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# Economic Effects of Pawtuckaway State Park vs. Effect of Park Use on Environmental Quality

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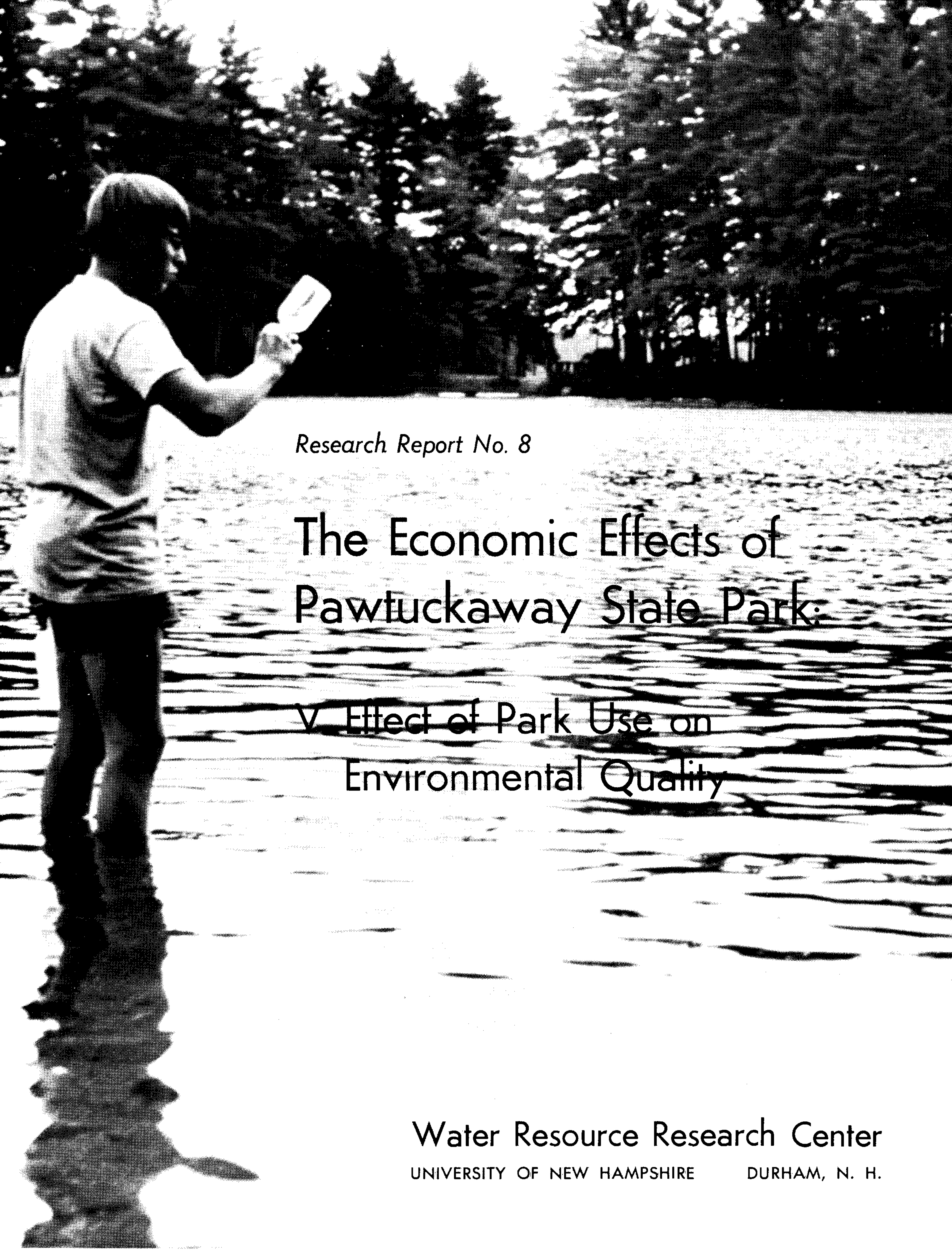

*Research Report No. 8*

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## V Effect of Park Use on Environmental Quality

Water Resource Research Center

UNIVERSITY OF NEW HAMPSHIRE DURHAM, N. H.

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# THE ECONOMIC EFFECTS OF PAWTUCKAWAY STATE PARK:

## V. Effect of Park Use on Environmental Quality

by

Chauncey T. K. Ching and George E. Frick

Completion Report Project No. A-026-NH

Water Resources Research Center
University of New Hampshire
Durham, New Hampshire

in cooperation with

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and
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ABSTRACT

Pawtuckaway State Park has been operating since 1966. This large rural park fronts on a portion of Pawtuckaway Lake which is 800 acres in size. Numberous clusters of seasonal houses are adjacent to the shoreline and the park. During the summer of 1971 an intensive study was made of (1) lake water quality as affected by park usage, and (2) the attitudes of private water-oriented landowners toward the park. Both the water quality analysis and the attitudinal survey indicated that the establishment of Pawtuckaway State Park has not had an adverse effect on the quality of the immediate environment. Coliform bacteria, a water quality indicator, occasionally exceeded the State standard at the beach area. However, neither climate, attendance, weekend use (as high as 8,000 people) nor time were significant determinants of the coliform level. The majority of the 90 landowners interviewed held favorable attitudes toward the park, including an opinion that the park improved their property values.

Key words: Water quality, environmental quality, parks.

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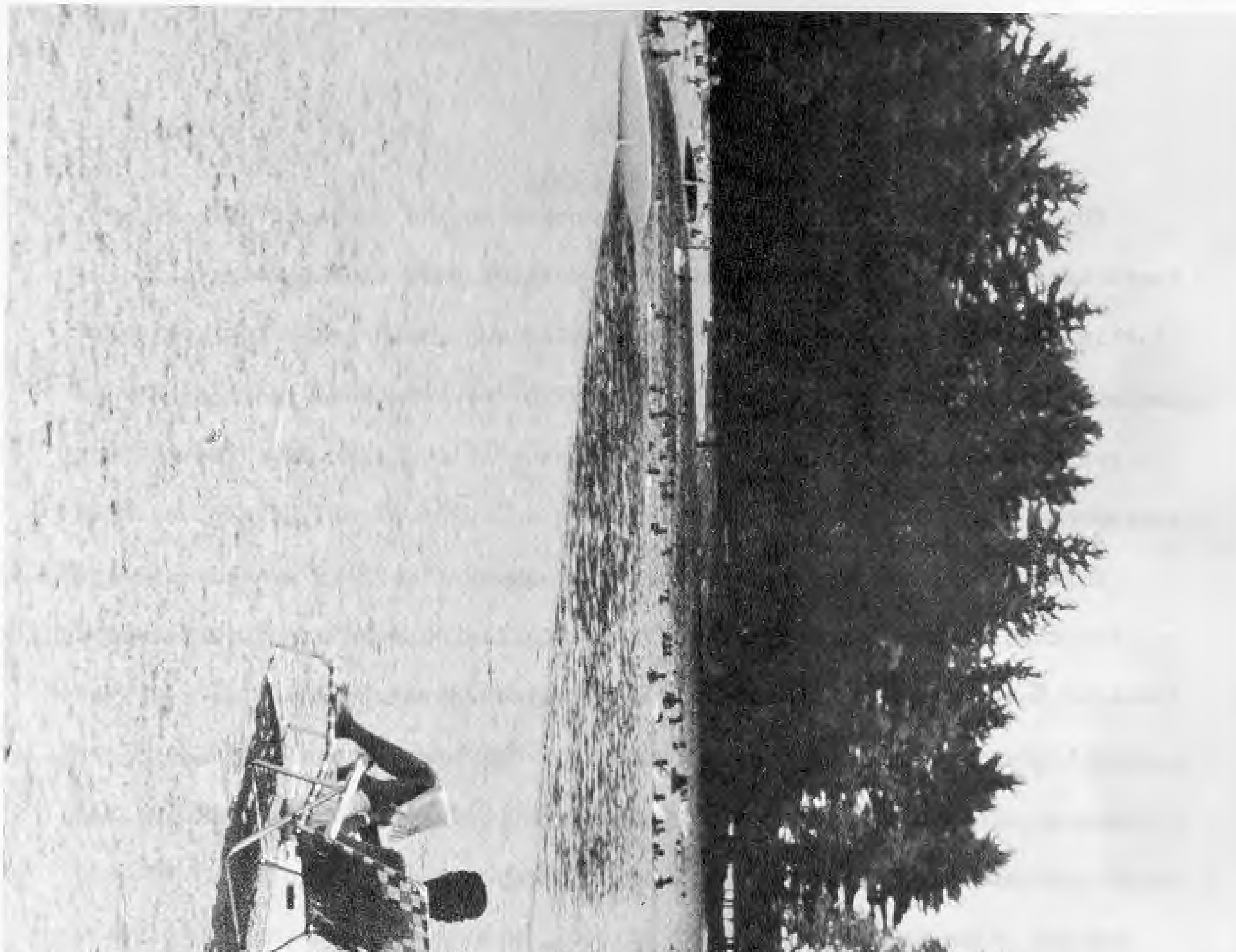
# PREFACE

This is the fifth in a series of reports on the economic effects of Pawtuckaway State Park. Previous reports (listed on the back inside cover of this report) were analyses of the origins and expenditure patterns of day users and campers, the changes in real property values resulting from the establishment of the park, and the impact of the park on selected local government expenditures and incomes.

This report concerns aspects of environmental quality as they are affected by park development. Specifically, the relation between water quality of the lake and boating practices/attendance patterns was analyzed. The results of a survey of private residents are included; they reveal the attitudes of the landowners concerning the impact of the park on the ecology of the area and the effect of the park on surrounding property values.



# THE ECONOMIC EFFECTS OF PAWTUCKAWAY STATE PARK:

## V. Effect of Park Use on Environmental Quality

### INTRODUCTION AND OBJECTIVES

This study was undertaken to determine the effect of Pawtuckaway State Park on the quality of environment. The results of this study have economic implications in that they provide insights for evaluating the external effects of rural park development; that is, those effects that go beyond the monetary considerations discussed in the other reports of this series.

Since the phrase "quality of the environment" can take on several meanings it is essential to define the way this term is used. First, physical features of the environment may be measured and compared to standards established by public officials and physical scientists. Given the relative importance of water in the Pawtuckaway region, and the possibility that this natural resource might deteriorate in quality, only water quality was measured and analyzed. Second, the attitudes of private residents in the vicinity of the park were examined in relation to the effect of the park on water quality, general ecology and "people-oriented" pollution. Attitudes of residents adjacent to the park were felt to be the most relevant and intense of any group regarding the quality of the environment in the Pawtuckaway region.

## THE WATER QUALITY OF PAWTUCKAWAY LAKE

### The Survey and Water Quality Data

During the 1971 park-user season beginning June 8, water samples were taken both along the shore of the public swimming area of the park ("inside points") and at selected intervals across the lake and toward the shoreline inhabited by seasonal and year-round property owners ("outside points") (Figure 1). Sampling points were determined in consultation with park officials familiar with water currents and areas of intensive use. A total of nine sampling points was selected. At each point, two water samples were taken: one sample was taken at the surface of the lake and the second at depths down to five feet when feasible. Samples near the beach were taken at the surface and at or near the bottom where the depth was less than five feet. The samples were collected twice each week -- on Mondays (after the weekend use) and on Thursdays (before the weekend use) -- to reflect the impact of recreational use on water quality.

Accumulative park attendance for the three days prior to sampling was chosen as the measure of use and people pressure on water quality (Table 1). The smallest use occurred early in the season, with only 420 people during a three-day period. The highest use totaled 8,000 people during the July 4th weekend. Total annual park attendance was estimated at 90,000 people for the 1971 season.

