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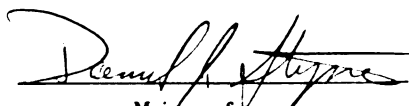
Evaluation of Two Approaches

presented by

Hideo Kikuchi

has been accepted towards fulfillment
of the requirements for

Doctor of Philosophy degree in Park and Recreation
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SEGMENTING MICHIGAN'S SPORT FISHING MARKET:
EVALUATION OF TWO APPROACHES

BY

Hideo Kikuchi

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirement
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ABSTRACT

SEGMENTING MICHIGAN'S SPORT FISHING MARKET: EVALUATION OF TWO APPROACHES

By

Hideo Kikuchi

The primary purpose of the study is the practical application of market segmentation techniques to the Michigan sport fishing market. The study also investigates a number of methodological issues related to developing and evaluating market segments. Three study objectives which guided the course of the study are: (1) to develop and evaluate segments based upon anglers' behavioral predispositions, (2) to develop and evaluate segments based upon the anglers' actual behavior, and (3) to evaluate and compare the two segmentation approaches based upon statistical criteria and applicability to fisheries management.

Six alternative segmentation bases were examined, two based on behavioral predispositions and four based on behavior. Data permitting segmentation of the market on these six bases were collected in the 1984 Michigan sport fishing market survey conducted by Fisheries Division, Michigan Department of Natural Resources. Segmentations based upon fishing attributes sought (behavioral predisposition) and species and locations to fish (actual behavior) were singled out for detailed study.

For each approach, segments were developed via a two-stage empirical clustering method, Ward's minimum variance method followed by an iterative

partitioning algorithm. Prior to clustering, variables were pre-treated by factor analysis to standardize them and eliminate multicollinearity.

The attribute segmentation produced eight angler segments with differing attribute seeking orientation, ranging in size from 8% to 17% of the sample. The species-location segmentation yielded eight segments with distinguishable fishing participation patterns, varying in size from 4% to 22%. The attribute sought segments were slightly more identifiable, while both yielded segments of substantial size. The attribute sought approach yielded more exploitable differences on behavioral predispositions (e.g. fishing benefits and attributes sought), while the species-location segments better discriminated actual behavior (e.g. fishing participation patterns). Management evaluation of the two approaches slightly favored the attribute sought approach.

Six major conclusions from the study are: (1) Michigan's sport fishing market is a heterogeneous mixture of angler subgroups, (2) socioeconomics were not found to be very useful for identifying angler segments defined by either approach, (3) both attribute and species-location variables are useful bases for segmenting the market, (4) factor analysis is useful in pre-treating variables prior to clustering, (5) the two-stage clustering algorithm performed fairly well, providing strong empirical support for its use, and (6) multivariate statistical procedures are quite helpful in better understanding market behavior, and consequently making better planning and management decisions.

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CHAPTER I
INTRODUCTION

MICHIGAN SPORT FISHERY RESOURCES

Michigan's Great Lakes, inland lakes, streams and rivers constitute important resources for water-based recreation and tourism activities. Among the most attractive and important is sport fishing. Sport fishing provided along Michigan's extensive waters is an important recreational activity having substantial social and economic impacts on the state and local communities.

Each year over one million sport fishing licenses are sold in Michigan. The number of Michigan anglers reached a high of 1.5 million in 1980 and remained relatively constant in succeeding years (Mahoney, Jester, and Jansen, 1986). In 1985 there were approximately 1.3 million Michigan licensed anglers. This does not include spouses of licensed fishermen and children under seventeen years of age, who are not required to purchase licenses.

Mahoney et. al. (1986) report 23.4 million angler-days in pursuit of Michigan's fish for the year 1981. Forty-five percent of these angler-days took place on inland lakes, 39 percent on the Great Lakes, and the rest (16 percent) on streams and rivers.

Economic values of the sport fishery can be assessed in terms of direct and indirect benefits. Direct values to anglers are measured by consumer surplus, while the anglers' expenditures provide a measure of indirect benefits, i.e. economic impacts. Direct benefits of Michigan's Great Lakes fishery in 1979 were estimated at \$525 million (Talhelm, et. al. 1979). However, those of inland lakes and streams/rivers fisheries are not available at present. Based upon Mahoney et. al. (1986), an average Michigan licensed angler spends roughly \$31 per angler-day. The total annual angler expenditure in 1981 was around \$725.4 million for Michigan's sport fisheries (total angler-days of 23.4 million multiplied by an average per angler-day spending of \$31). Both the direct and indirect benefit measures are rough estimates, but provide some indication of the value of the fishery. The sport fishery also contributes to employment opportunities and resort and vacation property values near good fishing areas.

Michigan's sport fishery is a valuable natural resource that can contribute to greater social and economic growth of the state and localities. Proper management and planning is important if we are to maximize the benefits from this resource.

MANAGEMENT OF THE FISHERY

An important goal of the Michigan Department of Natural Resources (MDNR) is to provide its public with maximum levels of social and economic benefits. Recognizing the significance, the Department of Natural Resources has placed major emphasis on the sport fishery. As a consequence, the fisheries in Michigan—especially those of its Great

Lakes waters--have undergone a dramatic change over the past 15-20 years. Sport fishing became more prominent in the 1970's, due largely to the success of the introduction of salmon in 1966 (Bails, 1986). The number of Michigan fishing licenses sold steadily increased from a low of 0.9 million in 1964 to a high of 1.5 million in 1984. Investment in sport fishing also increased significantly during this period. Contrary to the sport fishing, commercial fishing has declined from a major industry to one involving only 150 people (Talhelm, 1979).

The Fisheries Division, MDNR is responsible for managing sport fishing opportunities throughout the state. The Division exercises this responsibility by: (1) establishing fishery objectives for various waters, (2) securing public access, (3) establishing enforcement priorities which optimally balance fishing demand and supply, (4) providing information to recreational fishermen about fishing opportunities available to them, and (5) promoting the development of private and local support services.

With the increased popularity of sport fishing, however, the Fisheries Division has experienced growing difficulty in achieving these goals. All fisheries have limited productivity and Michigan's are no exception. For instance, demands for recreational fishing in Michigan are sufficiently high to overfish many of the state's fisheries and impair their values. Fishing activities must be controlled by regulation, enforcement, limiting access, and intensive management of fish populations.

A more serious and difficult problem comes from the heterogeneity of demands for fishing opportunities. Fisheries management is complicated by the existence of quite diverse fishing interests. Available methods for managing the fisheries unavoidably affect the distribution of benefits

to different groups of anglers. This heterogeneity of demand, coupled with recent budgetary reductions, increased competition for water resources, and an increasingly vocal and demanding public, has required the Fisheries Division to be more effective, efficient, and above all more responsive to its patronage, by adopting a stronger marketing orientation.

With a stronger marketing orientation, the Fisheries Division assesses angler needs/wants and builds them into better fishing opportunities. A key strategy for implementing this marketing orientation is to identify specific types of fishermen and develop fishing opportunities that more closely match the needs of these groups. More efficient and effective management and resource allocations are possible with information on the various fishing interests which make up the market. With this segmented strategy, the Fisheries Division will be in a better position to provide a more manageable, and balanced array of fishing opportunities.

MARKETING FISHERIES RESOURCES

The strategy of identifying and managing for groups of anglers with varying demand schedules is called market segmentation, and is no stranger to business communities. Since its introduction by Smith in the 1950s, market segmentation has been a prominent concept in both marketing literature and practice. Beside being one of the major ways of operationalizing or implementing the marketing concept of customer (i.e. user) orientation, segmentation provides direction for an organization's marketing, management, planning, and resource allocation. Because of its relevance and applicability, market segmentation has diffused from

traditional business applications to other fields including non-industrial, non-commercial, and non-profit organizations. Areas of public decision-making are no exception (Kotler and Levy, 1969; Kotler and Zaltman, 1971; Kotler, 1982).

In the case of fisheries management, the marketing approach—user orientation—has also come under examination. Although it is not too often that the word 'marketing' is explicitly used in fisheries management, an increased emphasis is being placed on demand-oriented management. In response, more research studies related to fisheries management have focused on the identification of anglers' motives, benefits desired, and satisfaction from fishing experiences (e.g. Moeller and Engleken, 1972; Knopf, et. al., 1973; Driver and Knopf, 1976; Kennedy and Brown, 1976; Weithman and Anderson, 1978; Howard, 1979; Smith, 1980; Buchanan, 1983; Hicks, et. al., 1983; Harris, et. al., 1984; Hudgins, 1984; Kershner and Kirk, 1984). Yet to date few systematic efforts have been undertaken for identifying and managing for different types of anglers—market segmentation. Given the potentials of a segmented strategy, more research effort needs to be focused upon segmentation. The focus of the present study is market segmentation of an angler market, specifically as applied to Michigan's sport fishing market.

THEORETICAL BACKGROUND; MARKET SEGMENTATION

The first step of market segmentation is the identification of market segments. This requires the selection of an appropriate segmentation base—one of the most important decisions in a market segmentation study (Frank, 1968; Wiseman, 1971; Pride and Ferrell, 1983). Over the past

three decades the widespread acceptance of the market segmentation concept has generated an extensive search for effective segmentation bases (criteria). Consequently, there are many variables that have been used as bases for segmenting the market. These include virtually all the variables suggested in the consumer behavior literature.

Selecting from among these variables often presents a problem. It has been acknowledged by some market researchers that a major source of difficulty in segmentation stems more from the number of alternative bases and/or ways of classifying customers than from a lack of possibilities (Frank, 1968). In addition, it has been claimed that using a single criteria (basis) to segment a market is not realistic (Hustad, Mayer, and Whipple, 1974; Dhalla and Mahatoon, 1976; Haley, 1984) and that alternative segmentation bases need to be tested for each market of interest (Hisrich and Peters, 1974).

Considering the dynamic nature of the market and the environment, and the range and variety of decisions that management has to make, it is quite unlikely that any single criterion (basis) can be used to segment the market in all cases and for all circumstances. Any attempts to use a single criterion for all marketing decisions may result in incorrect or inappropriate decisions as well as a waste of valuable resources (Wind, 1978). Also, it may be somewhat presumptuous to decide in advance, and without data, which segmentation base is going to be the most successful way to segment a particular market (Haley, 1984). The safest practice is to allow for several possibilities (alternatives) and to build these into a research program.

A market segmentation study should consider several alternative bases, rather than relying solely on one single criterion (base) to segment a given market. Although it is recognized by some that there has been a move away from the search for one single kind of segmentation base (Lunn, 1978), market segmentation studies are still dominated by single criterion (either single variable or single set of variables) based segmentations. Most published empirical studies still rely on one segmentation base and few have discussed possible alternatives for the market under investigation.

THE PROBLEM

Only a handful of empirical studies have attempted to segment the sport fishing market and none of these have explicitly compared alternative segmentation bases. One can argue that angler segmentation studies may have missed more useful segmentations. In segmenting Michigan's sport fishing market, therefore, there is a clear need for a market segmentation methodology that is capable of incorporating and evaluating alternative segmentation bases. Such a methodology should contribute not only to the improvement of segmentation research but also to the more effective management of Michigan's fishery resources.

Allowing multiple segmentation bases, however, does not necessarily mean segmenting a market on the basis of any possible segmentation base. Candidate bases should still be screened through a careful examination of all the possibilities for a given market. In selecting prospective or alternative segmentation bases, it is generally recommended to consider the following: management's specific needs (i.e. uses of segmentation),

theoretical relationship to the behavior under investigation, and contributions to the prediction of consumer behavior (Wiseman, 1971; Wind, 1978).

Having considered the above factors in relation to the Michigan's sport fishing market, several candidate segmentation bases were selected: (1) species fished, (2) species fished and the corresponding fishing locations, (3) modes of fishing, (4) methods of fishing, (5) fishing attributes sought, and (6) fishing benefits sought. The first four bases represent a segmentation approach based upon anglers' actual fishing behavior (use/purchase) and the last two represent a segmentation approach based upon anglers' behavioral predispositions (psychological factors). Data were gathered in a Michigan angler market survey to permit segmentation of the market on the basis of these six sets of variables.

STUDY OBJECTIVES

The primary focus of the study is the practical application of market segmentation techniques to the Michigan sport fishing market. Secondly, the study tackles a number of methodological issues related to developing and evaluating market segments. The study compares two popular approaches to segmenting a market; one based on psychological factors, the other on use/purchase behavior. Study objectives are:

OBJECTIVE 1: Develop and evaluate segments based upon the anglers' behavioral predispositions (psychological factors).

OBJECTIVE 2: Develop and evaluate segments based upon the anglers' actual fishing (use/purchase) behavior.

OBJECTIVE 3: Evaluate and compare the two segmentation approaches based upon statistical criteria and the applicability to fisheries management.

ORGANIZATION OF THE STUDY

The study is organized in eight chapters. Following this introductory chapter is a review of relevant literature. Relative to the study objectives, the following topics are discussed: market segmentation concept, market segmentation methods and approaches, segmentation studies in fisheries management, methods of forming segments, and criteria for evaluating segments. The third chapter presents an overview of the research approach, plan of the study, and methods which were employed to collect and analyze the data. Chapter IV provides profiles of the study population's socioeconomic characteristics and fishing behavior patterns. The results of the two segmentation analyses--the attribute segmentation and the species-location segmentation--are presented in detail in Chapters V and VI, respectively. For each segmentation base, the results are presented in the following order: factor analysis of original variables, formation of market segments, examination for between-segment differences, and profiles of the resulting angler segments. The two segmentation approaches are compared in Chapter VII. Finally, Chapter VIII contains a summary, conclusions and discussion, limitations, and recommendations for further research.

CHAPTER II

LITERATURE REVIEW

This chapter acquaints the reader with the literature on market segmentation and its application to fisheries and related markets. Market segmentation as a management strategy is introduced along with a review of methods and approaches for segmenting a market. Applications of market segmentation to recreation and tourism more generally and fisheries in particular are reviewed and evaluated. The review concludes with a detailed discussion of cluster analysis techniques for forming segments and a review of criteria for evaluating a segmentation.

THE MARKET SEGMENTATION CONCEPT

Market Segmentation

Market segmentation may be defined as the process of dividing a total market into subgroups of people or organizations who have relatively similar product needs for the purpose of designing a marketing mix (or mixes) that more precisely matches the needs of individuals in a selected segment or segments (Pride and Ferrell, 1983). Market segments arise from the segmentation process. Segmentation was introduced to the marketing field in the 1950's and became a central topic for both research and marketing strategy during the 1960's. Since then, it has generated a

proliferation of papers and studies, and remains an appealing integrative concept for the field.

Market segmentation has a solid theoretical base, having been derived from microeconomic models of price discrimination. The revitalization of economic theory in the 1930's by Chamberlin and Robinson, and the new theories of imperfect and monopolistic competition may be said to have provided a conceptual base for market segmentation (Arndt, 1974). For example, Robinson's decision rules (1948) for price discrimination show that optimal profits can be achieved if the firm uses consumers' marginal responses to price (i.e. price elasticities) to define mutually exclusive segments and sets price (or output) so that marginal profits achieved in each segment are equal. This rule can be easily generalized to other (non-price) marketing mix elements. In an economic sense, therefore, the concept of segmentation shows how a firm selling a homogeneous product in a market characterized by heterogeneous demand can maximize profits (Claycamp and Massy, 1968).

Segmentation, however, did not receive much recognition during the 1930's. Although there may have been heterogeneity in the market in terms of desires and product preferences, it was frequently possible to ignore those differences. This was permissible because the environment often was characterized by a lack of aggregate demand during the depression years (Engel, Fiorillo, and Cayley, 1972). It made little sense for many producers to treat the market in other than an undifferentiated manner in that environment. As a consequence, market segmentation remained relatively unutilized until the 1950's, when the American business community became more competitive.

Many credit Wendell Smith with having first spelled out the concept of market segmentation in relation to marketing problems. According to Smith (1956, P. 5):

Segmentation is based upon developments on the demand side of the market and represents a rational and more precise adjustment of product and marketing effort to consumer or user requirements. In the language of the economist, segmentation is disaggregative in its effects and tends to bring about recognition of several demand schedules where only one was recognized before.

