AN ABSTRACT OF THE THESIS OF

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In response to increasing recreation use, many resource managers have set use limits or carrying capacities in an attempt to protect the quality of experiences. These limits require definitions of quality which involve evaluative information about appropriate use levels or use conditions. Two papers are presented examining different approaches for collecting and analyzing evaluative information, based on data from a 1987 survey of boaters on Oregon's Deschutes River.

The first paper examines the utility of the social norm concept for establishing evaluative standards. Results suggest that social norms can be identified for a variety of impacts in a variety of settings, and that there are different identifiable types of norms. A "no tolerance" norm exists when strong majorities of users report that any impact is unacceptable, a "single tolerance" norm exists when users report similar standards at

some impact level greater than zero, and a "multiple tolerance" norm exists when there are two or more groups of users with standards at differing impact levels, perhaps reflecting different experience definitions. Norm crystallization, the level of group agreement, is strongest for no tolerance norms and weakest for multiple tolerance norms.

The second paper investigates the effects of objective use conditions and comparisons of those conditions with personal standards on perceived crowding. Results support the common research focus upon social interaction or encounters. These impacts are more strongly related to crowding than environmental or resource competition impacts. However, results provide less support for previous research which suggests that crowding is best understood as having both objective and subjective components. In a test of this idea, variables representing comparisons of impact conditions with subjective personal standards explained less of the variance in perceived crowding than variables representing objective conditions alone.

Impacts, Standards, and Perceived Crowding on the Deschutes River: Extending Carrying Capacity Research

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This thesis is dedicated to my parents, who have always encouraged my pursuits no matter how indulgent, and to my partner Julie, who not only shares them, but helps inspire them.

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I. INTRODUCTION

Many outdoor recreation resources experienced dramatic use increases in the 1960's and 1970's, particularly backcountry and undeveloped resources (Roggenbuck and Lucas 1986; Stankey and Lucas 1986; Shelby and Heberlein 1986). Previously considered "unspoiled" and uncrowded" --a contrast to cities--these places were suddenly faced with environmental or aesthetic problems, and visitors found themselves competing for resources such as campsites or fishing holes, unable to experience solitude or quietude. Concern over the impacts of visitor use in these settings was not new, but there were increasing complaints that the popularity of wildlands was damaging the quality of the environment and visitor experiences.

One potential tool for addressing these problems was to limit use. The idea that resources have recreational carrying capacities, defined as the "level of use an area can withstand while providing a sustained quality of recreation" (Wagar 1964, p.3), was a well-accepted concept in recreation theory, and many managers and policy-makers felt it could be applied successfully. Setting appropriate use levels proved a difficult task, however. There

was no specific definition of recreation quality for most resources, and managers had no way of evaluating how changes in use levels affected quality. In many cases, managers simply froze use at current levels, or picked arbitrary levels, pending more research.

A large body of literature was produced in response to this problem and managers' needs to solve it. The initial focus of this work was slanted toward the environmental consequences of visitor use (Stankey and Lime 1973), and although undocumented, many use limit decisions were based on and justified by this type of research. However, it was clear to some researchers that the social consequences of visitor use were also important determinants of overall recreation quality, even if these were less well understood (Shelby and Heberlein 1986). Among the challenges for social scientists was to describe relationships between use and experiential quality, as well as develop a process for organizing and analysing information about those relationships in order to make better use limit decisions.

CARRYING CAPACITY RESEARCH

Although there is still some debate whether researchers have completely met this challenge, there is little doubt that the social carrying capacity concept has matured (Graefe et al. 1984b). While several compet-

ing approaches and frameworks for examining carrying capacity have been developed, there is considerable congruence among them. There is agreement, for example, that use levels are not directly related to experiential quality or visitor satisfaction, and that several intervening variables and relationships must be considered (Graefe et al. 1984a). In addition, researchers concur that making carrying capacity decisions necessarily involves assessing human values--subjective information--about the desirability of certain conditions (Schreyer 1984).

The problem with social carrying capacity research is in its application (Graefe et al. 1984b). A review of empirical studies suggests that relationships between use levels, use impacts, and perceptions of impacts are complex and may vary depending upon resource settings, management systems, types of experiences, and visitors' own preferences and expectations (Graefe et al. 1984a). This complexity decreases the value of generalizations about these relationships and mandates extensive information collecting for each new capacity study. Perhaps more importantly, some researchers are not comfortable with methods of assessing evaluative judgements about use impacts, or suggest that these judgements are likely to be so diverse that they cannot be used (Burch 1984; Becker et al. 1984). The issue is not whether carrying capa-

city concepts are valid, but how they can be applied without bias, taking the variety of influencing factors into account (Wagar 1973).

At least two recently developed frameworks, the Limits of Acceptable Change Planning Process or LAC (Stankey and McCool 1984) and the Carrying Capacity Assessemnt Process or C-CAP (Shelby and Heberlein 1986), partially address these concerns. Although LAC attempts to shift attention away from use limits as a management tool while C-CAP focuses directly on the information necessary to make a use limit decision (Graefe et al. 1984b), both approach the issues of visitor impact management in the same way. First, both clearly separate descriptive information about use levels and use impacts from evaluative information about their acceptability. Second, they both advocate determining evaluative standards for relevant "impact parameters" or resource condition "indicators" in order to judge whether there is an overuse or visitor impact problem. Focusing on evaluative information that relates to measurable impact levels is the key to making the carrying capacity concept operational and meaningful. A major focus of current research in the field is on how to collect and interpret this kind of evaluative information.

THESIS OVERVIEW

This thesis addresses some of these issues. Using data from a 1986 survey of boaters on the Deschutes River in Oregon, it includes two papers which examine both the applied and theoretical problems of evaluating use or use conditions.

The first paper discusses the utility of the social norm concept for establishing evaluative standards. Social norms, a social-psychological term which refers to group agreement about appropriate behavior or social conditions (Cancian 1975), have been effectively determined in backcountry recreation settings for between-visitor contacts, but little work has focused on other impacts or more developed settings. Using descriptive information about users' reported standards, this paper examines methodological problems in adapting the concept to different types of impacts and settings, identifies social norms for those impacts and settings, and discusses the usefulness of those norms in establishing management standards for use in carrying capacity decisions.

The second paper examines the concept of perceived crowding, often suggested as a key variable in the carrying capacity equation. Perceived crowding is generally thought to represent a negative evaluation of a particular level of density or social interaction (Gramann 1983;

Shelby and Heberlein 1986), but it also appears to be related to other conditions affected by use. In addition, most current research suggests that crowding is not only influenced by the objective impacts of use, but also by comparisons of impacts with subjective personal standards based on expectations and preferences (Shelby et al. 1983; Shelby and Heberlein 1986). This paper examines relationships between perceived crowding, reported impact levels, and comparisons of impacts with personal standards on the Deschutes. It attempts to corroborate current understanding of the crowding concept, and present information about which conditions affect crowding the most.

This thesis was written in accordance with the Oregon State University guidelines for the manuscript option. The two papers were written for journal publication and are thus intended to stand alone; each has separate theory, methods, results, and discussion sections. While the papers are closely related and there is some overlap of ideas, they do not directly address each other. In addition, in keeping with journal demands for brevity, research methods are not discussed as extensively as they would be in a standard thesis.

In order to provide some of this information and more fully represent the ideas developed in the papers, additional information about the research and how it re-

lates to other work in recreation is presented. A brief overview of theoretical concepts is included in this chapter to help define the structure of carrying capacity research and provide a context into which the papers may fit. Following this, a chapter is presented describing the resource and the study from which the data for this thesis originated. Finally, additional information about sampling methods, additional results from the social norms paper, and the survey instrument will be included in the appendices.

OVERVIEW OF CONCEPTS

Social carrying capacity is an applied issue in recreation resource management which is concerned with documenting relationships between use levels and experiential quality (Schreyer 1984). While the term itself strictly refers to a certain use level beyond which use impacts are evaluated as unacceptable, any research describing or evaluating such impacts is typically given the carrying capacity label (Shelby and Heberlein 1986).

The carrying capacity concept comes from wildlife and range management models, and has been adapted by ecologists examining optimum human populations. Based on the idea that there is a finite level of resources which can be generated from a land area, the biological science concept broadly refers to the number of animals which can

be maintained in that area without decline in population health (Dasmann 1964). This definition, however, while appearing objective and straight-forward, is an over-simplification of the issue (Stankey 1971).

Most significantly, researchers recognize that there may be more than one carrying capacity depending upon how population health is defined and whether ecosystem conditions are used in this definition. The classic interpretation of the term refers to the maximum density of animals an area will support without significant vegetation changes (Caughley 1976), but other definitions have focused on "optimal" capacities which can refer to maximizing the number of harvestable animals, or meat-producing animals, or even the diversification of interrelated species (Dasmann 1964; Caughley 1976; Matzke, personal communication). The point here is that the existence of multiple carrying capacities and the use of the term "optimal" clearly introduces value judgements about definitions of quality into the model (Shelby and Heberlein 1986). Recognition of this is the key to understanding the concept, whether it is applied in biological or social settings.

Aside from this common structure, however, biological models of carrying capacity differ significantly from social models. First, definitions of social carrying capacity almost never refer to maximum density, but to

some optimum density whereby environmental and experiential damage is minimized. Second, the value judgements central to carrying capacity determination are largely agreed upon for animals (or are less controversial), while they are far more varied and diverse when referring to human social structures (Shelby and Heberlein 1986). It is much easier to agree to maximize meat production on cattle range, for example, than it is to agree to maximize one kind of recreation opportunity, say roadside sightseeing, in a national park. Third, nonhuman capacity studies focus on measurable, tangible variables such as meat production, number of harvestable animals, or species distribution and diversity, while human capacity studies must often focus upon the hard-to-measure, intangible variables such as perceptions, attitudes, and other psychological constructs (Shelby and Heberlein 1986). And finally, in a related point, the procedures used to assess "quality" in nonhuman settings are generally better-established than those used in social settings. As Shelby and Heberlein (1986) discuss, there are accepted ways of physically measuring certain biological or ecological conditions which do not have parallels in social science, which typically must collect information through survey research with its attendant difficulties.

In summary, nonhuman capacity models appear to provide a good starting point for human capacity models

because of their common structure which involves evaluative information. On the other hand, it is clear that this type of information is more easily used and applied to animals than to humans. Successfully applying the carrying capacity concept to social settings, and recreation settings in particular, requires better information about the relevant conditions which affect the quality of experiences and how those conditions can be measured and evaluated.

A number of interrelated social psychological theories and concepts address these issues, including expectancy value theory, satisfaction, perceived crowding, and social norms. In general, these ideas seem to fit into a hierarchical order, with each concept addressing a more specific facet.

Expectancy Value Theory

At the top of the hierarchy is expectancy theory, which suggests that people engage in behavior because they expect that it will lead to certain rewards (Lawler 1973). Applying this theory to recreation, certain "psychological outcomes" are identified as the rewards, and people are said to recreate because they expect participation will provide them (Driver and Tocher 1970). Research utilizing this model has identified extended lists of these outcomes, as well as relationships between them and several setting, activity, and user group vari-

ables (e.g. Driver and Brown 1978; Hautaluoma and Brown 1978). The general usefulness of this type of research is that it associates identifiable experience dimensions--the psychological outcomes--with variables which might be influenced by certain management actions. Its relevance to carrying capacity is that several of these outcomes, such as "getting away from it all" or "solitude," appear to be related to levels of visitor impact, which may be tied to use levels. Expectancy theory generally supports the notion that use levels affect experience quality, and suggests that well-developed research methods might relate use levels or use conditions with experience variables.

Work applying expectancy theory to recreation has not, however, typically focused upon the specific criteria by which use levels or use conditions could be evaluated. Instead, research in this area has focused on the combinations of outcomes associated with various recreational opportunities, which are not usually defined in quantifiable terms. Nonetheless, expectancy theory provides a general structure for understanding relationships between use and experience quality. In addition, it points to the complexity of these relationships, because expectancy research has documented that users engage in recreation to satisfy multiple expectations, and that there is considerable variation among individuals' ex-

pectations--even for similar user groups participating in the same activity in the same setting (Hendee 1974; Driver and Brown 1978; Schreyer and Roggenbuck 1978).

Satisfaction

A great deal of research has attempted to circumvent this complexity by examining overall user satisfaction with recreational experiences, based upon the idea that satisfaction will rise or fall depending upon how well users' expectations are fulfilled by opportunities provided. While satisfaction appears to be a broader variable even than those which might be developed from expectancy theory, it has been used by a number of social scientists to evaluate social services or individual happiness in work, home, or community settings.

In using satisfaction to evaluate use levels or use conditions, the basic idea is that as use levels and resultant use impacts increase, individual satisfaction with experiences will decrease (Alldredge 1972). Obviously, this notion does not apply to many recreation experiences which are unchanged by levels of social interaction or which may be enhanced by greater interaction (Wagar 1964). However, in settings offering recreation of a primitive type, particularly wilderness, the premise that higher use lowers satisfaction is fundamental. Applying the economic assumptions that the management goal is maximum total satisfaction and users react simi-

larly to use level or use condition changes, it follows that use should be allowed to increase until the total satisfaction gained by adding one visitor is offset by the loss in satisfaction of others (Fisher and Krutilla 1972; Shelby and Heberlein 1986).

The advantage of this basic model is that it develops a clear conceptual statement of how use and use impacts are related to a quality variable which can be measured using survey research methods (usually involving Likert-type scales or willingness to pay formats). The problem with the theory is that very few empirical studies support the hypothesized links: out of fourteen recent studies, none reported a significant negative correlation between satisfaction and use levels, and only one out of twenty-three reported a significant negative correlation between satisfaction and measures of use impacts (Graefe et al. 1984a). Despite the intuitive appeal of the satisfaction model, then, it simply does not appear to represent real relationships between use and quality.

In rejecting this hypothesis, however, research examining the satisfaction model has provided a number of important ideas which bear upon carrying capacity issues. For the most part, these ideas attempt to explain why satisfaction does not appear to be strongly related to use levels or use impacts, and thus point researchers

toward variables which are more directly related. Several of those ideas are discussed in detail by Stankey and McCool (1984) and Shelby and Heberlein (1986), and are presented briefly below.

- **Multiple Sources of Satisfaction.** Satisfaction is a broad concept which appears to be influenced by a number of factors. Expectancy theory and several empirical studies support this intuitively obvious point: a satisfactory recreation experience depends as much upon the weather, the friends one has along, and one's own personal attitudes about the trip as it does upon the management setting of the area and the level of interaction one has with others. The implication for management is to make use evaluations by more specific criteria, using variables which relate directly to the hypothesized problems rather than overall measures of quality.

- **Self-selection.** Visitors exercise free choice by engaging in a recreational activity so one expects that satisfaction will be high regardless of other circumstances (Heberlein and Shelby 1977). This similarly supports the notion of examining specific variables rather than a broad, abstract concept such as satisfaction.

- **Product Shifts.** When general expectations are not met during a recreation outing, visitors may rationalize or psychologically adjust those expectations, or alter their concept of what the product--the recreation exper-

ience--should be. While this concept is supported by limited empirical evidence (Shelby et al. 1986), many authors have discussed it (Hendee et al. 1978; Schreyer 1979; Stankey and McCool 1984; Shelby and Heberlein 1986). If valid, the implication is that researchers define the product, the experience, before gathering information about visitors' evaluations.

- **Displacement.** Recreationists whose satisfaction would be influenced by use levels or use impacts may be displaced by increasing use levels, and so surveys asking about satisfaction might miss one group of users (Shelby and Heberlein 1986).

- **Rationalizing.** Finally, recreationists may rationalize that overuse problems are not severe in an attempt to avoid a negative atmosphere about the experience; as Shelby and Heberlein (1986) point out, "most recreationists are out to have fun, and have fun they will." If this rationalizing process is active, satisfaction levels will not indicate real evaluations of use levels or use impacts.

In summary, satisfaction is just not a good criterion for evaluating use because it is influenced by too many other factors, appears insensitive to subtle changes in conditions, and may not be indicative of visitors' feelings toward an experience because shifting perceptions or behaviors may alter them. Satisfaction research

does, however, point toward variables which may help effectively evaluate use--variables which relate more specifically to overuse conditions rather than overall experiential quality.

