APPENDIX

DATA COMPILATION FOR THE SHOREHAM WEST SITE COVERING THE PERIOD 1 JULY 1973 - 16 JULY 1974

COLLECTED FOR THE

LONG ISLAND LIGHTING COMPANY

BY

GRUMMAN ECOSYSTEMS CORPORATION

1111 STEWART AVENUE

BETHPAGE, LONG ISLAND, NEW YORK 11714

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Introduction

The data contained in this appendix represent the first six months of data collected by the Grumman Ecosystems Corporation for the Long Island Lighting Company under purchase order 320012, dated September 10, 1973. The scope of work as stipulated in this purchase order is directed toward the collection of twelve months of data taken at two coastal sites (Shoreham West and Jamesport) located in the southeastern section of Long Island Sound. The period over which data are being collected begins July 1, 1973 and ends on June 30, 1974.

The data, pertinent to the Shoreham West site as presented in the following sections, consist of:

a) Chemical data collected at prescribed regular intervals (i.e., weekly, monthly, quarterly) in the offshore waters adjacent to the site and in the fresh water regions underlying the site proper, and

b) Physical data (i.e., currents, temperatures, tides, and winds) collected continuously either at the shoreline or just offshore of the site.

Included in the physical data section are the results of a separate dye study performed in July.

Field Activities (1973)

The following chronology details those days on which the required instrument servicing, chemical sampling, dye studies, and planning and maintenance were carried **out for the Shoreham West site.**

13 June — Meet with LILCO personnel at Northport to discuss placement of dye and instrument marker buoys and the tide gage site. Are advised that Shoreham dock will not be built in time for use as a home port.

20 June — Make arrangements for dockage of 50' - 60' boats at Naugle's dock, Mattituck.

27 June — Load one of the survey vessels, the PAUMANOK at Oyster Bay with hardware for instrument mooring.

28 June — Place both inshore and offshore instrument moorings.

29 June — Install two Endeco surface thermographs, two bottom thermographs and one middepth current meter as well as an Aanderaa current meter at mid depth at the offshore mooring. Also install an Endeco and an Aanderaa current meter at mid depth at the inshore mooring.

3 July — Begin outfitting dye release boats at Shoreham.

4 July — Fabricate parts for dye release boats.

5 July — Continue outfitting dye release boats.

6 July — Continue outfitting dye release boats. Check instrument moorings. Take weekly water samples.

9 July	Finish basic outfitting of dye release boats. Install two Endeco surface thermographs and bottom thermographs at the inshore mooring. Place moorings for dye release boats. Take weekly water samples.
11 July	Place dye in dye release boats and tow them out to their moorings.
12 July	Check security of dye release boats in heavy seas.
13 July	Install deep submergence pump and fluorometer equipment on SPINDRIFT, the second survey vessel. Check out equipment by making background measurements in Long Island Sound.
14 July	Install pumping system and fluorometer on ST. LUCY II, the third survey vessel, and make background measurements.
15 July	Install pumping system and fluorometer on ST. LUCY II, the third survey vessel, and make background measurements.
16 July	Turn on dye release boats, make some trial transect runs and check on operation of dye release boats.
17 July	Buildup Phase of dye study.
18 July	Buildup Phase of dye study.
19 July	Buildup Phase of dye study. Take weekly water samples.
20 July	Buildup Phase of dye study. Install meteorological instruments at LILCO weather station.
21 July	Buildup Phase of dye study.

22 July	Buildup Phase of dye study.
23 July	Buildup Phase of dye study.
24 July	Intensive Phase of dye study.
25 July	Intensive Phase of dye study.
26 July	Surface Mapping.
27 July	Too windy for morning Surface Mapping by ST. LUCY II, however, afternoon run made. SPINDRIFT takes weekly water samples. Install electronic winch on PAUMANOK.
30 July	Tow dye release boats back to Naugle's dock at Mattituck, remove excess dye, batteries, and pumps. Place boats on shore. Take monthly saline water samples.
3 August	Rework one dye release boat to make it self bailing.
6 August	Finish making all dye release boats self bailing. Service offshore instrument mooring. Take weekly water samples.
8 August	Service inshore instrument mooring. Install tide gage at newly constructed dock.
9 August	Take weekly water samples.
17 August	Take weekly water samples.
24 August	Take weekly water samples.
28 August	Quarterly Diurnal Water Sampling. Monthly ground water sampling. Service tide and meteorological stations.

29 August	Quarterly Dirunal Water Sampling.
1 September	Monthly ground water sampling.
6 September	Take weekly water samples. Service offshore instrument mooring.
7 September	Service inshore instrument mooring.
11 September	Offshore and inshore mooring repair and maintenance. Take weekly water samples.
12 September	Prepare moorings for large marker buoys supplied by LILCO.
13 September	Assemble marker buoys, cables, and anchors at Naugle's dock.
14 September	Place marker buoys at both inshore and offshore instrument moorings.
21 September	Take weekly water samples.
25 September	Take monthly saline water samples.
26 September	Service tide and meteorological stations.
1 October	Take quarterly ground water samples.
3 October	Service inshore instrument mooring. Take weekly water samples.
4 October	Attempt to service offshore instrument mooring but find all surface buoys missing. Search for subsurface float, unable to locate it.
8 October	Service inshore instrument mooring. Continue search for offshore subsurface float. Take weekly water samples.

9 October	Use otter trawl to search for subsurface float at offshore instrument mooring. End this procedure and place a temporary mooring.
15 October	Service meteorological and tide stations.
16 October	Take monthly ground water samples.
18 October	Take monthly saline water samples.
22 October	Take weekly water samples.
5 November	Take weekly water samples due previous week. Weather was too rough to take samples during last week. Service offshore instrument mooring.
6 November	Too windy to service instruments.
7 November	Attempt to start Quarterly Diurnals, but weather too rough.
8 November	Quarterly Diurnals.
9 November	Quarterly Dirunals.
14 November	Remove instruments from inshore mooring for field servicing ashore by ENDECO technician. Take weekly water samples. Service tide and meteorological stations. Take monthly ground water samples.
15 November	ENDECO field service.
16 November	Drag bottom for instruments lost at offshore mooring, but do not find them.

17 November	Attempt to drag bottom again for instruments lost at offshore mooring, but weather too rough.
19 November	Reinstall instruments at inshore mooring. Remove instruments from offshore mooring for field servicing ashore by ENDECO technician.
20 November	ENDECO field service. Take weekly water samples.
21 November	Reinstall instruments at offshore mooring.
23 November	Drag successfully for instruments on the bottom at the offshore mooring. Recover bottom thermograph and mid depth current meter.
26 November	Make current profiles at inshore and offshore instrument moorings. Take weekly water samples.
28 November	Service meteorological and tide stations. Take deep well samples.
1 December	Maintenance of dye release boats and pumps.
3 December	Take quarterly ground water samples.
5 December	Service inshore instrument mooring. Take weekly water samples.
10 December	Take bacteria and BOD samples at S1, S2, S3, and S5 stations. Attempt to service offshore instrument mooring but find surface float as well as surface and mid depth instruments missing. Drag bottom and find bottom instrument and anchors. Do not install any instruments. Take weekly water samples.

11 December Take monthly saline water samples.

12 December Perform D.O. titrations at Mattituck and prepare dye release mooring equipment for transport to Bethpage.

13 December Place new mooring and instruments at offshore location. Take BOD and bacteria samples at S1, S2, and S4. Make current profiles.

14 December Service meteorological and tide stations. Take deep well samples.

17 December Attempt instrument servicing but high winds preclude any ship work.

19 December Take weekly water samples, but weather too rough and temperature too cold for divers to operate; diving gear freezes and ship very slippery with ice.

26 December Service meteorological and tide stations. Find tide station inoperative and meteorological chart paper not feeding. Take deep well samples.

27 December Repair tide station. Service inshore instrument mooring.

Summary of Chemical Data

During the first six months of this program, 1380 water samples were collected for chemical analysis. From these a total of 5530 chemical determinations were made.

Samples were taken from the saline waters just offshore and from the fresh water aquifer underlying the site. Five stations were used to collect the saline water samples and two for the fresh water. The offshore stations were located directly opposite the site and extended approximately two miles east and west, and as far as two miles offshore. The fresh water stations consisted of two wells located on the site and designated as; (a) the observation well (375' deep) and (b) the monitoring well (75' deep).

Specific saline water data consisting of temperature, salinity, dissolved oxygen, percent oxygen saturation, and biochemical oxygen demand have been plotted for the samples collected weekly at Station S2 and monthly at the other four stations. The concentration values of the nutrients (i.e., nitrite, ammonia, nitrate, organic nitrogen, total nitrogen, particulate phosphorus, soluble phosphorus, and ortho phosphate) obtained from samples collected monthly and also chlorophyll a have been plotted for all five stations.

The tabulated data encompassing all chemical determinations obtained from the saline samples follow these plots and are presented in the following order:

1. Weekly data and temperature-salinity profile measurements taken at Station 2.
2. Monthly data and temperature-salinity profile measurements taken at all five stations and an offshore station (S6).

3. Quarterly data and temperature-salinity profile measurements taken at Stations 1, 2, and 3 every three hours for a twenty-four hour period on August 29-30 and November 8-9.

The tabulated data encompassing all chemical determinations obtained from fresh water samples are presented in the following order.

1. Quarterly data collected from the observation well in October and December.
2. Monthly data collected from both the observation and monitoring wells.

Data Reduction Techniques - Chemical Data

Temperature and salinities for Stations S1 through S5 have been plotted together in order to identify any stratification of the water column. As nutrients, chlorophyll a, dissolved oxygen, and biochemical oxygen demand are all related to biological productivity composite plots of these quantities have been constructed.

A list of the notations used on the plots and tabulations is provided below.

Turbidity	-	Jackson Turbidity Units (JTU)
Bacteria	-	Most Probable Number (MPN) per 100 milliliters of sample
Salinity	-	o/oo, parts per thousand by weight
Dissolved Oxygen Biochemical Oxygen Demand Alkalinity Suspended Solids	}	milligrams per liter (or parts per million)
All Other Chemical Parameters	-	micrograms per liter (or parts per billion)

Data Interruptions - Chemical Data

- Saline Waters

In the course of a sampling program as extensive as this, samples are missed at times because of a human error, adverse weather conditions, or accidental breakage or leakage. On one occasion, the week of October 29, the combination of adverse weather conditions and use of the survey vessel for a concurrent dye study near Jamesport delayed the collection of a weekly sample until Monday of the following week. The weekly samples were taken on November 5, followed by a second weekly sampling simultaneously with the second quarter diurnal study on November 8.

During the September, October, and December monthly sampling routines, samples were not reported for the middle depth at Station 1 where the water depths rarely exceed twenty feet.

The saline samples have not been analyzed for either surfactants or soluble chromium. The procedures currently employed for surfactant analysis of fresh water samples cannot be applied to saline samples due to interference from chloride ions. To determine acceptable methods for this analysis in sea water the Regional Office of the Environmental Protection Agency was contacted. They indicated that neither they nor any of their laboratories on the East Coast have done surfactant analysis for saline samples.

Additional contacts were made with the Woods Hole Oceanographic Institution and the University of Rhode Island. Woods Hole also had not performed this analysis on sea water. Professor Quinn of the University of Rhode Island has analyzed sea water for specific organic substances, such as hydrocarbons, fatty acids, and phythallic acid, but not for surfactants. A reference (Anal. Chemi. Acta, 46 (1969) 307-9) has been found which described a technique for concentrating dissolved organic materials using Amberlite XAD-1 resin. The surfactants are then extracted by elution and analyzed by standard methods. However, this procedure is still in the developmental stages.

A preliminary investigation revealed that chromium analysis in sea water is extremely difficult due to the low levels of detection and the unstable nature of the extraction procedure. However, one method used by Dr. Fru of the Woods Hole Oceanographic Institution seems promising. He has developed a procedure by complexing chromium with a fluorinated ketone followed by gas chromotography using an electron capture detector. Dr. Fru has indicated he will forward a description of his method to the GAC Chemical Laboratory for examination. However, because of its length only a few samples will be analyzed.

Some of the samples that have been missed during the regular saline sampling routine are:

Sampling Period and Type	Reason
August Monthly BOD	Samples delivered to wrong laboratory
August Diurnal Particulate Metals (Transects 2, 4, 6, 8)	Sample filter pads were contaminated during transport to laboratory
September Monthly Coliform Bacteria	Samples accidentally frozen with other samples
September 6 Weekly BOD	Samples lost as a result of leakage during transport to laboratory
November Monthly Coliform Bacteria	Contaminated sample bottles used for collection

o Fresh Water

Wells were not installed at the Shoreham site in time for the August sampling period. *In situ* measurements were made at an existing well but no water samples were collected. Dissolved oxygen measurements were not taken in September due to instrument servicing. In October, the Shoreham observation well had been vandalized to such an extent that samples could not be collected. Well samples were not analyzed for BOD until November. This interruption occurred when BOD and bacterial samples which are normally sent to an independent laboratory for analysis were inadvertently sent to the GAC Chemical Laboratory for chemical analysis.

Three notations have been included in the tabulated data to account for these data interruptions. They are as follows:

1. NA - Data not available
2. NR - Data not required
3. * - Water sample collected at a time other than the scheduled time

Summary of Physical Data

The physical data presented below were collected in two ways. The major portion (i.e. currents, temperatures and salinities) was obtained from in-situ instrumentation located at two stations directly offshore from the site. The remainder of the data (tides and winds) were collected at a shore based station located on LILCO's Shoreham site.

The two offshore stations were located approximately 5600 and 8400 feet from the shoreline. These have been designated D1-Inshore and D2-Offshore respectively on all plots. At each station, self recording instrumentation was fixed in a vertical array so that data could be collected simultaneously at three depths. For the case of the temperature data these have been indicated on the plots as surface, mid and bottom. These correspond to vertical locations within one and a half feet from the surface, mid depth and within one and a half feet from the bottom respectively. When redundant measurements were made these have been identified by the numbers 1 and 2 (e.g. Bottom 1 and 2). For the case of the current data (mid depth values only), whenever redundant instrumentation was available it has been identified on the plots by the manufacturer's name (e.g. Endeco, Aanderaa, and General Oceanics). In addition to the individual station plots, inshore-offshore comparison plots have also been included when sufficient data permitted their construction. Each plot contains data for a one week period beginning with July 1973.

A total of 163 plots covering the twenty-six week period ending December 29, 1973 is included in this Appendix.

Data Reduction Techniques - Physical Data

The Offshore in-situ instrumentation sampled the individual parameters at predetermined regular intervals, not continuously. These intervals varied with instrument type and manufacturer. The instruments that have been used during the first six months of this program are listed below with the name of the manufacturer.

Instrument Type	Manufacturer
Thermographs	Endeco and General Oceanics
Current Meters	Endeco, Aanderaa and General Oceanics

Endeco - Environmental Devices Corporation
Marion, Massachusetts
(Film recording)

Aanderaa - Ivar Aanderaa
Nesttun, Norway
(Magnetic tape recording)

General Oceanics - General Oceanics, Inc.
Miami, Florida
(Film recording)

For all thermographs and Endeco and General Oceanic current meters the sampling interval was set at 15 minutes. The Aanderaa current meter was set to sample at five minute intervals. This current meter was also equipped with sensors for measuring temperature, conductivity and depth at the same sampling rate. All the ENDECO data and the current speed data from the

Aanderaa meter are actually measurements of the average value of the parameter over the sampling interval (i.e. they are not instantaneous measurements). The data from the General Oceanics' instruments and the temperature, conductivity and depth data from the Aanderaa are measurements made over a time interval associated with the response times of the individual sensors. These response times are all generally less than one minute, which is in all cases less than the sampling interval.

For the first three months of the study every sample from the in-situ instrumentation was examined. As a result, it became apparent that the major temporal changes occuring in the temperature and current data resulted from tidal phenomena. Therefore, it was decided to plot these data on an hourly basis only. As this was also true for the data collected by the shore based instruments (with the exception of passing weather systems) the same rationale was adopted.

In summary, the plotted physical data are made up of hourly values of the individual parameters measured by instruments that either (a) average over the sampling interval (15 minutes) or (b) average over the sensor response times.

Data Interruptions - Physical Data

There are several reasons for the data interruptions that have occurred to date. In the early phases of the program (July to mid-November) instruments were serviced on a monthly basis. This generated problems of two types. As the in-situ instrumentation had a recording life of only approximately thirty days, delayed servicing due to bad weather conditions could exhaust the recording capability of some instruments. Generally this caused interruptions of only a few days. A more serious problem that arose, due partly to monthly servicing and partly to long turn-around times between retrieval of raw records and receipt of reduced data, was that instrument malfunctions could go undetected for several servicing periods. Fortunately, with the provision of redundant instrumentation in July and August, no data interruptions traceable to this problem occurred. It was considered such a serious problem, however, that after a trial month of non-redundant operation (September), redundancy was maintained thereafter. In addition, in November the servicing frequency was increased to every two weeks making earlier detection of instrument malfunction possible.

Instrument malfunctions also have been traced to such problems as flooding due to seal failure, jammed film cassettes, batteries becoming loose as a result of rough handling (either by the divers or by the sea), and some improper loading and inspection techniques.

The problem of marine fouling, especially in the case of current meters, has caused several days of questionable data (i.e. low current readings) in spite of antifouling coatings. A partial cure has been more frequent servicing.

