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TOWARD A BETTER UNDERSTANDING OF RECREATIONAL BOATING IN THE ADIRONDACK LAKES REGION[1]

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ABSTRACT: Results of a study to determine the relationship between physical characteristics of Adirondack lakes and variations in peak boat-use intensity indicated that 69 percent of the variation in peak use can be accounted for by the number of public and commercial boat-launching facilities per mile of lake shoreline. Other lake characteristics related to peak boat use were: the number of commercial overnight accommodations available, number of boat slips, lake size, and miles of lake shoreline. Lake characteristics not related to peak use were: accessibility, configuration, tent spaces available, surrounding landscape quality, volume of traffic and availability of other lakes. This information should provide recreation managers and planners with a better understanding of factors related to variation in peak boating-use periods.

INTRODUCTION

The rapid growth of boating on reservoirs and lakes may result in an overuse problem within a few years. Though conflicting recreational uses of water is already a problem at some places, the problem of gunwale to gunwale boats on a busy Sunday afternoon has not yet raised its ugly head. But if present trends continue, an excessively high level of use is a real possibility; and the boating experience may degenerate to that of driving a car at rush hour.

Much too often, nothing is done to prevent overuse of recreation areas until the problem is an immediate management concern. To have a measure of control over peak boat-use intensity, recreation managers and planners must anticipate potential problems rather than react to critical situations as they occur.

In our study, we tried to determine the relationship between lake characteristics and variations in peak period boat-use intensity on Adirondack lakes. We found a strong relationship between the number of boats using Adirondack lakes during peak use periods and the number of launching facilities available. This finding is not too surprising, but the quantification of the relationship should add to the tools that planners and managers utilize when anticipating overuse problems.

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STUDY METHOD

The 14 lakes studied are located in the Adirondack Forest Preserve of New York State. They range in size from 851 to 6,976 acres and are scattered throughout the interior of the Preserve.

Peak-Use Measurements

Because the study was concerned with variation in use of the lakes during peak use periods, the effect of weather – a major factor influencing use – had to be restricted. Data were collected only on warm, sunny afternoons on weekends – the time when lakes typically receive heaviest boating use. Boat counts were made on four separate weekend afternoons between July 4th and Labor Day. The holiday weekends were excluded because of the extraordinarily intense use typical at those times.

Boat counts were made by aerial observation on 12 lakes and by surface counts on the other two lakes. Flight time required to survey the 12 lakes was 2 - 1/2 hours. The flight path ran from Piseco Lake north to Upper Saranac Lake, then west, then south, finishing at Fourth Lake near Old Forge. The path was flown in opposite directions on alternate sampling afternoons.

During the aerial survey, the plane was flown at about 1,000 feet above lake surfaces. An enumerator marked each boat's position, determined the type of boat and the activity in which the boat occupants were engaged – still fishing, trolling, cruising, water-skiing, etc. The average flying time over any one lake was about 5 minutes. Surface enumerators recorded identical information. They took boat-use counts three times each sampling afternoon at 30-minute intervals. Boat-use counts were averaged to determine average afternoon peak use intensity for each lake (table 1).

TABLE 1. The Adirondack lakes where peak boating-use intensity was studied

Lake	Size (acres)	Average peak use[a]
1. Cranberry Lake	6,976	0.397
2. Big Tupper Lake	6,240	.524
3. Racquette Lake	5,274	1.047
4. Upper Saranac Lake	5,056	1.107
5. Indian Lake	4,365	.887
6. Schroon Lake	4,128	2.454
7. Long Lake	4,090	1.314
8. Piseco Lake	2,848	1.106
9. Hinkley Reservoir	2,754	.510
10. Fourth Lake	2,138	2.549
11. Lake Pleasant	1,440	1.684
12. Blue Mountain Lake	1,261	1.447
13. Sacandaga Lake	1,240	1.995
14. Seventh Lake	851	2.849

[a] Average number of boats per 100 acres of water surface on peak-use weekend afternoons.

