CEER-M-209

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UNIVERSITY OF PUERTO RICO - U.S. DEPARTMENT OF ENERGY

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INTRODUCTION

The purpose of this document is to provide in one source most of the data available for Puerto Rican Lakes. These data are sparse and the bulk of them have arisen from unpublished government documents. Because the data were collected for different purposes by a variety of persons using a variety of methods, changes had to be made to render them comparable. In most cases the changes made were straightforward conversions to equivalent units. Where data were omitted or assumptions made to accomplish the conversions, these are noted in the explanations. The user is cautioned to examine carefully the assumptions and conventions adopted here before unqualifiedly accepting the data in the summary tables.

Table 1 indicates the methods used for most of the chemical and limnological parameters. The available data for 27 lakes are presented as "Physical Features", Table 2; "Chemical Features", Table 3; and "Limnological Features", Table 4.

ANNOTATED LIST OF DATA SOURCES

1. Candelas, G. R. 1956. Studies on the freshwater plankton of Puerto Rico. Ph.D. Dissertation, University of Minnesota.

Sampling in this program was done once (or occasionally twice) at each lake with the exception of Lake Caonillas which was sampled monthly for one year. Other lakes sampled were Cidra, Dos Bocas, Matrullas. Guajataca, Guayabal, Patillas, and Cartagena. Averages for the water column temperatures were made on the basis of surface and bottom samples ("bottom" samples being from 3.05 m. in Dos Bocas and Guayabal to 12.19 m. in Patillas). Most surface and bottom measurements were from 0 and

6 meters, respectively. Parameters include pH, dissolved oxygen and total alkalinity. Color was measured by colored discs, reportedly, calibrated to the Pt-Co Standard, but values were so different from any other for these lakes that they were not used.

Phytoplankton counts were also omitted as they seemed to be 2 to 3 orders of magnitude too low. Plankton was collected by using a 30-40 um mesh net and by collecting ten gallon water samples which were preserved (5% formalin) and settled for 20 days. Low counts may have been a result of poor preservation or undersampling due to the use of nets.

The drainage basin area given for Dos Bocas included the drainages for Garzas and Caonillas, so this was not used.

2. Candelas, G. and G. C. Candelas. 1964. Plankton studies on Puerto Rico's fresh-water lakes: Physical and chemical nature. Carib. J. Sci. 4(4):451-458.

This paper was based on the dissertation and, therefore, is cited here jointly.

3. Martínez, R. R. 1979. Estudio comparativo de la limnologia de los embalses mayores de Puerto Rico. Master's Thesis, Dept. Biol. University of Puerto Rico, Rio Piedras.

Lakes sampled were Toa Vaca, Guajataca, Dos Bocas, Caonillas, Carite, La Plata, Patillas, Matrullas, Cidra, Luchetti, and Carraizo (Loiza). It was assumed that all measurements were taken once on each lake (at the dam sites) at various times of the year.

Concentrations evidently reported as PO_4, NO_3-N, NO_2-N and NH_4-N were converted to PO_4-P, NO_3-N, NO_2-N and NH_4-N by multiplying the quoted values by .319, .226, .304 and .875, respectively. The resultant values appeared consistent with the values from other studies. NO_3-N and NO_2-N reported separately

were summed for this report. Lake Caonillas and Matrullas lacked NO_2 data and the NO_3 data alone were used in the summary as equivalent to $NO_3 + NO_2$-N.

Akalinities were found to be twice the real value as a consequence of a calculation error (as determined in the methods section). The given values were halved and used.

Profile averages given were disregarded in favor of means computed from surface and bottom values in keeping with the fact that more systems could be compared on that basis in this summary.

Net productivity values given as "mg $C/m^2/4$ hr" on each lake summary sheet were assumed to be per m^3 on the basis of integral values tabled elsewhere in the report. Values were converted to hourly equivalents by simple division. The value closest to Secchi depth (as determined from other studies) was used or in most cases an average of the 0 and 2 meter depths. Integrals calculated for this study were not used because no other studies had them.

