

AN INVESTIGATION OF COLORADO RIVER TRIPS:

A USER STUDY<sup>1</sup>

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The number of people taking Colorado River trips through the Grand Canyon National Park and Monument has increased dramatically during the past few years, usually on the order of 60% to 70% over each preceding year. This increased user-intensity of the River has led to observations that the environmental carrying capacity<sup>3</sup> for the area has been reached, causing a possible quality degradation in this unique recreational experience. In response, both the National Park Service and the Colorado River Outfitters Association have adopted new policies to improve the quality of the trip, and to protect this valuable amenity for future generations.

Specifically, the National Park Service limited the use of the Colorado River beginning with the 1971 season to help protect the resource. The limit was based on user-days,<sup>4</sup> and each outfitter was allocated a number of user-days based on his past volume of business. Essentially, the limit was set at approximately

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<sup>3</sup> Kormondy (1969) defines the environmental carrying capacity as the limit at which the environment can support a population.

<sup>4</sup> A user-day is defined as an individual participating in a recreational activity during one day. Thus, a person taking a 10 day river trip will count as 10 user days.

10,000 users for the 1971 season, the same number of users who participated in the 1970 trips.

However, information on which to base policy is severely limited at this time. Consequently, there is a need to gain a greater awareness and understanding of visitor expectations, perceptions, interactions, and satisfactions and dissatisfactions.

#### OBJECTIVES OF STUDY

The primary objective of this study is to obtain information directly from users on the recreational use of the Colorado River for river trips, which can be used in the policy-making process. Specific objectives are to:

1. investigate user's perceptions of crowding;
2. determine the underlying structure of the variables obtained from the questionnaire;
3. determine the types of people who participate in river trips.

#### METHOD OF STUDY

The researchers decided to investigate the long-term effects of the experience by sampling past "river-runners," using a mailed questionnaire to 1967 through 1970 participants. A random sample of 2,622 people were sent questionnaires, and 65% completed and returned them; indicating a strong interest and concern for river trips. A second attempt to contact the 35% of those sampled who did not return their questionnaires was not made. Although this might bias the results of the study, it was judged that the additional cost necessary to collect these data was not justified.

## METHOD OF ANALYSIS

The data analysis consisted of both individual question tabulation and multi-variate data-cluster analysis. The tabulation presents the intensity of responses to the individual questions. Cluster analysis was used to determine if any underlying structure of the data existed, and consisted of both variable and object analysis (Tryon and Bailey, 1970).

### CROWDING?

Recreation areas of the United States are experiencing increased crowding of available facilities, and according to some observers, the Colorado River from Lee's Ferry to Lake Mead is no exception. Of critical importance is the user's perception of a crowding problem and the relationship of this perception to regulatory actions. Since user limits have been set for the River by the Park Service, this study attempted to determine if they were justifiable, adequate, and equitable from the viewpoint of past users. Ecological parameters were not considered.

One can distinguish and measure two distinct types of crowding conditions, or potential crowding conditions, associated with river trips: (1) the size of each individual group or trip, and (2) the interaction of different groups along the River at any one time. The size of an individual trip remains constant for the duration of the excursion. On the other hand, the second condition may only exist sporadically throughout the day, when one group overtakes another group. Two or more groups often stop at the same scenic or historic place for hiking, and on occasion, more than one group will share a camping site at night.<sup>5</sup>

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<sup>5</sup> This situation is avoided whenever possible by all the outfitters operating on the River.

Individuals were asked to indicate approximately how many people were on the river trip they took, and to evaluate this as: too few, too many, or about right. Table 1 reports the results of these questions. Virtually none responded "too few" regardless of the size of their trip. The percentage of those answering "too many" seems to increase as the size of the trip increases, whereas those answering "about right" decreases as the size of the trip increases. When considering these data together, one sees that the percentages answering "about right" are greater than those for answers of "too many" until trip sizes of 41 to 50 people. This indicates that in general, for trip sizes less than 40 people, the majority of users are satisfied with the trip size, but when trips get larger than 40 people, the majority felt the size was too large.

