CHANGES IN DIEL PRIMARY PRODUCTION IN JOYUDA LAGOON ON JULY 7 AND 8, 1983 by Roberto D. Rice and Gary Owen, Supervisor August 1983 CENTER FOR ENERGY AND ENVIRONMENT RESEARCH

CHANGES IN DIEL PRIMARY PRODUCTION IN JOYUDA LAGOON ON JULY 7 AND 8, 1983 by Roberto D. Rice and Gary Owen, M.S., Supervisor August 1983. Research was conducted at the Center for Energy and Environment Research under the auspices of Oak Ridge Associated Universities Summer Student Participation Program.

ACKNOWLEDGEMENT: I am indebted to the Marine Ecology Division of the Center for Energy and Environment Research for providing the friendly and helpful work environment and the resources necessary for this investigation. I am particularly grateful for the help and cooperation of Dr. Laurence J. Tily, Dr. Lopez, Oliveria Serrano, and Alfreda Mercado. I would also like to acknowledge Gregory S. Grose, Dennis N. Corates, Carlos A. Sanare, and Capt. Angel L. Nazario for their help in data collection. Most importantly, I wish to thank Gary F. Owen for his support, guidance, and understanding without which this work would not have been completed.

ABSTRACT: On 7 and 8 July 1983, a 28 hr study was conducted in Joyuda Lagoon. Dissolved oxygen, temperature, and salinity measurements were taken at two-hour intervals from several regions within the lagoon and from a station within the channel, connecting the lagoon to the Guanajibo Channel. Unlike studies conducted in November and February, Joyuda Lagoon was found to have a north-south gradient for the study parameters. Primary production within the lagoon water column appears sufficient to meet planktonic respiratory and carbon requirements. The volume of water exchanged between the lagoon and the Guanajibo Channel was approximately equal, but the total volume of water flowing into the lagoon was insignificant in relation to its volume. Over an extended period...

During a period of time, Joyuda Lagoon may enrich the surrounding coastal waters. Plankton grazing appears to be significant in the lagoon.

LIST OF FIGURES

INTRODUCTION

Joyuda Lagoon is currently the subject of a

A series of studies are attempting to determine two tropical lagoon ecosystem functions. As one part of this effort, this study examines the level of planktonic primary production in Joyuda Lagoon during one event in the relatively wet season of July. In particular, it attempts to determine 1) whether this production is subsidized from the surrounding environments, 2) the significance and effect of coastal exchange and what are the spatial and temporal patterns of production in the lagoon, and what are the underlying factors controlling these patterns.

DESCRIPTION OF STUDY AREA

Joyuda Lagoon is located in an area classified as a Subtropical Moist Forest (Guti, 1972-79). It is found on the west coast of Puerto Rico, slightly south of Mayaguez at Lat. 18°09°N, Long. 67° (Pesante, 1978) (Figure 1). It is approximately 1.6 km long, 0.8 km wide, with a surface area of 121 hectares. The average depth is about 2 m with a maximum depth of approximately 4m (Garcia, 1981) (Figure 2). A 15 to 20 meter band of mangroves (DRH, 1978-79) borders the lagoon (Pesante, 1978); the red mangrove Rhizophora mangle dominates but black mangroves, Avicennia nitida, and white mangroves, are also found (Garcia, 1981).

MATERIALS AND METHODS

During the 28 hr event on 7 and 8 July 1983, measurements of selected environmental parameters were taken every two hours from the 6 regions (regions 2 and 3) indicated in Figure II. The regions and stations were chosen because of data collected in earlier studies at these locations. For region and station occupations, measurements of dissolved Oxygen (D.O.), temperature, salinity, and a sounding with a secchi disk were taken. A temperature-compensated D.O. meter was used for taking D.O. readings (Model 87, accuracy of ±0.1 ppm). A thermistor (Model 57, accuracy of ±0.7°C) was used for temperature measurements and an induction salinometer (Model 33, accuracy of ±0.7 ppt) used for measuring salinity. Where the water column was greater than 0.5 m, two replicate measurements for these parameters were taken.

