AN INVESTIGATION OF LITTERING BEHAVIOR IN A PROVINCIAL PARK

by

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ABSTRACT

The readily apparent and rapid accumulation of litter in the environment has created social concern. Litter not only detracts from environmental experiences, but is an expensive problem. The traditional method of litter control, consisting of legal penalties for littering and public clean-up operations has not provided adequate means to reduce the litter in the environment.

Research investigating littering behavior has focused on individual characteristics, attitudes, educational procedures containing prompting techniques, and incentive procedures. Studies exploring how individual characteristics and attitudes relate to littering behavior have resulted in inconsistent findings. Prompting procedures have had limited effects on littering behavior while incentive techniques have been successful in reducing this environmental problem.

The present study investigated the effects of an educational and behavioral program on the littering behavior of campers at Bamberton Provincial Park in British Columbia. These programs are compared to control groups, which represented the existing littering conditions at the park.

The educational program consisted of distributing anti-litter flyers and plastic litterbags to randomly selected camping groups. Anti-litter stickers were also placed in prominent locations throughout the park. The behavioral program involved the use of incentives and

litterbags to reward campers for their participation in an anti-litter program.

Two measurement techniques were employed to assess the effects of the educational and behavioral procedures. These were the change in litter at the specific campsites and the decrease in the amount of planted litter placed along the roadsides of the campground by the researcher. Information was also collected on the characteristics of the camping groups in order to relate these to the subsequent littering behavior of the campers.

The results of this study indicated that four variables were related to the change in litter at the specific campsites. These were the number of nights spent at the campsites by the camping groups, the number of individuals in the camping groups, the number of children in the camping groups, and whether or not the camping groups were families.

The behavioral program resulted in the greatest decreases in the amount of litter discarded by the campers while the educational program resulted in no significant decreases in litter when compared to existing littering levels at the campground. The behavioral program was also significantly different from the other experimental conditions in terms of the average amount of litter left by the campers at the campsites. The decrease in the amount of planted litter during the study supplemented the research conclusions, in that the behavioral program produced the greatest reductions in planted litter while the reductions recorded during the educational program were only slightly greater than the control groups.

The present study has shown the effectiveness of an incentive technique in the control of an environmental problem. This procedure not only reduced littering behavior but also induced the collection of litter already on the ground. Given the success of the incentive procedure in the present research, further studies are needed to examine their value on large scale applications.

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CHAPTER I

INTRODUCTION

A walk along a quiet stream, a drive into the country, and a camping trip to a park are all enjoyable experiences for most individuals. Yet these experiences are being diminished today by the environmental problem of litter. Worn tires can be found in streams, bags of trash seen along the sides of the roads and beer bottles discovered around picnic areas and parks. The intrinsic value of an outdoor recreational experience is being abated by litter.

Litter seems to be a problem easily ignored and quickly solved; merely hire more people to clean up the mess. Yet travelling through North America one can see that the mess is winning the race over the clean-up crews. So what exactly can be done about litter? This is not an easy question to answer. Our society favors a type of punishment for littering behavior, with legal penalties imposed for being caught in the act. But this solution is not working, with too many littering individuals and not enough enforcement officials. One person dropping one wrapper is not a major crime, but millions of people discarding waste is an enormous environmental problem.

A second answer to the litter problem might be to teach individuals not to litter, yet our educational system has been doing this with limited results. Television, radio, newspaper, and magazine advertisements plead with the public against littering; signs and posters tell us not to litter with little obvious success. The only method that

appears to work against littering is the quick solution, pick it up. This is exemplified by local organizations setting out an environmental clean-up day and government agencies sending out machinery and men to deal with the litter problem.

The apparent solution of cleaning up litter is extremely expensive, with an estimated cost of five hundred million dollars to United States taxpayers, with twenty-two million dollars being spent to clean up litter left behind in National Forests by campers (Keep America Beautiful, Inc., 1970). These estimates are most certainly low because many additional costs incurred by litter are difficult to determine, such as lowering property values, causing accidents and fires, reducing recreational experiences, and causing legal expenses for apprehended littering individuals and the taxpayers. However this is not a solution, just a temporary bandage for a deep wound.

The solution to the littering problem lies with the individual. If we can observe people engaged in littering and develop experimental programs to deter this behavior, littering might be better understood and in the future decreased by applying successful programs to the general population.

Operational Definitions

The first topic that must be addressed is what exactly is litter and what determines littering behavior? Heberlein (1971, p. 5) defines litter as follows:

> Litter can be defined as any commodity which no longer has value to the owner and which, either intrinsically or because of distribution costs, has little value for others. Dollar bills, for example, although about the same size and composition as ice

> cream bar wrappers, are not litter because they have value for people. The act of littering is a behavior which contributes to the creation of a physical area containing unwanted and useless items.

Heberlein goes on to state that even this definition is not entirely correct and that there are problems in defining litter.

Many definitions are operational in nature, depending on the type of study being conducted. Finnie (1973, pp. 127-128) described litter in six points used in a series of urban experiments for measuring purposes:

(1) Count only items the size of a closed matchbook or larger unless otherwise indicated.
(2) Do not count dirt, rocks, or animal droppings.
(3) Do not count nails, string, or wire of less than one foot in length.
(4) Do not count tabs from beverage containers, matches, or cellophane tear strips from cigarette packs.
(5) Count broken glass that comes from a single bottle or jar as one piece.
(6) Count apple cores, orange peels, and similar organic materials.

McNees, Schnelle, Gendrich, Thomas, and Beagle (1979, p. 132) defined litter as ". . . any piece of glass, plastic, paper, metal, cloth, rubber, food, or food by-product which measures greater than 10.5 cm. in any dimension." Litter was divided into two classifications, metal and paper, by Powers, Osborne, and Anderson (1973).

For the purposes of this study, litter will be defined as inappropriately discarded material which is not natural to the environment. For example, such things as cans, bottles, and paper will be defined as litter while sticks, stones, and other similar material will not be included as litter.

Keep America Beautiful, Inc. (1968, p. 6) found that most individuals understand the term litter, associating it with "paper trash," "cans and bottles," "rubbish," and "garbage." Almost one-half of the individuals interviewed acknowledged that they engaged in littering behavior, yet failed to see the relationship of discarding waste material to the general litter problem. When asked the important question of why they littered, individuals cited such reasons as "no trash receptacle available--either on the street or in the car" or their own "laziness," "indifference," or "carelessness" (Keep America Beautiful, Inc., 1968, p. 3).

Another important consideration is what constitutes littering behavior? Heberlein (1971, p. 6), taking a sociological viewpoint, listed three criteria necessary for a behavior to be defined as littering.

> (1) The actor rids himself of material.
> (2) This material is valueless for the actor and for others.
> (3) The location where the material is disposed is socially defined as inappropriate by the actor or the vast majority of others.

Burgess, Clark, and Hendee (1971) describe littering in behavioral terms, placing it in a more general group of operant behaviors. The possession of litter is aversive, so that discarding it would be negatively reinforced. Negative reinforcement is the withdrawal of an aversive stimulus in behavioral terms. For this study the description of littering behavior will closely resemble the definition of inappropriately discarded litter. For example, if an individual places a piece of paper on a concrete slab designated for camping fires at a campsite, this is not littering because this is an appropriate location for types of

discarded material. However if the individual throws a piece of paper under a picnic table, this will be defined as littering behavior.

There does not appear to be any simple solution to the environmental problem of littering. It is a complex and expensive concern of our society. Existing programs to control littering behavior have not been successful. An experimental approach is proposed to investigate littering behavior on an individual, micro-scale in the hope of developing techniques that are applicable to the general public on a macro-scale.

Objectives and Rationale

Litter is a serious environmental problem (Keep America Beautiful, Inc., 1968, 1970; Heberlein, 1971; Stankey, 1973). Current trends to combat litter involve advertising pleas, legal sanctions, and educational programs. Past research (Burgess, Clark, and Hendee, 1971; Clark, Burgess, and Hendee, 1972) and the readily apparent accumulation of litter in the environment bring into question the validity of legal sanctions and educational programs as effective and economical, whereas motivational interventions appear to be worthy of further study.

The present study examined the littering behavior of campers at Bamberton Provincial Park in British Columbia during a five week period in July and August of 1979. Two main experimental programs were implemented in this study with control groups used for comparative analysis. The first experimental program will be defined as the educational approach which contained an anti-litter message and symbol to prompt appropriate littering behavior. Researchers have employed prompts, or

discriminative stimuli, to explore the effects on littering behavior (Marler, 1971; Geller, 1975; Geller, Witmer, and Orebaugh, 1976). The present study will investigate how this educational approach, using prompts, influences the littering behavior of campers.

The second experimental program will be defined as the behavioral approach which contained incentives for appropriate littering behavior. Innovative incentive techniques have been applied to environmental settings to promote anti-litter behavior (Powers, Osborne, and Anderson, 1973; Kohlenberg and Phillips, 1973; Chapman and Risley, 1974). The present study will implement an incentive program to evaluate the effects on littering behavior and to compare this program to the educational and control group approaches.

It is hoped that several beneficial results will be generated by this study. The objectives of the study were:

(1) To evaluate the effects of incentives, anti-litter flyers, and existing procedures on littering behavior.

(2) To determine whether the three programs, the behavioral, educational, and control group approaches, influence the amount of planted litter collected by campers.

(3) To investigate whether littering behavior is associated with the following variables: (a) campground area; (b) litter count before campsite occupation; (c) length of stay; (d) type of camper; (e) license plate or origin; (f) composition of camping group.

(4) To suggest a procedure to reduce littering behavior and increase litter collection by campers.

Summary

This chapter has pointed out the need for a different approach to combat the environmental problem of litter. The following chapters will explain the behavioral and educational programs, giving the results of the experiment along with the conclusions reached. Chapter II will contain a review of studies concerned with littering and other environmental concerns, such as recycling and energy conservation. It will focus on research with an experimental orientation relevant to the present study. Chapter III will deal with the methodology of this study, with an explanation of the subjects, setting, and procedure. Chapter IV will present the first aspect of the results from the experiment, which will involve testing the relationships between littering behavior and the observed descriptive variables. This will determine if such factors as the type of camper, composition of the camping group, place of origin, and length of stay are associated with littering behavior. Chapter V will contain the second aspect of the results, with an evaluation of the effectiveness of the behavioral and educational programs to litter control. The measurement technique employed for this analysis will be the change in litter at the specific campsites and the amount of planted litter collected by the campers. The final chapter, Chapter VI, will be a summation of the results with personal observation of littering behavior. Implications of the present study will be discussed along with suggestions for future research.

CHAPTER II

LITERATURE REVIEW

The concern with the preservation and rehabilitation of the environment has focused research on procedures which promote environmentally beneficial behavior. Experimental techniques have been applied to induce such activities as anti-littering behavior (Clark, Burgess, and Hendee, 1972), energy reduction (Hayes and Cone, 1977b), and recycling projects (Witmer and Geller, 1976). The emphasis on applied behavioral research relating to environmental problems is a rather recent phenomenon, appearing as a concentrated effort in the last two decades. In Geography, a behavioral focus was evident in the early 1970s.

> At the present time the pendulum is swinging towards a behavioral geography, characterized very strongly by a concern for the micro-spatial behavior of the individual, his cognitive mechanism and psyche. (Gould, 1973, p. 262)

Research in Geography exploring the man and environment relationships are numerous and diverse. In each sub-area of geographical investigation, there can be noted an increased tendency to include the human factor as a significant variable.

Psychology, in comparison, has traditionally focused on behavior and only recently considered the environment. A noted exception would be the sub-discipline of behaviorism, but the application of behavioral techniques to environmental problems also only occurred in the last two decades. The appearance of the sub-discipline, environmental psychology,

as a research area in the 1960s reflects the interest of psychology in environmental factors. Thus the sub-disciplines of behavioral geography and environmental psychology share an analogous orientation with respect to the relationship between man's behavior and the environment, but they often have mutually excluded one another.

> One man's signal is another man's noise, and what is signal to the geographer has often been so much noise to the psychologist. (Stea, 1973, p. 106)

The recognition by geographers of the importance of behavior with the interest of psychologists on environmental factors points to a synthesis of research directions and orientations. Unfortunately, with this research in its infancy, there is no theory to elucidate various strategies to control environmentally destructive behavior. A theoretical and methodological approach is needed to provide a conceptual framework. This criterion will be difficult to satisfy, because at first appearance no discipline or sub-discipline in the social sciences would seem plausible. However on closer examination, one sub-area has dealt with environment and behavior in a systematic manner, that being behaviorism.

Behaviorists have explained their research as the investigation of environmental factors related to behavior manifestations, an exact and orderly relationship (Watson, 1913; Skinner, 1953). An important variable in behaviorism is reinforcement, a concept which has been expanded on to include environmental contingencies. The behaviorist not only views behavior in terms of reinforcement and other variables but also associates these concepts with environmental factors.

Behaviorism originated in the early 1900s with Watson (1913) and has been evolving to the present, with the generally recognized leader of the field, B. F. Skinner (1948, 1953, 1956, 1971, 1974). "Behaviorism is not the science of human behavior; it is the philosophy of that science" (Skinner, 1974, p. 3). Skinner (1956) makes a strong case for an alternate research framework, pointing out the discrepancies in the scientific method. Research resulting from laboratory work has been extensively applied in the field, resulting in a large body of knowledge in the area of behavior modification (Keller and Ribes-Inesta, 1974; Willis and Giles, 1976; Herson, Eisler, and Miller, 1977). Thus behaviorism offers a philosophical, methodological, and applied approach to the environment and behavior field.

Behaviorism has investigated environment and behavior at the micro-scale, usually in controlled laboratory settings. A geographer's perspective on the environment, traditionally considered on a macro-scale, enhances the research orientation presented by behaviorists. Geography's focus has shifted toward applied research. The principles of behavior related to environmental problems provides an excellent opportunity for geographers to combat environmental issues.

The following literature review will focus on research using principles of behavior applied to environmental settings. The relationship of individual characteristics and attitudes to littering behavior will be examined as a primary attempt to understand who litters and why. A further, more elaborate distinction can be made in the research on littering behavior, dividing it into two main classifications; studies which use prompts, or discriminative stimuli, to measure the effects on

littering behavior and studies which employ incentives, or positive reinforcement, to investigate the effects on littering behavior. The first approach involves changing the environment through such things as anti-littering messages, increased trash cans, and signs in order to prevent littering behavior (Marler, 1971; Finnie, 1973; Heberlein, 1971). The other area of research uses rewards to influence the rate of littering behavior and to promote litter collection, reinforcing appropriate behavior (Clark, Burgess, and Hendee, 1972; Powers, Osborne, and Anderson, 1973; Kohlenberg and Phillips, 1973; Chapman and Risley, 1974; Hayes, Johnson, and Cone, 1975). As with most classification systems, there are studies which contain elements of both areas (Burgess, Clark, and Hendee, 1971) which provide an excellent opportunity for comparative analysis. For the purposes of this literature review, these studies will be included in the area of research employing incentives. Both areas of research, containing studies which suggest interesting facets of the environmental problem of litter, will be reviewed. Research using a behavioral orientation to investigate associated environmental concerns, such as recycling and energy conservation, will also be discussed.

Individual Characteristics and Attitudes

The initial attempt to understand littering behavior was to investigate the type of person who engaged in this behavior. Unfortunately, there is little consistency in the research findings. Through a series of interviews, McCool and Merriam (1970) found that there was no significant relationship between age and education to littering behavior.

They also found that individuals who carried out the most litter from the Boundary Waters Canoe Area were students, professionals, and managers while the least amount of litter carried out of the area was by operatives, salesworkers and craftsmen. Finnie (1973) concluded that individuals under the age of 18 engage in a high amount of littering behavior, while individuals between 19 and 26 have a littering rate similar to individuals over the age of 26. He also found that individuals classified as white collar workers litter at the same rate as blue collar workers. The author noted that the distinction between the two groups was often difficult to determine, making the conclusions questionable. No significant difference in littering behavior was found between men and women. Keep America Beautiful, Inc. (1968) found that men litter more than women and that individuals from the age of 21 to 35 littered frequently. Women were found to litter less than men by Heberlein (1971) and people who participated in water-related activities such as swimming and boating had a high level of littering behavior. These studies point out the inconsistencies in research findings trying to relate individual characteristics to littering behavior. The best conclusion that can be reached is that all types of individuals litter.

Another aspect of the investigation of littering behavior is the concept of attitudes. Attitude research has been a central focus in the history of social psychology. There is an abundance of definitions for what an attitude is. Sarnoff (1972, p. 211) states that an attitude is "a disposition to react favorably or unfavorably to a class of objects." Bem (1970, p. 14) gives us a somewhat more verbose definition:

> Attitudes are likes and dislikes. They are our affinities for and our aversions to situations, objects, persons, groups, or any other identifiable aspects of our environment including abstract ideas and social policies.

The components of an attitude are generally agreed upon in the literature to consist of three elements, a cognitive, emotional, and behavioral aspect. Social psychologists have tried to link attitudes to behavior. Thus if the attitude is changed, the behavior will also reflect this change. But the association between attitudes and behavior has not been established. Wicker (1969) reviewed 30 studies undertaken from 1930 to 1960 and concluded that generally attitudes are not related to behavior. Heberlein (1973, p. 28) agrees with this conclusion and comments on policy implications.

> Information about the public's attitudes cannot be directly and simply translated into knowledge of their behavior. In short, even if the manager knows or can change the public's attitude it may do him little good from a social control point of view since this is unlikely to affect behavior.

It is even possible, as Bem (1970) suggests, that behavior determines attitudes rather than attitudes determining behavior. More importantly, a major area of psychology, behaviorism, suggests that behavior is the only variable that can be effectively studied and mentalistic concepts should not be emphasized. Since attitudes do not seem important in helping to predict behavior, this brings into question research that tries to change individual's attitudes toward littering in hopes of reducing this behavior. This would include environmental education programs designed to promote environmental awareness and favorable attitudes.

Howell and Warmbrod (1974) investigated how a manual on environmental protection influenced the attitudes of students. The results

indicated that the use of the student manual did not produce significant differences in attitudes toward the environment as compared to a class that did not use the manual. After reviewing studies concerned with environmental education, Bell, Fisher, and Loomis (1978) stated that the majority of research does not support the view that environmental education promotes environmentally beneficial behavior.

In a specific study relating attitudes toward littering and the resulting behavior, Heberlein (1971) distributed over 7,000 election handbills to individuals on a street at a resort city in Wisconsin. If an individual was observed littering this handbill, an interview was conducted by the researcher and the individual was also asked to complete a questionnaire. Only 58 individuals were observed littering, 79.4 percent participated in the interviews and 46.5 percent of these individuals returned the questionnaire. A control group of 58 individuals who did not litter were also selected, 88 percent participated in the interviews and 70 percent of these individuals returned the questionnaire. The interviewer noted personal characteristics of the individuals; the interviews gathered information on the subject's views on littering and the questionnaire provided socioeconomic data.

An interesting finding by the author was that only 138 handbills were counted in the experimental area, which meant that 1.7 percent of the people given the handbills discarded them. The interviewer was only able to directly observe less than half of the people who dropped the handbills, making the researcher conclude that it is very difficult to detect littering behavior.

The subject's attitudes on littering behavior were evaluated in two ways and compared to their actual behavior. The first technique involved asking the subjects to give their views on the amount of money people should be fined for littering different types of waste in several areas. The researcher hypothesized that an increase in the amount of the fine would indicate an increase in the negative attitude toward littering. Using factor analysis, four elements were determined representing the subject's attitudes on littering. These were attitudes against littering in general, attitudes towards biodegradable waste, attitudes on sidewalk littering, and attitudes relating to discarding cigarette butts.

A second technique involved the subjects comparing littering behavior to four other activities which would indicate how serious they thought littering was. These other four acts were illegal parking, failing to put out a campfire, jaywalking, and swimming after eating. Littering was considered the second most serious behavior by the subjects, with failing to extinguish a campfire considered the most serious behavior.

The results from the first attitude measurement technique showed that less than 20 percent of the subjects were in favor of fines over $150, with most people advocating fines which were $50 or less. The subjects viewed littering biodegradable material as not very serious, with slightly more than half of the people suggesting fines of $10 or less. The littering of cigarette butts was also considered unimportant by about 10 percent of the subjects who suggested no fines at all. Littering on sidewalks was usually viewed to be not as serious as

littering in general.

