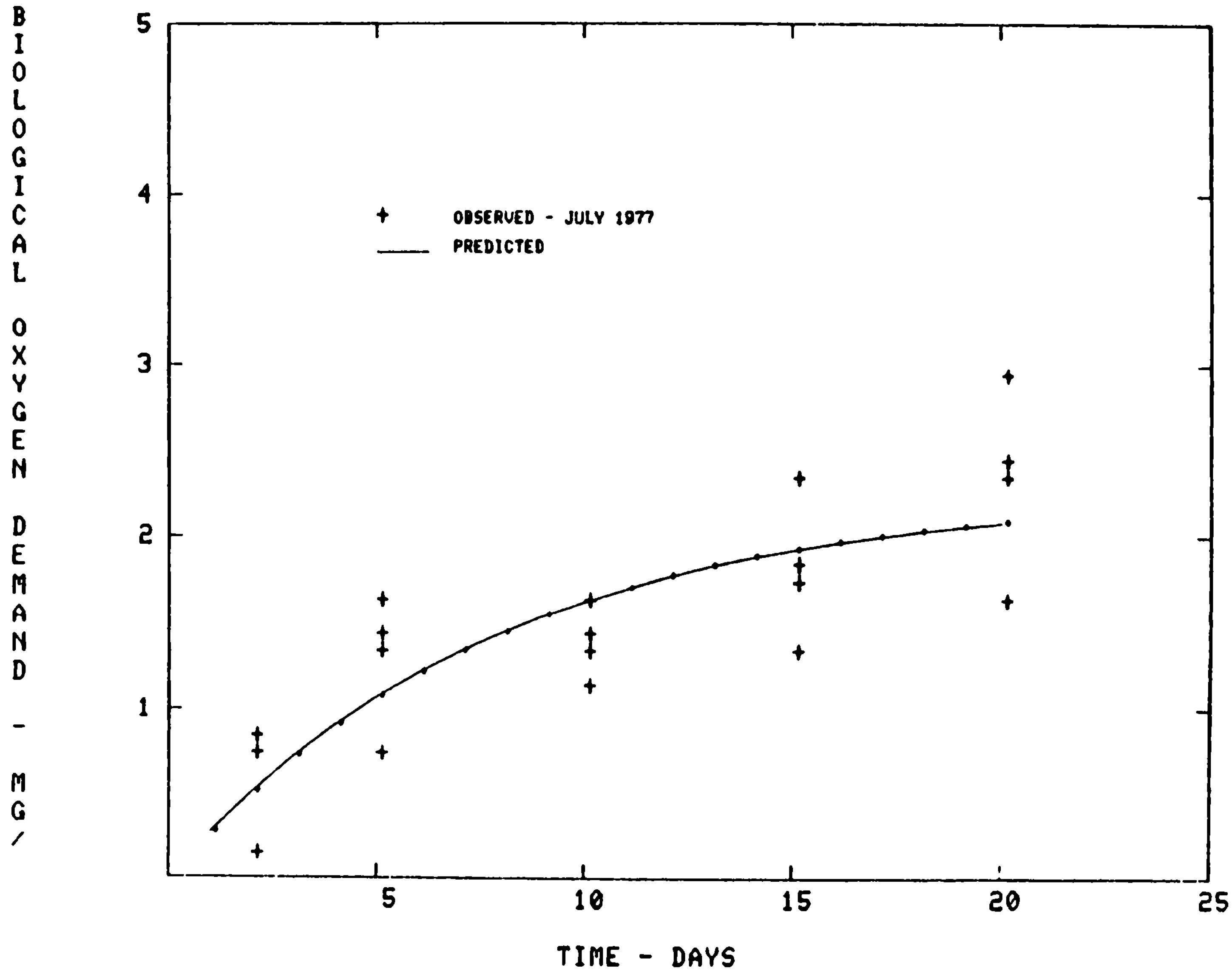


FIGURE 44. PREDICTED AND OBSERVED BOD AT STATION MC10 IN GRAYS HARBOR. K1=0.21 DAYS^-1(BASE E) BOD-ULT=2.15 MG/L

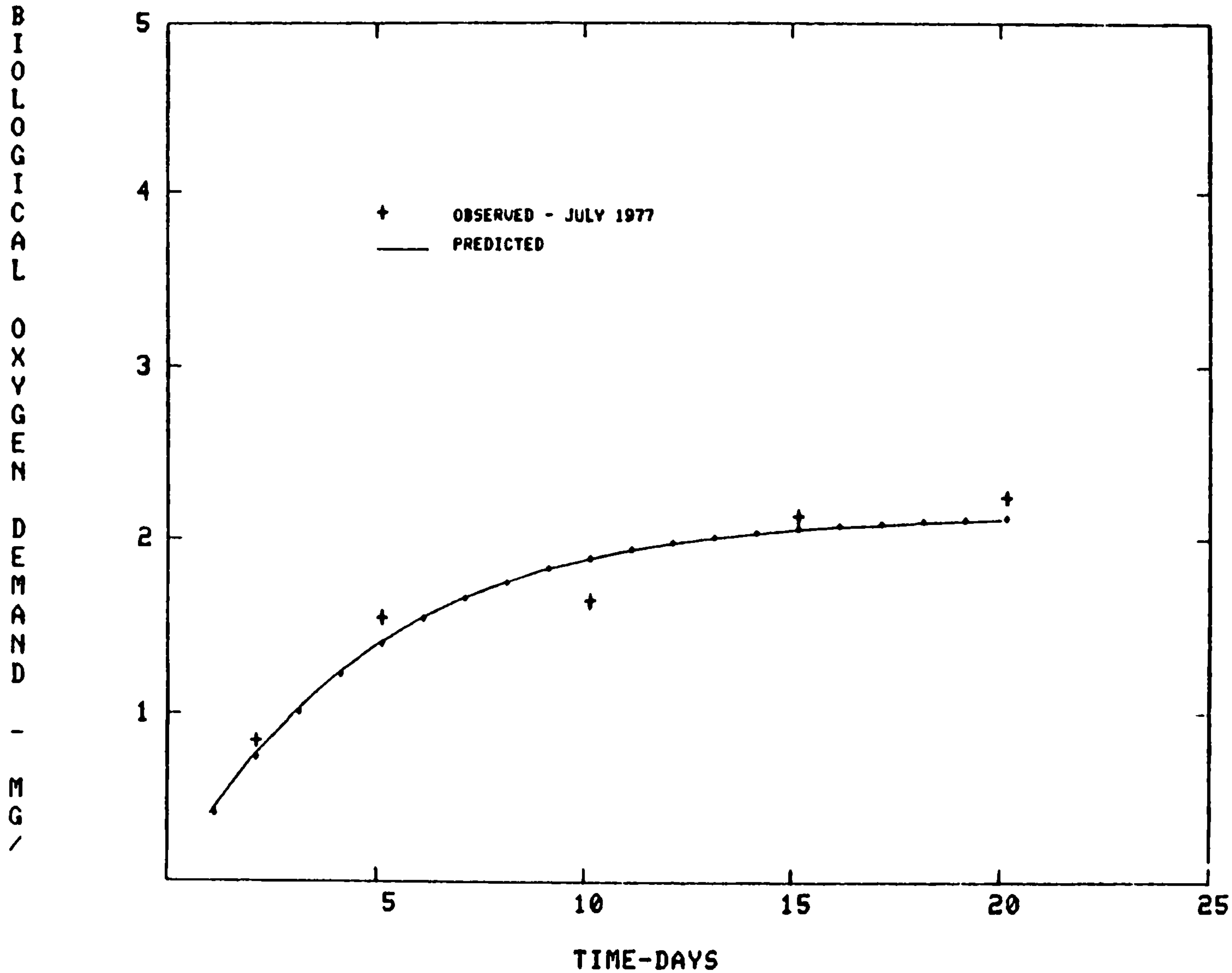


FIGURE 45l. PREDICTED AND OBSERVED BOD AT STATION MC10L IN GRAYS HARBOR. K1=0.25 DAYS^-1(BASE E) BOD-ULT=3.88

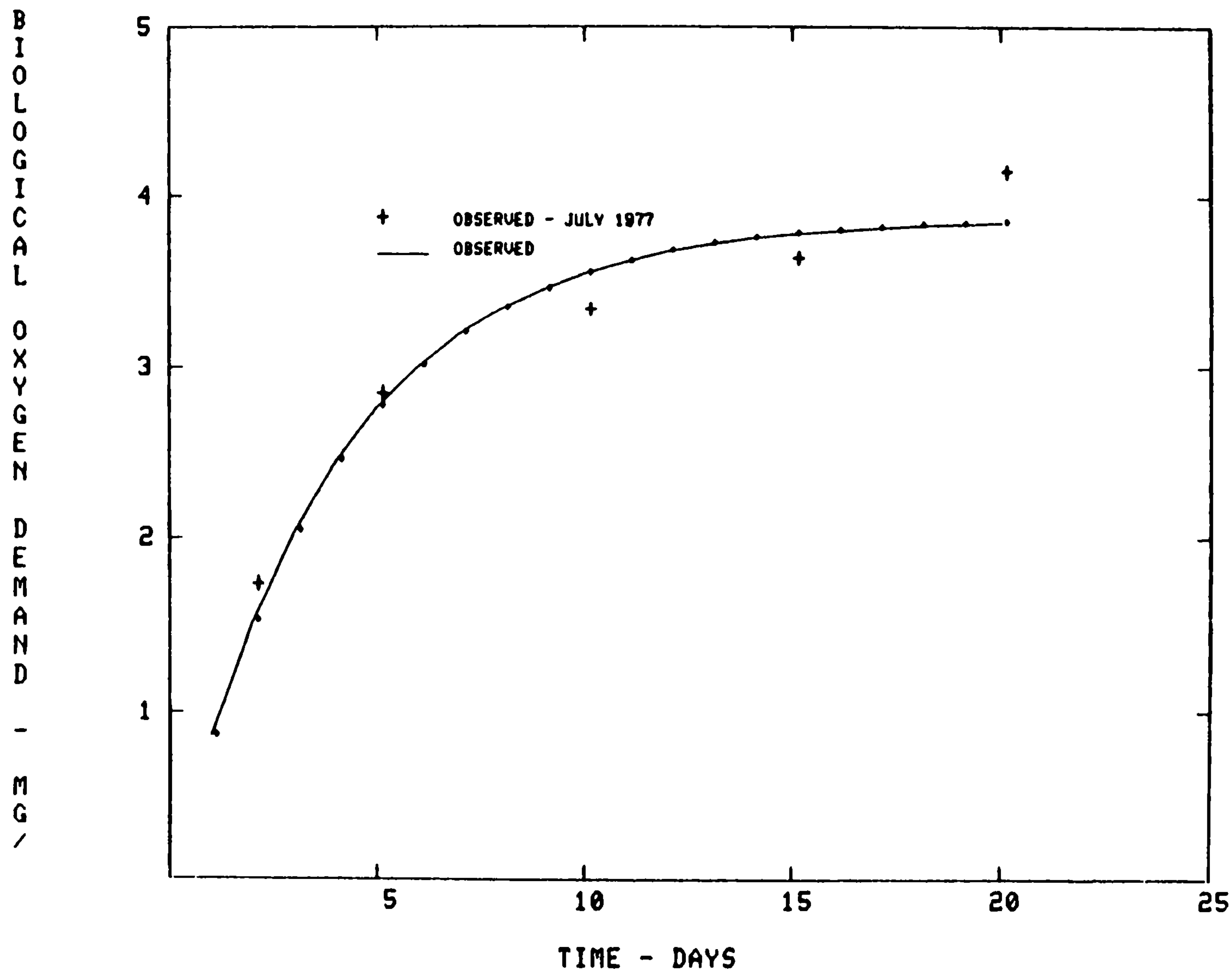


FIGURE 46l. PREDICTED AND OBSERVED BOD AT STATION MC11 IN GRAYS HARBOR. K1=0.22 DAYS^-1(BASE E) BOD-ULT=1.94 MG/L

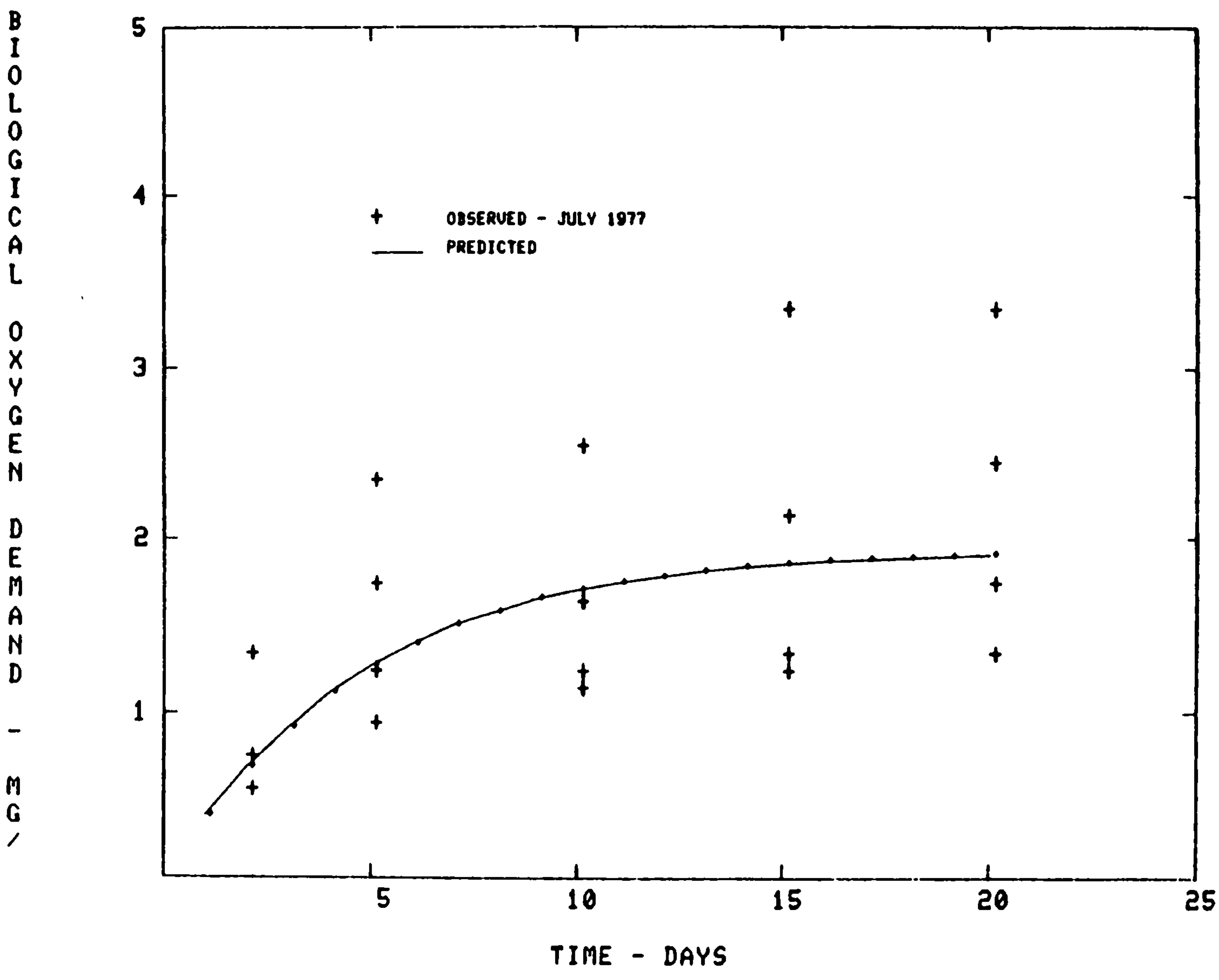
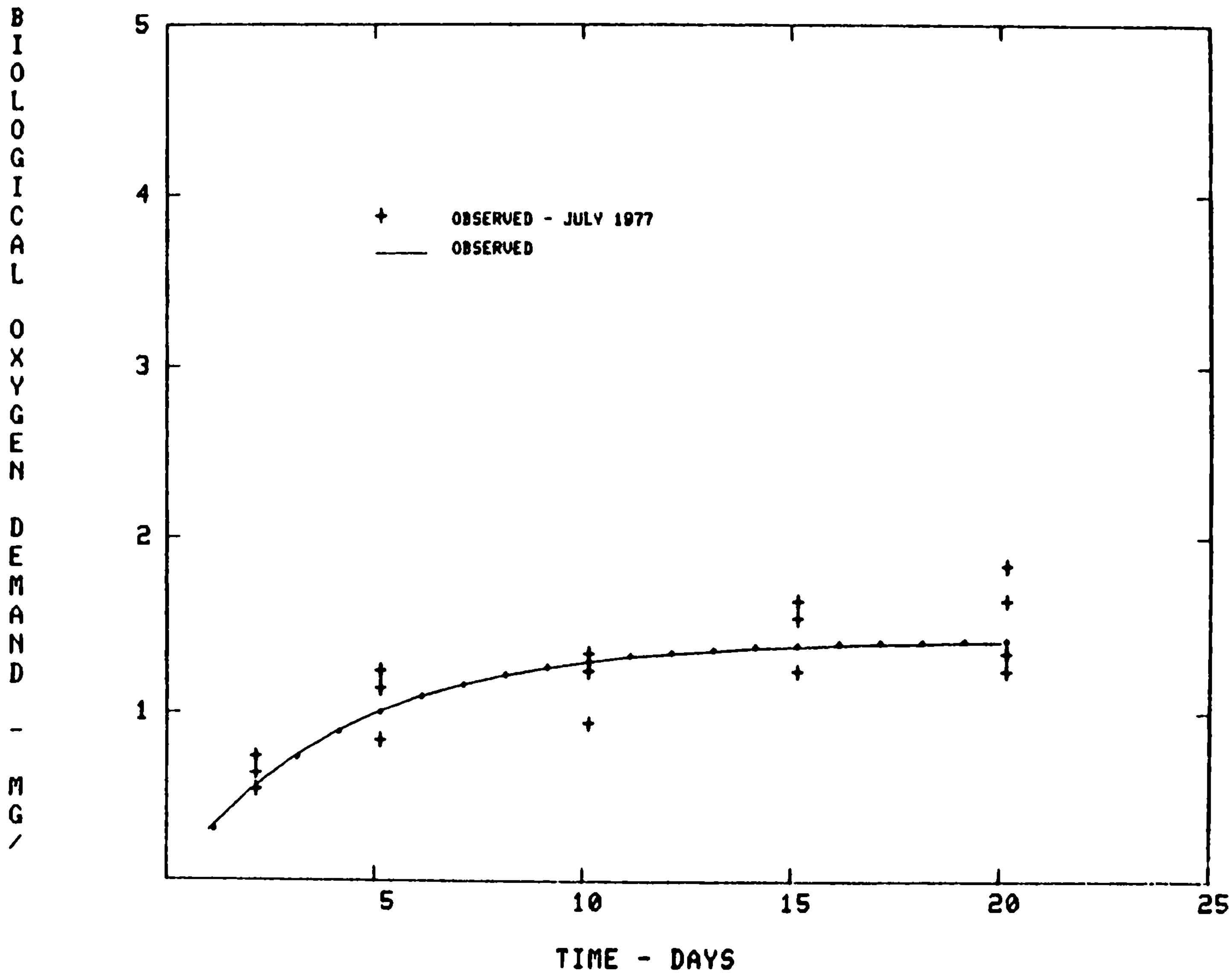


FIGURE 47. PREDICTED AND OBSERVED BOD AT STATION MC13 IN GRAYS HARBOR. K1=0.24 DAYS^-1(BASE E) BOD-ULT=1.42 MG/L



The average values of all temperature, dissolved oxygen and salinity for observations made in the South Channel of Grays Harbor are shown in Figures 48 through 50. Similar observations for North Bay stations are shown in Figures 51 through 53.

Temperature

The average of all temperatures measured during the survey varied from 12.9^oC. at the entrance to 19.0^oC, near Montesano (Figure 4). The ocean's influence upon river temperature extends to river mile 9.0 in the Chehalis River.

As one might expect, the variations in temperature are greatest at the entrance, where the differences between maximum and minimum observed temperatures is 6.7^oC. At the farthest upstream station, near Montesano, this difference is only 1.4^oC. A large part of this variation is associated with the tidal excursion. For example, at the first high slack of July 26, 1977 (Figure 8), the average temperature is 10.0^oC at the entrance to Grays Harbor and 19.0^oC at Montesano. At the first low slack of July 29, 1977 (Figure 15), the average temperature at the entrance is 15.0^oC and at Montesano 18.1^oC.

The South Channel data (Figure 48) indicates that the average temperature there is very similar to the average temperature distribution in the Main Channel.

FIGURE 48. AVERAGE, MAXIMUM AND MINIMUM TEMPERAURE IN SOUTH CHANNEL OF GRAYS HARBOR. EPA FIELD STUDY, JULY 25-29, 1977.

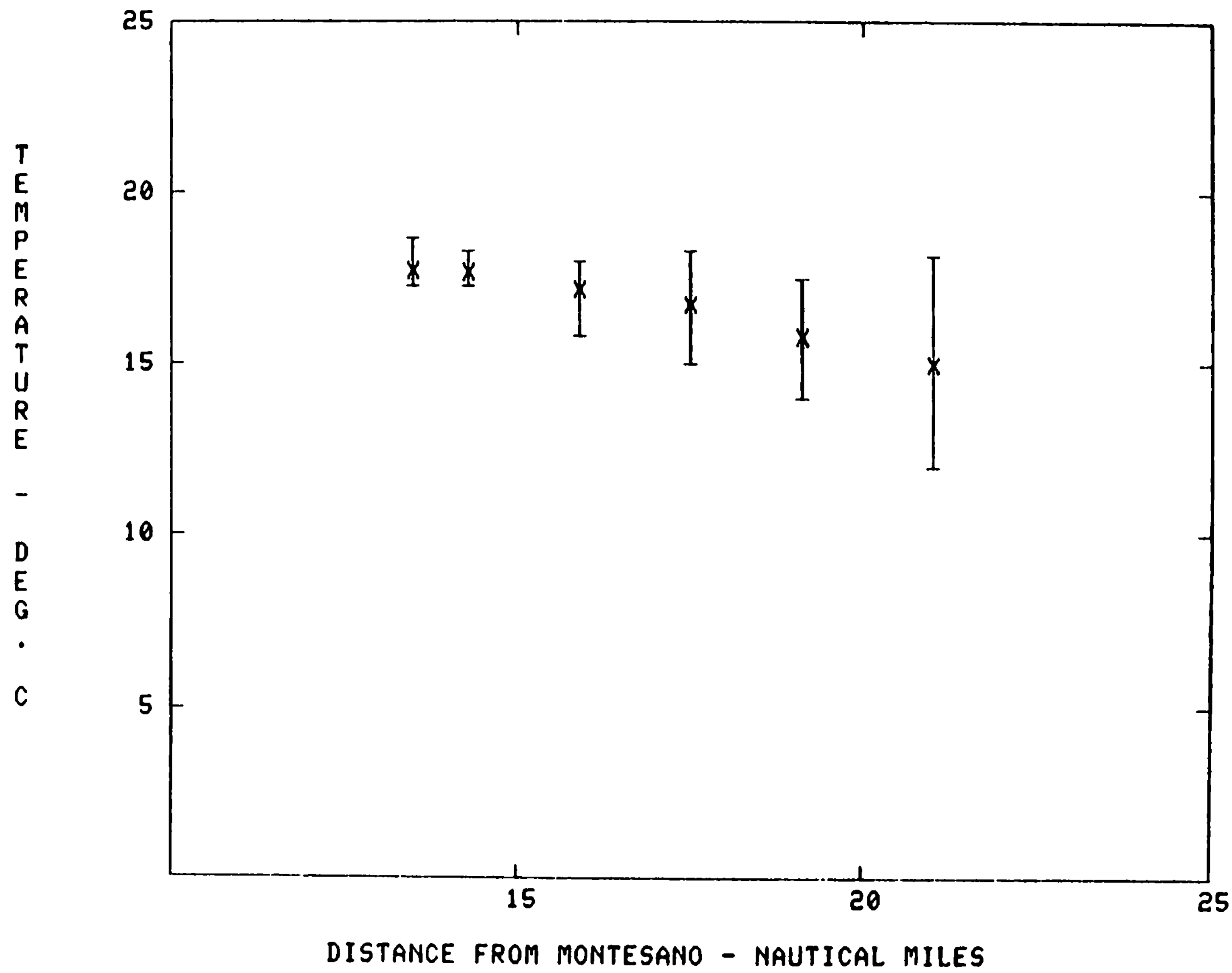


FIGURE 49|. AVERAGE, MAXIMUM AND MINIMUM DISSOLVED OXYGEN IN CHANNEL - GRAYS HARBOR. EPA FIELD STUDY, JULY 25-29, 1977.

