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PRELIMINARY RESULTS FROM A SURVEY OF WATER QUALITY IN SOME PUERTO RICAN LAKES

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Preliminary Results from A Survey of Water Quality in Some Puerto Rican Lakes

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ABSTRACT

High nutrient levels in Puerto Rican lakes resulted in high productivity with average daily gross oxygen production of 3.3 mg of oxygen per liter in 1977. Moderate to high algae numbers caused an undesirable green color and Secchi readings of less than 2.3 meters. In spite of large variation in nutrient loads entering some of the lakes, the number of algae changed only slightly throughout the year. The ecosystem of Lake Carraízo resulted in effective oxidation of entering organic wastes, and removal of 1900 kilograms of nitrogen and 6.6 kilograms of phosphorus a day in a lake with a surface area of 300 hectares. The lake was functioning as a tertiary sewage treatment system for sewage from Caguas and other municipalities. Despite the efficiency of this system, Lake Carraízo, which unfortunately is also the San Juan water supply reservoir, was the most highly polluted lake of the 12 included in this survey.

An appendix of ecological survey data is included at the end of this report covering the 4 years 1975-1978, but only the 1977 data is analyzed in the text.

Preliminary Results from A Survey of Water Quality in Some Puerto Rican Lakes.

INTRODUCTION

Twenty-eight lakes have been created in Puerto Rico since 1913, for hydroelectric power, irrigation and water supply. As the island's population has expanded, additional water supply reservoirs have been constructed, including Lake La Plata which collects water for metropolitan San Juan and which was completed in 1976. These water supply reservoirs are also receiving considerable amounts of domestic wastes from upstream communities and excessive growth of aquatic plants are developing (Figure 1). The lakes are contaminated by poorly constructed drainage fields of houses without sewers and by municipal sewage discharges located on streams in the watersheds.

Lake Carraízo receives the discharge of five municipal sewage treatment plants with a total output of 6.7 million gallons per day. This discharge makes up 6% of the total annual inflow to the lake and has an average oxygen demand (BOD_5) of 114 mg O_2 liter and 64 mg/liter of suspended solids. In times of drought the excessive nutrients cause a severe water quality problem in the entrant streams of Lake Carraízo. Throughout the year travel on this lake is restricted by heavy growths of water hyacinths which cover up to 30% of the

through experience in temperate zones may not be relevant to tropical environments. Previous studies on tropical lakes in other areas have demonstrated that these lakes are in general more productive than those in temperate zones. In order to examine these various themes this study was conducted on water quality of the major lakes in Puerto Rico (Figure 2). This report includes analysis of data collected on certain of the lakes in 1977. However the attached appendix also includes additional data collected between 1975 and 1978.

Figure 2. Sampling of lakes was facilitated with trailer-drawn boats equipped with dredges and winches.

Description of the Lakes

The lakes in this study range in volume from 700 to 49,000 acre feet (8.6×10^5 to 6.0×10^7 m^3). Where data are available the mean depth ranges from 13 to 59 feet (4 to 18 meters), and the residence times vary from one to thirteen months (Table 1). Lakes Carraizo, Dos Bocas, Caonillas and Carite are situated at elevations less than 1000 feet (300 m), whereas the others are located between 1000 and 2000 feet (300-600 m). Lake Carraizo, a major source of water for San Juan, is in the Loiza drainage basin (Figure 3); Lakes Dos Bocas, Caonillas and Garzas in the Arecibo drainage basin; Lake Carite in the Patillas drainage basin; and Lake Cidra in the Bayamón drainage basin. Although Lakes Prieto and Guayo are in the Añasco drainage basin, their discharge is to the Lajas Valley irrigation system by means of a tunnel. Lake Carraízo is in a heavily populated valley. The other lakes are in less populated areas, especially Lakes Garzas, Prieto and Toro which are quite isolated. The difficult nature of the terrain and roads have impeded ecological investigation in the past (Figure 4).

The lakes are located in the central mountainous region of Puerto Rico and were created by constructing dams at strategic points in the rivers. Since the rivers of Puerto Rico flow through narrow valleys, the shorelines tend to drop off rapidly with very little shallow water to provide a suitable

habitat for submerged vegetation. Only two lakes, Carraízo and Garzas, are in broader valleys which provide less of a vee-shaped bottom and are consequently more shallow (Table 1). Carraízo is the lake of most interest in this study since it is the lake receiving the heaviest nutrient loads and at the same time it serves as the principal source of San Juan's water supply. Carraízo is a very long narrow lake with a maximum width of about 250 meters and 5 kilometers in length. It is fed by two major rivers, the Loiza and the Gurabo, and three small streams.

TABLE 1

PHYSICAL CHARACTERISTICS OF THE PUERTO RICAN LAKES

LAKE	VOLUME acre-ft	VOLUME m^3	SURFACE AREA acre	SURFACE AREA ha	YEARLY INFLOW acre-ft	YEARLY INFLOW m^3	FLOW THROUGH TIME-DAYS	MEAN DEPTH ft	MEAN DEPTH m
Carraízo	20,000	2.47×10^7	968	392	132,783	1.64×10^8	55	21	6.4
Dos Bocas	32,000	3.95×10^7	573	232	274,409	3.38×10^8	43	56	17.1
Caonillas	49,000	6.04×10^7	833	337	84,621	1.04×10^8	211	59	18.0
Garzas	1,860	2.29×10^6	144	58	19,661	2.42×10^7	35	13	4.0
Guayo	15,150	1.86×10^7			14,177		390		
Prieto	580	7.14×10^5			24,551		6		
Carite	11,310	1.39×10^7			28,250	3.48×10^7	146		
Cidra	530	6.54×10^5							

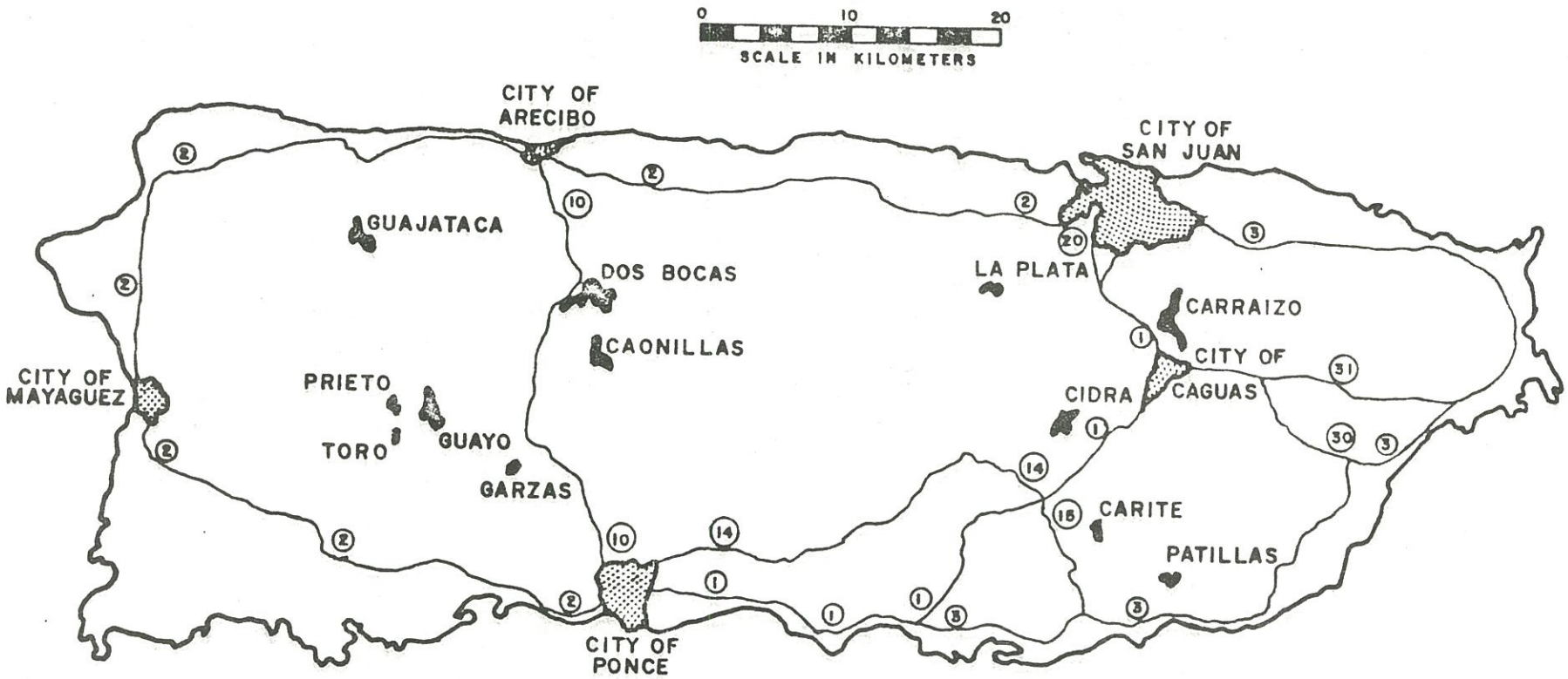


Figure 3

Major Lakes and Cities of Puerto Rico.

Materials and Methods:

Sampling the Lakes

The stations for assessment of oxygen evolution, algae, coliform bacteria and chemistry were selected to represent the entrant streams as well as the body of the lake. The number of stations varied between three and five depending on the size of the lake. On several occasions only three stations were used on Lake Carraízo because of blockage with water hyacinths. Data analyzed in the text came from the sampling during 1977 except for LakeCidra and Carite, which were studied in December 1975. However the Data Appendix covers the period from 1975 through 1978. Each lake was visited every three to four months.

Samples for dissolved oxygen were fixed on the lakes and analyzed within two hours at the mobile laboratory (Figure 5). Plates for total coliform determinations were also prepared and incubated at the mobile laboratory. Samples for chemical analysis were transported to the laboratory in San Juan and analyzed during the following week. Since all phosphate samples were transformed to orthophosphate by acid hydrolysis before analysis, it was not thought necessary to fix the samples.

Figure 4. Photosynthesis surveys required three consecutive days of oxygen measurements, thus a trailer for laboratory and sleeping quarters was used in remote mountain reservoirs.

Chemical Analysis

The analysis of water samples was performed according to "Standard Methods" (23). Total phosphate determinations were by the molybdate-stannous chloride method after acid hydrolysis. The nitrate plus nitrite concentrations were determined by the phenol disulfonic acid method after oxidation by permanganate. The azide modification of the Winkler method was used for dissolved oxygen. For the determination of chlorophyl a the fixed algae were sedimented by gravity and centrifugation and extracted with 90% acetone. The absorbance at 665nm was corrected for the presence of pheophytin by reading the samples before and after acidification.

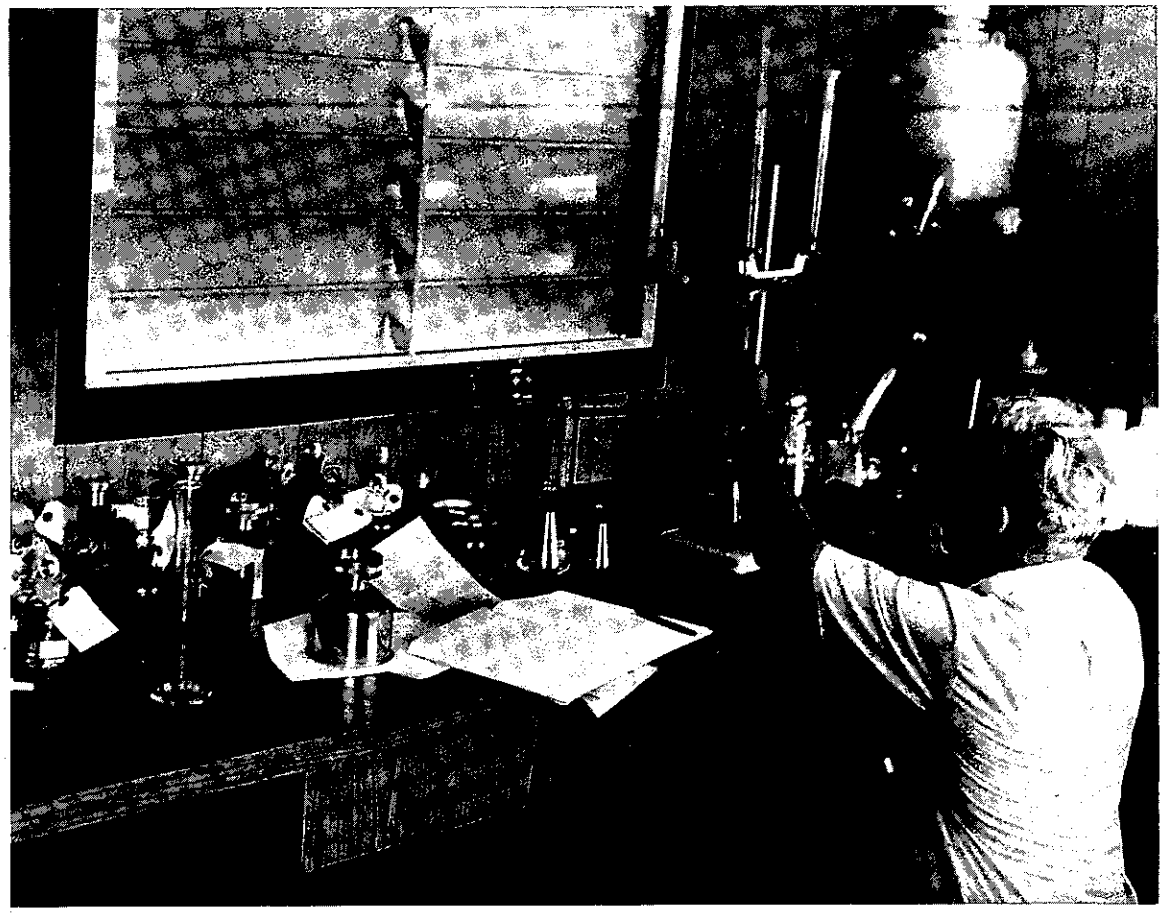


Figure 5. Oxygen titrations, coliform bacteria filtrations and reagent preparations were performed at the lake site, in the small mobile laboratory.

Biological Analysis

Twenty four hour oxygen production was measured using surface water samples in two light and two dark bottles and dissolved oxygen titrations. The samples were incubated *in situ* at a depth of 0.5 meters (Figure 6). Since an initial oxygen sample was taken, the 24 hour respiration rate was the difference between the oxygen concentrations in the initial samples and in the black bottles on the following day. Net productivity was calculated by subtracting the initial oxygen concentration from the final concentration in the light bottle, whereas gross productivity was calculated by subtracting the final concentration in the dark bottle from the final concentration in the light bottle.

Oxygen production and respiration were measured for 3 consecutive 24 hour periods. The 24 hour oxygen production was measured rather than 4 hour photosynthesis productivity because the former measurement is more directly related to water quality than the latter. Total coliform colonies for two consecutive days were counted after 24 hour incubation at 35°C, using Millipore media and filters. Algae were identified and counted by microscopy after fixation with formaldehyde and filtration on Millipore filters.

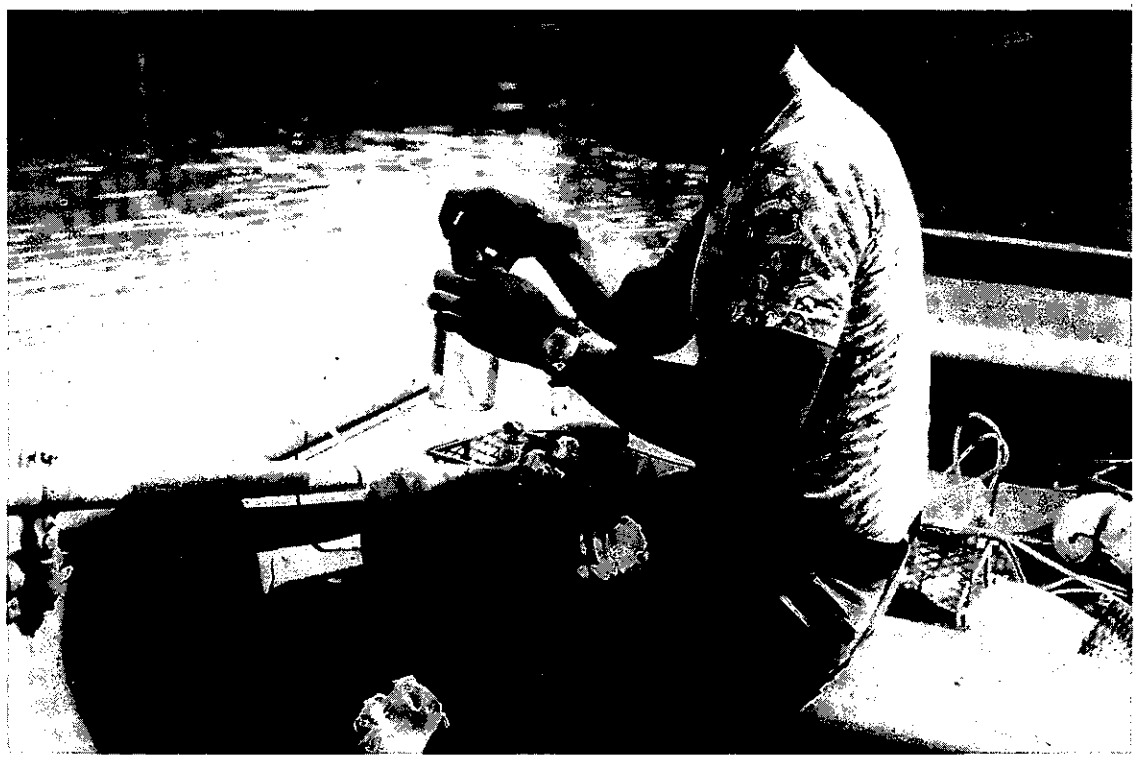


Figure 6. Photosynthesis stations consisted of two clear bottles and two opaque bottles in a basket suspended from a float, 0.5 meters below the water surface. These conditions simulate the natural algal environment under daylight and in the absence of light.

TABLE 2

MEAN ANNUAL BIOLOGICAL AND CHEMICAL DATA FOR SOME

PUERTO RICAN LAKES, 1977

LAKE	GROSS 24 HOUR OXYGEN PRODUCTION mgO_2/L	24 HOUR RESPIRATION mgO_2/L	TOTAL COLIFORM BACTERIA	NITRATE + NITRITE mgN/L	TOTAL PHOSPHATE mgP/L	SECCHI DEPTH (METER)
Carraízo	3.77	3.29	1.0×10^4	0.20	0.42	0.42
Carite	0.78	0.39	2.5×10^2	0.10	0.02	1.60
Caonillas	2.11	1.65	3.6×10^3	0.11	0.01	0.92
Cidra	0.93	0.37	4.7×10^2	0.02	0.02	----
Dos Bocas	1.52	1.58	3.1×10^2	0.15	0.017	0.85
Guajataca	0.72	0.54	---------	0.08	0.01	2.20
Guayo	1.14	0.63	1.8×10^3	0.43	0.013	2.15
Garzas	0.60	0.44	1.4×10^1	0.18	0.00	1.40
Prieto	0.68	1.04	7.0×10^3	0.10	0.04	0.37
Correlation with Oxygen Production	r =	0.95	0.70	0.18	0.87	-0.71

Results:

For each lake the oxygen production and other parameters showed substantial variation from station to station and from season to season. The variability frequently resulted from high turbidity caused by heavy sediment loads during flooding. The streams entering Lake Carraízo tended to be heavily contaminated, with one stream, Bairoa Creek, consistently showing total coliform bacteria counts of 10^6/100 ml or more. The high oxygen demand from the effluents of the sewage treatment plants (see introduction) in the watersheds of Lake Carraízo caused anaerobic conditions with no photosynthetic activity at the head of the lake during a drought in the Spring of 1977. By averaging the data over all stations and for the year, a more consistent pattern emerged. Oxygen productivity correlated with the amount of coliform bacteria, nitrate and phosphate with correlation coefficients of 0.70, 0.18, and 0.87 respectively (Table 2). The average Secchi depth was less than 1.0 meter in Carraízo, Caonillas, Dos Bocas and Prieto. It was inversely related to oxygen production with a correlation coefficient of 0.71.

The seasonal variation of productivity in the lakes was compared on a common basis by dividing the individual values by the annual average for a given lake. There was a correlation among the lakes in the variation of the productivity

with time (Figure 7). The changes in productivity were not simply related to the seasons, nor to the records of minutes of sunshine maintained by the local weather bureau (Figure 8).

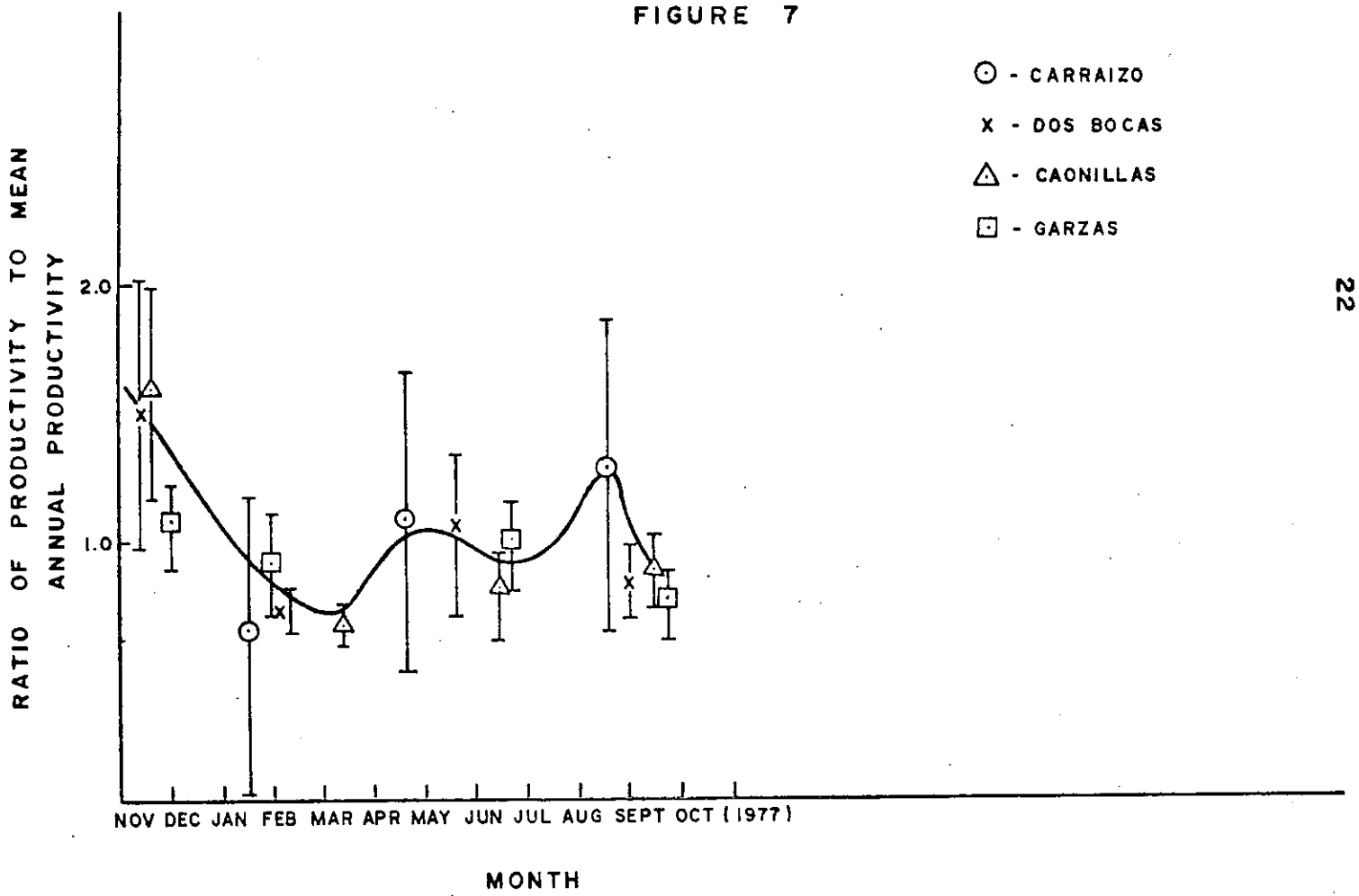
In contrast to heavily enriched lakes in the Mainland North, at no time during 1977 in any of the lakes in Puerto Rico was there an indication of algal blooms. The data in Figure 7 showing the modest and coordinated changes of oxygen production in the lakes with time supported this observation. In the detailed algal counts for samples taken from the five larger lakes, the number of organisms per ml tended to be moderate with no counts approaching 500 per ml, the level commonly accepted as the threshold for algal blooms in the North (Ref. 1). One did not see a predominance of any particular alga. The number of algae per ml for Lake Carraizo was low particularly in view of the high nutrient levels and oxygen production. Chlorophyl - a values in Lake Caonillas ranged as high as 40 μg/l (Table 3). Although blue green algae such as Oscilatoria and Anabaena, commonly associated with pollution induced algal blooms, were present in some of the more contaminated waters, their numbers were small (Table 4).

The nutrient levels in Lake Carraízo were high. The "Water Quality Record" (25) of the United States Department of the Interior have been used to calculate average annual flows and chemical concentrations for the influent and effluent water of Carraízo (Table 5). By calculating the average concentration

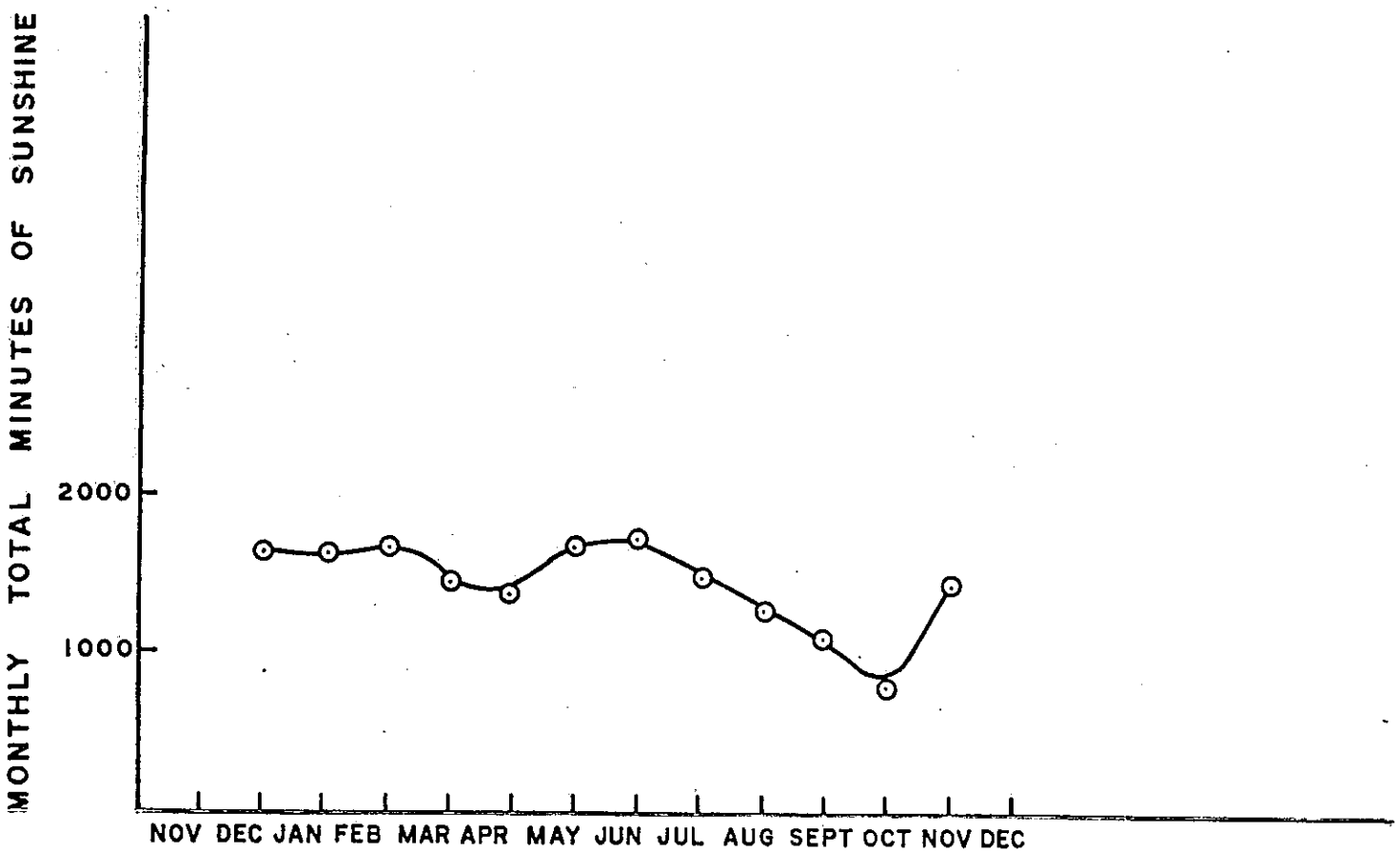
of the incoming and outgoing water and the total flow of the water into the lake, we estimated that 1.9 metric tons of nitrogen in the form of nitrate and 6.6 kilograms of phosphorus in the form of phosphate is removed from the water daily. Because the figures have not been corrected for evaporation and seepage as well as other errors, these numbers must be considered rough estimates.

VARIATION OF MEAN NORMALIZED PRODUCTIVITY AND THEIR STANDARD ERRORS WITH TIME IN PUERTO RICO LAKES

FIGURE 7



MONTHLY TOTAL MINUTES OF SUNSHINE IN 1977



MONTH OF 1977

FIGURE 8

TABLE 3

CHLOROPHYLL a CONCENTRATIONS IN PUERTO RICAN LAKES

Lake	Date	Station	Chlorophyll a (μg/l)
Carraízo	April 20, 1977	A	1.0
		B	12.0
		C	28.0
		D	24.0
Carraízo	August 8, 1977	A	5.6
		B	8.2
		C	11.5
Caonillas	June 16, 1977	A	5.9
		B	12.8
		C	34.2
		D	43.6
		E	31.8
Dos Bocas	May 20, 1977	B	5.6
		C	0.0
		D	1.6
		E	3.2
Guayo	July 8, 1977	A	4.8
		B	11.8
		C	4.8

TABLE 4

ALGAL CONCENTRATIONS IN SOME PUERTO RICAN LAKES

LAKE	STATION	DATE OF SAMPLES	TOTAL ALGAE (N/ml)	TYPE AND % OF ALGA IN HIGHEST CONCENTRATION	% BLUE GREEN ALGAE	% DIATOM	% ALGAE
Carraízo	A	Aug 1977	18.2	Actinostrum (31%)	6	37	57
	B	" "	18.1	Stephanodiscus (32%)	18	53	29
	C	" "	23.1	Cylindrospemum (23%)	26	38	36
Caonillas	A	Oct 1977	121.7	Synedra (53%)	7	77	16
	B	" "	177.2	Synedra (46%)	2	90	8
	C	" "	43.9	Synedra (43%)	10	68	29
	D	Oct 1977	78.9	Synedra (44%)	3	72	20
	E	" "	113.9	Synedra (46%)	20	74	6
Dos Bocas	A	December 1977	19.8	Starrastrum (35%)	3	27	70
	B	" "	13.6	Starrastrum (20%)	5	55	40
	C	" "	8.8	Starrastrum (20%)	4	35	61
	D	" "	9.1	Stephonodiscus (26%)	6	47	47
	E	" "	15.9	Novicula (50%)	0	63	37
Garzas	A	October 1977	29.2	Chlorella (28%)	17	27	56
	B	" "	14.7	Chlorella (16%)	17	38	45
	C	" "	18.8	Chlorella (33%)	6	23	71
	D	" "	16.5	Chlorella (28%)	6	36	58
	E	" "	16.8	Achnanthes (16%)	5	59	36
Guayo	A	Oct 1977	16.7	Gomphosphaeria (45%)	73	11	16
	B	" "	11.6	Oscilatoria (35%)	50	18	32
	C	" "	8.0	Gomphosphaeria (22%)	47	11	42
	D	" "	12.2	Gomphosphaeria (21%)	38	19	43

TABLE 5

AVERAGE PHYSICAL AND CHEMICAL PARAMETERS FOR LAKE CARRAIZO AND TRIBUTARIES (1974).

TRIBUTARY	AVERAGE FLOW Cu ft/sec	m^3/sec	AVERAGE NO_3 (mgN/L)	AVERAGE PHOSPHATE (mg P/L)
1. Río Grande de Loíza	87.6	2.48	6.0	0.33
2. Río Caguitas	9.3	0.26	19.7	1.84
3. Río Bairoa	3.0	0.08	48.7	3.17
4. Río Gurabo	79.3	2.25	0.71	0.25
5. At Dam	118.8	3.36	0.71	0.25

Discussion

The biology of these lakes could be characterized by a simple food chain but only fragmentary information relevant to these factors are available for Puerto Rican lakes. In general the aquatic vegetation was minimal with the exception of Lago Carraízo where an appreciable portion of the lake was covered by water hyacinths. Many of the lakes have steep shore lines which minimize aquatic vegetation. Although this paper presented data on algal populations which form the base of food chains leading to fish and ultimately man, no information on zoo-plankton populations was available.

A report on fish populations in a number of these lakes has recently been published (9). The data for Lakes Carraízo and Guajataca are relevant to this paper. The fish population observed in the former lake during 1975-1976 consisted almost entirely of *Tilapia mossambica* (83%) and channel catfish (*Ictalurus ponctatus*, 16%). This was in contrast to Lake Guajataca where large mouth bass (*Micropterus salmoides*), *Tilapia mossambica*, threadfin shad (*Dorosoma petenence*) and sunfish (*Lepomis microlophus*) made up 32%, 40%, 18%, and 8% of the fish population respectively. Lake Carraízo supported a more varied populations of fish which included large mouth bass in earlier times when it was less polluted. The data is suggestive that *Tilapia mossambica* may be now displacing large mouth bass in Lake Guajataca.

Woodwell, et al (26) have studied the process of water purification in several ecosystems and found a combination of a pond and marsh to be the most effective for treating domestic sewage. Their data were presented on the basis of surface areas. Extrapolating the data to a surface area equal to that of Lake Carraízo, one calculates that their system removed 26 metric tons of nitrogen and 38 metric tons of phosphate per day whereas in Lake Carraízo the figures were 1.9 tons and 66 kilograms respectively. Lake Carraízo was less efficient especially in the removal of phosphate. The latter is probably removed by fixation to the soil in the marsh system (26) and consequently the lake is substantially less efficient.

It is not clear how much of the water purification was the result of microbiological actions and how much of the nutrients were taken up by the water hyacinths. The productivity correlated with phosphate and total coliform concentration, with the best correlation being that with phosphate 0.87. Since these parameters are intercorrelated it is difficult to separate the effect of one from the other.

The 24 hour oxygen respiration is a reflection of activity by all the micro-organisms, principally bacteria and algae. It is also qualitatively related to the 5 day biochemical oxygen demand, and the two procedures should depend on the same parameters. Straskraba and Straskrabova (22) have shown that there is on excellent correlation between BOD_5 and the

Figure 9. Lake Yahuecas in Lares, although in an almost innacessible region, shows evidence of eutrophication, probably due to agricultural fertilizers applied in the citrus, coffee and banana farms of the mountain watershed.

number of bacteria detected on beef-peptose plates. Using their data and that of this paper one can say that the level of oxygen production in these tropical lakes is correlated with the presence of decomposition bacteria.

That in the stable lake environments of the tropics an ecological system should evolve, where algae supply the oxygen for bacterial decomposers and the latter provide a favorable biochemical environment for the algae, is reasonable. It is known that many algae depend on external sources of the vitamins, thiamine, biotin, and B_{12} (17). It is probable that the half life of these vitamins in tropical waters is rather short, making the algae dependent on local suppliers. The field of biochemical interactions between aquatic organisms is largely unexplored. It is known that the development of sea-weeds is dependent on the associated microflora; but the biochemical nature of this interactions is unknown (12).

Bartsch and Allum (3) have emphasized the symbiotic relationship between bacteria and algae; with the bacteria supplying nutrients through decomposition and the algae supplying oxygen for the decomposition process. In general there is not a proportionality between respiration and photosynthesis. Odum (16) has used the relationship to classify aquatic communities. Copeland et al (6) have emphasized the seasonal and temporal changes in the ratio of photosynthesis

Figure 10. The small reservoirs on Río de la Plata near Comerio show gross eutrophication due to sewage discharges. The 2 small reservoirs reduce some of the wasteload on the new La Plata reservoir in the San Juan water supply system;

to respiration. This study is unique in comparing photosynthesis and respiration in a series of tropical reservoirs where one has a reasonably constant regime of light and temperature.

In the present case, a cursory examination of the data showed that photosynthesis was not proportional to algal numbers. This is reminiscent of another study which showed that the ratio of chlorophyll-a to productivity varied by a factor of 3 (25). This and the data above would suggest that photosynthesis activity depends on unknown physiological factors.

A symbiotic relation between decomposition bacteria and algae was shown to exist by McKinney (13) and its importance in stabilization ponds has been emphasized in an EPA report (2). The data from this report suggested that the lakes studied here more closely resembled stabilization ponds than the lakes of the temperature zone studied by Odum (16) and Copeland (6). The ratio of respiration to photosynthesis appears to vary less in these tropical lakes than those in the temperate zone of North America.

One would expect more of a preponderance of blue green algae in the lakes with high nutrient levels. These organisms have a lower affinity for nutrients and consequently high phosphate and nitrate levels are particularly stimulatory for the blue green algae (4) which do not have natural predators. The low transit times of 21 days in Lake Carraízo, 56 days in Lake Dos Bocas, and 59 days in Lake Caonillas may have a

dampening effect on the slow growing blue green algae. It is notable that in Lake Guayo which is a relatively clean lake but with a transit time of 390 days the blue green algae made up 52% of the total population (Table 4).

Physical factors are important in determining the amount of phytoplankton growth (17). Phosphate chemistry is dependent on the degree of stratification and anaerobic conditions in the hypolimnion (8). Candelas and Candelas (5) have examined the Puerto Rican lakes and found that there was little temperature difference between top and bottom; and consequently stratification was minimal. In addition, tropical lakes are more susceptible to the destabilization effects of winds and surface cooling by rain (12). Although all investigators are agreed upon the key role of phosphorus in algal growth, there is conflicting opinion concerning nitrogen. The general observation is that algal blooms occur with levels of nitrate greater than 0.2 or 0.3 mg/l (20, 22); but some emphasize the ability of algae to fix nitrogen and the consequent unimportance of nitrate (21). The lack of blooms in the Puerto Rican lakes may be related to the very high efficienty of denitrification in the lakes.

Nothing is known about the pressure of zoo-plankton grazing upon phytoplankton in Puerto Rico. There are a number of studies (17) which suggest that zoo-plankton grazing is an important factor in controlling phytoplankton concentration.

Jassy et al (9) in a microcosm system showed that the increase in zoo-plankton numbers lagged behind that of the phytoplankton increase. The peak in zoo-plankton concentration coincided with a sharp decrease in phytoplankton numbers. The stability in phytoplankton numbers observed here may reflect a stable phytoplankton-zooplankton interaction. It is interesting to note that conditions for stability did not exist for several years after the formation of Lake Carraízo. Blooms of Synedra occurred as frequently as four times a year during the first five years (7).

In conclusion, one may say that, although the artificial reservoirs in Puerto Rico were heavily contaminated, there were no algal blooms and photosynthetic activity showed only moderate changes throughout the year. There was suggestive evidence of a copperative interaction between algae and bacteria. This interaction may make the lakes tolerant to high nutrient loads. The principal problem was the water hyacinths which covered 20-30% of the water surface of Lake Carraízo and clogged the lower parts of the rivers on the north coast. Since the interaction of the environment with pollution is receiving increasing attention, it would appear desirable to study in detail the biochemical and microbiological interactions which make possible the efficient decomposition of wastes in Puerto Rican Lakes.

SUMMARY AND CONCLUSION

High nutrient levels and pollution in Puerto Rican lakes lead to undesirable concentrations of algae, water of low clarity and poor sport fishing. Algae concentrations and photosynthetic productivity varied moderately throughout the year. In Lake Carraizo, large quantities of phosphate and nitrate were removed during the passage of water through the lake. A stable relationship between decomposition bacteria and photosynthesis by algae has developed in these tropical lakes in a manner very similar to sewage treatment ponds.

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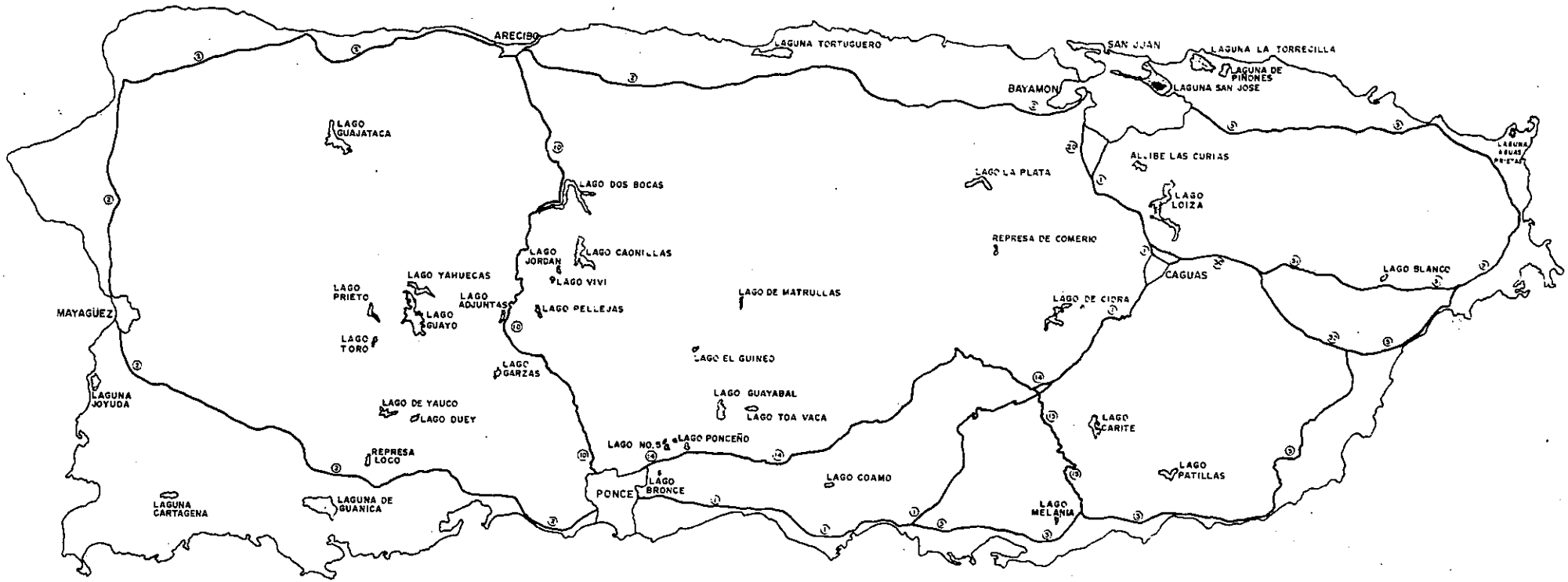
Appendix

This appendix is a complete listing of chemical, physical and biological data gathered from 12 lakes in Puerto Rico between December 1975 and September 1978. Only the data collected during 1977 have been analyzed in the text of this report, the remainder will be analyzed in a subsequent paper. Six reservoirs were studied intensively for seasonal variations and an additional six were studied about once a year over the 3 year period.

List of Tables in Appendix



LOCATION OF LAKES IN PUERTO RICO

Figure II

Table 6

Twelve Major Lakes Studied

1975-1978.

Lake	Drainage Area in Square Miles	Elevation of Spillway Crest in Feet
1. Caonillas	50.4	826
2. Carite	7.9	1784
3. Carraízo	206.0	102
4. Cidra	8.6	1322
5. Dos Bocas	170.0	295
6. Garzas	6.2	2415
7. Guajataca	24.6	646
8. Guayo	9.6	1460
9. Matrullas	4.4	2415
10. Patillas	25.2	217
11. Prieto	9.6	1485
12. Toro	4.0	1900

SAMPLING SCHEDULE FOR TWELVE LAKE STUDY

1975- 1978

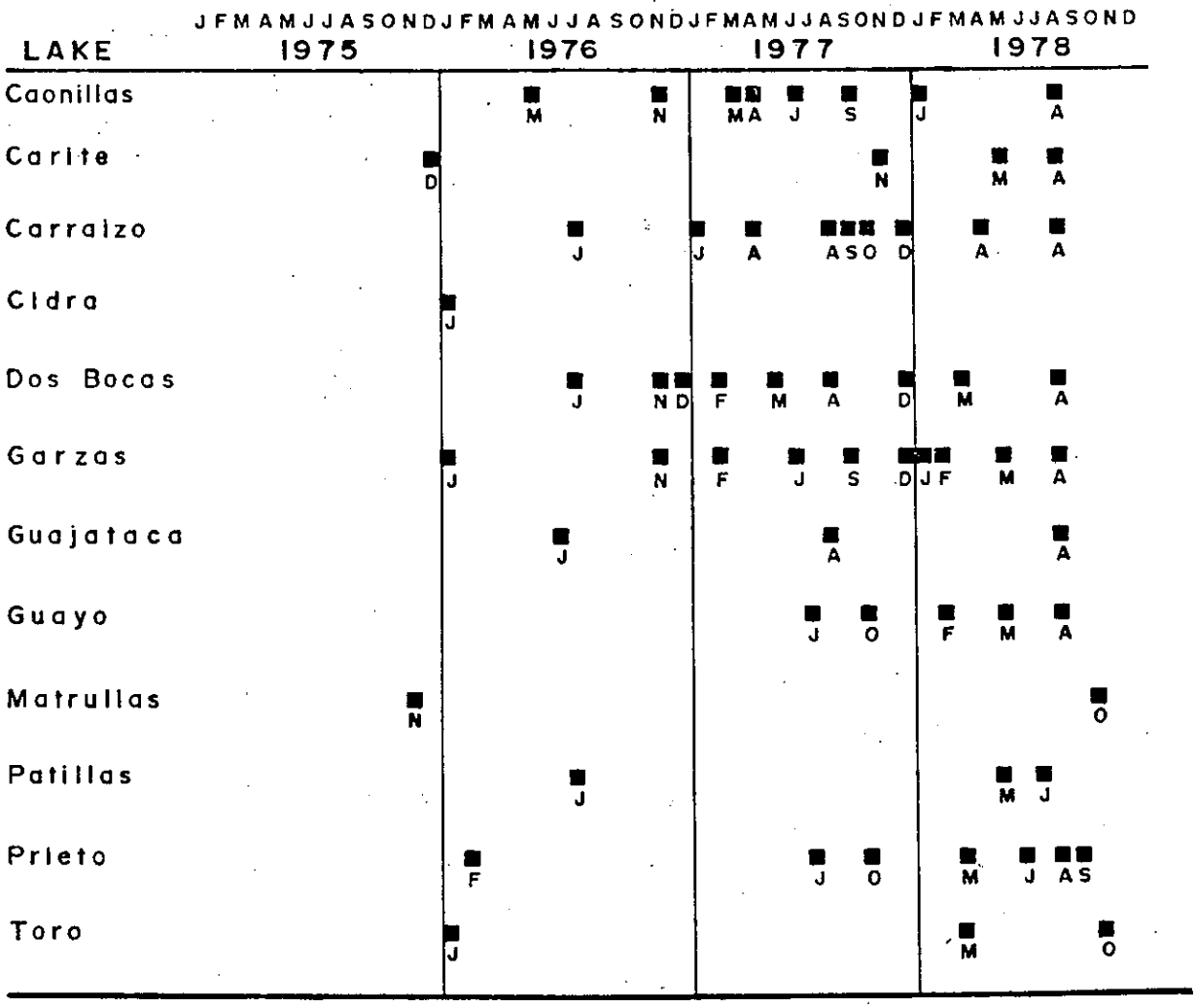


FIGURE 12

Table 7

MAJOR LAKES OF PUERTO RICO

Lake	Purpose	Storage Volume in acre-feet	Municipality	Tributaries	Outlet Rivers	Year constructed	Owner
1. Adjuntas	Power	465	Adjuntas	Vacas River	Tunnel & Arecibo River	1950	AFF
2. Caonillas	Power	49,000	Utuado	Caonillas, Yauco, and Jayuya Rivers	Caonillas River	1948	AFF
3. Carite	Domestic Water Supply and irrigation	11,300	Guayama	La Plata River	La Plata River & penstock	1913	AFF
4. Carraizo	DWS, power	20,000	Trujillo Alto	Valenciana, Loiza, Caguitas and Bairoa River	Loiza River	1954	AAA
5. Cartagena Lagoon	Wildlife Conservation	770	Lajas	Lajas Canal	None	Natural	-
6. Cidra	Domestic Water Supply	5,220	Cidra	Sabana and Bayamon Rivers	Bayamon River	1946	AAA
7. Coamo	Abandoned	200	Santa Isabel	Coamo River	Coamo River and Juana Diaz Canal	1914	AFF
8. Comerio #1	Abandoned	600	Comerio	La Plata River	La Plata River	1913	AFF
9. Comerio #2	Abandoned						
10. Dos Bocas	Power	32,000	Arecibo & Utuado	Caonillas Limon & Arecibo River	Arecibo River	1942	AFF
11. Garzas	Power, Irrigation	4,700	Adjuntas	Garzas and Vacas Rivers	Vacas River	1943	AFF
12. Guajataca	Irrigation	32,600	San Sebastian and Quebradillas	Guajataca River	Guajataca River & Diversion Canal	1929	AFF
13. Guayabal	Irrigation	10,000	Guayabal & Juana Diaz	Toa River Jacaguas River	Guayabal	1913	AFF
14. Guayo	Power, irrigation	17,400	Lares & Adjuntas	Guayo River & Cidra River	Guayo River	1956	AFF
15. Guineo	Power, irrigation	1,860	Ciales and Orocovis	Toro Negro River	Toro Negro River	1931	AFF
16. Jordan	Power		Utuado	Creeks	Tunnel & Rio Vivi	1950	AFF
17. La Plata	Domestic Water Supply		Toa Alta	La Plata River	La Plata	1973	AAA
18. Las Curias	Domestic Water Supply	1,100	Rio Piedras	Rio Piedras	Rio Piedras	1946	AAA
19. Loco	Power, irrigation	1,950	Yauco	Loco River	Loco River & Lajas Canal	1951	AFF
20. Luchetti	Power, irrigation	16,500	Yauco	Yauco River	Yauco River	1952	AFF
21. Matrullas	Power, irrigation	3,000	Orocovis	Matrullas River	Matrullas River	1934	AFF
22. Patillas	Irrigation	14,500	Patillas	Marin River Patillas River	Patillas River & Canal	1914	AFF
23. Pellejas	Power	152	Adjuntas	Pellejas River	Tunnel & Pellejas River	1950	AFF
24. Prieto	Power, irrigation	700	Lares	Prieto River	Prieto River	1955	AFF
25. Rio Blanco	Power		Naguabo	Rio Blanco	Rio Blanco		AFF
26. Toa Vaca	Domestic Water & irrigation	33,124	Villalba	Toa Vaca River	Toa Vaca River	1972	AAA
27. Toro	Power, irrigation	100	Maricao	Toro River	Toro River	1955	AFF
28. Tortuguero Lagoon	Wildlife Conservation		Manati	Canals	Ocean	Natural	Recursos Naturales
29. Vivi	Power	277	Utuado	Vivi River	Tunnel & Vivi River	1950	AFF
30. Yahuecas	Power, irrigation	1,800	Adjuntas	Blanco River	Blanco River	1956	AFF

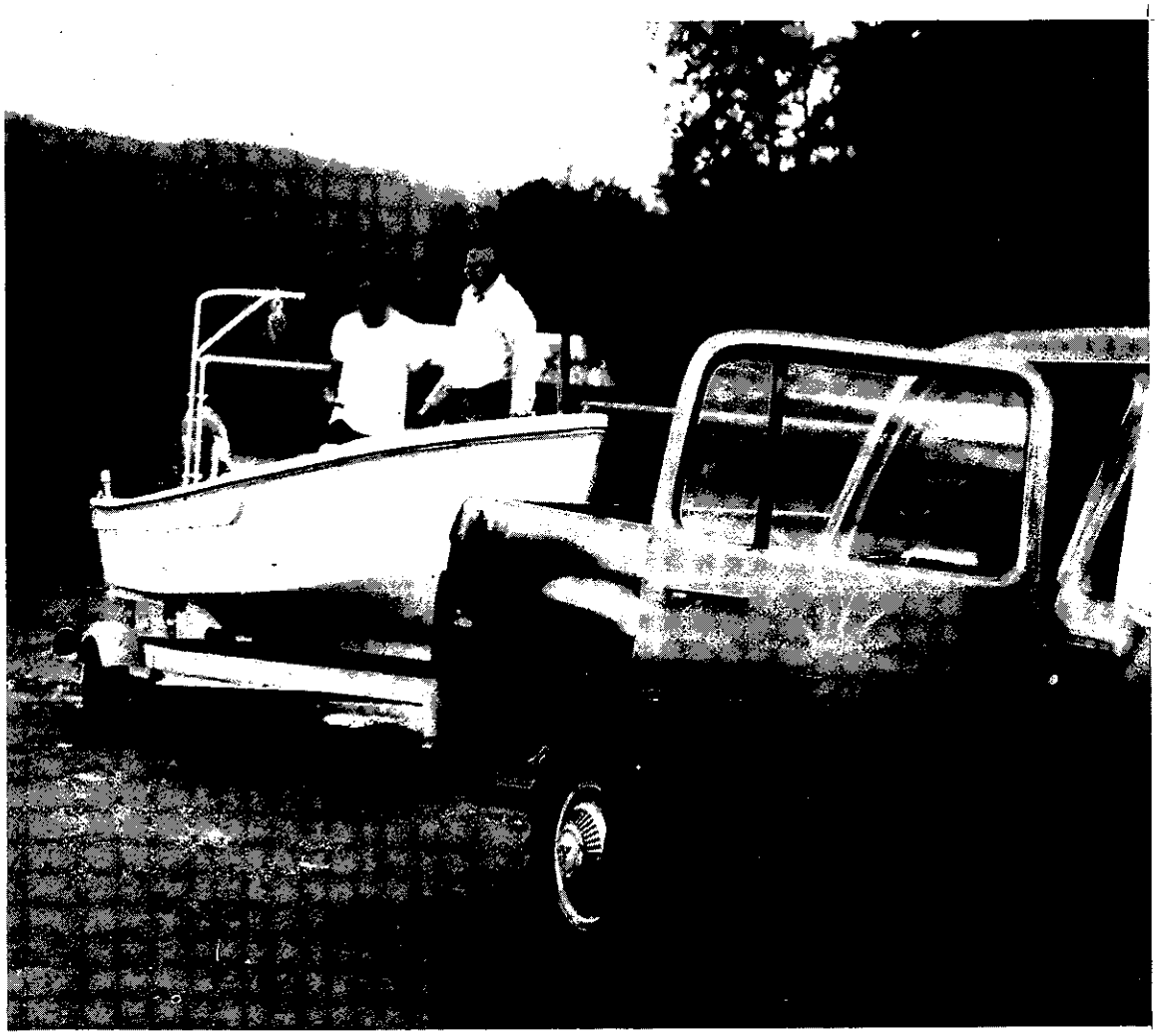


Figure 13. Lake Surveys were conducted from boats transported to the mountain lakes by trailer and pick-up trucks. The larger 18' fiberglass boat was equipped with a small winch and dredge.