The second type of crowding that can occur on the River is also important to river managers, outfitters, and users, as it concerns the total number of groups on the River at a given time, and their spatial distribution. Respondents were asked several questions to determine if they had seen other parties, what the effect of seeing other parties was, and what their opinions were about future management policies. More than 90% of the sample responded that they had seen other parties on the River, and their reactions are shown in Table 2. Notably, more people thought that the other groups were "reassuring" rather than "very annoying." The largest number (35.85%) thought that the other trips were "not annoying" while nearly equal numbers thought that they were "tolerable" and "enjoyable." The significance of the large number who felt that the other trips were "enjoyable" and "not annoying" should not be overlooked by the decision-makers. Only about 12% of the sample were annoyed or very annoyed at seeing other trips on the River. All other users were not overly upset by the other groups,

Table 1. Individual Reactions to Different Size River Trips

Size	% of Sample on Trip	Too Few	About Right	Too Many
1-5	0.31%	40%	60%	--
6-10	3.86%	3%	93%	3%
11-20	21.03%	--	83%	16%
21-30	35.74%	--	79%	21%
31-40	21.79%	--	62%	38%
41-50	7.98%	1%	40%	57%
over 50	9.06%	1%	36%	62%

Table 2. Reactions to Seeing Other Groups on the River

	Total	1967	1968	1969	1970
Very annoying	3%	3%	3%	2%	3%
Annoying	9%	11%	8%	7%	10%
Tolerable	25%	21%	21%	28%	26%
Not annoying	36%	34%	43%	36%	34%
Reassuring	4%	4%	3%	2%	4%
Enjoyable	22%	25%	19%	23%	22%

and in fact the majority found them at least tolerable.

One might expect some variation in response to the spatial distribution of trips when tabulated by years. The year 1967 had the fewest participants, and 1970 the most participants, so it would be useful in policy decisions to note any variations in the users' perceptions for the various years, and thus, in the different user-intensities.

There was a difference in the number of people who saw other groups when the yearly tabulations were compared to the aggregate results. In 1967, 75% of the sample saw other groups, compared to 85%, 89%, and 96% for 1968, 1969, and 1970, respectively, reflecting the increased user intensities per year. Thus, in 1970, it was virtually impossible to make the journey without encountering another party, whereas in 1967, three out of every four trips saw other groups. However, when the reactions to seeing other groups on the River are compared to both the aggregate response and to other years, there does not appear to be a difference (Table 2). Regardless of the user-intensity, and thus the incidence of encountering other groups, the participants' reactions to the other groups is consistent. However, the population of river trippers may have changed over time such that present populations have a greater tolerance of crowding than previous populations.

Cluster analysis was used to analyze information on the users' backgrounds and to help understand their perceptions of crowding.

#### WHAT IS CLUSTER ANALYSIS?

Understanding the entities that compose man's world has always been the goal of science, and cluster analysis is a general logic procedure that groups entities on the basis of their similarities and their differences. A set of variables can

logically be grouped according to one's own rational composition; however, this logical grouping procedure takes no account of the correlations among the variables. Cluster analysis of multivariate data affords the opportunity of studying the underlying structure of the data.

Cluster analysis of variables (V-analysis) was utilized to: 1) condense the variables into basic dimensions that captured a significant amount of the general covariation among the variables, and 2) select homogeneous subsets of variables that are observable representations of the basic dimensions. The goals of cluster analysis on the objects (O-analysis) was to: 1) compute the position of each of the objects within the dimensions described in variable analysis, and 2) find the points of concentration within the dimensions, i.e., the groups of people with similar characteristics in terms of the clusters defined in V-analysis.

#### APPLICABILITY TO COLORADO RIVER TRIPS' DATA

Computer analysis on all of the relevant variables produced clusters that were not judged "good" by the researchers using the criteria established by Tryon and Bailey (1970). Therefore, it was decided to use subsets of the data. The "Yes-No" questions (policy), "True-False" questions (individual values), and outdoor activity data were each run as an independent group. Other variables, e.g., income, age, etc., were included with the sub-groupings, but none of these variables appeared in final clusters.