4. Gomez-Gomez, F. and A. Torres-Gonzalez. 1978. Preliminary trophic state classification of seven reservoirs in Puerto Rico (and extrapolation to other island lakes). U.S.G.S. (administrative document.)

The seven lakes actually studied were Carite, Dos Bocas, Garzas, Guajataca, Guayo, Luchetti, and Patillas. Most of the data used were from these lakes only. Each lake was sampled at from 1 to 3 stations (once per station) in a period from November 1977 through January 1978. Nitrate and phosphorus data from other lakes were used which were from documents unavailable to us at the time or from written communication (Carvajal data for

Cidra and La Plata). In the case of lakes Caonillas, Cidra, Guayabal, Jordan, La Plata, Las Curias, Loco, Toa Vaca, and Vivi, only NO_3-N data were available and these were reported as equivalent to NO_3+NO_2-N. Data from this study reported NO_3-N and NO_2-N separately, so these were summed for this report. This reference also supplies organic nitrogen so this was summed with NO_3-N, NO_2-N, and NH_3-N to calculate total nitrogen for the summary.

Net productivity was converted from g $O_2/m^3/hr$ to mg $C/m^3/hr$ by multiplying by a factor of .375 (assuming a photosynthetic ratio of 1).

The use of a single value for net productivity for comparison with an average gross productivity for Lake Garzas resulted in the anomaly that the net productivity reported was greater than the gross.

Alkalinity was computed from bicarbonate (HCO_3) as: Alkalinity ($CaCO_3$) = $HCO_3/1.23$.

For lakes Guayo and Patillas total averages (based on surface and bottom samples) from page 39 were used for conductivity, temperature, and dissolved oxygen as the data for individual stations were given on crude graphs for these two lakes.

Most reservoir volume estimates used in Table 1 came from this report which had new volume estimates based on sedimentation studies.

5. Brown, R. A., W. R. Jobin, A. Laracuente, R. Mercado, and V. Quiñones. 1979. Preliminary results from a survey of water quality in some Puerto Rican lakes. Center for Energy and Environment Research, University of Puerto Rico. U.S. Department of Energy, CEER-15, 1979.

The lakes sampled were Caonillas, Carite, Carraizo, Cidra, Dos Bocas, Garzas, Guajataca, Guayo, Matrullas, Patillas, Prieto, and Toro. This study was carried out as a part of the Schistosoma study program. There were a number of sample sites on most lakes and these were looked at seasonally for six lakes, while others were sampled once a year for three years. All values were from surface samples taken at 0.5 m depth.

Phytoplankton values appeared anomalously low and were excluded. Because they were based on bottle measurements from 24 hour periods and definitely not comparable to other values, productivity measurements were not used.

6. Environmental Quality Board. 1982. Trophic classification and priority ranking for the restoration of lakes in Puerto Rico. Water Quality Planning Bureau.

Lakes studied were Cidra, Guayabal, Toa Vaca, Caonillas, Guineo, Las Curias, Carraizo, Toro, Loco, Matrullas, and Pellejas. The lakes were visited only once and at different times of the year. Most lakes had 3 stations; a few had 1. Data from reference 4 (Gomez and Torres, 1978) were included in the study, but excluded from consideration since they had already been used. Water Quality data were taken from Table IV, pp. 123-124. All samples in this study were taken at Secchi depth but, for our purposes, recorded as "surface".

Net and gross productivity were reported as g $O_2/m^3/hr$ and were converted to mg $C/m^3/hr$ by multiplying by a factor of .375 (assuming a photosynthetic ratio of 1).

7. Rivera-Gonzalez, J. E. 1976. Relationship between the population dynamics and environmental water quality of four fisheries in Puerto Rico: Guajataca, Loiza, Patillas, and Toa Vaca. Department of Natural Resources, Sport Fisheries Research and Surveys.