Table 8

SUMMARY OF MEAN WATER QUALITY PARAMETERS FOR MAJOR LAKES IN PUERTO RICO, 1975-1978.

LAKE	CHLORIDES IN MG/L	HARDNESS AS $MgSO_4$ IN MG/L	TOTAL PHOSPHATES AS P IN MG/L	NITRATES AND NITRITES AS N IN MG/L	IRON IN MG/L	TURBIDITY IN STANDARD UNITS	COLOR IN STANDARD UNITS	PH	DISSOLVED OXYGEN IN MG/L	CHLOROPHYL A IN μG/L	COLIFORM BACTERIA GEOMETRIC MEAN PER 100 ML
aonillas	5.9 ± 2.7	112 ± 21	0.01 ± 0.01	0.07 ± 0.06	0.15 ± 0.19	3.1 ± 3.7	13.0 ± 4.2	7.42 ± 0.50	7.1 ± 1.8	25.7 ± 15.7	1,919
arite	7.7 ± 2.2	29 ± 16	0.01 ± 0.01	0.03 ± 0.03	0.16 ± 0.14	3.2 ± 0.6	9.8 ± 0.7	7.18 ± 0.16	7.0 ± 0.7		155
arraizo	16.6 ± 4.1	126 ± 23	0.28 ± 0.33	0.33 ± 0.48	1.02 ± 1.11	18.3 ± 15.6	23.0 ± 10.1	7.24 ± 0.25	5.0 ± 2.1	12.9 ± 9.8	17,604
idra	14.2 ± 0.4	76 ± 0	0.02 ± 0.02	0.20 ± 0.11	0.56 ± 0.27	1.7 ± 1.5	8.2 ± 2.4	7.30 ± 0.23	5.4 ± 1.0		546
os Bocas	5.8 ± 1.6	97 ± 20	0.01 ± 0.01	0.15 ± 0.18	0.47 ± 0.59	8.4 ± 7.7	15.4 ± 14.0	7.38 ± 0.31	8.2 ± 1.9	2.6 ± 2.4	60
arzas	3.2 ± 2.5	101 ± 93	0.02 ± 0.03	0.06 ± 0.04	0.08 ± 0.06	1.0 ± 1.1	8.5 ± 2.2	7.62 ± 0.29	6.7 ± 1.1		47
uajataca	6.6 ± 5.8	224 ± 64	0.01 ± 0.00	0.47 ± 0.53	0.11 ± 0.09	7.6 ± 5.5	8.4 ± 3.4	7.36 ± 0.49	7.6 ± 0.3		102
uayo	7.6 ± 4.7	110 ± 34	0.02 ± 0.03	0.28 ± 0.53	0.12 ± 0.23	2.7 ± 4.3	11.1 ± 1.8	7.63 ± 0.34	7.4 ± 0.9	7.1 ± 4.0	939
atrullas	2.0 ± 1.4	21 ± 0	0.01 ± 0.00	0.53 ± 0.67	0.22 ± 0.04	1.8 ± 0.2	17.5 ± 10.6	7.85 ± 0.07	7.8 ± 1.0		64
atillas	9.6 ± 3.1	29 ± 17	0.01 ± 0.01	0.14 ± 0.19	0.07 ± 0.10	9.6 ± 6.3	10.6 ± 2.0	7.72 ± 0.30	7.4 ± 0.7		399
rieto	4.4 ± 3.2	157 ± 29	0.02 ± 0.02	0.29 ± 0.26	0.81 ± 1.30	25.3 ± 28.9	13.8 ± 5.9	7.44 ± 0.31	6.6 ± 2.5		2,704
oro	5.0 ± 7.0	137 ± 2	0.01 ± 0.00	0.38 ± 0.09	1.30 ± 0.00	10.6 ± 0.0	10.0 ± 7.1	7.30 ± 0.71	6.8 ± 1.0		1,229
eans for all Lakes	7.4	101	0.04	0.25	0.42	7.8	12.6	7.5	6.9	12.0	448

Oxygen Data Summary for Major Lakes in Puerto Rico, 1975-1978.

Lakes	Initial Oxygen from Previous day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Water Temp. °C	Secchi Disk Depth M
Caonillas	7.1 ± 1.8	7.6 ± 1.3	5.6 ± 1.8	1.1 ± 1.5	1.9 ± 1.4	24 ± 1.9	1.0 ± 0.4
Carite	7.0 ± 0.7	7.2 ± 0.6	6.5 ± 0.6	0.7 ± 0.4	0.5 ± 0.3	23 ± 1.1	1.6 ± 0.2
Carraizo	5.0 ± 2.1	5.5 ± 3.7	3.4 ± 2.3	2.4 ± 3.0	2.0 ± 1.7	26 ± 1.6	0.5 ± 0.4
Cidra	5.4 ± 1.0	6.0 ± 1.1	5.0 ± 0.8	1.0 ± 0.5	0.6 ± 0.4	23 ± 1.0	-
Dos Bocas	8.2 ± 1.9	8.6 ± 2.1	7.1 ± 1.5	1.6 ± 1.5	1.5 ± 1.3	26 ± 1.6	0.9 ± 0.6
Garzas	6.7 ± 1.1	6.9 ± 1.1	6.3 ± 1.1	0.6 ± 0.3	0.4 ± 0.4	21 ± 2.5	2.1 ± 0.4
Guajataca	7.6 ± 0.3	7.9 ± 0.6	7.3 ± 0.2	0.6 ± 0.5	0.5 ± 0.1	26 ± 1.3	2.2 ± 0.2
Guayo	7.4 ± 0.9	7.9 ± 0.9	6.8 ± 1.0	1.1 ± 0.9	0.7 ± 0.4	23 ± 2.3	2.7 ± 1.6
Patillas	7.4 ± 0.7	7.6 ± 0.4	6.7 ± 0.3	0.9 ± 0.2	0.8 ± 0.6	29 ± 1.6	1.8 ± 0.5
Prieto	6.6 ± 2.5	6.3 ± 2.3	5.6 ± 2.1	0.7 ± 0.8	1.0 ± 0.7	22 ± 2.2	0.8 ± 1.5
Means for all lakes	6.9	7.2	6.0	1.1	1.0	24	1.5

Table 9

Data Record By Lakes

The group of tables for each lake are in the following order:

Map of Lake with Sampling Stations

Chemical Water Quality

Variation with Time and Station for each Chemical Parameter

Summary of Snail Surveys

Summary of Coliform Bacteria Data

Oxygen Data Summary

Phytoplankton Data

Water Level Record for Lake

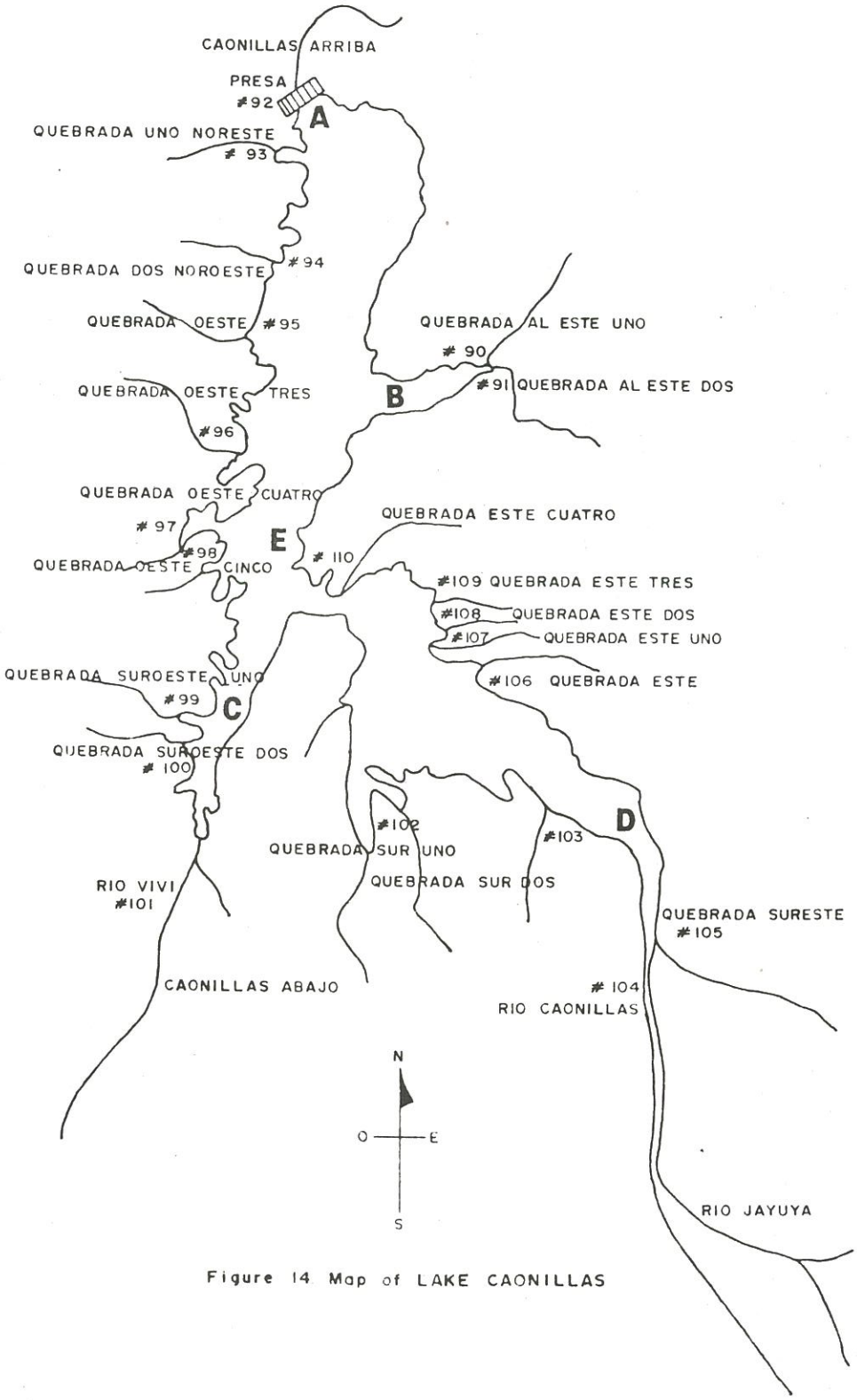


Figure 14 Map of LAKE CAONILLAS

Figure 15. Lake Caonillas has the largest volume of any of the lakes and discharges through hydroelectric generating turbines into Lake Dos Bocas.

CHEMICAL QUALITY DATA SUMMARY FOR LAKE Caonillas IN Utuado, PUERTO RICO

FROM November 1976 TO January 1978. SAMPLES ARE FROM 0.5 M DEPTH

Table 10

Station and Localization	Date	Time	Sample No.	Lab. No.	Chloride mg/l	Hardness as $MgSO_4$ Mg/l	Total Phosphates as P mg/l	Nitrate & Nitrite as N mg/l	Iron mg/l	Turbidity in Standard Unit	Color in Standard Unit	pH	Dissolved Oxygen mg/l	Chlorophyll A mg/l	Total Coliform count	Sample Size ml
	1976															
Dam A	17 Nov	7:00	CA- 9	326	5.5	87.0	0.01	0.07	0.10	2.2	12	7.3	7.0			
Middle Lake B	17 Nov	9:25	CA-23	327	7.4	93.1	0.01	0.10	0.20	9.8	20	7.3	8.2			
Entrada Río Vivi C	17 Nov	9:30	CA-10	328	8.2	100.0	0.06	0.06	0.10	4.6	12	7.2	5.3			
Entrada Río Jayuya D	17 Nov	8:20	CA-16	329	7.4	93.1	0.03	0.05	0.10	3.8	8	7.1	6.8			
	1977															
A	3 Apr	10:50	-----	352	4.1	97.1	0.01	0.04	0.10	1.4	20	7.6	---			
B	3 Apr	11:00	-----	353	3.7	101.6	0.01	0.02	0.10	2.2	20	7.7	---			
Middle Lake E	3 Apr	11:17	-----	354	4.7	107.9	0.01	0.03	0.10	2.2	15	7.4	---			
D	3 Apr	11:25	-----	355	6.6	107.9	0.01	0.02	0.20	3.6	20	7.6	---			
C	3 Apr	11:35	-----	356	3.1	107.9	0.02	0.12	0.20	14.6	20	6.6	---			
A	16 Jun		CA-73	366	2.0	133.0	0.01	0.03	0.04	2.2	10	7.3	11.0	5.9		
B	16 Jun		CA-72	367	15.7	127.7	0.01	0.03	0.07	2.8	12	6.9	9.3	12.8		
C	16 Jun		CA-58	368	5.9	138.3	0.01	0.04	0.00	4.0	10	7.1	7.6	34.2		
D	16 Jun		CA-62	369	5.9	138.3	0.01	0.03	0.80	10.1	10	7.2	7.1	43.6		
E	16 Jun		CA-67	370	7.8	133.0	0.01	0.06	0.60	4.1	12	7.5	7.8	31.8		
A	10 Sep	6:15	CA-33	394	3.9	128.7	0.01	0.05	0.20	0.3	15	8.5	---			
B	10 Sep	7:40	Ca-54	395	5.9	125.8	0.01	0.06	0.06	0.4	10	8.1	5.5			

CHEMICAL QUALITY DATA SUMMARY FOR LAKE Caonillas IN Utuado, PUERTO RICO

FROM November 1976 TO January 1978. SAMPLES ARE FROM 0.5 M DEPTH

Table 10 (continued)

Station and Localization	Date	Time	Sample No.	Lab. No.	Chloride mg/l	Hardness as $MgSO_4$ Mg/l	Total Phosphates as P mg/l	Nitrate & Nitrite as N mg/l	Iron mg/l	Turbidity in Standard Unit	Color in Standard Unit	pH	Dissolved Oxygen mg/l	Chlorophyll A mg/l	Total Coliform count	Sample Size ml
	1977															
C	10 Sep	6:45	CA-39	396	7.8	137.3	0.01	0.08	0.20	0.4	10	8.2	5.5			
D	10 Sep	7:10	CA-41	397	6.3	140.1	0.01	0.05	0.10	0.80	12	8.2	6.2			
E	10 Sep	7:15	CA-47	398	6.8	137.3	0.01	0.05	0.10	0.30	12	8.0	5.4			
	1978															
A	27 Jan	7:30	CA-53	424	3.9	78.6	0.01	0.20	0.03	1.00	8	7.0	7.8			
B	27 Jan	7:45	CA-58	425	3.9	84.3	0.01	0.02	0.03	0.00	10	7.0	8.0			
C	27 Jan	8:00	CA-63	426	3.9	89.9	0.01	0.20	0.03	0.03	10	7.0	7.1			
D	27 Jan	8:15	CA-68	427	5.9	89.9	0.01	0.20	0.03	1.20	10	6.9	8.0			

TABLE 11

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Caonillas

PARAMETER Chloride

UNITS mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1 17/11/76	28.5	4	7.13	0.80
2 3/4/77	22.2	5	4.44	0.97
3 16/6/77	37.3	5	7.46	3.43
4 10/9/77	30.7	5	6.14	0.99
5 27/1/78	17.6	4	4.4	0.75
6				
7				
8				
9				
10				
TOTALS	136.3	23	5.93	
B-VARIATION BY STATION				
A	19.4	5	3.88	0.90
B	36.6	5	7.32	3.38
C	28.9	5	5.78	1.82
D	32.1	5	6.42	0.46
E	19.3	3	6.43	1.16
F				
G				
H				
TOTALS	136.3	23	5.93	

TABLE 12

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Caonillas

PARAMETER Hardness

UNITS mg/1 Mg SO4

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	373.2	4	93.3	1.84
2	522.4	5	104.8	4.10
3	670.3	5	134.06	3.53
4	669.2	5	133.80	5.24
5	342.7	4	85.68	4.22
6				
7				
8				
9				
10				
TOTALS	2,577.8	23	112.08	
B-VARIATION BY STATION				
A	524.4	5	104.88	20.78
B	532.5	5	106.50	16.20
C	573.4	5	114.68	18.49
D	569.3	5	113.86	20.27
E	378.2	3	126.07	12.11
F				
G				
H				
TOTALS	2,577.8	23	112.08	

TABLE 13

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Caonillas

PARAMETER Total Phosphates as P

UNITS mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	0.11	4	0.03	0.02
2	0.06	5	0.01	0.00
3	0.05	5	0.01	0.00
4	0.05	5	0.01	0.00
5	0.04	4	0.01	0.00
6				
7				
8				
9				
10				
TOTALS	0.31	23	0.01	
B-VARIATION BY STATION				
A	0.05	5	0.01	0.00
B	0.05	5	0.01	0.00
C	0.11	5	0.02	0.01
D	0.07	5	0.01	0.00
E	0.03	3	0.01	0.00
F				
G				
H				
TOTALS	0.31	23	0.01	

TABLE 14

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Caonillas

PARAMETER Nitrate & Nitrite

UNITS mg/1

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	0.28	4	0.07	0.02
2	0.23	5	0.05	0.03
3	0.19	5	0.04	0.01
4	0.29	5	0.06	0.01
5	0.62	4	0.15	0.01
6				
7				
8				
9				
10				
TOTALS	1.61	23	0.07	
B-VARIATION BY STATION				
A	0.39	5	0.08	0.05
B	0.23	5	0.05	0.03
C	0.50	5	0.10	0.05
D	0.35	5	0.07	0.07
E	0.14	3	0.05	0.02
F				
G				
H				
TOTALS	1.61	23	0.07	

TABLE 15

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Caonillas

PARAMETER Iron

UNITS mg/1

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	0.5	4	0.12	0.035
2	0.66	5	0.14	0.06
3	1.51	5	0.30	0.32
4	0.7	5	0.13	0.09
5	0.12	4	0.03	0.00
6				
7				
8				
9				
10				
TOTALS	3.49	23	0.15	
B-VARIATION BY STATION				
A	0.47	5	0.09	0.05
B	0.46	5	0.09	0.05
C	0.53	5	0.11	0.08
D	1.23	5	0.25	0.22
E	0.80	3	0.27	0.22
F				
G				
H				
TOTALS	3.49	23	0.15	

TABLE 16

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Cao nillas

PARAMETER Turbidity

UNITS Standa rd Units

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	20.4	4	5.10	2.20
2	24.0	5	4.80	3.92
3	23.2	5	4.64	2.18
4	2.2	5	0.44	0.14
5	2.2	4	0.56	0.70
6				
7				
8				
9				
10				
TOTALS	72.0	23	3.13	
B-VARIATION BY STATION				
A	7.1	5	1.37	0.63
B	15.2	5	3.00	2.68
C	23.6	5	4.73	3.95
D	19.5	5	3.90	1.86
E	6.6	3	2.20	1.27
F				
G				
H				
TOTALS	72.0	23	3.13	

TABLE 17

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Caonillas

PARAMETER Color

UNITS Standard Unit

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	52.0	4	13.00	2.80
2	95.0	5	19.00	1.60
3	54.0	5	10.80	0.96
4	59.0	5	11.80	1.44
5	38.0	4	9.50	0.75
6				
7				
8				
9				
10				
TOTALS	298.0	23	12.96	
B-VARIATION BY STATION				
A	65.0	5	13.00	3.60
B	72.0	5	14.40	4.90
C	62.0	5	12.40	3.00
D	60.0	5	12.00	3.20
E	39.0	3	13.00	1.33
F				
G				
H				
TOTALS	298.0	23	12.96	

TABLE 18

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Caonillas

PARAMETER P H

UNITS

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	28.9	4	7.22	0.08
2	36.9	5	7.38	0.39
3	36.0	5	7.20	0.16
4	41.0	5	8.20	0.12
5	27.9	4	6.95	0.04
6				
7				
8				
9				
10				
TOTALS	170.7	23	7.42	
B-VARIATION BY STATION				
A	37.7	5	7.54	0.41
B	37.0	5	7.40	0.44
C	36.1	5	7.22	0.39
D	37.0	5	7.40	0.40
E	22.9	3	7.63	0.24
F				
G				
H				
TOTALS	170.7	23	7.42	

TABLE 19

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Caonillas

PARAMETER Dissolved Oxygen

UNITS mg/1

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	27.3	4	6.82	0.78
2	--	0	--	--
3	42.8	5	8.56	1.27
4	22.6	4	5.65	0.28
5	30.9	4	7.72	0.32
6				
7				
8				
9				
10				
TOTALS	123.6	17	7.27	
B-VARIATION BY STATION				
A	25.8	3	8.60	1.60
B	31.0	4	7.75	1.12
C	25.5	4	6.38	0.98
D	28.1	4	7.02	0.52
E	13.2	2	6.60	1.20
F				
G				
H				
TOTALS	123.6	17	7.27	

TABLE 20

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Caonillas

PARAMETER Chlorophyll A

UNITS µg/l

A-VARIATION WITH TIME

SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	--	0		
2	--	0		
3	128.3	5	25.66	13.10
4	--	0		
5	--	0		
6				
7				
8				
9				
10				
TOTALS				

B-VARIATION BY STATION

A				
B				
C				
D				
E				
F				
G				
H				
TOTALS				

Table 21

Summary of Snail Surveys in Lake Caonillas

Date	Inspector	Snails found
May. 6/76	P. Bermudez	*Tarebia granifera* *Marisa cornuarietis*
Nov. 23/76	W. Jobin	*Lymnaea columella* *Physa cubensis* *Tarebia granifera*
Mar. 11/77	K. Timoney & R. Mercado	*Tarebia granifera*
Jan 20/78	A. Laracuente	*Lymnaea columella* *Tarebia granifera* *Physa cubensis* *Succinea*
Aug. 9/78	A. Laracuente	*Tarebia granifera* *Marisa cornuarietis*

TABLE 22

SUMMARY OF COLIFORM DATA OF LAKE Caonillas IN Utuado, P.R.

FROM March 1977 TO January 1978.

STATION	DATE	FIELD NUM.	VOL. ml	COLONIES	COLONIES/ 100 ml
A	7/3/77	CA-102	0.1	16	16,000
C	7/3/77	CA-104	0.1	19	19,000
D	7/3/77	CA-106	0.1	11	11,000
E	7/3/77	CA-108	0.1	25	25,000
B	7/3/77	CA-110	0.1	13	13,000
A	8/3/77	CA-116	0.1	4	4,000
A	8/3/77	CA-116	1.0	19	1,900
C	8/3/77	CA-122	0.1	2	2,000
C	8/3/77	CA-122	1.0	27	2,700
D	8/3/77	CA-128	0.1	6	6,000
D	8/3/77	CA-128	1.0	31	3,100
E	8/3/77	CA-134	0.2	9	4,500
E	8/3/77	CA-134	1.0	29	2,900
B	8/3/77	CA-140	0.1	2	2,000
B	8/3/77	CA-140	1.0	28	2,800
C	14/6/77	CA-8	0.1	11	11,000
C	14/6/77	CA-8	1.0	105	10,500
D	14/6/77	CA-14	0.1	55	55,000
D	14/6/77	CA-14	1.0	TNTC	
E	14/6/77	CA-20	0.1	14	14,000
E	14/6/77	CA-20	1.0	80	8,000
B	14/6/77	CA-26	0.1	17	17,000
B	14/6/77	CA-26	1.0	75	7,500
A	14/6/77	CA-28	0.1	6	6,000
A	15/6/77	CA-28	1.0	41	4,100
C	15/6/77	CA-34	0.1	0	0
C	15/6/77	CA-34	1.0	3	300
D	15/6/77	CA-40	0.1	5	5,000
D	15/6/77	CA-40	1.0	36	3,600
E	15/6/77	CA-46	0.1	0	0
E	15/6/77	CA-46	1.0	1	100
B	15/6/77	CA-51	0.1	9	9,000
B	15/6/77	CA-51	1.0	73	7,300

TABLE 22 (continued)

SUMMARY OF COLIFORM DATA OF LAKE Caonillas IN Utuado, P.R.

FROM 197 TO 1978.

STATION	DATE	FIELD NUM.	VOL. ml	COLONIES	COLONIES/ 100 ml
A	15/6/77	CA-52	0.1	0	0
A	15/6/77	CA-52	1.0	2	200
A	16/9/77	CA-32	0.1	3	3,000
A	16/9/77	CA-32	1.0	49	4,900
B	16/9/77	CA-52	0.1	14	14,000
B	16/9/77	CA-52	1.0	57	5,700
C	16/9/77	CA-38	0.1	6	6,000
C	16/9/77	CA-38	1.0	36	3,600
D	16/9/77	CA-38	0.1	3	3,000
D	16/9/77	CA-38	1.0	38	3,800
E	16/9/77	CA-46	0.1	11	11,000
E	16/9/77	CA-46	1.0	92	9,200
A	11/1/78	CA-10	10	88	880
A	11/1/78	CA-10	1	16	1,600
B	11/1/78	CA-16	10	TNTC	
B	11/1/78	CA-16	1	56	5,600
C	11/1/78	CA-22	10	TNTC	
C	11/1/78	CA-22	1	74	7,400
D	11/1/78	CA-28	10	12	120
D	11/1/78	CA-28	1	1	100
A	12/1/78	CA-34	10	105	1050
A	12/1/78	CA-34	1	14	1,400
B	12/1/78	CA-40	10	TNTC	
B	12/1/78	CA-40	1	60	6,000
C	12/1/78	CA-42	10	4	40
C	12/1/78	CA-42	1	2	200
D	12/1/78	CA-48	10	10	100
D	12/1/78	CA-48	1	1	100

OXYGEN DATA SUMMARY FOR LAKE Caonillas IN Utuado, PUERTO RICO

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM November 1977 TO January, 1978.

Table 23

Page 1 of 4

Station	Date 1977	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
A Represa	17 Nov	7:00	25	1,5-8	8.0	9.0	7.6	1.4	0.4	1.6		23
A	18 Nov	6:45	25	22,31-36	6.4	7.3	5.0	2.3	1.4	1.6		24
A	19 Nov	10:30	27	30,53-56	6.6	7.4	5.3	2.1	1.3	1.5		28
C Río Vivi	17 Nov	7:35	26	2,12-15	6.3	5.7	3.5	2.2	2.8	1.2		22
C	18 Nov	7:15	26	11,61-64	5.1	6.5	0.6	5.9	4.5	1.0		24
C	19 Nov	10:45	27	34,	4.5	7.6	0.0	7.6	4.5	1.5		27
D Río Jayuya	17 Nov	8:20	25.5	3,18-21	9.1	8.4	7.8	0.6	1.3	1.1		22
D	18 Nov	8:15	26	17,43-46	3.4	8.41	2.2	6.21	1.2	1.3		24
D	19 Nov	11:15	27.5	42,65-68	8.0	8.8	3.8	5.0	4.2	1.0		27
B Middle Lake	17 Nov	9:20	26	4,25-28	8.8	9.4	6.9	2.5	1.9	1.7		23
B	18 Nov	9:25	26	24,47-50	7.6	8.9	6.3	2.6	1.3	1.3		24
B	19 Nov	11:15	27.5	52,57-60	8.1	7.5	5.7	1.8	2.4	1.0		26
	1978											
A Represa	8 Mar	9:50	25	101, 111-114	7.2	7.6	7.4	0.2	0.2	1.9		22
A	9 Mar	8:05	23	115, 141-144	7.0	7.6	6.9	0.7	0.1	1.6		23
A	10 Mar	7:35	24	145, 166-169	7.7	8.1	6.2	1.9	1.5	1.2		24
C Río Vivi	8 Mar	10:30	24	103, 117-120	8.4	7.9	7.1	0.8	1.3	0.8		22
C	9 Mar	8:35	23.5	121, 146-149	5.5	5.6	5.1	0.5	0.4	0.8		22
C	10 Mar	8:30	23.5	150, 170-173	6.8	7.3	5.67	1.6	1.0	0.8		24

OXYGEN DATA SUMMARY FOR LAKE Caonillas IN Utuado, PUERTO RICO

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM November 1977 TO January, 1978.

Table 23 (continued)

Station	Date 1977	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
D	8 Mar	11:00	24.5	105, 123-126	7.2	8.0	5.6	2.4	1.6	0.8		22
D	9 Mar	9:00	24	127, 151-154	5.9	6.3	4.9	1.4	1.0	0.7		22
D	10 Mar	8:15	23	155,	4.6	6.0	3.4	2.6	1.2	0.8		23
E Middle Lake	8 Mar	11:30	24.5	107, 129-132	8.3	8.1	6.4	1.7	1.9	1.4		22
E	9 Mar	9:20	24	133, 156-159	6.2	6.2	5.3	0.9	7.4	1.7		22
E	10 Mar	8:30	23	160, 178-181	6.4	7.6	5.9	1.7	0.5	1.5		23
B	8 Mar	11:50	25	109, 135-138	9.1	9.6	7.6	2.0	1.5	1.7		22
B	9 Mar	9:40	24.5	139, 161-164	7.9	8.1	6.2	1.9	1.7	1.4		22
B	10 Mar	8:45	24	165, 182-185	7.2	8.0	6.6	1.4	0.6	1.5		23
A Represa	14 Jun	8:35	27	1,	11.0	-	-	-	-	0.7		-
A	15 Jun	-	-	-	-	-	-	-	-	-		-
A	16 Jun	-	-	-	-	-	-	-	-	-		-
C Río Vivi	14 Jun	6:50	26	2,6	8.6	8.0	-	-	-	0.5		17
C	15 Jun	6:35	24	7,29-32	7.2	8.8	6.4	2.4	0.8	0.5		24
C	16 Jun	6:25	25	33,54-51	7.0	9.2	5.7	3.5	1.3	0.5		24
D Río Jayuya	14 Jun	7:15	24	3,9-12	7.3	5.7	5.8	- 0.1	1.5	0.5		16
D	15 Jun	6:55	25	13,35-38	6.2	6.0	4.0	2.0	2.2	0.3		24
D	16 Jun	6:35	25	39,58-61	7.7	6.1	5.0	1.1	2.7	0.2		24
E Middle Lake	14 Jun	7:35	26	4,15-18	9.3	8.3	7.5	0.8	1.8	0.8		16

OXYGEN DATA SUMMARY FOR LAKE Caonillas IN Utuado, PUERTO RICO

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM November 1977 TO January, 1978.

Table 23 (continued)

Station	Date 1977	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
E	15Jun	7:10	26	19,41-44	6.9	7.8	5.9	1.9	1.0	0.7		24
E Middle Lake	16 Jun	6:50	26	45,13-66	7.3	7.7	5.8	1.9	1.5	0.8		24
B	14 Jun	7:50	26	5,21-24	11.8	9.9	9.4	0.5	2.4	0.8		16
B	15 Jun	7:30	26	25,46-49	8.2	9.2	7.3	1.9	0.9	0.8		24
B	16Jun	7:00	26	50,68-71	7.8	8.5	6.4	2.1	1.4	0.8		24
A Represa	14 Sep	-	-	-	-	-	-	-	-	-		-
A	15 Sep	-	-	-	-	-	-	-	-	-		-
A	16 Sep	-	-	-	-	-	-	-	-	-		-
C Río Vivi	14 Sep	7:25	24	2,6-9	8.5	7.7	5.2	2.5	3.3	0.2		21
C	15 Sep	6:40	24	5,18-21	3.6	4.5	2.9	1.6	0.7	0.5		23
C	16 Sep	6:45	23	17,34-37	4.5	5.7	2.6	3.1	1.9	0.4		24
D Río Jayuya	14 Sep	9:40	26	3,	8.0	-	-	-	-	0.3		22
D	15 Sep	-	-	16,	4.3	-	-	-	-	-		-
D	16 Sep	-	-	-	-	-	-	-	-	-		-
E Middle Lake	14 Sep	7:55	26	4,11-14	7.6	7.4	6.3	1.1	1.3	0.6		20
E	15 Sep	7:00	24	10,23-26	4.1	5.3	3.4	1.9	0.7	0.8		23
E	16 Sep	7:15	24	22,42-44	4.6	5.8	4.2	1.6	0.4	0.7		24
B	14 Sep	9:25	26	-	-	-	-	-	-	0.6		-
B	15 Sep	7:20	24	15,28-31	5.1	5.6	4.4	1.2	0.7	0.8		
B	16 Sep	7:40	23	27,45-51	4.2	5.0	3.2	1.8	100	0.8		24

OXYGEN DATA SUMMARY FOR LAKE Caonillas IN Utuado, PUERTO RICO

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM November 1977 TO January, 1978.

Table 23 (continued)

Station	Date 1978	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
A Represa	11 Jan	7;30	21.5	1,6-10	10.9	9.8	8.6	1.2	2.3	1.2		17
A	12 Jan	7:30	21	5,31-34	6.3	8.4	6.0	2.4	0.3	1.0		24
A	13 Jan	7:30	21	30,49-52	6.3	8.2	6.2	2.0	0.1	1.0		24
C Río Vivi	11 Jan	8:25	21.5	3,19-22	7.5	6.8	6.6	0.2	0.9	0.5		17
C	12 Jan	8:10	22	18, -	7.0	-	-	-	-	0.8		24
C	13 Jan	8:00	17.5	42,59-62	6.9	8.2	5.9	2.3	1.0	0.8		24
D Río Jayuya	11 Jan	8:45	22	4,25-28	9.7	8.3	8.2	0.1	1.5	0.8		16
D	12 Jan	8:30	22	24,45-48	6.6	8.8	4.4	4.4	2.2	0.8		24
D	13 Jan	8:15	22	44,63-66	7.7	9.2	5.3	3.9	2.4	0.8		24
B Middle Lake	11 Jan	8:00	22	2,13-16	9.9	8.6	8.4	0.2	1.5	1.2		17
B	12 Jan	7:55	21.5	12,37-40	6.9	6.6	6.2	0.4	0.7	1.0		24
B	13 Jan	7:45	21	36,54-57	7.3	7.4	6.6	0.8	0.7	1.2		24

ALGAE DATA SUMMARY FOR LAKE Caonillas IN Utuado, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM October 1977 to , 1978.

Table 24

LOCALIZATION	SAMPLE	DATE 1977	ORGANISMS/ ML																(INCLUDES NEXT PAGE)
			ANABAENA (blue green)	ANACYSTIS (blue green)	CYLINDROSPERMUM (blue green)	OSCILATORIA (blue green)	ACTINASTRUM (green)	CHLORELLA (green)	MICRASTERIAS (green)	SCENEDESMUS (green)	SPHAEROCYSTIS (green)	STAURASTRUM (green)	TETRAEDRON (green)	ASTERIONELLA (diatom)	FRAGILARIA (diatom)	GOMPHONEMA (diatom)	NITZCHIA (diatom)	STEPHANODISCUS (diatom)	SYNEDRA (diatom)	TOTAL/ M L
Dam	A 1	Oct 16	1.07	5.37	0.0	0.0	4.83	0.0	1.07	0.0	0.0	6.44	2.69	5.91	4.30	1.07	0.0	2.15	13.96	48.87
Dam	A 2	Oct 16	1.07	2.15	0.0	0.0	0.0	1.61	1.07	0.0	0.0	2.15	1.61	8.05	3.22	1.07	0.0	1.61	9.66	33.29
Dam	A 3	Oct 16	2.15	2.69	0.0	1.61	0.0	0.0	1.07	0.0	0.0	2.69	3.22	5.37	4.30	1.07	0.0	2.15	8.59	34.91
Stream East	B 1	Oct 16	3.76	4.83	0.0	3.22	0.0	1.07	0.54	0.0	0.0	1.07	1.07	10.74	4.83	1.07	0.0	0.54	9.13	41.89
Stream East	B 2	Oct 16	4.30	3.76	1.07	2.69	0.0	1.07	1.07	0.0	0.0	1.61	2.15	11.82	5.91	1.07	0.0	3.22	11.28	51.02
Stream East	B 3	Oct 16	2.68	2.15	0.0	1.07	0.0	2.15	1.07	0.0	0.0	3.22	2.68	12.89	7.52	1.07	0.0	1.61	9.67	47.79
Vivi River	C 1	Oct 16	1.07	0.0	0.0	1.61	0.0	1.07	1.07	0.0	0.0	2.15	2.68	10.20	8.05	1.07	0.0	0.0	11.81	42.42
Vivi River	C 2	Oct 16	1.07	0.0	0.0	1.07	0.0	1.61	1.07	0.0	0.0	2.69	2.69	6.44	8.06	2.15	0.0	0.0	15.04	42.96
Vivi River	C 3	Oct 16	2.15	1.61	0.0	1.07	0.0	1.61	0.0	0.0	0.0	1.61	0.54	8.06	11.81	0.54	0.0	0.0	9.67	39.74
Jayuya River	D 1	Oct 16	0.0	3.22	0.0	2.69	0.0	4.83	0.0	0.0	3.22	2.69	1.07	6.44	1.07	1.07	0.0	5.37	3.22	35.98
Jayuya River	D 2	Oct 16	1.07	1.61	0.0	0.54	0.0	2.69	0.0	0.0	0.0	2.15	1.61	3.22	4.83	1.61	0.0	4.30	12.35	38.13
Jayuya River	D 3	Oct 16	2.15	3.22	0.0	0.54	0.0	1.61	0.0	0.0	0.0	1.61	2.15	5.91	3.76	1.61	0.0	0.54	8.59	33.83
Center Lake	E 1	Oct 16	15.04	18.26	0.0	12.35	0.0	2.15	1.07	0.0	0.0	5.91	5.91	5.37	2.68	1.07	1.07	0.0	9.13	80.01
Center Lake	E 2	Oct 16	13.42	22.55	0.0	6.44	0.0	1.61	0.0	1.07	0.0	5.37	6.44	5.37	3.22	1.61	1.07	0.0	8.05	76.25
Center Lake	E 3	Oct 16	10.74	24.70	0.0	9.67	0.0	2.69	0.0	1.61	1.61	4.30	0.0	3.76	3.22	1.61	0.0	1.61	5.37	71.96

ALGAE DATA SUMMARY FOR LAKE Caonillas IN Utuado, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM October 1977 to ______, 1978.

Table 24 (continued)

LOCALIZATION	SAMPLE	DATE 1977	CHRYSOCOCCUS (flagellate)	MALLOMONAS (flagellate)	TOTAL/ ML
			ORGANISMS/ ML		
Dam	A 1	Oct 16	0.0	0.0	
Dam	A 2	Oct 16	0.0	0.0	
Dam	A 3	Oct 16	0.0	0.0	
Stream East	B 1	Oct 16	0.0	0.0	
Stream East	B 2	Oct 16	0.0	0.0	
Stream East	B 3	Oct 16	0.0	0.0	
Viví River	C 1	Oct 16	1.61	0.0	
Viví River	C 2	Oct 16	1.07	0.0	
Viví River	C 3	Oct 16	0.0	1.07	
Jayuya River	D 1	Oct 16	0.0	1.07	
Jayuya River	D 2	Oct 16	0.0	2.15	
Jayuya River	D 3	Oct 16	0.0	2.15	
Center Lake	E 1	Oct 16	0.0	0.0	
Center Lake	E 2	Oct 16	0.0	0.0	
Center Lake	E 3	Oct 16	0.0	1.07	

ALGAE DATA SUMMARY FOR LAKE Caonillas IN Utuado, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM September 1977 to ____________, 1978.

Table 24 (continued)

LOCALIZATION	SAMPLE	DATE 1977	ANABAENA (blue green)	ANACYSTIS (blue green)	OSCIALTORIA (blue green)	NODULARIA (blue green)	ACTINASTRUM (green algae)	ANKISTRODESMUS (green algae)	CHLORELLA (green)	CLOSTERIUM (green)	CHLOROCOCCUM (green)	MICRASTERIAS (green)	PEDIASTRUM (green)	SCENEDESMUS (green)	STAURASTRUM (green)	SPHAEROCYSTIS (green)	TETRAEDRON (green)	ASTERIONELLA (diatom)	COCCONEIS (diatom)	(INCLUDES NEXT PAGE) TOTAL/ M L
			ORGANISMS/ ML																	
Dam	A 1	Sept 10	3.22	6.44	0.0	0.0	3.22	2.69	5.37	0.0	2.15	0.0	3.76	2.15	0.0	0.0	4.30	2.15	0.0	208.36
Dam	A 2	Sept 10	2.68	3.76	0.0	0.0	0.0	0.0	2.68	1.07	0.0	0.0	1.61	2.68	6.44	0.0	5.37	4.30	0.0	176.67
Dam	A 3	Sept 10	3.22	4.83	2.15	0.0	0.0	0.0	3.22	0.0	0.0	0.0	1.61	0.0	0.0	1.07	7.52	0.0	0.0	170.23
Stream East	B 1	Sept 10	4.30	0.0	0.0	0.0	0.0	0.0	5.37	0.0	0.0	0.0	1.61	0.0	0.0	0.0	5.91	1.07	0.0	186.34
Stream East	B 2	Sept 10	0.0	3.76	0.0	2.15	0.0	0.0	4.30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.76	1.61	0.0	171.84
Stream East	B 3	Sept 10	0.0	2.68	2.15	0.0	0.0	0.0	2.68	0.0	0.0	0.0	2.68	0.0	0.0	0.0	5.37	2.15	0.0	173.45
Entrance Vivf River	C 1	Sept 10	0.0	3.76	0.0	0.0	0.0	2.15	1.07	0.0	0.0	0.0	0.54	2.68	0.0	0.0	2.68	1.07	0.0	47.79
Entrance Vivf River	C 2	Sept 10	0.0	4.30	0.0	0.0	0.0	0.0	1.07	0.0	0.0	0.0	0.54	2.15	0.0	0.0	3.22	2.15	0.0	41.35
Entrance Vivf River	C 3	Sept 10	1.07	2.69	1.07	0.0	0.0	1.61	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.37	1.61	0.54	46.72
Entrance Jayuya River	D 1	Sept 10	1.61	1.07	0.0	0.0	0.0	0.0	2.15	0.0	0.0	0.0	0.0	0.54	0.0	0.0	4.30	0.0	0.0	83.24
Entrance Jayuya River	D 2	Sept 10	2.15	1.07	0.0	0.0	0.0	0.0	2.15	0.0	0.0	0.0	0.0	1.07	0.0	0.0	3.22	0.0	0.0	68.74
Entrance Jayuya River	D 3	Sept 10	0.0	1.61	0.0	0.0	1.61	4.30	2.68	0.0	0.0	1.07	0.0	1.61	2.15	0.0	9.67	4.30	0.0	92.90
Center Lake	E 1	Sept 10	0.0	0.54	2.15	0.0	0.0	2.69	1.61	0.0	0.0	0.0	0.54	3.22	4.30	0.0	8.06	0.0	0.0	111.16
Center Lake	E 2	Sept 10	3.76	2.68	3.22	0.0	0.0	3.76	1.61	0.0	0.0	0.0	0.0	3.22	6.44	0.0	4.83	2.15	0.0	126.73
Center Lake	E 3	Sept 10	2.15	3.22	3.76	0.0	0.0	0.0	2.15	0.0	0.0	0.0	1.07	1.61	4.30	0.0	5.37	2.15	0.0	107.94

ALGAE DATA SUMMARY FOR LAKE Caonillas IN Utuado, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM September 1977 to ______, 1978.

Table 24 (continued)

LOCALIZATION	SAMPLE	DATE	ORGANISMS/ ML																
			FRAGILARIA (diatom)	GOMPHONEMA (diatom)	NAVICULA (diatom)	NITZCHIA (diatom)	STEPHANODISCUS (diatom)	SYNEDRA (diatom)	TABELLARIA (diatom)	CHRYSOCOCCUS (flagellate)	MALLOMONAS (flagellate)	PHACOTUS (flagellate)	PHYROBOTRYS (flagellate)							(CONTINUATION OF PREVIOUS PAGE) TOTAL/ M L
Dam	A 1	Sept 10	59.07	0.0	0.0	0.0	0.0	79.48	32.22	0.0	2.15	0.0	0.0							
Dam	A 2	Sept 10	31.15	0.0	0.0	0.0	0.0	92.36	0.0	0.54	1.07	0.0	0.0							
Dam	A 3	Sept 10	36.52	1.07	0.0	0.0	0.0	83.24	35.98	0.0	0.54	0.0	0.0							
Stream East	B 1	Sept 10	41.35	1.61	0.0	0.0	0.0	78.94	44.57	0.0	1.61	0.0	0.0							
Stream East	B 2	Sept 10	23.63	1.61	0.0	0.0	0.0	90.75	35.44	0.0	3.22	0.0	1.61							
Stream East	B 3	Sept 10	33.29	2.15	1.61	0.0	1.07	68.74	45.11	0.0	3.76	0.0	0.0							
Entrance Viví River	C 1	Sept 10	2.68	0.0	0.0	0.0	0.0	20.94	4.30	0.0	5.91	0.0	0.0							
Entrance Viví River	C 2	Sept 10	2.69	1.07	0.0	0.0	0.0	15.04	3.76	0.0	5.37	0.0	0.0							
Entrance Viví River	C 3	Sept 10	0.0	1.07	0.0	1.07	0.0	20.41	2.69	0.0	7.52	0.0	0.0							
Entrance Jayuya River	D 1	Sept 10	8.59	0.54	0.0	0.0	0.0	43.50	18.80	0.0	2.15	0.0	0.0							
Entrance Jayuya River	D 2	Sept 10	8.06	1.61	0.0	0.0	0.0	32.76	15.04	0.0	1.61	0.0	0.0							
Entrance Jayuya River	D 3	Sept 10	9.67	0.0	0.0	0.0	0.0	29.00	15.04	1.61	3.05	0.54	0.0							
Center Lake	E 1	Sept 10	17.18	1.07	0.0	0.0	0.0	52.09	10.20	1.07	6.44	0.0	0.0							
Center Lake	E 2	Sept 10	15.04	0.0	0.0	0.0	0.0	55.85	16.65	1.07	6.44	0.0	0.0							
Center Lake	E 3	Sept 10	9.67	2.69	0.0	0.0	0.0	50.48	13.96	0.0	5.37	0.0	0.0							

ALGAE DATA SUMMARY FOR LAKE Caonillas IN Utuado, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM 1977 to January, 1978.

Table 24 (continued)

			ORGANISMS/ ML																
LOCALIZATION	SAMPLE	DATE 1978	ANABAENA (blue green)	ANACYSTIS (blue green)	GOMPHOSPHAERIA (blue green)	NODULARIA (blue green)	OSCILATORIA (blue green)	ACTINASTRUM (green)	ANKISTRODESMUS (green)	CHLORELLA (green)	PEDIASTRUM (green)	SCENEDESMUS (green)	SPHAEROCYSTIS (green)	TETRAEDRON (green)	ACHNANTHES (diatom)	ASTERIONELLA (diatom)	CYCLOTELLA (diatom)	DIATOMEA (diatom)	FRAGILARIA (diatom)	TOTAL/ M L
Dam	A 1	Jan 9	4.30	5.37	0.0	0.0	0.0	2.15	1.61	4.30	2.68	3.22	0.0	5.37	0.0	3.22	0.0	0.0	15.04	71.42
Dam	A 2	Jan 9	2.15	7.52	0.0	0.0	0.0	0.0	1.07	2.15	1.61	0.0	0.0	6.44	0.0	3.22	0.0	1.07	12.89	64.44
Dam	A 3	Jan 9	1.61	1.07	0.0	0.0	2.15	0.0	0.0	2.15	1.61	0.0	2.15	6.44	0.0	0.0	0.0	0.0	0.0	35.98
Stream East	B 1	Jan 9	3.22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.30	2.15	2.15	0.0	0.0	0.0	44.03
Stream East	B 2	Jan 9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.61	2.15	0.0	0.54	0.54	0.0	43.50
Stream East	B 3	Jan 9	4.83	1.61	0.0	0.54	0.0	1.07	0.0	0.0	0.0	0.0	0.0	3.22	3.22	0.0	0.0	0.54	0.0	42.95
Vivi River	C 1	Jan 9	2.68	1.61	1.61	0.54	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.30	3.22	0.0	0.0	0.0	0.0	30.07
Vivi River	C 2	Jan 9	3.22	0.0	0.0	1. 07	0.0	0.0	0.0	1.07	0.0	0.0	0.0	5.37	1.61	0.0	0.0	0.0	0.0	27.92
Vivi River	C 3	Jan 9	2.15	1.07	0.0	0.54	0.0	0.0	0.0	1.61	0.0	0.0	0.0	2.15	2.15	0.0	0.0	0.0	0.0	26.85
Jayuya River	D 1	Jan 9	10.20	1.61	1.07	1.07	0.0	0.0	0.0	2.15	0.0	0.0	0.0	0.0	1.61	0.0	0.0	0.0	0.0	39.74
Jayuya River	D 2	Jan 9	3.22	2.15	0.0	1.07	0.0	0.0	0.0	1.61	0.0	0.0	0.0	2.15	0.0	0.0	0.0	0.0	0.0	28.46
Jayuya River	D 3	Jan 9	2.15	1.61	0.0	0.0	0.0	0.0	0.0	1.07	0.0	0.0	0.0	3.22	0.0	0.0	0.0	0.0	0.0	29.00

ALGAE DATA SUMMARY FOR LAKE Caonillas IN Utuado, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

Table 24 (continued)

FROM ____________ 1977 to January, 1978.