Lake Characteristics

Accessibility of the lake from population centers, facilities available, and natural beauty are a few of the many factors that have been identified as contributing to boating-use on a particular body of water (Johnston and Pankey 1968 and Vamos 1970). Although innumerable factors could have been included, the objective of this study was to determine if easy-to-measure, on-site lake characteristics could be used to account for variation in boat-use intensity during peak use periods.

Only physical lake characteristics that could be easily measured on or near a particular lake were included in the study. The 12 lake characteristics and procedures used to measure them are described in table 2. The 12 characteristics and overall peak-use figures are summarized in table 3 for the 14 lakes.

TABLE 2. Lake Characteristics and Measurement criteria

Characteristic	Measurement procedure
X_1 Accessibility	Lake accessibility to population centers of 10,000 or more, located within 85 miles of a lake. The population of each city was divided by the square of the straight-line distance from the lake to the city. The resulting quotients were then summed to provide an accessibility index for a lake.
X_2 Lake configuration	Determined by dividing the short axis of a lake by its long axis. Long narrow lakes are characterized by small values of 0.10 or less, while circular lakes theoretically would have values approaching 1.0. (Krumbein and Sloss 1958).
X_3 Launching facilities	The number of public and commercial boat-launching ramps per mile of lake shoreline. Obtained by counting the number of ramps during lake survey.
X_4 Tentsites available	The number of public and commercial tentsites per mile of shoreline. The number of tentsites at each public campground on the lake was available from the New York State Department of Environmental Conservation. Tentsites at commercial facilities were counted only if the campground had direct access to the lake.
X_5 Landscape character	The number of mountain peaks visible from the center of a lake.
X_6 Landscape diversity	The vertical angle from the center of a lake to the highest visible mountain peak.
X_7 Commercial accommodations	The number of hotels, motels, and cottage rental enterprises within 5 miles of each lake.
X_8 Traffic volume	Average daily volume of traffic on highways around or directly adjacent to each lake. Data provided by the New York State Department of Transportation.
X_9 Other similar lakes available	The number of lakes of similar size within 15 miles of the lake of interest.

TABLE 2. (Continued)

X_{10} Boat slips	Number of boat moorings per mile of shoreline. A pier was counted as space for two boats, whereas a buoy was counted as space for only one boat.
X_{11} Lake size and X_{12} shoreline length	Lake size (acres) and shoreline length (miles) were obtained from *Characteristics of New York Lakes* (Greeson and Robinson 1970).

TABLE 3. Summary of lake characteristics for 14 Adirondack lakes[a]

Characteristic measured	**Average**	**Standard deviation**	**Minimum value**	**Maximum value**
X_1 Accessibility	180.214	193.112	31.000	803.000
X_2 Lake configuration	.141	.073	.040	.310
X_3 Launching facilities per mile of shoreline	.119	.056	.051	.208
X_4 Tentsites per mile of shoreline	3.670	5.369	.000	19.697
X_5 Landscape character (peaks)	16.929	7.839	2.000	31.000
X_6 Landscape diversity (angle)	11.000	4.472	3.000	20.000
X_7 Commercial accommodations (within 5 miles)	13.357	12.695	2.000	39.000
X_8 Traffic volume (autos per day)	979.000	355.984	500.000	1,665.000
X_9 Other similar lakes available	8.241	4.791	1.000	14.000
X_{10} Boat slips per mile of shoreline	29.957	30.904	2.739	126.326
X_{11} Lake size (acres)	3,477.929	1,977.111	851.000	6,976.000
X_{12} Shoreline length (miles)	25.764	14.458	8.400	55.500
Peak boat use per 100 acres of lake	1.419	.789	.397	2.849

[a] Specific measurement procedures are described in Table 2.

ANALYSIS

A two-step procedure was used to determine the relationship between lake characteristics and peak use intensity. First, factor analysis (Harmon 1960) was used to determine those lake characteristics that were functionally related. The factor analysis was done to determine the fewest number of lake characteristics that could be used to mathematically describe a lake. Next, stepwise regression analysis (Draper and Smith 1966) was used to relate selected lake characteristics (independent variables) to peak boat-use intensity (dependent variable).