The author found that there were no associations between the four elements representing the subject's attitudes on littering and the actual behavior. Individuals who suggested littering behavior should be severely fined, indicating a strong anti-litter attitude, were no less likely to discard litter than individuals who suggested low fines, indicating a weaker anti-litter attitude. The second measurement technique to assess attitudes resulted in a tendency for individuals who considered littering behavior as a serious offence to be more likely to engage in littering behavior. The author concluded that ". . . there is no statistically reliable relationship between anti-littering attitudes and actual behavior" (Heberlein, 1971, p. 45).

Prompts or Discriminative Stimuli

Studies on environmentally beneficial behavior have employed environmental indicators to designate appropriate responses. These indicators are prompts, or discriminative stimuli, which induce individuals to participate in environmentally beneficial behavior. They can be something as simple as a sign or the complex ordering of an environmental setting. Favell (1977, p. 82) describes a prompt as ". . . something which is effective in evoking the occurrence of the target response. . . ." This is compared to the somewhat more technical term of a discriminative stimulus, which Williams (1973, p. 17) defines as ". . . a visual or an auditory stimulus serving as a cue for the possible presentation of a positive or negative reinforcer. . . ." Rachlin (1976, p. 240) points out that a discriminative stimulus, more specifically an

S^D, ". . . is a stimulus during which there is a correlation between responding and reinforcement." Because of the difficulty in most cases of presenting a discriminative stimulus with the following associated reinforcer in applied environmental research, the indicators are generally considered prompts.

Litter

Prompts have been used in the research investigating the environmental problem of litter. A very simple prompt to control littering behavior is the distribution of litterbags. Clark, Hendee, and Washburne (1972) investigated the use of litterbags and the preferences of individuals for plastic or paper bags. The study was conducted at Mount Rainier National Park, with litterbags being handed out to visitors as they entered. These litterbags were marked, so that they could be identified when the researchers sampled trash cans in the park to determine the number of litterbags deposited and whether they had been used. The visitors were also questioned at the exits of the park concerning the type of litterbag they received and their use of that litterbag. Of the 1,410 paper and 1,411 plastic litterbags handed out, only 29 were found in the sampling of trash cans. The authors estimated that there would be 94 litterbags in all of the trash cans which is 3.3 percent of the total. Only one litterbag of the 29 found was plastic, and 25 of the 28 paper litterbags had been used by park visitors. It was found that 96.1 percent of the people questioned at the park exits had their litterbags with them, and that 51.4 percent of these litterbags were plastic and 48.6 percent were paper. The plastic litterbags were found

to be used more than paper litterbags of those litterbags still in the vehicles. The authors concluded that litterbags given out at parks are unlikely to be used, but of those that are used, plastic litterbags are more effective than paper litterbags.

Another aspect of prompting behavior is the condition of the environmental setting. With respect to littering behavior, one consideration would be whether the environment was 'clean', free from litter, or 'dirty', covered with litter. Several studies have investigated a 'clean' versus 'dirty' environment, along with related research on such prompts as signs, handouts, litter containers and other variables.

Heberlein (1971) gave out pieces of paper with an advertising message to students leaving a classroom. The area that the students subsequently walked through was either littered or litter-free. Only 3.6 percent of the students dropped the piece of paper when the area was litter-free, while 16.3 percent of the students dropped the piece of paper when the area was littered. Compiling data and using questionnaires, Heberlein also concluded that anti-litter signs and litter containers had little effect in reducing the amount of roadside litter.

Krauss, Freedman, and Whitcup (1978) viewed littering behavior as being controlled by social norms. They conducted four experiments to test this theoretical position. The first study found that the male segment of the sample littered more than the female segment and people evaluated to be under 20 years of age littered more than the rest of the sampled individuals. No significant difference was found for the relationship between the size of handbills given out to people and the rate of subsequent littering. A final conclusion reached was that

people litter more in an already littered environment as opposed to a clean environment. The second experiment was initiated in a highly controlled environment, and affirmed the results from the first experiment that people litter less in a clean situation. In experiment three, the researchers investigated the relationship of stress, represented by a noisy environment, to littering in another highly controlled experimental condition. It was found that there was not a significant relationship between the two variables in this third study. The fourth experiment again found that males litter more than females. Another conclusion reached was that subjects who signed a petition littered less than subjects who were not contacted by the researcher.

The experimental conditions of the second and third study make the generalization of the results questionable. In the first experiment, the information on the handbills was related to voter registration, a topic that might not be of great interest to individuals under 20 years of age or to many of the other subjects. Given the small sample size used in the clean versus dirty environment experiments, the results presented are questionable. The authors conclude that social norms do affect littering behavior, a conclusion which is not supported by the investigation of littering behavior by Heberlein (1971).

Finnie (1973), in one set of a series of experiments, found that people generally engage in littering behavior more often in a dirty environment as compared to a clean environment. Another set of experiments investigated the effects of litter containers on the rate of littering along highways and in two urban areas. The results showed that litter was reduced along highways by 28.6 percent and in the two

urban areas by 16.7 percent and 14.7 percent through the use of trash containers.

Crump, Nunes, and Crossman (1977) measured the effects of antecedent stimuli on littering behavior at a forest area picnic complex. Littered versus non-littered areas were compared as to their resulting effects on individuals. It was found that the subjects littered less in a littered area as compared to a clean area. As mentioned by the authors, these results are in contrast to the findings of Finnie (1973) and Heberlein (1971). The results of the experiments by Krauss, Freedman, and Whitcup (1978) also suggest that people litter more in an already littered environment as opposed to a clean environment. The difference between these findings may be discovered in the types of environments investigated, with the research by Crump, Nunes, and Crossman (1977) being initiated in a forest setting as compared to the urban environments of the other studies. It is not clear what the results of this study could lead to in that littering an area to reduce subsequent littering behavior would be impractical.

In an attempt to investigate written prompts, Marler (1971) distributed handouts containing either a reward, punishment, or neutral statement to campers visiting a National Forest. The reward statement indicated that not littering such items as metal and glass prevented injury. The punishment statement denoted littering as harmful and expensive in terms of the cost for cleaning the area. The neutral statement implied no reward or punishment but informed the campers that littering was dangerous. A control group which did not receive any handouts was used for comparative analysis. The researcher had the

subjects fill out a questionnaire concerning their views on littering. The behavior of the campers was determined by inspecting the campsites before and after the subjects used them.

The results of the study suggest that the punishment statement on the handouts was the most effective in reducing litter, with 90 percent of these campers leaving their campsites in the same condition or cleaner. The control group was second in terms of the condition of the campsites, with 75 percent of this group cleaning their campsites or leaving it in the same condition. The third ranked group consisted of campers who received a reward statement handout with 72 percent of them leaving their campsites in the same or better condition. The last group consisted of campers receiving a neutral statement handout and only 50 percent of them cleaning their campsites or leaving it in the same condition.

There are several problems in this study which should be considered when interpreting the results. The researcher found that only 60 percent of the campers who received handouts bothered to read them and not every person in a group was given a handout. The distinction between the written statements implying a reward, punishment, or neutral theme is very slight, making the effects of the statements on the campers questionable. From the analysis of the questionnaire, it was also found that the campers in the control groups scored highest on information contained in the handouts. This would suggest that most individuals did not read the handouts given to them. The author concluded that handouts are not effective in reducing litter in the environmental conditions present in the study.

Geller (1975) conducted two experiments on the effects of specific instructions on handbills to littering behavior. In the first experiment conducted over three successive nights, individuals entering a theatre were given handbills containing information on a coming attraction. The researchers did not put an anti-litter message on the handbills during the first night, but on the second night one-half of the handbills contained the message, "Please Dispose of Properly." During the third night, all of the handbills had the anti-litter message printed on them. Of those handbills that were not taken from the theatre, the anti-litter prompt during the third night produced 21 percent more handbills placed in trash cans and ash trays as compared to the first night when there was no anti-litter prompt on the handbills. During the second night when one-half of the handbills contained the anti-litter prompt and one-half did not, a 20 percent increase in appropriate disposal was found for the handbills containing the prompt.

The second experiment involved individuals entering a grocery store during a two hour period for 30 successive weekdays. Selected individuals were given three types of handbills, representing three phases of the experiment. During the first phase, the handbills did not have the anti-litter message; the handbills in the second phase had a general anti-litter message that said, "Please Dispose of Properly" and the handbills in the third phase had a specific anti-litter message which designated a certain trash can for the disposal of the handbills. The results of this experiment showed that the specific anti-litter prompt was most effective in the appropriate disposal of the handbills, with the general prompt being the next most effective and the no prompt phase

having the least effects. Individuals were also found to engage in littering behavior more often in the no prompt condition. The author concluded from both experiments that written prompts can motivate people to engage in anti-littering behavior, which was a similar conclusion reached in a previous study (Geller, 1973). The author suggested exhibiting specific anti-litter instructions in areas where the potential for littering is high.

A more elaborate and indepth research design was utilized by Geller, Witmer, and Orebaugh (1976) to explore the earlier findings by Geller (1973, 1975). The researchers gave out a series of handbills containing anti-litter prompts with different instructions at two grocery stores during a eight week period. The handbills were marked and distributed by gender so that a distinction could be made between males and females in terms of their reactions to the written instructions. For the first five weeks of the study, baseline conditions along with four specific written prompt conditions were in effect with the following anti-litter messages:

> (1) BASELINE--no antilitter prompt;
> (2) GENERAL antilitter prompt--"Please don't litter. Please dispose of properly";
> (3) SPECIFIC antilitter prompt--"Please don't litter. Please dispose in green trash can located at rear of store";
> (4) DEMAND antilitter prompt--"You must not litter, you must dispose in green trash can located at rear of store";
> (5) RECYCLE prompt--"Please help us recycle. Please dispose for recycling in green trash can located at rear of store." (Geller, Witmer, and Orebaugh, 1976, p. 424)

For the next six days, two written prompts were given out: one message asked people not to leave their handbills in the shopping cart and to deposit them in a trash can and the second message also asked individuals

to remove their handbills from the shopping cart but just asked them to deposit them properly. During the seventh week, customers were given handbills which asked them to drop their handbills on the floor; the eighth week was a baseline condition where customers were given a handbill which did not have any anti-litter instructions.

The results from the five weeks of the study showed that baseline and general prompt conditions were least effective in influencing the customers to deposit their handbills in the green trash can. The recycling message was the most effective in influencing this behavior, with the demand and specific message also producing effects greater than the baseline and general prompt conditions. All four prompt conditions reduced the amount of handbills improperly deposited in one grocery store as compared to the baseline condition, but this did not occur in the second grocery store. Females were found to leave their handbills in the shopping carts more than males in one grocery store but not in the other.

The results from the sixth week of the study, which investigated the effects of general versus specific information on the amount of handbills left in the shopping carts, indicated that the specific information was significantly greater in inducing appropriate disposals. Both prompting conditions resulted in a small amount of handbills found in the shopping carts as compared to the first five weeks of the study.

During the seventh and eighth weeks of the study, litter prompt and baseline conditions were conducted respectively. The litter message asked individuals to dispose of their handbills on the floor as compared to the baseline condition, where no litter message was on the handbills.

There was no difference in the amount of handbills dropped on the floor between males and females. An increasing proportion of handbills were found on the floor as the length of the litter prompting condition increased. The numbers of handbills found in the shopping carts during the litter message and baseline conditions were greater than the previous week when the prompts for removing the handbills from the shopping carts were in effect. It was also found that the litter message caused an increase in the amount of handbills placed in the green trash can as compared to the amount deposited in the baseline conditions.

The authors reached several conclusions based on their findings. A general anti-litter prompt was just as effective as a specific anti-litter prompt which indicates an appropriate area for litter deposits in decreasing the amount of handbill litter. An anti-litter prompt that provides a reason, such as the need for recycling, is somewhat more effective in influencing appropriate deposits of handbill litter. The behavioral responses to the prompt conditions in this experiment were the same for males and females. When asked to litter by a written message, some individuals will engage in this behavior.

There are several aspects of this study which must be considered. Generally, more than half of the handbills handed out by the researchers were taken from the two grocery stores. Of the handbills which remained in the stores, the next largest amounts of handbills were found in the shopping carts. The amounts of handbills deposited in the green trash cans were usually a distant third. Thus, the results of this study are based on a small number of handbills in comparison to the amount of handbills handed out. The authors indicated that the number of individ-

uals influenced by the prompts were generally low, making the behavioral effects found in this study somewhat questionable for the majority of people. The authors concluded that prompting anti-litter behavior requires extended time periods for desired effects, but that most people are not influenced by these prompts. They indicate that prompting procedures should be undertaken because of their ability to be applied on a large scale.

The application of prompts on a community scale was conducted by Schnelle, McNees, Thomas, Gendrich, and Beagle (1980) using a series of newspaper articles on littering. The research design was a multiple baseline employing litter counts on three target areas to determine the effects of the prompts and daily feedbacks on littering behavior. The results showed a precipitous drop in the litter levels in two areas with a gradual decrease in litter levels for the third area when the prompt and daily feedback conditions were in effect. The amount of litter rose again to the original level during the baseline conditions, which represented no intervention by the researchers. This points out a problem with behavioral research utilizing prompting techniques, the need to maintain behavior change programs. Regarding this specific study, it would have been interesting to examine the effects of the prompts and daily feedbacks over an extended experimental period in order to obtain stable measurements of litter change. There was considerable fluctuation in the amount of litter counted in the treatment phase of the experiment.

A final, innovative approach to prompting anti-litter behavior was utilized by Geller, Brasted, and Mann (1979). They found that trash cans

decorated as birds are effective in prompting trash disposal as measured against other receptacles over an eight week period. The novelty of these trash cans could be a factor in the results, since it was not known the number of times the subjects were exposed to the stimuli. Also, the amount of ground litter increased farther away from the decorated trash cans, but decreased near the cans. This implies that the decorated trash cans influence anti-litter behavior but their presence in one area results in higher levels of litter in other areas as compared to when the decorated trash cans were not present. In a related finding, the study concluded that the type of receptacle used for specific kinds of litter is associated with appropriate littering behavior.

Recycling and Energy Conservation

Research has also been focused on other environmental problems, using prompts to increase recycling and energy conservation. Reid, Luyben, Rawers, and Bailey (1976) investigated the effects of prompts and the location of recycling containers on the return of newspapers by individuals. It was found that instructing people on the location of recycling centers and placing containers in close proximity to popular areas increased the rate of newspaper recycling. The authors concluded that even more significant results might be obtained by the application of reinforcement techniques in future research.

Geller, Farris, and Post (1973) examined several prompting techniques which encourage customers at a store to purchase returnable soft drink containers. The use of a handbill containing a recycling message

persuaded more customers to purchase returnable containers as compared to a condition where the prompt was not in effect. Additional prompts such as a public display of the number of people buying returnable and non-returnable containers and a type of peer pressure group to encourage recycling behavior did not significantly alter the effects of the hand-bill prompt on the customers' purchasing behavior. A subsequent interview found that 55 percent of the customers stated that the prompts influenced them to some degree. The authors concluded that prompting techniques need to be systematically presented to the public over long periods of time.

Delprato (1977) found that a prompting technique was successful in reducing electrical usage in a university setting. The prompt was a sign located on the door or wall of a restroom along with "energy waste" slips and an orange arrow pointing to the light switch. The subjects used in this study were mainly university students and teachers which might bring into question the generalization of the results to the general public.

Employing an energy feedback system, Winett, Neale, Williams, Yokley, and Kauder (1978) successfully reduced the amount of electricity used in a suburban area. The authors suggest that individual feedback systems are important in producing energy conservation. In a related experiment, Palmer, Lloyd, and Lloyd (1977) found that feedback and prompting techniques resulted in a decrease in the amount of electricity used by three of four families in a suburb.

Behavioral techniques have also been applied to other environmental problems. Stokes and Fawcett (1977) investigated the effects of a

prompting technique and feedback on the manner in which individuals leave their garbage for collection. Instructions for the appropriate packaging of garbage were sent to individuals along with the notice that only this type of garbage would be collected. The sanitation crews also left violation notices for individuals who did not comply with the instructions. These techniques were effective in reducing the amount of individuals violating packaging regulations. In a somewhat different area of environmental concern, Hayes and Cone (1977a) employed prompts to reduce the number of individuals walking on lawns and destroying the grass.

Incentives or Reinforcement

The use of reinforcement techniques alone or in conjunction with prompting procedures has also been applied to environmental control problems. This has been achieved by the application of positive reinforcers, which Favell (1977, p. 63) defines as ". . . an event (stimulus) which, when presented immediately following (contingent on) a response, increases the strength of that response." The actual act of presenting the reward is the positive reinforcement. In many applied situations, the use of reinforcement is not possible and an incentive is substituted which is a promise of a reinforcer in exchange for some activity. Social demands are created of a non-punitive type. It is expected that people have already learned to comply with demands that promise rewards.

Litter

Research exploring littering behavior has employed incentive procedures to understand and reduce this environmental problem. Incen-

tive and prompting techniques were used by Burgess, Clark, and Hendee (1971) to investigate their effects on reducing littering behavior during Saturday children's matinees at two theatres. For the first theatre, eight experimental conditions were in effect over an eight week period. Weeks one, two, four, six, and eight were baseline conditions which represented existing conditions with respect to the amount of litter found in the theatre. During week three the subjects were given litterbags as they entered the theatre; week five consisted of the subjects also receiving litterbags but with instructions to use the litterbags and deposit them in the trash cans. An incentive system was used in week seven, with 10 cents being offered by the researcher for used litterbags turned in at the lobby. It was found that the incentive systems produced the most significant results, with 94 percent of the litter in the first theatre being picked up by the subjects. The next most successful technique was the prompting procedure of giving the subjects instructions along with a litterbag, which resulted in 57 percent of the litter being properly deposited. The effects of the litterbag alone on the subjects' behavior was that 31 percent of the litter was picked up. In the five baseline conditions an average of 19 percent of the litter was correctly deposited. During the six week experimental period for the second theatre, three baseline conditions were in effect for weeks one, two, and six. Week three consisted of the researchers placing extra trash cans in easily recognized areas. An anti-litter film was shown during week four of the experiment. During week five, the subjects were given a litterbag with the announcement that a free movie ticket would be issued for used litterbags that

were returned. Once again, the most significant experimental technique was the incentive system, with 95 percent of the litter being correctly deposited compared to an average of 16 percent in the three baseline conditions. The anti-litter film and extra trash cans had minimal effects. The authors concluded that:

> These observations suggest that the level of littering might be reduced if immediate positive consequences contingent on anti-litter behavior could be scheduled. The present data clearly indicate that such a tactic is possible and effective. (Burgess, Clark, and Hendee, 1971, p. 75)

Two factors must be considered when viewing the results of this study. The first factor is the environmental setting of the experiment. Many people consider the dropping of cups and wrappers in a theatre as socially acceptable. The second factor is the subjects chosen for the experiment. Children are easily manipulated in experimental conditions, making the generalization of the results to other age groups open to question.

A continuation and broader application of the results presented in the previous study was conducted in an experiment by Clark, Burgess, and Hendee (1972). The researchers planted litter on Thursday and Friday for two successive weekends at a forest campground. Litter counts were taken on Thursday, Friday, Saturday, and Sunday in the afternoon, with the final count on Monday morning for the two successive Thursday to Monday weekends. The first weekend consisted of baseline measurements; the second weekend contained the experimental conditions. Twenty-six children from camping families were contacted by an experimenter in a Forest Service Uniform on Saturday of the second weekend. The parents and children were informed of a litter problem in the campground, and

the children were asked for their cooperation in a litter clean-up program. For their help, the children would receive their choice of a patch, badge, comic book, ruler, pin, or box of gum. The children were given plastic litterbags and the rest of the day for the project; the experimenter returned that evening to collect the litterbags and give out the rewards.

The results for the first weekend, the baseline conditions, indicates a general decrease from 160 pieces of planted litter on Thursday to 56 pieces on Monday. During the second weekend, there was a marked decrease in the amount of litter on Friday, 145 pieces, to the amount of litter counted on Saturday, 24 pieces, for the experimental condition. It was found that litter with an inherent value, such as a deposit bottle, was collected in the baseline and experimental conditions in an almost equal level. Litter that was discarded by the campers (not planted litter) increased for both weekends, except for a decrease in litter after the experimental condition which did not last. The authors stated that:

> The results suggest that the level of all types of litter can be markedly reduced by providing positive consequences contingent on picking up litter. (Clark, Burgess, and Hendee, 1972, p. 4)

The researchers also feel that using rewards may be successful in inducing anti-litter behavior in an assortment of environmental settings.

