CLEAR TECHNICAL REPORT NO. 291

1983-1984 Oxygen Depletion Study

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Summary and Conclusions

General

This study was implemented in order to provide minimum information on the oxygen status in the open waters of Lake Erie. Two important concepts need to be recognized:

1. The yearly stratification cycle for the central and eastern basins are quite different from each other.

2. The annual variation between and within a stratified season can be substantial. This means oxygen concentrations, oxygen depletion rates, individual limnion thickness/temperature and nutrient related processes all can show considerable variation.

Thus, this study was very limited in scope. Only a one month segment was examined in 1983 and 1984 which provided a single oxygen depletion data point each year. Based upon this restraint it is not possible to make any detailed interpretation of the 1983 and 1984 stratified season.

Central Basin

The 1983 and 1984 July period were found to be representitive of the year to year variation reported for the basin since the 1970 study (Burns 1976). The initial thickness, temperature and dissolved oxygen concentrations of the stratified layers are variables which can show considerable fluctuation annually and within the stratified season. These physical considerations together with the biological processes which are responsible for the production and/or consumption of oxygen in the three limnions all interact in determining the rate at which the hypolimnion waters are depleted of oxygen.

The July period was considered stable enough to provide information that could be used for long term trend analysis but it does have limited application. When the 1983 and 1984 rates were compared with rates calculated for an equivalent time frame (July) since 1970, it is evident that the rates recorded for the first half of 1980 have become somewhat more stable at a decreased level over ten years ago. It is expected that the depletion rates will further respond to the decrease in phosphorus loading and in-lake concentrations.

Eastern Basin

The eastern basin is somewhat more stable physically than the central basin. Due to the thicker and colder hypolimnion, oxygen concentrations are not as variable as those encountered in the central basin. Even though the basin is more stable, depletion rates do vary from year to year. The rate calculated for 1983 was less than the 1970 rate while the 1984 rate was considerably greater. The eastern basin data base is not nearly as complete as for the c entral basin thus a trend analysis is not possible at this time.

The 1983-1984 study provide information on the depletion rates for the eastern and central basins but were not temporally complete enough to provide detailed information on the status of these basins. Until the concentrations of major nutrients (ie. phosphorus) and chlorophyll have stablized the programs designed to examine current basin conditions and establish long term trends need to be more inclusive.

INTRODUCTION

Prior to the early 1950's the increase in the eutrophication of Lake Erie was not well documented. Since the early 1930's (Wright 1955), the western basin had shown signs of increased enrichment primarily through periodic blue-green algae blooms. However, the first clear evidence that Lake Erie was being seriously impacted by eutrophication came in the mid 1950's. During the summer of 1954, a very warm and storm free period provided the necessary conditions for the western basin to thermally stratify and subsequently become oxygen depleted at the sediment water interface. Up until this time the concentration of the benthic mayfly larvae (Hexagenia) had been reported to be between 100 to 400 organisms per square meter throughout much of the basin. This anoxic period (July through August) killed nearly all the mayfly larva in the basin and by the 1960's no mayflies were evident in the open water regions of the basin.

By the 1960's it became clear that the detrimental effects of eutrophication had begun to seriously impact the central basin as well. The hypolimnion waters were found to be void of oxygen during the later portion of summer stratification (late August through mid September). Not only did the anoxic period eliminate the cooler water habitat for fish and benthic organisms but also resulted in the regeneration of soluble nutrients ie. phosphorus from the sediment bound interstitial water.

Lake Erie's central basin has been monitored annually since 1973 as required by the Water Quality Agreement between the United States and Canada. As a result of the reoccurring problems of oxygen depletion in the central basin associated with culturally accelerated eutrophication ie. phosphorus enrichment, the major concern and focus has been on the central basin hypolimnion. Since the early 1970's, remedial programs have been designed to decrease these reoccurring episodes of anoxia. Phosphorus reduction programs were implemented at all major (> 1 MGD) municipal sewage treatment facilities discharging into the drainage basin. These programs have resulted in nearly a 100% reduction in the phosphorus loadings to the lake since 1970. This loading decrease has also resulted in a decrease of open lake central basin phosphorus concentrations from 20 ug/l in 1970 to 10 ug/l in 1982 (Rosa and Burns 1985).

The Center for Lake Erie Area Research (CLEAR) under contract to USEPA Great Lakes Program Office, Region V - Chicago, examined the central and eastern basin hypolimnion oxygen concentrations during 1983 and 1984. The study format and calculation procedure utilized for this two year program were designed to be as compatible as possible with the programs employed in previous years.

METHODS

The 1983 - 1984 oxygen study examined hypolimnion temperature, thickness, and oxygen concentrations in the central and eastern basins of Lake Erie. In addition, central and eastern hypolimnion dissolved oxygen depletions rates were determined for the midsummer period (July) in 1983 and 1984.

SAMPLING SCHEDULE:

Central and eastern basin open waters were sampled during the same time span in 1983 and 1984. This design provided data for oxygen depletion rate calculations over a mid-summer period when conditions in the hypolimnion are most stable. Thus, this study design provided comparable data sets for the two year period.

	1983	1984
CRUISE 1	JUNE 25 - 29	JULY 2 - 3
CRUISE 2	AUGUST 4 - 7	AUGUST 7 - 9

SAMPLING LOCATIONS:

During the 1983 field season 14 stations were sampled in the central basin and 5 stations were sampled in the eastern basin. A somewhat different station pattern was used in the 1984 field season with 9 stations sampled in the central basin and 6 stations sampled in the eastern basin. Table 1 lists the station numbers and locations for both field seasons while Figures 1a and 1b present the relative station positions. The station pattern was modified to accommodate differences in ongoing tandem research programs during the two field seasons. Considering the similarity in the two sampling patterns ie. both patterns provided adequate coverage of the stratified region in both basins, no significant difference between the 1983 and 1984 results could be attributed to differences in the sampling patterns.

FIELD PROCEDURES:

Sample depths were determined from an Electronic Bathythermograph Trace (EBT) and water samples were obtained using Niskin bottles coupled with the EBT unit (Rosette Sampler). Water samples were taken in the following depth configuration:

1 Meter
Lower Epilimnion
Upper Hypolimnion
Bottom Minus 1 Meter

Dissolved oxygen concentrations were determined according to BStandard Methods procedures (APHA 1981).

QUALITY ASSURANCE

The quality assurance program for this study was designed to provide information about the reliability of the data base collected during the study. Ten percent of the total samples were replicated to determine variability between samples. Standard deviations were estimated by summing the differences between duplicate samples , calculating a mean and dividing by 1.128 (as suggested by the IJC). Acceptable limits for the range of differences were determined by multiplying the mean difference by the predetermined factor of 3.27. The calculated control limits for dissolved oxygen titrations was +/-.35. None of the data collected exceeded the control limits.

DATA ANALYSIS

Data analysis procedures used to evaluate open lake data bases were similar to those used in past studies (Fay et al. 1983). These procedure followed a sequence of steps. First, data for each of the parameters was entered into a data base file and reviewed for possible errors. Biomedical Computer Programs (BMDP) statistical software programs were then used to calculate means, medians, standard errors, 25 and 75 percent quartiles and histograms of the data set. The resulting data was plotted following a modified notch block plot format (Reckhow 1980). In addition, all data were tabulated and are presented in Appendixes A (1983) and B (1984).

Volume weighted mean concentrations of dissolved oxygen were determined for each limnion (epilimnion and hypolimnion) using the Survey "8" volume weighting program (Hanson et al, 1978). Oxygen depletion rate calculations were made using the Mesolimnion Exchange Model (Burns 1976). This model has been used for rate calculations since 1970 and was applied to the data sets to produce comparable values.

The dissolved oxygen depletion rates reported in this report for 1983 and 1984 were calculated for the open lake representivitve areas (Figure 1a and 1b) of the central and eastern basins as defined by Rosa and Burns (1985). Thus not all stations surveyed were included in the calculation procedure in order to make the rates compatable with previously reported data.

DATA INTERPRETATION

CENTRAL BASIN

Temperature Cycle:

Epilimnion and hypolimnion temperatures recorded during the July and August cruises in 1983 and 1984 were representative of the normal seasonal cycle. In addition, the differences between the two years were within the normal year to year variablity characteristic of the central basin (Figure 2).

Surface temperatures recorded during late June/early July indicated that lake temperatures were still increasing. Solar energy continues to add heat to the water column until early August when the surface waters reach their maximum. Consequently, the surface temperatures recorded during the early August cruise (1983 and 1984) indicated that epilimnion temperatures were near the maximum seasonal values (1983 - 23.5 C and 1984 - 24.5 C) (Table 2).

The hypolimnion temperatures recorded during the first survey of both 1983 and 1984 were indicative of the early seasonal temperature cycle (Figure 2). By the first cruise (late June/early July), hypolimnion temperatures had already increased over the temperatures recorded during the initial stages of thermal stratification (late May/early June). The mean 1983 late June/early July hypolimnion temperature (9.5 C) was 1 C warmer than the 1984 early summer bottom temperature however, this difference is typical of the year to year variability. As with the epilimnion, bottom or hypolimnion temperatures also increase through the stratified period. Over the cruise interval, mean hypolimnion temperatures increased by 0.8 C in 1983 and 1.3 C in 1984. This means that by early August temperatures may have increased 2 to 3 C over initial hypolimnion temperatures measured during early June and will continue to increase until fall mixing occurs. Mean hypolimnion temperatures calculated for the early August cruises of 1983 and 1984 were within 0.5 C (Table 2).

Thermal Structure:

Thermal stratification in the central basin exists for approximately 110 days, generally extending from late May through mid September. Due to the configuration and shallowness of the basin, the hypolimnion is considerably thinner than normally encountered in the other Great Lakes or even the eastern basin of Lake Erie. The average hypolimnion is approximately 4 meters thick covering an area of over 10,000 km .

The hypolimnion thickness recorded for 1983 was typical for the central basin (Figure 3). Two interesting observations were evident from the 1983 EBT information. First, the hypolimnion thickness was found to range from 1.7 to 7.7 meters. The central basin hypolimnion is characterized by a semi-permanent tilt, resulting in a thicker hypolimnion along the northern half of the basin and a thinner hypolimnion along the southern portion. This tilt results from southwesterly prevailing winds creating a depression in the southwestern corner of the basin and upwelling along the northern shore. Thus a range of 5 or more meters in hypolimnion thickness accross the basin is not considered unusual.

Second, an increase in the mean hypolimnion thickness and volume were noted during the 1983 stratified season. Between the June and August cruises the hypolimnion thickened by 1.3 meters and the volume increased from 61.7 to 73.9 km3 (Table 3). The total area of the hypolimnion decreased due to the erosion of hypolimnion waters in the shallower (< 15 meters) shoreline regions. This most commonly occurs in the southwestern section of the basin known as the Sandusky Sub-basin which has a mean depth of 13 meters. Increasing hypolimnion volumes were first reported for the central basin by Burns and Ross (1972) and recently studied by Ivey and Boyce (1982). An increasing volume results from the incorporation of mesolimnion waters into the hypolimniBon generally due to either internal waves or seiche activity. Accompanying this volume increase is an increase in the temperature and dissolved oxygen concentration. This is due to the higher oxygen concentrations and warmer water found in the incorporated mesolimnion waters. Thus, this volume increase represents an important physical process affecting the hypolimnion oxygen budget.

During 1984 a typical hypolimnion configuration was also apparent. The hypolimnion thickness again ranged from 6 to 9 meters in June and from 2 to 10 meters in August, indicative of the north - south tilt previously discussed. In contrast to the 1983 season, the hypolimnion indicated a steady thickness decrease over the period surveyed (Figure 3, Table 3).

Dissolved Oxygen:

Epilimnion dissolved oxygen concentrations are not an important consideration in Lake Erie since concentrations are not depleted to levels considered detrimental to oxygen dependent organisms. In fact, oxygen concentrations in the epilimnion are rarely found to be less than 85% of saturation and are frequently found to be in excess of 100% (Table 2). The oxygen rich conditions can be attributed to the free oxygen exchange between the surface waters and the atmosphere and to the photosynthetic production of oxygen by the phytoplankton community.

On the other hand, central basin hypolimnion dissolved oxygen annually decreases to levels below the minimum concentration necessary to sustain aerobic life. Since the hypolimnion can not freely exchange with the oxygen rich epilimnion and photosynthic oxygen production is not sufficient to offset the demand for oxygen by heterotrophic organisms, a net depletion of oxygen is recorded for the basin. Since the hypolimnion can not replenish the oxygen as rapidily as it is consumed and it contains an insufficient oxygen reservoir, the central basin hypolimnion is generally depleted of all dissolved oxygen reserves by early September.

The initial hypolimnion oxygen concentration and quantity varies annually depending on the initial hypolimnion temperature. The early 1983 (cruise 2) hypolimnion oxygen concentrations were 2.5 mg/l lower than the concentrations recorded for the same period during 1984 (Figure 4). The percent saturation calculated for 1983 was also less than that calculated for 1984 (Figure 5). These differences in the initial dissolved oxygen picture can be attributed to two factors. First, the 1984 hypolimnion temperature was nearly 1 C colder than in 1983, thus the 1984 initial oxygen content of the hypolimnion would have been slightly greater due to temperature dependent saturation. Second, the 1984 hypolimnion was found to be over 3 meters thicker than the 1983 hypolimnion, consequently the oxygen reservoir was 1.7 times greater in 1984 (Table 4). Since there was a greater quantity of oxygen available during 1984 the concentration would remain greater assuming equal depletion rates. As a result of these two factors the 1984 hypolimnion was found to have an initially (late June) higher oxygen concentration than was measured in 1983.

By the August cruise the mean 1984 central basin hypolimnion oxygen concentration was only 0.6 mg/l greater than the 1983 concentration (Figure 4) and the percent saturation was nearly the same (Figure 5). In addition, the mean hypolimnion temperature for 1983 and 1984 was now only 0.5 C different however the 1983 hypolimnion was thicker than the 1984 hypolimnion. Since the 1983 hypolimnion thickness increase was a result of an incorporation of mesolimnion water (richer in oxygen), the initially lower concentration and quantity of oxygen recorded during 1983 was offset resulting in similar oxygen conditions by early August. The entrainment process and subsequent reoxygenation have also been recorded during past central basin hypolimnion studies (Burns 1976).

OXYGEN DEPLETION RATES:

The calculation procedure used to determine the central basin hypolimnion oxygen rates for 1983 and 1984 followed a step-wise progression in order to insure the resulting rates would be comparable with the existing data base. First, the Survey "8" program was used to produce volume-weighted concentrations of dissolved oxygen, hypolimnion temperatures and limnion thicknesses for the complete central basin data set. This output was used to produce contour maps for the parameters discussed (Appendix C).

Second, the Survey "8" program was rerun restricting the area used for to the region identified to be representitive of the open of the basin (Rosa and Burns 1985). This provided the necessary information ie. dissolved oxygen concentrations, hypolimnion thickness and temperatures for the defined region.

Lastly, the Mesolimnion Exchange Model (Burns 1976) was used to calculate the quantity of oxygen added to the hypolimnion by physical processes. With this information, depletion rates were than calculated for the central basin open lake region. The results were than compared with rates determined for previous years which also had been corrected for vertical mixing (Rosa and Burns 1985).

The depletion rates calculated for the mid-summer (July) of 1983 and 1984 were 2.92 and 3.16 mg/l/mo. respectively (Figure 6). The 1983 and 1984 rates were plotted with rates calculated for the representitive area during the mid-summer (July) period from 1970 through 1982. The early 1980's depletion rates seem to represent a decrease compared to rates calculated for the early 1970's. If a downward trend in depletion rates is developing, the change can be considered to be a response to remedial action programs designed to reduce point source phosphorus loadings to the lake.

EASTERN BASIN

Temperature Cycle:

As was reported for the central basin, the eastern basin epilimnion and hypolimnion temperatures recorded during the 1983 and 1984 cruises were representitive of the normal seasonal cycle. The year to year variation was also within the normal range of annual variability (Figure 7). The 1983 - 1984 early cruise epilimnion temperatures showed the greatest difference (> 3 C) while the August cruises and the hypolimnion temperatures for the early and late summer cruises varied by less than 1 C (Table 5).

Surface temperatures measured in the eastern basin during late June of 1983 were cooler than those recorded for the same period in 1984 (2.6 C). This variation was due to cooler 1983 spring and early summer temperatures than recorded during 1984. In contrast, the 1983 - 1984 central basin epilimnion temperatures did not vary as greatly during the early summer. Due to the greater mean depth of the eastern basin compared to the central basin (27 vs 18 meters) early spring temperatures have a less pronounced effect on the heat budget during the early stratified period. Eastern basin surface temperatures reached near maximum levels by mid-August (23 - 24 C). Even though early summer surface temperatures were cooler in 1983, the mean August temperature was nearly 1 C warmer than the 1984 surface temperatures.

Stratification in the eastern basin initially begins to develop when water column (surface) temperatures begin to increase above 4 - 5 C. Due to the thicker eastern basin hypolimnion, the bottom water temperatures do not significantly increase through the stratified period. By the August cruise in both 1983 and 1984 mean hypolimnion temperatures had not increased by more than 1 C reaching nearly 6 C, while central basin values had elevated to 10 C. This colder hypolimnion temperature permits the eastern basin to maintain higher oxygen concentrations due to the saturation effect and at the same time keeps the biological metabolic activity at a slower rate. Thus the year to year variability in eastern basin hypolimnion temperatures is less than that associated with the central basin and is more representitive of the other Great Lakes.

Thermal Structure:

The stratified period in the eastern basin begins in early June and terminates by late October or early November. Thus, stratification persists for approximatly 135 - 145 days or over a month longer than in the central basin. The deeper conical configuration of the eastern basin allows for the formation of a thermal structure similar to that encountered in the other Great Lakes. If the thermal structure of a central basin station which has a depth of 20 meters is compared with an eastern basin station having a depth of 60 meters, differences in the mid-summer vertical profile are apparent:

	CENTRAL BASIN		EASTERN BASIN	
	THICKNESS (M)	%	THICKNESS (M)	%
EPILIMNION	14	70	36	60
MESOLIMNION	2	10	9	15
HYPOLIMNION	4	20	25	25

The percent of water column distributed between the three limnions is similar for the two basins however the actual thickness of the individual limnions is significantly greater in the eastern basin. The substantially thicker eastern basin hypolimnion accounts for the temperature and to a lesser degree oxygen stability of this water mass.

The volume weighted limnion thickness results from Survey "8" (Table 6) indicate a somewhat different thermal structure for the 1983 and 1984 early summer sampling period. During the first cruise in 1984 a narrow mesolimnion was encountered (3.8 meters) compared with a 10.6 meter thick mesolimnion found in 1983. This resulted in a hypolimnion that was 3 meters thicker during the first cruise in 1984 (17.4 meters) than was encountered during the June cruise of 1983 (Figure 8). Generally, the sharpness of the thermal structure is dependant upon the mixing of the water column (wind and wave action), consequently the more intense the mixing action the sharper the demarcation between the limnions. Due to the intensity of the 1984 early summer winds, the demarcation between the limnions in 1984 was sharper than that observed during the first cruise of 1983.

The August thermal structure (1983 and 1984) was characterized by a nearly equal thickness of epilimnion, mesolimnion and hypolimnion. The 1983 thermal structure indicated a normal seasonal increase in epilimnion thickness and volume and a slight decrease of both the mesolimnion and hypolimnion (Table 6). In 1984 a significant change in the thermal profile occurred between cruises. A major portion of the hypolimnion water mass was incorporated into the mesolimnion resulting in an increase in the mesolimnion water mass. The mean 1984 mesolimnion volume (thickness) increased from 19.2 km (3.8 meters) in June to 60 km (13.4 meters) in August or nearly a four fold increase. While during the same interval the hypolimnion volume (thickness) decreased from 78.8 km (17.4 meters) to 32.6 km (11.9 meters). Over this period the mesolimnion temperature increased only 2.4 C while the epilimnion temperature increased by 4.6 C. This indicates that the major contribution of water to the mesolimnion orginated from the colder hypolimnion layer.

The year to year variation in thermal structure described for the 1983 and 1984 field seasons is in the normal range of variablity consistant with the variation in the annual meterological cycle.

DISSOLVED OXYGEN:

Eastern basin epilimnetic dissolved oxygen values recorded during 1983 and 1984 were all greater than 80% saturated with numerous values recorded exceeding 100% saturation. As reported for the central basin, the epilimnion of the eastern basin also maintains dissolved oxygen concentrations in excess of 7 mg/l (Table 5).

Unlike the central basin, eastern basin hypolimnion dissolved oxygen concentrations do not reach critical levels during the stratified period. Similar concentrations were recorded for both years of the study. Initial mean hypolimnion oxygen concentrations measured for the early cruises in 1983 and 1984 were 10.4 and 10.8 mg/l respectively while the 1983 and 1984 August concentrations were 8.5 and 8.8 mg/l (Figure 9). Mean concentrations only decreased by 2 mg/l over the month of July during both years.

OXYGEN DEPLETION RATES:

Since the eastern basin has not presented an oxygen depletion problem, at least in the deeper regions (Figure 10), there has not been an intensive effort to monitor the oxygen regime in the basin equivalent to the past programs employed in the central basin. Consequently, a historical record of eastern basin oxygen depletion rates similar to that which is available for the central basin has not been developed.

Table 7 presents the volumetric and areal depletion rates for the 1983 and 1984 eastern basin hypolimnion. The volumetric rates calculated for midsummer (July) 1983 and 1984 were 1.40 and 1.86 mg/0 /month respectively. The rate calculated for the eastern basin midsummer period (July) during the 1970 Lake Erie study (Burns 1976) was 1.47 mg/0 /month. Based on the variation in the rates observed for the central basin over the period of record, it is not possible at this time to comment definitively on the eastern basin trend.

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TABLE 1

Geographic Coordinates of the 1983 - 1984
Lake Erie Oxygen Depletion Stations

Station	Basin	Latitude(N)	Longitude(W)	Water Depth (m)	Year
6	E	423754	792400	27.5	84
9	E	423218	793700	46.6	83-84
10	E	424048	794130	31.8	83-84
15	E	423100	795336	60.2	83-84
18	E	422518	800448	39.8	83-84
24	C	420554	802900	22.0	83
25	C	421454	803336	21.5	83
26	C	422400	803812	19.8	83
30	C	422548	801218	20.5	83
32	C	420454	810042	21.5	83
36	C	415606	812842	22.9	83-84
37	C	420636	813430	23.9	83-84
38	C	421654	814018	21.6	83-84
42	C	415754	820230	22.2	83-84
43	C	414718	815642	22.6	83-84
47	C	415018	821248	18.9	83
63	E	422500	794800	45.3	83-84
73	C	415840	814525	24.1	83-84
78	C	420700	811500	22.5	83-84
79	C	421500	804800	20.5	83-84

TABLE 2

CENTRAL BASIN WATER QUALITY SUMMARY

YEAR	DATE	LIMNION	STATISTICS	TEMP. (C)	D.O. (MG/L)	D.O. SAT. (%)
19B83	6/27	EPI	MEAN	19.0	8.2	86.3
			SE	0.7	0.1	0.3
			MEDIAN	18.5	8.3	86.1
			MAX	22.2	8.7	87.9
			MIN	16.5	7.6	84.2
			N	13	14	14
	6/27	HYPO	MEAN	9.5	6.7	58.5
			SE	0.3	0.2	2.3
			MEDIAN	9.5	6.8	58.5
			MAX	11.1	8.1	71.0
			MIN	8.0	4.7	40.7
			N	10	14	14
	8/5	EPI	MEAN	23.5	7.9	92.4
			SE	0.3	0.1	0.2
			MEDIAN	23.5	7.9	92.3
			MAX	25.0	8.2	93.4
			MIN	21.0	7.7	90.2
			N	13	13	13
	8/5	HYPO	MEAN	10.3	3.9	34.2
			SE	0.4	0.5	4.0
			MEDIAN	10.8	3.3	29.4
			MAX	13.0	8.0	69.0
			MIN	7.0	2.1	18.8
			N	13	13	13

TABLE 2 CONTINUED

CENTRAL BASIN WATER QUALITY SUMMARY

YEAR	DATE	LIMNION	STATISTICS	TEMP. (C)	D.O. (MG/L)	D.O. SAT. (%)
1984	7/2	EPI	MEAN	19.7	8.9	94.5
			SE	0.3	0.1	1.5
			MEDIAN	19.7	8.9	96.1
			MAX	20.9	9.8	103.8
			MIN	18.4	7.9	82.5
			N	8	13	16
	7/2	HYPO	MEAN	8.6	8.2	70.5
			SE	0.1	0.2	1.6
			MEDIAN	8.7	8.0	68.3
			MAX	8.9	9.9	85.3
			MIN	8.1	7.4	63.5
			N	8	16	16
	8/8	EPI	MEAN	24.5	8.0	94.5
			SE	0.2	0.2	3.2
			MEDIAN	24.3	8.5	99.7
			MAX	25.5	8.7	107.7
			MIN	23.5	5.1	57.4
			N	9	17	18
	8/8	HYPO	MEAN	9.9	4.5	39.3
			SE	0.2	0.4	3.8
			MEDIAN	9.8	4.8	40.9
			MAX	10.6	7.2	63.4
			MIN	8.9	1.9	16.6
			N	9	16	16

TABLE 3

Lake Erie Central Basin Limnion, Oxygen and Temperature Data
From Survey 8 Volume Weighting Procedure

Date	Yr/Cruise	Limnion	Volume (km3)	Area (km2)	Thickness (m)	Oxygen (mg/l)	Temp (C)
6/25-6/29	83/2	epi	182.9		11.2	8.2	19.2
		meso	72.4		4.9	7.4	14.8
		hypo	61.7	13,413	4.6	6.6	10.3
		total	317.0				
8/4-8/7	83/6	epi	213.9		13.1	7.7	23.6
		meso	29.1		2.2	5.7	16.4
		hypo	73.9	12,525	5.9	4.0	10.4
		total	316.9				
7/2-7/3	84/1	epi	206.5		12.6	8.9	19.4
		meso	27.8		1.9	8.5	13.4
		hypo	82.6	13,322	6.2	8.5	9.1
		total	316.9				
8/7-8/9	84/2	epi	196.7		12.0	8.2	23.5
		meso	71.7		4.8	6.3	16.2
		hypo	47.0	11,190	4.2	4.9	9.9
		total	315.4				

TABLE 4

Summary of Central Basin Hypolimnetic Surveys

Yr/Date	Area (km2)	Volume (km3)	Thick- ness (m)	Heat Total kcal (*)	Heat Conc (C)	02 Total kg 02 (**)	02 Conc mg/l	AVG T Grad C/m	AVG 02 Grad g 02/m
1983									
6/25 6/29	13,413	61.7	4.6	635.5	10.3	407.2	6.6	1.82	0.32
8/4- 8/7	12,525	73.9	5.9	768.6	10.4	295.6	4.0	6.0	1.68
1984									
7/2- 7/4	13,322	82.6	6.2	751.7	9.1	702.1	8.5	5.42	0.21
8/7- 8/9	11,190	47.0	4.2	465.3	9.9	230.3	4.9	2.83	0.69

*=kcal x 10(12)
**=kg 02 x 10(6)

TABLE 5

EASTERN BASIN WATER QUALITY SUMMARY

YEAR	DATE	LIMNION	STATISTICS	TEMP. (C)	D.O. (MG/L)	D.O. SAT. (%)
1983	6/27	EPI	MEAN	16.4	8.6	85.5
			SE	0.2	0.1	0.2
			MEDIAN	16.3	8.6	85.3
			MAX	17.3	8.7	86.2
			MIN	16.0	8.5	84.8
			N	5	5	5
	6/27	HYPO	MEAN	5.5	10.4	84.5
			SE	0.3	0.3	2.6
			MEDIAN	5.5	10.8	87.5
			MAX	6.3	11.0	88.2
			MIN	4.7	9.1	74.7
			N	5	5	5
	8/5	EPI	MEAN	24.2	7.9	93.5
			SE	0.1	0.1	0.4
			MEDIAN	24.1	7.9	93.4
			MAX	24.6	8.0	94.8
			MIN	23.8	7.8	92.4
			N	5	5	5
	8/5	HYPO	MEAN	5.8	8.5	69.4
			SE	0.3	0.2	1.8
			MEDIAN	5.6	8.6	69.8
			MAX	6.8	9.3	75.4
			MIN	5.1	7.9	65.4
			N	5	5	5

TABLE 5 CONTINUED

EASTERN BASIN WATER QUALITY SUMMARY

YEAR	DATE	LIMNION	STATISTICS	TEMP. (C)	D.O. (MG/L)	D.O. SAT. (%)
1984	7/2	EPI	MEAN	19.0	9.8	101.3
			SE	0.2	0.2	1.8
			MEDIAN	19.0	9.6	98.4
			MAX	19.7	11.1	114.4
			MIN	18.6	8.9	95.1
			N	6	12	12
	7/2	HYPO	MEAN	5.0	10.8	88.3
			SE	0.1	0.2	1.5
			MEDIAN	5.5	10.9	88.2
			MAX	5.3	11.6	96.8
			MIN	4.6	9.4	79.9
			N	6	12	12
	8/8	EPI	MEAN	23.4	8.6	99.7
			SE	0.1	0.1	1.7
			MEDIAN	23.5	8.5	100.3
			MAX	23.8	9.1	105.5
			MIN	22.8	7.5	82.1
			N	6	11	12
	8/8	HYPO	MEAN	5.9	8.8	71.5
			SE	0.5	0.4	3.0
			MEDIAN	5.4	9.2	73.3
			MAX	8.3	10.0	81.0
			MIN	4.8	5.6	47.5
			N	6	10	11