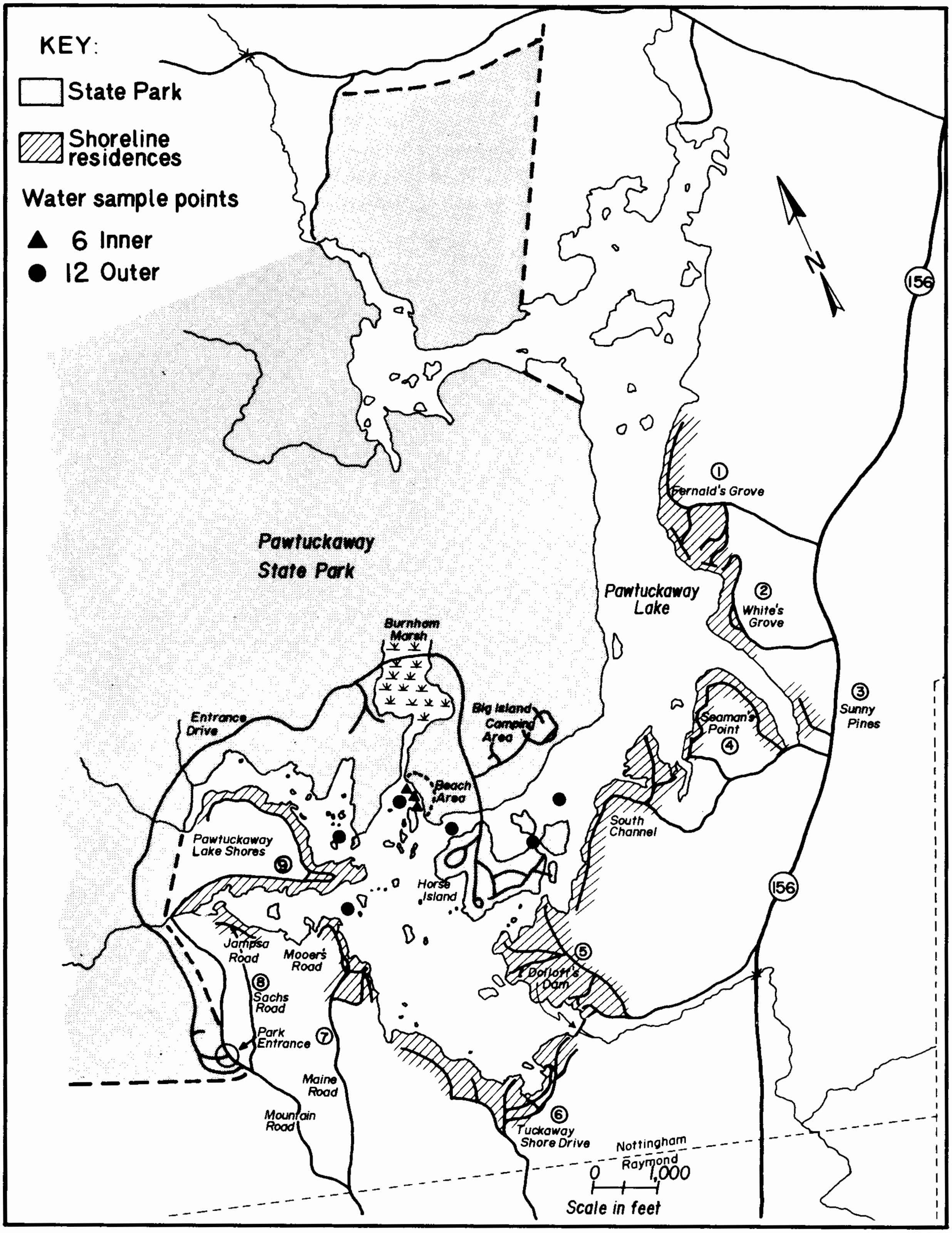



Figure 1.--Pawtuckaway State Park with sample sites, roads and shoreline residences.

Table 1.--Number of park users for the three-day periods prior to sampling, Pawtuckaway State Park, 1971 [a/]

| Month and week | | Weekday park users (3-days) | Weekend park users (3-days) |
|---|---|---|---|
| | | Number | Number |
| June | 6-12 | 420 | 2,025 |
| | 13-19 | 1,125 | 3,000 |
| | 20-26 | 1,700 | 7,250 |
| | 27-July 3 | 2,650 | 6,850 |
| July | 4-10 | 5,500 | 8,000 |
| | 11-17 | 2,200 | 6,350 |
| | 18-24 | 1,700 | 4,500 |
| | 25-31 | 1,525 | 5,500 |
| August | 1- 7 | 1,050 | 2,580 |
| | 8-14 | 3,150 | 5,050 |
| | 15-21 | 1,700 | 2,550 |
| | 22-28 | 475 | 3,760 |
| | 29-31 | -- | 1,250 |
| September | b/ | -- | -- |
| TOTALS | | 23,195 | 58,665 |

a/ Total park users were estimated at 90,000 for the entire season.
b/ Park closed early, because of the lack of funds.

Chemical analyses of the water samples were made at the Water Resources Research Center of the University of New Hampshire in accordance with standard methods for the examination of water and wastewater (American Public Health Association, 1965). Mechanical analyses of specific conductance and clarity were also performed by the University of New Hampshire. Coliform analyses were conducted by the Water Supply and Pollution Control Commission of the State of New Hampshire. There were eight major indices of water quality obtained, including the seven major physical and chemical determinants of water quality given by Mackenthem and Ingram (1964), and one additional test for clarity. These included:

(1) Specific conductance;

(2) pH (surface and bottom);

(3) Dissolved oxygen;

(4) Temperature;

(5) Coliform bacteria count (membrane filter technique);

(6) Alkalinity;

(7) Ions (calcium, magnesium, sodium, potassium, and chloride); and

(8) Clarity (Secchi disk).

## The Statistical Analysis of Water Quality Data

The set of water quality indices was used to assess the relation between water quality and park use. For a selected water quality index, the mean of all 18 samples (nine sample points with two samples at each point) could be used as an observation for a particular time period, if all sample points had equal means. Thus, the equality of means among the sample points was tested. Where significant differences were found, analysis of variance procedures were used to determine if the differences were due to sampling at "inside" or "outside" points. Six of the 18 samples were inside the roped-in beach area and constituted the inside points; 12 samples were outside of the roped-in beach area and constituted the outside points. If differences could not be attributed to sampling at inside or outside points, similar tests were performed (analysis of variance) to determine whether differences could be attributed to other sampling variables such as surface or depth levels. For example, if coliform counts were found to be statistically different at all sample points, further tests were conducted to determine whether inside points differed significantly from outside points. If differences still existed, tests were conducted to determine if coliform counts differed between surface and depth sample points.

This procedure provided a systematic approach for defining a homogeneous set of water quality data that could be related to park use. The procedure also provided a means for describing the characteristics of the water quality data.

In the next phase of the analysis, each water quality index (total dissolved solids, alkalinity, and so on) was posited as the dependent variable in a linear model. The specific sample points making up the $t^{th}$ observation on a particular index were determined through the analysis of variance procedures previously discussed.

The independent or explanatory variables included climatological and park-user data. More specifically:

$$Q_{it} = \alpha j + \sum_{j=1}^{7} \beta_j X_{jt} \qquad (1)$$

where: $Q_{it}$ = the $i^{th}$ water quality index observed at time period t;

$\alpha_j$ = constant or intercept term;

$\beta_j$ = "slope" coefficient to the variable Xj;

$X_{1t}$ = average temperature for the three days preceding period t;

$X_{2t}$ = cumulative precipitation of the three days preceding period t;

$X_{3t}$ = average wind speed during the three days preceding period t;

$X_{4t}$ = average number of hours of sunshine during the three days preceding period t;

$X_{5t}$ = cumulative number of park users during the three days preceding period t;

$X_{6t}$ = dummy variable equal to 1 if the $t^{th}$ observation corresponds to an "after weekend" use observation and equal to 0 if the $t^{th}$ observation corresponds to a "before weekend" use observation; and

$X_{7t}$ = a trend variable equal to t, t=1,2,..., 25, 25 being the number of observations.

This model was designed to measure the relative importance of climate and park use on water quality. While the model in equation (1) is expressed as a linear function, some non-linear functions were considered in the analysis.

The mean, standard deviation, and range for each water quality index are presented in Table 2. These statistics were computed from all observations (that is, all sample points for each observation-day were included in the computations). In addition to these statistics, water quality standards are included for each water quality index. In most cases, the water quality standards presented are drinking water quality standards; however, for potassium and pH, the standards presented are those typical of natural water. Only in the case of coliform bacteria is the water quality standard specifically defined for recreational use.

Generally, the statistics and standards presented in Table 2 indicate that the water in Pawtuckaway Lake is satisfactory for drinking purposes in all water quality dimensions except coliform bacteria. The means of all water quality indices are well within the range thought to be acceptable for drinking purposes. However, the measures of dispersion -- standard deviation and range -- indicate that the three water quality indices of calcium, magnesium, coliform count, fall outside of the limits of drinking water quality standards.

Calcium and magnesium both exhibit concentrations outside of the quality standard range. The tests for these two elements were determined by EDTA titration, a test for total hardness and calcium. Magnesium level is defined as the difference between total hardness and calcium. Because the waters of Pawtuckaway Lake are so dilute, the calcium and magnesium values are somewhat arbitrary, although the total hardness measurement is accurate. This explains the apparent deviation from the standard of comparisons.

The coliform count went as high as 9,300 (most probable number of colonies per 100 ml.) -- a serious departure from the recreational water quality standard of less than 240 MPN, especially in view of the large standard deviation of 520 MPN. The coliform count is the most important dimension in terms of public health. Coliform concentrations were sufficiently low for recreational purposes on most days, but exceeded the levels thought to be "safe" by the State of New Hampshire on some days. It should be noted, however, that the standard of less than 240 MPN is a somewhat stringent criterion. In other states, such as Massachusetts, less than 1,000 MPN is the level set by the State as being safe for recreational purposes. On the basis of that standard the water in Pawtuckaway Lake would still contain, on some days, excessive concentrations of coliform bacteria (maximum range = 9300 MPN, Table 2).

Table 2.--Statistical description of water quality indices and water quality standards or comparisons.

| Water quality index | Mean | Standard deviation | Range | Water quality standards or comparisons |
|---|---|---|---|---|
| Water temperature (°C) | 24.6 | 3.17 | 19.4-29.4 | not applicable |
| Dissolved oxygen (ppm) | 7.8 | 0.3 | 6.0-8.8 | saturation occurs at approximately 8 ppm at 25°C and 760 mm pressure a/ |
| Calcium (ppm $CaCO_3$) | 6.9 | 1.0 | 4.0-10.0 | 0.8-3.8 b/ |
| Magnesium (ppm $CaCO_3$) | 3.9 | 1.3 | 0.0-8.0 | 2.1-26.7 b/ |
| Chloride (ppm) | 3.3 | 1.1 | 0.9-7.2 | < 250 c/ |
| Sodium (ppm) | 2.4 | 0.2 | 1.8-3.8 | 1.5 - 4.0 b/ |
| Potassium (ppm) | 0.5 | 0.1 | 0.2-1.1 | < 50 d/ |
| Specific conductance (micromhos at 25°C) | 36.3 | 2.6 | 22.2-49.7 | < 770 e/ |
| pH at 25°C | 6.6 | 0.4 | 6.3-7.2 | 6 - 8 d/ |
| Coliform bacteria (MPN per 100 ml) | 118.5 | 520.0 | 1.0-9300.0 | < 240 f/ |

a/ Kittrell (1969).
b/ Range observed in New England Towns (U. S. Department of Public Health, 1962-63), assumed to be typical drinking water standards.
c/ American Public Health Association (1965).
d/ "Typical" in natural waters (Swenson and Baldwin, 1965).
e/ Adjusted for micromhos, equivalent to 500 ppm TDS.
f/ State of New Hampshire Standard for suitable bathing water.