This study contains the identical factor questioned in the previous study (Burgess, Clark, and Hendee, 1971), which was the use of children as subjects. The children were effective in collecting litter at a forest campground, but the littering behavior of the other campers was not investigated. In fact, the levels of non-planted litter seemed to

rise during both weekends, except for a temporary drop during the incentive procedure. This could be interpreted as the incentive technique having little effect except for the children involved, leaving out the majority of the campers. Another consideration is that the study was conducted over only two weekends, which may not be enough time to obtain results that can be generalized to other environmental settings.

An unsupervised recreational area was used by Powers, Osborne, and Anderson (1973) to study methods which induce individuals to collect litter. For picking up litter in the study site, the subjects filled out a card which entitled them to 25 cents or a chance to win $20. The results showed that the surrounding area was less littered during the incentive program and that more litter was deposited in trash barrels. The number of people participating in the collection of litter was very low, suggesting that the proportion of individuals participating needs to be greatly increased for this procedure to be effective in combatting litter.

Kohlenberg and Phillips (1973) investigated the littering behavior of people at a free-admission zoo. Individuals depositing litter in a specific trash can were rewarded with a ticket which was redeemable for a soft drink. A sign was placed near the trash can which displayed the following message: "At times persons depositing litter in this container will be rewarded." The experimenters observed the littering behavior of people with the sign being present but with no rewards issued. Measurements were taken of litter deposited in the trash can as well as the litter accumulation at the study area. The results indicated that

rewarding litter depositing increased this rate of behavior, while the surrounding area was visually improved. The reward increased the rate of litter deposited as compared to the condition when the sign was present but no reward was issued.

Chapman and Risley (1974) found that paying children for clean yards in a neighborhood area decreased the level of litter as compared to paying children for bags of litter. Greater amounts of litter were measured by the experimenters in the payment for volume condition, but it was attributed to children filling bags with household and commercial litter. This study suggests that an urban neighborhood can be economically maintained as relatively litter-free by employing children.

Another method to control litter was applied by Hayes, Johnson, and Cone (1975) which consisted of a "marked item technique" to induce inmates at a federal youth correctional facility to collect litter. Individuals turning in these marked items, identifiable only to the researchers, were rewarded with money or special privileges. The authors concluded that:

> The marked item technique appears to be an effective procedure for generating the removal of litter already on the ground. (Hayes, Johnson, and Cone, 1975, p. 384)

While the innovative concept of using marked items could be implemented on a small scale, the application of this technique would be impractical on a large scale. The authors did suggest several ways to mark and screen litter on a large scale, such as using isotopes and geiger counters, magnetic tapes and steel collectors, and fluorescent paints and black lights. But these solutions would create their own problems such as the health danger from using isotopes. Another aspect of this

study to be considered when interpreting the results is the highly controlled environment that the research took place in, which may hinder the application of the results to other settings.

A study to investigate two aspects of littering behavior was done by La Hart and Bailey (1975). The researchers not only sought to discourage children from discarding material but also to encourage them to collect pieces of litter already on the ground. The experiment compared an anti-litter statement treatment, a treatment phase with educational materials, a lecture treatment, an instructions phase, and an incentive system to baseline conditions. It was found that the incentive phase was the only experimental treatment which reduced litter that was previously placed on the ground by the researchers. In a clean area, the incentive program along with the instructions condition did not decrease the amount of litter left by the children as compared to the baseline conditions. The anti-litter statement, instructions, and lecture treatments did show an effect on littering behavior in this study.

One reason for the failure of the incentive program to show significant results in reducing littering behavior was the type of incentives used and construction of the program. Plastic litter badges were presented to the children as rewards, which might not have sufficient reinforcing properties to control behavior. Also the incentive program consisted of marking planted litter and asking the children to find these pieces. This does not affect the children's behavior in regards to their own litter, since that would not be in the incentive program. There also could be the tendency for the children to examine litter for

the specifically marked pieces and discard the rest. This might be a reason why the authors found planted litter in the clean area of the study site. As mentioned by the authors, they attempted to provide a real world situation, but in the process reduced the amount of experimental control. Further research is needed to evaluate litter control programs which would decrease littering behavior and increase the collection of litter already on the ground.

Baltes and Hayward (1976) applied four treatments, positive reinforcement, positive prompting, negative prompting, and litterbags only, to subjects at a football game to measure the effects on littering behavior. The researchers found that the effects of the four treatment programs combined reduced litter by a total of 45 percent as compared to the control groups. There was no statistical difference between the four treatment programs. The reduction of litter was measured by the weight of collected litter, which the authors mentioned as a less than ideal technique. The experimental site must be taken into consideration, in that a football stadium, like a theatre, is a socially acceptable place to litter by the majority of the population. The failure of the reinforcement treatment as compared to the other treatments might be due to the low reward of $1 for individuals with winning numbers on their litterbags.

Corey and Hamad (1976) used a token reinforcement program to increase the returned rate of food trays in a student dining room. In the treatment phases, the subjects were given cards thanking them for the proper disposal of trash when they returned their food trays. It was found that the treatment phases increased the rate of returned food

trays as compared to baseline conditions. The thank-you cards had no known back-up reinforcers according to the authors. This experiment was conducted in a controlled environment with a select group of subjects. This makes the generalization of the results open to question. It is believed that a token reinforcement system would be an interesting area for further research in establishing litter control programs.

At an amusement park, Casey and Lloyd (1977) instituted an incentive program which investigated the optimal age for litter collection by children and also explored the cost of such a program. It was found that children from the ages of 8 through 14 collected the most litter, with the optimal age being 13 years. The traditional method of clean-up at the amusement park was two and one-half times more expensive than the incentive program used in the experiment. The incentive program was very successful in reducing ground litter at the park, but the effects on reducing littering behavior by children was not discussed. It would seem to be important for a litter control program to not only reduce ground litter but also to reduce littering behavior.

A study by McNees, Schnelle, Gendrich, Thomas, and Beagle (1979) is an example of a litter control program on a large scale. The researchers used a series of prompts and incentives focused on students to encourage participation in a community litter program. The prompts consisted of such things as giving out litterbags, written anti-litter messages, letters to parents, verbal instructions, and media coverage of the event. The incentive system contained a marked item technique, "Litter Patrol" members reinforcing other children for picking up litter, and a raffle ticket system for returned bags of litter. The back-up

reinforcers used in the study were various food items from McDonalds. It was found that the litter control program reduced ground litter by 32 percent from baseline conditions. A return to a final baseline condition would have been interesting in order to view the generalizing effects of the litter control program. It would also have been beneficial if the authors had included an indication of individual littering behavior in the study.

Recycling and Energy Conservation

Applied behavior analysis promoting the environmentally beneficial behavior of recycling and energy conservation has been used by several researchers. Luyben and Bailey (1979) conducted a research design focused on rewarding children with small prizes for the recycling of newspaper and which also investigated how the proximity of containers related to recycling behavior. It was found that rewards produced the greatest increase in the amount of newspaper recycled with a lesser effect being the proximity of containers as compared to baseline conditions. As with several other behavior manipulation experiments, this research also focused on children. The rate of participation by the children involved in this study was also very low. This research was an extension and replication of an earlier study by Reid, Luyben, Rawers, and Bailey (1976) which investigated the effects of prompting and the proximity of containers in recycling newspaper with similar results.

Geller, Chaffee, and Ingram (1975) explored the use of prompts and reinforcement to promote paper recycling at a university setting. Two experimental programs were compared to baseline procedures. The first

program consisted of the researchers giving $15 to the dormitory which recycled the most paper. The second program instituted a raffle system where individuals were given a ticket for each time they returned paper to the collection room. The raffle system produced the greatest amount of returns to the collection room. The contest program, comparing group recycling behavior, also produced significant effects as compared to the baseline conditions. The prompts for the two programs consisted of announcement posters explaining the conditions for each program. The authors concluded that for litter control programs to be successful, the general public must become aware of the program through appropriate prompting techniques.

A similar study by Ingram and Geller (1975) compared verbal and flyer prompt conditions to an incentive system consisting of giving raffle tickets for paper that was turned in for recycling at university dormitories. As with the previous study, the raffle technique was most effective in inducing recycling behavior while the verbal and flyer prompt conditions were equally ineffective in promoting this behavior. When the raffle technique was discontinued by the researchers, the amount of paper turned in decreased, which points out the need for response maintenance in behavioral research.

A further extension of the previous two studies was done by Witmer and Geller (1976) who compared flyer, contest, and raffle conditions on the recycling behavior at six university dormitories. Once again the raffle technique produced the greatest effects, followed by the contest condition. The flyer condition was least effective in promoting recycling behavior by the subjects. An earlier study by Geller, Wylie,

and Farris (1971) combined the use of a prompt with social reinforcement to successfully increase the amount of returnable bottles purchased at a small convenience store. This technique did not have a significant effect at two larger stores which the authors attributed to the greater time period between the prompt and target behavior at the larger stores as compared to the smaller convenience store.

A raffle incentive system was successfully employed by Couch, Garber, and Karpus (1978) to promote recycling behavior at two university dormitories. They also employed a technique which required an increasing amount of paper to be turned in for a raffle ticket, making the program more efficient and less costly. But as with other studies, when the raffle technique was removed, the rate of recycling behavior by the subjects decreased. Also the proportion of individuals participating in the study was relatively low, which with the previous factor suggests a need to develop a technique that would involve a greater amount of people and create response maintenance.

Behavioral techniques have also been applied to the current concern for energy conservation. Hayes and Cone (1977b) investigated the effects of prompts, incentives, and feedback on the amount of electricity used by four families in a university housing area. The prompts consisted of handing out posters containing information on ways to reduce energy consumption; in the incentive system the researchers paid the subjects set amounts of money based on their energy reduction. The feedback technique involved the researchers giving out flyers which informed the families on the amount of electricity used for the previous day and week and projected this consumption for the rest of the week.

The level of electrical use as compared to a baseline week was also given to the subjects. All this information was provided in terms of dollars and cents. The results showed that providing information to the subjects was least effective in reducing the amount of electricity used, with the feedback system inducing limited reductions. The most significant results were obtained by employing the incentive system, which even was successful when the payments were reduced.

In a related study, McClelland and Belsten (1979) used prompts and feedback in one research design and added an incentive technique to the second research design to measure the effects on electrical consumption in a group of university dormitories. It was found that both research designs were successful as compared to baseline conditions. Once again the subjects and setting of the study make the generalization of the results to the rest of the public somewhat questionable.

The use of incentive techniques have been applied to similar areas of environmental concern. Everett, Hayward, and Meyers (1974) instituted a token reinforcement technique to increase the use of mass transit. Pierce and Risley (1974) decreased inappropriate behavior and increased membership at a community centre by using recreation time as a reinforcer. Individuals who brought new members to the community centre were given more recreation time and the community centre was closed early for inappropriate behavior.

Summary

This chapter has focused on research methods which promote environmentally beneficial behavior. The investigation of individual character-

istics and attitudes to understand environmental behavior provides inconsistent findings requiring other techniques to be explored. Researchers have used applied behavior analysis to develop innovative research strategies. Incentive systems have successfully reduced littering behavior and increased litter collection in numerous studies, with prompting techniques resulting in a more limited effect in comparison. These techniques have also been applied to induce recycling behavior, energy conservation, and associated environmental behavior with similar results.

The research presented in this chapter contained several weaknesses. The subjects used in the studies were often children or a select segment of the population, such as university students. This makes the generalization of the results to the entire population questionable. The study sites of the research were in many instances highly controlled or non-representative of general situations. This also leaves open to question the applicability of the results to other environmental settings. Another more difficult problem is the need for response maintenance and high rates of individual participation in behavioral technology. Many experiments were extremely effective on a short term, micro-scale, but the applications of the results to permanent, efficient programs have not been shown.

Specifically focusing on littering behavior, a procedure needs to be implemented that reduces littering behavior and increases litter collection. The following study proposes to create a technique which meets these requirements, using an incentive and prompting procedure which employs a random sample of the population in a normal campground

environment. Observed descriptive variables will also be investigated to explore their association with littering behavior. The next chapter will discuss these procedures in detail.

CHAPTER III

METHODOLOGY

The experimental analysis of littering behavior in a recreational environment was investigated from an educational and behavioral approach. The educational program was an appeal to campers to engage in anti-litter behavior. The behavioral program was also an appeal for anti-litter behavior, but promised a tangible reward. These two approaches were compared to the existing conditions in terms of littering behavior. This chapter will focus in detail on the educational and behavioral programs specifically explaining the research design, subjects and setting, procedure, and measurement techniques of this study.

Research Design

The methodology used in this study, which closely resembles designs used in applied behavior analysis, could be termed quasi-experimental with a reversal (ABAB) design (Favell, 1977, pp. 252-261). The reversal (ABAB) design is explained as follows:

> . . . this design begins with the observation of behavior under baseline conditions in which no intervention is implemented (A phase). After the behavior shows a stable rate, the intervention is introduced to alter it (B phase). After a stable rate is achieved under these new conditions, the intervention is withdrawn. Thus, baseline conditions are reinstated (A phase). Finally, the intervention is reinstated (B phase). (Kazdin, 1978, pp. 280-281)

Thus, if the target behavior is altered during the B phase and returns to baseline conditions during the A phase a causal association can be presumed. Sidman (1960, pp. 110-139) describes this method as a type

of systematic replication, which often increases the generality of the findings. The experimental design for this study, employing mainly the (ABAB) reversal method is shown by the following table.

TABLE 1: EXPERIMENTAL DESIGN

Week	Experimental Group
1	Baseline (Control)
2	Educational
3	Baseline (Control)
4	Behavioral
5	Baseline (Control)

In essence this is an (ABACA) reversal design with the educational program introduced at the B phase and the behavioral program being initiated at the C phase. The A phase for weeks 1, 3, and 5 represent the existing littering levels in the campground. The variables used to measure littering behavior were the change in litter for each specific campsite and the decrease in planted litter located along the roadsides of the park. Thus the behavioral and educational program will be evaluated in terms of whether the campers not only decrease their littering behavior at the campsites but also engage in litter collection along the roadsides of the campground.

Subjects and Setting

Bamberton Provincial Park, located 32 kilometres from Victoria, British Columbia on Highway 1, was selected as the site for this study (see Appendix A). This park has 44 single and 3 double camping units,

making a total of 50 campsites. A popular area for salt water swimming in Saanich Inlet, the park attracts visitors with its sandy beach and changehouse facilities. There are also picnic areas located near the beach and the parking lot area. Bamberton Provincial Park contains three camping areas, with areas 1 and 2 being single loops and area 3 a double loop. These areas represent the specific study site. There is only one access road into the camping area, with a small information centre being located near the entrance to area 1. The park is maintained during the day and patrolled at night by park personnel. In comparison to other Provincial Parks on Vancouver Island it is somewhat small, but certainly not the smallest park.

Bamberton Provincial Park was chosen by the researcher for several reasons. It is in relatively close proximity to Victoria. The size of the park, in terms of experimental manageability, is acceptable. The one access road into and out of the park enabled the researcher to record the flow of campers and to make personal observations of littering behavior from the information centre. In general it is a typical Provincial Park with camping facilities.

A sample of 293 randomly selected campsites and the resulting camping groups were chosen at Bamberton Provincial Park during a five week period from July 17th to August 20th of 1979. These dates were selected because attendance to the park during the summer months is near capacity. The visitors to the park represented a typical camping population. In weeks 1, 3, and 5, the baseline conditions, there were 60, 61, and 63 randomly selected camping groups respectively. The educational program, week 2, contained 56 randomly selected camping

groups while week 4, the behavioral program, contained 53 randomly selected camping groups.

In order to approximate the normal conditions of the camping environment, the researcher wore a Provincial Parks uniform while conducting the research. This also enabled the researcher to make observations on littering behavior while conducting other activities. The uniform provided credibility when the researcher contacted the camping groups in the educational and behavioral programs.

Procedure

Three main conditions, a baseline (control), educational, and behavioral group approach, were initiated over a five week period at the three camping areas at Bamberton Provincial Park. The first, third, and fifth week of the study consisted of the baseline or control group approach, while week 2 was the educational program and week 4 was the behavioral program. The programs were evaluated by the change in litter for each specific campsite and the decrease in planted litter located along the roadsides of the park. Each camping group was evaluated on a series of descriptive variables (see Appendix F). Each of these procedures will be explained in detail.

This study began on Tuesday, July 17th, with week 1 being the first baseline or control group. Sixty campsites were randomly selected in the three camping areas at the park. Weeks 3 and 5 were the second and third baselines or control groups, with 61 and 63 randomly selected campsites respectively. The control groups were not contacted by the researcher, thus existing environmental conditions with respect to

littering behavior were exemplified by these baseline conditions. The first control group, week 1, provided baseline data on the present level of littering behavior. Week 3, the second control group, was a return to baseline conditions after the educational program, and also enabled a one week spacing between experimental programs so that they did not overlap. The third control group, week 5, was again a return to baseline conditions after the behavioral program.

The educational program was initiated during the second week of the study and consisted of the researcher handing out printed anti-litter flyers (see Appendix E) and plastic litterbags to campers at 56 randomly selected campsites. On Tuesday morning of that week, the researcher placed anti-litter stickers (see Appendix H) on all garbage can lids at the campsites and other central locations in the three camping areas. The stickers had an anti-litter symbol which matched the symbol on the flyers distributed to the campers. The researcher contacted the 56 randomly selected camping groups during week 2 and informed them that there was a litter problem at the park. The flyers and litterbags were given to the campers, with a request to read the material. The anti-litter message on the flyers, the plastic litterbags, and the symbols on the flyers and stickers served as prompts, or discriminative stimuli for appropriate littering behavior, but promised no tangible, personal reward.

The behavioral program contained incentives for the collection of litter by the campers during week 4 of the study. During this aspect of the study, the researcher randomly selected 53 campsites and the resulting camping groups at these sites. The researcher approached these

campers, indicating that there was a litter problem in the park and asked them if they would like to participate in an anti-litter campaign. If the campers responded positively, which all campers did, the researcher explained the program as involving the collection of litter at their campsites and other areas of the park. Plastic litterbags, identical to the litterbags used in the educational program, were given to these campers for this purpose along with twelve framing prints or a recipe book from *Beautiful British Columbia Magazine* for their participation. These served as the incentives for the behavior program.

During the baseline, educational, and behavioral conditions of this study, litter information sheets (see Appendix F) were filled out on the camping groups that occupied the 293 randomly selected campsites. The information was obtained by direct observation by the researcher and thus the campers were not contacted. Along with the change in litter, which was ascertained from the difference between the litter counts before and after the campsites were occupied, the researcher recorded such information as the campground area, the length of stay, the type of camper, the origin of campers (license plate), the number in the camping group, and whether the campers were a family or not. These variables were selected for their ability to be directly observed and their possible association to littering behavior. Each variable will be discussed briefly.

The litter counts before and after were measures of the number of pieces of litter in a campsite. The litter count after will not be treated as a separate variable in the analysis, since the change in litter is a more suitable variable. The litter count before the camp-

sites were occupied will be investigated to determine whether a 'dirty' or 'clean' campsite, in terms of the amount of litter present, influences the subsequent littering behavior of the campers.

The campground area refers to areas 1, 2, and 3 located at Bamberton Provincial Park. This variable was examined in order to conclude whether any locations affected littering behavior.

The length of stay refers to the time spent by the camping group at the park. This is measured in terms of nights spent at the campsite. This ranged from one night to seven nights spent at the park, with the majority of campers staying one or two nights.

Another variable is the type of camper which concerns the mode of sleeping facilities used in the camping experience. The types of campers included tents, tent trailers, trailers, motor homes, and truck campers. The majority of campers used tents while staying at the park.

The province or state where the campers were from designated the variable origin. This information was obtained by observing the license plate on the camper's vehicle. These data were grouped into four categories of campers from British Columbia, Alberta, the other provinces and territories of Canada, and the United States. The majority of campers were from British Columbia.

The researcher made a simple count of the camping group to obtain the data for the variables number in group, number of adults, and number of children. The camping group was assessed as being a family if there were children present or displayed characteristics of a family unit. The number of individuals in the camping groups ranged from one to ten, while the number of adults and children varied from one to six. The

average number of campers in each group was three, while the average number of adults and children was two and one respectively. Other general observations on littering behavior were made by the researcher during the five week study period.