Several days of data interruptions occurred due to field servicing of instruments ashore by qualified technicians supplied by the instrument manufacturers. This field servicing has been found necessary to insure the maximum instrument reliability and accuracy. In addition to field servicing the instruments, the moorings have to be inspected and rebuilt periodically. These interruptions for maintenance have taken up to five days each time.

The most frustrating of all the data interruptions has been due to the surface thermographs being torn from their moorings. The reasons for this have been determined as (1) cable fatigue near the surface float as a result of wave action, (2) vandalism, (3) collision by boats or barges, and (4) failure of the mounting hardware supplied with the thermographs. In most cases, the thermographs have been found at a later date by Grumman personnel or local inhabitants with the result that a portion of the data has been recovered.

Although temperature measurements at mid depth are required during periods of stratification, these measurements have been taken continuously to provide backup for either the surface or bottom measurements in the event they are lost. By using the weekly profile data in conjunction with the mid depth measurements, accurate estimates of surface and bottom temperatures can be made.

When data interruptions have occurred for any of the above reasons these have been indicated on the plots by the words "Data Not Available". Instances of data interruptions longer than one week and their accompanying reason are listed as follows:

o <u>Surface Temperature</u>

A. Inshore Stations

24 August to 7 September	- Instrument malfunction
7 September to 3 October	- Failure of mooring due to storm; instrument not recovered
3 October to 14 November	- Instrument lost due to cable fatigue

B. Offshore Stations

6 September to 4 October	- Mooring destroyed by passing vessel; instrument recovered - no data
21 November to 10 December	- Instrument recovered in January. The duration of this data interruption will be reduced when raw data is processed.

o <u>Mid Currents</u>

A. Inshore Stations

8 September to 3 October	- Instrument malfunction: no redundant instrument

B. Offshore Stations

7 September to 3 October	- Instrument malfunction: no redundnat instrument
21 November to 10 December	- The duration of this data interruption will be reduced as instrument was recovered in January.

o <u>Bottom Temperature</u>

A. Offshore Stations

20 October to 8 November	- Instrument malfunction

In-situ mid depth salinity measurements were made only through August. An examination of these data indicated that salinity was such a slowly varying quantity that weekly salinity profiles, taken as part of the chemical data collection program, would suffice to describe its variations. For this reason, the plots beginning in September do not contain mid depth salinity data and in October the plot format was altered to reflect this change.

o <u>Tides</u>

1 July to 8 August	- Dock not completed	
26 September to 16 November	- Instrument malfunction and monthly servicing	shore station

o <u>Wind Speed and Direction</u>

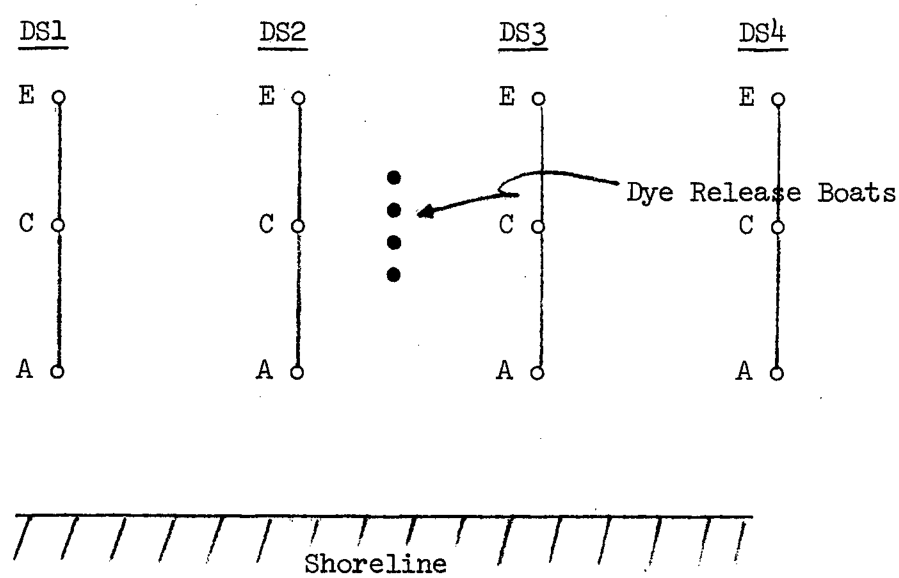
1 July to 20 July	- Dock not completed	
15 December to 26 December	- Instrument malfunction	shore station

Summary of July Dye Study

The dye study was carried out in the following three phases:

1. Buildup phase — July 17-23
2. Intensive monitoring phase — July 24-25
3. Surface mapping phase — July 26-27

The study area was located just offshore of the site and was delineated by a network of 12 buoys, each of which served as a dye station (DS). The pattern formed by the buoys is shown below (not to scale):



Transect lines have been designated as DS1 through DS4 and profile stations by the letters A, C, and E. Typical operating procedure during the buildup and intensive phases consisted of two boats simultaneously moving from station A to a point approximately 4000 feet beyond station E. One boat would make continuous surface measurements while the second boat would take profile data at the three stations along the transect line. Both boats were equipped with Turner Model 111 fluorometers and Yellow Springs Model 46 electronic thermometers for measuring dye concentration and ambient temperature.

During the buildup phase transects DS1-DS2 and DS3-DS4 were performed at low slack and high slack respectively. During the intensive phase DS1 transects were performed hourly after high slack and DS4 transects hourly after low slack.

The data collected during the buildup and intensive phases has been presented as both tabulations and plots. For the buildup phase, the average concentration at each station ($\overline{C}_{va}$, $\overline{C}_{vc}$ and $\overline{C}_{ve}$) and the corresponding surface concentration have been calculated using the data collected by the profile boat. These are tabulated below. For the buildup and intensive phases, the total average surface concentration (C_s) and the average surface values for the three stations ($\overline{C}_a$, $\overline{C}_c$ and $\overline{C}_e$) have been tabulated for each transect using the data collected during the intensive phase (both surface and profile data) have been plotted and tabulated for each transect.

In the surface mapping phase, three boats were normally employed. Two boats ran east-west zig-zag courses (one inshore and one offshore) making surface measurements while the third collected profile data between the two. These were performed primarily during periods of slack water, usually one in the morning and one in the afternoon. The data collected during this phase were then plotted on a hydrographic chart of the area showing the boat courses and dye concentrations at appropriate points along each leg of the ship's tracks. Accompanying these surface maps are tabulations of the data for which the maps were constructed as well as the profile data collected by the third boat.

Data Reduction - July Dye Study

The dye concentrations were calculated according to the following equation:

$$C = (D - D_b)\ k\ T$$

where

D = dial reading of fluorometer

D_b = background dial reading

k = instrument calibration constant

T = temperature correction term

C = dye concentration in ppb

The calibration constants and background dial readings for the fluorometers used in July were:

Fluorometer No.	k (at 70° F)	D_b
46	.0149	7
48	.0155	11

The temperature correction term, T, is exponential and is described by the following equation:

$$T = e^{-.02428\,(70-t)}$$

where t = temperature in degrees Fahrenheit. As the temperature of the water (t) decreases from 70°F, the temperature correction (T) is less than one and consequently the calculated dye concentration is decreased. During the dye study the summer water temperature varied little from 70°F so the resulting temperature correction was usually small during this period. In general the temperature correction in the neighborhood of 70°F was on the order of 1% for every 1/2°F change in temperature.

The data collected aboard the surface boat during the buildup phase were selected at 1000' intervals. The average fluorometer reading for each interval was then determined and reduced to a corresponding dye concentration. The surface averages in three segments, centered around stations A, C, and E, were then determined from these values.

The surface data collected during the intensive phase was reduced at the A, C, and E stations. If large variations in dye concentration were evident, additional points were included as necessary to describe the surface dye distribution in straight line segments on the intensive plots. The average surface concentrations for the three segments were calculated from the intensive plots by use of a planimeter or by graphical methods. The total surface averages, $\overline{C}_s$, for the buildup and intensive phases were calculated as a weighted average of the three surface segments taking into account the actual length of each segment.

The boat courses for the surface mapping phase were plotted by making use of the boat logs containing the compass course and bearings taken from shore features at each turning point. In laying out the length of each leg it was assumed that the boat traveled at a constant speed. Typically, during this phase the dye concentrations were reduced for each 2 or 3 minute intervals. More frequent points were reduced if the structure became variable.

Data Interruptions - July Dye Study

The vertical data for the DS2 transects on July 17 at 1846 and July 18 at 0605 were not reduced due to irregularities in the AC line voltage of the boat's generator.

The vertical sampling boat did not arrive at the sampling site in time for the DS1 (0730) transect on July 25 due to equipment servicing at shore.

On three occasions the vertical profile at A was not taken. These were omitted to allow the vertical sampling boat to return to normal schedule after minor delays caused by shipboard instrument servicing.

APPENDIX I-3

DATA COMPILATION FOR THE

SHOREHAM WEST SITE

COVERING THE PERIOD

30 DECEMBER 1973 - 1 AUGUST 1974

COLLECTED FOR THE

LONG ISLAND LIGHTING COMPANY

BY

GRUMMAN ECOSYSTEMS CORPORATION

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Summary

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The data, pertinent to the Shoreham West site as presented in the following sections, consist of:

a) Chemical data collected at prescribed regular intervals (i.e., weekly, monthly, quarterly) in the offshore waters adjacent to the site and in the fresh water regions underlying the site proper, and

b) Physical data (i.e., currents, temperatures, tides, and winds) collected continuously either at the shoreline of just offshore of the site.

Field Activities (1974)

The following chronology details those days on which the required planning, instrument servicing, chemical sampling and maintenance were carried out for the Shoreham West site.

3 January	Service offshore instrument mooring. Take weekly water samples.
8 January	Attempt to take monthly saline samples but water too rough for safe operation.
9 January	Snow storm prevents automobile travel to SPINDRIFT. Cancel monthly saline sampling scheduled for this day.
11 January	Take monthly saline samples.
14 January	Service inshore instrument mooring. Take weekly water samples.
15 January	Make monthly ground water measurements at both wells. Service tide gage and meteorological station.
21 January	Service offshore instrument mooring. Take weekly water samples.
28 January	Service inshore instrument mooring.
4 February	Too windy for ship operations. Make monthly ground water measurements at both wells. Service tide gage and meteorological station.
5 February	Too windy for ship operations.
6 February	Too windy for ship operations.
7 February	Too windy for ship operations.
8 February	Take weekly water samples. Too windy for instrument service.

11 February	Service offshore insrrument mooring. Take weekly water samples.
12 February	Repair inshore instrument mooring.
18 February	Too windy for ship operations.
19 February	Service inshore instrument mooring. Take weekly water samples.
20 February	Take monthly saline samples.
22 February	Service tide gage and meteorological station.
25 February	Snow storm precludes any ship activities.
26 February	Too windy for ship operations.
28 February	Service offshore instrument mooring. Take weekly water samples.
4 March	Service inshore instrument mooring. Take weekly water samples.
7 March	Make quarterly ground water measurements at both wells. Service tide gage and meteorological station.
11 March	Too windy for ship operations.
12 March	Service offshore instrument mooring. Take weekly water samples.
18 March	Too windy for ship operations. Service tide gage and meteorological station.
19 March	Service inshore instrument mooring. Take weekly water samples.
22 March	Start diurnal sampling.

23 March	Complete dirunal sampling
25 March	Take weekly water samples. SPINDRIFT proceeds to shipyard for scheduled maintenance.
1 April	Service tide gage and meteorological station.
4 April	Take weekly water samples. Too windy for instrument service.
8 April	Too windy for ship operations.
9 April	Too windy for ship operations.
10 April	Too windy for ship operations.
11 April	Service offshore instrument mooring and repair damaged floats and lines. Take weekly water samples.
15 April	Make monthly ground water measurements at both wells. Service tide gage and meteorological station.
16 April	Too windy for ship operations.
17 April	Service inshore instrument mooring. Take weekly water samples.
22 April	Service offshore instrument mooring. Take weekly water samples.
29 April	Service inshore instrument mooring. Take weekly water samples. Service tide gage and meteorological station.
6 May	Meeting with S. McLendon of H2M to discuss groundwater data. Recommended sterilization.
7 May	Service offshore instrument mooring. Take weekly water samples.
8 May	Sterilize observation well with chlorine.
10 May	Pump observation well for six hours to reduce chlorine concentration - incomplete.

13 May	Service inshore instrument mooring. Take weekly water samples.
14 May	Pump observation well for two hours. Take bacteria samples.
16 May	Take monthly saline samples.
22 May	Service offshore instrument mooring. Take weekly water samples.
28 May	Make monthly groundwater measurements at the observation well. Service tide gage and meteorological station.
29 May	Make monthly groundwater measurements at the monitoring well.
6 June	Service inshore instrument mooring. Take weekly water samples.
10 June	Service offshore instrument mooring, tide gage and meteorological station.
13 June	Start diurnal sampling.
14 June	Complete diurnal sampling.
17 June	Service inshore instrument mooring.
24 June	Take weekly water samples. Service tide gage and meteorological station.
25 June	Make quarterly groundwater measurements at both wells.
1 July	Recover instruments from both inshore and offshore moorings and remove offshore mooring.
2 July	Remove inshore mooring. Recover tide gage instrument and recorder from meteorological station.
15 July	Sterilize well pump

16 July	Make monthly groundwater measurements at both wells. Recover wind speed and direction sensors at meteorological station.
17 July	Return miscellaneous equipment to Bethpage from Mattituck.
1 August	Make monthly ground water measurements at both wells.

Summary of Chemical Data

During the second six months of this program, 1350 water samples were collected for chemical analysis. From these a total of 4694 chemical determinations were made. Total boron, sodium and sulfate was added to the monthly sampling of the saline waters and total iron, total silica and color was added to the monthly sampling of the observation well. Boron was analyzed by the method described in Marine Chemistry, Volume 1, 2nd edition, 1972 (Martin, D. F.). Sodium and sulfate were analyzed by the methods described in Analytical Methods for AAS, March 1971, (Perkin Elmer). Sample locations remain the same as those described in the first six months report. The specific parameters sampled and the data reduction techniques applied also remain the same as those reported in the first six months report.

After a review of the first three quarterly diurnal samplings the June diurnal was reduced in scope. Station S2 was eliminated and no metal analysis was conducted at Station S1.

The tabulated data encompassing all chemical determinations obtained from the saline samples are presented in the following order:

1. Weekly data and temperature-salinity profile measurements taken at Station 2.
2. Monthly data and temperature-salinity profile measurements taken at all five stations and an offshore station (S6).
3. Quarterly diurnal and temperature-salinity profile measurements taken at Stations 1, 2, and 3 on March 22-23; and at Stations 1 and 2 on June 13-14.

The tabulated data encompassing all chemical determinations obtained from fresh water samples are presented in the following order.

1. Quarterly data collected from the observation well in March and June.

2. Monthly data collected from both the observation and monitoring wells.

A list of the measurement units used on the plots and tabulations is provided below.

Turbidity	- Jackson Turbidity Units (JTU)
Bacteria	- Most Probable Number (MPN) per 100 milliliters of sample
Salinity	- o/oo, parts per thousand by weight
Sodium Sulfate	- grams per liter (parts per thousand)
Dissolved Oxygen Biochemical Oxygen Demand Alkalinity Total Boron Suspended Solids	- milligrams per liter (parts per million)
All Other Chemical Parameters	- micrograms per liter (parts per billion)

Data Interruptions - Chemical Data

o Saline and Fresh Waters

The complexity of a sampling effort as extensive as this one precludes the collection of all samples without any missing data. Specific losses that occurred during this six month period were quite small with 99% of the chemical determinations successfully completed.

o Notation Used

Three notations have been included in the tabulated data to account for these data interruptions. They are as follows:

1. NA - Data not available
2. NR - Data not required
3. ( ) - Water sample collected at a time other than the scheduled time.

Summary of Physical Data

The physical data presented below were collected in the same manner as reported for the first six months. The in-situ instrumentation was located at two stations directly offshore from the site approximately 5600 and 8400 feet from the shoreline. These have been designated D1-Inshore and D2-Offshore respectively on all plots. When redundant measurements were made these have been identified by the numbers 1 and 2 (e.g. Bottom 1 and 2). For the case of the current data (mid depth values only), whenever redundant instrumentation was available it has been identified on the plots by the manufacturer's name (e.g. ENDECO and General Oceanics). However, beginning in March no redundant notation was used as only primary instruments were plotted. Each plot contains data for a one week period beginning with January 1974.

A total of 181 plots covering the twenty-six week period ending July 1, 1974 is included in this Appendix.

Data Reduction Techniques - Physical Data

The data reduction methods used during the second six months are the same as those reported for the first six month period.

Data Interruptions - Physical Data

The primary reason for data gaps during this period has been due to the severe north-west winter and spring winds. Fortunately the winds subsided for sufficient periods to maintain two week intervals between instrument servicings. However, servicing instruments in moderate winds has caused some instrument malfunction that would not have occurred had the weather been more favorable.

By far, the largest problem in data acquisition has been the measurement of the water temperature within 1.5 feet of the surface due to failure of the mooring cable. Instrument failures have also been traced to such problems as jammed film cassettes, binding camera mechanisms and other manufacturing problems associated with new equipment.

The loss of data due to vandalism has decreased considerably from that of the previous period.