#### CLUSTER ANALYSIS ON OUTDOOR ACTIVITIES

Cluster analysis was used to determine whether a relationship exists between the type of outdoor activities in which "river-runners" participate and their income level. V-analysis defined three clusters, but none of the income categories entered into the resulting clusters. This indicates that there is no tendency for

any group of river trip participants in the same income category to participate in certain outdoor activities.

The three clusters defined by the algorithm can be described as follows: (1) wilderness activities, (2) individual activities expending relatively little energy, and (3) individual activities expending high energy values (see Table 3). These three clusters explain 94% of the total generality and 91% of the total variability. The reliabilities (repeatability of the clusters) for the three clusters are 64%, 54%, and 46%, respectively--somewhat lower than desired, suggesting only a moderate chance of reproducing the same clusters if another sample is drawn.

These clusters are dimensions on which one can measure the individual respondents, which is the next step--developing profiles for groups of respondents using O-analysis.

Factor scores were calculated for each individual. Using the concentration points in the score space, O-analysis was able to distinguish eleven different O-types, describing all but 24 of the total sample (less than 1%). The groups are relatively "tight" with homogeneities all between 79% and 92%. Figure 1 is a graphical representation of the factor means of the eleven profiles and also, the number of participants in each O-type. In order to become a useful input, each of the groups should be studied, characterized, and stereotyped. For example, the largest group is represented by O-type 5. These are the people who ranked about average on the wilderness and strenuous activities clusters, but low relative to others on the less strenuous individual activities of cluster 2. In contrast, the smallest O-type is number 11, people who ranked very high on clusters 1 and 3, and at about the same place as O-type 5 on the less strenuous

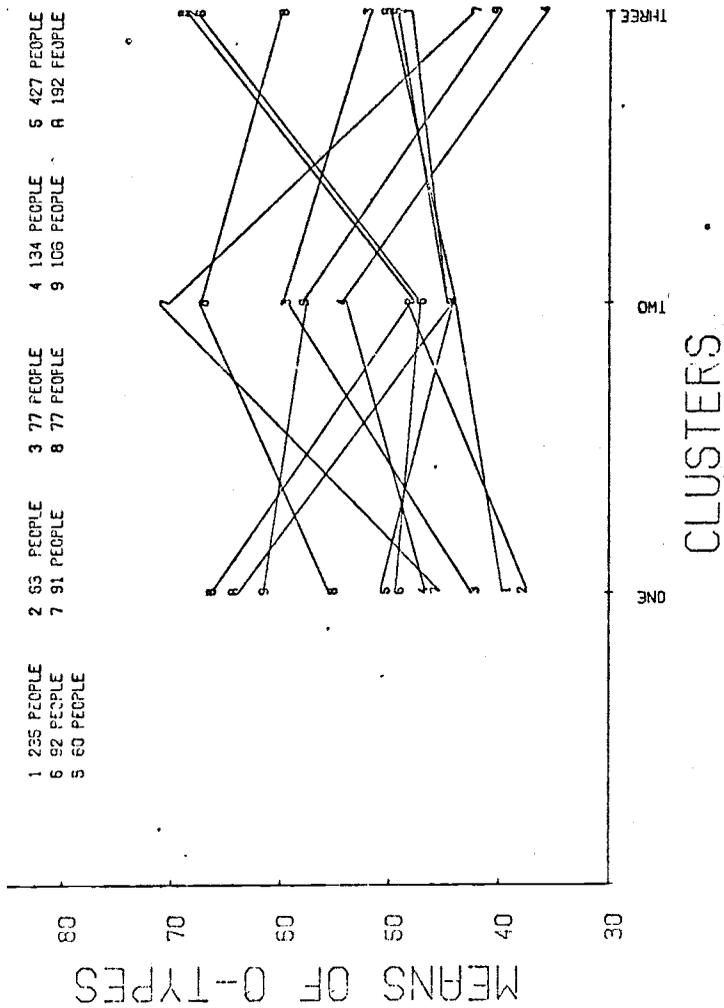


Figure 1. O-type Profiles on Outdoor Activities

Table 3. Clusters Defined on Outdoor Activities

Cluster	Definer
1. Wilderness Activities	Back-packing Hiking Camping Mountain climbing with equipment
2. Individual Activities Expending Relatively Little Energy	Fishing Hunting Golf Boating
3. Individual Activities Expending High Energy Values	Tennis Snow skiing Water skiing Not fishing

