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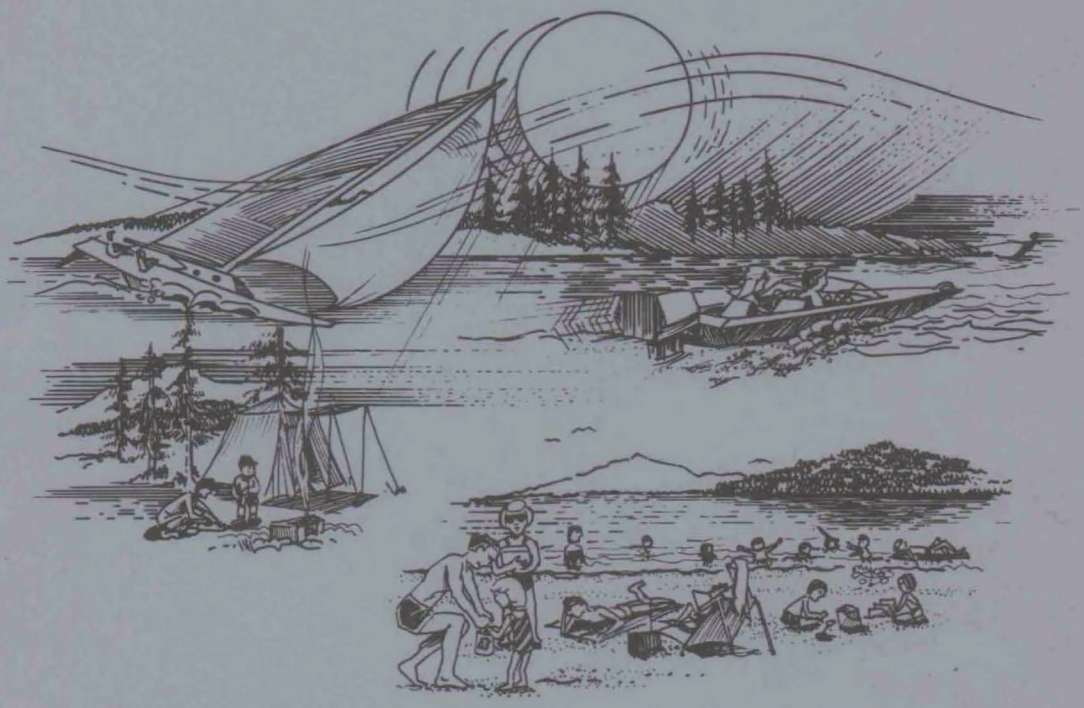

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VISITOR CROWDING AND CONFLICT AT WHISKEYTOWN: A CARRYING CAPACITY APPROACH

INTRODUCTION

This is the fifth and final in a series of reports resulting from research undertaken by the National Park Service and Oregon State University at the Whiskeytown Unit of the Whiskeytown-Shasta-Trinity National Recreation Area. Research at Whiskeytown, begun in 1984, has focused on issues of concern to National Park Service (NPS) staff. Primary objectives of the project have been to:

1) provide managers of the Whiskeytown Unit with a description of current use patterns on the lake; and
2) describe areas of conflict among user groups and between recreation activities.

Data were collected during the summer of 1985, when close to 3200 Whiskeytown visitors were contacted at various locations around the Lake. (See "Whiskeytown -- An Overview of the Visitor and the Recreation Resource" by Lee et al., 1986, OSU/CPSU 86-8 for a complete discussion of the sampling and survey methods used.) Results of the visitor survey are presented in a series of five reports. Prior reports include:

-- "People, Human Behavior and Water-based Recreation: A Working Bibliography" by Martinson and Field, 1985, OSU/CPSU 85-5. The report focuses on human behavior at water-based recreation locations and includes references

describing recreationists, water based recreation locations, visitor perceptions of water resources and management of water-based recreation areas.

- "Recreation Places: A Description of Recreation Sites at Whiskeytown" by Stark et al., 1986, OSU/CPSU 86 3. This report provides a description of the physical, social, and managerial characteristics of the 16 Whiskeytown locations around which the research effort was organized. Sites reflect the variety of physical settings, activities, and levels of management and development found at the Whiskeytown Unit.

- "Whiskeytown -An Overview of the Visitor and the Recreation Resource" by Lee et al., 1986, OSU/CPSU 86 8. This report describes current recreation use at the Whiskeytown Unit.

- "Human Use Issues at Whiskeytown: Visitor Perceptions of Management and Impacts" by Lee and Field, 1988, OSU/CPSU 88-4. This report focuses on visitor response to National Park Service management programs and recreation-related environmental impacts at Whiskeytown. Visitor expectations of available facilities and activities and perceptions of environmental and social impacts are discussed along with implications of these findings for Whiskeytown managers.

Objectives

Results presented here focus on visitor crowding and conflict at Whiskeytown using carrying capacity as the organizational framework from which to view these issues. Early in the Whiskeytown project planning stages, NPS managers participated in a nominal group exercise whose purpose was to place in priority order the most important human use issues and perceived problems at Whiskeytown. Results of this exercise were used in formulating research objectives for the Whiskeytown project. Overcrowding and knowledge of visitor

carrying capacity at developed sites emerged as two important issues. As a result, primary objectives of the Whiskeytown research effort included: 1) providing managers a description of conflicts between user groups; 2) providing input for establishing baseline parameters to assess crowding at Whiskeytown; and 3) outlining a process for monitoring use impacts over time. The current report addresses these issues using carrying capacity as the organizing framework.

The report is organized into four sections. Following this introduction, background is provided on the carrying capacity framework, focusing on past research on social carrying capacity and crowding. The importance of a partnership between research and management is discussed along with a brief description of management strategies developed to assess and monitor social carrying capacities. The background section ends with a cautionary note regarding carrying capacities, suggesting that managers can only do so much in shaping recreation experiences because users differentially adapt to recreation settings.

Findings on conflicts, crowding, and other carrying capacity issues at Whiskeytown are presented in the third section of the report. Comparisons are made among various developed and undeveloped sites around the lake and Whiskeytown results are compared with other similar case studies.

The final section of the report discusses recommendations for Whiskeytown managers based on these findings, including factors to consider in setting up a program to monitor visitor use and related impacts over time.

BACKGROUND

Carrying Capacity: An Organizational Framework[1]

As a result of rapidly expanding recreation use in the 1950's and 1960's, concern arose over appropriate use levels in outdoor recreation areas. Interest in impacts of recreation on the natural resource base predominated, though there began to emerge interest in the effects of increased use on the quality of the recreation experience. Carrying capacity emerged as an organizational framework used to help formulate outdoor recreation policy regarding impacts.

Carrying capacity has an extensive history in natural resources, particularly in wildlife and range management where it refers to the number of animals that can be maintained in a given habitat (Dasmann 1964).

Carrying Capacity and Outdoor Recreation

Lowell Sumner, a National Park Service wildlife technician, perhaps first suggested applying the concept of carrying capacity to outdoor recreation when in the mid-1930's, he questioned "How large a crowd can be turned loose in a wilderness without destroying its essential qualities?" (Sumner 1936). A little more than a decade later Wagar (1951) listed carrying capacity as one

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[1]Much of this review of carrying capacity is taken from Manning, R.E. 1987. Studies in Outdoor Recreation. Corvallis, Oregon State Univ. Press.

of eight major principles in recreation land use. The concept became a more formal part of the outdoor recreation field when listed as a major issue in Dana's (1957) analysis of forest recreation research and in the writings of the Outdoor Recreation Resources Review Commission (ORRRC 1962).

The first major application of carrying capacity to outdoor recreation came in the early 1960's with work done by Wagar (1964) and Lucas (1964a). Wagar expanded the idea of carrying capacity to include consideration of the social environment as well as the physical/biological environment. He suggested that as more people visit an area, not only are the environmental resources affected, but also the quality of the recreation experience. The effects of increasing use were seen to affect visitor satisfaction, the effects varying depending on visitor needs and motivations. Thus a carrying capacity is not a fixed number and will vary over time and situations.

Lucas (1964a) made a preliminary attempt to estimate the recreation carrying capacity of the Boundary Waters Canoe Area, Minnesota, and found that perceptions of crowding by different user groups varied. Paddlers were found to be more sensitive to crowding than motor canoeists, who were more sensitive to crowding than other motor boaters. A range of carrying capacities was estimated based on these different values.

The view of carrying capacity was later expanded to include, in addition to environmental and social considerations, a recognition of the role of management activities (Wagar 1968). For example, the durability of environmental resources might be enhanced through practices such as fertilization, and irrigation, and periodic rest and rotation of impact sites. In addition, the quality of recreation experiences might be enhanced by redistributing visitors, using appropriate rules and regulations,

providing additional visitor facilities and educational programs to encourage desirable visitor behavior.