## Variations in Water Quality Among Sample Points

The water quality data were analyzed through an analysis of variance (one-way design) to determine equivalence of the mean index values among the 18 sample points. More specifically, the hypothesis tested was that the means for each sample point were equal.

Computed F statistics for each of the water quality indices are presented in Table 3. These results indicate that significant differences existed among the sample points means for water temperature, sodium ions, potassium ions, and clarity. All other indices of water quality had statistically identical means among the sample points. The F statistic for coliform bacteria, however, was significant at the ten percent level of confidence. Since the coliform count is such an important index in terms of public health, it was subjected to further analysis.

Temperature, sodium, and potassium were also examined by additional analyses of variance. Water clarity, however, was not analyzed. Water clarity results (as measured by the Secchi disk) were unreliable because of the shallowness of the lake, the lake's natural coloring, and wind and outboard motor wave action.

Table 3.--Summary of analysis of variance: comparison of all sample points for selected water quality items, Pawtuckaway Lake, 1971.

| Water quality items tested | F statistic |
|---|---|
| Temperature ( C) | 5.89* |
| Dissolved oxygen (ppm) | 0.58 |
| Calcium (ppm $CaCO_3$) | 0.69 |
| Magnesium (ppm $CaCO_3$) | 0.91 |
| Chloride (ppm) | 0.52 |
| Sodium (ppm) | 4.21* |
| Potassium (ppm) | 5.71* |
| Specific conductance (micromhos) | 0.79 |
| Alkalinity (ppm $CaCO_3$) | 0.53 |
| pH at 25° C | 0.14 |
| Clarity (inches) | 157.46* |
| Coliform bacteria (MPN) | 1.66 |

* Statistically significant at the one percent level of confidence.

Temperature

There were significant differences in mean temperatures among the sample points. Surface and depth points were tested for homogeneity to determine the source of these differences, using analysis of variance procedures. There were significant differences in mean temperatures among the twelve surface points (inside sample points were essentially all surface points; see Table 4). In contrast, there were no significant differences in mean temperature among the six depth points.

The surface points were further divided into "surface points inside" (that is, inside points) and "surface points outside". Both groups were tested for homogeneity, and the mean temperatures for both the inside and outside surface points were found to be equal.

The findings suggest that there are three temperature groups with significantly different mean values: inside surface, outside depth and outside surface. The mean temperatures for these groups were 25.5° C, 24.9°C and 23.9°C, respectively. As might be expected, water temperatures near the shore are the highest, outside surface temperatures are lower, and outside depth temperatures are the lowest.

Sodium

The hypothesis that mean sodium concentrations were equal at all sample points was rejected (Table 3). Mean sodium values at the six inside points and at the twelve outside points were further tested for homogeneity (Table 5). The results indicate that the mean values at the six inside points were statistically equal. However, mean sodium values at the twelve outside points were not equal, with statistically significant variation ranging from 2.29 ppm to 2.58 ppm.

Table 4.--Statistical analysis of mean water temperatures, Pawtuckaway Lake, 1971

| Sample points tested | F statistic |
|---|---|
| All surface points | 4.33* |
| Depth points | 0.70 |
| Surface points inside | 1.00 |
| Surface points outside | 0.80 |
| Surface points inside surface points outside depth points | 43.39* |

* Statistically significant at the one percent level of confidence.

Table 5.--Statistical analysis of mean sodium values, Pawtuckaway Lake, 1971.

| Sample points tested | F statistic |
|---|---|
| 6 inside points | 1.32 |
| 12 outside points | 6.13* |

* Statistically significant at the one percent level of confidence.

Potassium

Mean potassium concentrations were found to be significantly different (Table 3). The six inside points have equal means, while the twelve outside points have unequal means (Table 6). Generally, concentrations are higher at inside points (0.62 ppm) than at outside points (0.51 ppm).

Coliform Bacteria

When mean coliform bacteria count was tested for equality among the 18 sample points, it was noted that the F statistic (1.66) just missed being statistically significant (that is, different means) at the five percent level. There were no significant differences in mean values for the six inside points. There was also no significant difference among mean values for the 12 outside points. But when the mean of the six inside points was tested for equality with the mean of the 12 outside points, there was a statistical difference.

These results indicate that coliform values were significantly different in the beach area (inside points), as opposed to outside the beach area (outside points). The mean MPN value for the beach area was 239, with a standard deviation of 483. Outside the beach area the mean coliform reading was 58, with a standard deviation of 528. While the results indicate a significant difference between the two areas, the mean figures do not exceed the public health standard of 240 or less as the safe level for recreational use of water. However, the large standard deviations associated with these coliform counts in both areas exceeded the public health standard.

Water Quality Indices

The results presented above indicate that for all water quality indices, there are no significant differences in the mean values of the six inside points. For each index, the mean for these six points for each sampling data will consititute the $t^{th}$ observation on the dependent variable described in equation 1. While the mean values may be considered equal, it is quite possible to observe large deviations from the means over the sample period. To illustrate the variations of the indices over time, the mean value for each water quality index for the six inner points was computed and plotted against time (Figures 2-10). These figures illustrate that, with the exception of the coliform count, the observed values for the water quality indices do not exceed the bounds considered acceptable for recreational water use (Table 2).

Table 6.--Statistical analysis of mean potassium values, Pawtuckaway Lake, 1971.

| Sample points tested | F statistic |
|---|---|
| 6 inside points | 0.79 |
| 12 outside points | 2.43* |

*Statistically significant at the one percent level of confidence.

Table 7.--Statistical analysis of mean coliform bacteria, Pawtuckaway Lake, 1971.

| Sample points tested | F statistic |
|---|---|
| 6 inside points | 0.77 |
| 12 outside points | 1.04 |
| Inside vs. outside points | 12.80* |

*Statistically significant at the one percent level of confidence.

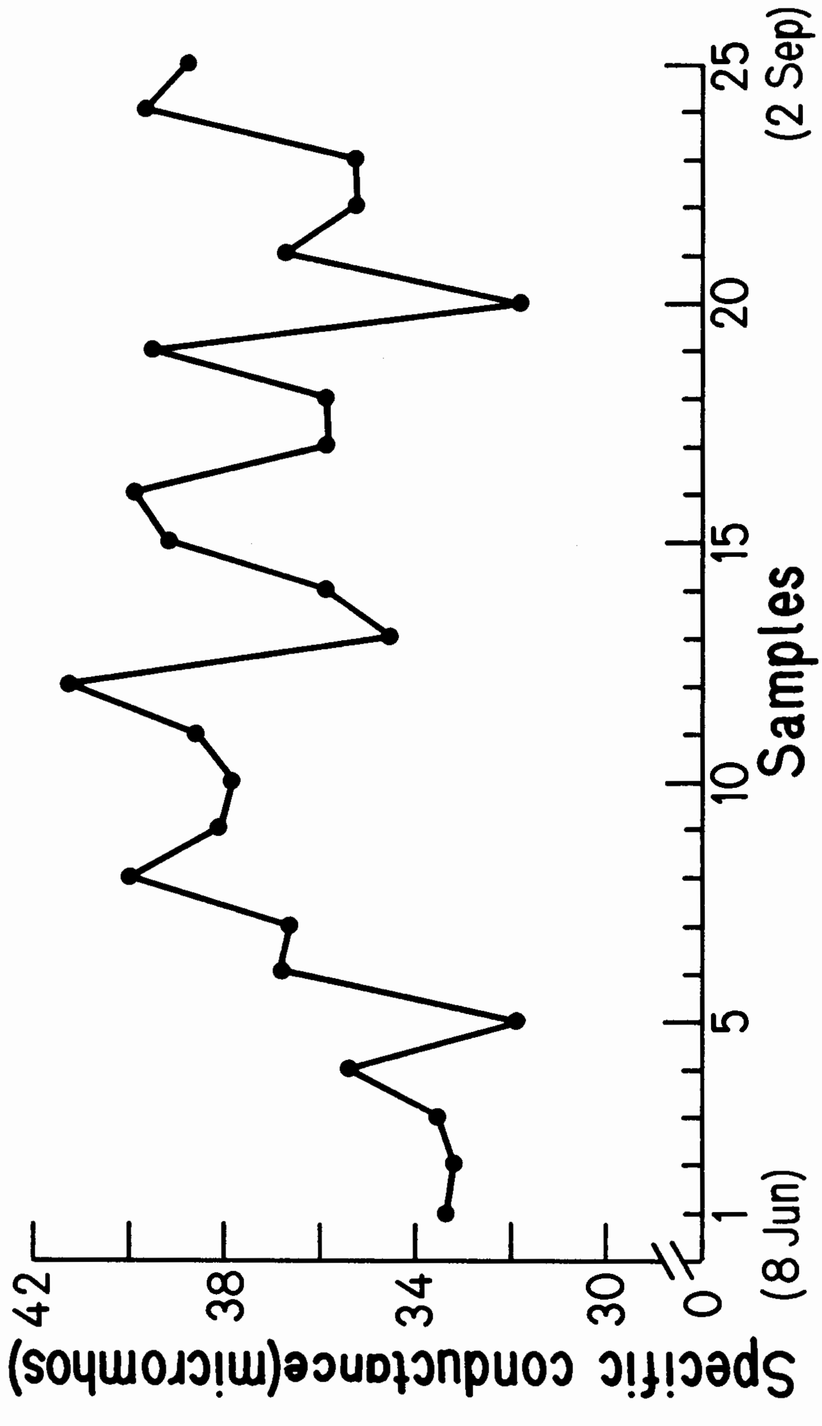



Figure 2.--Specific conductance: mean value for six inside points plotted against time.

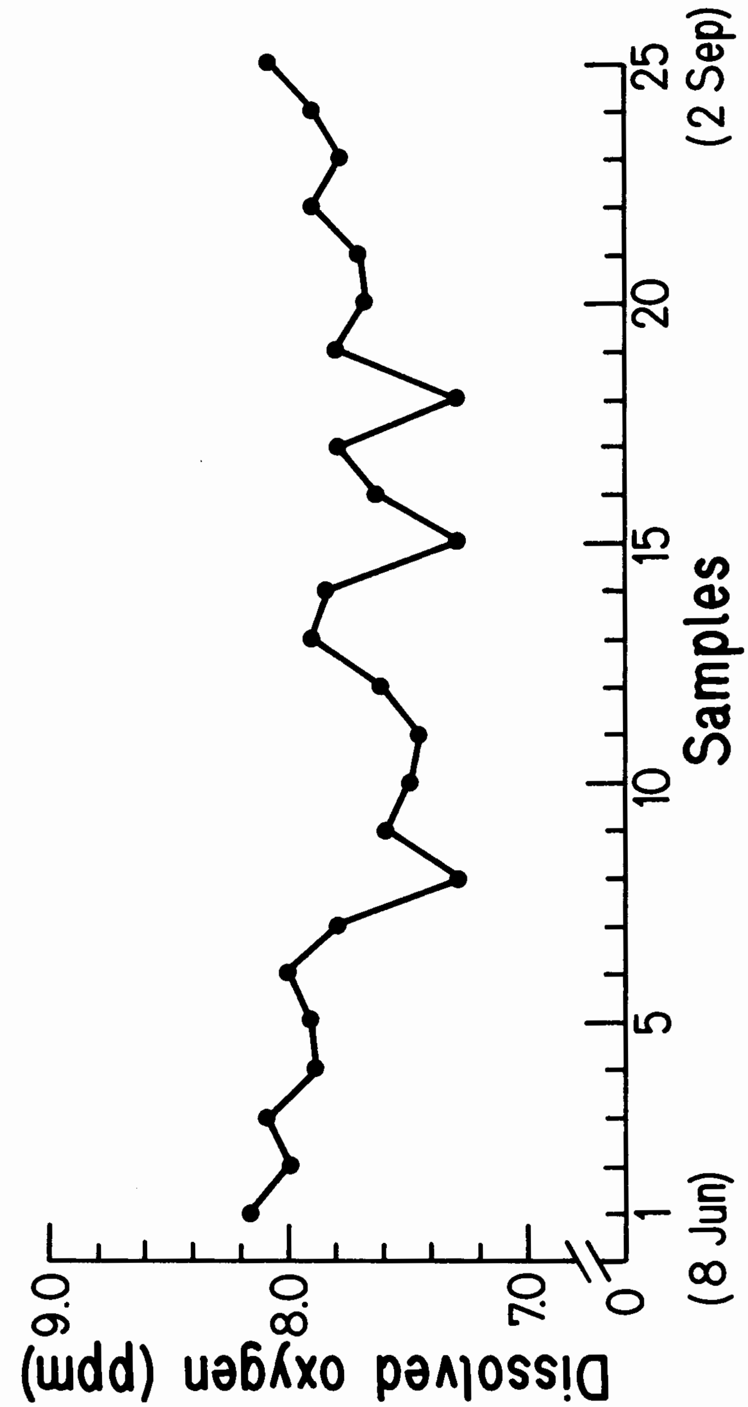



Figure 3.--Dissolved oxygen: mean value for six inside points plotted against time.