activities, cluster 2. The difference in intensities shown in Figure 2 is interesting. O-type 11 might be stereotyped as the "thrill seekers." They are interested in the thrill of the strenuous individual sports and also mountain climbing, hiking, back-packing, and camping; whereas, they are not interested in the more popular outdoor activities found in cluster 2.

Similar stereotypes can be assigned to each of the groups, giving the decision-makers a means of describing the people on the trip. For example, the second largest O-type is number 1, whose members can be described as having relatively little experience in the wilderness, and are generally non-participants in other outdoor activities. On the other hand, the second smallest group is O-type 2, whose members also have had little wilderness experience, but are very active in outdoor activities, especially in the strenuous ones.

O-types 9 and 10 are fairly large, and represent the other extreme--people with considerable wilderness experience. However, they differ in the type of outdoor activities in which they engage. Members of O-type 9 participate in the less strenuous outdoor activities rather than the strenuous ones, while the group represented by O-type 10 prefers the strenuous activities.

O-type 8 only represents 77 people, but they are the "super active" ones. They have had moderate wilderness experience and appear to engage in both types of outdoor activities regularly. The 91 members of O-type 7 are an interesting group. They have had some wilderness experience, do not generally engage in strenuous activities, but are the most active in the non-strenuous ones.

#### CLUSTER ANALYSIS ON "YES-NO" QUESTIONS

V-analysis on these data defined three distinct clusters that explain 78% of the total generality and 71% of the total variability for the data. The cluster reliabilities are lower than the desired 100%; 60%, 45%, and 42%, respectively, however they still provide valuable information. The clusters can be described as: (1) more trips, (2) management appreciation, and (3) wilderness regulation (see Table 4).

Once again, a factor score for each participant was calculated on each cluster, and the resulting factor means are shown in Figure 2. Ten O-types were distinguished in the O-analysis, classifying all but 69 of those sampled (less than 1%). The overall homogeneities of the O-types are generally high (81% to 95%), suggesting "tight" groupings.

There appear to be only two response areas for cluster 2: those who did not appreciate the trip management, and those who did; while clusters 1 and 3 seem to attract strong, medium, and low responses. For example, O-types 2, 6, and 10 can

Table 4. Clusters Defined on the "Yes-No" Questions

Cluster	Definer
1. More Trips	<p>A river trip is something I would do more often if I had more time.</p> <p>I would go on more river trips if I had more money.</p> <p>Do you expect to take more Colorado River trips through the Grand Canyon?</p> <p>Do you plan to run other wilderness and/or white water rivers?</p>
2. Management Appreciation	<p>Did the boatmen make your trip more enjoyable by pointing out natural phenomena?</p> <p>Were you encouraged to leave your campsites in better condition than when you had found them?</p> <p>Did you find what you were looking for on the trip?</p> <p>Did you feel that you had enough time for exploring on your trip?</p>
3. Wilderness Regulations	<p>Should people be encouraged to take river trips within the Grand Canyon?</p> <p>Do you consider an outboard motor a necessary part of a safe, pleasurable trip?</p> <p>Should more developments like the Phantom Ranch be built along the Colorado River?</p> <p>Not: Do you believe that the Colorado River should be maintained as a wilderness river within the Grand Canyon?</p> <p>Not: Should the number of people taking river trips through the Grand Canyon be limited?</p>