One to 3 stations per lake were visited monthly for Loiza (Carraizo) and quarterly for the other lakes, except for Toa Vaca at which sampling was discontinued. All samples were taken at 1 m depths and were recorded as "surface" for our summary.

Most of the data were from Appendix A: PO_4 (assumed to be SRP), TP, pH, alkalinity, specific conductance, NO_3-N, NO_2-N, chlorophyll A. These data were all in raw form so surface averages were computed. A few data points were judged to be impossible and, therefore, excluded from consideration: (total phosphorus for 3/4/75, stations 1 and 2 Loiza; soluble reactive phosphorus for 3/4/75, station 2 Loiza; and specific conductance for 7/11/75, station 2 Guajataca, and 8/14/75 for station 2 Patillas). In all of these cases there were many other data points for comparison. NO_3-N and NO_2-N separately reported were summed for this report.

Oxygen and temperature data were from profile graphs only which were too difficult to read accurately and, therefore, not used.

Data for volume, surface area, drainage and rainfall were taken from the text for use in the summary.

8. Quiñones-Marquez, F. 1980. Limnology of Lago Loiza, Puerto Rico. U.S. Geological Survey. Water Resources Investigations 79-97.

Most of the data was obtained from three lake stations (5, 6, and 7). Apparently, profiles were taken for dissolved oxygen, temperature, and specific conductance. Although it was not

stated whether the other averages cited were profile or surface-bottom averages, they were recorded as equivalent to surface-bottom means for this summary. Monthly samples were taken from September 1973 to October 1974. Average values for total phosphorus, total nitrogen, NO_3-N and NH_4-N were extracted from the text of the report (pp. 73-76). Many data shown on graphs were too difficult to read accurately and, therefore, were not used. A data summary, (Quinones-Marquez, 1976. Chemical, physical, biochemical and bacteriological determinations in Lago Loiza, P.R. and in its main tributaries. Sept. '73 - Dec. '74. U.S.G.S. Open File Report 6-7.) was not available to us at this time.

Dissolved oxygen data were read off graphs for station 7 (p.68) and were used to make surface-bottom averages for the data summary.

Productivity data were given from 2 sampling periods at 0.5 and 2 m depths. Data for 0.5 m depths were used as this was judged closest to Secchi depths. Data from the two periods were averaged and converted from g O_2/m^3/day to mg C/m^3/hr (again assuming a photosynthetic ratio of 1). To obtain net productivity, values for night respiration were doubled and subtracted from gross productivity values (this resulted in a negative overall net productivity value). All productivity values used were from p. 98.

9. Jobin, W. R., F. F. Ferguson, and R. Brown. 1976. Ecological review of hydroelectric reservoirs in Puerto Rico. Center for Energy and Environment Research, University of Puerto Rico. CEER-1, 1976.

Lakes sampled were Adjuntas, Caonillas, Carite, Carraizo, Cartagena, Cidra, Coamo, Comerio #1 and #2, Dos Bocas, Garzas, Guajataca, Guayabal, Guayo, Guineo, Jordan, La Plata, Las Curias, Loco, Luchetti, Matrullas, Patillas, Pellejas, Prieto, Toa Vaca, Toro, Tortuguero, Vivi, and Yahuecas (29 lakes 2 of which, Cartagena and Tortuguero, are not considered in our summary). Samples were for a number of stations on each lake and were often taken near the mouths of inlets. Very small lakes were only sampled at one station. All were surface samples and were usually collected in one or two visits (some were sampled through 1 or 2 consecutive months, each station visited once).

Values for pH were only given in the appendix. Values for color, turbidity, total phosphorus, and NO_3 + NO_2-N were taken from Table 6.

10. García-Sais, J. R. and L. J. Tilly. 1983. An environmental evaluation of La Plata Lake, Toa Alta. Center for Energy and Environmental Research. University of Puerto Rico, CEER.