When data interruptions have occurred for any of the above reasons, these have been indicated on the plots by the words "Data Not Available". Instances of data interruptions longer than one week and the accompanying reasons are listed below.

- Surface Temperature

  A. Inshore Station

  None

  B. Offshore Station

  12 March - 11 April - Instruments destroyed by transient vessel

- Mid Currents

  A. Inshore Station

  20 February to 4 March - Direction data lost due to instrument malfunction

  9 March to 17 April - Direction data lost due to instrument malfunction

o <u>Mid Currents</u>

A. Inshore Station (continued)

19 March to 17 April	-	Speed data lost due to instrument malfunction, backup being repaired.
6 June to 30 June	-	Direction data lost due to instrument malfunction

B. Offshore Station

None

o <u>Bottom Temperatures</u>

A. Inshore Station

None

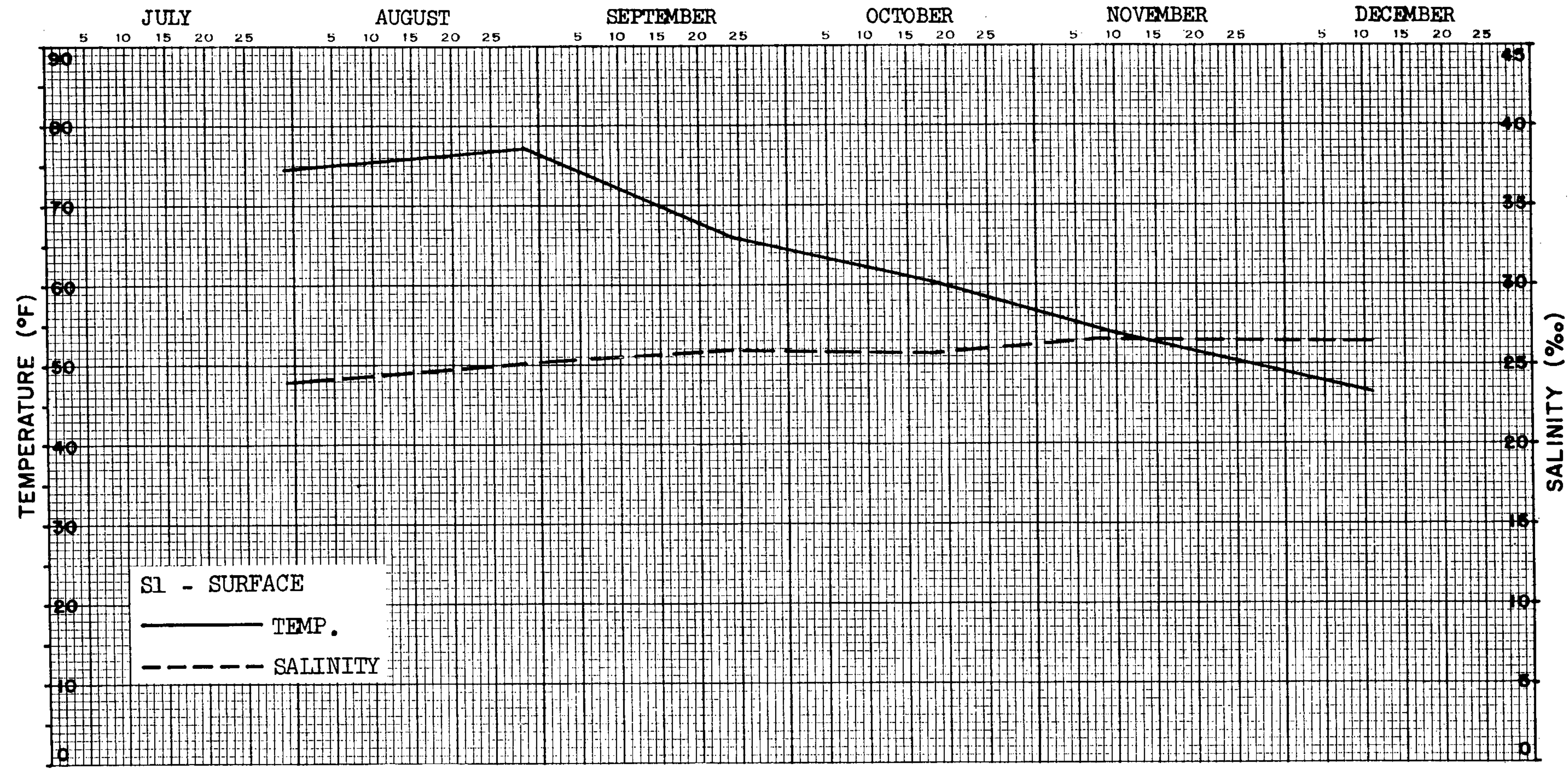
B. Offshore Station

None

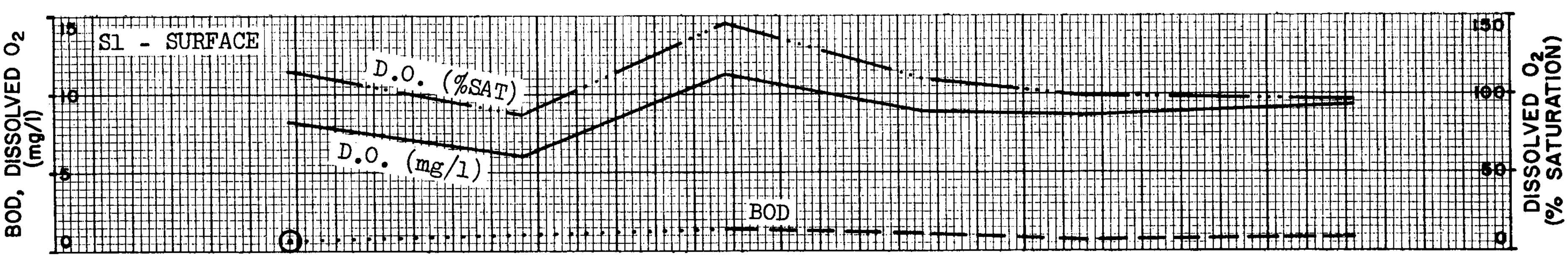
APPENDIX I

SECTION 1

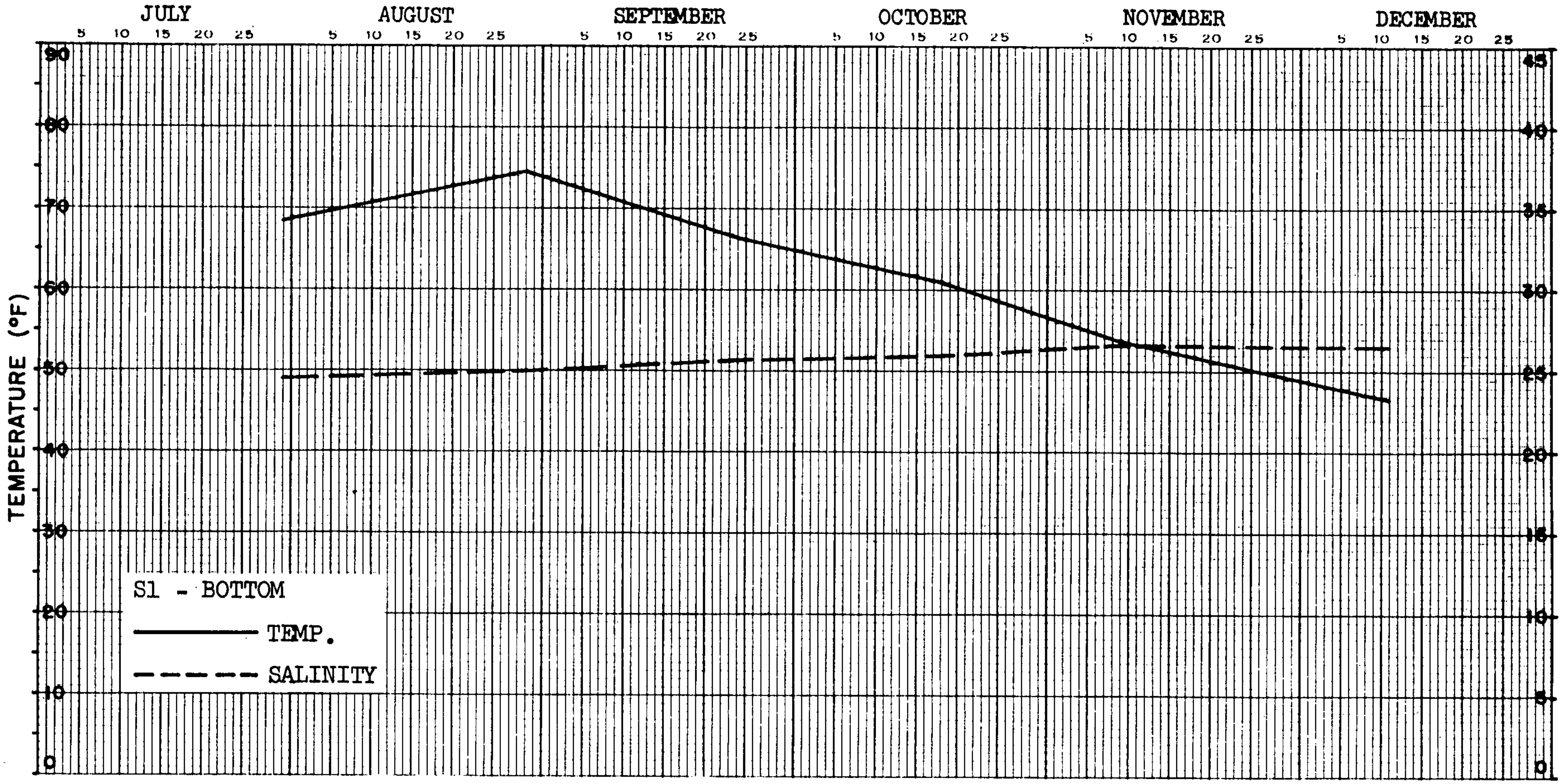
SHOREHAM WEST



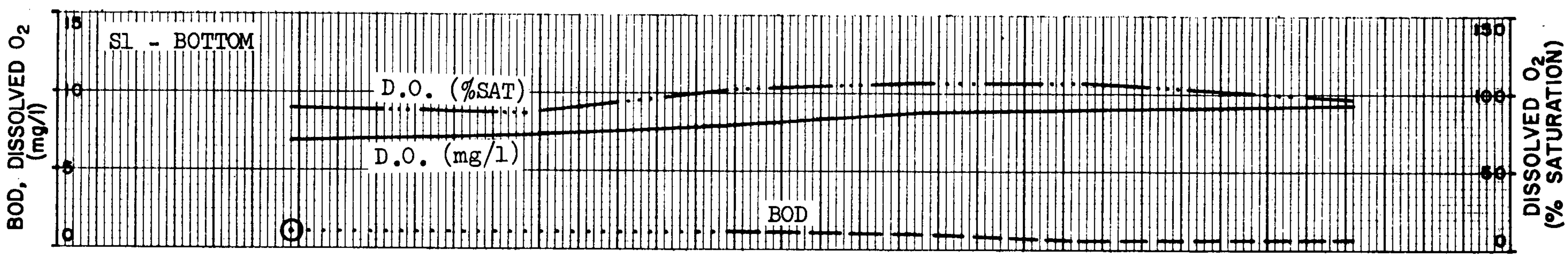
SHOREHAM WEST — TEMPERATURE AND SALINITY



SHOREHAM WEST — DISSOLVED OXYGEN AND BOD



SHOREHAM WEST — TEMPERATURE AND SALINITY



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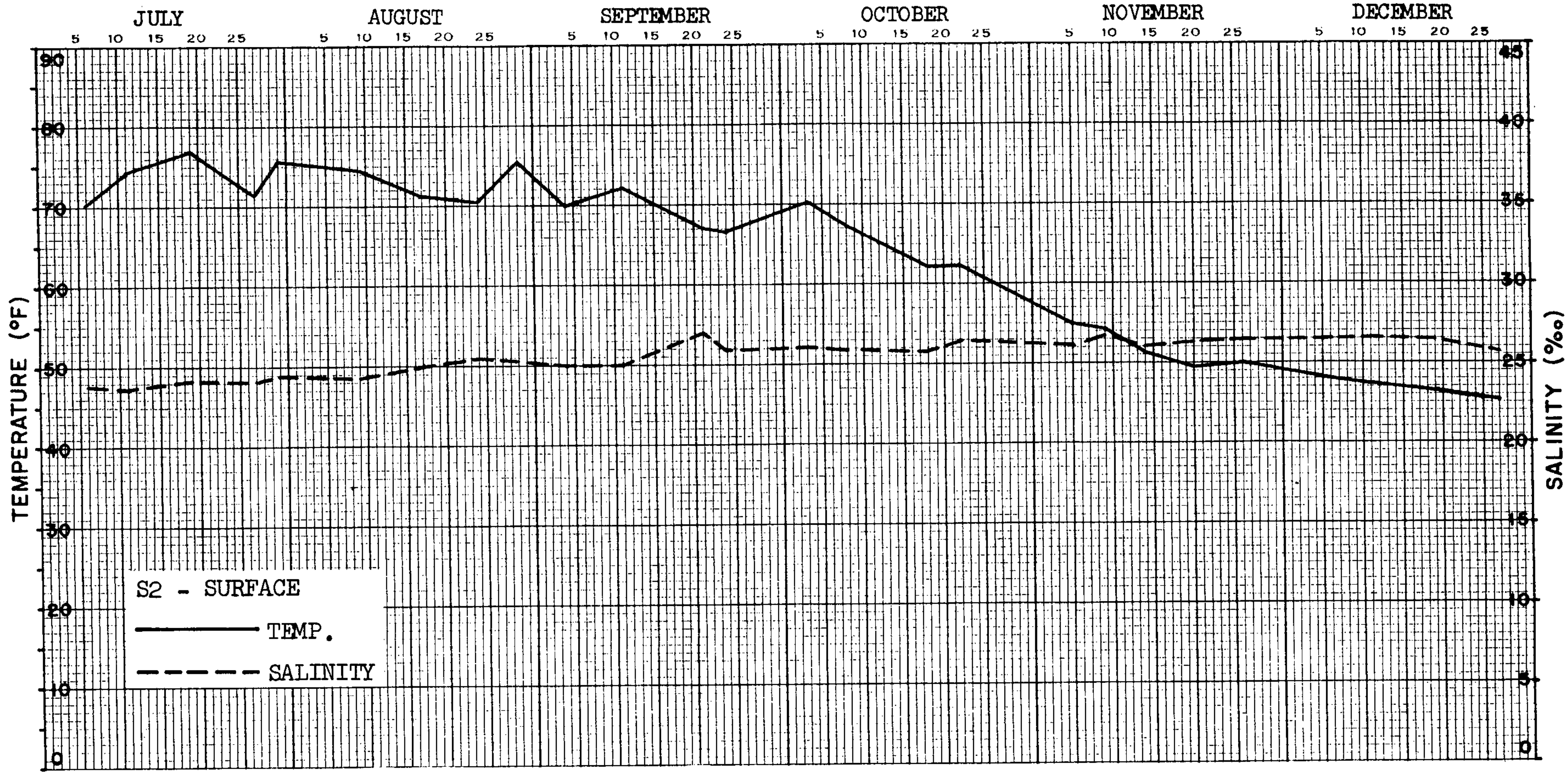

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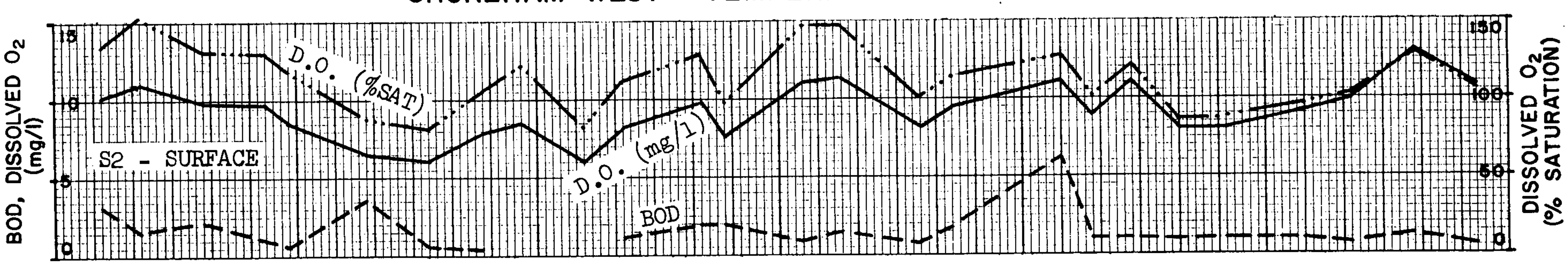