As mentioned in the introductory chapter, the operational definition for litter in this study will be inappropriately discarded material which is not natural to the environment. Leaves, branches, and other related material will not be considered litter while glass, paper products, and cans will be included as litter. The researcher counted pieces of litter which measured 1 inch by 1 inch (2.5 cm by 2.5 cm) or larger using a clear piece of plastic on which was drawn two 1-inch lines that formed a cross. If the researcher was able to place the end points of the 1-inch lines over the piece of litter, it was counted.

Measurement Techniques

The effectiveness of the litter control program was measured by the change in the amount of litter in each specific campsite and the decrease in planted litter placed along the roadsides of the park. These two measurement techniques can be viewed as complementary indices of the educational and behavioral procedures, but they also can be viewed as two associated experiments. The change in litter will be discussed with a following explanation on the decrease in planted litter.

For each of the 293 specific campsites used in the five weeks of this study, the researcher recorded the changes in the amount of litter. To obtain these data, the researcher counted the amount of litter in each specific campsite before being occupied by the camping group. The

sample number, campsite number, experimental group, date, area, and week of study were recorded on the litter information sheet (see Appendix F) along with the date and time of the litter count before the campsite was occupied. Once the campsite had been filled by a group, the additional data on the litter information sheet were recorded. The researcher then waited until the campers left the park to obtain a second count on the amount of litter at the campsite. The dates and times of these measurements were recorded by the researcher. The difference between these two counts was the change in litter for each campsite. This value could be a positive change (an increase in litter), 0 change (no change in litter), or a negative change (a decrease in litter). Thus values from -10 to 38 were recorded as the minimum and maximum change in litter.

Independent litter counts were taken by three assistant researchers of both the before and after litter amounts in order to check for reliability of measurements. A random sample of 19.80 percent of the 293 cases was performed by the assistant researchers. The association between the measurements was analyzed using a Pearson product moment correlation coefficient and the resulting coefficient was 0.95, indicating a high degree of reliability of measurement.

The researcher initiated another measurement technique in order to evaluate the educational and behavioral programs. This was the decrease in the amount of litter planted along the road of each of the three camping areas. On Tuesday morning of each of the five study weeks, the researcher planted 12 pieces of litter in area 1, 12 pieces of litter in area 2, and 18 pieces of litter in area 3. (The specific locations of the pieces of planted litter are given in Appendix B for area 1,

Appendix C for area 2, and Appendix D for area 3). More pieces of litter were planted in area 3 due to the larger number of campsites as compared to area 1 and area 2. The following table gives the amount and type of litter planted in each of the three areas.

TABLE 2: PLANTED LITTER

	Campsites	Beer Bottles	Tin Foil	Handy -wrap	Paper Towel	Total
Area 1	11	3	3	3	3	12
Area 2	12	3	3	3	3	12
Area 3	21	4	4	5	5	18

For each area, the researcher drew a specific map to locate each piece of planted litter. Using this map, the researcher checked the 42 individual locations where the planted litter was placed on Wednesday through Monday mornings for each of the five study weeks. This information was recorded on the planted litter sheet (see Appendix G) along with the sample number, the experimental group, the counter, the date, the week, the area, and the number of occupied campsites.

A brief example of this would be as follows. On Tuesday morning the researcher places 12 pieces of litter in area 1. On Wednesday morning the researcher, using a map, checks each specific location where the litter was placed on Tuesday to determine the amount collected by campers. If a piece of planted litter is not in its specific location, the researcher checks the surrounding area to see if it was dislodged or blown from its spot. If the litter is found, it is replaced to its original location; if it is not found, the researcher records this as a

decrease in planted litter. This procedure is repeated on Thursday through Monday mornings. On the following Tuesday, the litter is replanted along the roadsides of the camping areas, with counts resuming for the rest of the week. Thus measurements of the decrease in litter are obtained for each study week.

As mentioned earlier, the decrease in planted litter can be viewed as a complementary measurement technique to the change in litter for each specific campsite. This information would be supplemented by the decrease in planted litter indicating whether the educational and behavioral programs were affecting littering behavior not only at the campsites but also in other areas of the park. This would suggest a generalization of the litter control program. The decrease in planted litter can also be considered as an associated experiment with an (ABACA) reversal design. This experiment would be somewhat less controlled than the change in litter procedure in that the collection of litter by campers would not be as easily observed. Also the experimental study area would be increased as compared to the specific campsites for the change in litter procedure making the possibility of experimental contamination.

Summary

This chapter presented the methodology for the experimental litter control programs. The research design for this study used a modified (ABAB) reversal design (Favell, 1977, pp. 252-261). The study was conducted at Bamberton Provincial Park over a five week period, and investigated the effectiveness of an educational and behavioral program through

the measurement techniques of the change in litter at the specific campsites and the decrease in planted litter located along the roadsides in the park. The next chapter, Chapter IV, will present the results of the associations between the change in litter and the observed descriptive variables.

CHAPTER IV

THE ASSOCIATION BETWEEN THE OBSERVED DESCRIPTIVE VARIABLES AND THE CHANGE IN LITTER

This chapter will investigate the relationship between the change in litter at the campsites and the observed descriptive variables. These variables are the campground area, the litter count before campsite occupation, the length of stay, the type of camper, the license plate or origin, the number in the group, the number of adults and children in the group, and whether the campers were a family or not. These factors may influence littering behavior to some degree, and thus it is felt that exploring any possible associations would benefit future programs designed to control litter. The data for the variables were recorded over the five week period, making a total of 293 cases. Table 3 presents the frequencies and means for the variables in terms of the specific study weeks, the baseline weeks, and the total five weeks.

In order to examine the relationship between the change in litter at the campsites to the observed descriptive variables, a chi-square test was conducted. The chi-square test of statistical significance indicates whether two variables are related in a systematic manner. The observed descriptive variables were grouped into categories in order to meet the assumptions of the chi-square statistical test (Denenberg, 1976, pp. 268-269). It is felt by the researcher that the inclusion of the educational and behavioral groups into the analysis must be viewed

TABLE 3: FREQUENCIES AND MEANS FOR THE VARIABLES IN THE FIVE STUDY WEEKS

	Week 1 Control	Week 2 Educational	Week 3 Control	Week 4 Behavioral	Week 5 Control	Weeks 1,3,5 Baselines	All Weeks Total
Camping Groups per Area							
One	12	15	13	11	9	34	60
Two	21	23	16	19	18	55	97
Three	27	18	32	23	36	95	136
Litter Count: Before							
Mean	8.13	6.71	8.25	3.40	2.02	6.09	5.72
Length of Stay							
Mean	1.90	2.04	2.38	2.08	1.48	1.91	1.97
Type of Camper							
Tent trailer	8	12	9	14	6	23	49
Tent	20	17	27	21	23	70	108
Trailer	10	8	10	8	10	30	46
Truck camper	12	10	7	7	13	32	49
Motor home	10	9	8	3	11	29	41
License Plate (Origin)							
B.C.	40	31	39	26	26	105	162
Alberta	10	11	10	15	17	37	63
Canada	6	7	7	6	3	16	29
U.S.A.	4	7	5	6	17	26	39
Number in Group							
Mean	3.45	3.54	3.46	3.49	3.10	3.33	3.40
Family							
Yes	34	41	35	33	31	100	174
No	26	15	26	20	32	84	119
Number of Adults							
Mean	2.27	2.04	2.21	2.08	2.13	2.20	2.15
Number of Children							
Mean	1.18	1.50	1.25	1.42	0.97	1.13	1.25

with caution, since experimental manipulation and possible contamination could have resulted. Thus the baseline conditions, weeks 1, 3, and 5, where the groups were not contacted by the researcher, were considered more appropriate for this analysis. The variables will be discussed in detail as to the rationale for their selection and implications of other factors.

Campground Area

The first variable to be explained is the campground area, which specifically refers to the three camping areas at Bamberton Provincial Park (see Appendix A). Having a geographic perspective, the location is of prime consideration in terms of the influence on littering behavior. The campground consisted of three loops, or roads, with the campsites mainly located near the roads. Area 3 was somewhat larger in geographic size and number of campsites when compared to areas 1 and 2 which were very similar. Table 3 shows the numbers of camping groups in each area during the study weeks. Area 3 had the most camping groups, 95, as compared in descending order to area 2 with 55 camping groups and area 1 with 34 camping groups. This trend also occurred for the individual weeks with little variation except in week 2 when the numbers of camping groups were greater in area 2 than area 3. A chi-square analysis for the camping area as compared to the change in litter was not statistically significant at the 0.05 level for the baseline conditions. It is concluded that the factor of location was not significantly associated with littering behavior for this study.

Litter Count Before Campsite Occupation

The change in litter was obtained by the difference between the litter count before and after occupation of the campsites. But the variable, litter count before campsite occupation, was also of interest to determine if the amount of litter at a campsite influenced the littering behavior of the campers. The average amounts of litter at the campsites before being occupied by campers are presented in Table 3. It can be seen that the average amount of litter before the campsites were occupied for the baseline conditions was 6.09, with some variation for each individual week. The chi-square test for this variable and the change in litter was not statistically significant at the 0.05 level for the baseline conditions. Within this study, the amount of litter that is present before a camper arrives at a site does not affect his subsequent littering behavior.

Length of Stay

The length of stay is the amount of time the campers spent at Bamberton Provincial Park in terms of nights. The amount of time spent at a campsite might influence the littering behavior of campers in that they would simply have more time to engage in the behavior. Table 3 shows the average amount of nights spent at the park by the camping groups, with an average for the baseline conditions of essentially two nights which is the same for the individual weeks. The average length of stay did not vary significantly over the five study weeks. Table 4 indicates the statistically significant relationship at the 0.05 level between the length of stay and the change in litter for the baseline

TABLE 4: CHI-SQUARE FOR CHANGE IN LITTER AND LENGTH OF STAY

Change in Litter (pieces)	Length of Stay (nights)			Totals
	1	2	3-7	
0 to 3	30	12	5	47
4 to 6	34	18	12	64
7 to 9	22	12	7	41
10 to 38	6	7	19	32
Totals	92	49	43	184

Chi-square = 31.03 Degrees of Freedom = 6 Significance = 0.000

conditions. The categories for the variable, length of stay, are 1 night, 2 nights, and 3 to 7 nights while the categories for the variable, change in litter, are 0-3, 4-6, 7-9, and 10-38 pieces. It can be seen from Table 4 that the longer the campers stayed the more probable it was for a greater increase in litter. This would certainly agree with the initial assumption that the longer a camper is at a campsite, the more chance for an accumulation of litter. It should be remembered that the chi-square test does not indicate the relative strength of the association between the variables. There was not as much control over the experimental groups as could be hoped for. It would have been desirable to have identical groups (i.e., the same number of adults, children, types of camper, origin, etc.) and have equal numbers of groups for one through seven nights for comparative purposes. This, of course, is not always possible in field experiments. Thus, the statistically significant relationship between the length of stay and the change in litter should be viewed with caution.

Type of Camper

This variable refers to the mode of sleeping accommodations that the campers used. The classifications used in this study were tent trailer, tent, trailer, truck camper and motor home. Tents were usually one to three individual fabric structures; tent trailers were units pulled by a vehicle that could be folded into a flat surface, while trailers were self-contained units usually larger in size. Truck campers were self-contained units located on the back of a pick-up truck, while motor homes encompassed such recreational vehicles as vans and motorized camping units. The type of camper was investigated in order to determine if different styles of camping have an effect on littering behavior. Table 3 shows the four categories of campers, with most groups using a tent which is also prevalent in the individual weeks. The chi-square test for the type of camper and change in litter was not statistically significant at the 0.05 level for the baseline conditions. It is concluded that the style of camping, defined as using a tent, tent trailer, trailer, truck camper, or motor home, does not affect littering behavior in this study.

License Plate or Origin

The residence of the campers was determined by the license plate on their vehicle. Four categories of origin were used: campers from British Columbia, Alberta, the other Canadian provinces, and the United States. The frequencies for this variable can be seen in Table 3. The majority of campers came from British Columbia and to a lesser extent from Alberta. The place of residence could have an effect on littering

in that there would be different social conditions, laws, and other factors influencing this behavior. This did not prove to be the case in this study in that the chi-square test was not statistically significant at the 0.05 level for the variables license plate or origin and the change in litter. The place of residence does not seem to affect littering behavior.

Number in the Group

The number in the group refers directly to the number of campers in the group. An intuitive assumption about this variable would be that an increase in individuals at a campsite would result in an increase in the amount of litter. One would expect to find more litter at sites where large groups have congregated. Table 3 indicates the average number of individuals in a camping unit was slightly more than three, with basically each individual week reflecting this same average. The average number of campers in each group did not vary significantly over the five study weeks. The chi-square test for the variables change in litter and number in the group was statistically significant at the 0.05 level during the baseline conditions, as shown in Table 5. The categories for the number in the group are 1-2, 3-4, and 5-10 individuals while the categories for the change in litter are 0-3, 4-6, 7-9, and 10-38 pieces, the same as in Table 4. This table indicates that groups with small numbers of individuals are less likely to litter while large groups tend to litter more. This also agrees with an intuitive judgement that the more individuals camping at a site, the more litter there will be. As was mentioned for the variable, length of stay, the results

TABLE 5: CHI-SQUARE FOR CHANGE IN LITTER AND NUMBER IN GROUP

Change in Litter (pieces)	Number in Group			Totals
	1-2	3-4	5-10	
0 to 3	27	18	2	47
4 to 6	24	29	11	64
7 to 9	8	26	7	41
10 to 38	9	13	10	32
Totals	68	86	30	184

Chi-square = 21.45 Degrees of Freedom = 6 Significance = 0.002

of the chi-square test should be interpreted with caution. The number in the group is closely associated with the variables, family or non-family, the number of adults and the number of children. Again it would have been desirable to have more experimental control over the variables which was not possible in this study.

Family or Non-Family

The presence of children or associating factors determined whether a camping group was designated as a family or non-family. A family unit could influence littering behavior in a group with the parents not wanting to initiate 'bad' habits and the children modelling appropriate littering behavior. However it has been shown that the variable, number in the group, is associated with littering behavior, and a family would be larger than a non-family. Also a family would contain children, which could translate into a larger amount of gum and candy wrappers. There were more family units camping at Bambertom Provincial Park than non-family units in total, with only week 5 representing a reversal of this

TABLE 6: CHI-SQUARE FOR CHANGE IN LITTER AND FAMILY OR NON-FAMILY

Change in Litter (pieces)	Family		Totals
	No	Yes	
0 to 3	30	17	47
4 to 6	30	34	64
7 to 9	10	31	41
10 to 38	14	18	32
Totals	84	100	184

Chi-square = 13.81 Degrees of Freedom = 3 Significance = 0.003

situation for the individual weeks (see Table 3). The chi-square test displayed in Table 6 shows the statistically significant relationship at the 0.05 level between the change in litter and whether the camping group was a family or non-family. The categories for the change in litter are the same as in Tables 4 and 5 while the variable, family or non-family, is separated into a yes or no distinction. This table indicates that groups defined as families have a greater probability to be associated with larger amounts of litter. This again makes intuitive sense, since a family would usually have more individuals than a non-family and usually contains children which, for the purposes of this study, is a variable found to be associated with littering behavior. Thus the results of this analysis point to the conclusion that family units litter more than non-family units. The number of adults and children and the number in the group are closely related variables to the family or non-family distinction, as mentioned before. This relationship should again be viewed with caution, with a more controlled

experiment leading to more generalized results.

Number of Adults

The number of adults refers simply to the amount of adult individuals in a camping group. This variable was investigated in order to determine if the adult portion of the camping population could be related to littering behavior. This would also be an interesting comparison to camping groups with children. The average number of adults did not vary significantly over the five study weeks, with the average for the baseline conditions being slightly more than two. The average number of adults for each individual week was also slightly over two, as shown in Table 3. The chi-square test for the change in litter and the number of adults was not statistically significant at the 0.05 level for the baseline conditions. This is a contradictory conclusion with regards to the associations found for the number in the group, family or non-family, and the number of children to the change in litter. It could be interpreted that the adult factor in a camping group does not contribute to the accumulation of litter, with the number of children a more important consideration.

Number of Children

As with the previous variable, this simply refers to the individuals classified as children in a camping group. Children may have acquired inappropriate littering behavior, making them suspect for the accumulation of litter. The results of this study would seem to point in that direction, with the number in the group and family or non-family being associated with littering behavior and the number of adults not

TABLE 7: CHI-SQUARE FOR CHANGE IN LITTER AND NUMBER OF CHILDREN

Change in Litter (pieces)	Number of Children				Totals
	0	1	2	3-6	
0 to 3	30	7	7	3	47
4 to 6	29	12	13	10	64
7 to 9	10	13	10	8	41
10 to 38	14	2	8	8	32
Totals	83	34	38	29	184

Chi-square = 20.42 Degrees of Freedom = 9 Significance = 0.016

being related to this behavior. Table 3 represents the average number of children for the baseline conditions to be slightly over one, with the individual weeks also essentially one. The average number of children did not vary significantly over the five study weeks. The chi-square test was initiated for the change in litter and the number of children in the baseline conditions. This association was statistically significant at the 0.05 level (see Table 7). The categories for the number of children are 0, 1, 2, and 3-6 children, while the categories for the change in litter are 0-3, 4-6, 7-9, and 10-38 pieces. The relationship in this table would be that camping groups without children do not litter as much as camping groups with children. Intuitively this would be logical, matching the earlier assumptions about littering behavior in children. As mentioned earlier, the number of children is closely related to several other variables. This makes the isolation of causal factors difficult. And again, the less than ideal situation concerning experimental control would suggest caution when interpreting the results.

Summary

This chapter contained an analysis of the observed descriptive variables to the change in litter at the campsites. Four statistically significant relationships were found for the baseline conditions between the change in litter and the length of stay, the number in the group, the number of children, and whether the camping group was a family or non-family. As a point of interest, the chi-square test was conducted for all of the study weeks as well as the baseline weeks. The results of the chi-square test were identical for the baseline weeks and the five total study weeks. The chi-square test results need to be interpreted with caution due to a lack of isolation of effects between variables and a less than ideal amount of experimental control. This could have resulted in experimental contamination with outside factors causing the effects of the relationships. The next chapter will report the results indicating the influence of the behavioral and educational programs on litter control.

CHAPTER V

THE EFFECTIVENESS OF THE BEHAVIORAL AND EDUCATIONAL PROGRAMS

The effects of the behavioral and educational programs will be evaluated in this chapter along with the change in the amount of litter planted along the roadsides of each of the three camping areas. The behavioral and educational programs will be assessed using parametric and non-parametric statistical tests, specifically using the one-way analysis of variance test and the Kruskal-Wallis test to ascertain whether there is a significant statistical difference between the five study weeks. The variable, change in litter, will be used to compare the behavioral, educational, and control groups using these statistical tests. Once a statistical difference has been shown, parametric and non-parametric statistical tests, the Scheffé and Mann-Whitney tests respectively, are used to determine which study group or groups are significantly different in statistical terms from the others. The practical significance of these results will be discussed in the next chapter.

The change in planted litter will be examined in order to determine the effects of the behavioral and educational programs on the campers' behavior in terms of whether they not only picked up litter at their campsites but also in other areas of the park. This would indicate a generalization of the anti-litter behavior of the campers. This variable provides a supplementary measurement on the effects of the

anti-litter programs initiated in this study.

The present study contained three main divisions; a behavioral program that was initiated in week 4, an educational program that was started in week 2, and three control groups occurring in weeks 1, 3, and 5. The variable, change in litter, was measured during each of the five weeks in order to compare the different anti-litter programs. The control groups enable the researcher to determine the baseline, or existing conditions, in the park. The control group weeks also provide a spacing between the educational and behavioral programs in order to decrease any overlapping effects.