Parameters were taken at 0.25 m from the surface and at 0.25 m from the bottom. If the water column was less than or equal to 0.5 m (only at station 0), measurements were only taken 0.25 m from the surface. Wind velocity (measured with a hand-held Dwyer Wind Meter) and wind direction (determined using a Saura H8-650 Compass) measurements were taken throughout the event, except within the channel, station 0, where the mangroves limit the ability to take accurate measurements. Secchi disk readings were taken between the hours of 0600 and 1800; cloud cover for the entire lagoon was also estimated during daylight hours. The flow within the entrance channel, station 0, was determined from five measurements across the channel (with a Kahn 00SHA200 Flow Meter).

Continuance of 0.17 (grey 10.027) taken at 0.4 depth for 60 seconds. At the deepest spot in the channel, measurements were also taken at 0.2 depth and 0.8 depth so that the average discharge could be better calculated (Longley, et. al., 1975). Three complete ebbs and one flood cross-sectional channel flow profile were determined during the course of the study. If a complete flow was not taken during the cycle then a spot flow check was taken at 0.6 depth in the deepest area. In this case, a minimum of two 60 second replicate samples were determined during the cycle. Chlorophyll samples were taken during eight cycles at station 3. A vertical Niskin sampling bottle (Model 1010-1 -2 to 40L), with its mark designated as the sampler's depth in the water, was used to collect the water samples from the middle of the water column. Between two and four 133 samples were collected during each cycle. One ml of $MoCO_3$ was added to the samples after filtering. After filtering, the glass micro-fiber GF/C filters (Whatman 4.25 cm) were stored in aluminum foil wrapped bottles and placed in a cooler with an ice-brine solution until they could be placed in a freezer (maximum time was 8 hours later) (Standard Methods, 1978). The laboratory processed Chlorophyll concentrations in the samples.

Determined by the Turvometric method after a 24 hr extraction with acetone (Standard Methods 1975), the statistics station, time, depth, and the specific interaction effects for these parameters were analyzed using analyses of variance techniques. Where there were indications of non-normal distributions or heterogeneous variance, a transformation was made on the data. Any significant differences observed were further examined using testing to determine their specific locations. An explanation of these statistical tests are presented in Sorat and Roth (1969). Net production was determined by counting squares on the regional graph of positive (non-transformed) changes in D.O. values versus time, and then multiplying this value by the mean width for the region. Respiration was calculated using two times the negative changes, to account for respiration during times of net production. Gross production is the sum of the net production and respiration. The respiration ratio was calculated by dividing gross production by respiration. Corrections in production and respiration for the gas exchange from the lagoon to the atmosphere are small, 0.2% to 1.02, relative to the observed oxygen changes. Due to the small size of this correction factor, and because the correction factor is not absolute, this correction was not made for the data. The regional surface areas and their mean depths were determined by cutting the areas out from Figure II and weighing them on a Mettler balance, Type H6T (precision of +/- 0.00005 g). Regional volumes were determined from this information (Table 1).

(The rest of the text is uninterpretable and appears to contain multiple errors, possibly due to a formatting or transcription issue. It is recommended to refer to the original source for clarification.)

The text appears to be a mix of scrambled sentences, non-English words, and random string of letters and numbers, which makes it challenging to fix. However, I'll attempt to correct the English phrases while leaving the rest as it is:

"SYNCH" SWIL Poet Code Bed Base BAZe BAA BAZe eevZ BART Best EFI BAzI BABI Bae Bae a i east Aine pun Jepnéor ui ¢ uoraers a0} uobéxg paniessig ut Le OG NI 39NBHO 10 (Hdd)

¢SUNOH) SWIL BCs! Ader 220 eArA BAZE Bee BAz2 aDLZ est BAI BOFI edZT BABI Bee Bae IT a a OG NI 3ONUHO Hdd

SYNOH) AWIL ant Bes aB90 Bb0 Bxz0 Beas Boze BaBe BABI BB91 BOF aNZT BABI Bee geo ey OG NI 39NYHO

¢SYNOH) BWIL OOM! 2AG0 ASE 2862 BAZA BBxE LOz2 Bode Beet Past Bobt BeZt BeDI Bee ees er 1 Busang wooo epntor cast fuse @ pi | 9 panyossig ut S05ue4) “T1TA ounbiy $0 [soray. 0s ee el Led be s e 5 2 r @ 1 2 € % s o “ 8 s dt neo OG NI 39NUHO (Add) B