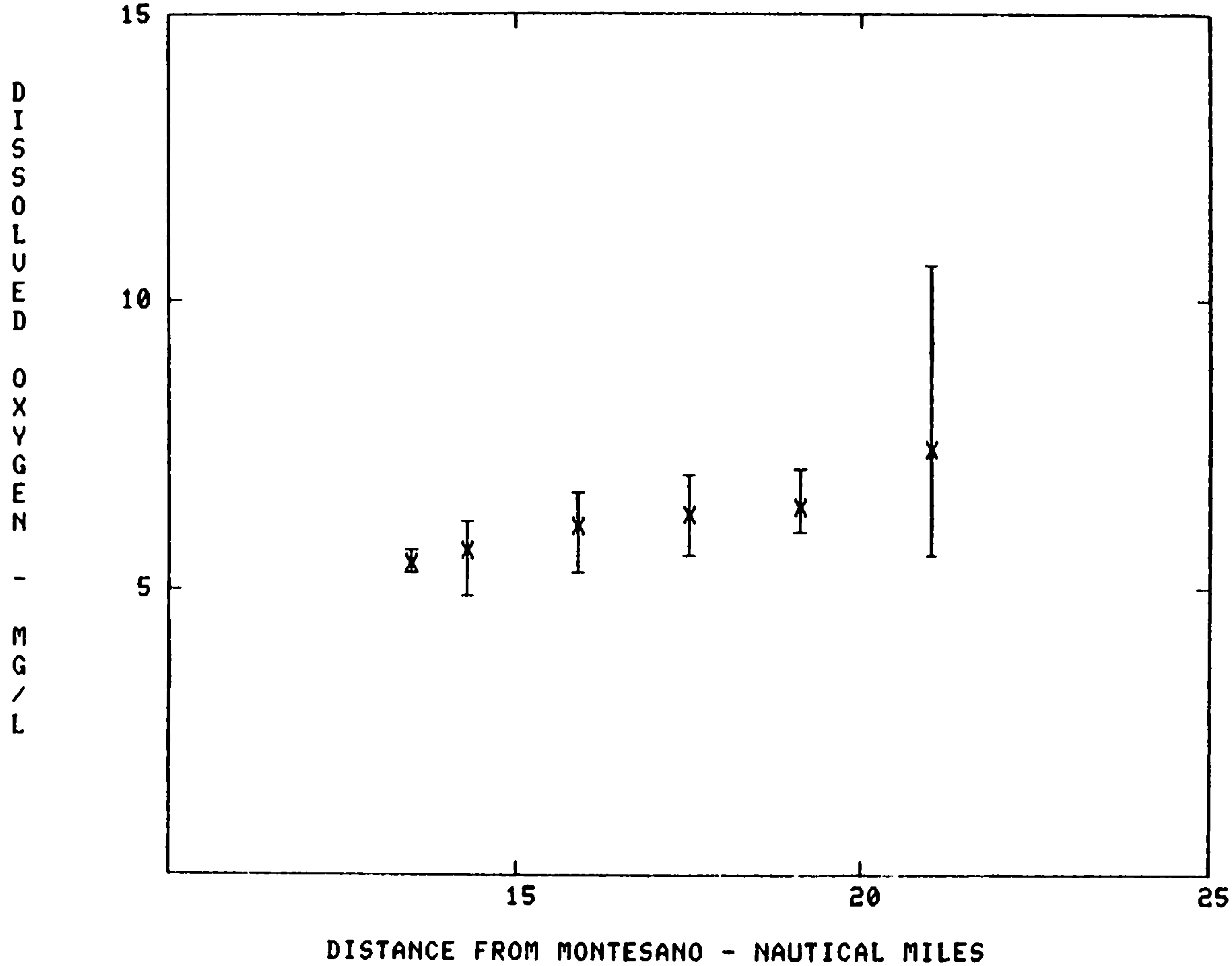


FIGURE 50. AVERAGE, MAXIMUM AND MINIMUM SALINITY IN SOUTH CHANNEL - GRAYS HARBOR. EPA FIELD STUDY, JULY 25-29, 1977.

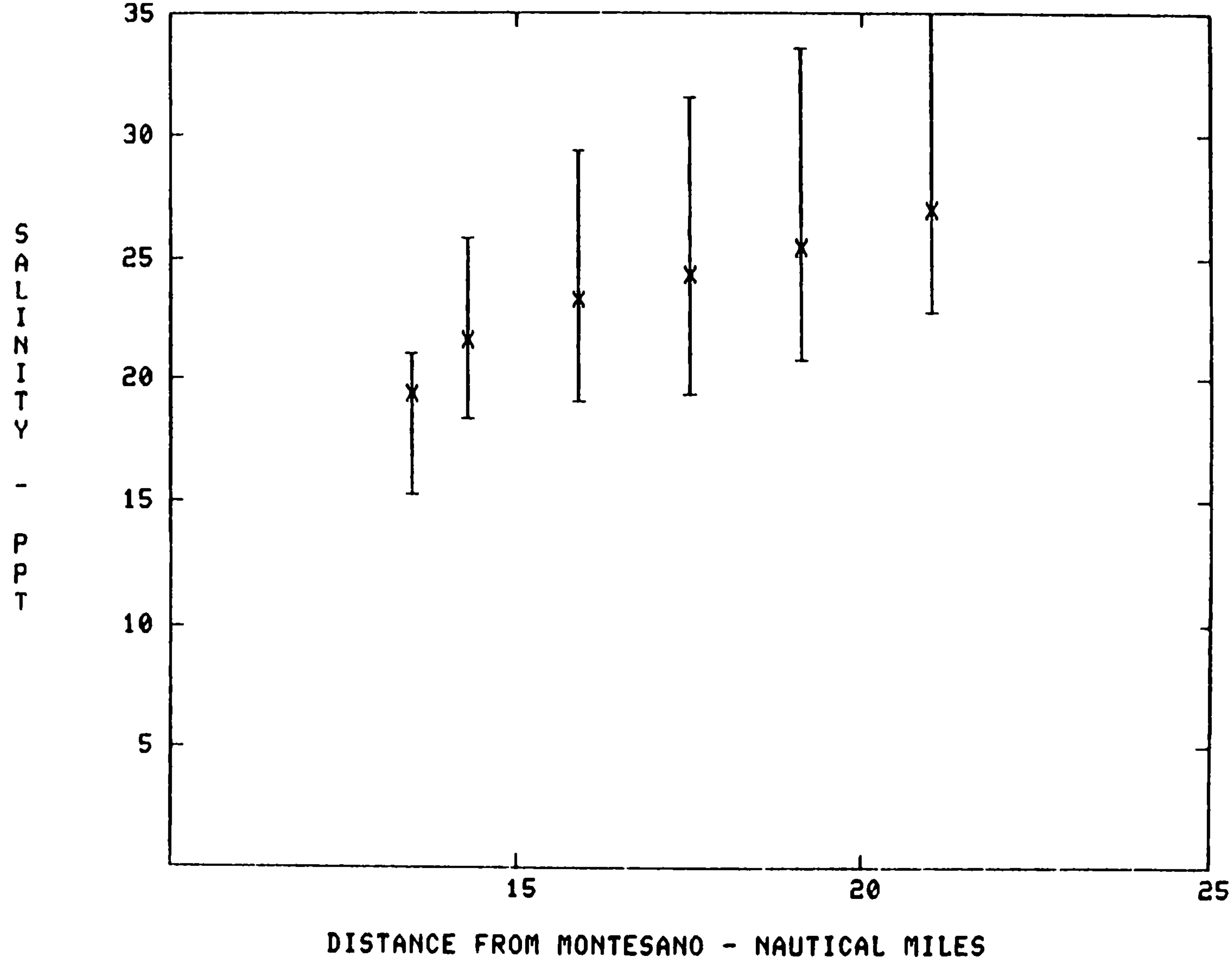


FIGURE 51. AVERAGE, MAXIMUM AND MINIMUM TEMPERATURE IN THE NORTH BAY - GRAYS HARBOR. EPA FIELD STUDY, JULY 25-29, 1977

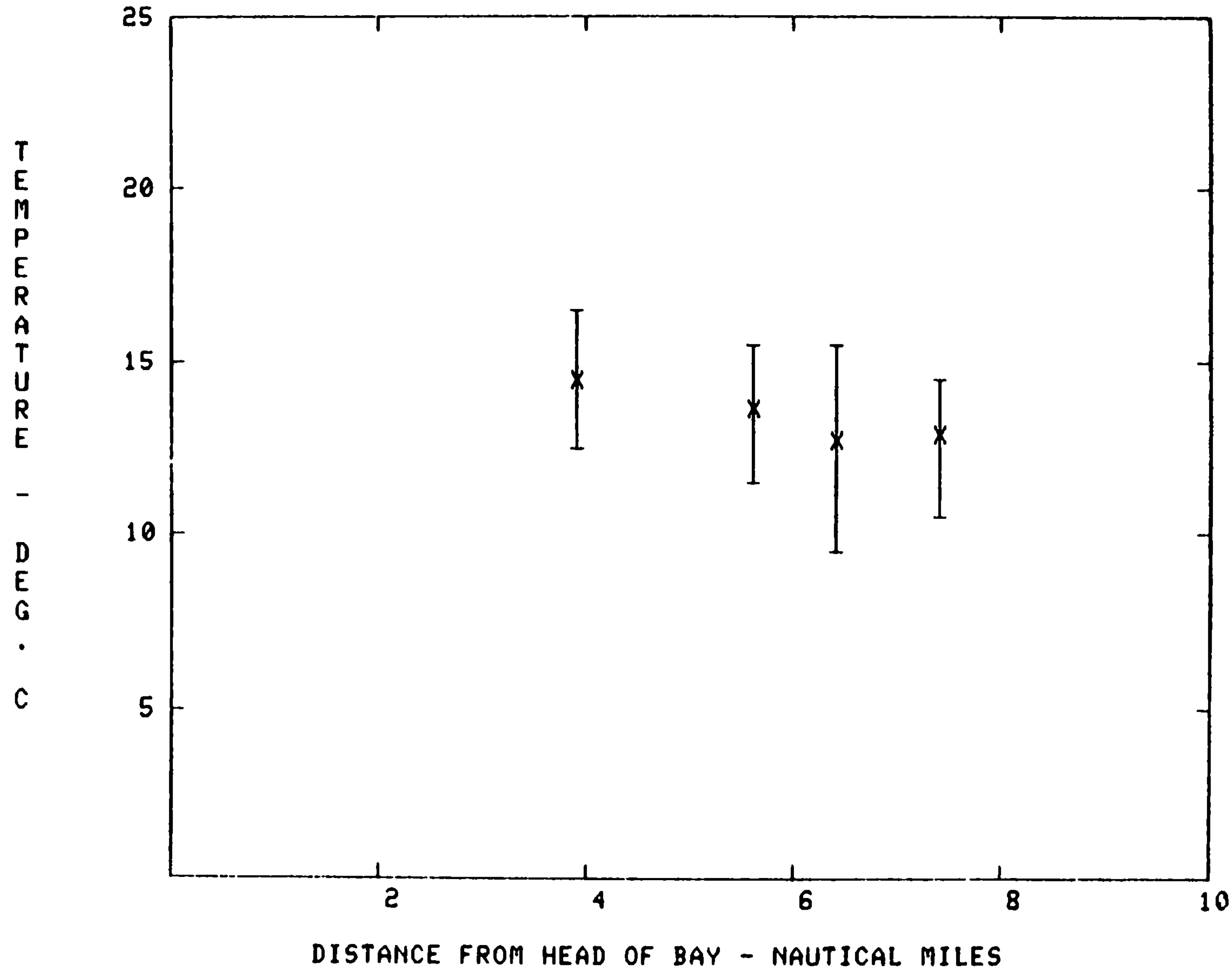


FIGURE 52|. AVERAGE, MAXIMUM AND MINIMUM DISSOLVED OXYGEN IN NORTH BAY - GRAYS HARBOR. EPA FIELD STUDY, JULY 25-29, 1977

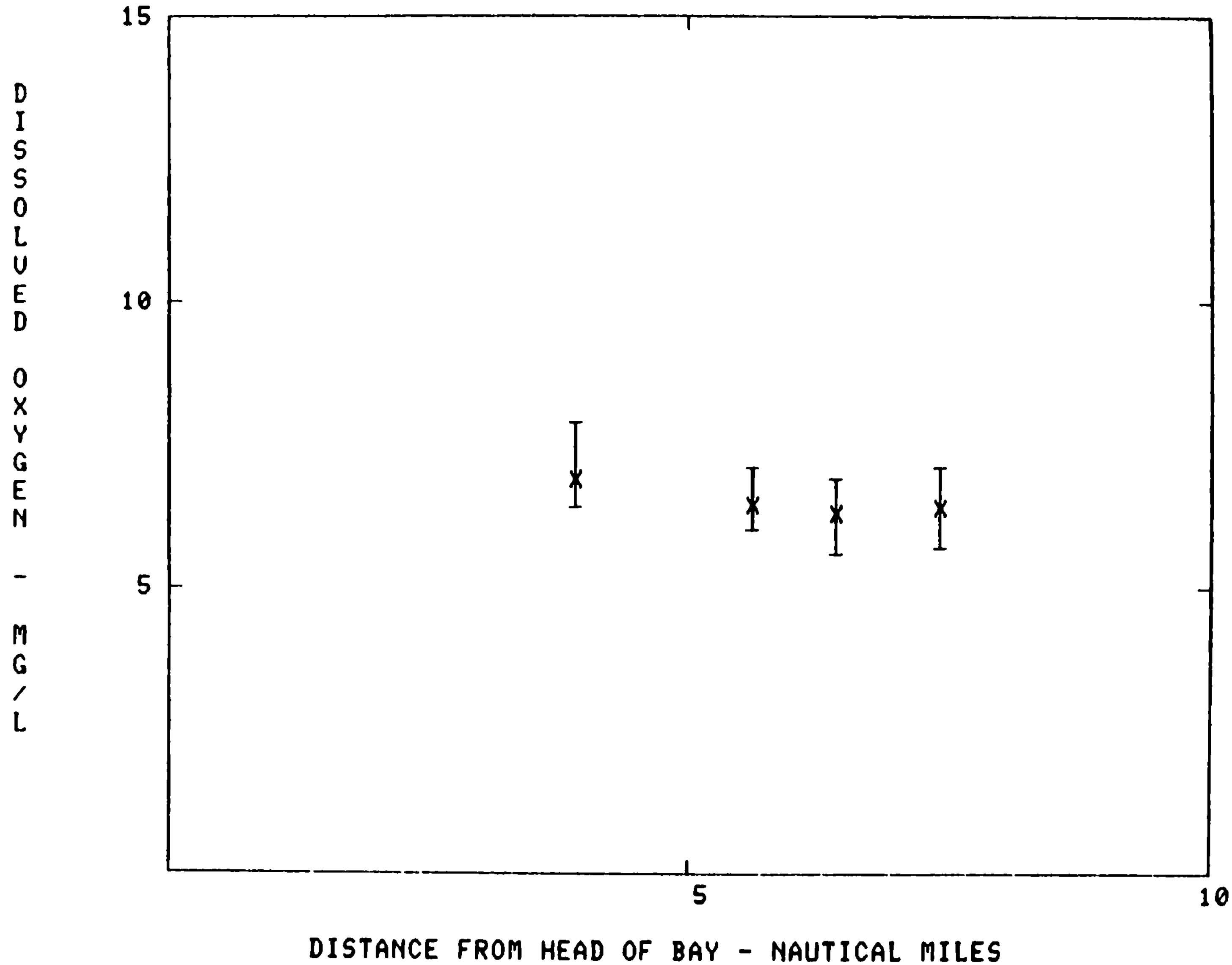
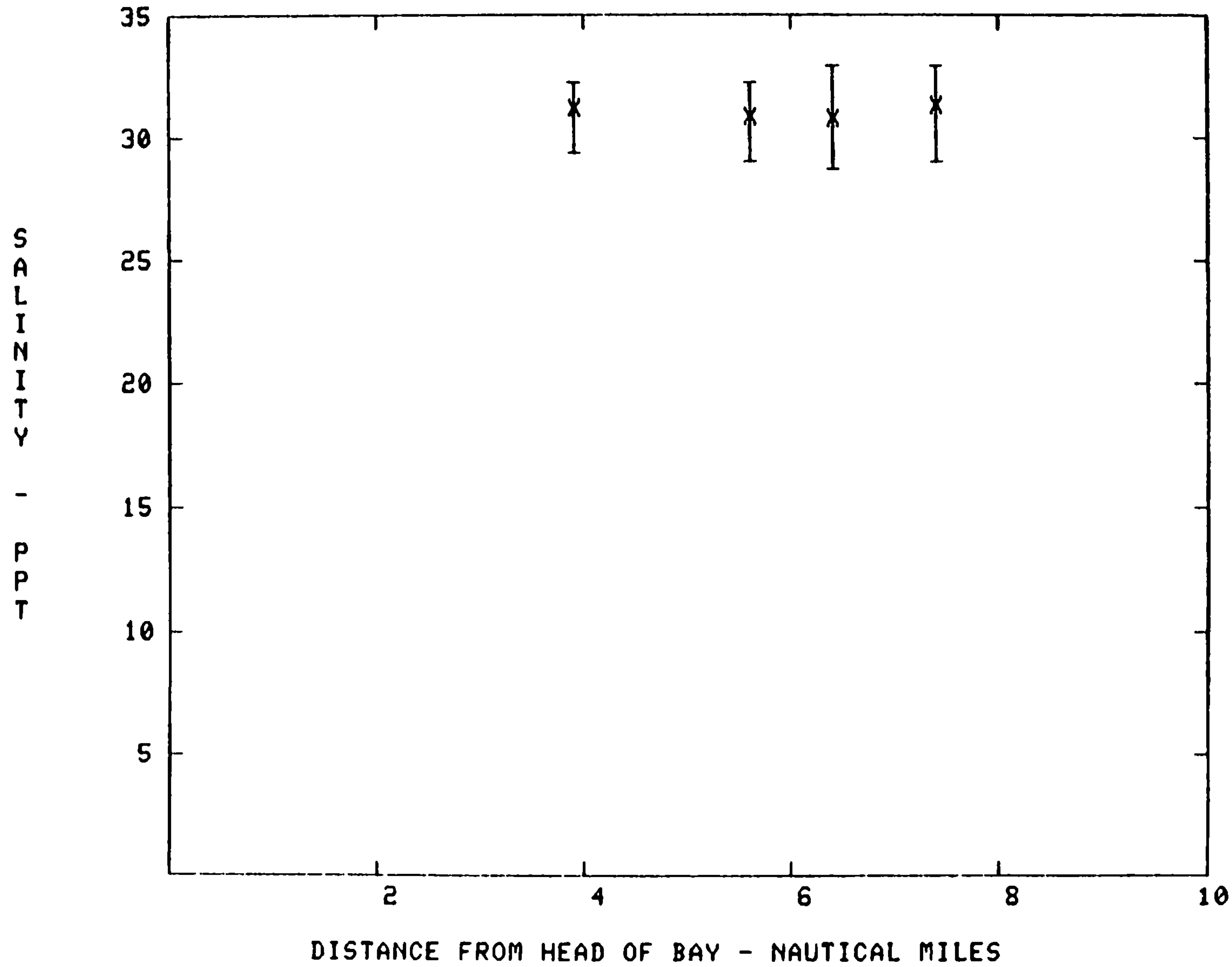


FIGURE 53. AVERAGE, MAXIMUM AND MINIMUM SALINITY IN NORTH BAY - GRAYS HARBOR. EPA FIELD STUDY, JULY 25-29, 1977.



Average values of temperature in the North Bay of Grays Harbor (Figure 51) indicate that temperatures are strongly influenced by the ocean. There is an increase in temperature, as distance from the head of the bay decreases. This temperature difference is, for the means, 1.6°C.

Dissolved Oxygen

The dissolved oxygen in Grays Harbor is affected by organic waste loads from municipal and industrial waste sources, photosynthesis and respiration of phytoplankton, and by the influx of ocean water with low dissolved oxygen. The major impact upon dissolved oxygen (Figure 5) occurs in the Inner Harbor between Moon Island and Cosmopolis. For this part of Grays Harbor, water quality standards of the State of Washington require that the dissolved oxygen exceed 5.0 mg/l, or 60% saturation, whichever is greater. The individual measurements (Appendix I) show numerous violations of this standard. The minimum dissolved oxygen measured during the survey was 4.9 mg/l. All standards violations occurred at, or near, the bottom of the estuary. Mathematical model (Yearsley and Hess (1979)) results show that the dissolved oxygen minimum which occurs approximately 12 nautical miles downstream from Montesano is a result of the organic waste discharge from the two major industrial sources, the ITT/Rayonier and Weyerhaeuser Company pulp mills, and oxygen demand attributed to organic material deposited on the river bottom.

There is some indication in the data that low dissolved oxygen associated with upwelling was present at the entrance to Grays Harbor at the beginning of the survey, July 25-26, 1977. The minimum values of dissolved oxygen at the entrance occurred on the second low slack of July 25, 1977 (Figure 16) and the first high slack of July 26, 1977 (Figure 17). Minimum values of temperatures (Figures 7 and 8) for the survey were associated with these two slack tides and maximum salinity was associated with these slack tides (Figures 25 and 26). The combination of low dissolved oxygen, low temperature and high salinity is a typical signature for upwelled ocean water (Stefansson and Richards (1964), Pearson and Holt (1960)).

Salinity

The distribution of average salinity (Figure 6) in Grays Harbor is typical for a coastal plain estuary. Oceanic values occur at the entrance and decrease, monotonically, to freshwater values at the upstream station near Montesano. The slack tide salinity data (Figures 25 through 33) suggest that the salinity at the entrance to Grays Harbor was decreasing during the survey in response to an upwelling event which ended as the survey began.

The slack tide salinity data (Figures 30 and 31, for example) indicate that the maximum tidal excursion at the tidal ranges occurring during the survey was approximately four nautical miles at the upstream locations, and six nautical miles near the entrance. These estimates are consistent with tidal excursion distances implied by the slack tide temperatures (Figures 10 and 12) and dissolved oxygen (Figures 19 and 21).

Ammonia Nitrogen

Average ammonia nitrogen (Figure 34) varied from 20 ug/l at the entrance to a maximum of 100 ug/l at nautical mile 13.2 to 8 ug/l at the upstream stations. Maximum values of ammonia occurred in the vicinity of the major point discharges to Grays Harbor.

These concentrations are of the same order as those observed in Puget Sound during the summer (Collias and Lincoln (1975)), but are substantially less than previous observations in Grays Harbor by Westley and Tarr (1965).

Nitrate-Nitrogen

Average nitrate-nitrogen, as shown in Figure 35, in Grays Harbor varied from a maximum of 180 ug/l at the entrance to a minimum of 6 ug/l at the upstream station near Montesano. The average nitrogen observed at the entrance is of the same order as found below 10 meters in the Pacific Ocean (Stefansson and Richards (1964)). The ocean, then, is a major source for nitrate nitrogen in Grays Harbor.

Dissolved Orthophosphorus

As in the case of nitrate-nitrogen, the ocean is a major source of inorganic phosphorus. The maximum average dissolved orthophosphorus (Figure 37) of 40 ug/l occurs at the entrance to Grays Harbor. This level is similar to that found in the Pacific Ocean, near the entrance (Stefansson and Richards (1964)).

Total Organic Carbon

Average total organic carbon (Figure 38) was at a minimum of 3.8 mg/l at the entrance to Grays Harbor, reached a maximum of 13.5 mg/l at nautical mile 11.6. Average total organic carbon was also high at the upstream stations near Montesano, indicating that the Chehalis River is a significant source of organic loading.

Carbonaceous Biological Oxygen Demand

Long-term BOD's were measured at several locations in Grays Harbor. The resulting average ultimate BOD and deoxygenation rate given in Table 11 for each sample station. Also, at each station, the observed results are compared to values predicted from Equation (2), using the appropriate values from Table 11.

The highest values for ultimate BOD occurred at Station MC10 during low slack tide on July 25, 1977. The Inner Harbor ultimate BOD's are higher than the oceanic values, as might be expected. The upstream values from the Chehalis River are also high compared to the ocean values. In general, the deoxygenation rates from the Chehalis River and Inner Grays Harbor are less than those from the outer portions of Grays Harbor.