Amount and Variability of Litter

Table 8 summarizes the change in litter in terms of the number of cases, total amount of litter, minimum and maximum changes in litter, mean, standard deviation, and the variances for each of the five experimental groups in the study. The total amount of litter, expressed in the change in pieces of litter, is considerably smaller in the behavioral group as compared to the other experimental groups. The difference between the minimum and maximum change in pieces of litter is greatest in week 3 and smallest in week 2. It can also be seen that the littering variability for the five study weeks is somewhat high, ranging from the educational program, week 2 with a standard deviation of 2.91, to the control group, week 3 with a standard deviation of 6.92. It should be noted that the number of cases is not equal for the five experimental groups, thus making the mean, or average change in the amount of litter, a more comparable measure. Week 4, the behavioral

TABLE 8: EXPERIMENTAL RESULTS FOR THE CHANGE IN LITTER

Week	Experimental Group	Cases	Change in Pieces of Litter	Minimum	Maximum	Mean	Standard Deviation	Variance
1	Control	60	411	1.0	25.0	6.85	4.73	22.33
2	Educational	56	316	2.0	17.0	5.64	2.91	8.49
3	Control	61	461	0.0	38.0	7.56	6.92	47.82
4	Behavioral	53	33	-10.0	17.0	0.62	3.83	14.70
5	Control	63	362	0.0	17.0	5.75	3.73	13.90

group, has a much lower mean (0.62) than the educational group (5.64) and the three control groups (6.85, 7.56, and 5.75 respectively). The difference in means is illustrated in Figure 1 which shows the behavioral group with the smallest mean of the five study weeks.

An example of exactly what this translates into in terms of pieces of litter is as follows. Suppose the researcher initially counted the amount of litter in a campsite and a total of five pieces was recorded. After the campers had vacated the campsite, the researcher took another litter count, and found that there were ten pieces of litter. This would mean a change in litter at this campsite of positive five pieces of litter. Thus the higher the mean, or average change in litter for each study group, the more the campers are littering.

Distribution Characteristics

The variable, change in litter, was analyzed to determine the frequency and resulting normality for each of the five experimental groups. Frequency polygons illustrate how well the variable, change in litter, approximates the normal curve in Figures 2 through 6. Week 1, the first control group, is skewed to the right with a leptokurtic distribution. Week 3, the second control group, has a platykurtic distribution and is skewed to the right. Week 5, the third control group, has a slight leptokurtic distribution and is positively skewed. The educational group, week 2, has a somewhat leptokurtic distribution and is positively skewed. The behavioral group, week 4, is skewed slightly to the right and has a somewhat leptokurtic distribution. The change in litter for this experimental group closely resembles the