Monthly sampling was conducted at a number of stations over a one year period. Profile averages were given for most parameters so surface and bottom values were extracted to make surface-bottom averages comparable to the other studies. Parameters measured included temperature, dissolved oxygen, pH, specific conductivity, alkalinity, NH_3-N, NO_3 + NO_2-N, TKN, TN, SRP, TP, Phytoplankton (cells/ml), and chlorophyll-A. Secchi values and productivity values were also extracted. Productivity values for

Secchi depth were used. Total nitrogen was calculated by adding surface and surface-bottom averages for $NO_3 + NO_2$-N and TKN.

11. Tilly, L. J. Unpublished. The following computations were made using rainfall-runoff coefficients, available lake volume information and published rainfall data to augment the lake inflow and turnover data available from other sources.

The complete table for these data is reproduced here.

	Area Drain Basin $10^6 m^2$	Rain m/yr	Basin Total $10^7 m^3$	Runoff Coefficient	Lake Input	Volume $10^6 m^3$	Flushing Rate Times/yr
Cidra	22.2	1.9314	4.3	0.49	2.1	.65	31.3
Patillas	65.3	1.6878	11.0	0.57	6.3	14.9	4.2
Matrullas	11.4	2.2095	2.5	0.5	1.26	4.4	2.9
Guajataca	63.7	1.5911	10.1	0.5	5.07	40.2	1.3
Toa Vaca	58	2.21221	12.8	0.5	6.4	69.4	.9

12. Nevarez, R. and J. Villamil. 1981. Productividad y contenido nutricional del jacinto de agua, Eichornia crassipes Mart (Solms), en relacion a algunos aspectos limnologicos del Lago Carraizo, Puerto Rico. Center for Energy and Environment Research, University of Puerto Rico, CEER-T-096.

Data used from this study came from one lake station on Lake Carraizo located approximately 1 km. from the dam. Samples were taken twice monthly for a period of 5 months (June-October, 1980) at three depths (surface, mid, and bottom). In situ measurements were made at 1 meter intervals for pH, D.O., temperature, specific conductivity and light. Secchi measurements were taken as well.

Laboratory analysis included TKN, TP, COD, BOD, Mn, Cu, Cd, Pb, Ca, and Hg. Data for total phosphorus (three times the concentrations found by Quiñones-Marquez) were judged to be in error and excluded. Alkalinities given from only one sampling were double other available values for Carraizo and were, therefore, excluded.

To make them comparable to other studies, values used were from surface and bottom only.

13. Negrón, E. 1983. A study of eutrophication and aquatic plants growths in selected lakes and rivers of Puerto Rico. Project No. A-071-PR. Final Technical Report, Bureau of Reclamation, U.S. Department of the Interior, Washington, D.C.

The lakes sampled in this study were Guajataca, Yauco (Luchetti), Toa Vaca, Cidra, and Loiza (Carraizo). Sampling for each lake was done twice at two stations each having three depths: surface, mid and bottom. Time between sampling was 2 months. Water was collected with an Alpha (Model 1120-C40) from Wildco.

Water samples were analyzed for pH, color, turbidity and temperature in the field. Dissolved oxygen, conductivity, dissolved ortho-phosphate, total phosphorus, TKN, NO_3-N, NO_2-N, NH_3-N and other parameters were analyzed in the laboratory. The NO_3-N and NO_2-N data were combined for this summary. Mid water column data were ignored and averages were computed based on the surface and bottom values for each lake.