TABLE 6

Lake Erie Eastern Basin Limnion, Oxygen and Temperature Data
From Survey 8 Volume Weighting Procedure

Date	Yr/Cruise	Limnion	Volume (km3)	Area (km2)	Thick ness (m)	Oxygen (mg/l)	Temp (C)
6/25-6/27	83/2	epi	66.0		11.2	8.6	16.5
		meso	52.4		10.6	10.2	8.7
		hypo	42.6	2,938	14.5	10.4	5.8
		total	161.0				
8/4-8/7	83/6	epi	80.3		13.6	7.9	24.1
		meso	49.2		10.6	9.2	13.0
		hypo	31.5	2,972	10.6	8.5	5.9
		total	161.0				
7/2-7/3	84/1	epi	63.0		10.7	9.8	18.3
		meso	19.2		3.8	10.5	12.5
		hypo	78.8	4,529	17.4	10.7	6.2
		total	161.0				
8/7-8/9	84/2	epi	65.4		11.4	8.6	22.9
		meso	60.0		13.4	8.3	14.9
		hypo	32.6	2,739	11.9	8.8	5.9
		total	158.0				

TABLE 7

Summary of Eastern Basin Hypolimnetic Surveys

Yr/Date	Area (km2)	Volume (km3)	Thick-ness (m)	Heat Total kcal (*)	Heat Conc (C)	02 Total kg 02 (**)	02 Conc mg/l	AVG T Grad C/m	AVG 02 Grad g 02/m
1983									
6/25-6/29	2,938	42.6	14.5	247.1	5.8	443.0	10.4	1.01	-.17
8/4-8/7	2,972	31.5	10.6	185.9	5.9	267.8	8.5	1.72	-.06
1984									
7/2-7/3	4,529	78.8	17.4	488.6	6.2	843.2	10.7	3.18	-.24
8/7-8/9	2,739	32.6	11.9	192.3	5.9	286.9	8.8	1.27	-.02

*=kcal x 10(12)
**=kg 02 x 10(6)

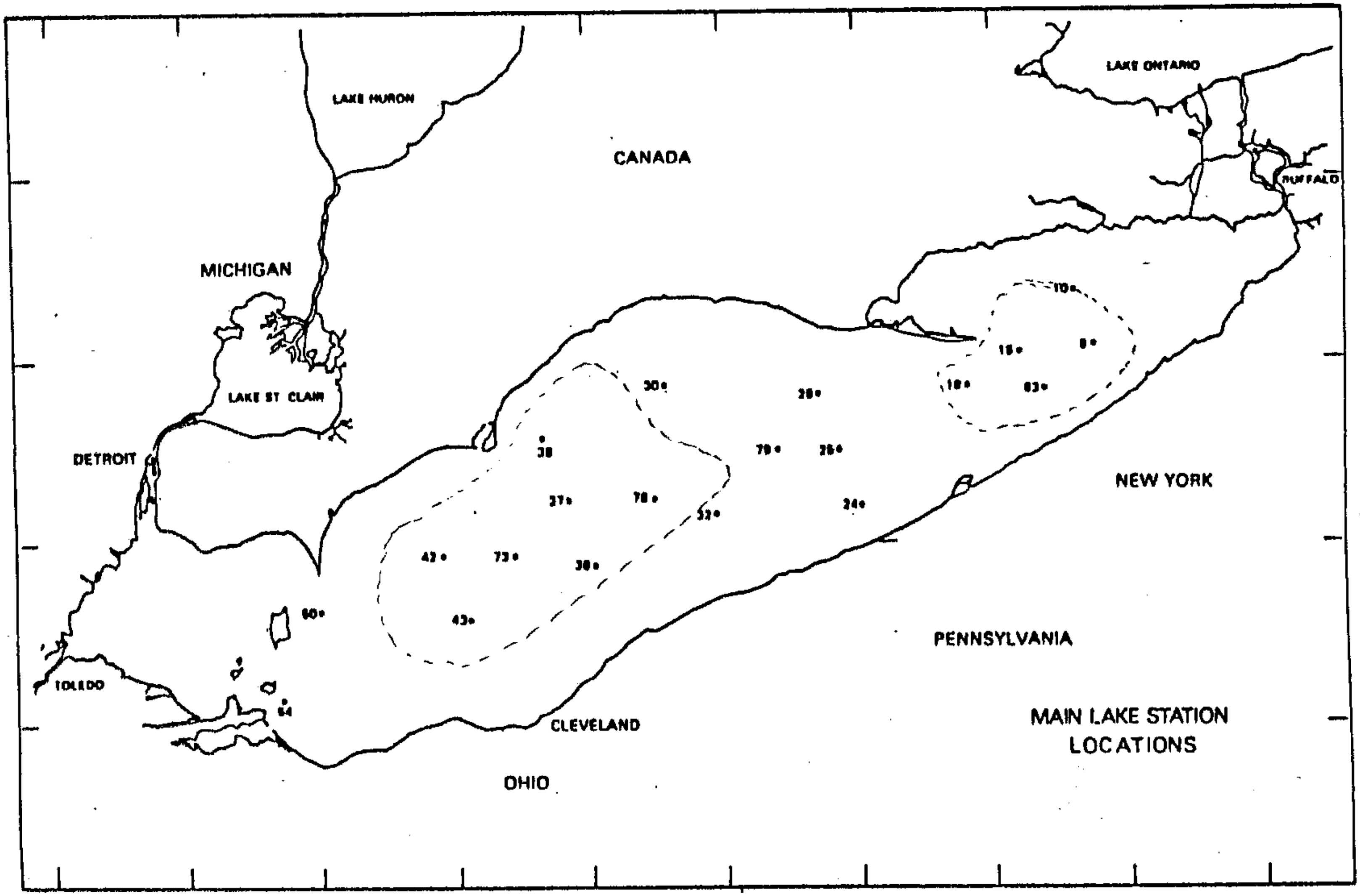


Figure 1a. 1983 Sampling Stations

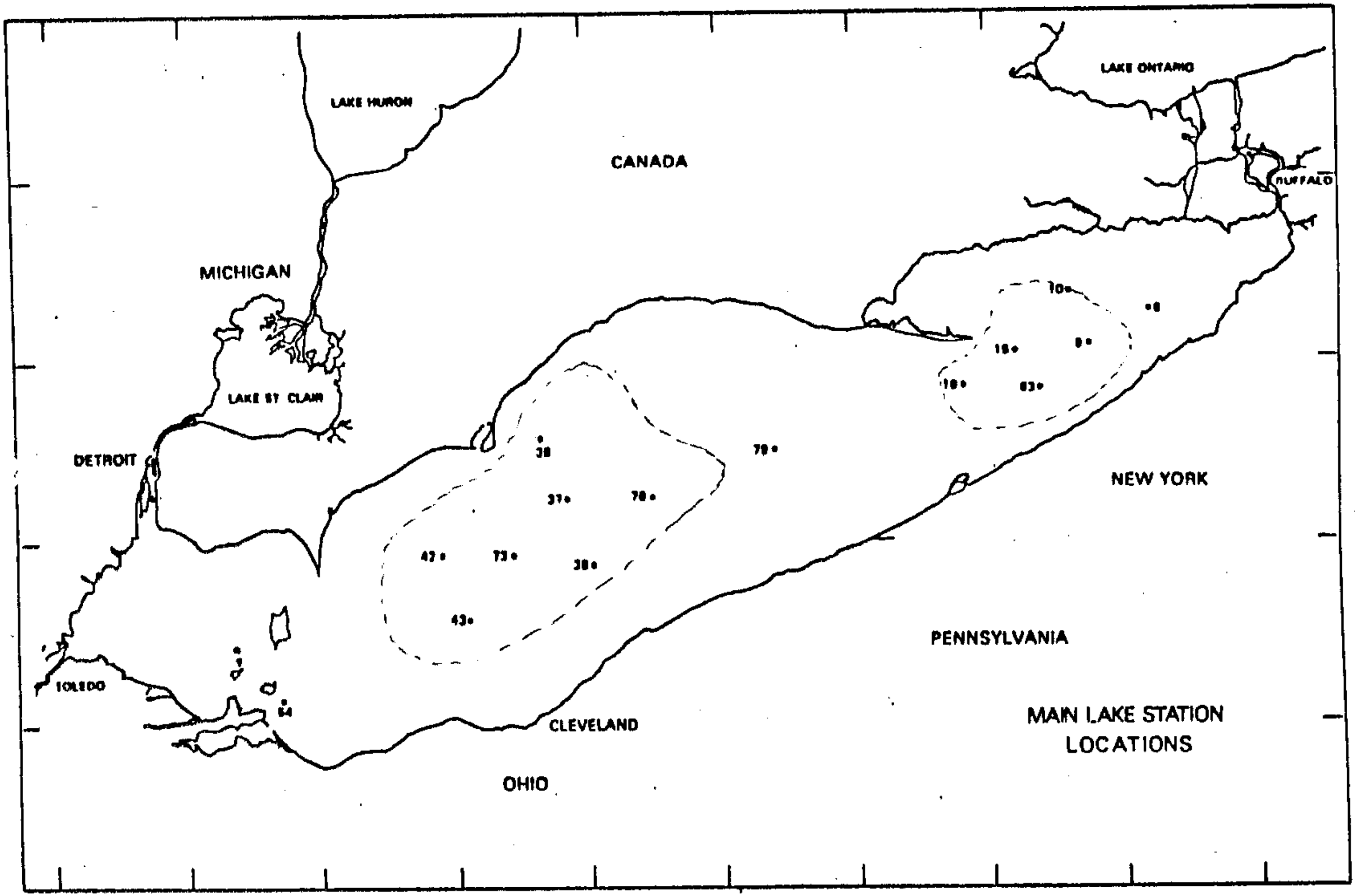


Figure 1b. 1984 Sampling Stations

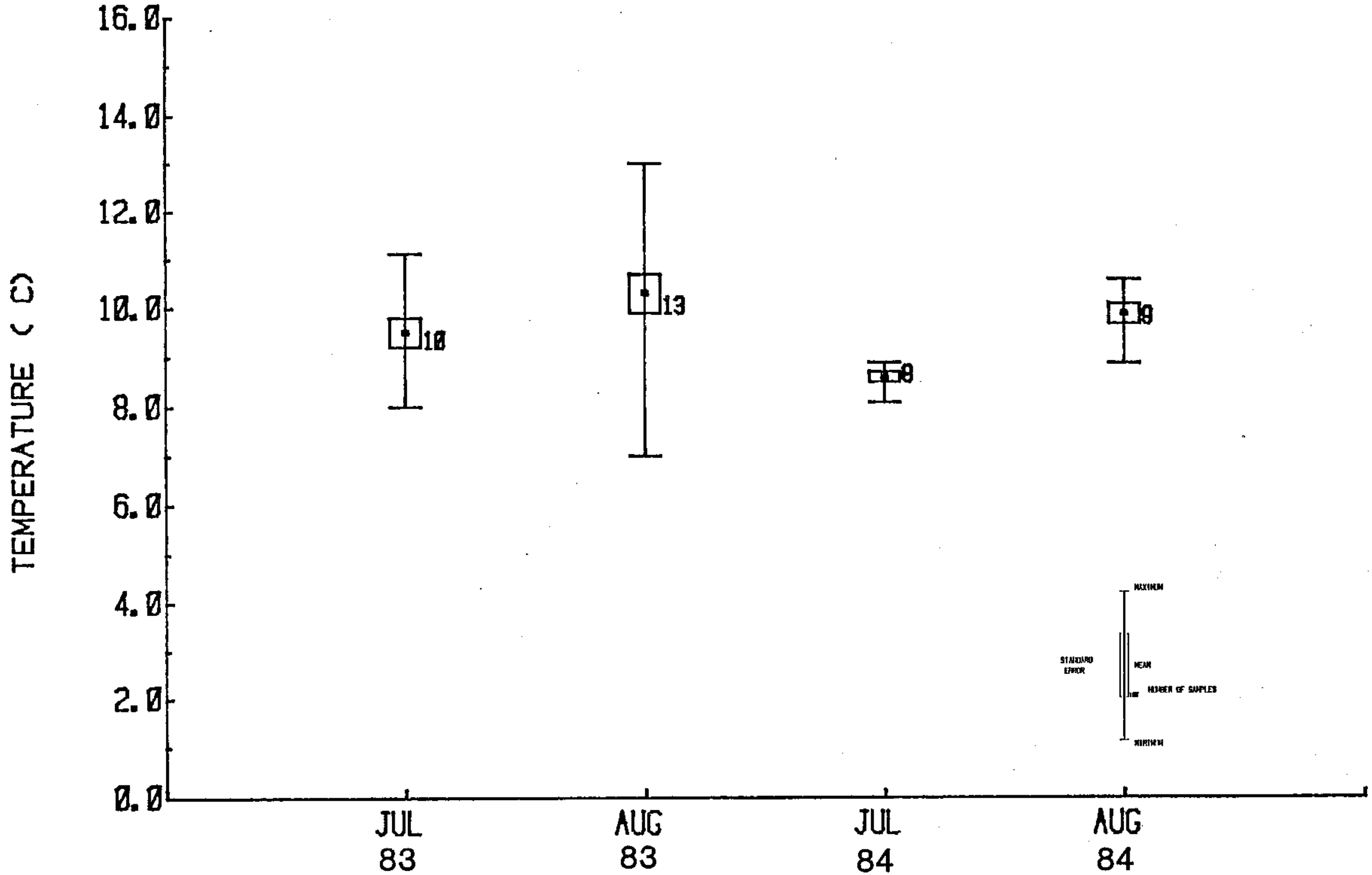


FIGURE 2. MEAN CENTRAL BASIN HYPOLIMNION TEMPERATURE FOR 1983 AND 1984.

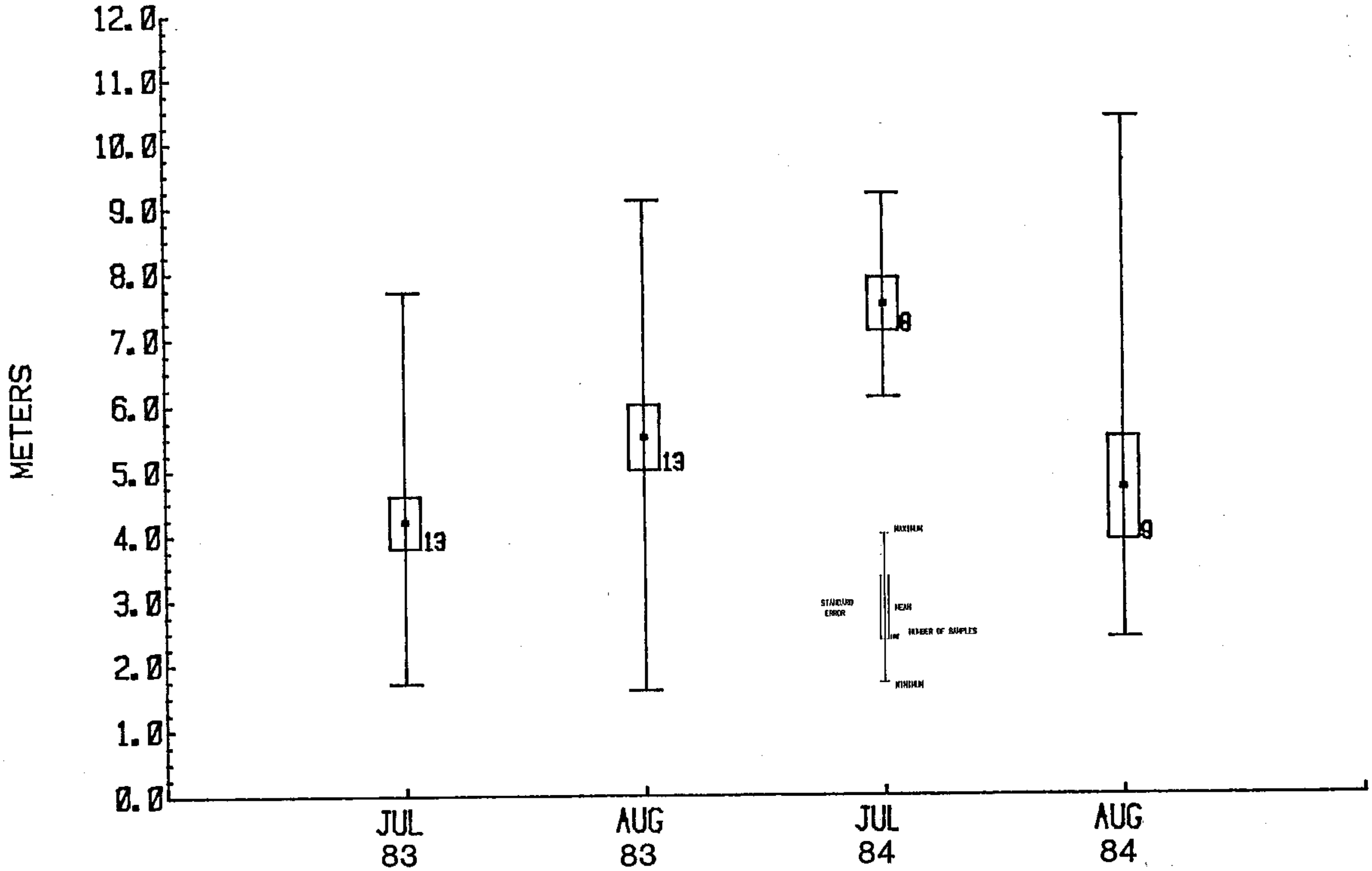


FIGURE 3. MEAN CENTRAL BASIN HYPOLIMNION THICKNESS FOR 1983 AND 1984.

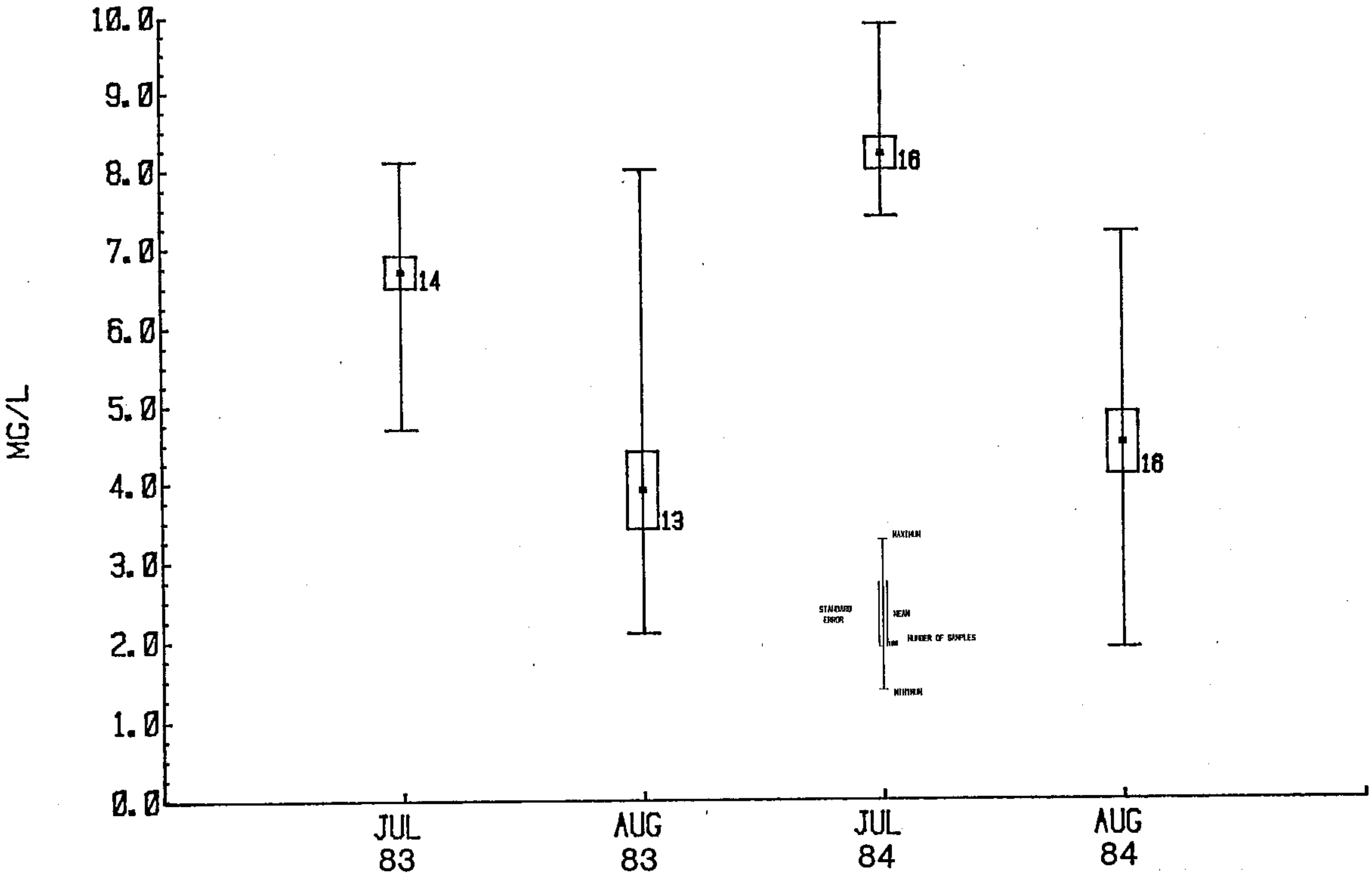


FIGURE 4. MEAN CENTRAL BASIN HYPOLIMNION DISSOLVED OXYGEN CONCENTRATIONS FOR 1983 AND 1984.

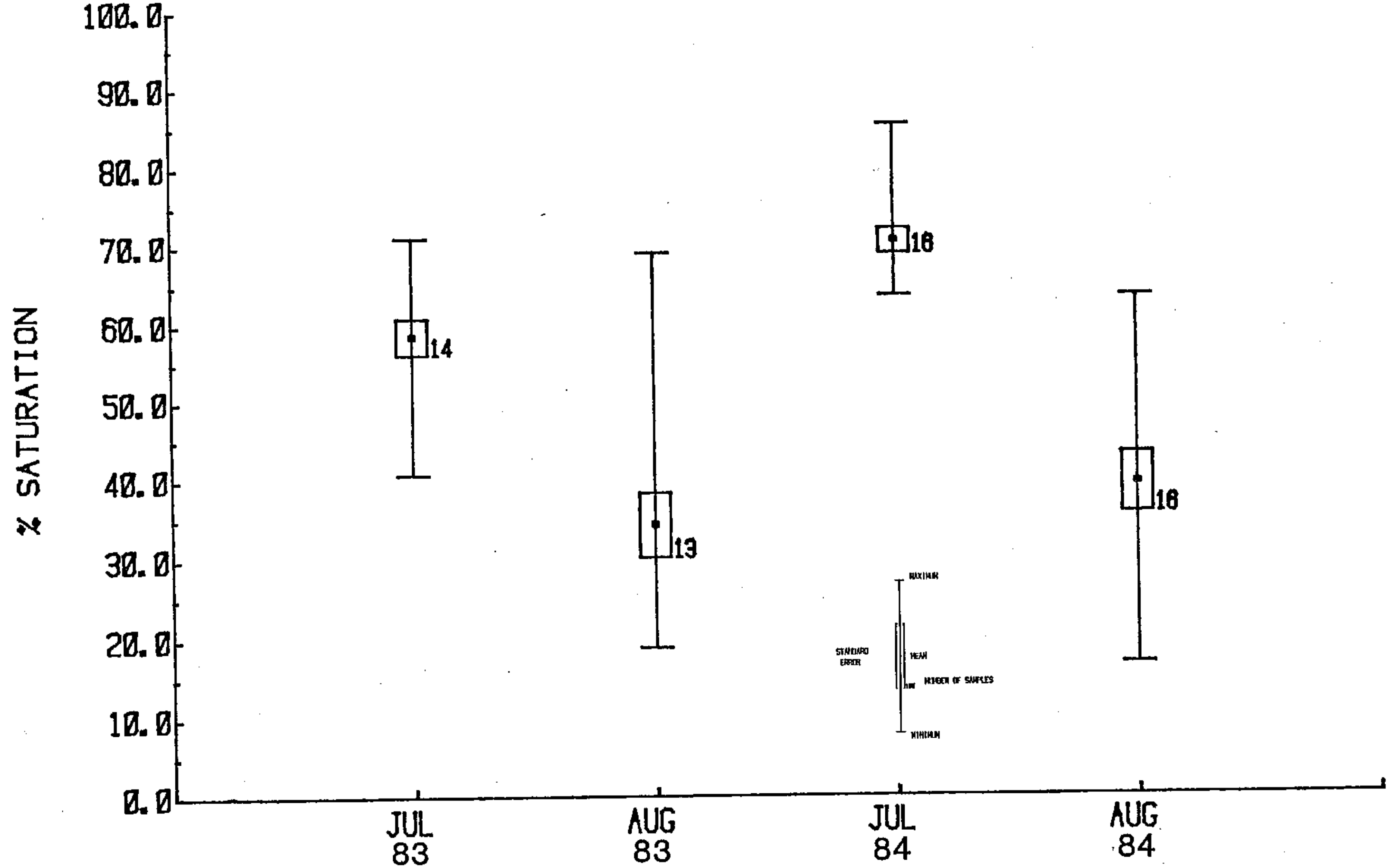


FIGURE 5. MEAN CENTRAL BASIN HYPOLIMNION DISSOLVED OXYGEN PERCENT SATURATION FOR 1983 AND 1984.

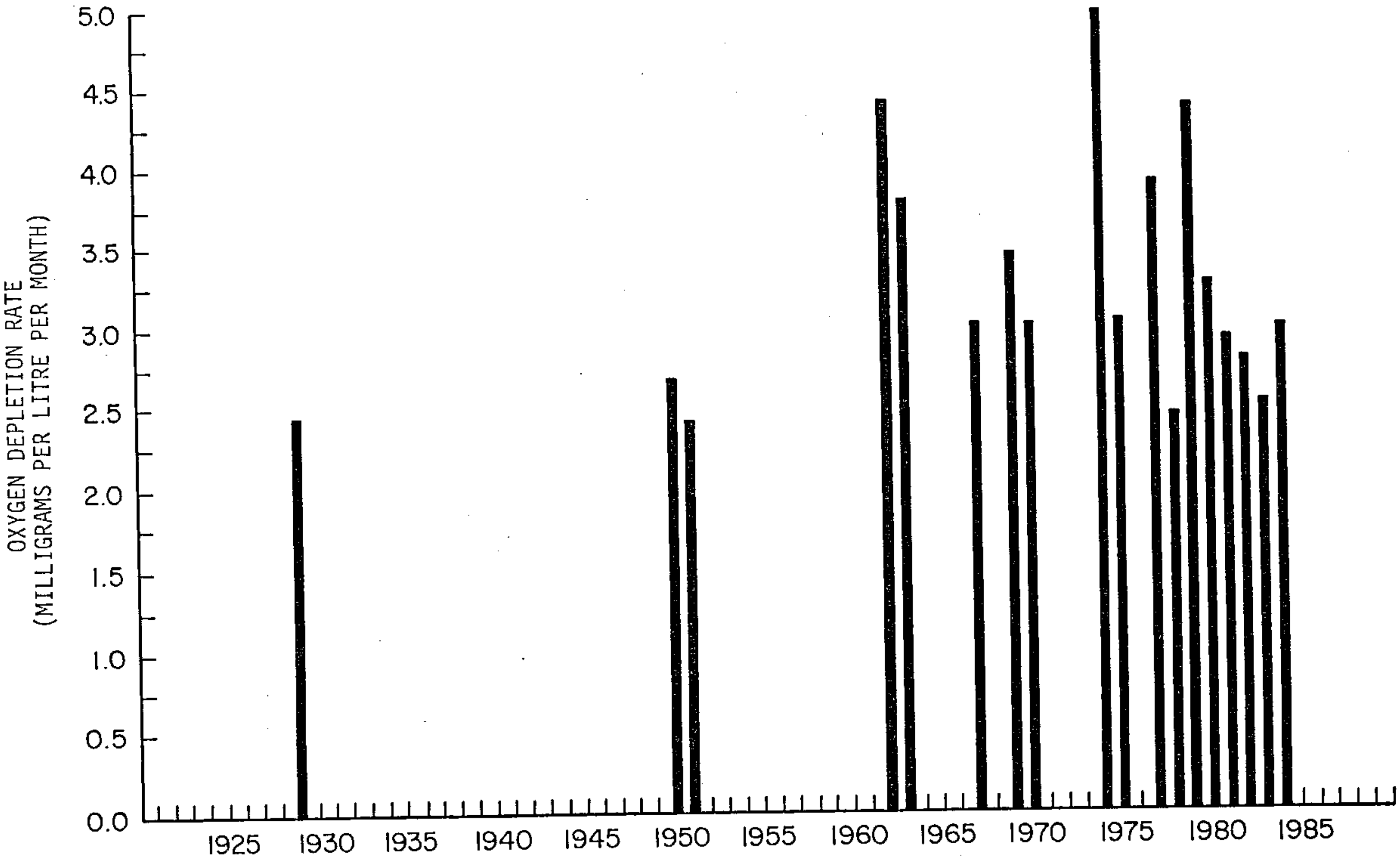


Figure 6. Central Basin Hypolimnion Oxygen Depletion Rates for July From 1929 to 1984. (Data for 1929 to 1980 from Rosa and Burns, 1985).