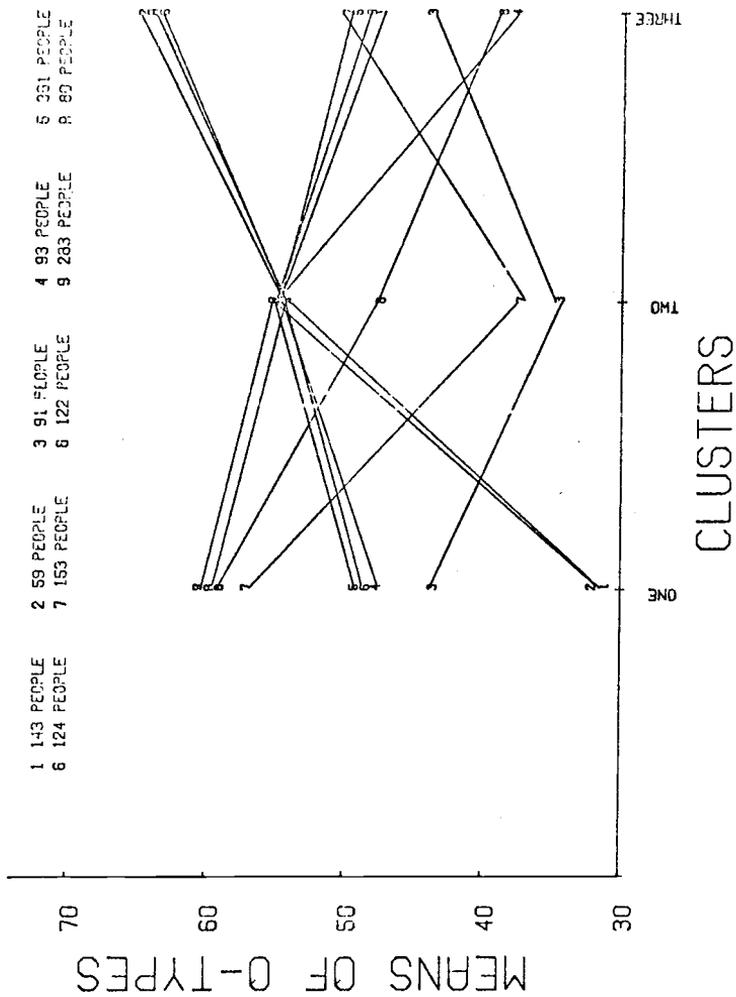


Figure 2. O-type Profiles on "Yes-No" Questions

be characterized as really appreciating the trip management, wanting to see regulatory policies initiated, and vary from desiring no additional river trips to planning to make more Colorado River trips. These groups all contain nearly the same number of participants. Those wanting to make additional river trips and also wanting regulatory policies appear somewhat hypocritical.

The largest group, O-type 5, are those who are moderate about taking more trips and desiring more regulations, but really enjoyed the trip. O-types 7 and 3 did not enjoy the management, were moderate about wilderness regulations, but O-type 7 was slightly more interested in taking more river trips. These are the people who perhaps wanted a type of experience that they did not completely receive.

#### CLUSTER ANALYSIS ON "TRUE-FALSE" QUESTIONS

V-analysis distinguished four distinct clusters that were able to account for 98% of the total generality and 95% of the total variability. The clusters can be described as: (1) learning, (2) trip experience, (3) "get away," and (4) wilderness adventure (see Table 5). The reliabilities for the first three clusters are reasonable (69%, 59%, and 60%, respectively), but the fourth cluster's reliability is low, 28%. The cluster was retained, however, for O-analysis.

The O-analysis found seven O-types using the "True-False" data (see Figure 3). The overall homogeneity of O-types ranges from 75% to 97%, and only 99 participants (less than 1%) are not represented in the O-types.