LOCALIZATION	SAMPLE	DATE 1978	GOMPHONEMA (diatom)	NAVICULA (diatom)	NITZSCHIA (diatom)	STAURONEIS (diatom)	STEPHANODISCUS (diatom)	SYNEDRA (diatom)	TABELLARIA (diatom)	CHRYSOCOCCUS (flagellate)	MALLOMONAS (flagellate)	TOTAL/ ML
			ORGANISMS/ ML									
Dam	A 1	Jan 9	0.0	0.0	0.0	0.0	0.0	12.89	9.67	0.0	1.61	
Dam	A 2	Jan 9	0.0	0.0	0.0	0.0	0.0	15.04	10.74	0.0	0.54	
Dam	A 3	Jan 9	2.15	0.0	0.0	0.0	0.0	16.11	0.0	0.0	0.54	
Stream East	B 1	Jan 9	2.15	2.15	2.15	0.0	6.44	11.28	6.44	1.61	0.0	
Stream East	B 2	Jan 9	3.22	0.54	0.0	0.0	9.67	20.41	4.30	0.54	0.0	
Stream East	B 3	Jan 9	2.15	0.0	0.0	0.0	2.15	22.55	0.0	1.07	0.0	
Vivi River	C 1	Jan 9	2.15	0.0	0.0	0.0	0.0	12.89	0.0	1.07	0.0	
Vivi River	C 2	Jan 9	2.15	0.0	0.0	0.0	1.61	10.74	0.0	0.54	0.54	
Vivi River	C 3	Jan 9	1.61	0.0	0.0	0.0	2.15	12.89	0.0	0.54	0.0	
Jayuya River	D 1	Jan 9	0.54	0.0	0.0	0.54	2.15	17.18	0.0	1.61	0.0	
Jayuya River	D 2	Jan 9	1.07	0.0	0.0	0.54	1.61	13.96	0.0	1.07	0.0	
Jayuya River	D 3	Jan 9	1.07	0.0	1.61	0.54	2.15	15.04	0.0	0.54	0.0	

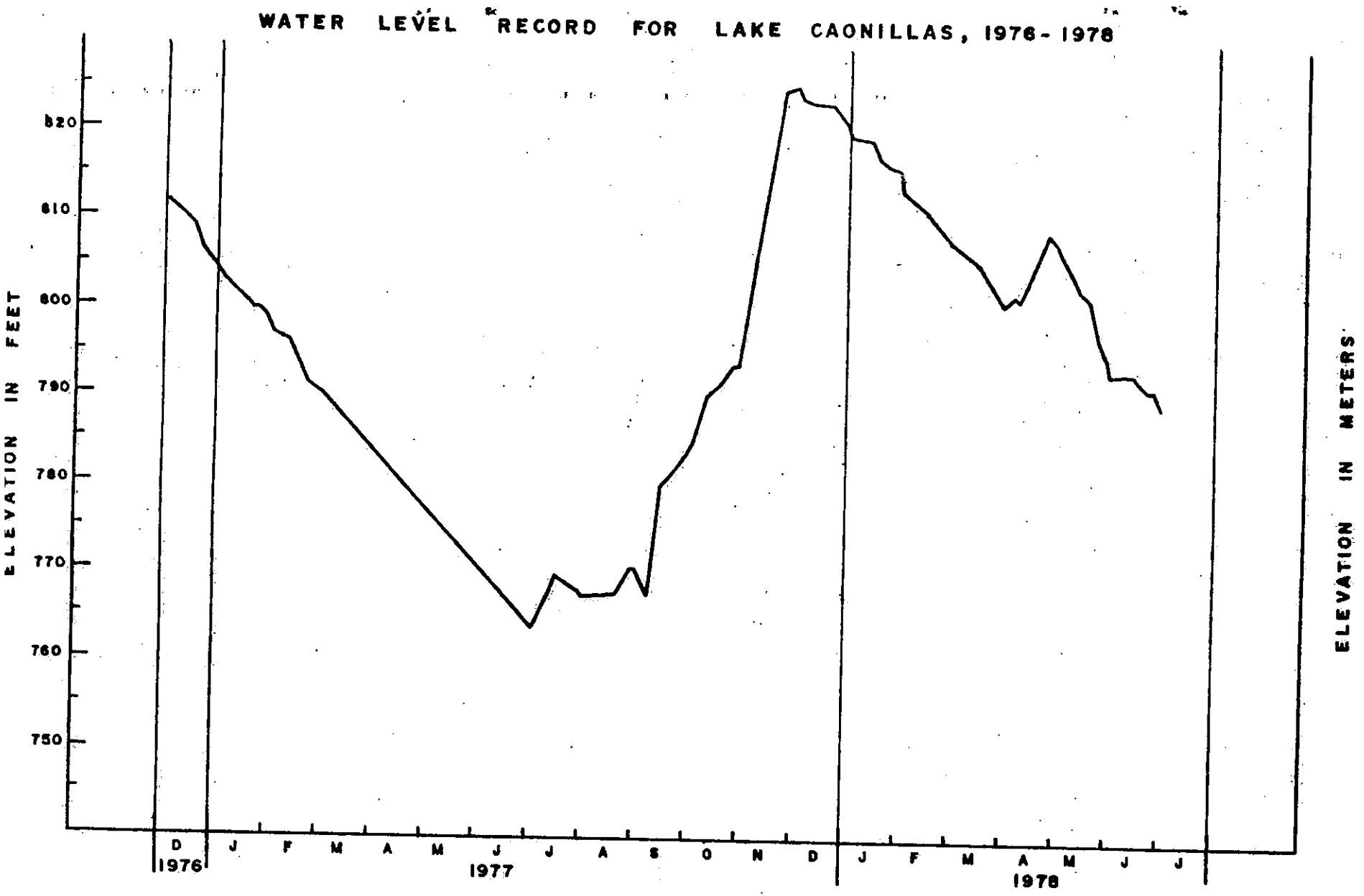
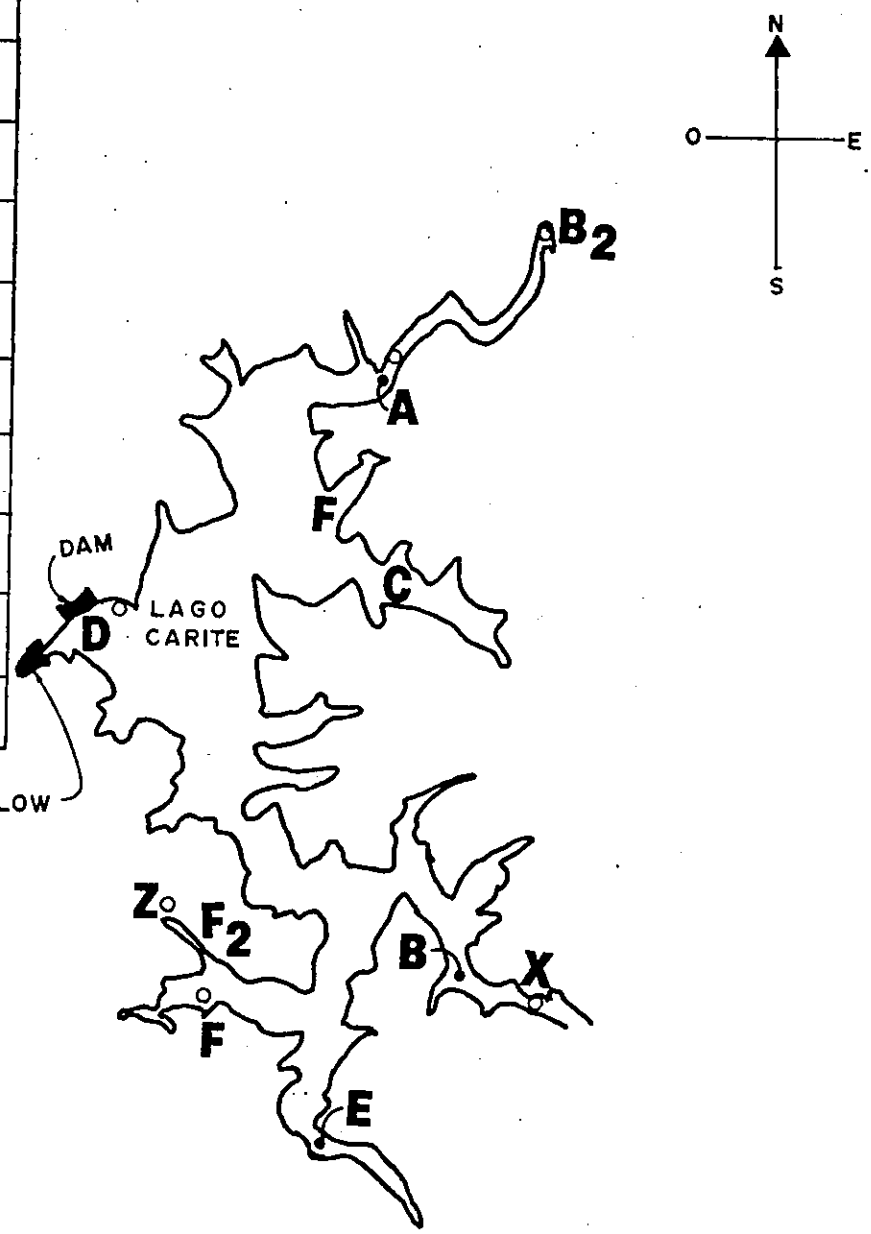

WATER LEVEL RECORD FOR LAKE CAONILLAS, 1976-1978
ELEVATION IN FEET
820
810
800
790
780
770
760
750
ELEVATION IN METERS
D
J
F
M
A
M
J
J
A
S
O
N
D
J
F
M
A
M
J
J
1976
1977
1978

Figure 16

TOTAL COLIFORMS PER 100 ML WATER

STATION	D 16	E 17	C 18
A	362	420	180
B	391	250	280
B_2	—	580	70
E	458	140	160
X	—	100	—
C	210	540	50
F.	301	310	180
F_2	—	—	120
Z	—	—	320



CARITE RESERVOIR

TOTAL COLIFORM STUDY DECEMBER 1975

Figure 17

CHEMICAL QUALITY DATA SUMMARY FOR LAKE Carite IN Guayama, PUERTO RICO

FROM November 1977 TO May 1978. SAMPLES ARE FROM 0.5 M DEPTH

Table 25

Station and Localization	Date 1977	Time	Sample No.	Lab. No.	Chloride mg/l	Hardness as $MgSO_4$ Mg/l	Total Phosphates as P mg/l	Nitrate & Nitrite as N mg/l	Iron mg/l	Turbidity in Standard Unit	Color in Standard Unit	pH	Dissolved Oxygen mg/l	Chlorophyll A mg/l	Total Coliform count	Sample Size ml
A	19 Nov		CE-44	411	5.9	44.4	0.01	0.08	0.20	2.7	8	7.4	6.8			
B	19 Nov		CE-49	412	7.8	50.0	0.01	0.05	0.10	2.8	10	7.1	6.8			
E	19 Nov		CE-39	413	3.9	38.9	0.01	0.05	0.30	4.1	10	7.3	7.0			
F	19 Nov		CE-34	414	5.9	44.4	0.01	0.02	0.40	3.2	10	7.3	5.8			
A	4 May	9:50	CE-65	510	8.8	19.4	0.01	0.00	0.20		10	7.1	---			
C	4 May	10:45	CE-74	511	9.8	12.9	0.01	0.00	0.04		10	7.2	7.4			
D	4 May	10:05	CE-70	512	9.8	12.9	0.01	0.00	0.03		10	6.9	7.7			
E	4 May	9:30	CE-60	513	9.8	12.8	0.03	0.02	0.04		10	7.1	7.2			

TABLE 26

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Carite

PARAMETER Chloride

UNITS Mg/1

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1 19/11/77	23.5	4	5.87	0.99
2 4/5/77	38.2	4	9.55	0.38
3				
4				
5				
6				
7				
8				
9				
10				
TOTALS	61.7	8	7.71	
B-VARIATION BY STATION				
A	14.7	2	7.35	1.45
B	7.8	1	7.80	0.00
C	9.8	1	9.80	0.00
D	9.8	1	9.80	0.00
E	13.7	2	6.85	2.95
F	5.9	1	5.90	0.00
G				
H				
TOTALS	61.7	8	7.71	

TABLE 27

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Carite

PARAMETER Hardness

UNITS mg/1 of Mg SO4

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	177.7	4	44.42	2.80
2	58.0	4	14.50	2.45
3				
4				
5				
6				
7				
8				
9				
10				
TOTALS	235.7	8	29.46	
B-VARIATION BY STATION				
A	63.8	2	31.90	12.50
B	50.0	1	50.00	0.00
C	12.9	1	12.90	0.00
D	12.9	1	12.90	0.00
E	51.7	2	25.85	13.05
F	44.4	1	44.40	0.00
G				
H				
TOTALS	235.7	8	29.46	

TABLE 28

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM

LAKE Carite

PARAMETER Phosphates

UNITS Mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	0.04	4	0.01	0.00
2	0.06	4	0.02	0.01
3				
4				
5				
6				
7				
8				
9				
10				
TOTALS	0.10	8	0.01	
B-VARIATION BY STATION				
A	0.02	2	0.01	0.00
B	0.01	1	0.01	0.00
C	0.01	1	0.01	0.00
D	0.01	1	0.01	0.00
E	0.04	2	0.02	0.01
F	0.01	1	0.01	0.00
G				
H				
TOTALS	0.10	8	0.01	

TABLE 29

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Carite

PARAMETER Nitrate

UNITS Mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	0.20	4	0.05	0.02
2	0.02	4	0.00	0.00
3				
4				
5				
6				
7				
8				
9				
10				
TOTALS	0.22	8	0.03	
B-VARIATION BY STATION				
A	0.08	2	0.04	0.04
B	0.05	1	0.05	0.00
C	0.00	1	0.00	0.00
D	0.00	1	0.00	0.00
E	0.07	2	0.04	0.02
F	0.02	1	0.02	0.00
G				
H				
TOTALS	0.22	8	0.03	

TABLE 30

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Carite

PARAMETER Iron

UNITS mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	1.00	4	0.25	0.10
2	0.31	4	0.08	0.06
3				
4				
5				
6				
7				
8				
9				
10				
TOTALS	1.31	8	0.16	
B-VARIATION BY STATION				
A	0.40	2	0.20	0.00
B	0.10	1	0.10	0.00
C	0.04	1	0.04	0.00
D	0.03	1	0.03	0.00
E	0.34	2	0.17	0.14
F	0.40	1	0.40	0.00
G				
H				
TOTALS	1.31	8	0.16	

TABLE 31

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM

LAKE Carite

PARAMETER Turbidity

UNITS Standard Unit

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	12.8	4	3.20	0.45
2				
3				
4				
5				
6				
7				
8				
9				
10				
TOTALS	12.8	4	3.2	
B-VARIATION BY STATION				
A	2.7	1	2.70	0.00
B	2.8	1	2.80	0.00
C				
D				
E	4.1	1	4.10	0.00
F	3.2	1	3.20	0.00
G				
H				
TOTALS	12.8	4	3.20	

TABLE 32

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Carite

PARAMETER Color

UNITS Standard Unit

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	38.0	4	9.50	0.75
2	40.0	4	10.00	0.00
3				
4				
5				
6				
7				
8				
9				
10				
TOTALS	78.0	8	9.75	
B-VARIATION BY STATION				
A	18.0	2	9.00	1.00
B	10.0	1	10.00	0.00
C	10.0	1	10.00	0.00
D	10.0	1	10.00	0.00
E	20.0	2	10.00	0.00
F	10.0	1	10.00	0.00
G				
H				
TOTALS	78.0	8	9.75	

TABLE 33

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Carite

PARAMETER P. H.

UNITS

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	29.1	4	7.28	0.08
2	28.3	4	7.08	0.08
3				
4				
5				
6				
7				
8				
9				
10				
TOTALS	57.4	8	7.18	
B-VARIATION BY STATION				
A	14.5	2	7.25	0.15
B	7.1	1	7.10	0.00
C	7.2	1	7.20	0.00
D	6.9	1	6.90	0.00
E	14.4	2	7.20	0.10
F	7.3	1	7.30	0.00
G				
H				
TOTALS	57.4	8	7.18	

TABLE 34

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Carite

PARAMETER Dissolved Oxygen

UNITS mg/1

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	26.4	4	6.60	0.40
2	22.3	3	7.43	0.18
3				
4				
5				
6				
7				
8				
9				
10				
TOTALS	48.7	7	6.96	
B-VARIATION BY STATION				
A	6.8	1	6.80	0.00
B	6.8	1	6.80	0.00
C	7.4	1	7.40	0.00
D	7.7	1	7.70	0.00
E	14.2	2	7.10	0.10
F	5.8	1	5.80	0.00
G				
H				
TOTALS	48.7	7	6.96	

Table 35

Summary of Snail Surveys in Lake Carite

Date	Inspector	Snails Found
Dec. 16/75	W. Jobin & A. Laracuente	*Biomphalaria glabrata* *Marisa cornuarietis* *Pomacea australis* *Tarebia granifera*
Nov. 18/77	W. Jobin	*Marisa cornuarietis* *Tarebia granifera*
May 3/78	W. Jobin	*Biomphalaria glabrata* *Marisa cornuarietis* *Tarebia granifera* *Pomacea australis*
Aug. 8/78	A. Laracuente	*Tarebia granifera* *Marisa cornuarietis* *Physa cubensis*

Table 36

SUMMARY OF COLIFORM DATA OF LAKE Carite IN Guayama, P.R.

FROM December 1975 TO May 1978.

STATION	DATE	FIELD NUM.	VOL. ml	COLONIES	COLONIES/ 100 ml
F	8/11/77	CE-11	0.1	5	5,000
F	8/11/77	CE-11	1.0	64	6,400
F	8/11/77	CE-11	10	TNTC	
E	8/11/77	CE-17	0.1	2	2,000
E	8/11/77	CE-17	1.0	25	2,500
E	8/11/77	CE-17	10	TNTC	
A	8/11/77	CE-23	0.1	1	1,000
A	8/11/77	CE-23	10	8	80
A	8/11/77	CE-23	10	65	650
B	8/11/77	CE-29	0.1	8	8,000
B	8/11/77	CE-29	1.0	54	5,400
	8/11/77	CE-29	10	TNTC	
E	1/5/78	CA-2	1	0	0
E	1/5/78	CA-2	10	8	80
A	1/5/78	CA-4	1	0	0
A	1/5/78	CA-4	10	24	240
C	1/5/78	CA-6	1	2	200
C	1/5/78	CA-6	10	18	180
D	1/5/78	CA-8	1	1	100
D	1/5/78	CA-8	10	6	60
E	2/5/78	CA-14	1	2	200
E	2/5/78	CA-14	10	8	80
A	2/5/78	CA-20	1	11	1,100
A	2/5/78	CA-20	10	4	40
C	2/5/78	CA-26	1	1	100
C	2/5/78	CA-26	10	20	200
D	2/5/78	CA-32	1	2	200
D	2/5/78	CA-32	10	5	50
E	4/5/78	CA-52	1	0	0
E	4/5/78	CA-52	10	6	60
A	4/5/78	CA-54	1	1	100
A	4/5/78	CA-54	10	1	10
C	4/5/78	CA-53	1	5	500
C	4/5/78	CA-53	10	14	140

Table 36 (continued)

SUMMARY OF COLIFORM DATA OF LAKE Carite IN Guayama, P.R.

FROM December 1975 TO May 1978.

STATION	DATE	FIELD NUM.	VOL. ml	COLONIES	COLONIES/ 100 ml
D	4/5/78	CA-51	1	0	0
D	4/5/78	CA-51	10	5	50
D	4/5/78	CA-51	1	0	0
D	4/5/78	CA-51	10	3	30
A Near Dam	12/18/75				180
A	12/16/75				280
A	12/16/75				480
A	12/17/75				420
B In lake near La Plata River	12/18/75				280
B	12/16/75				560
B	12/16/75				220
B	12/17/75				250
B_2 Up tream in La Plata River	12/18/75				70
B_2	12/17/75				580
E Across from Bont. Landing	12/18/75				160
E	12/16/75				250
E	12/16/75				660
E	12/17/75				140
F_1 In lake near housing	12/18/75				180
F_1	12/18/75				380
F_1	12/16/75				220
F_1	12/16/75				310
C in South Branch Near School	12/18/75				50
C	12/16/75				210
C	12/17/75				540
X in South East Branch	12/17/75				100
Z In Stram Above Sewage Plant	12/18/75				320
F_2 In lake just below Sewage Plant	12/18/75				120

OXYGEN DATA SUMMARY FOR LAKE Carite IN Guayama, PUERTO RICO

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM November 1977 TO May 1977, 1978.

Table 37

Station	Date 1977	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
C	18 Nov	7:40	23	1,	7.2	---	---	---	---	1.5		--
C	19 Nov	----	--	--------	---	---	---	---	---	---		--
F	18 Nov.	8:00	23	2, 7-10	7.0	6.6	6.1	0.5	0.9	1.7		19
F	19 Nov	9:15	24	6, 30-33	4.7	5.5	4.5	1.0	0.2	1.5		25
E	18 Nov	8:00	23	3, 14-16	7.6	6.9	6.8	0.1	0.8	1.9		23
E	19 Nov	9:25	23	12, 35-38	6.4	6.6	5.9	0.7	0.5	1.5		25
A	18 Nov	8:20	23	4, 19-21	7.6	7.3	7.0	0.3	0.6	1.7		19
A	19 Nov	9:35	24	18, 40-43	5.9	6.4	5.2	1.2	0.7	1.7		25
B	18 Nov	8:45	23	5, 25-28	7.3	7.2	6.7	0.5	0.6	1.5		19
B	19 Nov	10:05	26	24, 45-48	6.2	6.8	5.6	1.2	0.6	1.8		23
E	2 May	10:00	22	1, 10-13	8.0	6.9	6.8	0.1	1.2	1.6		20
E	3 May	10:06	22	9,	6.5	7.6	6.2	1.4	0.3	1.3		24
E	4 May	9:30	21.5	------	7.0	7.1	6.5	0.6	0.5	1.5		23
B	2 May	10:20	21.5	3, 16-19	8.4	7.3	6.8	0.5	1.6	1.6		20
B	3 May	10:25	22	15,	6.8	7.6*	6.4	0.9	0.4	1.2		24
B	4 May	9:50	21.5	--- -	7 0	7.5	6.6	0.9	0.4	1.2		23
C	2 May	10:40	22	5, 22-25	7.7	7.5	7.2	0.3	0.5	1.8		20
C	3 May	11:15	22	21,	7.0	7.9	7.2	0.7	-0.2	1.8		24

OXYGEN DATA SUMMARY FOR LAKE Carite IN Guayama, PUERTO RICO
ALL SAMPLES TAKEN AT 0.5 M DEPTH
FROM November 1977 TO May 1977, 1978.

Table 37 (continued)

Page 2 of 3

Station	Date 1977	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
C	4 May	10:45	22	-----	7.4	7.4	7.0	0.4	0.4	1.8		23
D	2 May	11:00	22	1, 28-31	7.8	7.8	7.0	0.8	0.8	1.8		20
D	3 May	10:45	22	27,	7.5	7.9	7.0	0.9	0.5	1.5		24
D	4 May	10:05	22	-----	7.7	7.6	7.1	0.5	0.6	1.5		23
	1975											
A Near Dam	15 Dic				6.4	6.6	6.0	0.6	0.4			
A	16 Dic				6.6	7.0	6.2	0.8	0.4			
A	17 Dic				6.1	6.5	5.6	0.9	0.5			
A	18 Dic				6.7	6.5	5.8	0.7	0.9			
B Near La Plata River entrance	15 Dic				6.5	6.7	6.1	0.6	0.4			
B	16 Dic				6.8	7.0	6.5	0.5	0.3			
B	17 Dic				6.2	6.9	6.0	0.9	0.2			
E South Branch Near School	15 Dic				7.6	7.4	7.0	0.4	0.6			
E	16 Dic				7.0	8.5	6.6	1.9	0.4			
E	17 Dic				7.0	7.0	5.8	1.2	1.2			
F In Lake Near Housing	15 Dic				7.2	7.6	7.3	0.3	-0.1			
F	16 Dic				7.4	8.2	7.2	1.0	0.2			
F	17 Dic				7.0	7.5	6.4	1.1	0.6			
E South Branch Near School	15 Dic				6.6	7.5	7.0	0.5	-0.4			

OXYGEN DATA SUMMARY FOR LAKE Carite IN Guayama, PUERTO RICO

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM November 197_7 TO May 1977, 1978.

Table 37 (continued)

Page 3 of 3

Station	Date	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
E	17 Dic				7.4	7.7	7.1	0.6	0.3			
E	18 Dic				6.8	7.3	6.4	0.9	0.4			

ALGAE DATA SUMMARY FOR LAKE Carite IN Cayey, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM _____ 1977 to May, 1978.

Table 38

LOCALIZATION	SAMPLE	DATE 1978	ORGANISMS/ ML																		TOTAL/ M L
			ANACYSTIS (blue green)	COMPHOSPHAERIA (blue green)	CHLORELLA (green)	SPHAEROCYSTIS (green)	STAURASTRUM (green)	ACHNANTHES (diatom)	CYCLOTELLA (diatom)	DIATOMEA (diatom)	NAVICULA (diatom)	STEPHANODISCUS (diatom)	SYNEDRA (diatom)	CHRYSOCOCCUS (flagellate)	MALLOMONAS (flagellate)	PERIDINIUM (flagellate)					
Lake Carite	A 1	May 4	1.07	1.07	1.07	0.0	1.61	1.07	0.0	0.0	0.0	6.98	0.0	1.07	0.0	0.0					13.96
Lake Carite	A 2	May 4	1.61	2.69	2.69	0.0	1.61	0.54	0.0	0.0	0.0	5.37	0.0	5.91	0.0	0.0					20.41
Lake Carite	A 3	May 4	1.07	2.15	1.61	0.0	1.61	0.54	0.0	0.0	0.0	8.06	0.0	1.07	0.0	0.0					16.11
Lake Carite	C 1	May 4	1.07	0.54	1.07	0.0	1.61	0.0	0.0	0.0	0.0	8.05	0.0	1.07	0.54	1.61					15.57
Lake Carite	C 2	May 4	2.15	2.69	2.69	0.0	0.0	0.0	1.07	0.0	0.0	9.67	0.0	1.61	1.07	1.07					22.02
Lake Carite	C 3	May 4	1.61	2.15	1.61	0.0	0.0	0.0	1.07	0.0	0.0	7.52	0.0	1.07	1.07	0.0					16.11
Lake Carite	D 1	May 4	1.07	3.22	1.61	0.0	0.0	0.0	0.0	0.0	0.0	8.59	0.0	0.54	1.61	1.61					18.26
Lake Carite	D 2	May 4	3.22	3.22	2.15	0.0	1.07	0.0	0.0	1.07	0.0	9.13	0.0	1.07	0.54	0.54					22.02
Lake Carite	D 3	May 4	1.61	0.0	1.61	0.54	0.54	0.0	0.0	0.0	0.0	5.37	0.0	1.61	1.07	0.0					12.35
Lake Carite	E 1	May 4	2.15	0.0	1.61	0.0	0.0	0.0	0.0	1.61	0.0	8.59	1.61	1.07	0.0	1.07					17.72
Lake Carite	E 2	May 4	2.69	1.61	2.69	0.0	0.0	0.0	0.0	1.07	0.54	8.05	0.0	0.0	0.0	1.07					17.72
Lake Carite	E 3	May 4	1.61	3.22	2.15	0.0	0.0	0.0	0.0	0.54	2.15	5.37	0.54	1.61	0.54	0.0					17.72

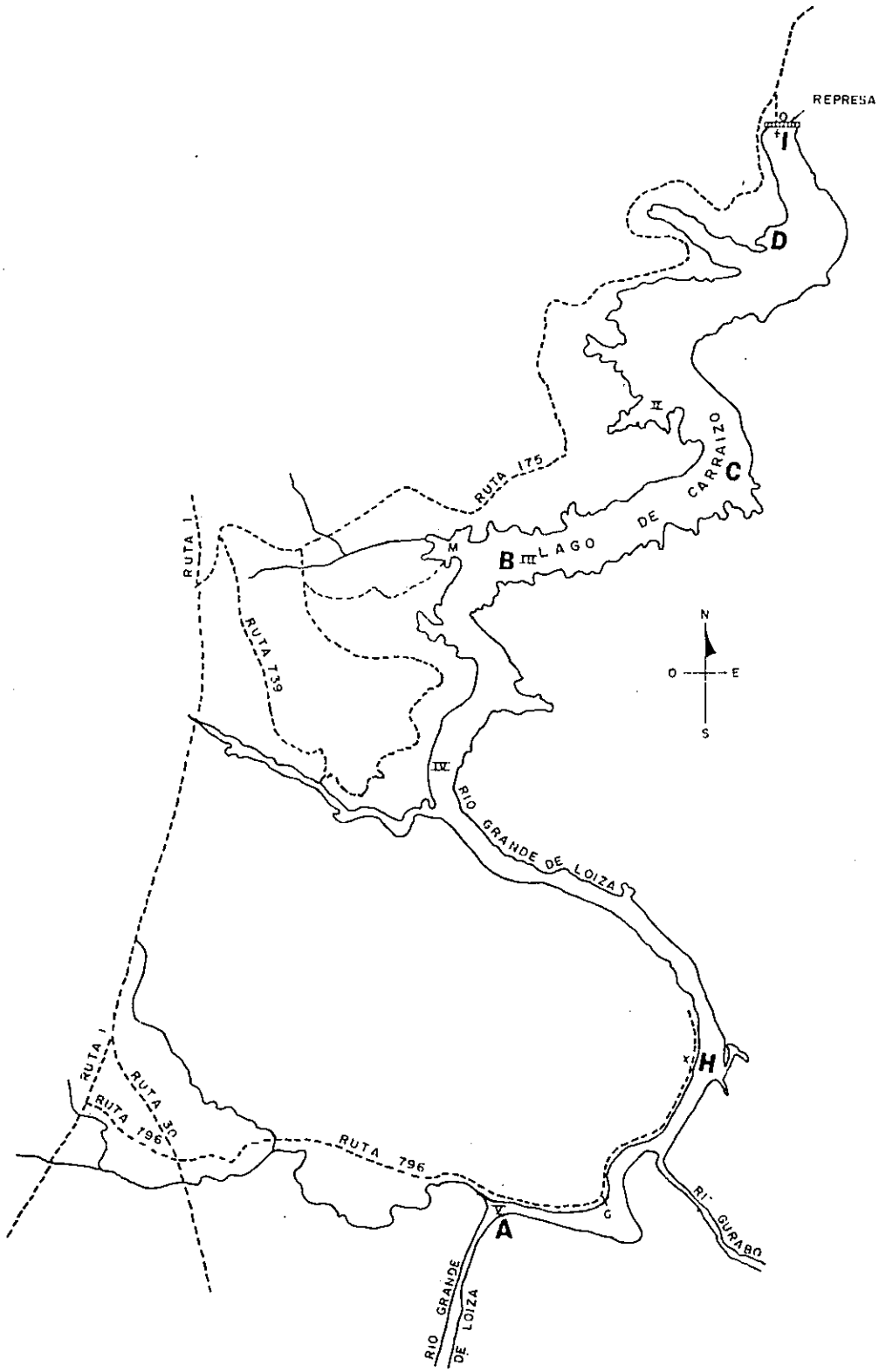

REPRESA
I
D
II
C
LAGO DE CARRAIZO
B
III
M
RUTA 175
RUTA I
RUTA 739
N
O
E
S
IV
RIO GRANDE DE LOIZA
H
RUTA I
RUTA 30
RUTA 196
RUTA 796
A
G
RIO GURABO
RIO GRANDE DE LOIZA

Figure 18

CHEMICAL QUALITY DATA SUMMARY FOR LAKE Carraizo IN Trujillo Alto, PUERTO RICO

FROM January 1977 TO April 1978. SAMPLES ARE FROM 0.5 M DEPTH

Table 39

Station and Localization	Date 1977	Time	Sample No.	Lab. No.	Chloride mg/l	Hardness as $MgSO_4$ Mg/l	Total Phosphates as P mg/l	Nitrate & Nitrite as N mg/l	Iron mg/l	Turbidity in Standard Unit	Color in Standard Unit	pH	Dissolved Oxygen mg/l	Chlorophyll A mg/l	Total Coliform count	Sample Size ml
I	1 Jan	1:05		335	17.6	117.6	0.10	0.2	0.2	2.7	20	7.6				
II	1 Jan	1:50		336	19.0	139.4	0.40	0.3	0.8	17.0	20	7.0				
III	1 Jan	2:05		337	20.2	129.4	0.7	0.2	1.1	25.0	20	7.0				
IV	1 Jan	2:25		338	16.8	114.7	0.4	0.2	1.5	29.9	15	7.1				
V	1 Jan	2:55		339	19.8	124.7	0.2	0.2	0.3	4.2	12	7.1				
Entrada Río Gde. Loiza A	26 Jan	9:30		340	17.6	131.1	0.5	0.1	1.2	22.3	30	6.9	3.1			
Middle Lake B	26 Jan	10:20		341	15.6	113.2	0.2	0.6	0.2	3.8	25	6.8	3.5			
A	19 Apr	9:00	LL-13	357	22.8	165.2	1.5	0.2	0.7	14.0	30	7.1	1.9	1.0		
B	18 Apr	11:20	LL- 4	358	20.0	165.2	0.2	0.1	0.1	5.4	20	7.1	3.6	12.0		
C	18 Apr	11:45	LL- 6	359	15.4	159.1	0.1	0.1	0.3	9.5	20	7.2	7.3	28.0		
D	19 Apr	10:25	LL-29	360	11.6	165.2	0.1	0.1	0.2	5.7	20	7.3	5.8	24.0		
A	18 Aug	9:00	LL-48	386	21.5	118.9	0.4	0.1	0.1	4.1	20	7.2	3.1	5.6		
B	18 Aug	9:55	LL-54	387	21.5	124.3	0.2	0.1	0.3	4.13	20	7.8	5.4	8.2		
C	18 Aug	10:15	LL-60	388	19.5	118.9	0.2	0.2	0.2	31.0	18	7.7	6.3	11.5		
B	1 Dec		LL-55	415	7.8	111.1	0.03	0.02	3.4	45	50	7.4	---			
A	1 Dec		LL-47	416	9.3	111.1	0.04	0.05	3.8	44	50	7.5	---			
C	1 Dec		LL-59	417	15.66	122.2	0.04	0.1	3.2	44	12	7.3	---			

CHEMICAL QUALITY DATA SUMMARY FOR LAKE Carraizo (Loiza) IN Trujillo Alto, PUERTO RICO

FROM January 1977 TO April 1978. SAMPLES ARE FROM 0.5 M DEPTH

Table 39 (continued)

Station and Localization	Date 1978	Time	Sample No.	Lab. No.	Chloride mg/l	Hardness as $MgSO_4$ Mg/l	Total Phosphates as P mg/l	Nitrate & Nitrite as N mg/l	Iron mg/l	Turbidity in Standard Unit	Color in Standard Unit	pH	Dissolved Oxygen mg/l	Chlorophyll A mg/l	Total Coliform count	Sample Size ml
Middle Lake Near Dam	21 Apr		LL-10	499	10.8	77.4	0.05	1.1	0.9		25	7.2	---			
Middle Río Gurabo	21 Apr		LL- 4	500	14.7	122.6	0.2	1.5	0.9		15	7.2	---			
Middle Río Gde. Loiza	21 Apr		LL- 1	501	16.6	135.5	0.2	1.4	1.3		20	7.3	---			
Middle Lake	21 Apr		LL- 7	502	14.7	90.2	0.1	1.2	0.8		20	7.3	---			

TABLE 40

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Carraizo

PARAMETER Chloride

UNITS Mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1 1/1/77	126.6	7	18.09	1.40
2 19/4/77	69.8	4	17.45	3.95
3 18/8/77	62.5	3	20.83	0.89
4 1/12/77	32.8	3	10.92	3.16
5 21/4/78	56.8	4	14.20	4.53
6				
7				
8				
9				
10				
TOTALS	348.5	21	16.59	
B-VARIATION BY STATION				
A	107.6	6	17.93	3.43
B	99.8	6	16.63	3.93
C	80.4	5	16.08	2.54
D	60.7	4	15.18	2.02
E				
F				
G				
H				
TOTALS	348.5	21	16.59	

TABLE 41

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Carraizo

PARAMETER Hardness

UNITS mg/1 of Mg SO4

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	870.1	7	124.30	7.83
2	654.7	4	163.68	4.00
3	362.1	3	120.70	3.60
4	344.4	3	114.80	4.93
5	425.7	4	106.43	22.63
6				
7				
8				
9				
10				
TOTALS	2,657.0	21	126.52	
B-VARIATION BY STATION				
A	786.5	6	131.10	12.35
B	733.4	6	122.23	17.45
C	617.0	5	123.4	20.68
D	520.1	4	130.03	17.58
E				
F				
G				
H				
TOTALS	2657.0	21	126.52	

TABLE 42

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Carraizo

PARAMETER Phosphates

UNITS mg/1

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	2.5	7	0.36	0.18
2	1.9	4	0.48	0.52
3	0.8	3	0.27	0.09
4	0.1	3	0.04	0.00
5	0.6	4	0.14	0.06
6				
7				
8				
9				
10				
TOTALS	5.9	21	0.28	
B-VARIATION BY STATION				
A	2.6	6	0.43	0.33
B	1.4	6	0.23	0.15
C	.8	5	.16	0.11
D	1.1	4	0.28	0.13
E				
F				
G				
H				
TOTALS	5.9	21	0.28	

TABLE 43

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Carraizo

PARAMETER Nitrate

UNITS mg/1

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	1.8	7	0.26	0.09
2	0.5	4	0.13	0.04
3	0.4	3	0.13	0.04
4	0.17	3	0.06	0.04
5	5.2	4	1.30	0.15
6				
7				
8				
9				
10				
TOTALS	8.07	21	0.38	
B-VARIATION BY STATION				
A	2.05	6	0.34	0.35
B	2.22	6	0.37	0.35
C	1.8	5	0.36	0.30
D	2.0	4	0.50	0.50
E				
F				
G				
H				
TOTALS	8.07	21	0.38	

TABLE 44

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Carraizo

PARAMETER Iron

UNITS mg/1

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	5.3	7	0.76	0.45
2	1.3	4	0.33	0.19
3	0.6	3	0.20	0.07
4	10.4	3	3.47	0.22
5	3.9	4	0.98	0.17
6				
7				
8				
9				
10				
TOTALS	21.5	21	1.02	
B-VARIATION BY STATION				
A	7.4	6	1.23	0.88
B	5.9	6	0.98	0.86
C	5.4	5	1.08	0.85
D	2.8	4	0.70	0.50
E				
F				
G				
H				
TOTALS	21.5	21	1.02	

TABLE 45

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Carraizo

PARAMETER Turbidity

UNITS Standard Unit

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	104.90	7	14.99	9.89
2	34.6	4	8.65	3.10
3	39.23	3	13.08	11.95
4	133.0	3	44.33	0.44
5				
6				
7				
8				
9				
10				
TOTALS	311.73	17	18.34	
B-VARIATION BY STATION				
A	88.6	5	17.72	12.38
B	83.33	5	16.67	14.67
C	101.5	4	25.38	12.12
D	38.3	3	12.77	11.42
E				
F				
G				
H				
TOTALS	311.73	17	18.34	

TABLE 46

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Carraizo

PARAMETER Color

UNITS Standard Unit

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	142.0	7	20.29	4.12
2	90.0	4	22.50	3.75
3	58.0	3	19.33	0.89
4	112.0	3	37.33	16.89
5	80.0	4	20.00	2.50
6				
7				
8				
9				
10				
TOTALS	482.0	21	22.95	
B-VARIATION BY STATION				
A	162.0	6	27.00	9.67
B	155.0	6	25.83	8.50
C	95.0	5	19.00	3.20
D	70.0	4	17.50	2.50
E				
F				
G				
H				
TOTALS	[illegible]	[illegible]	[illegible]	

TABLE 47

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Carraizo

PARAMETER P H

UNITS

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	49.5	7	7.07	0.17
2	28.7	4	7.18	0.08
3	22.7	3	7.57	0.24
4	22.2	3	7.40	0.67
5	29.0	4	7.25	0.05
6				
7				
8				
9				
10				
TOTALS	152.1	21	7.24	
B-VARIATION BY STATION				
A	43.1	6	7.18	0.15
B	43.4	6	7.23	0.27
C	36.4	5	7.28	0.26
D	29.2	4	7.30	0.15
E				
F				
G				
H				
TOTALS	152.1	21	7.24	

TABLE 48

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Carraizo

PARAMETER Dissolved Oxygen

UNITS mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	6.6	2	3.30	.2
2	18.6	4	4.65	1.9
3	14.8	3	4.93	1.22
4				
5				
6				
7				
8				
9				
10				
TOTALS	40.0	9	4.44	
B-VARIATION BY STATION				
A	8.1	3	2.70	0.53
B	12.5	3	4.17	0.82
C	13.6	2	6.80	0.50
D	5.8	1	5.80	0.00
E				
F				
G				
H				
TOTALS	40.0	9	4.44	

TABLE 49

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Carraizo

PARAMETER Chlorophyll A

UNITS µg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1				
2	65.0	4	16.25	9.75
3	23.3	3	8.43	2.04
4				
5				
6				
7				
8				
9				
10				
TOTALS	90.3	7	12.90	
B-VARIATION BY STATION				
A	6.6	2	3.30	2.3
B	20.2	2	10.10	1.9
C	39.5	2	19.75	8.25
D	24.0	1	24.0	0.00
E				
F				
G				
H				
TOTALS	90.3	7	12.90	

Table 50

Summary of Snail Surveys in Lake Carraizo

Date	Inspector	Snails Found
Jul. 14/76	W. Jobin	*Biomphalaria glabrata* *Marisa cornuarietis* *Tarebia granifera* *Pomacea australis*
Apr. 20/78	A. Laracuente	*Marisa cornuarietis* *Tarebia granifera* *Physa cubensis* *Pomacea australis*
Aug. 17/78	A. Laracuente	*Tarebia granifera* *Pomacea australis* *Lymnaea columella* *Marisa cornuarietis* *Physa cubensis*

Table 51

SUMMARY OF COLIFORM DATA OF LAKE Carraizo IN _____, P.R.

FROM January 1977 TO April 1978.

STATION	DATE	FIELD NUM.	VOL. ml	COLONIES	COLONIES/ 100 ml
X	21/1/77	-	1	6	600
X	21/1/77	-	10	99	990
H	21/1/77	-	1	1	100
H	21/1/77	-	10	74	740
G	21/1/77	-	1	overgrown	
G	21/1/77	-	10	overgrown	
P	21/1/77	-	1	overgrown	
P	21/1/77	-	10	overgrown	
M	21/1/77	-	1	3	300
M	21/1/77	-	10	5	50
G	25/1/77	LO-2	0.1	95	95,000
M	25/1/77	LO-4	10	3	30
X	25/1/77	LO-6	10	5	50
G	26/1/77	LO-9	0.1	392	392,000
M	26/1/77	LO-20	10	6	60
G	27/1/77	LO-21	0.01	177	1,770,000
A	15/8/77	-	-	3.8×10^4	
B	15/8/77	-	-	1.9×10^4	
C	15/8/77	-	-	2.5×10^4	
A	18/8/77	-	-	1.8×10^4	
B	18/8/77	-	-	3.3×10^4	
C	18/8/77	-	-	3×10^2	
A	28/9/77	LL-6	1	TNTC	
A	28/9/77	LL-6	.1	164	164,000
B	28/9/77	LL-2	1	TNTC	
B	28/9/77	LL-2	.1	224	224,000
C	28/9/77	LL-4	1	TNCT	
C	28/9/77	LL-4	.1	111	111,000
A	29/10/77	LL-24	.1	156	156,000
A	29/10/77	LL-24	.01	120	200,000
B	29/10/77	LL-18	.1	253	253,000
B	29/10/77	LL-18	.01	61	610,000

Table 51 (continued)

SUMMARY OF COLIFORM DATA OF LAKE Carraizo IN _____, P.R.

FROM January 1977 TO April 1978.

STATION	DATE	FIELD NUM.	VOL. ml	COLONIES	COLONIES/ 100 ml
C	29/10/77	-			
C	29/10/77	-	.01	79	7.9×10^5
A	30/10/77	LL-42	.1	253	2.53×10^5
A	30/10/77	LL-42	.01	161	1.61×10^6
B	30/10/77	LL-36	.1	112	1.12×10^5
B	30/10/77	LL-36	.01	27	2.7×10^5
C	30/10/77	LL-30	.1	165	1.65×10^5
C	30/10/77	LL-30	0	44	
	27/4/78	CA-2	0.1	74	7.4×10^4
	27/4/78	CA-2	1.0	TNTC	
	27/4/78	CA-5	0.1	135	1.35×10^5
	27/4/78	CA-5	1.0	TNTC	
	27/4/78	CA-8	0.1	15	1.5×10^4
	27/4/78	CA-8	1.0	139	13,900
	27/4/78	CA-11	0.1	2	2,000
	27/4/78	CA-11	1.0	8	800

OXYGEN DATA SUMMARY FOR LAKE Carraizo IN Trujillo Alto, PUERTO RICO
ALL SAMPLES TAKEN AT 0.5 M DEPTH
FROM January 1977 TO November, 1978.

Table 52

Page 1 of 2

Station	Date 1977	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
Entrada Río Grande de Loíza												
A	26 Jan	9:30	24.5	1,10-13	1.6	0.1	0.0	0.1	1.6	0.3		24
A	27 Jan	9:20	24.5	7,23-26	0.7	0.0	0.0	0.0	0.7	0.3		24
A	28 Jan	9:20	24.5	22,33-36	7.2	5.0	5.0	0.0	2.2	0.3		24
B Middle Lake	26 Jan	10:20	25.5	3,15-18	3.4	4.3	0.9	3.4	2.5	0.7		24
B	27 Jan	10:15	25.5	14,29-32	1.9	3.1	0.8	2.3	1.1	0.7		24
B	28 Jan	9:50	25	27,37-46	5.3	10.4	1.8	8.6	3.5	0.7		24
	1977											
A	19 Abr		-	1,9-12	1.9	0.0	0.0	0.0	1.9			
A	20 Abr	-	-	-	-	-	-	-	-	-		-
A	21 Abr	--	-	-	-	-	-	-	-	-		-
B	19 Abr		28	3,15-18	2.3	2.8	1.0	1.8	1.3	0.5		
B	20 Abr		28	19,42-45	2.7	1.7	1.0	0.7	1.7	0.6		
B	21 Abr		27	46,56-59	5.7	2.4	1.9	0.5	3.8	0.8		
D	19 Abr		27	7,23-26	9.5	8.8	6.8	2.0	2.7	0.6		
D	20 Abr		28	27,36-39	3.2	5.5	2.0	3.5	1.2	0.6		
D	21 Abr		26	40,52-55	4.7	7.4	2.6	4.8	2.1	0.8		
C	19 Abr		27	5,	6.9	-	-	-	-	0.7		
C	20 Abr		27	21,30-33	7.5	8.0	4.2	3.8	3.3	0.7		
C	21 Abr		26	34,48-51	7.6	7.0	5.4	1.6	2.2	0.7		

OXYGEN DATA SUMMARY FOR LAKE Carraizo IN Trujillo Alto, PUERTO RICO

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM January 197 7 TO November, 1978.

Table 52 (continued)

Station	Date 1977	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
A	16 Aug	8:50	28	1,7-10	4.9	3.5	1.5	2.0	3.4	0.3		21
A	17 Aug	9:25	28	11,26-29	2.5	2.0	0.6	1.4	1.9	0.4		23
A	18 Aug	9:00	28	25,43-46	1.8	0.4	0.0	0.4	1.8	0.3		24
B	16 Aug	9:40	28	3,13-16	5.6	13.7	3.6	10.1	2.0	0.8		22
B	17 Aug	10:05	28	17,32-35	5.3	13.6	2.9	10.7	2.4	0.8		24
B	18 Aug	9:55	28	31,49-52	5.3	7.5	2.9	4.6	2.4	0.8		24
C	16 Aug	10:05	28	5,19-22	5.0	4.6	3.0	1.6	2.0	0.8		24
C	17 Aug	10:30	28	23,38-41	7.9	13.8	6.0	7.8	1.9	1.9		24
C	18 Aug	10:15	28	37,55-58	6.1	8.6	4.0	4.6	2.10	0.8		24
C	29 Oct	9:10	24	5,6-9	5.8	5.0	5.2	- 0.2	0.6	0.1		23
C	30 Oct	9:00	25	15,26-29	5.9	5.5	5.2	0.3	0.7	0.2		24
C	1 Nov	8;30	25	25,43-46	4.6	4.8	4.6	0.2	0.0	0.2		23
B	29 Oct	9:30	24.5	3,14-17	6.2	5.4	5.0	0.4	1.2	0.1		23
B	30 Oct	9:20	25	13,32-35	4.6	4.6	4.6	0.0	0.0	0.2		24
B	1 Nov	8:45	25.5	31,49-52	5.0	4.4	4.5	-0.1	0.5	0.2		23
A	29 Oct	9:55	24	1,20-23	7.6	7.3	7.2	0.1	0.4	0.2		23
A	30 Oct	9:50	24	19,38-41	6.8	6.2	6.2	0.0	0.6	0.1		24
A	1 Nov	9:10	24.5	37,55-58	6.8	6.3	5.3	1.0	1.5	0.2		23

LAGO CARRAIZO (ESTACIÓN-A)
GRAFICA DE OXIGENO DISUELTO Y TEMPERATURA
DISTRIBUCIÓN VERTICAL (3 DE AGOSTO 1978)

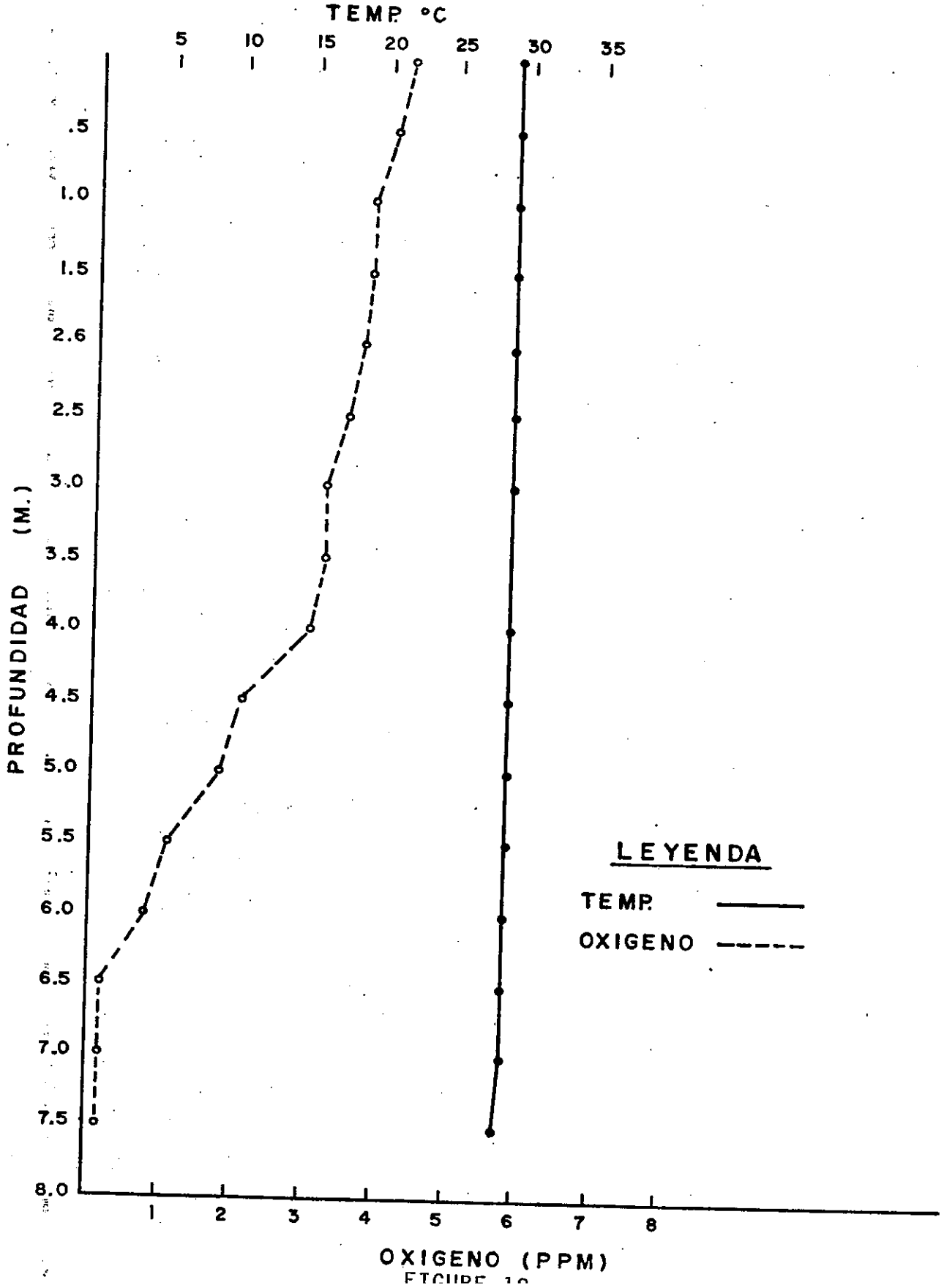


FIGURE 10

LAGO CARRAIZO (ESTACIÓN-B)
GRAFICA DE OXIGENO DISUELTO Y TEMPERATURA
DISTRIBUCIÓN VERTICAL (3 DE AGOSTO 1978)

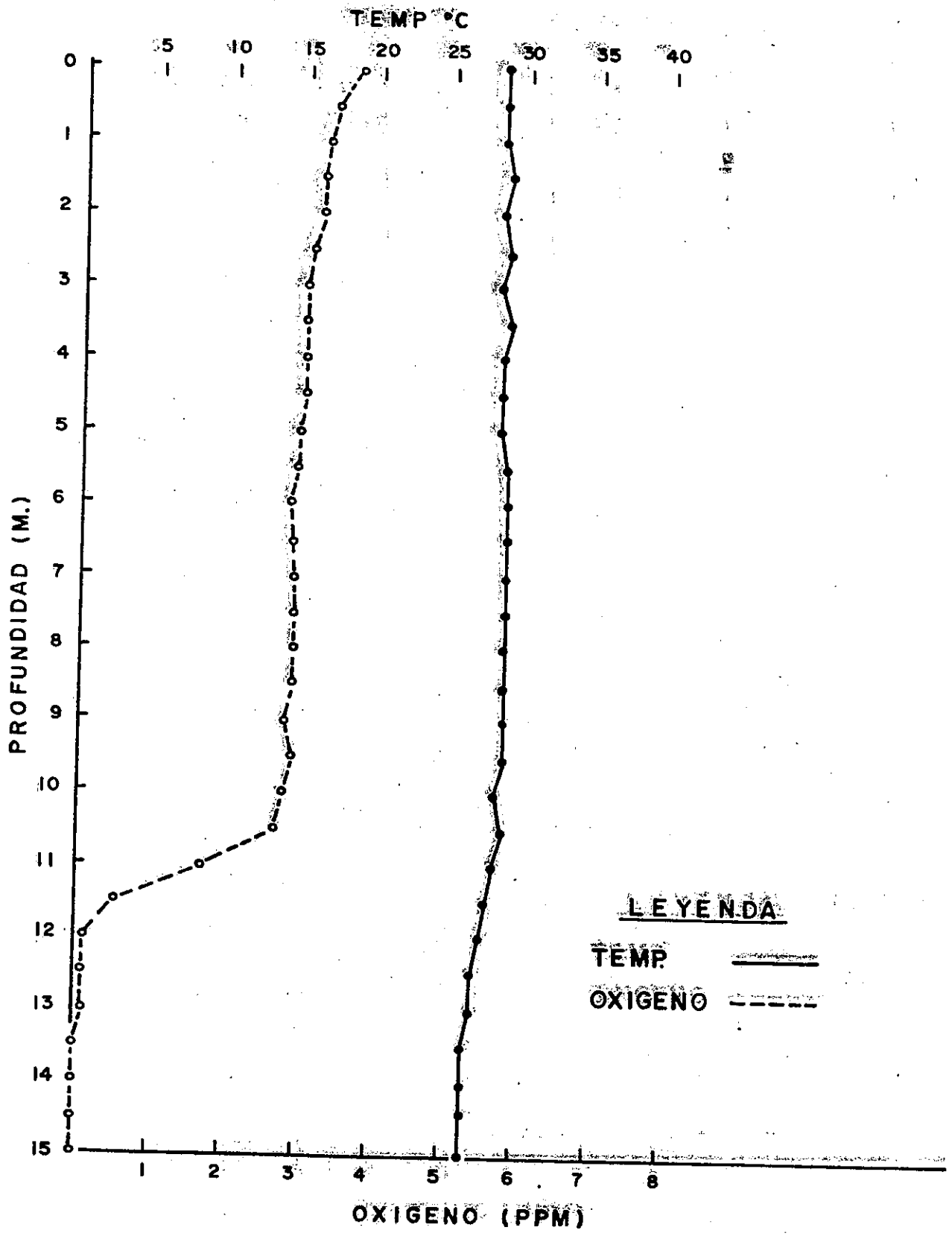


Figure 20

ALGAE DATA SUMMARY FOR LAKE Carraízo IN Trujillo Alto, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM August 1977 to ______________, 1978.