Smith emphasized that the end result of market segmentation is separate marketing strategies to satisfy the requirements of one or more distinguishable submarkets.

Since Smith's articulation of the concept, market segmentation has radically altered the thinking in the area of marketing strategy. While lack of homogeneity in consumer demand had been recognized before, little had been done to cater to the varied needs. It was the market segmentation concept that provided a way of operationalizing marketing strategies which effectively responded to those needs. Marketers were encouraged to shape marketing programs to fit the needs of submarkets based upon these differences. Substantial benefits to firms or organizations following a segmentation approach were suggested. Segmentation thus became one of the primary means of operationalizing the marketing concept as well as providing guidelines for planning and resource allocation problems (Wind, 1978). It is no surprise that it became a widely discussed concept among both managers and market researchers and remains so today.

Benefits of Segmentation

Benefits from using a segmentation approach are rather obvious. It offers a strong demand- or customer-orientation and provides guidelines for improving resource allocations. Engel, Fiorillo, and Cayley (1972), for example, discuss several specific benefits from segmentation in a business environment. These also apply to natural resources management and specifically fisheries management.

First, a segmentation perspective leads to a more precise definition of the market in terms of consumer needs and wants. Once it understands these needs and wants, management is in a much better position to direct marketing programs that will satisfy these needs and hence meet the demand of the market. To date, there has been few systematic efforts to identify the needs and wants of Michigan's sport fishing market. Consequently, little is known about various fishing interests that make up the market. The use of a segmentation approach should provide fisheries management with better perspectives on market demands, and insight into improved management.

Second, market segmentation, if it is continuously exercised, strengthens management's capabilities in meeting changing market demands. Like most markets, Michigan's sport fishing market is expected to be a quite fragmented and dynamic one. Continuous tracking of demands of the fishing publics coupled with proper adjustments in management strategies should be able to meet the changing nature of market demands.

Third, with a segmentation approach management is better able to assess its competitive strengths and weaknesses. With the identification of strengths and weaknesses of management's competitive position, systematic planning for future markets is strongly encouraged. Also, more

efficient resource allocation is possible with segmentation. For instance, decisions for managing fish populations (fish specie, size, and location) can be made with varying market demands in mind through a segmentation approach. Promotion or information dissemination efforts can be more easily coordinated and targeted once segments are clearly defined.

Finally, segmentation allows a more specific and precise setting of marketing or management objectives. These objectives can be defined operationally rather than arbitrarily. Once defined, management performance can be monitored and evaluated against these standards.

MARKET SEGMENTATION ANALYSIS

To translate the concept of market segmentation into a profitable managerial strategy, it is essential to define segments that exhibit different responses to changes in the firm's marketing mix variables. It is also necessary to identify each segment in terms of customer characteristics such as socioeconomics. Market segmentation analysis is a systematic method for defining and studying markets, to determine how markets are related to consumer characteristics, needs, wants, and preferences, and how products or services fit into those markets in the process of satisfying consumer wants (Engel, Fiorillo, and Cayley, 1972). This section outlines a basic framework for segmentation analysis and reviews major segmentation applications in both general consumer and recreation/travel markets.

Two Approaches to Market Segmentation

In general, there are two ways to isolate or separate segments within a market environment characterized by consumer differences (Bieda and

Kassarjian, 1969; Engle, Fiorillo, and Cayley, 1972). A market may be segmented based upon consumer characteristics or consumer response (behavioral differences).

In the analysis of consumer characteristics, the usual procedure is to measure a number of consumer characteristics, such as personality, age, income, education, social class, positions in the family life cycle, and so on. A determination is then made of the extent to which variations in these characteristics relate to (and are thereby assumed to predict) variations in market behavior (that is, brand usage and preference, purchasing pattern, media selection, and so on).

The analysis of consumer response, on the other hand, is designed to measure product characteristics, either directly or indirectly through consumer behavior, in order to better understand the structure of the market. The investigator begins with observed variations in consumers' behavior or stated preferences concerning the product under consideration. This represents the end point in the consumer characteristics approach. Once observations are made on these variations, the investigator works backward to variations in consumer characteristics (attributes) within the segments which result. Consumer response-based analysis has enjoyed more use in applications including product usage rate, product benefits, perceived attributes, value, ingredients or taste, and advertising appeals (Plummer, 1974).

Segmentation Study Designs

Three basic study designs have been identified for locating meaningful market segments. They are: (1) a priori segmentation, (2) post hoc (sometimes referred to as a response based or clustering)

segmentation, and (3) hybrid segmentation (Green, 1977). The first two designs are more frequently used in practice.

In a priori segmentation, the investigator chooses some cluster or group-defining descriptor in advance. Descriptors might include demographics, heavy versus light usage, or brand loyalty. Respondents are then classified into the prespecified groups (i.e. segments) and are further examined with respect to their difference on other characteristics. Usually this approach takes a form of univariate analysis (i.e. only one variable or descriptor is considered at a time).

Post hoc or clustering-based segmentation, on the other hand, involves multivariate analysis. This approach looks for patterns of product usage, attitudes, perceptions, and the like, that might hopefully signal useful market segments. In this approach, respondents are empirically clustered or grouped according to the similarity of their multivariate profiles across a number of variables. After empirically forming a classification of respondents (i.e. market segments), the investigator examines the segments for their differences on other characteristics, not used in forming the original classification. Cluster analysis is primarily used in this post hoc or clustering approach. The investigator does not know the number of clusters (i.e. market segments) and their relative size until the cluster analysis has been completed.

The third approach combines the two approaches mentioned above. As its name suggests, it is a hybrid of a priori and post hoc approaches. In this approach, for example, respondents could first be grouped according to certain a priori characteristic, say, favorite brand. Cluster analysis could then be applied to each favorite-brand segments to see if segments possessing common benefit-seeking profiles emerge within each of the a priori segments (i.e. favorite-brand segments).

Segmentation Bases

A segmentation base, variable, dimension, or characteristic serves as the basis for dividing a total market into more homogeneous submarkets. Segmentation bases (or variables) are the characteristics of individuals, groups, or organizations in a total market. There are a broad assortment of bases (i.e. variables) with which to segment a market. These bases may be classified into four groups: (1) socioeconomic-demographic, (2) geographic, (3) product-related, and (4) psychographic (Pride and Ferrell, 1983).

Socioeconomic/Demographic Segmentation

Socioeconomic/demographic (SED) segmentation divides the market into submarkets on the basis of SED variables, such as age, sex, family size, stages in family life cycle, income, occupation, education, social class, religion, race, and nationality. There may be a couple of reasons why SED variables enjoy greater popularity (Kotler, 1984). One reason is that these variables are generally thought to be highly associated with consumer needs and wants, preferences, and usage rates. Also, these variables are much easier to measure and understand than other types of variables. Empirical studies have often found SED variables are relatively poor predictors of purchase behavior (Evans, 1959; Koponen, 1960; Twedt, 1964; Yankelovich, 1965; Sissors, 1966; and Frank, 1967). Inability of SED variables, however, may be overcome by a more imaginative treatment of the variables, e.g. the use of a composite SED variables such as family life cycle (Clark, 1955; Lansing and Kish, 1957; Wells and Gubar, 1966; Hisrich and Peters, 1974). In summary, many agree that SED variables act as moderators upon the translation of consumer needs into

behavior, rather than as direct determinants of these needs (Worcester and Downham, 1978). SED variables may be helpful for identifying market potential, but appear to be less useful for predicting specific purchase behavior (Barnett, 1969).

Geographic Segmentation

Geographic segmentation is perhaps the oldest and still the most widely practiced form of segmentation (Tull and Hawkins, 1980). It involves dividing the market into different geographical units such as nations, states, counties, cities, or neighborhoods. These variables can signal or provide a useful basis for determining relative sales potential and costs from one geographic area to the next. Management can then decide to operate in one or a few geographic areas or operate in all but pay attention to variations in geographic needs and preferences. Geographic differences can also be found among urban, suburban, and rural consumers within a local area (Walters, 1974). The use of zip code areas as geographic segments has become quite common for firms that solicit mail orders (Tull and Hawkins, 1980). Segmentation keyed to geographic location, however, may become less stable as people become increasingly mobile (Darden, et al., 1979). Mobility itself may be a useful segmentation basis (Andreasen, 1966; Bell, 1969).

Product-Related Segmentation

Product-related segmentation divides the market on the basis of some characteristic(s) of the consumer's relationship to the product. These characteristics commonly involve some aspect of product usage, perceptions or expectations from the product. Numerous researchers have

investigated and/or discussed these characteristics including volume of use (Twedt, 1964), end use (Pride and Ferrell, 1983), brand loyalty (Frank, 1967; Massy, Frank, and Lodahl, 1968; Tull and Hawkins, 1980), and so forth. Benefit or attribute segmentation has enjoyed a great deal of popularity in recent years. Benefit or attribute segmentation calls for segmenting the market on the basis of the perceived benefits or attributes of the products or services. Introduced by Haley (1968), it is based upon the notion that individuals differ with regard to their evaluations of the want-satisfying attributes of products or services (Green, Wind, and Jain, 1972). For example, Haley (1968) in his study on toothpaste users found various customers seeking prevention, bright teeth, good taste, or low price. He characterized those seeking decay prevention as worriers, bright teeth as sociables, good taste as sensories, and low price as independents. The use of benefit or attribute segmentation data is largely in the selection of advertising and promotional appeals, although it may also be used for positioning new products so that they complement rather than compete with existing ones.

Psychographic Segmentation

It has been recognized that psychographics are crucial for discovering both the overt and the latent psycho-social motives that so often spell the difference in consumers' behavior, e.g., acceptance or rejection of the product (Dhalla and Mahatoo, 1976). In psychographic segmentation consumers are divided into different groups on the basis of their psychographic profiles. These profiles include life-style (e.g. Hanan, 1972; Plummer, 1974; Bryant, Currier, and Nielsen, 1979; Roberts and Wortzel, 1979) and personality (e.g. Koponen, 1960; Tucker and

Painter, 1961; Westfall, 1962; Kamen, 1964; Brody and Cunningham, 1968). Psychographic segmentation has received widespread prominence especially in advertising due in part to the recognition that important socioeconomic and demographic distinctions simply do not exist in many product categories and even where they do, one cannot intelligently decide how to attract any particular market segment unless one knows why the distinction exist (Ziff, 1971). To attract or motivate a particular group of consumers, it is necessary to know how they think and what their values and attitudes are, as well as who they are in terms of traditional SED variables.

Segmentation Studies in Recreation and Tourism

As marketing approaches and methods have diffused to the field of recreation and tourism, the number of segmentation studies in the field has experienced a dramatic increase. Although the quality of these segmentation studies has been mixed (Stynes, 1985), segmentation has been applied to a wide range of problems in quite different market settings.

Following the trend in the general consumer market, many early segmentation studies in recreation and tourism employ a priori approaches. Socioeconomic-demographic (SED) variables and geographic variables are the primary bases for these studies (e.g. Tathem and Dornoff, 1971; Plog, 1972; Hisrich and Peters, 1974; Anderson and Langemeyer, 1982; Stynes and Safronoff, 1983).

Despite the advantage of being readily available and understandable, SED segmentation bases are not free from criticism: they have been criticized for not signaling important behavioral differences (e.g. Romsa and Girling, 1976). As in the general consumer market, this has led to

greater use of other segmentation bases including psychographic and product-related variables.

Psychographics have been especially popular since the mid 1970's. Many applications of psychographics in relation to marketing problems in recreation and tourism have been published (Mayo, 1975; Richie, 1975; Goodrich, 1977; Hawes, 1977; Shewe and Calantone, 1978; Crompton, 1979; Reime and Hawkins, 1980; and Abbey, 1981). However, studies actually using psychographics to segment the market are relatively scarce. Only a few studies can be identified as having psychographic segmentation bases. These include segmentation studies based on vacation-specific life styles (Perrault, Darden, and Darden, 1977), motivations of travel (Knopf and Barnes, 1980), and degree of novelty sought (Bello and Etzel, 1985).

Product-related variables are the most popular segmentation bases in recreation and tourism, particularly over the past five years. This suggests that segmentation bases are increasingly specialized or tailored to particular recreation and/or travel products or services.

Earlier product-related studies based on volume of use, recreation/travel activity, or equipment types, primarily use a priori methods, e.g. Born (1976), Romsa and Girling (1976), Hawes (1978), Thompson and Pearce (1980), Stynes, Mahoney, and Spotts (1980), and Dandurand (1982).

Clustering-based approaches have enjoyed increasing popularity in recent years. The majority of these studies segment the market on the basis of (1) benefits that respondents seek from recreation/travel experiences (i.e. reasons for participation), or (2) specific attributes/features that respondents expect in recreation/travel products or services. Applications of the clustering-based segmentation include:

Calantone, Schewe, and Allen (1980), Crask (1980), Goodrich (1980), Stynes and Mahoney (1980), Ballman, Knopp and Merriam (1981), Mazanec (1984), and Allen (1985). More of these studies tend to use attributes sought, although authors at times do not distinguish benefits and attributes sought in words, referring to them interchangeably. This propensity to use attributes sought is due largely to a recognition that attributes sought (i.e. specific features of a product) are a more concrete and tangible construct than benefits sought (i.e. reasons for use/purchase of a product), and thus make more sense when formulating specific marketing strategies.

Trends in Segmentation Research

The basic framework of segmentation research used in past and present practice—in both fields of general consumer markets and recreation and tourism markets—has been introduced above. In reviewing the literature, a few trends are evident. First, there has been a move from a priori approaches to empirical or clustering approaches (Lunn, 1978).

Segmentation bases are increasingly tailor-made for particular markets, rather than being defined on the basis of researcher's preconceptions. The development of advanced statistical techniques such as cluster analysis, factor analysis, and multidimensional scaling for both qualitative and quantitative exploration has greatly contributed to this trend.

Second, there has been an increasing emphasis upon explanatory (segmentation) bases, which provide a direct measure of consumer needs and motives. Segmentation by benefits or attributes sought and AIOs (Activities, Interests, and Opinions) are examples of this trend.

On the other hand, there has been a continuing shift away from segmenting solely on the basis of customer characteristics such as socioeconomics. The applicability of customer characteristics segmentation has been challenged on the ground that the resulting segments are usually not exploitable from a marketing standpoint (Yanchelovich, 1965; Haley, 1968; Arndt, 1974). For example, Scissors (1966) contends that market segments derived on the basis of socioeconomics fail to provide the insight or informative content required for guiding product positioning decisions.

Third, there has been a gradual move away from the search for one single kind of variable (segmentation basis), a search which dominated much of the early work on market segmentation. It has been recognized that consumption behavior is determined by a multiplicity of factors, some of them being 'internal' to the customer such as her specific needs and attitudes, others being 'external' to the customer, e.g. his background and circumstances, and the situation in which the product is purchased and used. It is therefore reasonable that increasing numbers of market researchers are designing segmentation studies with the use of multiple criteria (bases), including all kind of variables that might be relevant to a particular market. Dhalla and Mahatoo (1976) assert that a well planned segmentation study will not rely solely on one criterion to aggregate consumers into market segments. In effect, chances of providing meaningful results from segmentation studies are greater if they employ multiple segmentation bases (Hustad, Thomas, and Meyers, 1975).

In addition to the above three trends, there is also an indication that researchers are beginning to place greater emphasis on the interpretability and managerial usefulness of segmentation studies. This is in part due to the criticism that too many researchers have been

preoccupied with the development of sophisticated statistical models and/or techniques. According to Guitan and Sawyer (1974), and Tucker (1974), methodological advances have not been accompanied by research responsiveness to the data needs of management. Baumwoll (1974) maintains that the emphasis placed on the development of more advanced statistical methods results from researchers erroneously viewing market segmentation as a research technique rather than a marketing strategy.

MARKET SEGMENTATION IN FISHERIES MANAGEMENT

Marketing Orientation in the Management of Fisheries Resources

An increased emphasis on demand-side considerations is apparent in the recent management and planning of fisheries resources. There has been a widespread recognition that fisheries management must be based upon what the fishing public desires from their fishing experiences before management actions are taken (Moeller and Engleken, 1972; Duttweiler, 1976; Lackey and Nielsen, 1980; Driver, 1985). Although the term 'marketing' has rarely been used within the fisheries management literature, it is not misleading to say that a marketing approach has come under examination in this field.