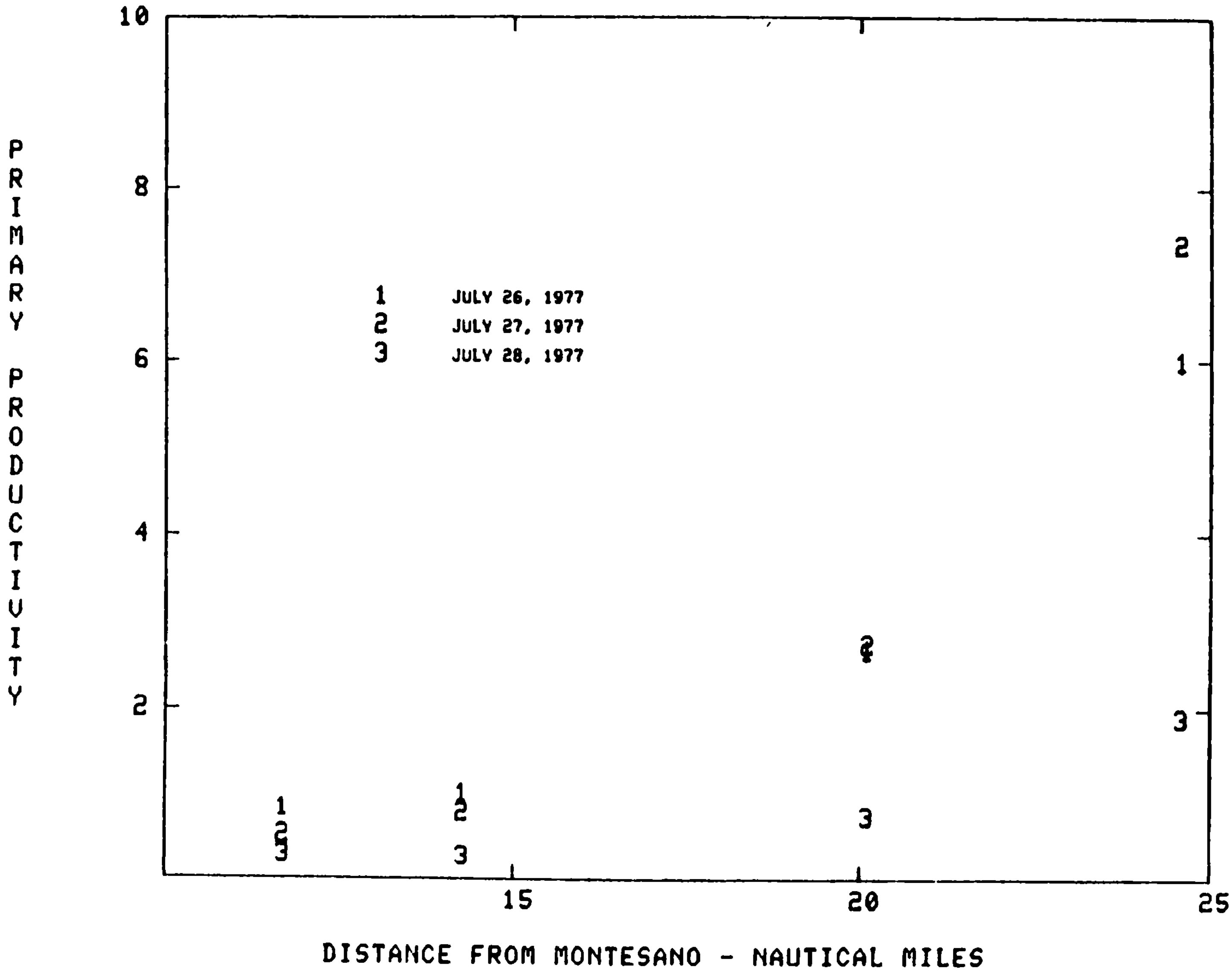
Aesthetics

On several occasions during the survey, severe foaming problems were observed and photographed near the ITT/Rayonier discharge. The estimated extent of the area covered by foam was two to five acres. The ITT/Rayonier pulp mill at Hoquiam was in the process of bringing their new treatment system on line. The foaming problems may have been associated with this process.

Primary Productivity

Primary productivity by phytoplankton in Grays Harbor was measured by the University of Washington, using the method described by Steeman - Nielsen (1952). In addition to primary productivity, they measured chlorophyll *a* phaeopigments and water clarity. These results are presented in Appendix III. The primary production per unit area, down to the level at which the light is 1% of the surface value, is shown in Figure 54. The decrease in productivity per unit area within the inner harbor is principally a result of the decrease in water clarity in the inner

FIGURE 54|. PRIMARY PRODUCTIVITY(G C/M^2/LAN-SS) IN GRAYS HARBOR. UNIV. OF WASH. FIELD STUDY, JULY 25-29, 1977.



harbor. Primary production per unit volume in the surface waters is only slightly less in the inner harbor than at the ocean entrance. The 1% light depth in the inner harbor was from one-half to one-third that at the ocean entrance, however.

Point Sources

Temperature, dissolved oxygen, pH, conductivity, and various nutrients were measured in the various point sources discharging to Grays Harbor or the Chehalis River. The point sources included the tributary rivers and municipal and industrial discharger. The data are given in Appendix III. Table 12 shows the estimated BOD-5 loadings associated with each of the point sources and Table 13 shows the corresponding discharge. Discharge measurements were not available for the Hoquiam, Wishkah and Chehalis at Montesano Rivers. Estimates of the Hoquiam and Wishkah Rivers were made using linear regression between the Wynoochee River above Black Creek and spot measurements from the East Fork of the Hoquiam and the Wishkah Rivers, respectively. In the case of the industrial and municipal sources in Grays Harbor report BOD-5 loadings to the Washington State Department of Ecology. Where available, they are shown with the EPA field data. In some cases, particularly the industrial discharges, there is a considerable difference between the loadings reported by the discharger and that reported by the EPA.

Table 12. Observed and estimated BOD_5 loading rates for the major point sources discharging to Grays Harbor, July 25-29, 1977. Name in parentheses refers to the entity which made the observation.

		BOD_5 Loading (lbs/day)				
Source		7/25	7/26	7/27	7/28	7/29
Chehalis River near Montesano	(EPA)			5,320*		
Wynoochee River	(EPA)	1,267	1,685	231		
Weyco #2	(EPA)		5.2	17		
	(Permittee)	30	140	180	60	70
Wishkah River			1,035*	404*	423	
Aberdeen STP	(EPA)			1,596	1,880	
	(Permittee)			2,520		
Weyco #1	(EPA)		454,200	37,127		62,867
	(Permittee)	19,000	23,200	19,200	27,200	23,100
ITT/Rayonier	(EPA)		641,074	31,329		
	(Permittee)	13,600	14,900	15,000	18,700	500
Hoquiam River	(EPA)	1,225*	758*	594*	289*	
Hoquiam STP	(EPA)			711	944	
	(Permittee)					

* Estimate

Table 13. Observed and estimated discharge rates for industrial and municipal point sources and tributary rivers discharging to Grays Harbor, July 25-29, 1977.

Source	Distance from Montesano (nautical miles)	Discharge (cfs) 7/25	7/26	7/27	7/28	7/29
Chehalis River near Montesano	0.0	643*	623*	616*	621*	614*
Wynoochee River	0.2	211.0	208.0	214.0	208.0	204.0
Weyco #2	8.5	0.8	0.8	0.8	0.8	0.8
Wishkah River	11.5	115*	115*	118*	112*	109*
Aberdeen STP	12.3	3.4	3.5	3.6	3.6	3.6
Weyco #1	13.4	33.0	34.3	31.3	35.8	33.3
ITT/Rayonier	14.2	43.7	45.5	46.5	46.4	45.6
Hoquiam River	14.3	108*	108*	110*	107*	105*
Hoquiam STP	16.2	1.9	1.9	1.9	4.6	4.6

* Estimated

Grays Harbor Community College Water Quality Monitoring Program

The Grays Harbor Community College measured temperature, dissolved oxygen, salinity and pH once a week at Point Chehalis, near the ocean entrance to Grays Harbor, and at the State Highway 107 bridge near Montesano, the approximate upstream boundary for the estuary. These results are given in Appendix IV. In addition, the depth-averaged temperature, dissolved oxygen and salinity are plotted in Figures 55, 56 and 57.

The temperature and dissolved oxygen concentrations at the ocean boundary (Figures 55 and 56) are uncoupled from those at the upstream boundary during the first three weeks of August, when the river flow was low. As the flow in the Chehalis River increased, due to heavy rainfall, the temperature and dissolved oxygen at the two boundaries became more closely coupled. In addition, the water at the ocean boundary showed a general decrease in salinity. This was a result of the three to four-fold increase in the freshwater inflow to Grays Harbor which occurred at the end of August and in September.

FIGURE 55|. TEMPERATURE IN GRAYS HARBOR NEAR PT. CHEHALIS AND IN THE CHEHALIS R. NEAR MONTESANO, 8/3/77-9/29/77.

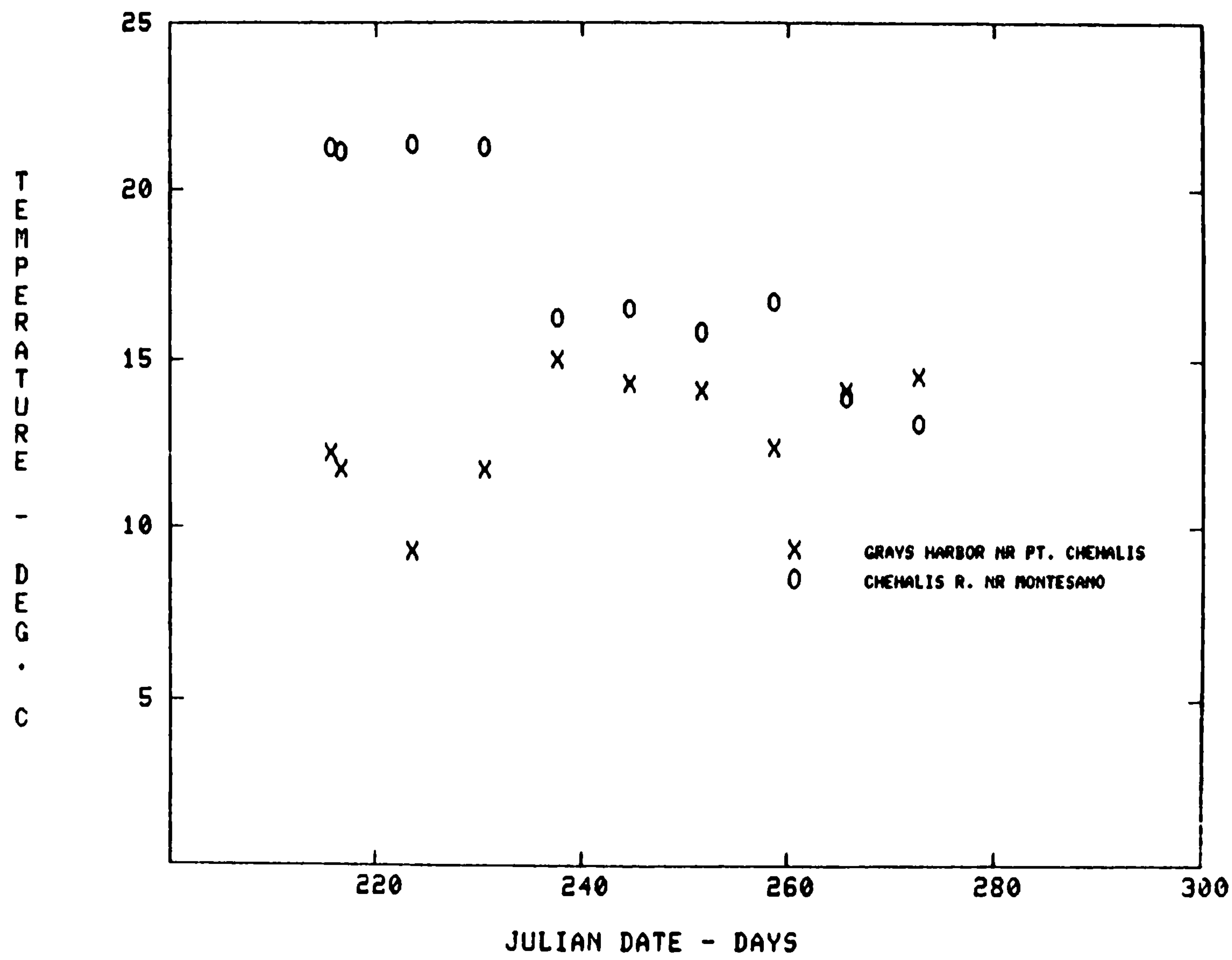


FIGURE 56. DEPTH-AVERAGED D.O. IN GRAYS HARBOR NEAR POINT CHEHALIS AND THE CHEHALIS R. NEAR MONTESANO, 8/4/77-9/29/77.

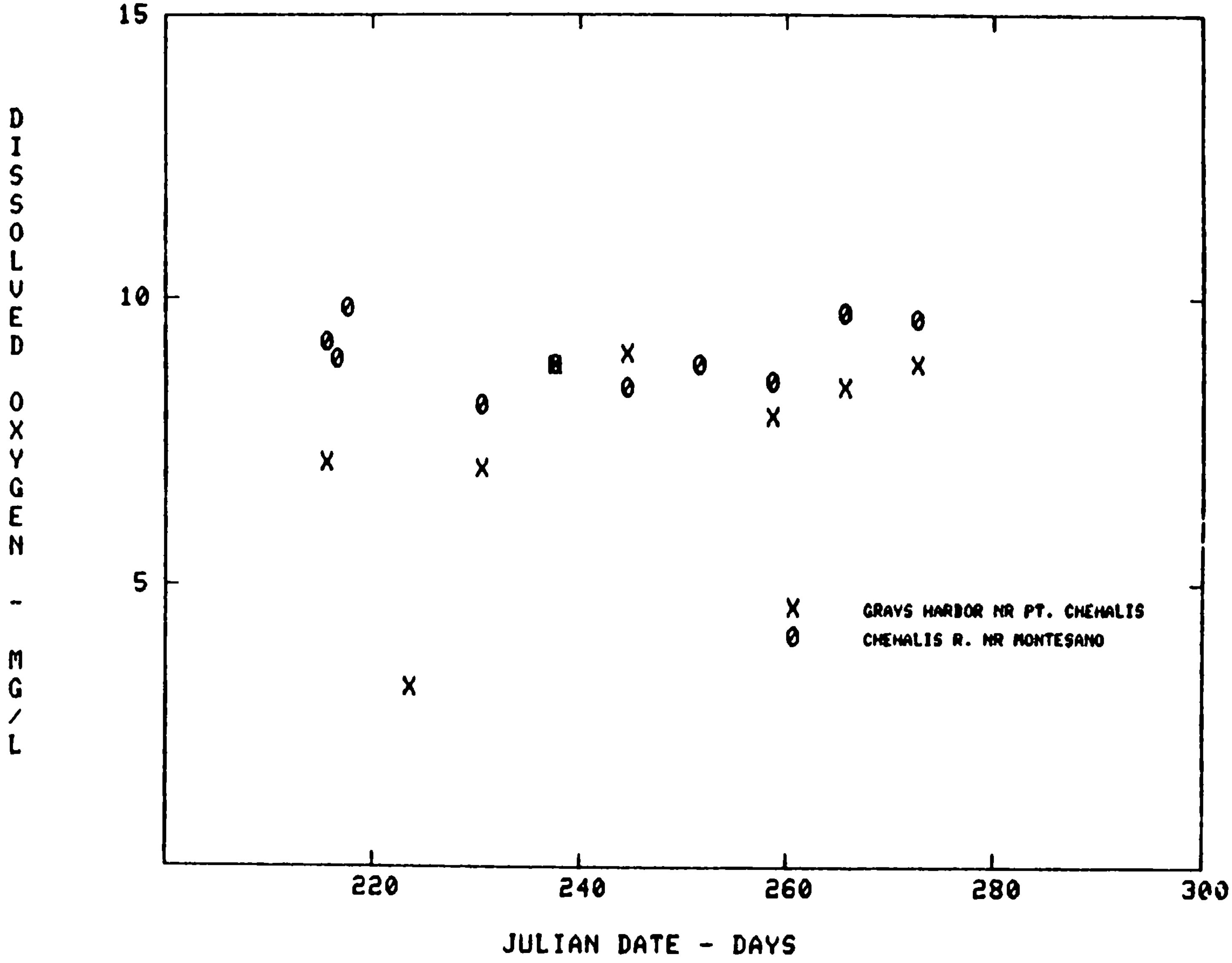
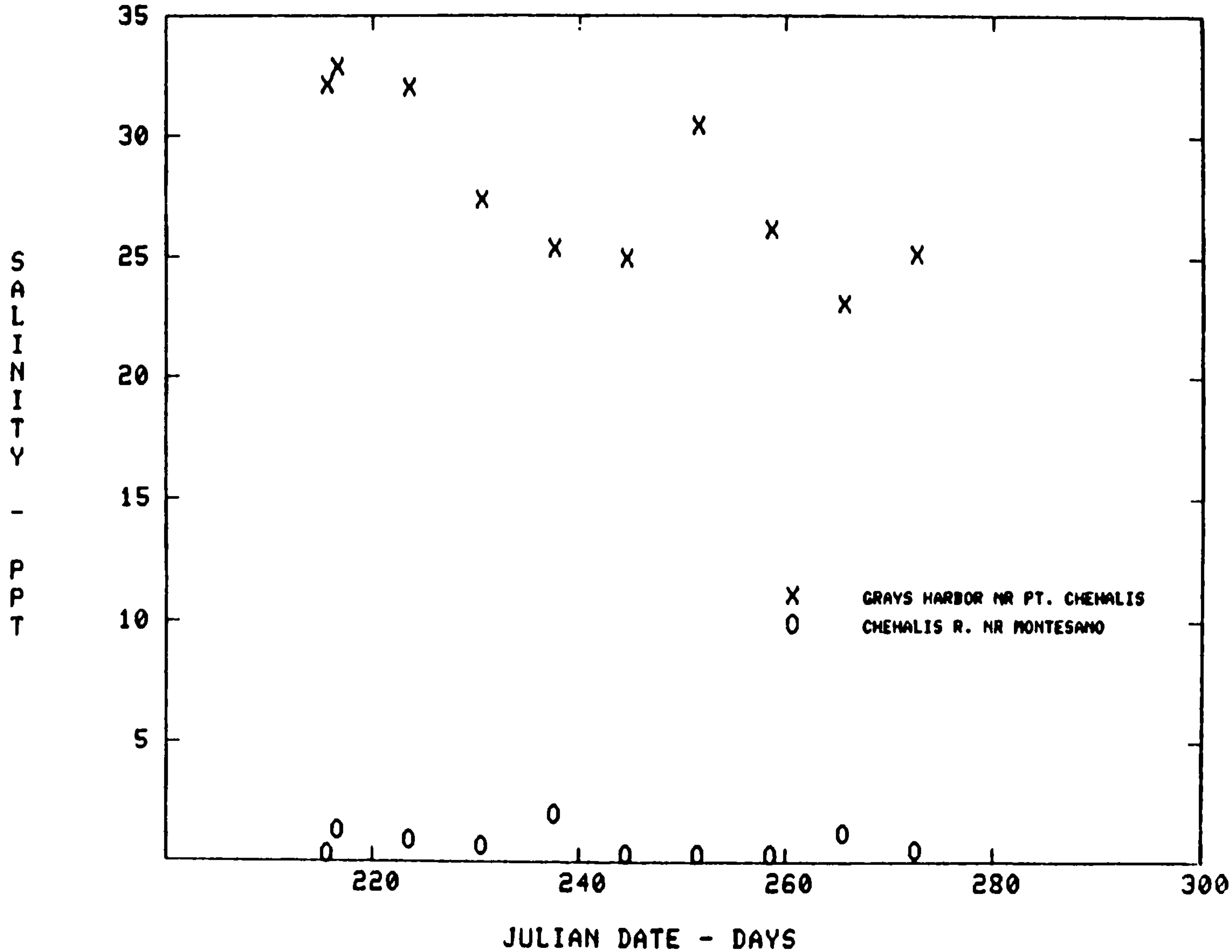


FIGURE 57. SALINITY IN GRAYS HARBOR NEAR PT. CHEHALIS AND IN THE CHEHALIS R. NEAR MONTESANO, 8/3/77-9/29/77.



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APPENDIX I

Water Quality Measurements

Made by EPA Region 10 in

Grays Harbor, Washington, July 25-29, 1977

TABLE I-1. TEMPERATURE, SALINITY, DISSOLVED OXYGEN, AND PH IN THE MAIN CHANNEL OF GRAYS HARBOR. EPA REGION 10 FIELD STUDY, JULY 26-29, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	WATER TEMP (CENT)	CNDUCTVY AT 25 C (MICROMHO)	SALINITY (PPT)	DISS OXYGEN (MG/L)	DISS OXYGEN (%SAT)	PH (SU)
MC02	24.6	7/26/77	1230	0.0	19.5	200.0	0.10	9.3	101.2	7.5
MC02	24.6	7/26/77	1830	11.0	19.5	600.0	0.40	8.6	93.5	7.2
MC02	24.6	7/26/77	1815	0.0	19.5	1100.0	0.70	9.5	103.3	7.2
MC02	24.6	7/26/77	1815	6.6	19.5	1100.0	0.70	9.3	101.2	7.1
MC02	24.6	7/27/77	1230	0.0	19.0	600.0	0.40	8.6	92.6	7.2
MC02	24.6	7/27/77	1230	13.0	19.0	800.0	0.50	8.2	88.3	7.1
MC02	24.6	7/27/77	1810	0.0	19.0	100.0	0.00	9.6	103.4	7.2
MC02	24.6	7/27/77	1810	5.2	19.0	100.0	0.00	9.5	102.3	7.1
MC02	24.6	7/28/77	750	0.0	18.5	100.0	0.00	9.7	103.4	6.9
MC02	24.6	7/28/77	750	4.4	18.5	100.0	0.00	9.6	102.3	6.9
MC02	24.6	7/28/77	1020	0.0	18.5	100.0	0.00	9.3	99.1	8.1
MC02	24.6	7/28/77	1020	6.0	18.5	100.0	0.00	9.1	97.0	8.1
MC02	24.6	7/29/77	830	0.0	18.1	100.0	0.00	9.8	103.6	7.9
MC02	24.6	7/29/77	830	4.5	18.1	100.0	0.00	9.6	102.0	7.9
MC02C	23.3	7/28/77	1010	0.0	19.0	600.0	0.40	8.7	93.7	8.1
MC02C	23.3	7/28/77	1010	4.5	19.0	600.0	0.40	8.2	88.3	8.1
MC02C	23.3	7/29/77	820	0.0	18.3	100.0	0.00	9.2	97.7	7.9
MC02C	23.3	7/29/77	820	3.0	18.3	100.0	0.10	8.8	93.4	7.9
MC03	22.2	7/26/77	1215	0.0	19.0	3900.0	2.40	7.8	85.1	7.2
MC03	22.2	7/26/77	1215	8.6	19.0	6800.0	4.00	7.0	77.5	7.1
MC03	22.2	7/26/77	1800	0.0	20.0	7900.0	4.70	8.9	118.0	7.2
MC03	22.2	7/26/77	1800	4.0	19.5	8500.0	5.00	8.6	95.7	7.2
MC03	22.2	7/27/77	1215	0.0	19.0	5500.0	3.30	7.2	78.6	7.1
MC03	22.2	7/27/77	1215	8.2	19.0	6700.0	4.00	6.9	75.4	7.1
MC03	22.2	7/27/77	1800	0.0	19.5	400.0	0.20	8.7	94.6	7.1
MC03	22.2	7/27/77	1800	7.0	19.5	400.0	0.30	8.7	94.6	7.1
MC03	22.2	7/28/77	740	0.0	18.5	100.0	0.10	9.2	98.1	6.9
MC03	22.2	7/28/77	740	4.2	18.5	100.0	0.10	9.2	98.1	6.9
MC03	22.2	7/28/77	1000	0.0	19.0	1300.0	0.80	8.4	90.4	8.1
MC03	22.2	7/28/77	1000	7.5	19.0	1600.0	0.90	8.1	87.2	8.1
MC03	22.2	7/29/77	810	0.0	18.5	100.0	0.10	8.8	94.3	7.9
MC03	22.2	7/29/77	810	6.0	18.5	200.0	0.10	8.7	92.7	7.9
MC04	20.6	7/26/77	1200	0.0	19.0	10000.0	5.90	7.0	77.6	7.1
MC04	20.6	7/26/77	1200	13.8	19.0	18000.0	10.90	6.3	72.1	7.1
MC04	20.6	7/26/77	1730	0.0	19.5	2400.0	1.50	8.0	88.1	7.2
MC04	20.6	7/26/77	1730	5.2	19.5	2900.0	1.80	7.8	85.9	7.1
MC04	20.6	7/27/77	1200	0.0	18.5	10000.0	5.90	6.6	72.5	7.1
MC04	20.6	7/27/77	1200	6.8	18.5	11000.0	6.50	6.3	69.3	7.1
MC04	20.6	7/27/77	1745	0.0	19.5	1500.0	0.90	8.0	87.0	7.1
MC04	20.6	7/27/77	1745	4.0	19.5	1600.0	1.00	7.9	85.9	7.1
MC04	20.6	7/28/77	730	0.0	19.0	500.0	0.30	8.7	93.7	6.9
MC04	20.6	7/28/77	730	3.4	19.0	600.0	0.40	8.5	91.5	6.9