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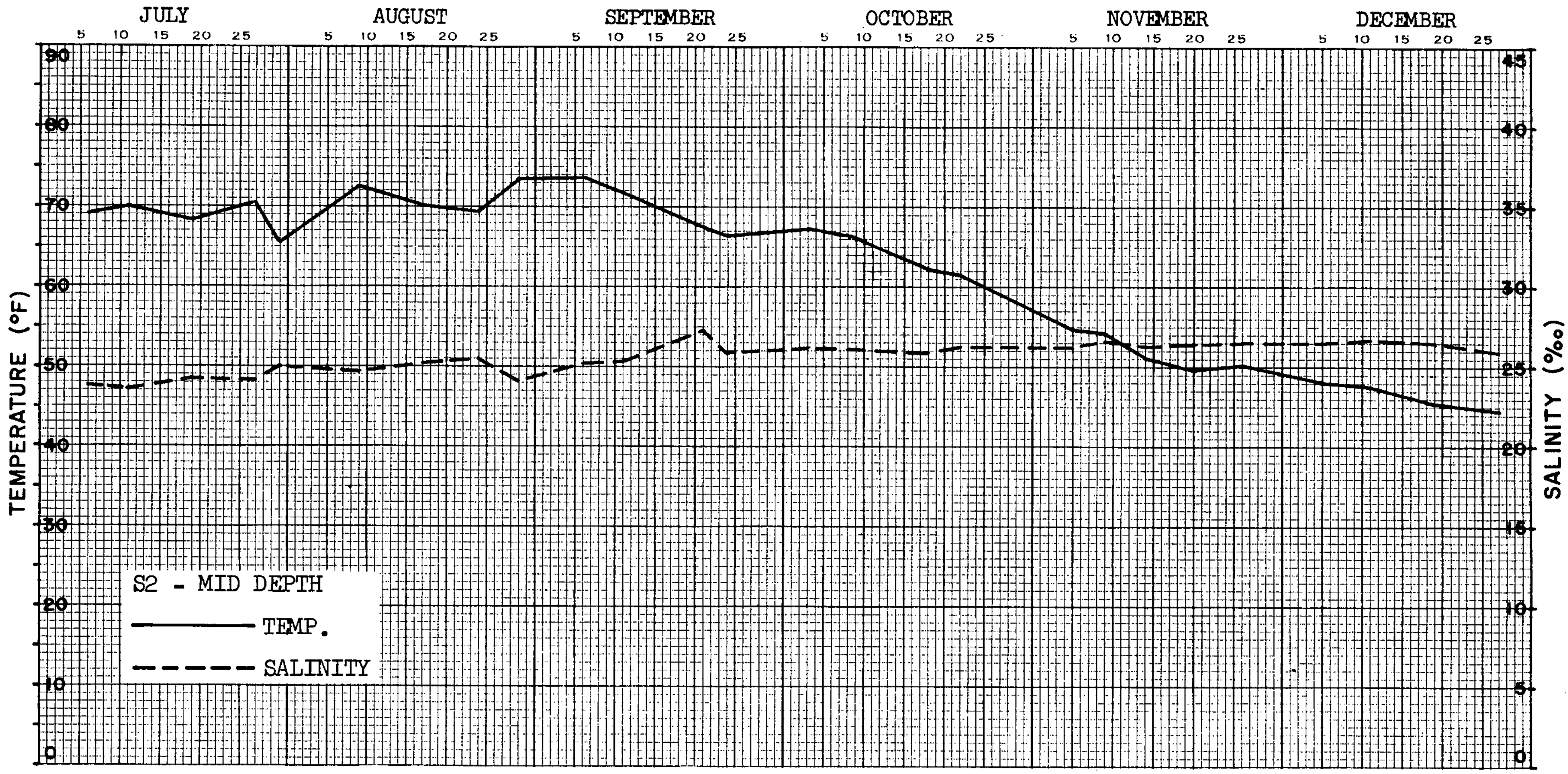

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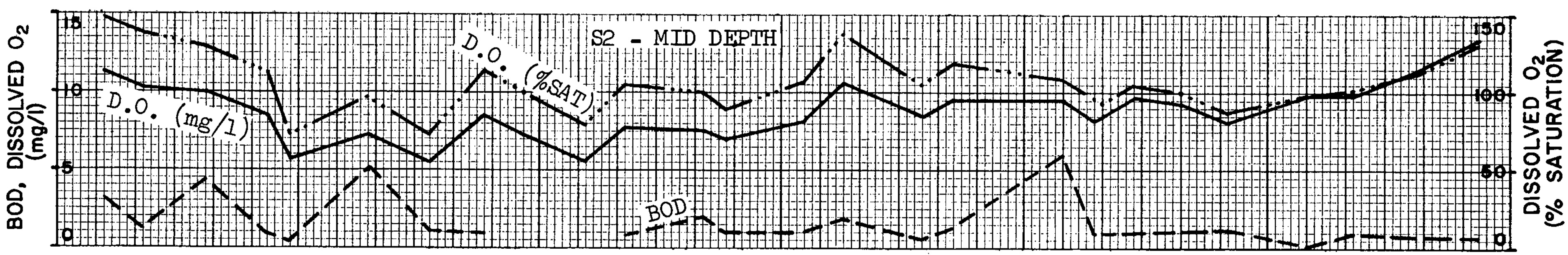

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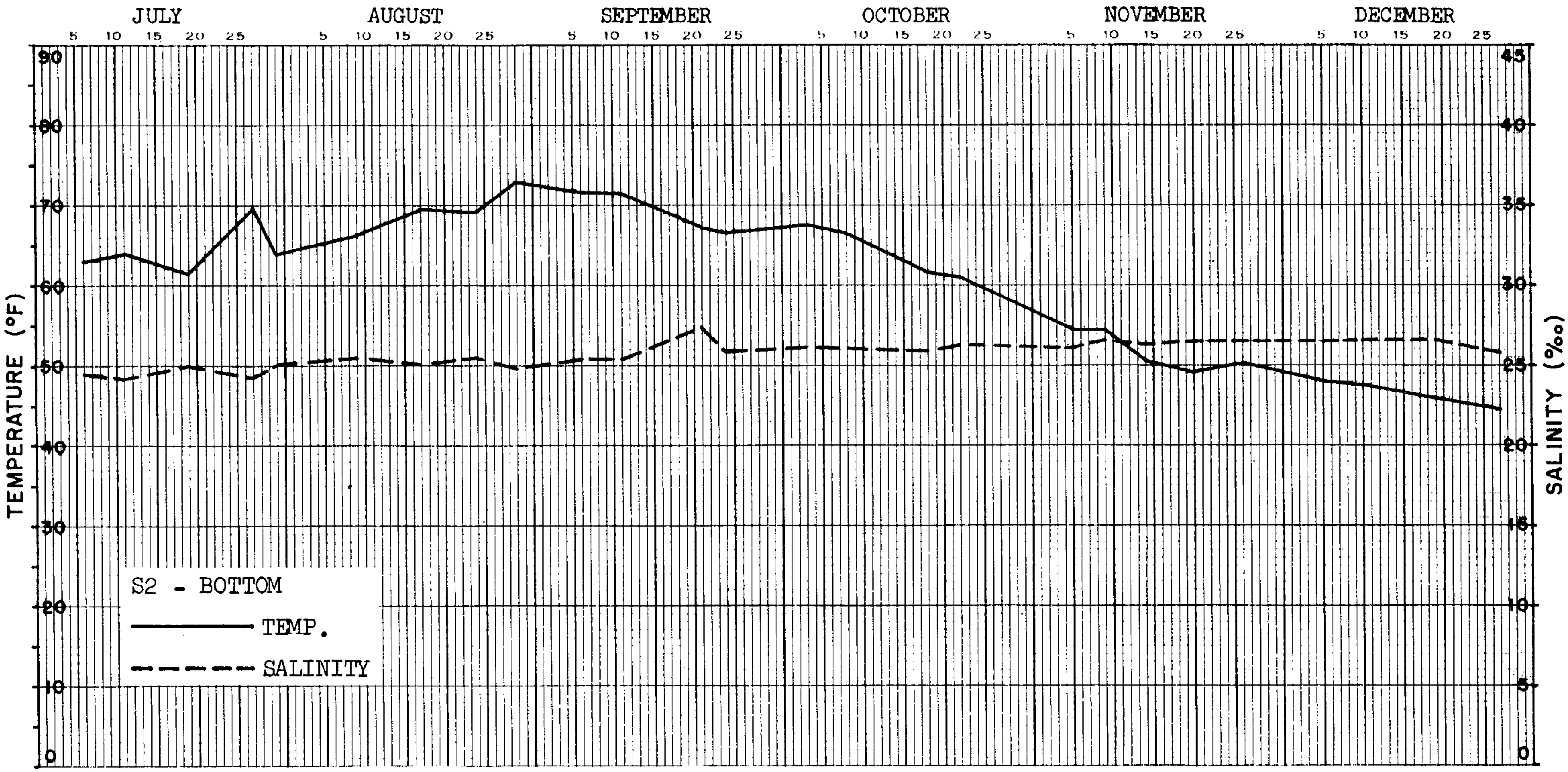

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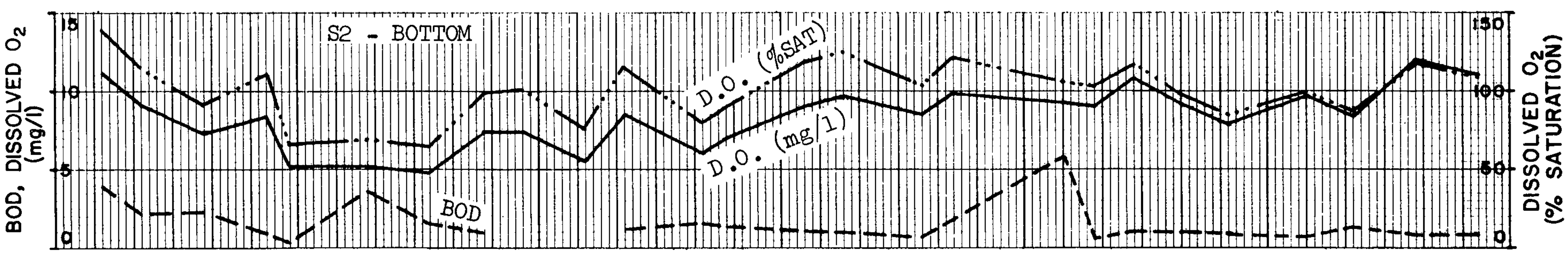

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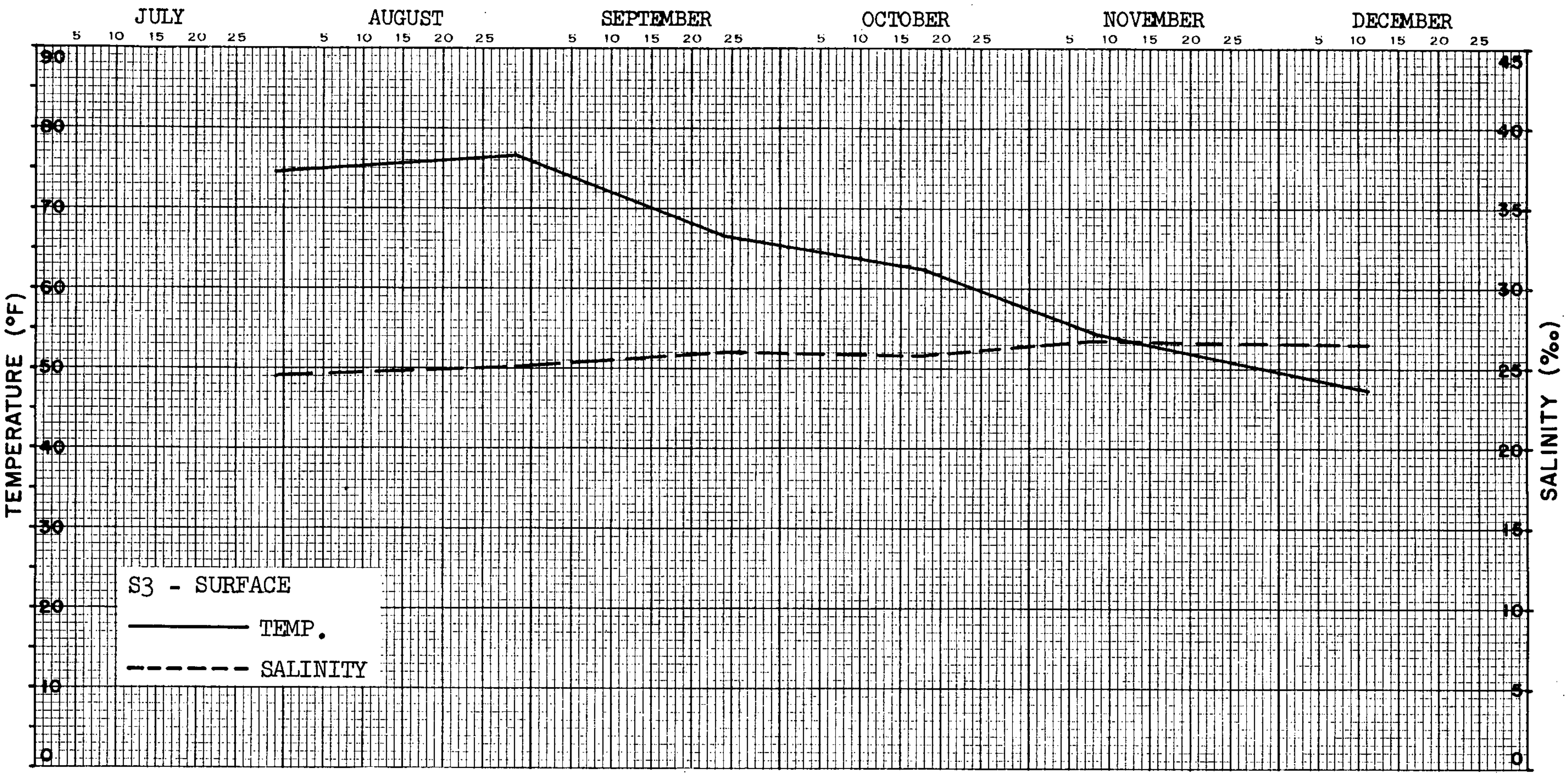

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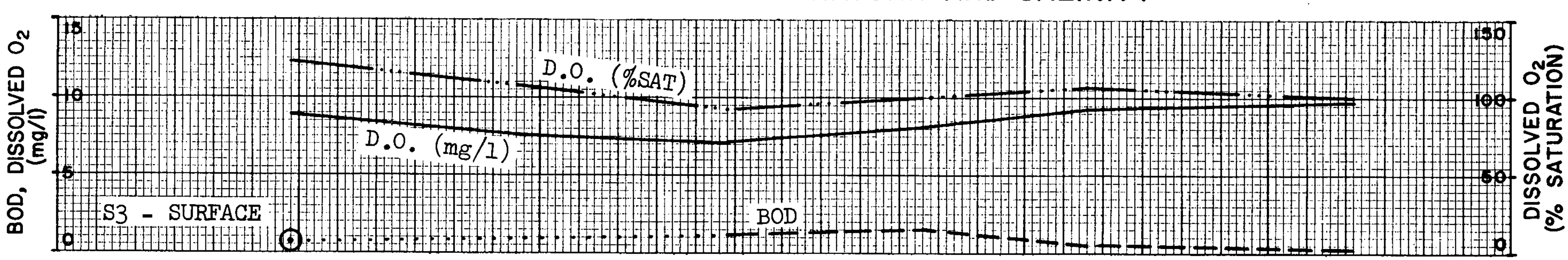

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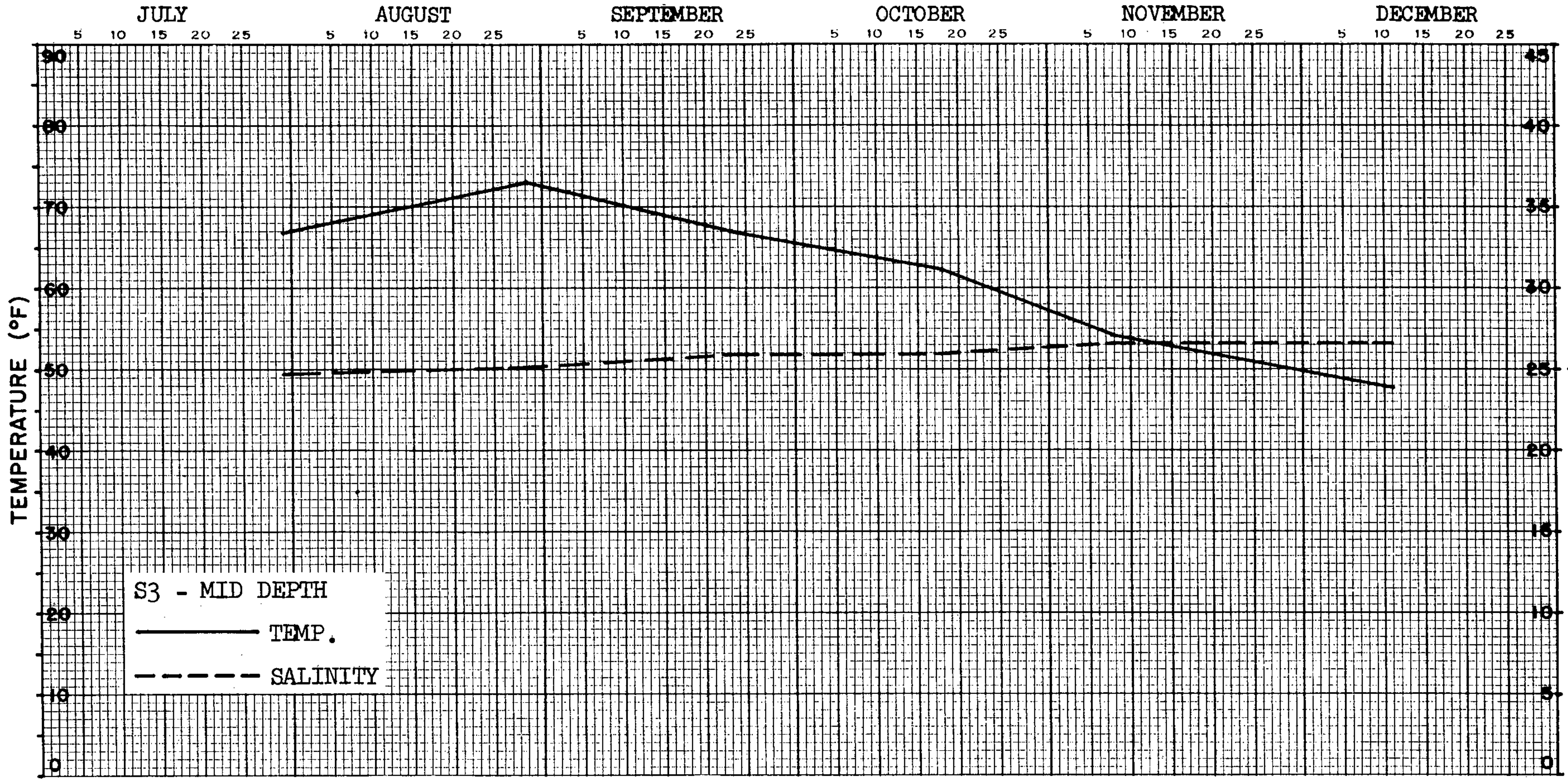