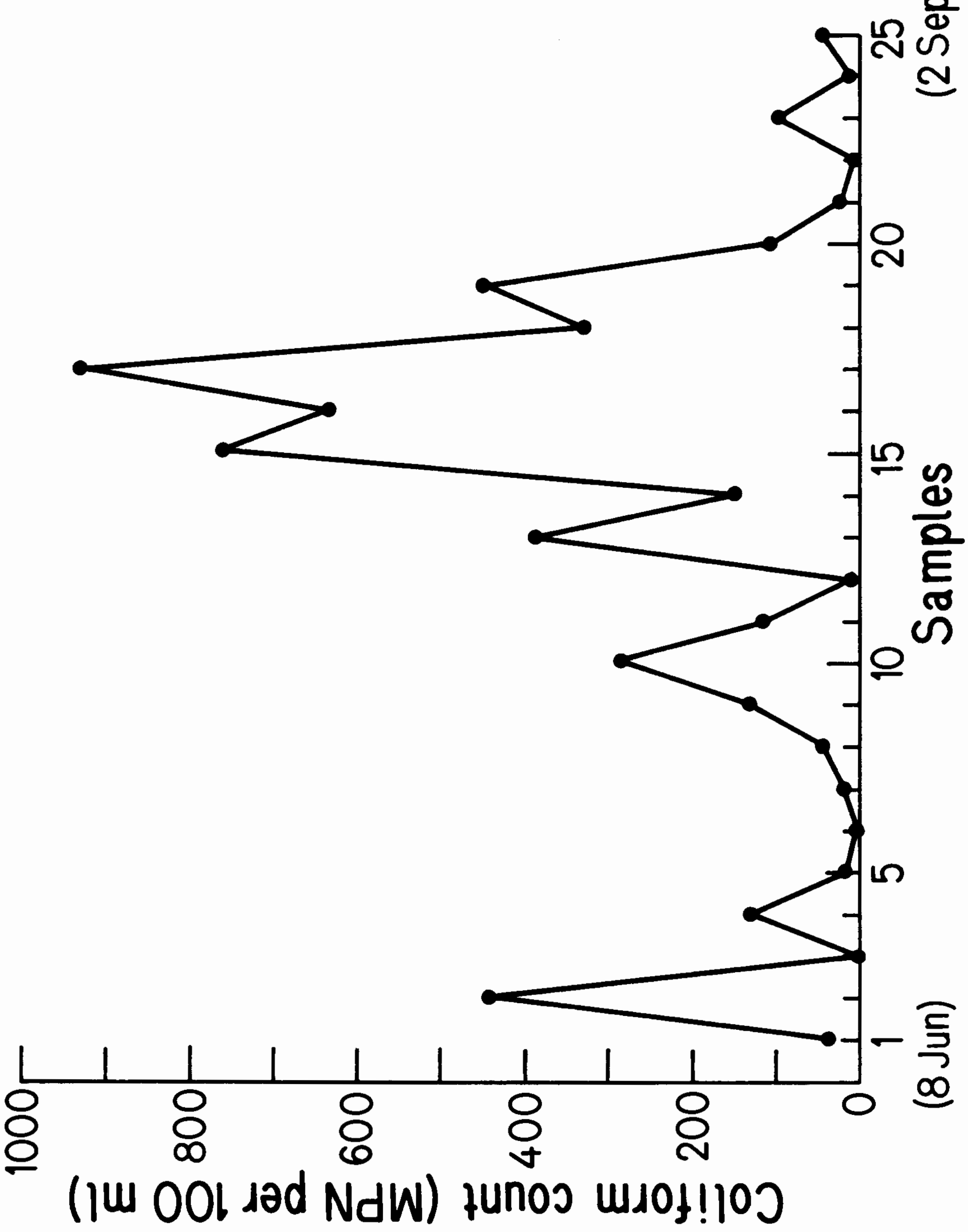



Figure 4.--Coliform count: mean value for six inside points plotted against time.

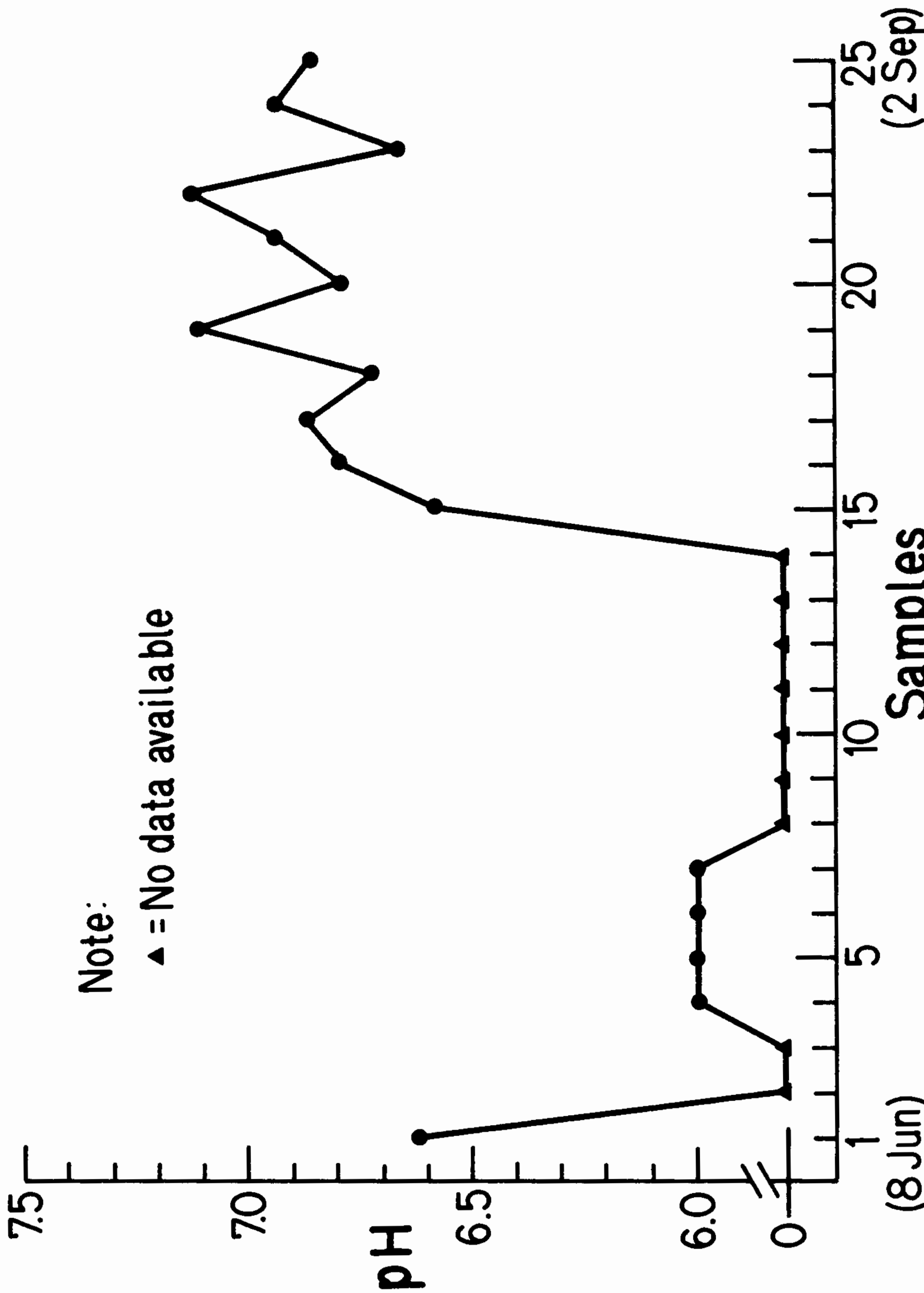



Figure 5.--pH: mean value for six inside points plotted against time.

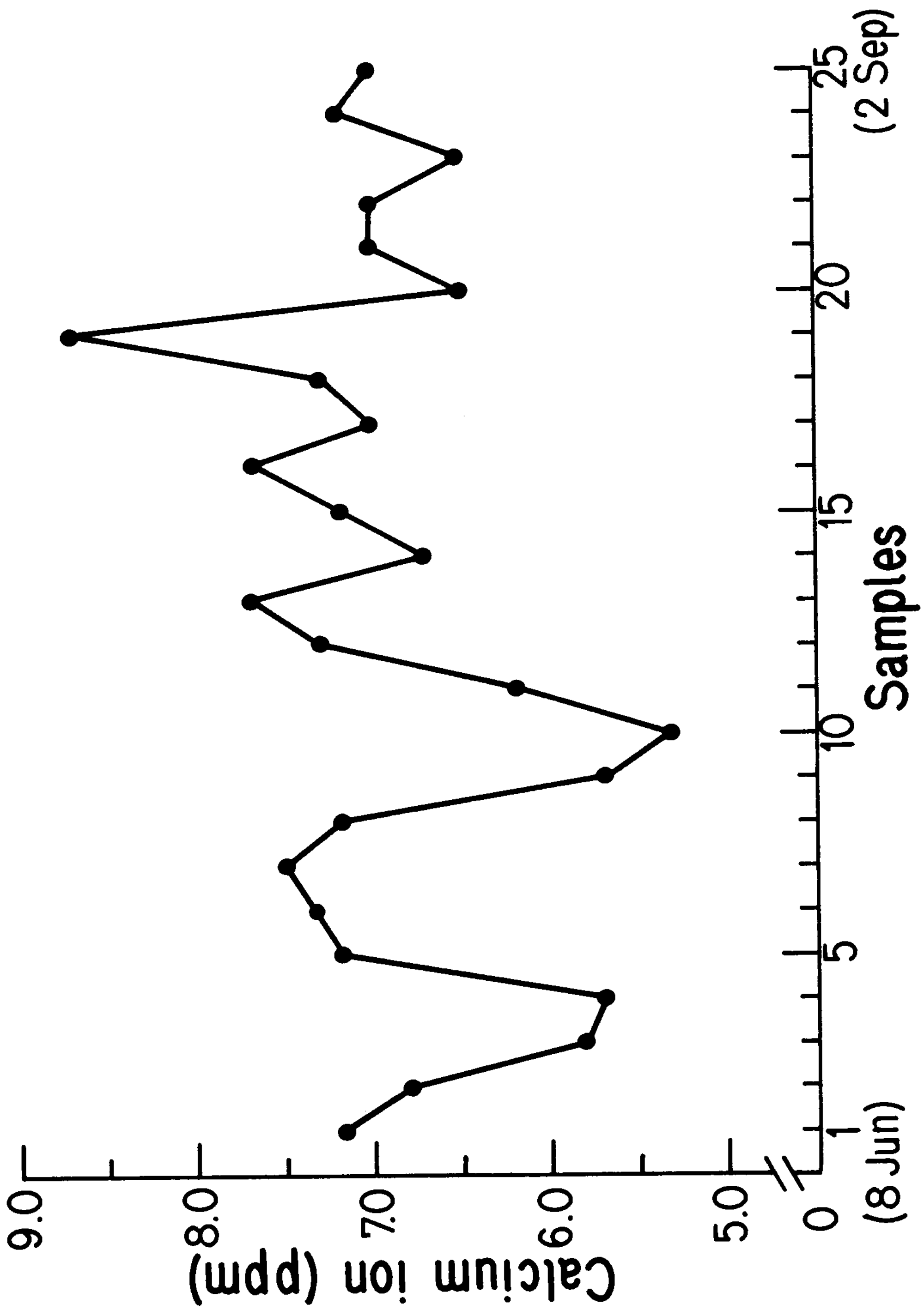



Figure 6.--Calcium ion: mean value for six inside points plotted against time.