RESULTS AND DISCUSSION

Elimination of the nonsignificant lake characteristics ("X" variables) results in the following regression equation:

$$Y = .027 + 11.799\,(X_3) \tag{1}$$

Where: Y = estimated number of boats per 100 acres of lake during peak use periods.
$.027$ = constant term.
X_3 = number of public and commercial boat-launching facilities per mile of lake shoreline.

Although the equation does not fit the data perfectly, the linear relationship is evident (figure 1). The multiple correlation coefficient (R^2) for the equation is 0.69. This means that about 69 percent of the observed variation in peak lake use was accounted for by equation 1.

Several other lake characteristics were related to launching facilities. In the analysis of the correlations among independent variables, launching facilities was the most highly loaded variable in the first factor of the rotated factor matrix. Other variables that were significantly loaded on that factor were: the number of commercial hotel, motel, and cottage rental enterprises available (X_7); the number of boat slips per mile of shoreline (X_{10}); acres of lake (X_{11}); and miles of shoreline (X_{12}). These variables are implicitly represented in the regression model because of their high correlation with launching facilities. In effect, the regression model contains components of five variables related to peak lake use, not just one.

Although regression analysis is often associated with prediction, the major purpose of this study was to provide a better understanding of the variables related to recreational use intensities on the lakes studied. The regression model (Equation 1) described 69 percent of the *variation* in peak use of the 14 Adirondack lakes. The relationship is mathematically valid, but the equation does not mean that the number of launching facilities per mile of shoreline caused variations in peak lake use among the lakes, nor does it imply that heavy boating use somehow caused construction of launching facilities. Rather, the model simply quantifies the mathematical relationship between launching facilities per mile of shoreline and peak use per 100 acres of lake in 1971, the survey period.

Each lake characteristic was included in this study because of our intuitive feeling that it might be related to peak use intensity. These hunches were tested individually for validity as a statistical hypothesis about the simple correlation coefficients. A correlation coefficient in this study was significantly different from zero at the 0.05 level if it exceeded 0.457 in absolute value. For instance, it was felt that as the accessibility (X_1) of a lake improved, peak use-intensity of the lake would increase. A very slight negative correlation between these two variables was actually found.