Perceived Crowding

The concept of crowding is directly related to the problems which prompted carrying capacity studies to begin with, and thus potentially offers a more specific approach to evaluating use (Shelby and Heberlein 1986). Although there is a great deal of literature concerned with the psychological dimensions of crowding and its effects, the basic model applied to recreational carrying capacity is simple. Crowding, which is defined as the negative evaluation of density and should not be confused with simply high densities (Stokols 1972), is presumed to increase as use levels rise above what individuals expect or desire (Graefe et al. 1986a). Crowding should be inversely related to satisfaction by this definition, and it fits in with expectancy theory by specifying that crowding is a function of both objective use conditions and subjective evaluations of those conditions.

Empirical tests of this crowding model have brought mixed results, substantiating basic ideas about the concept but also suggesting that the issue is more complex. While a number of studies have shown links between use densities and perceived crowding, and an even greater

number have shown links between use impacts (usually encounters) and perceived crowding, most of these associations are weak (Graefe et al. 1984a). In addition, links between perceived crowding and satisfaction have not been particularly strong (Graefe et al. 1984a). These results suggest that the perceived crowding variable alone--without considering expectations or preferences--may not be specific enough to evaluate use levels or use conditions (Shelby and Heberlein 1986). In addition, determining capacities according to the crowding model requires some sort of standard by which to judge the information about users' perceptions of crowding--and the theory does not offer any obvi-ous method for doing so. Clearly, more work needs to be done on these issues in order to better understand the concept and how it can be applied. The second paper in this thesis takes up some of these.

Despite these shortcomings, current understanding of the crowding model suggests it may be useful in some settings. Shelby and Heberlein (1986) suggest that a standard for the percentage of visitors who report feeling crowded might be acceptable if only a rough estimate of capacity is needed, and that close examination of the relationship between use and the crowding variable may show a break point (where a small increase in use brings about a large increase in crowding) which could suggest a

meaningful capacity.

In summary, the perceived crowding concept, like satisfaction, is not as useful as it initially appears. While it allows researchers to better understand how use levels relate to experiential quality, more information about intervening variables needs to be known and incorporated into the framework.

Social Norms

In focusing upon the specific conditions of overuse, researchers avoid the difficulty of specifying how use levels exactly relate to overall measures of quality like satisfaction or crowding. However, one still needs to specify the standard by which those conditions can be measured. Normative theory is the perspective which can provide this type of information, suggesting the precise relationship between the use levels or use conditions recreationists encounter and those which they expect or desire.

Normative theory is based on the concept that there are certain behaviors or conditions which are considered appropriate in social settings, and these "norms" are shared and regulated by the actors in those settings (Cancian 1975). In recreation, social norms can be explicit and formalized--as in the case of written rules for most competitive sports or games--or implicit, providing only general guidelines about acceptable etti-

quette or settting conditions (Shelby and Heberlein 1986). Using normative theory to make carrying capacity decisions means identifying the appropriate conditions for certain types of experiences, asking users to name the level at which an impact becomes unacceptable (Stankey and McCool 1984).

A number of researchers have utilized this theory to evaluate different impacts and impact levels in recreation settings, particularly backcountry settings (see Graefe et al. 1984a). This approach has led to a number of consistent findings about how certain groups of users react toward those levels, but it has not led to agreement over how to use that information to establish standards which could be used in carrying capacity decisions (Shelby and Heberlein 1986). The chief problem is that the methods used to identify norms are not well developed or accepted. Another problem is that not all researchers agree that norms are shared by recreationists in any given outdoor recreation setting. Current carrying capacity research suggests that these problems are not significant enough to discredit the general concept of norms in recreation settings, but further empirical and methodological work is needed to apply it effectively. The first paper in this thesis expands on this theme.

In summary, the normative approach to evaluating use appears the most useful for setting use limits because it

focuses directly upon specific conditions, and provides a general approach to collecting and analyzing evaluative information relating to those conditions.

II. THE RESOURCE AND THE STUDY[1]

The Deschutes River has its headwaters in the Three Sisters area of the Oregon Cascades and flows north along the eastern slopes of that range before joining the Columbia River near The Dalles, Oregon. Draining a watershed larger than the state of Maryland, the Deschutes has cut a deep valley through the lava-formed Deschutes-Umatilla Plateau and in places formed a steeply-walled canyon.

The river has had a major influence on present and historical patterns of settlement and activity in the region. Indians have fished and lived along the river's banks for centuries, beaver trappers arrived in the mid-1800's, railroads were built in response to booming timber industry needs in the early 1900's, and livestock grazing within the canyon has been practiced for over 100 years. In the recent past, the river has been diverted into four reservoirs and it is used for municipal water supplies, irrigation, and the generation of hydroelectric power. In addition, with over half the population of the state living within a three-hour drive of the river, the area has become one of the most popular rec-

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[1] This chapter is adapted from the background chapter in Shelby et al. (1987), which was principly written by Doug Whittaker.

reational resources in the state, providing excellent fishing, hunting, floating, boating, hiking and sightseeing opportunities. The lower 100 miles of the river, below the last of the dams, has proven to be particularly popular and important, and was named as one of twelve State Scenic Waterways in 1970, to be protected against "adverse development" and to enhance scenic, recreational, fish and wildlife values.

PHYSICAL DESCRIPTION

The lower Deschutes essentially begins below the Pelton re-regulating dam near Warm Springs, and ends at the confluence with the Columbia about 98 miles north (see Figure II.1). The river drops approximately 13 feet per mile, a figure comparable to the Colorado River through Grand Canyon, but the Deschutes carries far less water and has a more even gradient. Flows typically range from 3,000 to 9,000 c.f.s. (with 4,000 being normal summer flow), and the average current speed is about four miles per hour. There are thirteen major rapids on the river (navigable in various craft), and Sherar's Falls (which is unnavigable). Most whitewater is found between Trout Creek and Sherar's Falls, or below Kloan.

The terrain in the canyon is generally steep and rocky, the result of a powerful river having sliced through an ancient basalt plateau at the end of the last

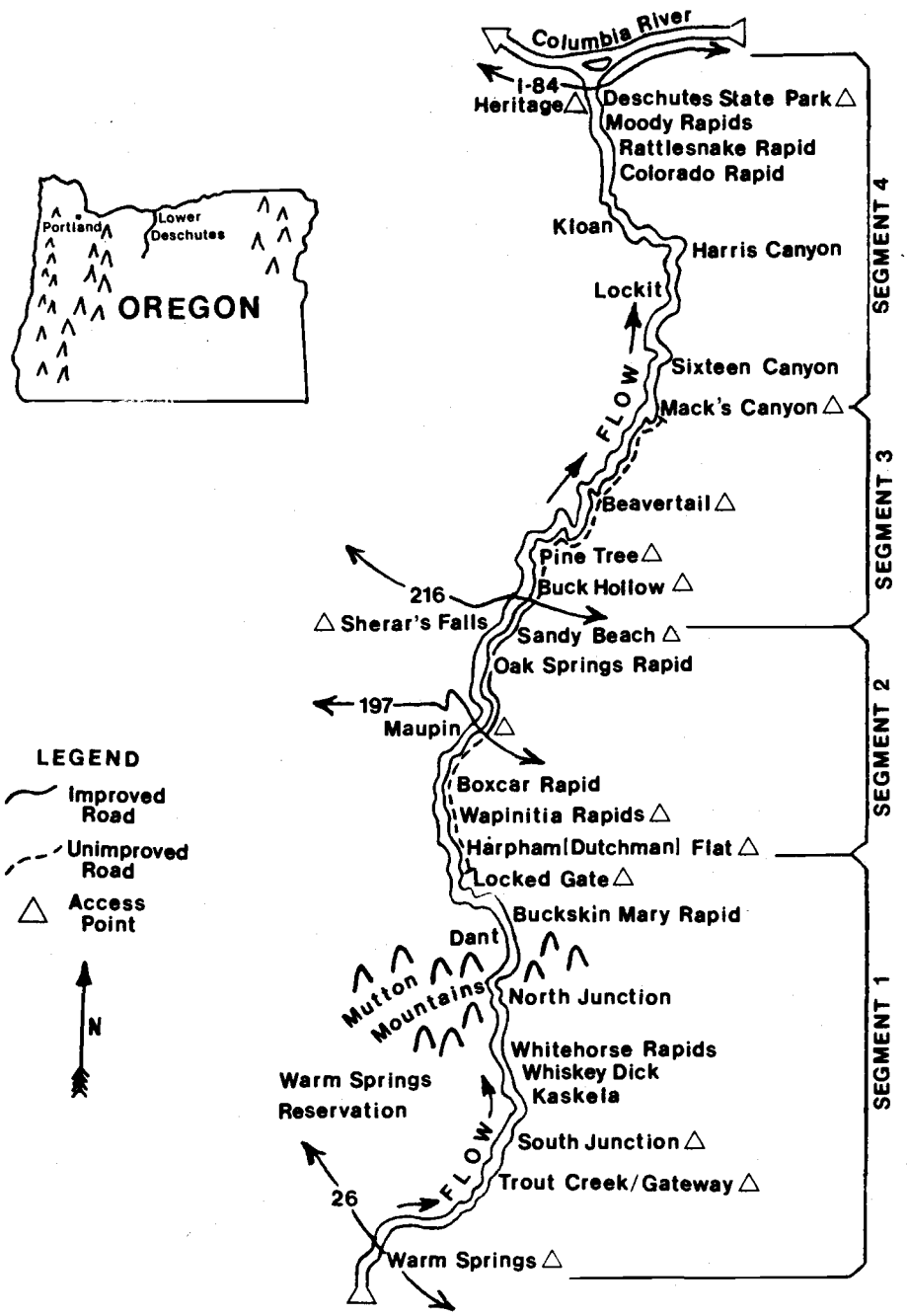

Figure II.1. Map of Deschutes River Scenic Waterway

ice age. There are, however, a number of flats and bars along the river. The processes of erosion and deposition are occuring in a number of areas along the river, and sometimes these processes are influenced by grazing practices or recreational use.

The vegetation of the area does not vary along its length and is best described as a sagebrush desert, although a variety of range grasses are prominent. Along the river and some of its tributaries there is a thin band of riparian vegetation that includes different varieties of grasses and shrubs, and trees such as alder and cottonwood.

A variety of wildlife inhabits the canyon, and fish are abundant in the river. The segment above Sherar's Falls is a nationally renown rainbow trout fishery, and the whole river has a reputation for summer steelhead and chinook salmon. Trout can be caught all season long, but are especiall active during the spring salmon fly and stone fly hatches. Steelhead and salmon enter the lower river in July and move upstream through the late fall.

The climate of the region is generally dry and hot during the summer months when most use occurs on the river; however, the nights in both spring and fall can be very cold. The water in the river, which comes out of the bottom of Pelton dam, is very cold, although it is swimmable in the midday heat of summer. Wind in the

canyon is variable but can be fierce and typically blows upstream in the afternoons.

STRUCTURES AND DEVELOPMENT

Railroad tracks, which are still used daily for freight traffic, run almost the entire length of the river, on the east side above North Junction and on the west side below. Another set of tracks once ran on the east side for the entire length, but were removed by mid-century. The railroad bed was converted into a graded road at that time but it is only maintained from North Junction to Mack's Canyon, and not all of this maintained road is accessible to the public. Several other gravel roads approach the river canyon from the plateau above.

A number of residences (most seasonal) are found along the river, particularly above the Locked Gate, and the city of Maupin (which is not within the designated scenic waterway) is perched on the river's western bluffs about halfway between Warm Springs and the mouth. Other development along the river includes a hatchery at Oak Springs rapids, the bridge below Sherar's Falls, various abandoned railroad boxcars, and a variety of recreational facilities including a handicapped-accessible fishing ramp, over ninety pit toilets, and fifteen boat launches.

Recreation users can enter the Deschutes Canyon in a number of places. There is unlimited road access from

Locked Gate to Mack's Canyon (about 35 miles, although only the 10 miles from Maupin to Sherar's Falls is paved), and users can walk along the river bank from either end. Camping is allowed along most of the roaded areas, and several turn-outs allow motorists to get their vehicles within feet of the river. There are six developed campgrounds in the canyon, which offer water, toilet facilities, and formalized campsite boundaries.

USE PATTERNS AND TRENDS

The lower Deschutes is used by many diverse groups of recreationists in many different ways. While angling, camping, and boating are clearly the most popular activities, users also sunbathe, swim, picnic, bicycle, and hike along the river, and it is important to recognize that these activities are done at different times and at different places. The best way to describe the spatial and temporal dimensions of use patterns is to break the river into four different segments, as shown in Figure II.1. The four segments can be briefly characterized as follows:

Segment 1 is known for its trout fishing and boater camping. Road access is limited, as is public land (the Warm Springs Indian Reservation abutts the river for 26 miles). Angling use peaks during the spring fly hatches, with whitewater/camping use peaking during the hotter

months of July and August. There is some good whitewater, but less than in Segment 2. Many whitewater floaters continue their trips into Segment 2, taking two or three days to complete their floats. Jet boat use is prohibited over most of this segment. Weekend use is generally much greater than weekday use.

Segment 2 is commonly referred to as the "day use segment" because it has road access along its length, allowing boaters to take shorter trips. It is best known for its whitewater, although many users also fish. This segment has the highest use levels, which peak in August. Because of the easy access, Segment 2 is also popular for riverside car camping, sightseeing, and picnicking. There are also a few beaches which are popular for sunbathing and wading. Few jet boaters use this segment because of the relatively difficult rapids. Weekend use is generally much greater than weekday use.

Segment 3 also has road access along its length, as well as two developed campgrounds, which attract car campers. However, because the access road is very rough, use is far less than in Segment 2. Fewer whitewater enthusiasts float this segment because it has relatively little whitewater. Steelhead fishing is excellent in early fall however, so many camping and drift boating anglers visit the area then. Jet boaters use this segment regularly during the steelhead runs, with most com-

ing upriver from the mouth through Segment 4. Weekend use is generally not significantly different from weekday use.

Segment 4 is best known for its steelhead fishing in late summer and early fall, but it also has some relatively large rapids which are becoming increasingly popular among whitewater enthusiasts. There is no shortage of public land on this segment, as on Segment 1. Several boaters drift through both Segment 3 and 4, taking two and three-day trips. Jet boats are common on this segment, often outnumbering floaters. There is no road access, but many anglers hike up from the mouth during steelhead season, especially over weekends. On the whole however, weekend use is not significantly different from weekday use.

Available data on use patterns and trends on the lower Deschutes is limited. While a number of surveys and counting techniques have been employed by various managing agencies, many of these figures may not be precise. However, they are useful in giving a rough indication of how use is currently distributed and how it has changed in recent years. Further details about how use is estimated on the Deschutes can be found in Shelby et al. (1987).

Patterns of use on the Deschutes have changed over time. Prior to 1979 when new regulations eliminated bait

fishing and multiple hooks, for example, approximately seventy-five percent of all use was associated with fishing. Now, less than half of all use is fishing-oriented. On the other hand, in 1975 only ten percent of use was associated with boating, while in recent years estimates suggest over half is boating-oriented.

Use levels have also fluctuated over time, although use on the whole has increased steadily since 1979, and on some segments these increases have been dramatic. Boating use in particular has increased; as shown in Figure II.2, State Parks estimates that boating use has almost tripled in the last decade. While there is no sign of overall boating use levelling off, however, it should be noted that increases on Segment 2 may account for as much as 80 percent of recent overall increases.

MANAGEMENT HISTORY

The lower Deschutes has been extensively managed by various state and federal agencies. The de facto lead agency on the river is the State Parks and Recreation Division, but this is a relatively recent development. While Oregon designated the river a Scenic Waterway in 1970, the Bureau of Land Management (BLM), as major landholder along the river, was the lead management agency prior to and throughout the 1970's.