TABLE I-1. TEMPERATURE, SALINITY, DISSOLVED OXYGEN, AND PH IN THE MAIN CHANNEL OF GRAYS HARBOR.
EPA REGION 10 FIELD STUDY, JULY 26-29, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	WATER TEMP (CENT)	CNDUCTVY AT 25 C (MICROMHO)	SALINITY (PPT)	DISS OXYGEN (MG/L)	DISS OXYGEN (%SAT)	PH (SU)
MC04	20.6	7/28/77	945	0.0	19.0	8400.0	1.50	7.7	83.4	8.1
MC04	20.6	7/28/77	945	10.2	19.0	3600.0	2.10	7.6	81.8	8.1
MC04	20.6	7/29/77	755	0.0	18.5	600.0	0.40	7.7	82.1	7.9
MC04	20.6	7/29/77	755	3.0	18.5	700.0	0.40	7.6	79.9	7.9
MC05	19.2	7/26/77	1110	0.0	18.5	15000.0	8.90	6.5	72.6	7.2
MC05	19.2	7/26/77	1110	14.8	18.5	20000.0	12.20	5.8	66.1	7.2
MC05	19.2	7/26/77	1700	0.0	19.5	4700.0	2.80	7.5	88.7	7.2
MC05	19.2	7/26/77	1700	9.4	18.5	16000.0	9.60	5.8	65.0	7.1
MC05	19.2	7/27/77	1130	0.0	18.5	12000.0	7.10	6.4	71.4	7.1
MC05	19.2	7/27/77	1130	10.8	18.5	18000.0	10.90	5.6	64.0	7.1
MC05	19.2	7/27/77	1715	0.0	19.0	4600.0	2.80	7.1	77.5	7.1
MC05	19.2	7/27/77	1715	9.0	19.0	5000.0	3.00	7.1	77.5	7.1
MC05	19.2	7/28/77	700	0.0	19.0	1500.0	0.90	8.1	87.2	6.9
MC05	19.2	7/28/77	700	7.4	19.0	1900.0	1.20	7.9	85.1	6.9
MC05	19.2	7/28/77	935	0.0	19.0	5100.0	3.10	7.3	79.7	8.1
MC05	19.2	7/28/77	935	11.5	19.0	7400.0	4.40	6.8	75.4	8.1
MC05	19.2	7/28/77	1240	0.0	18.5	15000.0	8.90	5.9	66.1	7.0
MC05	19.2	7/28/77	1240	12.4	18.5	18000.0	10.90	5.4	60.8	7.0
MC05	19.2	7/29/77	745	0.0	18.8	1500.0	0.90	7.0	75.6	7.9
MC05	19.2	7/29/77	745	9.5	18.8	1800.0	1.10	6.9	74.0	7.9
MC06	18.1	7/26/77	1100	0.0	18.0	20000.0	12.20	6.1	68.6	7.2
MC06	18.1	7/26/77	1100	12.2	18.0	24000.0	14.90	5.6	63.3	7.3
MC06	18.1	7/26/77	1645	0.0	19.5	8000.0	4.70	7.1	79.4	7.1
MC06	18.1	7/26/77	1645	9.6	18.0	21000.0	12.90	5.4	61.2	7.1
MC06	18.1	7/27/77	1120	0.0	18.5	18000.0	10.90	5.9	67.2	7.2
MC06	18.1	7/27/77	1120	12.2	18.0	23000.0	14.20	5.4	61.2	7.2
MC06	18.1	7/27/77	1645	0.0	19.0	8600.0	5.10	6.5	78.1	7.1
MC06	18.1	7/27/77	1645	14.2	19.0	18000.0	10.90	5.9	67.8	7.1
MC06	18.1	7/28/77	650	0.0	19.0	3600.0	2.10	7.7	84.0	6.9
MC06	18.1	7/28/77	650	12.0	19.0	3800.0	2.30	7.6	81.8	6.9
MC06	18.1	7/28/77	920	0.0	18.5	9800.0	5.80	6.7	74.1	8.1
MC06	18.1	7/28/77	920	8.0	18.5	10200.0	6.00	6.5	71.4	8.1
MC06	18.1	7/28/77	1220	0.0	18.0	21000.0	12.90	5.6	63.3	7.0
MC06	18.1	7/28/77	1220	11.4	18.0	22000.0	13.60	5.3	60.1	7.1
MC06	18.1	7/29/77	730	0.0	18.8	3100.0	1.90	6.7	72.4	7.9
MC06	18.1	7/29/77	730	7.5	18.8	4000.0	2.40	6.2	67.6	7.9
MC06C	17.5	7/29/77	1000	0.0	18.7	900.0	0.60	6.6	70.6	6.9
MC06C	17.5	7/29/77	1000	2.4	18.8	1000.0	0.60	6.5	70.2	6.9
MC06C	17.5	7/29/77	1000	4.0	18.8	1000.0	0.60	6.5	69.7	6.9
MC06C	17.5	7/29/77	1000	6.0	18.8	1000.0	0.60	6.5	69.7	6.9
MC06C	17.5	7/29/77	1000	8.0	18.8	1000.0	0.60	6.5	69.7	6.9
MC06C	17.5	7/29/77	1000	10.0	18.8	1000.0	0.60	6.4	69.2	6.9

. TEMPERATURE, SALINITY, DISSOLVED OXYGEN, AND PH IN THE MAIN CHANNEL OF GRAYS HARBOR.
EPA REGION 10 FIELD STUDY, JULY 25-29, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	WATER TEMP (CENT)	CNDUCTVY AT 25 C (MICROMHO)	SALINITY (PPT)	DISS OXYGEN (MG/L)	DISS OXYGEN (%SAT)	PH (SU)
MC06C	17.5	7/29/77	1000	15.0	18.8	1000.0	0.70	6.4	68.6	6.9
MC06G	16.6	7/27/77	1240	0.0	18.0	25000.0	15.60	6.0	69.5	7.2
MC06G	16.6	7/27/77	1240	2.0	18.0	26500.0	16.60	5.9	68.4	7.3
MC06G	16.6	7/27/77	1240	5.0	17.8	28000.0	17.70	5.7	66.4	7.3
MC06G	16.6	7/27/77	1240	10.0	17.6	30000.0	19.10	5.7	67.0	7.4
MC06G	16.6	7/27/77	1240	15.0	17.6	30500.0	19.40	5.8	67.4	7.4
MC06G	16.6	7/27/77	1240	20.0	17.6	31000.0	19.70	5.8	67.8	7.4
MC07	15.4	7/25/77	1520	0.0	17.5	15000.0	8.90	6.7	73.1	7.0
MC07	15.4	7/26/77	1520	12.2	16.5	33000.0	21.10	5.8	66.5	7.4
MC07	15.4	7/26/77	945	0.0	18.0	25000.0	15.60	5.8	68.5	7.2
MC07	15.4	7/26/77	945	10.0	17.5	32000.0	20.40	5.6	65.8	7.4
MC07	15.4	7/26/77	1000	0.0	18.0	26000.0	16.30	5.8	67.5	7.3
MC07	15.4	7/26/77	1000	10.0	17.5	32000.0	20.40	5.7	66.8	7.4
MC07	15.4	7/26/77	1020	0.0	18.0	26000.0	16.30	5.7	66.5	7.3
MC07	15.4	7/26/77	1020	10.0	17.5	33000.0	21.10	5.7	66.8	7.4
MC07	15.4	7/26/77	1040	0.0	18.0	27000.0	17.00	5.6	65.4	7.3
MC07	15.4	7/26/77	1040	9.8	17.5	32000.0	20.40	5.6	65.8	7.4
MC07	15.4	7/26/77	1130	0.0	17.4	******	*****	****	****	7.2
MC07	15.4	7/26/77	1130	5.0	17.1	******	*****	****	****	7.3
MC07	15.4	7/26/77	1130	10.0	16.9	******	*****	****	****	7.5
MC07	15.4	7/26/77	1130	12.0	16.8	******	*****	****	****	7.5
MC07	15.4	7/26/77	1530	0.0	19.0	16000.0	9.60	6.0	67.8	7.1
MC07	15.4	7/26/77	1530	14.0	18.0	30000.0	19.10	5.3	62.2	7.3
MC07	15.4	7/26/77	1545	0.0	19.0	16000.0	9.60	5.9	66.8	7.1
MC07	15.4	7/26/77	1545	14.4	17.5	35000.0	22.50	5.4	64.7	7.5
MC07	15.4	7/26/77	1600	0.0	19.0	16000.0	9.60	5.9	66.8	7.1
MC07	15.4	7/26/77	1600	14.8	17.5	35000.0	22.50	5.4	64.7	7.5
MC07	15.4	7/26/77	1615	0.0	19.0	16000.0	9.60	6.0	67.8	7.2
MC07	15.4	7/26/77	1615	14.2	17.0	35000.0	22.50	5.4	64.1	7.5
MC07	15.4	7/27/77	915	0.0	18.0	22000.0	13.60	5.7	64.4	7.2
MC07	15.4	7/27/77	915	15.0	18.0	27000.0	17.00	5.3	61.2	7.2
MC07	15.4	7/27/77	930	0.0	18.5	22000.0	13.60	****	*****	7.1
MC07	15.4	7/27/77	945	0.0	18.0	23000.0	14.20	5.4	62.2	7.2
MC07	15.4	7/27/77	945	15.2	18.0	27000.0	17.00	5.3	61.2	7.2
MC07	15.4	7/27/77	1000	0.0	18.0	24000.0	14.90	5.4	62.2	7.2
MC07	15.4	7/27/77	1000	15.2	18.0	28000.0	17.70	5.2	61.2	7.3
MC07	15.4	7/27/77	1015	0.0	18.0	24000.0	14.90	5.4	62.2	7.2
MC07	15.4	7/27/77	1015	15.2	17.5	29000.0	18.40	5.2	60.6	7.3
MC07	15.4	7/27/77	1030	0.0	18.0	25000.0	15.60	5.4	62.2	7.2
MC07	15.4	7/27/77	1030	15.2	17.5	30000.0	19.10	5.2	54.4	7.3
MC07	15.4	7/27/77	1045	0.0	18.0	26000.0	16.30	5.4	62.2	7.2
MC07	15.4	7/27/77	1045	15.2	17.5	31000.0	19.70	5.3	61.6	7.4

TABLE I-1. TEMPERATURE, SALINITY, DISSOLVED OXYGEN, AND PH IN THE MAIN CHANNEL OF GRAYS HARBOR. EPA REGION 10 FIELD STUDY, JULY 25-29, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	WATER TEMP (CENT)	CNDUCTVY AT 25 C (MICROMHO)	SALINITY (PPT)	DISS OXYGEN (MG/L)	DISS OXYGEN (%SAT)	PH (SU)
MC07	15.4	7/27/77	1100	0.0	18.0	26000.0	16.30	5.4	62.8	7.2
MC07	15.4	7/27/77	1100	15.2	17.5	32000.0	20.40	5.3	62.7	7.4
MC07	15.4	7/27/77	1205	0.0	17.9	27800.0	17.60	6.1	70.5	7.3
MC07	15.4	7/27/77	1205	2.0	17.8	28400.0	17.90	6.0	69.3	7.3
MC07	15.4	7/27/77	1205	5.0	17.5	32000.0	20.40	6.0	70.0	7.5
MC07	15.4	7/27/77	1205	10.0	17.1	34000.0	21.80	6.1	71.6	7.6
MC07	15.4	7/27/77	1205	14.5	17.0	34900.0	22.40	6.2	72.3	7.6
MC07	15.4	7/27/77	1500	0.0	18.5	22000.0	13.60	5.7	65.1	7.2
MC07	15.4	7/27/77	1500	16.0	17.5	28000.0	17.70	5.2	59.5	7.3
MC07	15.4	7/27/77	1515	0.0	18.5	20000.0	12.20	5.7	66.0	7.2
MC07	15.4	7/27/77	1515	15.2	18.0	27000.0	17.00	5.2	60.1	7.3
MC07	15.4	7/27/77	1530	0.0	18.5	20000.0	12.20	5.6	64.0	7.2
MC07	15.4	7/27/77	1530	15.8	18.0	26000.0	16.30	5.1	59.1	7.2
MC07	15.4	7/27/77	1545	0.0	18.5	19000.0	11.50	5.5	62.9	7.2
MC07	15.4	7/27/77	1545	15.6	18.0	25000.0	15.60	5.1	59.1	7.2
MC07	15.4	7/27/77	1600	0.0	18.5	19000.0	11.50	5.6	64.0	7.2
MC07	15.4	7/27/77	1600	14.4	18.0	24000.0	14.90	5.2	59.1	7.2
MC07	15.4	7/27/77	1615	0.0	18.5	19000.0	11.50	5.6	64.0	7.2
MC07	15.4	7/27/77	1615	14.2	18.0	24000.0	14.90	5.2	59.1	7.2
MC07	15.4	7/27/77	1630	0.0	18.5	18000.0	10.90	5.6	64.0	7.1
MC07	15.4	7/27/77	1630	14.2	18.0	23000.0	14.20	5.2	59.1	7.2
MC07	15.4	7/28/77	620	0.0	18.5	12000.0	7.10	6.4	71.4	7.0
MC07	15.4	7/28/77	620	12.0	18.5	13000.0	7.70	6.3	70.4	7.0
MC07	15.4	7/28/77	900	0.0	18.3	17000.0	10.20	6.0	66.0	8.1
MC07	15.4	7/28/77	900	3.0	18.3	19000.0	11.50	5.7	64.7	8.1
MC07	15.4	7/28/77	915	0.0	18.4	20100.0	12.30	6.3	71.3	****
MC07	15.4	7/28/77	915	7.6	18.0	21100.0	12.90	6.0	68.6	****
MC07	15.4	7/28/77	1200	0.0	18.0	26000.0	16.30	5.5	63.3	7.1
MC07	15.4	7/28/77	1200	14.0	17.5	30000.0	19.10	5.1	59.5	7.2
MC07	15.4	7/29/77	715	0.0	18.8	10200.0	6.00	5.7	63.3	7.9
MC07	15.4	7/29/77	715	3.0	18.8	10000.0	5.90	5.5	61.1	7.9
MC07	15.4	7/29/77	940	0.0	18.3	16400.0	9.80	5.7	64.3	6.9
MC07	15.4	7/29/77	940	2.0	18.6	17100.0	10.30	5.7	64.8	6.9
MC07	15.4	7/29/77	940	4.0	18.6	18100.0	10.90	5.6	63.0	7.0
MC07	15.4	7/29/77	940	6.0	18.6	18400.0	11.10	5.5	61.9	7.0
MC07	15.4	7/29/77	940	8.0	18.4	21100.0	12.90	5.1	58.0	7.0
MC07	15.4	7/29/77	940	10.4	18.8	20400.0	12.50	5.2	59.3	6.8
MC08	13.8	7/25/77	1840	0.0	17.8	31000.0	19.70	6.3	74.3	7.4
MC08	13.8	7/25/77	1840	5.0	17.5	34800.0	22.40	6.1	72.9	7.6
MC08	13.8	7/25/77	1840	10.0	17.0	38900.0	25.20	6.0	71.3	7.7
MC08	13.8	7/26/77	920	0.0	18.0	29000.0	18.40	6.1	71.7	7.3
MC08	13.8	7/26/77	920	6.7	18.0	33000.0	21.10	5.9	70.7	7.4

TABLE I-1. TEMPERATURE, SALINITY, DISSOLVED OXYGEN, AND PH IN THE MAIN CHANNEL OF GRAYS HARBOR. EPA REGION 10 FIELD STUDY, JULY 26-29, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	WATER TEMP (CENT)	CNDUCTVY AT 25 C (MICROMHO)	SALINITY (PPT)	DISS OXYGEN (MG/L)	(%SAT)	PH (SU)
MC08	13.8	7/26/77	1230	0.0	18.0	37000.0	23.90	5.8	70.7	7.4
MC08	13.8	7/26/77	1230	6.7	17.5	44000.0	28.70	6.0	74.1	7.7
MC08	13.8	7/26/77	1500	0.0	18.1	25000.0	15.60	5.9	68.3	7.1
MC08	13.8	7/26/77	1500	10.0	17.3	34000.0	21.80	5.8	68.6	7.3
MC08	13.8	7/27/77	1150	0.0	17.5	30500.0	19.40	6.1	71.0	7.4
MC08	13.8	7/27/77	1150	2.0	17.1	34400.0	22.10	6.3	73.5	7.5
MC08	13.8	7/27/77	1150	5.0	16.5	36900.0	23.80	6.4	74.7	7.6
MC08	13.8	7/27/77	1150	10.0	16.5	37000.0	23.90	6.4	75.2	7.7
MC08	13.8	7/27/77	1205	0.0	18.0	34000.0	21.80	5.8	69.6	7.5
MC08	13.8	7/27/77	1205	4.0	17.0	38000.0	24.50	6.0	71.3	7.6
MC08	13.8	7/27/77	1205	6.7	17.0	38000.0	24.50	5.9	70.3	7.6
MC08	13.8	7/27/77	1215	0.0	18.0	31000.0	19.70	5.8	68.6	7.4
MC08	13.8	7/27/77	1215	6.7	17.0	38000.0	24.60	5.9	70.3	7.6
MC08	13.8	7/27/77	1230	0.0	18.0	32000.0	20.40	5.8	68.0	7.4
MC08	13.8	7/27/77	1230	6.7	17.0	38000.0	24.60	5.9	70.3	7.6
MC08	13.8	7/27/77	1245	0.0	18.0	32000.0	20.40	5.7	67.5	7.5
MC08	13.8	7/27/77	1245	6.7	17.0	38000.0	24.60	5.8	69.2	7.6
MC08	13.8	7/27/77	1430	0.0	17.5	34000.0	21.80	6.0	71.0	7.4
MC08	13.8	7/27/77	1430	6.7	17.0	36000.0	23.20	5.9	69.2	7.5
MC08	13.8	7/27/77	1445	0.0	17.8	27300.0	17.20	5.9	67.8	7.2
MC08	13.8	7/27/77	1445	5.0	17.2	32000.0	20.40	5.8	67.4	7.3
MC08	13.8	7/27/77	1445	10.0	16.6	34000.0	21.80	6.0	69.3	7.4
MC08	13.8	7/27/77	1855	0.0	18.5	25500.0	15.90	5.8	67.7	7.3
MC08	13.8	7/27/77	1855	6.7	17.5	36000.0	23.20	5.3	63.7	7.5
MC08	13.8	7/28/77	610	0.0	18.5	27000.0	17.00	6.5	76.7	####
MC08	13.8	7/28/77	610	6.7	18.5	27000.0	17.00	6.4	74.6	####
MC08	13.8	7/28/77	850	0.0	18.0	22500.0	13.90	5.6	63.3	8.1
MC08	13.8	7/28/77	850	5.0	18.0	25000.0	15.60	5.4	62.2	8.1
MC08	13.8	7/28/77	910	0.0	18.5	23500.0	14.60	5.9	68.2	####
MC08	13.8	7/28/77	910	7.6	18.1	26100.0	16.40	5.6	65.0	####
MC08	13.8	7/28/77	916	1.2	####	#######	#####	####	#####	####
MC08	13.8	7/28/77	916	9.8	####	#######	#####	####	#####	####
MC08	13.8	7/28/77	1220	0.0	17.3	29500.0	18.70	6.1	70.6	7.7
MC08	13.8	7/28/77	1220	8.0	16.5	33000.0	21.10	6.3	72.6	7.7
MC08	13.8	7/28/77	1255	0.0	19.4	29800.0	18.90	6.0	72.1	7.5
MC08	13.8	7/28/77	1255	5.0	18.2	36400.0	23.40	6.3	78.4	7.8
MC08	13.8	7/28/77	1255	10.0	18.1	37100.0	23.90	6.4	78.1	7.9
MC08	13.8	7/28/77	1255	20.0	18.0	37200.0	24.00	6.4	78.1	####
MC08	13.8	7/28/77	1905	0.0	18.5	20500.0	12.60	5.6	64.0	7.7
MC08	13.8	7/28/77	1905	12.0	17.5	29500.0	18.70	4.9	56.4	7.7
MC08	13.8	7/28/77	1915	0.0	20.4	22000.0	13.60	5.7	67.5	7.6
MC08	13.8	7/28/77	1915	5.0	20.0	26000.0	16.30	5.0	60.4	7.6

TABLE I-1. TEMPERATURE, SALINITY, DISSOLVED OXYGEN, AND PH IN THE MAIN CHANNEL OF GRAYS HARBOR. EPA REGION 10 FIELD STUDY, JULY 25-29, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	WATER TEMP (CENT)	CNDUCTVY AT 25 C (MICROMHO)	SALINITY (PPT)	DISS OXYGEN (MG/L)	DISS OXYGEN (%SAT)	PH (SU)
MC08	13.8	7/28/77	1915	10.0	19.7	29100.0	18.40	5.0	60.6	7.7
MC08	13.8	7/28/77	1915	18.0	19.5	31800.0	20.30	4.9	60.3	7.8
MC08	13.8	7/29/77	700	0.0	18.3	17000.0	10.20	5.6	63.8	7.9
MC08	13.8	7/29/77	700	4.6	18.3	18500.0	11.20	4.8	54.7	7.9
MC08	13.8	7/29/77	925	0.0	18.5	20900.0	12.00	5.5	63.4	7.0
MC08	13.8	7/29/77	925	2.0	18.5	22400.0	13.00	5.2	59.0	7.0
MC08	13.8	7/29/77	925	4.0	18.0	23900.0	14.90	5.1	58.2	7.0
MC08	13.8	7/29/77	925	6.0	18.0	24600.0	15.30	5.0	58.0	7.1
MC08	13.8	7/29/77	925	8.0	18.0	25800.0	16.20	5.0	58.0	7.1
MC08	13.8	7/29/77	925	10.0	18.1	25900.0	16.20	5.0	57.8	7.1
MC08	13.8	7/29/77	925	12.0	19.0	26100.0	16.40	5.0	58.7	7.1
MC09	12.8	7/25/77	1825	0.0	17.6	32400.0	20.70	****	*****	7.6
MC09	12.8	7/25/77	1825	5.0	17.5	34100.0	21.90	6.2	72.9	7.6
MC09	12.8	7/25/77	1825	10.0	16.7	40900.0	26.50	6.1	72.9	7.7
MC09	12.8	7/25/77	1830	0.0	17.7	32400.0	20.70	6.5	77.1	7.6
MC09	12.8	7/26/77	1100	0.0	16.1	******	*****	****	****	7.5
MC09	12.8	7/26/77	1100	5.0	16.1	******	*****	****	****	7.6
MC09	12.8	7/26/77	1100	10.0	16.0	******	*****	****	****	7.6
MC09	12.8	7/26/77	1100	15.0	16.1	******	*****	****	****	7.6
MC09	12.8	7/26/77	1220	0.0	18.0	40000.0	25.90	6.2	76.0	7.5
MC09	12.8	7/26/77	1220	6.7	17.0	46000.0	30.10	6.2	76.5	7.8
MC09	12.8	7/26/77	1530	0.0	18.4	26200.0	16.40	6.2	71.8	7.1
MC09	12.8	7/26/77	1530	10.0	17.3	34000.0	21.80	5.8	68.4	7.4
MC09	12.8	7/27/77	1130	0.0	16.6	38000.0	24.50	6.7	79.0	7.6
MC09	12.8	7/27/77	1130	2.0	16.6	38000.0	24.50	6.6	77.4	7.6
MC09	12.8	7/27/77	1130	5.0	16.2	39600.0	25.60	6.5	77.8	7.7
MC09	12.8	7/27/77	1130	10.0	16.1	39400.0	25.50	6.5	77.1	7.7
MC09	12.8	7/27/77	1130	15.0	16.1	39000.0	25.20	6.5	76.7	7.7
MC09	12.8	7/27/77	1450	0.0	17.8	28000.0	17.70	6.0	69.3	7.3
MC09	12.8	7/27/77	1450	5.0	17.1	30900.0	19.70	5.8	67.3	7.4
MC09	12.8	7/27/77	1450	10.0	16.7	33000.0	21.10	5.9	68.8	7.4
MC09	12.8	7/27/77	1845	0.0	18.5	29500.0	18.70	5.6	66.1	7.3
MC09	12.8	7/27/77	1845	6.7	17.5	36000.0	23.20	5.4	64.7	7.5
MC09	12.8	7/28/77	850	0.0	18.0	26700.0	16.80	5.8	67.0	****
MC09	12.8	7/28/77	850	1.8	****	*******	*****	****	*****	****
MC09	12.8	7/28/77	850	7.6	17.7	29000.0	18.40	5.6	65.0	****
MC09	12.8	7/28/77	850	11.9	****	*******	*****	****	*****	****
MC09	12.8	7/28/77	1305	0.0	18.0	38000.0	24.50	6.8	82.4	7.9
MC09	12.8	7/28/77	1305	5.0	18.0	38000.0	24.60	6.9	83.5	7.9
MC09	12.8	7/28/77	1305	10.0	17.5	38800.0	25.10	6.8	82.6	8.1
MC09	12.8	7/28/77	1305	15.0	17.5	39000.0	25.20	6.7	80.9	8.1
MC09	12.8	7/28/77	1900	0.0	20.1	28100.0	16.40	6.2	74.3	7.7