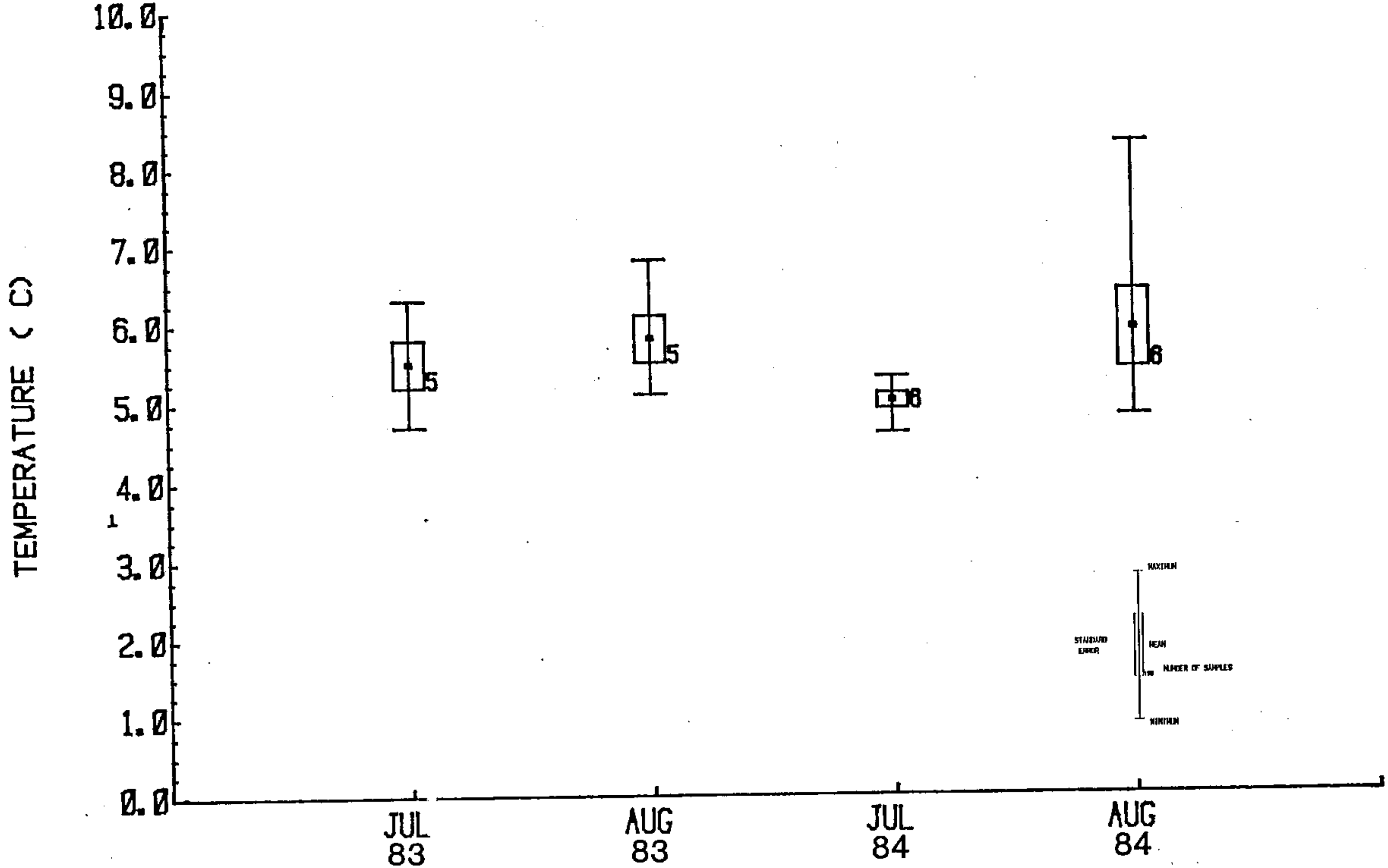


FIGURE 7. MEAN EASTERN BASIN HYPOLIMNION TEMPERATURE FOR 1983 AND 1984.

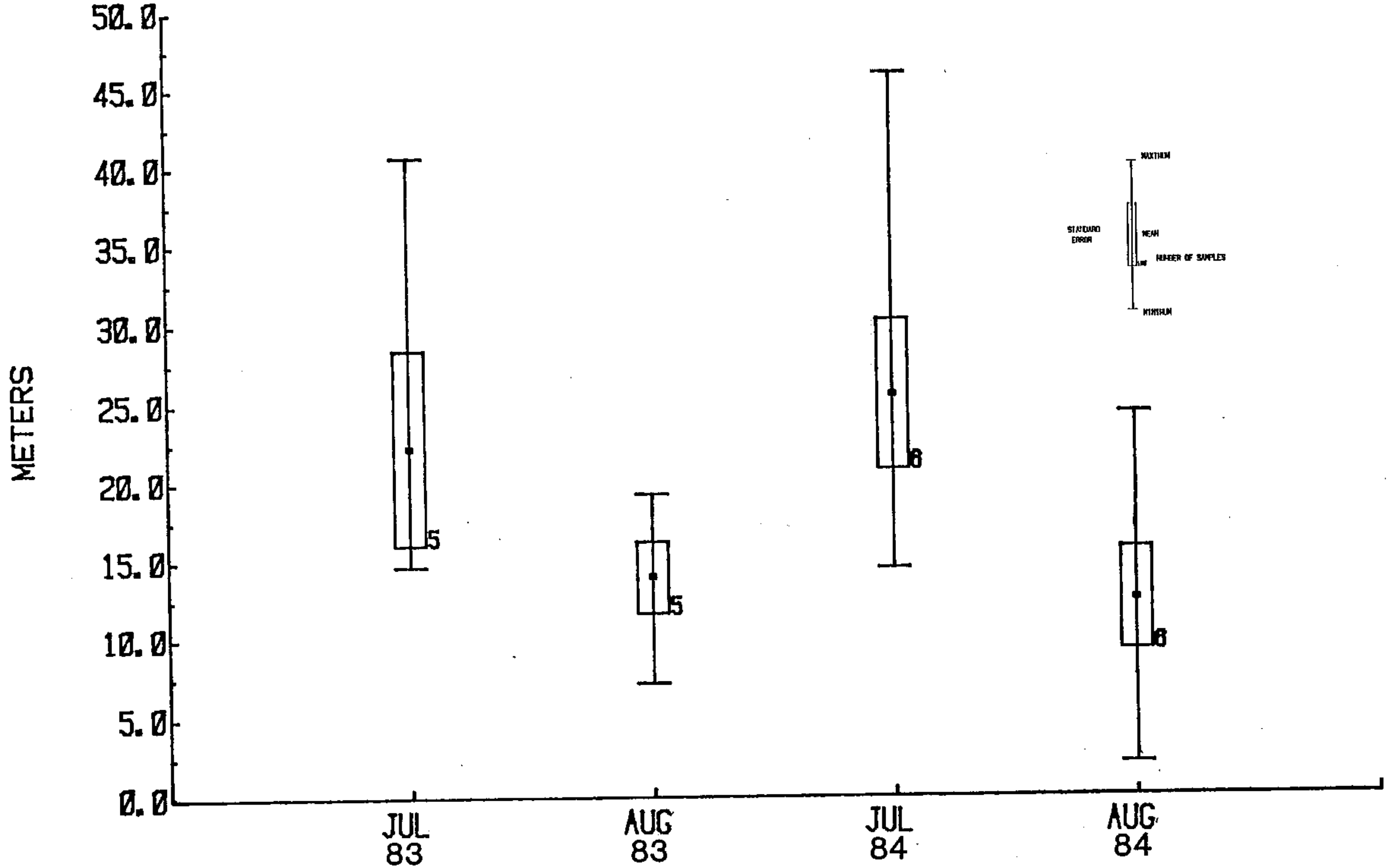


FIGURE 8. MEAN EASTERN BASIN HYPOLIMNION THICKNESS FOR 1983 AND 1984.

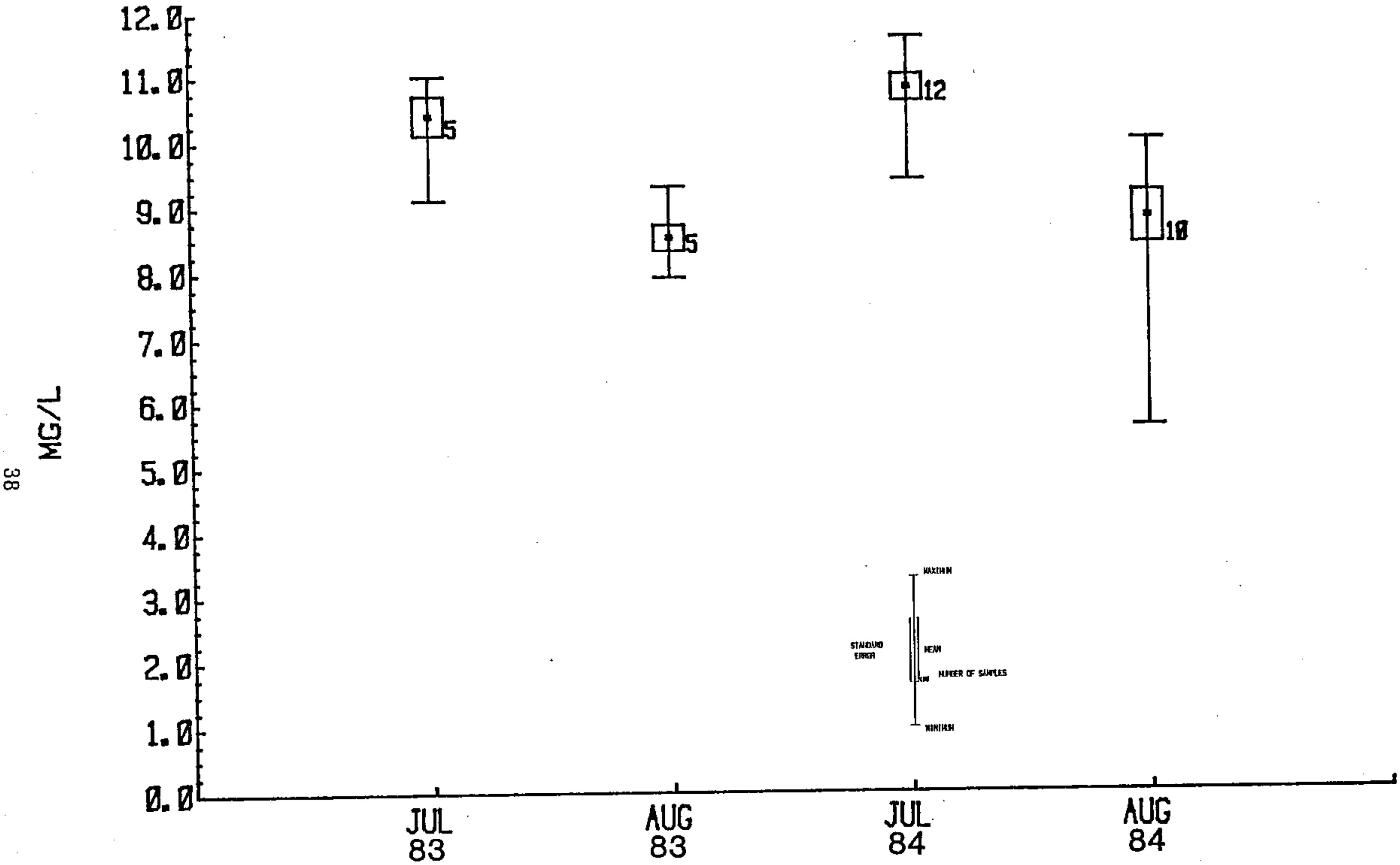


FIGURE 9. MEAN EASTERN BASIN HYPOLIMNION DISSOLVED OXYGEN CONCENTRATIONS FOR 1983 AND 1984.

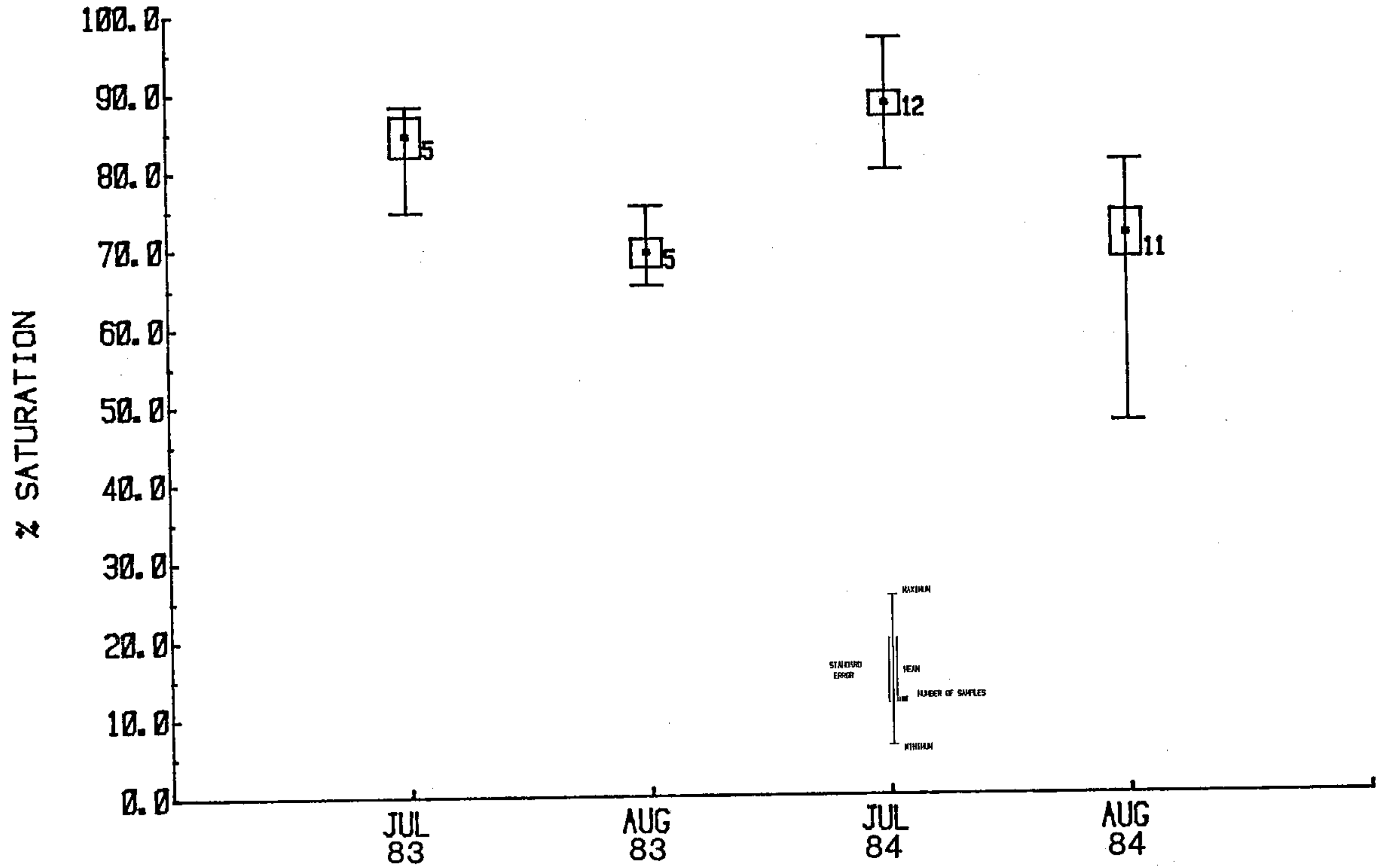


FIGURE 10. MEAN EASTERN BASIN HYPOLIMNION DISSOLVED OXYGEN PERCENT SATURATION FOR 1983 AND 1984.

APPENDIX A

LAKE ERIE OXYGEN STUDY 1983 - 1984

```
************
* STEMP    *
************
```

VARIABLE NUMBER	2	MAXIMUM	22.2000008
NUMBER OF DISTINCT VALUES .	10	MINIMUM	16.5000000
NUMBER OF VALUES COUNTED. .	13	RANGE	5.7000008
NUMBER OF VALUES NOT COUNTED	0	VARIANCE	5.5142326
		ST.DEV.	2.3482404
		(Q3-Q1)/2	2.4500008

EACH 'H' REPRESENTS 1 COUNT(S)

LOCATION ESTIMATES		ST.ERROR
MEAN	19.0384617	0.6512847
MEDIAN	18.5000000	1.4145093
MODE	16.7999992	

```
 H         H
 HH        H
 HHHHH HHH
L-----------U
```

EACH '-' ABOVE =	0.7500
L=	15.7500
U=	24.0000

	VALUE	VALUE/S.E.
SKEWNESS	0.25	0.37
KURTOSIS	-1.69	-1.25

Q1=	16.7999992
Q3=	21.7000008
S-=	16.6902218
S+=	21.3867016

EACH '.' BELOW = 0.0500

```
                                                                                          S     Q     M
     S Q                          M             M                            Q3         +     3     A
 M   - M                          E.............E.......................................................X
 I.....O..........................D             A
 N     D                          I             N
       E
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
16.50	2	15.4	15.4
16.80	3	23.1	38.5
18.00	1	7.7	46.2
18.50	1	7.7	53.8
19.30	1	7.7	61.5
20.30	1	7.7	69.2
21.70	1	7.7	76.9
22.00	1	7.7	84.6
22.10	1	7.7	92.3
22.20	1	7.7	100.0

Central Basin July 1983 - Surface

```
************
* DO       *
************

VARIABLE NUMBER . . . . . .        2      MAXIMUM          8.6999998
NUMBER OF DISTINCT VALUES .        9      MINIMUM          7.5999999
NUMBER OF VALUES COUNTED. .       14      RANGE            1.0999999
NUMBER OF VALUES NOT COUNTED       0      VARIANCE         0.1384616
                                          ST.DEV.          0.3721043
                                          (Q3-Q1)/2        0.3000000

                                                   ST.ERROR
LOCATION ESTIMATES
            MEAN                  8.2000008        0.0994490
            MEDIAN                8.3000002        0.1732051
            MODE                  8.3000002

                                                                     EACH 'H'
                                                                     REPRESENTS
                                                                         1
                                                                     COUNT(S)
                                                     H
                                               H     H HH
                                               HHHHH H HHH
                                              L-----------U

                                  EACH '-' ABOVE =      0.1000
                                              L=        7.6000
                                              U=        8.7000

                                                           Q1=     7.9000001
                                  VALUE     VALUE/S.E.     Q3=     8.5000000
              SKEWNESS            -0.33         -0.51      S-=     7.8278966
              KURTOSIS            -1.30         -0.99      S+=     8.5721054

                                  EACH ',' BELOW =      0.0100
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
7.600	2	14.3	14.3
7.800	1	7.1	21.4
7.900	1	7.1	28.6
8.000	1	7.1	35.7
8.100	1	7.1	42.9
8.300	3	21.4	64.3
8.500	2	14.3	78.6
8.600	2	14.3	92.9
8.700	1	7.1	100.0

Central Basin July 1983 - Surface

```
LAKE ERIE OXYGEN STUDY 1983-1984

 ************
 * DOSAT    *
 ************
                                                MAXIMUM       87.8600006
                                                MINIMUM       84.2399979
VARIABLE NUMBER . . . . . .          3         RANGE          3.6200027
NUMBER OF DISTINCT VALUES .         12         VARIANCE       1.2945530
NUMBER OF VALUES COUNTED. .         14         ST.DEV.        1.1377842
NUMBER OF VALUES NOT COUNTED         0         (Q3-Q1)/2      1.0649986

                                                   ST.ERROR
LOCATION ESTIMATES
                  MEAN           86.3014297      0.3040856
                  MEDIAN         86.0950012      0.6148775
                  MODE           NOT UNIQUE

                                                                              EACH 'H'
                                                                             REPRESENTS
                                                                        H        1
                                                                     HH H     COUNT(S)
                                                                     HH H
                                                                   H HHHHHH
                                                                  L----------U

                                                        EACH '-' ABOVE =       0.5000
                                                                    L=        83.5000
                                                                    U=        89.0000

                                                                        Q1=  85.3899994
                                                  VALUE   VALUE/S.E.    Q3=  87.5199966
                                       SKEWNESS   -0.06       -0.09     S-=  85.1636429
                                       KURTOSIS   -1.30       -0.99     S+=  87.4392166

                                                        EACH ',' BELOW =       0.0300
                                                                     S Q
                     S   Q               M    M                      + 3            M
  M                  -   1               E....E.................................................A
  I......................................D    A                                                  X
  N                                      I    N
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
84.24	1	7.1	7.1
85.24	2	14.3	21.4
85.39	1	7.1	28.6
85.70	2	14.3	42.9
85.79	1	7.1	50.0
86.40	1	7.1	57.1
86.61	1	7.1	64.3
87.24	1	7.1	71.4
87.52	1	7.1	78.6
87.63	1	7.1	85.7
87.66	1	7.1	92.9
87.86	1	7.1	100.0

Central Basin July 1983 - Surface

```
************
* BTEMP    *
************
```

VARIABLE NUMBER	3	MAXIMUM	11.1000004
NUMBER OF DISTINCT VALUES .	10	MINIMUM	8.0000000
NUMBER OF VALUES COUNTED. .	10	RANGE	3.1000004
NUMBER OF VALUES NOT COUNTED	3	VARIANCE	1.0355557
		ST.DEV.	1.0176226
		(Q3-Q1)/2	0.8000002

EACH 'H' REPRESENTS 1 COUNT(S)

LOCATION ESTIMATES

		ST.ERROR
MEAN	9.5000000	0.3218005
MEDIAN	9.5500002	0.4618806
MODE	NOT UNIQUE	

```
H  H   H
HH H HHH H
L----------U
```

EACH '-' ABOVE = 0.3000
L= 8.1000
U= 11.4000

	VALUE	VALUE/S.E.
SKEWNESS	-0.04	-0.05
KURTOSIS	-1.30	-0.84

Q1= 8.6999998
Q3= 10.3000002
S-= 8.4823771
S+= 10.5176229

EACH '.' BELOW = 0.0250

```
                S     Q                                   M M                        Q    S                          M
M               -     1                                   E.E........................3....+..........................A
I.........................................................A D                                                        X
N                                                         N I
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
8.000	1	10.0	10.0
8.200	1	10.0	20.0
8.700	1	10.0	30.0
9.100	1	10.0	40.0
9.300	1	10.0	50.0
9.800	1	10.0	60.0
10.000	1	10.0	70.0
10.300	1	10.0	80.0
10.500	1	10.0	90.0
11.100	1	10.0	100.0

Central Basin July 1983 - Bottom

LAKE ERIE OXYGEN STUDY 1983-1984

```
************
* DO       *
************
```

VARIABLE NUMBER	2	MAXIMUM	8.1000004
NUMBER OF DISTINCT VALUES .	12	MINIMUM	4.6999998
NUMBER OF VALUES COUNTED. .	14	RANGE	3.4000006
NUMBER OF VALUES NOT COUNTED	0	VARIANCE	0.8514287
		ST.DEV.	0.9227290
		(Q3-Q1)/2	0.6500001

LOCATION ESTIMATES

		ST.ERROR
MEAN	6.7285719	0.2466097
MEDIAN	6.7500000	0.3752779
MODE	NOT UNIQUE	

```
      H        EACH 'H'
     HH       REPRESENTS
    HHHH          1
 H HHHHHH      COUNT(S)
L-----------U

EACH '-' ABOVE =     0.5000
             L=      3.5000
             U=      9.0000
```

	VALUE	VALUE/S.E.		
			Q1=	6.0999999
			Q3=	7.4000001
SKEWNESS	-0.50	-0.77	S-=	5.8058429
KURTOSIS	-0.39	-0.30	S+=	7.6513009

```
                                                                        EACH '.' BELOW =     0.0300
                                                                         Q         S
                       S          Q                                      3         +          M
M                      -          1                  MM
I......................................................EE.......................................A
N                                                    AD                                         X
                                                     NI
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM	VALUE	COUNT	PERCENTS CELL	PERCENTS CUM	VALUE	COUNT	PERCENTS CELL	PERCENTS CUM	VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
4.700	1	7.1	7.1	6.400	1	7.1	35.7	6.800	1	7.1	57.1	7.400	2	14.3	85.7
5.800	2	14.3	21.4	6.600	1	7.1	42.9	7.200	1	7.1	64.3	7.900	1	7.1	92.9
6.100	1	7.1	28.6	6.700	1	7.1	50.0	7.300	1	7.1	71.4	8.100	1	7.1	100.0

Central Basin July 1983 - Bottom

LAKE ERIE OXYGEN STUDY 1983-1984

```
************
* DOSAT    *
************
```

VARIABLE NUMBER	3
NUMBER OF DISTINCT VALUES .	14
NUMBER OF VALUES COUNTED. .	14
NUMBER OF VALUES NOT COUNTED	0

MAXIMUM	71.0500031
MINIMUM	40.7000008
RANGE	30.3500023
VARIANCE	71.0783997
ST.DEV.	8.4308004
(Q3-Q1)/2	5.6299992

LOCATION ESTIMATES

		ST.ERROR
MEAN	58.4942894	2.2532260
MEDIAN	58.5450020	3.2504833
MODE	NOT UNIQUE	

```
                 EACH 'H'
                REPRESENTS
                     1
                  COUNT(S)
   H  H
  HH HH H
H HHH HH H
L----------U
```

EACH '-' ABOVE = 3.0000
L= 42.0000
U= 75.0000

	VALUE	VALUE/S.E.
SKEWNESS	-0.32	-0.49
KURTOSIS	-0.54	-0.42

Q1=	52.5400009
Q3=	63.7999992
S-=	50.0634880
S+=	66.9250870

EACH '.' BELOW = 0.2500

```
                     S       Q                  M                  Q        S          M
                     -       1                  E                  3        +          A
M                                                                                      X
I..............................................................................................
N                                                A
                                                 N
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
40.70	1	7.1	7.1
49.69	1	7.1	14.3
51.35	1	7.1	21.4
52.54	1	7.1	28.6
55.22	1	7.1	35.7
55.84	1	7.1	42.9
56.89	1	7.1	50.0
60.20	1	7.1	57.1
62.02	1	7.1	64.3
63.62	1	7.1	71.4
63.80	1	7.1	78.6
65.27	1	7.1	85.7
70.73	1	7.1	92.9
71.05	1	7.1	100.0

Central Basin July 1983 - Bottom

LAKE ERIE OXYGEN STUDY 1983 - 1984

```
 ************
 * THICK    *
 ************
                                                   MAXIMUM          7.6999998
VARIABLE NUMBER . . . . . . .        4             MINIMUM          1.7000000
NUMBER OF DISTINCT VALUES .         10             RANGE            5.9999995
NUMBER OF VALUES COUNTED. .         13             VARIANCE         2.0776923
NUMBER OF VALUES NOT COUNTED         0             ST.DEV.          1.4414202
                                                   (Q3-Q1)/2        0.6000001

LOCATION ESTIMATES                                  ST.ERROR
                   MEAN           4.1461539         0.3997780
                   MEDIAN         3.8000000         0.3464104
                   MODE           3.8000000
```

```
                                    H            EACH 'H'
                                   HH            REPRESENTS
                                   HHH               1
                                 HHHHHH  H        COUNT(S)
                                L-----------U

                     EACH '-' ABOVE =        0.7500
                                  L=         0.7500
                                  U=         9.0000

                                                   Q1=     3.5999999
                          VALUE    VALUE/S.E.      Q3=     4.8000002
        SKEWNESS           0.88         1.29       S-=     2.7047338
        KURTOSIS           0.92         0.67       S+=     5.5875740

                     EACH '.' BELOW =        0.0500
```

```
              S          Q                    Q        S                              M
 M            -          1  M    M            3        +                              A
 I..........................E....E.............................................X
 N                          D    A
                            I    N
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
1.700	1	7.7	7.7
2.900	1	7.7	15.4
3.500	1	7.7	23.1
3.600	2	15.4	38.5
3.800	3	23.1	61.5
4.000	1	7.7	69.2
4.800	1	7.7	76.9
5.200	1	7.7	84.6
5.500	1	7.7	92.3
7.700	1	7.7	100.0

Central Basin July 1983 - Hypolimnion

LAKE ERIE OXYGEN STUDY 1983 - 1984

```
************
* STEMP    *
************

VARIABLE NUMBER . . . . . .        2        MAXIMUM        25.0000000
NUMBER OF DISTINCT VALUES .        9        MINIMUM        21.0000000
NUMBER OF VALUES COUNTED. .       13        RANGE           4.0000000
NUMBER OF VALUES NOT COUNTED       0        VARIANCE        0.9425641
                                            ST.DEV.         0.9708574
                                            (Q3-Q1)/2       0.4000006

LOCATION ESTIMATES                            ST.ERROR
          MEAN              23.5384617        0.2692674
          MEDIAN            23.5000000        0.2309406
          MODE              23.5000000

                                                           H            EACH 'H'
                                                           H           REPRESENTS
                                                           H H              1
                                                          HH H          COUNT(S)
                                                       H  HHHHH
                                                      L----------U

                                      EACH '-' ABOVE =        0.5000
                                                   L=        20.5000
                                                   U=        26.0000

                                                             Q1=  23.2999992
                                  VALUE    VALUE/S.E.        Q3=  24.1000004
              SKEWNESS            -1.09       -1.60          S-=  22.5676041
              KURTOSIS             1.46        1.08          S+=  24.5093193

                                      EACH '.' BELOW =        0.0500

                      S          Q        Q      S          M
                      -          1   MM   3      +          A
      M                              .EE.........................X
      I..................................DA
      N                              IN
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
21.00	1	7.7	7.7
23.00	2	15.4	23.1
23.30	2	15.4	38.5
23.50	3	23.1	61.5
24.00	1	7.7	69.2
24.10	1	7.7	76.9
24.30	1	7.7	84.6
24.50	1	7.7	92.3
25.00	1	7.7	100.0