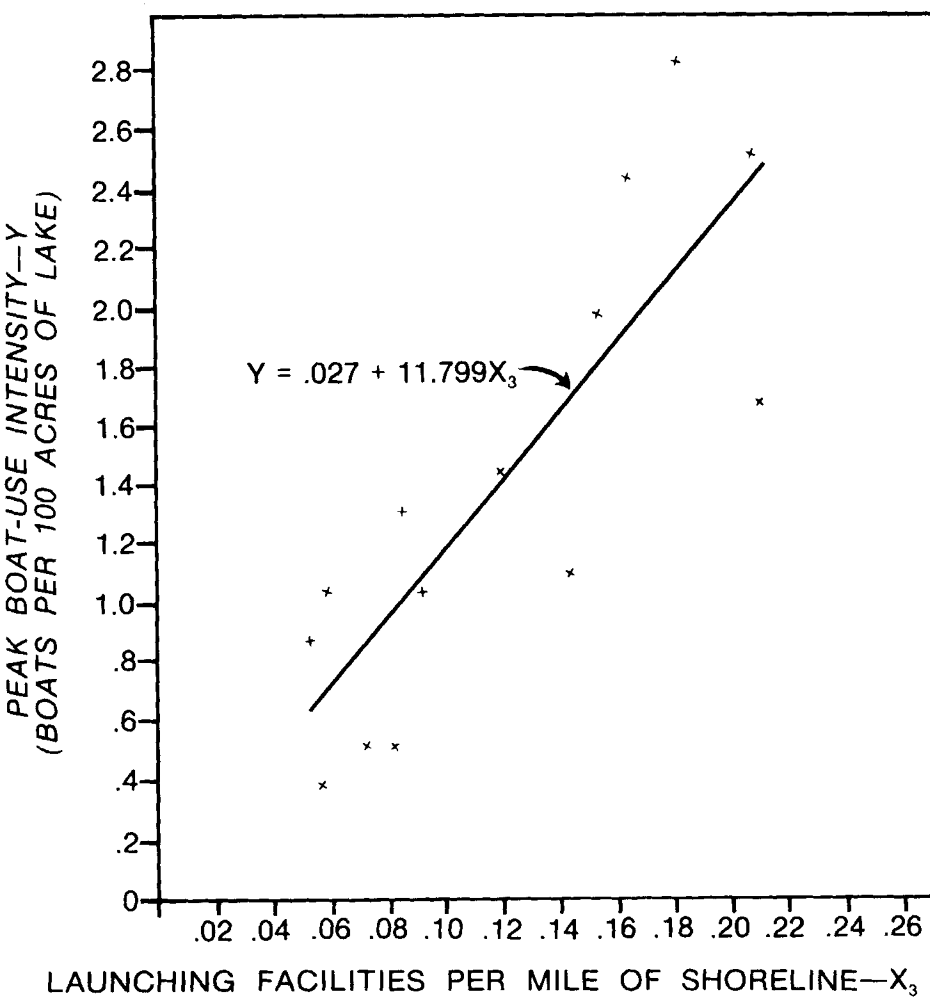

Figure 1. Least-squares regression line for estimating relationship between peak boat-use intensity and boat-launching facilities.

The same general assumption was made with regard to volume of traffic (X_8), and it too had a slight negative correlation with peak boat-use intensity. Because the sampling was done only on warm, sunny weekend afternoons, we felt that the number of tentsites per mile of shoreline (X_4) would probably have a high correlation with use intensity of the lakes. Although the relationship was positive, the correlation was barely perceptible at only 0.043.

Other characteristics not associated with peak lake use were lake configuration (X_2), landscape character and diversity (X_5 and X_6), and availability of other similar lakes (X_9).

What control do managers or planners have over peak lake use in terms of the lake characteristics considered in this study? Obviously, in the very long run, almost any lake characteristic can be changed. New lakes can actually be created; or lake environments be changed either absolutely or relative to such factors as population growth and changes in travel patterns.

Most managers are concerned with the relatively short run. What mechanisms do they have that can influence peak boat-use intensity before critical situations develop? Of course, lakes can be closed to use, use can be rationed, or quota systems can be established. These practices are possible and may be necessary in the long run, but we do not yet understand the effectiveness of such policies in terms of control effectiveness or equity to users.

Our study results indicate that the manager or planner does have some mechanisms available through which he might be able to influence use – factors that are not, in fact, fixed in the short run. A few of these directly manipulatable lake characteristics were considered in our study.

The most obvious control mechanism is the relationship between launching facilities and peak lake use. If the launching capability of a specific launching site were to be decreased or eliminated, or if charges were made during peak use periods at sites that now make no charges, the chances are good that the number of boats per 100 acres of lake would be less than if no action were taken. If, at the same time, a nearby lake that could accommodate more use than it had been receiving were to have more launching sites available, the variation in use per 100 acres of the two lakes might be decreased.

A second factor that could be manipulated directly is the number of boat slips per mile of shoreline. Commercial accommodations might be difficult to control in the short run, but long-run planning and zoning could be used to bring accommodations more in line with peak lake-use capacity. In addition, lot-size zoning might be used to decrease the number of shoreline residents, and thus the number of boat slips.

This planning tool may also exert some influence on other environmental problems that, in the long run, affect the quality of recreational experiences on lakes and reservoirs. Lake size and miles of shoreline (highly correlated in themselves), although related to peak use, cannot be manipulated in the short run. We found that tent sites available, one factor that could be manipulated to control lake use, would not be an effective control mechanism.

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