In recognition of the importance of a user-orientation, more research has focused on a better understanding of anglers' successful fishing experiences. As a consequence, many studies have centered around the identification of anglers' motives, satisfaction, and preferences for fishing (Moeller and Engleken, 1972; Knopf, et. al., 1973; Driver and Knopf, 1976; Kennedy and Brown, 1976; Weithman and Anderson, 1978; Howard,

1979; Smith, 1980; Buchanan, 1983; Hicks, et. al., 1983; Harris, et. al., 1984; Hudgins, 1984; Kershner and Kirk, 1984). These studies have consistently found that various factors other than fish play an important role in a successful fishing experiences, and that what is a successful fishing experience to one angler is not necessarily successful to another. Although these studies do not directly address management and marketing strategies, they lend both theoretical and empirical support to demand-oriented (i.e. marketing oriented) management of the fisheries.

Segmentation Studies

In contrast to the number of studies focusing on the identification of fishermen's motives and preferences, only a handful of studies focused on segmentation of fishermen (e.g., operationalizing and translating user-orientation into real management and planning).

Bryan (1977) is one of the first studies to identify subgroups of sport fishermen. Bryan segmented trout fishermen into four groups with differing degrees of fishing specialization from the general to the specialized. The specialization was operationally defined as a behavioral continuum reflected by fishing equipment, skills used, and preferences for specific recreation settings. Assignments of anglers to segments was to some extent based upon subjective judgements about the angler's equipment, skill, and resource orientation. Four segments of anglers were identified: (1) occasional fishermen, (2) generalists, (3) technique specialists, and (4) technique-setting specialists. These segments were compared with respect to their equipment preferences, fish orientation, resource orientation, angling history, social context, and vacation patterns.

Ditton and Mertens (1978) segmented charter boat fishermen in the Texas Gulf Coast into four groups on the basis of intra-party relationships. These groups were: (1) family—anglers with the family members, (2) friends—anglers with friends, (3) colleagues—anglers with friends from work, and (4) clients—businessmen entertaining clients. A limited number of comparative analyses were made to test between-segment differences. Segment differences were tested in terms of fishing locations, number of fishing trips taken, party size, age, and income distributions. Some noticeable segment differences were reported on locations, number of trips, and party size. However, few between group differences were observed with respect to socioeconomic characteristics (e.g. age and income).

Adams (1979) examined the utility of fishing party composition variables in segmenting a recreational fishing market. With the use of canonical correlation analysis, Adams evaluated the relationships between fishing party composition variables and a set of fishing trip attribute ratings. Specifically, three party composition variables were related to 22 fishing trip attribute variables. The results from the canonical analysis are reported separately for resident and non-resident fishermen. Relationships were statistically significant, but the amount of shared variation between the two sets of variables was rather small. Limitations in the use of canonical correlation are discussed in detail along with the possible use of the results for segmentation. The study also suggests the importance of identifying specific benefits or attributes sought in structuring the fishing experiences.

Brown (1983) uses a geographical criterion to segment a recreational fishing market in New York State. Brown identified the primary residential markets for angling on the various sections of New York's Great Lakes-St. Lawrence river system. Anglers are classified on the basis of their residence into ten media areas (submarkets) called "areas of communication influences." Characteristics and preferences of anglers by the ten areas are provided as well as angler days and destination expenditures.

Driver, Phillips, et. al. (1985) report two segmentation analyses applied to anglers in two different states, Wyoming and Colorado. Since the Colorado study is based on the results of the Wyoming study and the methodologies are basically the same, only the Wyoming study is reviewed here. First, basic fishing preference dimensions were identified with the use of cluster analysis of variables applied to 23 attitudinal variables. This resulted in seven distinct preference dimensions including (1) general outdoors, (2) yield, (3) solitude, (4) wild, (5) social, (6) general recreation, and (7) trophy. The general outdoor and social dimensions were dropped from further analysis due to a lack of variation across anglers. The remaining five attitudinal orientations were then assumed to constitute orientations of angler segments. Each angler was then assigned to the segment that reflected his/her highest score on the five attitudinal dimensions, as long as that score was at least 3.5 on a 5 point scale. This approach fails to consider possible interaction effects of the five attitudinal orientations.

In reviewing these fisheries-related segmentation studies, a number of observations can be made. First, the majority have been based on an a priori segmentation approach. As in the general consumer market, however,

increased attention is being given to empirical approaches to identifying market segments. Greater use of fishing preference data such as attributes sought (e.g. Adams, 1979; Driver, et. al., 1985) is indicative of this trend. Secondly, most studies have been relatively inadequate in systematically evaluating or testing for between-segment differences. Many of these studies stop at the point when an angler classification is derived, and fail to fully evaluate the segments either statistically or in terms of their applications to fisheries management. Thirdly, segment profiles (i.e., portraits) are rarely completed. To be managerially useful, segment portraits which assure separate marketing or management effort to the subgroups are necessary. Fourth, the relative size (i.e. market share) of each of derived segments are rarely estimated. Whether or not segments are substantial in size is crucial when formulating management policies and marketing strategies, and therefore needs more attention. Finally, the methods used for identifying segments are not clearly discussed.

Segmentation research in fisheries management improves with wider adoption of marketing methods and techniques and more experience in applying these methods. A large gap is still apparent between what has been done and what can and should be done with respect to segmenting fisheries users. Attempts will be made to fill this gap in the present study. The study differs from the previous studies primarily in that it employs an empirical or a clustering approach instead of an a priori approach, that more than one segmentation base specially tailored to the market are considered, and that segmentation results are more fully evaluated for application.

METHODS FOR FORMING SEGMENTS

A necessary condition of market segmentation is an identification of market segments. This requires classification of consumers into relatively homogeneous consuming units. An increasing number of studies are forming segments based on empirical (i.e. clustering) approaches, rather than a priori approaches. Examples of recent segmentation research using cluster analysis are: Bass, Pessemier, and Tigert (1969), Lessig and Tollefson (1971), Greeno, Sommers, and Kernan (1973), Calantone and Sawyer (1978), Schaninger, Lessig, and Panton (1980). Despite the increasing amount of research employing clustering techniques, there remains considerable confusion about available clustering procedures and selection of a particular technique(s). Punj and Stewart (1983) attribute this general lack of understanding to: (1) the failure of numerous authors in the marketing literature to specify what clustering method is being used, and (2) the tendency of some authors to differentiate among methods which actually differ only in name. Some clarification is necessary. With this in mind, this section focuses upon clustering techniques as a class of methods for forming segments. Cluster analysis is introduced, and the issue of choosing among various clustering techniques for the purpose of market segmentation is discussed.

Cluster Analysis

Cluster analysis is a statistical procedure for creating a classification from a data set. More specifically, it is a generic term for any type of multivariate statistical procedures which groups objects (either concepts or entities) into a number of homogeneous units or

clusters. The original development of cluster analysis goes back to the nineteen thirties when it was first discussed in the social sciences (Driver and Kroeber, 1932), and Tryon's (1939) and Zubin's (1938) publications came out. Cluster analysis, however, did not attract much interest until the early 1960's. With the publication of Sokal and Sneath's (1963) book entitled "Principles of Numerical Taxonomy," cluster analysis suddenly began to attract a great deal of attention (Blashfield and Aldenderfer, 1978). In addition to Sokal and Sneath's effort, the emergence of high-speed computers also greatly contributed to renewed interests in clustering procedures. During this period of expanding interests, at least one hundred different clustering methods were proposed (Blashfield, 1976). Anderberg (1973), Bailey (1974), Cormack (1971), Everitt (1974), and Hartigan (1975) provide reviews of these various clustering methods.

Despite the number of different methods in use, the basic mechanisms of clustering are generally the same. Most of the methods begin with an n-dimensional space in which each entity is represented by a single point. The dimensions in the space represent the characteristics upon which the entities are to be compared. Similarity between entities can be measured by the correlation between entities' scores on the dimensions or the distance between points in the space. The Pearson product moment correlation coefficient and squared Euclidean distance are generally used as measure of correlation and distance, respectively. The clustering process starts with the calculation of similarities between objects. The next step is the actual classification of cases. Based upon the similarity measures, the entities under investigation are then grouped into a number of (usually) disjoint clusters such that members within each cluster are alike with respect to the dimensions being considered.

Necessary Characteristics for Segmentation

Since different clustering methods use distinctly different algorithms and can result in distinctly different solutions to a given problem, a clustering method(s) needs to be selected with a particular research need in mind. In selecting a particular method(s), therefore, it is necessary to consider the characteristics of clustering techniques with respect to the given purpose of research and the characteristics of the data.

Peterson (1974), using differences among various clustering techniques discussed by Bailey (1974), points out some of the characteristics that a clustering technique should have for market segmentation. These include: (1) single level (reticulate) versus hierarchical, (2) agglomerative versus divisive, and (3) monothetic versus polythetic.

- (1) Single level vs. Hierarchical: Groups formed with hierarchical methods at one level become subgroups at a higher level. The result is a tree like structure representing various groups. In contrast, single level (reticulate) method merely defines groups separately on a single level. The inter-group links take the form of a network rather than a tree.
- (2) Agglomerative vs. Divisive: An agglomerative method builds up groups from individual units or smaller groups; hence, it is aggregative in nature. A divisive method starts with all the data and partitions them into subgroups; hence, it is disaggregative.
- (3) Monothetic vs. Polythetic: A monothetic method forms groups on the basis of an "either/or" criterion; individual units are clustered into the same group if and only if they possess exactly the same configuration of attributes. A polythetic technique clusters on the basis of overall similarity.

For the purpose of market segmentation, it is recommended that a clustering technique be hierarchical, agglomerative, and polythetic.

Peterson (1974) argues that a clustering technique be hierarchical and agglomerative since these characteristics result in a structure which is most consistent with the underlying theory of market segmentation. Optimal segmentation involves treating every individual consumer as a separate and distinct one since large individual differences exist with respect to demand elasticities (Claycamp and Massy, 1968). However, since it is inherently impossible to profitably pursue such a strategy, segments should be built up (aggregated) from homogeneous consuming units. This recommends a hierarchical, agglomerative techniques such that segment formation proceeds vertically rather than horizontally. Finally, the clustering techniques should be polythetic. Although the monothetic approach will produce purer groups, as the number of variables increases, it requires exceedingly large sample sizes. Even if a sufficiently large sample were available, a large residual pool of unclassifiable individuals would still remain. Thus, the only practical approach becomes a polythetic one.

Choosing Among Hierarchical Methods

There are several clustering techniques that satisfy the above three criteria. These include: (1) single linkage, (2) complete linkage, (3) average linkage, and (4) Ward's minimum variance method.

- (1) Single Linkage Method: A cluster is defined as a group of entities such that every member of the cluster is more similar to at least one member of the same cluster than it is to any member of another cluster.
- (2) Complete Linkage Method: A cluster is defined as a group of entities in which each member is more similar to all members of the same cluster than it is to all members of any other cluster.

- (3) Average Linkage Method: A cluster is defined as a group of entities in which each member has a greater average level of similarity with all members of the same cluster than it does with all members of any other cluster.
- (4) Ward's Minimum Variance Method: A cluster is defined as a group of entities such that the variance (error sum of squares) among the members of each cluster is minimal.

Choosing among these hierarchical methods is difficult. Each of these methods has its own advocates and critics. One approach to the selection is to evaluate these clustering techniques in terms of their performance. Because of the complexity of the study design required for this purpose, relatively little research has focused upon the evaluation of different clustering techniques. With the development of more sophisticated study designs and high speed computers, however, some studies have been undertaken to compare and evaluate different clustering techniques in recent years.

The mixture model or the so-called Monte Carlo study is one that has been most frequently used as a method of evaluating the performance of clustering techniques (Bailey, 1974; Blashfield, 1976). According to the mixture model, the task of cluster analysis is to recover underlying groups from a mixture of populations when the number of populations and their parameters are unknown. The general design of mixture studies has been to generate mixtures (of artificial data) with known parameters/distributions using Monte Carlo techniques and then to compare the ability of different techniques to recover the underlying populations. The degree of agreement between the obtained clusters and the underlying populations has been termed "accuracy" of the cluster solution. Rand's statistic (Rand, 1971) and statistic kappa (Cohen, 1960) have been used as measures of the accuracy in these studies.

Results from Evaluation Studies

Kuiper and Fisher (1975) compared six hierarchical clustering algorithms including single, complete, average, centroid, and median linkage methods, and Ward's minimum variance method. The analyses were limited to bivariate normal mixtures and Ward's method consistently outperformed the other methods in accuracy tests using Rand's statistic.

Blashfield (1976), using kappa as the measure of accuracy, compared single, complete, and average linkage, and Ward's method on 50 multi-normal mixtures. The highest median accuracy across the 50 tests was for Ward's method.

Edelbrock (1979) also employed kappa as an accuracy measure at several levels of a hierarchical tree, where accuracy is considered as a function of the coverage of the classification. Clustering techniques including single, complete, average, centroid linkage methods, and Ward's method were compared on ten multi-normal mixtures. The first four methods used either the product-moment correlation coefficient or Euclidian distance as a measure of similarity, while the Ward's minimum variance method, by definition, is a distance approach. Single, centroid, and average linkage methods using the correlation measure of similarity, and Ward's method performed best. The author suggests that clusters replicated by both the minimum variance method and a correlation algorithm would be particularly robust, since while both algorithms are accurate, they represent quite diverse approaches to clustering.

Edelbrock and McLaughlin (1980) compared 16 hierarchical clustering techniques on their ability to resolve 20 multivariate normal mixtures and 12 multivariate gamma mixtures, using both kappa and Rand's statistic.

The 16 algorithms represented a 4(amalgamation rules) x 4(similarity measures) design. The amalgamation rules (algorithms) include single, complete, average, and centroid linkage. Similarity measures were Euclidian distance, correlation, and the one-way and two-way intraclass correlations. Performances of these techniques were also compared with that of Ward's method. Ward's method was again found as highly accurate among the techniques compared.

Other evaluation studies (e.g. Zimmerman, Jacobs, and Farr, 1982; Morey, Blashfield, and Skinner, 1983) report similar results favoring Ward's method. Thus, the majority of studies have found Ward's method as one of the most accurate methods. Market researchers (e.g. Punj and Stewart, 1983) also recommend the use of Ward's method. As a consequence, Ward's method will be a major candidate for the clustering technique to be used here.

Ward's method, however, is not free from problems. Like all hierarchical clustering techniques, Ward's method is sensitive to outliers (Everitt, 1980; SAS Institute Inc, 1985) and contains no mechanism for reallocation of entities which may have been poorly classified at an early stage of clustering (Everitt, 1980). Elimination of outliers is recommended for the outlier problem (Everitt, 1980; Zupan, 1982; Punj and Stewart, 1983), while the use of a reallocation method (i.e. an iterative partitioning method) in conjunction with a hierarchical clustering method is recommended for the latter problem (Hartigan, 1975; Milligan, 1980; Punj and Stewart, 1983).

Reallocation Method and Two-Stage Clustering

The major benefit of using a reallocation method (sometimes called optimization method) in conjunction with a hierarchical method is that we can take advantage of characteristics of both hierarchical and non-hierarchical methods. A reallocation method admits reallocation of entities, thus allowing the possibility that a poor initial partition might be corrected at a later stage. However, a reallocation method generally assumes that the number of clusters has been decided a priori by the investigator (Everitt, 1980). Since hierarchical methods do not require a priori information to start the process, they can provide an initial cluster solution for a reallocation method. Being one of the most accurate hierarchical methods, Ward's method provides a good initial solution for a starting point of the reallocation.

The basic mechanism of a reallocation (or optimization) method is to reallocate entities among a set of clusters in such a way as to optimize some objective function, in effect, to select partitions that maximize intercluster differences and minimize intracluster differences. Most of these criteria are based upon the matrix equation

$$T = W + B$$

where T is the total scatter or dispersion matrix, W is the matrix of within-clusters dispersion, and B is the between-cluster dispersion matrix (Mezzich and Solomon, 1980). One seeks the situation where W is small and equivalently B is large in some sense, e.g. their discriminatory values are small and large, respectively. The employment of a reallocation procedure should provide proper corrections for possible poor classifications at earlier fusions or partitions during a hierarchical classification process, thus resulting in a better cluster solution.