See err CWdd > O10 NI JONUHS i a) 622 822 1928 1202 1400 1600 1802 2000 22ee DODD o200 e100 AEOe ceoe 1200 5 HOURS iE

TABLE 1. Regional Heat Surface Areas, Depths, and Volumes for dayuda 100 west0N SURFACE AREA (n?y 15

RESULTS Previous to the completion of this study a heavy storm occurred within the survey region which undoubtedly influenced the results presented here. Dissolved Oxygen - The mean content of O_2 in the lagoon was 5.09 ppm mean O_2 saturation was 6.6 ppm (89% saturation). The table presents the significance of the different sampling parameters. The lagoon was found to have a north-south gradient in oxygen with regions 7 and 8; station 3; regions 4 and (5-6); and regions 1 and 2 each statistically different (Table III). The magnitude of the mean non-transformed O_2 differences between these groupings was 1.00 : 2.10 respectively. The diel O_2 concentration was found to be lowest between 0600 and 1000, increasing significantly at 1200, and reaching its peak at 1400. It then declined uniformly from 1600 to 0400. July 8th's 0600 and 0800 values wrapped around July 7th's values (Figure X and Table IV). The lowest mean O_2 was 4.98 ppm and the highest mean O_2 was 6.52 ppm, a 23.6% difference. Mean O_2 was significantly higher, by

2% at 0.25 m from the surface is 5.96 ppm, whereas at 0.25 m from the bottom it's 5.84 ppm. There were significant differences in regional relative mean ratios during the event. Significant differences were also observed in the ratios at different depths among the regions. Additionally, there were significant differences in the mean ratios throughout the day with respect to depth. The ratios also varied significantly within the different regions with respect to time and depth.

Episode 243 02, potassium sender (49607) was measured at various temperatures: 0-32090°T, 50-35600"2, 90-3956"9, 96 0143, 0-72999"8, 90°30196"T, 0-20006°1. Measurements were taken at multiple levels including bottom (BL), middle (uadag), top (auyy), and surface (uosbay).

Table 111. Sitk Multiple Comparison Test for Dissolved Oxygen, Temperature, and Salinity Among Regions in the Lagoon During the Event: Region 1, 2, 3, 4, and so on up to Region 18.

CSUNOHD ANIL 8088 2298, B-0 ae22 ane edze BOA BBE Boot Bart BAZ Beal Bea azo SAT ee eo ee.

Table V presents information on net production, respiration, gross production, and the gross production to respiration (P/R) ratio for the different regions. The mean P/R ratio for the lagoon was 1.9 ± 0.034 g/m²/day. Region 2 had the highest P/R value, 2.8 g/m²/day, and Region 8 had the lowest value, 1.3 g/m²/day. Figures TI1-IX show that there is a large amount of fluctuation from the general trends of net production and respiration.

Table II presents the significance of the different sampling parameters. The mean temperature for the lagoon was 28.8 °C. The magnitude of the regional effects was significant.

"Minimal. Region (5-6) had the lowest mean temperature value, 28.6 °C, and region 8 had the highest value, 28.9 °C. The mean temperature for the lagoon rose in the morning, peaking at noon with a value of 30.0 °C. As cloud cover and wind velocity increased in the afternoon, the mean water temperature began its decline, which lasted throughout the afternoon and evening until 0200, where it leveled off to its low value of 28.0 °C. At 0800, temperature began increasing again (Figure X1). Tables III and IV provide the regional and time SNK groupings. The mean relationships of the temperatures between regions changed significantly throughout the event. It also changed significantly throughout the different regions with respect to depth, and with respect to both time and depth.

The mean salinity for the lagoon was 26.5 ppt. Table MI presents the significance of the different sampling parameters. Despite the significant regional effects, the range between the regions was only 0.6 ppt, a 2.2% difference. Region 4 had the lowest salinity, 26.2 ppt, and region 8 had the highest salinity, 26.8 ppt (Table III). Salinity for the lagoon varied 15% with respect to time; if the lowest value, an unexplained anomaly, is excluded, it varies only 8.22%. Salinity rose during the day, reaching its peak value of 28.0 ppt at 2200, and then declined until dawn (Figure XII and Table IV). Relative salinities between regions changed significantly throughout the event."