This three-dimensional view of carrying capacity remains today and is reflected in four types of carrying capacity identified in the literature (Shelby and Heberlein 1986). Ecological capacity is concerned with the affects of use levels on the ecosystem (e.g. damage to vegetation and soil compaction); physical capacity relates to the amount of space available within an undeveloped, natural area (e.g. the number of people that can camp on a beach); facility capacity is concerned with the number of people who can use a visitor facility within a specified period of time; and social capacity is related to impacts which detract from or change the recreation experience. Any one or a combination of these four parameters may limit the appropriate use level of a resource. However, social carrying capacity has been a primary concern for resource managers because it is often the most limiting factor in unique or backcountry areas and is often the most difficult capacity to determine.

Different resource settings and the activities users participate in will affect the acceptable carrying capacity. For example, a river system's physical capacity is commonly quite high. A stretch of river is usually long enough and wide enough to hold a great many users. Ecological capacities may be somewhat lower, especially in areas with unique and sensitive vegetation or natural formations. Facilities can often be a limiting capacity if parking areas along the river or accesses are small or few, a common problem at most remote rivers. Social capacity is often the limiting factor in any wilderness-type areas, including river settings, but can be quite high on more

developed rivers where users are not pursuing a solitude experience. These generalizations tend to hold for both lake and beach settings. In natural areas physical capacities are often high and social norms will usually restrict the acceptable number of people which can fit in an open space before the physical capacity is met. Ecological characteristics of beach areas are likely more tolerant of high use than lakes or rivers because of limited vegetation and durability of the beach to heavy foot traffic. Facility capacity will vary by the type and degree of development in an area.

Social Carrying Capacity

Social capacity, the focus of this report, is often more difficult to assess than the other three types because it deals with impacts on the recreation experience. This capacity is based on human values and attitudes which cannot be directly manipulated by managers. Perceptions of crowding and preferred levels of encounters are factors by which visitors evaluate social capacities (Shelby and Colvin 1981).

Perceived Crowding

"Crowding" is a subjective term used to define a specific density. Density is an objective measure of the number of people in a specified area (Shelby and Heberlein 1986). A density has no inherent value (Freedman, 1975) but the sensation of being crowded is a negative evaluation of a particular density. Crowding cannot simply be determined by measuring average density because use is often concentrated in the most desirable areas. An individual's psychological determination of a crowd is based on his/her

definition of the appropriate number of people in a certain situation (Shelby and Heberlein 1986). For example, 500 people at a concert in a park may not be defined as crowded but 500 people around a small alpine lake probably would be. Depending on the normative definition of the situation, people can feel crowded regardless of physical space available.

Using Crowding to Assess Carrying Capacity. Perceived crowding is one indirect means of assessing social carrying capacity. For example, if there are 100 people in an area and if 99 of them feel "not at all crowded" and one feels "slightly crowded," social carrying capacity probably has not been reached. However, if everyone feels "extremely crowded," capacity probably has been exceeded (Shelby and Heberlein 1986). The key is to determine the point where perceptions of crowdedness move from acceptable to unacceptable levels.

Shelby and Heberlein (1986) suggest two ways that perceived crowding can be used to approximate an evaluative standard for appropriate levels of use. The first is to assess the percentages of visitors who feel crowded. Comparing data from 22 different studies that utilized the same single measure of crowding, Shelby and Heberlein (1986) suggest that capacity has probably been exceeded if more than two-thirds of the visitors feel crowded. If fewer than one-third feel crowded, the area is probably below carrying capacity. When perceived crowding falls between these two thresholds, no determination can be made with this standard.

A second way perceived crowding can be used to approximate a standard for carrying capacity is identifying "break points," where large increases in perceived crowding occur at certain use or contact levels (Shelby and

Heberlein 1986). By looking at the relationship between use levels and perceived crowding it may be possible to identify points, or certain levels of use, where perceived crowding increases rapidly after remaining fairly constant at low use. That point might be considered a social carrying capacity. A similar procedure is suggested by Hendee et al. (1978) as a means of setting limits of acceptable environmental change due to human use in wilderness areas. Both groups of researchers are quick to point out that such obvious break points may not always exist and it may be difficult for managers to establish limits on this basis alone.

Factors Related to Perceived Crowding. A disadvantage of using perceived crowding as the sole means of determining carrying capacity is that there is not a strong relationship between crowding and use levels (Manning 1986). Perceptions of crowding have been found to be related to a number of other variables such as personal characteristics of recreationists, type and location of encounters among visitors, and setting considerations.

Personal Characteristics of Visitors. Researchers have found that motivations for recreation, expectations and preferences for encounters with other visitors are closely related to perceived crowding. In a study of recreationists on the Buffalo National River, Arkansas, Ditton et al. (1983) found motivations for the river trip such as "to get away from other people" or "to be part of a group" were significantly related to perceived crowding. They also found expected and preferred contacts were related to perceived crowding, with recreationists seeing more people than expected or preferred feeling more crowded. Other studies relating motivations to perceptions of

crowding include Absher and Lee's (1981) study of backcountry hikers in Yosemite National Park and Schreyer and Roggenbuck's (1978) study of floaters on the Green and Yampa rivers in Dinosaur National Monument.

Research focusing on the influence of preferred and expected contacts on crowding includes studies of campers at Katmai National Monument in Alaska (Womble and Studebaker 1981), and hikers at Mount McKinley National Park (Bultena et al. 1981).

Presenting data from six different studies of various recreation activities, Shelby et al. (1983) found that expectations tended to show a more consistent effect on crowding than did preferences for contact,s and both explained more of the variation in perceived crowding than actual contacts. Similar results were reported in a study of visitors to an eastern wilderness area (Vaske et al. 1982).

Experience level of users also influences perceived crowding, with more experienced users appearing more sensitive to higher use densities (Vaske et al. 1980; Ditton et al. 1983; Towler 1977; Murray 1974). This finding appears to hold true regardless of whether experience is measured as general experience in an activity, rate of participation, experience on-site, or some other measure (Manning 1986).

Attitudes of users toward wilderness values have also been found to influence perceived crowding, with those with the most "purist" attitudes reporting higher degrees of crowding (Schreyer and Roggenbuck 1978).

Characteristics of Those Encountered. There is considerable evidence that the characteristics of those encountered also affect perceived crowding.

Factors found to be important include type and size of group, behavior, and the degree to which groups are perceived to be alike (Manning 1986).

For example, in a classic study of canoeists and motor boaters in the Boundary Waters Canoe Area (BWCA), Lucas (1964a,b) found that paddling canoeists disliked encountering motorboats and felt crowded at much lower levels of use when motorboats were present. Stankey (1973; 1980) also found differential crowding effects based on mode of travel among wilderness users.

Lime (1972) has suggested that party size also affects perceived crowding and research on wilderness users supports this idea; a majority of users would prefer to see five small parties during the day rather than one large party (Stankey 1973).

Behavior of other groups also seems to affect crowding. Driver and Bassett (1975) found that fishermen and streamside residents on the Au Sable River in Michigan objected to seeing canoeists more because of inconsiderate behavior, such as yelling and shouting rather than sheer numbers. West (1982) studied behavior and crowding among forest hikers and found that negative behavior in addition to high perceived density resulted in much higher levels of perceived crowding than high density alone. The number of disruptive encounters among floaters on the Guadalupe River, Texas, was found to be a more consistent prediction of perceived crowding than any other measure, including perceived density (Titre and Mills 1982).

The third characteristic of other groups that seems to affect crowding is the degree to which groups are perceived to be alike. This factor seems closely related to behavior, but is more difficult to measure and study (Manning 1986). Lee's (1972) work on the social definition of outdoor

recreation places suggests that people choose recreation places where they can be with others similar enough to themselves to be able to take for granted everyday behavioral norms. From this view, it is not so much the number of other users present, but a shared system of values and behavioral norms.

This concern for alikeness is illustrated in an observational study of fishing and other recreation behavior at high mountain lakes in Washington State (Hendee et al. 1977). Eighty percent of fishermen fished within 20 feet of a companion, but 75 percent remained 100 feet or more from people in other parties. Little conversation was observed with those in other parties.

In a reexamination of the conflict between canoeists and motorboaters in the Boundary Waters Canoe Area (Lucas 1964a), Adelman et al. (1982) assessed the perceived similarity of each group of users to the other. The majority of motorboaters perceived paddling canoeists as similar to themselves, while the majority of paddling canoeists perceived motorboaters as dissimilar to themselves. Thus, it appears that perceptions of similarity or alikeness between recreation groups may be closely associated with perceptions of crowding.