Central Basin August 1983 - Surface

```
************
* DO       *
************

VARIABLE NUMBER . . . . . .          2      MAXIMUM        8.1999998
NUMBER OF DISTINCT VALUES .          5      MINIMUM        7.6999998
NUMBER OF VALUES COUNTED. .         13      RANGE          0.5000000
NUMBER OF VALUES NOT COUNTED         0      VARIANCE       0.0207692
                                            ST.DEV.        0.1441153
                                            (Q3-Q1)/2      0.0999999

                                                      ST.ERROR
LOCATION ESTIMATES
                  MEAN            7.9076924     0.0399704
                  MEDIAN          7.9000001     0.0577350
                  MODE            8.0000000

                                                           H                EACH 'H'
                                                           H                REPRESENTS
                                                      H    H                   1
                                                     HH H  H                COUNT(S)
                                                     HH H  H    H
                                                     L----------U

                                      EACH '-' ABOVE =        0.0500
                                                  L=          7.7000
                                                  U=          8.2500

                                                              Q1=   7.8000002
                                 VALUE     VALUE/S.E.         Q3=   8.0000000
               SKEWNESS           0.20        0.30            S-=   7.7635770
               KURTOSIS          -0.72       -0.53            S+=   8.0518074

                                      EACH '.' BELOW =        0.0050
```

```
                                                          Q         S
        S    Q                          MM                M         +                        M
 M      -    1                          EE                O                                  A
 I......................................EE.................O.................................A
 N                                      DA                D                                  X
                                        IN                E
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
7.700	2	15.4	15.4
7.800	3	23.1	38.5
7.900	2	15.4	53.8
8.000	5	38.5	92.3
8.200	1	7.7	100.0

Central Basin August 1983 - Surface

LAKE ERIE OXYGEN STUDY 1983-1984

```
************
* DOSAT    *
************
```

VARIABLE NUMBER	3
NUMBER OF DISTINCT VALUES .	10
NUMBER OF VALUES COUNTED. .	13
NUMBER OF VALUES NOT COUNTED	0

MAXIMUM	93.4000015
MINIMUM	90.2099991
RANGE	3.1900024
VARIANCE	0.6400595
ST.DEV.	0.8000372
(Q3-Q1)/2	0.3549995

LOCATION ESTIMATES

		ST.ERROR
MEAN	92.4261551	0.2218904
MEDIAN	92.2699966	0.2049592
MODE	NOT UNIQUE	

```
                   H        EACH 'H'
                   H       REPRESENTS
                   H            1
                   H H       COUNT(S)
                   H H H
         H         HHH H
         L-----------U
```

EACH '-' ABOVE =	0.3000
L=	90.3000
U=	93.6000

	VALUE	VALUE/S.E.
SKEWNESS	-1.45	-2.13
KURTOSIS	2.27	1.67

Q1=	92.2399979
Q3=	92.9499969
S-=	91.6261215
S+=	93.2261887

EACH '.' BELOW = 0.0250

```
                                                      S                                       Q                       Q          S     M
                                                      -                                      1M     M                 3          +     A
M                                                                                             E.....E..................................X
I.............................................................................................D     A
N                                                                                             I     N
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
90.21	1	7.7	7.7
92.16	1	7.7	15.4
92.20	1	7.7	23.1
92.24	2	15.4	38.5
92.27	2	15.4	53.8
92.43	1	7.7	61.5
92.89	1	7.7	69.2
92.95	2	15.4	84.6
93.33	1	7.7	92.3
93.40	1	7.7	100.0

Central Basin August 1983 - Surface

```
************
* BTEMP    *
************
                                              MAXIMUM        13.0000000
VARIABLE NUMBER . . . . . .        3          MINIMUM         7.0000000
NUMBER OF DISTINCT VALUES .       11          RANGE           6.0000000
NUMBER OF VALUES COUNTED. .       13          VARIANCE        2.5019231
NUMBER OF VALUES NOT COUNTED       0          ST.DEV.         1.5817468
                                              (Q3-Q1)/2       0.8000002

LOCATION ESTIMATES                            ST.ERROR
                MEAN           10.2769232     0.4386976
                MEDIAN         10.8000002     0.4618806
                MODE           NOT UNIQUE
```

```
                 H
                 H          EACH 'H'
                 H         REPRESENTS
                HHH            1
             HH HHHH H      COUNT(S)
           L-----------U

EACH '-' ABOVE =      0.7500
            L=        6.0000
            U=       14.2500
```

	VALUE	VALUE/S.E.		
			Q1=	9.5000000
			Q3=	11.1000004
SKEWNESS	-0.61	-0.90	S-=	8.6951761
KURTOSIS	-0.17	-0.12	S+=	11.8586702

EACH ',' BELOW = 0.0500

```
                   S            Q             M       M      Q       S                M
M                  -            1             E       E      3       +                A
I.........................................................................................X
N                                             A       D
                                              N       I
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
7.000	1	7.7	7.7
7.800	1	7.7	15.4
9.100	1	7.7	23.1
9.500	1	7.7	30.8
10.500	2	15.4	46.2
10.800	2	15.4	61.5
11.000	1	7.7	69.2
11.100	1	7.7	76.9
11.200	1	7.7	84.6
11.300	1	7.7	92.3
13.000	1	7.7	100.0

Central Basin August 1983 - Bottom

LAKE ERIE OXYGEN STUDY 1983-1984

```
************
* DO       *
************
                                                     MAXIMUM           8.0000000
VARIABLE NUMBER . . . . . . .          2             MINIMUM           2.0999999
NUMBER OF DISTINCT VALUES .           10             RANGE             5.9000001
NUMBER OF VALUES COUNTED. .           13             VARIANCE          3.0941031
NUMBER OF VALUES NOT COUNTED           0             ST.DEV.           1.7590063
                                                     (Q3-Q1)/2         0.4500000

LOCATION ESTIMATES                                  ST.ERROR
                  MEAN             3.9076922        0.4878606
                  MEDIAN           3.3000000        0.2598078
                  MODE             3.7000000
```

```
                                        H
                                        HH              EACH 'H'
                                        HH             REPRESENTS
                                        HH                 1
                                        HHH  HH H        COUNT(S)
                                       L-----------U

                  EACH '-' ABOVE =          0.7500
                              L=            1.5000
                              U=            9.7500

                                                        Q1=      2.8000000
                   VALUE     VALUE/S.E.                 Q3=      3.7000000
SKEWNESS            1.21          1.78                  S-=      2.1486859
KURTOSIS            0.12          0.09                  S+=      5.6666985

                  EACH ',' BELOW =          0.0500
```

```
S       Q     M   Q  M               S                             M
M       1     E   M  E               +                             A
I...............E....O..E...........................................X
N             D   D  A
              I   E  N
```

VALUE	COUNT	PERCENTS CELL	CUM	VALUE	COUNT	PERCENTS CELL	CUM	VALUE	COUNT	PERCENTS CELL	CUM	VALUE	COUNT	PERCENTS CELL	CUM
2.100	1	7.7	7.7	2.900	1	7.7	38.5	3.700	3	23.1	76.9	8.000	1	7.7	100.0
2.600	2	15.4	23.1	3.100	1	7.7	46.2	5.800	1	7.7	84.6				
2.800	1	7.7	30.8	3.300	1	7.7	53.8	6.500	1	7.7	92.3				

Central Basin August 1983 - Bottom

```
************
* DOSAT.   *
************
                                                 MAXIMUM        69.0299988
                                                 MINIMUM        18.7999992
VARIABLE NUMBER . . . . . .          3           RANGE          50.2299995
NUMBER OF DISTINCT VALUES .         13           VARIANCE      209.7951050
NUMBER OF VALUES COUNTED. .         13           ST.DEV.        14.4843054
NUMBER OF VALUES NOT COUNTED         0           (Q3-Q1)/2       4.1399994

                                                      ST.ERROR
LOCATION ESTIMATES
                MEAN                 34.1738434       4.0172234
                MEDIAN               29.3799992       2.3902309
                MODE                 NOT UNIQUE
```

```
                                         H                  EACH 'H'
                                         HHH                REPRESENTS
                                         HHH                    1
                                         HHH  HH  H         COUNT(S)
                                        L-----------U

                        EACH '-' ABOVE =        5.0000
                                    L=         20.0000
                                    U=         75.0000

                                                      Q1=   24.7900009
                       VALUE   VALUE/S.E.             Q3=   33.0699997
          SKEWNESS      1.25        1.84              S-=   19.6895390
          KURTOSIS      0.36        0.27              S+=   48.6581497

                        EACH ',' BELOW =            0.5000
```

```
         S           Q            M       Q                             S                                      M
       M -           1            E       3 M                           +                                      A
       I.........................E........E..........................................................................A
       N                          D         A                                                                  X
                                  I         N
```

VALUE	COUNT	PERCENTS CELL	CUM	VALUE	COUNT	PERCENTS CELL	CUM	VALUE	COUNT	PERCENTS CELL	CUM	VALUE	COUNT	PERCENTS CELL	CUM
18.80	1	7.7	7.7	26.93	1	7.7	38.5	32.94	1	7.7	69.2	69.03	1	7.7	100.0
23.32	1	7.7	15.4	26.94	1	7.7	46.2	33.07	1	7.7	76.9				
23.37	1	7.7	23.1	29.38	1	7.7	53.8	48.90	1	7.7	84.6				
24.79	1	7.7	30.8	32.76	1	7.7	61.5	54.03	1	7.7	92.3				

Central Basin August 1983 - Bottom

```
************
* THICK    *
************
                                                MAXIMUM            9.1000004
                                                MINIMUM            1.6000000
VARIABLE NUMBER . . . . . .          4          RANGE              7.5000005
NUMBER OF DISTINCT VALUES .         10          VARIANCE           3.2730772
NUMBER OF VALUES COUNTED. .         13          ST.DEV.            1.8091648
NUMBER OF VALUES NOT COUNTED         0          (Q3-Q1)/2          0.7500000

                                                     ST.ERROR
LOCATION ESTIMATES
                  MEAN               5.5153852        0.5017720
                  MEDIAN             5.8000002        0.4330129
                  MODE               6.4000001
```

```
                                                                   EACH 'H'
                                                                  REPRESENTS
                                                         HH            1
                                                         HH        COUNT(S)
                                                         HH
                                                      H HHHHH    H
                                                     L-----------U

                                       EACH '-' ABOVE =         0.7500
                                                    L=          1.5000
                                                    U=          9.7500

                                                                Q1=    4.9000001
                                       VALUE    VALUE/S.E.      Q3=    6.4000001
                     SKEWNESS          -0.33       -0.48        S-=    3.7062204
                     KURTOSIS           0.34        0.25        S+=    7.3245502

                                       EACH ',' BELOW =         0.0750
```

```
                   S          Q             Q       S
                   -          1      M  M   M       +                 M
M                                                                     
I......................................E...E.......D......................A
N                                      A   D       D                  X
                                       N   I       E
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
1.600	1	7.7	7.7
3.400	1	7.7	15.4
4.000	1	7.7	23.1
4.900	1	7.7	30.8
5.500	1	7.7	38.5
5.700	1	7.7	46.2
5.800	2	15.4	61.5
6.400	3	23.1	84.6
6.700	1	7.7	92.3
9.100	1	7.7	100.0

Central Basin August 1983 - Hypolimnion

```
************
* STEMP    *
************
                                                   MAXIMUM         17.2999992
VARIABLE NUMBER . . . . . .          2             MINIMUM         16.0000000
NUMBER OF DISTINCT VALUES .          3             RANGE            1.2999992                                      EACH 'H'
NUMBER OF VALUES COUNTED. .          5             VARIANCE         0.2869997                                     REPRESENTS
NUMBER OF VALUES NOT COUNTED         0             ST.DEV.          0.5357235                                         1
                                                   (Q3-Q1)/2        0.1499996                                      COUNT(S)

                                                    ST.ERROR
LOCATION ESTIMATES                                                                                               HH
                  MEAN               16.3800011     0.2395828                                                    HH   H
                  MEDIAN             16.2999992     0.3752776                                                   L------U
                  MODE               NOT UNIQUE
                                                                                          EACH '-' ABOVE =      0.2500
                                                                                                      L=       16.0000
                                                                                                      U=       17.5000

                                                                                                              Q1=   16.0000000
                                                                               VALUE    VALUE/S.E.            Q3=   16.2999992
                                                         SKEWNESS               1.09          0.99            S-=   15.8442783
                                                         KURTOSIS              -0.70         -0.32            S+=   16.9157238

                                                                                    EACH ',' BELOW =            0.0150
                                                                          S
            S         Q                Q     M                            +                   M
            -         M                M     M                                                .A
            ..........I................E.....E............................................... X
                      N                D     A
                                       I     N

                           PERCENTS                         PERCENTS                         PERCENTS
   VALUE    COUNT   CELL    CUM      VALUE    COUNT   CELL    CUM      VALUE    COUNT   CELL    CUM
   16.00        2   40.0   40.0      16.30        2   40.0   80.0      17.30        1   20.0  100.0
--------------------------------------------------------------------------------------------------------
```

Eastern Basin July 1983 - Surface

```
************
* DO       *
************
                                                    MAXIMUM          8.6999998
                                                    MINIMUM          8.5000000
VARIABLE NUMBER . . . . . .            2            RANGE            0.1999998                                   EACH 'H'
NUMBER OF DISTINCT VALUES .            3            VARIANCE         0.0050000                                   REPRESENTS
NUMBER OF VALUES COUNTED. .            5            ST.DEV.          0.0707106                                       1
NUMBER OF VALUES NOT COUNTED           0            (Q3-Q1)/2        0.0000000                                   COUNT(S)
                                                                                                               H
                                                         ST.ERROR                                              H
LOCATION ESTIMATES                                                                                           H H H
                 MEAN               8.6000004        0.0316227                                              L------U
                 MEDIAN             8.6000004        0.0577350
                 MODE               8.6000004
                                                                                     EACH '-' ABOVE =        0.0500
                                                                                                  L=         8.4500
                                                                                                  U=         8.7500

                                                                                                           Q1=    8.6000004
                                                                                  VALUE   VALUE/S.E.       Q3=    8.6000004
                                                                    SKEWNESS      -0.00        -0.00       S-=    8.5292902
                                                                    KURTOSIS      -1.00        -0.46       S+=    8.6707106

                                                                                  EACH ',' BELOW =          0.0020
                                                           Q                                S
                       S                                   M                                +          M
                M      -                                                                               A
                I...........................................E..........................................X
                N                                           A
                                                            N

                           PERCENTS                          PERCENTS                         PERCENTS
   VALUE   COUNT   CELL   CUM     VALUE   COUNT   CELL   CUM     VALUE   COUNT   CELL   CUM
   8.500       1   20.0   20.0    8.600       3   60.0   80.0    8.700       1   20.0  100.0
------------------------------------------------------------------------------------------------------
```

Eastern Basin July 1983 - Surface

```
************
* DOSAT    *
************
                                                 MAXIMUM         86.1500015
VARIABLE NUMBER . . . . . . .        3           MINIMUM         84.8099976
NUMBER OF DISTINCT VALUES .          4           RANGE            1.3400040
NUMBER OF VALUES COUNTED. .          5           VARIANCE         0.2597723
NUMBER OF VALUES NOT COUNTED         0           ST.DEV.          0.5096787
                                                 (Q3-Q1)/2        0.2300034

                                                      ST.ERROR
LOCATION ESTIMATES
                    MEAN            85.4879990         0.2279352
                    MEDIAN          85.3399963         0.3868260
                    MODE            85.3399963

                                                                                      EACH 'H'
                                                                                     REPRESENTS
                                                                                          1
                                                                                      COUNT(S)
                                                                                 H
                                                                               H H HH
                                                                              L------U

                                                            EACH '-' ABOVE =        0.2500
                                                                        L=         84.7500
                                                                        U=         86.2500

                                                                               Q1=   85.3399963
                                                      VALUE    VALUE/S.E.      Q3=   85.8000031
                                      SKEWNESS         0.00         0.00       S-=   84.9783173
                                      KURTOSIS        -1.47        -0.67       S+=   85.9976807

                                                            EACH '.' BELOW =        0.0150

                    S                 Q                          Q         S
             M      -                 M       M                  3         +        M
             I................................E.......E.......................................A
             N                        D       A                                      X
                                      I       N
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
84.81	1	20.0	20.0
85.34	2	40.0	60.0
85.80	1	20.0	80.0
86.15	1	20.0	100.0

Eastern Basin July 1983 - Surface

```
 ************
 * BTEMP    *
 ************
                                                MAXIMUM          6.3000002
VARIABLE NUMBER . . . . . .         3           MINIMUM          4.6999998
NUMBER OF DISTINCT VALUES .         5           RANGE            1.6000004
NUMBER OF VALUES COUNTED. .         5           VARIANCE         0.5030001           EACH 'H'
NUMBER OF VALUES NOT COUNTED        0           ST.DEV.          0.7092250          REPRESENTS
                                                (Q3-Q1)/2        0.5999999               1
                                                                                      COUNT(S)
LOCATION ESTIMATES                                ST.ERROR
                   MEAN            5.4600000      0.3171751                      H
                   MEDIAN          5.5000000      0.4618806                      H HHH
                   MODE           NOT UNIQUE                                    L------U

                                                                EACH '-' ABOVE =        0.3000
                                                                            L=          4.8000
                                                                            U=          6.6000

                                                                                   Q1=     4.8000002
                                                           VALUE    VALUE/S.E.     Q3=     6.0000000
                                        SKEWNESS            0.02          0.02     S-=     4.7507749
                                        KURTOSIS           -1.91         -0.87     S+=     6.1692252

                                                                EACH ',' BELOW =        0.0150
                                                                  Q       S
        S  Q                                                      3       +       M
     M  -  1                                   M  M                               A
     I.........................................E..E...............................X
     N                                         A  D
                                               N  I
```

VALUE	COUNT	PERCENTS CELL	CUM	VALUE	COUNT	PERCENTS CELL	CUM	VALUE	COUNT	PERCENTS CELL	CUM	VALUE	COUNT	PERCENTS CELL	CUM
4.700	1	20.0	20.0	5.500	1	20.0	60.0	6.300	1	20.0	100.0				
4.800	1	20.0	40.0	6.000	1	20.0	80.0								

Eastern Basin July 1983 - Bottom

```
************
* DO       *
************
                                              MAXIMUM          11.0000000
VARIABLE NUMBER . . . . . .         2         MINIMUM           9.1000004
NUMBER OF DISTINCT VALUES .         4         RANGE             1.8999996
NUMBER OF VALUES COUNTED. .         5         VARIANCE          0.5929998
NUMBER OF VALUES NOT COUNTED        0         ST.DEV.           0.7700648
                                              (Q3-Q1)/2         0.1500001

LOCATION ESTIMATES                                 ST.ERROR
                   MEAN             10.4400005     0.3443834
                   MEDIAN           10.8000002     0.5484829
                   MODE             10.8000002

                                                                                        EACH 'H'
                                                                                       REPRESENTS
                                                                                            1
                                                                                         COUNT(S)
                                                                                     H
                                                                                     H
                                                                                   H HH
                                                                                 L------U

                                                                      EACH '-' ABOVE =       0.5000
                                                                                  L=         8.5000
                                                                                  U=        11.5000

                                                                                     Q1=    10.5000000
                                                             VALUE    VALUE/S.E.     Q3=    10.8000002
                                              SKEWNESS       -1.17       -1.07       S-=     9.6699352
                                              KURTOSIS       -0.61       -0.28       S+=    11.2100658

                                                                      EACH '.' BELOW =       0.0200
                              S                                 Q     Q                      S
      M                       -                              M  1     M       M              +
      I..............................................................E...........E.........A..........
      N                                                      A        D       X
                                                             N        I

                 PERCENTS                      PERCENTS                      PERCENTS                      PERCENTS
   VALUE   COUNT CELL   CUM     VALUE   COUNT CELL   CUM     VALUE   COUNT CELL   CUM     VALUE   COUNT CELL   CUM
   9.100       1 20.0  20.0    10.500       1 20.0  40.0    10.800       2 40.0  80.0    11.000       1 20.0 100.0
-------------------------------------------------------------------------------------------------------------------
```

Eastern Basin July 1983 - Bottom

```
LAKE ERIE OXYGEN STUDY 1983-1984

 ************
 * DOSAT    *
 ************
                                                   MAXIMUM         88.2399979
VARIABLE NUMBER . . . . . . .          3           MINIMUM         74.7300034
NUMBER OF DISTINCT VALUES .            5           RANGE           13.5099945
NUMBER OF VALUES COUNTED. .            5           VARIANCE        32.8353119
NUMBER OF VALUES NOT COUNTED           0           ST.DEV.          5.7302103
                                                   (Q3-Q1)/2        2.0749969

LOCATION ESTIMATES                                      ST.ERROR
                  MEAN               84.4840012          2.5626280
                  MEDIAN             87.4800034          3.9000015
                  MODE               NOT UNIQUE

                                                                        EACH 'H'
                                                                       REPRESENTS
                                                                            1
                                                                        COUNT(S)
                                                                      H
                                                                   H HHH
                                                                  L------U

                                                 EACH '-' ABOVE =      2.5000
                                                             L=       75.0000
                                                             U=       90.0000

                                                                  Q1=  83.9100037
                                            VALUE   VALUE/S.E.    Q3=  88.0599976
                             SKEWNESS       -1.07        -0.97    S-=  78.7537918
                             KURTOSIS       -0.80        -0.36    S+=  90.2142105

                                                 EACH '.' BELOW =      0.1500
                     S                      Q                      Q      S
                     -                      1  M               M   3M     +
     M
     I......................................E..................E....A.....
     N                                         A               D   X
                                               N               I

                PERCENTS                 PERCENTS                 PERCENTS                 PERCENTS
VALUE   COUNT  CELL   CUM   VALUE COUNT CELL  CUM   VALUE COUNT CELL   CUM  VALUE  COUNT  CELL  CUM
 74.73      1  20.0  20.0   87.48     1 20.0 60.0   88.24     1 20.0 100.0
 83.91      1  20.0  40.0   88.06     1 20.0 80.0
--------------------------------------------------------------------------------------------------
```

Eastern Basin July 1983 - Bottom

```
 ************
 * THICK    *
 ************
                                          MAXIMUM        40.5999985
VARIABLE NUMBER . . . . . .      4        MINIMUM        14.6000004
NUMBER OF DISTINCT VALUES .      4        RANGE          25.9999981
NUMBER OF VALUES COUNTED. .      4        VARIANCE      154.2691498                                   EACH 'H'
NUMBER OF VALUES NOT COUNTED     1        ST.DEV.        12.4205132                                  REPRESENTS
                                          (Q3-Q1)/2       7.5749993                                      1
                                                                                                      COUNT(S)
LOCATION ESTIMATES                              ST.ERROR                                        H
                    MEAN         22.2250004     6.2102566                                       H
                    MEDIAN       16.8500004     7.5055566                                       H    H
                    MODE         NOT UNIQUE                                                    L------U

                                                                             EACH '-' ABOVE =       5.0000
                                                                                          L=       15.0000
                                                                                          U=       45.0000

                                                                                            Q1=   14.6500006
                                                                         VALUE   VALUE/S.E.     Q3=   29.7999992
                                                              SKEWNESS    0.92        0.75      S-=    9.8044872
                                                              KURTOSIS   -1.31       -0.53      S+=   34.6455154

                                                                             EACH ',' BELOW =       0.2500
 S             Q                                                     Q              S
 -             M      M                M                             3              +                  M
 ..............I......E................E...................................................................A
               N      D                A                                                               X
                      I                N

            PERCENTS                       PERCENTS                        PERCENTS                        PERCENTS
VALUE   COUNT  CELL  CUM     VALUE   COUNT  CELL  CUM      VALUE   COUNT  CELL  CUM      VALUE   COUNT  CELL  CUM
 14.60      1  25.0  25.0     14.70      1  25.0  50.0      19.00      1  25.0  75.0      40.60      1  25.0 100.0
----------------------------------------------------------------------------------------------------------------------
```

Eastern Basin July 1983 - Hypolimnion

LAKE ERIE OXYGEN STUDY 1983 - 1984

```
************
* STEMP    *
************
                                                  MAXIMUM          24.6000004
                                                  MINIMUM          23.7999992
VARIABLE NUMBER . . . . . .              2        RANGE             0.8000011
NUMBER OF DISTINCT VALUES .              5        VARIANCE          0.0930002
NUMBER OF VALUES COUNTED. .              5        ST.DEV.           0.3049593
NUMBER OF VALUES NOT COUNTED             0        (Q3-Q1)/2         0.1499996

                                                       ST.ERROR
LOCATION ESTIMATES
                         MEAN            24.1599998     0.1363819
                         MEDIAN          24.1000004     0.2309406
                         MODE            NOT UNIQUE

                                                                   VALUE    VALUE/S.E.
                                                 SKEWNESS           0.33          0.30
                                                 KURTOSIS          -1.40         -0.64
```

```
                                                             EACH 'H'
                                                            REPRESENTS
                                                                 1
                                                              COUNT(S)
       H
       HHH  H
      L------U

EACH '-' ABOVE =     0.1500
             L=     23.8500
             U=     24.7500

                     Q1=   24.0000000
                     Q3=   24.2999992
                     S-=   23.8550415
                     S+=   24.4649582

EACH '.' BELOW =     0.0075
```

```
      S                  Q            M      M                    Q                   S                 M
M     -                  1            E      E                    3                   +                 A
I.............................................................................................................X
N                                     D      A
                                      I      N
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
23.80	1	20.0	20.0
24.00	1	20.0	40.0
24.10	1	20.0	60.0
24.30	1	20.0	80.0
24.60	1	20.0	100.0

Eastern Basin August 1983 - Surface

LAKE ERIE OXYGEN STUDY 1983-1984

```
************
* DO       *
************

VARIABLE NUMBER . . . . . .        2      MAXIMUM         8.0000000
NUMBER OF DISTINCT VALUES .        3      MINIMUM         7.8000002
NUMBER OF VALUES COUNTED. .        5      RANGE           0.1999998
NUMBER OF VALUES NOT COUNTED       0      VARIANCE        0.0070000
                                          ST.DEV.         0.0836659
                                          (Q3-Q1)/2       0.0500000

                                                     ST.ERROR
LOCATION ESTIMATES
                MEAN           7.8800001     0.0374165
                MEDIAN         7.9000001     0.0577350
                MODE           NOT UNIQUE
```

```
                                                        EACH 'H'
                                                       REPRESENTS
                                                            1
                                                        COUNT(S)
                                               H H
                                               H H H
                                              L------U

                         EACH '-' ABOVE =          0.0500
                                      L=           7.7500
                                      U=           8.0500

                                                 Q1=     7.8000002
                        VALUE    VALUE/S.E.      Q3=     7.9000001
           SKEWNESS      0.31         0.28       S-=     7.7963343
           KURTOSIS     -1.52        -0.69       S+=     7.9636660

                         EACH '.' BELOW =          0.0020
```

```
 SQ                              M      Q                    S              M
 -M                              E      M                    +              A
 .I..............................E......E.........................................A
  N                              A      D                                   X
                                 N      I
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM	VALUE	COUNT	PERCENTS CELL	PERCENTS CUM	VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
7.800	2	40.0	40.0	7.900	2	40.0	80.0	8.000	1	20.0	100.0

Eastern Basin August 1983 - Surface

LAKE ERIE OXYGEN STUDY 1983-1984

```
************
* DOSAT    *
************

VARIABLE NUMBER . . . . . .        3        MAXIMUM        94.7900009
NUMBER OF DISTINCT VALUES .        5        MINIMUM        92.4300003
NUMBER OF VALUES COUNTED. .        5        RANGF           2.3600006
NUMBER OF VALUES NOT COUNTED       0        VARIANCE        0.8884704
                                            ST.DEV.         0.9425871
                                            (Q3-Q1)/2       0.6049995

                                            ST.ERROR
LOCATION ESTIMATES
              MEAN          93.5180054      0.4215378
              MEDIAN        93.3799973      0.6812738
              MODE          NOT UNIQUE

                                                  EACH 'H'
                                                  REPRESENTS
                                                      1
                                                  COUNT(S)

                                                  H
                                                  HH HH
                                                  L------U

                          EACH '-' ABOVE =        0.5000
                                      L=         92.5000
                                      U=         95.5000

                                                  Q1=   92.8899994
                          VALUE    VALUE/S.E.     Q3=   94.0999985
SKEWNESS                   0.21         0.20      S-=   92.5754166
KURTOSIS                  -1.64        -0.75      S+=   94.4605942

                          EACH '.' BELOW =        0.0200
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
92.43	1	20.0	20.0
92.89	1	20.0	40.0
93.38	1	20.0	60.0
94.10	1	20.0	80.0
94.79	1	20.0	100.0