In the late 1970's, increasing use levels, use im-

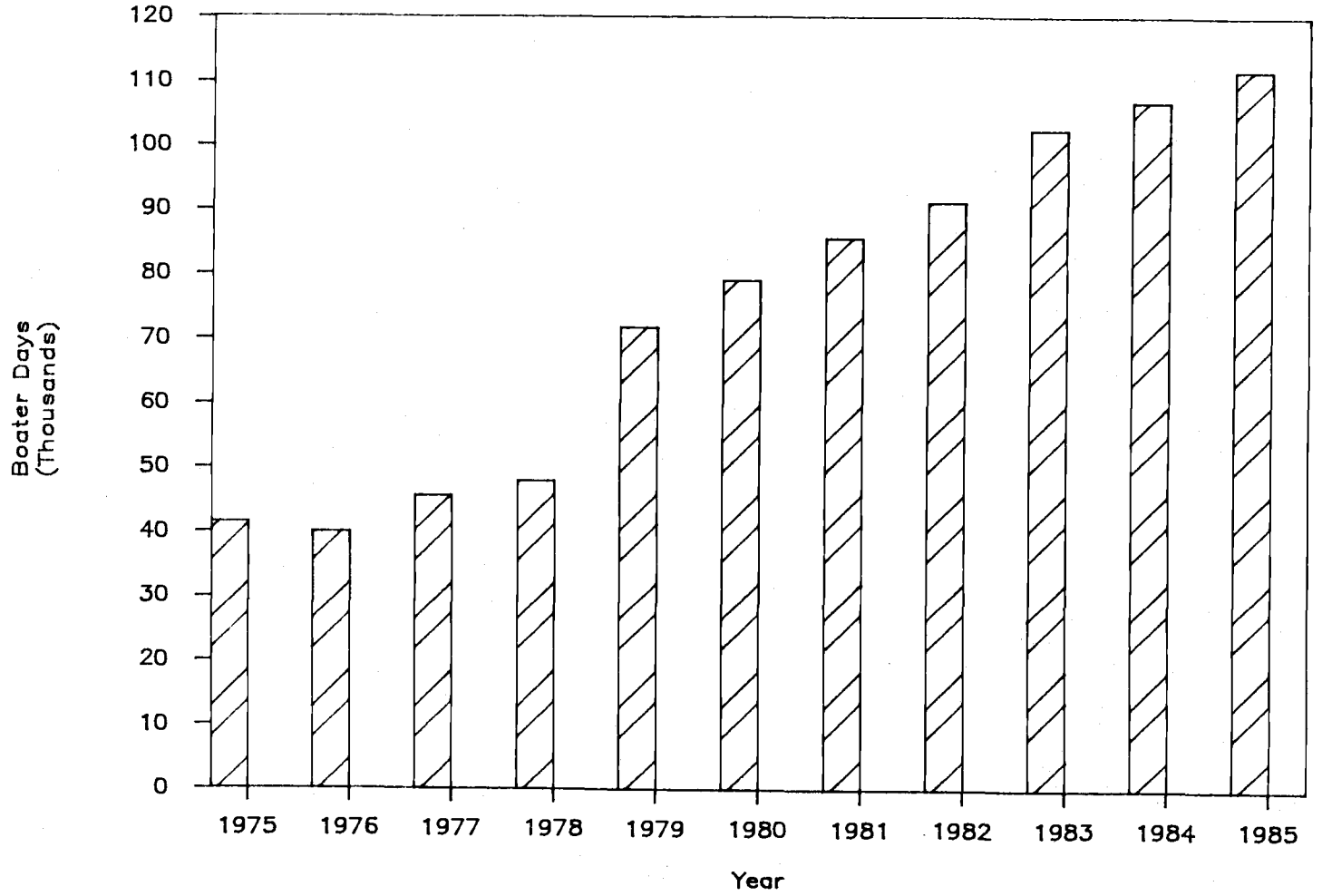

Figure II.2. Boating Use on the Deschutes River 1975-1985

pacts, and user group conflicts led Oregon Governor Atiyeh to establish a task force reviewing river management. The 1980 Task Force recommendations urged more intensive and coordinated management focusing upon user education, tighter regulations, adding and improving facilities, and land acquisition. It recommended against use limits on boating at that time. In order to finance the greater management effort, the Task Force recommended establishing a fee system for boaters, which was adopted in 1982. It was hoped that the money generated from the fee system ($1.75 per boater per day) would help solve river problems while allowing unlimited use.

Funds from the boater pass program were used to implement Task Force recommendations. A governor-appointed Advisory Committee periodically reviewed management direction over the next three years, and generally endorsed the focus on resource improvements. By 1985, however, some interest groups were becoming increasingly unsatisfied with this focus, calling for more attention to social or experiential problems on the Deschutes.

In response to this concern, the Oregon legislature commissioned a study to investigate both the social and environmental problems on the Deschutes, and suggest management alternatives which might be used to solve or mitigate those problems.

THE STUDY

Three objectives formed the framework for the study as outlined by the legislative act:

1) Identify perceived social and ecological impacts of recreational use, and assess the existing natural resource condition.

2) Identify and establish standards for acceptable levels of identified impacts.

3) Identify management strategies which might be used to limit impacts to acceptable levels, and evaluate public support for them.

These objectives were accomplished through information collected by several methods, including focus group meetings held with interest groups, extensive surveys of both boating and non-boating users, discussions with scientists and agency personnel, and on-site field work. The information was organized by the four geographical river segments. The data from the boater survey were used for both papers presented in this thesis.

Findings from the study suggest that average impacts for a variety of conditions were greater than average standards, indicating a number of impact or overuse problems. The study also found that users preferred management strategies which emphasized small-scale capital improvements or user education over use limits, but that a substantial number of users would accept limits in

order to insure higher quality experiences. The study report was concluded by a chapter which outlined a process for integrating the results from the study into a management plan determining appropriate amounts and types of use.

III. IMPACT STANDARDS ON A RECREATIONAL RIVER: EXTENDING THE SOCIAL NORMS CONCEPT

INTRODUCTION AND THEORY

Opportunities for different types of recreation experiences are affected by various attributes of a resource's physical and social settings (Driver and Brown 1978). Many of these attributes may be influenced by impact from visitors themselves. Faced with dramatic recreation use increases and increasing impacts, many resource managers have set use limits or carrying capacities in an effort to protect the quality of environments and experiences. The assumption is that impacts are negative and must be minimized; the problem is that any use results in at least some impact (Shelby and Heberlein 1986). To effectively limit use, it is necessary to specify acceptable impact levels.

The carrying capacity issue has been extensively studied in recreation for over 20 years, and several conceptualizations of the idea have been described (Graefe et al. 1984a). While many issues remain to be resolved, there is increasing agreement that the concept is most useful when it is understood as having both descriptive and evaluative components (Graefe et al. 1984b). Specifically, the descriptive component involves knowing the link between use levels and the impacts or conditions

which result from use, while the evaluative component involves value judgements about how much impact is acceptable for a given type of experience (Shelby and Heberlein 1986). The consensus is that impact does not necessarily imply "damage" to either the environment or visitor experiences, and that use does not become "overuse" until impacts exceed some acceptable level or standard (Stankey and McCool 1984; Graefe et al. 1984a; Shelby and Heberlein 1986; Jacob and Schreyer 1980). The difficulty is specifying standards.

The concept of social norms, well developed in social psychological literature, addresses this problem. A social norm is a shared standard for appropriate conditions or behavior in a social setting and can be identified by examining individual preferences or personal norms (Cancian 1975). A social norm held by recreationists in regard to appropriate impact levels provides the evaluative information needed to establish an objective standard for addressing carrying capacity or overuse issues. The problem for researchers and managers is to develop a method for collecting, analyzing, and interpreting information about personal preferences in order to identify social norms for relevant impacts.

Many approaches have been used to address this problem. The earliest attempts were conducted by Lucas (1964) and Stankey (1973; 1979), who investigated prefer-

ences for between-group contacts in wilderness settings. Lucas' work in the Boundary Waters Canoe Area established that users have opinions about appropriate contact levels (preferring to see very few), and their preferences differ depending upon the type of contact (motorized vs. non-motorized parties). Stankey's more extensive studies of visitors in several western wilderness areas confirmed that users' preferences are similar across settings (preferring to minimize contacts), but there are differences in preferences for types of contacts (horsepackers vs. backpackers), as well as differences depending upon the the place where the contacts take place (in camp or on the trail). In addition, Stankey found that different types of users (purists vs. non-purists) have different preferences. The major implication from these studies is that precisely determining norms requires careful definitions of the impacts in question, and that many impacts and many groups might need to be examined.

The methods used in these studies did not specifically ask respondents to report how much impact was preferred or tolerable. Lucas, for example, only asked respondents to report the highest impact levels which would be tolerable if the area was thought of as a wilderness, while Stankey simply asked respondents how pleasant or unpleasant various impact levels were. It is difficult to establish a justifiable standard based upon

these types of items because a social norm only emerges when personal preferences are clearly understood and there is substantial agreement among those preferences (Shelby and Heberlein 1986). One option with the Stankey data is to adopt a decision rule such as, "acceptable levels of impact are exceeded when 50 percent report that level as unpleasant," but this is somewhat arbitrary.

Schreyer and Neilson (1978) investigated user tolerance for contacts on the Colorado (Westwater Canyon) and Green Rivers (Gray and Desolation Canyons), using a more specific survey question, but their method also did not systematically define a social norm in terms of the structure of personal norms. Establishing an impact standard requires such a definition.

Other researchers have posited and tested an economic model for establishing carrying capacities that examines users' willingness to pay for different experiences with varying encounter levels, and might be used to help define social norms. However, in a study of Spanish Peaks recreationists who were asked about hypothetical trips with varying encounter levels, Cicchetti and Smith (1973) essentially found no relationship between encounters and willingness to pay. Similarly, McConnell (1976) found that relationships between density and willingness to pay on six Rhode Island beaches were not significant unless a number of other variables (such as the frequency

users went to the beach, users' income, and the temperature) were statistically controlled. In general then, these studies suggest that willingness to pay is not a useful way of measuring how users feel about various densities or use conditions. Fisher and Krutilla (1972) and Cicchetti and Smith (1973) discuss several problems with the willingness to pay approach and suggest other alternatives for investigating capacities (particularly using a satisfaction variable), but the obvious implication is that willingness to pay cannot provide useful information about social norms.

A different method for examining social norms was developed by Jackson (1965) and first applied in a recreation setting by Vaske (1977). The Jackson approach is similar to Stankey's, which asked respondents to react to various impact levels, but provides more information. The Jackson return potential model, when applied to norms in recreation settings, defines a social norm in terms of average personal norms (the mean response favorable or unfavorable for each level of impact). It also allows discussion of four important norm characteristics: the optimum level of impact, the range of tolerable impacts, the intensity or strength of the norm, and the norm crystallization or level of group agreement. This kind of information can allow managers to establish justifiable standards for impact conditions.

Using this technique to determine contact preferences among anglers, canoers, and tubers on the Brule River, Vaske (1977) found that the different groups have different norms, and that the norms differ according to the type of contact (for example, canoeists indicated they would tolerate fewer contacts with tubers than with anglers or other canoeists). In addition, Vaske found there is less agreement about acceptable contact levels among tubers than among canoers or anglers, suggesting that less "specialized" users may have less well-defined norms. These findings were not unexpected; in many ways Vaske's research corroborated earlier research which used other techniques to describe or define user preferences for contacts (Lucas 1964; Stankey 1973; Badger 1975). However, the important implication of this research was that it provided a clear and specific method for characterizing norms.

Vaske's approach, however, involved a cumbersome method of asking about many different impact levels, thus precluding analysis of norms for a variety of impacts, for different settings, or different experience definitions (Shelby 1981). Because previous research had suggested that these issues needed investigation, Shelby developed a more streamlined method which gives information on three of the four norm characteristics specified by Vaske (no information on intensity). Using data from

surveys of boaters on the Colorado River through Grand Canyon and Oregon's Illinois and Rogue Rivers, Shelby found that contact norms differ depending upon the type of experience being considered and where the contact took place (in camp or on the river). Shelby also found that contact norms for the same experience definitions (wilderness and semi-wilderness) are remarkably consistent, and are comparable to contact norms reported for wilderness definitions by Stankey (1973; 1979) and Lucas (1964)--less than three per day on the trail or river/lake, none at camp. Finally, Shelby found that agreement about norms is less crystallized for more developed experience definitions, suggesting there is likely to be greater difficulty in establishing impact standards in such settings. In any case, the implication of this study was that describing group norms for different settings and for different experience definitions could be done efficiently, and that future research should attempt to look at norms for a variety of impacts in a variety of settings, particularly those settings which have higher use densities or are more developed.

Shelby and Harris (1986) examined user preferences for different levels of environmental impacts (fire ring size and the amount of bare ground) at campsites in Oregon's Mt. Jefferson Wilderness, a departure from the focus on inter-party contacts. The findings from this

research suggest that norms for different areas within the same resource may differ, and that some low level of impact may be more acceptable than no impact. This confirms the theoretical notion that not all impacts are perceived as negative (Wagar 1964), and adds further impetus to the task of discovering what levels of impact are perceived as unacceptable in different settings.

This paper reports research which extends the social norms concept as it relates to establishing impact standards. First, it examines norms in a less remote, more developed, and more heavily used setting than most previous studies (which have typically been conducted in backcountry areas). Second, it examines differences in norms for different settings within a larger resource area. Finally, this paper examines norms or standards for a variety of different impacts. Because most earlier studies suggest that contact norms differ depending upon the timing and type of contact, this study examines different types of contacts, in different places, at different times during trips. In addition, it examines norms for environmental and resource competition impacts which are distinctly different from contacts. The inclusion of environmental impacts follows from studies by Lucas (1980) and Shelby and Harris (1986), and further justification comes from a study by Vaske et al. (1982) which suggests that environmental impacts have an import-

ant effect on perceptions of crowding. The inclusion of the resource competition impacts follows from discussions with resource users during public meetings held as part of this study (Shelby et al. 1987).

The goals of this paper are to describe and characterize norms for a variety of impacts across different settings, and discuss their usefulness in establising standards for acceptable levels of impacts. Specifically, this paper will 1) define three different kinds of norms based upon the structure of aggregate personal preferences; 2) describe norms and norm types for each of the impacts and settings studied; 3) describe norm crystallization (the level of agreement) for each of the impacts and settings studied; 4) discuss the "importance" of various impacts relative to each other; and 5) discuss how this information can be used to establish impact standards.

METHODS

Data for this research come from a study of recreation use impacts on the lower Deschutes River, a central Oregon resource known for its fishing and whitewater boating opportunities (see Shelby et al. 1987 for complete details of the project). Use on the Deschutes had almost tripled in the ten years prior to the study, and several interest groups were concerned that the impacts

of that use were too severe. The study was designed to identify impacts, define standards, and review management alternatives which might mitigate unacceptable impacts. One of the information-gathering techniques was an extensive survey of boaters who use the river.

Relevant impacts to be explored in the survey were determined during "focus group" meetings with various interest groups such as a fishing club, an outfitters' organization, and a rafters' club. These meetings were limited to between 5 and 10 people and had an agenda which focused discussion. In general, attendees were asked to describe specific problems or impacts they encountered on the river. After several of these meetings, the impacts mentioned began to be repeated, suggesting that the range had been covered. These meetings were an effective way of identifying issues for questionnaire development.

The questionnaire was mailed to individuals randomly selected from a list of boater pass purchasers, and questions were asked about their typical river experiences. Because managers of the Deschutes had determined that there were at least four river segments with differing resource or experience characteristics, respondents were asked to tell about their experiences on the segment they knew best. This essentially resulted in four separate samples (although few boaters chose one segment and it is

not reported here), allowing for comparisons between settings. The three segments used in this analysis can be differentiated as follows:

Segment 1 features trout fishing, whitewater floating, and riverside camping, and has high use levels but low development levels (no public road along its 40-mile length).

Segment 2 features whitewater floating, car camping, and to a lesser degree, trout fishing, and has the highest use levels (many are day users) and development levels (there is a public road and a town along its 15-mile length).

Segment 3 features steelhead fishing, riverside camping, jet boating, and to a lesser degree, whitewater floating, and has lower use and development levels (no public road along its 23-mile length).

In all, 800 boater names were sampled for the study; 108 were undeliverable, and 576 were completed and returned (a response rate of 83 percent). The sample analysed for this research was further cut to 460 as a subset of outfitters was removed, along with the boaters from the little chosen segment. The sample sizes for each segment are given in Table III.1.