"TABLE V. Net Production, Respiration, Gross Production, and Production/Respiration Ratio for the Seven Regions Within Joyuds Lagoon for the Event of 7 and 8 July 1983

REGION	NET PRODUCTION	RESPIRATION	GROSS PRODUCTION	F/R
6	Op/ne/aay	G/ne/day	Gia /day	2.5
LT	2	5a	23	8.0
2.8	3	an	44	35.1
1.9	4	3.0	4.0	7.0
1.8	(5-6)	2.4	2.9	5.3
18	7	2a	a7	48
1.8	8	5	5.0	6.5

(SYNOH) AWIL | egae | Bas6 | Bea | Be2 | BDA | Bez | BDA | BeEI | BUSI | BAbI | GAZI | eBAI | eee | Bo | TT | wee | Buz |

And region 8 had the highest salinity, 26.8 ppt (Table III). Salinity for the lagoon varied 15% with respect to time; if the lowest value, an unexplained anomaly, is excluded, it varies only 8.22. Salinity rose during the day, reaching its peak value of 28.0 ppt at 2200, and then declined until dawn (Figure XII and Table IV). Relative salinities between regions changed significantly throughout the event."

Event: Chlorophyll - The mean value for chlorophyll was 5.97 - 40.01 mg/m^3; there was no significant change in chlorophyll throughout the event. Secchi Disk - There was no significant change in Secchi disk readings as a function of time throughout the day. However, there was a significant difference in Secchi visibility between regions 8, 7, and 4. The mean Secchi depth was 9.94 m. The differences in magnitude between the three regions were 1.02 and 1.20, respectively.

Ebbs occurred at all times except during the 1600, 1800, and 2000 sampling cycles when strong floods appeared. Due to significant variance of unexplainable nature in the flow data, it is impossible to calculate the precise flow volumes. However, the total flood volume for the event appears to be equal to or higher than the total ebb volume. Despite this, the maximum flood volume (150 m^3 to 330m^3) for a two-hour period would be between 2.6% and 5.7% of region 1 volume, 0.00012% to 0.00027% of the total lagoon's volume. Wind Velocity and Direction - The mean wind velocity for all regions in the lagoon during the event was 4.2 mph (Table VI). Wind velocity varied significantly throughout the event; it also differed significantly for the different regions. (Table VII presents the significance of the different sampling parameters). Wind velocity continued on the next page.

Table VI. Regional Wind Velocity and Direction for Joyuda Lagoon during the Event

	Mean Wind Velocity (Miles/Hour)	Mean Wind Direction (In Degrees)
1	0.0	2.0
2	4.3	160
3	4.8	90
4	4.7	(5-6) 49 123
7	5.2	335
8	2.4	149

Table VII. Analysis of Variance in Wind Velocity for July 1983

Source	Mean Square
Subgroups	7 14.3033
Region	6 15.5412
Time	3 "begin x time" 78 3.6421
Error	

Note: A logarithmic transformation (Log10 N) was applied to the data.

Different sampling parameters and wind velocity data continue on the next page.

The wind velocity increased throughout the morning, peaking at 12:00 with a mean velocity of 6.1 mph. By 16:00, the mean wind velocity declined rapidly, developing into the lowest SMK grouping between 20:00 to 9:500 (Fri), which had a mean velocity of 0.77 mph (Table TY and Figure X131). The wind direction in the southern part of the lagoon tended to come from the east, while the wind direction in the northern part came from the southeast (Table VI).

Cloud cover varied significantly throughout the day (Table VIII presents the significance of the different sampling parameters). The mean cloud cover during periods of daylight was 38.2%. During the early morning, the percent cloud cover was lowest, with a mean value of 21.2%. Between 12:00 and 18:00, the percent cloud cover was highest, at 41.7% (Figure XIV and Table IV).

Wind direction in the southern part of the lagoon tended to come from the east, while wind direction in the northern part came from the southeast (Table VI).

Table VII showcases the percent cloud cover for the seven regions in Joyuda Lagoon for the 7th and 8th of July 1983.

In the discussions and conclusions, the P/% ratios (Table V) show that the water column in all regions of Joyuda Lagoon produced more carbon than they used. Consequently, it does not appear that the planktonic primary production needs a carbon subsidy from the surrounding environment. The volume of water flowing through the Guanajibo channel is insignificant compared to the volume of water in region 1. Consequently, it would have no effect on the parameters measured in the lagoon.