Table 53

LOCALIZATION	SAMPLE	DATE 1977	ANABAENA (blue green)	CYLINDROSPERMUM (blue green)	GOMPHOSPHAERIA (blue green)	OSCILATORIA (blue green)	ACTINASTRUM (green algae)	SCENEDESMUS (green algae)	CHLOROCOCCUM (green algae)	CHLORELLA (green algae)	FRAGILARIA (diatom)	GOMPHONEMA (diatom)	NITZCHIA (diatom)	STAURONEIS (diatom)	STEPHANODISCUS (diatom)	TOTAL/ M L
			ORGANISMS/ ML													
Entrance Río Grande de Loiza	A 1	Aug.	0.0	0.0	0.0	0.0	15.91	1.07	2.15	2.15	0.0	0.54	3.76	0.0	0.0	15.57
Entrance Río Grande de Loiza	A 2	Aug.	0.0	0.0	0.0	2.15	5.37	0.0	0.54	3.76	0.0	1.07	6.44	1.61	0.0	20.94
Middle Lake	B 1	Aug.	0.0	2.15	0.54	0.0	1.07	0.0	0.0	1.61	0.54	0.54	2.69	0.0	6.44	16.11
Middle Lake	B 2	Aug.	0.0	3.76	0.0	0.0	1.61	0.0	6.44	0.0	0.0	0.0	0.0	3.76	8.06	23.63
Near Dam	C 1	Aug.	0.0	6.98	0.0	0.0	2.15	0.0	5.37	0.0	2.15	0.0	1.07	0.0	3.22	20.94
Near Dam	C 2	Aug.	0.54	4.30	0.0	0.0	5.37	0.0	3.76	0.0	1.61	0.0	2.15	0.0	4.83	22.55

ALGAE DATA SUMMARY FOR LAKE Carraizo IN Trujillo Alto, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

Table 53 (continued)

FROM November 1977 to , 1978.

LOCALIZATION	SAMPLE	DATE 1977	CYLINDROSPERMUM (blue green)	GOMPHOSPHAERIA (blue green)	ACTINASTRUM (green)	CHLOROCOCCUM (green)	CHLORELLA (green)	SCENEDESMUS (green)	FRAGILARIA (diatom)	GOMPHONEMA (diatom)	NITZSCHIA (diatom)	STAURONEIS (diatom)	STEPHANODISCUS (diatom)	CHRYSOCOCCUS (flagellate)	TOTAL/ M L
			ORGANISMS/ ML												
Entrance Río Grande de Loiza	A 1	Nov.	0.0	0.0	2.15	1.61	1.61	3.22	3.76	2.15	2.68	1.61	0.0	0.54	19.33
Entrance Río Grande de Loiza	A 2	Nov.	0.0	0.0	0.0	0.0	1.07	1.61	2.15	2.69	2.15	1.07	2.15	1.61	14.50
Entrance Río Grande de Loiza	A 3	Nov.	0.0	0.0	0.0	0.0	3.22	1.07	2.68	3.22	1.61	1.07	2.15	2.15	17.18
Middle Lake	B 1	Nov.	0.0	0.0	0.0	1.07	0.0	2.15	1.61	2.68	2.15	3.22	3.22	1.07	17.18
Middle Lake	B 2	Nov.	0.0	0.0	0.0	0.50	0.0	2.01	1.51	2.52	2.52	1.51	3.53	1.01	15.11
Middle Lake	B 3	Nov.	0.0	0.0	1.61	1.07	0.0	2.69	1.07	3.22	1.61	3.76	2.15	1.61	18.80
Near Dam	C 1	Nov.	1.07	2.15	0.54	0.0	2.15	0.0	0.0	1.61	2.69	3.22	1.61	2.15	15.04
Near Dam	C 2	Nov.	1.61	2.69	1.07	1.61	0.0	0.0	0.0	1.07	3.22	1.61	1.61	0.0	14.50
Near Dam	C 3	Nov.	3.22	0.0	1.61	1.07	0.0	2.15	2.15	1.61	2.69	2.69	2.69	2.15	22.02

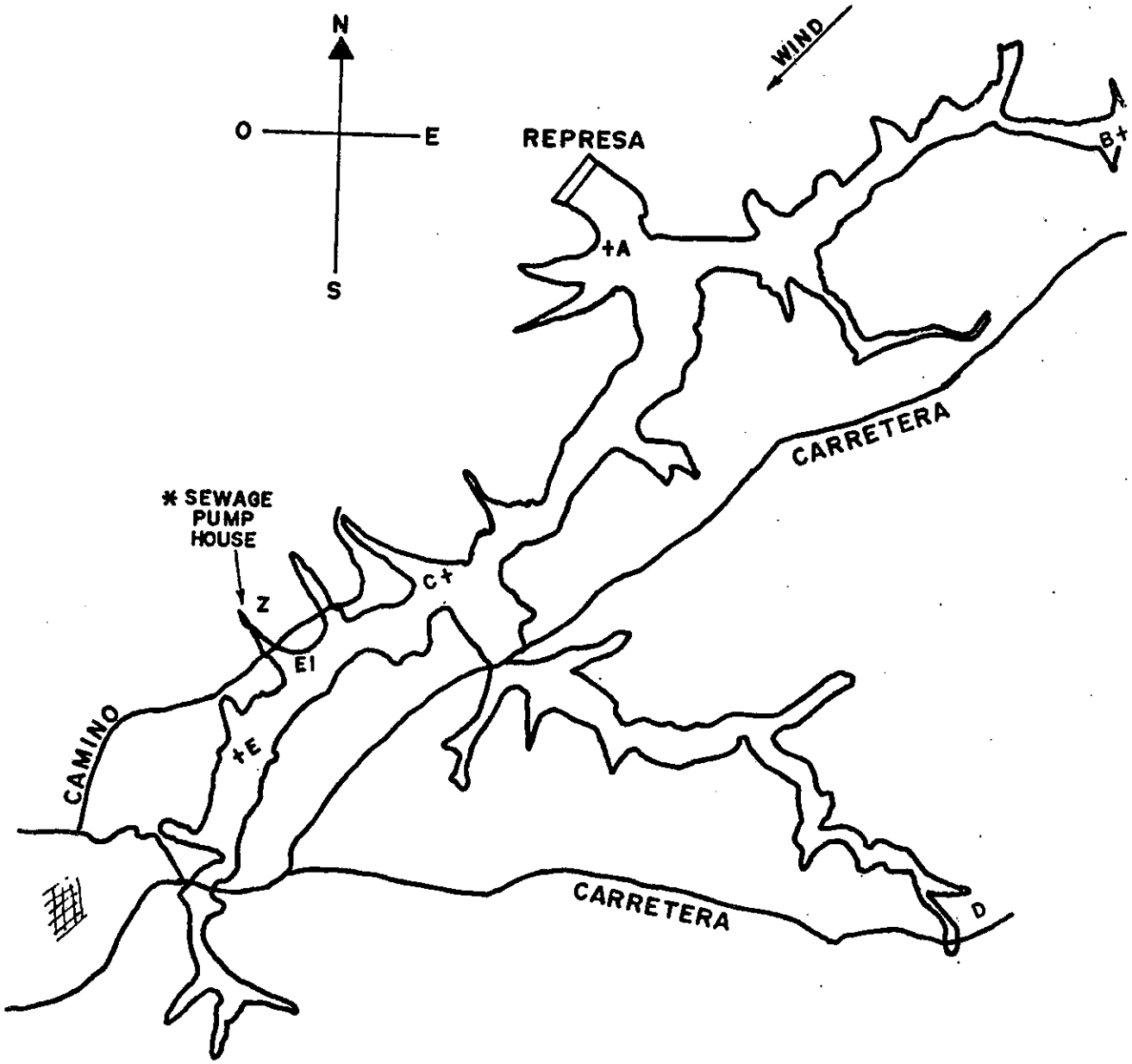
ALGAE DATA SUMMARY FOR LAKE Carraízo IN Trujillo Alto, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM ______ 1977 to April ______, 1978.

Table 53 (continued)

LOCALIZATION	SAMPLE	DATE 1977	GOMPHOSPHAERIA (blue green)	OSCILATORIA (blue green)	ACTINASTRUM (green)	CHLORELLA (green)	SCENEDESMUS (green)	COCCONEIS (diatom)	FRAGILARIA (diatom)	GOMPHONEMA (diatom)	NITZCHIA (diatom)	STAURONEIS (diatom)	CHRYSOCOCCUS (flagellate)	TOTAL/ M L
Entrance Río Grande de Loiza	A 1	Apr.	1.61	0.0	0.0	2.69	0.0	1.07	1.61	0.54	3.76	3.22	0.54	15.04
Entrance Río Grande de Loíza	A 2	Apr.	2.68	0.0	2.15	3.22	2.15	0.0	0.0	1.61	4.30	0.0	1.61	17.72
Entrance Río Grande de Loiza	A 3	Apr.	0.0	0.0	0.0	2.15	2.69	0.0	1.07	1.61	3.22	2.69	1.07	14.50
Middle Lake	B 1	Apr.	0.0	1.07	1.61	3.22	3.22	0.0	0.0	1.61	2.69	1.61	0.0	15.04
Middle Lake	B 2	Apr.	1.61	3.22	1.07	1.07	3.76	0.0	0.0	2.15	1.61	2.68	0.0	17.18
Middle Lake	B 3	Apr.	2.69	2.15	3.22	3.76	1.61	0.0	0.0	0.54	1.07	1.07	0.0	16.11
Near Dam	C 1	Apr.	3.22	0.0	0.0	2.68	0.0	1.61	1.61	2.68	0.0	1.07	1.07	13.96
Near Dam	C 2	Apr.	2.69	0.0	3.22	3.76	1.07	0.0	0.0	1.61	4.30	2.15	1.61	20.41
Near Dam	C 3	Apr.	1.61	0.0	0.0	2.69	1.61	0.0	0.0	1.07	4.83	2.5	2.15	16.11



* OUT OF ORDER JAN 16, 17-1976
SPILLING IN LAKE

LAGO DE CIDRA

Figure 21

Figure 22. This concrete dam across the Bayamón River forms Lake Cidra part of the San Juan urban water supply. Although this section of the lake near station A is clean, an upstream discharge of raw sewage was stimulating water hyacinth growth in the southwest branch near station E, during 1976.

CHEMICAL QUALITY DATA SUMMARY FOR LAKE Cidra IN Cidra, PUERTO RICO

FROM January 1976 TO 1978. SAMPLES ARE FROM 0.5 M DEPTH

Table 54

Station and Localization	Date 1976	Time	Sample No.	Lab. No.	Chloride mg/l	Hardness as $MgSO_4$ Mg/l	Total Phosphates as P mg/l	Nitrate & Nitrite as N mg/l	Iron mg/l	Turbidity Standard Unit	Color in Standard Unit	pH	Dissolved Oxygen mg/l	Chlorophyll A mg/l	Total Coliform count	Sample Size ml
A-dam	Jan 14				14.2	74.5	0.01	0.39	0.4	0.5	10	7.2			80	100
B-NE end	Jan 14				14.1	72.9	0.01	0.19	0.6	0.3	5	7.5			80	100
C-confluence	Jan 14				14.2	76.6	0.02	0.15	0.3	3.5	10	7.1			1,620	100
D-SE end	Jan 14				14.7	78.7	0.02	0.11	1.0	3.2	8	7.6			200	100
E-SE end	Jan 14				13.7	78.7	0.05	0.14	0.5	1.0	-	7.1			5,970	100
E_1-inlet	Jan 14														------	
Z-sewage	Jan 14														------	
A	Jan 16														30	
B	Jan 16														30	
C	Jan 16														2,600	
D	Jan 16														------	
E	Jan 16														17,335	3 x 100
E_1	Jan 16														13,384	3 x 100
Z	Jan 16														20,974	3 x 100

Table 55

Summary of Snail Surveys in Lake Cidra.

Date	Inspector	Snails Found
Jan. 23/76	W. Jobin,	*Pomacea australis*
	A. Laracuente	*Lymnaea cubensis*
	& S. Vélez	*Physa marmorata*
		Marisa cornuarietis

OXYGEN DATA SUMMARY FOR LAKE Cidra IN Cidra, PUERTO RICO

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM January 197_ TO January, 1978.

Table 56

Station	Date 1976	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
A	1/14/76		26		5.4	5.6	4.8	0.8	0.6			
A	1/15/76		22		5.3	5.6	4.4	1.2	0.9			
A	1/15/65		22		6.1	6.4	5.6	0.8	0.5			
B	1/14/76		26		5.4	6.8	5.4	1.2	0.0			
B	1/16/76		22		6.1	6.7	6.1	0.6	0.0			
C	1/14/76		22		5.3	5.6	4.8	0.8	0.5			
C	1/15/76		22		5.7	5.2	4.8	0.4	0.9			
C	1/16/76		22		5.5	7.1	5.4	1.7	0.1			
D	1/14/76		22		6.6	6.9	5.8	1.1	0.8			
D	1/15/76		22		6.2	6.2	5.0	1.2	1.2			
D	1/16/76		22		5.6	7.1	5.5	1.6	0.1			
E	1/14/76		24		3.5	3.2	3.3	-0.1	0.2			
E	1/15/76		22		3.3	4.1	3.5	0.6	-0.2			

Table 57

JOINT STUDY OF CAYEY UNIVERSITY COLLEGE AND PUERTO RICO NUCLEAR CENTER

PHYTOPLANKTON DENSITY

STATION A

SUMMARY OF DATA FROM LAKE CIDRA
SURVEY OF: JANUARY 1976

Date	Algae	Total Count for All Squares	Density of Phytoplankton per/ML
1-14-76	*Fragilaria* spp.	4	4.30
	Coelastrum spp.	1	1.10
	Staurastrum spp.	2	2.15
	Kirchneriella spp.	1	1.10
	Flagellate (Diatom) - Unidentified	2	2.15
	Gp. Green Algae - Unidentified	2	2.15
	Sum Total of Count for All Squares	12	-
	Total Phytoplankton Density per ML	-	12.90

Table 58

JOINT STUDY OF CAYEY UNIVERSITY COLLEGE AND PUERTO RICO NUCLEAR CENTER

PHYTOPLANKTON DENSITY

STATION B

SUMMARY OF DATA FROM LAKE CIDRA
SURVEY OF: JANUARY 1976

Date	Algae	Total Count for All Squares	Density of Phytoplankton per/ML
1-14-76	*Staurastrum* spp.	4	4.30
	Gomphosphaeria spp.	1	1.10
	Dictyosphaerium spp.	1	1.10
	Fragilaria spp.	1	1.10
	Peridinium spp.	7	7.52
	Flagellate (Diatom) - Unidentified	13	14.0
	Gp. Green Algae (Colonial) - Unidentified	1	1.10
	Sum Total of Count for All Squares	28	-
	Total Phytoplankton Density per ML	-	30.07

Table 59

JOINT STUDY OF CAYEY UNIVERSITY COLLEGE AND PUERTO RICO NUCLEAR CENTER

PHYTOPLANKTON DENSITY

STATION C

SUMMARY OF DATA FROM LAKE CIDRA
SURVEY OF: JANUARY 1976

Date	Algae	Total Count for All Squares	Density of Phytoplankton per/ML
1-14-76	*Fragilaria* spp.	8	8.60
	Frustulia spp.	1	1.10
	Navicula spp.	1	1.10
	Dictyosphaerium spp.	6	6.44
	Mallomonas spp.	2	2.15
	Coelastrum spp.	2	2.15
	Synedra spp.	1	1.10
	Scenedesmus spp.	1	1.10
	Flagellate (Diatom) - Unidentified	3	3.22
	Centric Diatom - Unidentified	1	1.10
	Sum Total of Count for All Squares	26	-
	Total Phytoplankton Density per ML	-	28.0

Table 60

JOINT STUDY OF CAYEY UNIVERSITY COLLEGE AND PUERTO RICO NUCLEAR CENTER

PHYTOPLANKTON DENSITY

STATION D

SUMMARY OF DATA FROM LAKE CIDRA
SURVEY OF: JANUARY 1976

Date	Algae	Total Count for All Squares	Density of Phytoplankton per/ML
1-14-76	*Peridinium* spp.	20	21.50
	Staurastrum spp.	3	3.22
	Gomphosphaeria spp.	2	2.15
	Cosmarium spp.	1	1.10
	Mallomonas spp.	1	1.10
	Gp. Green Algae - Unidentified	1	1.10
	Flagellate (Diatom) - Unidentified	19	20.40
	Sum Total of Count for All Squares	47	-
	Total Phytoplankton Density per ML	-	50.50

Table 61

JOINT STUDY OF CAYEY UNIVERSITY COLLEGE AND PUERTO RICO NUCLEAR CENTER

PHYTOPLANKTON DENSITY

STATION E

SUMMARY OF DATA FROM LAKE CIDRA
SURVEY OF: JANUARY 1976

Date	Algae	Total Count for All Squares	Density of Phytoplankton per/ML
1-14-76	*Frustulia* spp.	1	1.10
	Scenedesmus spp.	2	2.15
	Mallomonas spp.	1	1.10
	Fragilaria spp.	6	6.44
	Dictyosphaerium spp.	1	1.10
	Staurastrum spp.	2	2.15
	Peridinium spp.	1	1.10
	Gomphoneis spp.	1	1.10
	Gp. Green Algae - Unidentified	1	1.10
	Sum Total of Count for All Squares	16	-
	Total Phytoplankton Density per ML	-	17.20

Table 62

JOINT STUDY OF CAYEY UNIVERSITY COLLEGE AND PUERTO RICO NUCLEAR CENTER

PHYTOPLANKTON DENSITY

STATION X

(Below Cattle igrid)
(*Bubulcus ibis*) nest

SUMMARY OF DATA FROM LAKE CIDRA
SURVEY OF: JANUARY 1976

Date	Algae	Total Count for All Squares	Density of Phytoplankton per/ML
1-14-76	*Scenedesmus* spp.	1	1.10
	Peridinium spp.	5	5.40
	Staurastrum spp.	1	1.10
	Mallomonas spp.	1	1.10
	Euglena spp.	1	1.10
	Cymbella spp.	1	1.10
	Fragilaria spp.	3	3.22
	Dictyosphaerium spp.	2	2.15
	Navicula spp.	1	1.10
	Gp. Green Algae - Unidentified	3	3.22
	Gp. Green Algae (Colonial) - Unidentified	1	1.10
	Sum Total of Count for All Squares	20	-
	Total Phytoplankton Density per ML	-	17.20

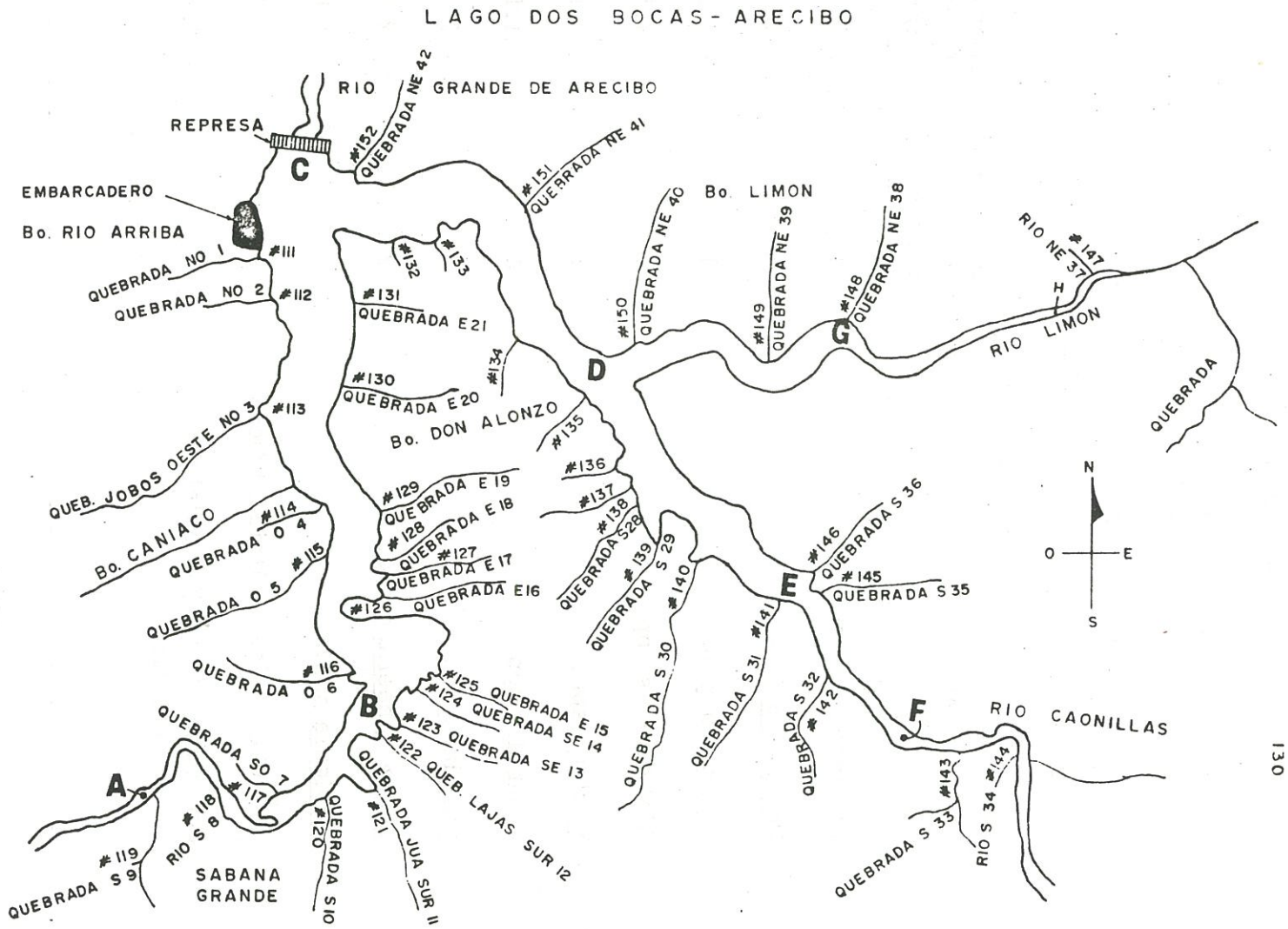

LAGO DOS BOCAS - ARECIBO
RIO GRANDE DE ARECIBO
REPRESA
EMBARCADERO
Bo. RIO ARRIBA
QUEBRADA NO 1
QUEBRADA NO 2
QUEB. JOBOS OESTE NO 3
Bo. CANIACO
QUEBRADA O 4
QUEBRADA O 5
QUEBRADA O 6
QUEBRADA SO 7
RIO S 8
QUEBRADA S 9
SABANA GRANDE
QUEBRADA S 10
QUEBRADA JUA SUR 11
QUEB. LAJAS SUR 12
QUEBRADA SE 13
QUEBRADA SE 14
QUEBRADA E 15
QUEBRADA E 16
QUEBRADA E 17
QUEBRADA E 18
QUEBRADA E 19
QUEBRADA E 20
QUEBRADA E 21
Bo. DON ALONZO
QUEBRADA NE 42
QUEBRADA NE 41
QUEBRADA NE 40
Bo. LIMON
QUEBRADA NE 39
QUEBRADA NE 38
RIO NE 37
RIO LIMON
QUEBRADA
QUEBRADA S 28
QUEBRADA S 29
QUEBRADA S 30
QUEBRADA S 31
QUEBRADA S 32
QUEBRADA S 33
RIO S 34
QUEBRADA S 35
QUEBRADA S 36
RIO CAONILLAS
A
B
C
D
E
F
G
H
N
O
E
S

Figure 23

Figure 24. A dense population of Tarebia granifera on a stick taken from Lake Dos Bocas near station B.

CHEMICAL QUALITY DATA SUMMARY FOR LAKE Dos Bocas IN Arecibo, PUERTO RICO

FROM November 1976 TO March 1978. SAMPLES ARE FROM 0.5 M DEPTH

Table 63

Station and Localization	Date	Time	Sample No.	Lab. No.	Chloride mg/l	Hardness as $MgSO_4$ Mg/l	Total Phosphates as P mg/l	Nitrate & Nitrite as N mg/l	Iron mg/l	Turbidity in Standard Unit	Color in Standard Unit	pH	Dissolved Oxygen mg/l	Chlorophyll A mg/l	Total Coliform count	Sample Size ml
	1976															
A	9 Nov	2:27	DB- 2	314	4.9	120.9	0.05	0.80	2.6	---	20	7.3	---			
B	9 Nov	3:45	DB- 4	315	6.5	87.6	0.04	0.60	0.3	8.0	15	6.8	---			
Dam C	9 Nov	4:20	DB- 6	316	6.6	75.5	0.01	0.20	0.2	6.4	15	7.1	---			
D	10 Nov	3:15	DB-10	317	5.9	72.0	0.01	0.20	0.4	16.0	25	7.2	10.7			
Entrada Río Caonillas E	10 Nov	3:10	DB- 9	318	7.9	67.4	0.03	0.20	0.5	18.0	35	7.6	12.2			
A	11 Nov		DB-15	319	8.4	130.6	0.02	0.60	1.8	25.0	5	7.4	7.7			
B	11 Nov	7:30	DB-17	320	4.5	95.5	0.01	0.40	0.4	11.8	8	7.1	12.3			
C	11 Nov	7:40	DB-19	321	5.5	80.1	0.00	0.10	0.2	7.0	8	7.4	10.6			
D	11 Nov	7:55	DB-21	322A	3.5	75.8	0.02	0.20	0.4	12.1	10	7.5	---			
E	11 Nov	8:03	DB-23	322B	5.5	73.3	0.02	0.10	0.5	16.2	12	7.1	---			
Río Caonillas F	11 Nov	8:22	DB-25	323B	4.1	64.7	0.01	0.30	1.4	----	70	7.0	---			
F	10 Nov	2:10	DB-12	323A	4.5	67.8	0.01	0.30	1.5	26.0	75	6.9	4.7			
Entrada Río Limón G	11 Nov	8:43	DB-27	325	7.4	86.2	0.01	0.20	0.7	10.8	10	7.2	8.9			
H	10 Nov	3:00	DB-13	325A	5.5	97.3	0.01	0.60	0.2	4.1	5	7.6	9.9			
H	11 Nov	8:55	DB-29	325B	5.5	99.8		----	0.4	2.2	5	7.4	---			
	1977															
B	26 Jan	1:40	DB-15	342	3.7	88.8	0.01	0.02	0.2	1.6	35	7.4	---			
C	1 Feb	12:10	DB- 3	343	4.7	148.0	0.01	0.02	0.1	1.9	15	7.4	8.3			
D	1 Feb	12:25	DB- 6	344	3.7	94.1	0.01	0.03	0.2	4.3	15	7.3	---			
E	1 Feb	1:00	DB-12	345	5.7	82.2	0.01	0.03	0.2	3.1	15	7.4	---			

CHEMICAL QUALITY DATA SUMMARY FOR LAKE Dos Bocas IN Arecibo, PUERTO RICO

FROM November 1976 TO March 1978. SAMPLES ARE FROM 0.5 M DEPTH

Table 63 (continued)

Station and Localization	Date 1977	Time	Sample No.	Lab. No.	Chloride mg/l	Hardness as $MgSO_4$ Mg/l	Total Phosphates as P mg/l	Nitrate & Nitrite as N mg/l	Iron mg/l	Turbidity in Standard Unit	Color in Standard Unit	pH	Dissolved Oxygen mg/l	Chlorophyll A mg/l	Total Coliform count	Sample Size ml
G	1 Feb	12:45	DB- 9	346	5.7	88.8	0.01	0.06	0.70	7.6	15	7.3	---			
B	3 Feb	1:00	DB-68	347	4.9	97.3	0.02	0.06	0.10	4.7	12	6.9	8.0			
C	3 Feb	11:15	DB-39	348	6.8	91.2	0.01	0.03	0.70	1.2	15	7.3	8.0			
D	3 Feb	11:40	DB-46	349	3.9	91.2	0.01	0.03	0.10	7.6	15	7.3	7.9			
E	3 Feb	12:20	DB-60	350	4.9	94.2	0.01	0.04	0.10	10.0	15	7.0	4.9			
G	3 Feb	12:50	DB-63	351	6.8	91.2	0.01	0.12	0.30	6.7	20	7.5	5.6			
C	20 May		DB-312	361	5.9	115.5	0.01	0.10	0.10	0.0	8	7.9	7.8	0.0		
D	20 May		DB-308	362	5.9	115.5	0.01	0.10	0.10	0.0	10	7.7	8.0	1.6		
G	20 May		DB-310	363	5.9	115.5	0.01	0.10	0.80	0.1	12	8.1	8.7			
E	20 May		DB-311	364	9.8	121.6	0.01	0.10	0.10	0.0	10	7.7	7.6	3.2		
B	20 May		DB-313	365	9.8	121.6	0.01	0.10	0.30	0.1	15	7.9	8.8	5.6		
C	29 Aug	6:30	DB- 56	389	6.8	118.8	0.01	0.00	0.03	0.1	10	7.4	7.1			
D	29 Aug	6:50	DB- 64	390	6.8	118.8	0.01	0.00	0.03	2.7	8	7.5	7.0			
G	29 Aug	7:10	DB- 72	391	4.9	113.4	0.01	0.00	0.03	4.7	10	6.9	5.4			
E	29 Aug	7:30	DB- 76	392	9.8	129.6	0.01	0.00	0.10	2.5	12	7.2	7.1			
B	29 Aug	8:08	DB- 80	393	7.8	129.6	0.01	0.02	0.03	28.0	10	7.5	7.4			

CHEMICAL QUALITY DATA SUMMARY FOR LAKE Dos Bocas IN Arecibo, PUERTO RICO

Table 63 (continued) FROM November 1976 TO March 1978. SAMPLES ARE FROM 0.5 M DEPTH

Station and Localization	Date 1977	Time	Sample No.	Lab. No.	Chloride mg/l	Hardness as $MgSO_4$ Mg/l	Total Phosphates as P mg/l	Nitrate & Nitrite as N mg/l	Iron mg/l	Turbidity in Standard Unit	Color in Standard Unit	pH	Dissolved Oxygen mg/l	Chlorophyll A mg/l	Total Coliform count	Sample Size ml
C	5 Dec		DB- 2	418	3.9	89.9	0.01	0.10	0.50	14.8	15	7.3	9.8			
D	5 Dec		DB- 4	419	3.9	86.0	0.01	0.10	0.30	10.0	10	7.3	7.4			
G	5 Dec		DB- 6	420	5.9	98.3	0.01	0.05	0.90	14.3	10	7.2	7.4			
E	5 Dec		DB- 8	421	5.9	84.3	0.01	0.10	0.80	11.0	8	7.1	8.1			
B	5 Dec		DB-10	422	5.8	112.4	0.01	0.10	2.30	20.0	5	7.2	9.8			
	1978															
B	28 Mar	8:35	DB- 2	470	5.9	88.4	0.01	0.10	0.03	----	12	7.7				
C	28 Mar	9:15	DB- 4	471	5.9	78.0	0.01	0.03	0.20	----	10	7.7				
D	28 Mar	9:25	DB- 6	472	3.9	83.2	0.01	0.00	0.20	----	10	7.9				
E	28 Mar	9:45	DB-10	473	4.9	100.2	0.01	0.04	0.04	----	10	8.0				
G	28 Mar	9:35	DB- 8	474	5.9	106.7	0.01	0.10	0.20	----	10	7.7				

TABLE 64

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Dos Bocas

PARAMETER Chlorides

UNITS mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1 1976 9-10-11/11	86.2	15	5.75	1.10
2 1/2/77	50.8	10	5.08	0.94
3 20/5/77	37.3	5	7.46	1.87
4 29/8/77	36.1	5	7.22	1.26
5 5/12/77	25.4	5	5.08	0.94
6 28/3/78	26.5	5	5.30	0.72
7				
8				
9				
10				
TOTALS	262.3	45	5.83	
B-VARIATION BY STATION				
A	13.3	2	6.65	1.75
B	48.9	8	6.11	1.44
C	46.1	8	5.76	0.80
D	37.5	8	4.69	1.14
E	54.4	8	6.80	1.78
F	8.6	2	4.30	0.20
G	42.5	7	6.07	0.59
H	11.0	2	5.50	0.00
TOTALS	262.3	45	5.83	

TABLE 65

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Dos Bocas

PARAMETER Hardness as Mg SO4

UNITS mg/1

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	1,294.5	15	86.30	15.21
2	967.0	10	96.70	10.38
3	589.7	5	117.94	2.93
4	610.2	5	122.04	6.05
5	470.9	5	94.18	8.94
6	456.5	5	91.30	9.72
7				
8				
9				
10				
TOTALS	4,388.8	45	97.53	
B-VARIATION BY STATION				
A	251.5	2	125.75	4.85
B	821.2	8	102.65	13.91
C	797.0	8	99.62	20.86
D	736.6	8	92.08	13.05
E	752.8	8	94.10	17.30
F	132.5	2	66.25	1.55
G	700.1	7	100.1	10.16
H	197.1	2	98.55	1.25
TOTALS	4,388.8	45	97.53	

TABLE 66

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Dos Bocas

PARAMETER Total Phosphates as P

UNITS mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	0.25	14	0.02	0.01
2	0.11	10	0.01	0.00
3	0.05	5	0.01	0.00
4	0.05	5	0.01	0.00
5	0.05	5	0.01	0.00
6	0.05	5	0.01	0.00
7				
8				
9				
10				
TOTALS	0.56	44	0.01	
B-VARIATION BY STATION				
A	0.07	2	0.04	0.02
B	0.12	8	0.02	0.01
C	0.07	8	0.01	0.00
D	0.09	8	0.01	0.00
E	0.11	8	0.01	0.00
F	0.02	2	0.01	0.00
G	0.07	7	0.01	0.00
H	0.01	1		
TOTALS	0.56	44	0.01	

TABLE 67

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Dos Bocas

PARAMETER Nitrate & Nitrite as N

UNITS mg/1

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	4.8	14	0.34	0.18
2	0.44	10	0.04	0.02
3	0.50	5	0.10	0.00
4	0.02	5	0.00	0.00
5	0.45	5	0.09	0.02
6	0.27	5	0.05	0.03
7				
8				
9				
10				
TOTALS	6.48	44	0.15	
B-VARIATION BY STATION				
A	1.4	2	0.70	0.10
B	1.4	8	0.18	0.16
C	0.58	8	0.07	0.04
D	0.66	8	0.08	0.05
E	0.61	8	0.08	0.04
F	0.60	2	0.30	0.00
G	0.63	7	0.09	0.03
H	0.60	1		
TOTALS	6.48	44	0.15	

TABLE 68

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Dos Bocas

PARAMETER Iron

UNITS mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	11.5	15	0.77	0.57
2	2.7	10	0.27	0.18
3	1.4	5	0.28	0.22
4	0.22	5	0.04	0.02
5	4.8	5	0.96	0.54
6	0.67	5	0.13	0.08
7				
8				
9				
10				
TOTALS	21.29	45	0.47	
B-VARIATION BY STATION				
A	4.4	2	2.20	0.40
B	3.66	8	0.46	0.46
C	2.03	8	0.25	0.17
D	1.73	8	0.22	0.11
E	2.34	8	0.29	0.23
F	2.9	2	1.45	0.05
G	3.63	7	0.52	0.29
H	0.6	2	0.30	0.10
TOTALS	21.29	45	0.47	

TABLE 69

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Dos Bocas

PARAMETER Turbidity

UNITS Standard Units

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	163.6	13	12.58	5.89
2	48.9	10	4.89	2.40
3	0.2	5	0.04	0.02
4	38.0	5	7.60	8.16
5	70.1	5	14.02	2.82
6				
7				
8				
9				
10				
TOTALS	320.8	38	8.44	
B-VARIATION BY STATION				
A	25.0	1		
B	74.2	7	10.60	8.03
C	31.4	7	4.49	3.57
D	52.9	7	7.56	3.34
E	60.8	7	8.69	4.60
F	26.0	1		
G	44.2	6	7.37	1.16
H	6.3	2	3.15	0.95
TOTALS	320.8	38	8.44	

TABLE 70

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Dos Bocas

PARAMETER Color

UNITS Standard Unit

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	318.0	15	21.20	16.03
2	172.0	10	17.20	4.12
3	55.0	5	11.00	2.00
4	50.0	5	10.00	0.80
5	48.0	5	9.60	0.92
6	52.0	5	10.40	0.64
7				
8				
9				
10				
TOTALS	695.0	45	15.44	
B-VARIATION BY STATION				
A	25.0	2	12.50	7.50
B	112.0	8	14.00	6.00
C	96.0	8	12.00	3.00
D	103.0	8	12.88	4.10
E	117.0	8	14.62	5.28
F	145.0	2	72.5	2.50
G	87.0	7	12.43	2.90
H	10.00	2	5.00	0.00
TOTALS	695.0	45	15.44	

TABLE 71

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Dos Bocas

PARAMETER P H

UNITS

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	108.6	15	7.24	0.20
2	72.8	10	7.28	0.13
3	39.3	5	7.86	0.13
4	36.5	5	7.30	0.20
5	36.1	5	7.22	0.06
6	39.0	5	7.80	0.12
7				
8				
9				
10				
TOTALS	332.3	45	7.38	
B-VARIATION BY STATION				
A	14.7	2	7.35	0.05
B	58.5	8	7.31	0.31
C	59.5	8	7.44	0.18
D	59.7	8	7.46	0.19
E	59.1	8	7.39	0.29
F	13.9	2	6.95	0.05
G	51.9	7	7.41	0.30
H	15.0	2	7.50	0.10
TOTALS	332.3	45	7.38	

TABLE 72

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Dos Bocas

PARAMETER Dissolved Oxygen

UNITS mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	77.0	8	9.62	1.90
2	42.7	6	7.12	1.24
3	40.9	5	8.18	0.46
4	34.0	5	6.80	0.56
5	42.5	5	8.50	1.04
6				
7				
8				
9				
10				
TOTALS	237.1	29	8.18	
B-VARIATION BY STATION				
A	7.7	1		
B	46.3	5	9.26	1.43
C	51.6	6	8.60	1.07
D	41.0	5	8.20	1.00
E	39.9	5	7.98	1.74
F	4.7	1		
G	36.0	5	7.20	1.36
H	9.9	1		
TOTALS	237.1	29	8.18	

TABLE 73

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Dos Bocas

PARAMETER Chlorophyll A

UNITS mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1				
2				
3	10.4	4	2.60	1.15
4				
5				
6				
7				
8				
9				
10				
TOTALS	10.4	4	2.60	
B-VARIATION BY STATION				
A	5.6	1		
B	0.0	1		
C	1.6	1		
D	3.2	1		
E				
F				
G				
H				
TOTALS	10.4	4	2.60	

Table 74

Summary of Snails Surveys in Lake Dos Bocas

Date	Inspector	Snails Found
Jul. 12/76	J. A. Bermudez	*Marisa cornuarietis* *Tarebia granifera*
Dec. 16/76	W. Jobin	*Lymnaea cubensis* *Tarebia granifera* *Marisa cornuarietis* *Physa marmorata* *Biomphalaria glabrata*
Mar. 31/78	R. Brown & A. Laracuente	*Physa marmorata* *Lymnaea cubensis* *Tarebia granifera* *Marisa cornuarietis* *Tropicorbis riisei*
Aug. 8/78	A. Laracuente	*Helisoma caribaeum* *Tarebia granifera* *Marisa cornuarietis* *Physa marmorata* *Lymnaea columella*

Table 75

SUMMARY OF COLIFORM DATA OF LAKE Dos Bocas IN Arecibo, P.R.

FROM Feb. 197 TO March 1978.

STATION	DATE	FIELD NUM.	VOL. ml	COLONIES	COLONIES/ 100 ml
C	3/2/77	DB-38	1	0	0
C	3/2/77	DB-38	10	0	0
D	3/2/77	DB-45	1	1	100
D	3/2/77	DB-45	10	4	40
F	3/2/77	DB-52	1	3	300
F	3/2/77	DB-52	10	5	50
E	3/2/77	DB-59	1	6	600
E	3/2/77	DB-59	10	39	390
B	3/2/77	DB-67	1	12	1,200
B	3/2/77	DB-67	10	TNTC	0
C	3/2/77	-	20	0	0
B	8/2/77	DB-95	10	3	30
B	8/2/77	DB-85	1	2	200
D	8/2/77	DB-90	10	6	60
D	8/2/77	DB-90	1	0	0
G	8/2/77	DB-92	10	4	40
G	8/2/77	DB-92	1	2	200
E	8/2/77	DB-93	10	65	650
E	8/2/77	DB-93	1	7	700
C	8/2/77	DB-96	10	12	120
C	8/2/77	DB-96	1	1	100
C	9/2/77	DB-110	10	0	0
C	9/2/77	DB-110	1	0	0
D	9/2/77	DB-98	10	1	10
D	9/2/77	DB-98	1	0	0
G	9/2/77	DB-104	10	0	0
G	9/2/77	DB-104	1	2	200
E	9/2/77	DB-112	10	22	220
E	9/2/77	DB-112	1	1	100
B	9/2/77	DB-114	10	192	1,920
B	9/2/77	DB-114	1	34	3,400
C	16/5/77	DB-201	1	0	0
C	16/5/77	DB-201	1	0	0

Table 75 (continued)

SUMMARY OF COLIFORM DATA OF LAKE DosBocas IN Arecibo, P.R.

FROM February 1977 TO March 1978.

STATION	DATE	FIELD NUM.	VOL. ml	COLONIES	COLONIES/ 100 ml
D	16/5/77	DB-203	1	1	100
D	16/5/77	DB-203	1	0	0
G	16/5/77	DB-204	1	6	600
G	16/5/77	DB-204	1	1	100
E	16/5/77	DB-205	1	5	500
E	16/5/77	DB-205	.1	1	1000
B	16/5/77	DB-209	1	1	100
B	16/5/77	DB-209	.1	0	0
C	17/5/77	DB-215	1	0	0
C	17/5/77	DB 215	.1	0	0
D	17/5/77	DB-221	1	1	100
D	17/5/77	DB-221	.1	0	0
G	17/5/77	DB-227	1	7	700
G	17/5/77	DB-227	.1	1	1000
E	17/5/77	DB-232	1	1	100
E	17/5/77	DB-232	.1	0	0
B	17/5/77	DB-239	1	9	900
B	17/5/77	DB 239	.1	1	1000
C	18/5/77	DB-245	10	8	80
C	18/5/77	DB-245	1	0	0
D	18/5/77	DB-247	10	4	40
D	18/5/77	DB-247	1	1	100
G	18/5/77	DB-248	10	62	620
G	18/5/77	DB-248	1	12	1200
E	18/5/77	DB-254	10	1	10
E	18/5/77	DB-254	1	0	0
B	18/5/77	DB-260	10	47	470
B	18/5/77	DB-260	1	17	1700
C	19/5/77	DB-266	10	7	70
C	19/5/77	DB-266	1	0	0
D	19/5/77	DB-272	10	11	110
D	19/5/77	DB-272	10	25	25
G	19/5/77	DB-274	1	90	900
G	19/5/77	DB-274	10	6	60

Table 75 (continued)

SUMMARY OF COLIFORM DATA OF LAKE Dos Bocas IN Arecibo, P.R.

FROM February 1977 TO March 1978.

STATION	DATE	FIELD NUM.	VOL. ml	COLONIES	COLONIES/ 100 ml
E	19/5/77	DB-280	10	6	60
E	19/5/77	DB-280	1	3	300
D	19/5/77	DB-286	10	90	900
D	19/5/77	DB-286	1	18	1,800
A	1/9/77	DB-58	10	9	90
A	1/9/77	DB-58	1	2	200
B	1/9/77	DB-66	10	1	10
B	1/9/77	DB-66	1	0	0
C	1/9/77	DB-74	10	64	640
C	1/9/77	DB-74	1	5	500
D	1/9/77	DB-78	10	26	260
D	1/9/77	DB-78	1	2	200
E	1/9/77	DB-82	10	102	1020
E	1/9/77	DB-82	1	8	800
A	6/12/77	-	0.1	1	1000
A	6/12/77	-	1.0	23	2.300
B	6/12/77	-	0.1	22	22,000
B	6/12/77	-	1.0	TNTC	
C	6/12/77	-	0.1	1	1000
C	6/12/77	-	1	15	1500
D	6/12/77	-	.1	0	0
D	6/12/77	-	1	14	1,400
E	6/12/77	-	.1	15	15,000
E	6/12/77	-	1	82	8,200
A	7/12/77	-	.1	0	0
A	7/12/77	-	1	41	4,100
B	7/12/77	-	.1	0	0
B	7/12/77	-	1	10	1,000
C	7/12/77	-	.1	6	6,000
C	7/12/77	-	1	22	2,200
D	7/12/77	-	.1	7	7,000
D	7/12/77	-	1	10	1,000
E	7/12/77	-	.1	26	26,000
E	7/12/77	-	1	125	2,500

Table 75 (continued)

SUMMARY OF COLIFORM DATA OF LAKE Dos Bocas IN Arecibo, P.R.

FROM February 1977 TO March 1978.

STATION	DATE	FIELD NUM.	VOL. ml	COLONIES	COLONIES/ 100 ml
B	28/3/78	-	0.1	1	1,000
B	28/3/78	-	1.0	7	700
C	28/3/78	-	0.1	0	0
C	28/3/78	-	1.0	0	0
D	28/3/78	-	0.1	0	0
D	28/3/78	-	1.0	1	100
E	28/3/78	-	0.1	0	0
E	28/3/78	-	1.0	0	0
G	28/3/78	-	0.1	0	0
G	28/3/78	-	1.0	2	200
B	28/3/78	-	1.0	0	0
C	28/3/78	-	10.0	2	20
C	28/3/78	-	1.0	0	0
C	28/3/78	-	10.0	0	0
D	28/3/78	-	1.0	0	0
D	28/3/78	-	10.0	0	0
E	28/3/78	-	1.0	0	0
E	28/3/78	-	10.0	2	20
G	28/3/78	-	1.0	2	200
G	28/3/78	-	10.0	6	60

OXYGEN DATA SUMMARY FOR LAKE Dos Bocas IN Arecibo, PUERTO RICO

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM November 1976 TO December, 1978.

Table 76

Page 1 Of 5

Station	Date 1976	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
D Entrada Rio Limón	11 Nov	7:55	28.0	7,46-49	9.9	10.5	8.3	2.2	1.6	0.4		19
D	12 Nov	12:45	25.5	50,86-89	11.5	12.4	8.8	3.6	2.7	0.3		29
E	11 Nov	8:07	27.5	8,51-54	12.5	10.8	9.4	1.4	3.1	0.9		19
E	12 Nov	12:40	27.0	55,82-85	11.9	11.8	10.2	1.6	1.7	0.4		20
F Río Coanillas	11 Nov	8:22	26.0	11,	4.6	-	-	-	-	0.1		-
F	12 Nov	-	-	-	-	-	-	-	-	-		-
H	11 Nov	8:55	24.5	14,56-60	12.2	7.4	7.1	0.3	5.1	0.9		20
H	12 Nov	7:15	22.0	61,74-77	7.6	6.9	7.4	- 0.5	0.2	-		23
A	11 Nov	10:45	25.0	1,31-34	6.9	5.2	4.9	0.3	2.0	0.1		44
A	12 Nov	10:25	24.5	35,62-65	7.3	6.7	6.9	- 0.2	0.4	0.1		24
B	11 Nov	11:15	27.5	3,36-39	13.9	14.4	7.2	7.2	6.7	0.5		44
B	12 Nov	10:45	27.5	40,66-69	10.7	12.0	8.4	3.6	2.3	0.4		23
C Represa	11 Nov	11:45	28.0	5,41-44	9.8	13.8	7.6	6.2	2.2	0.8		43
C	12 Nov	11:05	27.5	45,70-73	11.5	13.0	10.0	3.0	1.5	0.7		23
G Río Limón	12 Nov	12:05	26.0	56,78-81	8.9	8.5	7.3	1.2	1.6	0.3		23
	1977											
C Represa	2 Feb	11:45	25.5	1,16-16	8.3	8.0	7.4	0.6	0.9	1.9		23
C	3 Feb	11:15	24.5	20,41-44	8.8	8.6	8.0	0.6	0.8	2.0		24
C	4 Feb	9:30	23.5	40,69-72	7.8	8.3	7.6	0.7	0.2	1.7		22

OXYGEN DATA SUMMARY FOR LAKE Dos Bocas IN Arecibo PUERTO RICO

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM November 1976 TO December, 1978.