Punj and Stewart (1983) recommend two-stage procedure for forming clusters. In the first stage, Ward's method or average linkage method is applied to a data set to obtain a preliminary cluster solution. These clusters are then submitted to a reallocation procedure which yields a final cluster solution (i.e. market segments).

CRITERIA FOR EVALUATING MARKET SEGMENTS

While statistical considerations are important, the ultimate test of any segmentation rests on how useful the segmentation is in developing and implementing management and marketing strategies (Bieda and Kassarian, 1969). For segments to be useful, certain conditions must be met. Kotler (1984) suggests that usefulness of a particular segmentation be evaluated based upon four criteria:

Measurability:

The degree to which the size and purchasing power of the segments can be measured

Accessibility:

The degree to which the segments can be effectively reached and served.

Substantiality:

The degree to which the segments are large and/or profitable enough. A segment should be the largest possible homogeneous group worth going after with a tailored marketing program and expenditure.

Actionability:

The degree to which effective programs can be formulated for attracting and serving the segments.

The fourth criterion actionability largely depends upon how the other three criterion are satisfied. Kotler also emphasizes that a combination of these criteria must be optimized (i.e. maximized), not any one or two or three of them alone.

Engel, Fiorillo, and Cayley (1972) propose three criteria similar to Kotler's first three criteria: (1) size, (2) reachability, and (3) variation in market response. The size criterion is equivalent to Kotler's substantiality criterion, while reachability corresponds to the accessibility criterion. To some extent the variation (to market responses) criterion corresponds to Kotler's measurability. However, the variation criterion differs in that it places more importance on measurable differences in market behavior across segments, whereas Kotler is more concerned with how easily segmentation variables can be measured. Differences in market behavior are an important factor for segments having no clear variations among themselves in response to change in the marketing mix are not meaningfully defined for practical purposes.

Guiltinan and Sawyer (1975) also emphasize that managerial usefulness of segments be assessed in terms of: (1) differences in market behavior and (2) identifiability or accessibility of the segments. It is often possible to find segments with distinguishable behavioral differences, but the segments cannot be reached feasibly through promotion efforts. Obviously, these two become necessary conditions for evaluating segments.

It is important to recognize that there are definite overlaps among these criteria. On the basis of these overlaps and/or similarities, the proposed criteria can be summarized into the following four segmentation criteria.

Identifiability: Segments must be recognizable and accessible. This is reasonably measured by socioeconomic characteristics and media habits.

Substantiality: Segments must be substantial in size--there must be a sufficient number of people within each segment to justify designing distinct marketing efforts for each subgroup.

Variation in Market Response: Segments must differ with respect to their needs/wants and market behavior so that distinct marketing programs can profitably be designed to serve them.

Exploitability: Distinguishing characteristics of the segments must lend themselves to marketing appeals or offerings that will achieve the intended results.

Of these four criteria, the first three are of fundamental importance and can be used to statistically evaluate the segments. The fourth criterion exploitability is concerned with the overall usefulness or applicability of the segments. This requires consideration of the other three criteria in relation to conditions of a particular management environment and intended application. The exploitability may be best evaluated externally by management.

CHAPTER III

RESEARCH METHODS

This chapter presents research methods employed to accomplish the study objectives. The chapter first discusses the overall research design and research plan. The research plan is divided into five phases: (1) data collection and preparation, (2) segment creation, (3) internal evaluation, (4) external evaluation, and (5) comparison of segmentations. In the initial phase, data needed for segmenting the market are collected and prepared for analysis. Alternative segmentations are individually carried out in the next three phases. The alternative segmentations are then directly compared for their managerial contribution in the last phase. Specific methodological components which make up the study are discussed in detail in order of this research plan.

RESEARCH DESIGN

There are two major approaches to identifying market segments: (1) a priori and (2) clustering approaches (Tull and Hawkins, 1980). In an a priori segmentation, consumers are classified into prespecified groups (segments) usually based on one or two variables. In a clustering approach, they are grouped into segments according to their similarities on some selected set of variables. Unlike the a priori approach, the

number and types of segments are not known in advance in a clustering approach, but are determined from the clustering process itself based upon some statistical criteria.

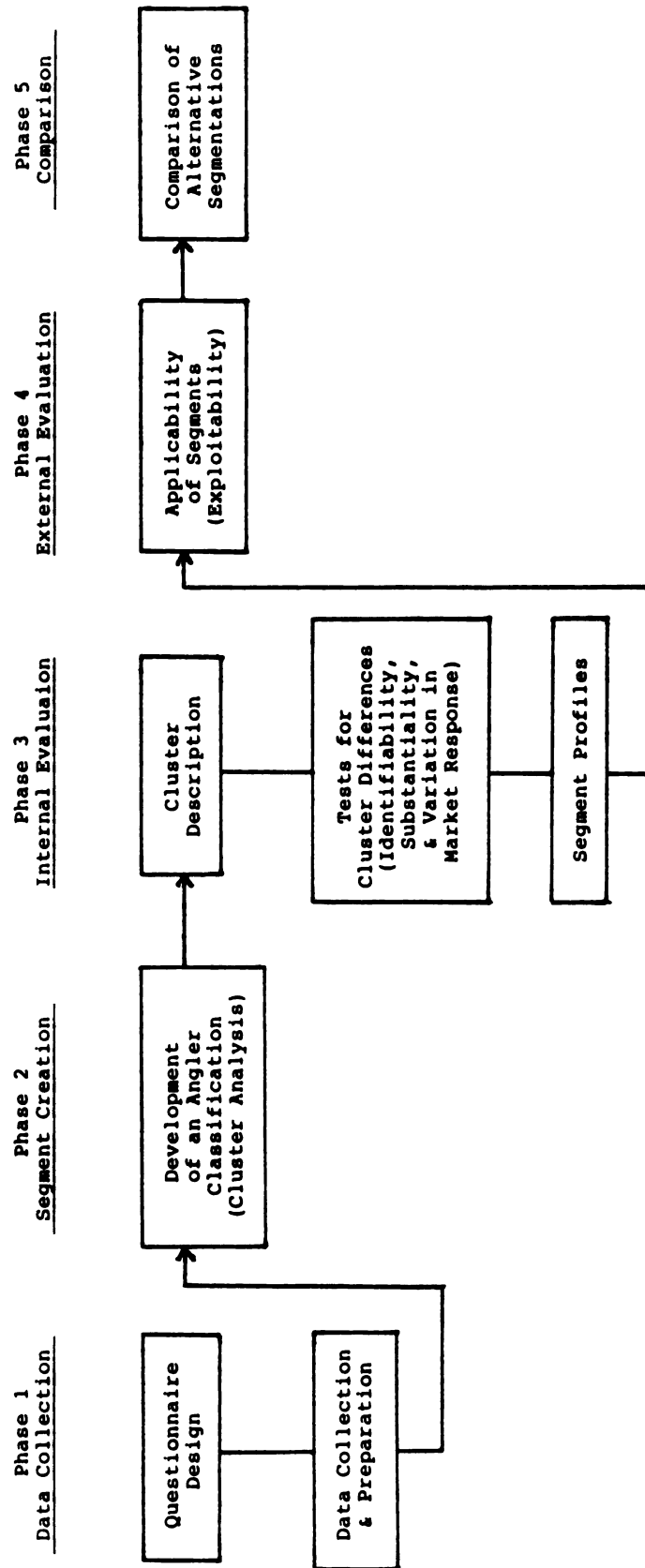
The study objectives are to segment the sport fishing market across several variables measuring participation patterns and behavioral predispositions. A clustering approach is used as there is no clear a priori way of forming segments on these variables.

A segmentation study requires that information on segmentation bases and other variables be collected. The usual method of obtaining such information is through a market survey. A cross-sectional survey design was selected to define segments and to determine certain relationships within and between the segments as of the particular period of time covered by the survey. Cross-sectional designs are used in the majority of segmentation studies (Tull and Hawkins, 1980).

RESEARCH PLAN

Segmentation analysis is divided into five distinct phases in this study: (1) data collection and preparation, (2) segment creation, (3) internal evaluation, (4) external evaluation, and (5) comparison of segmentations (Figure 1). The first phase involves the design of a questionnaire that allows alternative segmentations, collection of empirical data, and preparation of the data for analysis. Alternative segmentations (segment development and evaluation) are separately carried out during the next three phases. In the segment creation phase, a classification is developed using cluster analysis techniques. The third and fourth phases involve evaluation of the resulting segments,

Figure 1. Market Segmentation: Steps of the Analysis



first based upon statistical analyses on a particular sample (i.e. internal evaluation) and then based upon their applicability (i.e. external evaluation). Specifically, internal evaluation involves evaluation of segments' intragroup homogeneity, intergroup heterogeneity, discriminatory power on variables not used for forming segments, and sizes. Also, detailed segment profiles are developed by putting together all the information from these evaluations in this phase. Following the internal evaluation, segments are evaluated with respect to their external validity and intended applications. This external evaluation is more subjective and includes evaluation by the intended users of the segmentation results. After these four phases are completed for each segmentation base, alternative segmentation approaches are directly compared with respect to four evaluation criteria: identifiability, substantiality, variation in market response, and exploitability.

DATA COLLECTION METHOD: THE MICHIGAN SPORT FISHING SURVEY

Data used for the study were collected through the 1984 Michigan Sport Fishing Survey, a multi-purpose survey, conducted by Fisheries Division, Michigan Department of Natural Resources. Three primary types of data were collected: (1) fishing effort and catch rate data, (2) data needed for segmenting the sport fishing market, and (3) economic impact data. Although segmentation was a part of the data collection effort, the survey was not designed solely for market segmentation purposes. The present investigator's role in the data collection phase was to design and recommend instruments that allowed segmentation analyses of the sport fishing market. The Fisheries Division was responsible for the remaining parts of the data collection.

In this section, the survey methods are briefly explained, paying particular attention to matters most relevant to the segmentation analyses. Greater details on other aspects of the data collection are presented in a forthcoming report being prepared at the Fisheries Division, Michigan Department of Natural Resources. Interested readers should consult that report.

Survey Design

The survey design was partially patterned after previous fishing activity surveys conducted annually by the Fisheries Division of Michigan Department of Natural Resources. The design called for a cross-sectional mail survey of Michigan's licensed sport fishermen including both Michigan residents and non-residents. Study objectives dictated the kinds of questions to be included in the survey. Since the primary purpose of previous angler surveys had been to collect information on fishing effort and catch rate, it was necessary to include additional questions to permit segmentation of the sport fishing market.

Instrumentation

Questions were designed to gather information on the following areas:

(1) Fishing Activity Participation Characteristics

- (a) number of years fished
- (b) fishing skill level (self-rated)
- (c) boat/canoe ownership
- (d) fishing activity in the last two years
 - species fished
 - fishing locations used

- modes of fishing used
- methods of fishing used
- favorite species
- most frequented fishing sites
- favorite fishing modes
- favorite fishing methods
- out-of-state fishing participation

(2) Fishing Attributes Sought

22 attributes (specific features or factors) in selecting when and where to fish

(3) Fishing Benefits Sought

12 benefits sought from fishing experience
(reasons for fishing)

(4) Usage of Fishing Information/Media Sources

(5) The Last Fishing Trip Activities and Spending¹

(6) Socioeconomic-Demographic Characteristics

- (a) age
- (b) sex
- (c) marital status
- (d) presence of children
- (e) work status and occupation
- (f) racial background
- (g) education level
- (h) family income

A copy of the survey questionnaire is included in Appendix A.

Variables included specifically for the purposes of forming segments were: (1) species fished, (2) species fished and the corresponding fishing locations, (3) modes of fishing, and (4) methods of fishing, (5) fishing

¹Another purpose of the Michigan Sport Fishing Survey was to investigate and document economic impacts of Michigan's sport fishing activities. For this reason, a series of questions regarding anglers' last fishing trip activities and spending were asked.

attributes, and (6) fishing benefits sought. The first 4 sets of variables represent segmentation approach based on use or purchase behavior, while the last two represent approach based upon behavioral predispositions (i.e. psychological factors). Remaining variables were collected for further description of the segments or for other purposes.

Population and Sample

The population for the study is the 1984 Michigan licensed sport fishermen, i.e. anglers who purchased annual licenses for the 1984 fishing season. Daily license holders were excluded from the study population because of technical difficulties involved in the present registration system.¹

In order to keep records of licensees, the Fisheries Division maintains a passbook system which is partially automated. Annual license holders are listed on computer files as they purchase licenses. The computer files are updated approximately every three months. This computerized passbook system served as the sampling frame.

There were 116,340 licensed anglers listed on the passbook system as of August 10, 1984. A random sample of 3,300 anglers was drawn from those listed on the passbook August 10, 1984. The sample was drawn with the use of computer assisted random selection. Anglers do not appear on computer license lists until 2 months after a license is purchased. Thus, sampled anglers must have purchased licenses during June of 1984 or earlier,

¹Daily license purchases are processed differently from annual license purchases. Record keeping of daily license purchases is not automated. A sample of daily license holders needs to be drawn manually from carbon copies of this license purchase.

representing annual license holders who purchased licenses relatively early in the year.

Survey Administration

Questionnaires were mailed out September 1, 1984, to a random sample of 3300 Michigan licensed anglers. Each questionnaire was given an identification number. A brief explanation of the purpose of the survey, and the confidentiality of responses, and an appreciation for prompt responses and cooperation were provided at the beginning of the questionnaire. One follow-up post card reminder was sent to non-respondents on September 18, 1984. Questionnaires received after October 26, 1985 were excluded from the data processing.

Response Rate

Of 3300 questionnaires mailed out, a total of 3082 questionnaires were successfully delivered to the intended respondents. The remaining 218 questionnaires did not reach the respondents and were mailed back due to address changes or incorrect addresses.

Of those delivered, 1156 completed questionnaires were returned during the survey period. A response rate of 37.5 percent was estimated as the number of completed questionnaires (1156) divided by the number of questionnaires delivered (3082).

Testing for Non-Response Bias

A test of non-response bias was conducted at the Fisheries Division. This involved sending a smaller version of the questionnaire (one-page letter format) to a random sample of 240 non-respondents and telephone

interviews with 30 non-respondents. Greater details of the non-response bias test are documented in a report being prepared concurrently at the Fisheries Division. The majority of non-respondents who were successfully contacted by either a letter or a telephone call gave reasons for not responding that related to not having fished for a year or two and/or having little interest in fishing during the time of the survey. Non-response bias did not appear to be a serious problem in proceeding with the analysis on the data obtained through the survey. It is more likely to affect the estimation of segment size (i.e. market share), rather than the types or nature of market segments to be found. In particular, we will likely underestimate the number of casual fishermen. Interpretation of the results from the study should be made with this in mind.

DATA PREPARATION

After examining the returned questionnaires, a small number of questionnaires were eliminated from further processing due to incompleteness. A total of 1152 questionnaires qualified for further data processing and analysis.

These questionnaires were keypunched into a computer data form on a mainframe computer at the Michigan Department of Transportation. A special computer program written in COBOL, which allowed direct data entry from questionnaires, was developed and used in the data entry process. This data entry program virtually eliminated the traditional use of coding sheets which often invite coding errors. The data entry was carried out by employees of the Fisheries Division, MDNR, using computer terminals at the Division.

After the completion of data entry, a computer data file containing all the information from the 1152 questionnaires was created . Since statistical analysis of the survey data was to take place at Michigan State University, the data file was transferred to the Computer Center at Michigan State University in an EBCDIC data form using a nine-track computer tape.

Finally, the data were subject to detailed cleaning at the University. The data cleaning was executed by checking each variable's frequency distribution for out-of-range or extreme values. A small number of identified possible keying mistakes, were eliminated or corrected where possible. The data were then ready for statistical analysis.