Because of the limited period of study, it is of interest to note that there is a north-south gradient in mean O.O. values with the regions closest to the channel having the highest mean O.O. values and those furthest away from the channel having the lowest mean O.O. values. It is possible that while the coastal exchange does not affect the lagoon over a limited period of study, it may affect it over an extended period. Since the lagoon produces more carbon than it uses, it may export some of that carbon and thereby increase coastal productivity over an extended period of time. It is also possible that the excess carbon sinks or is actively pulled down to the benthos by filter feeders for benthic consumption. Increases in dissolved oxygen parallel increases in water temperature and the non-significant trend observed in solar insulation. Both temperature and salinity distributions indicate that the lagoon is well mixed vertically. Since O.O. is slightly, but significantly higher at the surface, the benthos is probably using oxygen at a higher rate than the rest of the water column. The increased oxygen demand is probably being used to decompose the rich organic sediments (which were frequently noticed on the anchor when it was raised). The significant variation in relative O.O. values within the water column during the study probably reflect temporal variation in production and respiration. Since O.O. experienced significant changes in productivity and standing stock, it would be expected that chlorophyll, another indicator of productivity would also experience these changes. Since it did not, the plankton are probably being grazed upon or they are settling to the benthos. The different mean regional values in wind velocity and direction and the changes in these factors throughout the event are probably responsible for the minimal change in spatial temperature, and the changes in the regional x time temperature parameter. The regional x depth differences in temperature may be caused by a...

The circulation pattern may change according to wind direction and velocity. The rise in temperature from 0600 to 1200 is probably due to solar insolation. The high percentage of cloud cover and the increased wind velocity is likely responsible for the decline in temperature in the early afternoon. Nightfall causes this trend to continue until dawn. The inability to find a stratified lagoon with respect to temperature or salinity indicates that the lagoon is well-mixed vertically. This is not surprising since the lagoon was choppy in the late morning and then during the afternoon. The regional changes in salinity may be due to the regions being affected by differences in solar insulation, which would affect the rates of evaporation. An additional factor could be that the volumes of freshwater intrusion may vary from region to region. The increase in salinity during the day is attributed to increased evaporation from solar insulation and increased wind velocity. The significant change in the regional time parameter is believed to be caused by the changes in wind velocity and direction during the event.

Using two times secchi disk visibility as an absolute limiting factor for production (Parsons and Takahashi, 1973), light penetration was only a limiting factor in the deepest holes. Although the secchi disk did not detect any difference in light intensity during the day, data from the percentage of cloud cover, and temperature would indicate that there was a trend toward high light intensity. Increase in the morning, peak in early afternoon, and then decline until dawn. The Secchi disk probably failed to notice this difference because it is not a very precise instrument.

In comparison to the diurnal events of Owen on 24 November 1982 and 28 February 1983, this event noticed a different grouping of regions with respect to the three main parameters. Whereas this event tended to group regions 1 and 2; station 3 and regions 4 and 5-6; and regions 7 and 8, Owen's studies tended to group regions 1,8, and 7; 3 and

63 and 2 and 55 with region 8 overlapping the two latter groups. The difference between this grouping may be due to differences in wind direction and velocity, or the coastal exchange having a different effect on the lagoon during those relatively dry seasons. It is of interest to note that during these events, regions 7 and 8 had the lowest DO (Dissolved Oxygen) values, and diurnal temperature and DO fluctuations were consistently noticed.

LITERATURE CITED

APHA (American Public Health Association). 1975. Standard Methods for the Examination of Water and Wastewater. 14th Ed. Washington D.C. pp. 1081-1992.

Departamento de Recursos Naturales. 1978-79. Estudio de la Laguna Joyuda: un ecosistema marino. Informe Final. pp. 1-3.

Garcia, J.B. 1981. Temporal patterns of the metazoan parasites in the white mullet, Mugil curema Valenciennes from Joyuda Lagoon, Puerto Rico. Master's Thesis, Department of Marine Sciences, RUM, Mayaguez, Puerto Rico. pp. 89.

Linsley, R.K., M.A. Kohler, and J.L.H. Paulhus. 1975. Hydrology for Engineers. McGraw-Hill, New York. p. 119.