Table 76 (continued)

Station	Date 1977	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
D Río Limón	2 Feb	12:00	25.5	4,22-25	8.1	9.1	7.6	1.5	0.5	1.0		24
D	3 Feb	11:40	25.0	21,48-41	8.5	8.1	8.0	0.1	0.5	1.3		24
D	4 Feb	9:45	24.0	47,73-76	7.1	7.6	6.9	0.7	0.2	1.5		22
D	9 Feb	10:00	24.0	89,99-102	8.4	8.2	7.8	0.4	0.6	1.8		23
D	10 Feb	7.46	23.0	97, 123-126	7.7	8.4	7.4	1.0	0.3	1.8		22
G	9 Feb	10:15	25.0	91, 105-108	6.3	6.5	5.1	1.4	1.2	0.5		23
G	10 Feb	8:00	23.0	103, 127-130	5.0	5.0	4.2	0.8	0.8	0.5		22
B	9 Feb	2:25	26.0	94,	10.6	-	-	-	-	1.0		-
B	10 Feb	8:50	24.0	113, 115-118	5.3	11.0	10.8	0.2	-5.5	1.2		18
C Represa	10 Feb	7:25	22.0	109,-	5.3	9.0	7.8	1.2	-2.5	2.0		23
E	10 Feb	8:15	23.0	111,-	4.9	5.1	4.2	0.9	0.7	0.5		23
C Represa	17 May	6:55	29.0	300, 210-213	8.8	8.6	7.7	0.9	1.1	1.5		19
C	18 May	7:30	27.0	214, 240-243	7.8	8.4	7.1	1.3	0.7	1.9		23
C	19 May	6:55	27.0	244, 255-258	7.4	10.4	5.6	4.8	1.8	1.8		24
C	20 May	6:00	27.0	265, 287-290	7.2	8.6	6.8	1.8	0.4	1.5		23
D Río Limón	17 May	7:30	27.0	202, 216-219	8.3	8.2	7.6	0.6	0.7	1.2		19
D	18 May	7:55	27.0	220,	7.9	-	-	-	-	1.4		-
D	19 May	7:15	27.0	246, 267-270	7.7	9.0	7.2	1.8	0.5	1.2		23

OXYGEN DATA SUMMARY FOR LAKE Dos Bocas IN Arecibo, PUERTO RICO

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM November 1976 TO December, 1978.

Table 76 (continued)

Station	Date 1977	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
D Río Limón	20 May	-	-	271, 291-294	8.2	-	-	-	-	-		-
G	17 May	7:50	27.0	204 222-225	7.8	7.2	6.8	0.4	1.0	1.5		19
G	18 May	8:05	-	226,-	11.4	-	-	-	-	-		-
G	19 May	7:40	-	-	-	-	-	-	-	-		-
G	20 May	6:35	27.0	273, 295-298	7.0	7.6	6.4	1.20	0.6	0.5		23
E	17 May	8:15	28.0	206, 228-231	8.2	8.2	7.6	0.6	0.6	1.2		19
E	18 May	8:40	28.0	232, 249-250	7.7	8.4	7.6	0.8	0.1	1.5		24
E	19 May	7:55	27.0	253, 275-278	7.4	8.3	6.6	1.7	0.8	1.5		23
E	20 May	6:55	27.0	279, 299-302	7.2	8.2	6.6	1.5	0.6	1.5		23
B	17 May	9:00	28.0	208, 234-237	10.2	11.1	9.2	1.9	1.0	0.8		19
B	18 May	9:15	28.0	238, 255-258	9.8	11.5	7.6	3.9	2.2	0.5		24
B	19 May	8:30	28.0	259, 281-284	8.0	11.4	7.3	4.1	0.7	0.2		23
B	20 May	7:30	27.0	285, 303-306	7.4	11.8	7.4	4.4	0.0	0.5		23
C Represa	30 Aug	6:30	27.0	1,7-10	6.7	7.0	6.0	1.0	0.7	1.8		18
C	21 Aug	6:50	27.0	6,32-35	6.9	7.8	6.4	1.4	0.5	1.8		24
C	1 Sep	6:30	27.0	31,52-55	7.7	8.4	6.8	1.6	0.9	1.8		24
D Río Limón	30 Aug	6:50	27.0	2,12-15	7.8	7.9	6.8	1.1	1.0	1.5		18
D	31 Aug	7:10	27.0	11,37-40	6.6	7.8	6.0	1.8	0.6	1.5		24

OXYGEN DATA SUMMARY FOR LAKE Dos Bocas IN Arecibo, PUERTO RICO

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM November 1976 TO December, 1978.

Table 76 (continued)

Station	Date 1977	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
D Río Limón	1 sep	6:50	27.0	36,60-63	6.6	7.6	5.7	- 0.1	- 1.1	1.8		24
G	30 Aug	7:05	27.0	3,17-20	7.0	7.2	6.8	0.4	0.2	0.5		24
G	31 Aug	10:00	28.0	16,-	4.8	-	-	-	-	1.5		-
G	1 Sept	7:10	26.0	51,68-71	4.5	4.0	3.6	0.4	0.9	0.6		21
E	30 Aug	7:30	27.0	4,22-25	8.5	7.8	7.4	0.4	1.1	1.2		19
E	31 Aug	8:05	28.0	21,42-45	7.5	7.8	5.2	2.6	2.3	1.2		-
E	1 Sep	-	-	41,-	5.4	-	-	-	-	-		-
B	30 Aug	8:00	26.5	5,27-30	8.3	8.4	7.8	0.6	0.5	0.4		19
B	31 Aug	8:25	23.5	26,47-50	6.6	5.0	4.4	0.6	1.9	0.1		24
B	1 Sep	-	-	46,-	-	-	-	-	-	-		-
C Represa	6 Dec	10:15	27.0	1,11-14	10.9	11.4	8.9	2.5	2.0	0.4		23
C	7 Dec	9:50	26.0	16,41-43	8.9	9.6	7.1	2.5	1.8	0.5		24
C	8 Dec	9:30	25.0	46,68-71	9.6	9.8	8.0	1.8	1.6	0.5		24
D Río Limón	6 Dec	10:35	27.0	3,17-20	8.0	7.4	7.2	0.2	0.8	0.4		22
D	7 Dec	10:05	26.0	22,47-50	6.7	6.2	5.0	1.2	1.7	0.6		24
D	8 Dec	9:45	24.0	52,72-75	7.6	7.1	6.6	0.5	1.0	0.5		24
G	6 Dec	10:50	27.0	5,23-26	6.6	5.6	4.6	1.0	2.0	0.5		23
G	7 Dec	10:20	26.0	28,53-55	7.4	6.2	5.6	0.6	1.8	0.4		24

OXYGEN DATA SUMMARY FOR LAKE Dos Bocas IN Arecibo, PUERTO RICO

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM November 1976 TO December, 1978.

Table 76 (continued)

Station	Date 1977	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
G	8 Dec	9:55	24.0	57,76-79	8.2	8.3	6.4	1.9	1.8	0.6		24
E	6 Dec	11:10	27.0	7,29-32	7.6	7.2	6.8	0.4	0.8	0.4		24
E	7 Dec	10:35	26.0	34,58-60	8.3	8.3	6.1	2.2	2.2	0.5		24
E	8 Dec	10:30	24.0	62,80-83	8.5	8.4	7.2	1.2	1.3	0.6		24
B	6 Dec	11:55	27.0	9,35-38	10.1	9.2	7.4	1.8	2.7	0.3		25
B	7 Dec	10:55	27.0	40,63-65	10.0	10.5	6.3	4.2	3.7	0.3		23
B	8 Dec	10:45	26.0	67,84-87	7.9	8.9	6.0	2.9	1.9 (1.9)	0.4		24

LAGO DOS BOCAS

GRAFICA DE OXIGENO DISUELTO Y TEMPERATURA
DISTRIBUCIÓN VERTICAL ESTACIÓN-C (8 DE AGOSTO DE 1978)

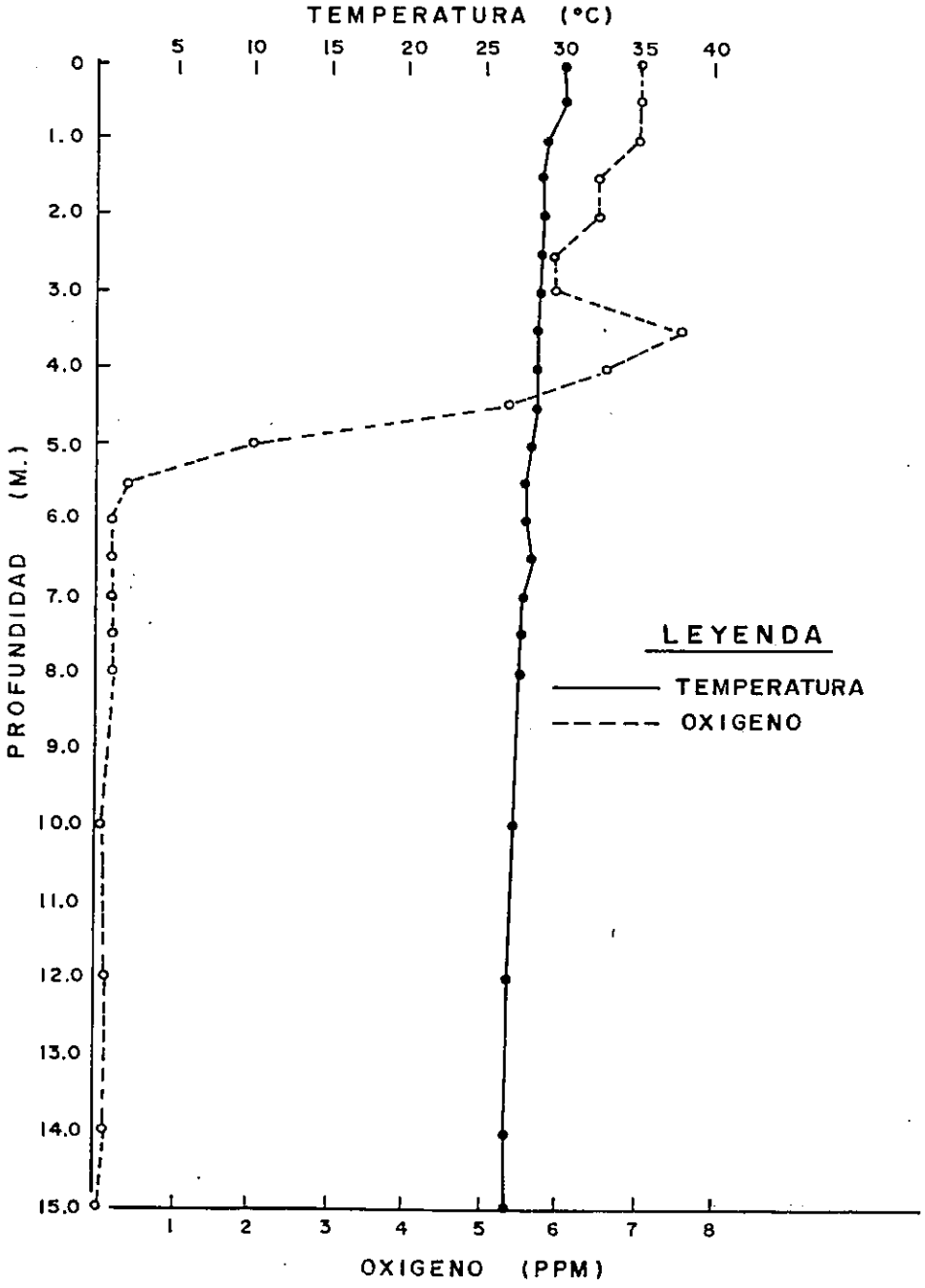


Figure 25

LAGO DOS BOCAS

GRAFICA DE OXIGENO DISUELTO Y TEMPERATURA
DISTRIBUCIÓN VERTICAL ESTACIÓN-D (3 DE AGOSTO DE 1978)

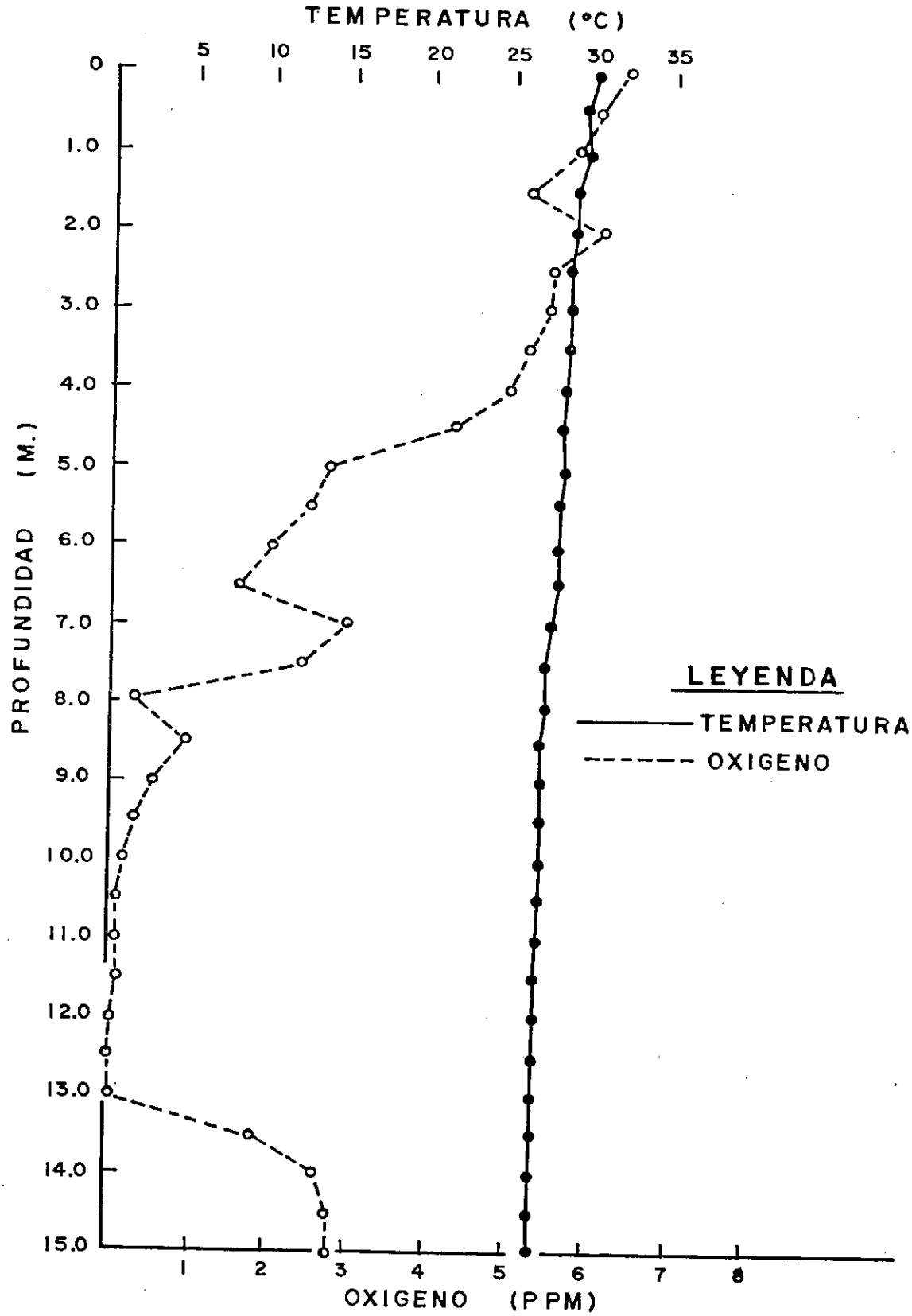


Figure 26

LAGO DOS BOCAS

GRAFICA DE OXIGENO DISUELTO Y TEMPERATURA 157
DISTRIBUCIÓN VERTICAL ESTACIÓN-E (8 DE AGOSTO DE 1978)

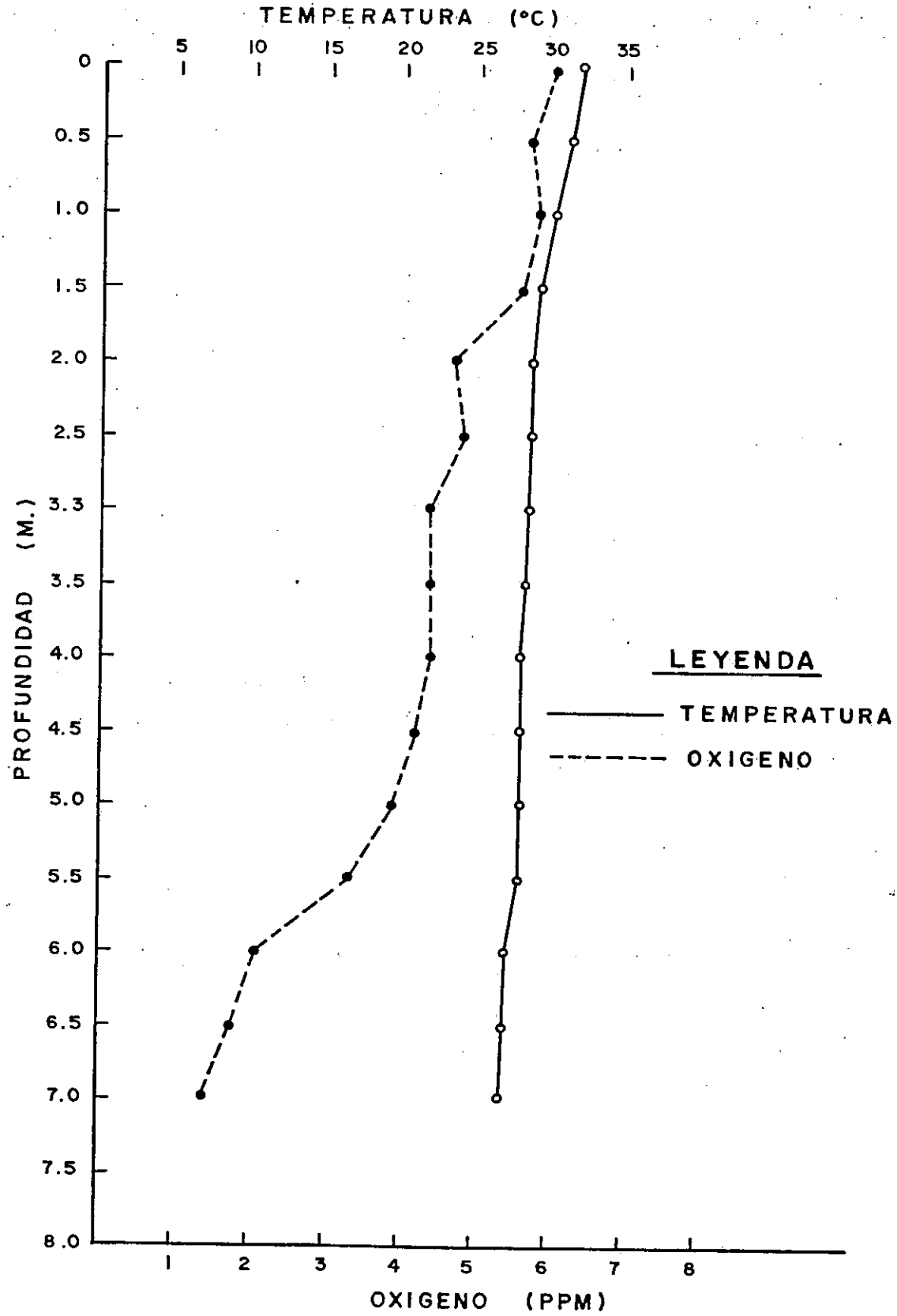


Figure 27

LAGO DOS BOCAS
GRAFICA DE OXIGENO DISUELTO Y TEMPERATURA
DISTRIBUCIÓN VERTICAL ESTACIÓN-B (8 DE AGOSTO DE 1978)

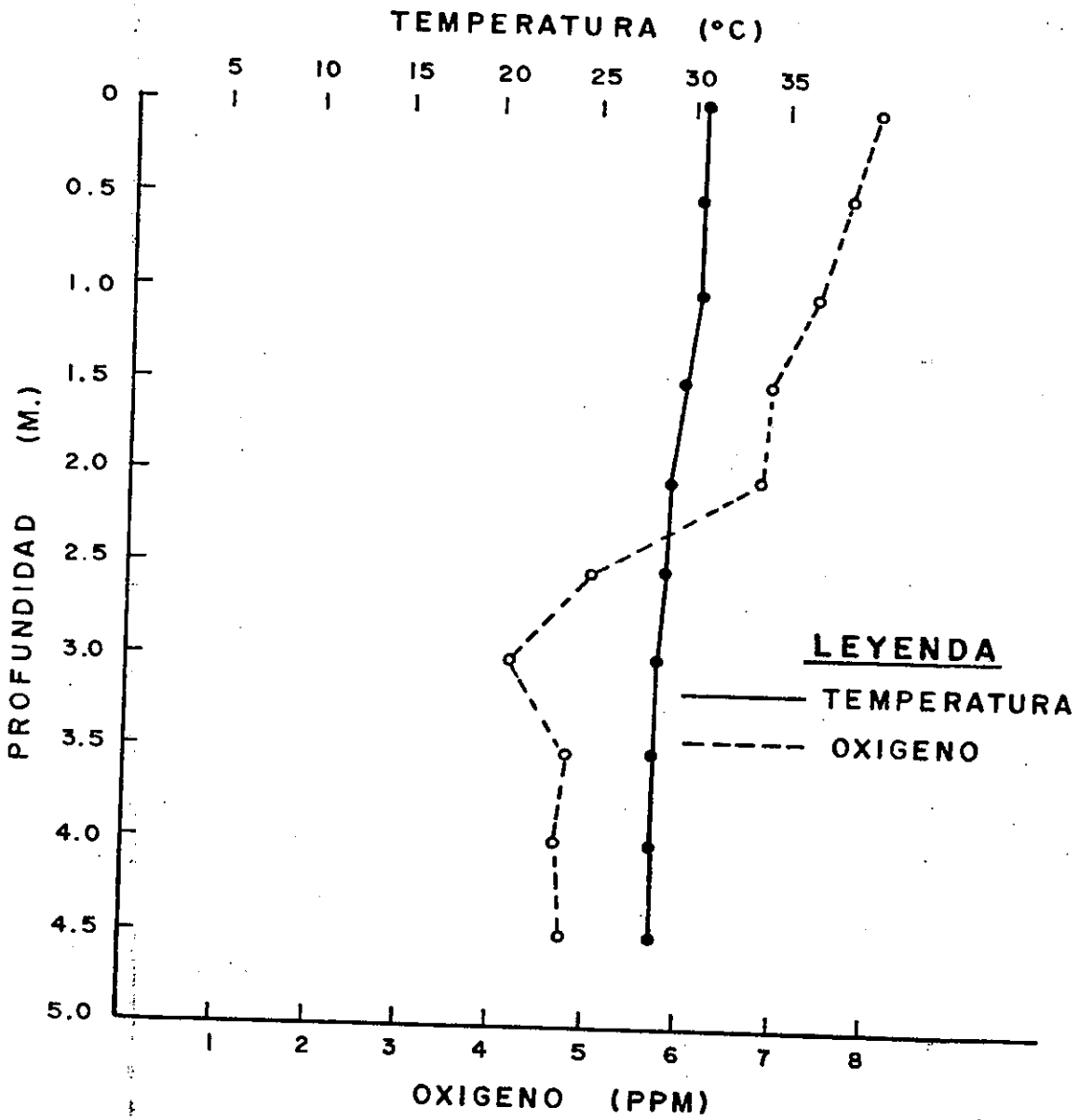


Figure 28

ALGAL DATA SUMMARY FOR LAKE Dos Bocas IN Ecuado, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM Diciembre 1977 to Enero, 1978.

Table 77

LOCALIZATION	SAMPLE	DATE 1978	ANACYSTIS (blue green)	GOMPHOSPHAERIA (blue green)	OSCILATORIA (blue green)	CHLORELLA (green)	PEDIASTRUM (green)	STAURASTRUM (green)	TETRAEDRON (green)	COCCONEIS (diatom)	FRAGILARIA (diatom)	GOMPHONEMA (diatom)	NAVICULA (diatom)	NITZSCHIA (diatom)	STEPHANODISCUS (diatom)	SYNEDRA (diatom)	MALLOMONAS (flagellate)	PERIDINIUM (flagellate)			TOTAL/ ML
			ORGANISMS/ ML																		
Near Dam	A 1	1/13	0.0	0.0	0.0	2.68	2.15	8.59	3.22	0.0	2.68	0.0	1.07	0.0	0.54	0.0	2.15	1.61			24.70
Near Dam	A 2	1/13	0.0	0.0	1.07	0.0	0.0	6.44	2.15	0.0	3.22	0.0	0.54	0.0	1.61	1.07	1.61	0.54			18.26
Near Dam	A 3	1/13	0.0	0.0	0.54	0.0	0.0	5.91	1.07	0.0	1.07	0.0	0.0	0.0	2.15	2.15	2.69	1.07			16.65
Near Limón River	B 1	1/13	2.15	0.0	0.0	0.0	2.15	3.22	0.0	0.0	0.0	0.0	1.07	0.0	3.76	1.61	1.61	0.0			15.57
Near Limón River	B 2	1/13	0.0	0.0	0.0	0.0	0.0	2.15	0.0	5.91	1.07	0.0	0.0	0.0	1.67	1.67	1.61	0.54			13.43
Near Limón River	B 3	1/13	0.0	0.0	0.0	0.0	1.07	2.68	0.0	0.0	1.07	0.0	1.61	0.0	2.68	1.61	1.07	0.0			11.81
Near Caonillas River	C 1	1/13	0.0	0.0	0.0	0.0	1.07	2.68	0.0	1.07	0.0	1.07	1.07	0.0	1.61	0.0	1.07	0.0			10.20
Near Caonillas River	C 2	1/13	0.0	0.0	0.0	1.07	1.61	1.61	0.0	0.0	0.0	0.54	0.0	0.54	1.07	0.0	1.61	0.0			8.06
Near Caonillas River	C 3	1/13	0.0	1.07	0.0	0.54	2.15	1.07	0.0	0.0	0.0	0.0	0.54	0.54	1.07	0.0	1.61	0.0			8.59
Near Caonillas River	D 1	1/13	0.0	0.0	0.0	0.54	0.0	2.69	0.0	0.0	1.07	0.0	1.07	1.61	2.67	0.0	1.61	0.0			11.28
Near Caonillas River	D 2	1/13	0.0	0.0	0.0	0.54	0.54	1.61	0.0	0.0	0.54	0.0	1.07	0.0	1.61	0.0	1.07	0.0			5.37
Near Caonillas River	D 3	1/13	0.0	1.61	0.0	1.07	0.0	2.15	0.0	0.0	0.54	0.0	0.0	0.0	2.69	0.0	1.07	0.0			9.13
Near Stream South Lajas	E 1	1/13	0.0	0.0	0.0	1.61	0.0	0.54	0.0	0.0	1.07	0.0	9.67	0.0	0.54	0.0	1.61	1.07			16.11
Near Stream South Lajas	E 2	1/13	0.0	0.0	0.0	3.22	0.0	2.15	0.0	0.0	2.15	0.0	7.52	0.0	1.07	0.0	2.15	0.0			18.26
Near Stream South Lajas	E 3	1/13	0.0	0.0	0.0	1.61	0.0	1.61	0.0	0.0	0.0	0.0	6.45	0.54	1.07	0.0	1.61	0.54			13.43

ALGAE DATA SUMMARY FOR LAKE Dos Bocas IN Utuado, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM ____________ 1977 to April, 1978.

Table 77 (continued)

LOCALIZATION	SAMPLE	DATE 1978	ANACYSTIS (blue green)	CHLORELLA (green)	PEDIASTRUM (green)	SCENEDESMUS (green)	STAURASTRUM (green)	TETRAEDRON (green)	COCCONEIS (diatom)	DIATOMEA (diatom)	FRAGILARIA (diatom)	NAVICULA (diatom)	STEPHANODISCUS (diatom)	SYNEDRA (diatom)	TABELLARIA (diatom)	MALLOMONAS (flagellate)	PERIDINIUM (flagellate)	PYROBOTRYS (flagellate)		TOTAL/ M L
			ORGANISMS/ ML																	
Dam	A 1	Apr. 27	1.07	1.61	0.0	0.0	4.30	1.07	0.0	0.0	1.07	1.07	0.0	2.15	0.0	3.76	0.0	0.0		16.11
Dam	A 2	Apr. 27	0.54	1.07	0.0	0.0	4.83	1.07	0.0	0.0	1.61	0.0	0.54	1.61	0.0	2.15	0.0	0.0		13.43
Dam	A 3	Apr. 27	0.0	0.0	1.07	0.0	2.15	0.54	0.0	0.0	1.07	0.0	1.61	1.61	0.0	1.07	1.07	0.0		10.20
Entrance Río Arecibo	B 1	Apr. 27	0.0	0.0	1.07	0.0	2.69	1.07	0.0	1.07	1.07	0.0	1.61	1.07	0.0	1.61	0.0	0.0		11.28
Entrance Río Arecibo	B 2	Apr. 27	0.0	0.0	0.0	0.0	4.30	1.61	3.76	0.0	0.0	0.0	1.07	1.07	0.0	1.61	0.0	0.0		13.43
Entrance Río Arecibo	B 3	Apr. 27	0.0	0.54	1.07	0.0	3.22	1.07	2.69	0.0	0.0	0.0	1.07	1.61	0.0	1.61	0.0	0.0		12.89
Near Dam	C 1	Apr. 27	0.0	0.0	0.0	0.0	1.61	2.15	0.0	1.07	1.07	0.0	1.61	0.0	1.07	1.61	1.07	0.0		11.28
Near Dam	C 2	Apr. 27	1.61	0.54	1.07	0.0	3.22	0.0	2.69	0.0	0.0	0.0	1.61	0.54	0.0	1.61	0.0	0.0		12.89
Near Dam	C 3	Apr. 27	0.0	0.0	0.54	1.61	2.15	0.0	0.0	0.0	1.61	0.54	0.54	1.07	0.0	2.15	0.0	0.0		10.20
Middle Lake	D 1	Apr. 27	0.0	2.15	0.0	0.0	2.69	0.0	1.61	0.0	1.07	0.0	1.07	0.0	0.0	1.07	1.07	0.0		10.74
Middle Lake	D 2	Apr. 27	0.0	1.07	0.0	0.0	2.69	1.07	0.0	0.54	1.61	0.0	2.69	1.07	0.0	2.15	0.54	0.0		13.43
Middle Lake	D 3	Apr. 27	1.27	1.61	0.0	0.0	3.22	0.0	0.0	0.0	1.07	0.0	1.07	0.54	0.0	1.07	0.54	0.0		11.28
Entrance Río Caonillas	E 1	Apr. 27	0.0	1.07	0.54	0.0	1.61	0.0	4.30	0.0	0.0	0.0	1.07	0.0	0.0	1.61	1.07	1.61		12.89
Entrance Río Caonilas	E 2	Apr. 27	0.0	1.07	1.07	0.0	2.15	0.0	2.15	0.0	0.0	0.0	1.61	0.54	0.0	1.07	0.0	0.0		9.67
Entrance Río Caonillas	E 3	Apr. 27	0.0	1.61	0.0	0.0	2.15	0.0	2.69	1.07	0.0	0.0	1.61	1.07	0.0	1.07	0.0	0.0		11.28

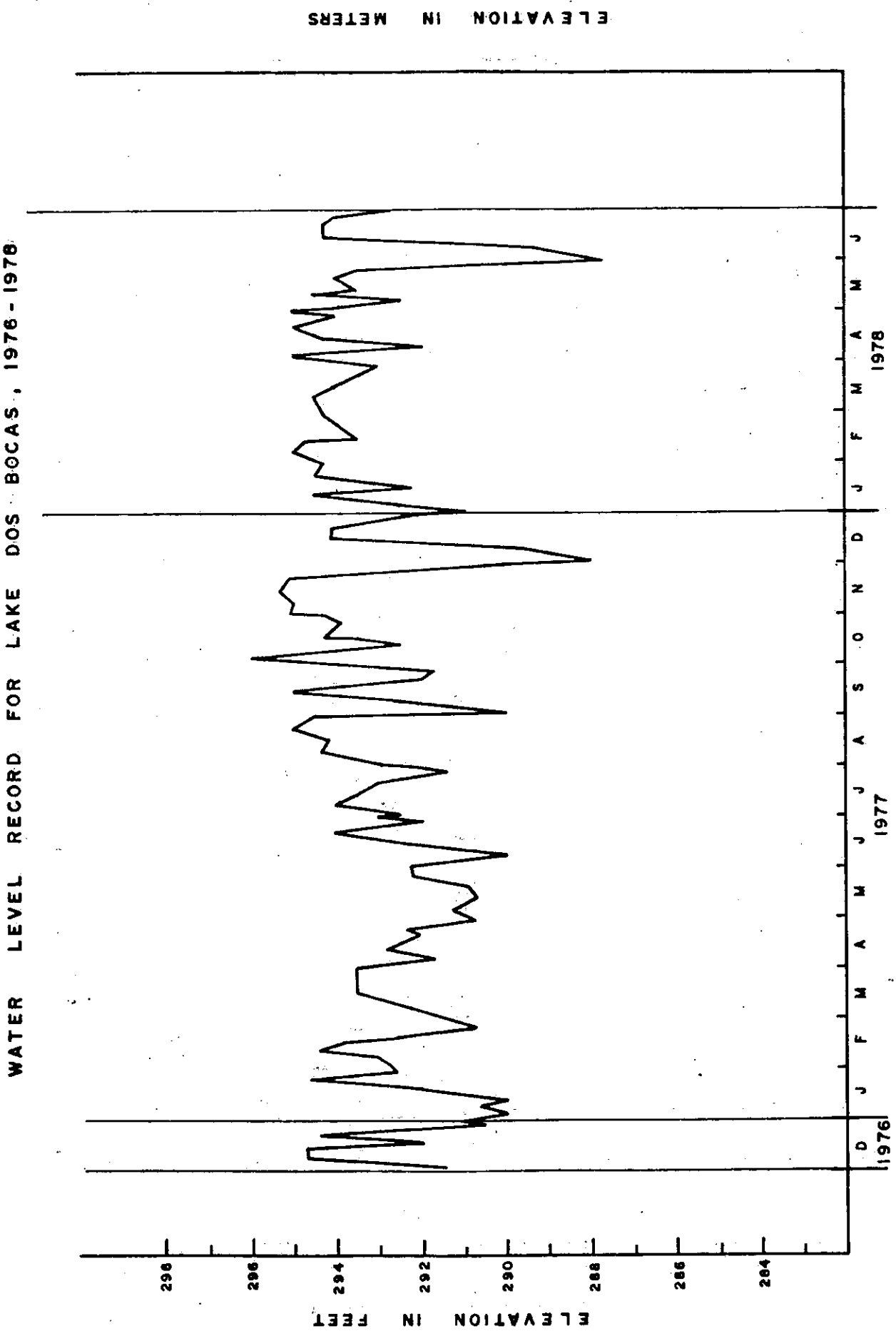
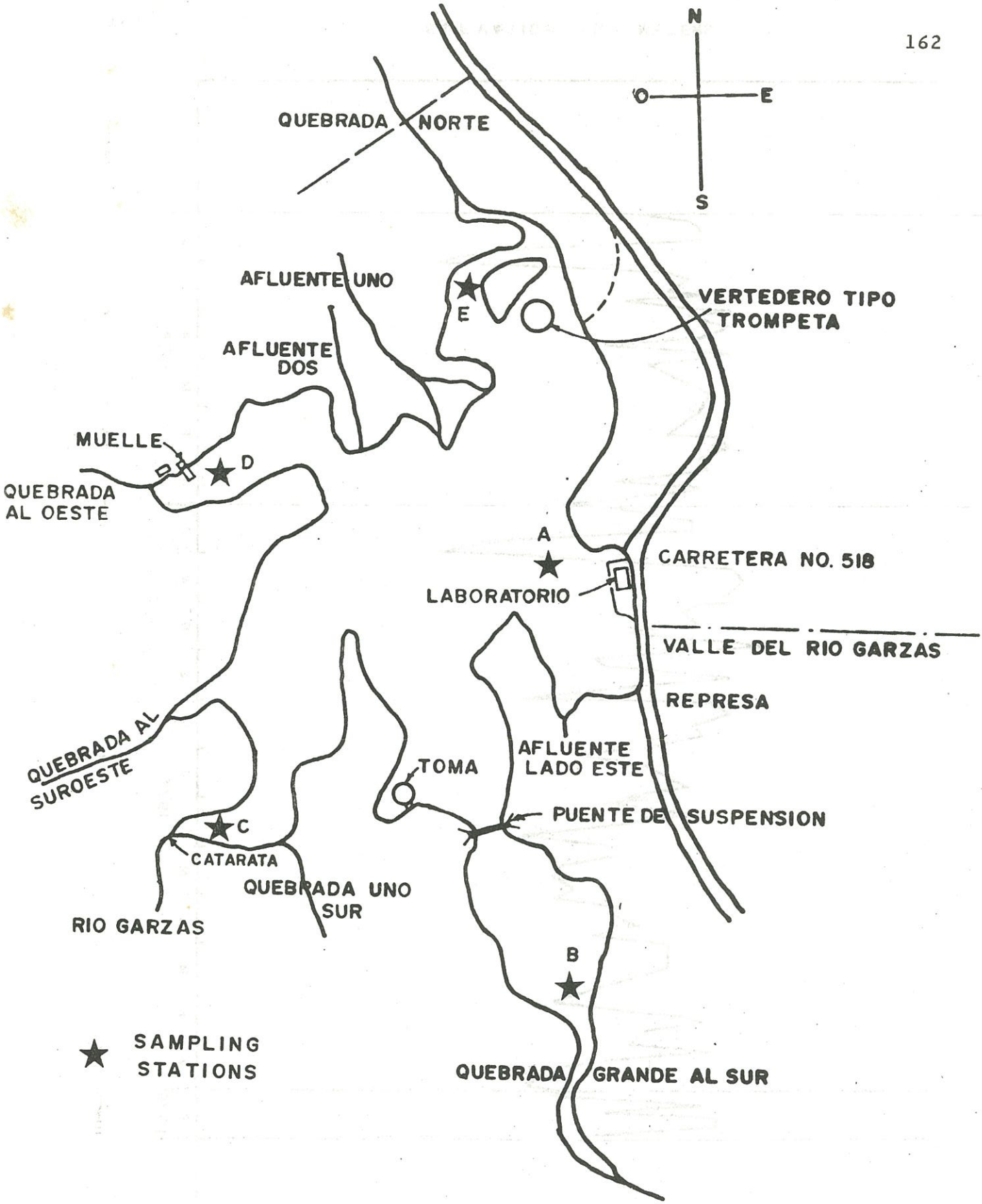

WATER LEVEL RECORD FOR LAKE DOS BOCAS, 1976-1978
ELEVATION IN METERS
ELEVATION IN FEET
298
296
294
292
290
288
286
284
D
J
F
M
A
M
J
J
A
S
O
N
D
J
F
M
A
M
J
1976
1977
1978

Figure 29



REPRESA GARZAS DE ADJUNTAS, P. R.

Figure 30

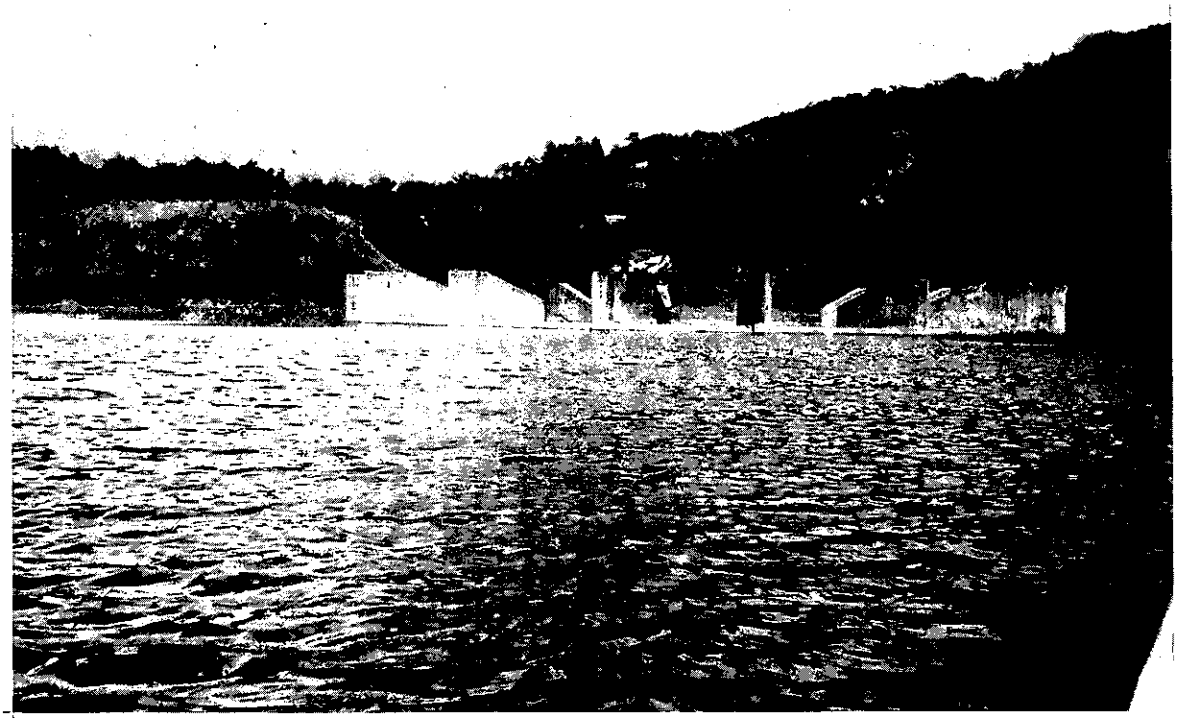


Figure 31. Overflow spillway on Lake Garzas at high water level in November 1976.

Figure 32. Overflow spillway on Lake Garzas at low water level in July 1976.

CHEMICAL QUALITY DATA SUMMARY FOR LAKE Garzas IN Adjuntas, PUERTO RICO

FROM November 1976 TO May 1978. SAMPLES ARE FROM 0.5 M DEPTH

Table 78

Station and Localization	Date 1976	Time	Sample No.	Lab. No.	Chloride mg/l	Hardness as $MgSO_4$ Mg/l	Total Phosphates as P mg/l	Nitrate & Nitrite as N mg/l	Iron mg/l	Turbidity in Standard Unit	Color in Standard Unit	pH	Dissolved Oxygen mg/l	Chlorophyll A mg/l	Total Coliform count	Sample Size ml
Quebrada Gde. al Sur B	30 Nov	11:00	GZ-11	330	3.9	57.2	0.00	0.07	0.13	1.5	10	7.5	6.5			
Middle Lake A	30 Nov	10:30	GZ- 8	331	3.9	57.2	0.00	0.07	0.10	4.4	10	7.5	6.5			
Río Garzas C	30 Nov	8:30	GZ-11	332	3.9	57.2	0.00	0.20	0.10	1.9	5	7.4	7.1			
Quebrada al Oeste D	30 Nov	9:15	GZ- 5	333	3.9	57.2	0.00	0.02	0.20	1.9	10	7.3	---			
Quebrada Norte E	30 Nov	9:55	GZ- 7	334	3.9	62.9	0.00	0.08	0.10	1.7	10	7.3	---			
	1977															
A	23 Jun		GZ-136	371	2.0	95.8	0.01	0.03	0.05	0.3	10	7.9	8.6			
B	23 Jun		GZ-123	372	2.0	101.1	0.01	0.05	0.08	0.3	10	7.3	8.4			
C	23 Jun		GZ-128	373	0.1	95.8	0.01	0.06	0.10	0.3	10	7.1	8.1			
D	23 Jun		GZ-130	374	2.0	101.1	0.01	0.08	0.20	0.3	10	7.4	---			
E	23 Jun		GZ-131	375	2.0	526.6	0.01	0.01	0.06	1.2	12	7.3	---			
A	23 Sep	6:40	GZ-49	399	2.0	103.0	0.01	0.06	0.03	0.7	10	8.1	5.7			
B	23 Sep	7:00	GZ-58	400	2.0	85.8	0.01	0.05	0.10	0.2	10	8.0	5.3			
C	23 Sep	7:35	GZ-66	401	2.0	131.6	0.01	0.06	0.06	2.5	10	8.1	6.6			
D	23 Sep	7:55	GZ-73	402	0.8	65.8	0.01	0.10	0.06	0.2	10	8.0	5.6			
E	23 Sep	8:05	GZ-77	403	1.0	117.3	0.01	0.05	0.04	1.7	8	8.0	---			

CHEMICAL QUALITY DATA SUMMARY FOR LAKE Garzas IN Adjuntas, PUERTO RICO

FROM November 197_ TO May 1978. SAMPLES ARE FROM 0.5 M DEPTH

Table 78 (continued)

Station and Localization	Date 1978	Time	Sample No.	Lab. No.	Chloride mg/l	Hardness as $MgSO_4$ Mg/l	Total Phosphates as P mg/l	Nitrate & Nitrite as N mg/l	Iron mg/l	Turbidity in Standard Unit	Color in Standard Unit	pH	Dissolved Oxygen mg/l	Chlorophyll A mg/l	Total Coliform count	Sample Size ml
A	27 Jan	7:35	GZ-72	428	1.9	84.2	0.01	0.06	0.03	0.03	5	7.5	6.4			
B	27 Jan	6:55	GZ-57	429	0.0	78.6	0.01	0.07	0.10	0.07	5	7.5	5.7			
C	27 Jan	7:15	GZ-62	430	1.0	73.6	0.01	0.10	0.03	0.03	8	7.6	6.9			
E	27 Jan	7:25	GZ-67	431	2.0	80.3	0.01	0.07	0.03	0.10	5	7.5	7.1			
A	17 May		GZ-2	514	7.8	76.7	0.03	0.03	0.03		10	7.5	---			
B	17 May		GZ-4	515	7.8	76.7	0.06	0.00	0.20		8	8.0	---			
C	17 May		GZ-6	516	7.8	83.1	0.04	0.07	0.00		5	7.7	---			
D	17 May		GZ-8	518	6.8	83.1	0.01	0.00	0.03		5	7.7	---			
E	17 May		GZ-10	519	6.8	76.7	1.42	0.00	0.05		8	7.7	---			

TABLE 79

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Garzas

PARAMETER Chlorides

UNITS mg/1

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1 30/11/76	19.5	5	3.90	0.00
2 23/6/77	8.1	5	1.62	0.61
3 23/9/77	7.8	5	1.56	0.53
4 27/1/78	4.9	4	1.22	0.72
5 17/5/78	37.0	5	7.40	0.48
6				
7				
8				
9				
10				
TOTALS	77.3	24	3.22	
B-VARIATION BY STATION				
A	17.6	5	3.52	1.86
B	15.7	5	3.14	2.17
C	14.8	5	2.96	2.31
D	13.5	4	3.38	1.98
E	15.7	5	3.14	1.77
F				
G				
H				
TOTALS	77.3	24	3.22	

TABLE 80

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Garzas

PARAMETER Hardness as MgSo4

UNITS mg/1

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	291.7	5	58.34	1.82
2	920.4	5	184.08	137.01
3	503.5	5	100.70	19.92
4	316.7	4	79.18	3.08
5	396.3	5	79.26	3.07
6				
7				
8				
9				
10				
TOTALS	2,428.6	24	101.19	
B-VARIATION BY STATION				
A	416.9	5	83.38	13.04
B	399.4	5	79.88	10.86
C	441.3	5	88.26	20.35
D	307.2	4	76.80	15.30
E	863.8	5	172.76	141.54
F				
G				
H				
TOTALS	2,428.6	24	101.19	

TABLE 81

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Garzas

PARAMETER Total Phosphates as P

UNITS mg/1

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	0.0	5	0.00	0.00
2	0.05	5	0.01	0.00
3	0.05	5	0.01	0.00
4	0.04	4	0.01	0.00
5	1.56	5	0.31	0.44
6				
7				
8				
9				
10				
TOTALS	1.7	24	0.07	
B-VARIATION BY STATION				
A	0.06	5	0.01	0.01
B	0.09	5	0.02	0.02
C	0.07	5	0.01	0.01
D	0.03	4	0.01	0.00
E	1.45	5	0.29	0.45
F				
G				
H				
TOTALS	1.7	24	0.07	

TABLE 82

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Garzas

PARAMETER Nitrte & Nitrite as N

UNITS mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	0.44	5	0.09	0.05
2	0.23	5	0.05	0.02
3	0.32	5	0.06	0.01
4	0.30	4	0.08	0.02
5	0.10	5	0.02	0.01
6				
7				
8				
9				
10				
TOTALS	1.39	24	0.06	
B-VARIATION BY STATION				
A	0.25	5	0.05	0.02
B	0.24	5	0.05	0.02
C	0.49	5	0.10	0.04
D	0.20	4	0.05	0.04
E	0.21	5	0.04	0.02
F				
G				
H				
TOTALS	1.39	24	0.06	

TABLE 83

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Garzas

PARAMETER Iron

UNITS mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	0.63	5	0.13	0.03
2	0.49	5	0.10	0.04
3	0.29	5	0.06	0.02
4	0.19	4	0.05	0.03
5	0.31	5	0.06	0.05
6				
7				
8				
9				
10				
TOTALS	1.91	24	0.08	
B-VARIATION BY STATION				
A	0.24	5	0.05	0.02
B	0.61	5	0.12	0.03
C	0.29	5	0.06	0.03
D	0.49	4	0.12	0.08
E	0.28	5	0.06	0.02
F				
G				
H				
TOTALS	1.91	24	0.08	

TABLE 84

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM

LAKE Garzas

PARAMETER Turbidity

UNITS Standard Unit

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	11.40	5	2.28	0.85
2	2.40	5	0.48	0.29
3	5.30	5	1.06	0.83
4	0.23	4	0.06	0.03
5				
6				
7				
8				
9				
10				
TOTALS	19.33	19	1.02	
B-VARIATION BY STATION				
A	5.43	4	1.36	1.52
B	2.07	4	0.52	0.49
C	4.73	4	1.18	1.02
D	2.40	3	0.80	0.73
E	4.70	4	1.18	0.54
F				
G				
H				
TOTALS	19.33	19	1.02	

TABLE 85

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Garzas

PARAMETER Color

UNITS Standard Unit

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	45.0	5	9.00	1.60
2	52.0	5	10.40	0.64
3	48.0	5	9.60	0.64
4	23.0	4	5.75	1.12
5	36.0	5	7.20	1.76
6				
7				
8				
9				
10				
TOTALS	204.0	24	8.50	
B-VARIATION BY STATION				
A	45.0	5	9.00	1.60
B	43.0	5	8.60	1.68
C	38.0	5	7.60	2.08
D	35.0	4	8.75	1.88
E	43.0	5	8.60	1.92
F				
G				
H				
TOTALS	204.0	24	8.50	

TABLE 86

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Garzas

PARAMETER P. H.