PROCEDURES FOR FORMING SEGMENTS

Identification of market segments requires a classification of consumers into a set of mutually exclusive and exhaustive groups with high levels of intragroup homogeneity and intergroup heterogeneity (Arndt, 1974). Cluster analysis is a set of multivariate analysis methods to obtain such a classification. Therefore, cluster analysis was employed as the primary methods for identifying segments.

Cluster analysis generally entails four key decisions: (1) selecting and preparing variables, (2) selecting a clustering technique and a corresponding similarity measure, (3) deciding on the number of clusters, and (4) evaluating the resulting clusters. This section explains each of these steps in detail.

Variable Selection and Preparation

Three issues need to be addressed in this step: selection of the set of variables (i.e. segmentation bases), standardization of the data, and interdependencies (or multicollinearity) in the data.

The selection of variables is crucial for one or two irrelevant variables may distort an otherwise useful cluster solution (Punj and Stewart, 1983). Punj and Stewart (1983) suggest the selection of the basis for classification be guided by an explicit theory or hypothesis. In this study, literature on fisheries resources, angler behavior, and general recreation and tourism, was reviewed in relation to the Michigan sport fishing market. This led to the inclusion of six types of potential segmentation variables in the survey instrument: (1) species fished, (2) species fished and the corresponding fishing locations, (3) modes of fishing, (4) methods of fishing, (5) fishing attributes sought, and (6) fishing benefits sought. Preliminary study based upon these 6 candidate segmentation bases indicated that two bases—attributes sought and species-location were more promising than the others in terms of statistical criteria and interpretability.¹ Therefore, these two segmentation bases are examined in detail in this dissertation. The wording and variable names for fishing attributes and species-location variables are provided in Tables 1 and 2.

Once a particular set of variables is selected as a basis of clustering (i.e. segmentation), the variables must be examined for intercorrelations and differences in means and variances. Intercorrelated

¹Cluster analysis (Ward's method) was applied to each set of variables and cluster solutions ranging from 5 to 12 clusters were examined and evaluated.

Table 1. Attributes Sought Information

<u>Attributes Sought</u>	<u>Keyword</u>
Respondents were asked to indicate the importance of each attribute on a scale: Crucial - Very Important - Important - Somewhat Important - Not Important.*	
1. Angler crowding	CROWDING
2. Competition with other recreationist, e.g., canoes, sailboats	COMPETITION
3. Places to fish from shore	SHORE
4. Boat launching facilities	BOAT
5. Marina facilities and services	MARINA
6. Availability of parking facilities	PARKING
7. Nearness of restaurants	RESTAURANT
8. Nearness of bait and tackle shops	BAIT
9. Nearness of overnight accommodations, e.g., motels, campgrounds	MOTEL
10. Natural Beauty of the area	BEAUTY
11. Solitude	SOLITUDE
12. Water clarity	WATER
13. Presence of contaminants in fish	CONTAMINATION
14. Catch rate of keepable fish	KEEPABLE
15. Catch rate of all fish	ALL FISH
16. Presence of favorite fish (species)	FAVORITE
17. Size of fish	SIZE
18. Diversity of fish species which can be caught	DIVERSITY
19. Nearness to home (travel distance)	DISTANCE
20. Information about the area, e.g., catch rates, best fishing method, hot spots ..	INFORMATION
21. Nearness to second home/cottage/camp	COTTAGE
22. The chance to catch a large or trophy fish	CHANCE

*Respondents were asked to indicate the importance of each of those attributes in selecting where and when to fish.

For the purpose of statistical analysis, a numeric value of 4 was assigned to "Crucial", 3 to "Very Important", 2 to "Important", 1 to "Somewhat Important", and 0 to "Not Important".

Table 2. Species-Location Information

Species	Location of Fishing		
	Inland Lakes (IL)	Great Lakes (GL)	Stream/ River (SR)
— species-location variables —			
1. Yellow Perch (YEP)	YEP-IL	YEP-GL	YEP-SR
2. Panfish (BLG)	BLG-IL	BLG-GL	BLG-SR
3. Bass (LMB)	LMB-IL	LMB-GL	LMB-SR
4. Walleye/Sauger (WAE)	WAE-IL	WAE-GL	WAE-SR
5. Pike or Musky (NOP)	NOP-IL	NOP-GL	NOP-SR
6. Lake Trout (LAT)	LAT-IL	LAT-GL	LAT-SR
7. Steelhead (STT)	STT-IL	STT-GL	STT-SR
8. Rainbow Trout (RBT)	RBT-IL	RBT-GL	RBT-SR
9. Brown Trout (BNT)	BNT-IL	BNT-GL	BNT-SR
10. Brook Trout (BKT)	BKT-IL	BKT-GL	BKT-SR
11. Chinook Salmon (CHS)	CHS-IL	CHS-GL	CHS-SR
12. Coho Salmon (COM)	COM-IL	COM-GL	COM-SR
13. Catfish/Bullhead (CCF)	CCF-IL	CCF-GL	CCF-SR
14. Suckers/Carp (CAR)	CAR-IL	CAR-GL	CAR-SR
15. Smelt (SMT)	SMT-IL	SMT-GL	SMT-SR

Note: Combination of 15 species and 3 fishing locations produced a total of 45 species-locations variables. Respondents were asked if they fished certain specie(s) at certain location(s) in the last two years by indicating "yes" or "no" to those 45 variables. To facilitate statistical analysis, a numeric value of one (1) was assigned to each response of "yes", while a numeric value of zero (0) was assigned to each response of "no". Thus, species-location variables represented dichotomous variables.

variables and variables with different means and variances can cause problems in a cluster analysis. Highly correlated variables implicitly weight underlying dimensions that are tapped by several variables. A variable with a significantly larger mean and/or variance than others in the set will receive greater weight in determining the cluster solution. Interrelation among variables (i.e. multicollinearity) also requires special attention as distance-based similarity measures (e.g. the Euclidean distance or error sum of squares) implicitly assume orthogonality (or independence) of variables. To correct the former problem, some heavily intercorrelated variables should be eliminated. Variations in measurement scale can be corrected by converting all the variables to z-scores (i.e. standardizing them).

In this study, these two problems are corrected simultaneously through the pre-treatment of variables with factor analysis. Factor analysis is one of the more widely used multivariate statistical procedures for analyzing interdependencies within a set of data. Specifically, factor analysis groups correlated variables into factors that are orthogonal to each other. It also yields factor scores that are standardized to have a zero mean and standard deviation of one. Factor analysis also serves to reduce the number of variables prior to clustering, reducing costs and generally making the clusters easier to interpret. Factor analyses were performed on the two candidate segmentation bases using all 1152 observations. Specific factoring procedures are explained below.

The Method of Initial Factor Extraction

A principal axes factoring technique was employed as a method of initial factor extraction. This is a mathematical technique long used to

determine the principal axes of an ellipse in two or more dimensions (Rummel, 1970). A salient characteristic of this technique is that the first factor to be extracted is calculated to maximize the variance accounted for in the correlation matrix. Each succeeding factor is, in turn, extracted to maximize the residual variance explained. This technique generally produces a factor structure which accounts for the most variance with the fewest number of factors.

Criteria for Deciding the Number of Factors

A number of criteria for deciding the number of factors to extract have been proposed. These are well documented in Gorsuch (1974) and Stewart (1981). The present study employs four criteria: (1) unit eigenvalue, (2) scree test, (3) variance explained, and (4) interpretability of factors. Using such a combination of criteria for the number of factors to retain has been highly recommended (Gorsuch, 1974; Harman, 1976; Cattell, 1978). A brief explanation of each criterion is provided below.

- (1) Unit Eigenvalue is the most popular criterion for addressing the number of factors to retain. With this procedure factor extraction stops when all factors with eigenvalue greater than 1.0 have been removed.
- (2) Scree Test involves plotting the eigenvalues against the number of factors. A large break in the plot indicates the point where factoring should stop. The last factor to include is the one whose eigenvalue immediately precedes the break.
- (3) Variance Explained by the factors is another criterion. While it is desirable to account for as much of the variance as possible, at the same time it is also preferable to do so with as few factors as possible. The decision then becomes a

trade-off between the amount of parsimony and comprehensiveness that can be attained (Kachigan, 1982).

- (4) Interpretability of factors involves inspecting a number of different solutions with respect to the meanings of the variables loading on the representative factors and deciding which solution makes the most sense in light of what is already known about the subject matter. In deciding the number of factors, statistical considerations alone are not entirely satisfactory and in most instances the meaning or interpretability of the retained factors play an important part.

The Method of Factor Rotation

There are two types of rotation—orthogonal and oblique. Because subsequent grouping procedures (i.e. cluster analysis) require the calculation of Euclidean distance among factors, it is essential to employ an orthogonal factor rotation. For this reason, Varimax rotation is employed. This is one of the most common factor rotation procedures and has been shown to be the best among orthogonal procedures (Gorsuch, 1974). Proposed by Kaiser (1958), the Varimax method is a modification of another orthogonal rotation (i.e. Quartimax) to meet the requirement of a simple structure, the rotation criteria proposed by Thurstone (1947). This rotation procedure tends to produce some high loadings and some near zero loadings on each factor, by simplifying the columns of a factor matrix (Nie, et al, 1975).

Selection of Clustering Method

Choosing an appropriate clustering technique(s) among a range of techniques is a critical issue. Different clustering techniques can result in different solutions for a given problem. Further information on

different clustering techniques and their relative strengths and weaknesses is provided in the literature review.

A two-stage clustering process was used in the study, based upon a review of the literature and some experimentation with different methods. Ward's method of hierarchical clustering is applied to the data set for obtaining preliminary or part-optimal cluster solutions in the first stage. These clusters then become the initial solution for a non-hierarchical, iterative partitioning technique which provides the final cluster solution. Similar two-stage clustering procedures have been proposed and supported by Hartigan (1975) and Milligan (1980). The two-stage clustering procedure helps in selecting the number of clusters to keep, and in identifying and eliminating outliers.

Factor scores obtained from the preceding factor analysis serve as input variables to the cluster analysis procedure. Due largely to computer program limitations and the cost of executing cluster analysis programs, it was necessary to reduce the number of observations used in the clustering process. Factor scores of a random sample of 281 anglers are used in the cluster analysis. Statistical tests yielded no significant differences between the subsample and the remaining members of the total survey sample with respect to any of the study variables. This indicates the subsample is reasonably representative of the survey sample as a whole.

Ward's Minimum Variance Method

Ward's method was selected as the hierarchical method to be used in the first stage. Developed by Ward (1963), the minimum variance method has been one of the more popular hierarchical agglomerative cluster

analysis techniques. Alternative names for this method include "Ward's method," "error sum of squares method," "hierarchical grouping to minimize $tr W$," or "HGROUP" (Blashfield and Aldenderfer, 1978).

In brief, the minimum variance method represents a hierarchical method which is designed to generate clusters in such a way that the variance within the clusters is minimal (Ward, 1963; Wishart, 1982). The method is based upon the premise that the greatest amount of information, as indicated by an objective function, is available when a set of N members is ungrouped (Ward, 1963). Hence the grouping process starts with these N members, which are termed groups or subsets, although they contain one member. The method maintains that at any stage of analysis the loss of information which results from the grouping of subsets into clusters can be measured by the total sum of squared deviations of every point from the mean of the cluster to which it belongs. At each step in the analysis the central point is calculated for the union of every possible pair of clusters and then the total sum of squared distances from this point to all objects in this hypothetical cluster is evaluated. The association of two clusters whose fusion results in the minimum increase in error sum of squares is then considered to be the new cluster (Everitt, 1980; Zupan, 1982).

Major characteristics of this method are that it favors spherical clusters (Cormack, 1971) and that the amalgamation rule (i.e. algorithm) does not depend upon covariance relations between variables (Edelbrock, 1979). The method is known to be sensitive to outliers (SAS Institute Inc, 1985). For this reason, examination should be exercised for identifying possible outliers both prior to and during the clustering. Elimination of outliers are recommended whenever possible (Everitt,

1980). The method has been found to be the most accurate among hierarchical methods in reproducing various mixture of simulated data with known distributions (e.g. Kuiper and Fisher, 1975; Blashfield, 1976; Edelbrock, 1979; Edelbrock and McLaughlin, 1980).

Reallocation Method

The disadvantage of using hierarchical clustering methods, like Ward method, is that they contain no mechanism for reallocating entities that may have been poorly classified at an early stage of clustering (Everitt, 1980). To cope with this problem, Punj and Stewart (1985) recommend the use of a reallocation method (i.e. an iterative partitioning method) in conjunction with the hierarchical clustering procedure. Iterative partitioning methods produce partitions of entities, but differ from the hierarchical techniques in that they admit reallocation of the entities at different iterations. They thus allow the possibility that a poor partition might be corrected at a later stage. The use of a reallocation method with Ward's method allows us to take advantages of the characteristics of both methods. The squared Euclidean distance criterion which is in essence equivalent to the error sum of squares criterion is used as a similarity measure in the reallocation process.

Two characteristics of iterative partitioning methods are that they require a prespecified number of clusters and a well defined initial cluster solution for a starting point. The use of Ward's method in the first stage of clustering solves both of these problems. Ward's method helps to select the number of clusters to retain and it provides a good starting point for the non-hierarchical clustering procedure. Conversely, the reallocation procedure helps to correct for possible poor

classifications at early fusions of Ward's method and possible sensitivity to outliers.

Criteria for Deciding the Number of Clusters

At each stage of clustering, decisions need to be made with respect to the number of clusters to retain. A statistical criterion was used to decide the number of clusters at the first stage (Ward's method), while two managerial criteria were employed in the second stage (the iterative partitioning method).

The error sum of squares statistic (sometimes called the coefficient of hierarchy) was used in evaluating solutions from Ward's method. In this method, the loss of information which results from the grouping of observations into clusters is measured by the total error sum of squares. At each step in the clustering process, the two clusters whose fusion results in the minimum increase in the error sum of squares are combined. The increase in the error sum of squares can be plotted against the number of clusters. A break point in the curve, which indicates a large increase in the error sum of squares, suggests that a cluster solution immediately preceding the corresponding jump in error sum of squares should be selected. In some cases, there may exist a number of such break points or in other cases no clear break point may be evident. Since the major purpose of using Ward's method is to identify candidate cluster solutions for cluster refinement, up to three possible solutions are retained from the first stage.

Two managerial criteria were used in choosing the final cluster solution at the second stage of clustering (the iterative partitioning method): interpretability and size of resulting clusters. Candidate

solutions should be evaluated in terms of what is known and/or expected with respect to the subject matter under investigation, and the solution that appears to make the best sense should be retained as a final solution. Some degree of subjectivity is unavoidable with this decision. For this reason, the interpretability of the resulting clusters was evaluated in cooperation with the Fisheries Division. The size of the clusters is also important, as discussed in the next section.

CRITERIA FOR EVALUATING SEGMENTS

The literature recommends four general criteria for evaluating market segmentations:

Identifiability: Segments must be recognizable and accessible.

This is usually measured by socioeconomics and media habits.

Substantiality: Segments must be substantial in size—there must be a sufficient number of people within each segment to make the subgroup worth treating separately.

Variation in Market Response: Segments must differ with respect to their needs/wants and market behavior so that distinct marketing programs can profitably be designed to serve them.

Exploitability: Distinguishing characteristics of the segments must lend themselves to cost-effective marketing appeals or offerings that will achieve the intended results.

The first three criteria lend themselves to statistical evaluation, and are therefore more objective. The exploitability criterion is more subjective, but is likely the most important one in determining whether or not a segmentation is used. The first three criteria are termed internal

evaluation criteria as they can be judged largely based upon statistical analyses of a particular sample. Exploitability is an external criterion as it requires evaluation of the segments with respect to the intended applications. Some segment differences may simply not be relevant to the problem at hand. Others may not be exploitable due to excessive costs or other management and environmental constraints. Other external evaluation criteria include the stability of segments over time and over different samples of the populations. Although testing for these stability criteria is beyond the scope of this study, it is important and should be considered in future research.

INTERNAL EVALUATION

Following the segment creation phase is the internal evaluation of the segmentation. Internal evaluation includes: (1) evaluation of the resulting clusters (segments) in terms of variables in segmentation base, (2) evaluation of variables other than those used for forming segments, and (3) segment profiling. Each of these tasks is briefly explained here.