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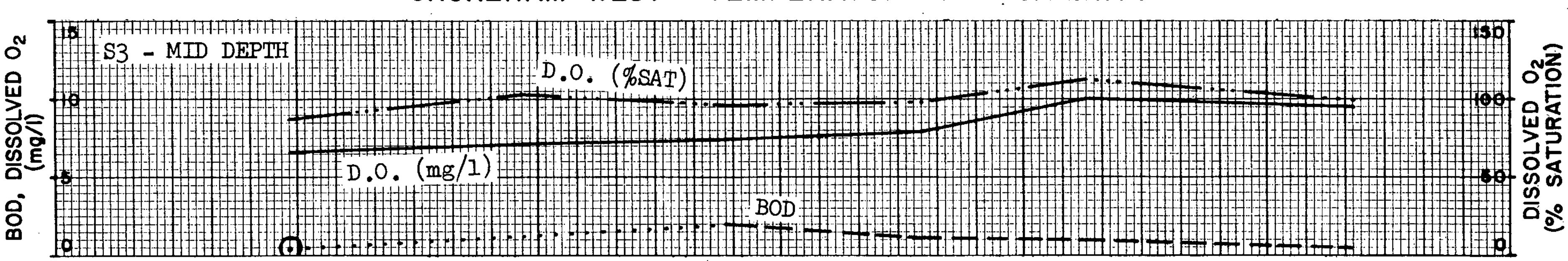

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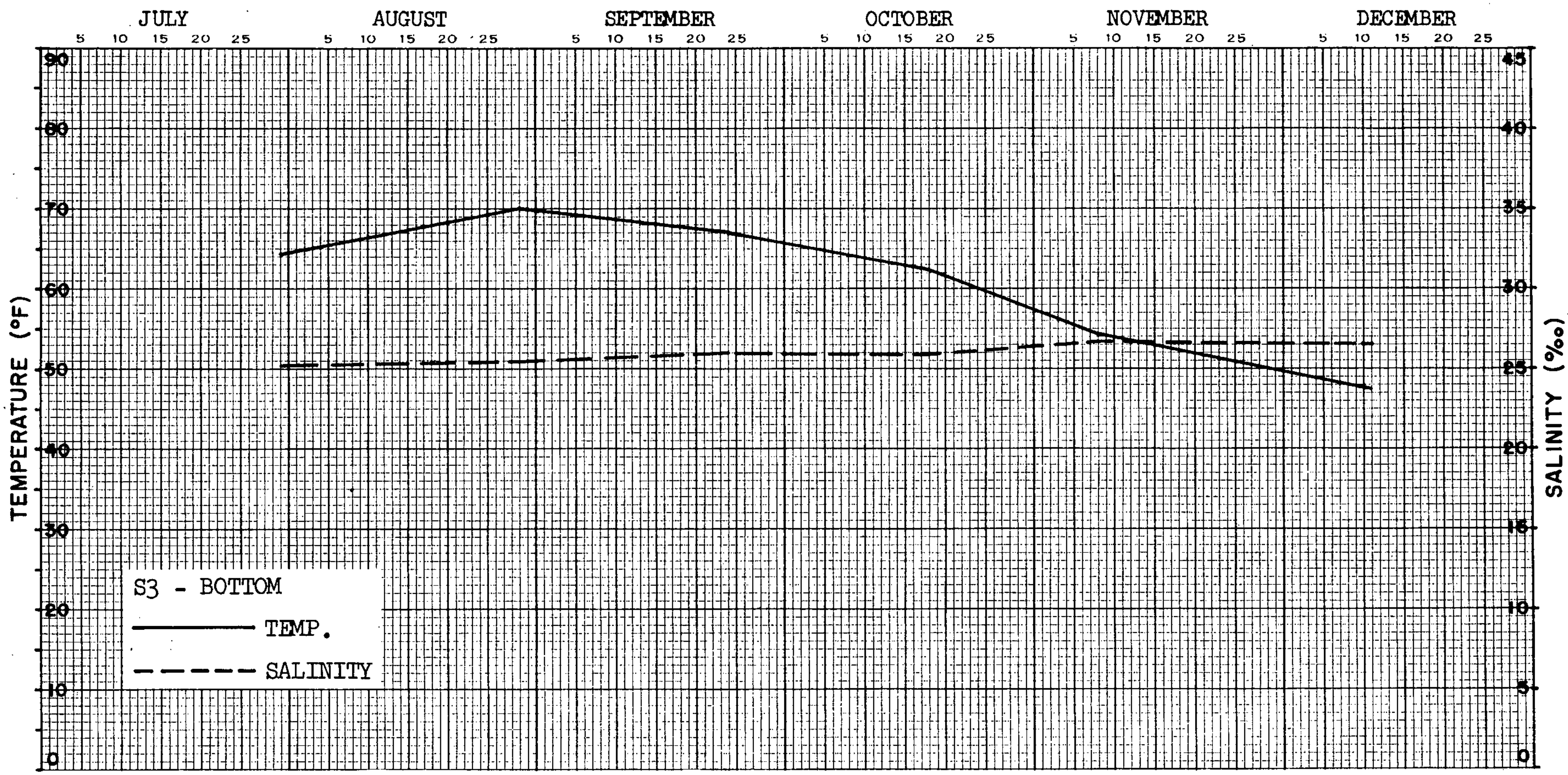

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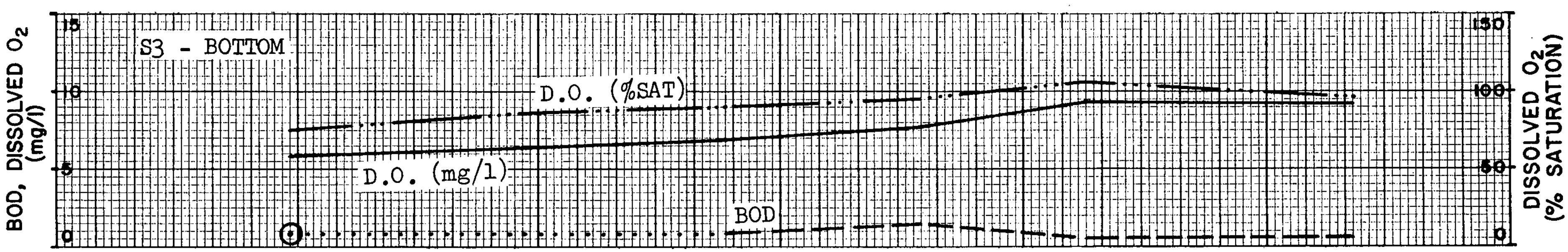

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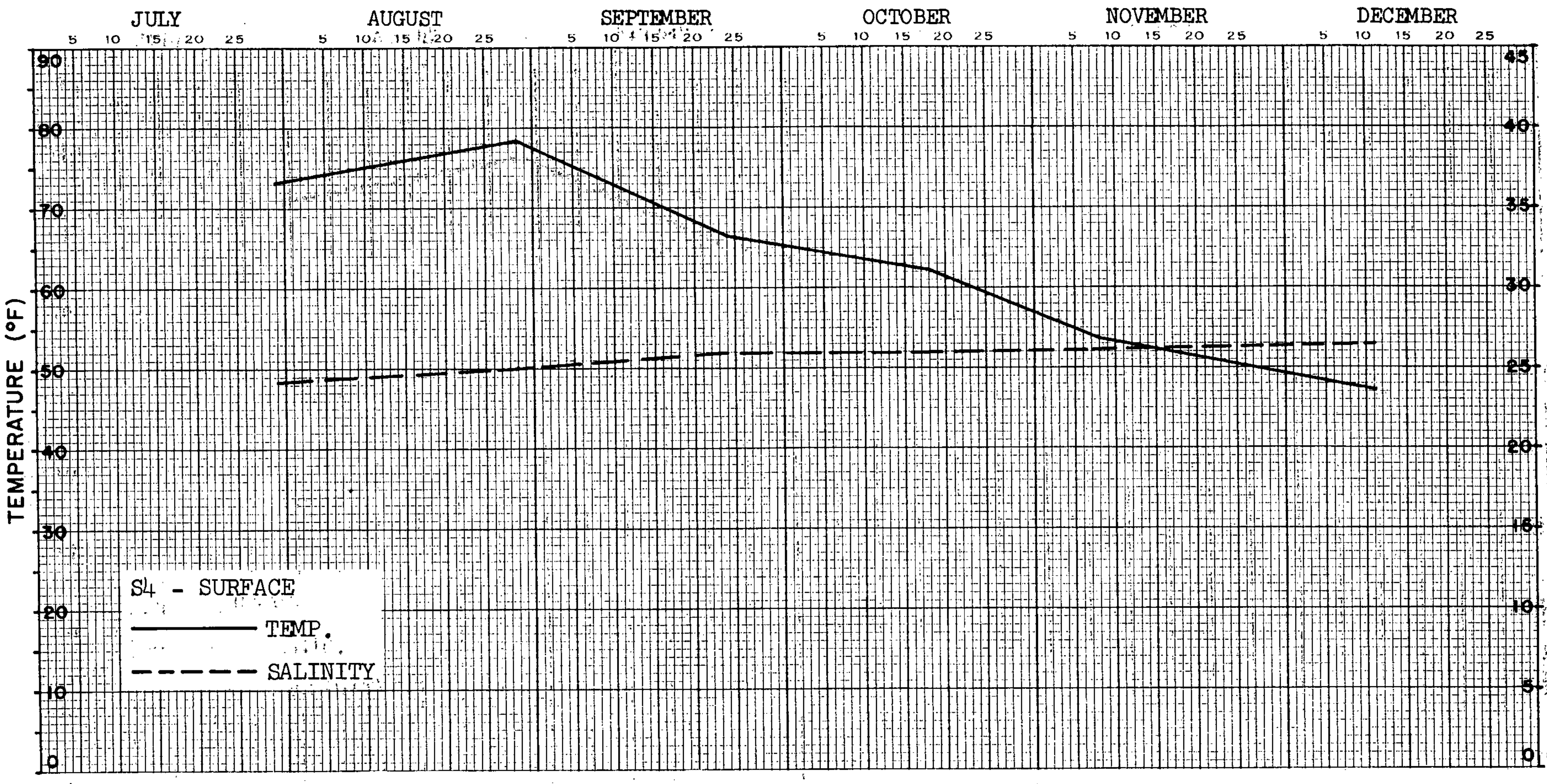

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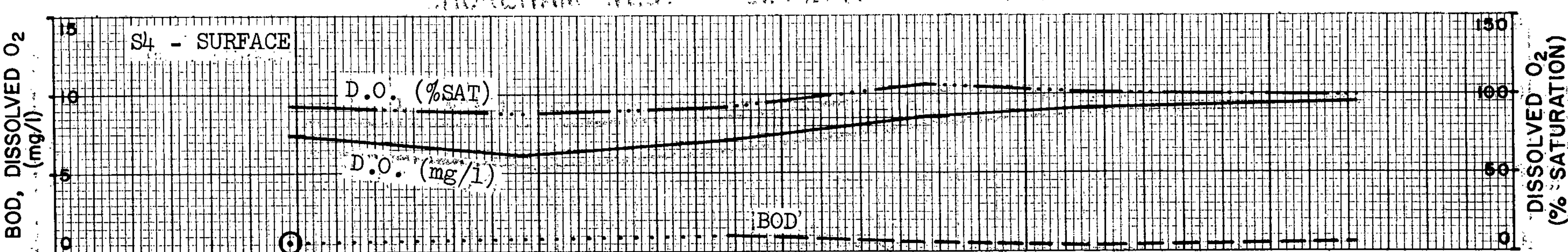

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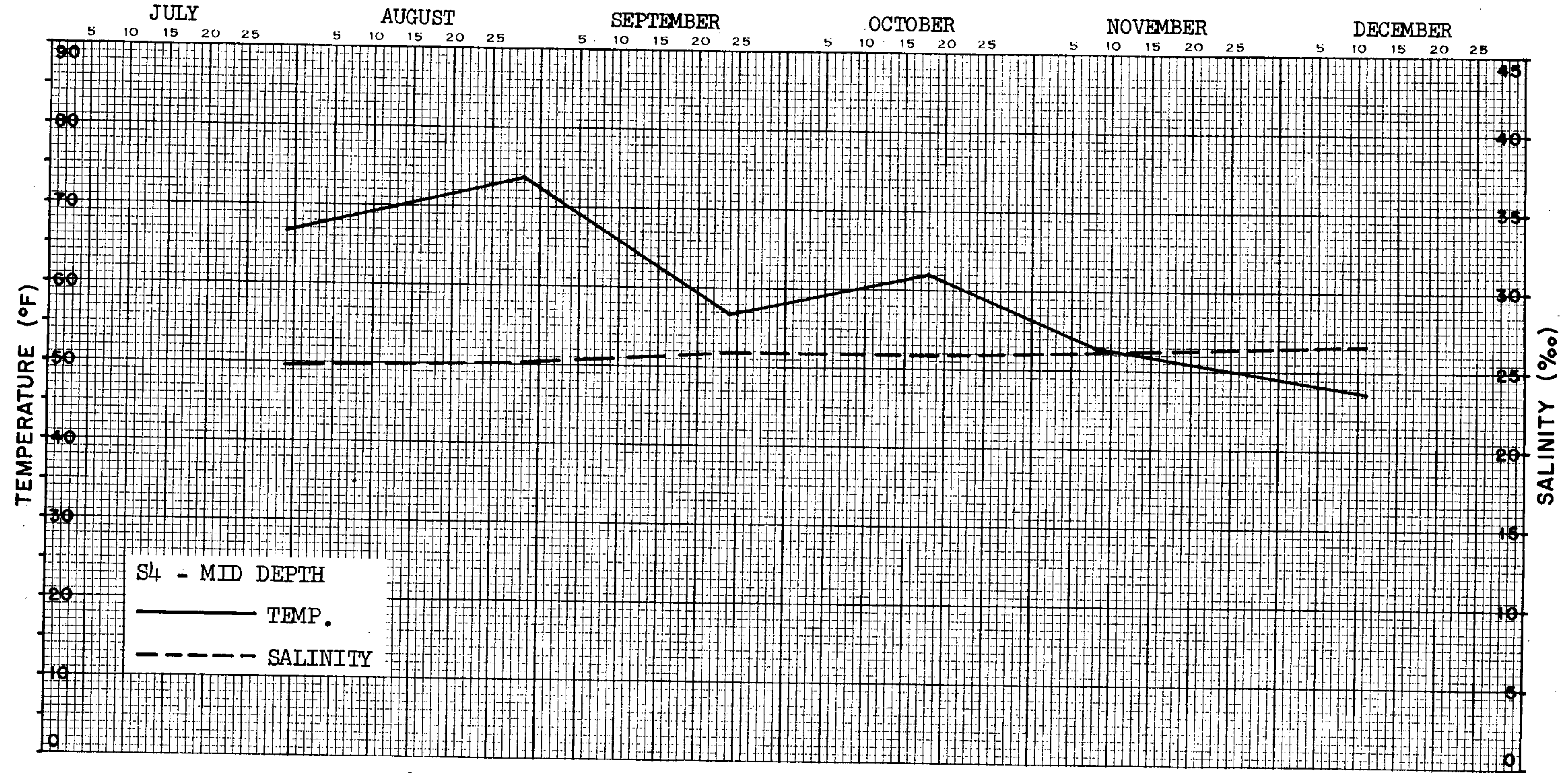