Eleven impacts were assessed in the survey. For each, boaters were asked to report the level of impact they encountered and indicate the level they would tol-

Table III.1

Sample Sizes for Different Impacts and Segments

	Segment 1	Segment 2	Segment 3
River Encounters	114	115	64
Discourteous Behavior	153	180	102
Human Waste	155	183	101
Jet Boat Encounters	134	142	44[a]
			23[b]
Angling Disturbances	80	32	55
Fishing Competition	100	40	78
Launch Waiting Time	140	150	77
Camp Encounters	117	79	64
Camp Sharing	126	85	78
Camp Competition	132	100	76
Fire Rings	96	74	57
Total Sample Possible	158	192	110

[a] Non-jet boaters

[b] Jet boaters

erate (their personal standard). The specific format for these questions about standards followed from the technique developed by Shelby (1981), and asked users to report "How much impact is tolerable before your experience becomes unpleasant?" Users then responded to specific statements such as, "It is OK to be in sight of other parties as many as ___ hour(s) out of four when boating this segment." Because some users might not have opinions about tolerable levels of some impacts, "it doesn't matter to me" was an option included for each impact question. The availability of this response meant that sample sizes differ for each segment and for each impact. In addition, because some impacts refer to fishing and camping but not all users fish and camp, sample sizes again fluctuate. Table III.1 summarizes the sample sizes used in this analysis, with the "no preference" respondents taken out. The eleven impacts studied were as follows:

1. River Encounters: the number of hours out of four spent within sight of another party when on the river. (The high use levels on the Deschutes made it difficult for users to report how many other parties they actually encountered, although many said they could report how much time they were in contact with others.)

2. Discourteous Behavior: the number of incidents of discourteous or inconsiderate behavior encountered per

day.

3. Human Waste: the number of stops out of four where human waste is encountered.

4. Jet Boat Encounters: the number of jet boats encountered per day.

5. Angling Disturbances: the number of boats per hour that pass anglers while they are fishing.

6. Fishing Water Competition: the number of times out of four that anglers pass up good fishing water because it is occupied by another angler.

7. Launch Waiting Time: the amount of time (in minutes) boaters have to wait for another party to clear the launch area when putting in or taking out.

8. Camp Encounters: the number of nights out of four spent within sight or sound of another party.

9. Camp Sharing: the number of nights out of four spent right next to (within 50 feet of) another party.

10. Camp Competition: the number of times out of four that boaters pass up a good quality site because it is occupied and settle for one of lower quality.

11. Fire Rings: the number of campsites out of four which have fire rings present.

Analysis of the data involved graphing the frequencies of responses for each impact question to allow discussion of the general characteristics of social norms and provide distinctions between different types of

norms. Various statistical descriptors of the curves were defined in the same manner as Shelby (1981), further allowing comparisons of norms across impacts and settings. Specifically, the optimum level was defined as the median, the tolerable range was from 0 to the median, and the level of agreement or norm crystallization was the standard deviation. It should be noted that this last piece of information cannot be compared across segments unless response categories have the same scale (which is true for seven of the eleven impacts studied here). Finally, an "importance" measure was calculated as the percentage of respondents who reported an impact standard (rather than choosing the "it doesn't matter" category).

RESULTS

Comparing the graphs of frequencies for each of the impact standards suggests that there are three basic curve shapes which suggest different norm types. The human waste standards shown in Figure III.1, for example, characterize a "no tolerance" norm. Between 74 and 89 percent of the respondents (depending upon the segment) reported it was never acceptable to see signs of human waste, and of the remaining respondents, only 4 percent reported they would tolerate seeing human waste at more than one stop per day. In general, a no tolerance norm

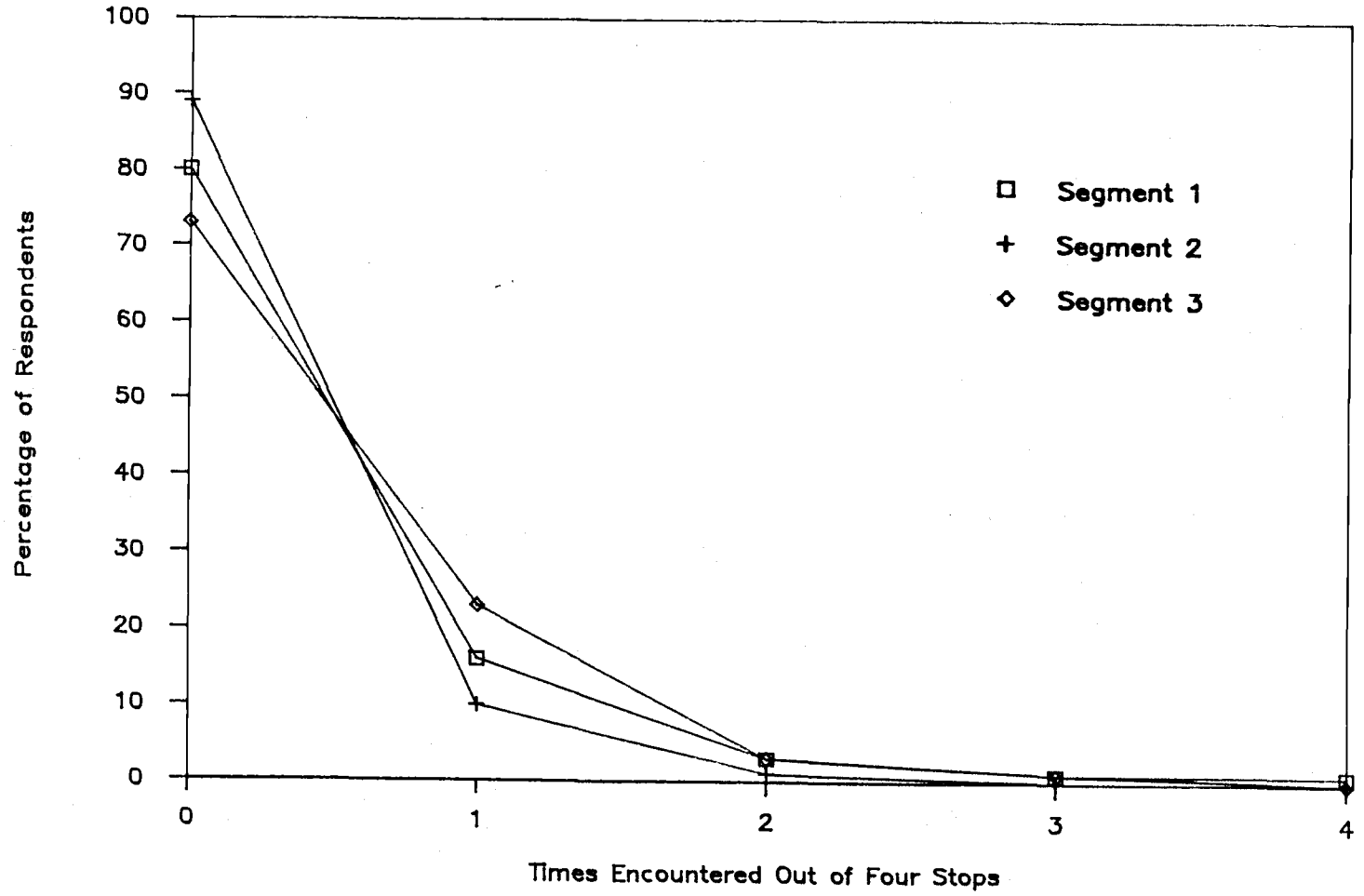

Figure III.1. Human Waste Standards: a "No Tolerance" Norm

is characterized by a mode at zero impact, with few respondents tolerating any impact at all. In addition, there is usually little variation between norms for different segments, and one would also expect little variation for different resources. These kinds of impacts appear to be unacceptable under most circumstances. Other norms in this study which fit the no tolerance type include discourteous behavior (for all respondents), and jet boat encounters (for non-jet boaters).

The river encounter (time in sight) standards shown in Figure III.2, in contrast, appear to represent a "single tolerance" norm. In this example, the majority of users (99 and 98 percent for Segments 1 and 2, 63 percent for Segment 4) reported standards greater than zero, but few said they were willing to tolerate impacts beyond a certain level, represented by the peaks in the graph (at two hours out of four for Segments 1 and 2, and one hour out of four for Segment 3). In general, a single tolerance norm is characterized by a mode at some impact level greater than zero. There also tend to be differences between the modes or medians for the different river segments, and one would expect differences between different resources also. Nonetheless, the tolerance level for a given impact in a given setting is well defined; there is typically a sharp drop in the percentage of respondents reporting tolerances for impacts greater than

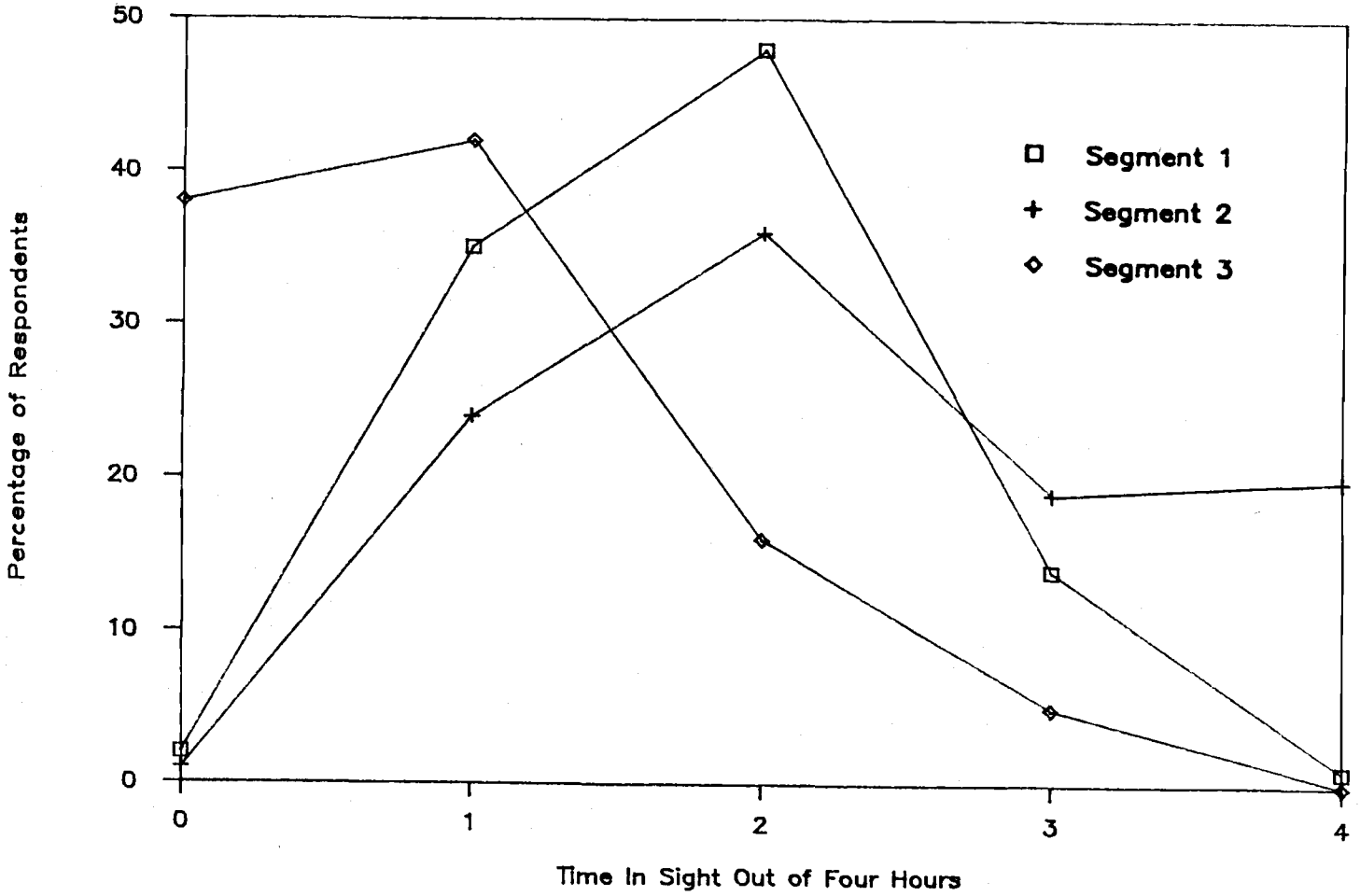

Figure III.2. River Encounter Standards: a "Single Tolerance" Norm

the modal level. Other impacts from this study which fit the single tolerance norm type include jet boat encounters for jet boaters, launch waiting time, angling disturbances, fishing competition, camp sharing, and camp competition.

The last type of norm, represented by the fire ring standards shown in Figure III.3, appears to be a "multiple tolerance" norm. In this example, between 33 and 48 percent of respondents (depending upon the segment) favor a standard at zero impact, and the percentage reporting higher tolerances declines at each of the next three impact levels. However, the curve turns upward at the highest impact level, where 13 to 18 percent would tolerate a fire ring at every campsite. Because the distribution is essentially bi-modal, there appear to be two groups with different social norms for this impact, and it obviously makes little sense to talk about an average or median representing some consensus of opinion. Other impacts which fit the multiple tolerance type include camp encounters (although not for Segment 1 boaters), and river encounters (time in sight) for Segment 2 users.

Social norms for each impact for each of the three segments are given in Table III.2. The norms are represented by medians, which can be understood as "fifty percent of respondents indicated that the impact should be

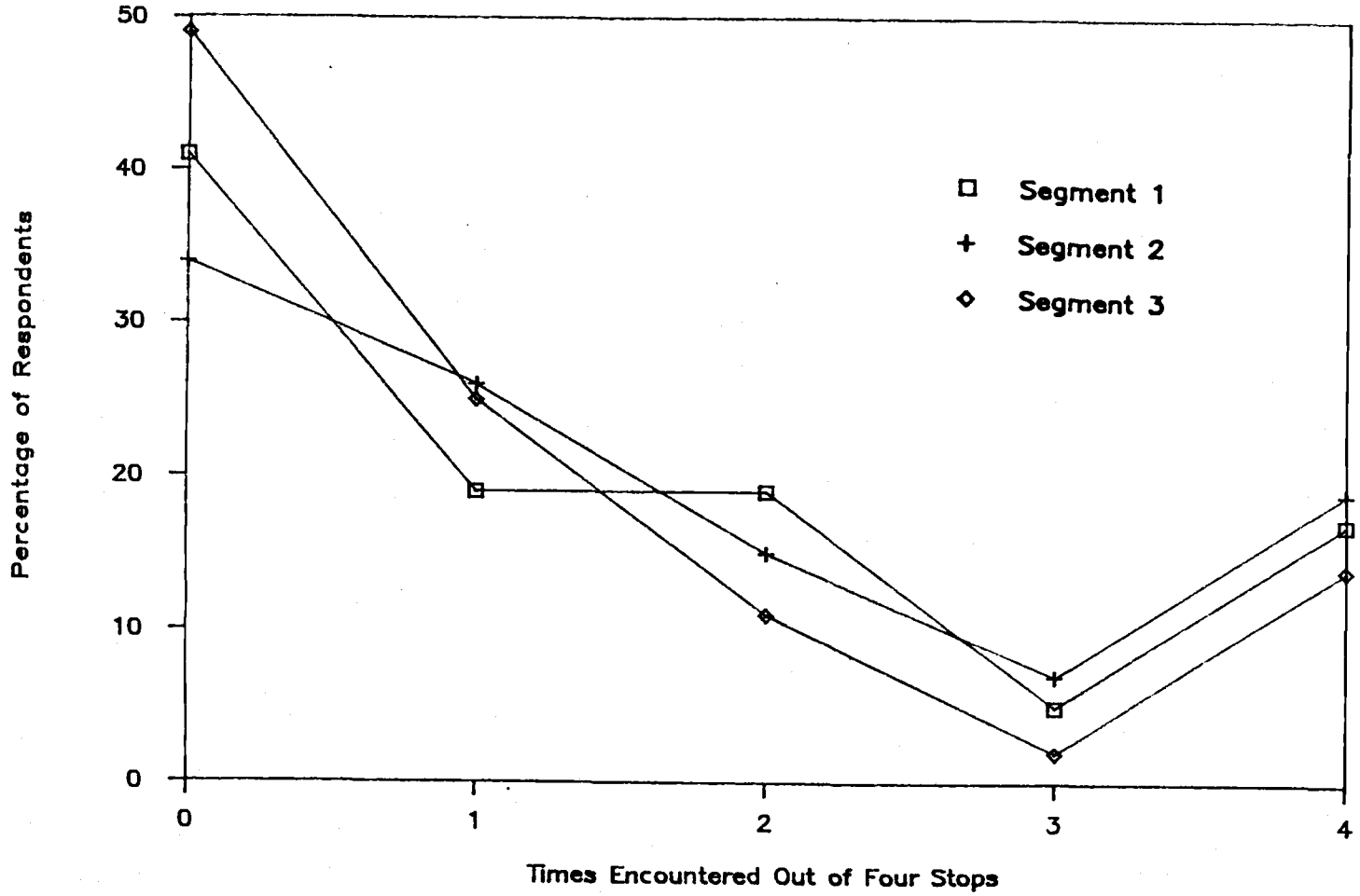

Figure III.3. Fire Ring Standards: a "Multiple Tolerance" Norm

Table III.2

Social Norms for Different Impacts and Segments[a]

Impact	Section 1	Section 2	Section 3	Norm Type
River Encounters (hours out of four in sight)	1.8	2.2	1.8	Single Tolerance
Discourteous Behavior (incidents per day)	0.2	0.1	0.2	No Tolerance
Human Waste (out of four stops)	0.3	0.1	0.2	No Tolerance
Jet Boat Encounters (boats per day)	0.6	0.3	1.3[b]	No Tolerance[b]
			9.7[c]	Single Tolerance[c]
Angling Disturbances (boats per hour)	4.2	4.7	4.0	Single Tolerance
Fishing Competition (holes passed up out of four)	1.3	1.6	1.7	Single Tolerance
Launch Waiting Time (minutes waiting)	14.9	10.3	14.9	Single Tolerance
Camp Encounters (nights out of four)	1.8	1.9	1.4	Multiple Tolerance
Camp Sharing (nights out of four)	0.9	0.9	0.4	Single Tolerance
Camp Competition (camps passed up out of four)	1.1	1.2	1.2	Single Tolerance
Fire Rings (out of four camps)	1.0	1.1	0.5	Multiple Tolerance

[a] Figures are medians, which can be read as "Fifty percent would tolerate ___ or fewer" hours in sight, encounters, etc. before their "experience becomes unpleasant."