Eastern Basin August 1983 - Surface

LAKE ERIE OXYGEN STUDY 1983 - 1984

```
************
* BTEMP    *
************
                                                   MAXIMUM          6.8000002
                                                   MINIMUM          5.0999999
VARIABLE NUMBER . . . . . .          3             RANGE            1.7000003
NUMBER OF DISTINCT VALUES .          4             VARIANCE         0.4020001                                                      EACH 'H'
NUMBER OF VALUES COUNTED. .          5             ST.DEV.          0.6340348                                                     REPRESENTS
NUMBER OF VALUES NOT COUNTED         0             (Q3-Q1)/2        0.2000000                                                          1
                                                                                                                                    COUNT(S)
LOCATION ESTIMATES                                      ST.ERROR
                  MEAN               5.8200002          0.2835490                                                              H
                  MEDIAN             5.5999999          0.4907480                                                             HHH  H
                  MODE               5.5999999                                                                               L------U

                                                                                              EACH '-' ABOVE =          0.3000
                                                                                                             L=          5.1000
                                                                                                             U=          6.9000

                                                                                                                   Q1=     5.5999999
                                                                                          VALUE     VALUE/S.E.     Q3=     6.0000000
                                                                          SKEWNESS         0.54           0.49     S-=     5.1859655
                                                                          KURTOSIS        -1.15          -0.52     S+=     6.4540348

                                                                                              EACH '.' BELOW =          0.0150
                                 Q                                  Q                        S
        S                        M             M                    3                        +                        M
  M     -                        E             E                                                                      A
  I..............................E.............E..........................................................................A
  N                              D             A                                                                      X
                                 I             N

                    PERCENTS                              PERCENTS                              PERCENTS                              PERCENTS
  VALUE     COUNT   CELL    CUM      VALUE     COUNT   CELL    CUM      VALUE     COUNT   CELL    CUM      VALUE     COUNT   CELL    CUM
    5.100      1    20.0   20.0        5.600      2    40.0   60.0        6.000      1    20.0   80.0        6.800      1    20.0  100.0
-------------------------------------------------------------------------------------------------------------------------------------------
```

Eastern Basin August 1983 - Bottom

```
LAKE ERIE OXYGEN STUDY 1983-1984

 ************
 * DO       *
 ************
                                                  MAXIMUM          9.3000002
VARIABLE NUMBER . . . . . .            2          MINIMUM          7.9000001
NUMBER OF DISTINCT VALUES .            5          RANGE            1.4000001                                           EACH 'H'
NUMBER OF VALUES COUNTED. .            5          VARIANCE         0.3020000                                          REPRESENTS
NUMBER OF VALUES NOT COUNTED           0          ST.DEV.          0.5495452                                              1
                                                  (Q3-Q1)/2        0.2999997                                           COUNT(S)

                                                      ST.ERROR
LOCATION ESTIMATES                                                                                                H H
                 MEAN              8.5199995      0.2457641                                                       H H  H
                ,MEDIAN            8.6000004      0.4041454                                                      L------U
                 MODE             NOT UNIQUE

                                                                                    EACH '-' ABOVE =          0.2500
                                                                                                 L=           8.0000
                                                                                                 U=           9.5000

                                                                                                            Q1=      8.1000004
                                                                                VALUE    VALUE/S.E.         Q3=      8.6999998
                                                                 SKEWNESS        0.25          0.23         S-=      7.9704547
                                                                 KURTOSIS       -1.49         -0.68         S+=      9.0695448

                                                                                EACH '.' BELOW =          0.0150
                    S       Q                                   Q                       S
                 M  -       1                       M     M     3                       +           M
                 I..........................................E.....E.......................................A
                 N                                  A     D                                         X
                                                    N     I

                   PERCENTS                          PERCENTS                          PERCENTS                          PERCENTS
   VALUE   COUNT   CELL   CUM     VALUE   COUNT   CELL   CUM     VALUE   COUNT   CELL   CUM     VALUE   COUNT   CELL   CUM
   7.900       1   20.0   20.0    8.600       1   20.0   60.0    9.300       1   20.0 100.0
   8.100       1   20.0   40.0    8.700       1   20.0   80.0
-----------------------------------------------------------------------------------------------------------------------------
```

Eastern Basin August 1983 - Bottom

LAKE ERIE OXYGEN STUDY 1983-1984

```
 ************
 * DOSAT    *
 ************
                                                  MAXIMUM          75.4599991
VARIABLE NUMBER . . . . . .         3             MINIMUM          65.4400024
NUMBER OF DISTINCT VALUES .         5             RANGE            10.0199966
NUMBER OF VALUES COUNTED. .         5             VARIANCE         15.8185129
NUMBER OF VALUES NOT COUNTED        0             ST.DEV.           3.9772494
                                                  (Q3-Q1)/2         1.9099998

LOCATION ESTIMATES                                 ST.ERROR
                   MEAN              69.3720016     1.7786800
                   MEDIAN            69.7799988     2.8925254
                   MODE              NOT UNIQUE
```

```
                                                                                              EACH 'H'
                                                                                             REPRESENTS
                                                                                                  1
                                                                                              COUNT(S)

                                                                                        HH
                                                                                        HH  H
                                                                                       L------U

                                                                     EACH '-' ABOVE =        2.0000
                                                                                  L=        66.0000
                                                                                  U=        78.0000

                                                                                         Q1=    66.1800003
                                                                VALUE    VALUE/S.E.      Q3=    70.0000000
                                          SKEWNESS               0.53          0.48      S-=    65.3947525
                                          KURTOSIS              -1.28         -0.59      S+=    73.3492508

                                                                 EACH '.' BELOW =        0.1000
```

```
      S    Q                                       Q                        S
     -M    1                              M    M  3                         +                          M
     .I....................................E...E.............................................................A
      N                                   A    D                                                       X
                                          N    I
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM	VALUE	COUNT	PERCENTS CELL	PERCENTS CUM	VALUE	COUNT	PERCENTS CELL	PERCENTS CUM	VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
65.44	1	20.0	20.0	69.78	1	20.0	60.0	75.46	1	20.0	100.0				
66.18	1	20.0	40.0	70.00	1	20.0	80.0								

Eastern Basin August 1983 - Bottom

```
LAKE ERIE OXYGEN STUDY 1983 - 1984

 ************
 * THICK    *
 ************
                                                  MAXIMUM          19.2000008
VARIABLE NUMBER . . . . . . .          4          MINIMUM           7.0999999
NUMBER OF DISTINCT VALUES .            5          RANGE            12.1000013                                 EACH 'H'
NUMBER OF VALUES COUNTED. .            5          VARIANCE         26.8970032                                REPRESENTS
NUMBER OF VALUES NOT COUNTED           0          ST.DEV.           5.1862321                                    1
                                                  (Q3-Q1)/2         3.8000002                                 COUNT(S)

LOCATION ESTIMATES                                     ST.ERROR
                   MEAN               13.9200010        2.3193536                                                H
                   MEDIAN             12.8999996        3.4929712                                           HHH  H
                   MODE               NOT UNIQUE                                                           L------U

                                                                                  EACH '-' ABOVE =        2.0000
                                                                                               L=         8.0000
                                                                                               U=        20.0000

                                                                                                        Q1=   11.3999996
                                                                           VALUE     VALUE/S.E.         Q3=   19.0000000
                                                            SKEWNESS       -0.10          -0.09         S-=    8.7337685
                                                            KURTOSIS       -1.74          -0.79         S+=   19.1062336

                                                                                  EACH ',' BELOW =        0.1000
             S                   Q                                                                              QS
  M          -                   1                   M       M                                                 3+M
  I..................................................E.......E.................................................A
  N                                                  D       A                                                  X
                                                     I       N

                   PERCENTS                          PERCENTS                          PERCENTS                          PERCENTS
  VALUE    COUNT  CELL   CUM      VALUE    COUNT  CELL   CUM      VALUE    COUNT  CELL   CUM      VALUE    COUNT  CELL   CUM
    7.100      1  20.0  20.0     12.900      1  20.0  60.0     19.200      1  20.0 100.0
   11.400      1  20.0  40.0     19.000      1  20.0  80.0
-----------------------------------------------------------------------------------------------------------------------------
```

Eastern Basin August 1983 - Hypolimnion

APPENDIX B

LAKE ERIE OXYGEN STUDY 1983 - 1984

```
************
* STEMP    *
************

VARIABLE NUMBER . . . . . .      2        MAXIMUM         20.8999996
NUMBER OF DISTINCT VALUES .      8        MINIMUM         18.3999996
NUMBER OF VALUES COUNTED. .      8        RANGE            2.5000000
NUMBER OF VALUES NOT COUNTED     0        VARIANCE         0.6098213
                                          ST.DEV.          0.7809106
                                          (Q3-Q1)/2        0.4750004

                                                 ST.ERROR
LOCATION ESTIMATES    MEAN       19.6875000    0.2760936
                      MEDIAN     19.6499996    0.3752776
                      MODE       NOT UNIQUE

                                   VALUE   VALUE/S.E.       Q1=  19.2500000
                     SKEWNESS       0.00      0.01          Q3=  20.2000008
                     KURTOSIS      -0.92     -0.53          S-=  18.9065895
                                                            S+=  20.4684105

EACH 'H' REPRESENTS 1 COUNT(S)

       H
  H HHHH HH
 L---------U

EACH '-' ABOVE =    0.3000
              L=   18.3000
              U=   21.0000

EACH '.' BELOW =    0.0200

                 S         Q         MM         Q       S        M
                 -         1         EE         3       +        A
 M                                   DA                          X
 I...................................IN..............................
 N
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM	VALUE	COUNT	PERCENTS CELL	PERCENTS CUM	VALUE	COUNT	PERCENTS CELL	PERCENTS CUM	VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
18.40	1	12.5	12.5	19.30	1	12.5	37.5	19.80	1	12.5	62.5	20.50	1	12.5	87.5
19.20	1	12.5	25.0	19.50	1	12.5	50.0	19.90	1	12.5	75.0	20.90	1	12.5	100.0

Central Basin July 1984 - Surface

LAKE ERIE OXYGEN STUDY 1983-1984

```
************
* DO       *
************

VARIABLE NUMBER . . . . . .        2      MAXIMUM         9.8000002
NUMBER OF DISTINCT VALUES .        9      MINIMUM         7.9000001
NUMBER OF VALUES COUNTED. .       13      RANGE           1.9000001
NUMBER OF VALUES NOT COUNTED       3      VARIANCE        0.2607694
                                          ST.DEV.         0.5106558
                                          (Q3-Q1)/2       0.3499999

                                                   ST.ERROR
LOCATION ESTIMATES  MEAN          8.8923082     0.1416304
                    MEDIAN        8.8999996     0.2020726
                    MODE          NOT UNIQUE

                                                                         EACH 'H'
                                                                        REPRESENTS
                                                                            1
                                                                         COUNT(S)
                                                            H
                                                         H H HH
                                                        H HHHHHH H
                                                        L-----------U

                                                EACH '-' ABOVE =       0.2000
                                                            L=         7.8000
                                                            U=        10.2000

                                                                     Q1=    8.6000004
                                                                     Q3=    9.3000002
                                       VALUE     VALUE/S.E.          S-=    8.3816528
                          SKEWNESS     -0.14        -0.21            S+=    9.4029636
                          KURTOSIS     -0.67        -0.49

                                                EACH '.' BELOW =       0.0150
                                                 Q    S                              M
                  S          Q          MM       3    +                              A
                  -          1          .EE.............................................X
M                                        AD
I.......................................  NI
N
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
7.900	1	7.7	7.7
8.400	2	15.4	23.1
8.600	1	7.7	30.8
8.700	2	15.4	46.2
8.900	1	7.7	53.8
9.100	2	15.4	69.2
9.300	2	15.4	84.6
9.400	1	7.7	92.3
9.800	1	7.7	100.0

Central Basin July 1984 - Surface

LAKE ERIE OXYGEN STUDY 1983-1984

```
************
* DOSAT    *
************
```

VARIABLE NUMBER	3	MAXIMUM	103.7500000
NUMBER OF DISTINCT VALUES .	14	MINIMUM	82.5199966
NUMBER OF VALUES COUNTED. .	16	RANGE	21.2300034
NUMBER OF VALUES NOT COUNTED	0	VARIANCE	37.8491287
		ST.DEV.	6.1521645
		(Q3-Q1)/2	4.3875008

LOCATION ESTIMATES		ST.ERROR
MEAN	94.5025024	1.5380411
MEDIAN	96.1200027	2.1564047
MODE	NOT UNIQUE	

```
                 EACH 'H'
                REPRESENTS
                    1
                 COUNT(S)
       H
  H H  HHH
 H HHHHHHHHH
L-----------U
```

EACH '-' ABOVE = 2.0000
L= 82.0000
U= 106.0000

	VALUE	VALUE/S.E.
SKEWNESS	-0.34	-0.55
KURTOSIS	-1.01	-0.83

Q1= 90.1650009
Q3= 98.9400024
S-= 88.3503342
S+= 100.6546707

EACH '.' BELOW = 0.2000

```
                S      Q                    M        M         Q     S          M
                -      1                    E........E.........3.....+..........A
M                                           A        D                          X
I...........................................N        I
N
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
82.52	1	6.2	6.2
86.05	1	6.2	12.5
87.36	1	6.2	18.7
89.25	1	6.2	25.0
91.08	2	12.5	37.5
92.97	1	6.2	43.7
95.90	1	6.2	50.0
96.34	2	12.5	62.5
98.52	1	6.2	68.7
98.55	1	6.2	75.0
99.33	1	6.2	81.2
101.08	1	6.2	87.5
101.92	1	6.2	93.7
103.75	1	6.2	100.0

Central Basin July 1984 - Surface

LAKE ERIE OXYGEN STUDY 1983 - 1984

```
************
* BTEMP    *
************
                                                      MAXIMUM          8.8999996
                                                      MINIMUM          8.1000004
VARIABLE NUMBER . . . . . .        3                  RANGE            0.7999992
NUMBER OF DISTINCT VALUES .        5                  VARIANCE         0.1057142
NUMBER OF VALUES COUNTED. .        8                  ST.DEV.          0.3251372
NUMBER OF VALUES NOT COUNTED       0                  (Q3-Q1)/2        0.2999997

                                                            ST.ERROR
LOCATION ESTIMATES
                  MEAN                     8.6000004         0.1149533
                  MEDIAN                   8.6999998         0.2020726
                  MODE                     8.8999996
```

	VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
	8.100	1	12.5	12.5
	8.200	1	12.5	25.0
	8.400	1	12.5	37.5
	8.700	2	25.0	62.5
	8.900	3	37.5	100.0

```
                                       H                 EACH 'H'
             H     H H                 REPRESENTS
             H H   H H                     1
             L---------U               COUNT(S)

     EACH '-' ABOVE =      0.1000
                  L=       8.1000
                  U=       9.0000

                                                   Q1=    8.3000002
                   VALUE    VALUE/S.E.             Q3=    8.8999996
SKEWNESS           -0.47      -0.55                S-=    8.2748632
KURTOSIS           -1.54      -0.89                S+=    8.9251375

     EACH '.' BELOW =       0.0075
```

```
                                                                                   Q  S
                     S Q                           M          M                    M  +
 M                   - 1                           E          E....................A....
 I.............................................E..........................................X
 N                                                 A          D
                                                   N          I
```

Central Basin July 1984 - Bottom

LAKE ERIE OXYGEN STUDY 1983-1984

```
************
* DO       *
************

VARIABLE NUMBER . . . . . .          2        MAXIMUM        9.8999996
NUMBER OF DISTINCT VALUES .         10        MINIMUM        7.4000001
NUMBER OF VALUES COUNTED. .         16        RANGE          2.4999995
NUMBER OF VALUES NOT COUNTED         0        VARIANCE       0.5356249
                                              ST.DEV.        0.7318640
                                              (Q3-Q1)/2      0.3750000

                                                       ST.ERROR
LOCATION ESTIMATES
                    MEAN            8.2312508         0.1829660
                    MEDIAN          8.0000000         0.1443376
                    MODE            7.9000001
```

```
                              EACH 'H'
                              REPRESENTS
          H                      1
          H                   COUNT(S)
       HHHHHH   H
       HHHHHH   H
      L-----------U

EACH '-' ABOVE =     0.2500
            L=       7.2500
            U=      10.2500

                                            Q1=   7.7500000
              VALUE    VALUE/S.E.           Q3=   8.5000000
SKEWNESS       1.23       2.01              S-=   7.4993868
KURTOSIS       0.46       0.38              S+=   8.9631147

EACH '.' BELOW =     0.0200
```

```
    S          Q                                Q                    S                          M
M   -          1      M   M        M            3                    +  ........................A
I.....................O...E........E....................................................        X
N                     D   D        A
                      E   I        N
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
7.400	1	6.2	6.2
7.500	1	6.2	12.5
7.700	2	12.5	25.0
7.800	1	6.2	31.2
7.900	3	18.7	50.0
8.100	2	12.5	62.5
8.300	2	12.5	75.0
8.700	2	12.5	87.5
9.800	1	6.2	93.7
9.900	1	6.2	100.0

Central Basin July 1984 - Bottom

```
************
* DOSAT    *
************

VARIABLE NUMBER . . . . . .          3        MAXIMUM          85.2699966
NUMBER OF DISTINCT VALUES .         13        MINIMUM          63.5099983
NUMBER OF VALUES COUNTED. .         16        RANGE            21.7599983
NUMBER OF VALUES NOT COUNTED         0        VARIANCE         41.5262032
                                              ST.DEV.           6.4440827
                                              (Q3-Q1)/2         3.0675011

                                                                     EACH 'H'
                                                                    REPRESENTS
                                                      H                 1
                                                      H              COUNT(S)
                                                      HH
                                                      HHHH H    H
                                                      HHHH H    H
                                                     L-----------U

LOCATION ESTIMATES                          ST.ERROR
              MEAN           70.4650040     1.6110207
              MEDIAN         68.2850037     0.9843838
              MODE           NOT UNIQUE

                                          EACH '-' ABOVE =      2.0000
                                                      L=       64.0000
                                                      U=       88.0000

                                                            Q1=   66.5699997
                                  VALUE   VALUE/S.E.        Q3=   72.7050018
                     SKEWNESS      1.31         2.14        S-=   64.0209198
                     KURTOSIS      0.54         0.44        S+=   76.9090881

                                          EACH '.' BELOW =      0.2000

       S        Q                      Q              S                         M
    M  -        1       .M      M      3              +                        .A
    I.....................E..........E.............................................X
    N                     D          A
                          I          N
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
63.51	1	6.2	6.2
64.37	1	6.2	12.5
65.96	1	6.2	18.7
66.08	1	6.2	25.0
67.06	1	6.2	31.2
67.31	2	12.5	43.7
67.92	1	6.2	50.0
68.65	1	6.2	56.2
68.77	1	6.2	62.5
70.47	2	12.5	75.0
74.94	2	12.5	87.5
84.41	1	6.2	93.7
85.27	1	6.2	100.0

Central Basin July 1984 - Bottom

LAKE ERIE OXYGEN STUDY 1983 - 1984

```
 ************
 * THICK    *
 ************                          MAXIMUM           9.1999998
                                       MINIMUM           6.0999999                              EACH 'H'
VARIABLE NUMBER . . . . . .      4     RANGE             3.0999999                             REPRESENTS
NUMBER OF DISTINCT VALUES .      7     VARIANCE          1.4050002                                 1
NUMBER OF VALUES COUNTED. .      8     ST.DEV.           1.1853271                              COUNT(S)
NUMBER OF VALUES NOT COUNTED     0     (Q3-Q1)/2         1.0000000
                                                                                           H
                                          ST.ERROR                                         H
LOCATION ESTIMATES                                                                         HH HHHH
                MEAN          7.4750009   0.4190764                                      L---------U
                MEDIAN        7.2500000   0.6062182
                MODE          6.5000000                                     EACH '-' ABOVE =    0.5000
                                                                                        L=      5.5000
                                                                                        U=     10.0000

                                                                                          Q1=     6.5000000
                                                                    VALUE   VALUE/S.E.    Q3=     8.5000000
                                                     SKEWNESS        0.20        0.23     S-=     6.2896738
                                                     KURTOSIS       -1.76       -1.01     S+=     8.6603279

                                                                     EACH '.' BELOW =        0.0250
                                                                         Q    S                         M
                                                                         3    +                         A
       S       Q                        M     M  ...................................................... X
 M     -       M                        E.....E.
 I.............O........................D     A
 N             D                        I     N
               E
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
6.100	1	12.5	12.5
6.500	2	25.0	37.5
6.600	1	12.5	50.0
7.900	1	12.5	62.5
8.400	1	12.5	75.0
8.600	1	12.5	87.5
9.200	1	12.5	100.0

Central Basin July 1984 - Hypolimnion

```
************
* STEMP    *
************

VARIABLE NUMBER . . . . . .        2          MAXIMUM        25.5000000
NUMBER OF DISTINCT VALUES . .      7          MINIMUM        23.5000000
NUMBER OF VALUES COUNTED. .        9          RANGE           2.0000000
NUMBER OF VALUES NOT COUNTED       0          VARIANCE        0.5152775
                                              ST.DEV.         0.7178283
                                              (Q3-Q1)/2       0.6499996

                                              ST.ERROR
LOCATION ESTIMATES
              MEAN            24.5444450      0.2392761
              MEDIAN          24.2999992      0.3752776
              MODE            NOT UNIQUE

                                                                 EACH 'H'
                                                                 REPRESENTS
                                                                     1
                                                                 COUNT(S)
                                                          H
                                                       H  H
                                                    HHHH H H
                                                   L---------U

                                    EACH '-' ABOVE =      0.2500
                                                L=       23.5000
                                                U=       25.7500

                                                         Q1=   24.0000000
                          VALUE   VALUE/S.E.             Q3=   25.2999992
             SKEWNESS      0.07         0.09             S-=   23.8266163
             KURTOSIS     -1.63        -1.00             S+=   25.2622738

                                    EACH '.' BELOW =      0.0200
                                            S Q
                                            + 3
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
23.50	1	11.1	11.1
24.00	2	22.2	33.3
24.10	1	11.1	44.4
24.30	1	11.1	55.6
24.90	1	11.1	66.7
25.30	2	22.2	88.9
25.50	1	11.1	100.0

Central Basin August 1984 - Surface

LAKE ERIE OXYGEN STUDY 1983-1984

```
************
* DO       *
************
                                                  MAXIMUM           8.6999998
                                                  MINIMUM           5.0999999
VARIABLE NUMBER . . . . . .           2           RANGE             3.5999999
NUMBER OF DISTINCT VALUES .          11           VARIANCE          1.0018383
NUMBER OF VALUES COUNTED. .          17           ST.DEV.           1.0009187
NUMBER OF VALUES NOT COUNTED          1           (Q3-Q1)/2         0.4500003

                                                      ST.ERROR
LOCATION ESTIMATES
                    MEAN              8.0058823       0.2427585
                    MEDIAN            8.5000000       0.2598079
                    MODE              NOT UNIQUE
```

```
                                          H
                                          H
                                          H    EACH 'H'
                                          H   REPRESENTS
                                          H        1
                                          H    COUNT(S)
                                          H
                                       H HH
                                H   HH HHHH
                                L----------U

                   EACH '-' ABOVE =        0.3000
                                L=         5.1000
                                U=         8.7000

                                                     Q1=     7.6999998
                    VALUE     VALUE/S.E.             Q3=     8.6000004
SKEWNESS            -1.68        -2.83               S-=     7.0049639
KURTOSIS             1.95         1.64               S+=     9.0068007

                    EACH '.' BELOW =       0.0500
```

```
                                                                     Q          S
                                      S           Q        M       M 3 M        +
M                                     -           1        E.......E...A.......
I..........................................................A.......D   X
N                                                          N       I
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
5.100	1	5.9	5.9
6.500	1	5.9	11.8
6.900	1	5.9	17.6
7.600	1	5.9	23.5
7.700	1	5.9	29.4
7.900	1	5.9	35.3
8.300	1	5.9	41.2
8.400	1	5.9	47.1
8.500	1	5.9	52.9
8.600	4	23.5	76.5
8.700	4	23.5	100.0

Central Basin August 1984 - Surface

LAKE ERIE OXYGEN STUDY 1983-1984

```
************
* DOSAT    *
************
```

VARIABLE NUMBER	3	MAXIMUM	107.7200012
NUMBER OF DISTINCT VALUES .	16	MINIMUM	57.4300003
NUMBER OF VALUES COUNTED. .	18	RANGE	50.2900009
NUMBER OF VALUES NOT COUNTED	0	VARIANCE	183.3174133
		ST.DEV.	13.5394764
		(Q3-Q1)/2	7.7149963

LOCATION ESTIMATES		ST.ERROR
MEAN	94.4661102	3.1912854
MEDIAN	99.7050018	2.6096249
MODE	NOT UNIQUE	

```
               H    EACH 'H'
               H    REPRESENTS
               H        1
              HHH    COUNT(S)
            H HHH
   H  HH HHHHH
  L-----------U
```

EACH '-' ABOVE = 5.0000
L= 55.0000
U= 115.0000

	VALUE	VALUE/S.E.
SKEWNESS	-1.40	-2.42
KURTOSIS	1.03	0.89

Q1= 87.6600037
Q3= 103.0899963
S-= 80.9266357
S+= 108.0055847

EACH ',' BELOW = 0.5000

```
                                                      S               Q                M          M     Q        S
                                                      -               1                           E     3        M
 M                                                                                     E..........E..............A
 I.............................................................................................. D               X
 N                                                                                     A          I
                                                                                       N
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
57.43	1	5.6	5.6
72.68	1	5.6	11.1
76.79	1	5.6	16.7
86.30	1	5.6	22.2
87.66	1	5.6	27.8
93.38	1	5.6	33.3
96.89	1	5.6	38.9
98.11	1	5.6	44.4
99.00	1	5.6	50.0
100.41	2	11.1	61.1
101.58	1	5.6	66.7
102.42	1	5.6	72.2
103.09	1	5.6	77.8
103.98	1	5.6	83.3
106.27	2	11.1	94.4
107.72	1	5.6	100.0

Central Basin August 1984 - Surface

LAKE ERIE OXYGEN STUDY 1983 - 1984

```
************
* BTEMP    *
************
                                                MAXIMUM         10.6000004
                                                MINIMUM          8.8999996
VARIABLE NUMBER . . . . . .         3           RANGE            1.7000008
NUMBER OF DISTINCT VALUES .         6           VARIANCE         0.2675002
NUMBER OF VALUES COUNTED. .         9           ST.DEV.          0.5172042
NUMBER OF VALUES NOT COUNTED        0           (Q3-Q1)/2        0.1500001

                                                ST.ERROR
LOCATION ESTIMATES
                  MEAN              9.9000006    0.1724014
                  MEDIAN            9.8000002    0.2886753
                  MODE              9.8000002
```

```
                                                   EACH 'H'
                                                   REPRESENTS
                                                        1
                                                   COUNT(S)
        H
        H   H
   H HHHH H
   L---------U

EACH '-' ABOVE =       0.2000
             L=        8.8000
             U=       10.6000

                                                  Q1=     9.8000002
                      VALUE    VALUE/S.E.         Q3=    10.1000004
SKEWNESS              -0.30        -0.37          S-=     9.3827963
KURTOSIS              -0.40        -0.24          S+=    10.4172049

EACH '.' BELOW =       0.0150

                     S                 Q               Q         S     M
                     -                 M    M          3         +     A
M                                      E....E..........................X
I......................................D    A
N                                      I    N
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
8.900	1	11.1	11.1
9.600	1	11.1	22.2
9.800	3	33.3	55.6
9.900	1	11.1	66.7
10.100	1	11.1	77.8
10.600	2	22.2	100.0

Central Basin August 1984 - Bottom

LAKE ERIE OXYGEN STUDY 1983-1984

```
************
* DO       *
************

VARIABLE NUMBER . . . . . .          2     MAXIMUM         7.1999998
NUMBER OF DISTINCT VALUES .         14     MINIMUM         1.9000000
NUMBER OF VALUES COUNTED. .         16     RANGE           5.2999997
NUMBER OF VALUES NOT COUNTED         0     VARIANCE        3.1038337
                                           ST.DEV.         1.7617700
                                           (Q3-Q1)/2       1.4500002

LOCATION ESTIMATES                            ST.ERROR
                 MEAN            4.4874997    0.4404425
                 MEDIAN          4.7500000    0.7794234
                 MODE           NOT UNIQUE
```

```
                                  EACH 'H'
                                 REPRESENTS
                                     1
                                  COUNT(S)
      H   H
  H HH    H H
  H HH H HHHHH
 L-----------U

EACH '-' ABOVE =        0.5000
              L=        1.5000
              U=        7.5000

                                                   Q1=    3.0500000
                          VALUE    VALUE/S.E.      Q3=    5.9500003
             SKEWNESS     -0.01        -0.02       S-=    2.7257297
             KURTOSIS     -1.53        -1.25       S+=    6.2492700

EACH ',' BELOW =        0.0500
```

```
                S      Q                      M     M                        Q    S                     M
M               -      1                      E     E                        3    +                     A
I.............................................E.....E...............................................A
N                                             A     D                                               X
                                              N     I
```

VALUE	COUNT	PERCENTS CELL	CUM
1.900	1	6.2	6.2
2.000	1	6.2	12.5
2.800	1	6.2	18.7
3.000	1	6.2	25.0
3.100	2	12.5	37.5
3.200	1	6.2	43.7
4.200	1	6.2	50.0
5.300	1	6.2	56.2
5.500	2	12.5	68.7
5.800	1	6.2	75.0
6.100	1	6.2	81.2
6.300	1	6.2	87.5
6.800	1	6.2	93.7
7.200	1	6.2	100.0

Central Basin August 1984 - Bottom

LAKE ERIE OXYGEN STUDY 1983-1984

```
************
* DOSAT    *
************
```

VARIABLE NUMBER	3	MAXIMUM	63.3899994
NUMBER OF DISTINCT VALUES .	16	MINIMUM	16.6399994
NUMBER OF VALUES COUNTED. .	16	RANGE	46.7500000
NUMBER OF VALUES NOT COUNTED	0	VARIANCE	236.9878387
		ST.DEV.	15.3944092
		(Q3-Q1)/2	12.5724993

LOCATION ESTIMATES

		ST.ERROR
MEAN	39.2806244	3.8486023
MEDIAN	40.9200020	6.8387170
MODE	NOT UNIQUE	