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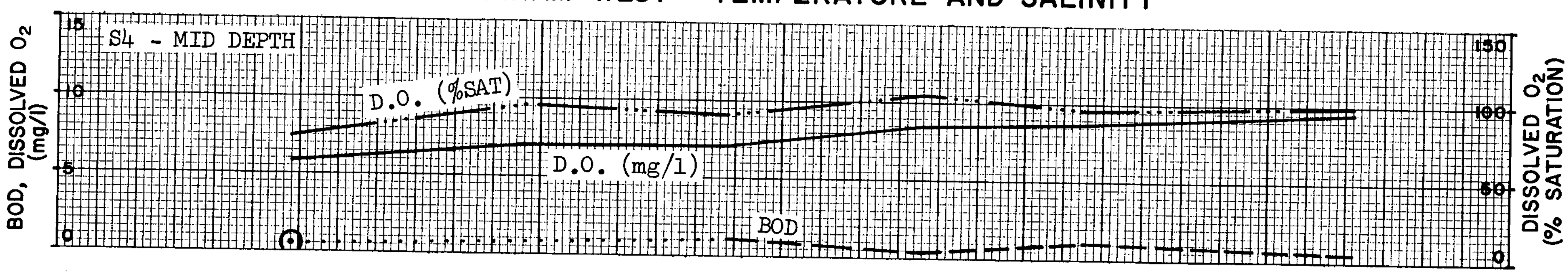

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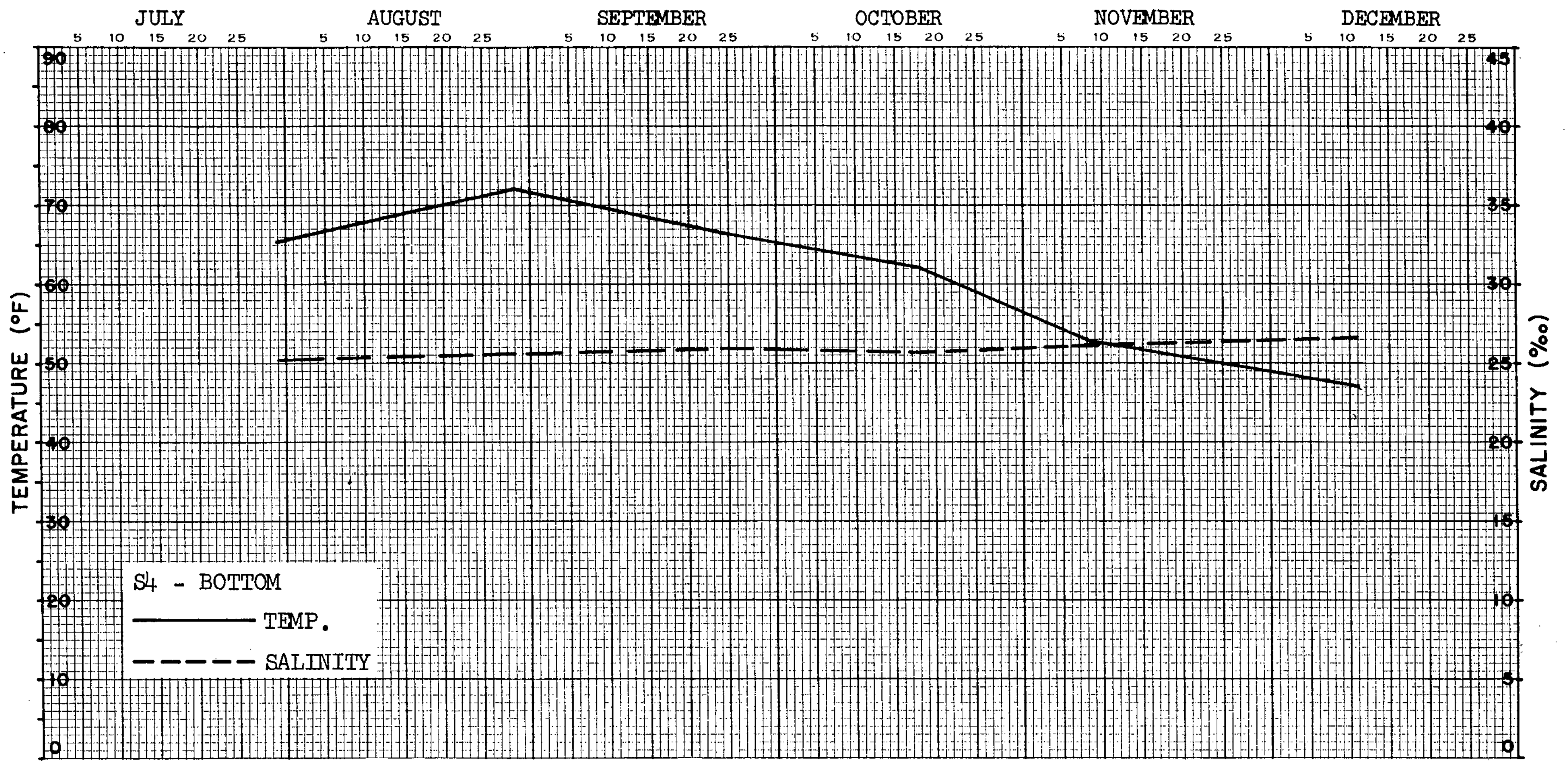

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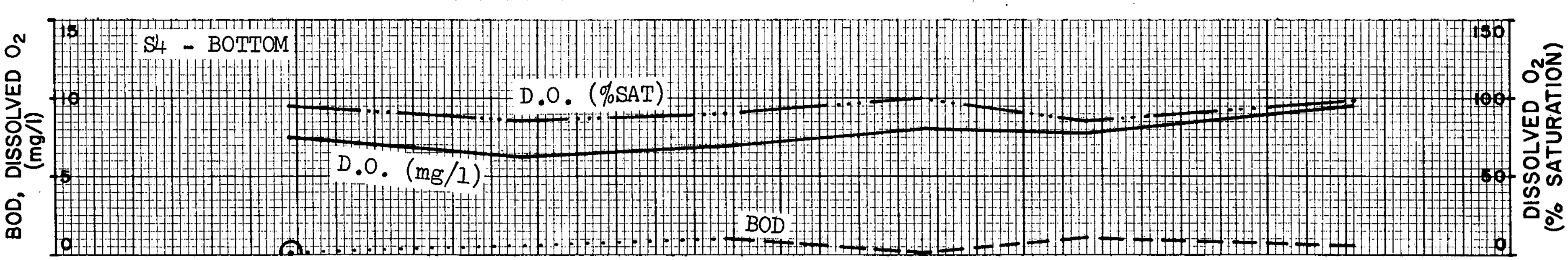

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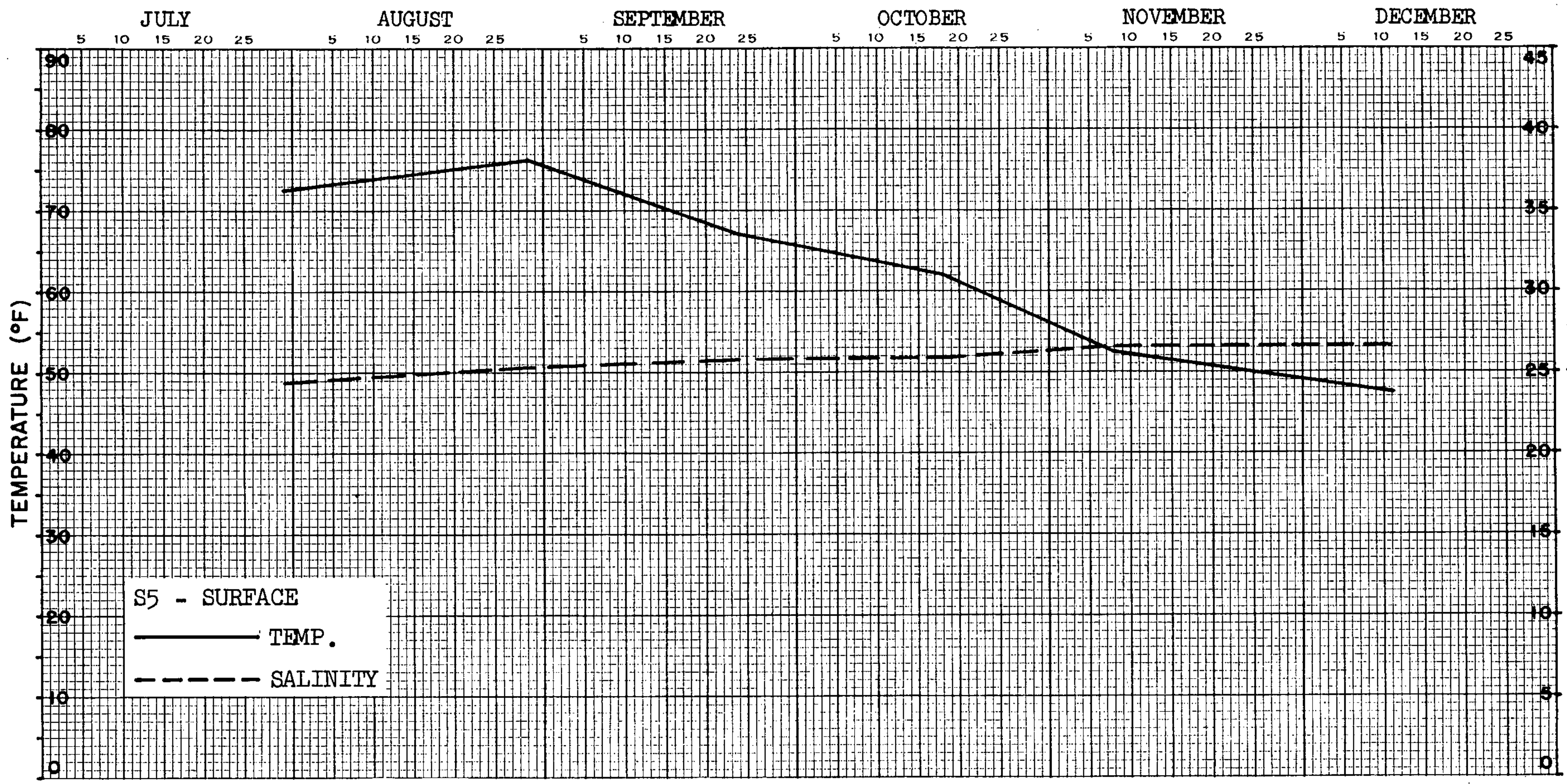

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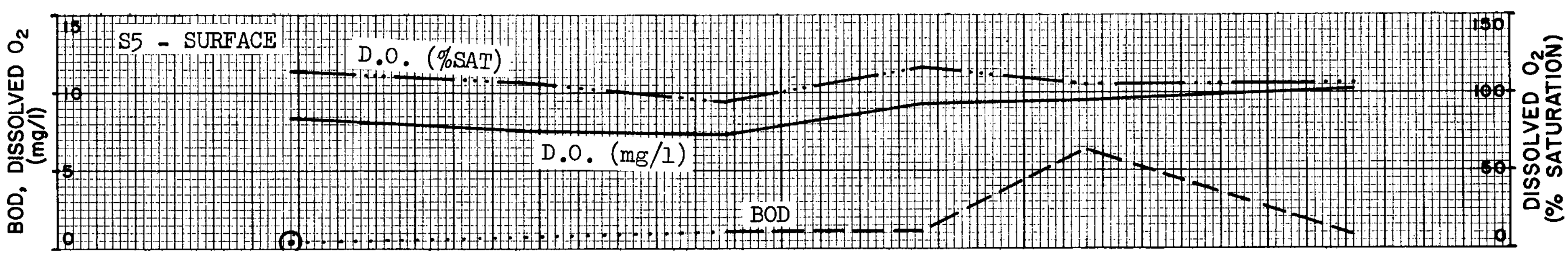

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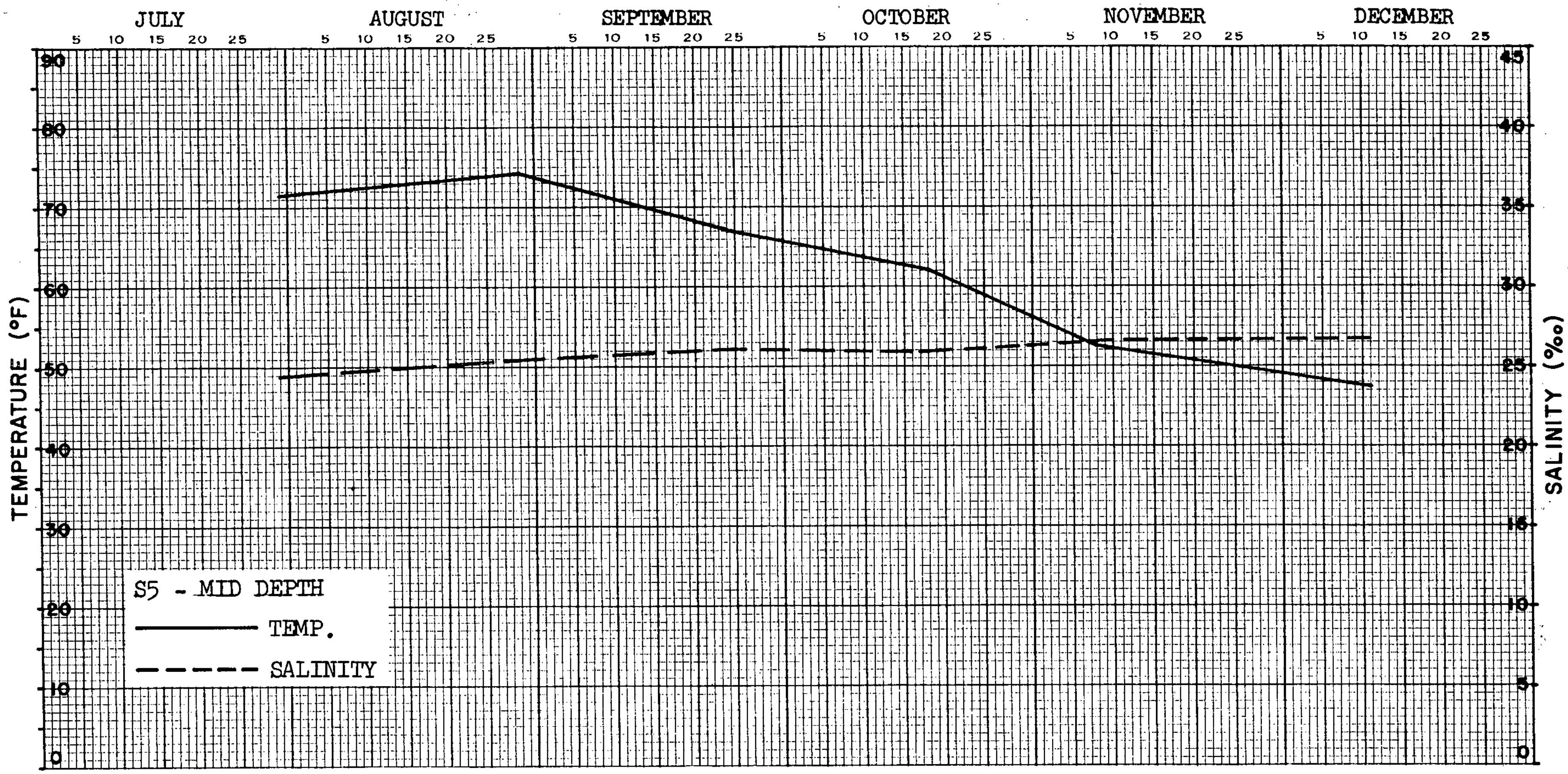

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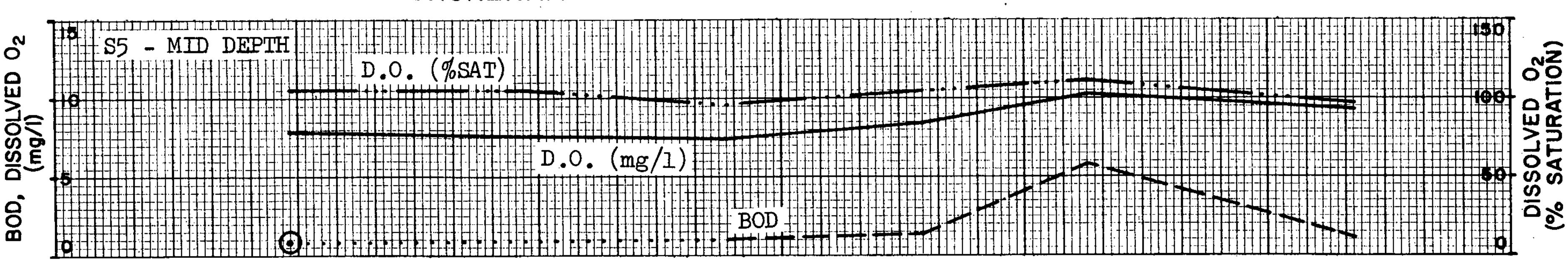