Table 1. Methods Used in Puerto Rican Lakes*

Parameter	1&2	3	4	5	6
Temperature	Maximum, minimum Thermometer	YSL	Probe	No details	212 Temp
Dissolved O_2	Winkler	Winkler modified Carpenter 10	Probe	Winkler	422-A Iodometric
pH	Gramery Color charts	La Motte Model HA	Probe	No details	No details
Alkalinity	H_2SO_4 titration	H_2SO_4 titration	Electrometric titration	-	Alkalinity
Conductivity	-	La Motte Model DA	Probe	-	205 Wheatstone-Bridge
Turbidity	-	HATCH 4500°A FIU	-	No details	-
Color	Pt-Co Standards (color discs)	-	-	No details	-
Transparency	All Secchi	Light meter (not used)	Secchi	Secchi	Secchi
NO_3	-	11,13,20,25	6,18	Phenol disulfonic	419-C Cadmium
NO_2	-	28	also did organic-N	acid after oxidation of permanganate	reduction
NH_3	-	No details	-	-	418-C phenate
TKN	-	-	-	-	421 Kjeldahl
TP, PO_4	-	-	6,18	Molybdate Stannous Chloride after acid hydrolysis	425-F Ascorbic Acid
SRP	-	22	-	-	No details
Counts Phytoplankton	Net and settled plankton	-	6,18	Fixed and millipore filtered	-
Net Prod/ Gross Prod.	-	31,34	Light dark bottle 4 hr 20	24 hr. incubation	1002-1 oxygen method of Gaarder and Gran
Chl-a	-	-	6,18	Extraction and absorbance before and after acid	No details
Sample Collection	Kemmerer Water-Sampler	No details	No details	No details	Alpha Horizontal sampler at Secchi depth
Frequency, Stations, etc.	Caonillas: monthly for 1 yr. Others Once.	Once per lake Samples from near dam	Once per station 1-3 station/lake. Nov-Jan 1977	6 examined seasonally. Others 1/yr. for 3 yrs.	Ea. lake visited once (diff. times of the yr.) 1-3 stations/lake.
Other	Samples kept from light and heat, no methodological reference.	Water generally unfiltered for chemistry, analyzed within 24 hr. for NO_3, NO_2, NH_3, ALF, PO_4	No photosynthetic or respiration quoted for NPP ref: 6, 18, 32, 33	*Unusable numbers not believable Ref: 3	References: 4 (most methods) 26 Samples analyzed in field or UPR San Juan

Numbers in column headings refer to lake studies reviewed.
Numbers in text refer to literature cited.

Table 1. (cont.)

Parameter	7	8	9	10	11	12
Temperature	YSI-54	Profiles	-	Hydrolab 4041 meter	YSI	No details
Dissolved O_2	YSI-54	No details	-	Hydrolab	YSI	No details
pH	Beckman Digital pH	No details during NPP studies	No details	4041 Potentiometer	Orion specific ion meter	No details
Alkalinity	No details	USGS lab	-	Trirrimetric pH 4.5	-	-
Conductivity	Bassett-Bergman Later: La Motte multi-range conduct.	Profiles No details	-	Hydrolab 4041 potentiometer	YSI	No details
Turbidity	-	-	No details	-	-	No details
Color	-	-	No details	-	-	No details
Transparency	-	Secchi	-	Secchi	Secchi	-
NO_3	USGS "Standard methods"	USGS lab	No details	353.2 Cadmium reduction	-	No details
NO_2	Beckman Spectrophotometer	USGS lab	No details	"	-	No details
NH_3	-	-	-	Colorimetric automated	-	No details
TKN	-	-	-	351.2	Micro Kjeldahl	No details
TP, PO_4	EPA	USGS lab	No details	365.1 Ascorbic Acid	Vanadium Molydate	No details
SRP	"Methods"	-	-	365.1	-	No details
Counts Phytoplankton	-	Caribbean District Lab, 29	- -	400 cell counts	-	-
Net Prod/ Gross Prod.	-	Twice at .5 and 2 m. depth 29	-	Light dark with free water diurnal curves	-	-
Chl-a	USGS "Standard methods"	- -	- -	Fluorometer	-	-
Sample Collection	1 meter below surface	1 m depth except profile data	All surface	6 bottle cast of 4 meter intervals to 20 m depth	2 liter Van Dorn	Model 1120 C 40 Alpha
Frequency, Stations, etc.	Monthly for Carraizo, quarterly for other lakes. (Toa Vaca disc)	Monthly: Sept. 1973 to Oct. 1974	Ea. lake station visited once. Stations near tributaries and lake center.	Monthly samples for one year. Several stations	Twice mothly for 5 months: June-Oct	Each lake sampled twice 2 stations/lake
Other	Samples cooled and taken to lab, no methodological ref. in literature cited, except 12	Samples analyzed USGS Doraville, GA. Ref: 2,6, 29, 30	Lit. cited text says "ALPHA 1973 Standard Methods"	Most methods from 36:EPA-600/4-79-020 also reference:4	References: 4,11,14,36	Surface, mid, and bottom samples Ref: 2,5,35,36