O-types 1, 6, and 7 represent the three largest groups of people, and are very similar in their characteristics. All three rate high on the trip experience, thought that it provided the opportunity to "get away," and perceived the trip as a wilderness adventure. Those members of O-type 1 felt that the trip was less

Table 5. Clusters Defined on the "True-False" Questions

Cluster	Definer
1. Learning	allows one to learn about himself allows one to gain communion with God allows one to learn about other people allows one to test his physical abilities
2. Trip Experience	is a unique experience allows one to observe the beauty of Nature allows one to enjoy the companionship of camp life allows one to get away from the im- personal urban environment
3. "Get away"	allows one to get away from the tech- nology of civilization allows one to "get away from it all" allows one to get away from pollution allows one to get away from people
4. Wilderness Adventure	is full of excitement and adventure is a wilderness experience

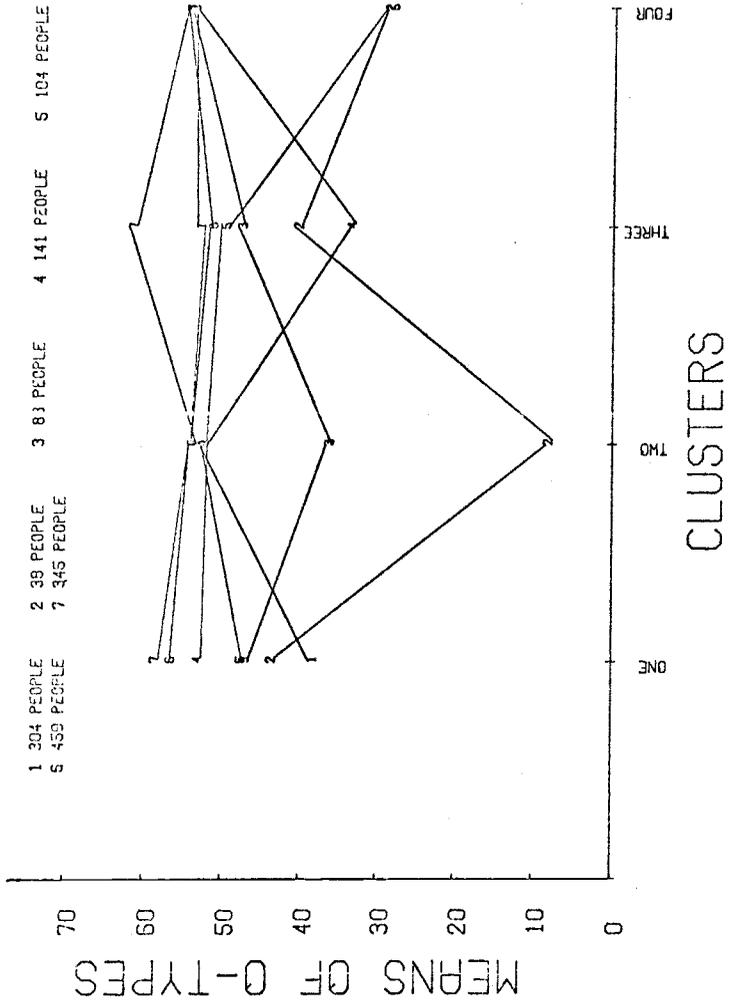


Figure 3. O-type Profiles on "True-False" Questions

of a learning experience than those in the other two O-types. Generally, these are the people who probably enjoyed their entire river trip. In contrast to these three O-types, the smallest group is represented by O-type 2. These are the people who tended not to appreciate the trip; they did not believe the trip was a learning experience; they ranked considerably lower than any of the other O-types on the trip experience cluster, and they did not feel that the trip allowed them to "get away" or that it was a wilderness adventure. These people are probably the chronic complainers who regularly give negative feedback to the National Park Service.

#### MANAGEMENT IMPLICATIONS

The cluster analysis results can become a useful tool of policy-making institutions. Both the Park Service and the outfitters should gain some understanding of the variables that comprise each of the clusters, and look at the profiles of the people, noting the size of each of the O-types. This will enable them to know more about the people who make rivers trips, and thus, to better determine the type of trips desired.

Cluster analysis will be used in future work to predict which groups of people defined in O-analysis perceive a crowding problem.

#### REFERENCES

- Kormondy, Edward J., Concepts of Ecology. Prentice-Hall, Inc., Engelwood Cliffs, N. J., 1969.
- Tryon, Robert C., and Daniel E. Bailey, Cluster Analysis. McGraw-Hill Book Co., New York, 1970.