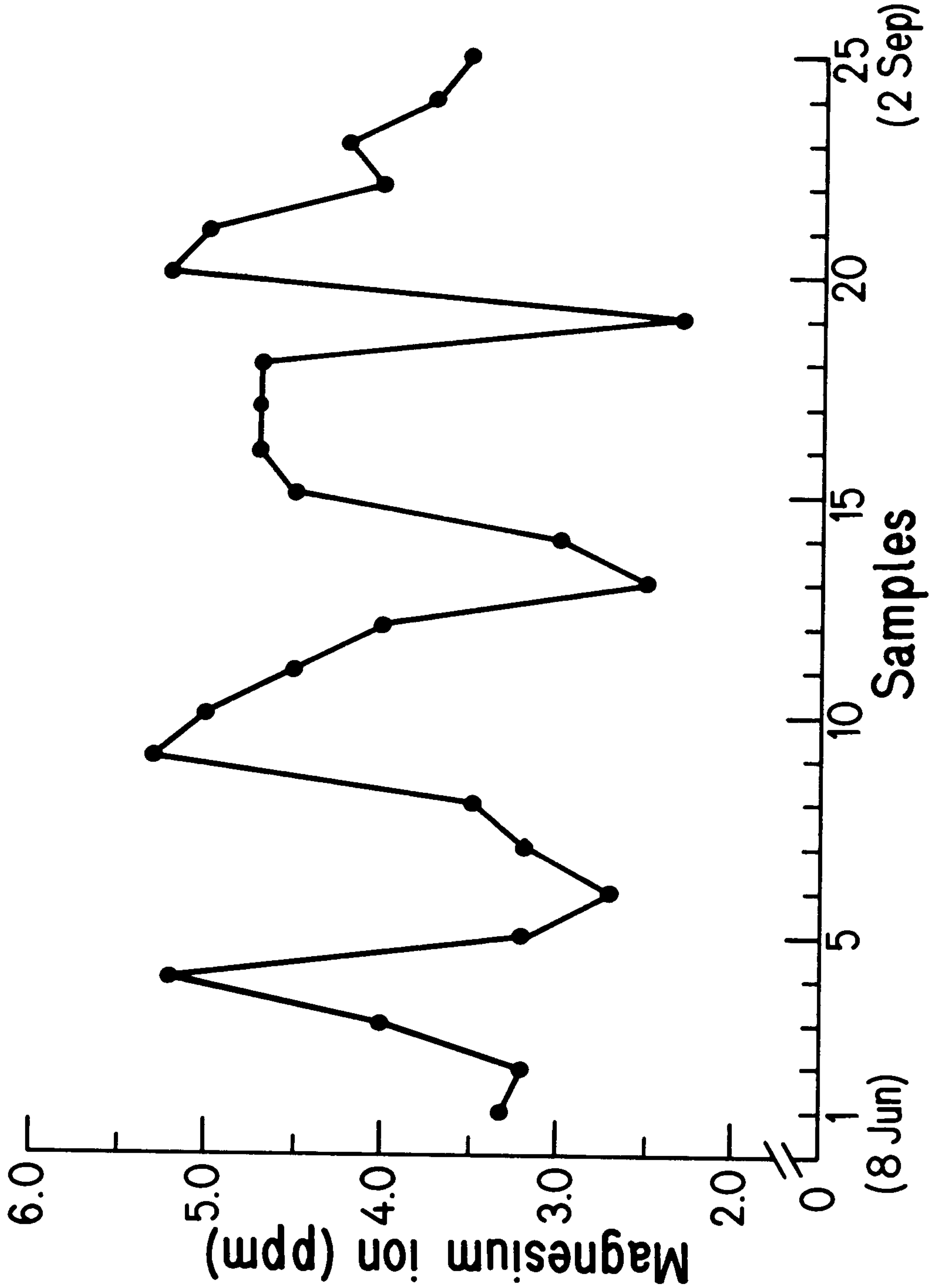



Figure 7.--Magnesium ion: mean value for six inside points plotted against time.

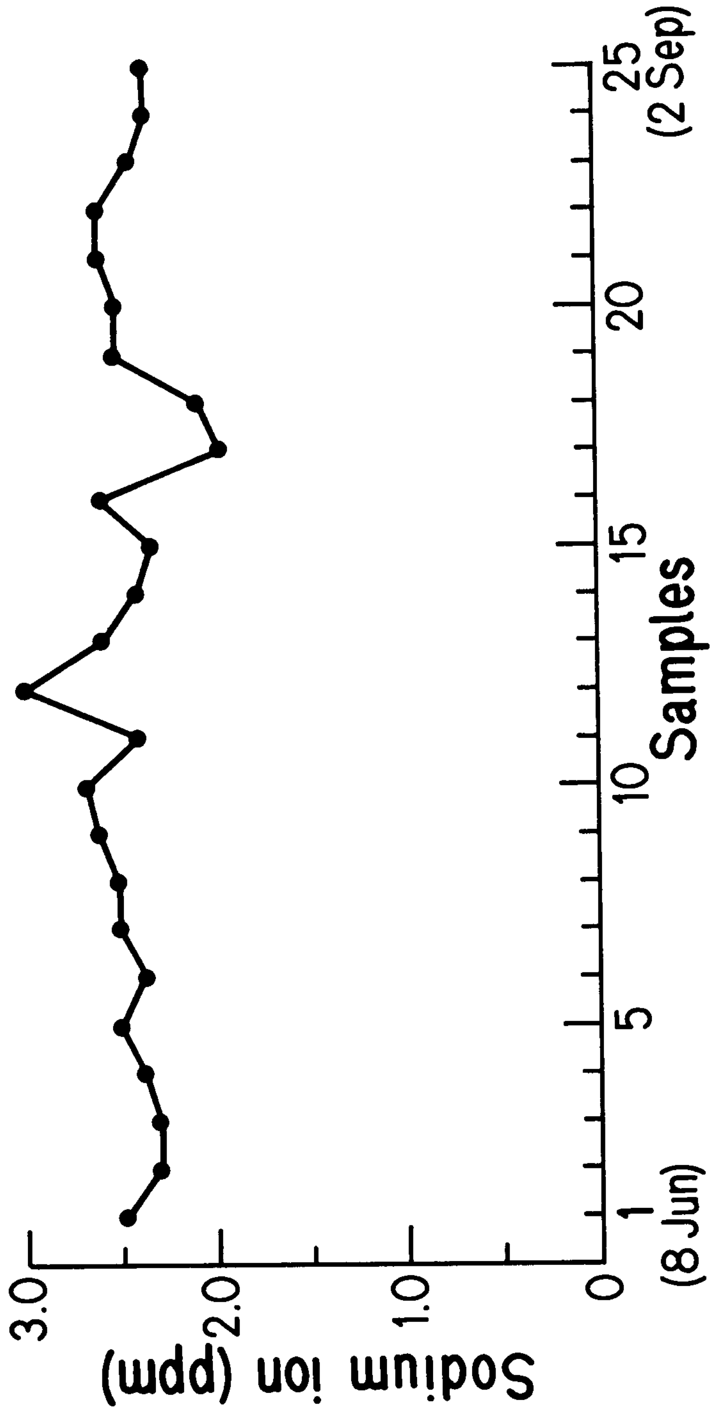



Figure 8.--Sodium ion: mean value for six inside points plotted against time.

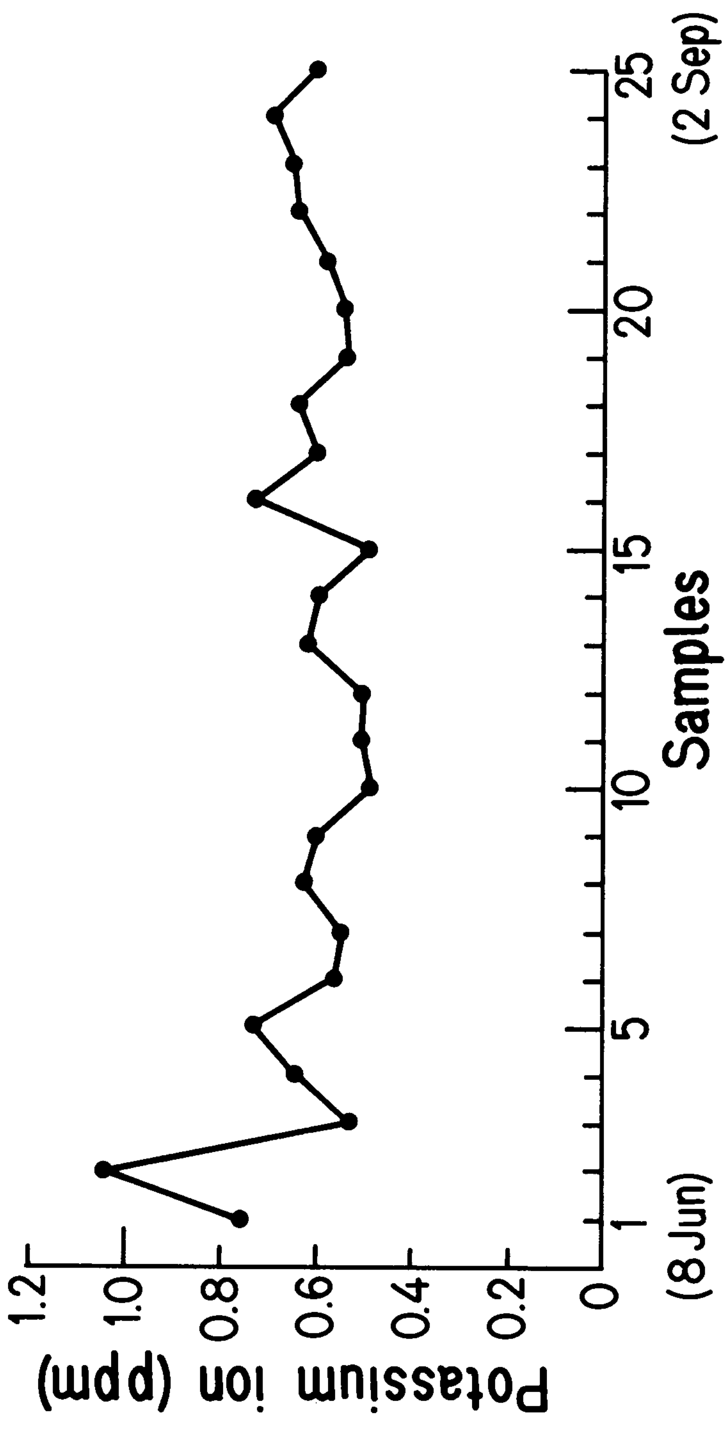



Figure 9.--Potassium ion: mean value for six inside points plotted against time.