Table 2. Physical Features of Puerto Rican Lakes

Lake	Mean Depth m	Maximum Depth m	Volume 10^6 m^3	Surface Area hectares	Catchment Area 10^6 m^2	Annual Rainfall cm/yr	Inflow $10^7 m^3$/yr	Flushing Rate times/yr
Aljuritas	-	-	.574	-	-	-	-	-
Cacaillos	21.3	21.6	60.4	283.3	130.5	115.07	10.4	2.1
Carite	10.0	22.0	9.7	141.5	29.7	168.78	1.68	1.7
Carraizo	6.1	17.7	16.4	340.5	133.0	145.07	16.4	14.7
Cidra	2.7	24.1	.65	126.5	22.2	168.14	2.1	2.5
Coamo	-	-	.29	-			-	-
Comerio 1	-	-	.74	-			-	-
Comerio 2	-	-	-	-			-	-
Dos Bocas	15.0	28.0	27.3	256.6	196	177.96	33.8	11.0
Garzas	10.0	35.0	5.6	43.7	15.9	-	2.42	7.5
Guajataca	17.0	30.0	39.8	404.8	73.7	174.56	5.05	1.1
Guayabal	5.7	35.6	19.3	163.1	74.4	143.78	-	3.8
Guayo	18.0	49.0	12.5	115.3	24.9	-	-	1.12
Guineo	10.5	30.1	2.4	21.9	4.1	-	-	2.0
Jordán	-	-		-	-	-	-	-
La Plata	7.1	32.9	28.0	390	437.8	165.5	34.2	25.2
Las Curias	6.2	22.9	1.36	22.3	2.9	-		-
Loco	2.8	21.9	2.61	28.0	21.9	-	-	3.8
Lucchetti	15.0	31.0	14.2	107.6	44.8	-	-	1.5
Matrullas	11.8	36.6	3.7	31.7	11.4	230.95	1.25	5.0
Patillas	13.0	24.0	14.9	130.4	65.2	148.04	5.5	1.8
Pellejas	9.3	15.2	0.39	2.0	22.0	-	-	72.5
Prieto	-	-	0.9	-	24.9		-	64.8
Toa Vaca	20.4	65.5	40.69	331.7	58	112	6.4	.02
Toro	-	-	0.12	-	9.5	-	-	-
Vivi	-	-	0.34	-	-	-	-	-
Yahuecas	-	-	1.05	-	-	-	-	-
$\bar{X}$	11.6	33.8	11.89	165.8	93.4	164.93	10.8	12.8
N	18	18	25	16	20	11	11	18
SE	1.34	3.62	3.17	32.3	31.6	10.6	3.9	5.0