Owen, G.P. 1983. Long-term monitoring sampling design. (Unpublished) pp. 1-5.

Parsons, T.R. and N. Takahashi. 1973. Biological Oceanographic Processes. Pergamon Press, New York. pp. 86.

Pesante, D. 1978. A study of the plankton in Laguna Joyuda, a tropical lagoon on the west coast of Puerto Rico. Master's Thesis, Center for Energy and Environment Research. pp. 4-8.

Sokal, R.R. and F.J. Rohlf. 1969. Biometry. W.H. Freeman and Company, San Francisco. pp. 143-355.

APPENDIX. 36

Dissolved Oxygen Measurements (ppm)

Surface	Bottom
1652	1229
2003	2282
2440	0309

Station 0

1st Reading	2nd Reading
5.65	5.55
5.78	5.45
48	47

Surface	Bottom
1029	1206
2503	1703
1835	2030
2300	2451
0315	0523
Over 50	Depth

Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Region 1 1st Reading 38 6.6 6.8 87 2nd Reading 5.35 5.13
Time 700 630 1036 - 1513 - 1885 2009 20 2510 0325 - 0735 0359 Depth Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface 38
Time - 0240 1085 - - 220 1856 - - 0335 0541 - 908 Depth Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface 40 2nd Reading 4.95 5.11 5.15 5.12 5.55 5.16
Depth 1st Reading 2nd Reading Surface 5.6 5.55 Bottom 5.35 5.05 1009 Surface 5.7 5.75 Bottom 5.175 5.75 1140 Surface 5.78 5.65 Bottom 5.78 5.75 1400 Surface 6.55 6.35 Bottom 6.2 6.25 1609 Surface 6.6 6.7 Bottom 6.5 6.6 2804 Surface 6.5 6.4 Bottom 6.1 6.2 1956 Surface 6.4 6.2 Bottom 6.2 6.2 2218 Surface 6.1 6.0 Bottom 6.0 5.195 25 Surface 6.1 6.0 Bottom 6.1 6.0 2640 Surface 5.95 5.8 Bottom 5.85 5.7 0826 Surface 5.98 5.75 Bottom 5.85 5.9 0837 Surface 6.1 5.9 Bottom 6.0 6.0 0825 Surface 5.05 5.75 Bottom 5.55 5.15 1014 Surface 6.2 6.25 Bottom 6.3 6.25
Time 722 9920 1105 1320 1535 - 2134 2330 2555 0350 0602 0753 0838 Depth Surface Bottom

Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Region (5-8) 1st Reading 2 8.38 13 5.45 6. 6 5. 5. 5. 5. 2nd Reading
1st 1085, 2208 2400 2620 0420 0624 0813 1002 Depth Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface

Bottom Surface Bottom Surface Bottom surface Bottom Surface Bottom 1st Reading 43 7 4135 5.45 5.25 2nd Reading 4.25 4

0730 0930 1 1538 1545 2 2180 2350 2605 0405 0613 302 09 Surface Bottom Surface Bottom Surface Bottom Surface Bottom surface Bottom surface Bottom surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Region 8 1st Reading 4 2nd Reading 3.95

Time (0600 0221 1023 1200 1456 1682 1829 2023 2250 0309 0501 0710 Temperature Measurements (°C) Depth Surface Bottom Surface Bottom Surface Bottom Surface Bottom surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom surface Bottom Surface Bottom Surface Bottom Station 0 1st Reading 45 2nd Reading 29

Time 0650 0825 1029 1206 1503 1703 1835 2030 2300 2845 03 05 08 50 Depth surface Bottom surface Bottom Surface Bottom Surface Bottom Surface Bottom surface Bottom Surface Bottom surface Bottom surface Bottom Surface Bottom Surface Bottom surface Bottom Surface Bottom surface Bottom Region 1 1st Reading 29 23 28.8 28.9 28 2 28 28 28 27.8 2nd Reading 29 20 29.5 29.5 29.5 29.5 31.5 31.5 29.1 23.0 29 29 23 28.8 28 28 28 28 27.8 27.8 28 20.5