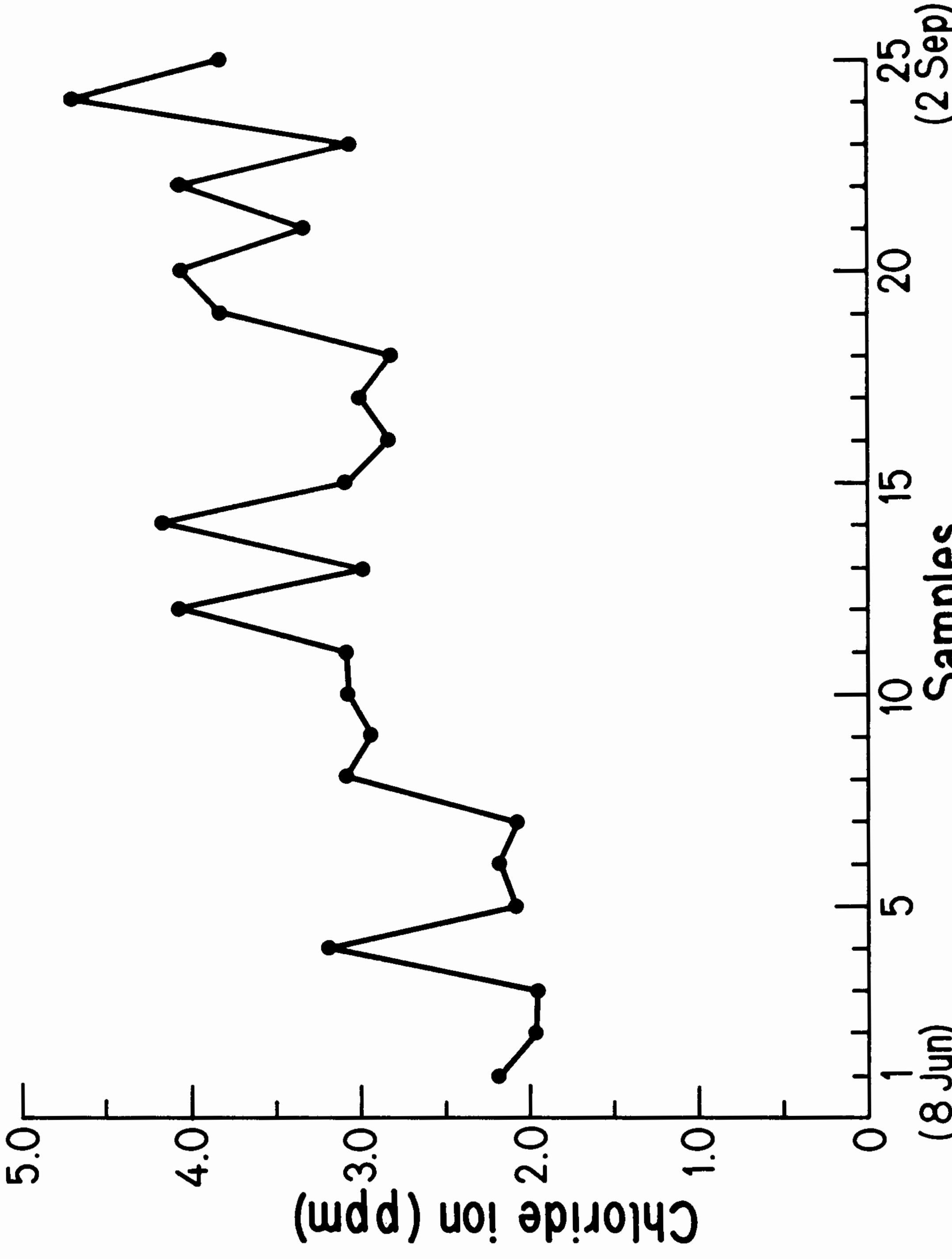



Figure 10.--Chloride ion: mean value for six inside points plotted against time.

## The Effect of Climate and Park Use on Water Quality

To assess the impact of park use on water quality, a linear regression model (equation 1) was used to describe variations in water quality as a function of park use and climate. A dummy or zero-one variable was also included to measure differences in water quality associated with use before and after weekends; and a trend variable was included to measure any time-oriented variation in water quality.

Although equation 1 is expressed as a linear function, other functional forms (linear by transformation) were also fitted by least squares. By the usual statistical criteria, involving t and F statistics and coefficients of determination, it was found that the following functional form provided the best explanation of variance in water quality:

$$Q_{it} = \alpha \prod_{i=1}^{6} X_{it}^{\beta i} \, e^{\beta_7 t} \qquad (2)$$

The estimated coefficients for equation 2 and the related test statistics are presented in Table 8. A total of nine equations (hence, nine water quality indices) were fitted by least squares. Only five equations were found to be statistically significant as indicated by the F statistic. The significant equations included those with the following dependent variables: water temperature, dissolved oxygen, chloride, sodium and potassium.

Table 8.--Estimated coefficients from the water quality determination model.

| Dependent variable | Intercept | Independent variables a/ | | | | | | | $R^2$ | F |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Climate | | | | | | | | |
| | | Air Temperature | Precipi-tation | Wind | Sunshine | Atten-dance | Weekend Dummy | Trend | | |
| Water temperature | 1.390 | 0.416* | -0.008*** | -0.033 | -0.017 | 0.026** | -0.066* | -0.011 | 0.70 | 5.55* |
| | | (0.118) | (0.004) | (0.038) | (0.012) | (0.011) | (0.021) | (0.011) | | |
| Dissolved Oxygen | 11.013 | -0.034 | 0.003 | -0.042 | 0.031* | -0.024* | 0.044* | -0.009 | 0.64 | 4.25* |
| | | (0.076) | (0.003) | (0.025) | (0.008) | (0.007) | (0.014) | (0.007) | | |
| Calcium | 9.373 | -0.034 | 0.002 | -0.016 | 0.001 | -0.034 | 0.085 | 0.031 | 0.15 | 0.42 |
| | | (0.392) | (0.014) | (0.128) | (0.041) | (0.038) | (0.070) | (0.035) | | |
| Magnesium | 0.477 | 0.454 | 0.009 | 0.030 | -0.076 | 0.050 | -0.162 | 0.038 | 0.22 | 0.68 |
| | | (0.814) | (0.030) | (0.266) | (0.085) | (0.079) | (0.146) | (0.073) | | |
| Chloride | 4.134 | -0.200 | 0.021 | -0.010 | 0.106*** | -0.010 | -0.154 | 0.266* | 0.76 | 7.68* |
| | | (0.494) | (0.018) | (0.161) | (0.052) | (0.048) | (0.089) | (0.045) | | |
| Specific Conductance | 43.611 | -0.117 | -0.009 | 0.027 | -0.007 | 0.020 | -0.058 | 0.042*** | 0.33 | 1.19 |
| | | (0.230) | (0.008) | (0.075) | (0.024) | (0.022) | (0.041) | (0.021) | | |
| Coliform Bacteria | 10.748 | 0.465 | 0.040 | -0.270 | 0.074 | -0.066 | -0.344 | 0.412 | 0.05 | 0.12 |
| | | (6.894) | (0.258) | (2.279) | (0.723) | (0.681) | (1.253) | (0.630) | | |
| Sodium | 6.145 | -0.428*** | -0.004 | 0.220* | -0.006 | 0.076* | -0.140* | -0.007 | 0.57 | 3.23** |
| | | (0.215) | (0.008) | (0.070) | (0.023) | (0.021) | (0.039) | (0.019) | | |
| Potassium | 1.325 | -0.109 | -0.014 | 0.104 | 0.051 | -0.101** | 0.054 | -0.026 | 0.56 | 3.15** |
| | | (0.425) | (0.016) | (0.139) | (0.045) | (0.041) | (0.076) | (0.039) | | |

a/ Numbers in parentheses beneath regression coefficients are standard errors.
* Statistically significant at the one percent level of confidence.
** Statistically significant at the five percent level of confidence.
*** Statistically significant at the 10 percent level of confidence.

Significant Climate Variables

Climate variables were significant in four equations: water temperature, dissolved oxygen, chloride and sodium. In the water temperature equation, both air temperature and precipitation were statistically significant and appeared to have the correct (logical) sign. The air temperature coefficient of 0.416 is significant at the one percent level of confidence. The interpretation of this is that with other variables held constant, a one percent increase in air temperature would result in a 0.4 percent increase in water temperature. In the dissolved oxygen and chloride equations, the "number of hours of sunshine" variable had significant coefficients. While the sign of the coefficient in the chloride equation appeared logical the sign in the dissolved oxygen equation appeared incorrect. Finally, in the sodium equation, air temperature and average wind velocity were statistically significant.

Significant Park-use (Attendance) Variables

Park-use variables were significant in four equations: water temperature, dissolved oxygen, sodium and potassium. In the water temperature and sodium equations, the coefficients to attendance are positive and, as such, logical in sign. In the dissolved oxygen and potassium equations, the coefficients to attendance are negative. In the case of dissolved oxygen, this appears logical, in that as attendance increases, dissolved oxygen decreases. In the case of potassium, the negative sign is illogical.

Significant Dummy Variables*

The weekend dummy variable was significant in three equations: water temperature, dissolved oxygen and sodium. The values for the weekend dummies for the water temperature, dissolved oxygen and sodium equations were 0.94, 1.04 and 0.87, respectively.

These results indicate that water temperatures and sodium concentrations after weekend use were lower than before weekend use, by 6 and 13 percent, respectively. Thus, while these coefficients to the weekend dummy are statistically significant, their signs are completely opposite from what one would expect. The positive coefficient in the dissolved oxygen equation indicates that dissolved oxygen after weekend use in approximately 1.04 times as high as before weekend use; this could be due to increased outboard motor usage.

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* A zero-one variable was used with the functional form expressed in equation (2). The transformation by logarithms of zero-one variables causes difficulties, in that the logarithm of zero is not defined. Thus, to use the power function form of equation (2), transformation of the zero-one status must be made before the logarithmic transformation: if $X_6$ was initially equal to zero, set $X_6$ equal to 1.0; if $X_6$ was initially equal to 1.0, set $X_6$ equal to 2.71828, the base of natural logarithms. This prior transformation of the zero-one variables makes logarithmic transformations possible.

## Significant Trend Variables

The trend variables were included in the model (equation 2) in a way that provided convenient summarization of any time-oriented changes in the water quality indices. The trend variable was significant in two equations: chloride and specific conductance. The coefficient in the chloride equation equalled 0.27 and was statistically significant. This meant that the concentration of chlorides in the water increased at a rate of 27 percent per time period (each time period was about one-half week in duration). In contrast, the trend variable coefficient in the specific conductance equation was statistically significant at 0.04. This meant that the concentration of total dissolved solids increased at a rate of four percent per time period.

## Implications of the Results

The results of the foregoing statistical analyses clearly indicated that there were variables other than climate and park use that determine water quality. At best, 70 to 75 percent of the variance in water temperature and chloride concentration was explained by regression; about 60 percent of the variance for dissolved oxygen, sodium and potassium was explained by regression.

Only three equations were significant. First, the dissolved oxygen equation was significant in identifying the relation between attendance and dissolved oxygen. The coefficient to dissolved oxygen was -0.024; this means that a one percent increase in attendance (or park use) was related to a 0.024 percent decrease in dissolved oxygen. Second, the specific conductance equation is significant in terms of identifying the trend in total dissolved solids over time. The coefficient to the trend variable indicated that total dissolved solid concentration increased at about a rate of four percent per half-week period. Third, the coliform equation was significant by its very statistical insignificance. In other words, neither climate, attendance, weekend use, nor time were significant determinants of the coliform content of the water. This does not mean that these variables have no relation to coliform count. Instead, it probably means that some of these explanatory variables, especially attendance, were neither systematic enough nor of sufficient magnitude to permit statistical measurement and verification.