FIGURE 1 THE MEANS OF THE EXPERIMENTAL GROUPS

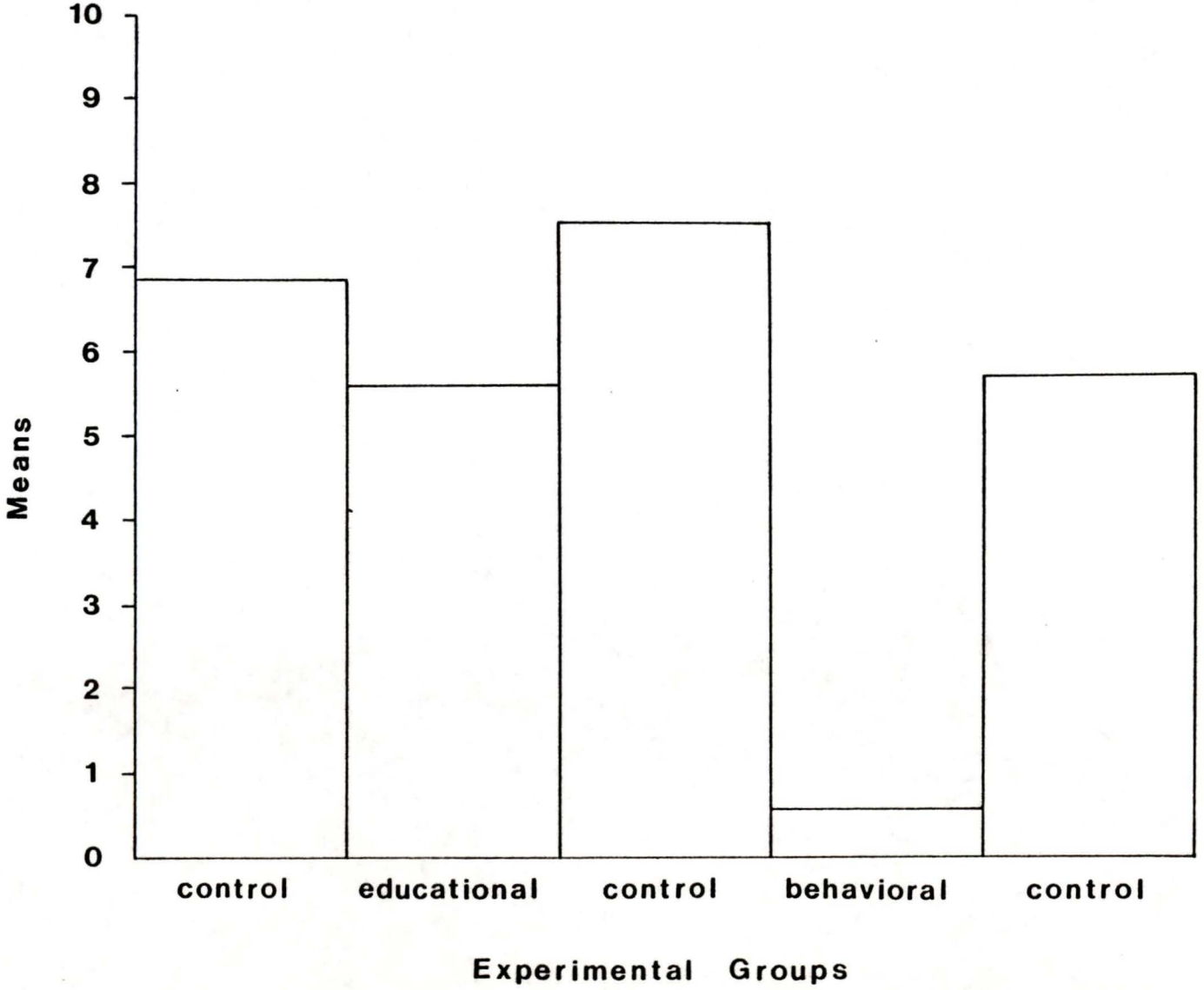


FIGURE 2 THE CHANGE IN LITTER FOR WEEK 1

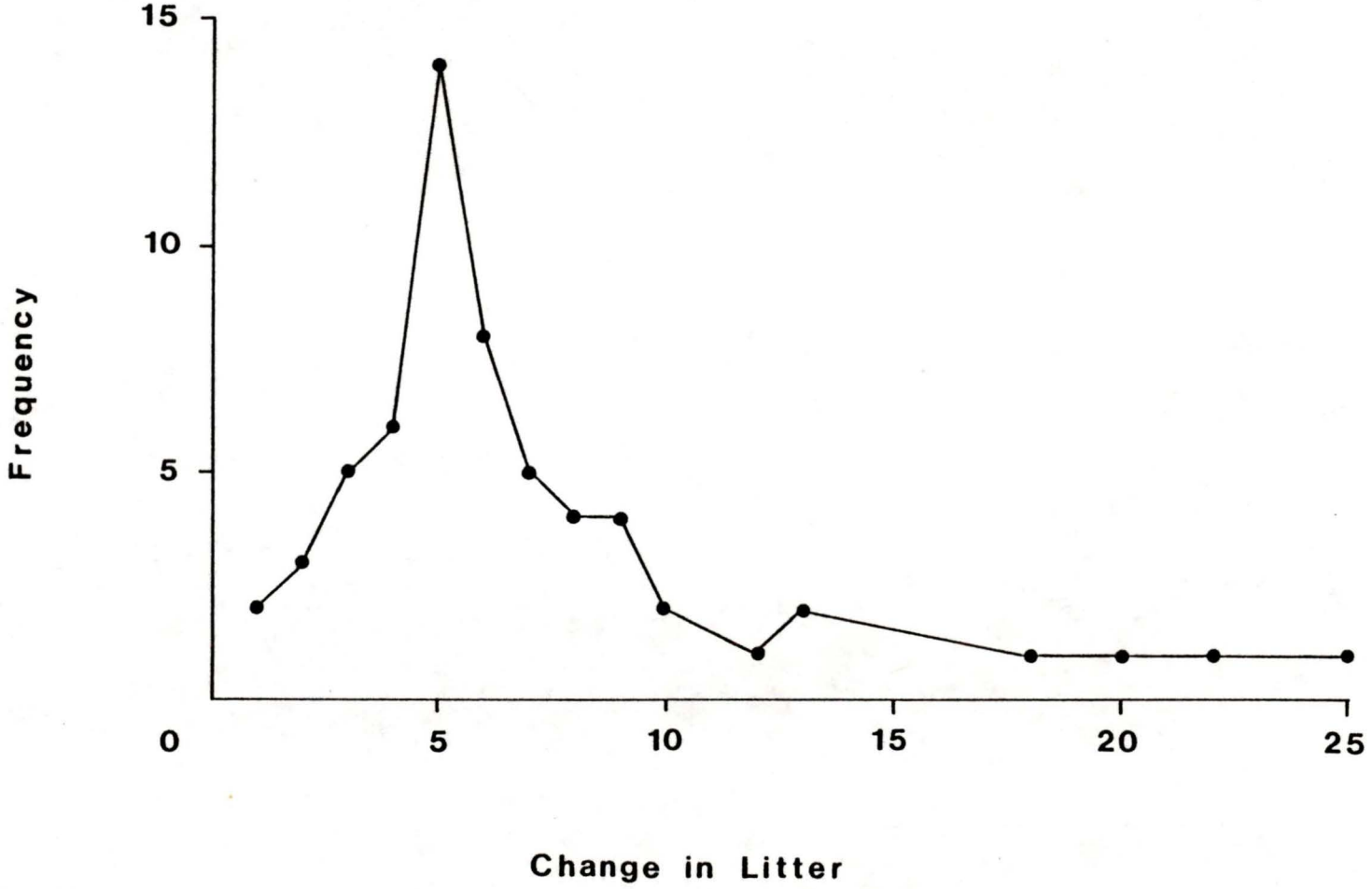


FIGURE 3 THE CHANGE IN LITTER FOR WEEK 2

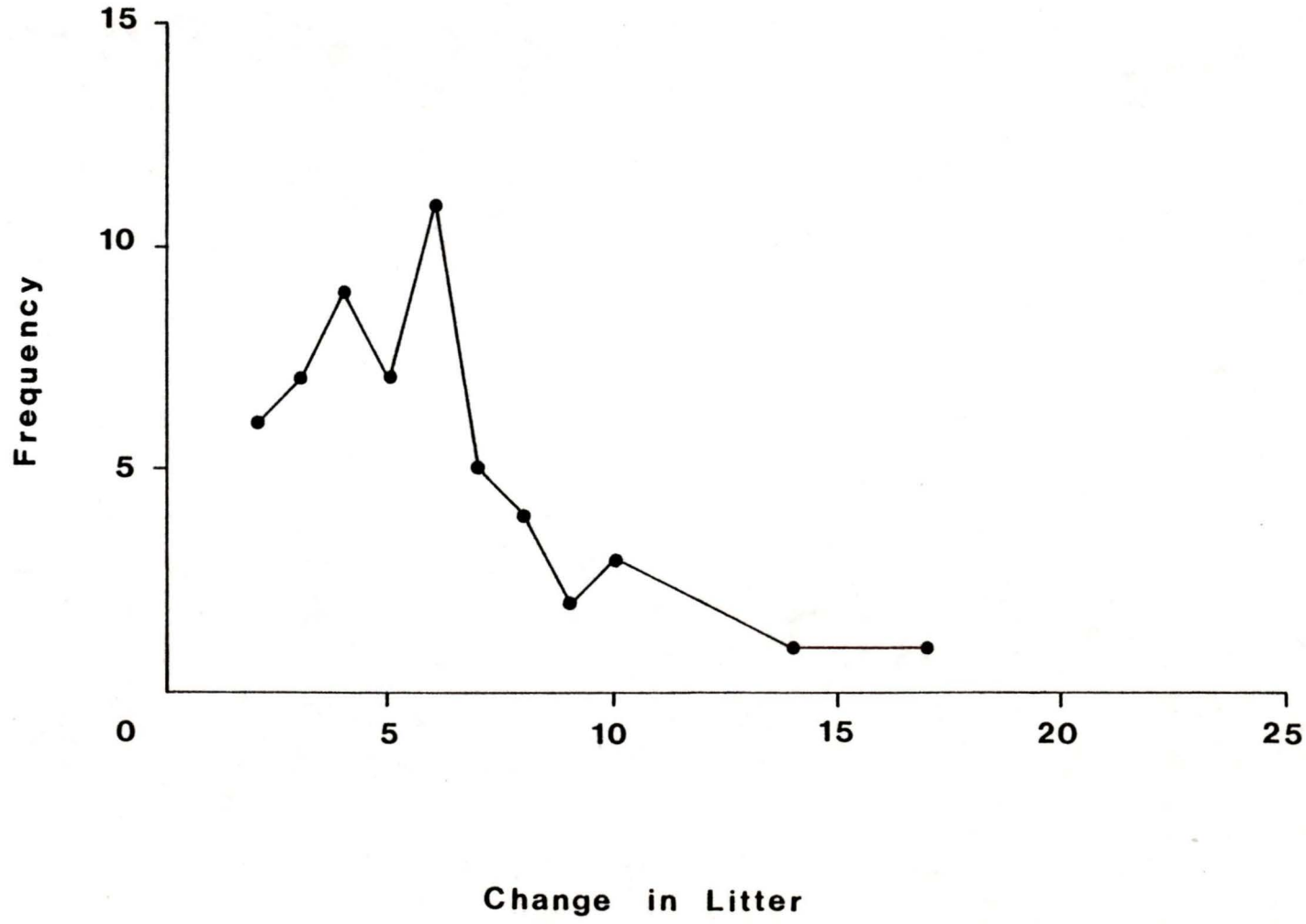


FIGURE 4 THE CHANGE IN LITTER FOR WEEK 3

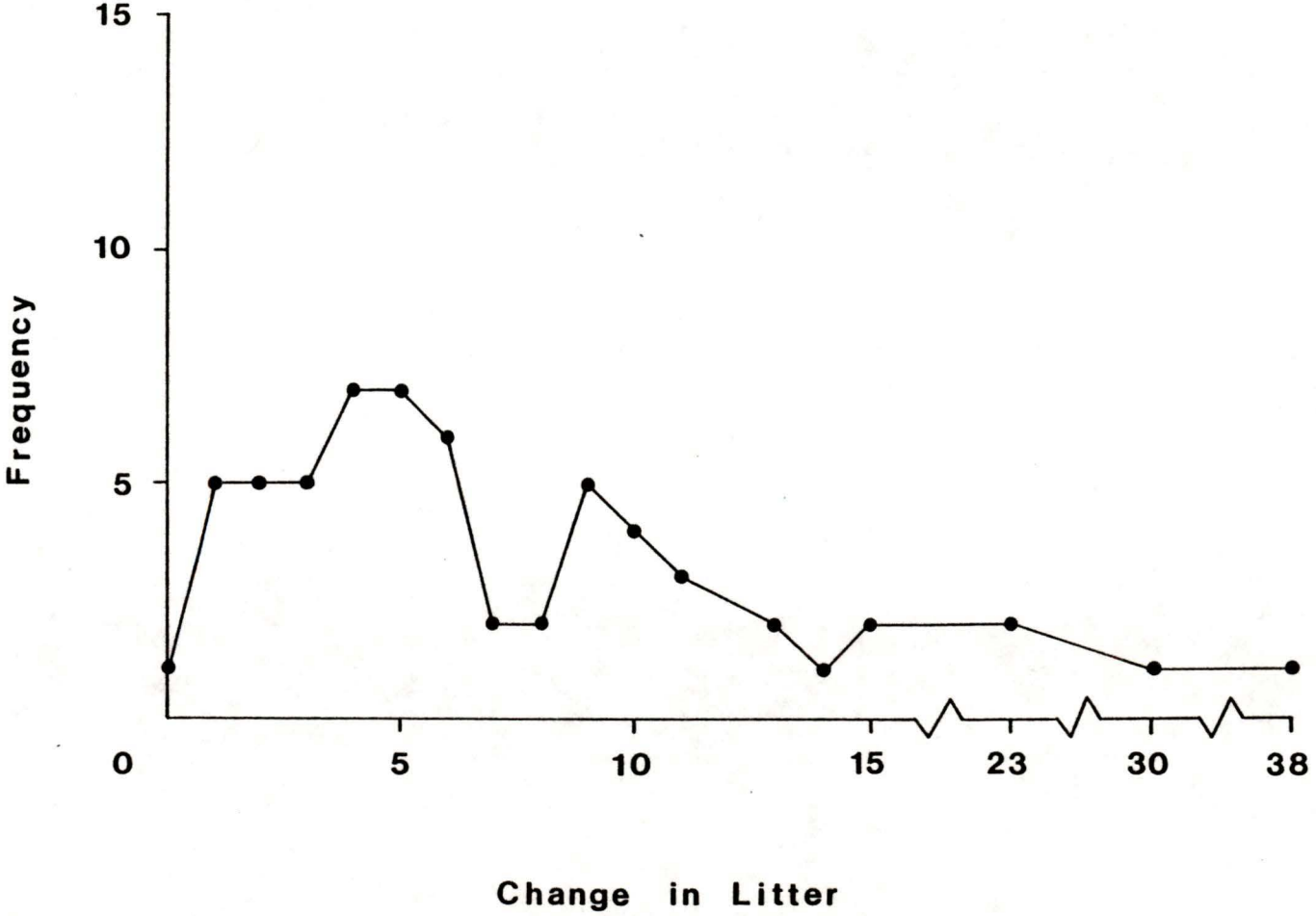


FIGURE 5 THE CHANGE IN LITTER FOR WEEK 4

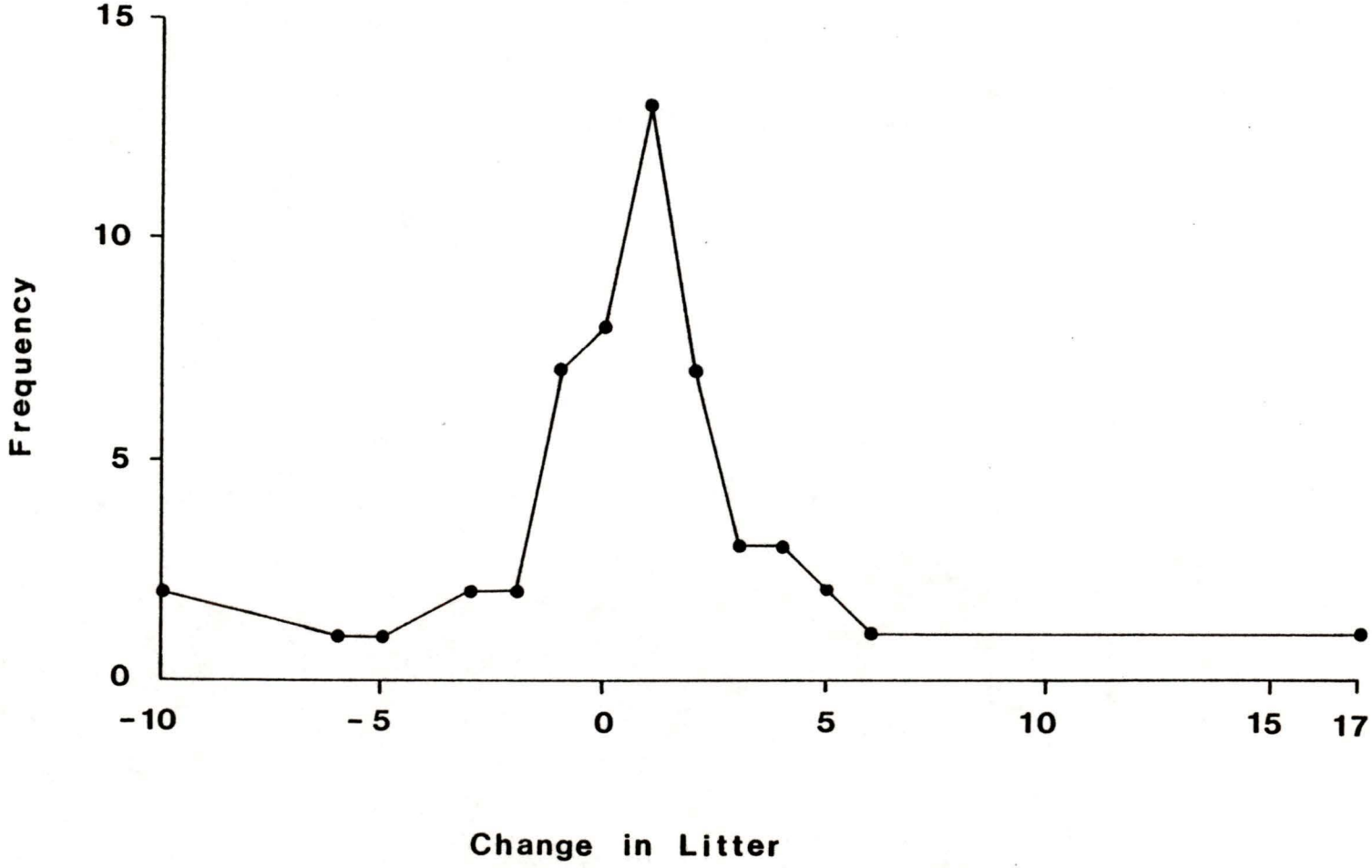
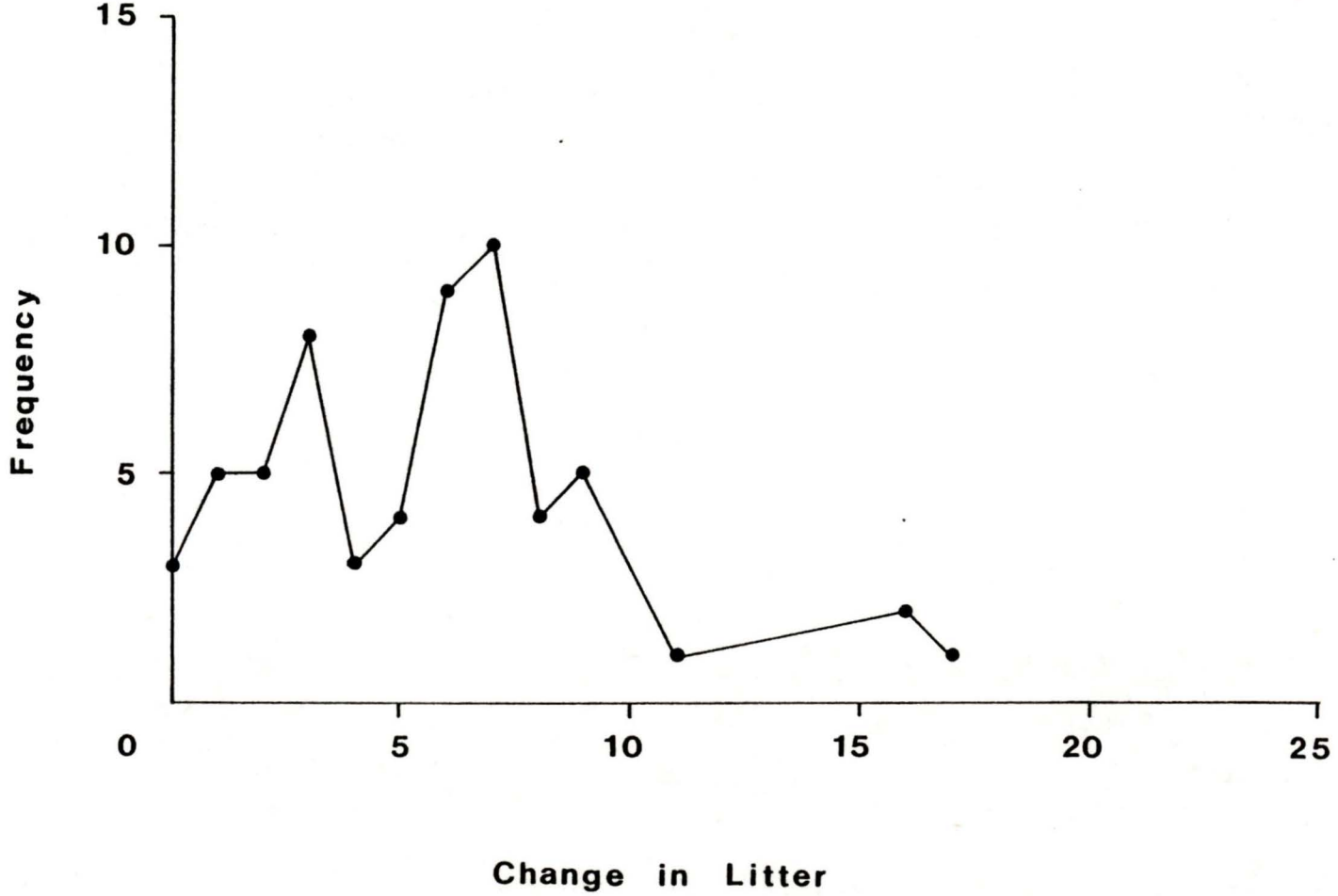


FIGURE 6 THE CHANGE IN LITTER FOR WEEK 5



normal curve in its distribution. Comparing the five experimental groups in terms of the distribution characteristics of the change in litter, the first control group and the behavioral group more closely approximate normality. Because the variable, change in litter, does not have a normal distribution for the five experimental groups, non-parametric analysis will be used to supplement the parametric statistical tests.

Comparison of the Five Experimental Groups

A parametric test was conducted in order to determine if there was a significant statistical difference between the five experimental groups. The one-way analysis of variance test was selected for this purpose. According to Blalock (1972) the analysis of variance test may be applied to ascertain the difference in means of more than two samples, specifically focusing on variances. Scheffé (1959) views the F-test as a first step to determine whether multiple comparison tests will produce any further information.

A one-way analysis of variance test was implemented for the variable, change in litter, for the five experimental groups. Table 9 indicates the results of this test, with the F ratio being 18.69, significant at the 0.05 level. This shows that there is a statistically significant difference in the average amount of litter left by the campers for the five experimental groups.

In using the one-way analysis of variance test, certain assumptions must be made about the data. The assumptions that the samples are independent and random have been met, but the assumptions of normality

TABLE 9: ONE-WAY ANALYSIS OF VARIANCE

Source	Degrees of Freedom	Sum of Squares	Mean Squares	F Ratio	F Probability
Between groups	4	1630.53	407.63	18.69	0.000
Within groups	288	6279.92	21.81		
Total	292	7910.45			

and homogeneous variances have been violated. Many authors do not consider these violations serious since the one-way analysis of variance test is viewed as being robust.

> Generally speaking, moderate departures from normality and equality of variance can be tolerated without necessitating the use of nonparametric alternatives. (Blalock, 1972, p. 325)

Roscoe (1969) feels that generally the researcher may ignore these assumptions. Lindman (1974, pp. 31-35, 43-45) concludes that the one-way analysis of variance test is robust with respect to the assumptions of normality and homogeneous variances.

A non-parametric technique, the Kruskal-Wallis one-way analysis of variance by ranks test, was employed to supplement the parametric test and the previous results. Even though the one way analysis of variance test is considered robust, it was felt that a non-parametric test would strengthen the conclusions reached. The results of this test are presented in Table 10, with a chi-square value of 85.74 when corrected for ties which is significant at the 0.05 level. The results of this test agree with the previous parametric test in that there is a signif-

TABLE 10: KRUSKAL-WALLIS TEST

Week	Experimental Group	Cases	Mean Ranks
1	Control	60	175.99
2	Educational	56	162.05
3	Control	61	173.23
4	Behavioral	53	50.61
5	Control	63	161.70

Cases 293	Chi-square 85.13	Significance	0.000
	Corrected for ties		
	Chi-square 85.74	Significance	0.000

icant statistical difference between the five experimental groups.

Comparisons Between the Five Experimental Groups

The one-way analysis of variance test and the Kruskal-Wallis one-way analysis of variance by ranks test have shown that there is a statistically significant difference between the five experimental groups. The next step is to determine which experimental groups are different from each other in a statistical sense. Using a parametric test, the Scheffé procedure provides this information. The results of the Scheffé test are presented in Table 11, which shows that the behavioral group is statistically different from the other four experimental groups at the 0.05 level. In terms of the violation of assumptions concerning this parametric test, it is quite analogous to the one-way analysis of variance test. "Like the analysis of variance, the Scheffé procedure is quite insensitive to departures from normality and homo-

TABLE 11: MULTIPLE RANGE TEST, SCHEFFÉ PROCEDURE

	Week	Experimental Group
Pairs of experimental groups significantly different at the 0.05 level	1	Control
	4	Behavioral
	2	Educational
	4	Behavioral
	3	Control
	4	Behavioral
	5	Control
	4	Behavioral

The table ranges for the 0.05 level are: 4.38, 4.38, 4.38, and 4.38.

The value actually compared with mean (J) - mean (I) is 3.3019.

geneity of the variances" (Roscoe, 1969, p. 240).

The Mann-Whitney test, a non-parametric test, was used to give complementary analysis to the previous parametric test. Again it was felt that the conclusions reached would be enhanced by a non-parametric technique.

> . . . the Mann-Whitney U test may be used to test whether two independent groups have been drawn from the same population. This is one of the most powerful of the nonparametric tests. . . . (Siegel, 1956, p. 116)

Table 12 illustrates the results of this test, with the behavioral group being significantly different from the other four experimental groups at the 0.05 level. These findings directly agree with the Scheffé procedure.

Planted Litter

Another major aspect of the study was to measure the change in the amount of planted litter placed by the researcher along the roadsides at

TABLE 12: MANN-WHITNEY TEST

	Week	Experimental Group	Mean Rank	U	Z Corrected for Ties
	1	Control	79.58	235.0	-7.83
	4	Behavioral	31.43		
	2	Educational	77.16	243.0	-7.55
Pairs of experimental groups significantly	4	Behavioral	31.58		
different at the 0.05	3	Control	78.25	351.0	-7.22
level	4	Behavioral	33.62		
	5	Control	78.29	422.5	-6.94
	4	Behavioral	34.97		

the three camping areas. As mentioned in the procedure section of Chapter III, the researcher planted 12, 12, and 18 pieces of litter in areas 1, 2, and 3 respectively on Tuesday morning for each of the five study weeks. The litter consisted of beer bottles, tin foil, plastic wrap, and paper towels. The researcher placed the litter in specifically mapped locations along the roadsides of the three camping areas in order to take accurate counts on Wednesday through Monday mornings for each of the five study weeks.* The type of litter picked up by the campers and the decrease in the amount of litter planted along the roadsides were recorded by the researcher.

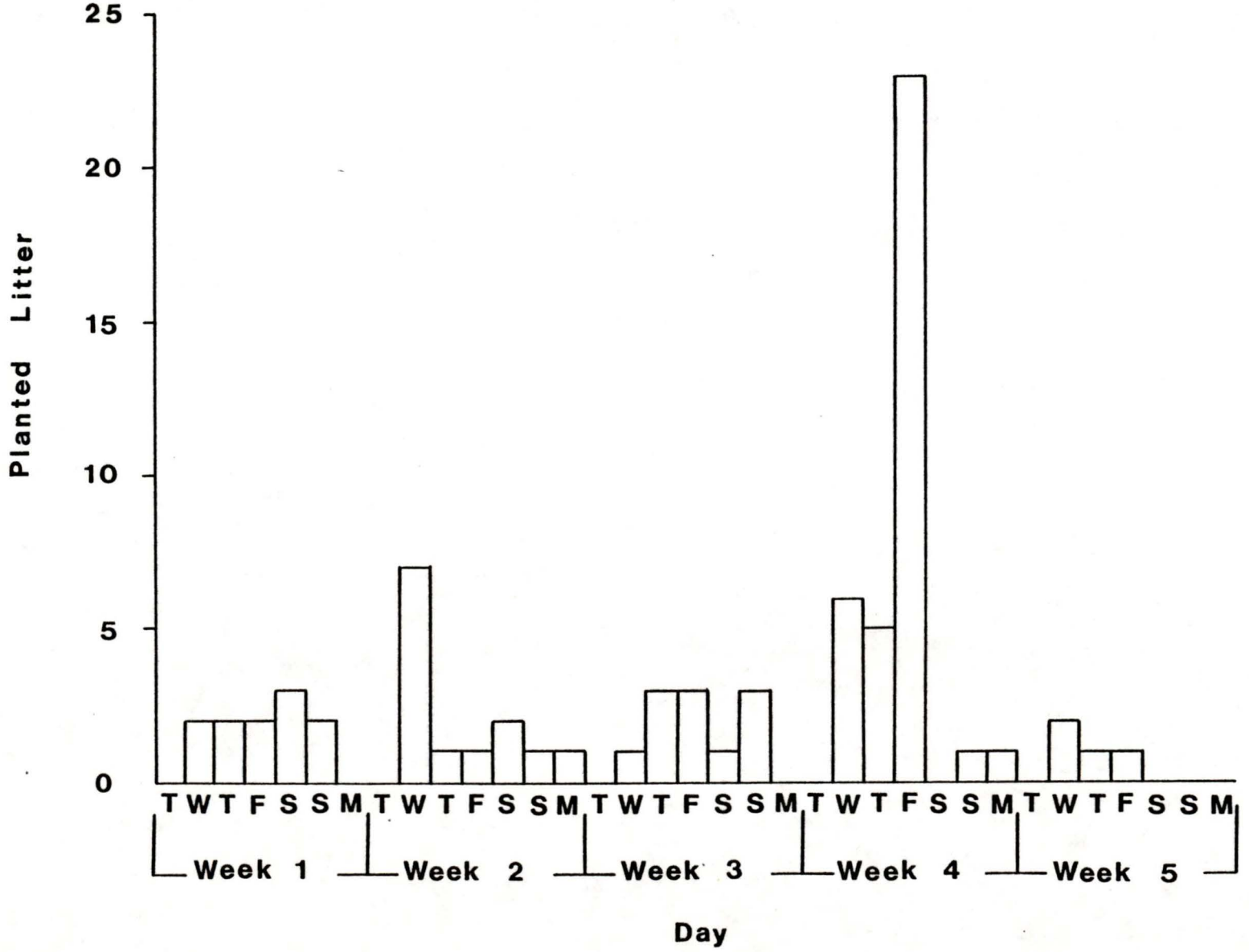
Table 13 represents the pieces of planted litter picked up by day, with Figure 7 displaying this visually. In week 1, the first baseline

*For the amounts and types of litter planted in the three camping areas, see Table 2 in the procedure section of Chapter III. The specific locations of the planted litter are given in Appendices B, C, and D.

TABLE 13: PIECES OF PLANTED LITTER PICKED UP BY DAY

	Week 1			Total	Week 2			Total	Week 3			Total	Week 4			Total	Week 5			Total
Area	1	2	3		1	2	3		1	2	3		1	2	3		1	2	3	
Tuesday	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wednesday	1	1	0	2	2	2	3	7	0	0	1	1	0	2	4	6	2	0	0	2
Thursday	1	1	0	2	0	0	1	1	1	1	1	3	2	2	1	5	0	1	0	1
Friday	1	0	1	2	1	0	0	1	1	0	2	3	10	5	8	23	1	0	0	1
Saturday	1	0	2	3	0	2	0	2	0	1	0	1	0	0	0	0	0	0	0	0
Sunday	0	1	1	2	1	0	0	1	2	1	0	3	0	0	1	1	0	0	0	0
Monday	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	1	0	0	0	0
Totals	4	3	4	11	4	5	4	13	4	3	4	11	12	9	15	36	3	1	0	4

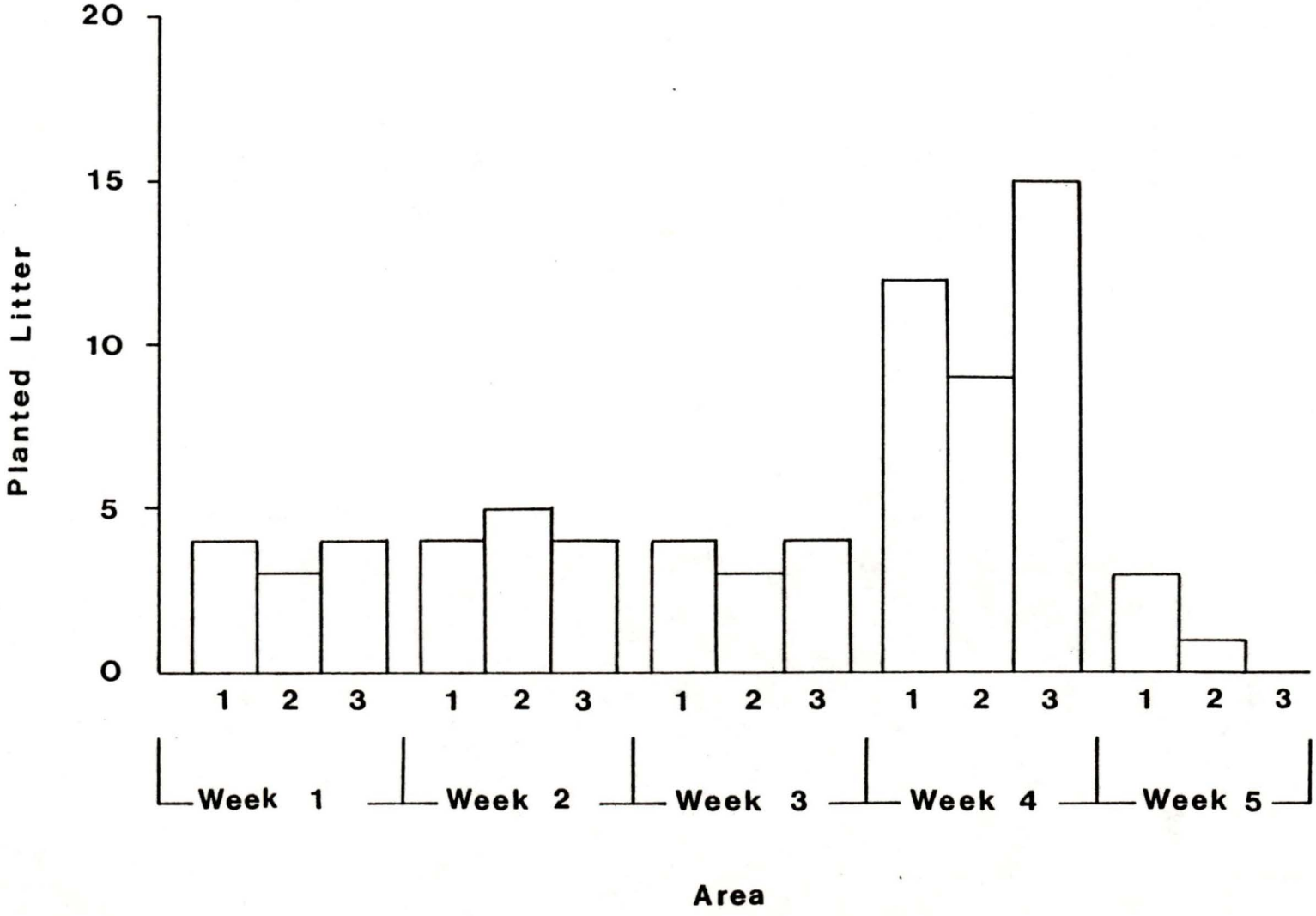
FIGURE 7 PLANTED LITTER PICKED UP BY DAY



condition, there were 11 pieces of planted litter picked up by the campers for the three study areas, with litter collection by day fairly consistent. The educational program, study week 2, produced 13 pieces of litter being picked up, a slight increase from week 1. On Wednesday of week 2, 7 pieces of litter were collected which could be attributed to the initial effects of the educational program. Week 3 reverted to baseline conditions, with 11 pieces of litter being picked up by the campers. This is the same total as in week 1, with the litter collection by day not being as consistent. The behavioral program, week 4, shows a dramatic increase in the amount of planted litter picked up by campers, a total of 36 pieces. Friday was the peak day of that week for litter collection, with 23 pieces being picked up. This day is also the usual start of the camping weekend, with a large influx of people. The relatively low levels of collection for the rest of the week could be a result of the fact that after Friday, 34 of the possible 42 pieces of litter had been picked up. Week 5 represented baseline conditions, as in week 1 and week 3. Only 4 pieces of litter were picked up during this week, a decrease of 7 pieces of litter from the other two baseline weeks. This could be attributed to lower attendance figures during this week, especially during the weekend.

At the bottom of Table 13, the total amount of planted litter picked up by area per week is given. This is also represented in Figure 8. Week 1 and week 3 have 4, 3, and 4 pieces of litter collected from areas 1, 2, and 3 respectively. The measurements from these two baseline conditions are identical, with week 5 having a slight reduction in the amount of litter collected in the three study areas. Week 2, the

FIGURE 8 PLANTED LITTER PICKED UP BY AREA



educational program, has 4, 5, and 4 pieces of litter picked up for areas 1, 2, and 3 respectively which is a slight increase for area 2 as compared to weeks 1 and 3. The behavioral program, week 4, again has a dramatic increase in the amount of litter picked up by area, with 12 pieces in area 1, 9 pieces in area 2, and 15 pieces in area 3.