Situational Variables. The environment in which encounters occur apparently influences the ways in which those encounters are perceived and evaluated. Important variables include the type of recreation area, location within an area, and environmental design and quality of the recreation area (Manning 1986).

Differences in crowding among different types of recreation areas is a fairly intuitive idea, though not a lot is known about this issue.

McConnell's (1977) study of density and crowding found different relationships at different types of beaches ranging from a natural area to a highly developed "singles" beach. Manning and Ciali (1981) also found different patterns of desired use density among users of six river types ranging from "primitive torrent" to "urban meander."

More emphasis has been placed on intra-area differences in crowding, particularly related to campsite location. Wilderness visitors tend to prefer campsites far away from others (Burch and Wenger 1967; Stankey 1973; 1980; Lucas 1980).

Hammitt (1983) has suggested that crowding may also depend on the physical, non-human environment. The amount and configuration of facilities, for example, may contribute to feeling crowded. This issue has received little research, though in a study of crowding in a national park campground, Womble and Studebaker (1981) found proximity of campsites and insufficient facilities as contributing to perceptions of crowding.

A related consideration is the perceived quality of the recreation environment. Research findings suggest that visitors are often more disturbed by the presence of litter or other environmental degradation than by contacts with other visitors (Vaske et al. 1982; Stankey 1973; Lee 1975; Lucas 1980).

Perceived crowding is obviously a complex phenomenon influenced by many interrelated factors -- personal characteristics of visitors, characteristics of those encountered, and situational variables such as type of area and environmental quality. Due to the difficulty in measuring all of the factors that affect perceived crowding, it can, by itself, be only used to approximate social carrying capacities. Crowding is, however, a useful and important indicator of potential conflict in recreation settings.

Contact Preference Standards

A second approach used in determining social carrying capacity involves focusing specifically on encounters with other parties rather than perceptions of crowding. This approach is described in depth by Shelby and Heberlein (1986) in their book Carrying Capacity in Recreation Settings. "Contact preference standards" are based on shared beliefs among recreationists about the "appropriate number and type of encounters for a particular setting" (p. 74). Also called encounter norms, these standards can be determined for various settings basically by asking recreationists the number of people or contacts consistent with a particular kind of experience. Social carrying capacities can be based on contact preference standards when visitors agree about the type of experience to be provided and the appropriate number of contacts for that experience (Shelby and Heberlein 1986).

Factors Related to Contact Preferences. Preferences for contact with other users is closely tied to perceptions of crowding. If we encounter what we think are too many people, we will likely feel crowded. Thus, many of the above factors that influence perceived crowding can also influence preferences for contacts. Three important factors are the activity, the situational definition, and particularly the experience to be provided.

For example, water based activities, such as waterskiing, are often a large part socializing with family and friends (Field and Cheek 1974). In a study of Lake Mead (USDI 1980) it was found water skiers often traveled in large groups, a third in groups larger than eleven people. The activity itself requires cooperation between several users including the skier and boat

driver. Contacts with other groups would likely not bother water skiers unless they physically got in the way. On the other hand, trout fishing tends to be a solitary activity and fishermen usually prefer to be alone or in a group of two, and not to encounter other groups (Driver and Basset 1975). Users participating in different activities appear to have different encounter norms.

The number of contacts is not always as important as the type of contact. Encounters with certain types of user groups are less acceptable than encounters with others. Canoers on the Bois Brule River had a low tolerance for contacts with innertubers (only 3 contacts were considered acceptable) but were much more tolerant of contacts with trout fishermen (Vaske 1978). Almost all user groups at Lake Mead were annoyed by waterskiers but were not bothered by other groups of users (USDI 1980). Both canoeists in Boundary Waters Canoe Area and river runners in the Grand Canyon felt crowding occurred at a much lower level of encounters with motorized as opposed to non-motorized travelers (Lucas 1964a, Shelby and Nielsen 1976).

The situational definition also influences encounter norms. Numerous studies have demonstrated that the acceptable number of camp encounters at night is considerably lower than encounters with groups during the day (e.g. Shelby 1981, 1980, Shelby and Nielsen 1976, Shelby and Colvin 1979, 1981).

The type of recreation experience opportunities that are available in an area will influence the number of contacts that are acceptable among groups in that area. Shelby (1981) found that visitors defining a wilderness-type experience preferred to encounter fewer other groups than river runners defining a more developed recreation experience. Schreyer et al. (1976) note

that certain resources are associated with specific kinds of experiences. The character of a whitewater river may imply a primitive, wilderness-type experience, while the character of an urban beach may imply a social, developed experience.

An individual's or group's norms for encounters and perceptions of crowding are contingent on numerous factors. Still, these two measures can be helpful in establishing social carrying capacities.

Capacities can be based on contact preference standards when visitors agree about the type of recreation experience to be provided and the appropriate number of contacts for that experience (Shelby and Heberlein 1986). These standards were developed for canoers on the Boise Brule River in northwestern Wisconsin, floaters in the Grand Canyon, and river runners on the Rogue River in southwestern Oregon (see Shelby and Heberlein 1986 for a discussion of methods and results).

Perceptions of crowding can be used as a rough indicator of carrying capacity, to make comparisons among areas, and to identify problem areas. Both approaches provide information useful in looking at visitor use levels and impacts on recreation experiences.

Conflicts

Another issue often related to increasing use levels is conflict among recreation uses. There are many different causes for conflicts among recreationists using limited resources. However, studies have shown that managers often have incorrect conceptions of what the causes are and, therefore, take actions which don't affect, or further complicate, the

situation. For instance, overuse of a resource is often not as much the problem as is crowding or concentrations of use at particular attraction sites or during certain times.

Gramann and Burdge (1981) examined conflicts between waterskiers and fishermen and determined that the problem was due to incompatibility of recreation goals between the two groups. Fishermen who reported tranquility, nature enjoyment, and tension release as important reasons for fishing were bothered more by skiers than those fishermen whose goals were thrill-seeking, exercise, or meeting and observing people. The authors also determined that conflicts increased as contact levels increased between the two groups.

Driver and Bassett (1975) attributed conflict among canoeists and fishermen on the Au Sable River to incompatibilities in the kinds of psychological satisfactions desired from an experience, as well as different groups' definitions of appropriate social behavior and high contact levels. River users defined unacceptable behavior and a lack of consideration as the primary conflicts.

In studies of several whitewater rivers, conflicts have noted between motorized and nonmotorized travelers (Schreyer et al., 1976; Shelby 1980; Shelby and Nielsen, 1976). Floaters on oar trips generally felt that motorized use was inappropriate for such areas. However, motorized users were often not at all bothered by nonmotorized users. Conflicts between user groups are often one-sided, a condition referred to as "asymmetrical antipathy" (Heberlein, 1977, Adelman et al. 1982).

It appears that conflict occurs primarily due to inappropriate behavior by one or more user groups as perceived by another group. As with perceived

crowding, conflicts tend to increase as contact levels increase. However, contact levels are not always directly related to use levels (Heberlein and Vaske, 1977) so managers should not attempt to alleviate conflict simply by decreasing use. Different users pursuing a variety of activities will perceive contacts differently. In their study of paddling canoeists and motorcraft users in the Boundary Waters Canoe Area (BWCA), Adelman et al. (1982) found that perceived similarity, perceptions of the type of experience the BWCA provided, reasons for coming, competition for resources, and greeting behaviors influenced the one-sided conflicts between these two groups. What is important is to identify "the conflict potential of various recreation resource clientele. . ." (Jacob and Schreyer 1980) and determine the social carrying capacities for different types of recreation experiences desired by visitors.

Carrying Capacity and Conflict Research Study Areas

The Whiskeytown Unit of the Whiskeytown-Shasta-Trinity National Recreation Area is a reservoir in Northern California managed by the National Park Service. To provide a basis for addressing carrying capacity issues at Whiskeytown, the following section reviews carrying capacity research at reservoirs and in National Park Service areas.

Crysdale (1973), in addressing the issue of carrying capacity at reservoirs, suggests the carrying capacity considerations at water impoundments are particularly complex due to the wide variety of activity groups attracted to the resource. As opposed to a single major activity, such as skiing on a ski hill or white water boating on a white water river, primary

activities at or adjacent to reservoirs commonly include swimming, fishing, sailing, waterskiing, canoeing, jet skiing, picnicking, sunbathing, and camping. Because of the large number of activity groups recreating within the confines of the shore area, visitor conflicts will commonly occur at reservoirs which have reached or are approaching their use saturation levels.