TABLE I-1. TEMPERATURE, SALINITY, DISSOLVED OXYGEN, AND PH IN THE MAIN CHANNEL OF GRAYS HARBOR. EPA REGION 10 FIELD STUDY, JULY 25-29, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	WATER TEMP (CENT)	CNDUCTVY AT 25 C (MICROMHO)	SALINITY (PPT)	DISS OXYGEN (MG/L)	DISS OXYGEN (%SAT)	PH (SU)
MC09	12.8	7/28/77	1900	5.0	20.1	27800.0	17.50	6.0	78.9	7.7
MC09	12.8	7/28/77	1900	10.0	19.2	33600.0	21.60	5.8	70.4	7.9
MC09	12.8	7/28/77	1900	15.0	19.8	34200.0	21.90	5.8	71.2	7.9
MC09	12.8	7/29/77	910	0.0	18.3	23400.0	14.50	5.3	60.5	7.0
MC09	12.8	7/29/77	910	2.0	17.6	24800.0	15.50	5.2	59.1	7.1
MC09	12.8	7/29/77	910	4.0	17.9	26400.0	16.60	5.0	57.9	7.1
MC09	12.8	7/29/77	910	6.0	18.0	27500.0	17.30	5.0	58.6	7.2
MC09	12.8	7/29/77	910	8.0	17.9	29400.0	18.60	5.0	58.9	7.1
MC09	12.8	7/29/77	910	14.0	17.6	29400.0	18.60	4.9	57.6	7.2
MC10	10.8	7/25/77	1805	0.0	16.8	40900.0	26.50	7.0	84.6	7.7
MC10	10.8	7/25/77	1805	5.0	16.0	44100.0	28.70	6.3	75.7	7.7
MC10	10.8	7/25/77	1805	10.0	15.6	44600.0	29.10	6.3	75.3	7.7
MC10	10.8	7/26/77	1210	0.0	17.0	46000.0	30.10	6.6	81.6	7.8
MC10	10.8	7/26/77	1210	6.7	16.0	49000.0	32.20	6.4	78.9	7.8
MC10	10.8	7/27/77	1115	0.0	15.7	41000.0	26.60	7.1	83.1	7.7
MC10	10.8	7/27/77	1115	2.0	15.6	41000.0	26.60	6.9	81.3	7.7
MC10	10.8	7/27/77	1115	5.0	15.6	41000.0	26.60	6.7	78.3	7.7
MC10	10.8	7/27/77	1115	11.0	15.6	40900.0	26.50	6.7	78.3	7.7
MC10	10.8	7/27/77	1530	0.0	17.4	30200.0	19.20	6.1	71.4	7.4
MC10	10.8	7/27/77	1530	5.0	16.3	35000.0	22.50	6.1	70.9	7.6
MC10	10.8	7/27/77	1530	10.0	15.8	35900.0	23.10	6.3	72.3	7.6
MC10	10.8	7/27/77	1835	0.0	18.0	35000.0	22.50	5.8	69.6	7.6
MC10	10.8	7/27/77	1835	6.7	16.6	39000.0	25.20	5.8	68.5	7.7
MC10	10.8	7/28/77	835	0.0	17.5	30400.0	19.30	6.2	72.6	****
MC10	10.8	7/28/77	835	7.6	17.2	34600.0	22.20	5.9	70.0	****
MC10	10.8	7/28/77	1325	0.0	17.4	40000.0	25.90	6.2	76.0	8.0
MC10	10.8	7/28/77	1325	5.0	17.0	40500.0	26.30	6.0	71.9	8.0
MC10	10.8	7/28/77	1325	10.0	16.7	40700.0	26.40	5.9	70.9	8.1
MC10	10.8	7/28/77	1325	13.0	16.7	40800.0	26.50	5.6	67.4	8.1
MC10	10.8	7/28/77	1845	0.0	19.6	31000.0	19.70	5.5	67.0	7.8
MC10	10.8	7/28/77	1845	5.0	19.6	34100.0	21.90	5.9	72.5	8.0
MC10	10.8	7/28/77	1845	10.0	18.6	36100.0	23.20	5.3	64.1	8.0
MC10	10.8	7/29/77	850	0.0	17.6	28600.0	18.10	5.5	63.8	7.1
MC10	10.8	7/29/77	850	2.0	17.7	30100.0	19.10	5.3	61.9	7.2
MC10	10.8	7/29/77	850	4.0	17.5	31800.0	20.30	5.3	62.3	7.2
MC10	10.8	7/29/77	850	6.2	17.4	33000.0	21.10	5.4	63.5	7.3
MC10	10.8	7/29/77	850	9.0	17.5	33100.0	21.20	5.4	63.6	7.3
MC10L	8.2	7/25/77	1730	0.0	16.7	41800.0	27.10	7.3	87.8	7.7
MC10L	8.2	7/25/77	1730	5.0	15.8	45000.0	29.40	6.7	80.6	7.8
MC10L	8.2	7/25/77	1730	10.0	14.6	46800.0	30.60	6.1	71.7	7.8
MC10L	8.2	7/26/77	1155	0.0	15.5	50000.0	32.90	6.6	79.1	7.8
MC10L	8.2	7/26/77	1155	6.7	14.6	52000.0	34.30	5.9	71.6	7.8

TABLE I-1. TEMPERATURE, SALINITY, DISSOLVED OXYGEN, AND PH IN THE MAIN CHANNEL OF GRAYS HARBOR. EPA REGION 10 FIELD STUDY, JULY 25-29, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	WATER TEMP (CENT)	CNDUCTVY AT 25 C (MICROMHO)	SALINITY (PPT)	DISS OXYGEN (MG/L)	DISS OXYGEN (%SAT)	PH (SU)
MC10L	8.2	7/27/77	1825	0.0	18.0	39000.0	25.20	6.7	82.3	7.7
MC10L	8.2	7/27/77	1825	6.7	17.0	40000.0	25.90	6.6	78.6	7.7
MC11	7.0	7/25/77	1645	0.0	****	*******	*****	****	*****	****
MC11	7.0	7/25/77	1710	0.0	15.0	46000.0	30.10	6.7	79.7	7.8
MC11	7.0	7/25/77	1710	5.0	14.6	47100.0	30.80	6.3	74.2	7.7
MC11	7.0	7/25/77	1710	10.0	14.2	47100.0	30.80	6.1	71.1	7.7
MC11	7.0	7/26/77	1015	0.0	13.0	******	*****	****	****	7.5
MC11	7.0	7/26/77	1015	5.0	13.0	******	*****	****	****	7.7
MC11	7.0	7/26/77	1015	10.0	13.0	******	*****	****	****	7.7
MC11	7.0	7/26/77	1145	0.0	15.0	51000.0	33.60	6.4	78.3	7.8
MC11	7.0	7/26/77	1145	6.7	14.0	52000.0	34.30	5.9	70.8	7.8
MC11	7.0	7/26/77	1615	0.0	16.0	38200.0	24.70	6.7	79.6	7.6
MC11	7.0	7/26/77	1615	10.0	14.6	44000.0	28.70	6.0	69.7	7.6
MC11	7.0	7/26/77	1615	13.5	14.2	43300.0	28.20	6.2	71.2	7.6
MC11	7.0	7/27/77	1045	0.0	14.0	43600.0	28.40	6.9	81.1	7.8
MC11	7.0	7/27/77	1045	2.0	13.8	43800.0	28.60	6.9	79.5	7.8
MC11	7.0	7/27/77	1045	5.0	13.7	43600.0	28.40	6.9	78.8	7.8
MC11	7.0	7/27/77	1045	10.0	13.6	43500.0	28.30	6.8	77.8	7.8
MC11	7.0	7/27/77	1045	14.0	13.6	43700.0	28.50	6.7	77.1	7.8
MC11	7.0	7/27/77	1550	0.0	16.2	36500.0	23.60	6.9	80.5	7.6
MC11	7.0	7/27/77	1550	5.0	15.1	38100.0	24.60	6.4	73.7	7.7
MC11	7.0	7/27/77	1550	10.0	14.4	39200.0	25.40	6.4	72.4	7.7
MC11	7.0	7/27/77	1815	0.0	16.5	41000.0	26.60	6.4	76.7	7.7
MC11	7.0	7/27/77	1815	6.7	16.0	42000.0	27.30	6.5	76.9	7.8
MC11	7.0	7/28/77	750	0.0	16.3	36800.0	23.70	7.0	81.5	7.6
MC11	7.0	7/28/77	750	11.9	****	*******	*****	****	*****	****
MC11	7.0	7/28/77	750	12.8	16.0	37900.0	24.50	6.7	77.9	7.4
MC11	7.0	7/28/77	1355	0.0	16.0	42900.0	27.90	6.7	80.4	8.4
MC11	7.0	7/28/77	1355	5.0	14.7	44600.0	29.10	6.4	74.8	8.3
MC11	7.0	7/28/77	1355	10.0	13.8	45900.0	30.00	7.5	86.4	8.4
MC11	7.0	7/28/77	1355	16.0	13.7	45900.0	30.00	7.7	89.1	8.4
MC11	7.0	7/28/77	1820	0.0	18.9	38300.0	24.70	7.4	91.9	8.1
MC11	7.0	7/28/77	1820	5.0	18.3	39400.0	25.50	7.2	88.2	8.1
MC11	7.0	7/28/77	1820	12.0	16.8	48500.0	27.60	6.9	83.4	8.2
MC11	7.0	7/29/77	810	3.0	16.5	38500.0	24.90	6.7	78.7	7.6
MC11	7.0	7/29/77	810	5.0	16.4	39300.0	25.40	6.7	79.6	7.6
MC11	7.0	7/29/77	810	6.0	16.3	39600.0	25.60	6.7	79.4	7.6
MC11	7.0	7/29/77	810	7.0	16.3	39600.0	25.60	6.7	79.4	7.6
MC11	7.0	7/29/77	810	10.0	16.3	37900.0	24.50	6.8	80.5	7.5
MC11	7.0	7/29/77	810	12.6	16.3	39600.0	25.60	6.6	78.5	7.6
MC12	5.1	7/25/77	1640	0.0	15.8	45600.0	29.80	7.3	87.7	7.8
MC12	5.1	7/25/77	1640	5.0	14.5	47500.0	31.10	6.4	75.3	7.8

TABLE I-1. TEMPERATURE, SALINITY, DISSOLVED OXYGEN, AND PH IN THE MAIN CHANNEL OF GRAYS HARBOR. EPA REGION 10 FIELD STUDY, JULY 25-29, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	WATER TEMP (CENT)	CNDUCTVY AT 25 C (MICROMHO)	SALINITY (PPT)	DISS OXYGEN (MG/L)	DISS OXYGEN (%SAT)	PH (SU)
MC12	5.1	7/25/77	1640	10.0	13.8	48800.0	32.00	5.5	64.4	7.7
MC12	5.1	7/27/77	1030	0.0	11.4	47000.0	30.80	8.8	91.3	8.0
MC12	5.1	7/27/77	1030	5.0	11.4	46800.0	30.60	8.3	91.4	8.0
MC12	5.1	7/27/77	1030	10.0	11.4	46300.0	30.30	8.3	91.4	8.0
MC12	5.1	7/27/77	1625	0.0	15.8	38100.0	24.60	7.3	84.6	7.7
MC12	5.1	7/27/77	1625	2.0	15.4	38800.0	25.10	7.1	82.5	7.7
MC12	5.1	7/27/77	1625	5.0	14.6	40000.0	25.90	6.7	78.4	7.7
MC12	5.1	7/27/77	1625	10.0	13.0	41400.0	26.90	6.7	75.1	7.7
MC12	5.1	7/28/77	1415	0.0	13.9	43400.0	28.30	9.1	104.3	8.2
MC12	5.1	7/28/77	1415	5.0	13.9	45500.0	29.70	9.8	113.3	8.3
MC12	5.1	7/28/77	1415	10.0	12.8	46000.0	30.10	9.8	111.0	8.4
MC12	5.1	7/28/77	1415	12.0	12.5	46100.0	30.10	9.9	111.6	8.4
MC12	5.1	7/28/77	1755	0.0	17.5	41500.0	26.90	7.0	85.1	8.1
MC12	5.1	7/28/77	1755	5.0	17.0	42200.0	27.40	6.6	80.4	8.2
MC12	5.1	7/28/77	1755	10.0	16.1	43200.0	28.10	6.4	76.3	8.2
MC12	5.1	7/29/77	740	0.0	####	#######	#####	####	#####	####
MC12	5.1	7/29/77	740	0.0	16.4	37600.0	24.30	7.0	82.2	7.4
MC12	5.1	7/29/77	740	1.0	15.5	39600.0	25.60	6.9	80.6	7.7
MC12	5.1	7/29/77	740	2.0	15.5	41000.0	26.60	7.2	83.9	7.7
MC13	2.5	7/25/77	1610	0.0	14.1	48000.0	31.50	6.7	78.7	7.9
MC13	2.5	7/25/77	1610	5.0	13.0	49500.0	32.50	5.9	68.3	7.7
MC13	2.5	7/25/77	1610	10.0	12.0	50100.0	33.00	5.6	63.5	7.7
MC13	2.5	7/25/77	1610	15.0	10.6	50700.0	33.40	5.1	56.6	7.6
MC13	2.5	7/25/77	1930	0.0	####	#######	#####	####	#####	####
MC13	2.5	7/26/77	930	0.0	9.8	******	*****	****	****	7.8
MC13	2.5	7/26/77	930	5.0	9.6	******	*****	****	****	7.6
MC13	2.5	7/26/77	930	10.0	9.5	******	*****	****	****	7.6
MC13	2.5	7/26/77	930	15.0	9.3	******	*****	****	****	7.5
MC13	2.5	7/26/77	1700	0.0	14.6	43500.0	28.30	7.3	84.6	7.7
MC13	2.5	7/26/77	1700	5.0	13.4	45200.0	29.50	6.5	74.7	7.7
MC13	2.5	7/26/77	1700	10.0	12.6	45200.0	29.50	6.4	72.4	7.7
MC13	2.5	7/26/77	1700	15.0	10.7	47000.0	30.80	6.0	65.5	7.7
MC13	2.5	7/26/77	1730	0.0	15.0	43100.0	28.00	7.3	85.0	7.7
MC13	2.5	7/27/77	1010	0.0	10.4	46700.0	30.60	6.4	69.6	7.8
MC13	2.5	7/27/77	1010	2.0	10.2	46800.0	30.60	6.5	69.8	7.8
MC13	2.5	7/27/77	1010	5.0	10.0	46800.0	30.60	6.5	70.1	7.8
MC13	2.5	7/27/77	1010	10.0	10.0	46800.0	30.60	6.5	69.9	7.7
MC13	2.5	7/27/77	1010	15.0	10.0	46800.0	30.60	6.5	70.3	7.7
MC13	2.5	7/27/77	1850	0.0	14.5	41000.0	26.60	7.3	83.9	7.8
MC13	2.5	7/27/77	1850	5.0	13.7	42200.0	27.40	7.3	83.5	7.8
MC13	2.5	7/27/77	1850	10.0	13.1	42000.0	27.30	7.1	79.9	7.8
MC13	2.5	7/27/77	1850	14.0	12.5	43600.0	28.30	6.9	77.3	7.7

TABLE I-1. TEMPERATURE, SALINITY, DISSOLVED OXYGEN, AND PH IN THE MAIN CHANNEL OF GRAYS HARBOR. EPA REGION 10 FIELD STUDY, JULY 26-29, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	WATER TEMP (CENT)	CNDUCTVY AT 25 C (MICROMHO)	SALINITY (PPT)	DISS OXYGEN (MG/L)	DISS OXYGEN (%SAT)	PH (SU)
MC13	2.5	7/27/77	1725	0.0	14.2	41500.0	26.90	7.5	85.3	8.1
MC13	2.5	7/27/77	1725	5.0	13.1	42800.0	27.80	7.2	80.8	8.1
MC13	2.5	7/27/77	1725	10.0	12.4	43500.0	28.30	7.0	78.1	8.0
MC13	2.5	7/27/77	1725	14.0	11.6	43800.0	28.50	7.1	78.1	8.0
MC13	2.5	7/27/77	1740	0.0	13.8	41900.0	27.20	7.6	85.5	8.1
MC13	2.5	7/27/77	1740	2.0	13.4	42100.0	27.40	7.5	84.3	8.1
MC13	2.5	7/27/77	1740	5.0	13.0	42900.0	27.90	7.2	80.7	8.0
MC13	2.5	7/27/77	1740	10.0	12.6	42900.0	27.90	7.2	79.9	8.0
MC13	2.5	7/27/77	1740	14.0	11.6	44000.0	28.70	7.1	78.1	8.1
MC13	2.5	7/27/77	1800	0.0	13.6	42000.0	27.30	7.6	86.3	8.0
MC13	2.5	7/27/77	1800	2.0	13.6	42500.0	27.60	7.4	84.4	8.1
MC13	2.5	7/27/77	1800	5.0	13.0	42900.0	27.90	7.2	81.1	8.0
MC13	2.5	7/27/77	1800	10.0	12.6	43000.0	28.00	7.1	78.0	8.0
MC13	2.5	7/27/77	1800	15.0	11.6	43900.0	28.60	7.3	79.7	8.1
MC13	2.5	7/28/77	700	0.0	14.8	38500.0	24.90	7.6	86.8	7.8
MC13	2.5	7/28/77	700	5.0	14.8	38500.0	24.90	7.6	86.3	7.8
MC13	2.5	7/28/77	700	10.0	15.0	39000.0	25.20	7.5	86.7	7.8
MC13	2.5	7/28/77	700	13.0	15.0	38800.0	25.10	7.5	86.2	7.8
MC13	2.5	7/28/77	1730	0.0	16.0	43600.0	28.40	8.5	105.4	8.2
MC13	2.5	7/28/77	1730	5.0	15.7	43900.0	28.60	8.6	102.8	8.2
MC13	2.5	7/28/77	1730	10.0	15.3	44200.0	28.80	8.5	103.9	8.2
MC13	2.5	7/28/77	1730	13.0	14.9	45000.0	29.40	8.7	103.0	8.3
MC13	2.5	7/29/77	715	0.0	15.0	42000.0	27.30	7.6	89.1	7.7
MC13	2.5	7/29/77	715	1.0	15.0	42500.0	27.60	7.9	93.6	7.8
MC13	2.5	7/29/77	715	2.0	15.0	43600.0	28.40	7.6	89.1	7.8

TABLE I-2. TEMPERATURE, SALINITY, DISSOLVED OXYGEN AND PH IN THE SOUTH CHANNEL OF GRAYS HARBOR. EPA REGION 10 FIELD STUDY, JULY 26-29, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	WATER TEMP (CENT)	CNDUCTVY AT 25 C (MICROMHO)	SALINITY (PPT)	DISS OXYGEN (MG/L)	DISS OXYGEN (%SAT)	PH (SU)
S01	6.0	7/26/77	1030	0.0	14.5	45000.0	29.40	6.5	75.5	7.6
S01	6.0	7/26/77	1030	6.7	13.0	47000.0	30.80	5.6	64.5	7.4
S01	6.0	7/26/77	1055	0.0	13.5	45000.0	29.40	6.0	72.0	7.8
S01	6.0	7/26/77	1055	6.7	13.0	46000.0	30.10	6.8	77.7	7.6
S01	6.0	7/26/77	1135	0.0	14.0	52000.0	34.30	6.0	71.7	7.8
S01	6.0	7/26/77	1135	6.7	13.5	53000.0	35.10	6.0	70.9	7.8
S01	6.0	7/26/77	1400	0.0	16.0	44000.0	28.70	7.1	85.0	7.8
S01	6.0	7/26/77	1400	3.0	15.5	45000.0	29.40	6.8	81.1	7.9
S01	6.0	7/26/77	1400	4.6	15.5	45000.0	29.40	6.7	80.1	7.9
S01	6.0	7/26/77	1400	6.7	15.5	45000.0	29.40	6.7	80.1	8.0
S01	6.0	7/26/77	1415	0.0	16.5	43000.0	28.00	7.0	84.9	7.8
S01	6.0	7/26/77	1415	6.7	15.0	45000.0	29.40	6.5	77.3	7.9
S01	6.0	7/26/77	1430	0.0	16.5	43000.0	28.00	7.0	83.9	7.8
S01	6.0	7/26/77	1430	6.7	15.0	45000.0	29.40	6.5	77.3	7.9
S01	6.0	7/26/77	1445	0.0	16.5	43000.0	28.00	7.0	84.9	7.8
S01	6.0	7/26/77	1445	6.7	15.5	45000.0	29.40	6.5	77.1	7.9
S01	6.0	7/26/77	1500	0.0	16.5	43000.0	28.00	7.0	84.9	7.8
S01	6.0	7/26/77	1500	3.0	16.0	43000.0	28.00	6.9	82.0	7.8
S01	6.0	7/26/77	1500	4.6	16.0	44000.0	28.70	6.7	81.0	7.8
S01	6.0	7/26/77	1500	6.7	16.0	44000.0	28.70	6.6	78.9	7.9
S01	6.0	7/26/77	1515	0.0	17.0	42000.0	27.30	6.9	83.7	7.8
S01	6.0	7/26/77	1515	6.7	16.5	44000.0	28.70	6.2	73.1	7.8
S01	6.0	7/26/77	1530	0.0	17.0	42000.0	27.30	6.9	83.7	7.8
S01	6.0	7/26/77	1530	4.6	16.0	43000.0	28.00	6.9	82.0	7.8
S01	6.0	7/26/77	1530	6.7	14.5	48000.0	30.10	6.1	71.5	7.8
S01	6.0	7/26/77	1545	0.0	17.0	42000.0	27.30	6.8	82.7	7.8
S01	6.0	7/26/77	1545	6.7	15.0	45000.0	29.40	6.1	72.3	7.8
S01	6.0	7/26/77	1600	0.0	17.0	41000.0	26.60	6.9	83.7	7.8
S01	6.0	7/26/77	1600	3.0	16.5	42000.0	27.30	6.7	80.8	7.8
S01	6.0	7/26/77	1600	4.6	15.5	45000.0	29.40	6.3	75.1	7.8
S01	6.0	7/26/77	1600	6.7	15.0	46000.0	30.10	6.2	73.3	7.8
S01	6.0	7/27/77	1540	0.0	16.0	41000.0	26.60	6.7	78.9	7.7
S01	6.0	7/27/77	1540	3.0	16.0	41000.0	26.60	6.7	78.9	7.7
S01	6.0	7/27/77	1540	4.6	15.5	42000.0	27.30	6.5	77.1	7.7
S01	6.0	7/27/77	1540	6.7	15.0	43000.0	28.00	6.6	76.3	7.7
S01	6.0	7/27/77	1600	0.0	16.0	41000.0	26.60	6.7	78.9	7.7
S01	6.0	7/27/77	1600	6.7	15.3	42500.0	27.60	6.5	76.8	7.7
S01	6.0	7/27/77	1615	0.0	16.5	41000.0	26.60	6.7	79.8	7.7
S01	6.0	7/27/77	1615	6.7	15.0	43000.0	28.00	6.8	78.3	7.8
S01	6.0	7/27/77	1630	0.0	16.5	41000.0	26.60	6.7	79.8	7.7
S01	6.0	7/27/77	1630	6.7	15.0	43000.0	28.00	6.2	78.3	7.7
S01	6.0	7/27/77	1645	0.0	16.0	41000.0	26.60	6.6	77.9	7.7

TABLE I-2. TEMPERATURE, SALINITY, DISSOLVED OXYGEN AND PH IN THE SOUTH CHANNEL OF GRAYS HARBOR. EPA REGION 10 FIELD STUDY, JULY 26-29, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	WATER TEMP (CENT)	CNDUCTVY AT 25 C (MICROMHO)	SALINITY (PPT)	DISS OXYGEN (MG/L)	DISS OXYGEN (%SAT)	PH (SU)
S01	6.0	7/27/77	1645	6.7	15.0	43000.0	28.00	6.1	71.3	7.7
S01	6.0	7/27/77	1700	0.0	16.5	41000.0	26.60	6.7	70.8	7.7
S01	6.0	7/27/77	1700	6.7	15.0	43000.0	28.00	6.1	71.3	7.7
S01	6.0	7/28/77	745	0.0	16.0	36000.0	23.20	7.2	83.0	8.1
S01	6.0	7/28/77	745	10.0	15.0	37000.0	23.90	6.7	76.3	8.1
S01	6.0	7/28/77	1330	0.0	12.5	44500.0	29.00	10.4	116.3	7.7
S01	6.0	7/28/77	1330	5.0	12.3	44500.0	29.00	10.4	115.0	7.7
S01	6.0	7/28/77	1330	10.0	12.0	44500.0	29.00	10.4	115.0	7.7
S01	6.0	7/28/77	1330	15.0	12.0	43500.0	28.30	10.4	115.0	7.7
S01	6.0	7/28/77	1345	0.0	13.3	44500.0	29.00	9.0	103.0	7.7
S01	6.0	7/28/77	1345	5.0	12.5	45000.0	29.40	9.9	111.6	7.7
S01	6.0	7/28/77	1345	10.0	12.0	45000.0	29.40	10.3	114.0	7.7
S01	6.0	7/28/77	1345	15.0	12.0	44000.0	28.70	10.6	116.8	7.7
S01	6.0	7/28/77	1405	0.0	13.5	42500.0	27.60	9.1	103.5	7.7
S01	6.0	7/28/77	1405	13.0	12.0	42500.0	27.60	10.3	113.1	7.7
S01	6.0	7/28/77	1415	0.0	14.0	40500.0	26.30	7.7	87.7	7.7
S01	6.0	7/28/77	1415	5.0	14.0	41000.0	26.60	8.0	91.1	7.7
S01	6.0	7/28/77	1415	7.0	13.0	42000.0	27.30	8.8	98.6	7.7
S01	6.0	7/28/77	1425	0.0	13.6	41500.0	26.90	8.5	95.9	7.7
S01	6.0	7/28/77	1425	5.0	12.6	42000.0	27.30	9.5	105.0	7.7
S01	6.0	7/28/77	1425	10.0	12.5	42500.0	27.60	10.1	118.5	7.7
S01	6.0	7/28/77	1425	13.0	12.3	42500.0	27.60	10.3	113.7	7.7
S01	6.0	7/28/77	1500	0.0	14.0	41000.0	26.60	7.3	83.4	7.7
S01	6.0	7/28/77	1600	4.0	14.0	41000.0	26.60	7.7	87.2	7.7
S01	6.0	7/28/77	1515	0.0	14.8	39000.0	25.80	7.9	90.0	7.7
S01	6.0	7/28/77	1515	2.5	14.5	39000.0	25.80	7.3	83.3	7.7
S01	6.0	7/28/77	1530	0.0	15.0	37500.0	24.20	8.1	92.1	7.7
S01	6.0	7/28/77	1530	2.5	15.0	37500.0	24.20	8.0	91.1	7.7
S01	6.0	7/28/77	1545	0.0	14.8	38000.0	24.50	8.0	90.6	7.7
S01	6.0	7/28/77	1545	2.5	14.8	38000.0	24.50	8.0	90.6	7.7
S01	6.0	7/28/77	1600	0.0	15.0	38000.0	24.50	7.8	89.6	7.7
S01	6.0	7/28/77	1600	2.5	15.0	38000.0	24.50	7.9	90.1	7.7
S01	6.0	7/28/77	1615	0.0	15.3	38000.0	24.50	7.8	89.6	7.7
S01	6.0	7/28/77	1615	2.5	15.3	38000.0	24.50	7.6	87.1	7.7
S01	6.0	7/28/77	1630	0.0	15.5	37500.0	24.20	7.9	90.6	7.7
S01	6.0	7/28/77	1630	2.5	15.3	37500.0	24.20	7.8	90.1	7.7
S01	6.0	7/28/77	1645	0.0	15.5	36500.0	23.50	7.9	90.0	7.7
S01	6.0	7/28/77	1645	5.0	15.3	36500.0	23.50	7.8	89.6	7.7
S01	6.0	7/28/77	1700	0.0	16.0	36500.0	23.50	7.7	89.1	7.7
S01	6.0	7/28/77	1700	4.0	15.5	37000.0	23.90	7.6	87.6	7.7
S01	6.0	7/28/77	1715	0.0	16.3	35500.0	22.80	7.7	90.0	7.7
S01	6.0	7/28/77	1715	4.0	15.8	36000.0	23.20	7.6	86.0	7.7