Table 3. Chemical Features of Puerto Rican Lakes

Lake	Total Phosphorus mg/l S $\bar{X}$	Total Phosphorus mg/l S-B $\bar{X}$	SRP mg/l S $\bar{X}$	SRP mg/l S-B $\bar{X}$	NO_3+NO_2-N mg/l S $\bar{X}$	NO_3+NO_2-N mg/l S-B $\bar{X}$	NH_3-N mg/l S $\bar{X}$	NH_3-N mg/l S-B $\bar{X}$	TKN mg/l S $\bar{X}$	TKN mg/l S-B $\bar{X}$	TN mg/l S $\bar{X}$	TN mg/l S-B $\bar{X}$	Chlorophyll A $\bar{X}$ µg/l	Net P mg/m^3/hr	Phyto Plankton 10^3cells/ml
Adjuntas	0.25	-	-	-	.22	-	-	-	-	-	-	-	-	-	-
Caonillas	.026	-	.01	.03	.19	.0025*	.038	.033	.55	-	-	-	30.4	55.92	-
Carite	.02	.02	0	.005	.068	.181	.016	.099	-	-	.45	.65	12	33.18	4.7
Carraizo	.27	.44	.14	.47	.426	.61	.098	.112	1.08	1.30	1.34	1.10	26.5	228.27	10.0
Cidra	.04	.15	.01	.05	.098	.08	.067	.53	.60	1.4	.48	1.51	17	45.25	-
Coamo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Comerio 1	.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Comerio 2	.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dos Bocas	.034	.07	0	.006	.176	.134	.018	.066	-	-	.56	.86	6.1	50.6	2.4
Garzas	.013	.02	0	0	.108	.17	0	.01	-	-	.17	.22	5.0	18.75	-
Guajataca	.014	.04	.005	.01	.10	.072	.031	.134	.59	.73	.61	.78	6.2	22.47	69.0
Guayabal	.067	-	.06	-	.107	-	.02	-	1.14	-	-	-	62	341.21	-
Guayo	.018	.03	0	.01	.323	.63	.02	.05	-	-	.77	.94	7.0	30.0	1.13
Guineo	.08	-	-	-	.04	-	.12	-	.74	-	-	-	41.4	7.5	-
Jordán	.015	-	-	-	.018	-	-	-	-	-	-	-	-	-	-
La Plata	.077	.22	.06	.07	.067	.205	.023	.170	.48	.72	.64	.95	11.7	49.45	14.3
Las Curias	.04	-	0	-	.45	-	.12	-	1.11	-	-	-	18	0	-
Loco	.17	-	0	-	.367	-	.08	-	.49	-	-	-	9.7	45.0	-
Lucchetti	.03	.03	.01	.013	.19	.23	.20	.228	.34	.40	.67	.78	13	76.4	23.0
Matrullas	.43	-	.01	.009	.208	.0025*	.175	.073	.75	-	-	-	71.3	.18	-
Patillas	.037	.14	.009	.044	.15	.23	.015	.059	-	-	.99	1.43	9.5	43.39	4.5
Pellejas	.09	-	.10	-	.405	-	.01	-	.36	-	-	-	16	20.0	-
Prieto	.023	-	-	-	.22	-	-	-	-	-	-	-	-	-	-
Toa Vaca	.043	.10	.015	.07	.023	.013	.0014	.24	.45	.79	.34	.80	9.3	14.38	-
Toro	.315	-	0	-	.723	-	0	-	.25	-	-	-	6.0	0	-
Vivi	.025	-	-	-	.33	-	-	-	-	-	-	-	-	-	-
Yahuecas	.04	-	-	-	1.03	-	-	-	-	-	-	-	-	-	-
$\bar{X}$	.097	.115	.024	.061	.253	.197	.056	.139	.639	.89	.64	.91	19.89	60.16	16.75
N	26	11	18	13	24	13	19	13	14	6	11	11	19	19	8
SE	.022	.038	.006	.035	.048	.057	.014	.038	.077	.36	.096	.107	4.37	19.27	7.85