Reservoirs are commonly located close to urban areas resulting in significant numbers of users from the local population. At Lake Shelbyville reservoir considerable conflict was observed between local residents and transient recreationists (Roper 1981). The major problem, as viewed by the locals, was objectional behavior on the part of transient recreationists (e.g., littering and invasion of private property.) Therefore, conflict between locals and non locals is a consideration for managers of reservoirs.

Several significant carrying capacity studies have been conducted in National Park Service areas including Grand Canyon National Park, Dinosaur National Monument, and Lake Mead National Recreation Area.

Shelby and Nielsen (1976) conducted an indepth study of Colorado River boaters in the Grand Canyon. A primary objective of the study was to identify the sociological carrying capacity of the area.

Schreyer and colleagues (Shreyer et al. 1976) studied the recreational river use of the Green and Yampa Rivers in Dinosaur National Monument in 1975. With an annual growth rate of white water use in the Monument of 55 percent, the Park Service felt an urgency to determine a carrying capacity for river running and to develop appropriate management strategies to prevent deterioration of the resource while maintaining a high quality recreation experience.

In 1978 the National Park Service conducted a carrying capacity study at Lake Mead National Recreation Area (USDI 1980). The purpose of this effort was to determine the maximum number of boats which could be accommodated at one time in various zones of the lake. They were also interested in describing Lake Mead visitors according to primary activities, area of the lake visited, and their degree of satisfaction, conflict, and crowding.

Science/Management Partnership

Quality research provides the data for carrying capacity decisions. Resource managers provide judgments to evaluate the data, based on agency objectives, their own expertise, and public input. Valuable information about recreation carrying capacity in backcountry areas has come from the NPS and numerous other studies. A good base has been laid for continued research and management action. But, as the literature emphasizes, managers and researchers must cooperate and work together if the data base is to be used adequately. In developing any carrying capacity, it is necessary to consider all the interrelated qualities of the visitor, resource, management objectives and constraints, and existing situations (Brown, 1977).

Research must provide the data and methods while management must provide the criteria for evaluating the data. For instance, managers need to know what the users' values and perceptions are before they can identify what makes up a quality experience. Theories from social psychology on norm development and perceptions of crowding have provided researchers with the background for studying these issues. The link between science and management is inseparable but the critical issue is application. Research must provide an application

of important strategies and managers must use applications based on sound scientific research.

Applying the Carrying Capacity Framework

Three approaches have emerged in the resource management literature which apply research findings to management issues related to carrying capacities: (1) Limits of Acceptable Change (LAC), (2) Carrying Capacity Assessment Process (CCAP), and (3) Visitor Impact Management (VIM).

Limits of Acceptable Change (LAC)

One of the first applications of carrying capacity research for resource managers was the model of LAC by Stankey (1973) as it applied to wilderness settings. Stankey described three basic components of the model:

1) Consider the source(s) of change on the recreation resource, in this case wilderness. The source(s) of change .re impacts from recreation use. The components considered are:
    a) the amount of use encountered;
    b) the type of use encountered;
    c) the space and time in which encounters occur; and
    d) the behavior of the recreationists encountered.
2) Identify the definition of "acceptable" change considering internal and external constraints, including federal regulations, administrative policies, user input, ecological input, the decision maker's perception of the problem, and knowledge.
3) Finally, adopt techniques to manage the resource within the limits of acceptable change (i.e., rationing, reducing visitor impacts, restoration).

The LAC model has more recently been formalized as a nine-step planning process (see Stankey and McCool 1984). The focus of the LAC process is on "management of the environmental and social conditions identified as desired" (p. 466). They suggest a misconception in traditional carrying capacity studies has been an emphasis on the relation between use levels and impacts in attempting to determine how much is too much. Instead, they submit the emphasis should be on "location, type, and level of change considered appropriate and acceptable in an area and the actions consistent with protecting an area from changes in excess of those judged acceptable" (p. 466).

Carrying Capacity Assessment Process (C-CAP)

Shelby and Heberlein (1986) developed a detailed assessment process for developing carrying capacity studies and continued monitoring of impacts:

1) Evaluate the background information and identify the current situation of such factors as the management structure, geographical context, political climate, and use patterns.
2) In light of objectives and constraints identify the type of experience opportunity to be provided (e.g. wilderness).
3) Identify important impacts which may affect the resource or experience.
4) Collect data on the experience types, standards to evaluate impacts, and the existing conditions.
5) Develop management alternatives which would limit impacts to acceptable levels and
6) Select a management strategy. The strategy may involve setting use limits (the carrying capacities). Finally, monitor impacts to insure that they fall within acceptable levels.

This process, as LAC, focuses on acceptable levels of change. It incorporates use of visitor defined encounter norms in developing standards to evaluate impacts. A detailed description of this process and the six settings where it was used to assess carrying capacity are found in Carrying Capacity in Recreation Settings (Shelby and Heberlein 1986).

Visitor Impact Management (VIM)

Graefe and associates (1986) provide a discussion of factors affecting types of impacts, principles for managers to use in evaluating the impacts, and a framework to guide decision-making in visitor impact management. The authors contend that prior to determining the tolerable level of impact on a component of the recreation resource managers need to understand the nature of those impacts, whether they be physical, ecological, or social impacts. Review of the carrying capacity literature provides several key points about the nature of impacts: 1) they take a variety of direct and indirect forms; 2) tolerance to impacts varies by species, habitat, and user group; and 3) impacts vary by site conditions, type of use, and amount of use.

Incorporating consideration of factors that influence impacts, the authors suggest a sequential process aimed at reducing or controlling the "impacts that threaten the quality of outdoor recreation areas and experiences" (p. 433).

Briefly, the VIM process includes:

1) Preassessment data base review;
2) Review of management objectives;
3) Selection of key impact indicators;
4) Selection of standards for key impact indicators;

5) Comparison of standards and existing conditions;

6) Identification of probable cause of impacts;

7) Identification of management strategies; and

8) Implementation.

Graefe et al. (1986) present a case study from Great Smoky Mountains National Park used to illustrate the VIM process.

The primary principles identified by Graefe et al. (1986) as important in evaluating impacts and making required value judgments are similar to those proposed by Shelby and Heberlein (1986). One of Graefe et al.'s (1986) principles emphasizes the need to identify a range of acceptable impact levels in light of the characteristic range of environs and experience opportunities in any natural setting.

The carrying capacity models described above have been applied in several different cases. Each provide a useful process for developing strategies to assess, control, and monitor impacts associated with recreation use.

Additional Considerations in Assessing Social Carrying Capacity

Carrying capacity is a managerial concept designed to help managers make judgments about a predefined species/habitat relationship. The preceding discussion traced its origins in range and wildlife management to its current use in recreation.

A basic tenet of the carrying capacity concept is the idea of "preferred condition". Applied to range and wildlife management, it is the idea there is a certain level of use, beyond which either the population or the resource can no longer be sustained at a preferred level. This notion comes from the

biological imperatives which animal systems must meet to ensure survival of the organism and the species. All animal populations must adapt to their environment successfully enough to sustain reproducing numbers of individuals.

In applying the idea of preferred condition to recreation use, recreation managers have looked to the users or some characteristic of recreation use to provide the preferred condition. Assumptions are made about human behavior and preferred environmental conditions based on acceptable numbers of encounters, perceptions of crowding, levels of acceptable change, etc.

Implicit to the human carrying capacity concept is a second set of relationships that is unique to humans. While all animal populations, including humans, must attain certain goals and adapt to their external environment to survive, humans must also maintain linkages and relationships within a social system.

Humans are intelligent and culture-creating creatures. The social structures are held together not by automatic response but by integration of individuals through the sharing of norms and symbols. Integration is the focusing of relationships within the system so as to achieve solidarity, cohesion, stability, order, and permanence of the social system.

It is this second level of knowledge, mostly overlooked in research, that is important to consider in addressing carrying capacity. It is simply a basic understanding of human populations and social behavior associated with environmental settings — buildings, parks, beaches, etc. In this research no prejudgments are made about behavior and environment, rather what are the relationships between people and places. This approach suggests that outdoor recreation places may best be understood in terms of the meanings assigned to

them by particular sociocultural groups as they seek to adapt and integrate group members (Lee 1972; Cheek, Field and Burdge 1976). Groups coming to a recreation place bring with them their culture, beliefs, and values. These they use in adapting to the environment and creating what has been termed "leisure settings" the combination of sociocultural groups and recreation places.[1]

In adapting to recreation places certain integrative schemes of order and informal rules of behavior are constructed that are peculiar to the groups occupying that particular place (Lee 1972). For example, at Whiskeytown's Brandy Creek Beach different social behaviors can be observed at the "Lifeguard" Beach and the "Teen" Beach. The focus on the Lifeguard Beach is on family-related behavior, while the Teen Beach is a place to socialize with peers. The social groups by and large define the experiences occurring in these settings. As different groups come and go, the rules and norms governing group behavior -- the social definition of a place -- may change as part of the adaptation process (Lee 1972).