UNITS

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	37.0	5	7.40	0.08
2	37.0	5	7.40	0.20
3	40.2	5	8.04	0.05
4	30.1	4	7.52	0.04
5	38.6	5	7.72	0.11
6				
7				
8				
9				
10				
TOTALS	182.9	24	7.62	
B-VARIATION BY STATION				
A	38.5	5	7.70	0.24
B	38.3	5	7.66	0.27
C	37.9	5	7.58	0.26
D	30.4	4	7.60	0.25
E	37.8	5	7.56	0.23
F				
G				
H				
TOTALS	182.9	24	7.62	

TABLE 87

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Garzas

PARAMETER Dissolved Oxygen

UNITS mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	20.1	3	6.70	0.27
2	25.1	3	8.37	0.18
3	23.2	4	5.80	0.40
4	26.1	4	6.52	0.38
5				
6				
7				
8				
9				
10				
TOTALS	94.5	14	6.75	
B-VARIATION BY STATION				
A	27.2	4	6.80	0.90
B	25.9	4	6.48	0.98
C	28.7	4	7.18	0.46
D	5.6	1		
E	7.1	1		
F				
G				
H				
TOTALS	94.5	14	6.75	

Table 88

Summary of Snails Surveys in Lake Garzas

Date	Inspector	Snails Found
Jan. 29/76	P. Bermudez	*Biomphalaria glabrata* *Physa marmorata* *Marisa cornuarietis* *Tarebia granifera*
Dec. 7/76	H. Negrón	*Marisa cornuarietis* *Lymnaea cubensis* *Physa marmorata* *Tarebia granifera* *Biomphalaria glabrata*
Jun 28/77	W. Jobin & A. Laracuente	*Marisa cornuarietis* *Tarebia granifera* *Physa marmorata* *Lymnaea cubensis*
Dec. /77	W. Jobin	*Physa marmorata* *Biomphalaria glabrata* *Marisa cornuarietis* *Lymnaea cubensis*
Feb. 2/78	W. Jobin	*Marisa cornuarietis* *Lymnaea cubensis* *Physa marmorata* *Tarebia granifera*

Table 88 (continued)

Date	Inspector	Snails Found
May 17/78	R. Brown	*Marisa cornuarietis*
		Tarebia granifera
		Physa marmorata
Aug. 28/78	A. Laracuente	*Marisa cornuarietis*
		Tarebia granifera

Table 89

SUMMARY OF COLIFORM DATA OF LAKE Garzas IN _____, P.R.

FROM _____ 197 TO _____ 1978.

STATION	DATE	FIELD NUM.	VOL. ml	COLONIES	COLONIES/ 100 ml
A	30/11/76	GZ-10	1	12	1200
A	30/11/76	GZ-10	10	103	1030
B	30/11/76	GZ-3	1	92	9,200
B	30/11/76	GZ-3	10	TNTC	
C	30/11/76	GZ-13	1	327	32,700
C	30/11/76	GZ-13	10	TNTC	
D	30/11/76	GZ-4	1	301	30,100
D	30/11/76	GZ-4	10	TNTC	
E	30/11/76	GZ-6	1	102	10,200
E	30/11/76	GZ-6	10	TNTC	
A	1/12/76	GZ-27	1	56	5,600
A	1/12/76	GZ-27	10	TNTC	
B	1/12/76	GZ-33	1	15	1500
B	1/12/76	GZ-33	10	TNTC	
C	1/12/76	GZ-19	1	1	100
C	1/12/76	GZ-19	10	15	150
D	1/12/76	GZ-40	1	63	6,300
D	1/12/76	GZ-20	10	TNTC	
E	1/12/76	GZ-21	1	21	2,100
E	1/12/76	GZ-21	10	TNTC	
A	2/12/76	GZ-47	01	26	2600
A	2/12/76	GZ-47	1	TNTC	
B	2/12/76	GZ-53	01	2	200
B	2/12/76	GZ-53	10	TNTC	
C	2/12/76	GZ-39	01	0	-
C	2/12/76	GZ-39	10	7	70
D	2/12/76	GZ-40	01	2	200
D	2/12/76	GZ-40	10	3	30
E	2/12/76	GZ-41	01	6	600
E	2/12/76	GZ-41	10	36	360
A	20/6/77	GZ-75	10	0	0
A	20/6/77	GZ-75	1	0	0
B	20/6/77	GZ-77	10	0	0

Table 89 (continued)

SUMMARY OF COLIFORM DATA OF LAKE Garzas IN _____, P.R.

FROM _____ 197 TO _____ 1978.

STATION	DATE	FIELD NUM.	VOL. ml	COLONIES	COLONIES/ 100 ml
B	20/6/77	GZ-77	1	0	0
C	20/6/77	GZ-79	10	0	0
C	20/6/77	GZ-79	1	0	0
D	20/6/77	GZ-80	10	0	0
D	20/6/77	GZ-80	1	0	0
E	20/6/77	GZ-81	10	0	0
E	20/6/77	GZ-81	1	0	0
B	21/6/77	GZ-87	10	0	0
B	21/6/77	GZ-87	1	0	0
C	21/6/77	GZ-93	10	0	0
C	21/6/77	GZ-93	1	0	0
D	21/6/77	GZ-94	10	0	0
D	21/6/77	GZ-94	1	0	0
E	21/6/77	GZ-95	10	0	0
E	21/6/77	GZ-95	1	0	0
A	21/6/77	GZ-101	10	0	0
A	21/6/77	GZ-101	1	0	0
A	22/6/77	GZ-117	1	0	0
A	22/6/77	GZ-117	10	0	0
A	22/6/77	GZ-107	1	0	0
B	22/6/77	GZ-107	10	0	0
C	22/6/77	GZ-113	1	0	0
C	22/6/77	GZ-113	10	0	0
D	22/6/77	GZ-114	1	0	0
D	22/6/77	GZ-114	10	1	10
E	22/6/77	GZ-115	1	2	200
E	22/6/77	GZ-115	10	2	20
A	8/78				5.5×10^3
A	8/78				7.9×10^3
B	8/78				1.7×10^4
B	8/78				2.0×10^4
C	8/78				2.9×10^4
C	8/78				2.5×10^3
E	8/78				7.5×10^3
E	8/78				5.3×10^3

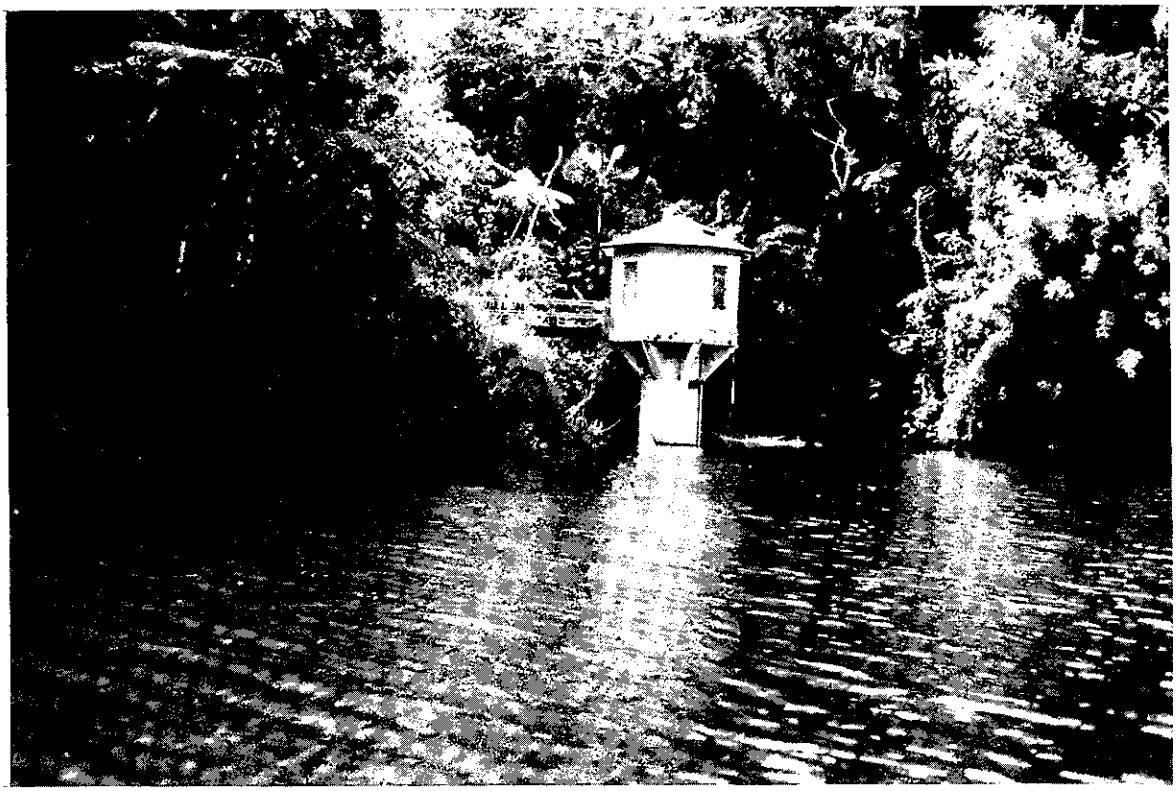


Figure 33. Outlet gate from Lake Garzas diverting flow to turbines and irrigation system on south coast.

OXYGEN DATA SUMMARY FOR LAKE Garzas IN Adjuntas, PUERTO RICO

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM December 1976 TO January, 1978.

Table 90

Station	Date 1976	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
C Río Garzas	1 Dec	7:07	22	3,22-25	6.6	7.0	6.0	1.0	0.6	2.8		23
C	2 Dec	6:55	21	14,34-37	6.9	6.8	6.4	0.4	0.5	2.5		24
C	3 Dec	7:30	21	38,54-57	7.7	6.7	6.3	0.4	1.4	-		23
A Middle Lake	1 Dec	8:00	22.5	9,22-25	6.9	7.6	6.9	0.7	0.0	2.5		23
A	2 Dec	7:50	21	26,42-45	6.2	7.0	6.0	1.0	0.2	2.5		24
A	3 Dec	8:00	22	46,62-65	6.4	6.6	6.0	0.6	0.4	-		24
B	1 Dec	8:30	22.5	12,31-28	7.0	7.2	6.8	0.4	0.2	2.0		23
B	2 Dec	8:10	22	32,48-51	6.4	6.9	6.2	0.7	0.2	2.0		24
B	3 Dec	7:45	21.5	52,58-61	6.0	6.8	5.8	1.0	0.2	-		24
	1977											
A	21 Jun	10:45	25	74,97-100	9.8	8.6	7.9	0.7	1.9	1.5		21
A	22 Jun	10:10	25	96,	8.2	-	-	-	-	1.5		24
A	23 Jun	8:10	24	116, 132-135	7.9	8.8	8.4	0.4	- 0.5	1.8		22
B	21 Jun	8:20	25	76,83-86	8.6	8.6	8.2	0.4	0.4	2.0		19
B	22 Jun	8:45	25	82, 103-106	8.0	8.8	8.3	0.5	- 0.3	2.0		24
B	23 Jun	7:25	24	102, 118-121	8.7	8.8	8.1	0.7	0.6	1.8		23
C	21 Jun	8:45	25	77,89-92	8.1	8.4	8.0	0.4	0.1	1.2		19
C	22 Jun	9:15	25	88, 109-112	8.0	9.2	7.6	1.6	0.4	1.8		23
C	23 Jun	7:45	24	108, 124-127	8.3	9.0	8.0	1.0	0.3	2.0		22

OXYGEN DATA SUMMARY FOR LAKE Garzas IN Adjuntas, PUERTO RICO

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM December 1976 TO January, 1978.

Table 90 (continued)

Station	Date 1977	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
A	21 Sep	7:20	21	1,6-9	5.6	5.9	5.5	0.4	0.1	1.8		23
A	22 Sep	8:30	21	5,26-29	5.9	6.0	5.2	0.8	0.7	2.4		23
A	23 Sep	6:40	22	2,11-14	5.6	6.0	5.2	0.8	0.4	2.0		22
B	21 Sep	7:50	21.5	2,11-14	6.0	5.3	5.4	-0.1	0.6	1.8		23
B	22 Sep	8:50	21.5	10,31-34	5.2	5.3	4.8	0.5	0.4	2.0		25
B	23 Sep	7:00	21.5	30,53-56	4.7	4.6	4.2	0.4	0.5	1.5		22
C	21 Sep	8:20	22	3,16-19	6.6	6.4	6.0	0.4	0.6	2.0		23
C	22 Sep	9:25	21	15,36-39	6.6	6.4	5.8	0.6	0.8	2.2		23
C	23 Sep	7:35	21.5	35,61-64	6.6	6.8	6.0	0.8	0.6	2.2		22
D	21 Sep	8:45	21	4,21-24	5.8	6.2	5.4	0.8	0.4	2.0		23
D	22 Sep	9:45	21	20,41-44	5.4	6.0	5.1	0.9	0.3	1.8		25
D	23 Sep	7:55	21.5	40,69-72	5.5	5.6	5.0	0.6	0.5	2.0		22
	1978											
B	25 Jan	7:05	17	1,6-8	5.7	5.4	5.0	0.4	0.7	2.1		21
B	26 Jan	7:10	18	5,30-33	5.7	5.8	5.2	0.6	0.5	2.0		24
B	27 Jan	6:55	18	29,53-56	5.6	6.1	5.4	0.7	0.2	2.0		24
C	25 Jan	7:25	18	2,12-15	6.1	6.4	6.1	0.3	0.0	2.3		21
C	26 Jan	7:30	18	11,36-39	6.9	7.1	6.6	0.5	0.3	2.3		24
C	27 Jan	7:15	18	35,58-61	7.7	7.9	7.4	0.5	0.3	2.4		24

OXYGEN DATA SUMMARY FOR LAKE Garzas IN Adjuntas, PUERTO RICO

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM December 1976 TO January, 1978.

Table 90 (continued)

Station	Date	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
E	24 Jan	7:40	18	3,18-21	7.0	6.9	6.4	0.5	0.6	2.6		21
E	26 Jan	7:45	18	17,42-45	6.8	7.1	6.3	0.8	0.5	2.5		24
E	27 Jan	7:25	18	41,63-66	6.9	7.3	6.9	0.4	0.0	3.0		24
A	25 Jan	7:55	18	4,24-27	6.3	6.2	5.7	0.5	0.6	2.6		20
A	26 Jan	8:00	18	23,48-51	6.1	6.8	5.9	0.9	0.2	2.3		24
A	27 Jan	7:25	18	47,68-71	6.7	7.1	6.2	0.9	0.5	2.5		23

ALGAE DATA SUMMARY FOR LAKE Garzas IN Utuado, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM September 1977 to ____________, 1978.

Table 91

LOCALIZATION	SAMPLE	DATE	ORGANISMS/ ML																
			ANABAENA (blue green)	ANACYSTIS (blue green)	AGMENALLUM (blue green)	ACTINASTRUM (green algae)	CHLORELLA (green algae)	SCENEDESMUS (green algae)	STAURASTRUM (green algae)	TETRAEDRON (green algae)	ACHNANTHES (diatom)	ASTERIONELLA (diatom)	COCCONEIS (diatom)	DIATOMEA (diatom)	FRAGILARIA (diatom)	GOMPHONEMA (diatom)	NAVICULA (diatom)	STEPHANODISCUS (diatom)	SYNEDRA (diatom)	(include next page) TOTAL/ M L
Center Lake	A 1	Sept 23	1.61	4.83	1.61	3.22	6.44	1.07	1.61	0.0	3.22	0.0	0.0	0.0	0.0	1.07	0.0	1.07	3.22	35.98
Center Lake	A 2	Sept 23	1.07	1.61	0.0	1.61	8.06	0.0	0.0	1.07	2.69	0.0	0.0	0.0	0.0	0.54	1.07	2.15	1.07	25.24
Center Lake	A 3	Sept 23	1.61	2.68	0.0	1.07	9.66	0.0	1.61	1.61	2.68	0.0	0.0	0.0	0.0	1.61	0.0	1.61	1.61	27.92
South Quebrada Grande	B 1	Sept 23	0.0	3.22	0.0	1.07	3.22	0.0	0.0	0.0	1.07	1.07	0.0	2.15	0.0	0.0	0.0	1.07	0.54	15.57
South Quebrada Grande	B 2	Sept 23	0.0	1.61	0.0	0.0	0.0	0.0	0.0	1.07	2.15	1.07	0.0	0.0	1.07	1.07	0.0	1.07	0.54	12.89
South Quebrada Grande	B 3	Sept 23	1.07	1.61	0.0	0.0	3.76	0.54	0.0	0.54	1.61	0.0	0.0	0.0	0.0	2.15	0.0	1.07	0.0	16.65
Entrance Río Garzas	C 1	Sept 23	2.15	0.0	0.0	1.61	6.48	0.0	0.0	3.76	1.61	0.0	0.0	0.0	0.0	1.07	0.0	0.54	0.0	20.94
Entrance Río Garzas	C 2	Sept 23	0.0	0.0	0.0	1.07	6.44	0.0	0.0	1.07	1.07	0.0	0.0	0.0	1.07	0.54	0.0	0.54	1.07	15.57
Entrance Río Garzas	C 3	Sept 23	1.07	0.0	0.0	1.61	5.37	0.0	0.0	2.15	1.61	0.0	0.0	0.0	1.07	1.61	0.0	1.07	0.0	19.82
West Stream	D 1	Sept 23	1.07	0.0	0.0	0.0	3.22	0.0	0.0	2.15	0.54	0.0	0.0	0.0	2.69	1.61	0.0	0.54	0.54	15.04
West Stream	D 2	Sept 23	1.07	1.61	0.0	0.0	5.37	0.0	0.0	1.07	2.15	0.0	0.54	0.0	0.0	1.07	0.0	0.54	0.0	16.11
West Stream	D 3	Sept 23	1.07	0.0	0.0	0.0	5.37	0.0	1.61	1.07	1.61	0.0	0.0	0.0	0.0	2.15	0.54	1.61	2.68	20.54
Near Spill Way	E 1	Sept 23	1.07	0.0	0.0	0.0	1.61	0.0	1.61	0.0	3.22	0.0	0.0	0.0	1.61	2.15	1.07	1.07	1.61	18.26
Near Spill Way	E 2	Sept 23	1.07	0.0	0.0	0.0	1.61	0.0	2.68	0.0	2.15	0.0	0.0	0.0	1.61	1.61	0.54	0.54	1.61	15.57
Near Spill Way	E 3	Sept 23	0.54	0.0	0.0	0.0	3.22	0.0	1.61	0.0	2.68	0.0	0.0	0.0	2.15	0.54	1.07	1.61	2.68	17.72

ALGAE DATA SUMMARY FOR LAKE Garzas IN Utuado, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM September 1977 to ____________, 1978.

Table 91 (continued)

LOCALIZATION	SAMPLE	DATE	ORGANISMS/ ML			TOTAL/ ML
			CHRYSOCOCCUS (flagellate)	MALLOMONAS (flagellate)	PERIDINIUM (flagellate)	
Center Lake	A 1	Sept 23	1.61	5.37	0.0	
Center Lake	A 2	Sept 23	1.07	3.22	0.0	
Center Lake	A 3	Sept 23	0.0	1.61	0.54	
South Quebrada Grande	B 1	Sept 23	0.54	1.61	0.0	
South Quebrada Grande	B 2	Sept 23	0.54	2.45	0.54	
South Quebrada Grande	B 3	Sept 23	1.07	3.22	0.0	
Entrance Río Garzas	C 1	Sept 23	0.54	1.61	1.07	
Entrance Río Garzas	C 2	Sept 23	1.07	1.07	0.54	
Entrance Río Garzas	C 3	Sept 23	1.07	2.15	1.07	
West Stream	D 1	Sept 23	1.07	1.07	0.54	
West Stream	D 2	Sept 23	1.61	1.07	0.0	
West Stream	D 3	Sept 23	0.0	3.22	0.0	
Near Spill Way	E 1	Sept 23	0.0	1.07	2.15	
Near Spill Way	E 2	Sept 23	0.0	0.54	1.61	
Near Spill Way	E 3	Sept 23	0.0	1.61	0.0	

ALGAE DATA SUMMARY FOR LAKE Garzas IN Utuado, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM _____ 1977 to Enero, 1978.

Table 91 (continued)

LOCALIZATION	SAMPLE	DATE	ORGANISMS/ ML																																			
			ANABAENA	(blue green)	ANACYSTIS	(blue green)	ANKISTRODESMUS	(green algae)	CHLORELLA	(green algae)	CHLOROCOCCUM	(green algae)	SCENEDESMUS	(green algae)	STAURASTRUM	(green algae)	TETRAEDRON	(green algae)	COCCONEIS	(diatom)	DIATOMA	(diatom)	GOMPHONEMA	(diatom)	NAVICULA	(diatom)	NITZSCHIA	(diatom)	STEPHANODISCUS	(diatom)	SYNEDRA	(diatom)	CHRYSCOCCUS	(flagellate)	MALLOMONAS	(flagellate)	TOTAL/ M L
Center Lake	A 1	1/27/78	1.61		1.07		0.0		3.22		0.0		0.0		1.07		1.07		0.0		0.0		1.07		1.61		0.0		3.22		2.68		0.0		0.54		17.18
Center Lake	A 2	1/27/78	1.07		0.54		0.0		2.69		0.54		0.0		5.91		0.0		0.0		0.54		0.54		1.61		0.0		0.54		2.15		0.0		0.0		16.11
Center Lake	A 3	1/27/78	1.07		0.54		0.0		1.61		0.0		0.0		4.30		0.0		0.0		1.07		0.54		0.54		1.07		2.15		1.07		0.0		0.0		13.96
South Quebrada Grande	B 1	1/27/78	1.07		0.54		0.0		2.68		0.0		0.0		3.22		1.61		0.0		0.0		2.15		0.0		0.0		2.15		1.07		1.07		0.0		15.57
South Quebrada Grande	B 2	1/27/78	0.0		0.0		0.0		1.61		0.0		0.0		0.54		0.54		2.15		0.0		1.07		1.07		0.0		3.22		0.0		1.07		1.61		12.89
South Quebrada Grande	B 3	1/27/78	0.0		0.0		1.07		1.61		0.0		0.54		0.0		2.15		0.0		0.0		2.15		0.54		0.0		2.68		0.0		3.22		0.0		13.96
Entrance Garzas River	C 1	1/27/78	0.0		0.0		0.0		2.15		0.0		1.07		3.22		0.0		0.0		0.0		0.54		1.07		0.0		2.15		2.15		1.61		0.0		13.96
Entrance Garzas River	C 2	1/27/78	0.0		0.0		0.0		2.69		0.0		0.0		2.15		0.0		0.0		0.0		1.07		2.15		1.61		2.15		2.15		1.07		0.0		15.04
Entrance Garzas River	C 3	1/27/78	2.15		0.0		0.0		2.69		0.0		1.61		2.15		0.0		0.0		0.0		1.07		1.07		0.0		2.69		1.61		1.61		0.0		16.65
West Quebrada	D 1	1/27/78	1.07		0.0		0.0		0.0		1.61		0.0		0.0		2.15		2.15		1.07		0.0		0.54		0.0		2.15		1.61		0.0		0.0		12.35
West Quebrada	D 2	1/27/78	1.07		0.0		0.0		2.15		0.0		0.0		0.0		1.61		0.0		0.54		1.61		1.07		0.0		3.22		2.15		0.0		0.0		13.43
West Quebrada	D 3	1/27/78	1.61		0.0		0.0		3.22		0.0		0.0		0.0		1.61		0.0		0.0		1.07		1.07		0.0		2.15		2.15		0.54		0.0		13.43
Near Spill Way	E 1	1/27/78	0.0		0.0		0.0		3.22		0.0		0.0		2.15		1.61		0.0		0.0		1.07		1.61		1.07		3.22		1.61		0.54		0.0		16.11
Near Spill Way	E 2	1/27/78	2.15		0.0		0.0		3.22		0.0		0.0		1.61		1.07		0.0		0.0		2.15		1.61		1.07		0.0		3.22		0.54		0.0		16.65
Near Spill Way	E 3	1/27/78	0.0		0.0		0.0		3.22		0.0		0.0		1.61		1.07		0.0		0.0		2.69		1.61		0.0		1.61		2.15		1.07		0.0		15.04

ALGAE DATA SUMMARY FOR LAKE Garzas IN Utuado, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM ____ 1977 to May, 1978.

Table 91 (continue)

LOCALIZATION	SAMPLE	DATE 1978	ANABAENA (blue green)	ANACYSTIS (blue green)	OSCILATORIA (blue green)	CHLORELLA (green)	SCENEDESMUS (green)	STAURASTRUM (green)	TETRAEDRON (green)	COCCONEIS (diatom)	DIATOMEA (diatom)	GOMPHONEMA (diatom)	NAVICULA (diatom)	NITZSCHIA (diatom)	STEPHANODISCUS (diatom)	SYNEDRA (diatom)	CHRYSOCOCCUS (flagellate)	MALLOMONAS (flagellate)		TOTAL/ M L
			ORGANISMS/ ML																	
Lake Garzas	A 1	May 17	1.07	1.61	0.0	2.15	0.0	0.0	0.54	0.0	0.0	1.61	1.07	1.07	4.83	3.22	0.0	0.54		17.72
Lake Garzas	A 2	May 17	1.61	0.0	0.54	3.22	0.0	0.0	1.61	0.0	0.0	0.0	2.15	1.61	3.76	4.30	0.0	1.07		19.87
Lake Garzas	A 3	May 17	1.61	0.0	1.07	1.61	0.0	0.0	2.15	0.0	0.0	0.54	0.0	0.54	2.15	2.15	0.0	1.07		12.89
Lake Garzas	B 1	May 17	0.54	1.61	0.0	1.61	0.0	4.30	1.07	0.0	0.0	2.15	0.0	0.0	2.15	1.61	1.07	0.0		16.11
Lake Garzas	B 2	May 17	0.0	1.07	0.0	2.15	0.0	1.61	0.0	1.61	0.0	1.07	0.54	0.0	2.69	0.0	1.07	1.07		12.89
Lake Garzas	B 3	May 17	0.0	1.61	0.0	1.07	0.0	2.15	0.0	0.0	0.0	0.54	1.61	0.0	3.22	2.15	0.54	0.54		13.43
Lake Garzas	C 1	May 17	0.54	0.0	0.0	1.61	1.61	1.07	0.0	1.61	0.0	2.15	0.0	0.0	0.0	2.15	0.54	0.54		11.81
Lake Garzas	C 2	May 17	0.54	0.0	0.0	2.15	3.22	0.0	0.0	0.54	0.0	1.07	1.07	0.0	2.15	1.61	0.54	0.54		13.43
Lake Garzas	C 3	May 17	1.61	0.0	0.0	2.15	1.07	0.0	1.61	1.61	1.07	1.61	0.54	0.0	0.0	2.15	0.0	0.54		13.96
Lake Garzas	D 1	May 17	1.07	1.61	0.0	3.22	0.0	2.15	2.15	0.0	0.0	1.61	2.15	0.0	1.07	1.61	0.0	0.54		17.18
Lake Garzas	D 2	May 17	0.54	1.61	0.0	1.07	0.0	3.22	3.22	0.0	0.0	2.15	0.0	0.0	4.30	2.15	0.54	0.54		19.33
Lake Garzas	D 3	May 17	0.54	0.54	0.0	1.61	0.0	2.15	1.07	0.0	0.0	0.54	1.07	0.0	1.61	2.15	0.0	1.61		12.89
Lake Garzas	E 1	May 17	0.0	0.0	0.0	2.15	0.0	2.69	1.61	0.0	0.0	1.61	0.54	1.07	2.15	2.15	1.07	1.07		16.11
Lake Garzas	E 2	May 17	0.0	0.0	0.0	1.07	0.0	1.07	1.61	0.0	0.0	0.54	2.15	0.0	1.07	3.22	1.07	1.07		12.89
Lake Garzas	E 3	May 17	0.0	0.0	0.0	1.07	0.0	2.15	2.15	0.0	0.0	1.61	1.61	3.22	2.15	3.22	0.54	1.07		18.80

WATER LEVEL RECORDS FOR LAKE GARZAS, 1976-78

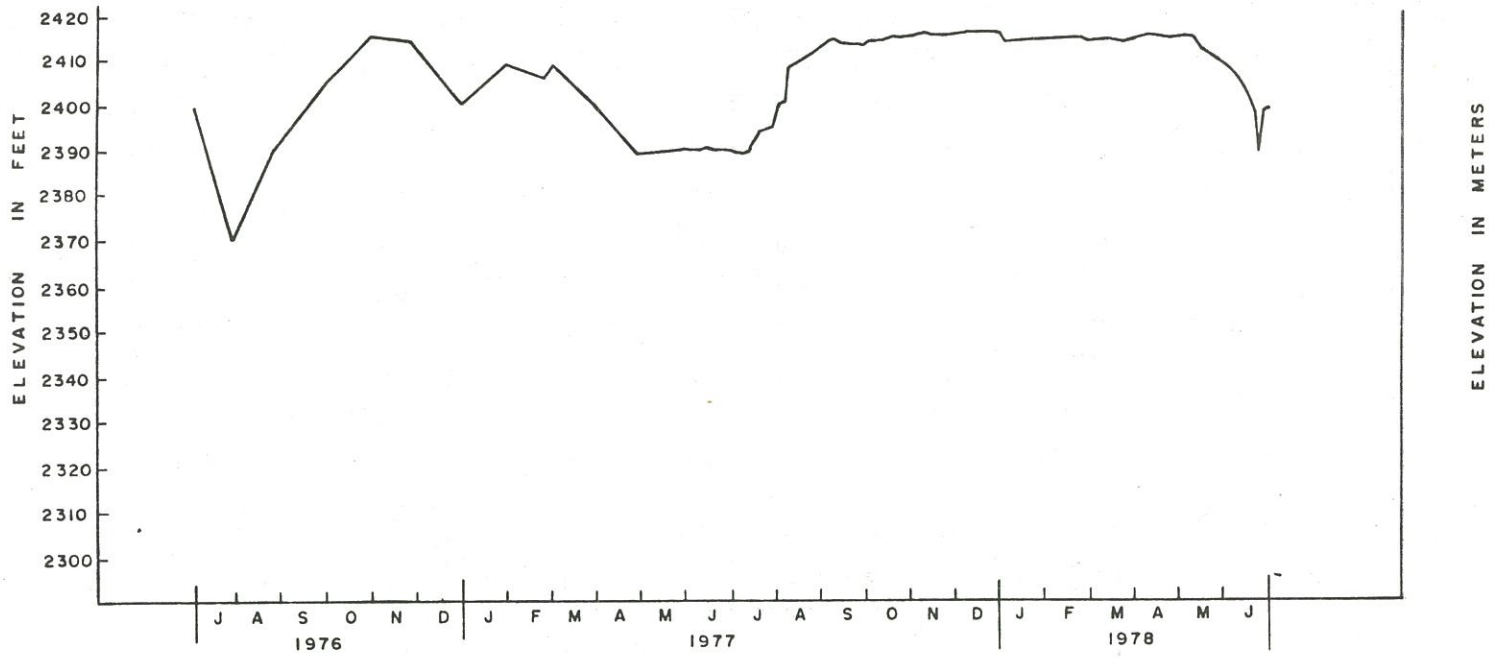


Figure 34

Figure 35. Garzas River cascading into the Lake Garzas near Station C. Quiet pool below cascade was site of *Biomphalaria glabrata* populations in 1975, eventually replaced by large colony of *Marisa cornuarietis*.

LAGO GUAJATACA

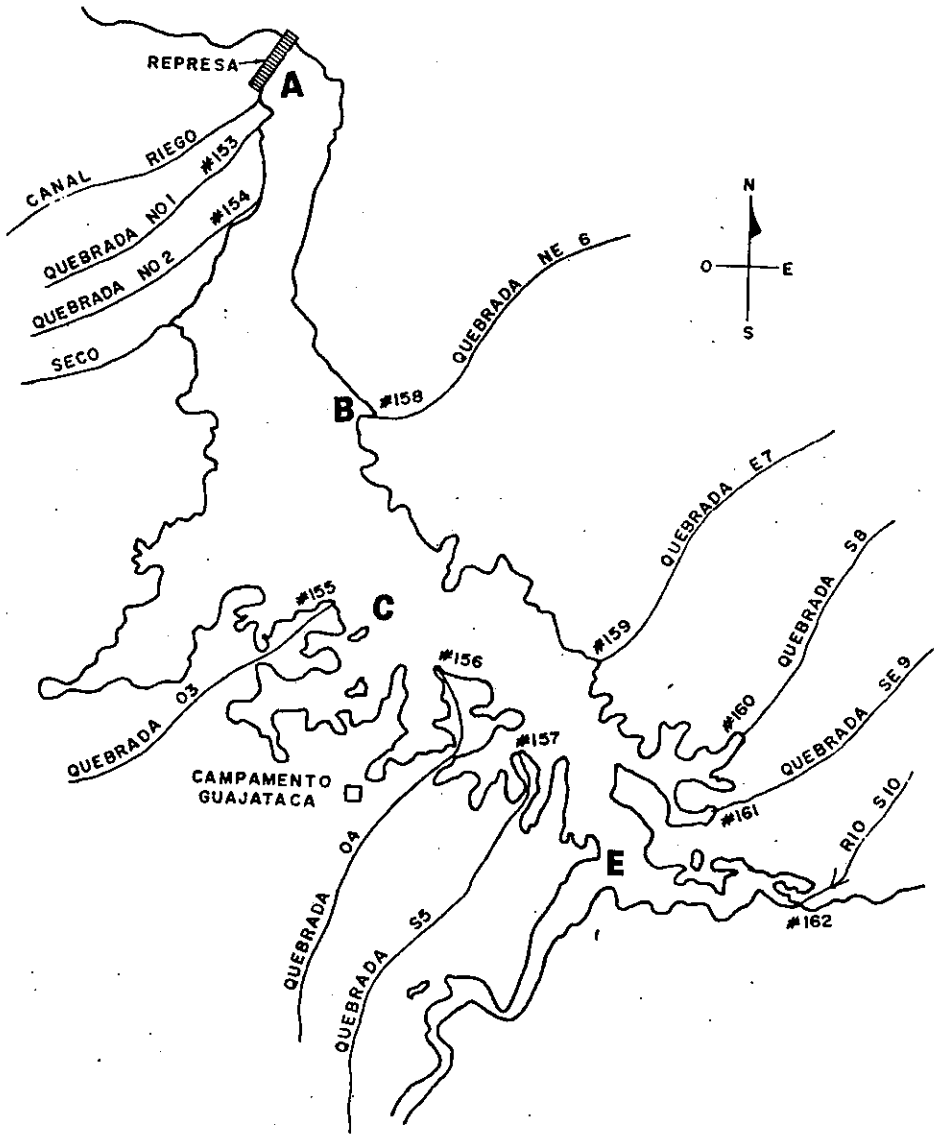


Figure 36

CHEMICAL QUALITY DATA SUMMARY FOR LAKE Guajataca IN San Sebastián, PUERTO RICO

FROM August 197 7 TO 1978. SAMPLES ARE FROM 0.5 M DEPTH

Table 92

Station and Localization	Date 1977	Time	Sample No.	Lab. No.	Chloride mg/l	Hardness as $MgSO_4$ Mg/l	Total Phosphates as P mg/l	Nitrate & Nitrite as N mg/l	Iron mg/l	Turbidity in Standard Unit	Color in Standard Unit	pH	Dissolved Oxygen mg/l	Chlorophyll A mg/l	Total Coliform count	Sample Size ml
B	11 Aug		GT-29	383	0.0	210.8	0.01	0.06	0.06	11	10	7.8	7.8			
A	11 Aug		GT-23	384	0.0	210.8	0.01	0.04	0.20	10	10	8.0	7.8			
C	11 Aug		GT-31	385	0.0	221.6	0.01	0.13	0.02	14.3	10	7.7	7.3			

TABLE 93

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Guajataca

PARAMETER Chlorides

UNITS mg/l

A-VARIATION WITH TIME

SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1 11/8/77	0.0	3	0.00	0.00
2				
3				
4				
5				
6				
7				
8				
9				
10				
TOTALS	0.0	3	0.00	

B-VARIATION BY STATION

A	0.0	1		
B	0.0	1		
C	0.0	1		
D				
E				
F				
G				
H				
TOTALS	0.0	3	0.00	

TABLE 94

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Guajataca

PARAMETER Hardness as Mg SO4

UNITS mg/1

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	643.2	3	214.40	4.80
2				
3				
4				
5				
6				
7				
8				
9				
10				
TOTALS	643.2	3	214.40	
B-VARIATION BY STATION				
A	210.8	1		
B	210.8	1		
C	221.6	1		
D				
E				
F				
G				
H				
TOTALS	643.2	3	214.40	

TABLE 95

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Guajataca

PARAMETER Total Phosphates as P

UNITS mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	0.03	3	0.01	0.00
2				
3				
4				
5				
6				
7				
8				
9				
10				
TOTALS	0.03	3	0.01	
B-VARIATION BY STATION				
A	0.01	1		
B	0.01	1		
C	0.01	1		
D				
E				
F				
G				
H				
TOTALS	0.03	3	0.01	

TABLE 96

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Guajataca

PARAMETER Nitrate & Nitrite as N

UNITS mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	0.23	3	0.08	0.04
2				
3				
4				
5				
6				
7				
8				
9				
10				
TOTALS	0.23	3	0.08	
B-VARIATION BY STATION				
A	0.04	1		
B	0.06	1		
C	0.13	1		
D				
E				
F				
G				
H				
TOTALS	0.23	3	0.08	

TABLE 97

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Guajataca

PARAMETER Iron

UNITS Mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	0.28	3	0.09	0.07
2				
3				
4				
5				
6				
7				
8				
9				
10				
TOTALS	0.28	3	0.09	0.07
B-VARIATION BY STATION				
A	0.06	1		
B	0.20	1		
C	0.02	1		
D				
E				
F				
G				
H				
TOTALS	0.28	3	0.09	

TABLE 98

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Guajataca

PARAMETER Turbidity

UNITS Standard Unit

A-VARIATION WITH TIME

SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	35.3	3	11.77	1.69
2				
3				
4				
5				
6				
7				
8				
9				
10				
TOTALS	35.3	3	11.77	

B-VARIATION BY STATION

A	10	1		
B	11	1		
C	14.3	1		
D				
E				
F				
G				
H				
TOTALS	35.3	3	11.77	

TABLE 99

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Guajataca

PARAMETER Color

UNITS Standard Unit

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	30.0	3	10.00	0.00
2				
3				
4				
5				
6				
7				
8				
9				
10				
TOTALS	30.0	3	10.00	
B-VARIATION BY STATION				
A	10.0	1		
B	10.0	1		
C	10.0	1		
D				
E				
F				
G				
H				
TOTALS	30.0	3	10.00	

TABLE 100

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Guajataca

PARAMETER P H

UNITS

A-VARIATION WITH TIME

SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	23.5	3	7.83	0.33
2				
3				
4				
5				
6				
7				
8				
9				
10				
TOTALS	23.5	3	7.83	

B-VARIATION BY STATION

A	8.0	1		
B	7.8	1		
C	7.7	1		
D				
E				
F				
G				
H				
TOTALS	23.5	3	7.83	

TABLE 101

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Guajataca

PARAMETER Dissolved Oxygen

UNITS Mg/1

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	22.9	3	7.63	0.22
2				
3				
4				
5				
6				
7				
8				
9				
10				
TOTALS	22.9	3	7.63	
B-VARIATION BY STATION				
A	7.8	1		
B	7.8	1		
C	7.3	1		
D				
E				
F				
G				
H				
TOTALS	22.9	3	7.63	

Table 102

Summary of Snail Surveys in Guajataca

Date	Inspector	Snails Found
Jun 30/76	Quirindongo	*Marisa cornuarietis* *Tarebia granifera* *Pomacea australis*
Aug. 10/78	W. Jobin	*Marisa cornuarietis* *Tarebia granifera*

OXYGEN DATA SUMMARY FOR LAKE Guajataca IN San Sebastian, PUERTO RICO

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM August 1977 TO August, 1977.

Table 103

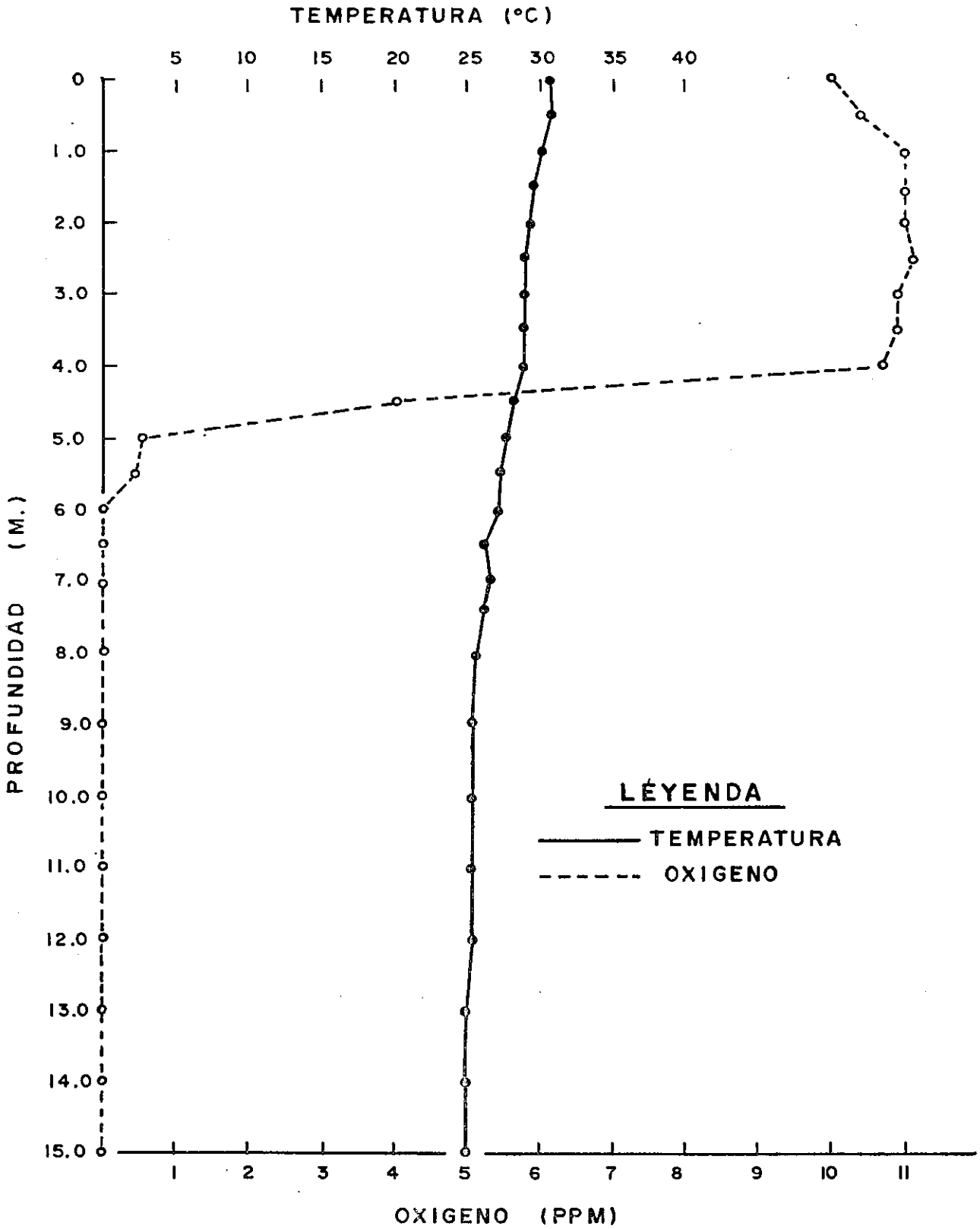
Page 1 of 1

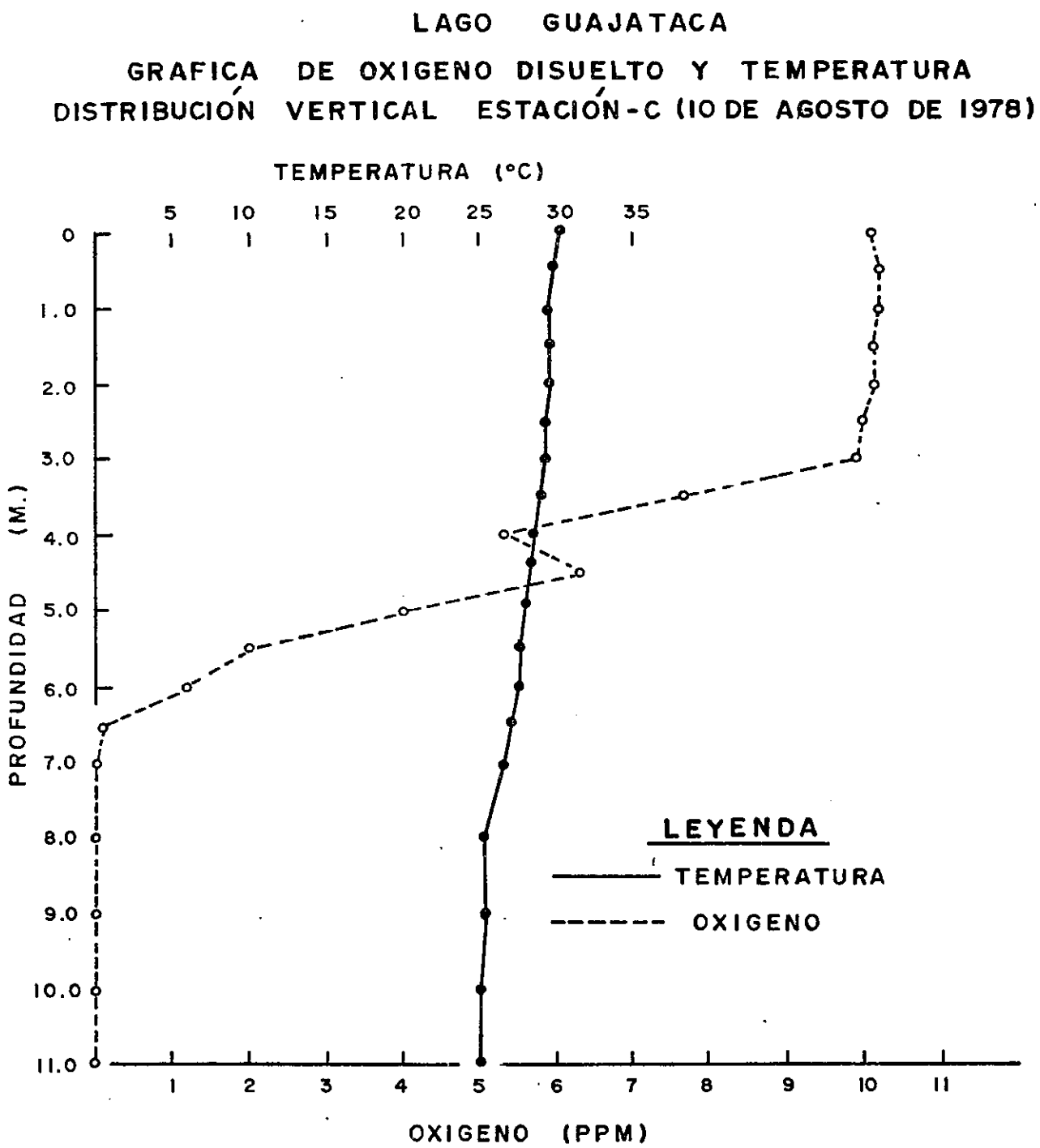
Station	Date 1977	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
A	11 Aug	4:40	26	1,5-7	7.9	8.6	7.4	1.2	0.5	2.5		19
A	12 Aug	-	-	4, -	7.8	-	-	-	-	-		-
B	11 Aug	8:10	25	2,10-13	7.8	7.5	7.4	0.1	0.4	2.0		19
B	12 Aug	8:00	28	9,25-28	7.8	8.0	7.2	0.8	0.6	2.2		24
C	11 Aug	8:30	26	3,15-18	7.6	7.4	7.1	0.3	0.5	2.0		19
C	12 Aug	-	-	14, -	7.	-	-	-	-	-		-

Figure 37

LAGO GUAJATACA

GRAFICA DE OXIGENO DISUELTO Y TEMPERATURA
DISTRIBUCIÓN VERTICAL ESTACIÓN-A (10 DE AGOSTO DE 1978)




LAGO GUAJATACA
GRAFICA DE OXIGENO DISUELTO Y TEMPERATURA
DISTRIBUCIÓN VERTICAL ESTACIÓN-C (10 DE AGOSTO DE 1978)
TEMPERATURA (°C)
5 10 15 20 25 30 35
PROFUNDIDAD (M.)
0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0
LEYENDA
TEMPERATURA
OXIGENO
1 2 3 4 5 6 7 8 9 10 11
OXIGENO (PPM)

LAGO GUAJATACA

GRAFICA DE OXIGENO DISUELTO Y TEMPERATURA
DISTRIBUCIÓN VERTICAL ESTACIÓN-E (10 DE AGOSTO DE 1978)

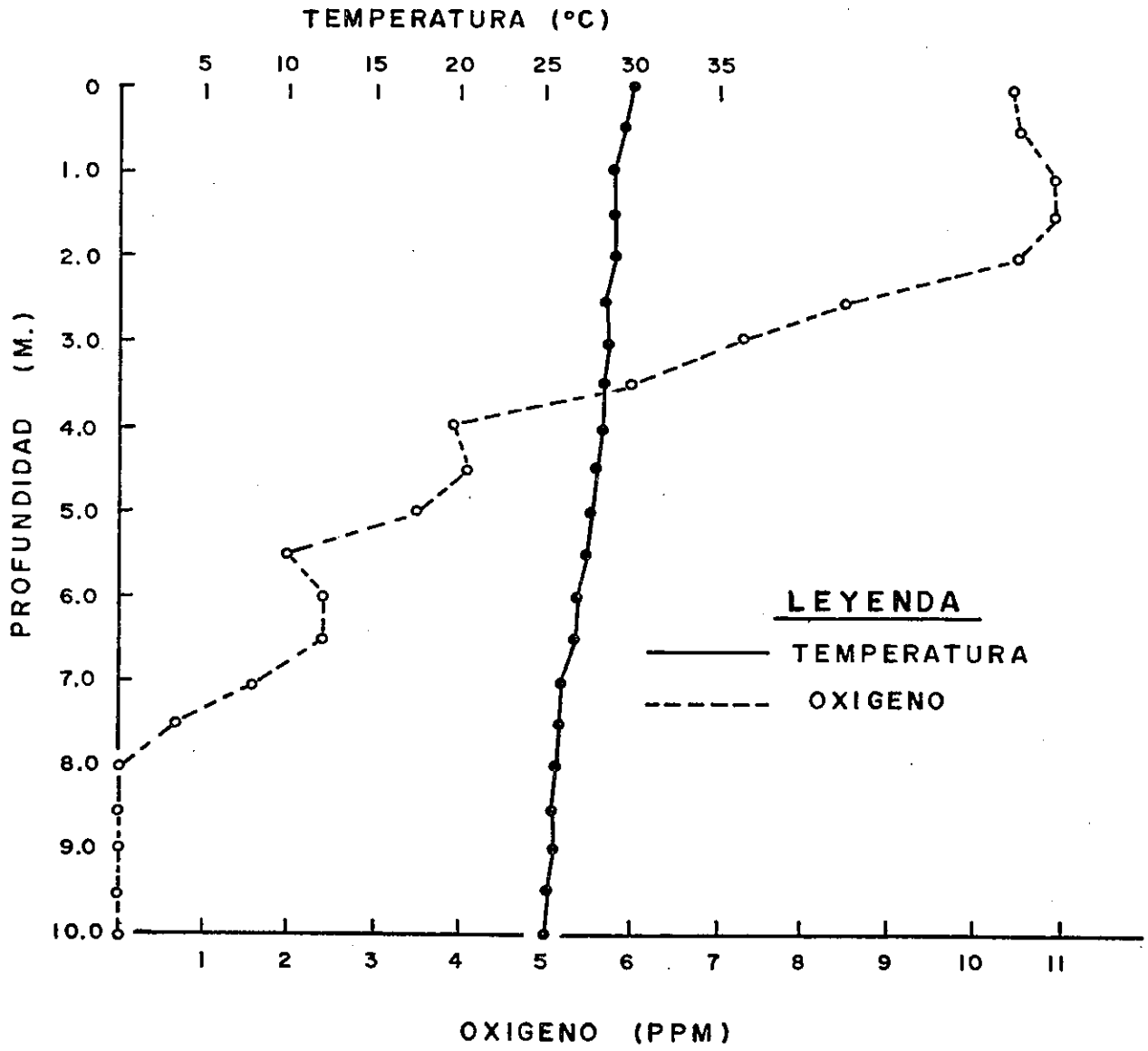
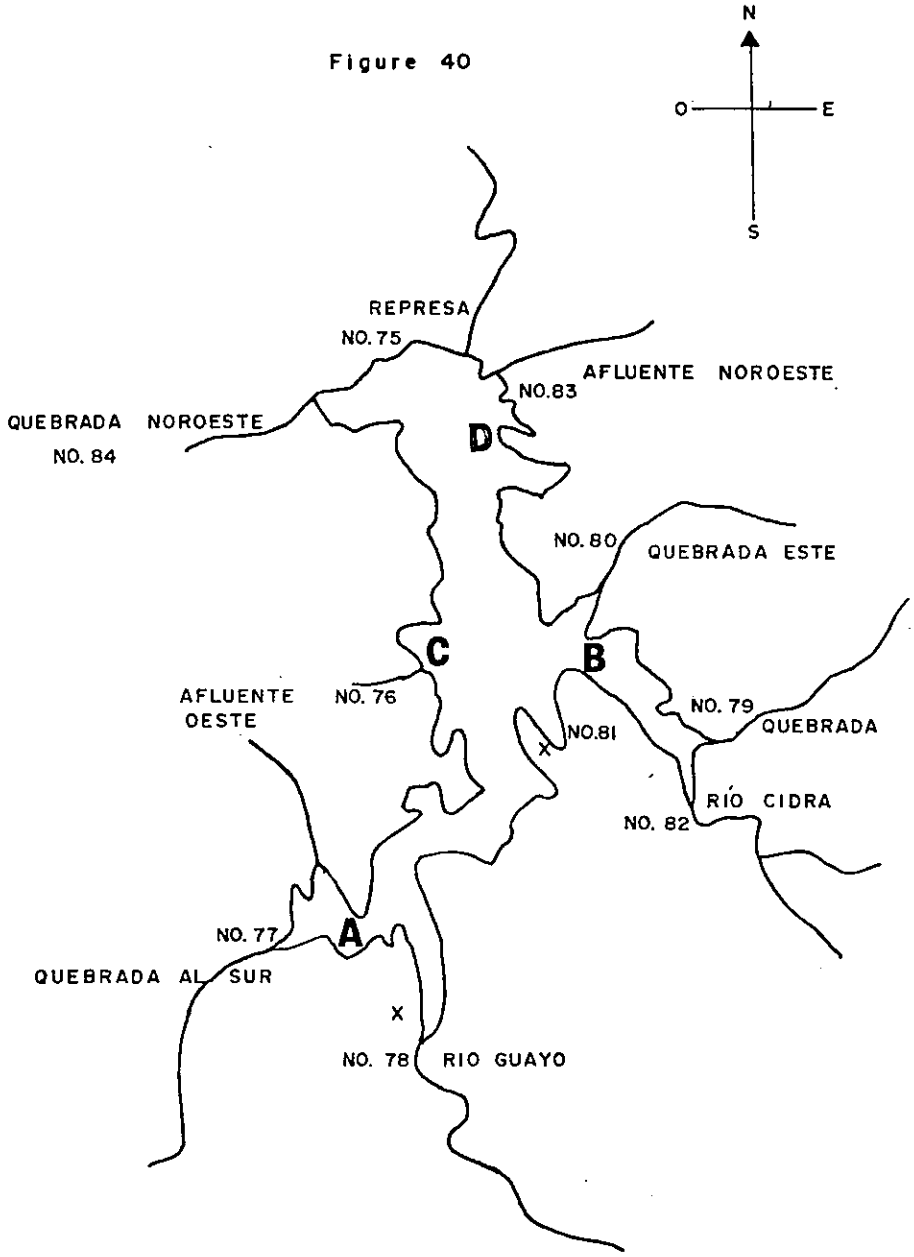


Figure 40



LAGO GUAYO - LARES - ADJUNTAS

Figure 41. Concrete gravity dam at Lake Guayo in Castañer. This lake is one of several which divert water to Lajas Valley System. It is the clearest of the lakes and has the longest residence time of flow.