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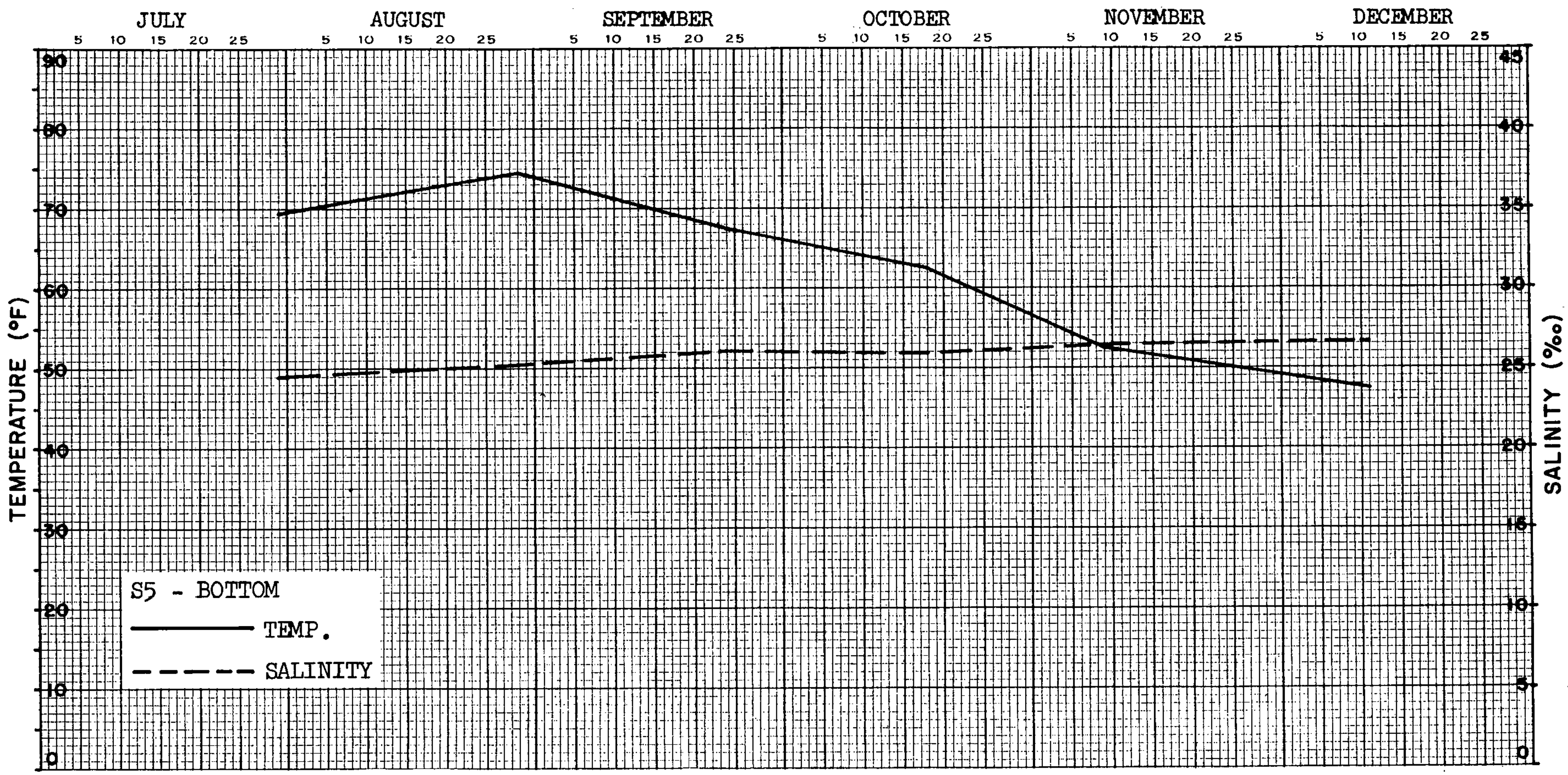

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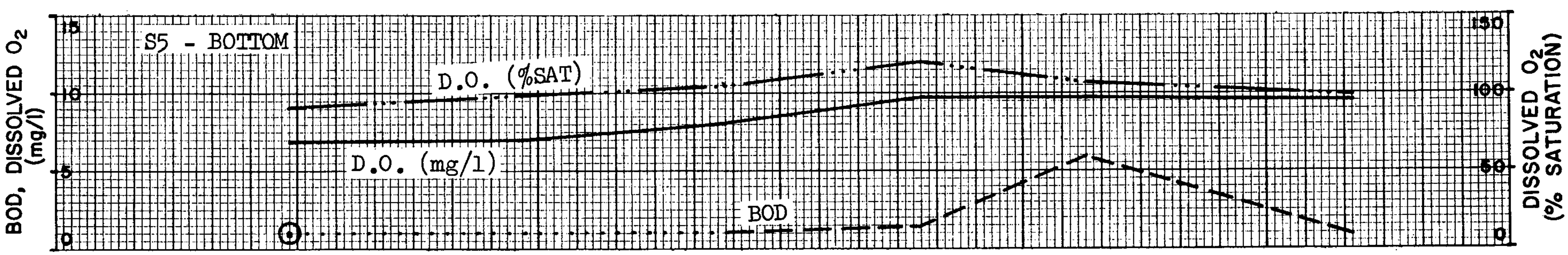

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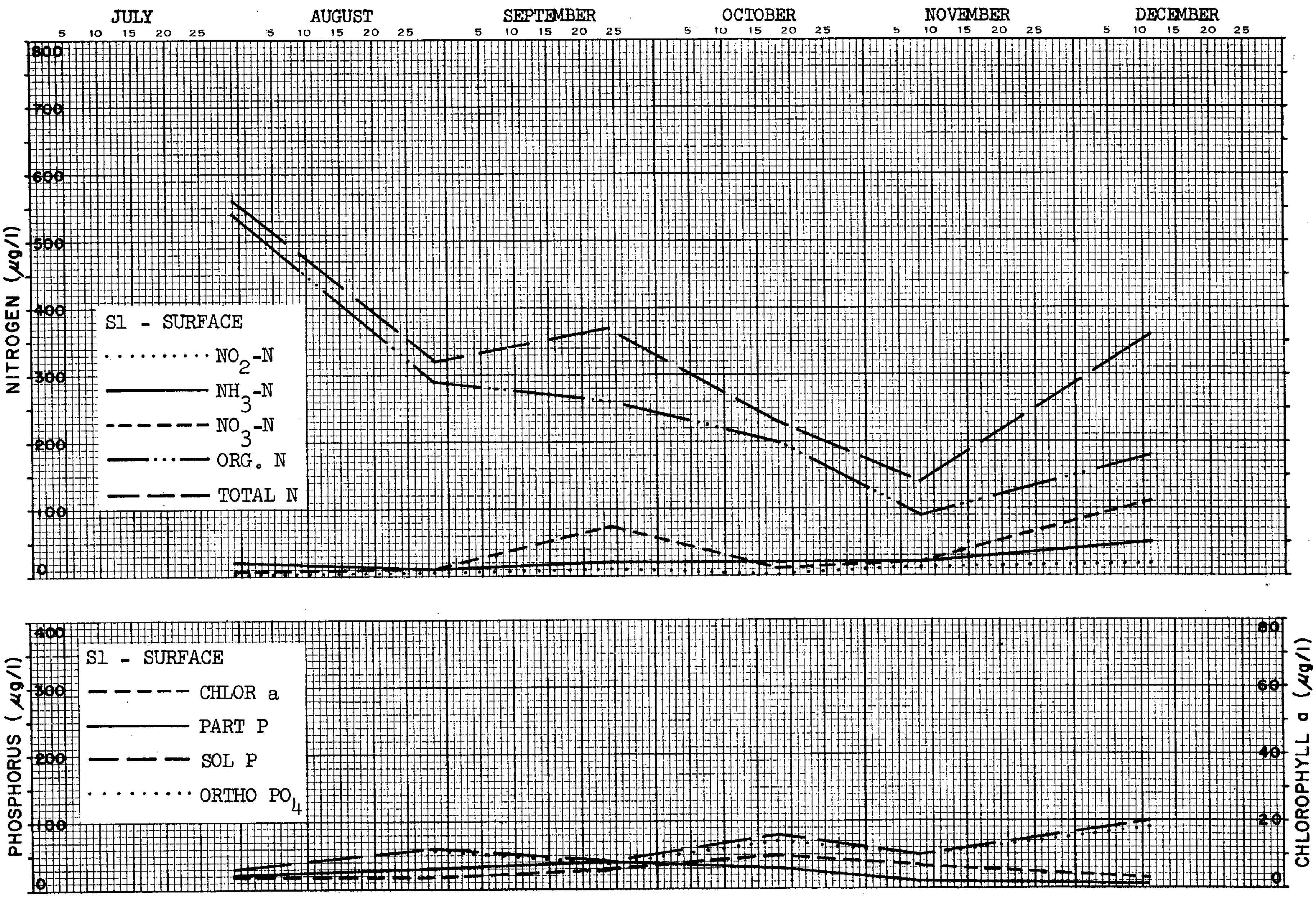
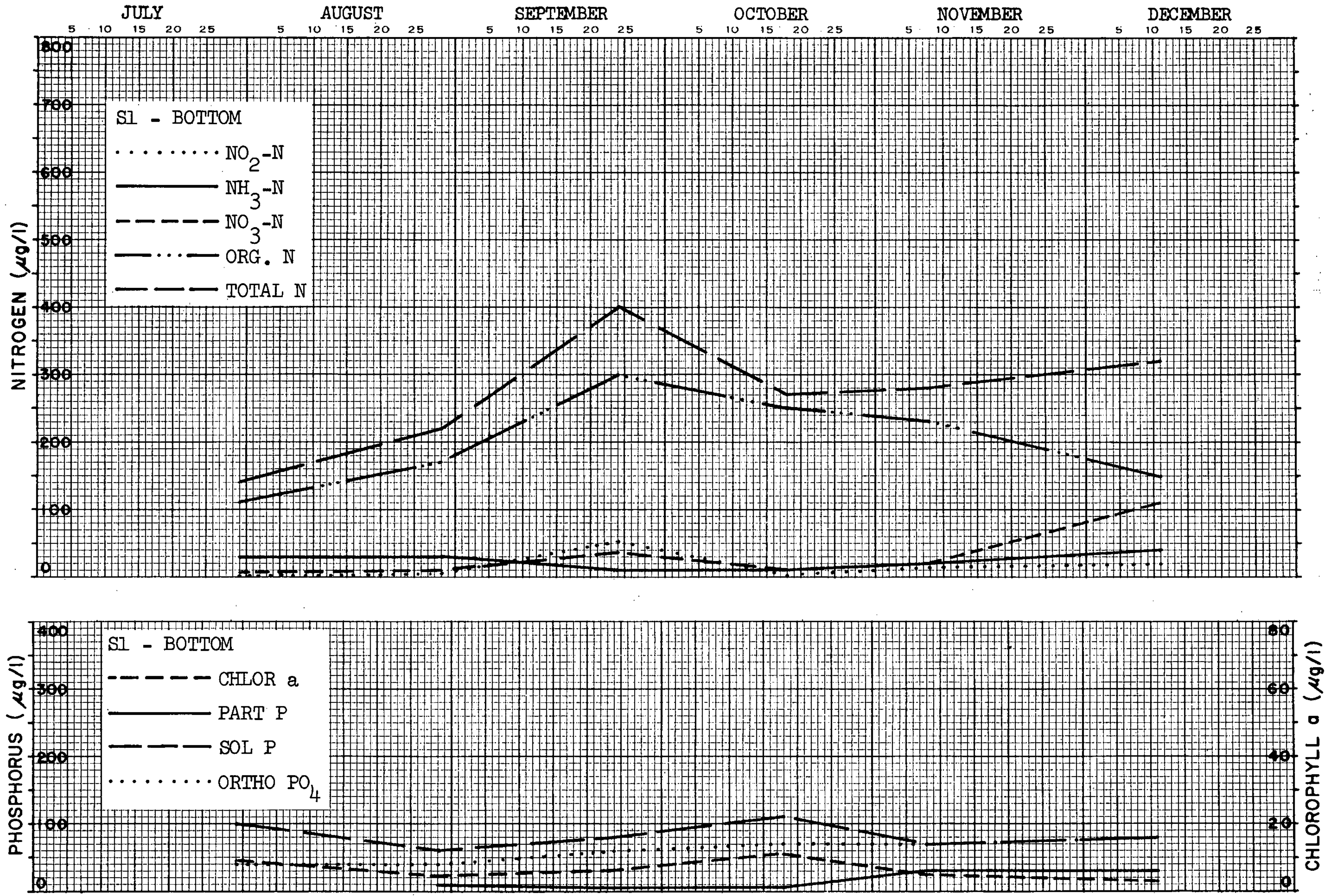


SHOREHAM WEST — NUTRIENTS AND CHLOROPHYLL a



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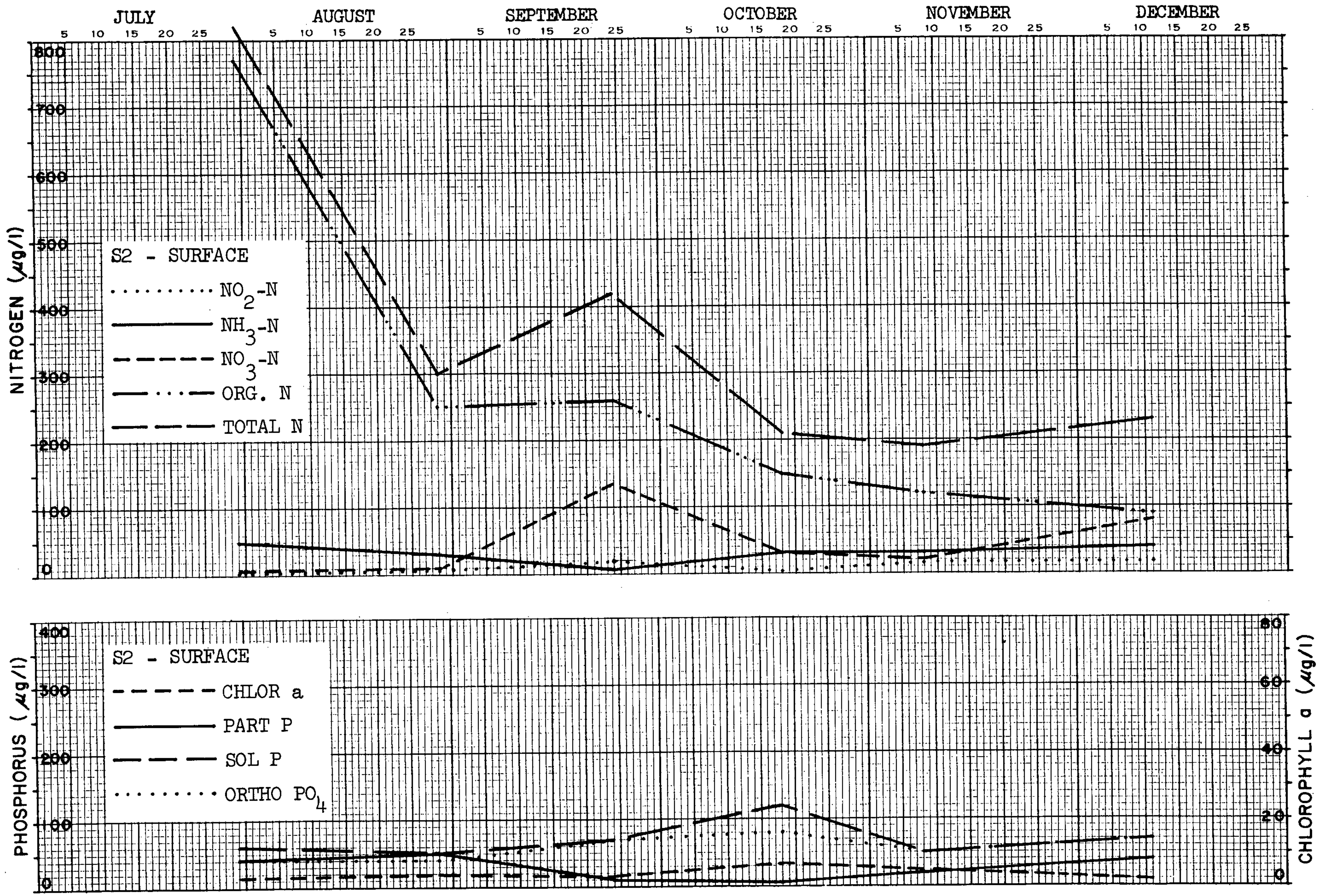