[b] Non-jet boaters

[c] Jet boaters

this level or lower." The tolerable range is thus from zero to the median. Norm types are also summarized in this table.

Two interesting patterns are revealed in these results. First, eight of the eleven sets of norms have medians greater than zero, and would not be classified as "no tolerance" norms. This suggests that Deschutes boaters tolerate certain levels of impact for a number of conditions, which is understandable given that this is a higher development, higher use area.

Second, while the no tolerance norms do not vary for each of the river segments most others do. More interesting, the norms for these impacts are generally at higher levels for segments with higher levels of development and use. For example, Segment 2, which has the highest use, has higher norms for river encounters and angling disturbances, while Segment 3, which has the lowest use, has lower norms for camp encounters, camp sharing, and fire rings. It should be noted that this general rule does not always apply. Other factors which may explain norm differences across settings will be discussed later.

Norm crystallization, or the level of agreement about a norm among users of a segment, is given in Table III.3, with larger figures meaning less agreement or less crystallization. Patterns in these results are not so

Table III.3

Social Norm Crystallization

for Different Impacts and Segments[a]

Impact	Segment 1	Segment 2	Segment 3
River Encounters*	0.74	**1.08**	0.85
Discourteous Behavior	0.48	0.52	0.45
Human Waste*	0.62	**0.38**	0.63
Jet Boat Encounters	1.54	1.48	**3.28**[b]
			7.62[c]
Angling Disturbaces	4.16	**6.40**	3.12
Fishing Competition*	0.64	0.64	0.59
Launch Waiting Time	12.62	**8.27**	10.28
Camp Encounters*	1.09	1.26	1.13
Camp Sharing*	1.10	1.06	0.89
Camp Competition*	0.85	0.86	0.83
Fire Rings*	1.48	1.49	1.40

[a] Crystallization is represented by standard deviations from means. Standard deviations are compared when they refer to similar scales; thus crystallization can only be compared across sections for each impact, or across impacts and sections for starred (*) impacts. Differences across segments are statistically significant ($p<.05$) only when indicated, with the different figure in bold type.

[b] Non-jet boaters

[c] Jet boaters

clear, but two general trends are evident. First, there appear to be some differences between segments for many impacts, but most of them are not statistically significant ($p > .05$). Those which are significantly different across segments include river encounter and angling disturbance impacts, which are less crystallized for Segment 2 users than for users of Segment 1 or 3; human waste and launch waiting, which are less crystallized for Segment 1 and 3 users; and jet boat encounters, which are less crystallized for Segment 3 users.

Second, no tolerance norms are more crystallized than the other types. Crystallization can be compared across impacts only when response scales are the same, so this finding is more tenative, but the level of disagreement for human waste (0.38 to 0.63) is less than the level of disagreement for fire rings (1.40 to 1.48) and camp encounters (1.09 to 1.06) . Other highly crystallized norms (those with lower figures) are camp competition, fishing competition, and river encounters (except for Segment 2 boaters).

"Importance" ratings for each of the impacts are given in Table III.4. These represent the percentage of respondents who indicated a standard for each impact (those who did not respond "the impact doesn't matter to me"), and reveal some interesting patterns. First, no tolerance norms tend to be viewed as more important:

Table III.4

Relative Importance of Impacts for Different Segments[a]

Impact	Segment 1	Segment 2	Segment 3
River Encounters	73	61	60
Discourteous Behavior	97	97	96
Human Waste	99	97	94
Jet Boat Encounters	88	79	88[b]
			43[c]
Angling Disturbances	67	44	58
Fishing Competition	81	49	81
Launch Waiting Time	89	80	74
Camp Encounters	83	67	74
Camp Sharing	89	74	91
Camp Competition	94	85	88
Fire Rings	70	64	65

[a] Importance refers to percentage of sample expressing a preference for some impact standard. Those without a preference checked "it doesn't matter to me."

[b] Non-jet boaters

[c] Jet boaters

between 94 and 99 percent of respondents specified a standard for the human waste and discourteous behavior impacts, while only 65 to 70 percent did so for the fire ring impact. Second, among the single tolerance norms, the lowest importance ratings are associated with the fishing impacts on Segment 2, the segment not known for its fishing opportunities, while the same impacts on Segments 1 and 3 show higher importance ratings. Similarly, the camping impacts were rated lower for Segment 2, the day use section, than on the other segments. Finally, the time in sight impact was not rated as important (by this measure) as many other impacts.

DISCUSSION

This research suggests several conclusions about social norms for impact standards, how they differ across settings and impacts, and their utility in making carrying capacity decisions. First, there are social norms which define tolerable levels of impacts, even in relatively developed, higher use settings. While there appear to be differences for some impacts, in most cases standards emerge which suggest a consensus opinion about acceptable levels.

Second, the methods developed in earlier studies to identify encounter norms in backcountry areas (Vaske 1977; Shelby 1981; Shelby and Harris 1986) can be used to

describe norms for a variety of impacts in relatively developed, higher use areas. In particular, the focus group meeting procedures allow effective identification of the relevant impacts, the survey item formats provide meaningful information about user opinions, and descriptive statistics allow effective analysis and interpretation of data. In general, it appears that social norms exist, and they can be identified and used to develop standards for acceptable levels of impact in higher use as well as lower use settings.

Third, there appear to be three basic types of norms, with the characteristics of each having different implications for developing management standards. No tolerance norms, for example, are agreed upon by a majority of users and also have high "importance" ratings, thus providing a clear basis for managers to set a standard at no impact. In addition, because users appear consistent in their opinions of these impacts, regardless of the setting or circumstances, managers probably do not have to collect norm information on them for different resources. These types of impacts are clearly unacceptable, and it is probably not necessary to ask varied user groups about them.

On the other hand, there are a number of norms which require more careful investigation on a case-by-case basis. In the case of single tolerance norms, there is

relative consensus about acceptable levels among users with a preference, but the tolerance level suggested by these types of norms needs to be verified for each setting. In addition, there are sometimes larger numbers of users who don't report a standard.

In order to develop a credible management standard from a single tolerance norm, decisions about analyzing norm information need to be made. This research suggests standards should generally correspond to the median impact level (or the modal level, which is essentially the same in most cases if the median is rounded), in order to reflect the standards of the majority of respondents who have a preference. However, other criteria could be used, depending on management objectives for the resource. For example, norms for jet boat encounters among Segment 3 non-jet boaters suggests setting a standard at about 10 per day, which would be significantly less than the number currently encountered during peak use periods. Managers may thus choose to ignore information about this groups' standard in order to provide a jet boating opportunity which cannot be provided elsewhere in the region. The point is, norms can provide useful information for making decisions about standards, but they cannot make the decision.

With multiple tolerance norms, developing a credible standard becomes more complex because there may be

two or more acceptable impact levels. In general, it appears that different experiences are being envisioned by users, and developing a standard for the impact in question may mean choosing between those experiences. With regard to fire ring impacts on the Deschutes, for example, there seem to be two competing views: either camp fires are a desirable aspect of a river experience and fire rings are acceptable at every site, or fires are unnecessary or dangerous and unacceptable at any site. This is a use conflict situation, similar to the Wisconsin deer hunting case (see Shelby and Heberlein 1986, p.88), where users did not agree whether higher densities of hunters increased or decreased the chances of success, and thus disagreed over acceptable contact levels. In these situations, managers setting a standard can please neither group with a compromise: a clear choice would seem preferable.

Fourth, for social norms which differ in different settings, this variation appears to be associated with identifiable setting attributes. This conclusion is best seen through a comparison of the results presented here with those from other studies. Researchers have suggested that users of more developed, more heavily used resources would be more tolerant of impacts associated with that use (Wagar 1964; Vaske 1977; Shelby 1981), and these results support this hypothesis. While not dir-

ectly comparable, standards for time in sight impact on the Deschutes, for example, are much less stringent than those reported for the Colorado River in Grand Canyon, and the Rogue and the Illinois Rivers in Oregon, which are clearly resources experiencing lower density use (Shelby 1981). Similarly, the norm for camp encounters in this study was between one and two nights out of four, while other studies have reported that users in lower density settings, usually wilderness, do not like to have any camp contacts (Lucas 1980; Stankey 1973; Shelby 1981). In general, the differences between norms for different segments on the Deschutes also support the notion that in areas with higher use levels, users show greater tolerance.

When this general rule does not hold true, other information about the setting and impact appear to have some explanatory power. For example, the launch waiting time norms for Segment 2 are lower even though use levels are higher and waiting times are probably longer. However, this may be explained by the fact that a majority of Segment 2 users are day users, so they spend a greater percentage of their time at put-ins and take-outs and are more concerned about wasting time in these places. Similarly, Segment 1 anglers fish for trout which can apparently be found along most of this segment, so they do not expect to have to compete for spots and tolerate

passing up fishing water only about 1.3 times out of four. On Segment 3, anglers fish for steelhead which congregate in a smaller number of holes, so they expect angling competition and are willing to put up with it more often.

These types of explanations are clearly speculative, but these results nonetheless imply that managers should set standards in light of setting differences, even if these differences occur within the same resource area. This is consistent with both conceptual papers (Driver and Brown 1978; Clark and Stankey 1979) and other empirical studies (McLaughlin et al. 1982; Stankey and McCool 1984; Shelby and Harris 1986) which have suggested that users perceive differences between areas within a wilderness or segments of a river, and management should likewise treat those places separately.

In a related finding, crystallization of some norms differs across settings, although there was substantial agreement about standards for most impacts studied on the Deschutes. Previous work has suggested that users in more developed, higher use settings would have less crystallized norms (Vaske 1977; Shelby 1981), but the data from this study do not necessarilly support this idea. While crystallization among Segment 2 users (who experience the highest use levels) was substantially less for two impacts, it was substantially greater for two

others. Crystallization appears to differ across settings in some cases, but these data do not suggest that there is a consistent pattern to these differences.

A more significant conclusion about norm agreement is that no tolerance types are more likely to be strongly crystallized than single or multiple tolerance types. The implication of this finding is that establishing standards for no tolerance norms is potentially easier than for other norms.

Finally, some impacts appear to be more important than others, suggesting that some tolerance norms are more useful than others for making carrying capacity decisions. Almost all users say they "care about" some impacts, while for other impacts there are significant numbers who say the level of impact "doesn't matter." Since carrying capacities should be based upon maintaining standards for relevant impacts, it is necessary to determine which impacts are more relevant than others. Unfortunately, the percentage of users with an opinion about tolerable levels (as used in this study) is probably not a good proxy for the importance or relevance of an impact, and developing a more accurate measure of this concept is a good focus for future research.

In summary, this research suggests that tolerance norms can and should be described for a variety of impacts in a variety of settings. While the concept re-

quires care in collecting and analysing this type of information, understanding and measurement methods are sufficiently advanced to make it a viable input for carrying capacity decision-making.

IV. IMPACTS, STANDARDS, AND PERCEIVED CROWDING ON A RECREATIONAL RIVER

INTRODUCTION AND THEORY

Increasing use pressures at many recreation resources have led managers to establish carrying capacities, or use limits, in order to maintain high quality recreation opportunities. Implicit in this management strategy is the assumption that high use densities increase social interaction, which increases perceptions of crowding, the basic phenomenon associated with the problem managers face. For the most part, research supports this assumption: several studies have noted links between density and crowding (Heberlein and Vaske 1977; Shelby and Colvin 1979; Absher and Lee 1981; Ditton et al. 1982; Hammitt et al. 1982), as well as between interaction (contacts) and crowding (Shelby 1980; Shelby and Colvin 1979; Heberlein and Vaske 1977; Bultena et al. 1981; Vaske et al. 1982; Hammitt et al. 1982; Schreyer 1979; Titre and Mills 1982). However, evidence suggests that crowding is also sensitive to levels of resource competition (Heberlein 1977) or environmental degradation caused by use (Stankey 1973; Badger 1975; Lee 1975; Lucas 1980; Vaske et al. 1982). Perhaps more importantly, these interaction or density variables alone do not often explain the bulk of the variance in perceived crowding,

suggesting the phenomenon is more complex.

In dealing with this complexity, most researchers suggest that crowding is a social psychological phenomenon which goes beyond objective conditions such as density, social interaction, or other use impacts; it is also dependent upon subjective judgements about those conditions (Shelby et al. 1983). From this perspective crowding is defined as a negative evaluation of density or density-related conditions (Stokols 1972; Gramann 1982) which appears related to both the characteristics of individuals and the context in which those conditions occur (Manning 1985). In short, crowding may not simply refer to a set of impacts, but also to the evaluation of those impacts. The issue is discovering how those evaluations are made.

Individuals' expectations and preferences are often important in the evaluation of density-related conditions (Shelby et al. 1983). Several empirical studies suggest, for example, that recreationists feel more crowded when they expect to see relatively few other users, or when they expect to see fewer than they actually see (Shelby 1980; Hammitt et al. 1984; Bultena et al. 1981; Ditton et al. 1982). Likewise, studies of preferences suggest that users feel more crowded if they prefer to see fewer other people, sometimes independant of the number they actually see (Shelby 1980; Donnelly and Vaske 1982; Bultena 1981;

Womble and Studebaker 1981). A paper exploring the individual and combined effects of these variables on perceived crowding in six diverse settings also substantiates these notions, and further suggests that expectations have a greater effect than preferences (Shelby et al. 1983). In general, this research focus emphasizes the normative nature of crowding, suggesting that crowding is largely a function of subjective variables related to the way visitors define the recreation opportunity which they experience.

Work on recreation motives, and particularly expectancy value theory, further supports this idea. Based on the concept that visitors engage in recreation because they expect it will result in certain sets of desired psychological outcomes (Driver and Brown 1975), researchers have identified and classified those outcomes, many of which appear to be related to crowding. Field studies testing this theory have noted, for example, that recreationists who reported being motivated by a desire for "stress release/solitude" or "self-awareness" felt more crowded than those who were motivated more by such things as "learning about nature" or "affiliation" (Schreyer and Roggenbuck 1978). Similarly, visitors whose recreation goal is more strongly associated with "quietude" or "getting away from other people" also felt more crowded (Absher and Lee 1981; Ditton et al. 1982). The general

notion, first discussed by Wagar (1964) in his monograph on carrying capacity, is that visitors who are motivated by outcomes associated with solitude will feel more crowded and less satisfied in higher density situations than those for whom solitude is less salient (Stankey and McCool 1984; Shelby and Heberlein 1986).

Still other work has identified visitor experience as a crucial variable influencing perceptions of crowding, further supporting the normative perspective. The basic notion is that users who have more experience with a recreational activity or setting are likely to feel more crowded at a given density than novice users. One reason given for this idea is that individuals' expectations and preferences are shaped by their earliest experiences with an activity and setting, with older users experiencing lower densities when they first started (Neilson et al. 1977; Heberlein 1977). Schreyer et al. (1984) have further suggested that more experienced recreationists evaluate recreation events differently because they have more information with which they can compare current conditions; in other words, more experienced users tend to refine their tastes.