```
  H              EACH 'H'
  H    HH       REPRESENTS
 H H   HH           1
 HHH H HHHH      COUNT(S)
L-----------U
```

EACH '-' ABOVE = 5.0000
L= 10.0000
U= 70.0000

	VALUE	VALUE/S.E.
SKEWNESS	0.01	0.02
KURTOSIS	-1.50	-1.23

Q1= 26.8500004
Q3= 51.9949989
S-= 23.8862152
S+= 54.6750336

EACH '.' BELOW = 0.5000

```
                   S     Q                                        Q     S
M                  -     1                  M  M                  3     +                  M
I...........................................E..E...........................................A
N                                           A  D                                           X
                                            N  I
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM	VALUE	COUNT	PERCENTS CELL	PERCENTS CUM	VALUE	COUNT	PERCENTS CELL	PERCENTS CUM	VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
16.64	1	6.2	6.2	27.09	1	6.2	31.2	45.73	1	6.2	56.2	53.21	1	6.2	81.2
17.51	1	6.2	12.5	27.55	1	6.2	37.5	48.07	1	6.2	62.5	54.96	1	6.2	87.5
24.84	1	6.2	18.7	27.97	1	6.2	43.7	48.16	1	6.2	68.7	59.87	1	6.2	93.7
26.61	1	6.2	25.0	36.11	1	6.2	50.0	50.78	1	6.2	75.0	63.39	1	6.2	100.0

Central Basin August 1984 - Bottom

```
************
* THICK    *
************
```

VARIABLE NUMBER	4	MAXIMUM	10.3999996
NUMBER OF DISTINCT VALUES .	9	MINIMUM	2.4000001
NUMBER OF VALUES COUNTED. .	9	RANGE	7.9999995
NUMBER OF VALUES NOT COUNTED	0	VARIANCE	5.6644435
		ST.DEV.	2.3800092
		(Q3-Q1)/2	0.7500000

LOCATION ESTIMATES

		ST.ERROR
MEAN	4.6777782	0.7933364
MEDIAN	4.0999999	0.7794234
MODE	NOT UNIQUE	

```
                                                  EACH 'H'
                                                 REPRESENTS
                                                     1
                                                  COUNT(S)
   HHHH
   HHHH     H
  L---------U

EACH '-' ABOVE =     1.0000
            L=       2.0000
            U=      11.0000
```

	VALUE	VALUE/S.E.		
			Q1=	3.5999999
			Q3=	5.0999999
SKEWNESS	1.53	1.87	S-=	2.2977691
KURTOSIS	1.36	0.84	S+=	7.0577874

EACH '.' BELOW = 0.0750

```
S                  Q          M       M     Q                           S                                              M
- M                1          E       E     3                           +                                              A
..I.....................E......E.........................................................................................X
  N                           D       A
                              I       N
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
2.400	1	11.1	11.1
2.600	1	11.1	22.2
3.600	1	11.1	33.3
3.700	1	11.1	44.4
4.100	1	11.1	55.6
4.900	1	11.1	66.7
5.100	1	11.1	77.8
5.300	1	11.1	88.9
10.400	1	11.1	100.0

Central Basin August 1984 - Hypolimnion

LAKE ERIE OXYGEN STUDY 1983 - 1984

```
************
* STEMP    *
************

VARIABLE NUMBER . . . . . .       2      MAXIMUM          19.7000008
NUMBER OF DISTINCT VALUES .       6      MINIMUM          18.6000004
NUMBER OF VALUES COUNTED. .       6      RANGE             1.1000004
NUMBER OF VALUES NOT COUNTED      0      VARIANCE          0.1746667
                                         ST.DEV.           0.4179315
                                         (Q3-Q1)/2         0.2999992

                                                   ST.ERROR
LOCATION ESTIMATES
              MEAN              19.0333347        0.1706198
              MEDIAN            18.9500008        0.3175429
              MODE              NOT UNIQUE
```

```
                                                        EACH 'H'
                                                        REPRESENTS
                                                            1
                                                        COUNT(S)
                                             H
                                             H
                                             H HH H
                                             L-------U

                               EACH '-' ABOVE =       0.2000
                                           L=        18.6000
                                           U=        20.0000

                                                   Q1=   18.7000008
                   VALUE    VALUE/S.E.             Q3=   19.2999992
SKEWNESS            0.51        0.51               S-=   18.6154041
KURTOSIS           -1.34       -0.67               S+=   19.4512653

                               EACH '.' BELOW =       0.0100
```

```
                                                Q          S                    M
                                                3          +                    A
 S     Q              M     M  ........................................................X
 M-    1              E.....E.......
 I........................D     A
 N                    I     N
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
18.60	1	16.7	16.7
18.70	1	16.7	33.3
18.80	1	16.7	50.0
19.10	1	16.7	66.7
19.30	1	16.7	83.3
19.70	1	16.7	100.0

Eastern Basin July 1984 - Surface

LAKE ERIE OXYGEN STUDY 1983-1984

```
************
* DO       *
************
```

VARIABLE NUMBER	2	MAXIMUM	11.1000004
NUMBER OF DISTINCT VALUES .	10	MINIMUM	8.8999996
NUMBER OF VALUES COUNTED. .	12	RANGE	2.2000008
NUMBER OF VALUES NOT COUNTED	0	VARIANCE	0.4693184
		ST.DEV.	0.6850682
		(Q3-Q1)/2	0.4500003

EACH 'H' REPRESENTS 1 COUNT(S)

```
   H
  HH HH
 HHH HH  HH
L----------U
```

LOCATION ESTIMATES

		ST.ERROR
MEAN	9.7750006	0.1977622
MEDIAN	9.6000004	0.2598076
MODE	NOT UNIQUE	

EACH '-' ABOVE = 0.2500
L= 8.7500
U= 11.2500

	VALUE	VALUE/S.E.
SKEWNESS	0.62	0.88
KURTOSIS	-0.87	-0.62

Q1= 9.2500000
Q3= 10.1500006
S-= 9.0899324
S+= 10.4600687

EACH '.' BELOW = 0.0200

```
                                                                                           S                         M
                                                                         Q                 +                         A
      S      Q             M      M                                      3  ..................................................X
   M  -      1             E......E...............................................
   I............................D      A
   N                             I      N
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
8.900	1	8.3	8.3
9.200	2	16.7	25.0
9.300	2	16.7	41.7
9.400	1	8.3	50.0
9.800	1	8.3	58.3
10.000	1	8.3	66.7
10.100	1	8.3	75.0
10.200	1	8.3	83.3
10.800	1	8.3	91.7
11.100	1	8.3	100.0

Eastern Basin July 1984 - Surface

```
LAKE ERIE OXYGEN STUDY 1983-1984

 ************
 * DOSAT    *
 ************                                            MAXIMUM         114.4400024
                                                         MINIMUM          95.0599976
VARIABLE NUMBER . . . . . .              3               RANGE            19.3800049
NUMBER OF DISTINCT VALUES .             12               VARIANCE         38.9051666
NUMBER OF VALUES COUNTED. .             12               ST.DEV.           6.2374005
NUMBER OF VALUES NOT COUNTED             0               (Q3-Q1)/2         3.0750008

                                                              ST.ERROR
LOCATION ESTIMATES                                            1.8005825
                    MEAN              101.2808304             1.7349391
                    MEDIAN             98.4300003
                    MODE               NOT UNIQUE

                                                                                         H                   EACH 'H'
                                                                                         H                  REPRESENTS
                                                                                         H                       1
                                                                                         HH H                COUNT(S)
                                                                                         HHHH    HH
                                                                                        L----------U

                                                                              EACH '-' ABOVE =       2.0000
                                                                                           L=       96.0000
                                                                                           U=      116.0000

                                                                                                 Q1=   97.1549988
                                                                         VALUE   VALUE/S.E.      Q3=  103.3050003
                                                               SKEWNESS   1.14         1.62      S-=   95.0434265
                                                               KURTOSIS  -0.13        -0.09      S+=  107.5182343

                                                                              EACH ',' BELOW =        0.1500

                                                                      S                                              M
              Q                               Q                       +                                              A
S             1        M             M        3                                                                      X
M                      E             E.....................................................................................
I......................D..............A
N                      I             N

                     PERCENTS                             PERCENTS                        PERCENTS                        PERCENTS
  VALUE    COUNT    CELL   CUM    VALUE   COUNT    CELL   CUM    VALUE   COUNT    CELL   CUM    VALUE   COUNT    CELL   CUM
  95.06      1       8.3   8.3    97.36     1       8.3  33.3    98.44     1       8.3  58.3   103.37     1       8.3  83.3
  96.31      1       8.3  16.7    97.98     1       8.3  41.7   101.48     1       8.3  66.7   112.32     1       8.3  91.7
  96.95      1       8.3  25.0    98.42     1       8.3  50.0   103.24     1       8.3  75.0   114.44     1       8.3 100.0
---------------------------------------------------------------------------------------------------------------------------
```

Eastern Basin July 1984 - Surface

LAKE ERIE OXYGEN STUDY 1983 - 1984

```
************
* BTEMP    *
************
                                                 MAXIMUM          5.3000002
                                                 MINIMUM          4.5999999
VARIABLE NUMBER . . . . . .          3           RANGE            0.7000003
NUMBER OF DISTINCT VALUES .          5           VARIANCE         0.0946667
NUMBER OF VALUES COUNTED. .          6           ST.DEV.          0.3076796
NUMBER OF VALUES NOT COUNTED         0           (Q3-Q1)/2        0.3000002

                                                    ST.ERROR
LOCATION ESTIMATES
                 MEAN              5.0333333         0.1256097
                 MEDIAN            5.1500001         0.2020728
                 MODE              5.3000002
```

```
                                                   EACH 'H'
                                                   REPRESENTS
                                                       1
                                                   COUNT(S)
              H   H
              H  HHH
              L-------U

EACH '-' ABOVE =      0.1000
           L=         4.6000
           U=         5.3000

                                        Q1=     4.6999998
          VALUE    VALUE/S.E.           Q3=     5.3000002
SKEWNESS  -0.52      -0.52              S-=     4.7256536
KURTOSIS  -1.69      -0.85              S+=     5.3410130

EACH '.' BELOW =      0.0075
```

```
                                                                                        Q    S
          Q   S                                    M            M                       M    +
M         1   -                                    E............E.......................A......
I..................................................A            D                       X
N                                                  N            I
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
4.600	1	16.7	16.7
4.700	1	16.7	33.3
5.100	1	16.7	50.0
5.200	1	16.7	66.7
5.300	2	33.3	100.0

Eastern Basin July 1984 - Bottom

LAKE ERIE OXYGEN STUDY 1983-1984

```
************
* DO       *
************
```

VARIABLE NUMBER	2	MAXIMUM	11.6000004
NUMBER OF DISTINCT VALUES .	10	MINIMUM	9.3999996
NUMBER OF VALUES COUNTED. .	12	RANGE	2.2000008
NUMBER OF VALUES NOT COUNTED	0	VARIANCE	0.4087881
		ST.DEV.	0.6393654
		(Q3-Q1)/2	0.3000002

LOCATION ESTIMATES

		ST.ERROR
MEAN	10.8166666	0.1845689
MEDIAN	10.9499998	0.1443376
MODE	NOT UNIQUE	

```
                    H           EACH 'H'
                    H          REPRESENTS
                    H               1
                    H H          COUNT(S)
              H H H HHHH
              L---------U

EACH '-' ABOVE =      0.2500
             L=       9.2500
             U=      11.7500
```

	VALUE	VALUE/S.E.		
SKEWNESS	-0.95	-1.35	Q1=	10.6000004
KURTOSIS	-0.05	-0.04	Q3=	11.2000008
			S-=	10.1773014
			S+=	11.4560318

EACH '.' BELOW = 0.0200

```
                          S                      Q                        Q      S    M
                          -                      1      M    M            3      +    .A
M                                                       .E....E...................... X
I...................................................... A    D
N                                                       N    I
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
9.400	1	8.3	8.3
9.900	1	8.3	16.7
10.400	1	8.3	25.0
10.800	1	8.3	33.3
10.900	2	16.7	50.0
11.000	2	16.7	66.7
11.100	1	8.3	75.0
11.300	1	8.3	83.3
11.500	1	8.3	91.7
11.600	1	8.3	100.0

Eastern Basin July 1984 - Bottom

LAKE ERIE OXYGEN STUDY 1983-1984

```
************
* DOSAT    *
************
                                                              MAXIMUM          96.7600021
VARIABLE NUMBER . . . . . .           3                       MINIMUM          79.9199982
NUMBER OF DISTINCT VALUES .          11                       RANGE            16.8400040
NUMBER OF VALUES COUNTED. .          12                       VARIANCE         25.6255798
NUMBER OF VALUES NOT COUNTED          0                       ST.DEV.           5.0621715
                                                              (Q3-Q1)/2         2.4500008

                                                                    ST.ERROR
LOCATION ESTIMATES
                      MEAN               88.3158340          1.4613230
                      MEDIAN             88.1650009          1.8763893
                      MODE               87.1100006
```

```
                                                  H
                                                  HH
                                                  HH
                                              HH  HH HHH
                                             L----------U

                                   EACH '-' ABOVE =         2.0000
                                                L=         78.0000
                                                U=         98.0000

                                                           Q1=   86.7099991
                                 VALUE    VALUE/S.E.       Q3=   91.6100006
            SKEWNESS             -0.14         -0.19       S-=   83.2536621
            KURTOSIS             -0.69         -0.49       S+=   93.3780060

                                   EACH '.' BELOW =         0.1500
```

```
                        S                          Q                                Q         S                  M
                        -                          1 M      MM            .         3         +                  A
M                                                                                                                X
I...................................................O......EE........................................................
N                                                   D      DA
                                                    E      IN
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
79.92	1	8.3	8.3
80.10	1	8.3	16.7
86.31	1	8.3	25.0
87.11	2	16.7	41.7
87.83	1	8.3	50.0
88.50	1	8.3	58.3
88.65	1	8.3	66.7
89.61	1	8.3	75.0
93.61	1	8.3	83.3
94.28	1	8.3	91.7
96.76	1	8.3	100.0

Eastern Basin July 1984 - Bottom

```
************
* THICK    *
************
                                                      MAXIMUM          46.0000000
VARIABLE NUMBER . . . . . .          4                MINIMUM          14.3999996
NUMBER OF DISTINCT VALUES .          6                RANGE            31.6000004
NUMBER OF VALUES COUNTED. .          6                VARIANCE        129.6880035
NUMBER OF VALUES NOT COUNTED         0                ST.DEV.          11.3880644
                                                      (Q3-Q1)/2         5.5500002

LOCATION ESTIMATES                                         ST.ERROR
                   MEAN                 25.5000019         4.6491575
                   MEDIAN               22.9500008         9.1221390
                   MODE                 NOT UNIQUE
```

```
                                                                  H
                                                                  H H         EACH 'H'
                                                                  H H   H     REPRESENTS
                                                                 L-------U       1
                                                                              COUNT(S)
                                                EACH '-' ABOVE =      5.0000
                                                            L=       15.0000
                                                            U=       50.0000

                                                                   Q1=   17.7999992
                                        VALUE   VALUE/S.E.         Q3=   28.8999996
                      SKEWNESS           0.90         0.90         S-=   14.1119375
                      KURTOSIS          -0.66        -0.33         S+=   36.8880653

                                                EACH ',' BELOW =      0.2500
S         Q                                          Q                    S                           M
-M        1                   M       M              3                    +                           A
.I............................E.......E.........................................................A
 N                            D       A                                                           X
                              I       N
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM	VALUE	COUNT	PERCENTS CELL	PERCENTS CUM	VALUE	COUNT	PERCENTS CELL	PERCENTS CUM	VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
14.40	1	16.7	16.7	19.70	1	16.7	50.0	28.90	1	16.7	83.3				
17.80	1	16.7	33.3	26.20	1	16.7	66.7	46.00	1	16.7	100.0				

Eastern Basin July 1984 - Hypolimnion

LAKE ERIE OXYGEN STUDY 1983 - 1984

```
 ************
 * STEMP    *
 ************
                                                     MAXIMUM          23.7999992
                                                     MINIMUM          22.7999992
VARIABLE NUMBER . . . . . .          2               RANGE             1.0000000
NUMBER OF DISTINCT VALUES .          4               VARIANCE          0.1120001
NUMBER OF VALUES COUNTED. .          6               ST.DEV.           0.3346641
NUMBER OF VALUES NOT COUNTED         0               (Q3-Q1)/2         0.1000004

                                                           ST.ERROR
LOCATION ESTIMATES                      23.3999996         0.1366260
                  MEAN                  23.5000000         0.2886753
                  MEDIAN                23.5000000
                  MODE

                                                                                          EACH 'H'
                                                                                         REPRESENTS
                                                                                             1
                                                                                          COUNT(S)
                                                                                      H
                                                                                      H
                                                                                   H  HH H
                                                                                  L-------U

                                                                EACH '-' ABOVE =        0.1500
                                                                              L=       22.8000
                                                                              U=       23.8500

                                                                                      Q1=   23.2999992
                                                              VALUE    VALUE/S.E.      Q3=   23.5000000
                                              SKEWNESS        -0.80      -0.80         S-=   23.0653362
                                              KURTOSIS        -0.52      -0.26         S+=   23.7346630

                                                                EACH ',' BELOW =        0.0100
                                                                              S
                                                          Q                   +        M
                             S                 Q      M   M                            A
                             -                 1      E   E                            X
        M                                             A   D
        I.............................................N...I............................
        N

VALUE     COUNT  PERCENTS     VALUE   COUNT  PERCENTS     VALUE   COUNT  PERCENTS     VALUE   COUNT  PERCENTS
                 CELL  CUM                   CELL  CUM                   CELL  CUM                   CELL  CUM
 22.80       1   16.7  16.7    23.30      1  16.7  33.3    23.50      3  50.0  83.3    23.80      1  16.7 100.0
-------------------------------------------------------------------------------------------------------------------
```

Eastern Basin August 1984 - Surface

LAKE ERIE OXYGEN STUDY 1983-1984

```
************
* DO       *
************

VARIABLE NUMBER . . . . . .           2
NUMBER OF DISTINCT VALUES .           6
NUMBER OF VALUES COUNTED. .          11
NUMBER OF VALUES NOT COUNTED          1
```

MAXIMUM	9.1000004
MINIMUM	7.5000000
RANGE	1.6000004
VARIANCE	0.1896364
ST.DEV.	0.4354727
(Q3-Q1)/2	0.1999998

LOCATION ESTIMATES

		ST.ERROR
MEAN	8.5818186	0.1312999
MEDIAN	8.5000000	0.1154700
MODE	8.5000000	

```
                         H
                         H
                         HH H
                     H   HHHHH
                    L---------U
```

EACH 'H' REPRESENTS 1 COUNT(S)

EACH '-' ABOVE = 0.2000
L= 7.4000
U= 9.4000

	VALUE	VALUE/S.E.
SKEWNESS	-1.16	-1.57
KURTOSIS	1.24	0.84

Q1=	8.5000000
Q3=	8.8999996
S-=	8.1463461
S+=	9.0172911

EACH '.' BELOW = 0.0150

```
                                              Q            S     M
                        S             Q  M                 3      +     A
M                       -             M  E
I.....................................E....E.............................X
N                                     D  A
                                      I  N
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
7.500	1	9.1	9.1
8.400	1	9.1	18.2
8.500	4	36.4	54.5
8.700	2	18.2	72.7
8.900	1	9.1	81.8
9.100	2	18.2	100.0

Eastern Basin August 1984 - Surface

LAKE ERIE OXYGEN STUDY 1983-1984

```
 ************
 * DOSAT    *
 ************
```

VARIABLE NUMBER	3	MAXIMUM	105.4700012
NUMBER OF DISTINCT VALUES .	11	MINIMUM	82.1299973
NUMBER OF VALUES COUNTED. .	12	RANGE	23.3400040
NUMBER OF VALUES NOT COUNTED	0	VARIANCE	36.0995941
		ST.DEV.	6.0082936
		(Q3-Q1)/2	1.8474998

LOCATION ESTIMATES		ST.ERROR
MEAN	99.6658325	1.7344450
MEDIAN	100.2850037	1.0998521
MODE	99.0000000	

```
                                   H         EACH 'H'
                                   H        REPRESENTS
                                   H            1
                                   HHHH      COUNT(S)
                              H    HHHH
                              L----------U
```

EACH '-' ABOVE = 2.5000
L= 82.5000
U= 107.5000

	VALUE	VALUE/S.E.
SKEWNESS	-2.08	-2.94
KURTOSIS	3.75	2.65

Q1= 99.0000000
Q3= 102.6949997
S-= 93.6575394
S+= 105.6741257

EACH '.' BELOW = 0.2000

```
                                                       Q                         S
                           S                           M  M  M             Q     M+
                           -                           O..E..E.............3.....A.
M                                                      D  A  D                   X
I......................................................E  N  I
N
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
82.13	1	8.3	8.3
98.31	1	8.3	16.7
99.00	2	16.7	33.3
99.49	1	8.3	41.7
99.98	1	8.3	50.0
100.59	1	8.3	58.3
101.42	1	8.3	66.7
102.58	1	8.3	75.0
102.81	1	8.3	83.3
105.21	1	8.3	91.7
105.47	1	8.3	100.0

Eastern Basin August 1984 - Surface

```
************
* BTEMP    *
************

VARIABLE NUMBER . . . . . .        3        MAXIMUM        8.3000002
NUMBER OF DISTINCT VALUES .        6        MINIMUM        4.8000002
NUMBER OF VALUES COUNTED. .        6        RANGE          3.5000000
NUMBER OF VALUES NOT COUNTED       0        VARIANCE       1.6136667
                                            ST.DEV.        1.2703018
                                            (Q3-Q1)/2      0.5000000

                                                 ST.ERROR
LOCATION ESTIMATES
           MEAN                5.8833337        0.5185986
           MEDIAN              5.4000001        1.0103635
           MODE                NOT UNIQUE
```

```
                                                         EACH 'H'
                                             H           REPRESENTS
                                             H               1
                                             H           COUNT(S)
                                             H H   H
                                            L-------U

                         EACH '-' ABOVE =       0.5000
                                      L=        5.0000
                                      U=        8.5000

                                                Q1=   5.1999998
                      VALUE   VALUE/S.E.        Q3=   6.1999998
         SKEWNESS      1.20        1.20         S-=   4.6130319
         KURTOSIS     -0.25       -0.12         S+=   7.1536355

                         EACH '.' BELOW =       0.0300
```

```
                                                           S                        M
S        Q       M         M        Q                      +                        A
-  M     1       E         E        3                                               X
......I..........E.........E.........................................................
   N             D         A
                 I         N
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
4.800	1	16.7	16.7
5.200	1	16.7	33.3
5.300	1	16.7	50.0
5.500	1	16.7	66.7
6.200	1	16.7	83.3
8.300	1	16.7	100.0

Eastern Basin August 1984 - Bottom

LAKE ERIE OXYGEN STUDY 1983-1984

```
************
* DO       *
************

VARIABLE NUMBER . . . . . .        2     MAXIMUM        10.0000000
NUMBER OF DISTINCT VALUES .        9     MINIMUM         5.5999999
NUMBER OF VALUES COUNTED. .       10     RANGE           4.4000001
NUMBER OF VALUES NOT COUNTED       1     VARIANCE        1.8890003
                                         ST.DEV.         1.3744091
                                         (Q3-Q1)/2       0.7999997

                                                 ST.ERROR
LOCATION ESTIMATES
          MEAN                 8.7700005       0.4346263
          MEDIAN               9.2000008       0.4618803
          MODE                 9.1000004

                                                                                 H      EACH 'H'
                                                                                 HH     REPRESENTS
                                                                                 HH         1
                                                                           H   H H HH   COUNT(S)
                                                                           L----------U

                                                            EACH '-' ABOVE =      0.5000
                                                                        L=        5.5000
                                                                        U=       10.5000

                                                         VALUE   VALUE/S.E.    Q1=   8.1000004
                                         SKEWNESS        -1.29     -1.67       Q3=   9.6999998
                                         KURTOSIS         0.41      0.26       S-=   7.3955917
                                                                               S+=  10.1444092

                                                            EACH '.' BELOW =      0.0500
                                                                 Q          S
                      S         Q          M     M M       3      M   +
 M                    -         1 .........E......O.E..............A...
 I.................................................  A     D D           X
 N                                           N     E I
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
5.600	1	10.0	10.0
7.400	1	10.0	20.0
8.100	1	10.0	30.0
9.100	2	20.0	50.0
9.300	1	10.0	60.0
9.600	1	10.0	70.0
9.700	1	10.0	80.0
9.800	1	10.0	90.0
10.000	1	10.0	100.0

Eastern Basin August 1984 - Bottom

LAKE ERIE OXYGEN STUDY 1983-1984

```
************
* DOSAT    *
************

VARIABLE NUMBER . . . . . .          3        MAXIMUM        81.0000000
NUMBER OF DISTINCT VALUES .         10        MINIMUM        47.5499992
NUMBER OF VALUES COUNTED. .         11        RANGE          33.4500008
NUMBER OF VALUES NOT COUNTED         0        VARIANCE       97.1087799
                                              ST.DEV.         9.8543787
                                              (Q3-Q1)/2       6.2900009

LOCATION ESTIMATES                              ST.ERROR
                MEAN            71.4700012      2.9712069
                MEDIAN          73.3399963      3.6315355
                MODE            73.3399963

                                                                  H       EACH 'H'
                                                                 HH       REPRESENTS
                                                                 HH           1
                                                             H  HHHHH     COUNT(S)
                                                            L----------U

                                              EACH '-' ABOVE =      5.0000
                                                          L=       40.0000
                                                          U=       90.0000

                                                                   Q1=   66.4000015
                                         VALUE    VALUE/S.E.       Q3=   78.9800034
                            SKEWNESS     -1.34       -1.82         S-=   61.6156235
                            KURTOSIS      0.77        0.52         S+=   81.3243790