Time 0700 0830 1036 1213 1513 1700 1836 2039 2310 2510 035 0521 0735 0850 Depth Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom Surface Bottom surface Bottom Surface Bottom Surface Bottom Surface Bottom surface Bottom surface Bottom surface Bottom Region 2 1st Reading 29 29 20 30 29.5 29.5 31.8 31.5 29.2 29.2 29.2 29.2 29 29 29 29 2.5 28.5 28.5 28.5 28 27.9 29 27.9 23.0 23.1 2nd Reading 23 29

Region 3 Time Depth 1st Reading 2nd Reading 0710 Surface 29 29 Bottom 29 29 1040 Surface 30 30 Bottom 30 30 1085 Surface 29.5 29.5 Bottom 29.5 30 1228 Surface 31.5

31.5 Bottom 315 315 128 Surface 28.8 20.8 Bottom 20.8 28.8 1720 Surface 28.8 28.8 Bottom 28.8 28.8 1856 Surface 28.8 28.8 Bottom 28.8 28.8 2048 Surface 28.8 28.8 Bottom 288 28.8 2317 Surface 28.5 28.5 Bottom 28.5 28.5 2515 Surface 28.5 28.5 Bottom 2.8 28.5 0335 Surface 28 28 Bottom, 28 28 0541 Surface 8 28.1 Bottom EF 28.2 0783 Surface: 28.1 28.1 Bottom 23.8 28.1 0908 Surface 23.2 28.2 Bottom 28.2 28.2 48

Region 4 1st reading 30 29 29.5 29.5 30 30 28.8 28.8 29 29 28.9 9 2nd Reading 30 30 29.5 29.5

30 30 28.8 28.8 29 29 29 23

Region (5-6) 1st Reading 30 2nd Reading 29.5 29.5 30 30 30 30 29 29 29 29 28.9 28.3 28.9

Region 7 1st Reading 28.5 28.5 28.5 28.5 28 28 28 28 28.2 28.1 28 28

Region 8 Time Depth 1st Reading 0730 Surface 30 Bottom 30 0930 Surface 30 30 Bottom 30 30 1115 Surface 30.5 30 Bottom 30 30 1335 Surface 29 29 Bottom 29 29.1 1585 Surface 29.5 29.4 Bottom 29.5 29.4 1742 Surface 29.2 29.2 Bottom 29.2 29.2 1932 Surface 29 29 Bottom 29 29 2150 Surface 29 29 Bottom 29 29 2350 Surface 28.5 28.5 Bottom 28.5 28.5 0205 Surface 28 28.5 Bottom 28.5 28.5 0405 Surface 28 28 Bottom 28 28 0613 Surface 28.1 28.2 Bottom 28.1 28.2 0802 Surface 28.1 28.2 Bottom

28.2 28.2 0988 = Surface 28.5 28.5 Bottom 28.3 28.2 32
Salinity Measurements (ppt)
Station 0
Time: Sept 0600
Surface: 0@21
Bottom: 0@21
Surface: 25 25
Bottom: * 7 1023
Surface: 25.5 25.5
Bottom: 2 1200
Surface: 26 26
Bottom: - - 1656
Surface: 2 a
Bottom: a 27.1 1652
Surface: 3 3
Bottom: 33.2 33.8 1823
Surface: 33.2 33.2
Bottom: 33.2 33.2 2023
Surface: 3 3
Bottom: 33 33 2252
Surface: 29.5 29.5
Bottom: 3 33.5 2460
Surface: Ey Ey
Surface: 25 2.5
Bottom: - : 0514
Surface: 24.2 24.3
Bottom: 20.3 26.3 0717
Surface: 26.1 26.2
Bottom: 26.2 76.2 0644
Surface: 26.5 26.6
Bottom: 26.5 26.7
Region 1 56 1st Reading

Surface: 26 26 25.5 5 26 26 26.5 26.5 27a 2712 2 aa 2 21.5 26.8 26.9 28 30 28 28 2.8 275 24.2 202 26.2 26.7 26:2
2nd Reading: 6 26 25.5 25.5 27.5 25 20.2 24.2 26.2 26.2 26.8 26.3
Depth: Surface 25.5 2.2 22 2.2 2.2 2 2 26.9 26.9 8 28 8 Ea 27.8 27.5 2.3 23.9 26.2 26.2 26.5 26.7
2nd Reading: 26 26 25.5 25.5 26 26 26.5 26.5 27.2 2 21.2 273 2 2 26.9 26.9 28 27.8 as 23.9 23.9 26.2 26.2 26.6 26.7
Station 56 3
Surface: 26.9 26.9 a a 26.9 26.9 2.5 275 23.5 23.7 26.3 26.2 26.5 26.6
June 4
1st Reading
0758 Surface: 25.5
Bottom: 25.5
1700 Surface: 26 26
Bottom: 26 26

(Note: Some of the data in the provided text was too inconsistent or unclear to be accurately corrected.)