Several field studies provide support for these explanations. Vaske et al. (1980) found that boaters whose first trip to an area occurred earlier were more likely to feel crowded than others, and Ditton et al.

(1982) found higher crowding ratings among Buffalo National River boaters who had been floating for more years, had floated more rivers, and who had floated the Buffalo more times. In a study of hikers on the Appalachian Trail, Murray (1974) reported that more experienced hikers preferred low density hiking, while Heberlein and Dunwiddie (1979) observed that more experienced campers in the Bridger-Teton Wilderness tended to choose campsites farther away from other campers. It has also been noted in several studies that more specialized recreationists (in terms of equipment, skills) tend to have more developed preferences for interaction, usually favoring lower density situations (Bryan 1977; Wellman et al. 1982; Hammitt et al. 1982). The point is, experience also appears to affect individuals' attitudes toward a recreation opportunity, filtering expectations and preferences for densities and density-related conditions.

In summary, research broadly supports the idea that both objective conditions and subjective evaluations are important in understanding perceived crowding. The idea is that individuals base their perceptions of crowding not only on the conditions they experience, but on those conditions relative to some subjective personal standard. The next step is to determine which conditions affect crowding perceptions the most, and more precisely sort out the objective and subjective dimensions of those

perceptions. This paper explores both of these issues through examination of relationships between perceived crowding and variables representing several objective conditions and comparisons of those conditions with individuals' personal standards.

HYPOTHESES

In many ways, this research is exploratory. Little research has examined the relative effects of different kinds of impacts on perceptions of crowding (although most research has implicitly suggested that encounter impacts are more important). In addition, few studies have directly addressed the question of whether crowding is based more on objective conditions or a comparison of those conditions with subjective standards. Nonetheless, current understanding of the relationships between crowding and use impacts, as outlined above, suggests the following general hypotheses:

1. Density-related impacts (whether encounters, resource competition, or environmental impacts) will be related to perceived crowding; users will feel more crowded when objective impacts are greater.

2. Variables representing comparisons of impacts with subjective standards will be related to perceived crowding; users will feel more crowded when impacts are greater than their standard for that impact.

3. Some impacts and the corresponding comparison variable for those impacts (which should be related), will affect perceptions of crowding more than other impacts and their corresponding comparison variables. Specifically, encounter or interaction conditions will affect crowding more than environmental or resource competition conditions.

4. The relative influence of impacts and impact-standard comparisons on crowding perceptions will vary from setting to setting, depending on the types of opportunities provided by each setting and the setting attributes.

5. The comparison of impacts with personal standards will explain more of the variance in perceived crowding than impacts alone.

The goals of this research are to emprically corroborate current theoretical understanding of the crowding concept, to verify the subjective nature of crowding perceptions, and suggest which types of conditions are most likely to influence those perceptions. In addition, it is important to see how that understanding can be used in order to make better management decisions.

METHODS

The data used for this study come from a survey of boaters on the lower Deschutes River, a central Oregon resource known for its fishing and whitewater boating opportuinites (see Shelby et al. 1987 for complete details of the project). Use on the Deschutes had almost tripled in the ten years prior to the study, and several interest groups were concerned that the impacts of that use were too severe. The study attempted to identify impacts, define standards, and review management alternatives which might mitigate unacceptable impacts. One of the information-gathering techniques was an extensive survey of boaters who use the river.

For the survey, relevant impacts were determined during "focus group" meetings with various interest groups. In general, attendees were asked to describe specific impacts or problems they encountered on the river. After several of these meetings, the impacts mentioned began to repeat themselves, suggesting the range had been covered and that an effective questionnaire could be developed.

The questionnaire was mailed to individuals randomly selected from a list of boater pass purchasers, and questions were asked about their typical river experiences. Because managers of the Deschutes had determined that there were at least four river segments with differing

resource or experience characteristics, respondents were asked to tell about their experiences on the segment they knew best. This essentially resulted in four separate samples (although few boaters chose one segment which is not reported in this research), allowing comparisons between settings. The three segments used in this analysis can be differentiated as follows:

Segment 1 features trout fishing, whitewater floating, and riverside camping. It has high use levels but low development levels (no public road along its 40-mile length).

Segment 2 features whitewater floating, car camping, and to a lesser degree, trout fishing. It has the highest use levels (many of whom are day-users) and development levels (there is a public road and a town along its 15-mile length).

Segment 3 features steelhead fishing, riverside camping, jet boating, and to a lesser degree, whitewater floating. It has lower use and development levels (no public road along its 23-mile length).

In all, 800 boater names were sampled for the study; 108 were undeliverable, and 576 were completed and returned (a response rate of 83 percent). The sample analyzed for this research was further cut to 460 after commercial outfitters and boaters from the little chosen segment were removed.

Perceived crowding was measured with a single item on the questionnaires. Users were asked whether they felt crowded on the segment they knew best, and responses were given on a nine-point scale ranging from "not at all crowded" to "extremely crowded." This item has appeared in over thirty recreation field studies (See Shelby and Heberlein 1986 and Shelby et al., in press, for details), as well as in laboratory studies (Langer and Saegert 1977).

Objective impact conditions were reported by users. Relevant conditions were chosen based on previous research (Shelby and Heberlein 1986) and the "focus group" meetings held with Deschutes river users. Respondents were asked about twelve different conditions concerned with specific types of encounters, resource competition, and environmental impacts. For each, users were asked to report the level of impact they typically encountered. The specific format for these objective impact questions was similar to the item shown below:

> About how much of the time are you in sight of another boat (not in your party) when you are boating this segment?
>
> ___ almost never
> ___ about one hour out of four
> ___ about two hours out of four
> ___ about three hours out of four
> ___ almost all the time

Respondents were also asked to report the level of impact they would tolerate before their experience became

unpleasant, to be used in calculating the subjective evaluation variable. The specific format for these "standards" questions followed from the technique developed by Shelby (1981), as shown in the example below:

> It is okay to be in sight of other parties as many as ___ hour(s) out of four when boating on this segment.
>
> ___ It doesn't matter to me.

Preliminary factor analysis of the original twelve impacts and standards indicated that in three cases responses were closely correlated, and composite variables could be created to simplify analysis. In addition, two impacts associated with fishing conditions were dropped because many Deschutes users do not fish and their inclusion in the analysis would mean smaller sample sizes. Variables representing seven objective impacts and seven corresponding subjective evaluations were used in the analysis, as described below:

1. River Encounters: the number of hours out of four spent within sight of another party when on the river. (Note: the high use levels on the Deschutes make it difficult for users to report how many actual parties they encounter, although many said they could estimate how much of the time they were in contact.)

2. Jet Boat Encounters: the number of jet boats seen per day.

3. Launch Waiting Time: a composite variable made

up from the the number of minutes boaters have to wait for another party to clear the launch area when putting in and taking out.

4. Inconsiderate Behavior: a composite variable made up from the number of incidents of discourteous behavior encountered per day plus the number of stops out of four where human waste is encountered.

5. Camp Proximity: a composite variable made up from the number of nights out of four spent within sight or sound of another party, plus the number of nights out of four spent within fifty feet of another party.

6. Camp Competition: the number of times out of four that boaters pass up a good quality site because it is occupied.

7. Fire Rings: the number of campsites out of four which have fire rings (which are illegal in the desert environment).

Respondents who did not report a standard (those who checked "it doesn't matter to me") were dropped from the analysis except when this response could be reasonably interpreted. For example, for fire ring impacts, those who say "it doesn't matter to me" are essentially in the same group as those who would tolerate fire rings at four out of four campsites. This reassignment was done with four impacts (river encounters, camp proximity, camp competition, and fire ring scars) to avoid discarding

valuable information.

The impact-standard comparison variable was calculated as the difference between the two (the impact minus the corresponding standard). This means that the comparison variable is larger when impacts are greater than users tolerate, and smaller (actually negative) when impacts are less than users tolerate.

Analysis of the data involved calculations of bivariate and partial correlations between the impact variables and perceived crowding, and between the comparison variables and perceived crowding, for samples of users from each segment and from the whole river. The bivariate correlations indicate the simple relationships, while the partial correlations control for the other variables of the same type, filtering out overlap. Sample sizes for bivariate correlations were larger than for partial correlations because the latter involved more variables with increased amounts of missing data.

Two regression equations using perceived crowding as the dependent variable were also calculated for all boaters taken together. Independent variables in the first equation include all of the objective impact variables, while the second includes all of the comparison variables. Standardized coefficients from the two equations allow further investigation of the relative contributions of the different conditions, and the R squared values

allow comparisons of the variance explained by the two sets of variables. Again, the sample size used for these calculations was smaller than those used for bivariate or partial correlations because they involved more variables.

RESULTS

Bivariate correlations between impacts and perceived crowding, and between impact-standard comparisons and perceived crowding, are given in Table IV.1. These figures reveal several patterns. First, the relationship between objective impacts and perceived crowding or Hypothesis 1 is supported in 24 of 28 cases, while the relationship between impact-standard comparisons and perceived crowding, Hypothesis 2, is supported in 23 of 28 cases. Those conditions which are not significantly related to perceived crowding include jetboat encounters on Segments 1 and 2 (where jet boats are either restricted or not typically seen), and launch waiting time, camp competition, and fire rings on Segment 3 (where use is lower and campsites are more plentiful).

Second, these relationships appear to support Hypothesis 3, the idea that some conditions affect crowding more than others. In general, when the relationship between an impact and perceived crowding is high, the relationship between the comparison variable and crowding is

Table IV.1

Bivariate Correlations:

Perceived Crowding with Impacts and Impact-Standard Comparisons

	Segment 1		Segment 2		Segment 3		All Boaters	
	Impact	Comparison	Impact	Comparison	Impact	Comparison	Impact	Comparison
River Encounters	.49	.35	.41	.50	.56	.51	.48	.45
Jet Boat Encounters	ns	ns	ns	ns	.37	.27	.08	.10
Waiting Time	.21	.25	.26	.38	.21	ns	.22	.23
Inconsiderate Behavior	.25	.23	.27	.26	.33	.43	.26	.29
Camp Proximity	.30	.22	.28	.46	.41	.44	.32	.37
Camp Competition	.32	.28	.37	.34	ns	ns	.31	.25
Fire Rings	.36	.26	.25	.23	ns	ns	.26	.19
Sample Size Ranges	114-153	92-145	120-189	72-175	89-107	55-97	350-449	219-417

ns - not significant ($p > .05$)

also high. This is consistent with the notion that impacts and comparisons for a given condition are related. More importantly, the highest correlations with perceived crowding are for river encounters (.41 to .56 for the impact; .35 to .51 for the comparison), while correlations for other conditions are relatively weaker (.21 to .41 for the impacts; .19 to .46 for the comparisons). The weakest correlation for all users is for jet boat encounters (.08 for the impact; .10 for the comparison).

Third, there are some differences between settings in the relative strength of relationships between perceived crowding and certain conditions, in support of Hypothesis 4. For example, jet boat encounter impacts and evaluations were not significantly related to crowding on Segments 1 and 2 (where jet boat use is limited), but were related to crowding on Segment 3. Similarly, camp competition and fire ring conditions were not significantly related to crowding on Segment 3 (where use is lower and campsites are more plentiful), but were on the other segments.

Partial correlations are shown in Table IV.2. These results generally follow from the bivariate correlations, although statistical control reveals other patterns. First, there appears to be some overlap in the effects of the various conditions on crowding. Considerably fewer of the 28 possible correlations are statistically sig-

Table IV.2

Partial Correlations:

Perceived Crowding with Impacts and Impact-Standard Comparisons

	Segment 1		Segment 2		Segment 3		All Boaters	
	Impact	Comparison	Impact	Comparison	Impact	Comparison	Impact	Comparison
River Encounters	.38	.28	.43	.48	.47	.28	.41	.30
Jet Boat Encounters	ns	ns	ns	ns	.23	ns	.16	ns
Waiting Time	ns	ns	ns	.35	.26	ns	.13	ns
Inconsiderate Behavior	ns	.23	.33	.28	ns	ns	.17	.19
Camp Proximity	ns	ns	.12	.22	ns	.29	.11	.16
Camp Competition	.18	ns	.19	ns	ns	-.28	.17	ns
Fire Rings	.31	ns	ns	ns	ns	ns	.16	ns
Sample Sizes	89	78	86	59	59	38	250	191

ns - not significant ($p > .05$)

nificant (only 17 between impacts and crowding, and only 12 between comparisons and crowding), and correlations were generally much lower (96 percent of the bivariate correlations were greater than .20, compared to 62 percent of the partials). This is counter to both Hypotheses 1 and 2.

Second, river encounter level is the only one of the seven conditions which is consistently correlated (both the impact and the comparison for all groups of users) with crowding. While correlations between river encounters and crowding for all boaters are .41 for impacts and .30 for comparisons, for the other conditions impact correlations are never above .17, and comparison correlations never above .19. This supports Hypothesis 3, which suggests that encounters affect crowding more than other use conditions.

Third, there are differences between settings in the strength of partial correlations between perceived crowding and impacts or impact-standard comparisons, supporting Hypothesis 4. Again, for example, jet boat encounters were not related to crowding on Segments 1 and 2, but were for Segment 3, where jet boats are most plentiful. However, because far fewer impacts or comparisons were related to perceived crowding when the other conditions were statistically controlled, support for this hypothesis is less strong.

Finally, there is a slight tendency for impact variables be more highly correlated with crowding than comparison variables (for 14 of 21 pairs which had differences). This suggests that objective impacts are more influential than comparisons, counter to Hypothesis 5.

Standardized regression coefficients and explained variance for the two regression equations are given in Table IV.3. Coefficients follow from the results of the partial correlations, supporting Hypothesis 3. On the other hand, the explained variance from the two equations suggests rejection of Hypothesis 5, which predicts that comparisons of impacts with standards will explain more of the variance in crowding than just impacts alone. The impacts alone explain about 38 percent of the variance, while the variables comparing impacts with personal standards only explain about 29 percent.

DISCUSSION

These results support several current notions about crowding. First, crowding appears to be directly associated with reports of objective use conditions (the number of encounters or fire rings, for example, or the level of camp competition), as suggested by Hypothesis 1. This simple relationship has been supported in many other studies which examined crowding and reported encounters, but appears valid for other impacts as well. The im-

Table IV.3

Regression Results:

Impacts and Impact-Standard Comparisons

on Perceived Crowding

	Impacts	Comparisons
River Encounters	.59***	.35***
Jet Boat Encounters	.17	.02
Launch Waiting Time	.01	.01
Inconsiderate Behavior	.20**	.18**
Camp Proximity	.08	.12*
Camp Competition	.17	.06
Fire Rings	.15*	.07
R SQUARED	.38	.29
F (7,195)	17.01	11.39

* p < .05
** p < .005
*** p < .0005

n = 203

plication for managers is that information about several different objective impacts may be useful for understanding what makes users feel crowded.

It should be noted that this finding relates to reported rather than actual impacts. In a study of Rogue River boaters, Shelby and Colvin (1981) noted that encounters were underreported by about half if there were more than six per day. On the Deschutes, use is much higher than on the Rogue, and one would expect that reported impacts would not accurately reflect real conditions. However, Shelby and Colvin (1979) found that reported encounters from boaters on the Rogue were more highly correlated with crowding than actual encounters (.30 compared to .12); the relevant measure was not how many other parties boaters saw, but how many they remembered seeing. This suggests that it may not be important that reported impacts do not reflect actual conditions because individuals' perceptions of those conditions are the key to their evaluations of experience quality. It is also generally easier to collect information about reported impacts.

Second, the variable representing comparisons of impacts with personal standards were directly related to crowding, supporting the notion that crowding includes a subjective dimension. Deschutes users felt more crowded when impacts were greater than their standards for that

impact. This means that managers should not only review information about use conditions when addressing crowding issues, but also examine individuals' standards relevant to those use conditions. The survey questions used in this research appear to effectively provide this type of information (see previous chapter in this thesis for more discussion of this issue).

Third, this research suggests, in support of Hypothesis 3, that certain use conditions are more relevant than others with regard to crowding, particularly river encounters. Deschutes boaters feel the most crowded when the time they spend in sight of others is high, regardless of other conditions. This finding supports the focus on encounter variables in previous studies, and stresses the importance of social interaction impacts when managing to reduce crowding.