TABLE I-2. TEMPERATURE, SALINITY, DISSOLVED OXYGEN AND PH IN THE SOUTH CHANNEL OF GRAYS HARBOR.
EPA REGION 10 FIELD STUDY, JULY 26-29, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	WATER TEMP (CENT)	CNDUCTVY AT 25 C (MICROMHO)	SALINITY (PPT)	DISS OXYGEN (MG/L)	DISS OXYGEN (%SAT)	PH (SU)
S01	6.0	7/28/77	1730	0.0	16.3	36000.0	23.20	7.7	90.0	7.7
S01	6.0	7/28/77	1730	5.0	16.0	36000.0	23.20	7.6	88.5	7.7
S01	6.0	7/28/77	1745	0.0	16.3	36500.0	23.50	7.6	89.0	7.7
S01	6.0	7/28/77	1745	5.0	15.8	36500.0	23.50	7.5	87.1	7.7
S01	6.0	7/28/77	1800	0.0	16.3	37000.0	23.90	7.7	90.0	7.7
S01	6.0	7/28/77	1800	5.0	16.3	37000.0	23.90	7.6	88.5	7.7
S01	6.0	7/28/77	1800	10.0	14.8	38500.0	24.90	6.9	78.8	7.7
S01	6.0	7/28/77	1805	0.0	18.2	39500.0	25.60	6.7	82.1	8.1
S01	6.0	7/28/77	1805	5.0	17.6	40000.0	26.90	6.3	76.9	8.1
S01	6.0	7/28/77	1805	10.0	16.4	40800.0	26.50	5.8	68.9	8.1
S02	7.9	7/26/77	1040	0.0	14.5	43000.0	28.00	6.3	72.5	7.7
S02	7.9	7/26/77	1040	2.1	14.5	43000.0	28.00	6.3	72.6	7.8
S02	7.9	7/26/77	1120	0.0	14.5	43000.0	28.00	6.3	72.5	7.8
S02	7.9	7/26/77	1180	4.3	14.6	44000.0	28.70	6.4	74.5	7.8
S02	7.9	7/26/77	1185	0.0	15.0	51000.0	33.60	6.0	73.3	7.8
S02	7.9	7/27/77	1525	0.0	16.5	40000.0	25.90	6.6	78.7	7.7
S02	7.9	7/27/77	1525	4.6	16.0	41000.0	26.60	6.3	74.9	7.7
S02	7.9	7/28/77	700	0.0	17.6	35500.0	22.80	6.0	72.1	****
S02	7.9	7/28/77	700	6.7	17.5	36000.0	23.20	6.2	74.1	****
S02	7.9	7/28/77	800	0.0	16.8	33500.0	21.50	6.6	76.6	8.1
S02	7.9	7/28/77	800	2.0	16.8	32500.0	20.80	6.2	71.5	8.1
S02	7.9	7/28/77	1310	0.0	14.5	40000.0	25.90	7.1	81.3	7.7
S02	7.9	7/28/77	1310	7.0	14.0	40500.0	26.30	6.9	78.5	7.7
S02	7.9	7/28/77	1815	0.0	17.3	34000.0	21.80	6.9	81.0	7.7
S02	7.9	7/28/77	1815	3.5	17.3	34000.0	21.80	6.9	81.0	7.7
S03	9.5	7/26/77	1020	0.0	16.0	40000.0	25.90	6.4	74.9	7.7
S03	9.5	7/26/77	1020	6.7	16.0	40000.0	25.90	6.4	74.9	7.7
S03	9.5	7/26/77	1045	0.0	16.5	48000.0	31.50	6.5	79.8	7.8
S03	9.5	7/26/77	1045	5.2	16.5	48000.0	31.50	6.3	77.7	7.8
S03	9.5	7/27/77	1130	0.0	16.0	41000.0	26.60	6.4	75.9	7.7
S03	9.5	7/27/77	1130	6.4	15.5	41000.0	26.60	6.4	75.1	7.7
S03	9.5	7/27/77	1515	0.0	18.0	37000.0	23.90	6.3	76.0	7.6
S03	9.5	7/27/77	1515	2.4	18.0	37000.0	23.90	6.3	76.0	7.6
S03	9.5	7/28/77	650	0.0	17.6	33000.0	21.10	5.7	68.8	****
S03	9.5	7/28/77	650	3.0	17.5	34000.0	21.80	5.6	66.8	****
S03	9.5	7/28/77	810	0.0	17.0	33500.0	21.50	6.4	74.4	8.1
S03	9.5	7/28/77	810	2.5	17.0	32500.0	20.80	6.3	73.4	8.1
S03	9.5	7/28/77	1300	0.0	16.3	38500.0	24.90	7.0	80.2	7.7
S03	9.5	7/28/77	1300	7.0	16.0	39500.0	25.60	6.8	78.7	7.7
S03	9.5	7/28/77	1830	0.0	18.0	30500.0	19.40	6.1	72.3	7.7
S03	9.5	7/28/77	1830	3.0	18.3	31500.0	20.10	6.0	77.9	7.7
S04	11.1	7/28/77	956	0.0	17.5	36000.0	23.20	6.4	76.2	7.6

TABLE I-2. TEMPERATURE, SALINITY, DISSOLVED OXYGEN AND PH IN THE SOUTH CHANNEL OF GRAYS HARBOR. EPA REGION 10 FIELD STUDY, JULY 26-29, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	WATER TEMP (CENT)	CNDUCTVY AT 25 C (MICROMHO)	SALINITY (PPT)	DISS OXYGEN (MG/L)	DISS OXYGEN (%SAT)	PH (SU)
S04	11.1	7/26/77	955	4.6	17.5	36000.0	23.20	6.3	75.2	****
S04	11.1	7/26/77	1025	0.0	17.6	45000.0	29.40	6.6	81.5	7.7
S04	11.1	7/26/77	1025	8.1	17.6	46000.0	29.40	6.6	81.6	7.7
S04	11.1	7/27/77	1140	0.0	16.5	39000.0	26.20	6.6	77.7	7.7
S04	11.1	7/27/77	1140	5.5	16.5	40000.0	25.90	6.4	75.7	7.7
S04	11.1	7/27/77	1500	0.0	18.0	33000.0	21.10	6.5	65.4	7.4
S04	11.1	7/27/77	1500	4.3	18.0	34000.0	21.80	5.3	63.3	7.4
S04	11.1	7/28/77	635	0.0	17.5	42000.0	27.30	6.0	73.6	****
S04	11.1	7/28/77	825	0.0	17.0	32000.0	20.40	5.9	68.2	8.1
S04	11.1	7/28/77	825	2.5	17.0	31500.0	20.10	5.8	67.2	8.1
S04	11.1	7/28/77	1255	0.0	16.0	34500.0	22.10	6.7	76.9	7.7
S04	11.1	7/28/77	1255	5.5	15.8	36000.0	23.20	6.6	76.6	7.7
S04	11.1	7/28/77	1835	0.0	18.0	30000.0	19.10	5.7	66.5	7.7
S04	11.1	7/28/77	1835	3.0	18.0	30500.0	19.40	5.7	67.6	7.7
S05	12.7	7/26/77	935	0.0	18.0	33000.0	21.10	5.7	67.5	7.4
S05	12.7	7/26/77	935	3.7	17.6	34000.0	21.80	5.6	65.0	7.4
S05	12.7	7/26/77	940	0.0	18.0	39000.0	25.20	5.7	69.6	7.4
S05	12.7	7/26/77	940	2.4	18.0	40000.0	25.90	5.8	70.7	****
S05	12.7	7/27/77	1150	0.0	18.0	35000.0	22.50	6.1	72.8	7.6
S05	12.7	7/27/77	1150	4.3	17.5	35000.0	22.50	6.0	71.0	7.5
S05	12.7	7/27/77	1450	0.0	17.5	33000.0	21.10	5.8	67.9	7.3
S05	12.7	7/27/77	1450	3.7	17.5	35000.0	22.50	5.6	66.0	7.4
S05	12.7	7/28/77	625	0.0	18.0	35000.0	22.50	5.9	70.7	****
S05	12.7	7/28/77	625	2.7	18.0	36000.0	23.20	6.0	72.8	****
S05	12.7	7/28/77	840	0.0	17.3	31000.0	19.70	5.4	62.3	8.1
S05	12.7	7/28/77	840	0.5	17.3	31000.0	19.70	5.4	62.3	8.1
S05	12.7	7/28/77	1245	0.0	17.3	33500.0	21.50	6.2	73.2	7.7
S05	12.7	7/28/77	1245	5.0	17.3	32000.0	20.40	6.2	72.7	7.7
S05	12.7	7/28/77	1850	0.0	18.3	29000.0	18.40	5.0	60.9	7.7
S05	12.7	7/28/77	1850	2.0	18.0	29000.0	18.40	4.9	57.5	7.7
S05A	13.5	7/27/77	1200	0.0	17.5	33000.0	21.10	5.3	62.7	7.4
S05A	13.5	7/27/77	1200	3.0	17.5	33000.0	21.10	5.3	62.7	7.4
S05A	13.5	7/27/77	1445	0.0	18.0	31000.0	19.70	5.7	67.5	7.4
S05A	13.5	7/27/77	1445	2.1	18.0	31000.0	19.70	5.7	67.5	7.4
S05A	13.5	7/28/77	1235	0.0	17.6	31000.0	19.70	5.6	65.3	7.7
S05A	13.5	7/28/77	1235	5.5	17.3	30500.0	19.40	5.4	63.3	7.7
S05A	13.5	7/28/77	1855	0.0	18.7	24500.0	15.30	5.4	63.2	7.7
S05A	13.5	7/28/77	1855	3.0	18.3	27500.0	17.30	4.9	56.7	7.7

TABLE I-3. TEMPERATURE, SALINITY, DISSOLVED OXYGEN AND PH IN THE NORTH BAY OF GRAYS HARBOR. EPA REGION 10 FIELD STUDY, JULY 25-29, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	WATER TEMP (CENT)	CNDUCTVY AT 25 C (MICROMHO)	SALINITY (PPT)	DISS OXYGEN (MG/L)	(%SAT)	PH (SU)
NB01	3.7	7/25/77	1730	0.0	11.0	49000.0	32.20	5.9	65.2	7.6
NB01	3.7	7/25/77	1730	6.7	10.5	50000.0	32.90	5.7	62.7	****
NB01	3.7	7/26/77	1620	0.0	14.0	48000.0	31.50	6.6	77.5	7.9
NB01	3.7	7/26/77	1620	6.7	13.5	49000.0	32.20	6.6	77.7	7.9
NB01	3.7	7/27/77	1720	0.0	14.5	44500.0	29.00	6.5	76.4	7.8
NB01	3.7	7/27/77	1720	6.7	14.0	46500.0	30.40	7.1	82.9	7.9
NB02	3.8	7/25/77	1740	0.0	10.0	49000.0	32.20	5.9	63.7	7.7
NB02	3.8	7/25/77	1740	6.7	9.5	50000.0	32.90	5.6	60.4	7.7
NB02	3.8	7/26/77	1630	0.0	15.5	45000.0	29.40	6.8	81.1	7.8
NB02	3.8	7/26/77	1630	6.7	13.0	48000.0	31.50	6.3	72.1	7.8
NB02	3.8	7/27/77	1730	0.0	15.5	44000.0	28.70	6.9	82.1	7.8
NB02	3.8	7/27/77	1730	6.7	13.0	46000.0	30.10	6.4	73.0	7.8
NB03	3.9	7/25/77	1805	0.0	11.5	49000.0	32.20	6.2	69.7	7.7
NB03	3.9	7/25/77	1805	6.7	11.5	49000.0	32.20	6.0	67.0	7.9
NB03	3.9	7/26/77	1640	0.0	15.0	47000.0	30.80	7.1	84.8	7.9
NB03	3.9	7/26/77	1640	6.7	14.0	48000.0	31.50	6.0	70.8	7.8
NB03	3.9	7/27/77	1710	0.0	15.5	44500.0	29.00	7.1	85.1	7.8
NB03	3.9	7/27/77	1710	6.7	14.5	45500.0	29.70	6.3	73.5	7.8
NB04	4.4	7/25/77	1825	0.0	12.5	49000.0	32.20	6.4	73.1	7.0
NB04	4.4	7/25/77	1825	2.4	12.5	49000.0	32.20	6.4	73.1	6.8
NB04	4.4	7/26/77	1645	0.0	16.0	47000.0	30.80	7.2	88.0	7.9
NB04	4.4	7/26/77	1645	4.6	15.0	48000.0	31.50	6.7	80.2	7.9
NB04	4.4	7/27/77	1750	0.0	16.5	45000.0	29.40	7.9	95.6	7.9
NB04	4.4	7/27/77	1750	4.3	15.0	45000.0	29.40	6.7	79.2	7.8

TABLE I-4. BIOLOGICAL OXYGEN DEMAND AND NUTRIENT LEVELS IN THE MAIN CHANNEL OF GRAYS HARBOR.
EPA REGION 10 FIELD STUDY, JULY 25-29, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	BOD 2 DAY (MG/L)	BOD 5 DAY (MG/L)	BOD 10 DAY (MG/L)	BOD 15 DAY (MG/L)	BOD 20 DAY (MG/L)	NH3-N TOTAL (MG/L)	NO2+NO3 N-TOTAL (MG/L)	TOT KJEL N (MG/L)	PHOS-DIS ORTHO (MG/L P)	PHOS-TOT (MG/L P)	TOT ORG C C (MG/L)
MC02	24.6	7/26/77	1230	0.0	1.0	1.9	1.8	2.3	3.1	0.002	0.002	######	0.002	0.036	3.0
MC02	24.6	7/26/77	1230	11.0	0.8	1.4	1.5	1.9	2.3	0.006	0.002	######	0.002	0.044	3.0
MC02	24.6	7/26/77	1815	0.0	1.3	1.7	2.1	2.7	3.2	0.002	0.002	0.200	0.002	0.036	4.0
MC02	24.6	7/26/77	1815	6.6	1.1	1.7	2.3	2.7	3.8	0.006	0.005	0.200	0.002	0.046	######
MC02	24.6	7/27/77	1230	0.0	#####	0.7	#####	#####	#####	0.006	0.004	0.300	0.002	0.038	######
MC02	24.6	7/27/77	1230	13.0	0.3	0.5	0.3	1.2	1.4	0.012	0.010	0.400	0.002	0.048	4.0
MC02	24.6	7/27/77	1810	0.0	0.9	1.3	2.3	2.6	3.2	0.003	0.002	0.300	0.002	0.028	21.0
MC02	24.6	7/27/77	1810	5.2	#####	1.5	#####	#####	#####	0.008	0.002	0.300	0.002	0.036	27.0
MC02	24.6	7/28/77	750	0.0	0.7	1.1	1.7	2.2	2.8	0.012	0.002	0.400	0.002	0.052	######
MC02	24.6	7/28/77	750	4.4	#####	1.8	#####	#####	#####	0.002	0.002	0.500	0.002	0.056	######
MC05	19.2	7/26/77	1110	0.0	0.7	1.1	1.0	1.2	2.1	0.076	0.068	######	0.014	0.048	4.0
MC05	19.2	7/26/77	1110	14.8	0.7	1.5	1.6	1.9	2.4	0.098	0.078	######	0.014	0.076	5.0
MC05	19.2	7/26/77	1700	0.0	0.7	1.8	1.2	1.5	2.0	0.038	0.038	0.200	0.004	0.036	6.0
MC05	19.2	7/26/77	1700	9.4	0.8	1.0	1.1	1.7	2.0	0.078	0.084	0.200	0.014	0.060	5.0
MC05	19.2	7/27/77	1130	0.0	#####	0.4	#####	#####	#####	0.080	0.068	0.300	0.014	0.066	######
MC05	19.2	7/27/77	1130	10.8	#####	0.4	#####	#####	#####	0.100	0.080	0.200	0.018	0.100	8.0
MC05	19.2	7/27/77	1715	0.0	0.3	0.5	0.6	1.1	1.5	0.038	0.042	0.500	0.002	0.050	6.0
MC05	19.2	7/27/77	1715	9.6	#####	0.6	#####	#####	#####	0.054	0.044	0.300	0.004	0.048	5.0
MC05	19.2	7/28/77	700	0.0	0.2	0.9	0.5	1.0	1.1	0.030	0.024	0.400	0.002	0.060	######
MC05	19.2	7/28/77	700	7.4	0.2	0.4	0.7	0.9	1.1	0.042	0.026	0.400	0.002	0.076	######
MC07	15.4	7/26/77	1520	0.0	1.1	1.3	1.4	2.2	2.4	0.088	0.078	######	0.016	0.052	5.0
MC07	15.4	7/25/77	1520	12.2	0.7	1.2	1.5	1.9	2.6	0.100	0.076	######	0.026	0.068	6.0
MC07	15.4	7/26/77	1020	0.0	0.7	1.8	1.5	2.8	2.5	0.100	0.078	######	0.030	0.068	7.0
MC07	15.4	7/26/77	1020	10.0	0.8	1.3	1.5	1.9	2.6	0.086	0.068	######	0.030	0.086	8.0
MC07	15.4	7/26/77	1615	0.0	0.9	1.4	1.6	1.8	2.6	0.092	0.078	0.300	0.020	0.050	6.0
MC07	15.4	7/26/77	1615	14.2	0.6	1.6	1.9	2.5	3.3	0.088	0.066	0.400	0.030	0.100	83.0
MC07	15.4	7/27/77	1000	0.0	#####	0.9	#####	#####	#####	0.110	0.078	0.300	0.034	0.082	10.0
MC07	15.4	7/27/77	1000	15.2	#####	1.2	#####	#####	#####	0.080	0.074	0.400	0.032	0.150	11.0
MC07	15.4	7/27/77	1205	0.0	#####	#####	#####	#####	#####	0.088	0.074	0.400	0.031	0.092	9.0
MC07	15.4	7/27/77	1205	14.5	#####	#####	#####	#####	#####	0.052	0.070	0.300	0.031	0.088	9.0
MC07	15.4	7/27/77	1615	0.0	#####	1.5	#####	#####	#####	0.090	0.082	0.400	0.014	0.072	7.0
MC07	15.4	7/27/77	1615	14.2	#####	0.8	#####	#####	#####	0.098	0.082	0.400	0.026	0.098	7.0
MC07	15.4	7/28/77	620	0.0	0.3	0.2	0.8	1.3	1.7	0.098	0.076	0.800	0.012	0.190	######
MC07	15.4	7/28/77	620	12.6	0.3	0.6	0.7	1.2	1.7	0.084	0.080	0.400	0.010	0.150	######
MC07	15.4	7/28/77	915	0.0	#####	#####	#####	#####	#####	0.092	0.082	0.200	0.024	0.068	7.0
MC08	13.8	7/26/77	1840	0.0	0.9	1.5	1.8	2.4	2.7	0.138	0.080	######	0.039	0.074	8.0
MC08	13.8	7/26/77	1500	0.0	#####	#####	#####	#####	#####	0.094	0.074	######	0.024	0.058	8.0
MC08	13.8	7/26/77	1500	10.0	0.7	1.2	1.8	1.7	2.0	0.070	0.064	######	0.032	0.062	8.0
MC08	13.8	7/28/77	915	1.2	#####	#####	#####	#####	#####	0.100	0.078	0.300	0.024	0.068	8.0
MC08	13.8	7/28/77	915	9.8	#####	#####	#####	#####	#####	0.088	0.080	0.300	0.026	0.100	9.0
MC08	13.8	7/29/77	925	0.0	#####	#####	#####	#####	#####	0.140	0.082	######	0.036	0.098	######
MC09	12.8	7/25/77	1825	0.0	0.8	1.6	1.6	2.3	2.9	0.092	0.066	######	0.033	0.082	9.0

TABLE I-4. BIOLOGICAL OXYGEN DEMAND AND NUTRIENT LEVELS IN THE MAIN CHANNEL OF GRAYS HARBOR.
EPA REGION 10 FIELD STUDY, JULY 25-29, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	BOD 2 DAY (MG/L)	BOD 5 DAY (MG/L)	BOD 10 DAY (MG/L)	BOD 15 DAY (MG/L)	BOD 20 DAY (MG/L)	NH3-N TOTAL (MG/L)	NO2+NO3 N-TOTAL (MG/L)	TOT KJEL N (MG/L)	PHOS-DIS ORTHO (MG/L P)	PHOS-TOT (MG/L P)	TOT ORG C C (MG/L)
MC09	12.8	7/26/77	1100	0.0	0.7	1.3	1.4	1.7	2.3	0.086	0.062	******	0.033	0.066	******
MC09	12.8	7/26/77	1100	15.0	*****	*****	*****	*****	*****	0.062	0.074	******	0.033	0.080	6.0
MC09	12.8	7/26/77	1530	0.0	*****	*****	*****	*****	*****	0.094	0.074	******	0.026	0.054	8.0
MC09	12.8	7/26/77	1530	10.0	0.7	1.4	1.3	1.8	2.4	0.088	0.068	******	0.030	0.076	7.0
MC09	12.8	7/27/77	1130	0.0	*****	*****	*****	*****	*****	0.024	0.074	******	0.024	0.074	7.0
MC09	12.8	7/27/77	1130	15.0	*****	*****	*****	*****	*****	0.034	0.084	******	0.033	0.082	7.0
MC09	12.8	7/27/77	1450	0.0	0.1	0.7	1.1	1.3	1.6	0.082	0.076	0.400	0.030	0.086	******
MC09	12.8	7/27/77	1450	10.0	*****	0.9	*****	*****	*****	0.052	0.080	0.200	0.032	0.098	******
MC09	12.8	7/28/77	850	0.0	*****	*****	*****	*****	*****	0.098	0.086	0.200	0.031	0.070	10.0
MC09	12.8	7/28/77	850	1.8	*****	*****	*****	*****	*****	0.084	0.082	0.300	0.037	0.066	10.0
MC09	12.8	7/28/77	850	11.9	*****	*****	*****	*****	*****	0.076	0.080	0.300	0.036	0.082	10.0
MC09	12.8	7/29/77	910	0.0	*****	*****	*****	*****	*****	0.120	0.090	******	0.026	0.068	******
MC10	10.8	7/25/77	1805	0.0	0.8	1.5	1.6	2.1	2.2	0.040	0.058	******	0.029	0.060	6.0
MC10	10.8	7/29/77	850	0.0	*****	*****	*****	*****	*****	0.110	0.084	******	0.034	0.068	******
MC10L	8.2	7/25/77	1730	0.0	1.7	2.8	3.3	3.6	4.1	0.050	0.072	******	0.035	0.080	6.0
MC11	7.0	7/25/77	1645	0.0	1.3	2.3	2.5	3.3	3.3	0.056	0.110	******	0.066	0.084	5.0
MC11	7.0	7/25/77	1710	0.0	*****	*****	*****	2.3	1.7	******	******	******	******	******	5.0
MC11	7.0	7/26/77	1015	0.0	0.7	1.2	1.2	1.3	1.3	0.064	0.170	******	0.046	0.084	4.0
MC11	7.0	7/26/77	1015	10.0	*****	*****	*****	*****	*****	0.060	0.170	******	0.047	0.066	4.0
MC11	7.0	7/26/77	1615	0.0	0.5	1.7	1.6	2.1	2.4	0.052	0.070	******	0.030	0.062	7.0
MC11	7.0	7/26/77	1615	10.0	0.6	0.9	1.1	1.2	1.3	0.035	******	******	0.036	0.066	4.0
MC11	7.0	7/27/77	1045	0.0	*****	*****	*****	*****	*****	0.049	0.140	0.300	0.038	0.066	4.0
MC11	7.0	7/27/77	1045	14.0	*****	*****	*****	*****	*****	0.038	0.140	0.300	0.039	0.066	4.0
MC11	7.0	7/27/77	1550	0.0	0.5	0.9	1.1	1.3	1.7	0.024	0.074	0.200	0.030	0.062	******
MC11	7.0	7/27/77	1550	10.0	*****	0.6	*****	*****	*****	0.050	0.130	0.300	0.030	0.066	******
MC11	7.0	7/28/77	750	0.0	*****	*****	*****	*****	*****	0.028	0.074	0.300	0.028	0.060	6.0
MC11	7.0	7/28/77	750	11.9	*****	*****	*****	*****	*****	0.040	0.092	0.200	0.051	0.080	10.0
MC11	7.0	7/28/77	750	12.8	*****	*****	*****	*****	*****	0.032	0.072	0.200	0.037	0.068	7.0
MC11	7.0	7/29/77	810	12.0	*****	*****	*****	*****	*****	0.048	0.068	******	0.036	0.076	******
MC12	5.1	7/25/77	1640	0.0	0.8	1.6	1.5	*****	*****	0.052	0.130	******	0.047	0.062	******
MC12	5.1	7/29/77	740	0.0	*****	*****	*****	*****	*****	0.068	0.076	******	0.038	0.076	******
MC13	2.6	7/25/77	1930	0.0	0.7	1.2	1.3	1.6	1.8	0.050	0.290	******	0.066	0.088	2.0
MC13	2.5	7/26/77	930	0.0	0.6	1.2	1.2	1.5	1.6	0.020	0.260	******	0.049	0.074	******
MC13	2.5	7/26/77	930	15.0	*****	*****	*****	*****	*****	0.040	0.250	0.600	0.054	0.100	4.0
MC13	2.5	7/26/77	1700	0.0	0.6	1.1	0.9	1.8	1.3	0.016	0.150	******	0.032	0.060	4.0
MC13	2.6	7/26/77	1700	15.0	0.6	4.8	1.2	1.8	1.2	0.022	0.210	******	0.044	0.068	3.0
MC13	2.6	7/27/77	1010	0.0	*****	*****	*****	*****	*****	0.002	0.240	0.100	0.045	0.066	4.0
MC13	2.6	7/27/77	1010	16.0	*****	*****	*****	*****	*****	0.002	0.230	0.100	0.045	0.072	3.0
MC13	2.6	7/27/77	1650	0.0	*****	*****	*****	*****	*****	0.016	0.120	0.200	0.030	0.060	******
MC13	2.6	7/27/77	1650	5.0	*****	*****	*****	*****	*****	0.028	0.140	0.300	0.034	0.062	******
MC13	2.6	7/27/77	1650	10.0	*****	*****	*****	*****	*****	0.028	0.140	0.300	0.034	0.066	******
MC13	2.6	7/27/77	1650	14.0	*****	*****	*****	*****	*****	0.028	0.160	0.400	0.036	0.062	4.0