1180 Surface: 2.5, 23.5 Bottom: 25.5, 25.5
1400 Surface: 26.5, 26.5 Bottom: 26.5, 26.5
2509 Surface: 2, a Bottom: a, a
Surface: 7, 2 Bottom: 2, a
1956 Surface: 26.9, 26.9 Bottom: 26.5, 26.9
225 Surface: 28, 28 Bottom: a, cy
2815 Surface: 27.5, a Bottom: 2, 8
0280 Surface: 20.5, 2.5 Bottom: 25, 25
0826 Surface: 26.5, 26.5 Bottom: a, 26.5
9637 Surface: 25.2, 2.8 Bottom: 23.8, 23.2
0825 Surface: 26.5, 26.5 Bottom: 26.8, 26.4
201€ Surface: 25.2, 2.9 Bottom: a1, 21

1320, 1535, 192, 2138, 2330, 2585, 0350, 0602, 0753, 0934
Depth Surface Bottom Surface Bottom Surface Bottom
Surface Surface Bottom Surface Bottom Surface Bottom
Surface Bottom Surface Bottom Surface Bottom Surface Bottom
First Reading: 26, 26, 25, 25, 26, 26, 25.5, as, 27.0, 2.0, 2, a, 2, 26.8, 28.5
Third Reading: 26, 6, 25.5, 35, 28, 2B, 2. a, 5, 5, 25, 15, 4, 5, 3, 0

1557, 51, 1985, 2205, 0000, 9220, 0820, 0628, 0813, 100
Depth Surface Bottom Surface Bottom Surface Bottom
Surface Bottom Surface Bottom Surface Bottom Surface Bottom
Surface Bottom Surface Bottom Surface Bottom Surface Bottom
Surface Bottom: 38, 26.8, 26.9, a, 21.2, 2, 27.2, a, a, Fa, & 28, Ea, 27.5, as, 7, a, 24.5, 23.2, 26.5, 26.5, a, 25, 27.2, 27.2, 24, ana, ar, 2, 2B, 28, 28, 2.8, a5, a, 2, 2B, 3.2, 26.5, 26.5, 28.2, 20.2

0930, ms, ie, 1032, 2150, 2350, 0208, 0405
Depth Surface Bottom Surface Bottom Surface Bottom
Surface Bottom Surface Bottom Surface Bottom Surface Bottom
Surface Bottom Surface Bottom Surface Bottom Surface Bottom
Reading: 26, 26, 26.5, 26.5, 26, 25.5, my, a, 27.3, ane, 27.2, we, 27.0, 2, 28, 8, 28, 2.5, 2s, 27.5, a5, 24.8, 2a8, 26.5, 26.5, 26.8, 26.5

STATION 0
Percent Cloud Cover: a, Secchi Dish Visibility: Trial 1 - 2nd test: 5, 55, 5, 6, 5, 6, 3, 10, 10, 1.0, 10, Lo, Lo, 10, 1.0, 35, Mi, 12, Lo, 12, 0.25, 0.5, Lo, Lo, 10, 1.0

Secchi Disk Velocity: Fervent visibility {aties/he) le
First Trial: 2nd Trial: Sounding: 5, 80%, Lo, 10, Lo, 3, 2, i, Lo, 10, 10, 4, 0, 45, a, 7, a7, ‘, eo%, 1.0, 10, 10, 0, 135%, 0, 10, 10, 1.25, °, 15%, 0, Lo, 1.0, 12, 55, 125, eo, 10, 1.0

I apologize, but the text you've provided appears to be data records or measurements with a lot of symbols, numbers, and random words, which makes it hard to understand and correct without any context provided. Could you please provide more information about the content? This would help me understand the required corrections better.

I apologize, but the text you provided seems to consist of random characters, symbols, and numbers. It's unclear what the context or content should be. Could you please provide more context or clarify the text you want me to fix?