CHEMICAL QUALITY DATA SUMMARY FOR LAKE Guayo IN Lares, PUERTO RICO

Table 104 FROM July 1977 TO May 1978. SAMPLES ARE FROM 0.5 M DEPTH

Station and Localization	Date	Time	Sample No.	Lab. No.	Chloride mg/l	Hardness as $MgSO_4$ Mg/l	Total Phosphates as P mg/l	Nitrate & Nitrite as N mg/l	Iron mg/l	Turbidity in Standard Unit	Color in Standard Unit	pH	Dissolved Oxygen mg/l	Chlorophyll A mg/l	Total Coliform count	Sample Size ml
	1977															
A	8 Jul		GU-49	376	6.8	121.4	0.01	2.1	0.20	5.0	15	7.7	6.4	4.8		
B	8 Jul		GU-44	377	6.8	47.5	0.03	0.1	0.90	15.0	15	6.7	6.6	11.8		
C	8 Jul		GU-54	378	9.8	10.5	0.00	0.2	0.30	2.5	10	8.0	7.2	4.8		
Río Guayo Entrada A	6 Oct		GU-57	404	5.9	143.0	0.01	0.2	0.05	0.4	10	7.5	6.7			
Entrada Río Cidra B	6 Oct		GU-62	405	5.9	125.8	0.01	0.1	0.04	0.5	12	7.5	7.3			
Middle Lake C	6 Oct		GU-67	406	5.9	125.8	0.01	0.1	0.04	0.3	12	7.3	7.8			
Dam D	6 Oct		GU-72	407	2.0	125.8	0.01	0.2	0.04	0.3	12	7.7	7.6			
	1978															
A	15 Feb	10:40	GU-56	432	5.9	112.8	0.01	0.2	0.04	1.6	10	8.0	9.2			
B	15 Feb	10:25	GU-54	433	4.9	118.0	0.01	0.6	0.06	1.9	10	7.7	8.6			
C	15 Feb	9:45	GU-52	434	4.9	123.1	0.01	0.2	0.00	1.2	10	7.7	7.8			
D	15 Feb	9:30	GU-46	435	2.9	118.0	0.01	0.2	0.08	1.2	10	7.8	8.1			
A	25 May	11:30	GU-4	519	9.8	127.8	0.04	0.0	0.00		10	7.5	---			
B	25 May	11:00	GU-1	520	21.5	115.0	0.01	0.0	0.04		10	7.7	---			
C	25 May	11:20	GU-3	521	11.7	121.4	0.06	0.0	0.03		10	7.6	---			
D	25 May	11:15	GU-2	522	9.7	121.4	0.10	0.0	0.00		10	8.1	---			

TABLE 105

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM

LAKE Guayo

PARAMETER Chlorides

UNITS mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1 8/7/77	23.4	3	7.80	1.33
2 6/10/77	19.7	4	4.92	1.46
3 15/2/78	18.6	4	4.65	0.88
4 25/5/78	52.7	4	13.18	4.16
5				
6				
7				
8				
9				
10				
TOTALS	114.4	15	7.63	
B-VARIATION BY STATION				
A	28.4	4	7.10	1.35
B	39.1	4	9.78	5.86
C	32.3	4	8.08	2.68
D	14.6	3	4.87	3.22
E				
F				
G				
H				
TOTALS	114.4	15	7.63	

TABLE 106

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Guayo

PARAMETER Hardness (Mg SO4 mg/l)

UNITS mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	179.4	3	59.80	41.07
2	520.4	4	130.10	6.45
3	471.9	4	117.98	2.58
4	485.6	4	121.40	3.20
5				
6				
7				
8				
9				
10				
TOTALS	1,657.3	15	110.49	
B-VARIATION BY STATION				
A	505.0	4	126.25	9.15
B	406.3	4	101.58	27.04
C	380.8	4	95.20	42.35
D	365.2	3	121.73	2.71
E				
F				
G				
H				
TOTALS	1,657.3	15	110.49	

TABLE 107

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Guayo

PARAMETER Total Phosphates as P

UNITS mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	0.04	3	0.01	0.01
2	0.04	4	0.01	0.00
3	0.04	4	0.01	0.00
4	0.21	4	0.05	0.03
5				
6				
7				
8				
9				
10				
TOTALS	0.33	15	0.02	
B-VARIATION BY STATION				
A	0.07	4	0.02	0.01
B	0.06	4	0.02	0.01
C	0.08	4	0.02	0.02
D	0.12	3	0.04	0.04
E				
F				
G				
H				
TOTALS	0.33	15	0.02	

TABLE 108

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Guayo

PARAMETER Nitrate + Nitrite as N

UNITS mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	2.4	3	0.80	0.88
2	0.6	4	0.20	0.05
3	1.2	4	0.30	0.20
4	0.0	4	0.00	0.00
5				
6				
7				
8				
9				
10				
TOTALS	4.2	15	0.28	
B-VARIATION BY STATION				
A	2.5	4	0.62	0.58
B	0.8	4	0.20	0.20
C	0.5	4	0.12	0.04
D	0.4	3	0.13	0.05
E				
F				
G				
H				
TOTALS	4.2	15	0.28	

TABLE 109

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Guayo

PARAMETER Iron

UNITS mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	1.4	3	0.47	0.29
2	0.17	4	0.04	0.00
3	0.18	4	0.04	0.02
4	0.07	4	0.02	0.02
5				
6				
7				
8				
9				
10				
TOTALS	1.82	15	0.12	
B-VARIATION BY STATION				
A	0.29	4	0.07	0.06
B	1.04	4	0.26	0.32
C	0.37	4	0.09	0.10
D	0.12	3	0.04	0.03
E				
F				
G				
H				
TOTALS	1.82	15	0.12	

TABLE 110

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Guayo

PARAMETER Turbidity

UNITS Standard Unit

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	22.5	3	7.50	5.00
2	1.5	4	0.38	0.08
3	5.9	4	1.48	0.28
4				
5				
6				
7				
8				
9				
10				
TOTALS	29.9	11	2.72	
B-VARIATION BY STATION				
A	7.0	3	2.33	1.78
B	17.4	3	5.80	6.13
C	4.0	3	1.33	0.78
D	1.5	2	0.75	0.45
E				
F				
G				
H				
TOTALS	29.9	11	2.72	

TABLE III

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM

LAKE Guayo

PARAMETER Color

UNITS Standard Unit

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	40.0	3	13.33	2.22
2	46.0	4	11.50	0.75
3	40.0	4	10.00	0.00
4	40.0	4	10.00	0.00
5				
6				
7				
8				
9				
10				
TOTALS	166.0	15	11.07	
B-VARIATION BY STATION				
A	45.0	4	11.25	1.88
B	47.0	4	11.75	1.75
C	42.0	4	10.50	0.75
D	32.0	3	10.67	0.89
E				
F				
G				
H				
TOTALS	166.0	15	11.07	

TABLE 112

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Guayo

PARAMETER P. H.

UNITS

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	22.4	3	7.47	0.51
2	30.0	4	7.50	0.10
3	31.2	4	7.80	0.10
4	30.9	4	7.72	0.18
5				
6				
7				
8				
9				
10				
TOTALS	114.5	15	7.63	
B-VARIATION BY STATION				
A	30.7	4	7.68	0.18
B	29.6	4	7.40	0.35
C	30.6	4	7.65	0.25
D	23.6	3	7.87	0.16
E				
F				
G				
H				
TOTALS	114.5	15	7.63	

TABLE 117

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Guayo

PARAMETER Dissolved Oxygen

UNITS mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	20.2	3	6.73	0.31
2	29.4	4	7.35	0.35
3	33.7	4	8.42	0.48
4				
5				
6				
7				
8				
9				
10				
TOTALS	83.3	11	7.57	
B-VARIATION BY STATION				
A	22.3	3	7.43	1.18
B	22.5	3	7.50	0.73
C	22.8	3	7.60	0.27
D	15.7	2	7.85	0.25
E				
F				
G				
H				
TOTALS	83.3	11	7.57	

TABLE 114

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Guayo

PARAMETER Chlorophyll A

UNITS mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	21.4	3	7.13	3.11
2				
3				
4				
5				
6				
7				
8				
9				
10				
TOTALS	21.4	3	7.13	
B-VARIATION BY STATION				
A	4.8	1		
B	11.8	1		
C	4.8	1		
D				
E				
F				
G				
H				
TOTALS	21.4	3	7.13	

Table 115

Summary of Snail Surveys in Lake Guayo

Date	Inspector	Snail Found
Jun 30/77	W. Jobin	*Marisa cornuarietis* *Tarebia granifera* *Ampularia australis*
Aug. 28/78	A. Laracuente	*Marisa cornuarietis* *Tarebia granifera*

Table 116

SUMMARY OF COLIFORM DATA OF LAKE Guayo IN Lares, P.R.

FROM July 1977 TO February 1978.

STATION	DATE	FIELD NUM.	VOL. ml	COLONIES	COLONIES/ 100 ml
B	6/7/77	GU-9	1	11	1,100
B	6/7/77	GU-9	10	97	970
C	6/7/77	GU-15	1	15	1,500
C	6/7/77	GU-15	10	TNTC	
A	6/7/77	GU-21	1	3	300
A	6/7/77	GU-21	10	18	180
B	7/7/77	GU-27	1	16	1600
B	7/7/77	GU-27	10	TNTC	
A	7/7/77	GU-33	1	0	0
A	7/7/77	GU-33	10	14	140
C	7/7/77	GU-39	1	15	1500
C	7/7/77	GU-39	10	TNTC	
A	4/10/77	GU-9	1	38	3800
A	4/10/77	GU-9	10	TNTC	
B	4/10/77	GU-15	1	67	6,700
B	4/10/77	GU-15	10	TNTC	
C	4/10/77	GU-21	1	71	7,100
C	4/10/77	GU-21	10	TNTC	
D	4/10/77	GU-27	1	59	5900
D	4/10/77	GU-27	10	TNCT	
A	5/10/77	GU-33	1	77	7,700
A	5/10/77	GU-33	10	TNTC	
B	5/10/77	GU-39	1	94	9,400
B	5/10/77	GU-39	10	TNTC	
C	5/10/77	GU-45	1	8	800
C	5/10/77	GU-45	10	45	450
D	5/10/77	GU-51	1	93	9,300
D	5/10/77	GU-51	10	TNTC	
A	13/2/77	GU-2	1	78	7,800
A	13/2/77	GU-2	.1	13	13,000
B	13/2/77	GU-4	1	37	3,700
B	13/2/77	GU-4	.1	2	2,000

Table 116 (continued)

SUMMARY OF COLIFORM DATA OF LAKE Guayo IN Lares, P.R.

FROM July 1977 TO February 1978.

STATION	DATE	FIELD NUM.	VOL. ml	COLONIES	COLONIES/ 100 ml
C	13/2/77	GU-6	1	50	5,000
C	13/2/77	GU-6	.1	12	12,000
D	13/2/77	GU-8	1	160	16,000
D	13/2/77	GU-8	.1	12	12,000
A	15/2/78	GU-8	1.0	3	300
A	15/2/78	GU-8	0.1	0	0
B	15/2/78	GU-8	0.1	6	6,000
B	15/2/78	GU-8	1.0	1	100
C	15/2/78	GU-8	0.1	0	0
C	15/2/78	GU-8	1.0	1	100
D	15/2/78	GU-8	1.0	1	100
D	15/2/78	GU-8	0.1	1	1000

OXYGEN DATA SUMMARY FOR LAKE Guayo Lares (Castañer), PUERTO RICO

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM July 1977 TO February, 1978.

Table 117

Station	Date 1977	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
B	6 July	7:00	24	1,4-7	7.3	5.8	5.5	0.3	1.8	0.5		22
B	7 July	6:50	24	8,22-25	5.9	7.3	4.7	2.6	1.2	0.4		24
B	8 July	6:45	24	26,40-43	6.1	8.0	4.6	3.4	1.5	0.3		24
A	6 July	8:30	25	2	6.9	-	-	-	-	0.8		23
A	7 July	7:10	25	20,28-31	5.9	6.6	6.0	0.6	- 0.1	1.0		23
A	8 July	7:10	24	32,45-48	6.3	6.9	6.1	0.8	0.2	1.2		24
C	6 July	7:40	25	3,10-13	7.9	7.5	7.5	0.0	0.4	0.4		22
C	7 July	7:25	25	14,34-37	6.5	7.4	6.0	1.4	0.5	0.8		24
C	8 July	7:25	25	3850-53	7.2	7.7	6.6	1.1	0.6	0.8		24
	1977											
A	4 Oct	6:55	24	1,5-8	6.7	7.6	5.9	1.7	0.8	2.3		20
A	5 Oct	6:35	23	10,29-32	7.5	9.1	6.1	3.0	1.4	2.3		24
A	6 Oct	6:30	24	34,53-56	6.8	7.9	6.3	1.6	0.5	3.3		24
B	4 Oct	7:15	23	2,11-14	7.1	6.8	6.6	0.2	0.5	4.0		21
B	5 Oct	7:05	24	16,35-38	7.8	8.0	7.0	1.0	0.8	4.8		24
B	6 Oct	6:55	24	40,58-61	7.0	7.7	6.8	0.9	0.2	4.5		24
C	4 Oct	7:35	24	3,17-20	8.2	7.7	7.5	0.2	0.7	4.0		21
C	5 Oct	7:20	24	22,41-44	7.6	7.7	7.0	0.7	0.6	3.7		24
C	6 Oct	7:10	24	46,63-66	7.6	8.4	7.6	0.8	0.0	3.7		24

OXYGEN DATA SUMMARY FOR LAKE Guayo Lares (Castañer), PUERTO RICO
ALL SAMPLES TAKEN AT 0.5 M DEPTH
FROM July 197 TO February, 1978.

Table 117 (continued)

Station	Date 1977	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
D	4 Oct	7:50	24	4,23-26	7.5	7.7	7.0	0.7	0.5	4.0		21
D	5 Oct	7:40	24	28,47-50	7.7	7.8	7.2	0.6	0.5	4.0		24
D	6 Oct	7:20	24	52,68-71	7.5	8.4	7.6	0.8	0.1	3.7		24
	1978											
D	14 Feb	8:30	19	1,10-13	8.5	8.0	7.6	0.4	0.9	4.5		22
D	15 Feb	9:30	19	9,32-35	7.2	7.6	6.8	0.8	0.4	4.2		25
C	14 Feb	8:40	19	3,16-19	8.5	8.4	7.6	0.8	0.9	4.5		21
C	15 Feb	9:45	19	15,36-39	7.0	7.4	6.6	0.8	0.4	4.5		25
B	14 Feb	8:50	20	5,22-25	9.2	8.9	8.4	0.5	0.8	2.75		21
B	15 Feb	10:25	19	21,40-43	8.0	8.4	7.2	1.2	0.8	3.5		26
A	14 Feb	9:10	19	7,28-31	9.7	10.4	9.0	1.4	0.7	2.0		21
A	15 Feb	10:40	19.5	27,44-48	8.8	10.0	7.2	2.8	1.6	2.0		25

ALGAE DATA SUMMARY FOR LAKE Guayo IN Lares, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM October 1977 to ________, 1978.

Table 118

LOCALIZATION	SAMPLE	DATE 1977	ANABAENA (blue green)	ANACYSTIS (blue green)	GOMPHOSPHAERIA (blue green)	OSCILATORIA (blue green)	CHLORELLA (green)	PEDIASTRUM (green)	STAURASTRUM (green)	FRAGILARIA (diatom)	NAVICULA (diatom)	STEPHANODISCUS (diatom)	SYNEDRA (diatom)	PERIDINIUM (flagellate)	TOTAL/ ML
			ORGANISMS/ ML												
Entrance Guayo River	A 1	Oct. 6	0.0	2.69	1.61	3.76	0.0	2.15	0.0	0.0	1.07	0.0	1.07	1.07	13.43
Entrance Guayo River	A 2	Oct. 6	0.0	1.07	1.61	2.69	1.07	0.0	0.0	0.0	3.22	0.0	1.61	0.0	11.28
Entrance Guayo River	A 3	Oct. 6	0.0	2.68	2.15	4.30	1.07	2.15	0.0	0.0	1.07	0.0	1.07	1.07	15.57
Entrance Cidra River	B 1	Oct. 6	0.0	1.61	0.54	4.30	2.15	0.54	0.0	0.0	0.54	0.0	0.0	1.07	10.74
Entrance Cidra River	B 2	Oct. 6	1.61	0.0	1.61	4.30	0.0	1.61	0.0	0.0	1.07	0.0	1.61	1.07	12.89
Entrance Cidra River	B 3	Oct. 6	1.07	0.0	2.15	5.37	0.0	1.61	0.0	0.0	2.15	0.0	1.07	1.07	14.50
Center Lake	C 1	Oct. 6	0.0	1.61	0.0	6.45	1.61	0.54	0.0	1.07	1.07	0.0	0.0	1.07	13.43
Center Lake	C 2	Oct. 6	0.0	1.61	0.54	3.76	1.07	2.69	0.0	0.0	1.07	0.0	0.0	2.15	12.89
Center Lake	C 3	Oct. 6	0.0	1.61	1.07	4.30	1.61	1.61	0.54	0.0	0.54	0.0	0.0	1.07	12.35
Exit Guayo River	D 1	Oct. 6	0.0	2.68	2.68	0.0	1.07	1.07	0.0	0.0	1.61	0.0	2.15	1.07	12.35
Exit Guayo River	D 2	Oct. 6	0.0	2.68	2.68	0.0	2.15	1.61	0.0	0.0	2.15	0.0	1.61	1.07	19.33
Exit Guayo River	D 3	Oct. 6	0.0	1.61	0.0	5.91	1.61	1.61	2.15	0.0	1.61	2.15	0.0	1.07	17.72

ALGAE DATA SUMMARY FOR LAKE Guayo IN Lares, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM 1977 to February, 1978.

Table 118 (continued)

LOCALIZATION	SAMPLE	DATE 1978	ORGANISMS/ ML																	
			ANABAENA (blue green)	ANACYSTIS (blue green)	COMPHOSPHAERIA (blue green)	OSCILATORIA (blue green)	CHLORELLA (green)	MICRASTERIAS (green)	PEDIASTRUM (green)	STAURASTRUM (green)	COCCONEIS (green)	CYCLOTELLA (diatom)	COMPHONEMA (diatom)	STEPHANODISCUS (diatom)	SYNEDRA (diatom)	MALLOMONAS (flagellate)	PERIDINIUM (flagellate)			TOTAL/ ML
Lake Guayo	A 1	Feb. 17	1.07	3.22	0.0	0.54	0.0	0.0	2.15	4.83	0.0	0.54	0.0	4.83	0.0	0.54	3.76			21.48
Lake Guayo	A 2	Feb. 17	1.61	2.68	0.0	0.0	1.61	0.0	2.68	4.30	1.07	0.0	2.15	4.83	0.0	0.0	2.68			23.09
Lake Guayo	A 3	Feb. 17	2.15	1.61	0.0	0.0	1.61	0.0	3.22	5.91	1.61	0.0	0.0	3.22	0.0	1.07	6.44			25.24
Lake Guayo	B 1	Feb. 17	2.15	2.15	2.15	1.07	2.15	0.0	3.76	4.83	0.0	0.0	0.0	4.83	1.61	0.0	0.0			24.70
Lake Guayo	B 2	Feb. 17	1.61	0.0	2.69	1.61	1.61	0.0	2.69	5.37	0.0	0.0	0.0	6.44	2.15	1.07	0.0			25.24
Lake Guayo	B 3	Feb. 17	0.0	1.61	2.15	1.61	1.07	0.0	2.15	3.76	0.0	0.0	3.22	3.22	0.0	1.61	0.0			20.41
Lake Guayo	C 1	Feb. 17	1.07	1.61	2.15	0.0	1.61	0.0	2.69	6.98	0.0	0.0	2.69	2.69	0.0	0.54	1.61			23.63
Lake Guayo	C 2	Feb. 17	0.0	1.61	2.15	0.0	2.15	1.07	3.22	5.37	0.0	0.0	2.15	3.76	0.0	1.07	1.07			23.63
Lake Guayo	C 3	Feb. 17	1.61	0.0	2.15	0.0	1.07	0.0	3.76	5.91	0.0	0.0	3.22	1.61	0.0	1.07	1.07			22.55
Lake Guayo	D 1	Feb. 17	1.61	0.0	0.0	0.0	2.15	0.0	4.30	5.37	3.22	0.0	2.15	4.30	0.0	1.61	1.07			25.78
Lake Guayo	D 2	Feb. 17	0.0	1.07	0.0	0.0	3.22	0.0	2.15	3.22	1.61	0.0	3.22	4.30	0.0	1.61	1.07			21.48
Lake Guayo	D 3	Feb. 17	0.0	3.22	2.15	0.0	1.61	0.0	1.07	5.37	1.07	0.0	2.15	1.61	0.0	0.54	1.07			19.87
Lake Guayo	E 1	Feb. 17	0.0	4.30	1.61	0.0	0.0	0.0	2.15	4.30	1.61	1.07	2.69	3.22	0.0	0.54	1.07			20.41
Lake Guayo	E 2	Feb. 17	0.0	1.61	1.07	0.0	0.0	0.0	1.61	5.37	1.61	1.61	2.15	2.69	0.0	1.61	1.07			20.41
Lake Guayo	E 3	Feb. 17	0.0	0.54	3.22	0.0	0.0	0.0	1.61	6.44	2.69	1.07	1.61	2.15	0.0	2.15	0.0			21.48

ALGAE DATA SUMMARY FOR LAKE Guayo IN Utuado, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM ______ 1977 to May, 1978.

Table 118 (continued)

			ORGANISMS/ ML													
LOCALIZATION	SAMPLE	DATE	ANABAENA (blue green)	ANACYSTIS (blue green)	GOMPHOSPHAERIA (blue green)	OSCILATORIA (blue green)	CHLORELLA (green)	PEDIASTRUM (green)	ASTERIONELLA (diatom)	FRAGILARIA (diatom)	NAVICULA (diatom)	NITZSCHIA (diatom)	STEPHANDODISCUS (diatom)	SYNEDRA (diatom)	PERIDIMUIM (flagellate)	TOTAL/ M L
Entrance Guayo River	A 1	Feb 15	0.0	0.0	5.37	4.30	0.0	1.61	0.0	1.07	0.54	1.07	0.0	0.0	1.07	15.04
Entrance Guayo River	A 2	Feb 15	0.0	0.54	9.13	3.22	0.0	2.15	0.0	1.07	0.0	0.0	0.0	1.07	0.0	17.18
Entrance Guayo River	A 3	Feb 15	0.54	0.0	8.05	5.37	0.54	2.68	0.0	0.0	0.0	0.54	0.0	0.0	0.0	17.72
Entrance Cidra River	B 1	Feb 15	0.0	0.0	0.54	3.22	1.07	1.07	0.0	2.15	0.0	0.54	0.0	1.07	1.07	10.74
Entrance Cidra River	B 2	Feb 15	0.0	0.54	1.61	4.83	1.07	2.69	0.0	0.0	1.07	0.0	0.0	1.07	1.61	14.50
Entrance Cidra River	B 3	Feb 15	0.0	1.07	1.07	4.30	1.61	0.54	1.07	0.0	0.54	0.0	0.0	0.0	0.54	10.74
Center Lake	C 1	Feb 15	0.0	0.54	1.61	0.54	1.61	0.54	0.0	0.0	0.0	0.54	0.0	0.0	1.61	6.98
Center Lake	C 2	Feb 15	0.0	0.54	1.61	1.61	1.07	1.07	0.0	0.0	0.54	0.0	0.0	0.0	1.07	7.52
Center Lake	C 3	Feb 15	0.0	0.0	2.15	2.69	0.0	1.61	0.0	0.0	0.0	0.54	1.07	0.0	1.07	9.67
Exit Guayo River	D 1	Feb 15	0.0	0.0	1.61	1.61	0.0	2.69	0.0	1.07	1.07	1.07	0.54	0.0	1.07	10.74
Exit Guayo River	D 2	Feb 15	0.0	0.0	2.68	1.61	1.61	1.61	0.0	0.0	0.54	0.54	0.0	0.0	3.22	11.81
Exit Guayo River	D 3	Feb 15	0.0	0.0	3.22	3.22	0.54	1.61	0.0	0.0	2.69	0.54	0.0	0.0	3.22	15.04

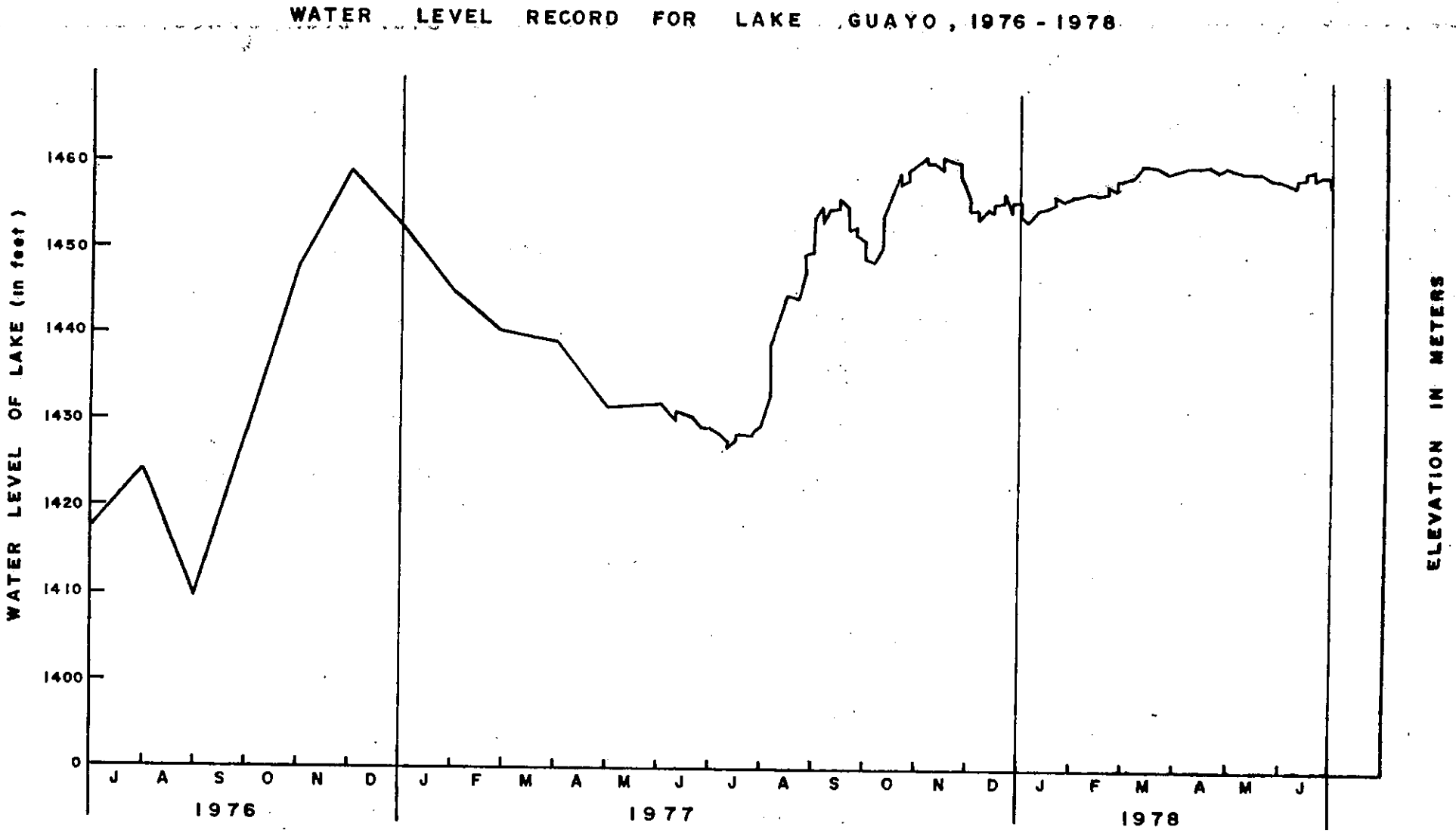
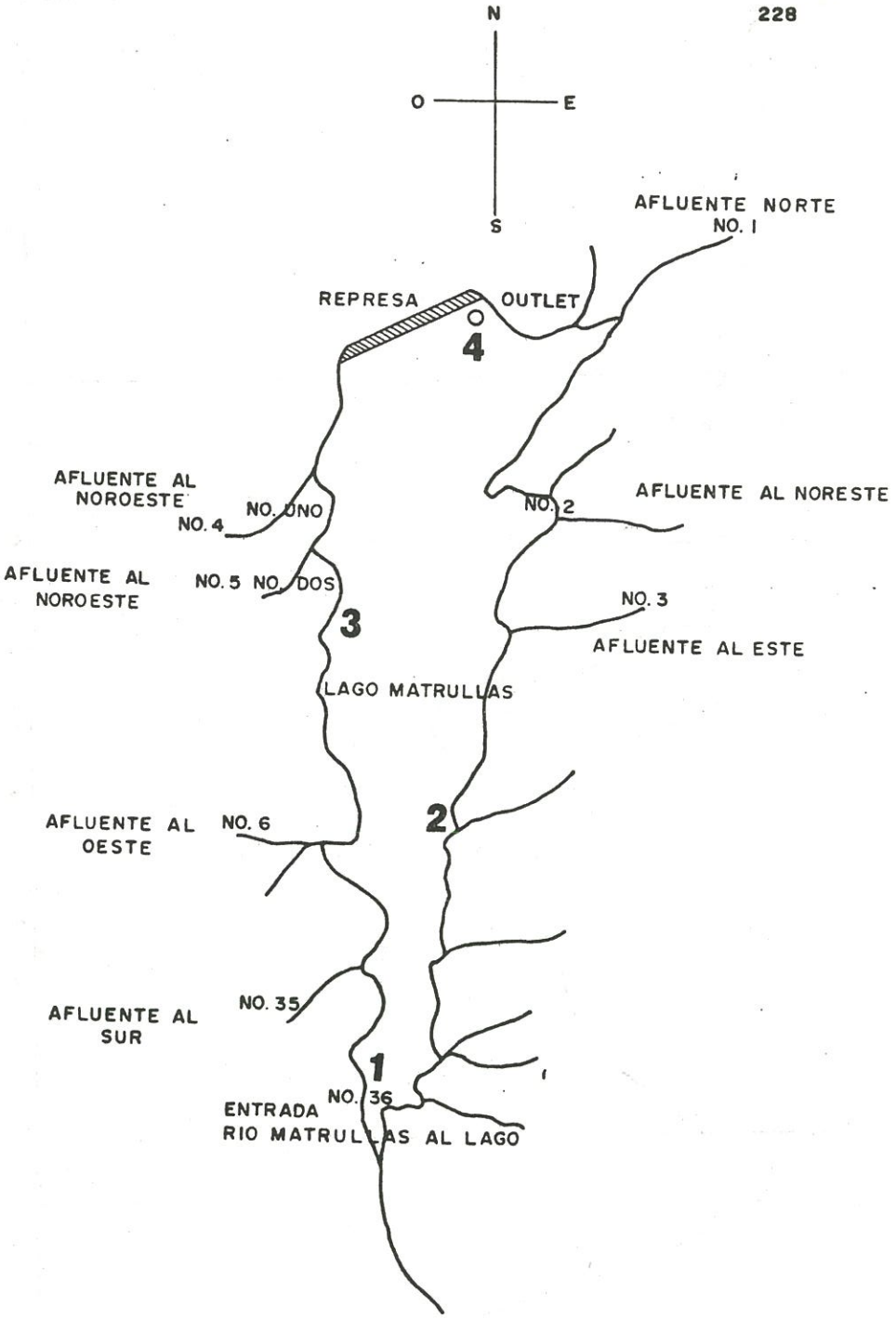

WATER LEVEL RECORD FOR LAKE GUAYO, 1976 - 1978
WATER LEVEL OF LAKE (in feet)
1460
1450
1440
1430
1420
1410
1400
0
J A S O N D J F M A M J J A S O N D J F M A M J
1976
1977
1978
ELEVATION IN METERS

Figure 42



LAGO DE MATRULLAS - OROCOVIS

Figure 43

Figure 44. Emergency Spillway of Lake Matrullas at high water level.

CHEMICAL QUALITY DATA SUMMARY FOR LAKE Matrullas IN Orocovis, PUERTO RICO

FROM November 197_ TO February 1978. SAMPLES ARE FROM 0.5 M DEPTH

Table 119

Station and Localization	Date 1975	Time	Sample No.	Lab. No.	Chloride mg/l	Hardness as $MgSO_4$ Mg/l	Total Phosphates as P mg/l	Nitrate & Nitrite as N mg/l	Iron mg/l	Turbidity in Standard Unit	Color in Standard Unit	pH	Dissolved Oxygen mg/l	Chlorophyll A mg/l	Total Coliform count	Sample Size ml
Quebrada lado suroeste	12/11			35	9.5		0.0	0.06	0.3	2.0	5					
Río Matrulla	12/11			36	0.5		0.0	0.05	0.03	3.0	5					
Quebrada Este	7/11		b2	36	5.5		0.0	0.07	0.03	2.0	5					
Quebrada Este	9/11			37	4.8		0.0	0.00	0.03	3.0	5					
Qda. Oeste	10/11			38	5.5		0.0	0.08	0.03	2.0	5					
" "	"			39	5.0		0.0	0.004	0.03	1.0	5					
" "	"			40	4.5		0.0	0.00	0.02	3.0	5					
Qda. Noroeste	7/11		A'	35	4.5		0.0	0.06	0.03	2.0	5					
Lago Matrullas	21/2/78			449	0.97	20.96	0.01	0.1	0.2	1.9	10					
" "	"			450	2.9	20.96	0.01	0.5	0.2	1.6	25					

CHEMICAL QUALITY DATA SUMMARY FOR LAKE Matrullas IN Orocovis, PUERTO RICO

FROM October 1978 TO October 1978. SAMPLES ARE FROM 0.5 M DEPTH

Table 120

Station and Localization	Date 1978	Time	Temp C°	Lab. No.	Chloride mg/l	Hardness as $MgSO_4$ Mg/l	Total Phosphates as P mg/l	Nitrate & Nitrite as N mg/l	Iron mg/l	Turbidity in Standard Unit	Color in Standard Unit	pH	Dissolved Oxygen mg/l	Chlorophyll A mg/l	Total Coliform count	Sample Size ml
1-River	10/20		21										7.2		3	1
1	10/20														17	10
2-east S.	10/20		24										9.2		9	1
2	10/20														10	10
3-west s.	10/20		25										7.2		0	1
3	10/20														7	10
4-dam	10/20		25										7.6		3	1
4	10/20														3	10

Table 121

Summary of Snails Surveys in Lake Matrullas

Date	Inspector	Snails Found
Feb. 27/75	Quirindongo	*Physa marmorata* *Tarebia granifera*
Nov. 14/75	P. Bermudez	*Physa marmorata*
Oct. 20/78	A. Laracuente & R. Mercado	*Tarebia granifera* *Marisa cornuarietis* *Physa marmorata*

ALGAE DATA SUMMARY FOR LAKE Matrullas IN Orocovis, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM _____ 1977 to October, 1978.

Table 122

LOCALIZATION	SAMPLE	DATE 1978	ORGANISMS/ ML																	
			ANABAENA (blue green)	ANACYSTIS (blue green)	AGMENELLUM (blue green)	COCOCCLORIS (blue green)	GOMPHOSPHAERIA (blue green)	CHLORELLA (green algae)	CLOSTERIUM (green algae)	MICRASTERIAS (green algae)	MOUGEOTIA (green algae)	STANRASTRUM (green algae)	SCENEDESMUS (green algae)	TETRAEDRON (green algae)	ASTERIONELLA (diatom)	COCCONEIS (diatom)	CYCLOTELLA (diatom)	DIATOMEA (diatom)	GOMPHONEMA (diatom)	TOTAL/ M L
Lake Matrullas	A 1	Oct. 3	2.15	1.61	0.0	0.0	0.0	1.61	0.0	0.0	0.0	4.30	3.22	1.61	0.54	3.76	0.0	0.0	1.07	38.66
Lake Matrullas	A 2	Oct. 3	0.0	3.76	0.0	0.0	0.0	2.15	0.54	0.0	0.0	1.61	1.07	0.0	0.0	2.15	0.0	0.54	5.91	34.91
Lake Matrullas	A 3	Oct. 3	0.0	5.37	0.0	0.0	0.0	2.15	0.0	0.0	0.0	2.69	3.76	3.22	0.0	1.07	2.15	2.15	5.37	54.24
Lake Matrullas	B 1	Oct. 3	0.0	3.22	0.0	1.07	0.0	0.54	0.0	0.0	0.0	3.22	1.61	1.07	0.0	0.0	0.0	1.07	2.15	29.54
Lake Matrullas	B 2	Oct. 3	0.0	2.15	0.0	0.0	1.07	0.0	0.0	0.54	0.54	4.83	2.69	0.0	0.0	0.0	0.0	0.54	1.07	26.85
Lake Matrullas	B 3	Oct. 3	0.0	4.30	2.15	0.0	2.15	1.61	0.0	0.0	3.22	2.69	0.0	0.0	0.0	0.0	0.0	1.07	1.07	30.61

ALGAE DATA SUMMARY FOR LAKE Matrullas IN Orocovis, P.R.

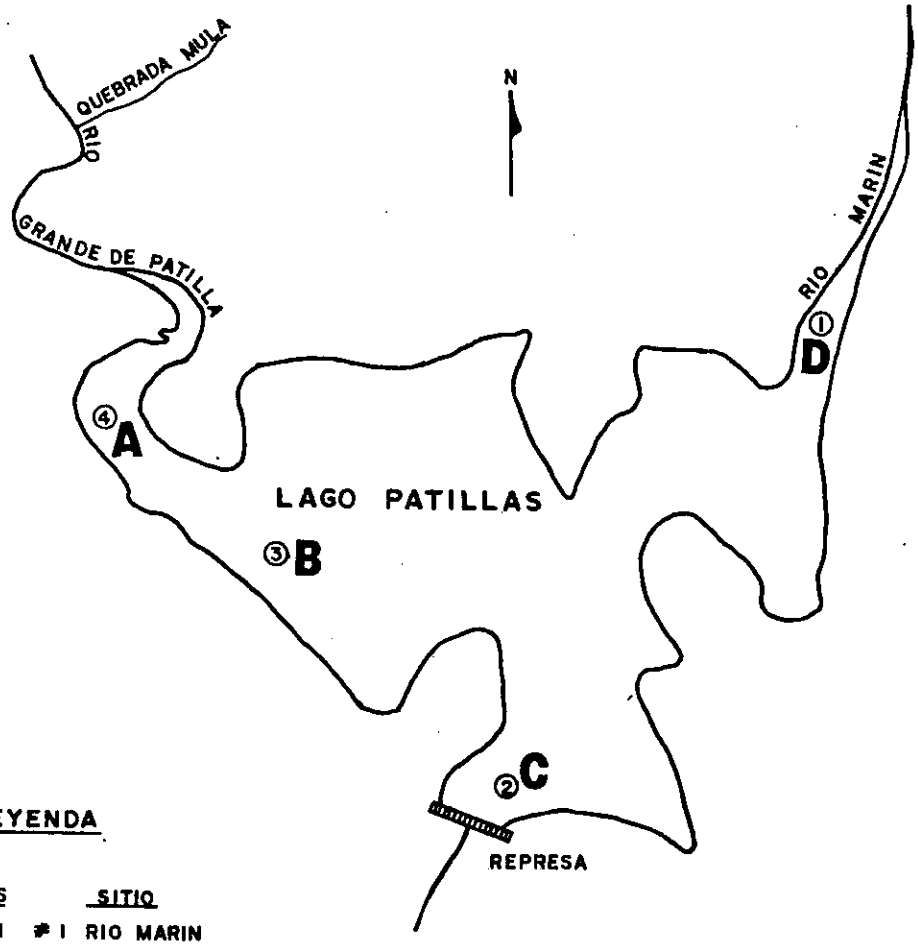
ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM ______ 1977 to October, 1978.

Table 122 (continued)

LOCALIZATION	SAMPLE	DATE 1978	NAVICULA (diatom)	NITZCHIA (diatom)	PINNULARIA (diatom)	STEPHANODISCUS (diatom)	SYNEDRA (diatom)	TABELLARIA (diatom)	MALLOMONAS ((flagellate)	PERIDINIUM (flagellate)	PHACOTUS (flagellate)	UROGLENOPSIS (flagellate)								TOTAL/ M L
			ORGANISMS/ ML																	
Lake Matrullas	A 1	Oct. 3	5.37	0.0	0.0	4.30	1.07	0.0	1.07	2.15	0.0	4.83								
Lake Matrullas	A 2	Oct. 3	3.22	0.0	0.0	5.91	1.07	0.0	0.0	2.69	1.61	2.69								
Lake Matrullas	A 3	Oct. 3	4.30	0.54	8.06	4.83	1.61	0.54	0.0	4.30	0.0	2.15								
Lake Matrullas	B 1	Oct. 3	1.61	0.0	6.45	2.15	0.0	0.0	1.61	2.15	0.0	1.61								
Lake Matrullas	B 2	Oct. 3	1.07	2.15	4.30	2.15	0.0	0.0	1.07	2.69	0.0	0.0								
Lake Matrullas	B 3	Oct. 3	0.0	0.54	3.76	4.30	2.69	0.0	1.07	0.0	0.0	0.0								

SURVEY OF LAKE PATILLAS



LEYENDA

ESTACIONES	SITIO
1 - ESTACION	# 1 RIO MARIN
2 - "	# 2 REPRESA
3 - "	# 3 SECTOR LA PLAYITA
4 - "	# 4 RIO GRANDE DE PATILLAS

Figure 45

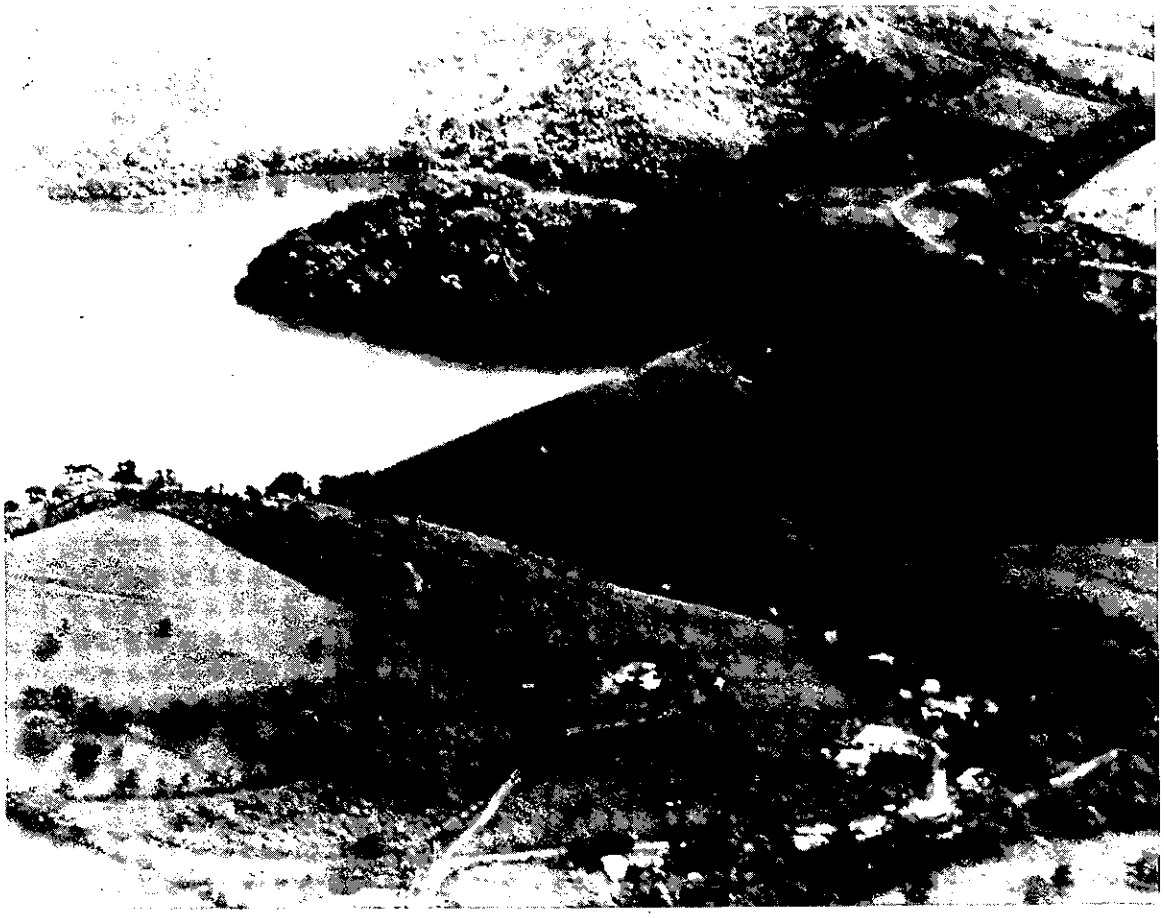


Figure 46. Earthen dike on Lake Patillas near station 3. Outlet to Patillas canal is hidden at left-hand end of dike, and is site for proposed low head turbine installation.

CHEMICAL QUALITY DATA SUMMARY FOR LAKE Patillas IN Patillas, PUERTO RICO

FROM July 1976 TO July 1978. SAMPLES ARE FROM 0.5 M DEPTH

Table 123

Station and Localization	Date 1978	Time	Sample No.	Lab. No.	Chloride mg/1	Hardness as $MgSO_4$ Mg/1	Total Phosphates as P mg/1	Nitrate & Nitrite as N mg/1	Iron mg/1	Turbidity in Standard Unit	Color in Standard Unit	pH	Dissolved Oxygen mg/1	Chlorophyll A mg/1	Total Coliform count	Sample Size ml
Río Patillas *4-A	5-9			525	13.7	19.4	0.01	0.00	0.6		10	--				
Dique *5-B	5-9			526	13.7	52.6	0.01	0.05	0.00		10	7.8				
Entrada Canal *2-C	5-9			527	11.7	38.7	0.01	0.02	0.00		10	7.7				
Tributario Este (Río Marin) *1-D	5-9			528	11.7	38.7	0.01	0.06	0.12		10	---				
*4-A	7-14	7:25	PT-44	529	6.8	28.0	0.01	0.01	0.04		10	7.2	7.0			
*5-B	7-14	7:40	PT-49	530	4.8	54.0	0.01	0.01	0.00		10	7.5	8.2			
*2-C	7-14	7:50	PT-54	531	6.8	37.8	0.01	0.00	0.00		10	7.4	7.7			
*1-D	7-14	8:02	PT-59	532	8.8	18.9	0.01	0.01	0.13		10	7.8	7.6			
	1976															
*1-D	7-22		12	309	9.4	42.3	0.01	0.51		15.6	15	8.0				
*5-B	7-22			310	4.8	7.3	0.03	0.32	0.30	4.7	8	8.1				
*4-A	7-22		15	311	9.4	39.3	0.03	0.19		4.3	10	7.9				

*SEE MAP, FIGURE 3

Table 124

Summary of Snails Surveys in Lake Patillas

Date	Inspector	Snails Found
Jul. 22/76	A. Laracuente	*Marisa cornuarietis* *Tarebia granifera*
May 9/78	W. Jobin	*Marisa cornuarietis* *Tarebia granifera* *Ampularia australis*
Jul. 12/78	R. Mercado	*Marisa cornuarietis* *Tarebia granifera* *Ampularia australis*

OXYGEN DATA SUMMARY FOR LAKE Patillas IN Patillas, PUERTO RICO

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM July 1978 TO July, 1978.

Table 125

Station	Date	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
Entrada Río Patillas *4-A	12 July	9:50	29.0	1 6-9	7.2	7.0	6.4	0.60	0.80	1.4		21
*4-A	13 July	12:00	27.0	5,	7.0	---	---	---	----	0.8		
*4-A	14 July	7:25	27.5	36, 40-43	6.7	7.3	6.3	1.0	0.4	1.8		20
Dique *5-B	12 July	10:15	29.5	2 12-15	7.9	7.7	7.0	0.7	0.9	2.4		21
*5-B	13 July	10:20	27.5	11, 29-32	7.9	8.0	7.0	1.0	0.9	2.2		24
*5-B	14 July	7:40	27.0	28 45-48	8.9	7.6	6.7	0.9	2.2	2.2		21
Entrada al Canal *2-C	12 July	10:35	29.5	4, 17-20	8.1	8.0	6.8	1.2	1.3	1.8		20
*2-C	13 July	10:40	28.5	-----	---	---	---	---	---	2.4		--
*2-C	14 July	7:50	27.0	34, 51-53	6.8	7.8	6.6	1.2	0.2	2.0		21
Entrada Río Marín *1-D	12 July	10:55	29.0	3, 23-26	7.2	8.2	7.3	0.9	0.1	1.5		20
*1-D	13 July	12:20	29.0	22,	7.4	----	---	---	---	1.2		22
*1-D	14 July	8:02	27.0	38,	6.9	7.5	6.5	1.0	0.4	1.2		20

*SEE MAP, FIGURE 3.