Because of the need of human groups to adapt to their environment while maintaining group solidarity and integration, the carrying capacity of a site may change with the user group. As a result, carrying capacity levels may not be generalizable to other groups or sites. Only when there is homogeneity in the socio-cultural makeup of groups and the experiences being provided can assumptions be made about the social capacity of sites to provide acceptable levels of recreation benefits.

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[1]For a more complete discussion of "leisure settings" see the Whiskeytown report, "Recreation Places. A Description of Recreation Sites at Whiskeytown," Stark et al. 1986. CPSU/OSU 86-3. Cooperative Park Studies Unit, Oregon State University, Corvallis.

RESULTS AND DISCUSSION

Results presented here focus on crowding and conflicts between visitors. Perceptions of crowding at the 16 survey locations at Whiskeytown are discussed and potential carrying capacity problem areas identified using the one-third two thirds rule of thumb (Shelby and Heberlein 1986). Visitor expectations and preferences for seeing others are also presented. Results describing conflicts among visitors focus on conflicting activities and sites where conflicts may have occurred.

Crowding at Whiskeytown

Crowding is a complex phenomenon influenced by many factors. Thus it is unlikely that perceived crowding is, by itself, a valid criterion for determining carrying capacity. However, data on perceived crowding may be useful as a "rule of thumb" indicator to identify problem areas and to make rough comparisons among areas (Shelby and Heberlein 1986).

Based on mean responses to a crowding scale ranging from 1= not at all crowded to 9= extremely crowded, visitors at the 16 interview locations (see Figure 1) were compared in Table 1. Significant differences among mean values were tested using the Student Newman-Keuls multiple range test (Steel and Torrie 1980). Estimates of the number of other people seen at each location are presented in Table 2. Visitors at the Oak Bottom tent camping area felt most crowded, followed by visitors at the Brandy Creek "Lifeguard" and "Teen" beaches. Research has shown that contact with others at campsites are evaluated more negatively than contacts elsewhere (Stankey 1973). People expect more privacy at campsites which may be viewed as their temporary

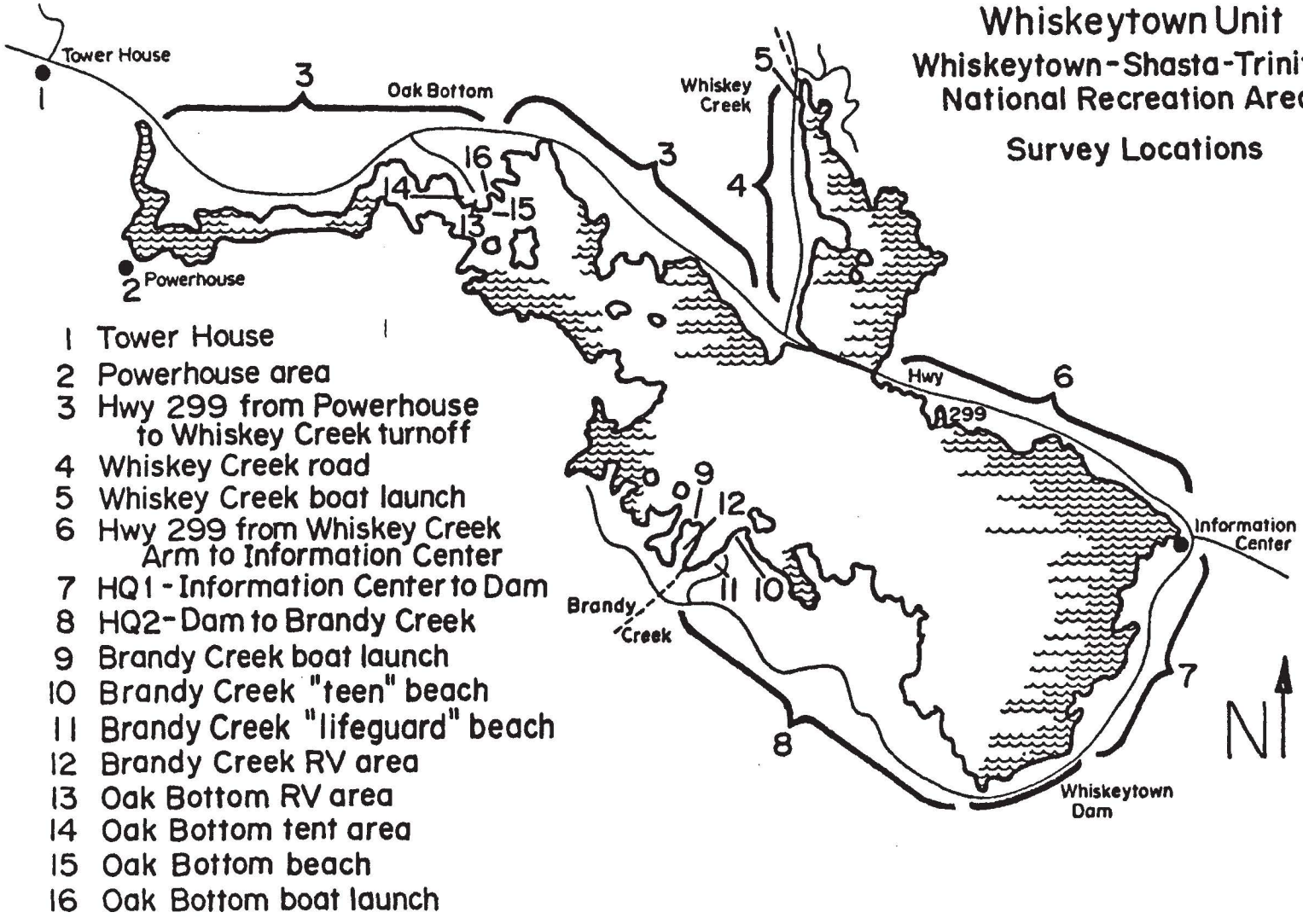

FIGURE 1. SIXTEEN SURVEY LOCATIONS, WHISKEYTOWN, SUMMER 1985.

Table 1. Crowding means by location.

Location (site number)	Mean[a]	N	Differences among means[b]
Oak Bottom tent (14)	5.0	154	A
"Lifeguard" beach (11)	4.5	151	A B
"Teen" beach (10)	4.5	135	A B
Oak Bottom RV (13)	4.0	142	B C
Oak Bottom beach (15)	3.8	145	C
HQ1 shoreline (7)	3.6	135	C D
Oak Bottom boat launch (16)	3.5	150	C D
Whiskey Creek boat launch (5)	3.4	147	C D E
Whiskey Creek road shoreline (4)	3.0	133	D E
Brandy Creek boat launch (9)	2.9	146	D E F
Brandy Creek RV (12)	2.7	152	E F
Powerhouse (2)	2.6	153	F
Hwy 299--Powerhouse to WC shoreline (3)	2.5	133	F
HQ2 shoreline (8)	2.5	126	F
Hwy 299--WC to Info shoreline (6)	2.3	142	F
Tower House (1)	1.6	129	G

[a]Mean of crowding scale where 1=not at all crowded ... 9=extremely crowded.

[b]Means with the same letter are not significantly different at the .05 level using student-Newman Keuls test.

Table 2. Number of other people seen by location.

Location (site number)	<20	21-50	51-100	>100	Couldn't Estimate	n
	Percent					
Towerhouse (1)	92	7	-	.8		129
Powerhouse (2)	86	10	2	--	.6	154
Hwy 299-PH-WC shoreline(3)	91	7	2	--	--	133
Whiskey Creek road to shoreline (4)	69	26	3	2	.8	133
Whiskey Creek WC boat launch (5)	70	22	4	.7	3	149
Hwy 299-WC-Info. shoreline (6)	95	3	1	--	--	142
HQ1 shoreline (7)	60	30	7	.7	2	135
HQ2 shoreline (8)	90	8	--	--	2	124
Brandy Creek boat launch (9)	46	33	12	8	.7	144
Brandy Creek "Teen" beach (10)	11	21	26	38	4	133
Brandy Creek "Lifeguard" beach (11)	11	19	35	29	7	150
Brandy Creek RV area (12)	72	18	5	4	1	153
Bottom RV area (13)	32	34	24	7	3	144
Oak Bottom tent area (14)	60	27	6	3	4	153
Oak Bottom beach (15)	15	22	41	20	2	142
Oak Bottom boat launch (16)	49	34	10	5	2	146

residence. It is thus not surprising that tent campers felt crowded. Even though 60 percent of these visitors saw fewer than 20 other people in the area, it is where they saw them that likely resulted in their feeling crowded. Many campsites offer little screening from others and during the summer months the campsites are full to facility capacity. A somewhat similar situation exists at the Oak bottom RV area where there is nos creening and lots of traffic--both foot and vehicle.