# THE ATTITUDES OF SHORELINE RESIDENTS

## The Survey and Attitudinal Data

Private landowners residing on Pawtuckaway Lake were interviewed to determine their attitudes regarding the effect of the establishment of Pawtuckaway State Park on the quality of the environment in the area. The nine identifiable summer home subdivisions around Pawtuckaway Lake (Figure 1) were grouped into four "summer home clusters" on the basis of proximity (Table 9) in order to maintain confidentiality of the information obtained. Random cluster sampling was used in the survey of these local residents.

Of the 221 actual residences, 90 were sampled for the attitudinal survey. Some residents did not wish to respond to all questions in the survey; the non-respondents were not included in the summaries of replies presented in Tables 10-18. Individual totals for separate cluster groups or grand totals as they appear in Tables 10-18, therefore, will not be the same as the totals presented in Table 9.

The survey was designed to elicit information about the general attitudes of lake residents regarding boating; "people pollution" (overcrowding); ecology; park-resident relations; and property values. In addition to general attitudes, additional information regarding specific characteristics of problems was also obtained. For example, if a resident indicated that there was a boating problem, he was further queried concerning the causes and severity of the problem.

Table 9.--Subdivisions included in summer home clusters on Pawtuckaway Lake, 1971.

| Summer home cluster | Subdivisions | | Number of residences | |
|---|---|---|---|---|
| | Number[a/] | Name | Actual | Sampled |
| I | 9 | Pawtuckaway Shores | 43 | 19 |
| II | 8 | Sachs and Jampsa Roads | 6 | 2 |
| | 7 | Maine & Mooers Roads | 27 | 6 |
| | 6 | Tuckaway Shores | 22 | 8 |
| III | 5 | Dolloff's Dam | 16 | 8 |
| | 4 | Seaman's Point | 50 | 19 |
| | 3 | Sunny Pines & South Channel | 5 | 3 |
| IV | 2 | White's Grove | 27 | 15 |
| | 1 | Fernald's Grove | 19 | 8 |
| Totals | | | 221 | 90 |

a/ See Figure 1 for location of subdivisions.

## The Statistical Analysis of Attitudinal Data

The Chi-Square test for independent samples was used to test for differences in response among the four clusters of summer homes (Siegel, 1956). The null hypothesis was that attitudes regarding ecology and other selected variables were independent of the residential cluster of the respondent. Therefore, the stated null hypothesis was that the proportion of residents in a cluster near the park, who stated that there was an ecology problem, was the same as that of residents in a cluster distant from the park.

No attempt was made to statistically analyze individual characteristics of a particular problem. The nature of many of the survey questions encouraged respondents to express a wide variety of opinions. In some cases, particularly in the ecology section where space for write-in answers was provided, a broad spectrum of responses was obtained. Thus, no significant categories of responses were formed that could be statistically analyzed.

To perform the Chi-Square test, four-by-two contingency tables were formulated for each of five attitudinal topics. An example is the contingency table for boat problem attitudes presented in Table 10.

Shoreline residents sampled were queried regarding their views on boating practices, "people pollution" (overcrowding), ecology, park-resident relations, and the effect of the park on property values. The survey questions and the results, computed by residential cluster, are summarized in Table 11.

Table 10.--Number and percent distribution of responses on boating problem by summer home cluster.a/

| Summer home cluster | Yes | | No | | Total | |
|---|---|---|---|---|---|---|
| | Number | Percent | Number | Percent | Number | Percent |
| I | 11 | 24 | 8 | 20 | 19 | 22 |
| II | 7 | 15 | 8 | 20 | 15 | 17 |
| III | 15 | 33 | 14 | 35 | 29 | 34 |
| IV | 13 | 28 | 10 | 25 | 23 | 27 |
| Totals | 46 | 100 | 40 | 100 | 86 | 100 |

a/ Question: "Do you think there is a boat problem on the lake?"

The majority of residents were generally favorable toward the park and its users, and did not report any marked deterioration of the lakeshore environment (Table 11). Although over half of the respondents felt there was a boat problem on Pawtuckaway Lake, only one-third of this group attributed it directly to park users. In the categories of overcrowding and ecological change, one-third of the respondents felt there were problems. Over 60 percent of the residents surveyed had little or no association with the park or its visitors. Almost 60 percent of the respondents felt that the founding of the park had improved or protected their property values. The attitudes of lakeshore residents toward the park and its visitors are discussed below; detailed breakdowns of questionnaire responses are provided in Tables 14-18, Appendix A.

Boating Practices

Although over half of the respondents felt there was a boat problem, only about one-fourth of this group felt it was serious or very serious. About one-third of the respondents felt there was a slight problem, but reported that problems were "just beginning" and that they existed mainly on the weekends. There were no significant differences among residential clusters regarding perceptions of the boating problems.

Of the residents who felt that a boating problem existed, 25 attributed it either directly to park users or to a combination of shore residents and park users. There is no way to identify a boat as one belonging to a park user. A few respondents who felt a problem existed noted this lack of identifiability as one reason for the problem.

Table 11.--Summary of replies to attitude questions of the survey, by clusters and for the total sample, Pawtuckaway Lake, 1971.

| Questions | Replies | Summer home clusters | | | | Total sample | Chi Square statistic | Is there a significant difference between clusters? |
|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV a/ | | | |
| Is there a boating problem? | Yes | 11 | 7 | 15 | 13 | 46 | 0.28 | No |
| | No | 8 | 8 | 14 | 10 | 40 | | |
| Is there a people problem? (Overcrowding) | Yes | 4 | 4 | 10 | 9 | 27 | 1.48 | No |
| | No | 15 | 11 | 19 | 14 | 59 | | |
| Is there an ecology problem? | Yes | 5 | 1 | 7 | 16 | 29 | 16.63 | Yes |
| | No | 15 | 14 | 21 | 8 | 58 | | |
| Do you have any direct contacts with the park? | Yes | 6 | 6 | 15 | 6 | 33 | 3.61 | No |
| | No | 13 | 9 | 14 | 17 | 53 | | |
| Does the park have a favorable effect on property values? | Yes | 10 | 12 | 17 | 8 | 47 | 7.19 | No |
| | No | 8 | 2 | 10 | 13 | 33 | | |

a/ Residents of Cluster IV differ significantly (probability at 0.01) from all others in their perception of an ecology problem.

Pawtuckaway Lake has a varied shoreline with many long, narrow coves, as well as a few fairly long open stretches of water. Respondents were asked to judge the boat problem as they experienced it in their own areas. People with homes in secluded coves had very few complaints, as opposed to families whose property fronted on heavily traveled areas.

About 80 percent of the people who felt there was a boat problem perceived it as occurring only on weekends; this cannot be directly connected to park users since private residences are more heavily used on weekends. During the summer of 1971, the park administration recorded only 116 boats with motors (Table 12). Total campsite occupancy for the season was slightly more than 11,000 camper nights. With average site occupancy of about seven nights, it was estimated that one visiting party out of every 15 had a power boat; about one half of the campers' motorboats were 10 horsepower or less. There was no relation between the arrival of motorboats and weekends. In other words, the number of campers with motorboats did not vary from weekday to weekend day. For these reasons, much of the boating activity and associated problems on weekends must be due to private residents.

The 80 lakeshore residents who responded had a total of 96 motorboats. In contrast with the park users, 58 percent of the residents' motors were over 30 horsepower compared to 33 percent by park campers. Estimated daily hours of use per boat varied considerably with size of motor and day of week (Table 13). Greatest daily use was reported for the two larger motor size-classes on weekends. Apparently, the motorboat problem is created more by private residents than by park users.

Table 12.-- Number of boats with motors of various sizes registered by campers at Pawtuckaway Park, 1971.

| Motor size | Month | | | Total |
|---|---|---|---|---|
| | June | July | August | |
| Horsepower | Number | Number | Number | Number |
| Under 10 hp | 20 | 20 | 16 | 56 |
| 10-30 hp | 8 | 7 | 7 | 22 |
| Over 30 hp | 5 | 18 | 15 | 38 |
| TOTALS | 33 | 45 | 38 | 116 |

Table 13.--Number of boats with motors of various sizes located at private residences with estimated daily and weekly hours of use, 1971.

| Motor size | Boats | Estimated daily use | | Estimated weekly use | |
|---|---|---|---|---|---|
| | | Weekday | Weekend | Weekday (5 days) | Weekend (2 days) |
| Horsepower | Number | Hours | Hours | Hours | Hours |
| Under 10 hp | 25 | .61 | .42 | 76 | 21 |
| 10-30 hp | 15 | .38 | 1.30 | 28 | 39 |
| Over 30 hp | 56 | .36 | 1.60 | 101 | 180 |
| TOTALS | 96 | ---- | ---- | 205 | 240 |

In addition to the seven categories listed on the questionnaire, residents were encouraged to add their own answers when replying to the question on characteristics of the boat problem (Table 14, Appendix A). The most commonly volunteered answers to the boating problem mentioned unsafe and inconsiderate operation. Many of these respondents believed that most of the unsafe and discourteous boaters were from the park.

A need for further boating regulations was expressed by 39 respondents. These replies were not as explicitly anti-visitor as were those describing the boat problem. The park is a contributing factor toward the boat problem, of course, but only users of campsites bring in power boats. Specifically, 13 respondents felt that more hours of water policing were needed. The New Hampshire Board of Water Resources provided only one part-time policeman for the lake during the 1971 season. A suggestion that park campers be subject to more stringent boating regulations than lakeshore residents was made by five respondents.

"People Pollution" (Overcrowding)

About one-third of the residents felt that too many people used the lake: eight thought the problem was serious or very serious, and 19 thought it was slight or "just beginning" (Table 15, Appendix A). There were no significant differences between residential clusters regarding attitudes towards overcrowding.

Of those who perceived overcrowding on the lake, only seven attributed it directly to park users. In fact, most residents said they were not really aware of either beach or campsite users in the park because of the irregular shoreline of the lake. No appreciable problem with park users trespassing on private property was reported.

Although there was little immediate concern about crowding on the lakeshore, almost two-thirds of the residents interviewed expressed a desire for regulations to control the future use of the lake. The greatest concern centered around regulating back-lot development and limiting the number of park users in the future.

Ecology

Residents were asked to comment upon any changes they perceived in the ecology of the area since the park began operation (Table 16, Appendix A). The majority noted no changes at all in fish, plants or wildlife. Those who listed unfavorable effects on the environment did seem alarmed, and the comments varied greatly. A complaint noted by a large number of respondents concerned a decline in the quality of fishing in recent years.

The figures for opinions on change in water quality were almost identical with those for ecology. Of the 25 respondents who felt there had been a decline in quality of the lake water, 21 felt it was only slight. There were statistically different views of the ecology problem among the four summer home clusters (Tables 11 and Appendix A, 16). In clusters I, II and III, about 80 percent of the respondents felt there had been no changes in the ecology since the establishment of the park. In contrast, two-thirds of the respondents in cluster IV felt that the ecology had changed. A possible explanation for this difference is that one subdivision in cluster IV (White's Grove) is one of the oldest of the subdivisions and hence the residents have had a longer period to observe changes. This may be the case, in spite of the fact that the question was phrased with the establishment of the park as the beginning point of comparison.

Park-Resident Relations

The majority of shore residents had no direct contact with the park (Table 17, Appendix A). The 33 respondents who reported that they or their families had used park facilities were generally favorable to the park and its management. Some complaints, however, were listed with respect to the admission fee payment required and the strict rules for visiting campsites.

The Effect of the Park on Property Values

Respondents were asked if they felt that the establishment of Pawtuckaway Lake as a State park had improved or protected their property values (Table 18, Appendix A). Almost 66 percent believed it had. Those who disagreed generally felt the park had no effect on their property values. The Chi-Square analysis indicated that there were no statistically significant differences among clusters with respect to their views on park-property value relations.