OXYGEN DATA SUMMARY FOR LAKE Patillas IN Patillas, PUERTO RICO

ALL SAMPLES TAKEN AT 0.5 M DEPTH

Table 125 (continued) FROM July 1978 TO July, 1978.

Station	Date 1978	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
A Entrada Río Patillas	7/12	9:50	29	1, 6 - 9	7.2	7.0	6.4	0.6	0.8	1.4		21
A	7/13	12:00	30	5,	7.0	---	---	---	---	0.8		22
A	7/14	7:25	28	36, 40 - 43	6.7	7.3	6.3	1.0	0.4	1.8		19
B Dique	7/12	10:15	30	2, 12 - 15	7.9	7.7	7.0	0.7	0.9	2.4		21
B	7/13	10:20	28	11, 29 - 32	7.9	8.0	7.0	1.0	0.9	2.2		24
B	7/14	7:40	27	28, 45 - 48	8.9	7.6	6.7	0.9	2.2	2.2		21
C Entrada al canal	7/12	10:35	30	4, 17 - 20	8.1	8.0	6.8	1.2	1.3	1.8		21
C	7/13	10:40	28	-------	----	---	---	---	---	2.4		24
C	7/14	7:50	27	34, 50 - 53	6.8	7.8	6.6	1.2	0.2	2.0		21
D Entrada Río Marín	7/12	10:35	29	3, 23 - 26	7.2	8.2	7.3	0.9	-0.1	1.5		20
D	7/13	12:20	29	22,	7.4	---	---	---	---	1.2		21
D	7/14	8:02	27	38, 55 - 58	6.9	7.2	6.5	0.7	0.4	1.2		20

LAGO PATILLAS (ESTACIÓN-A)

GRAFICA DE OXIGENO DISUELTO Y TEMPERATURA
DISTRIBUCIÓN VERTICAL (20 DE JULIO DE 1978)

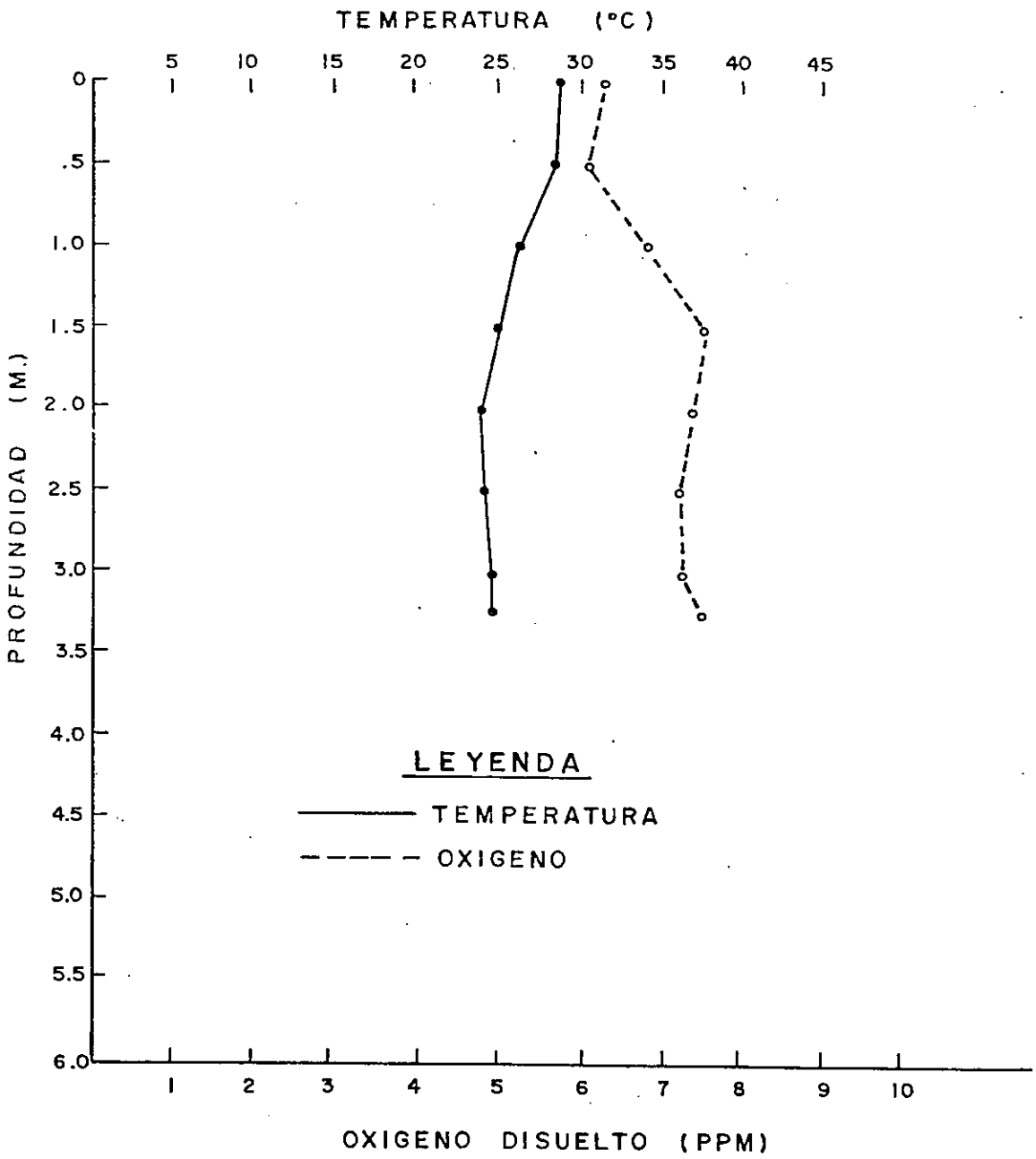


FIGURE 47

LAGO PATILLAS (ESTACIÓN-B)

GRAFICA DE OXIGENO DISUELTO Y TEMPERATURA
DISTRIBUCION VERTICAL (20 DE JULIO DE 1978)

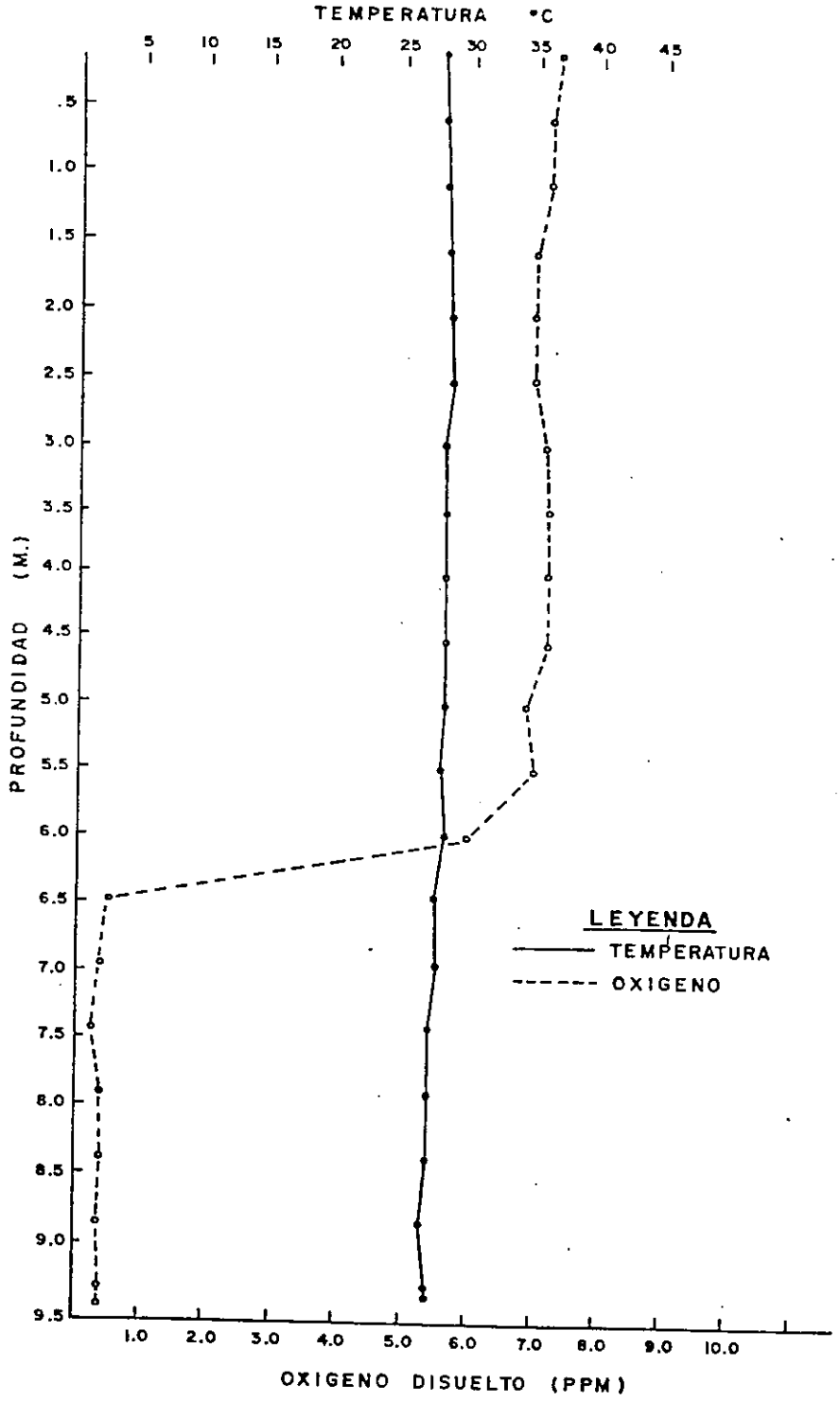


FIGURE 48

LAGO PATILLAS (ESTACIÓN-C)

GRAFICA DE OXIGENO DISUELTO Y TEMPERATURA
DISTRIBUCIÓN VERTICAL (20 DE JULIO DE 1978

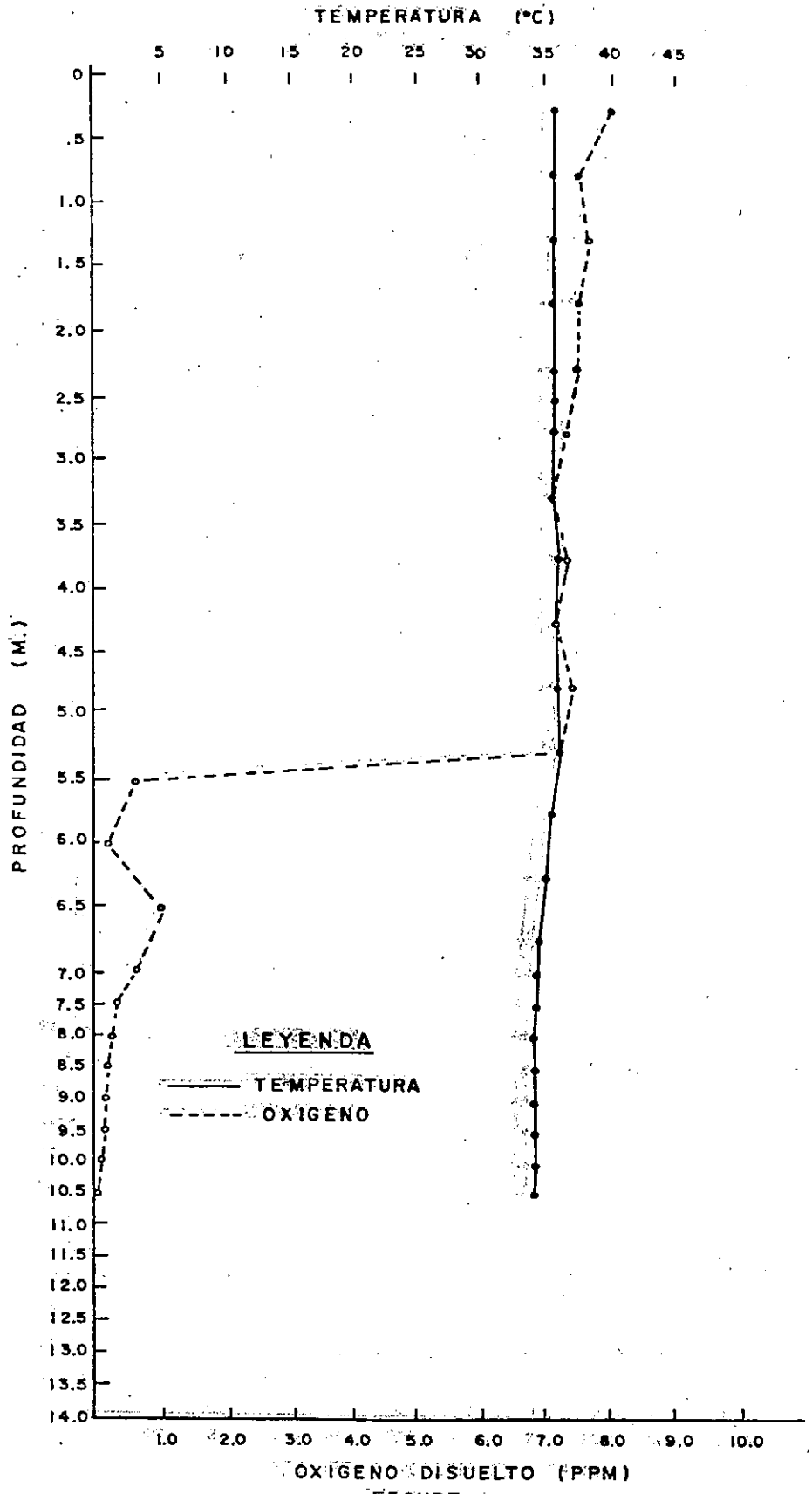


FIGURE 49

LAGO PATILLAS (ESTACIÓN-D)

GRAFICA DE OXIGENO DISUELTO Y TEMPERATURA
DISTRIBUCION VERTICAL (20 DE JULIO DE 1978)

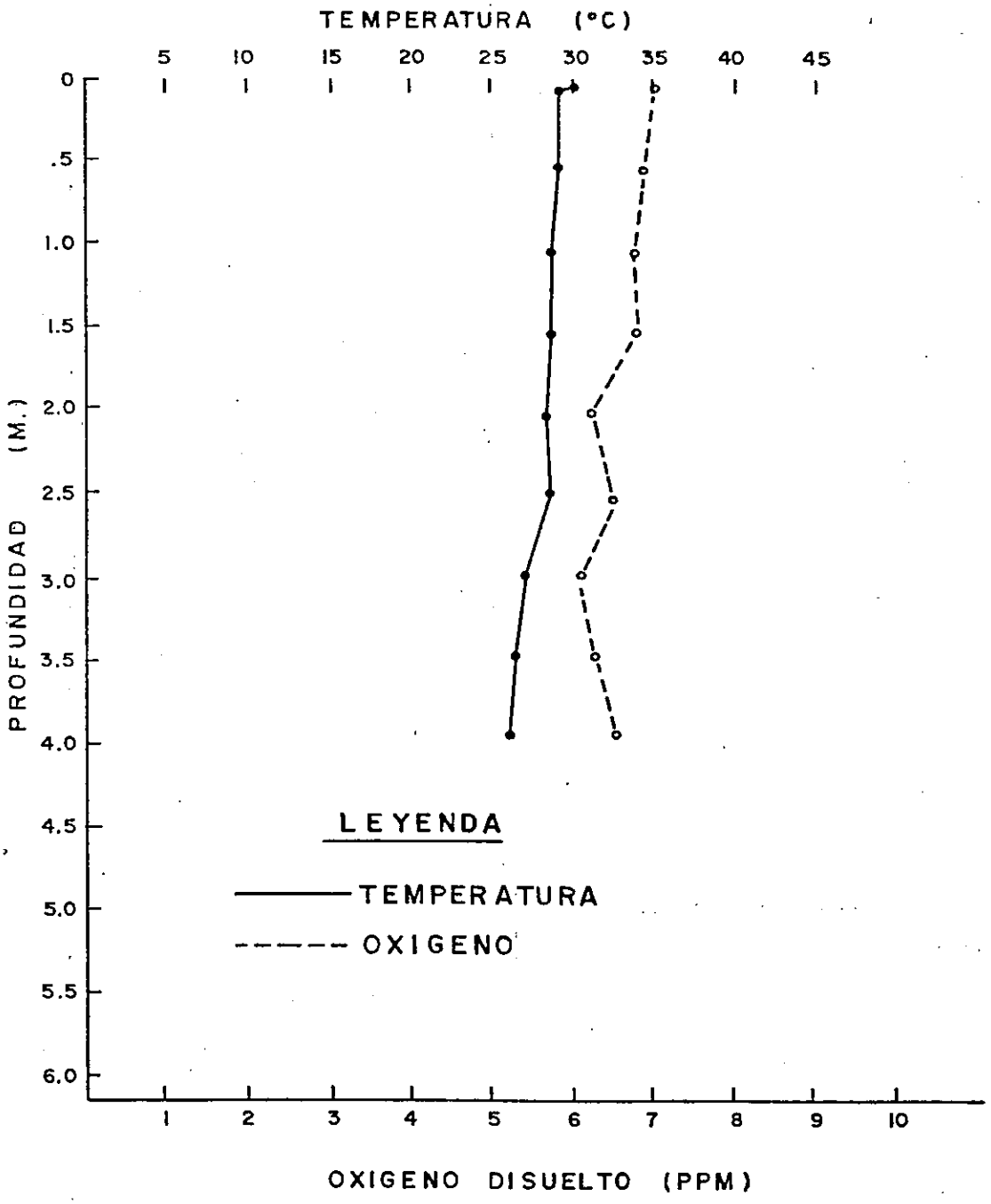


FIGURE 50

ALGAE DATA SUMMARY FOR LAKE Patillas IN Patillas, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM 1977 to Mayo, 1978.

Table 126

LOCALIZATION	SAMPLE	DATE 1978	ORGANISMS/ ML																	
			ANACYSTIS (blue green)	COMPHOSPHAERIA (blue green)	ACTINASTRUM (green)	CHLORELLA (green)	STAURASTRUM (green)	SCENEDESMUS (green)	ACHNANTHES (diatom)	COCCONEIS (diatom)	GOMPHONEMA (diatom)	NITZSCHIA (diatom)	NAVICULA (diatom)	STEPHANODISCUS (diatom)	SYNEDRA (diatom)	TETRAEDRON (diatom)	TABELLARIA (diatom)	CHRYSOCOCCUS (flagellate)	MALLOMONAS (flagellate)	TOTAL/ M L
Lake Patillas	A 1	Mayo 9	2.15	3.76	1.61	3.22	6.98	3.22	0.0	0.0	0.0	0.0	0.0	0.0	2.15	1.61	0.0	0.0	0.0	24.70
Lake Patillas	A 2	Mayo 9	2.68	1.61	1.07	3.22	4.83	1.61	0.0	0.0	0.0	1.07	0.0	0.0	0.0	1.07	0.0	0.0	0.0	17.18
Lake Patillas	A 3	Mayo 9	0.0	2.15	2.69	3.22	6.44	2.15	0.0	0.0	0.0	0.0	0.0	0.0	2.69	2.69	0.0	0.0	1.61	23.63
Lake Patillas	B 1	Mayo 9	2.15	3.22	2.68	3.22	10.74	2.68	0.54	0.0	0.0	0.0	0.0	1.61	1.61	9.13	0.0	0.0	1.61	32.20
Lake Patillas	B 2	Mayo 9	3.76	4.30	2.15	3.22	12.35	3.22	0.0	0.0	0.0	1.07	1.07	1.61	3.22	10.74	0.0	0.0	1.07	47.79
Lake Patillas	B 3	Mayo 9	2.15	2.69	2.15	1.61	8.06	6.44	0.0	0.0	0.0	0.0	0.0	0.54	3.22	6.98	0.0	0.0	0.54	34.37
Lake Patillas	C 1	Mayo 9	3.22	2.15	7.52	0.0	6.44	0.0	0.0	0.0	1.07	0.0	0.0	3.22	4.30	7.52	0.0	0.54	1.07	37.05
Lake Patillas	C 2	Mayo 9	2.69	2.15	4.30	0.0	8.06	0.0	0.0	0.0	1.61	0.0	0.0	2.15	3.22	5.91	1.07	2.15	1.07	34.37
Lake Patillas	C 3	Mayo 9	2.15	1.61	3.76	0.0	8.59	0.0	0.0	0.0	1.61	0.0	0.0	1.61	2.68	6.44	2.15	1.61	1.07	33.29
Lake Patillas	D 1	Mayo 9	2.15	1.61	6.45	0.0	2.69	0.0	0.0	0.0	0.0	0.0	1.07	1.61	4.30	1.07	1.61	0.0	1.61	24.17
Lake Patillas	D 2	Mayo 9	1.07	1.07	2.15	0.0	5.91	0.0	0.0	0.0	0.54	0.0	2.15	0.0	2.15	3.76	2.68	0.0	1.07	22.57
Lake Patillas	D 3	Mayo 9	3.22	1.07	0.0	0.0	3.76	0.0	0.0	1.61	0.54	0.0	0.0	2.15	3.22	3.76	0.0	0.54	1.61	21.48

LAGO PRIETO

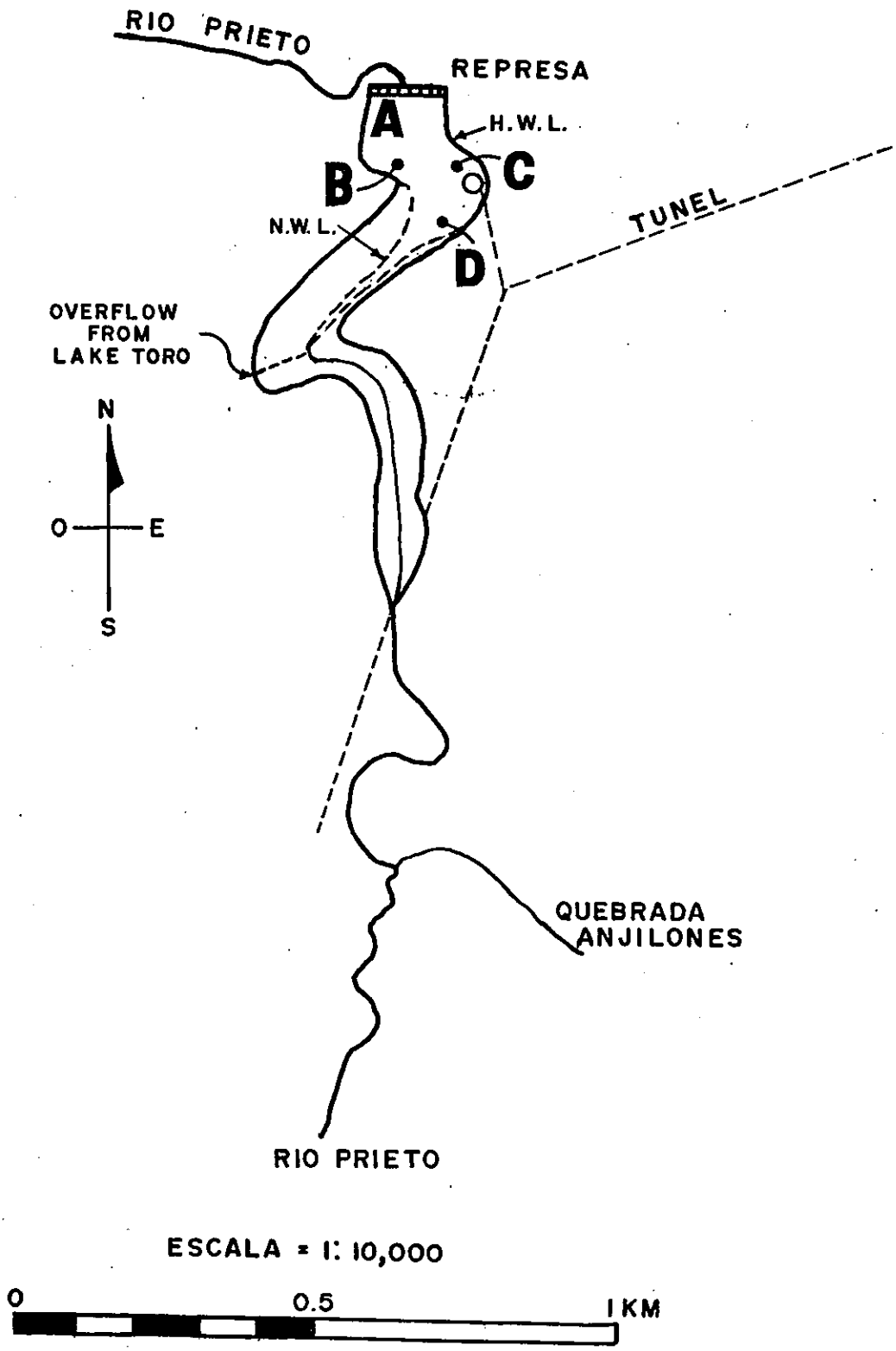


Figure 51

CHEMICAL QUALITY DATA SUMMARY FOR LAKE Prieto IN Lares, PUERTO RICO

FROM July 1977 TO June 1978. SAMPLES ARE FROM 0.5 M DEPTH

Table 127

Station and Localization	Date 1977	Time	Sample No.	Lab. No.	Chloride mg/l	Hardness as $MgSO_4$ Mg/l	Total Phosphates as P mg/l	Nitrate & Nitrite as N mg/l	Iron mg/l	Turbidity in Standard Unit	Color in Standard Unit	pH	Dissolved Oxygen mg/l	Chlorophyll A mg/l	Total Coliform count	Sample Size ml
Dam A	22 Jul		LP-50	379	3.9	156.6	0.01	0.10	0.03	0.3	15	7.1	8.8			
Middle Lake B	22 Jul		LP-55	380	2.9	151.2	0.01	0.05	0.03	2.2	15	7.1	9.4			
Entrada Río Prieto C	22 Jul		LP-60	381	9.8	151.2	0.01	0.10	0.03	5.7	12	7.3	8.6			
— D	22 Jul		LP-61	382	3.9	189.0	0.01	0.80	0.04	3.8	8	7.5	---			
A	21 Oct		LP-47	408	1.0	133.4	0.06	0.10	3.60	65.0	12	7.4	4.9			
B	21 Oct		LP-52	409	2.9	139.0	0.00	0.10	2.30	50.0	15	7.3	5.2			
C	21 Oct		LP-56	410	2.9	133.4	0.06	0.10	2.40	50.0	15	7.7	5.6			
	1978															
C	31 Mar		LP-19	458	3.9	132.6	0.01	0.40	0.10		30	7.3	4.4			
A	31 Mar		LP-25	459	0.0	142.8	0.01	0.60	0.10		10	7.4	4.0			
A	1 Jun			523	9.8	225.8	0.01	0.50	0.20		10	8.2				
B	1 Jun			524	6.8	167.8	0.01	0.30	0.10		10	7.5				

TABLE 128

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Prieto

PARAMETER Chlorides

UNITS mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1 22/7/78	20.5	4	5.12	2.34
2 21/10/78	6.8	3	2.27	0.84
3 31/3/78	3.9	2	1.95	1.95
4 1/6/78	16.6	2	8.30	1.50
5				
6				
7				
8				
9				
10				
TOTALS	47.8	11	4.35	
B-VARIATION BY STATION				
A	14.7	4	3.68	3.18
B	12.6	3	4.20	1.73
C	16.6	3	5.53	2.84
D	3.9	1		
E				
F				
G				
H				
TOTALS	47.8	11	4.35	

TABLE 129

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Prieto

PARAMETER Hardness as Mg SO4

UNITS mg/1

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	648.0	4	162.00	13.50
2	405.8	3	135.27	2.49
3	275.4	2	137.70	5.10
4	393.6	2	196.8	29.00
5				
6				
7				
8				
9				
10				
TOTALS	1,722.8	11	156.62	
B-VARIATION BY STATION				
A	658.6	4	164.65	30.58
B	458.0	3	152.67	10.09
C	417.2	3	139.07	8.09
D	189.0	1		
E				
F				
G				
H				
TOTALS	1,722.8	11	156.62	

TABLE 130

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Prieto

PARAMETER Total Phosphates as P

UNITS Mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	0.04	4	0.01	0.00
2	0.12	3	0.04	0.03
3	0.02	2	0.01	0.00
4	0.02	2	0.01	0.00
5				
6				
7				
8				
9				
10				
TOTALS	0.20	11	0.02	
B-VARIATION BY STATION				
A	0.09	4	0.02	0.02
B	0.02	3	0.01	0.00
C	0.08	3	0.03	0.02
D	0.01	1		
E				
F				
G				
H				
TOTALS	0.20	11	0.02	

TABLE 131

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Prieto

PARAMETER Nitrate & Nitrite as N

UNITS Mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	1.05	4	0.26	0.27
2	0.30	3	0.10	0.00
3	1.00	2	0.50	0.10
4	0.80	2	0.40	0.10
5				
6				
7				
8				
9				
10				
TOTALS	3.15	11	0.29	
B-VARIATION BY STATION				
A	1.30	4	0.32	0.22
B	0.45	3	0.15	0.10
C	0.60	3	0.20	0.13
D	0.80	1		
E				
F				
G				
H				
TOTALS	3.15	11	0.29	

TABLE 132

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Prieto

PARAMETER Iron

UNITS Mg/l

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	0.13	4	0.03	0.00
2	8.30	3	2.77	0.56
3	0.20	2	0.10	0.00
4	0.30	2	0.15	0.05
5				
6				
7				
8				
9				
10				
TOTALS	8.93	11	0.81	
B-VARIATION BY STATION				
A	3.93	4	0.98	1.31
B	2.43	3	0.81	0.99
C	2.53	3	0.84	1.04
D	0.04	1		
E				
F				
G				
H				
TOTALS	8.93	11	0.81	

TABLE 133

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Prieto

PARAMETER Turbidity

UNITS Standard Unit

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	12.0	4	3.00	1.75
2	165.0	3	55.00	6.67
3				
4				
5				
6				
7				
8				
9				
10				
TOTALS	177.0	7	25.29	
B-VARIATION BY STATION				
A	65.3	2	32.65	32.35
B	52.2	2	26.10	23.90
C	55.7	2	27.85	22.15
D	3.8	1		
E				
F				
G				
H				
TOTALS	177.0	7	25.29	

TABLE 134

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM

LAKE Prieto

PARAMETER Color

UNITS Standard Unit

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	50.0	4	12.50	2.50
2	42.0	3	14.00	1.33
3	40.0	2	20.00	10.00
4	20.0	2	10.00	0.00
5				
6				
7				
8				
9				
10				
TOTALS	152.0	11	13.82	
B-VARIATION BY STATION				
A	47.0	4	11.75	1.75
B	40.0	3	13.33	2.22
C	57.0	3	19.00	7.33
D	8.0	1		
E				
F				
G				
H				
TOTALS	152.0	11	13.82	

TABLE 135

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Prieto

PARAMETER P H

UNITS

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	29.0	4	7.25	0.15
2	22.4	3	7.47	0.16
3	14.7	2	7.35	0.05
4	15.7	2	7.85	0.35
5				
6				
7				
8				
9				
10				
TOTALS	81.8	11	7.44	
B-VARIATION BY STATION				
A	30.1	4	7.52	0.34
B	21.9	3	7.30	0.13
C	22.3	3	7.43	0.18
D	7.5	1		
E				
F				
G				
H				
TOTALS	81.8	11	7.44	

TABLE 136

HYDROELECTRIC RESERVOIR STUDY
SUMMARY OF DATA FROM
LAKE Prieto

PARAMETER Dissolved Oxygen

UNITS Mg/1

A-VARIATION WITH TIME				
SAMPLE DATE	TOTAL	NUMBER OF SAMPLES	MEAN	STANDARD DEVIATION
1	26.8	3	8.93	0.31
2	15.7	3	5.23	0.24
3	8.4	2	4.20	0.20
4				
5				
6				
7				
8				
9				
10				
TOTALS	50.9	8	6.36	
B-VARIATION BY STATION				
A	17.7	3	5.90	1.93
B	14.6	2	7.30	2.10
C	18.6	3	6.20	1.60
D				
E				
F				
G				
H				
TOTALS	50.9	8	6.36	

Table 137

Summary of Snail Surveys in Lake Prieto

Date	Inspector	Snails Found
Feb. 2/76	P. Bermudez	*Marisa cornuarietis*
Jul 15/77	W. Jobin	*Pomacea australis* *Helisoma caribaeum* *Biomphalaria glabrata*
Mar. 8/78	R. Brown	*Marisa cornuarietis* *Physa cubensis* *Lymnaea columella* *Biomphalaria glabrata*
Jun 1/78	W. Jobin & A. Laracuente	*Marisa cornuarietis* *Lymnaea columella*
Aug. 28/78	A. Laracuente	*Marisa cornuarietis* *Tarebia granifera* *Biomphalaria glabrata* *Lymnaea columella*
Sept.27/78	A. Laracuente	*Marisa cornuarietis* *Biomphalaria glabrata* *Physa cubensis*

Table 138

SUMMARY OF COLIFORM DATA OF LAKE Prieto IN _____, P.R.

FROM July 1977 TO October 1978.

STATION	DATE	FIELD NUM.	VOL. ml	COLONIES	COLONIES/ 100 ml
A	2/7/77	LP-13	1	3	300
A	21/7/77	LP-13	10	39	390
B	21/7/77	LP-19	1	94	9,400
B	21/7/77	LP-19	1	94	9,400
B	21/7/77	LP-19	10	130	1300
C	21/7/77	LP-25	1	0	0
C	21/7/77	LP-25	10	51	510
D	21/7/77	LP-26	1	173	17,300
D	21/7/77	LP-26	10	TNTC	
A	22/7/77	LP-32	1	45	4500
A	22/7/77	LP-32	10	60	600
B	22/7/77	LP-38	1	84	8,400
B	22/7/77	LP-38	10	TNTC	
C	22/7/77	LP-44	1	4	400
C	22/7/77	LP-44	10	TNTC	
D	22/7/77	LP-45	1	27	2,700
D	22/7/77	LP-45	10	90	900
A	18/10/77	LP-2	10	TNTC	
A	18/10/77	LP-2	10	TNTC	
B	18/10/77	LP-4	10	TNTC	
B	18/10/77	LP-4	1	TNTC	
C	18/10/77	LP-6	10	TNTC	
C	18/10/77	LP-6	1	TNTC	
A	19/10/77	LP-12	10	TNTC	
A	19/10/77	LP-12	1	TNTC	
A	19/10/77	LP-12	.1	148	1,480
B	19/10/77	LP-18	10	TNTC	
B	19/10/77	LP-18	1	TNTC	
B	19/10/77	LP-8	.1	87	87,000
C	19/10/77	LP-24	10	TNTC	
C	19/10/77	LP-24	1	TNTC	
C	19/10/77	LP-24	.1	TNTC	
A	20/10/77	LP-30	1	TNTC	

Table 139

SUMMARY OF COLIFORM DATA OF LAKE Prieto IN _____, P.R.

FROM _____ 197 TO _____ 1978.

STATION	DATE	FIELD NUM.	VOL. ml	COLONIES	COLONIES/ 100 ml
A	20/10/77	LP-30	.1	72	72,000
B	20/10/77	LP-36	1	TNTC	
B	20/10/77	LP-36	.1	74	74,000
C	20/10/77	LP-42	1	TNTC	
C	20/10/77	LP-42	.1	90	90,000

OXYGEN DATA SUMMARY FOR LAKE Prieto IN Lares (Bartolo), PUERTO RICO

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM July 1977 TO March, 1978.

Table 140

Page 1 of 2

Station	Date 1977	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
A Dam	20 Jul	8:30	22	1,9-12	11.5	10.2	8.8	1.4	2.7	0.2		22
A	21 Jul	8:20	25	8,28-31	7.1	8.5	6.3	2.2	0.8	0.2		24
A	22 Jul	8:30	23	27,46-49	7.8	8.0	7.5	0.5	0.3	0.2		24
B Middle Lake	30 Jul	8:45	22	3,15-18	11.6	11.0	8.8	2.2	2.8	0.2		22
B	21 Jul	8:30	24	14,34-37	7.1	8.0	5.2	2.8	1.9	0.2		24
B	22 Jul	8:45	22	33,51-54	9.1	9.1	7.8	1.3	1.3	0.4		24
C Entrada Río Prieto	20 Jul	8:55	23	5,21-24	11.0	9.8	9.9	- 0.1	1.1	0.2		22
C	21 Jul	8:45	25	20,40-43	6.5	5.6	5.4	0.2	1.1	0.2		24
C	22 Jul	8:50	22	39,56-59	8.4	9.2	8.6	0.6	- 0.2	7.5		24
A Dam	19 Oct	8:15	21	1,18-11	6.1	5.4	5.2	- 0.6	0.9	0.4		24
A	20 Oct	8:10	22	7,26-29	4.8	4.6	4.6	0.0	0.2	0.2		24
A	21 Oct	8:00	22	25,43-46	3.8	3.2	2.6	0.6	1.2	1.2		24
B Middle Lake	19 Oct	8:25	21	3,14-17	6.9	6.1	6.1	0.0	0.8	0.8		24
B	20 Oct	8:20	22	13,32-35	4.5	4.5	4.4	0.1	0.1	0.1		24
B	21 Oct	8:10	22	31,48-51	4.3	3.4	3.4	0.0	0.9	0.9		24
C Entrada Río Prieto	19 Oct	8:35	20.5	5,20-23	6.5	6.2	5.7	0.5	0.8	0.8		24
C	20 Oct	8:35	22	19,38-41	5.3	4.8	4.8	0.0	0.5	0.5		24
C	21 Oct	8:20	22	37,53-56	5.0	4.1	4.0	0.1	1.0	1.0		24

OXYGEN DATA SUMMARY FOR LAKE Prieto IN Lares (Bartolo), PUERTO RICO

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM July 1977 TO March, 1978.

Table 140 (continued)

Station	Date 1978	Time Hour	Water Temp. °C	Sample No.	Initial Oxygen from Previous Day mg/l	Light Bottle Oxygen mg/l	Dark Bottle Oxygen mg/l	Light -Dark Oxygen mg/l	Initial -Dark Oxygen mg/l	Secchi Disk Depth M	Ratio of Full Sunlight From NOA	Elapsed Time Hours
C Entrada Río Prieto	8 Mar	7:30	18	1,3-6	5.3	5.3	4.6	0.7	0.7	0.8		23
C	9 Mar	7:00	17	7,15-18	3.6	4.3	3.3	1.0	0.3	0.9		24
A Dam	8 Mar	7:45	18	2,9-12	4.8	4.7	4.1	0.6	0.7	0.8		23
A	9 Mar	7:10	17	13,21-24	3.1	2.6	2.5	0.1	0.6	0.9		23

ALGAE DATA SUMMARY FOR LAKE Prieto IN Lares, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM October 1977 to , 1978.

Table 141

LOCALIZATION	SAMPLE	DATE 1977	ANACYSTIS (blue green)	ANKISTRODESMUS (green)	CHLORELLA (green)	SCENEDESMUS (green)	STAURASTRUM (green)	GOMPHONEMA (diatom)	NAVICULA (diatom)	NITZSCHIA (diatom)	STAURONEIS (diatom)	STEPHANODISCUS (diatom)	SYNEDRA (diatom)	CHRYSOCOCCUS (flagellate)	MALLOMONAS (flagellate)					TOTAL/ M L
Entrance	A 1	Oct.	4.30	1.61	0.0	3.76	4.30	2.69	2.15	0.0	1.07	1.61	0.0	0.0	0.54					22.02
Entrance	A 2	Oct.	3.22	0.0	0.0	3.22	2.15	2.15	1.07	0.0	0.54	3.22	2.15	0.0	0.54					16.65
Entrance	A 3	Oct.	2.68	0.0	3.22	2.15	1.61	0.0	2.15	0.0	1.07	2.68	2.68	0.54	0.54					19.33
Near Dam	B 1	Oct.	2.68	3.76	3.22	2.68	4.30	0.0	0.0	4.30	3.22	2.15	3.22	0.54	0.0					26.31
Near Dam	B 2	Oct.	3.22	0.0	3.22	3.22	2.15	1.61	3.76	2.15	1.61	2.15	4.30	1.07	0.0					28.46
Near Dam	B 3	Oct.	3.22	0.0	3.76	3.22	0.0	2.15	2.68	2.15	2.15	3.76	0.0	1.07	0.54					24.70

ALGAE DATA SUMMARY FOR LAKE Prieto IN Lares, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM _____ 1977 to March, 1978.

Table 141 (continued)

LOCALIZATION	SAMPLE	DATE 1978	ORGANISMS/ ML																	TOTAL/ ML
			ANACYSTIS (blue green)	GOMPHOSPHAERIA (blue green)	AGMENELLUM (green)	ANKISTRODESMUS (green)	SCENEDESMUS (green)	CYCLOTELLA (diatom)	DIATOMEA (diatom)	GOMPHONEMA (diatom)	NAVICULA (diatom)	NITZSCHIA (diatom)	PINNULARIA (diatom)	STEPHANODISCUS (diatom)	SYNEDRA (diatom)	TABELLARIA (diatom)	CHRYSOCOCCUS (flagellate)	MALLOMONAS (flagellate)		
Entrance	A 1	Mar. 9	0.0	2.69	0.0	0.0	2.15	3.76	0.54	0.0	1.07	0.0	0.54	0.0	1.07	1.61	0.0	0.0		13.43
Entrance	A 2	Mar. 9	4.30	0.0	0.0	1.61	3.76	2.15	0.0	0.0	1.07	0.0	1.07	3.76	0.0	0.0	0.0	0.0		17.72
Entrance	A 3	Mar. 9	3.76	0.0	0.54	0.0	5.37	0.54	1.61	0.0	0.0	0.0	1.07	1.07	0.0	0.0	0.0	0.0		13.96
Near Dam	B 1	Mar. 9	1.07	0.0	0.0	0.0	1.61	0.0	1.07	1.61	2.15	1.07	0.54	2.69	0.0	0.0	2.15	1.07		15.04
Near Dam	B 2	Mar. 9	4.83	0.0	0.0	0.0	3.22	0.0	0.0	0.0	1.61	0.54	0.0	6.44	0.54	0.0	0.0	1.07		18.26
Near Dam	B 3	Mar. 9	4.30	0.0	0.0	0.0	1.61	1.61	1.07	0.0	1.61	0.0	1.07	3.76	0.54	0.0	0.54	1.07		17.18

ALGAE DATA SUMMARY FOR LAKE Prieto IN Lares, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM 1977 to June, 1978.

Table 141 (continued)

LOCALIZATION	SAMPLE	DATE	ORGANISMS/ ML																TOTAL/ M L
			ANACYSTIS (blue green)	ANKISTRODESMUS (green algae)	CHILORELLA (green algae)	SCENEDESMUS (green algae)	STAURASTRUM (green algae)	GOMPHONEMA (diatom)	NITZSCHIA (diatom)	NAVICULA (diatom)	PINNULARIA (diatom)	STEPANODISCUS (diatom)								
Near Dam	A 1	3/9/78	3.76	1.61	0.0	4.30	1.07	0.0	0.54	1.07	0.0	7.52								19.87
Near Dam	A 2	3/9/78	2.69	1.07	0.0	3.22	0.54	0.0	0.54	0.54	0.0	4.83								13.43
Near Dam	A 3	3/9/78	2.15	1.07	0.0	3.76	1.07	0.0	0.54	1.07	0.0	5.91								15.57
Middle Lake	B 1	3/9/78	2.68	1.61	1.07	2.15	0.0	0.0	1.07	0.54	0.54	2.15								11.81
Middle Lake	B 2	3/9/78	2.68	1.61	1.07	1.61	0.0	0.54	0.54	0.54	0.0	1.61								10.20
Middle Lake	B 3	3/9/78	5.37	2.15	0.54	5.91	0.0	1.07	0.54	0.0	0.0	3.76								19.33

LAGO TORO

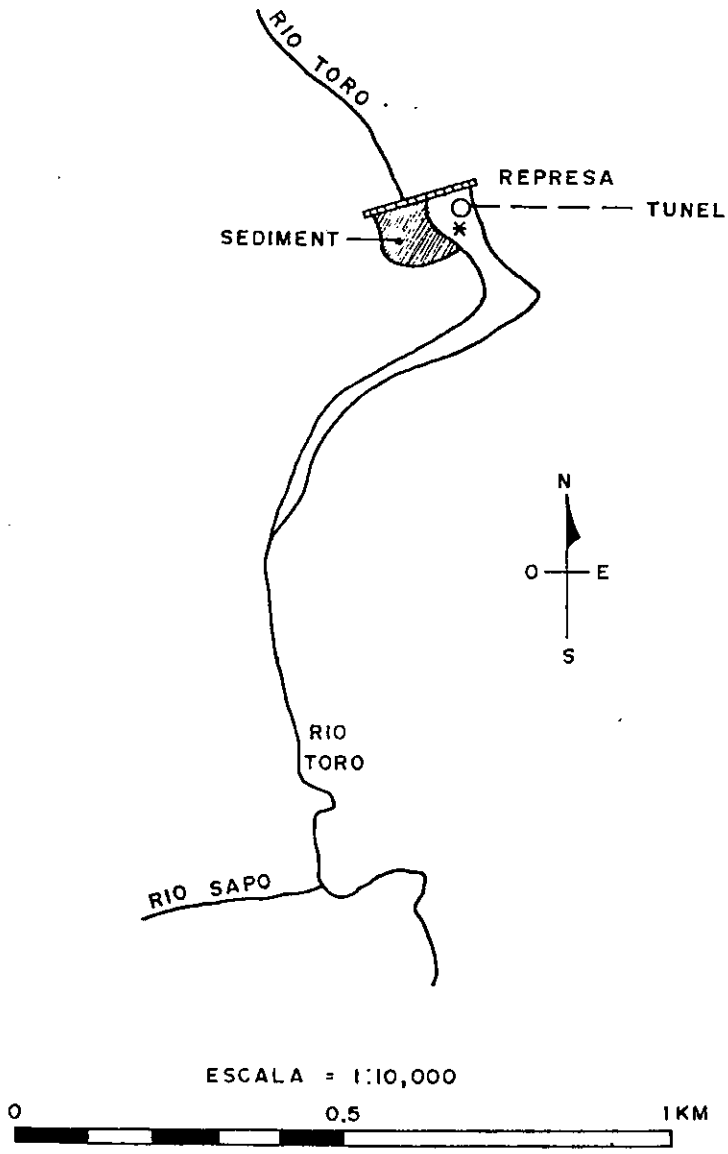


Figure 52

CHEMICAL QUALITY DATA SUMMARY FOR LAKE Toro IN Maricao, PUERTO RICO

Table 142

FROM January 1976 TO 1978. SAMPLES ARE FROM 0.5 M DEPTH

Station and Localization	Date 1976	Time	Sample No.	Lab. No.	Chloride mg/l	Hardness as $MgSO_4$ Mg/l	Total Phosphates as P mg/l	Nitrate & Nitrite as N mg/l	Iron mg/l	Turbidity in Standard Unit	Color in Standard Unit	pH	Dissolved Oxygen mg/l	Chlorophyll A mg/l	Total Coliform count	Sample Size ml
Rio Toro	1/ 2	-	89	206	9.9	138.3	-	.44		10.6	5.0	6.8	-	-	-	-
	1978															
Tunnel	3/16	-	I	469	---	135.2	0.01	0.31	1.3	----	15.0	7.8			17	1
Tunnel	10/18		Temp. 23°										6.8		70	10
															24	1
															80	10

ALGAE DATA SUMMARY FOR LAKE Toro IN Maricao, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM _____ 1977 to October, 1978.

Table 143

LOCALIZATION	SAMPLE	DATE 1978	ORGANISMS/ ML																	
			ANACYSTIS (blue green)	AGMENELLUM (blue green)	CHLORELLA (green)	CHLOROCOCCUM (green)	PEDIASTRUM (green)	STAURASTRUM (green)	CYCLOTELLA (diatom)	DIATOMEA (diatom)	GOMPHONEMA (diatom)	NITZSCHIA (diatom)	NAVICULA (diatom)	PINNULARIA (diatom)	STEPHANODISCUS (diatom)	SYNEDRA (diatom)	TABELLARIA (diatom)	CHRYSOCOCCUS (flagellate)	MALLOMONAS (flagellate)	TOTAL/ M L
Lake Toro	A 1	Oct. 3	1.61	5.37	1.07	0.0	0.0	0.0	1.07	0.0	1.07	0.0	2.15	0.0	2.68	0.0	2.68	0.0	1.07	20.94
Lake Toro	A 2	Oct. 3	1.07	3.76	0.0	2.15	0.0	0.0	4.83	1.61	2.68	0.0	5.37	0.54	2.15	0.0	0.0	0.54	0.0	24.70
Lake Toro	A 3	Oct. 3	1.61	4.30	0.0	3.22	0.0	0.54	1.61	0.0	2.68	1.61	2.68	0.0	0.0	0.0	0.0	1.07	0.0	19.33
Lake Toro	B 1	Oct. 3	3.22	0.0	0.0	0.54	0.0	2.15	1.07	0.0	1.61	2.15	2.15	0.0	0.0	3.76	0.0	0.0	0.0	16.65
Lake Toro	B 2	Oct. 3	2.15	0.0	0.0	1.07	1.07	1.61	1.07	0.0	2.15	3.22	0.0	0.0	1.61	0.0	0.0	1.07	0.54	15.57
Lake Toro	B 3	Oct. 3	1.61	5.37	3.22	0.0	0.0	0.0	1.07	1.07	1.07	0.0	2.15	0.0	3.76	0.0	2.69	0.0	0.0	23.63

ALGAE DATA SUMMARY FOR LAKE Toro IN Maricao, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM 1977 to October, 1978.

Table 143 (continued)

			ORGANISMS/ ML																		
LOCALIZATION	SAMPLE	DATE 1978	PERIDINIUM (flagellate)																		TOTAL/ ML
Lake Toro	A 1	Oct. 3	2.15																		
Lake Toro	A 2	Oct. 3	0.0																		
Lake Toro	A 3	Oct. 3	0.0																		
Lake Toro	B 1	Oct. 3	0.0																		
Lake Toro	B 2	Oct. 3	0.0																		
Lake Toro	B 3	Oct. 3	1.61																		

ALGAE DATA SUMMARY FOR LAKE Toro IN Maricao, P.R.

ALL SAMPLES TAKEN AT 0.5 M DEPTH

FROM 1977 to March, 1978.

Table 143 (continued)

LOCALIZATION	SAMPLE	DATE 1978	ANACYSTIS (blue green)	CHLOROCOCCUM (green)	CHLORELLA (green)	PEDIASTRUM (green)	STAURASTRUM (green)	DIATOMEA (diatom)	GOMPHONEMA (diatom)	STEPHANODISCUS (diatom)	SYNEDRA (diatom)	CHRYSOCOCCUS (flagellate)	MALLOMONAS (flagellate)	TOTAL/ M L
Lake Toro	A 1	Mar 19	3.22	0.54	2.15	1.61	1.61	0.0	1.07	0.0	1.61	0.0	0.54	12.35
Lake Toro	A 2	Mar 19	1.61	0.0	1.07	0.0	1.61	1.07	1.61	2.15	2.68	0.54	1.61	13.96
Lake Toro	A 3	Mar 19	1.07	0.0	0.0	0.0	1.07	1.61	1.61	2.15	1.61	1.07	1.07	11.88

Table 144

SUMMARY OF WIND PATTERMS FOR

PUERTO RICO 1975-1976

Direction	Percent of Time	
	Isla Verde	Tallaboa
N	2.95%	0.15%
NNE	2.81	3.10
NE	5.93	9.88
ENE	19.26	29.39
E	19.71	17.93
ESE	12.73	13.88
SE	9.08	14.24
SSE	7.55	7.53
S	10.18	1.50
SSW	3.13	1.12
SW	1.65	0.48
WSW	1.98	0.13
W	1.34	0.18
WNW	0.36	0.17
NW	0.39	0.11
NNW	0.93	0.03