                                              EACH '.' BELOW =      0.3000
```

VALUE	COUNT	PERCENTS CELL	PERCENTS CUM
47.55	1	9.1	9.1
61.19	1	9.1	18.2
66.40	1	9.1	27.3
72.17	1	9.1	36.4
73.34	2	18.2	54.5
75.33	1	9.1	63.6
77.76	1	9.1	72.7
78.98	1	9.1	81.8
79.11	1	9.1	90.9
81.00	1	9.1	100.0

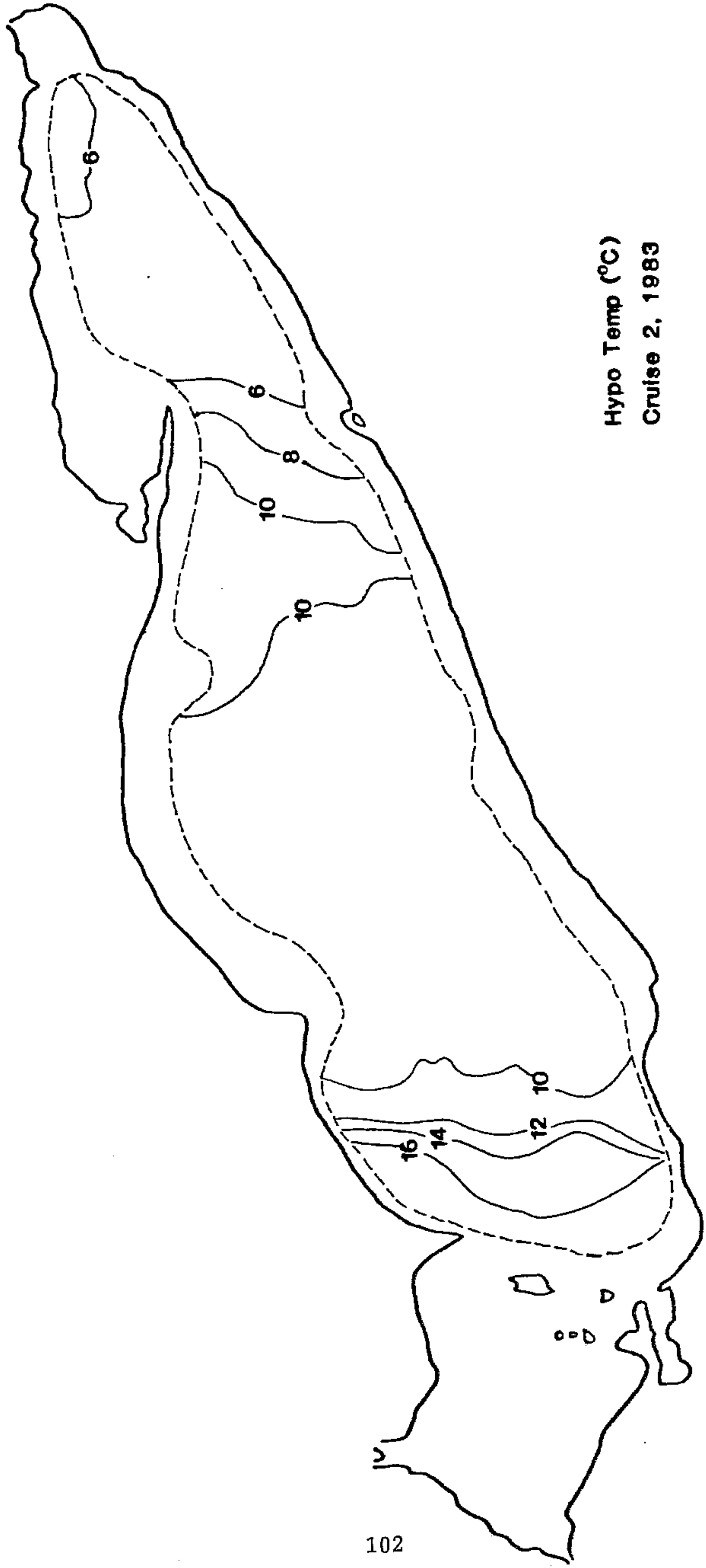
Eastern Basin August 1984 - Bottom

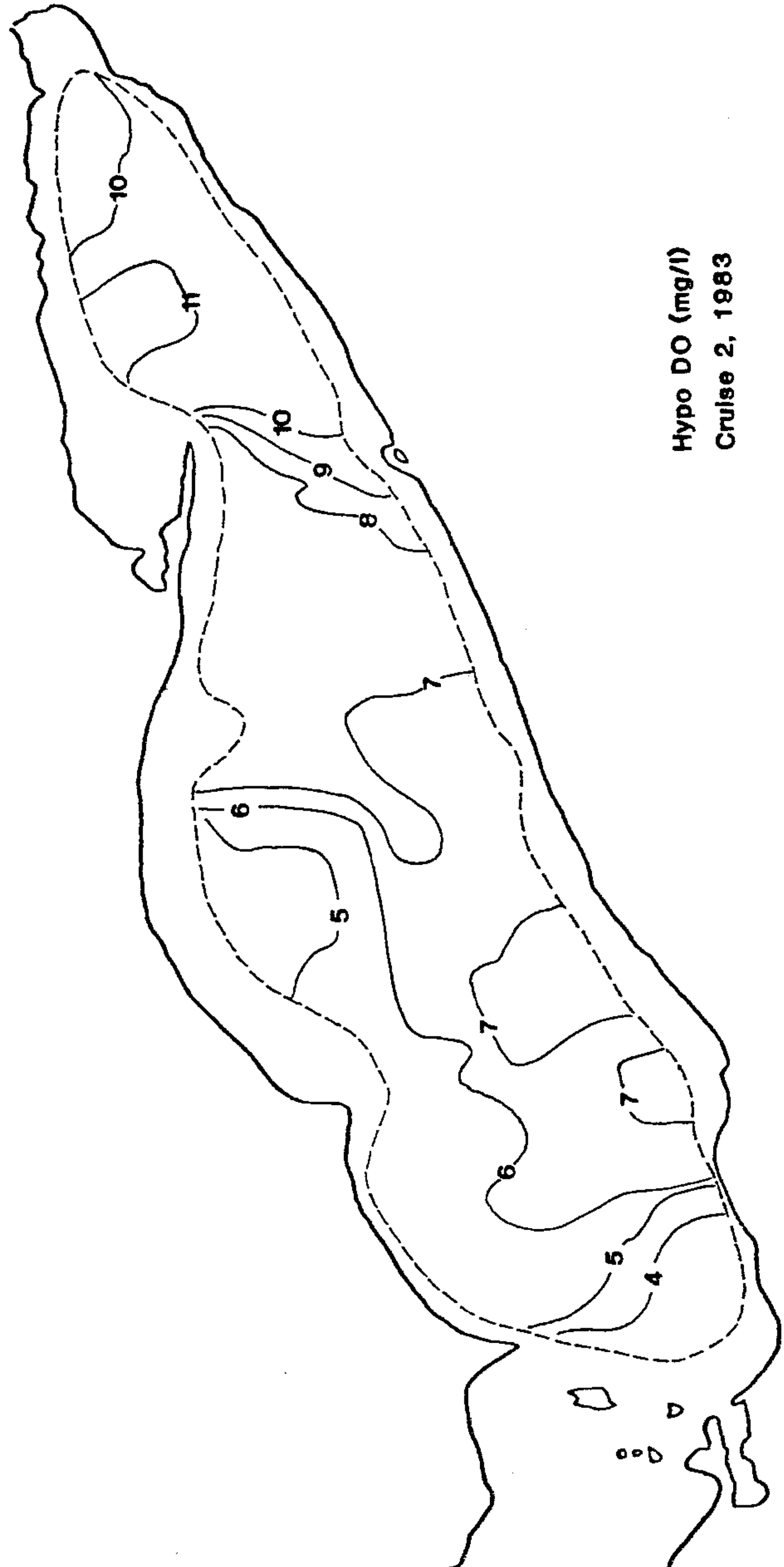
LAKE ERIE OXYGEN STUDY 1983 - 1984

```
************
* THICK    *
************
                                                  MAXIMUM          24.2999992
VARIABLE NUMBER . . . . . .          4            MINIMUM           2.0000000
NUMBER OF DISTINCT VALUES .          6            RANGE            22.2999992           EACH 'H'
NUMBER OF VALUES COUNTED. .          6            VARIANCE         63.6039925          REPRESENTS
NUMBER OF VALUES NOT COUNTED         0            ST.DEV.           7.9752111               1
                                                  (Q3-Q1)/2         5.0499997            COUNT(S)

                                                      ST.ERROR
LOCATION ESTIMATES                                                                          H
                   MEAN            12.4000006        3.2558663                             HHHHH
                   MEDIAN          11.3000002        6.4374585                           L-------U
                   MODE            NOT UNIQUE
                                                                            EACH '-' ABOVE =      5.0000
                                                                                        L=        0.0000
                                                                                        U=       35.0000

                                                                                             Q1=    7.6999998
                                                                    VALUE    VALUE/S.E.      Q3=   17.7999992
                                                       SKEWNESS      0.22         0.22       S-=    4.4247894
                                                       KURTOSIS     -1.35        -0.68       S+=   20.3752117

                                                                            EACH ',' BELOW =      0.2000
                                                                      Q          S
              S              Q               M    M                   3          +                   M
      M       -              1               E    E                                                  A
      I..............................................E.....E................................................A
      N                                      D    A                                                  X
                                             I    N