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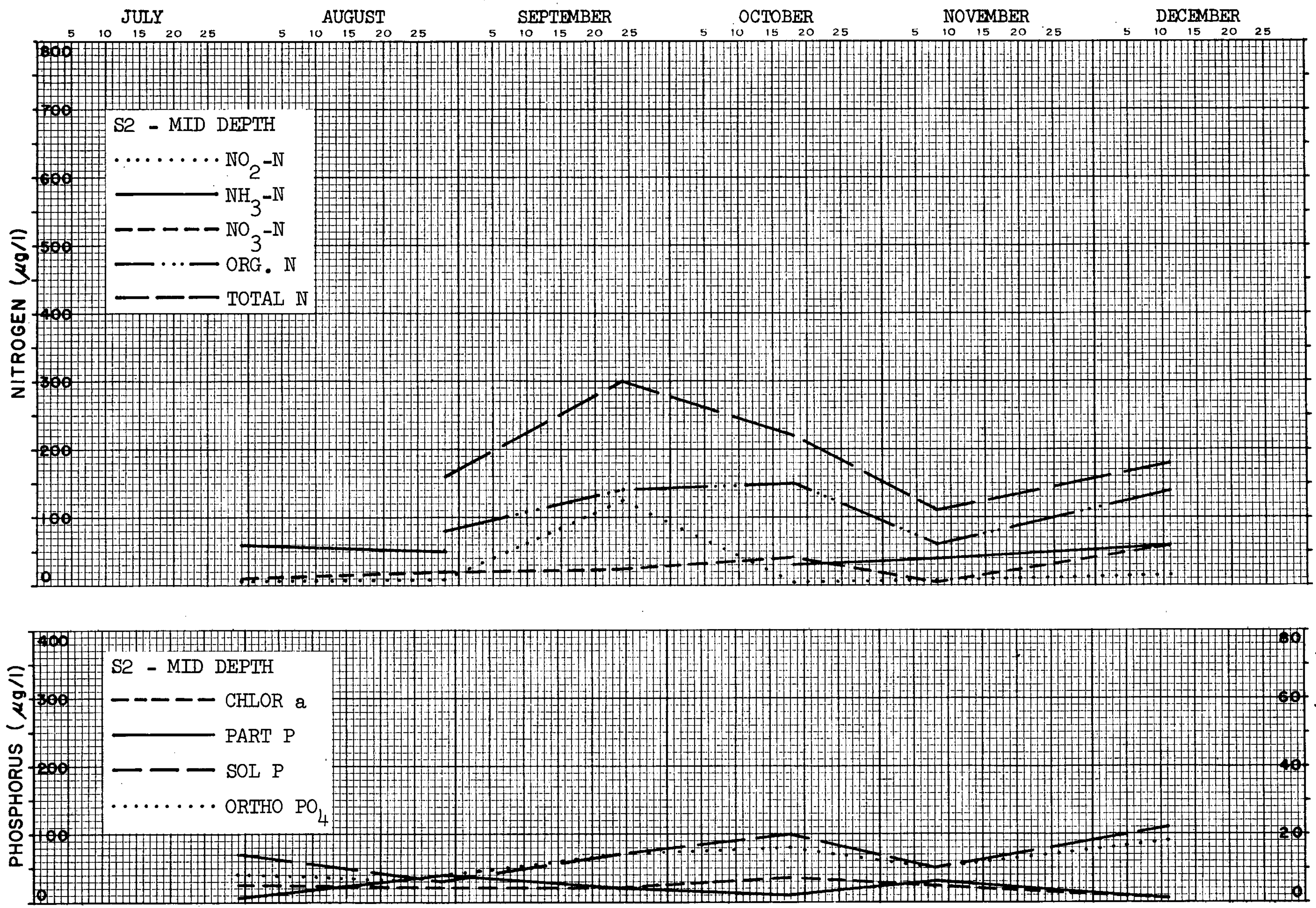

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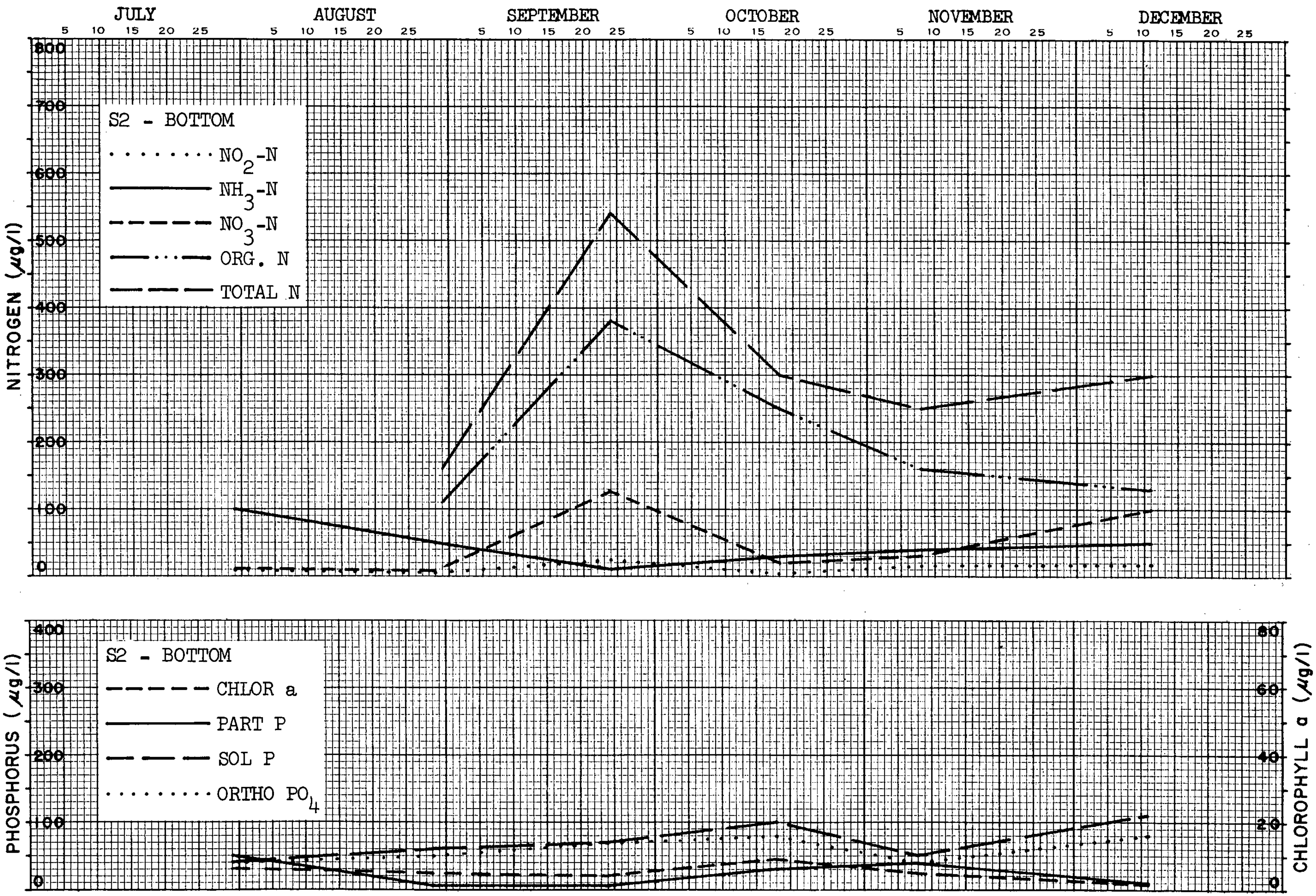

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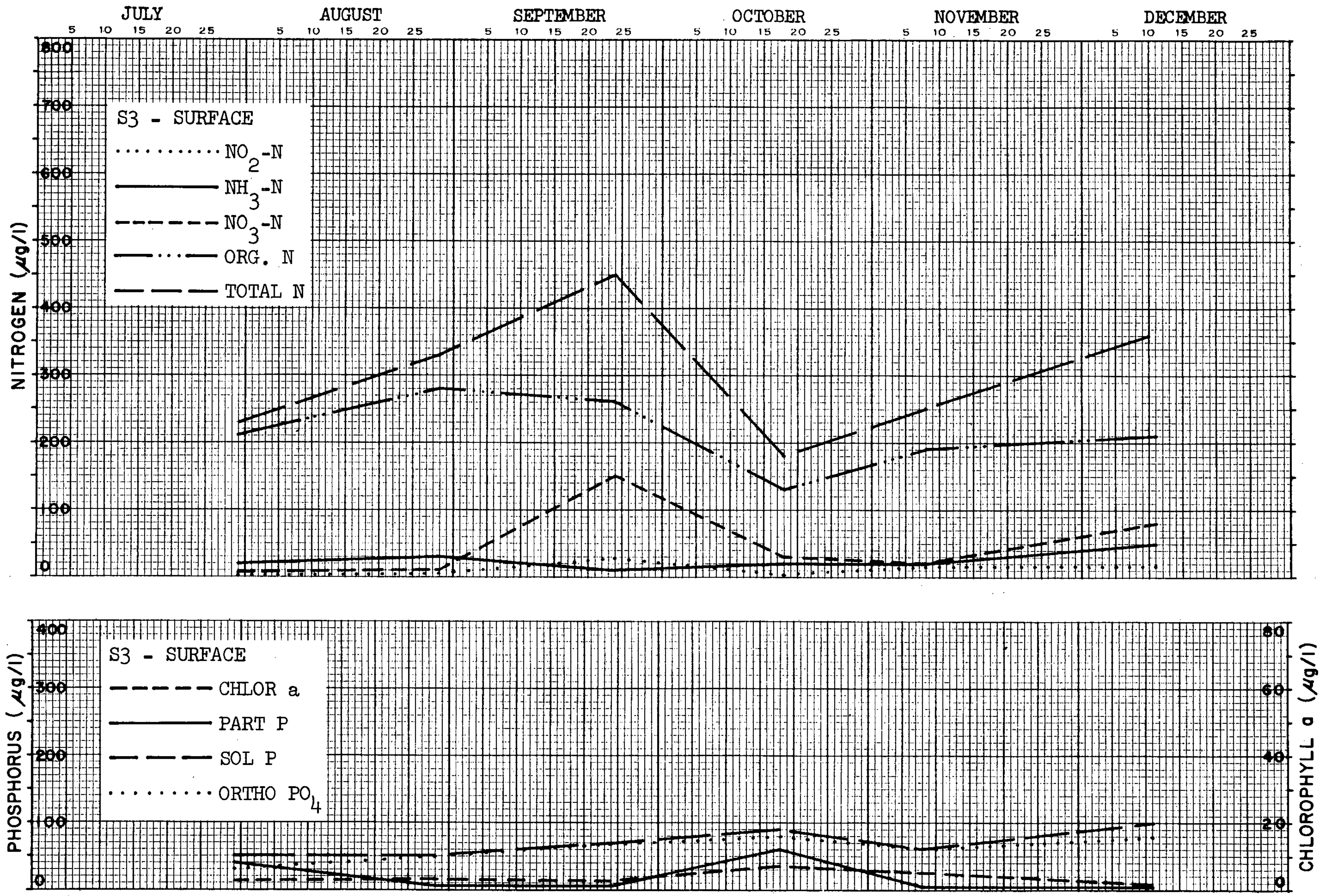

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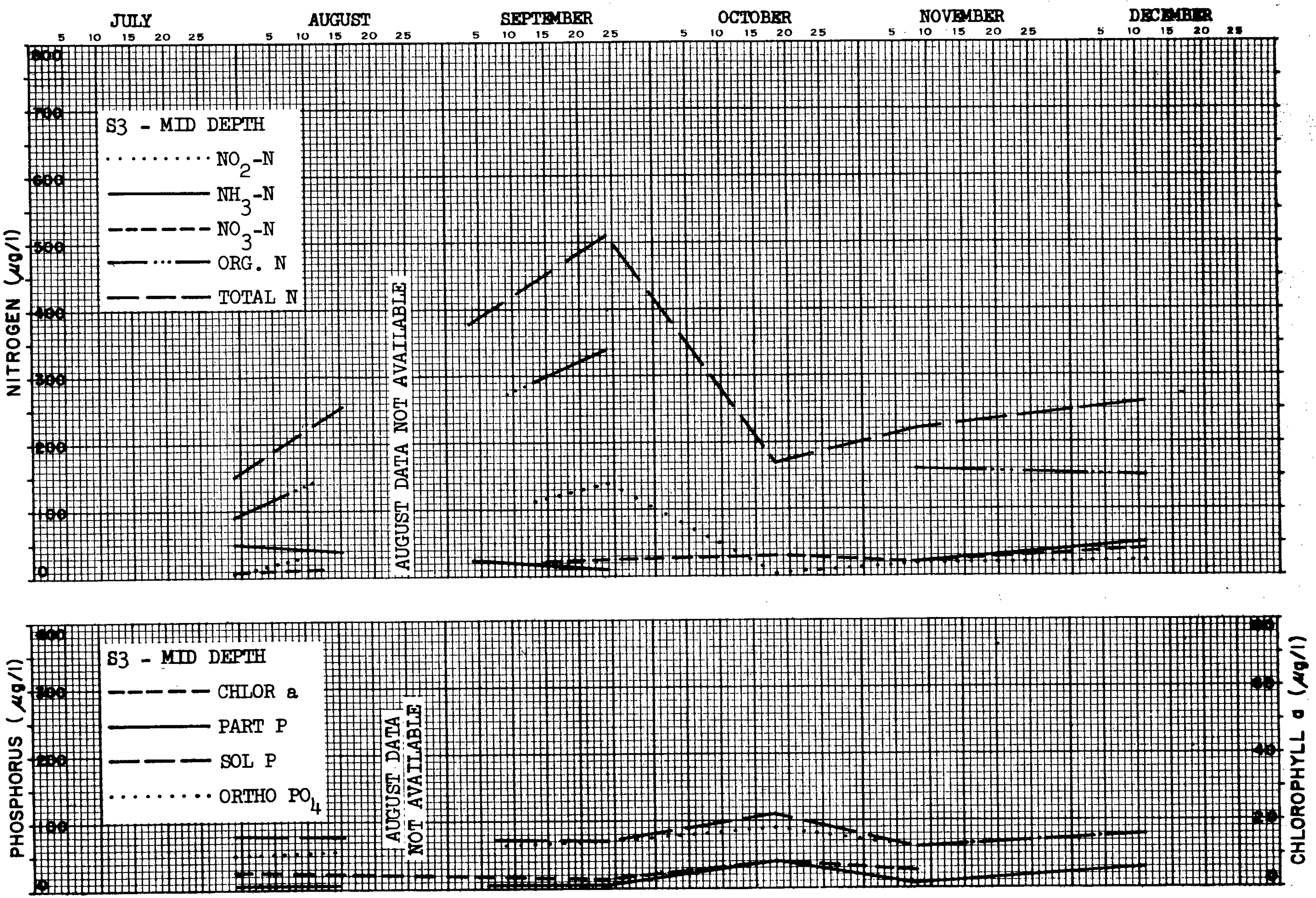

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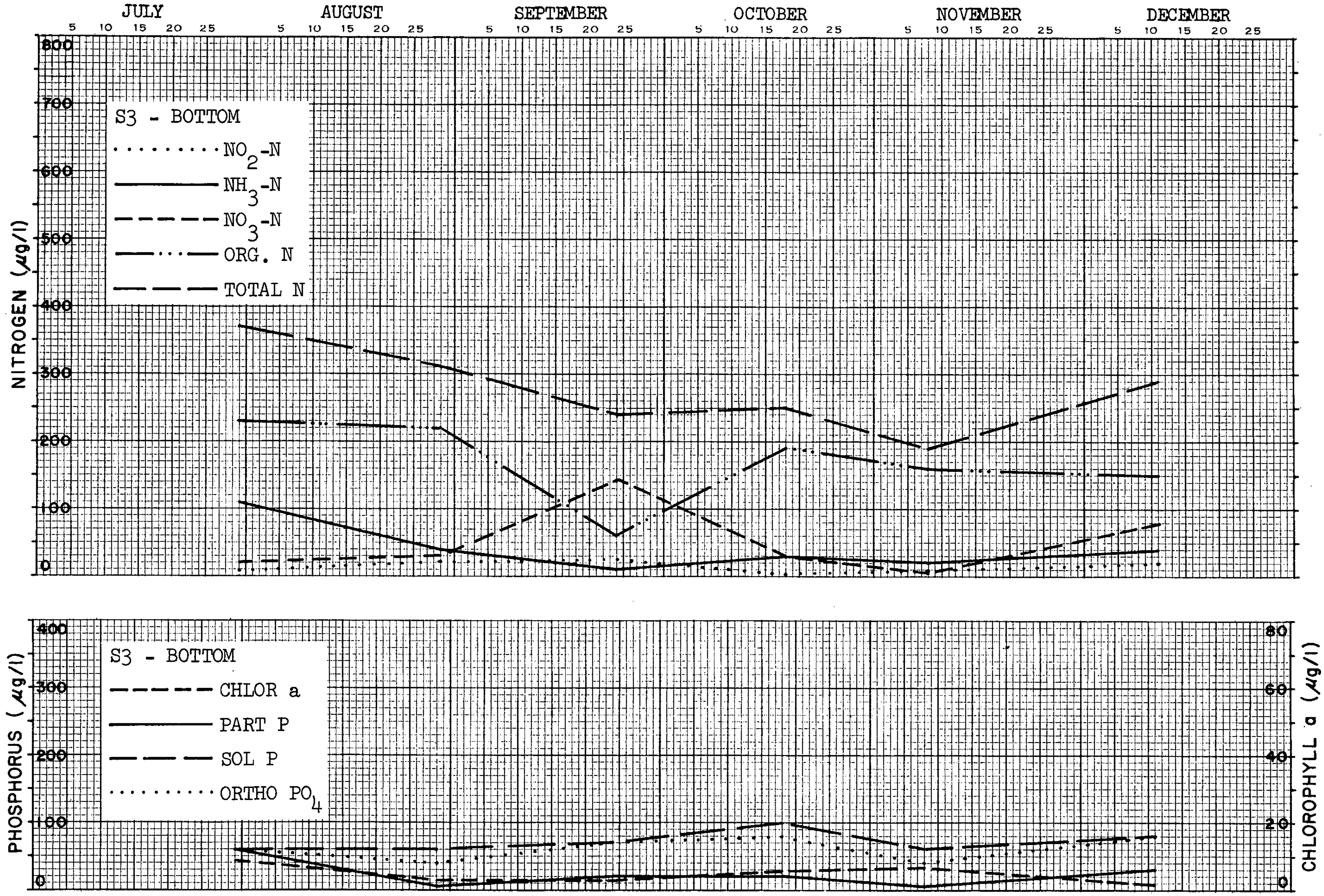

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