Table 14 represents the cumulative total and percentage of planted litter picked by day and week. For each week there were 42 pieces of planted litter that could be collected by the campers which would represent 100 percent of the planted litter collected for that week. Weeks 1 and 3, representing baseline conditions, are identical with a cumulative percentage of 26.19 while week 5, the third baseline condition, has a lower cumulative percentage of 9.52. Week 2, the educational program, is slightly higher in cumulative percentage with 30.95, while the behavioral program, week 4, has a drastic increase to 85.71 cumulative percentage. These cumulative percentages are illustrated in Figure 9, which shows the significant effects of the behavioral program.

The researcher recorded the types of planted litter picked up by the campers which consisted of beer bottles, tin foil, plastic wrap, and paper towels. Table 15 shows the amount of planted litter collected by the campers for each of the five study weeks. This again illustrates the significant effects of the behavioral program in terms of planted litter collection. An interesting aspect of Table 15 is that beer bottles were collected the most by campers in all of the study weeks. The beer bottles should be the first type of litter picked up, since there is a five cent deposit for each bottle. Thus there is an existing monetary reward for returning beer bottles. But in the behavioral

TABLE 14: CUMULATIVE TOTAL AND PERCENTAGE OF PLANTED LITTER PICKED UP

	Week 1 Cumulative		Week 2 Cumulative		Week 3 Cumulative		Week 4 Cumulative		Week 5 Cumulative	
	Total	%	Total	%	Total	%	Total	%	Total	%
Tuesday	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Wednesday	2	4.76	7	16.67	1	2.38	6	14.29	2	4.76
Thursday	4	9.52	8	19.05	4	9.52	11	26.19	3	7.14
Friday	6	14.29	9	21.43	7	16.67	34	80.95	4	9.52
Saturday	9	21.43	11	26.19	8	19.05	34	80.95	4	9.52
Sunday	11	26.19	12	28.57	11	26.19	35	83.33	4	9.52
Monday	11	26.19	13	30.95	11	26.19	36	85.71	4	9.52

FIGURE 9 PERCENT PLANTED LITTER PICKED UP BY THE GROUPS

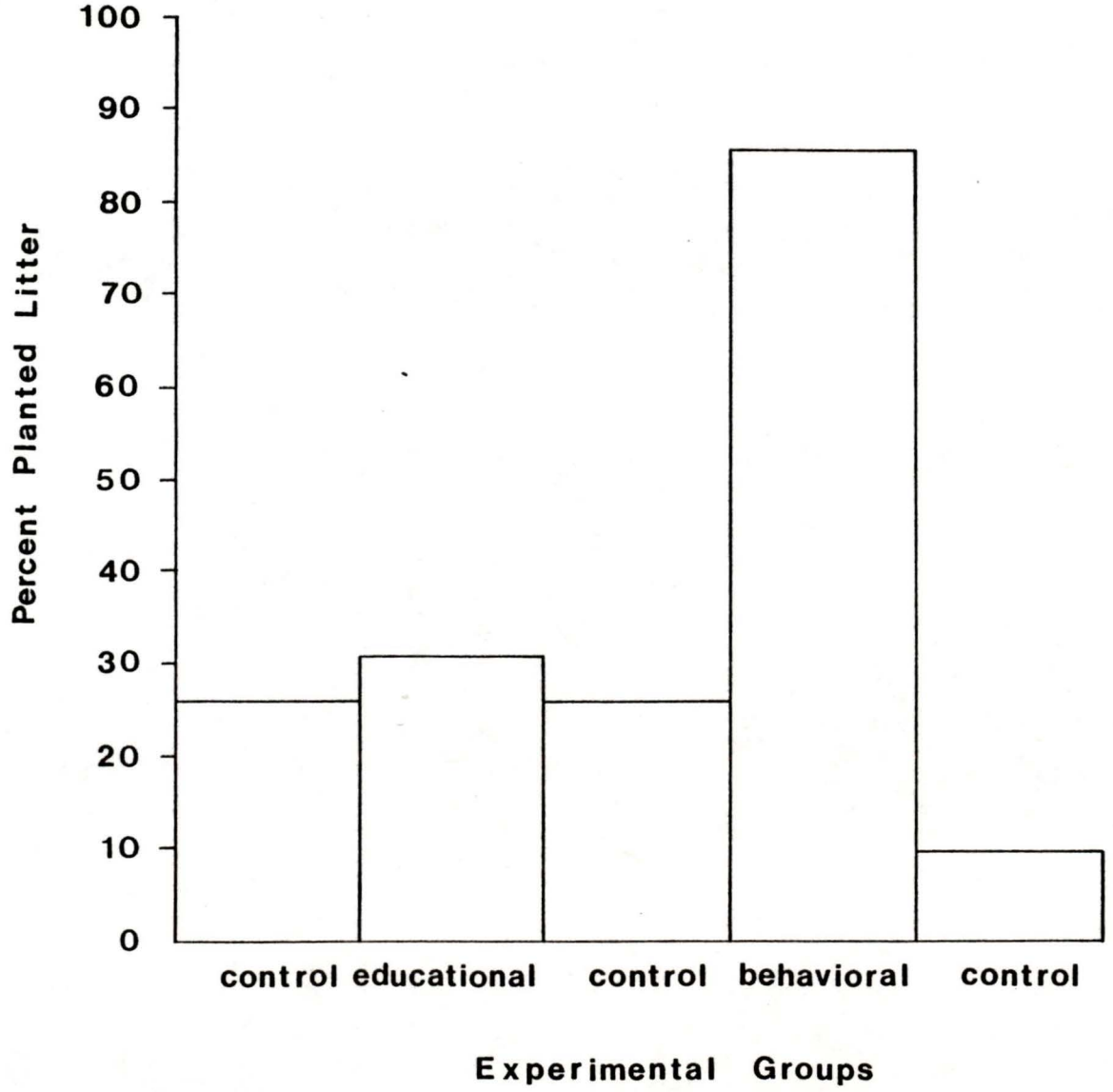


TABLE 15: THE NUMBERS AND TYPES OF PLANTED LITTER COLLECTED

	Control Week 1	Educational Week 2	Control Week 3	Behavioral Week 4	Control Week 5	Total
Beer bottles	5	8	8	10	3	34
Tin foil	0	2	1	10	0	13
Plastic wrap	4	1	1	8	0	14
Paper towels	2	2	1	8	1	14

program there were 10 pieces of tin foil collected which equalled the number of beer bottles picked up. The numbers of plastic wrap and paper towels collected were also equal, being slightly lower than 8 pieces collected. This may suggest a generalization of litter collection during the behavioral program, in that campers collected other types of litter as well as litter with a monetary reward.

Summary

Two main conclusions can be drawn from the analyses presented in this chapter. The first is that the behavioral program, as measured in terms of the change in litter at the specific campsites, is significantly different from the other four experimental groups. The educational program did not differ significantly from the control groups which represented existing conditions. The second point is that the decrease in planted litter was very evident in the behavioral program, while the educational program did not produce significant changes in litter collection as compared to the baseline conditions. The practical significance of these results along with the findings of preceding chapters will be presented in the final chapter.

CHAPTER VI

DISCUSSION AND CONCLUSIONS

The experimental analysis of littering behavior in this study produced several interesting facets in the understanding of this environmental problem. The following discussion will focus on the major findings in the results presented in Chapters IV and V, keeping in perspective previous research conclusions. Personal observations on the control of litter at a Provincial Park will be given along with an analysis of the cost of the present study and suggestions for implementing the program on a larger scale. The concluding remarks will contain a summation of the study along with the implications of the results and recommendations for future research.

The Association Between the Observed Descriptive Variables and the Change in Litter

Conflicting research findings (McCool and Merriam, 1970; Finnie, 1973; Keep America Beautiful, Inc., 1968; Heberlein, 1971) on the role that individual characteristics play in influencing littering behavior resulted in the investigation of several, readily observable variables in this study. The environmental setting with respect to littering behavior has been explored with many studies suggesting that a 'dirty' area promotes additional littering (Heberlein, 1971; Kraus, Freedman, and Whitcup, 1978; Finnie, 1973) while a study by Crump, Nunes, and Crossman (1977) found that a 'clean' area influences additional litter-

ing. The variable, litter count before campsite occupation, used in this study was not significantly related to the change in litter at the campsites. The results of the present study conclude that the state of the campsite at a Provincial Park, being 'clean' or 'dirty', is not associated with subsequent littering behavior by campers. Other variables which were found not to be significantly related to the change in litter at the campsites were the campground area, the type of camper, the origin of the campers, and the number of adults.

The significant relationship between the change in litter at the campsites and four variables, determined by using a chi-square test, agrees with intuitive assumptions on littering behavior. The first variable found to be related to littering behavior was the number of nights spent at the campsites by the camping groups. This would seem to be a logical conclusion, since the longer an individual is at a campsite, the more probable it is there will be more waste material to discard. The simple factor of time allows for more littering behavior to occur. The second variable that was related to the change in litter at the campsites was the number of individuals in the camping groups. This again would appear correct, since an increase in the number of campers should mean an increase in the amount of litter. The definition of a camping group as a family or non-family was associated with the change in litter at the campsites. A reason for this could be that the family group would generally be larger in numbers than a non-family group, a factor which was also associated with littering behavior. Another reason for this association might be that a family group consisted of children, which was the fourth variable significantly related

to the change in litter at the campsites. The number of children in a camping group would seem a likely conclusion if one associates discarded wrappers with this age group. It could also simply indicate that there are more individuals at the campsite so there would be an increased probability of litter accumulation, again associating this variable with the number in the camping group.

There are several factors to be considered when interpreting the results of the present study. The primary focus of the research design was the investigation of the effectiveness of the behavioral and educational programs on litter control. Of secondary interest was the relationship of individual characteristics to littering behavior. Thus this segment of the study had a less than ideal amount of experimental control which could have resulted in random factors producing the experimental results.

An ideal situation to test the relationship between the change in litter at the campsites and the litter count before campsite occupation would be to have groups with similar characteristics and numbers exposed to a 'clean' versus a 'dirty' environment over equal time periods. Since this is not often possible in field research, further studies are needed to test the influence of the environmental setting, with respect to the amount of litter present, on subsequent littering behavior.

A more specific problem is the overlapping nature of the variables used in the analysis. The number in a camping group was significantly related to littering behavior, but this factor could also be associated with whether the camping group was a family or non-family, since a family would have more people in the camping group than a non-family.

The number of children in a camping group could be affected in the same manner, with more children indicating a larger camping group. The number of nights spent at the campsites might also be affected by one or a combination of these variables, making the significant relationships to littering behavior open to question. The only variable that does not directly appear to agree with these factors is the number of adults in the camping groups, which was not related to littering behavior. The number of children might be a more important factor in the number in the camping group and family or non-family which were variables associated with litter accumulation.

Another consideration is the grouping of the data into categories to meet the requirements of the chi-square test. This could have distorted the results, with a larger sample allowing a greater distinction between categories. When weeks 2 and 4, the educational and behavioral groups, were included in the analysis, the results were the same. Further research is required to test the conclusions reached in this aspect of the study.

The Effectiveness of the Behavioral and Educational Programs

The determination of the effects of an educational and behavioral program on the littering behavior of campers was the primary goal of this study. Previous research suggested that educational techniques such as prompts had limited influence on promoting environmentally beneficial behavior (Bell, Fisher, and Loomis, 1978; Clark, Hendee, and Washburne, 1972; Reid, Luyben, Rawers, and Bailey, 1976). In comparison, incentive programs have been successfully applied to environmental

problems in numerous studies (Burgess, Clark, and Hendee, 1971; Clark, Burgess, and Hendee, 1972; Luyben and Bailey, 1979; Hayes and Cone, 1977b).

The conclusions reached in the present study agree with the findings of the previous research on incentive and prompting programs. The behavioral procedure produced the lowest average amount of litter discarded by the campers while the educational procedure did not produce significant effects with respect to existing littering levels at the campground. This is succinctly illustrated in Figure 1. Using parametric and non-parametric statistical tests it was found that there was a significant difference between the five experimental groups in the average amount of litter left by the campers (see Tables 9 and 10). Further testing showed that the behavioral group was statistically different from the other four experimental groups in the average amount of litter left by the campers while the educational group was not significantly different (see Tables 11 and 12).

The decrease in the amount of planted litter can be viewed as a supplementary measurement technique for the above conclusions or as an associated experiment. In either case, the behavioral program again produced the greatest effects with the campers collecting 85.71 percent of the planted litter during that study week. This is compared to the educational procedure which resulted in 30.95 percent of the planted litter collected during the second week by the campers which was only slightly higher than the amount picked up in the baseline conditions. Figure 9 presents these results, showing the dramatic effects of the behavioral program.

The type of planted litter picked up by the campers was of interest. Clark, Burgess, and Hendee (1972) found that litter with a value, such as a deposit bottle, does not need additional techniques to promote collection while other forms of litter need some type of reward system. These conclusions were generally supported by the results of the present study. But in the previous study, the deposit bottles were picked up the most during baseline and treatment phases of the experiment, while in the present study the number of deposit bottles collected in the behavioral procedure was equal to the number of pieces of tin foil picked up and slightly greater than the pieces of plastic wrap and paper towel collected. This suggests a generalization of the incentive technique effects in that individuals will collect other types of litter as well as litter with a value. This is an important consideration in the implementation of any anti-litter program.

The results from this aspect of the study exhibited the highly successful incentive procedure applied in the behavioral program to control litter. To be an effective anti-litter procedure, a technique must not only reduce the amount of litter that people discard but also encourage them to collect litter already on the ground. The incentive technique in the present study has accomplished both of these requirements, with individuals not only decreasing their littering behavior but also picking up litter at the specific campsites and along the roadsides of the campground. The behavioral program has been shown to be an effective procedure in inducing environmentally beneficial behavior.

Personal Observations

Conducting research in the field often necessitates extraneous variables to be considered in the analysis of the results. Highly controlled experiments are difficult to put into practice in environmental settings in order to accurately represent real world situations. But what is lost in experimental rigor is often gained in observations of the environment in a natural state. This is the case with the present study. One of the factors that must be considered over the five study weeks is the influence of the weather. Wet, cool weather during one week could result in a reduced amount of time and activities at the campsite, reducing the probability of littering behavior by the campers. If this litter level is compared to a warm, dry week, inaccuracies could result. Fortunately, the weather over the five study weeks was excellent, with most days clear with warm temperatures.

In fact, the weather during the experimental period was too good. The warm, dry conditions resulted in a fire ban at the campsite being put into effect on August third, which was the fourth day of the second baseline condition. This fire ban continued for the rest of the experimental period, which was almost exactly the second half of the five week period. No open fires were allowed during this period, which meant that campfires and open barbeques were not permitted. This could have influenced the littering rate of the campers in that there would be less time spent cooking and sitting around the campfire, possible situations where littering might occur. The data in the present study do not seem to indicate any direct influence from the fire ban, with the lower amount of litter in the third baseline condition probably due to small

numbers of campers during that final week.

Various personal observations were made by the researcher on the littering behavior of the campers while conducting the research. The researcher saw several small boys looking for and collecting planted beer bottles. Referring to these bottles, one small boy asked, "Why do people throw away money?" Other park employees had also observed children and adults, especially senior citizens, collecting the beer bottles. This certainly agrees with the conclusion that litter with a value will be picked up, many time without any need for a reward system.

The researcher was informed by a few campers that they liked the idea of a Parks Ranger checking the campsites to make sure they are clean after the camper leaves a campsite. Even though the researcher tried to be unobtrusive when counting the litter at the campsites, these campers must have interpreted this action as a means of checking up on camping groups to see if they had conformed to litter standards. Since there were few reports of this nature and the researcher conducted counts in all of the five study weeks, the effects of this factor must be considered minimal.

During the behavioral program, the researcher asked one camping group, a man with several children, if they had observed anyone picking up litter. He replied that they had collected litter, using the litter-bag provided. They had also observed other children and adults engaging in litter collection. These observations agree with the data in that the planted litter was drastically reduced during the incentive technique, showing that not only children but adults participated in the litter collection.

The rewards used in the behavioral program were quite popular, with many campers asking for another set of prints or cookbook. These incentives were presented to the campers upon their agreement to participate in an anti-litter campaign, not after the subjects had completed some anti-litter behavior as in previous studies. The results of the present study show that the reward can be successfully presented before the actual behavior occurs, but after the verbal agreement to participate in the program has been given. This is an important consideration in the implementation of anti-litter programs using an incentive system. The rewards could be efficiently and economically distributed at the entrance or in a central location of an environmental setting.

The majority of the litterbags observed or found by the researcher contained waste material. The researcher often saw litterbags hanging from trees, most likely to prevent animals from scattering the contents. Litterbags were also observed hanging from the door handles on cars, the sides of camping units, and from the picnic tables. These locations seemed to facilitate the use of the litterbags by making them conveniently located. During the educational program, the anti-litter flyers handed out with the litterbags were also found on several trees. Very few flyers were found discarded at the campsites, with some being found in the garbage cans. Of the 51 anti-litter stickers placed on the lids of the garbage cans at the campground, 16 were found to be missing at the end of the study week. On inspecting the garbage can lids, some of the missing stickers looked as if they were peeled off, with portions of the stickers still present. A possible explanation for this is that small children may have tried to take the stickers off the garbage can

lids, but this behavior was not observed by the researcher.

Analysis of Cost

In order to be a viable method to control litter, a program must be economical and efficient. The results of the present study show that the incentive technique applied to the camping population was highly successful in reducing littering behavior and promoting the collection of litter already on the ground. The cost of the incentive program in terms of the materials used was about $125. This was the cost of the 53 framing prints and recipe books. The four park employees at Bamberton Provincial Park could easily have implemented this program, making such additional costs as wages, transportation, and other considerations unnecessary to include since the program could be incorporated into the existing park maintenance.

During the behavioral program, the change in litter was 33 pieces compared to the week before and after which had a change in litter of 461 and 362 pieces respectively. This is a precipitous decline in the amount of litter present during the incentive program. The Parks and Outdoor Recreation Division estimated that $1,551 would be spent picking up litter at Bamberton Provincial Park during a normal year.* Thus a substantial saving could be gained by applying an incentive program to this park. The Parks and Outdoor Recreation Division also estimated that $17,600 would be spent collecting litter in the Malahat District

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*Information communicated from the Assistant District Superintendent, Malahat District, to the Supervisor of Operations, Parks and Outdoor Recreation Division, Ministry of Lands, Parks, and Housing, 1979.

during a normal year.* Incentive programs could be applied on a macro-scale, again providing great savings in expenditures on traditional litter control procedures. The ease of implementation, low costs, and the proficient control of litter make an incentive procedure extremely viable in an environmental setting.

Conclusion

The present study investigated the effects of the behavioral and educational programs on the littering behavior of individuals at a campground area. The campers at Bamberton Provincial Park represented a typical camping population, when compared to other campgrounds in British Columbia. The educational program did not differ significantly from existing littering conditions, while the behavioral program produced drastic reductions in not only littering behavior but also the level of litter already present on the ground.

The research design used in this study was an ABACA reversal design, a modification of an ABAB reversal design. This modified research design reduced the reliability of the behavioral program in that the incentive procedure was not repeated. However an ABACA research design enabled the investigation of the effects of not only incentives but also prompts on littering behavior. The comparison of the behavioral and educational programs was of prime importance, with further research showing the reversal effects of the behavioral program.

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*Ibid.

The incentive technique used in the present study is a discriminative stimulus, an S^D, for the appropriate disposal of litter and the collection of litter already on the ground by the campers. Because these anti-litter behaviors should decrease over time in the absence of a reinforcer, a reinforcement procedure could be intermittently employed to ensure compliance with the behavioral program. The problem of response maintenance could be solved by initially continuing the behavioral program and then reimplementing the procedure at periodic intervals.

Another consideration in the present research is the relative strengths of the educational and behavioral programs. The educational program may have produced significant effects if there was more information presented to the campers on littering and a subsequent measure of their having read the material. The behavioral program might have been a stronger procedure in comparison to the educational program.