I I-4. BIOLOGICAL OXYGEN DEMAND AND NUTRIENT LEVELS IN THE MAIN CHANNEL OF GRAYS HARBOR.
EPA REGION 10 FIELD STUDY, JULY 25-29, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	BOD 2 DAY (MG/L)	BOD 5 DAY (MG/L)	BOD 10 DAY (MG/L)	BOD 15 DAY (MG/L)	BOD 20 DAY (MG/L)	NH3-N TOTAL (MG/L)	NO2+NO3 N-TOTAL (MG/L)	TOT KJEL N (MG/L)	PHOS-DIS ORTHO (MG/L P)	PHOS-TOT (MG/L P)	TOT ORG C C (MG/L)
MC13	2.5	7/28/77	700	0.0	#####	#####	#####	#####	#####	0.028	0.100	0.400	0.032	0.062	5.0
MC13	2.5	7/28/77	700	5.0	#####	#####	#####	#####	#####	0.020	0.100	0.400	0.038	0.062	######
MC13	2.5	7/28/77	700	13.0	#####	#####	#####	#####	#####	0.021	0.084	0.300	0.034	0.068	5.0
MC13	2.5	7/29/77	715	0.0	#####	#####	#####	#####	#####	0.048	0.076	######	0.036	0.068	######

TABLE I-5. DISSOLVED OXYGEN, TEMPERATURE AND NUTRIENTS FOR INDUSTRIAL AND MUNICIPAL POINT SOURCES AND TRIBUTARIES DISCHARGING TO GRAYS HARBOR (C-COMPOSITE). EPA REGION 10 FIELD STUDY, JULY 26-29, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	BOD 2 DAY (MG/L)	BOD 5 DAY (MG/L)	BOD 10 DAY (MG/L)	BOD 15 DAY (MG/L)	BOD 20 DAY (MG/L)	NH3-N TOTAL (MG/L)	NO2+NO3 N-TOTAL (MG/L)	TOT KJEL N (MG/L)	PHOS-DIS ORTHO (MG/L P)	PHOS-TOT (MG/L P)	TOT ORG C C (MG/L)
GH01	26.8	7/26/77	1600	0.0	0.9	1.2	1.4	2.2	2.4	0.018	0.086	******	0.002	0.046	4.0
GH01	26.8	7/26/77	1700	0.0	0.7	1.5	1.1	1.2	1.6	0.012	0.088	******	0.008	0.034	3.0
GH01	26.8	7/27/77	1200	0.0	*****	*****	*****	*****	*****	0.020	0.096	******	0.002	******	******
GH01	26.8	7/27/77	1230	0.0	*****	*****	*****	*****	*****	0.018	0.002	0.100	0.002	0.004	13.0
GH01	26.8	7/27/77	1230	0.0	*****	0.2	*****	*****	*****	0.012	0.084	0.200	0.002	0.040	3.0
GH01	26.8	7/27/77	1230	0.0	*****	*****	*****	*****	*****	0.004	0.002	0.100	0.002	0.002	6.0
GH01	26.8	7/27/77	1245	0.0	*****	*****	*****	*****	*****	0.018	0.084	0.300	0.002	0.018	3.0
GH01	26.8	7/27/77	1245	0.0	*****	*****	*****	*****	*****	0.048	0.130	0.100	0.039	0.066	3.0
GH01	26.8	7/27/77	1245	0.0	*****	*****	*****	*****	*****	0.012	0.084	0.100	0.008	0.028	2.0
GH01	26.8	7/27/77	1800	0.0	*****	0.4	*****	*****	*****	0.012	0.082	0.600	0.008	0.026	3.0
GH02	18.5	7/26/77	1630	0.0	0.4	1.8	0.9	1.0	1.7	0.030	0.025	******	0.050	0.086	4.0
GH02	18.5	7/27/77	1030	0.0	*****	4.0	*****	*****	*****	0.580	0.018	******	0.045	0.220	******
GH02	18.5	7/27/77	1100	0.0	*****	*****	*****	*****	*****	******	******	******	******	******	******
GH02	18.5	7/28/77	1650	0.0	*****	4.0	*****	*****	*****	0.172	0.004	******	0.002	0.250	******
GH03	15.5	7/26/77	1130	0.0	*****	*****	*****	*****	*****	0.110	0.078	******	0.026	0.068	8.0
GH03	15.5	7/26/77	1130	3.1	*****	1.3	*****	*****	*****	0.100	0.082	******	0.026	0.074	8.0
GH03	15.5	7/26/77	1730	0.0	0.8	1.5	1.9	2.0	2.6	0.090	0.096	******	0.020	0.058	6.0
GH03	15.5	7/26/77	1730	3.1	1.3	2.2	2.0	2.7	3.3	0.092	0.098	******	0.020	0.074	7.0
GH03	15.5	7/27/77	1300	0.0	*****	0.6	*****	*****	*****	0.100	0.080	0.400	0.026	0.080	9.0
GH03	15.5	7/27/77	1300	3.1	*****	0.7	*****	*****	*****	0.100	0.078	0.400	0.026	0.086	10.0
GH03	15.5	7/27/77	1730	0.0	*****	0.6	*****	*****	*****	0.054	0.090	0.300	0.008	0.050	5.0
GH03	15.5	7/28/77	745	0.0	0.5	0.7	1.1	1.5	1.7	0.048	0.092	0.300	0.004	0.088	8.0
GH03	15.5	7/28/77	1315	0.0	*****	*****	*****	*****	*****	0.110	0.084	******	0.034	0.096	******
GH03	15.5	7/28/77	1835	0.0	*****	*****	*****	*****	*****	0.078	0.090	******	0.014	0.058	******
GH03	15.5	7/29/77	730	0.0	*****	*****	*****	*****	*****	0.040	0.090	******	0.010	0.078	13.0
GH04	14.7	7/26/77	830	0.0	*****	*****	*****	*****	*****	******	******	******	******	******	******
GH04	14.7	7/27/77	915	0.0	*****	*****	*****	*****	*****	******	******	******	******	******	******
GH04	14.7	7/27/77 C	915	0.0	*****	82.0	*****	*****	*****	19.000	0.006	******	2.800	5.700	40.0
GH04	14.7	7/28/77	915	0.0	*****	*****	*****	*****	*****	******	******	******	******	******	******
GH04	14.7	7/28/77 C	915	0.0	*****	97.0	*****	*****	*****	14.000	0.004	******	3.800	8.200	******
GH04	14.7	7/29/77	915	0.0	*****	*****	*****	*****	*****	******	******	******	******	******	******
GH04	14.7	7/29/77 C	915	0.0	*****	*****	*****	*****	*****	13.000	0.010	******	2.500	5.400	******
GH05	13.6	7/26/77 C	600	0.0	*****	*****	*****	*****	*****	******	******	******	1.300	1.800	228.0
GH05	13.6	7/27/77	1130	0.0	*****	*****	*****	*****	*****	******	******	******	******	******	******
GH05	13.6	7/27/77 C	600	0.0	*****	220.0	*****	*****	*****	******	******	******	1.100	1.600	285.0
GH05	13.6	7/28/77 C	1545	0.0	*****	*****	*****	*****	*****	******	******	******	1.800	2.300	******
GH05	13.6	7/29/77 C	600	0.0	*****	350.0	*****	*****	*****	******	******	******	1.500	2.800	******
GH06	12.8	7/26/77 C	600	0.0	*****	*****	*****	*****	*****	******	******	******	0.030	3.500	360.0
GH06	12.8	7/27/77 C	600	0.0	*****	125.0	*****	*****	*****	******	******	******	0.910	3.400	449.0
GH06	12.8	7/28/77 C	600	0.0	*****	180.0	*****	*****	*****	******	******	******	1.600	1.100	415.0
GH06	12.8	7/29/77 C	600	0.0	*****	610.0	*****	*****	*****	******	******	******	1.600	6.200	******
GH07	12.7	7/26/77	1600	0.0	1.3	2.1	1.7	2.6	3.1	0.100	0.110	******	0.022	0.062	9.0

TABLE I-5. DISSOLVED OXYGEN, TEMPERATURE AND NUTRIENTS FOR INDUSTRIAL AND MUNICIPAL POINT SOURCES AND TRIBUTARIES DISCHARGING TO GRAYS HARBOR (C=COMPOSITE). EPA REGION 10 FIELD STUDY, JULY 26-29, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	BOD 2 DAY (MG/L)	BOD 5 DAY (MG/L)	BOD 10 DAY (MG/L)	BOD 15 DAY (MG/L)	BOD 20 DAY (MG/L)	NH3-N TOTAL (MG/L)	NO2+NO3 N-TOTAL (MG/L)	TOT KJEL N (MG/L)	PHOS-DIS ORTHO (MG/L P)	PHOS-TOT (MG/L P)	TOT ORG C C (MG/L)
GH07	12.7	7/26/77	1030	6.1	*****	1.4	*****	*****	*****	0.068	0.070	******	0.032	0.092	8.0
GH07	12.7	7/26/77	1045	0.0	0.7	1.2	1.3	1.9	2.6	0.096	0.074	******	0.030	0.068	8.0
GH07	12.7	7/26/77	1045	0.0	*****	*****	*****	*****	*****	0.088	0.070	******	0.032	0.066	7.0
GH07	12.7	7/26/77	1045	0.0	*****	*****	*****	*****	*****	0.092	0.070	******	0.032	0.068	7.0
GH07	12.7	7/26/77	1800	0.0	0.7	1.3	1.2	1.8	2.6	0.110	0.084	******	0.034	0.068	10.0
GH07	12.7	7/26/77	1800	6.2	*****	*****	*****	*****	*****	0.110	0.080	******	0.040	0.110	9.0
GH07	12.7	7/27/77	1325	0.0	*****	0.9	*****	*****	*****	0.062	0.078	0.200	0.031	0.088	8.0
GH07	12.7	7/27/77	1325	6.2	*****	0.9	*****	*****	*****	0.060	0.088	0.300	0.031	0.010	8.0
GH07	12.7	7/27/77	1700	0.0	*****	1.1	*****	*****	*****	0.086	0.098	0.300	0.016	0.068	9.0
GH07	12.7	7/27/77	1700	6.2	*****	1.1	*****	*****	*****	0.078	0.100	0.300	0.018	0.210	10.0
GH07	12.7	7/28/77	815	0.0	0.5	0.6	0.9	1.6	2.2	0.110	0.110	0.600	0.018	0.086	10.0
GH07	12.7	7/28/77	1333	0.0	*****	*****	*****	*****	*****	0.060	0.078	******	0.040	0.082	******
GH07	12.7	7/28/77	1855	0.0	*****	*****	*****	*****	*****	0.110	0.106	******	0.022	0.078	******
GH07	12.7	7/29/77	815	0.0	*****	*****	*****	*****	*****	0.110	0.120	0.500	0.014	0.078	******
GH07*	12.7	7/28/77	1030	0.0	*****	*****	*****	*****	*****	0.140	0.120	******	0.080	0.110	8.0
GH08	10.8	7/26/77	930	0.0	*****	*****	*****	*****	*****	******	******	******	******	******	******
GH08	10.8	7/26/77	1845	0.0	*****	*****	*****	*****	*****	******	******	******	******	******	******
GH08	10.8	7/27/77	1630	0.0	*****	*****	*****	*****	*****	******	******	******	******	******	******
GH08	10.8	7/27/77	C 940	0.0	*****	68.0	*****	*****	*****	0.990	0.044	******	2.800	4.800	56.0
GH08	10.8	7/28/77	840	0.0	*****	38.0	*****	*****	*****	2.000	0.042	******	3.800	6.300	42.0
GH08	10.8	7/28/77	840	0.0	*****	*****	*****	*****	*****	******	******	******	******	******	******
GH08	10.8	7/29/77	840	0.0	*****	*****	*****	*****	*****	******	******	******	******	******	******
GH08	10.8	7/29/77	C 840	0.0	*****	*****	*****	*****	*****	2.200	0.038	******	4.200	5.300	******
GH09	10.8	7/27/77	940	0.0	*****	*****	*****	*****	*****	******	******	******	******	******	******
MC01	27.0	7/27/77	630	0.0	1.3	1.6	2.6	3.6	3.9	0.004	0.002	0.400	0.002	0.058	5.0
MC01	27.0	7/28/77	645	0.0	*****	*****	*****	*****	*****	0.026	0.048	0.300	0.028	0.092	******
MC01	27.0	7/28/77	645	0.0	*****	*****	*****	*****	*****	0.008	0.002	0.400	0.002	0.044	******
MC01	27.0	7/28/77	645	0.0	*****	*****	*****	*****	*****	0.002	0.002	0.400	0.008	0.046	******
MC01	27.0	7/28/77	1235	0.0	*****	*****	*****	*****	*****	0.004	0.002	******	0.008	0.044	******
MC01	27.0	7/28/77	1800	0.0	*****	*****	*****	*****	*****	0.002	0.008	******	0.002	0.050	******
MC01	27.0	7/29/77	800	0.0	*****	*****	*****	*****	*****	0.010	0.010	******	0.010	0.040	11.0

APPENDIX II

Water Quality Measurements

Made by Grays Harbor Community College in

Grays Harbor, Washington,

August 3 - September 29, 1977

TABLE II-1. TEMPERATURE, D.O., SALINITY AND PH AT THE UPSTREAM(MC01) AND DOWNSTREAM(MC13) BOUNDARIES OF GRAYS HARBOR, AUGUST-SEPTEMBER, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	WATER TEMP (CENT)	SALINITY (PPT)	DISS OXYGEN PROBE (MG/L)	DISS OXYGEN WINKLER (MG/L)	PH (SU)
MC13	2.5	8/ 3/77	1300	0.0	12.0	32.0	7.5	7.0	7.2
MC13	2.5	8/ 3/77	1305	2.0	12.0	32.5	7.6	****	6.4
MC13	2.5	8/ 3/77	1310	5.0	12.0	32.0	7.7	****	7.8
MC13	2.5	8/ 3/77	1315	10.0	12.0	31.0	7.8	****	7.1
MC13	2.5	8/ 3/77	1320	13.0	12.0	****	8.1	7.0	7.1
MC01	27.0	8/ 3/77	1500	0.0	22.0	0.0	9.5	9.1	5.6
MC01	27.0	8/ 3/77	1512	2.0	12.0	0.0	****	9.0	7.0
MC01	27.0	8/ 3/77	1515	3.0	11.0	0.0	9.6	9.1	7.5
MC13	2.5	8/ 4/77	1518	0.0	11.6	34.5	7.2	7.0	7.8
MC13	2.5	8/ 4/77	1521	2.0	11.6	33.0	7.0	7.2	7.8
MC13	2.5	8/ 4/77	1524	5.0	11.6	33.1	7.0	7.1	7.8
MC13	2.5	8/ 4/77	1527	10.0	11.4	32.0	6.6	6.8	7.8
MC13	2.5	8/ 4/77	1530	13.0	11.2	31.0	6.4	6.4	7.0
MC01	27.0	8/ 4/77	1835	0.0	20.7	1.2	8.9	8.7	7.4
MC01	27.0	8/ 4/77	1850	2.0	21.0	1.0	8.9	8.7	7.4
MC01	27.0	8/ 4/77	1910	3.0	21.0	0.7	8.9	8.8	7.4
MC13	2.5	8/11/77	1045	0.0	9.5	31.8	3.8	3.2	7.4
MC13	2.5	8/11/77	1045	2.0	9.0	31.8	3.8	3.2	7.5
MC13	2.5	8/11/77	1045	5.0	9.0	31.8	2.6	3.3	7.5
MC13	2.5	8/11/77	1045	10.0	9.0	31.7	2.6	3.0	7.6
MC13	2.5	8/11/77	1130	15.0	9.6	31.7	3.0	3.1	7.6
MC01	27.0	8/11/77	1400	0.0	21.1	0.5	9.1	9.2	7.7
MC01	27.0	8/11/77	1405	2.0	21.1	0.5	9.1	9.5	7.7
MC01	27.0	8/11/77	1415	3.0	21.1	1.0	9.0	10.7	7.7
MC13	2.5	8/18/77	1500	0.0	11.2	27.1	6.2	7.0	7.8
MC13	2.5	8/18/77	1505	2.0	11.2	27.1	6.2	7.3	7.8
MC13	2.5	8/18/77	1510	5.0	11.5	27.1	6.2	7.4	7.9
MC13	2.5	8/18/77	1515	10.0	11.5	27.1	6.0	6.5	7.8
MC13	2.5	8/18/77	1525	15.0	12.0	27.0	6.0	6.5	7.8
MC01	27.0	8/18/77	1810	0.0	20.7	0.5	8.1	8.0	7.7
MC01	27.0	8/18/77	1810	2.0	20.7	0.4	7.9	8.1	7.7
MC01	27.0	8/18/77	1810	3.0	21.0	0.3	7.9	8.0	7.7
MC13	2.5	8/25/77	1145	0.0	14.7	23.0	8.8	8.8	8.1
MC13	2.5	8/25/77	1130	2.0	14.7	24.0	8.8	8.9	8.1
MC13	2.5	8/25/77	1120	5.0	14.8	24.0	8.8	8.7	8.1
MC13	2.5	8/25/77	1100	10.0	14.8	24.0	8.8	8.6	****
MC13	2.5	8/25/77	1050	15.0	15.0	31.0	8.8	8.7	****
MC01	27.0	8/25/77	1415	0.0	18.0	1.4	8.6	8.1	7.6
MC01	27.0	8/25/77	1400	2.0	18.0	1.4	8.7	9.0	7.4
MC01	27.0	8/25/77	1345	3.0	18.0	2.5	8.8	8.8	7.4
MC13	2.5	8/26/77	1645	0.0	16.0	24.0	10.1	8.5	7.3
MC13	2.5	8/26/77	1650	2.0	15.8	24.8	10.2	8.6	7.3

TABLE II-1. TEMPERATURE, D.O., SALINITY AND PH AT THE UPSTREAM(MC01) AND DOWNSTREAM(MC13) BOUNDARIES OF GRAYS HARBOR, AUGUST-SEPTEMBER, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	WATER TEMP (CENT)	SALINITY (PPT)	DISS OXYGEN PROBE (MG/L)	DISS OXYGEN WINKLER (MG/L)	PH (SU)
MC13	2.5	8/26/77	1600	5.0	15.5	24.4	10.2	8.8	7.4
MC13	2.5	8/26/77	1610	10.0	15.2	24.8	10.0	8.7	7.4
MC13	2.5	8/26/77	1615	15.0	****	24.8	****	9.0	7.5
MC13	2.5	8/26/77	1725	0.0	16.3	23.5	9.5	7.8	7.2
MC13	2.5	8/26/77	1730	2.0	16.3	23.5	9.5	7.9	7.3
MC13	2.5	8/26/77	1745	5.0	16.2	23.8	9.4	7.8	7.3
MC13	2.5	8/26/77	1815	10.0	16.2	23.8	9.4	7.7	7.4
MC13	2.5	8/26/77	1830	15.0	16.1	24.0	9.3	7.8	7.4
MC13	2.5	8/26/77	1940	0.0	16.1	24.0	10.6	8.1	7.6
MC13	2.5	8/26/77	1950	2.0	16.0	23.8	10.5	8.0	7.6
MC13	2.5	8/26/77	2000	5.0	16.0	23.8	10.4	8.3	7.7
MC13	2.5	8/26/77	2010	10.0	15.9	23.8	10.5	8.3	7.7
MC13	2.5	8/26/77	2015	15.0	15.2	23.7	10.7	8.1	7.7
MC13	2.5	8/26/77	2140	0.0	15.0	25.6	11.2	9.3	7.8
MC13	2.5	8/26/77	2150	2.0	14.8	26.8	11.8	9.4	7.7
MC13	2.5	8/26/77	2200	5.0	14.8	26.8	11.2	9.2	7.7
MC13	2.5	8/26/77	2210	10.0	14.7	26.9	11.1	9.3	7.8
MC13	2.5	8/26/77	2215	15.0	14.7	27.0	11.1	9.2	7.7
MC13	2.5	8/26/77	2340	0.0	15.0	26.5	11.0	9.6	7.5
MC13	2.5	8/26/77	2350	2.0	14.9	26.2	11.0	9.6	7.6
MC13	2.5	8/27/77	0	5.0	14.9	26.5	11.7	9.6	7.6
MC13	2.5	8/27/77	10	10.0	14.7	26.5	11.5	9.6	7.6
MC13	2.5	8/27/77	10	15.0	14.5	26.9	11.4	9.0	7.6
MC13	2.5	8/27/77	135	0.0	14.7	26.0	10.8	9.0	7.8
MC13	2.5	8/27/77	140	2.0	14.8	26.0	10.8	9.1	7.8
MC13	2.5	8/27/77	150	5.0	14.8	26.0	10.8	9.3	7.7
MC13	2.5	8/27/77	200	10.0	14.8	26.0	10.7	9.1	7.8
MC13	2.5	8/27/77	205	15.0	14.7	26.1	10.7	8.9	7.7
MC13	2.5	8/27/77	340	0.0	15.5	26.5	9.8	8.2	7.6
MC13	2.5	8/27/77	345	2.0	15.3	26.5	9.7	8.1	7.6
MC13	2.5	8/27/77	350	5.0	15.3	26.6	9.6	8.4	7.6
MC13	2.5	8/27/77	400	10.0	15.3	26.6	9.6	8.8	7.6
MC13	2.5	8/27/77	405	15.0	15.2	26.7	9.6	****	****
MC13	2.5	8/27/77	540	0.0	16.3	26.0	10.1	7.3	7.2
MC13	2.5	8/27/77	545	2.0	16.6	26.0	9.8	7.3	7.3
MC13	2.5	8/27/77	550	5.0	16.5	26.0	9.9	7.4	7.3
MC13	2.5	8/27/77	600	10.0	16.8	26.0	9.8	7.3	7.3
MC13	2.5	8/27/77	610	15.0	16.8	26.8	9.7	7.2	7.3
MC13	2.5	8/27/77	730	0.0	16.2	26.0	9.5	7.1	7.4
MC13	2.5	8/27/77	740	2.0	16.2	26.0	9.5	7.0	7.4
MC13	2.5	8/27/77	750	5.0	16.3	26.0	9.3	7.2	7.5
MC13	2.5	8/27/77	800	10.0	16.4	26.0	9.2	7.1	7.6