The two Brandy Creek beaches and Oak Bottom beaches are popular sites at Whiskeytown. It is not unexpected that visitors at these locations reported seeing more people than visitors at other sites (e.g., 38 percent of "teen" beach visitors indicated seeing more than 100 people at one time). All three of these areas are fairly open and there is much opportunity to see, hear, and interact with other visitors.

A mean score between 3 and 4 indicated slightly crowded--expressed by visitors contacted at the three boat launch sites, HQ1 shoreline area, located on the southeast side of the lake, the Whiskey Creek road shoreline, and Brandy Creek RV area. Visitors at the remaining locations felt less crowded, particularly those contacted at the Tower House historic site.

Using the "one-third two-thirds" rule of thumb suggested by Shelby and Heberlein (1986) for identifying carrying capacity problem areas, the 16 locations are grouped in Table 3. According to this breakdown, four areas at Whiskeytown may have exceeded their social carrying capacity: Oak Bottom tent camping area, Brandy Creek "Lifeguard" beach, Brandy Creek "Teen" beach, and Oak Bottom beach.

Table 3. Carrying capacity levels using "one-third two-thirds" rule of thumb. (Shelby and Heberlein 1986).

- Above capacity - >66% of visitors felt crowded
    - . Oak Bottom tent area (79%)
    - . Brandy Creek "Lifeguard" beach (73%)
    - . Brandy Creek "Teen" beach (72%)
    - . Oak Bottom beach (67%)

- Uncertain - 33% - 66% of visitors felt crowded
    - . Oak Bottom RV area (63%)
    - . HQ1 shoreline (61%)
    - . Oak Bottom boat launch (59%)
    - . Whiskey Creek boat launch (47%)
    - . Whiskey Creek road shoreline (47%)
    - . Brandy Creek boat launch (47%)
    - . Brandy Creek RV area (38%)
    - . HQ2 shoreline (38%)
    - . Hwy 299-PH to WC shoreline (38%)
    - . Powerhouse (38%)

- Below capacity - <33% of visitors felt crowded
    - . Hwy 299-WC to Info. shoreline (32%)
    - . Tower House (16%)

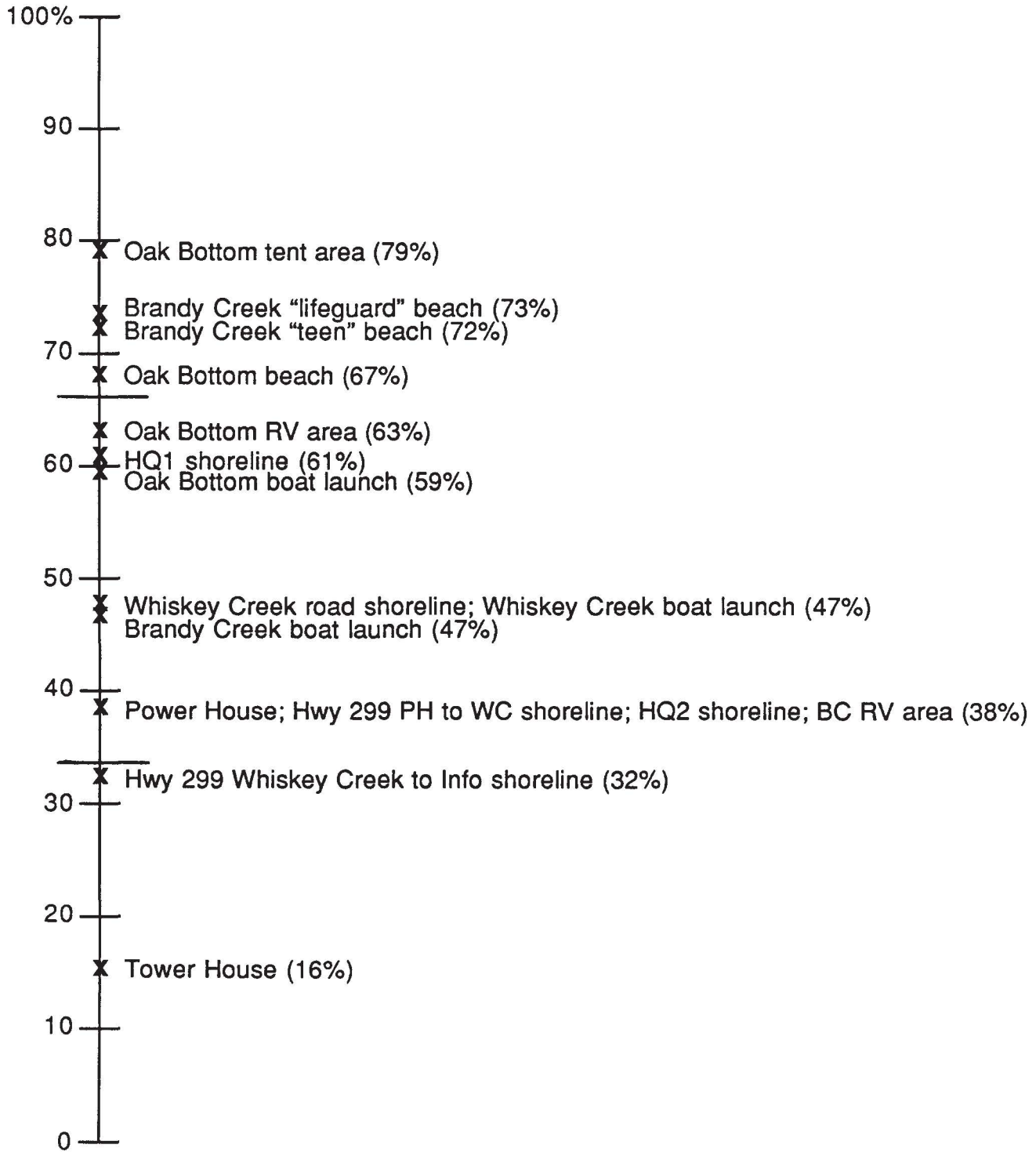

Figure 2. Percentage of Whiskeytown visitors who felt crowded, by location.

The two areas likely below carrying capacity, according to this scheme, are Hwy 99 shoreline between Whiskey Creek and the Information Center and the Tower House. The bulk of Whiskeytown locations fall in the middle where a judgment as to carrying capacity is uncertain and may require more information.

A comparison of the 16 locations is shown in Figure 2. One interesting observation is that HQ1 shoreline visitors felt more crowded than visitors at any of the other four shoreline areas. This heavily used shoreline area appears to lack the opportunities for solitude and privacy that may draw users to shoreline sites.

Crowding at boat launch areas is not unexpected and would be particularly evident at Oak Bottom where there is congestion from the beach and RV area as well as the boat launch -all likely contributing to perceived crowding.

Expectations and Preferences for Visitor Contacts

Two important factors related to perceived crowding are visitor expectations and preferences for coming into contact with other recreationists. Researchers suggest that people feel more crowded if they encounter more people than they expect and more than they prefer (Ditton et al. 1983, Womble and Studebaker 1981, Shelby et al. 1983). We wanted to test this hypothesis for Whiskeytown visitors.

To measure preferences, respondents were asked how they felt about the number of people they saw at the interview location, whether they would have liked to have seen a lot more, a few more people, neither, if they saw a few too many, or far too many. Expectations were assessed by asking respondents

to compare the number of people they saw at that particular location with the number they thought they would see, indicating whether they saw a lot less than expected, less than expected, about as expected, more than expected, or a lot more than expected.

Correlations were used to assess the relationship between feeling crowded and expectations and preferences for seeing other people (Table 4).

Table 4. Correlation between feeling crowded and preferences and expectations for seeing other people.

Rank ordered variables	Pearson correlation coefficient
Preferences for numbers of other visitors	0.511[a]
Expectations for numbers of other visitors seen	0.454[a]

[a]Significant at 0.0001 level.