Cluster Evaluation; Variables in Base

The purpose of using cluster analysis is to identify clusters (i.e. segments) homogeneous within and heterogeneous between groups. Once clusters are defined, it is necessary to evaluate them with respect to these statistical properties. In this study, clusters (segments) are defined on the basis of: fishing attributes sought and species-location variables. The clusters need to be evaluated for their within-group homogeneity and between-group heterogeneity on these variables.

The first step of this evaluation is to examine cluster centroids, using graphical presentations for visual inspection of the relative locations of each cluster in the multi-dimensional space. Clusters are then statistically evaluated in terms of their within homogeneity and between heterogeneity with the use of diagnostic statistics.

Two diagnostic statistics proposed by Wishart (1982) were used for cluster evaluation. They are defined as follows (assuming variables measured at an interval scale):

Let $X(J)$ = The overall mean for variable J ,

$S(J)$ = The overall standard deviation for variable J ,

$V(J)$ = The overall variance of variable J ($V(J) = S(J)^2$).

The equivalent statistics for the subset of cases which comprise a cluster C are denoted by

$X(C,J)$, $S(C,J)$, and $V(C,J)$.

The cluster diagnostic statistics are then defined as follows:

$F\text{-ratio} = V(C,J)/V(J)$

$T\text{-value} = (X(C,J) - X(J))/S(J)$

The expected values of the F and T statistics (assuming no segment differences) are 1.0 and 0.0, respectively. Small F -ratios indicate variables having comparatively low variation within the cluster relative to the overall variation. Large T -values indicate variables having cluster means that are substantially different from the population means. Good discriminatory variables will have low F -ratios and in most cases high T -values.

In addition to the T -values defined above, analysis of variance tests are used to further examine if cluster means differ from each other significantly. The difference-of-means tests are necessary for T -values

only provide information on how cluster means differ from the population mean, rather than information on differences between cluster means.

Segment Comparisons

Once segments are evaluated for their statistical properties on the variables in the segmentation base, the segments are compared on other variables which were not directly used for forming the segments. This serves to evaluate segments with respect to two of the three internal evaluation criteria: the segments' identifiability and variation in market response.

Identifiability is defined as the degree to which angler segments are recognizable and accessible so that marketing effort may be directed at and reach the target groups. This is assessed by the number and size of between-segment differences observed on: (1) socioeconomic characteristics—age, marital status, presence of children, race, family income, education, and occupation, and (2) media usage—usage of fishing information sources (e.g. angler opinion, DNR information, newspapers, magazines, bait-tackle shops, radio-TV).

Variation in Market Response is defined as the degree to which angler segments differ with respect to their fishing needs and behavior. These differences are necessary for developing distinct marketing programs designed to serve them. This is assessed by the number and type of between-segment differences observed on: (1) fishing participation characteristics—skill level, out-of-state fishing participation, boat-canoe ownership, second home ownership, most frequented fishing site, preferred fish species, fishing modes, and methods, and (2) fishing attribute and/or benefit sought ratings.

The remaining internal criterion substantiality is also evaluated in this phase. Unlike the other two criteria discussed above, the substantiality criterion does not lend itself to statistical tests. Substantiality is evaluated by simply reporting the relative size of each market segment in the study as estimated from the sample.

Segment Profiling

The last phase of the internal evaluation is to profile the segments by putting together all the information. Detailed profiles of segments help to more clearly identify the segments and are useful for developing specific marketing and management programs aimed at target groups. The statistical tests of differences between segments provide information needed for the profiling. Segments are profiled in terms of their: socioeconomic characteristics, media habits, fishing participation patterns, and behavioral predispositions (fishing attributes and benefits sought).

EXTERNAL EVALUATION

The final phase of the segmentation evaluation is the external evaluation. In addition to the three criteria used in the internal evaluation, the literature recommends an exploitability criterion for assessing segments' applicability. That is, segments must have distinguishing characteristics which lend themselves to cost-effective marketing programs for intended applications.

Exploitability is defined as the degree to which segments assist fisheries management in making key management decisions. This is assessed

by the degree of utility that management assigns to the segmentation approach when making decisions regarding: (1) fish populations (size/type/location), (2) regulations (catch & release/tackle), (3) promotion and development of support-amenity facilities (bait/tackle shops), (4) access programs (boat launching/shore access), and (5) information dissemination/angler education/promotion.

Unlike the other three segmentation criteria which are evaluated largely through statistical analyses on a particular sample, the exploitability criterion requires more subjective evaluation, preferably in part by those who will use the segmentation results. This criterion is likely the most important one in determining whether or not the segmentation is used and useful.

The evaluation of segments' exploitability took place at a two-and-a-half day long workshop on segmentation of Michigan's sport fishing market, sponsored by the Fisheries Division, Michigan Department of Natural Resources. Participants included managers from the Fisheries Division, and representatives from Michigan Waterways Division, Wildlife Division, State Park Division, and the Michigan Travel Bureau. The workshop included: explanation of the (1) conceptual basis of market segmentation, (2) general survey findings, and (3) results from the two segmentations (i.e. the attribute and species-location segmentations).

A short evaluation form was distributed to fisheries managers after the presentation. Managers were asked to evaluate the degree of utility they would assign to each segmentation approach when making decisions with respect to:

- a. fish populations,
- b. regulations,

- c. promotion of support-amenity facilities development,
- d. access programs, and
- e. information dissemination/angler education/promotion.

Six managers rated each segmentation approach for each category of decisions on a 5 point scale varying from "very useful" to "not useful" (The evaluation instrument is included in Appendix C.)

Responses obtained from the managers were tabulated for each category of decision to assess the degree of a segmentation's utility in making a particular management decision. The responses were also tabulated across the five types of decisions to assess the overall utility of a segmentation, assuming that the five decisions are of equal importance.

COMPARISON OF ALTERNATIVE SEGMENTATIONS

After thoroughly evaluating each segmentation by itself, the two sets of analyses were compared to evaluate their relative performance, advantages and disadvantages. The focus of the comparison is to evaluate the relative usefulness of alternative segmentation approaches. Information furnished from this comparison serves to determine which segmentation offers desirable results to the management of the sport fishing market.

To assure the comparability of the results, two segmentation approaches—the attribute segmentation and species-location segmentation—are performed on the same random sample of 281 anglers. Due to elimination of four observations due to their extreme values, the sample size was reduced from 281 to 277 for the species-location segmentation during the analysis. However, this does not appear to be a serious

problem for the comparability of the results from the two approaches.

The four evaluation criteria defined above are used as a basis for comparison. The attribute segmentation and species-location segmentation are directly compared with respect to their performance on identifiability, substantiality, variation in market response, and exploitability.

COMPUTER PROGRAMS

All the statistical analyses were performed with the use of statistical packages on the CDC Cyber 750 mainframe computer at Michigan State University. Two major computer programs were used for the analyses: (1) the Statistical Package for the Social Sciences (Nie, Hull, et al, 1975) and (2) CLUSTAN (Version 2 Release 1) cluster analysis package (Wishart, 1982).

CLUSTAN was used because of the availability of both hierarchical and non-hierarchical clustering procedures, and its compatibility with SPSS in data transfer. Procedure HIERARCHY with Option 6 was used for executing Ward's minimum variance method and procedure RELOCATE was used for performing the iterative partitioning method.

The Statistical Package for the Social Sciences (SPSS) was chosen for general statistical analysis purposes due to its comprehensiveness and availability. Factor analysis, statistical testing for between-segment differences, and data modifications and transformations were carried out with SPSS.

STATISTICAL TESTING PROCEDURES

Statistical procedures used for testing between-segment differences included analysis of variance (ANOVA) and the Chi-square test of independence. One-way fixed model of analysis of variance was used for testing between-segment differences on continuous variables, while Chi-square tests were used for testing differences on categorical variables. A .05 level of statistical significance was used throughout the study. With a relatively small sample size for most tests ($N=281$ and $N=277$ for the attribute segmentation and the species-location segmentation, respectively) and comparison of 8 subgroups (i.e. market segments), the .05 level of statistical significance yields statistical differences that are usually meaningful in practical terms. Confirmed statistically significant differences at the .05 level are denoted by an asterisk (*) throughout this dissertation.

CHAPTER IV

POPULATION CHARACTERISTICS

In this chapter, the overall profiles of Michigan licensed anglers are presented. This provides an aggregate picture of Michigan's sport fishing market and some indication of its diversity. Information presented in this chapter is based on all 1152 anglers who were surveyed. The anglers are profiled in five parts: (1) the socioeconomic and demographic characteristics, (2) general fishing participation patterns, (3) usage level of fishing information sources, (4) the anglers' fishing activities, and (5) fishing benefits sought.

SOCIOECONOMIC CHARACTERISTICS OF ANGLERS

Michigan licensed anglers are predominantly male (95 percent) and white (88 percent), averaging 44.4 years of age. Seventy-six percent of the anglers are married and 35 percent have at least one child under 17 of age. Approximately one-half (45.9 percent) have completed high school. Sixty-two percent have family income of less than \$30,000 (Table 3). The majority (94.8 percent) are Michigan residents. The out-of-state residents are predominantly from Michigan's adjacent states including Indiana, Illinois, Ohio, and Wisconsin.

Table 3. Racial Background, Education, and Family Income

	Count	Percent*	Cumulative Percent*
RACE			
White	969	87.8	87.8
Black	29	2.6	90.4
Native American	2	.2	90.6
Hispanic	5	.5	91.0
Oriental	1	.1	91.1
Other	98	8.9	100.0
Incomplete Data	48		
EDUCATION			
Grade School	64	5.9	5.9
Some High School	130	11.9	17.7
High School	398	36.4	54.1
Some College	311	28.4	82.5
College Degree	134	12.2	94.8
Some Grad/Med/Law School	5	.5	95.2
Advanced Degree	52	4.8	100.0
Incomplete Data	58		
FAMILY INCOME			
Under \$10,000	134	12.9	12.9
\$10,000 to \$14,999	123	11.9	24.8
\$15,000 to \$19,999	120	11.6	36.4
\$20,000 to \$24,999	132	12.7	49.1
\$25,000 to \$29,999	132	12.7	61.8
\$30,000 to \$34,999	89	8.6	70.4
\$35,000 to \$39,999	96	9.3	79.7
\$40,000 to \$44,999	66	6.4	86.0
\$45,000 to \$49,999	50	4.8	90.8
\$50,000 and Over	95	9.2	100.0
Incomplete Data	115		
Total	1152		

*Percentage is based only on valid cases.

The majority (67 percent) of the anglers are employed on either full-time or part-time basis. A relatively large proportion (24.7 percent) are retired, while students represent only 2.3 percent of the anglers. Of those employed, over one half (53.3 percent) are blue collar workers (Table 4).

There are noticeable differences between the age distribution of the Michigan anglers and that of the general population (17 years of age or older) in Michigan (Figure 2). The distribution of the general population is based on the 1980 Census data. Individuals in the 17-24 year age group appeared in the survey sample at a much lower proportion (11.3 percent) than in the angler population (21.5 percent). On the other hand, individuals appeared in the sample at higher proportion for the remaining age groups except for the group of 45 to 54 years of age.

GENERAL FISHING PARTICIPATION PATTERNS

General fishing participation patterns are summarized in nine categories: (1) license types purchased, (2) years of involvement in fishing, (3) fishing skill levels (self-rated), (4) out-of-state fishing participation, (5) boat or canoe ownership, (6) favorite species, (7) favorite fishing modes, (8) favorite fishing methods, and (9) the most frequented fishing sites.

The majority of Michigan anglers (77 percent) are 'resident' license holders and over half (55.5 percent) have 30 or more years of fishing experience. The average length of fishing involvement among the anglers is 32 years with a median of 30. Most anglers (90.2 percent) are either 'experienced' or 'somewhat experienced' based upon a self-evaluation (Table 5). Approximately 30 percent of the anglers have participated in

Table 4. Work Status and Occupation of the Respondents

Employed	758 (66.9)*		
		Professional	111 (15.8)
		Administrator	52 (7.4)
		Sales	55 (7.8)
		Clerical	18 (2.6)
		Craftsman	188 (26.8)
		Operatives	34 (4.8)
		Labourers	79 (11.3)
		Service Workers	73 (10.4)
		Others	92 (13.1)
		Total (for Employed)	758 (100.0)
Unemployed	64 (5.6)*		
Retired	284 (24.7)*		
Student	27 (2.3)*		
Incomplete Data	19		
Total	1152		

*Numbers in the parentheses indicate percentages based on the number of valid cases (1133).

Figure 2. Comparison of Age Distributions

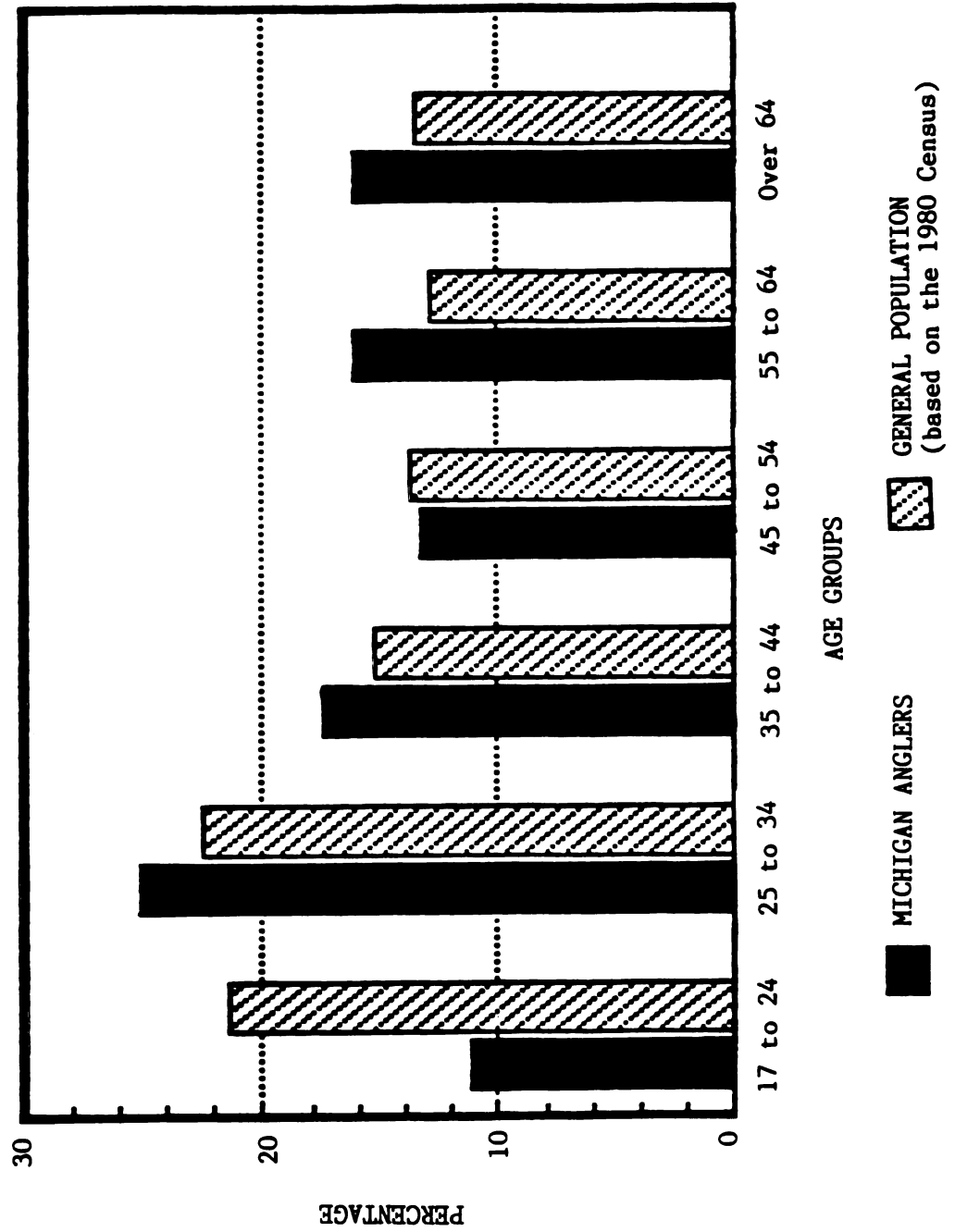


Table 5. Types of License, Length of Fishing Involvement,
and Self-Reported Fishing Skill Level

	Count	Percent*	Cumulative Percent*
LICENSE TYPE			
Resident	883	76.6	76.6
Non-Resident	24	2.1	78.7
Non-Resident & Wife	34	3.0	81.7
Sportsman	21	1.8	83.5
Senior	190	16.5	100.0
FISHING INVOLVEMENT			
Less than 10 years	85	7.7	7.7
10 to 19 years	167	15.1	22.8
20 to 29 years	240	21.7	44.5
30 to 39 years	215	19.4	63.9
40 to 49 years	154	13.9	77.8
50 to 59 years	151	13.7	77.8
60 years and more	94	8.5	100.0
Incomplete Data	46		
SKILL LEVEL			
Beginner	63	5.6	5.6
Somewhat Experienced	458	40.6	46.1
Experienced	560	49.6	95.7
Expert	48	4.3	100.0
Incomplete Data	23		
Total	1152		

*Percentage is based only on valid cases.

fishing outside the state of Michigan. Over half (58.4 percent) own a boat and/or canoe that is used for fishing.