The incentive technique used in this study is easy to apply and very inexpensive to operate. However, the most important aspect of this technique is that the people exposed to it really enjoyed it. The researcher encountered favorable reactions to the program on all levels; the subjects liked the idea of receiving an incentive for participating in a litter control program. An added benefit of the campers picking up the litter is that the park rangers are given more time to conduct other activities, such as nature walks, informational lectures and promoting campground safety.

The present system penalizes individuals for doing things wrong, punishing people for inappropriate behavior. Why not reinforce people for doing things right, giving rewards for environmentally beneficial

behavior? Incentive systems could and should be applied to more environmental settings. But in order to effectively promote incentive systems on a macro-scale, further research is needed.

The findings of the present study answer some questions but the research also leaves more questions to be answered. The influence of the environmental setting needs to be studied in order to determine if certain stimuli affect behavior. Individual characteristics might play a role in certain types of environmental behavior, enabling programs to be focused on these groups. Educational programs could have a positive influence on environmental behavior, but more indepth studies are needed. Incentive procedures need to be developed that produce high levels of behavior and participation, which are maintained over long periods of time. Token reward systems might be a partial answer but more research is needed in this area. Efficient methods are needed to distribute the rewards presented in incentive systems, along with strategies to manage and control such programs. But most importantly, incentive procedures need to be applied on large scale projects of environmental concern. Increased applications of behavioral techniques in real world situations should permit these procedures to be successfully refined.

Even though great strides are being made in utilizing reusable containers and promoting recycling behavior, it is not practical simply to eliminate all the materials causing the litter problem. The answer to the littering problem lies with the individual. People litter, use energy, and pollute. Only by understanding these behaviors and developing techniques to promote environmentally beneficial behavior will we solve some of the environmental problems facing our society.

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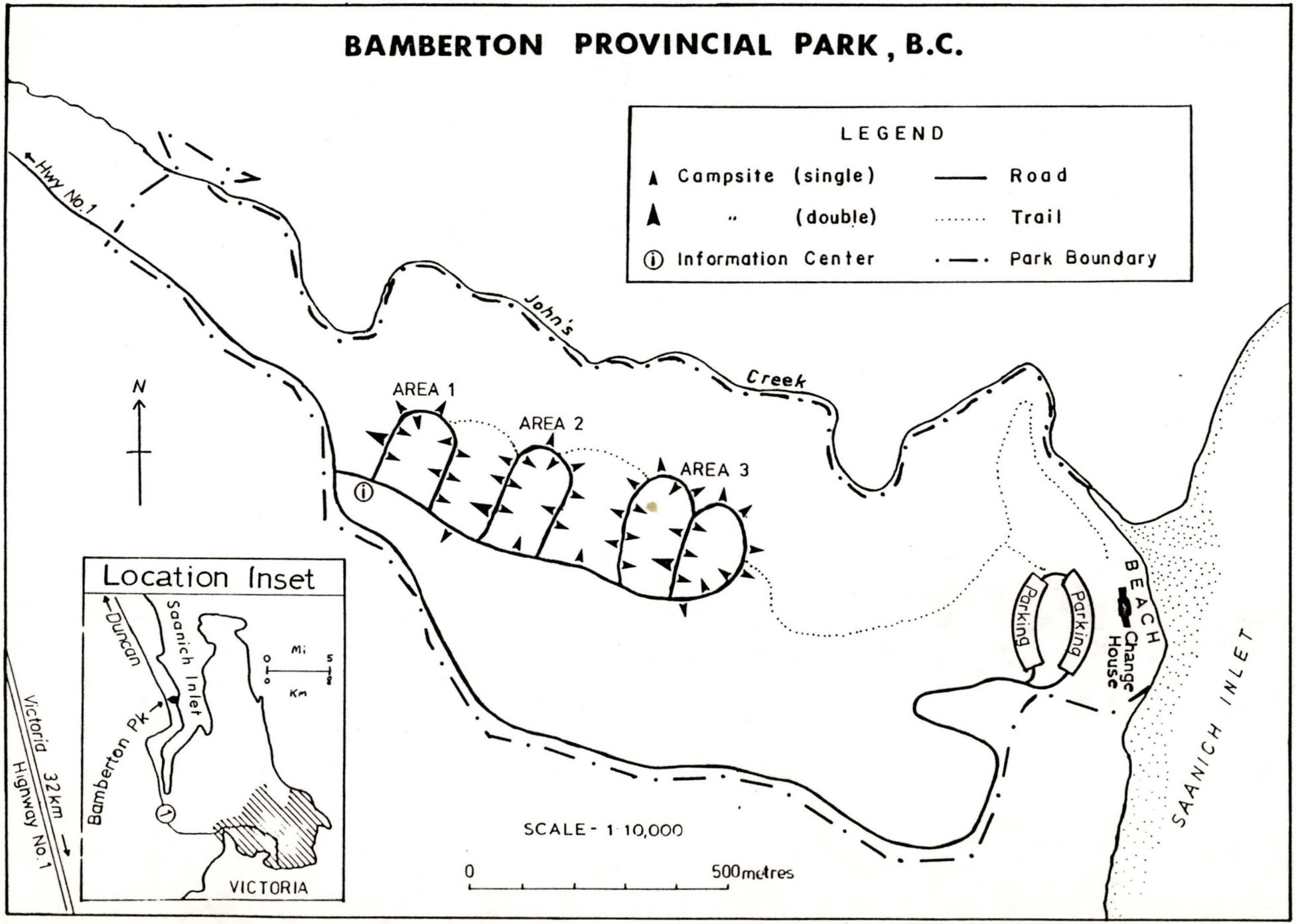
Addenda

Clark, R.N., Hendee, J.C., and Washburne, R.F. (1972) "Litterbags: An Evaluation of Their Use." *USDA Forest Service Research Note,* PNW-184, pp. 1-5.

APPENDIX A

MAP OF BAMBERTON PROVINCIAL PARK

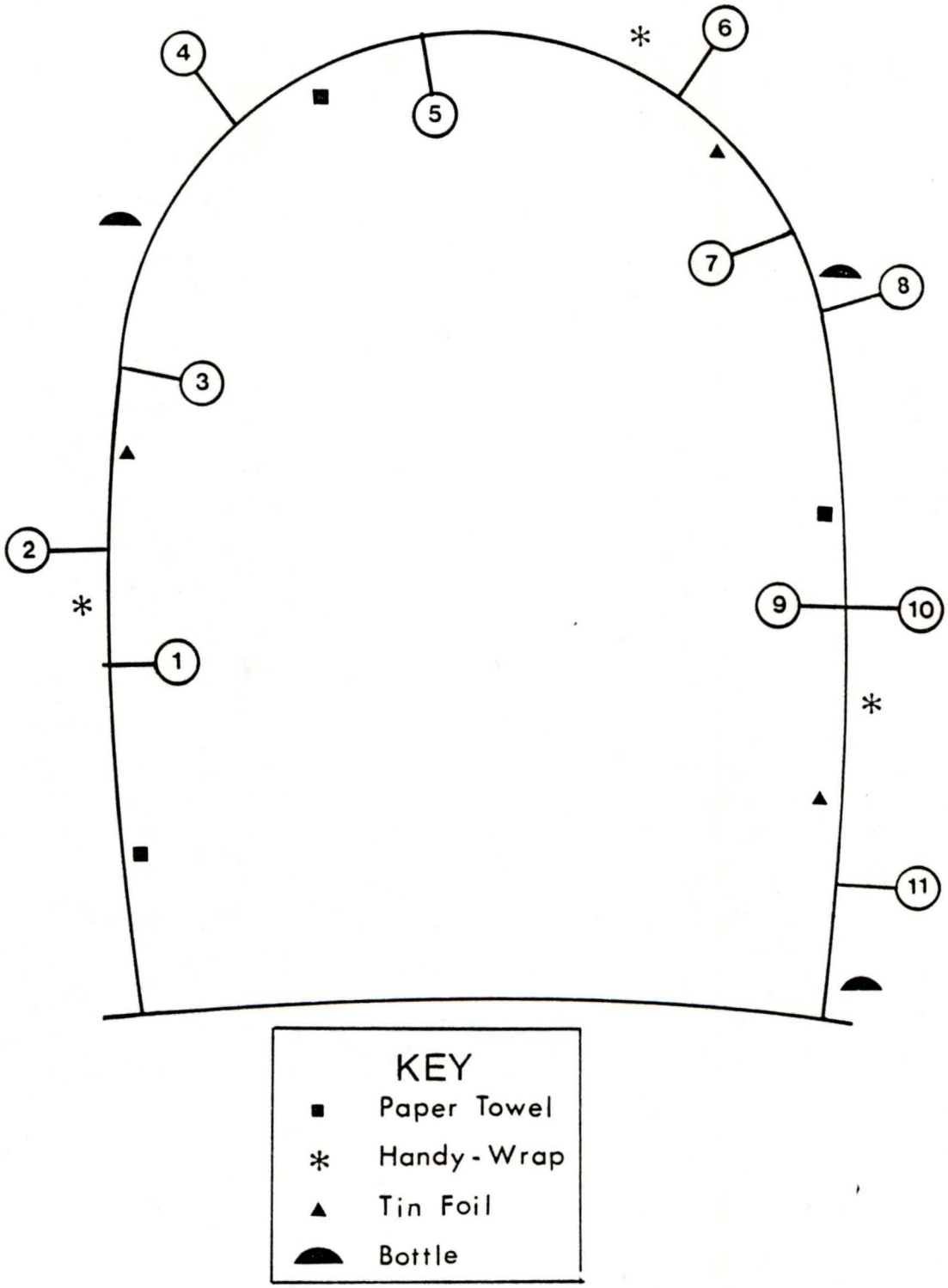
BRITISH COLUMBIA


BAMBERTON PROVINCIAL PARK, B.C.
LEGEND
Campsite (single)
" (double)
Information Center
Road
Trail
Park Boundary
Hwy No.1
John's
Creek
AREA 1
AREA 2
AREA 3
N
Location Inset
Duncan
Saanich Inlet
Bamberton Pk
Victoria 32km
Highway No.1
VICTORIA
Mi
Km
SCALE - 1:10,000
0
500 metres
Parking
Parking
BEACH
Change House
SAANICH INLET

APPENDIX B

LOCATION OF PLANTED LITTER IN AREA 1

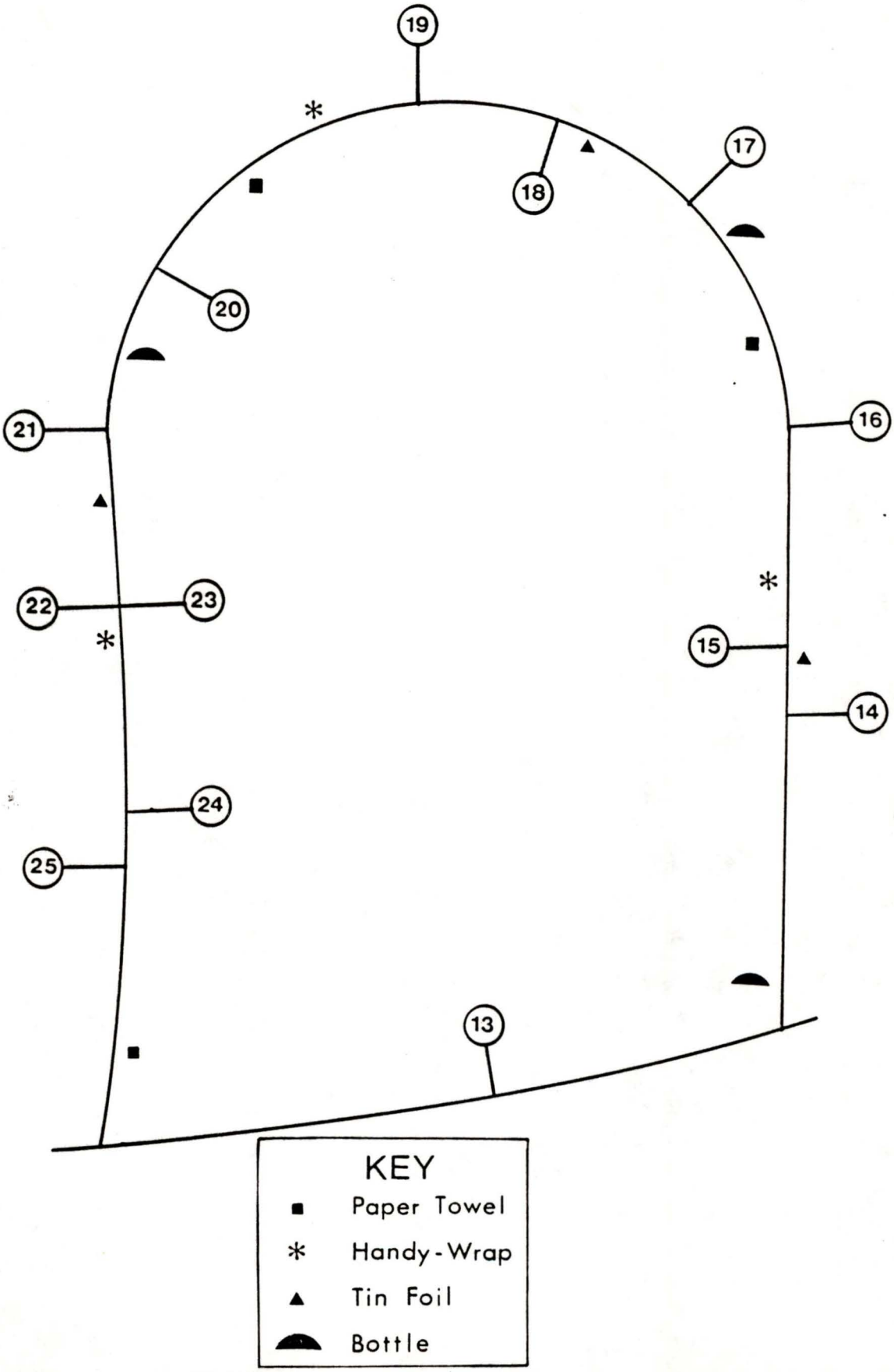
Location of Planted Litter: Area 1



APPENDIX C

LOCATION OF PLANTED LITTER IN AREA 2

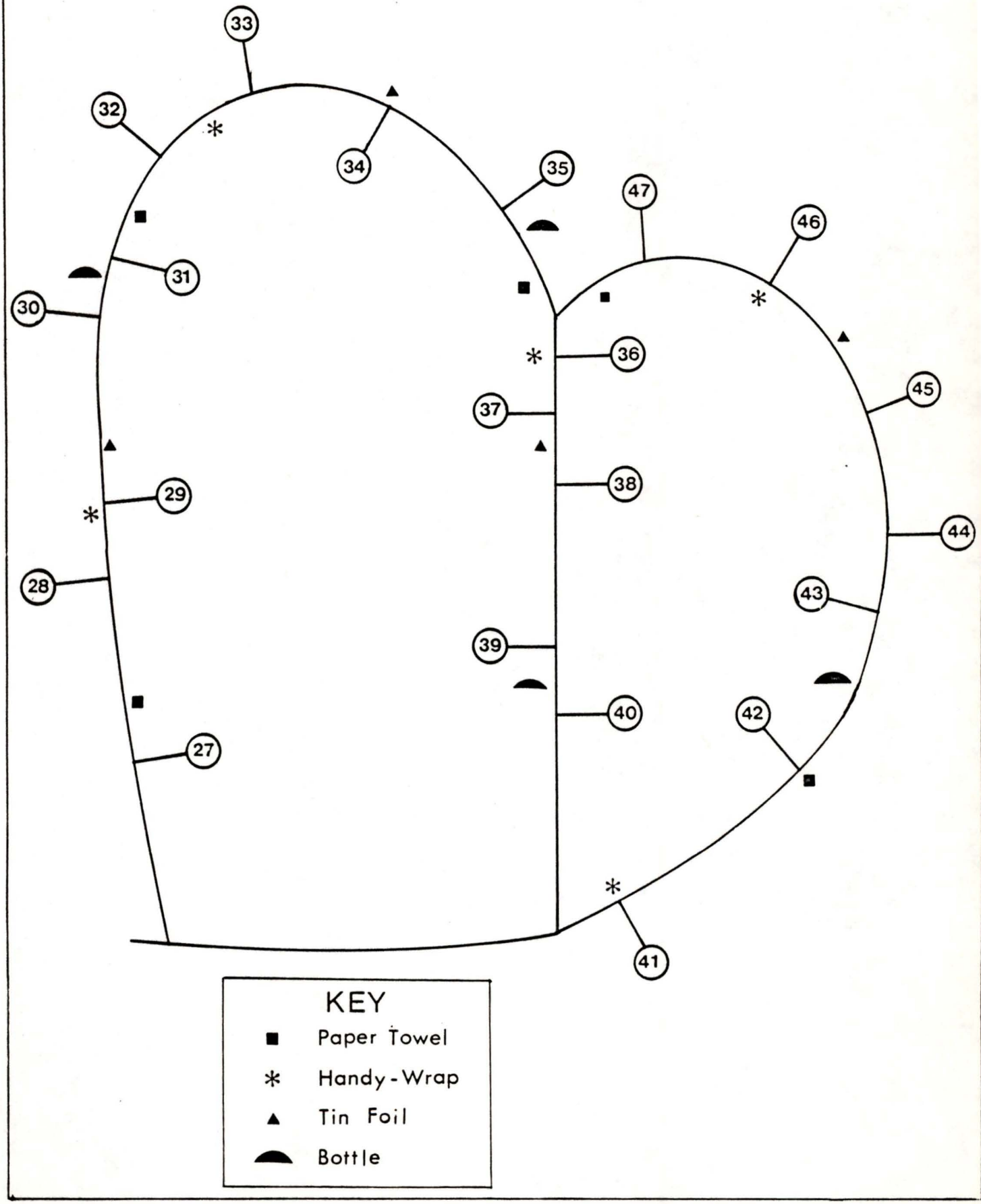
Location of Planted Litter : Area 2



APPENDIX D

LOCATION OF PLANTED LITTER IN AREA 3

Location of Planted Litter: Area 3



APPENDIX E

ANTI-LITTER FLYER

Please Keep Your Campsite Clean

Lend a Hand To Clean Our Land

Pitch In

APPENDIX F

LITTER INFORMATION SHEET

LITTER INFORMATION SHEET

Sample Number _____ Date _____

Campsite _____ Area _____

Experimental Group _____ Week _____

Litter Count - Before _____ Date _____ Time _____

Litter Count - After _____ Date _____ Time _____

Change in Litter _____

Length of Stay _____

Type of Camper _____

License Plate _____

Number in Group _____

Family Yes _____ No _____

Adults _____

Children _____

Comments:

APPENDIX G

PLANTED LITTER INFORMATION SHEET

PLANTED LITTER INFORMATION SHEET

Sample Number _____ Date _____

Experimental Group _____ Week _____

Counter _____ Area _____

Litter Planted _____

Date _____

Time _____

	Litter	Occupied Sites
Monday	_____	_____
Tuesday	_____	_____
Wednesday	_____	_____
Thursday	_____	_____
Friday	_____	_____
Saturday	_____	_____
Sunday	_____	_____

Comments:

APPENDIX H

ANTI-LITTER STICKER

VITA

Surname: BURR Given Names: KEVIN FLOYD

Place of Birth: EAU CLAIRE, WISCONSIN, U.S.A.

Date of Birth: NOVEMBER 27, 1953

Educational Institutions Attended,
with Dates of Entering and Leaving:

UNIVERSITY OF WISCONSIN--EAU CLAIRE	1972 to 1977
UNIVERSITY OF VICTORIA	1977 to 1980
	____ to ____

Degrees, Diplomas, Etc., Awarded,
with Dates and Names of Institutions:

B.Sc.	1977	University of Wisconsin--Eau Claire

Honors and Awards:

Graduated Magna Cum Laude from the University of Wisconsin--Eau Claire

Member of Gamma Theta Upsilon, International Honorary Geographical Society

Member of Psi Chi, The National Honor Society in Psychology

University of Victoria Fellowships, 1977/78 and 1978/79

Publications:

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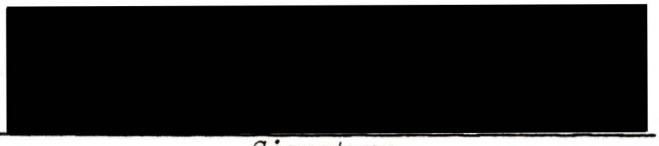
AN INVESTIGATION OF LITTERING BEHAVIOR IN A PROVINCIAL PARK

Author 

Signature

KEVIN F. BURR

Name

December 12, 1980

Date