Other impacts also contribute to crowding, however, consistent with past research (Stankey 1973; Badger 1975; Lee 1975; Lucas 1980; Vaske et al. 1982). The present paper suggests, for example, that environmental conditions such as fire rings or the amount of human waste affect perceptions of crowding in some situations, as does the camp competition condition. In addition, these results suggest that both camp and jet boat encounters are different from river encounters, consistent with numerous studies which have differentiated between camp

and river or trail encounters, or between encounters with motorized and non-motorized parties (see Graefe et al. 1984a, pp.412-415 for a review of these studies). The implication is that managers should consider different types of encounters.

Fourth, this research suggests that the relative influence of certain conditions on perceived crowding will differ from setting to setting, in support of Hypothesis 4. In addition, the conditions related to crowding perceptions in a given setting appear to be related to the opportunity provided in that setting. For example, jet boat encounters only affect crowding on Segment 3 because that is where most jet boat use is concentrated. On the other segments, so few jet boats are present that it would be surprising if users said this impact made them feel crowded. Similarly, camp competition and fire rings are not related to crowding on Segment 3 (because it has lower use levels and more good campsites without fire rings) but these conditions are related to crowding on Segments 1 and 2 (where campsites are limited and there appear to be higher percentages of fire rings). The implication is that the conditions affecting crowding, aside from encounters, are likely to be related to certain setting attributes. Managers attempting to reduce crowding should identify relevant conditions by examining setting attributes in light of user demand for opportuni-

ties. On the Deschutes, for example, managers would have been justified in examining camping impacts on Segments 1 and 2 because of the high use and limited campsites.

The surprising finding of this research is that it does not substantially corroborate the notion that crowding is more likely to be related to comparisons of conditions with subjective standards than conditions alone. On the Deschutes, even though comparison variables for many conditions were correlated with crowding, most objective impacts were more highly correlated. More importantly, the variance in crowding explained by the comparison variables was less than the variance explained by impacts alone. According to these data, Deschutes boaters feel crowded when impacts increase, regardless of whether that increase is over or under their standard.

This is a somewhat puzzling finding, and it throws doubt on current understanding of crowding perceptions. Two methodological issues may help explain this. First, the measure used in this study for objective impacts probably included some subjective dimensions. Aside from being reported impacts rather than actual impacts, as discussed earlier, the measure also referred to users' typical trips, and thus may have been related to expectations. For example, individuals reporting being in sight of other parties two hours out of four on a typical trip are also saying they expect to see other parties two

hours out of four. Given that previous studies have shown that expectations are related to crowding (Bultena 1981; Ditton et al. 1982; Shelby et al. 1983; Hammitt et al. 1984), it is perhaps not so surprising that our reported impact measures appear so highly correlated.

Second, the measure used to compare impacts with personal standards in this study was a researcher-created variable, and might not perfectly reflect the comparison an individual might have made. Vaske et al. (1983) have suggested that a researcher-defined variable relating to "similarity judgements" in substitutability studies is not as subjective as recreationist-defined variables. Creating a variable from comparisons of answers from two different questions may simply not provide the same information as a variable created from a single question asking respondents to make the comparison themselves.

A theoretical explanation for this finding might be related to the level of development in the setting. The Deschutes is a more highly developed, less remote river than settings studied in the past. Users on the Deschutes recognize that the river has a number of overuse problems, and in most cases average impacts were significantly greater than average standards (Shelby et al. 1987). Perhaps when impacts are generally much greater than users report as acceptable, crowding refers less to the difference between impacts and standards and more to

the impact level alone.

There is some support for this notion in the data from Shelby et al. (1982). Preferences for different contact levels on the Brule River, the most developed resource examined in that research, explained less of the variance in crowding than reported contacts. Although this explanation must be considered tentative because it is based upon results from only two settings, it does appear to make some sense and deserves further study. It may be that standards for more developed settings are less clearly defined and thus matter less, an issue which has been examined briefly in past studies (Vaske 1977; Shelby 1981) and in the preceeding chapter of this thesis.

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APPENDICES

APPENDIX A

ADDITIONAL INFORMATION ON SAMPLING

The sample of Deschutes River boaters was taken from a list of over 13,000 purchasers of 1985 boater passes. Each individual boater is required to pay for a boater pass for each day they spend on the river, but only one individual from each party is required to give a name and address when purchasing passes. The sample used in this research is thus not strictly a sample of boaters, but a sample of pass buyers.

Eight hundred names were originally selected from the 13,000 on the list using a computerized random selection program. Each of those individuals received a cover letter and information sheet which explained the project, as well as a questionnaire. Two weeks after the initial mailing, a first reminder letter was sent to individuals who had not returned the survey. Five weeks after the initial mailing, a second reminder letter was sent out. Finally, eight weeks after the initial mailing, a second questionnaire and a new cover letter were sent out by registered mail to those who had not returned the first.

In total, 576 of the boater questionnaires were returned. Because 108 were undeliverable, this represented a response rate of 83 percent. Seventy-eight of the returned questionnaires indicated that respondents

were outfitters, and were removed from the boater sample. An additional four questionnaries did not indicate whether the respondent was a boater or outfitter and were also removed.

Boaters answered questions about only one of the four river segments, and boaters made this choice themselves. In total, 158 chose Segment 1, 192 chose Segment 2, 26 chose Segment 3, and 110 chose Segment 4. Eight respondents did not choose a segment.

All sampling and coding procedures were conducted by Oregon State Parks and Recreation Division in accordance with the contract between them and the Department of Resource Recreation Management at Oregon State University.