Results showed a positive correlation between perceived crowding and preferences (.51) and expectations (.45). That is, visitors felt more crowded if they saw more people than they preferred or more than they expected. These findings support what other researchers have found and suggests that these two factors are important to consider in dealing with crowding. Shelby et al. (1983) suggest that it may be possible to reduce levels of perceived crowding by improving the accuracy of users' expectations. If people have more realistic expectations about the numbers of other people they may encounter, they may feel less crowded. Providing information about probable numbers of contacts and types of activities going on would help clarify and improve

expectations. Preferences may be harder to change because they represent personal standards or ideals (Shelby et al. 1983).

Visitor expectations for seeing others varied among Whiskeytown locations (Table 5). Among tent area users, the group with the highest level of perceived crowding, 34 percent saw more people than expected. In contrast, more than half of visitors at Brandy Creek RV area saw fewer people than expected and 38 percent of them felt crowded. Approximately half of visitors at the majority of locations saw about as many people as expected.

Almost half of the tent area visitors saw too many people (Table 6). They were followed by HQ1 and HQ2 shoreline visitors. The majority of visitors at virtually all locations preferred to see neither more nor fewer numbers of visitors.

It is interesting to note that with the exception of HQ1 visitors, shoreline visitors did not tend to feel crowded (see Table 1), and did not see large number of other visitors (see Table 2), yet at least 30 percent of visitors at four of the five shoreline locations indicated they saw too many people. If privacy and solitude are motivations for seeking out these sites, visitors there may have a lower tolerance for seeing other visitors than at other locations.

Visitor Conflicts

Conflict between visitor groups was a concern to Whiskeytown managers. As discussed above, conflict can occur between groups pursuing different activities because of differences in motivation, goals, and because of the perceived inappropriate behavior of other groups.

Table 5. Expectations for number of people seen by location.[a]

Location	Saw fewer than expected	Saw about as expected	Saw more than expected	n
		Percent		
Towerhouse	40	48	12	116
Powerhouse	44	45	11	132
Hwy 299-PH-WC shoreline	36	44	19	124
Whiskey Creek road to shoreline	44	43	12	120
Whiskey Creek WC boat launch	39	45	16	141
Hwy 299-WC-Info. shoreline	39	50	12	129
HQ1 shoreline	31	49	20	130
HQ2 shoreline	42	50	8	119
Brandy Creek boat launch	42	50	8	137
Brandy Creek "Teen" beach	39	45	16	121
Brandy Creek "Lifeguard" beach	38	44	18	147
Brandy Creek RV area	53	31	15	130
Oak Bottom RV area	34	54	12	130
Oak Bottom tent area	18	47	34	135
Oak Bottom beach	37	51	11	132
Oak Bottom boat launch	40	47	12	136

[a]Differences in expectations among locations were significant at the 0.000 level using chi square statistic.

Table 6. Preferences for number of people seen by location.[a]

Location	Like to have seen more	Neither too few or too many	Saw too many	n
		Percent		
Towerhouse	12	81	7	112
Powerhouse	8	68	23	133
Hwy 299-PH-WC shoreline	8	60	32	116
Whiskey Creek road to shoreline	8	65	27	126
Whiskey Creek WC boat launch	5	65	30	127
Hwy 299-WC-Info. shoreline	15	67	18	126
HQ1 shoreline	6	58	36	123
HQ2 shoreline	7	62	31	119
Brandy Creek boat launch	11	70	19	127
Brandy Creek "Teen" beach	14	55	31	110
Brandy Creek "Lifeguard" beach	6	59	35	129
Brandy Creek RV area	8	73	19	134
Oak Bottom RV area	11	62	26	114
Oak Bottom tent area	4	43	52	137
Oak Bottom beach	9	62	30	125
Oak Bottom boat launch	4	69	27	123

[a]Differences in preferences among locations were significant at 0.000 level using chi-square statistic.

Visitors were asked whether any group had interfered with their activities at Whiskeytown. Twenty percent of all respondents reported "yes". For those that reported interference, we wanted to know what they were doing, where they were, and what the interfering groups were doing.

Visitors who experienced interference tended to be swimming, fishing, sunbathing, resting/relaxing, sailing, and doing campsite activities. A few were motorboating and waterskiing, and the remainder listed miscellaneous other activities.

Interview locations of the six most frequent activities are presented in Table 7. Note that the interference did not necessarily occur at this location. The question about interference dealt with a respondent's entire Whiskeytown visit and it was assumed that the probability that the interference occurred at the interview location was fairly high. Swimmers reporting interference with were found primarily at shoreline locations, particularly HQ1 and HQ2. Anglers were contacted most often in the Powerhouse area, at the Whiskey Creek boat launch, and along shoreline areas. Sunbathers were found primarily on shorelines and the Brandy Creek "teen" beach. Those resting and relaxing when interfered with were contacted most often at the Oak Bottom tent area, the Oak Bottom boat launch, and Brandy Creek RV area. Visitors interfered with while sailing were contacted at Brandy Creek and Oak bottom boat launch sites and those doing campsite activities were most often found at the three campsite areas.

Table 8 takes the analysis one step further and presents the activities that conflicted with the most often mentioned activities of those who felt interference. The most noticeable finding is that motorboats and, to a lesser

Table 7. Locations[a] of six most frequent activities of respondents who felt interference from others.

Swimming (n=90)

- HQ2 shoreline (20%)
- HQ1 shoreline (17%)
- Whiskey Creek road shoreline (12%)
- Hwy 299-WC to Info. shoreline (12%)
- Hwy 299--PH to WC shoreline (6%)
- Brandy Creek "Teen" beach (6%)
- Powerhouse (4%)
- Brandy Creek boat launch (4%)
- Oak Bottom beach (4%)
- Others (15%)

Fishing (n=71)

- Powerhouse (25%)
- WC boat launch (16%)
- HQ2 shoreline (9%)
- Oak bottom RV (9%)
- Hwy 299 - Ph to WC shoreline (8%)
- Hwy 299 - WC to Info shoreline (5%)
- Oak Bottom boat launch (5%)
- HQ1 shoreline (5%)
- Others (18%)

Sunbathing (n=48)

- Hwy 299 - WC to Info. shoreline (17%)
- Brandy Creek "Teen" beach (15%)
- HQ1 shoreline (112%)
- Hwy 299 - PH to WC shoreline (12%)
- WC road shoreline (10%)
- Powerhouse (6%)
- HQ2 shoreline (6%)
- Brandy Creek "Lifeguard" beach (6%)
- Others (16%)

Resting/Relaxing (n=43)

- Oak Bottom tent (23%)
- Oak Bottom boat launch (14%)
- Brandy Creek RV (12%)
- Tower House (7%)
- HQ1 shoreline (7%)
- HQ2 shoreline (7%)
- Oak Bottom RV 97%)
- Others (23%)

Table 7. Continued.

Sailing (n=41)

- Brandy Creek boat launch (63%)
- Oak Bottom boat launch (22%)
- Others (15%)

Campsite activities (n=35)

- Oak bottom tent area (37%)
- Oak Bottom RV area (15%)
- Oak Bottom beach (9%)
- Brandy Creek RV area (9%)
- Others (30%)

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[a]Interference did not necessarily occur at the interview location. Question dealt with respondent's entire Whiskeytown visit.

Table 8. Conflicting activities.

Activities of those who experienced interference	Activities of those who interfered[b]								
	Motorboating	Water Skiing	Swimming	Walking	Pets/ Animals	Loud Music	Yelling	Campsite Activities	n
	Percent								
Swimming	50	21							90
Fishing	47	26	14						76
Sunbathing	25	8		10	10				48
Resting/relaxing	19					33			43
Sailing	68	12	10						41
Campsite activities						38	23	18	34

[a]Six most often mentioned activities.

[b]Most often mentioned activities.

extent water skiing, conflicted with virtually all activities. Swimmers and anglers in particular experienced interference from motorboats. Types of interference included speeding, coming too close to shore, making large wakes, disturbing fish, invading privacy, and noise. Anglers also mentioned having problems with swimmers getting in the way, both while fishing and while launching and loading boats. Sunbathers were bothered by motorboats and mentioned people walking through the area and pets and animals running loose as interfering activities.

Many of the swimmers, sunbathers and anglers complaining about motorboats and water skiers were contacted at shoreline locations. Often these areas do not have restrictions on boat speed and wakes. Boats and skiers may not realize their wakes and noise are disturbing these visitors and in some cases may be dangerous for swimmers.

Those who were interfered with while sailing were also most often referring to motorboats. Water-skiers and swimmers were also a problem to a much lesser degree. Visitors interfered with while resting and relaxing, many of whom were contacted at the tent and RV areas most often mentioned loud music as the interfering activity as did visitors who were doing campsite activities. These overnight visitors also complained about people yelling and other unacceptable campsite activities.