TEMPERATURE, D.O., SALINITY AND PH AT THE UPSTREAM(MC01) AND DOWNSTREAM(MC13) BOUNDARIES OF GRAYS HARBOR, AUGUST-SEPTEMBER, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	WATER TEMP (CENT)	SALINITY (PPT)	DISS OXYGEN PROBE (MG/L)	DISS OXYGEN WINKLER (MG/L)	PH (SU)
MC13	2.5	8/27/77	810	15.0	16.4	26.1	9.2	7.4	7.6
MC13	2.5	8/27/77	940	0.0	14.6	23.0	9.1	8.0	7.4
MC13	2.5	8/27/77	945	2.0	14.5	22.9	9.1	8.0	7.4
MC13	2.5	8/27/77	950	5.0	14.5	22.9	9.1	8.1	7.5
MC13	2.5	8/27/77	100	10.0	14.5	22.9	8.9	8.0	7.6
MC13	2.5	8/27/77	1005	15.0	14.5	22.9	8.9	8.0	7.6
MC13	2.5	8/27/77	1130	0.0	14.8	23.4	11.0	9.0	7.7
MC13	2.5	8/27/77	1140	2.0	14.7	23.8	11.1	9.1	7.7
MC13	2.5	8/27/77	1150	5.0	14.8	23.2	10.9	9.0	7.7
MC13	2.5	8/27/77	1200	10.0	14.8	23.2	10.9	8.9	7.8
MC13	2.5	8/27/77	1205	15.0	14.6	23.3	10.8	8.9	7.8
MC13	2.5	8/27/77	1330	0.0	15.0	23.6	11.4	9.8	7.5
MC13	2.5	8/27/77	1340	2.0	15.0	23.0	11.4	9.7	7.6
MC13	2.5	8/27/77	1350	5.0	15.0	23.0	11.4	9.8	7.6
MC13	2.5	8/27/77	1355	10.0	14.8	23.2	11.3	9.7	7.7
MC13	2.5	8/27/77	1400	15.0	14.8	23.4	11.1	9.7	7.7
MC01	27.0	8/26/77	1510	0.0	16.0	0.0	9.1	9.0	7.2
MC01	27.0	8/26/77	1520	2.0	16.0	1.0	8.9	8.8	7.1
MC01	27.0	8/26/77	1540	4.0	16.0	1.0	8.9	8.6	7.2
MC01	27.0	8/26/77	1700	0.0	16.0	0.8	9.2	9.2	7.2
MC01	27.0	8/26/77	1705	2.0	16.0	0.6	9.0	9.1	7.2
MC01	27.0	8/26/77	1710	4.0	15.6	0.6	8.9	9.0	7.0
MC01	27.0	8/26/77	1900	0.0	15.5	****	9.0	9.1	7.0
MC01	27.0	8/26/77	1905	2.0	15.5	****	9.1	6.7	7.1
MC01	27.0	8/26/77	1910	4.0	15.5	****	9.0	7.9	7.1
MC01	27.0	8/26/77	2100	0.0	16.0	****	8.9	9.8	7.2
MC01	27.0	8/26/77	2105	2.0	16.0	****	8.7	9.1	7.2
MC01	27.0	8/26/77	2110	4.0	16.0	****	8.7	8.9	7.2
MC01	27.0	8/26/77	2300	0.0	15.0	****	8.7	8.9	7.2
MC01	27.0	8/26/77	2305	2.0	15.0	****	8.7	8.9	7.1
MC01	27.0	8/26/77	2305	4.0	15.0	****	9.1	9.2	7.1
MC01	27.0	8/27/77	100	0.0	15.0	****	9.0	9.0	7.1
MC01	27.0	8/27/77	105	2.0	15.0	****	8.8	8.9	7.1
MC01	27.0	8/27/77	110	4.0	15.0	****	9.0	8.9	7.1
MC01	27.0	8/27/77	300	0.0	15.0	****	8.8	9.1	7.1
MC01	27.0	8/27/77	305	2.0	15.0	****	8.9	9.0	7.1
MC01	27.0	8/27/77	310	4.0	15.0	****	9.0	8.8	7.1
MC01	27.0	8/27/77	500	0.0	15.0	****	8.9	9.0	7.1
MC01	27.0	8/27/77	505	2.0	15.1	****	9.1	9.0	7.1
MC01	27.0	8/27/77	510	4.0	15.1	****	8.8	9.0	7.1
MC01	27.0	8/27/77	700	0.0	15.0	0.0	8.7	8.7	7.1
MC01	27.0	8/27/77	705	2.0	15.0	0.0	8.8	8.6	7.1

TABLE II-1. TEMPERATURE, D.O., SALINITY AND PH AT THE UPSTREAM(MC01) AND DOWNSTREAM(MC13) BOUNDARIES OF GRAYS HARBOR, AUGUST-SEPTEMBER, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	WATER TEMP (CENT)	SALINITY (PPT)	DISS OXYGEN PROBE (MG/L)	DISS OXYGEN WINKLER (MG/L)	PH (SU)
MC01	27.0	8/27/77	710	4.0	15.0	0.0	8.8	8.7	7.1
MC01	27.0	8/27/77	900	15.0	8.8	7.1	8.9	0.0	77.0
MC01	27.0	8/27/77	900	0.0	15.0	0.0	8.8	8.9	7.1
MC01	27.0	8/27/77	905	2.0	15.5	0.0	8.9	8.8	7.1
MC01	27.0	8/27/77	910	4.0	15.5	0.0	8.8	9.0	7.1
MC01	27.0	8/27/77	1100	0.0	15.5	0.0	9.0	8.7	7.1
MC01	27.0	8/27/77	1105	2.0	15.5	0.0	9.0	8.8	7.1
MC01	27.0	8/27/77	1110	4.0	15.0	0.0	9.0	8.8	7.2
MC01	27.0	8/27/77	1300	0.0	15.5	0.0	9.1	8.9	7.2
MC01	27.0	8/27/77	1305	2.0	15.5	0.0	9.1	8.9	7.2
MC01	27.0	8/27/77	1310	4.0	15.0	0.0	9.1	9.0	7.2
MC13	2.5	9/ 1/77	1530	0.0	14.3	24.8	9.4	8.7	8.0
MC13	2.5	9/ 1/77	1540	2.0	14.1	24.8	9.2	9.0	8.1
MC13	2.5	9/ 1/77	1545	5.0	14.1	24.8	9.2	9.1	8.1
MC13	2.5	9/ 1/77	1550	10.0	14.0	24.5	8.8	8.8	8.1
MC13	2.5	9/ 1/77	1555	15.0	14.0	24.5	8.7	8.6	8.1
MC01	27.0	9/ 1/77	1750	0.0	16.5	0.0	8.6	8.2	6.9
MC01	27.0	9/ 1/77	1810	2.0	16.2	0.0	8.4	8.3	7.1
MC01	27.0	9/ 1/77	1825	4.0	16.1	0.0	8.4	8.3	7.2
MC13	2.5	9/ 8/77	1004	0.0	15.0	29.2	8.0	****	8.0
MC13	2.5	9/ 8/77	1012	2.0	14.8	29.8	8.0	****	8.0
MC13	2.5	9/ 8/77	1015	5.0	14.7	30.1	7.3	****	8.0
MC13	2.5	9/ 8/77	1018	10.0	13.0	30.4	7.2	****	7.9
MC13	2.5	9/ 8/77	1020	15.0	13.0	30.4	7.1	****	8.0
MC01	27.0	9/ 8/77	1230	0.0	16.0	0.0	7.9	8.6	6.9
MC01	27.0	9/ 8/77	1240	2.0	15.6	0.0	7.8	8.7	6.5
MC01	27.0	9/ 8/77	1250	4.0	15.4	0.0	7.7	8.8	6.8
MC13	2.5	9/15/77	1500	0.0	12.1	26.1	8.0	7.9	8.1
MC13	2.5	9/15/77	1505	2.0	12.1	26.1	7.8	7.9	8.1
MC13	2.5	9/15/77	1510	5.0	12.1	26.0	7.8	8.0	8.1
MC13	2.5	9/15/77	1515	10.0	12.1	25.8	7.8	7.7	8.1
MC13	2.5	9/15/77	1522	15.0	12.6	****	7.8	****	****
MC01	27.0	9/15/77	1720	0.0	16.5	0.0	****	8.4	8.2
MC01	27.0	9/15/77	1730	2.0	16.5	0.0	****	8.4	8.0
MC01	27.0	9/15/77	1745	4.0	16.5	0.0	****	8.3	7.8
MC13	2.5	9/92/27	1000	0.0	14.8	23.0	7.3	8.4	8.2
MC13	2.5	9/92/27	1010	2.0	14.0	22.9	7.2	8.5	8.2
MC13	2.5	9/92/27	1020	5.0	14.0	22.8	7.2	8.3	8.2
MC13	2.5	9/92/27	1030	10.0	13.9	22.8	7.1	8.3	8.2
MC13	2.5	9/92/27	1035	15.0	13.8	22.8	7.1	8.3	8.2
MC01	27.0	9/22/77	1230	0.0	13.8	0.9	8.9	9.0	7.8
MC01	27.0	9/22/77	1240	2.0	13.6	0.9	8.9	9.9	7.5

TABLE II-1. TEMPERATURE, D.O., SALINITY AND PH AT THE UPSTREAM(MC01) AND DOWNSTREAM(MC13) BOUNDARIES OF GRAYS HARBOR, AUGUST-SEPTEMBER, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	WATER TEMP (CENT)	SALINITY (PPT)	DISS OXYGEN PROBE (MG/L)	DISS OXYGEN WINKLER (MG/L)	PH (SU)
MC01	27.0	9/22/77	1250	4.0	13.9	1.0	9.1	9.1	7.4
MC13	2.5	9/24/77	1020	0.0	14.5	21.0	8.6	8.6	7.8
MC13	2.5	9/24/77	1025	2.0	14.8	21.2	8.6	8.8	7.8
MC13	2.5	9/24/77	1030	5.0	14.2	21.3	8.6	8.7	7.8
MC13	2.5	9/24/77	1035	10.0	14.1	21.3	8.6	8.7	7.9
MC13	2.5	9/24/77	1040	13.0	14.1	21.5	8.6	8.6	7.9
MC13	2.5	9/24/77	1210	0.0	14.6	20.5	8.6	8.8	7.6
MC13	2.5	9/24/77	1215	2.0	14.4	20.8	8.6	8.8	7.6
MC13	2.5	9/24/77	1220	5.0	14.2	21.3	8.6	8.9	7.6
MC13	2.5	9/24/77	1225	10.0	14.1	21.7	8.6	8.9	7.6
MC13	2.5	9/24/77	1230	13.0	14.0	21.8	8.6	8.9	7.7
MC13	2.5	9/24/77	1415	0.0	14.6	22.0	8.8	8.6	7.7
MC13	2.5	9/24/77	1420	2.0	14.6	22.2	8.9	8.6	7.7
MC13	2.5	9/24/77	1425	5.0	14.5	22.2	9.0	8.7	7.7
MC13	2.5	9/24/77	1430	10.0	14.5	22.4	9.0	8.7	7.8
MC13	2.5	9/24/77	1435	13.0	14.8	22.4	8.9	8.7	7.8
MC13	2.5	9/24/77	1615	0.0	14.9	20.8	8.9	8.8	7.6
MC13	2.5	9/24/77	1620	2.0	14.9	20.8	8.8	8.8	7.6
MC13	2.5	9/24/77	1625	5.0	14.8	20.8	8.8	8.6	7.5
MC13	2.5	9/24/77	1630	10.0	14.8	21.0	8.8	8.6	7.5
MC13	2.5	9/24/77	1635	13.0	14.5	21.0	8.9	8.6	7.6
MC13	2.5	9/24/77	1815	0.0	14.8	19.2	8.6	8.0	7.8
MC13	2.5	9/24/77	1820	2.0	14.8	19.5	8.6	8.0	7.8
MC13	2.5	9/24/77	1825	5.0	14.8	20.0	8.5	8.1	7.8
MC13	2.5	9/24/77	1830	10.0	14.8	20.2	8.5	8.3	7.7
MC13	2.5	9/24/77	1835	13.0	14.8	20.6	8.6	8.0	7.8
MC13	2.5	9/24/77	2015	0.0	17.0	20.0	9.6	9.2	7.6
MC13	2.5	9/24/77	2020	2.0	16.0	20.5	9.4	9.0	7.6
MC13	2.5	9/24/77	2025	5.0	15.8	21.0	9.6	9.2	7.6
MC13	2.5	9/24/77	2030	10.0	16.5	21.5	9.0	9.2	7.5
MC13	2.5	9/24/77	2035	13.0	16.8	21.8	9.4	9.1	7.5
MC13	2.5	9/24/77	2220	0.0	14.1	21.1	****	8.8	7.9
MC13	2.5	9/24/77	2225	2.0	14.1	22.0	****	8.8	7.9
MC13	2.5	9/24/77	2228	5.0	14.2	22.1	****	8.9	7.9
MC13	2.5	9/24/77	2233	10.0	14.2	23.0	****	8.9	7.9
MC13	2.5	9/24/77	2236	13.0	14.2	23.0	****	8.7	7.9
MC13	2.5	9/25/77	15	0.0	13.8	23.5	****	8.8	7.6
MC13	2.5	9/25/77	20	2.0	13.8	23.5	****	8.9	7.6
MC13	2.5	9/25/77	25	5.0	13.6	23.5	****	9.0	7.6
MC13	2.5	9/25/77	30	10.0	13.6	23.7	****	9.1	7.6
MC13	2.5	9/25/77	35	13.0	13.5	23.7	****	9.0	7.6
MC13	2.5	9/25/77	220	0.0	13.5	23.1	****	8.4	7.9

TABLE II-1. TEMPERATURE, D.O., SALINITY AND PH AT THE UPSTREAM(MC01) AND DOWNSTREAM(MC13) BOUNDARIES OF GRAYS HARBOR, AUGUST-SEPTEMBER, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	WATER TEMP (CENT)	SALINITY (PPT)	DISS OXYGEN PROBE (MG/L)	DISS OXYGEN WINKLER (MG/L)	PH (SU)
MC13	2.5	9/25/77	822	2.0	13.5	23.1	****	8.4	7.9
MC13	2.5	9/25/77	825	5.0	13.6	24.0	****	8.7	7.9
MC13	2.5	9/25/77	830	10.0	13.6	24.0	****	8.7	7.9
MC13	2.5	9/25/77	835	13.0	13.5	24.0	****	8.8	7.9
MC13	2.5	9/25/77	410	0.0	13.6	21.3	****	8.2	7.7
MC13	2.5	9/25/77	413	2.0	13.7	20.8	****	8.2	7.8
MC13	2.5	9/25/77	420	5.0	13.7	20.4	****	8.3	7.8
MC13	2.5	9/25/77	430	10.0	13.8	20.4	****	8.4	7.6
MC13	2.5	9/25/77	450	13.0	13.8	20.8	****	8.3	7.6
MC13	2.5	9/25/77	645	0.0	12.5	23.5	9.9	7.8	7.8
MC13	2.5	9/25/77	648	2.0	13.0	23.7	9.8	7.8	7.7
MC13	2.5	9/25/77	650	5.0	13.0	24.2	10.0	7.9	7.7
MC13	2.5	9/25/77	655	10.0	13.0	25.0	10.0	8.1	7.7
MC13	2.5	9/25/77	658	13.0	13.0	25.0	10.2	****	****
MC13	2.5	9/25/77	815	0.0	13.6	25.3	9.5	8.0	7.6
MC13	2.5	9/25/77	818	2.0	14.0	25.5	9.4	8.0	7.5
MC13	2.5	9/25/77	820	5.0	14.0	25.5	9.4	8.1	7.5
MC13	2.5	9/25/77	823	10.0	14.5	25.8	9.6	8.2	7.5
MC13	2.5	9/25/77	828	13.0	14.5	26.0	9.8	8.0	7.4
MC01	27.0	9/24/77	1000	0.0	13.0	0.0	9.1	9.2	6.6
MC01	27.0	9/24/77	1005	2.0	13.1	0.0	9.3	9.4	6.7
MC01	27.0	9/24/77	1010	4.0	13.1	0.0	9.3	9.3	6.7
MC01	27.0	9/24/77	1200	0.0	13.6	0.0	8.9	9.3	7.2
MC01	27.0	9/24/77	1205	2.0	13.4	0.0	9.2	9.5	6.2
MC01	27.0	9/24/77	1210	4.0	13.5	0.0	9.2	9.4	6.1
MC01	27.0	9/24/77	1400	0.0	13.5	0.0	9.1	9.1	7.7
MC01	27.0	9/24/77	1405	2.0	13.8	0.0	9.1	9.4	7.5
MC01	27.0	9/24/77	1410	4.0	14.5	0.0	9.0	9.5	7.4
MC01	27.0	9/24/77	1600	0.0	14.0	0.0	9.0	9.2	7.6
MC01	27.0	9/24/77	1605	2.0	13.8	0.0	8.9	9.2	7.0
MC01	27.0	9/24/77	1610	4.0	13.6	0.0	8.5	9.2	6.7
MC01	27.0	9/24/77	1800	0.0	13.1	0.0	9.4	9.6	7.6
MC01	27.0	9/24/77	1805	2.0	13.1	0.0	9.1	9.6	6.5
MC01	27.0	9/24/77	1810	4.0	13.1	0.0	9.0	9.8	7.2
MC01	27.0	9/24/77	2000	0.0	13.0	0.0	9.1	9.5	7.2
MC01	27.0	9/24/77	2005	2.0	13.1	0.0	9.1	9.5	7.0
MC01	27.0	9/24/77	2010	4.0	13.1	0.0	9.0	9.5	****
MC01	27.0	9/24/77	2200	0.0	13.4	0.0	9.0	9.8	7.0
MC01	27.0	9/24/77	2205	2.0	13.6	0.0	9.0	9.9	7.0
MC01	27.0	9/24/77	2210	4.0	13.5	0.0	9.0	9.9	7.5
MC01	27.0	9/25/77	0	0.0	13.6	0.0	9.1	9.0	7.1
MC01	27.0	9/25/77	5	2.0	13.6	0.0	9.4	9.4	7.2

TABLE II-1. TEMPERATURE, D.O., SALINITY AND PH AT THE UPSTREAM(MC01) AND DOWNSTREAM(MC13) BOUNDARIES OF GRAYS HARBOR, AUGUST-SEPTEMBER, 1977.

STATION NAME	OCEAN DIST (NM)	DATE	TIME	DEPTH (METERS)	WATER TEMP (CENT)	SALINITY (PPT)	DISS OXYGEN PROBE (MG/L)	DISS OXYGEN WINKLER (MG/L)	PH (SU)
MC01	27.0	9/26/77	10	4.0	13.5	0.0	9.3	9.6	7.0
MC01	27.0	9/26/77	200	0.0	13.0	0.0	9.1	9.0	7.1
MC01	27.0	9/25/77	205	2.0	13.0	0.0	9.3	9.6	6.9
MC01	27.0	9/26/77	210	4.0	13.0	0.0	9.3	9.6	6.7
MC01	27.0	9/26/77	400	0.0	12.0	0.0	9.4	9.9	####
MC01	27.0	9/25/77	405	2.0	12.0	0.0	9.5	9.8	####
MC01	27.0	9/25/77	410	4.0	12.0	0.0	9.6	9.8	####
MC01	27.0	9/26/77	600	0.0	12.0	0.0	9.3	9.3	####
MC01	27.0	9/26/77	605	2.0	12.0	0.0	9.2	9.4	####
MC01	27.0	9/25/77	610	4.0	12.0	0.0	9.4	9.6	####
MC01	27.0	9/26/77	800	0.0	12.0	0.0	8.9	9.3	####
MC01	27.0	9/25/77	805	2.0	12.0	0.0	9.3	9.4	####
MC01	27.0	9/26/77	810	4.0	12.0	0.0	9.3	9.4	####
MC13	2.5	9/29/77	1440	0.0	14.1	24.9	8.4	8.7	8.2
MC13	2.5	9/29/77	1443	2.0	14.1	24.9	8.4	8.8	8.2
MC13	2.5	9/29/77	1448	5.0	14.1	24.9	8.4	8.7	8.2
MC13	2.5	9/29/77	1452	10.0	14.4	24.9	8.4	8.7	8.2
MC13	2.5	9/29/77	1600	13.0	14.9	25.0	8.4	8.8	8.2
MC01	27.0	9/29/77	1650	0.0	13.0	0.3	9.5	9.5	7.4
MC01	27.0	9/29/77	1658	2.0	12.9	0.2	9.6	####	####
MC01	27.0	9/29/77	1715	4.0	12.9	0.2	9.8	####	####

APPENDIX III

Primary Productivity Measurements

Made by the University of Washington

Department of Oceanography in

Grays Harbor, Washington, July 26-28, 1977

Table III-1. Observed values of chlorophyll a, phaeopigments, and primary productivity in Grays Harbor, July 26-28, 1977. Measurements by the University of Washington Department of Oceanography.

Date	Station	Depth m	Depth ft.	Hour	Chl a mg/m^3	Phaeopigments mg/m^3	Fo/Fa	Productivity mgC/m^3/LAN-SS	Other
072677	MC13	0	0	0930	3.43	1.55	1.55	491.8	Secchi = 10 feet
072677	MC13	1.5	5	"	2.10	0.85	1.57	456.9	
072677	MC13	5.0	16	"	1.88	0.54	1.62	95.0	
072677	MC13	12.0	40	"	2.53	0.79	1.61	-	
072677	MC11	0	0	1020	2.98	1.57	1.52	317.1	Secchi = 8 feet
072677	MC11	1	3	"	2.89	1.66	1.51	256.2	
072677	MC11	3.5	12	"	1.57	0.70	1.55	64.6	
072677	MC11	10	33	"	1.62	0.59	1.59	-	
072677	MC09	0	0	1100	7.23	1.52	1.66	370.4	Secchi = 4 feet
072677	MC09	0.6	2	"	1.96	1.01	1.53	165.2	
072677	MC09	1.8	6	"	2.16	1.79	1.44	17.0	
072677	MC09	10.7	35	"	1.35	1.30	1.41	-	
072677	MC07	0	0	1135	6.48	1.18	1.68	344.8	Secchi = 3.5 feet
072677	MC07	0.6	2	"	2.98	1.43	1.54	113.6	
072677	MC07	1.5	5	"	0.79	1.06	1.34	33.1	
072677	MC07	10.4	34	"	1.59	1.69	1.39	-	
072777	MC13	0	0	1005	5.55	2.35	1.56	564.8	Secchi = 12 feet
072777	MC13	1.5	5	"	5.95	1.70	1.62	442.8	
072777	MC13	6.5	21	"	6.30	1.56	1.64	88.6	
072777	MC13	13.7	45	"	5.56	1.41	1.64	-	
072777	MC11	0	0	1050	4.33	1.73	1.57	418.5	Secchi = 7 feet
072777	MC11	1	3	"	4.60	1.89	1.57	302.4	
072777	MC11	3.5	11	"	3.61	2.02	1.51	47.2	
072777	MC11	8.5	28	"	4.42	1.93	1.56	-	
072777	MC09	0	0	1130	2.43	1.61	1.48	200.0	Secchi = 4 feet
072777	MC09	0.5	2	"	2.15	1.44	1.48	180.2	
072777	MC09	1.5	5	"	2.00	1.74	1.43	10.6	
072777	MC09	13.7	45	"	1.53	1.30	1.43	-	

Date	Station	Depth m	Depth ft.	Hour	Chl a mg/m^3	Phaeopigments mg/m^3	Fo/Fa	Productivity mgC/m^3/LAN-SS	Other
072777	MC07	0	0	1210	5.95	1.30	1.66	137.0	Secchi = 3 feet
072777	MC07	0.6	2	"	6.36	1.76	1.63	139.7	
072777	MC07	1.2	4	"	2.05	1.57	1.45	8.6	
072777	MC07	11.6	38	"	2.53	1.63	1.49	-	
072877	MC13	0	0	0705	3.25	1.52	1.55	292.3	Secchi = 8 feet
072877	MC13	1	3	"	2.38	1.35	1.51	176.4	
072877	MC13	4	13	"	3.52	1.68	1.54	25.5	
072877	MC13	11.9	39	"	3.07	2.85	1.41	-	
072877	MC11	0	0	0750	2.34	1.21	1.53	188.0	Secchi = 5 feet
072877	MC11	0.6	2	"	1.38	0.64	1.55	95.3	
072877	MC11	2.4	8	"	2.62	1.73	1.48	16.1	
072877	MC11	11.9	39	"	2.98	2.98	1.40	-	

Note: Station L32, chlorophyll sample from 2 feet, dilution volume may be incorrect, value thus doubtful.

Date	Station	Depth m	Depth ft.	Hour	Chl a mg/m^3	Phaeopigments mg/m^3	Fo/Fa	Productivity mgC/m^3/LAN-SS	Other
072877	MC09	0	0	0845	1.76	1.71	1.41	75.8	Secchi = 3 feet
072877	MC09	0.6	2	"	1.29	1.57	1.36	39.2	
072877	MC09	1.5	5	"	1.57	1.67	1.39	5.2	
072877	MC09	11.6	38	"	1.72	2.71	1.31	-	