Two coolwater species, walleye and bass, are the most popular catch species among Michigan anglers. Each of these species accounts for approximately 20 percent of the responses (Table 6). These are followed in popularity by yellow perch (11.0 percent), chinook salmon (10.5 percent), and pike or musky (9.9 percent). The trout group (including brook trout, steelhead, trout, brown trout, and lake trout) when combined accounts for nearly 20 percent of all responses, but individually no single trout specie was cited by more than 6.1 percent.

Boat fishing is by far the most popular mode of fishing. Seventy percent of the anglers report that they prefer fishing from their own or rented boats to any other fishing modes (Table 6). Those preferring fishing from shore or wading account for 20 percent of the anglers. Ice fishing, pier or dock fishing, and charter boat fishing are relatively less popular fishing modes.

Bait fishing is the most preferred fishing method. Thirty-four percent of the anglers prefer bait fishing to other methods (Table 6). The next most preferred methods are trolling and spin/spincasting, each accounting for 21 and 20 percent of the responses, respectively. Following the above methods are casting (14.9 percent) and fly fishing (7.3 percent).

A large proportion (42 percent) of the anglers report that their fishing takes place mostly on inland lakes (Table 6). Thirty-seven percent report that most of their fishing occurs on and around the Great Lakes, and 21 percent report stream/rivers where most of their fishing takes place.

Table 6. Preferred Catch Specie, Fishing Modes, Methods,
and the Most Frequented Fishing Sites

	Count	Percent*	Cumulative Percent*
PREFERRED CATCH SPECIE			
Walleye	217	19.8	19.8
Bass	216	19.7	39.5
Yellow Perch	121	11.0	50.5
Chinook Salmon	115	10.5	61.0
Panfish	109	9.9	70.9
Pike or Musky	68	6.2	77.1
Brook Trout	67	6.1	83.2
Steelhead	63	5.7	88.9
Trout	37	3.4	92.3
Brown Trout	28	2.6	94.9
Lake Trout	19	1.7	96.6
Catfish or Bullhead	15	1.4	98.0
Coho Salmon	14	1.3	99.3
Smelt	6	.5	99.8
Suckers or Carp	0	0.0	99.8
Others	3	.2	100.0
Incomplete Data	54		
PREFERRED MODE			
Private Boat	701	70.1	70.1
Shore or Wading	202	20.2	90.3
Ice Fishing	50	5.0	95.3
Pier or Dock	44	4.4	99.7
Charter Boat	4	.4	100.1
Incomplete Data	151		
PREFERRED METHOD			
Bait Fishing	367	34.3	34.3
Trolling	228	21.3	55.6
Spin or Spincasting	216	20.2	75.8
Casting	159	14.9	90.7
Fly Fishing	78	7.3	98.0
Spearing	10	.9	98.9
Snagging	6	.6	99.5
Dipping	5	.5	100.0
Incomplete Data	83		
MOST FREQUENTED SITE			
Inland Lakes	445	42.0	42.0
Great Lakes	392	37.0	79.0
Streams or Rivers	222	21.0	100.0
Incomplete Data	93		
Total	1152		

*Percentage is based only on valid cases.

FISHING INFORMATION SOURCES

Anglers were asked how often they made use of particular sources of information when selecting where to fish. Six possible information sources were presented to the respondents: (1) comments and opinions of other anglers, (2) information provided by the Michigan Dept. of Natural Resources (DNR), (3) newspaper articles, (4) magazine articles, (5) bait and tackle shops, and (6) radio or TV. For each information source anglers reported whether they used that information source often, occasionally, or never.

The most frequently used information source is other anglers (Table 7). Nine out of ten (93 percent) anglers use the comments or opinions of other anglers either often (40 percent) or occasionally (53 percent). The second most popular information source is through bait and tackle shops. About three-quarters (77 percent) of the anglers used information from bait and tackle shops. The Michigan DNR (67 percent) and newspaper articles (61 percent) are the third and fourth most popular information sources, respectively. Magazine articles and radio or TV are less frequently used. Approximately half of the respondents consult magazine articles (51 percent) and radio or TV (48 percent).

THE 1981-1983 FISHING ACTIVITIES

Information was collected on the angler's fishing activities during the two years before the survey. The respondents were asked to report what fish species they had fished for, and the type(s) of location(s), mode(s), and method(s), for each species they had fished.

Table 7. Use of Fishing Information Sources

Sources of Information	n*	Levels of Use			Total
		Often	Occasionally	Never	
		percent			
Comments and opinions of other anglers	1093	40.0	53.2	6.9	100.0
Bait and tackle shops	1066	25.0	51.7	23.4	100.0
Information provided by the DNR	1069	13.9	53.6	32.5	100.0
Newspaper articles	1062	13.3	48.0	38.7	100.0
Magazine articles	1051	9.5	41.4	49.1	100.0
Radio or TV	1058	7.8	39.9	52.4	100.0

*Number of valid cases for each item.

To solicit the above information, a response table with species on the row, and fishing locations, modes, and methods on the columns were presented to the respondents on the survey questionnaire (see Question 9 on the survey instrument in Appendix A). The respondents were asked to check any applicable cells in the table. A summary of responses is displayed in Tables 8 and 9. Greater details on this information will be presented in a forthcoming report from the Fisheries Division, Michigan Department of Natural Resources.

Species Fished

Five coolwater species were fished most heavily. These species were bass, yellow perch, panfish, walleye, and pike. Over 60 percent of the anglers fished bass (65.0 percent), yellow perch (64.7 percent), and panfish (63.6 percent). Approximately half fished for walleye (50.3 percent) and pike (46.1 percent). Salmon were the second most heavily fished species. Chinook and coho salmon were fished by one-third of the anglers. Those who fished for trout (i.e. brown, steelhead, lake, rainbow, and brook trout) accounted for 24 to 30 percent of the anglers. Approximately one quarter of the respondents fished for smelt and catfish.

Locations, Modes, and Methods of Fishing

Along with the percentage of angler respondents who fished for each species, Tables 8 and 9 show for each specie the percentage of the location(s) where the angler fished; mode(s) of fishing used; and methods(s) of fishing used. Since the tables are fairly complicated, it will be helpful to explain the tables with an example. We will use bass, which appears on line 3. According to the tables, 65 percent of the

Table 8. Summary of the 1981-1982 Fishing Activities -- Part 1 --
(Species/Locations/Modes)

Species	count (N*)	Fishing Locations				Fishing Modes				
		Inland Lakes	Great Lakes	Stream/River	Shore Wading	Pier/Dock	Private Boat	Charter Boat	Ice Fishing	
		percent	percent	percent	percent	percent	percent	percent	percent	
Yellow Perch	745 (64.7)	64.4	55.4	10.6	20.3	28.6	78.7	2.9	43.1	
Panfish	733 (63.6)	91.1	10.9	13.5	32.9	21.0	80.9	--	36.4	
Bass	749 (65.0)	85.3	15.6	23.8	35.6	16.4	84.2	.8	4.4	
Walleye/Sauger	579 (50.3)	54.7	44.2	30.4	19.2	11.4	86.5	3.5	14.2	
Pike/Musky	531 (46.1)	82.3	19.8	21.7	22.2	8.9	83.2	1.1	26.6	
Lake Trout	325 (28.2)	19.4	80.0	12.3	13.5	15.0	78.2	9.5	7.4	
Steelhead	322 (28.8)	8.4	64.5	58.1	52.2	23.3	58.1	8.4	1.6	
Rainbow Trout	291 (25.3)	28.2	21.3	73.9	70.1	12.0	40.9	2.1	4.8	
Brown Trout	345 (29.9)	12.8	45.8	62.0	62.0	17.4	43.8	3.2	3.8	
Brook Trout	272 (23.6)	12.9	8.8	90.8	87.5	3.3	17.6	--	.7	
Chinoo Salmon	383 (33.2)	4.2	80.9	33.2	31.1	25.6	69.7	13.8	.3	
Coh Salmon	368 (31.9)	4.1	79.3	33.2	28.5	23.6	68.5	13.9	1.1	
Catfish	280 (24.5)	59.3	22.5	41.4	48.2	26.8	56.1	--	2.1	
Carp	202 (17.5)	27.7	10.4	74.3	75.2	17.8	19.8	--	3.5	
Smelt	284 (24.7)	7.4	53.5	45.8	77.1	13.0	4.9	--	--	

*Percentage in parentheses is based on the total sample (N=1152).

Note: Percentage appearing for locations and modes is based on the number of respondents who fished that particular species, not the total sample.

Table 9. Summary of the 1981-1983 Fishing Activities -- Part 2 --
(Species/Fishing Methods)

Species	count (%)	Fishing Methods						
		Cast- ing	Spin/ Spincst	Bait Fishing	Troll- ing	Fly Fishing	Spear- ing	Snagg- ing
Yellow Perch	745(64.7)	16.4	22.3	85.2	6.9	2.1	--	--
Panfish	733(63.6)	20.9	32.7	80.6	5.9	19.4	--	--
Bass	749(65.0)	48.5	51.8	55.1	26.8	10.8	--	--
Walleye/Sauger	579(50.3)	26.3	32.8	56.1	65.1	.7	--	--
Pike/Musky	531(46.1)	39.5	38.4	51.0	55.2	1.3	--	--
Lake Trout	325(28.2)	16.3	17.5	22.8	76.3	2.5	--	--
Steelhead	322(28.8)	28.3	38.5	41.3	51.9	13.9	--	.3
Rainbow Trout	291(25.3)	24.4	39.2	52.9	27.8	31.9	--	--
Brown Trout	345(29.9)	20.6	32.8	48.1	36.8	25.8	--	--
Brook Trout	272(23.6)	22.4	31.9	62.9	6.9	37.5	--	--
Chinook Salmon	383(33.2)	20.9	25.3	19.3	73.1	3.9	--	11.1
Coho Salmon	368(31.9)	21.7	25.3	19.6	69.8	2.9	--	10.3
Catfish	280(24.5)	15.0	13.9	78.9	--	--	--	--
Carp	202(17.5)	14.9	11.9	65.8	--	--	21.3	12.4
Smelt	284(24.7)	--	--	--	--	--	--	90.8

*Percentage in parentheses is based on the total sample (N=1152).

Note: Percentage appearing for methods is based on the number of respondents who fished that particular species, not the total sample.

respondents (749 out of 1152) fished for bass. Inland lakes are the predominant location for fishing bass. Of those who fished for bass, 91.1 percent fished the specie on inland lakes, 13.5 percent on streams or rivers, and 10.9 percent on the Great Lakes. (The percentages do not add up to 100.0 because anglers could report more than one fishing location.) Similarly, boat fishing (not including charter boats) is the predominant mode of fishing among those who fished for bass. Eighty-four percent of bass fishermen fished the specie from private or rental boat(s), while 35.6 percent fished from shore. Finally, three fishing methods were popular for bass fishing: bait fishing (55.1 percent), spin or spincasting (51.8 percent), and casting (48.5 percent).

Similar interpretations can be made for other fish species listed on the tables. Interested readers are encouraged to do so. The species-location segments (discussed in detail in Chapter VI) are derived from information in Table 8.

IMPORTANCE OF FISHING BENEFITS SOUGHT

Michigan anglers were asked about the benefits they seek from their fishing experiences (i.e. reasons why they fish). The anglers rated each of twelve benefits from fishing experiences on a scale: crucial - very important - important - somewhat important - not important. The average and median importance rating of each benefit sought is presented in Table 10.

According to the average ratings, the most important benefits are: (1) relaxation, (2) to enjoy nature, (3) the challenge and excitement, and

(4) to get away. Scores for these benefits averaged 2.7, 2.7, 2.4, and 2.4, respectively. To catch fish to eat was the fifth most important reason for fishing with an average score of 1.8. Fishing benefits related to social affiliation such as companionship and family togetherness rank 6th and 7th, respectively. Anglers are least concerned with exercise as a benefit from fishing, with the lowest score of 1.1.

Table 10. Importance Ratings on Benefits Sought

Benefits Sought (Keyword)	n*	Mean**	Median
Relaxation	1101	2.7	2.8
Nature	1093	2.7	2.8
Excitement	1080	2.4	2.4
Get Away	1076	2.2	2.4
Companionship	1071	1.7	1.8
Eat	1102	1.8	1.8
Family	1069	1.6	1.7
Achievement	1072	1.4	1.4
Skill	1072	1.4	1.4
Alone	1071	1.2	.9
Exercise	1073	1.1	.7
Trophy	1070	1.1	.6

*Number of valid cases for each item.

**Scale of responses: 0 Not important

1 Somewhat important

2 Important

3 Very important

4 Crucial

CHAPTER V

THE ATTRIBUTE SOUGHT SEGMENTATION

This chapter presents the results of the attribute sought segmentation analysis which was performed on a sample (N=281) of Michigan sport fishermen. Presentation of the attribute segmentation will be divided into five parts: (1) importance of attribute sought, (2) attributes sought factors, (3) forming attribute sought segments, (4) testing for segment differences, and (5) profiles of segments.

IMPORTANCE OF FISHING ATTRIBUTES SOUGHT

The importance that Michigan anglers assign to specific fishing attributes when selecting where to fish was measured for each of 22 specific attributes on a scale: crucial - very important - important - somewhat important - not important. To facilitate statistical analysis, a numeric value of four (4) was assigned to 'crucial', three (3) to 'very important', two (2) to 'important', one (1) to 'somewhat important', zero (0) to 'not important', and an interval scale was assumed. The average importance scores, medians, and standard deviations are presented in Table 11.

The average importance scores show that anglers place the greatest importance on attributes related to environment and fish when selecting

Table 11. Importance Ratings on Attributes Sought

Attributes Sought (Keyword)	n*	Mean**	Median
Contaminant	1057	3.1	3.5
Favorite	1071	2.7	2.8
Water	1064	2.6	2.6
Keepable	1066	2.3	2.3
Size	1075	2.3	2.3
Crowding	1018	2.1	2.2
Beauty	1064	2.2	2.2
Solitude	1050	2.1	2.1
All Fish	1054	2.1	2.1
Boat	1063	2.0	2.1
Diversity	1063	1.9	1.9
Competition	1034	1.9	1.9
Parking	1057	1.8	1.8
Distance	1066	1.8	1.8
Information	1060	1.8	1.8
Shore	1056	1.6	1.6
Chance	1058	1.5	1.4
Bait	1063	1.3	1.2
Marina	1041	1.2	.9
Motel	1057	1.0	.5
Cottage	1026	.9	.4
Restaurant	1054	.6	.2

*Number of valid cases for each item.