Table 4. Limnological Features of Puerto Rican Lakes

Lake	Temperature °C		Dissolved Oxygen mg/l		Conductivity umhos/cm		pH units		Alkalinity mg/l CaCO3		Secchi	Turbidity FTU		Color
	$\bar{X}$	S-B $\bar{X}$	$\bar{X}$	S-B $\bar{X}$	$\bar{X}$	S-B $\bar{X}$	$\bar{X}$	S-B $\bar{X}$	$\bar{X}$	S-B $\bar{X}$	m	$\bar{X}$	S-B $\bar{X}$	STU
Adjuntas	-	-	-	-	-	-	7.1	-	-	-	-	1.1	-	6.7
Caonillas	26.3	27.4	8.5	5.8	184	195	7.5	7.2	75.5	82.5	1.22	10.3	9.0	10.6
Carite	23.3	23.0	8.2	7.0	63.5	68.6	7.2	7.1	30.5	33.6	1.55	6.4	15	8.8
Carra. o	27.4	25.6	7.3	4.6	247	247	7.4	7.2	86.2	78.3	0.69	20.8	25.8	22.0
Cidra	26.6	25.6	7.04	3.94	156	130	7.3	7.1	70.3	52.5	0.95	5.9	36.1	13.9
Coamo		-	-	-	-	-	-	-	-	-	-	-	-	-
Comerio 1		-	-	-	-	-	-	-	-	-	-	6.5	-	10.0
Comerio 2	-	-	-	-	-	-	-	-	-	-	-	10.5	-	10.0
Dos Bocas	26.6	25.8	9.6	6.2	198	213	7.6	7.6	88.8	86.0	1.14	7.4	7.5	13.35
Garzas	21.8	22.2	6.5	4.9	125	124	7.4	6.9	65.1	66.7	2.08	1.6	-	7.9
Guajataca	27.7	27.0	7.9	4.6	236	213	7.8	7.4	146.1	161.1	2.40	5.5	7.6	6.63
Gueyabal	26.1	25.6	9.8	10.4	185	-	7.6	8.0	145.5	177	0.63	5.2	-	11.7
Guayo	24.3	23.6	7.1	3.8	205	202	7.1	7.2	108.4	99.9	2.78	2.7	-	10.6
Guineo	23.5		9.4		80		7.9	-	36	-	-	1.6	-	5.0
Jordán	-	-	-	-	-	-	6.8	-	-	-	-	11.8	-	6.0
La Plata	28.3	26.2	5.9	3.1	234	219	7.2	6.9	103	90.0	1.6	8.6	38	9.0
Las Curias	26.5	-	5.2	-	208	-	6.7	-	72	-	-	6.8	-	9.0
Loco	26.5	-	7.2	-	210	-	6.6	-	127	-	1.8	5.3	-	5.3
Lucchetti	28.4	27.3	10.8	7.9	226	206	8.2	7.7	92.1	98.6	1.37	6.1	47.3	4.7
Matrullas	24.8	24.6	8.8	5.2	90	120	7.4	6.9	43.0	43.3	0.90	3.3	27	11.25
Patillas	26.2	26.4	8.3	5.7	132	126	7.9	7.4	52.5	49.8	1.4	12.2	18.5	11.6
Pellejas	22.0	-	9.0	-	290	-	7.1	-	100	-	0.8	15.3	-	6.5
Prieto	22.0	-	6.6	-	-	-	7.2	-	-	-	0.59	12.9	-	12.9
Toa Vaca	27.9	26.8	7.3	3.8	238	246	7.8	7.4	132.3	130	2.30	1.9	9.0	5.3
Toro	21.0	-	6.8	-	210	-	7.2	-	83.2	-	1.0	10.6	-	7.5
Vivi	-	-	-	-	-	-	6.7	-	-	-	-	1.9	-	6.3
Yahuecas	-	-	-	-	-	-	7.4	-	-	-	-	75.0	-	10.5
P	25.33	25.51	7.91	5.50	185	177.7	7.36	7.29	87.29	80.82	1.36	9.89	21.89	9.35
N	20	14	20	14	19	13	24	14	19	14	18	26	11	26
SD	.60	.43	.30	.52	14.18	15.7	.08	.09	7.93	12.10	.15	2.77	4.21	0.74

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