There does seem to be conflict between various user groups at Whiskeytown though only a relatively small number of visitors--one-fifth of those contacted experienced interference. It is important, however, that Whiskeytown managers note and monitor activities that appear to conflict and attempt to avoid problems if possible, particularly potentially dangerous encounters between motorboats and/or water skiers and swimmers.

RECOMMENDATIONS

Results presented here have focused on crowding and conflicts at Whiskeytown. Based on these results we present several recommendations to managers.

Crowding

Although carrying capacity for Whiskeytown cannot be determined using perceived crowding alone, it is useful for identifying potential over-capacity and problem areas. Several sites that merit watching emerged from visitors' perceptions of crowding and use of the "one-third two-thirds" rule of thumb.

The Oak Bottom tent area was consistently perceived to be the most crowded area at Whiskeytown. Although visitors at this site did not report seeing large numbers of people, the fact that they saw them while in a campsite "home" resulted in their feeling crowded. The tent campground is a popular overnight area at Whiskeytown and is likely often full. Vegetation provides a useful screen for separating groups and should be utilized as much as possible. It may be necessary to redistribute campers in the area to decrease the number of contacts between groups.

User expectations as to the numbers of other people present and the likelihood of contact influence feeling crowded. Every effort should be made to make campers aware of the situation at the campground in order to minimize unrealistic expectations and perhaps decrease crowding.

Educating visitors about what to expect may also be appropriate at the Brandy Creek's "teen" and "lifeguard" beaches, two areas managers should view

as potential carrying capacity problem areas. Visitors at both areas reported seeing large numbers of other visitors, to be expected on open expanses of heavily used beaches. Almost one third of visitors at both areas saw more people than they preferred and close to 20 percent saw more people than expected. Accurate information about the number and types of people encountered at each area would allow potential visitors to either adjust their expectations or select a setting more to their liking. Either could reduce feelings of crowdedness among visitors at the beach areas. For example, letting visitors know that the "lifeguard" beach is a good place for families with children while the "teen" beach area offers good sunbathing opportunities but has no lifeguards allows them to choose and provides for more accurate expectations.

Oak Bottom beach is also an area managers should watch for crowding problems. This area is somewhat different from the Brandy Creek beaches due to its nearness to the Oak Bottom tent and RV campground. As a result it accommodates visitors staying several days as well as day-use visitors.

The shoreline area with potential crowding and capacity problems is HQ1, the shoreline from the Information Center to the dam. Use is concentrated at a few heavily used sites and crowding may become a problem. Shoreline areas at Whiskeytown are unique in that they provide access to the lake and some, such as HQ1, have toilets and garbage cans. Yet these quasi-developed areas also offer opportunities for privacy and solitude not available at developed beach areas. It may be that HQ1 is providing an experience that falls somewhere between a developed beach and a primitive shoreline site. Twenty percent of visitors contacted there saw more people than expected and more than one-third saw more than they preferred.

Managers need to consider what type of experience they want to provide at this shoreline site. If opportunities for privacy are desired and are no longer being provided then it may be necessary to consider limiting use at this site. Other shoreline sites, though not experiencing crowding problems at present, should also be viewed in the same light--what type of recreation opportunities do managers want to provide?

Oak Bottom RV area is the other overnight area that may have a carrying capacity problem. Given the lack of screening and congestion from boat trailers, it is not surprising these people feel crowded. In addition to making potential RVers aware of conditions at the RV campground, it might also help to let them know about the alternative RV campground at Brandy Creek, a much less crowded campground. A long term partial solution to the crowding problem at the Oak Bottom RV area would be to remove a portion of the asphalt and plant trees and other vegetation to provide screening.

Conflicts

There were a variety of conflicts between groups at Whiskeytown and those reported most often involved motorboats. Swimmers, sunbathers, and anglers at shoreline areas in particular noted problems with excessive speed, being too close to shore, and wakes. Encounters between boats and swimmers can be potentially dangerous. Speed limits and no wake signs are currently posted near designated swimming areas and it may be necessary to restrict boat speed near shorelines or prohibit boats and waterskiers from coming too close to shoreline areas.

Boaters and skiers should be made aware of the problems caused by wakes and the potential danger in coming too near to shorelines where there might be

people swimming. In turn those using shoreline areas should be made aware of possibilities of encounters with boats and skiers and the potential dangers involved.

Areas most heavily used by anglers could be designated as "non-motorboating" and "non-waterskiing" areas. In areas where segregating uses is not feasible, boat speed limits should be instigated and enforced. Swimmers need to be made aware of fishing use in certain areas to minimize conflict between these users.

Loud music interfered with visitors contacted primarily at the tent campground who were resting or doing campsite activities. People playing music and yelling, another activity mentioned, are common problems in campgrounds with sites in close proximity. Rules regarding quiet hours should be enforced and visitors urged to be considerate of others.

The common theme in recommendations discussed here is increased visitor awareness of potential conflicts between users. Research has shown that groups may not be aware that their actions are causing problems for other users. For example, motorboaters may not be aware of the problems caused by their coming too close to shore and creating major wakes. Making them aware of the consequences of their actions along with enforcement of speed limits may decrease the conflicts among users. The same logic applies to campground users. Awareness of problems caused by inconsiderate behavior will hopefully decrease occurrences of conflicts between visitors.

Monitoring Impacts Over Time

Efforts have been made to formulate a process for applying the carrying capacity framework. Three were briefly described above--Limits of Acceptable

Change (LAC); Carrying Capacity Assessment Process (C-CAP); and Visitor Impact Management (VIM). It is not the intent of this research effort to suggest one process over another. Rather, the similarities among the three processes are discussed as important considerations for managers in setting up a monitoring system at Whiskeytown. We encourage Park Service managers to implement such a system, particularly since carrying capacity problems and conflicts are arising in specified locations.

All three processes focus on managing environmental and social conditions identified as desired, including periodically monitoring existing conditions to insure that impacts fall within acceptable limits.

One of the first steps common to all three processes is to identify the types of experience opportunities to be provided. For example, Whiskeytown managers could decide shorelines were to be managed to provide opportunities for seclusion and privacy and developed beach areas managed to provide opportunities for family socializing and safe swimming for children.

Impact indicators such as amount of vegetation lost or numbers of parties encountered per day are selected that represent the kinds of conditions or opportunities managers are striving for. Standards are specified for key impact indicators such as "no more than 30 percent vegetation loss" or "encountering no more than 3 other parties per day". These standards are monitored and periodically compared to existing conditions. If there are discrepancies, management strategies to correct the situation are examined and implemented.

Management objectives answer the question of how much change is acceptable by deciding what type of recreation experience opportunities a particular

setting should provide, including the level of naturalness, the kind of experience offered, and the intensity of management practices (Manning 1986). Numerous research reports emphasize the need for management objectives (e.g., Frissell and Stankey 1982; Lucas and Stankey 1974; Bury 1976; Brown 1977; Boteler 1984). Manning (1986) suggests that determining management objectives for outdoor recreation areas should be based on three broad considerations: natural resource conditions (physical and biological characteristics of the natural resource base); institutional factors (legal directives and agency mission statements); and social factors (needs and wants of visitors).

Implementation of a monitoring system based on the carrying capacity framework involves not only an understanding of the concept but also necessitates developing a systematic approach to managing conditions. whichever approach is adopted, key considerations include:

1) Review of management objectives;
2) Identify the types of recreation experience opportunities to be provided;
3) Select key impact indicators that reflect desired opportunities;
4) Select standards for key indicator variables;
5) Compare standards and existing conditions;
6) Develop management strategies to deal with impacts;
7) Implement selected strategy if needed; and
8) Continue to monitor impacts.

Results provided in this report and previous Whiskeytown reports present managers with a fairly detailed picture of the current situation at Whiskeytown. It is apparent that there is much diversity there--in

activities, facilities available, social environments, and recreation experience opportunities. Managers can use these kinds of information along with management objectives in determining the types of experience opportunities to provide and corresponding indicators and standards. Perceptions of crowding using the "one-third two-thirds" rule of thumb is an example of a social impact indicator and standard. encounter norms, which were not determined for Whiskeytown, is another example.

Once indicators and standards have been developed periodic monitoring conditions at Whiskeytown may reveal changes over time that would otherwise go unnoticed until a major problem or conflict had developed. Monitoring the visitor clientele, their preferences and the experiences they seek will also provide managers with a current picture of their users, what they want, and how they view the Whiskeytown resource, all valuable input for management planning.

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