                  PERCENTS                      PERCENTS                      PERCENTS                      PERCENTS
  VALUE   COUNT  CELL   CUM    VALUE   COUNT  CELL   CUM    VALUE   COUNT  CELL   CUM    VALUE   COUNT  CELL   CUM
  2.000       1  16.7  16.7    8.600       1  16.7  50.0   17.800       1  16.7  83.3
  7.700       1  16.7  33.3   14.000       1  16.7  66.7   24.300       1  16.7 100.0
-------------------------------------------------------------------------------------------------------------------
```

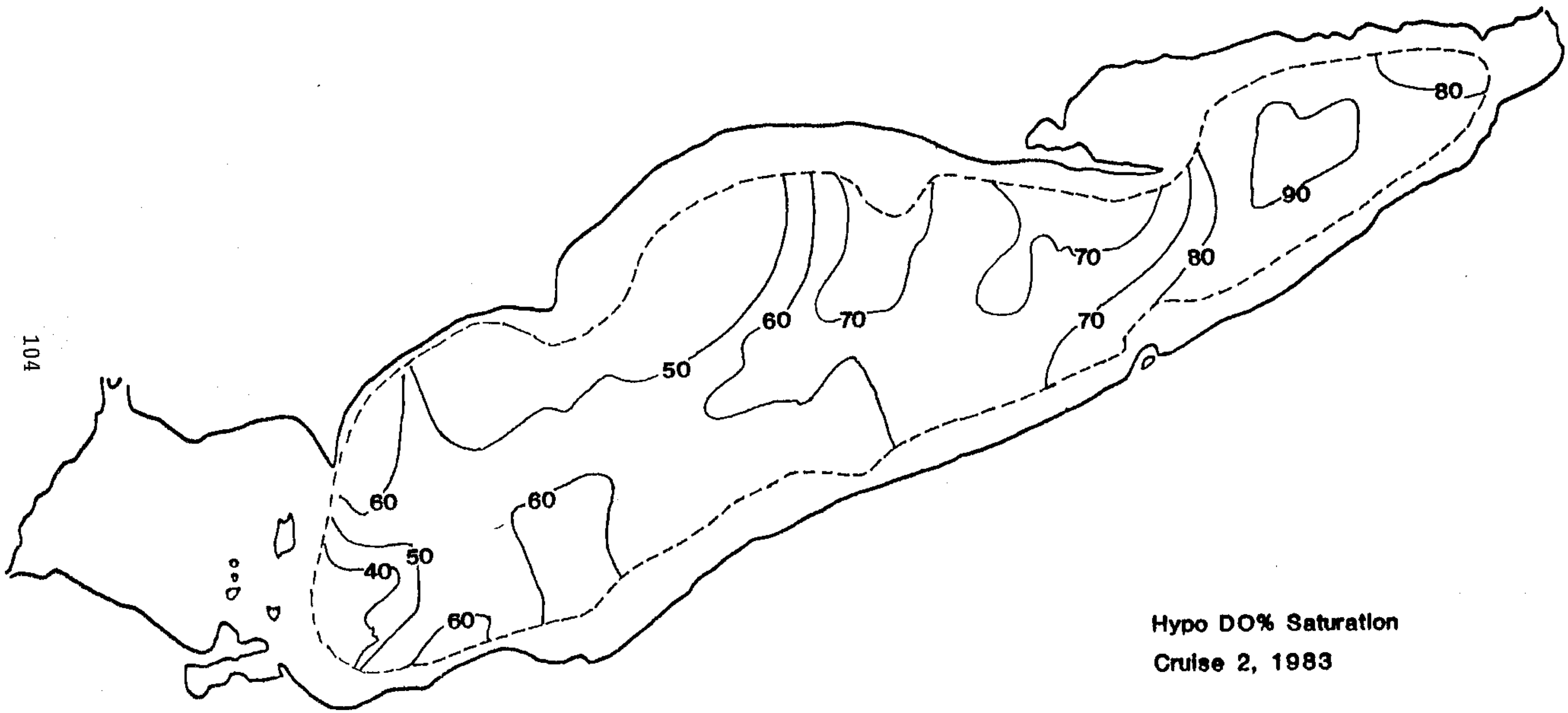
Eastern Basin August 1984 - Hypolimnion

APPENDIX C

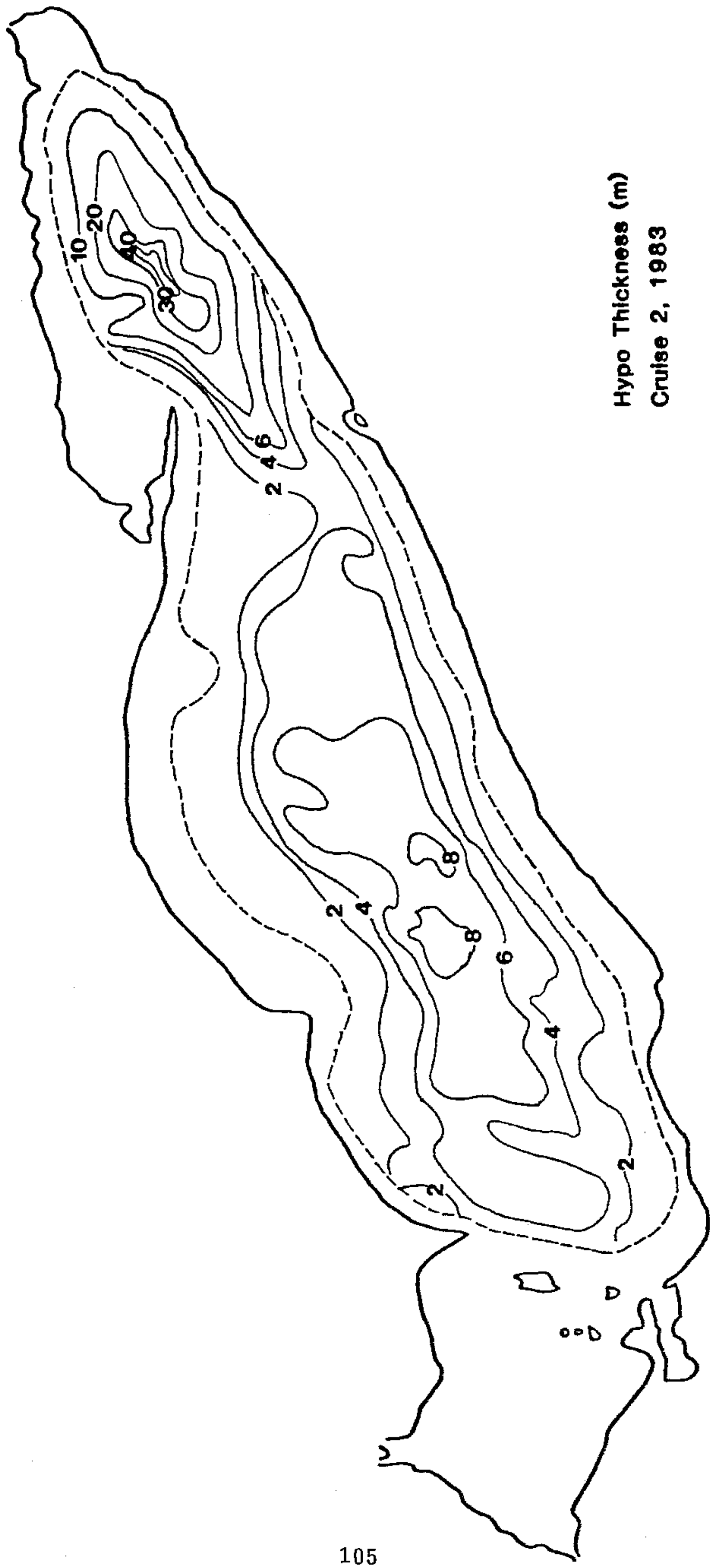

Hypo Temp (°C)
Cruise 2, 1983
6
6
8
10
10
10
12
14
16



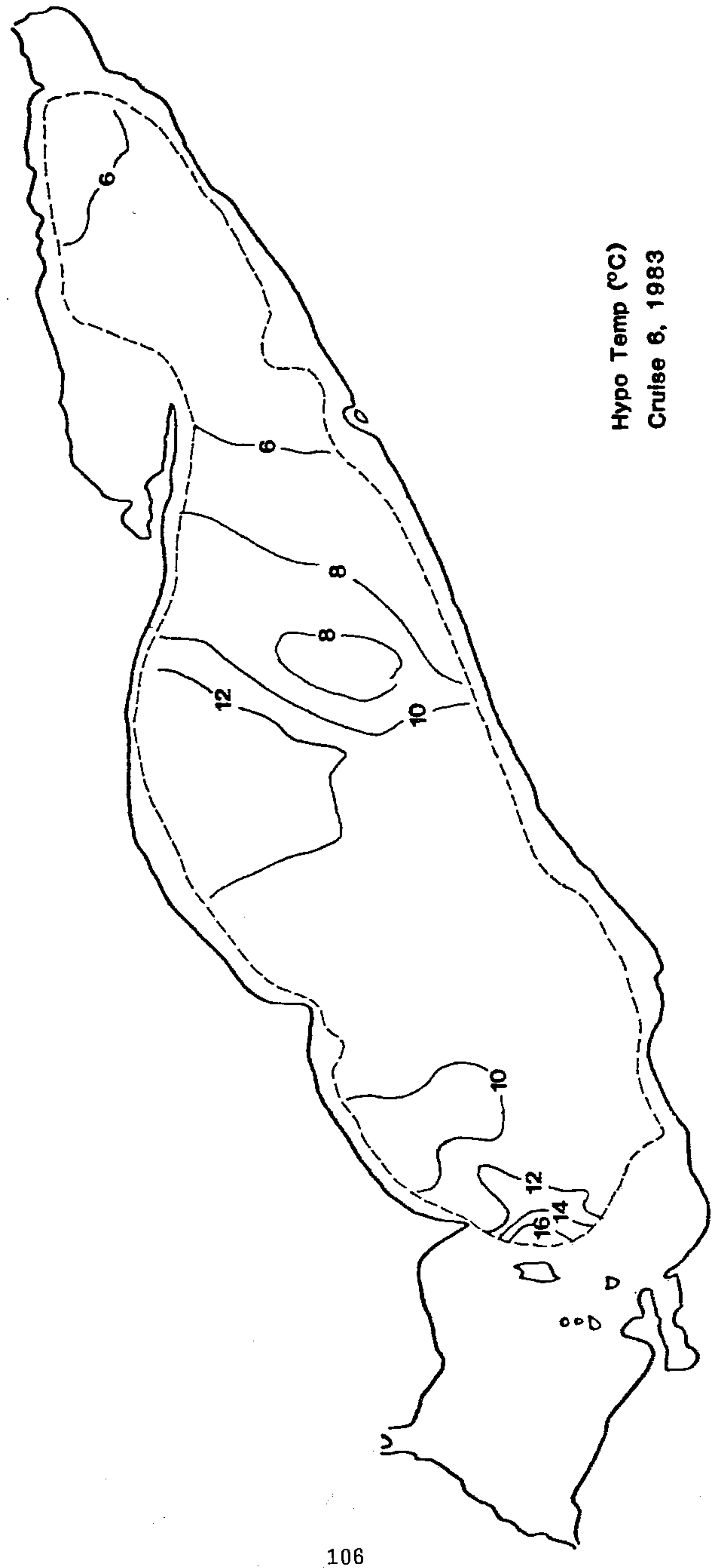
Hypo DO (mg/l)
Cruise 2, 1983



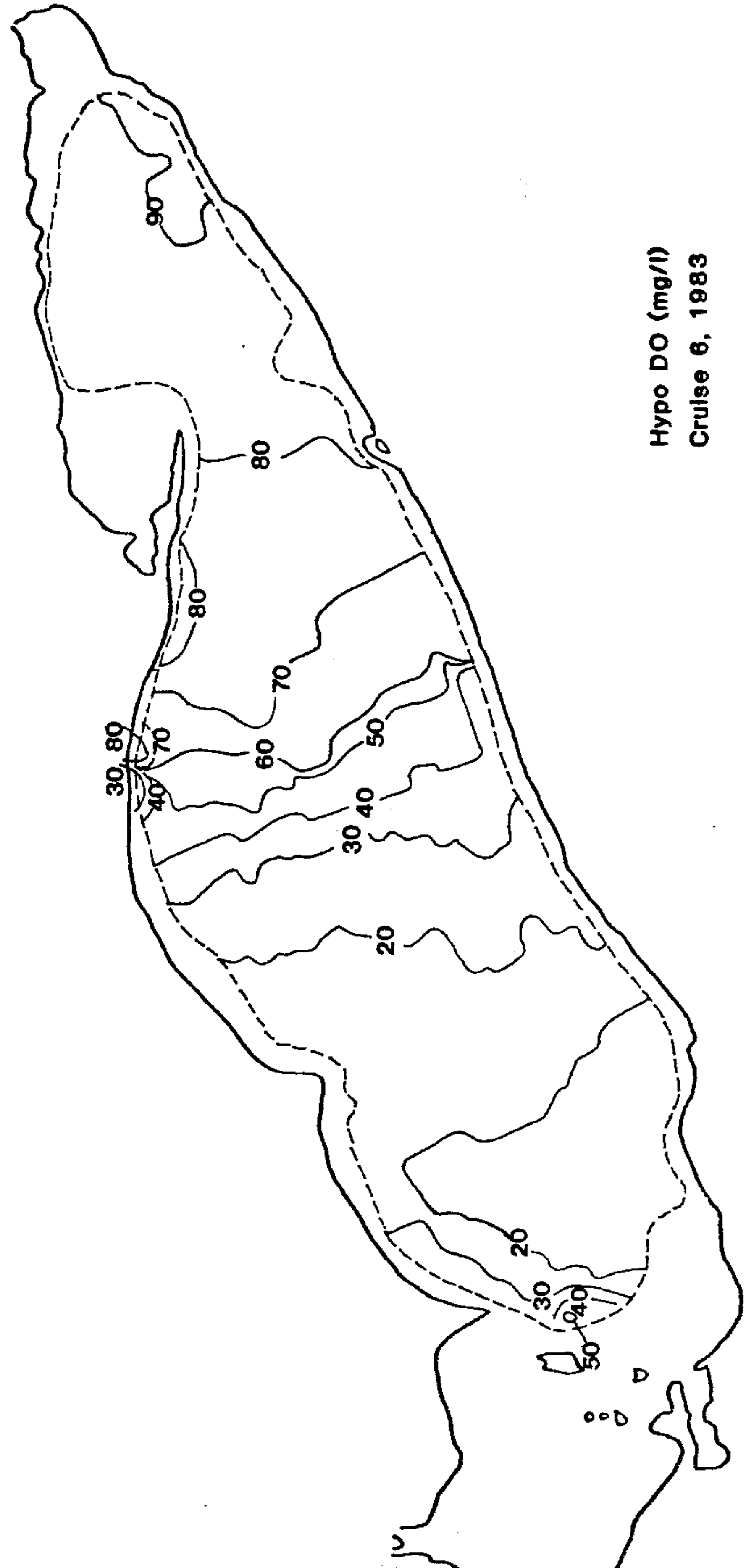
Hypo DO% Saturation
Cruise 2, 1983



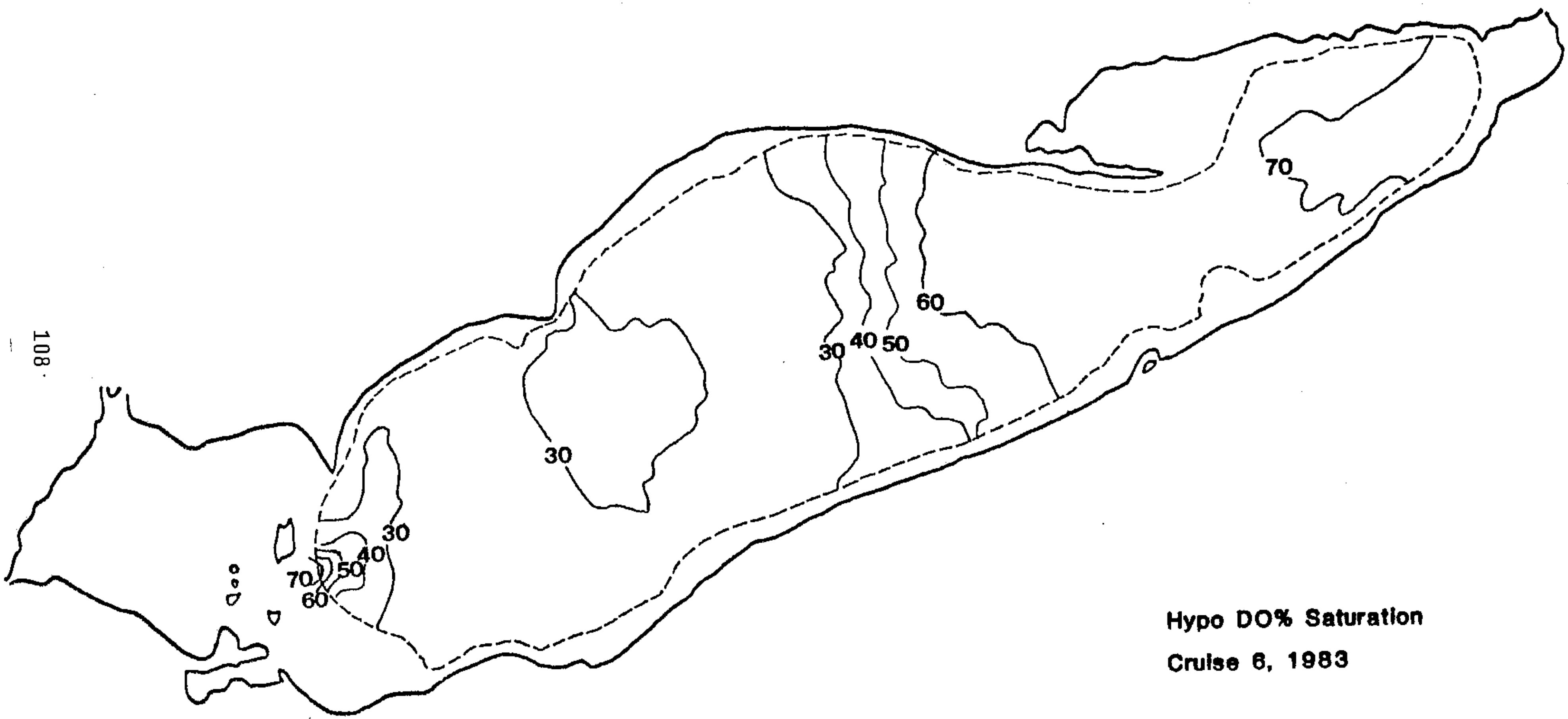
Hypo Thickness (m)
Cruise 2, 1983



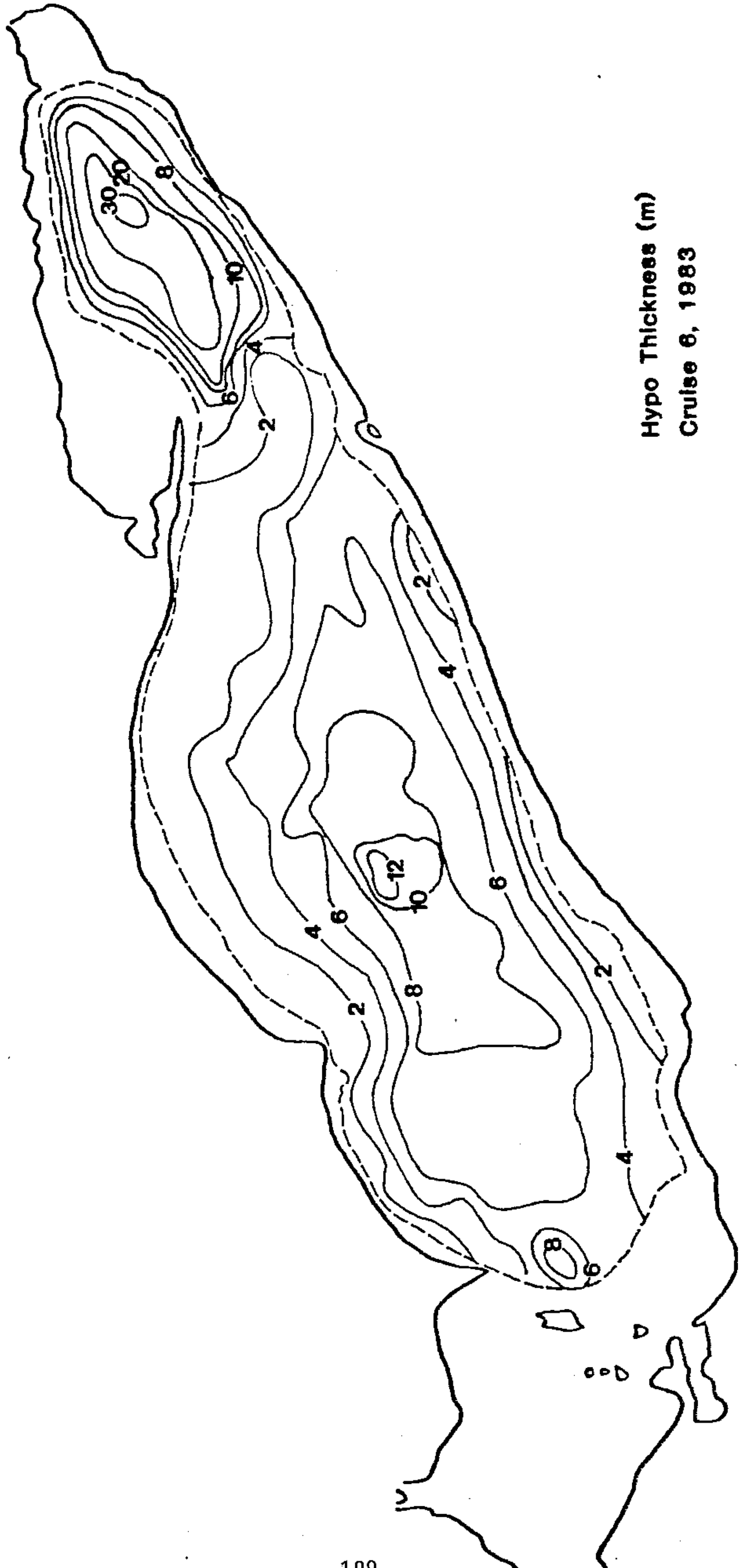
Hypo Temp (°C)
Cruise 6, 1983



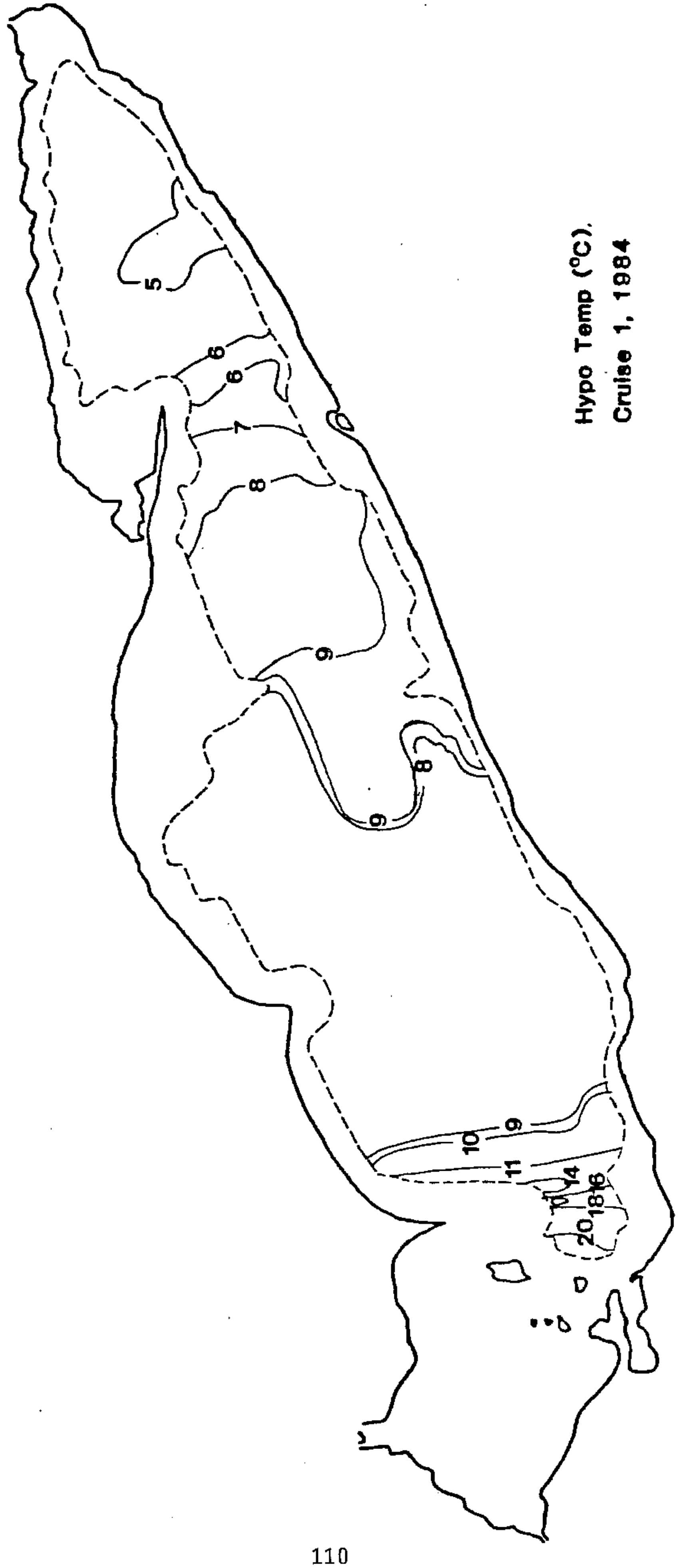
Hypo DO (mg/l)
Cruise 6, 1983



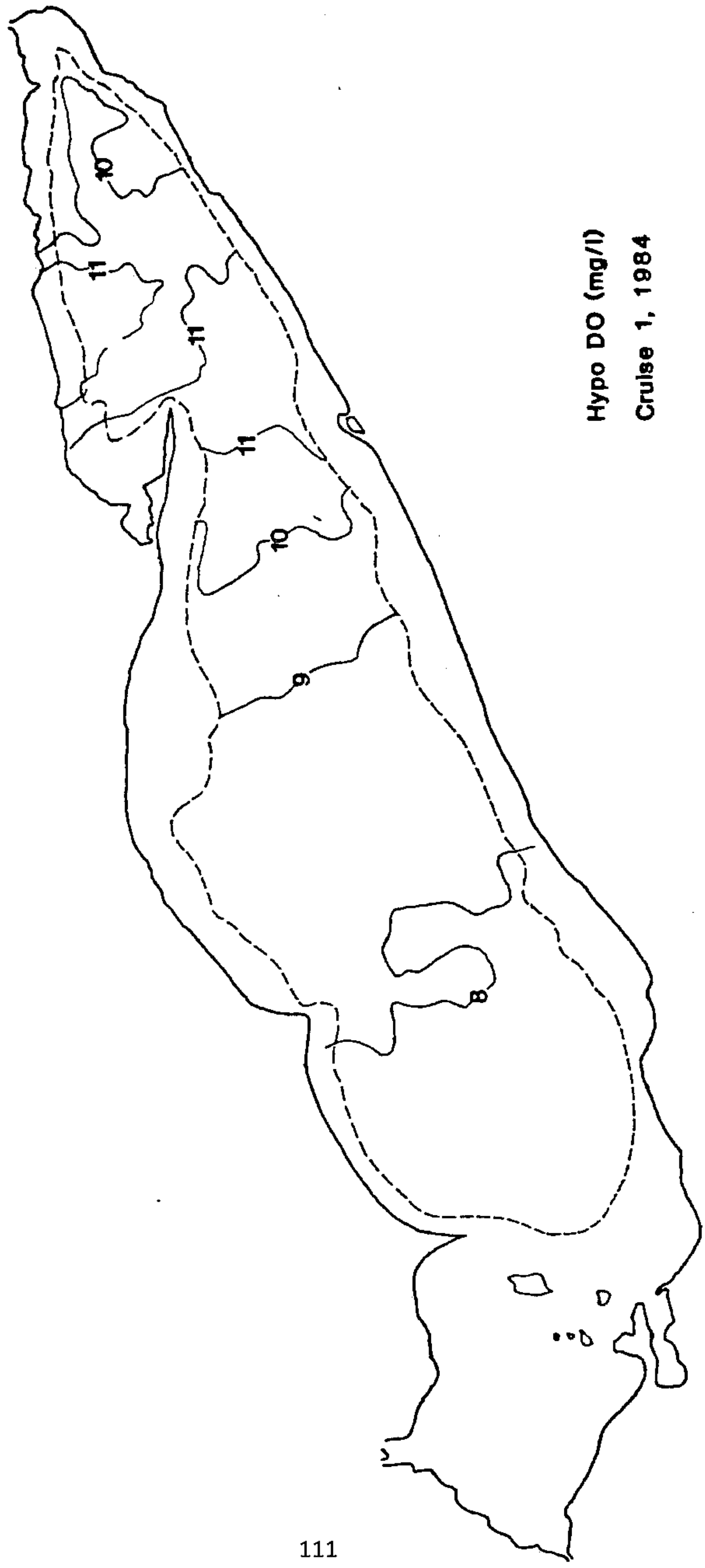
Hypo DO% Saturation
Cruise 6, 1983



Hypo Thickness (m)
Cruise 6, 1983

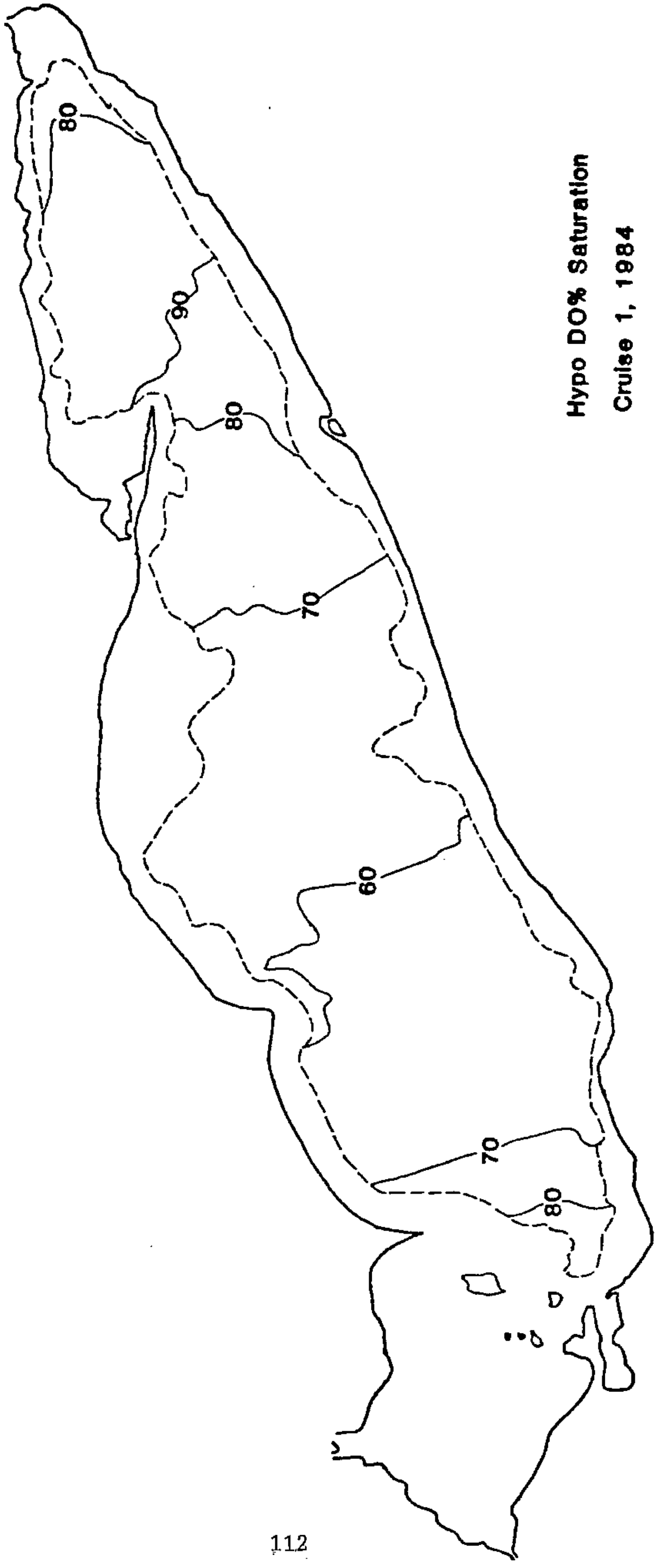


Hypo Temp (°C), Cruise 1, 1984



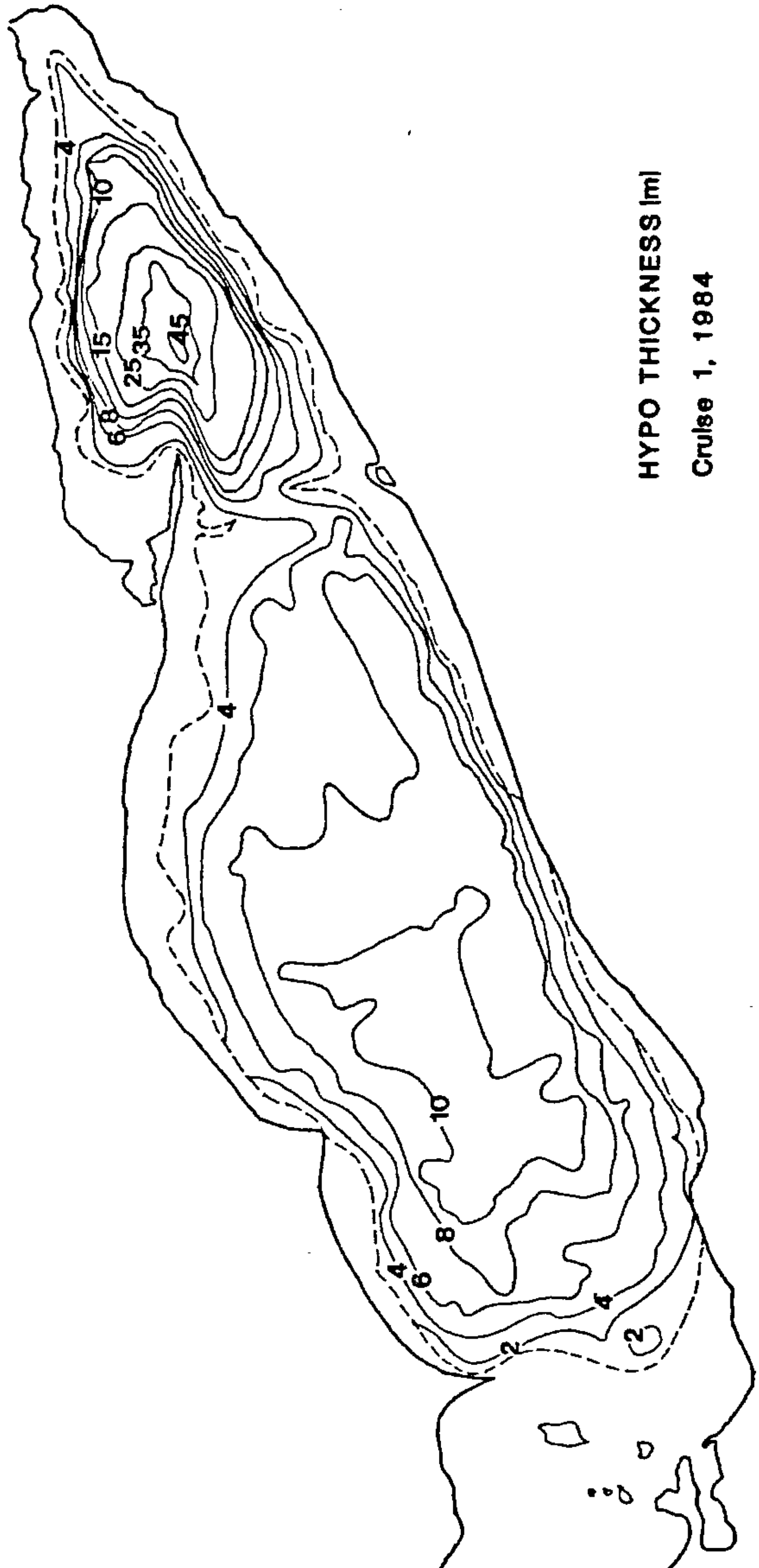
Hypo DO (mg/l)

Cruise 1, 1984



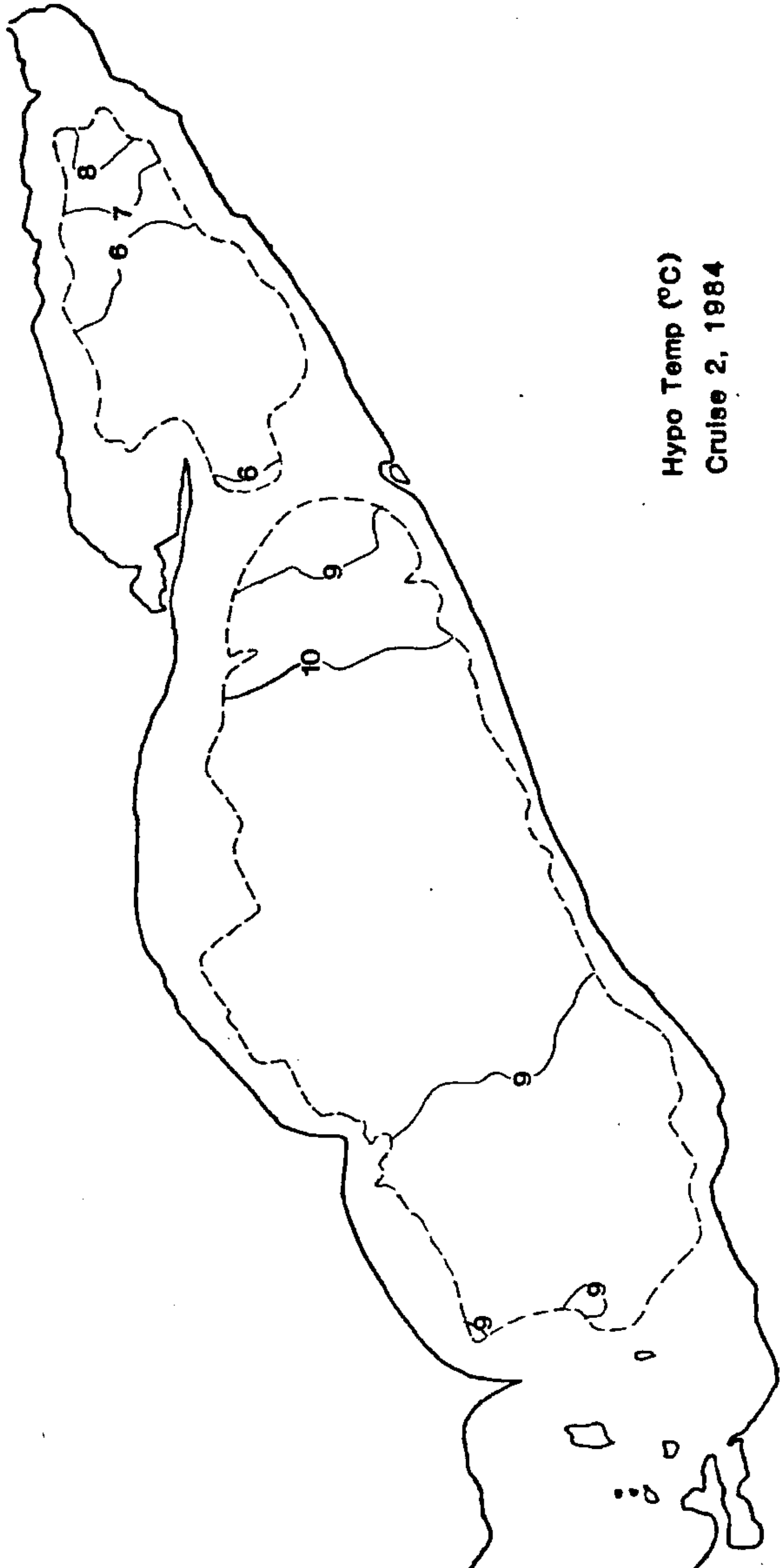
Hypo DO% Saturation

Cruise 1, 1984

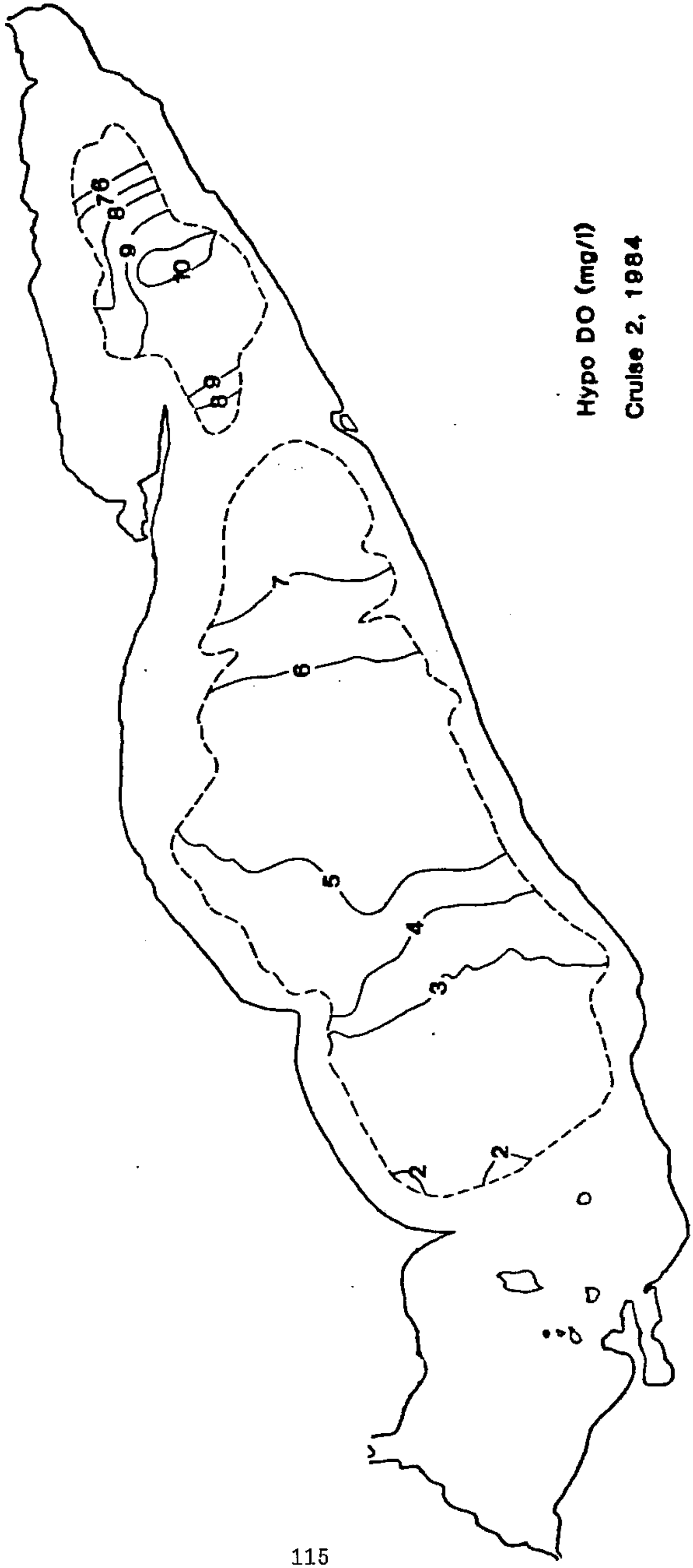


HYPO THICKNESS [m]

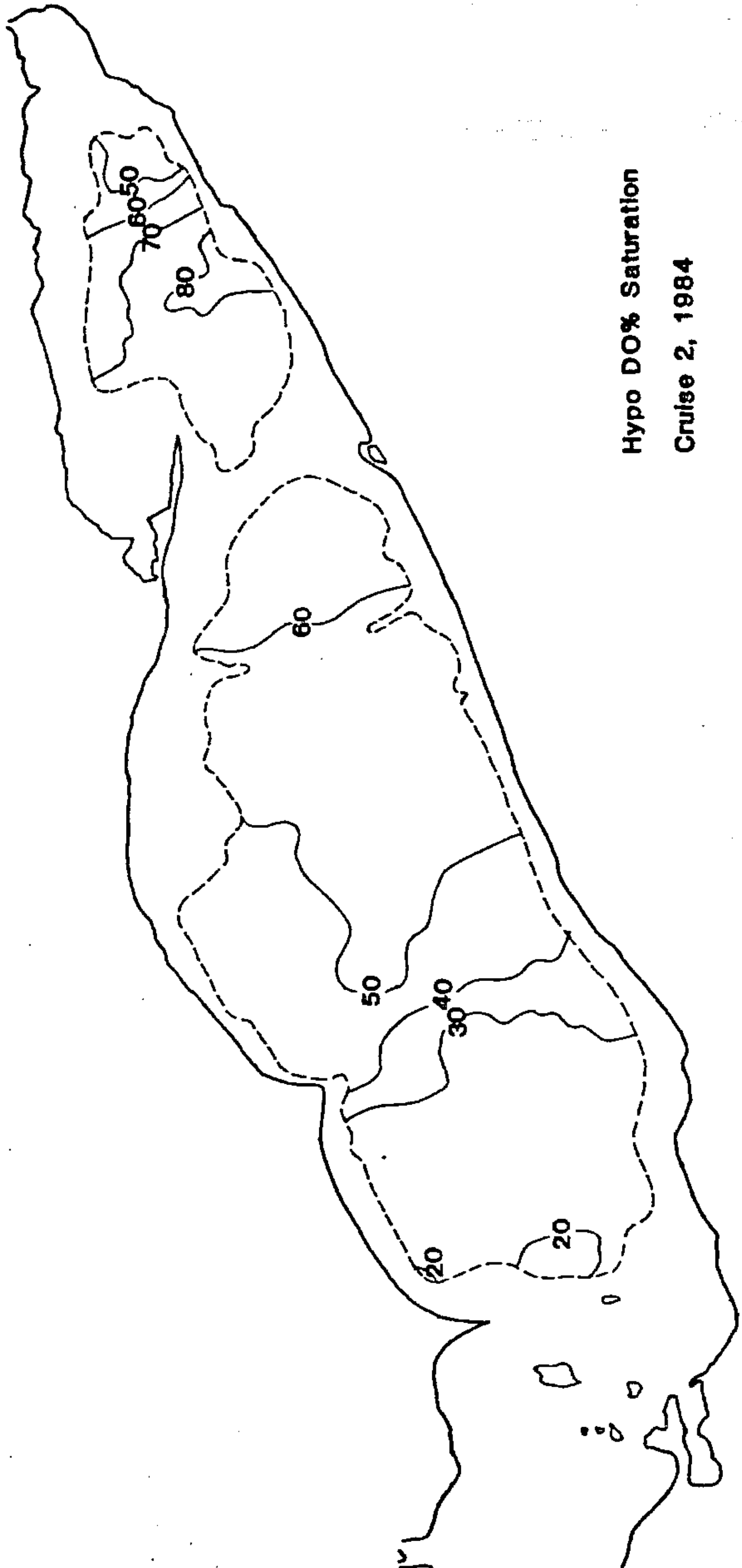
Cruise 1, 1984



Hypo Temp (°C)
Cruise 2, 1984

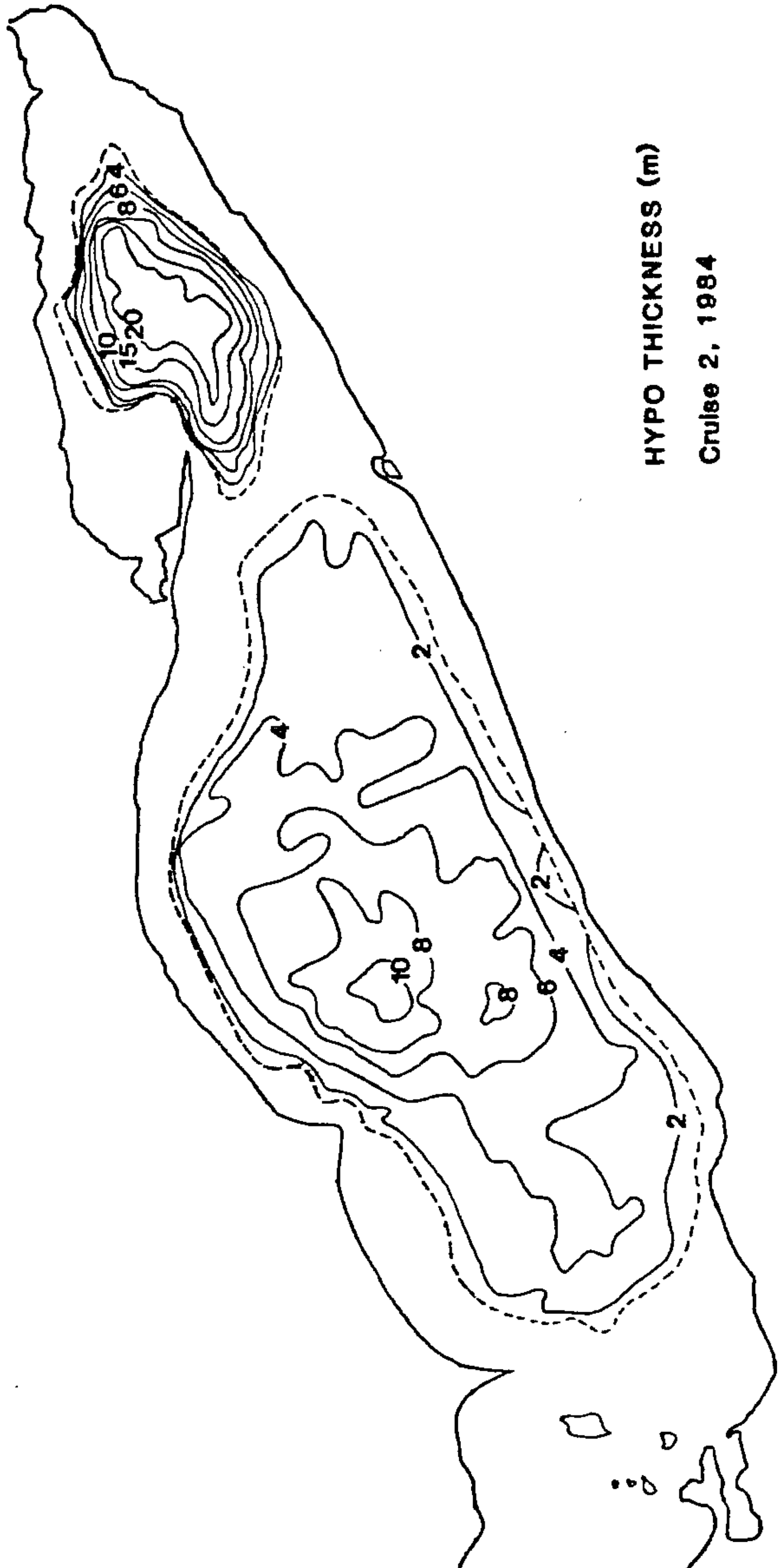


Hypo DO (mg/l)
Cruise 2, 1984



Hypo DO% Saturation

Cruise 2, 1984



HYPO THICKNESS (m)

Cruise 2, 1984

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.
3. RECIPIENT'S ACCESSION NO.	
4. TITLE AND SUBTITLE 1983 - 1984 Lake Erie Oxygen Depletion Study	5. REPORT DATE
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7. AUTHOR(S) David E. Rathke, Laura A. Fay	8. PERFORMING ORGANIZATION REPORT NO. CLEAR Technical Report # 291
9. PERFORMING ORGANIZATION NAME AND ADDRESS The Ohio State University Center for Lake Erie Area Research 484 W. Twelfth, Room 112 Columbus, Ohio 43210	10. PROGRAM ELEMENT NO.
	11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS US Environmental Protection Agency Great Lakes National Program Office 536 South Clark Street, Room 958 Chicago, Illinois 60605	13. TYPE OF REPORT AND PERIOD COVERED Final, 1983 - 1984
	14. SPONSORING AGENCY CODE Great Lakes National Program Office, USEPA, Region V
15. SUPPLEMENTARY NOTES David Rockwell, Project Officer	

16. ABSTRACT

Lake Erie has been monitored annually since 1970 to determine lake eutrophication status and to discern trends. The key parameter of interest is the oxygen content during the late summer stratified period. Oxygen budgets have been calculated for both the central and eastern basins of Lake Erie since 1970 and this trend data has been summarized.

In an effort to reduce costs and variability in results, a "homogeneous area" has been determined for both the central and eastern basin. The oxygen depletion trend data reported here has been calculated for the "homogeneous area" only.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Great Lakes Lake Erie eutrophication stratification thermal structure heat budget oxygen budget oxygen depletion homogeneous area oxygen trends dissolved oxygen limnions water quality nutrients		

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