Of the respondents in clusters I, II and III, 66 percent felt that park establishment had a favorable effect on property values. In contrast, about two-thirds of the respondents in cluster IV felt that the park had not had a favorable effect on property values. Although this difference was not statistically significant, it could be related to the fact that cluster IV was the only group that also felt there was an ecology problem.

Residents around the lakeshore generally had favorable attitudes towards Pawtuckaway State Park and its users. The problems that residents noted, after the six years that the park has been a "neighbor", did not appear to be serious. Lakeshore residents indicated a desire to maintain the status quo, in that they did not want further development of the lakeshore by private developers. Further, when asked if they would have preferred private rather than state development of the area, the answers were emphatic: with respect to a possible increase in commercial development, very strong negative opinions were evoked. The only commercial enterprise on the lake in 1971 was one small marina, and even this modest enterprise was strongly opposed by many residents at its inception. Table 18 (Appendix A) shows that residents were divided as to whether the park had actually improved or protected their property values. Their answers indicated that they were quite opposed to change; unsolicited comments made by respondents indicated general satisfaction with the present state of the lake, including all direct and indirect effects of the park.

## SUMMARY AND CONCLUSIONS

This report assessed the impact of Pawtuckaway State Park on the quality of the immediate environment. Environmental quality measurements in this study were based on two major criteria. First, physical measurements of the water quality of Pawtuckaway Lake were made; 12 water quality indices were determined by a sampling process. The indices were graphically depicted as a function of time. Second, a survey of shoreline residents was conducted to determine their attitudes toward the relation between the park and perceived environmental quality changes.

Analysis of the water quality data indicates two major findings. First, except for the coliform count, the levels of the water quality indices were within the bounds thought to be acceptable for recreational (or higher) use. However, even for coliform counts, the mean value of the beach area was below the limit of the standard set by the State of New Hampshire as acceptable for recreational use. Second, the level of park use or attendance had minimal effects on the water quality indices. The statistical analysis of the data indicated a positive relation between dissolved oxygen and attendance and a slight increase of total dissolved solids over the observation period (summer, 1971). These results relate only to the beach area, where changes in the water quality indices were more pronounced relative to observations taken in the middle of the lake.

The attitudinal survey indicated that the majority of the respondents favored the park and its users; that is, most felt that the park had not created any marked deterioration in the quality of the environment. Rather, most respondents felt that the park was an asset in that it had kept a large tract of land from being privately developed and helped to improve and maintain real property values.

The results of both the water quality analysis and the attitudinal survey, therefore, indicated that the establishment of Pawtuckaway State Park had not had an adverse effect on the quality of the immediate environment. It should be emphasized that Pawtuckaway State Park is a rural public park, with intensive use only during certain times of the year, and even then primarily during weekends and holidays. This type of use, the intensity of use, and the level of use has not resulted in any noticeable harm to the environment as yet. However, an inverse relation between water quality and attendance was found, and if use were intensified, quality could decline.

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Table 14.--Summary of replies to boating problems section of questionnaire, by clusters and for the total sample, Pawtuckaway Lake, 1971.

| Questions | Replies | Summer home cluster I | II | III | IV | Total sample |
|---|---|---|---|---|---|---|
| Is there a boating problem? | Yes | 11 | 7 | 15 | 13 | 46 |
| | No | 8 | 8 | 14 | 10 | 40 |
| How severe is the problem? | Slight | 9 | 5 | 11 | 9 | 34 |
| | Serious | 2 | 1 | 2 | 2 | 7 |
| | Very serious | 0 | 1 | 2 | 2 | 5 |
| What are the characteristics of the problem? | Number of boats | 4 | 2 | 4 | 4 | 14 |
| | Size of boats | 1 | 0 | 2 | 2 | 5 |
| | Size of motors | 2 | 0 | 5 | 7 | 14 |
| | Noise | 1 | 1 | 3 | 1 | 6 |
| | Oil pollution | 5 | 0 | 3 | 1 | 9 |
| | Litter | 0 | 0 | 1 | 0 | 1 |
| | Waves | 0 | 0 | 0 | 0 | 0 |
| | Other | 5 | 6 | 8 | 9 | 28 |
| When does the problem occur? | No response | 0 | 1 | 0 | 0 | 1 |
| | Weekdays | 0 | 0 | 0 | 0 | 0 |
| | Weekends | 11 | 4 | 10 | 12 | 37 |
| | Both | 0 | 2 | 1 | 0 | 3 |
| What causes the problem? | No response | 5 | 0 | 0 | 0 | 5 |
| | Park users | 2 | 1 | 5 | 6 | 14 |
| | Private residents | 2 | 1 | 2 | 1 | 6 |
| | Both | 2 | 4 | 3 | 2 | 11 |
| | Others | 1 | 1 | 1 | 2 | 5 |
| Is there a need for further regulation of boating? | Yes | 6 | 7 | 13 | 13 | 39 |
| | No | 13 | 8 | 16 | 10 | 47 |
| What types of regulation? | Boat size | 0 | 2 | 2 | 4 | 8 |
| | Horsepower | 2 | 3 | 5 | 2 | 12 |
| | Number of boats | 0 | 0 | 1 | 1 | 2 |
| | Water skiing | 1 | 1 | 3 | 1 | 6 |
| | Non-power boats | 0 | 0 | 1 | 0 | 1 |
| | More speed limits | 2 | 0 | 2 | 2 | 6 |
| | Others | 1 | 4 | 7 | 9 | 21 |

Table 15.--Summary of replies to "people problems" section of questionnaire, by clusters and for total sample, Pawtuckaway Lake, 1971.

| Question | Replies | Summer home cluster | | | | Total sample |
|---|---|---|---|---|---|---|
| | | I | II | III | IV | |
| Is there a "people problem"? | Yes | 4 | 4 | 10 | 9 | 27 |
| | No | 15 | 11 | 19 | 14 | 59 |
| How severe is the problem? | Slight | 3 | 2 | 7 | 7 | 19 |
| | Serious | 1 | 2 | 3 | 1 | 7 |
| | Very serious | 0 | 0 | 0 | 1 | 1 |
| What causes the problem? | No response | 0 | 0 | 0 | 0 | 0 |
| | Park users | 4 | 0 | 2 | 1 | 7 |
| | Private residents | 0 | 0 | 1 | 3 | 4 |
| | Both | 0 | 4 | 4 | 3 | 11 |
| | Others | 0 | 0 | 0 | 0 | 0 |
| When does the problem occur? | Weekdays | 0 | 0 | 0 | 0 | 0 |
| | Weekends | 3 | 2 | 4 | 3 | 12 |
| | Both | 0 | 2 | 3 | 3 | 8 |
| Are park users causing problems on private property? | Yes | 0 | 0 | 4 | 3 | 7 |
| | No | 19 | 15 | 25 | 20 | 79 |
| How severe is the problem? | Slight | 0 | 0 | 0 | 0 | 0 |
| | Serious | 0 | 0 | 0 | 0 | 0 |
| | Very serious | 0 | 0 | 0 | 0 | 0 |
| What are the characteristics of the problem? | Trespassing | 0 | 0 | 1 | 0 | 1 |
| | Litter | 0 | 0 | 0 | 1 | 1 |
| | Noise | 0 | 0 | 1 | 0 | 1 |
| | Snowmobiles | 0 | 0 | 3 | 3 | 6 |
| | Campfire smoke | 0 | 0 | 1 | 0 | 1 |
| | Traffic | 0 | 0 | 0 | 0 | 0 |
| | Other | 0 | 0 | 0 | 0 | 0 |
| Should the number of lake users be regulated? | Yes | 14 | 6 | 18 | 17 | 55 |
| | No | 5 | 9 | 11 | 6 | 31 |
| What type of regulations? | Limit lakeshore development | 6 | 4 | 7 | 2 | 19 |
| | Limit back lot development | 11 | 3 | 12 | 13 | 39 |
| | Limit number of park users | 4 | 3 | 11 | 12 | 30 |
| | Limit access to lake | 2 | 0 | 0 | 0 | 2 |
| | Larger minimum lot size | 4 | 0 | 1 | 1 | 6 |

Table 16.--Summary of replies to ecology section of questionnaire, by clusters and for total sample, Pawtuckaway Lake, 1971.

| Questions | Replies | Summer home cluster | | | | Total sample |
|---|---|---|---|---|---|---|
| | | I | II | III | IV | |
| Has there been a change in the ecology? | None at all | 13 | 12 | 19 | 7 | 51 |
| | Favorable | 2 | 2 | 2 | 1 | 7 |
| | Unfavorable | 5 | 1 | 7 | 16 | 29 |
| Has the water quality been affected since 1966? | Stayed same | 8 | 12 | 17 | 9 | 46 |
| | Improved | 2 | 0 | 3 | 1 | 6 |
| | Declined | 7 | 1 | 6 | 11 | 25 |
| How severe is the problem? | Slight | 5 | 1 | 6 | 9 | 21 |
| | Serious | 2 | 0 | 0 | 2 | 4 |
| What causes the problem? | Boats | 4 | 0 | 3 | 3 | 10 |
| | Swimming | 1 | 0 | 0 | 0 | 1 |
| | Pollution (residential) | 1 | 0 | 1 | 1 | 3 |
| | Pollution (park) | 1 | 0 | 0 | 2 | 3 |
| | Other | 2 | 0 | 1 | 2 | 5 |

Table 17.--Summary of replies to park organization, administration and staff section of questionnaire, by clusters and for total sample, Pawtuckaway Lake, 1971.

| Questions | Replies | Summer home cluster I | II | III | IV | Total sample |
|---|---|---|---|---|---|---|
| Do you have any direct contacts with the park? | Yes | 6 | 6 | 15 | 6 | 33 |
| | No | 13 | 9 | 14 | 17 | 53 |
| What type of interaction do you have with park employees? | Recreation facilities | 6 | 4 | 8 | 3 | 21 |
| | Lowering lake in fall | 2 | 0 | 3 | 3 | 8 |
| | Employees aid property owners | 1 | 0 | 0 | 0 | 1 |
| | Wildlife protection | 1 | 0 | 2 | 0 | 3 |
| | Other | 0 | 1 | 1 | 0 | 2 |
| Did you make recreational use of the park in 1970? | Number of times | 84 | 44 | 75 | 0 | 203 |
| | Size of party | 6 | 422 | 11 | 0 | 59 |
| | Weekends | 1 | 1 | 0 | 0 | 2 |
| | Weekdays | 2 | 0 | 1 | 0 | 3 |
| What are your relations with park staff? | Poor | 0 | 0 | 0 | 0 | 0 |
| | Fair | 1 | 0 | 1 | 0 | 2 |
| | Good | 3 | 0 | 6 | 3 | 12 |
| | Excellent | 2 | 6 | 7 | 1 | 16 |
| | No opinion | 0 | 0 | 1 | 2 | 3 |

Table 18.--Summary of replies to property values section of questionnaire, by clusters and for total sample, Pawtuckaway Lake, 1971.

| Questions | Replies | Summer home cluster | | | | Total sample |
|---|---|---|---|---|---|---|
| | | I | II | III | IV | |
| Does the park have a favorable effect on property values? | Yes<br>No | 10<br>8 | 12<br>2 | 17<br>10 | 8<br>13 | 47<br>33 |
| The park protects property values: | | 6 | 10 | 15 | 7 | 38 |
| The park improves property values: | | 9 | 6 | 5 | 2 | 22 |
| Should there be more residences in the area to broaden the tax base? | Yes<br>No | 2<br>16 | 1<br>14 | 0<br>28 | 0<br>16 | 3<br>74 |
| Would the area be more attractive if private development had occurred where the park is? | Yes<br>No | 1<br>17 | 0<br>15 | 2<br>27 | 1<br>21 | 4<br>80 |
| Would you favor an increase in commercial lakefront development? | Yes<br>No | 1<br>17 | 1<br>14 | 2<br>27 | 1<br>21 | 5<br>79 |


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