APPENDIX B

ADDITIONAL RESULTS

FROM THE "SOCIAL NORMS" PAPER, CHAPTER III

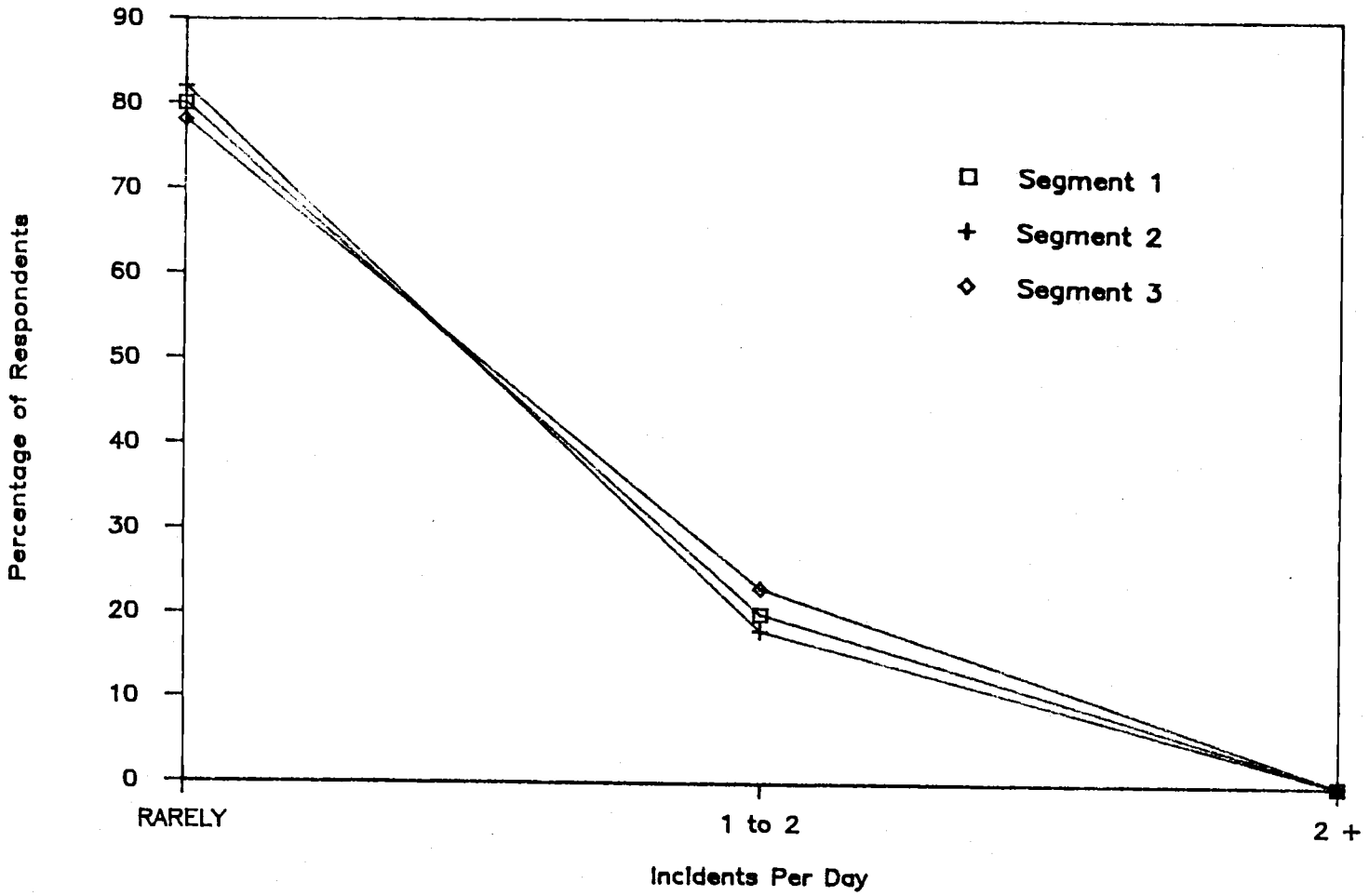

Figure B.1. Discourteous Behavior Standards: a "No Tolerance" Norm

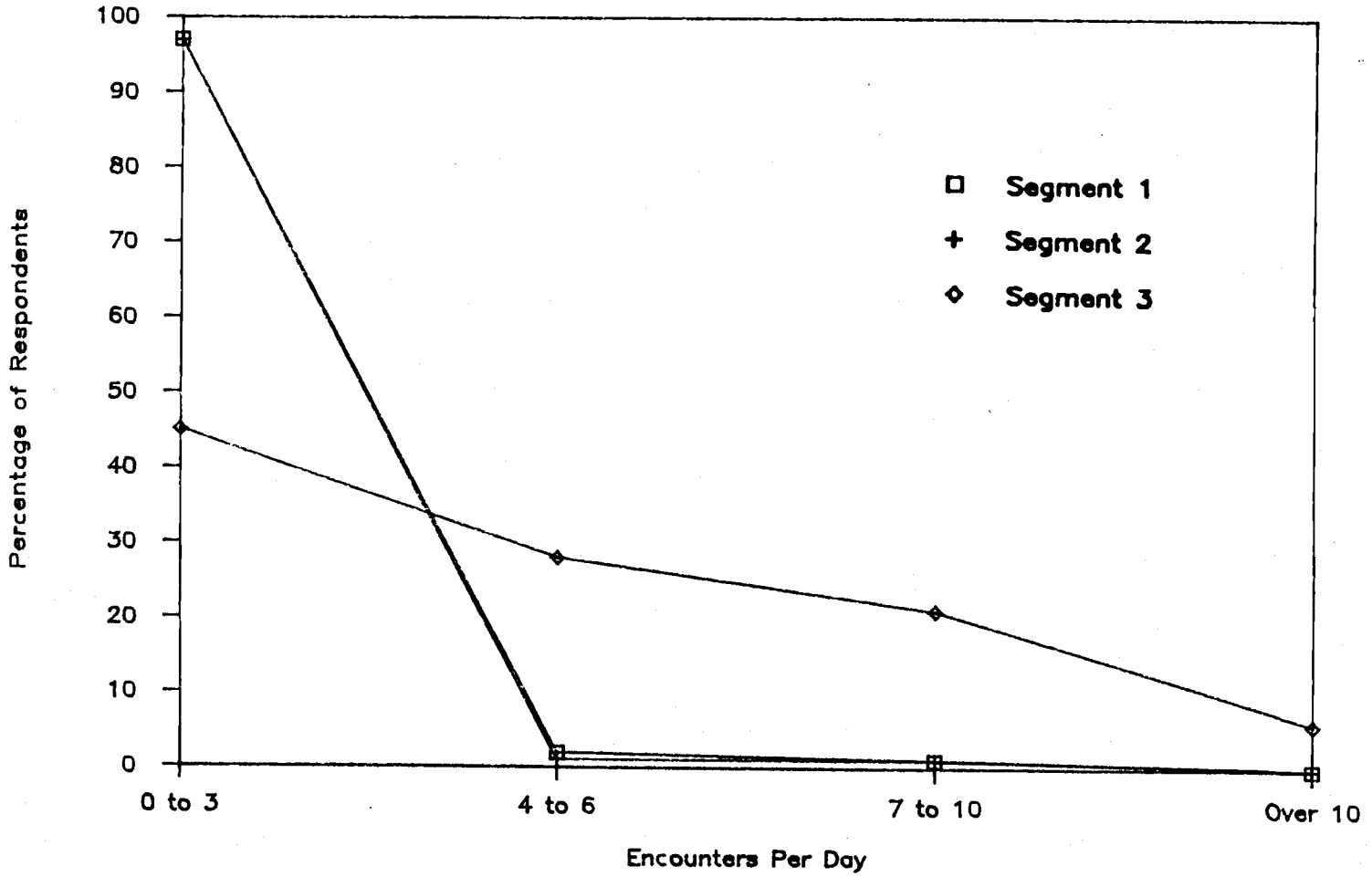

Figure B.2. Jet Boat Encounter Standards: a "Single Tolerance" Norm

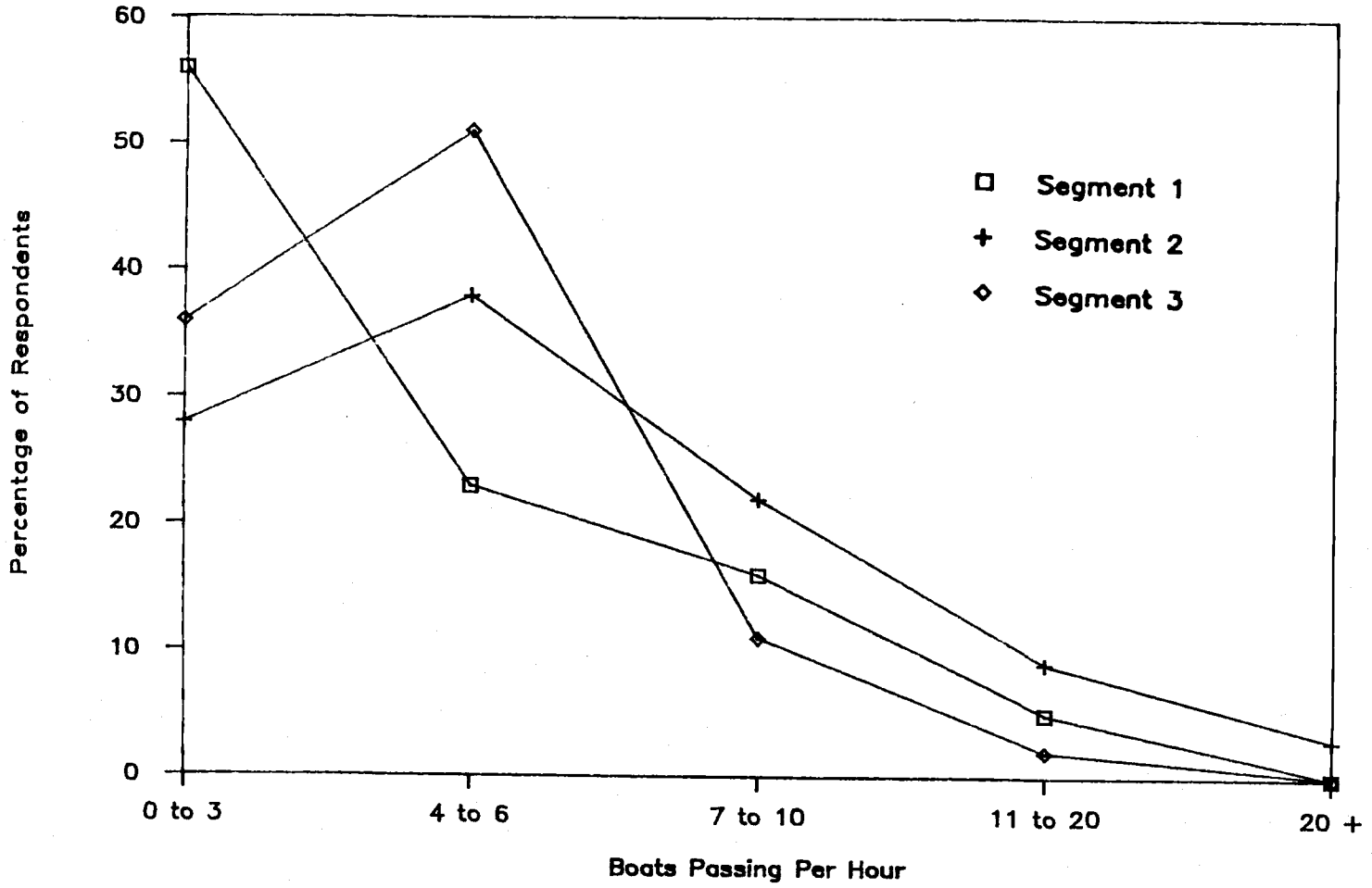

Figure B.3. Angling Disturbance Standards: a "Single Tolerance" Norm

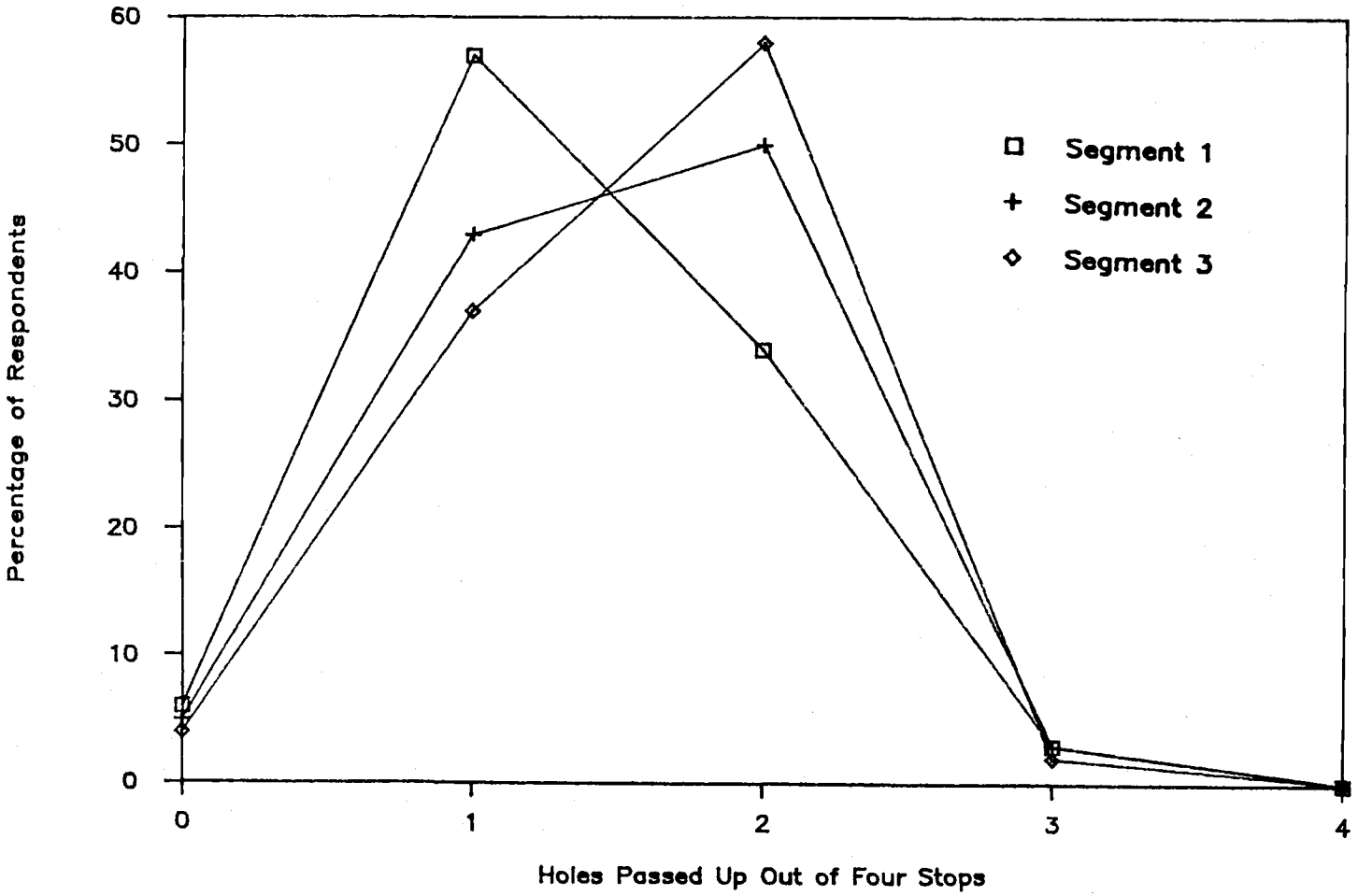

Figure B.4. Fishing Competition Standards: a "Single Tolerance" Norm

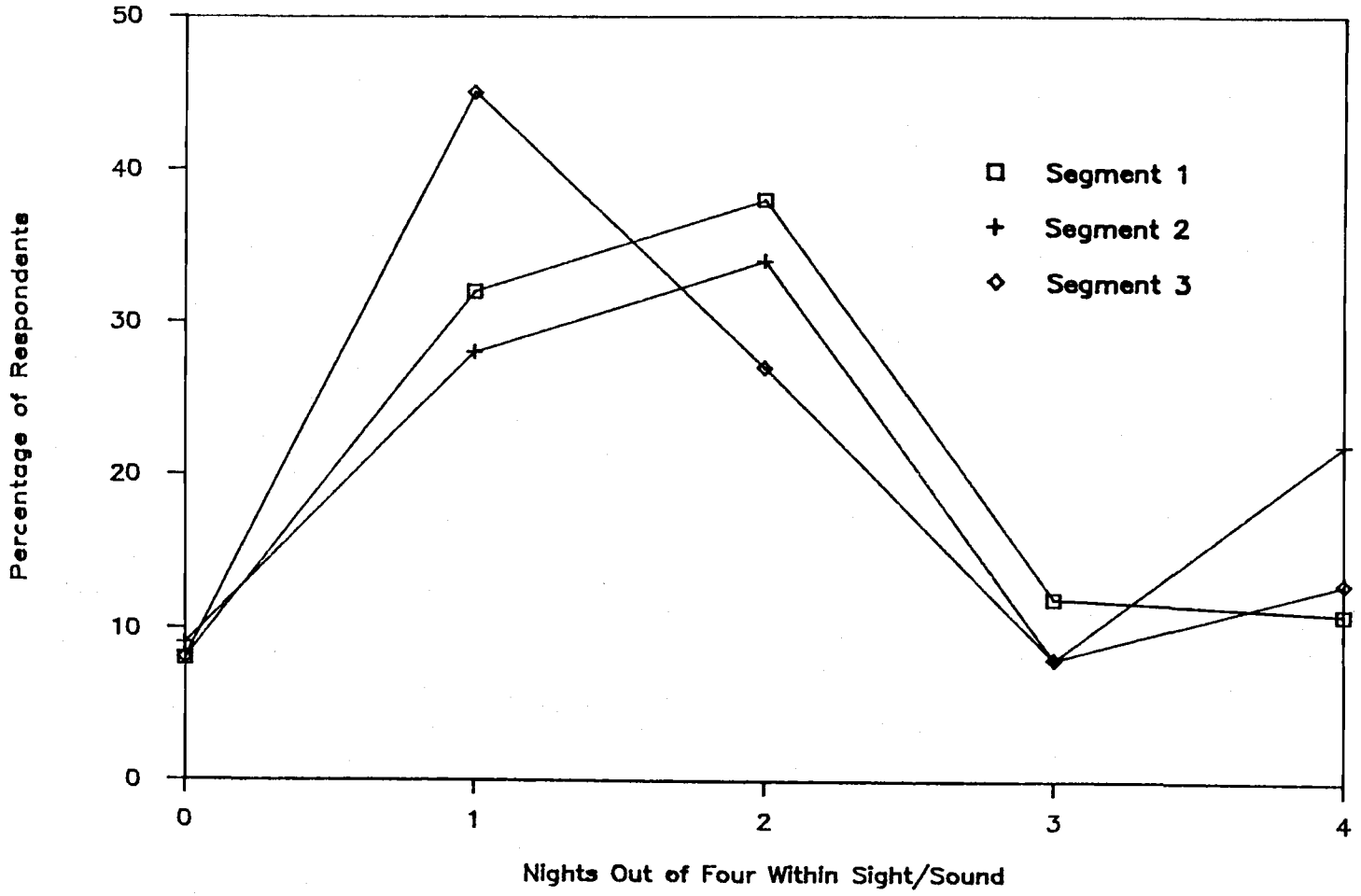

Figure B.5. Camp Encounter Standards: a "Multiple Tolerance" Norm

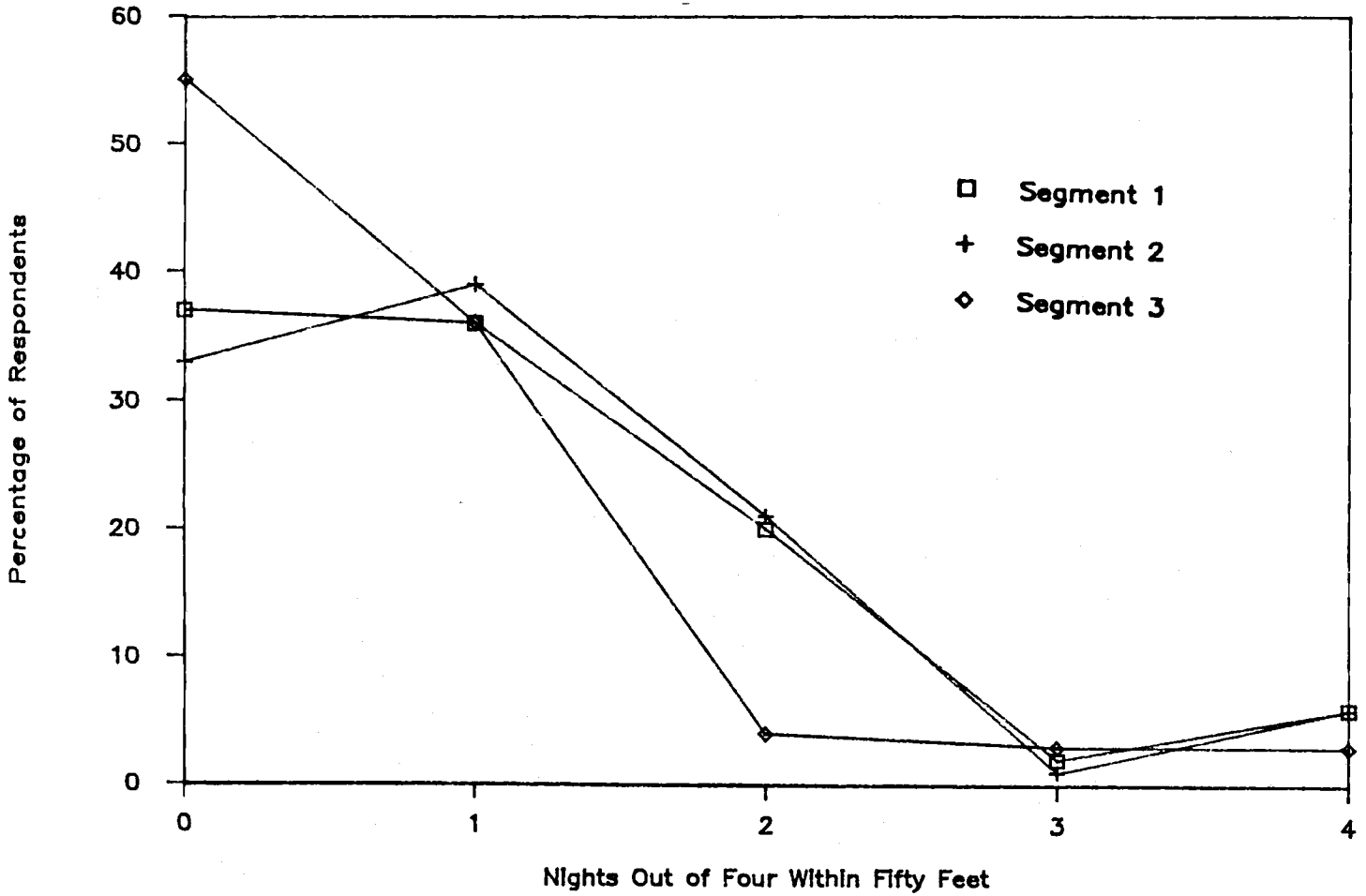

Figure B.6. Camp Sharing Standards: a "Single Tolerance" Norm

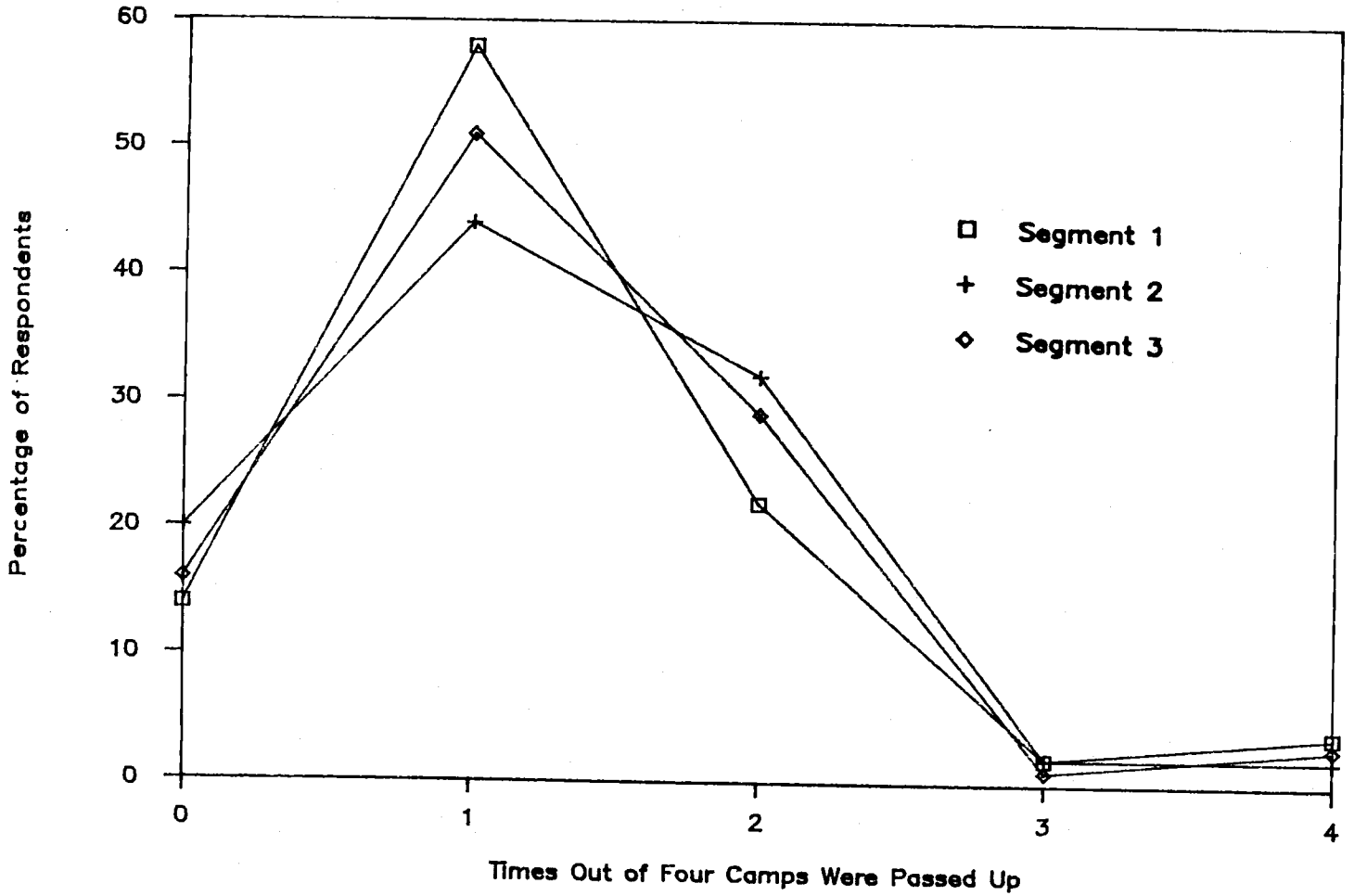

Figure B.7. Camp Competition Standards: a "Single Tolerance" Norm

APPENDIX C

THE SURVEY INSTRUMENT

(in pocket)