**Scale of responses: 0 Not important
 1 Somewhat important
 2 Important
 3 Very important
 4 Crucial

where to fish. Among the 22 attributes, the presence of contaminants in fish was the most important one. The average score for this attribute was 3.1 on a five point scale ranging from 0 to 4, with a median of 3.5. The presence of the angler's favorite fish species was the second most important attribute with the average score of 2.7. This was followed by water clarity (2.6), the catch rate of keepable fish (2.3), and the size of fish (2.3). Anglers as a whole were less concerned with amenity or support facilities. Marina facilities/services, nearness to overnight accommodations, second home/cottage/camp, were among the least important attributes, ranking 19th, 20th, 21st, and 22nd, respectively.

ATTRIBUTES SOUGHT FACTORS

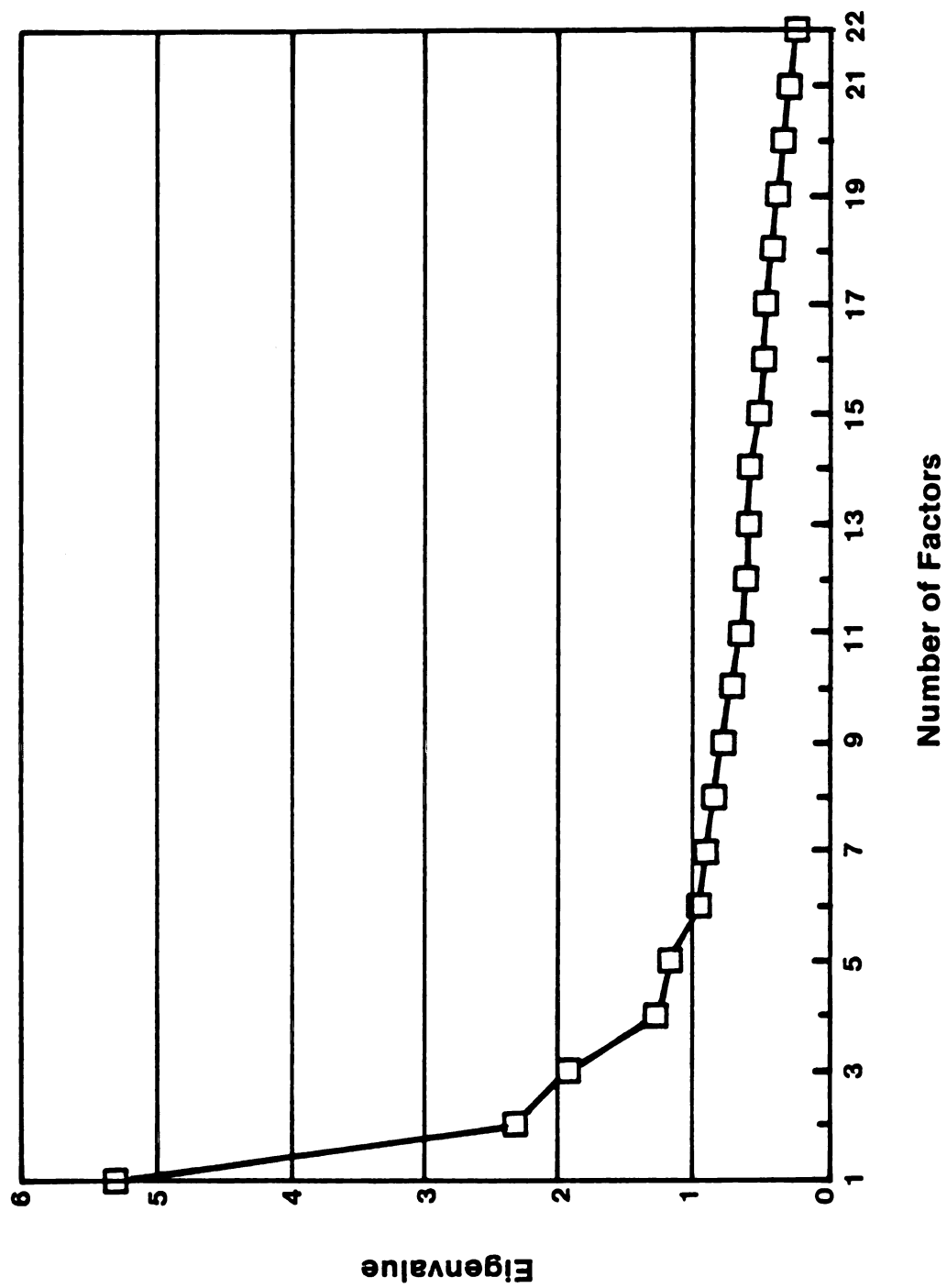
Since the 22 attribute variables were intercorrelated and too numerous to clearly define attribute segments, a principal axes factor analysis was performed on these scores in order to identify a smaller number of independent attribute dimensions. Table 12 summarizes basic statistical information (e.g. eigenvalues, percent of variance explained, and cumulative percent of variance explained) from the factor analysis before factor rotation. A scree test is graphically presented in Figure 3. Four criteria were used in deciding the number of factors to extract. These criteria included unit eigenvalue, a scree test, total variance explained, and interpretability.

After examining the factors in light of these criteria, it was decided to retain five factors for the final solution. The five factors accounted for 54.6 percent of the total variance of the original attribute

Table 12. Statistical Information from Initial Factoring on
Attributes Sought

Factor	Eigenvalue	Percent of Variance Explained	Cum. Percent of Variance Explained
1	5.30843	24.1	24.1
2	2.32446	10.6	34.7
3	1.94329	8.8	43.5
4	1.27197	5.8	49.3
5	1.16993	5.3	54.6
6	.96929	4.4	59.0
7	.90880	4.1	63.2
8	.85620	3.9	67.1
9	.78869	3.6	70.6
10	.73295	3.3	74.0
11	.66062	3.0	77.0
12	.62233	2.8	79.8
13	.60701	2.8	82.6
14	.59544	2.7	85.3
15	.52099	2.4	87.6
16	.49458	2.2	89.9
17	.47907	2.2	92.1
18	.43529	2.0	94.0
19	.39903	1.8	95.9
20	.34338	1.6	97.4
21	.31036	1.4	98.8
22	.25790	1.2	100.0

Figure 3. Scree Test for Attribute Factors



scores. The five factors were rotated by means of a Varimax orthogonal method. The final factor pattern matrix obtained after rotation is presented in Table 13, where the attribute sought items are ordered according to their factor loadings. A factor loading indicates the relationship that a variable has to a factor, and can be interpreted as a correlation coefficient between the variable and the factor. The greater the absolute value of a factor loading, the stronger the relationship between the variable and the factor. In this study, a high factor loading is defined as a loading at .35 or higher. High factor loadings are noted by parentheses in the table. A highlighted summary of the derived factors is presented in Table 14, where only variables with high loadings on the orthogonal factors are included.

Five Attribute Factors Derived

The first factor accounted for 24.1 percent of the original attribute variables. Five different fish related variables loaded on this factor; catch rate of keepable fish, catch rate of all fish, size of fish, presence of favorite fish species, and diversity of species which can be caught. Two other variables, information about the area and the chance to catch a trophy fish, also loaded on this factor but not at .35 or higher. Because of its close association with fish related variables, this factor has been named the 'fish' factor.

The second factor accounted for 10.6 percent of the original variance. Five attribute variables loaded on this factor: nearness of restaurants, nearness of overnight accommodations, nearness of bait and tackle shops, marina facilities and services, and information about the

Table 13. Attribute Sought Factor Pattern Matrix After Varimax Rotation

Variables	Varimax Rotated Factors				
	F1	F2	F3	F4	F5
Keep Fish	(.79)	.09	.04	.08	.08
All Fish	(.73)	.11	.03	.08	.07
Fish Size	(.73)	.08	.14	.03	.02
Favorite Fish	(.60)	.04	.20	.11	.08
Diversity	(.52)	.27	.15	.13	.04
Restaurant	.09	(.69)	.01	.17	.00
Motel	.00	(.55)	.12	.25	.04
Bait	.19	(.54)	.09	.21	-.06
Marina	.13	(.50)	.07	.44	-.08
Information	.34	(.38)	.19	.18	-.05
Natural Beauty	.04	.18	(.74)	-.03	.10
Water Clarity	.19	.08	(.64)	.10	.11
Solitude	.07	.09	(.61)	-.08	.36
Contamination	.23	-.00	(.39)	.11	.07
Parking	.15	.23	.06	(.82)	.03
Boat Facilities	.15	.20	.06	(.68)	.08
Competition	.09	.02	.17	.02	(.69)
Crowding	.07	-.00	.22	.06	(.67)
Shore	.09	.19	.22	.15	.07
Distance	.30	.23	.07	.07	-.02
Second Home	.15	.33	.06	-.11	.09
Chance	.34	.27	.11	.03	.13

Note: Unfactored items (variables) include Shore, Distance, Second Home, and Chance. The five factors account for 54.6 percent of the total variance of original variables.

Table 14. Attribute Sought Factors After Varimax Rotation

Factors and Items	Factor Loadings	Cronbach's Alpha
<u>Factor 1: Fish</u>		.83
Catch rate of keepable fish	.79	
Catch rate of all fish	.73	
Size of fish	.73	
Presence of favorite fish (species)	.60	
Diversity of fish species which can be caught	.52	
<u>Factor 2: Support Facilities</u>		.74
Nearness of restaurants	.69	
Nearness of overnight accommodations, e.g., motels, campground	.55	
Nearness of bait and tackle shops	.54	
Marina facilities and services	.50	
Information about the area, e.g. catch rates, best fishing methods, hot spots	.38	
<u>Factor 3: Nature</u>		.73
Natural beauty of the area	.74	
Water clarity	.64	
Solitude	.61	
Presence of contamination in fish	.39	
<u>Factor 4: Boating</u>		.77
Availability of parking facilities	.82	
Boat launching facilities	.68	
<u>Factor 5: Crowding</u>		.67
Competition with other recreationists, e.g., canoes, sailboats	.69	
Angler crowding	.67	
Unfactored items		
Places to fish from shore		
Nearness to home (travel distance)		
Nearness to second home/cottage/camp		
The chance to catch a large or trophy fish		

area. Since the majority of those variables are related to amenity and/or support facilities, the factor has been labeled the 'support facilities' factor.

Four nature or environment related variables loaded on the third factor: natural beauty of the area, water clarity, solitude, and presence of contaminants in fish. It has been named the 'nature' factor. Approximately nine percent of the original variance was explained by this factor.

The fourth factor has been called the 'boating' factor. Three variables, availability of parking facilities, boat launching facilities, and marina facilities/services, loaded on this factor. The 'boating' factor accounted for 6 percent of variance of the original variables.

The fifth and last factor accounted for 5.3 percent of the variance. The factor has been named the 'crowding' factor, since the two variables which loaded on it were competition with other recreationists and angler crowding.

Reliability of Factors

The derived factor's reliability or internal consistency is contingent on the reliability of a factor's scale. Cronbach's alpha was used to assess the reliability of attribute sought factors. Cronbach's alpha is one of the most widely used reliability coefficients for continuous data (Nie et. al., 1981). Each of the five factors possessed a .67 or higher level of coefficient alpha, indicating that all the attribute sought factors were stable, with a reasonably high degree of unidimensionality (Table 14).

FORMING ATTRIBUTE SOUGHT SEGMENTS

Market segments as defined by product attributes sought are groups of anglers who are homogeneous with respect to the importance they attach to certain attributes when selecting where to fish. Cluster analysis was used to create a classification of anglers. Michigan anglers were empirically grouped according to the similarities on their attribute factor scores.

The attribute factor scores of a random sample of 281 anglers was used in the cluster analysis. It was necessary to reduce the number of anglers because of: (1) the limitation (on the number of cases to be clustered) of the clustering procedure, and (2) the high cost associated with hierarchical clustering procedures. The random sample also permitted checks on the validity of the clustering results.

A two-step clustering procedure was employed. First, Ward's minimum variance method was performed on the attribute sought factor scores. Having decided on the number of clusters to retain, a reallocation method was used to refine the preliminary cluster solution(s) from the Ward's method.

Three criteria were used in determining the number of clusters during the clustering process. These are (1) increase in coefficient of hierarchy (i.e. error sum of squares resulting from hierarchical fusions), (2) interpretability—primarily whether the market segments made sense, and (3) size of clusters—whether each segment is substantial in size for studying. The first criterion was primarily used in deciding the number(s) of clusters from the Ward's method, while the latter two managerial criteria were heavily used in deciding a final solution after the refinement through the reallocation method.

Preliminary Clustering: Ward's Method

In Figure 4, the increase in coefficient of hierarchy which resulted from fusion of anglers via Ward's method is plotted against the number of clusters beginning at the 25 cluster solution. A break point on the plot of the coefficient indicates a large loss of information resulting from hierarchical fusion at that point or level. Cluster solution(s) immediately preceeding a break point(s), therefore, generally constitutes candidate solution(s) for a final cluster solution.

Based upon the coefficient of hierarchy criterion, three cluster solutions were retained from Ward's method: the 10 cluster solution, 8 cluster solution, and 7 cluster solution. These solutions were then subject to a reallocation procedure for cluster refinement.

Refining Clusters: Reallocation

An iterative partitioning method was performed on each of the three solutions from Ward's method. The refined solutions were then candidates for the final market segments. Selecting among the three refined solutions for the final attribute sought cluster solution was primarily based on managerial considerations. After examining each solution in terms of its interpretability and size criteria, the 8 cluster solution was selected. The reallocation process for this solution required a total number of 8 iterations. Reallocations during the process are descending in number from 47 at the first iteration to 2 at the eighth iteration. Clusters were stable at Iteration 9, and no further reallocations were made. The number of anglers in each attribute sought cluster and the relative sizes of the eight clusters are presented in Table 15.

Figure 4. Coefficient of Hierarchy by Number of Attribute Sought Clusters

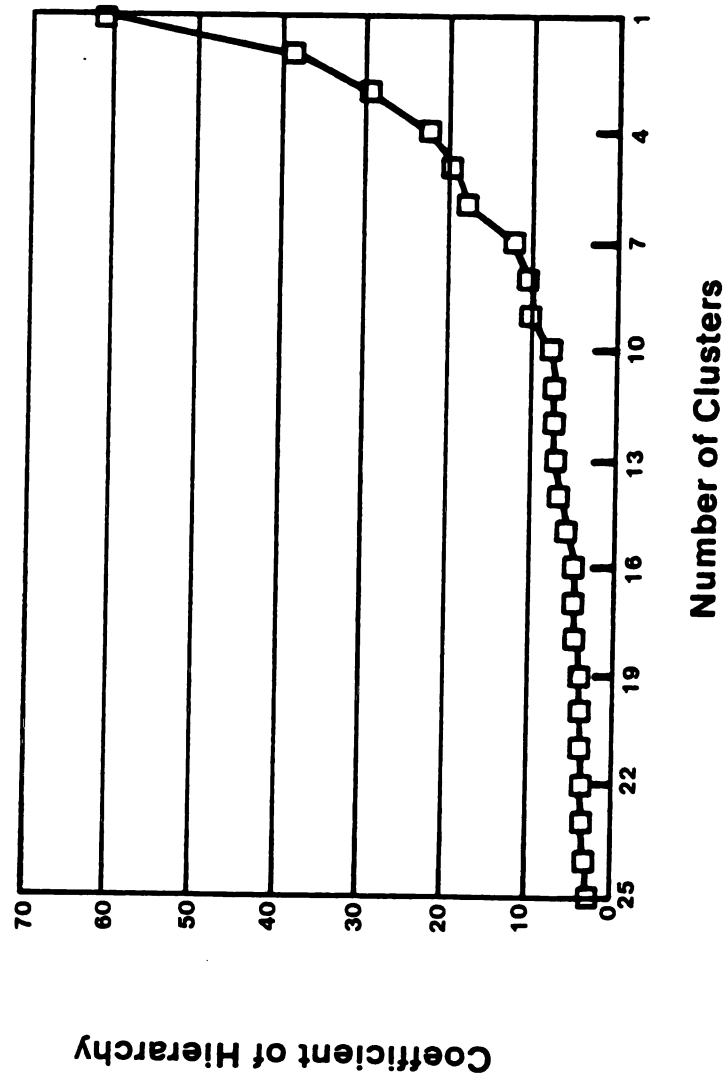


Figure 4. Coefficient of Hierarchy by Number of Attribute Sought Clusters

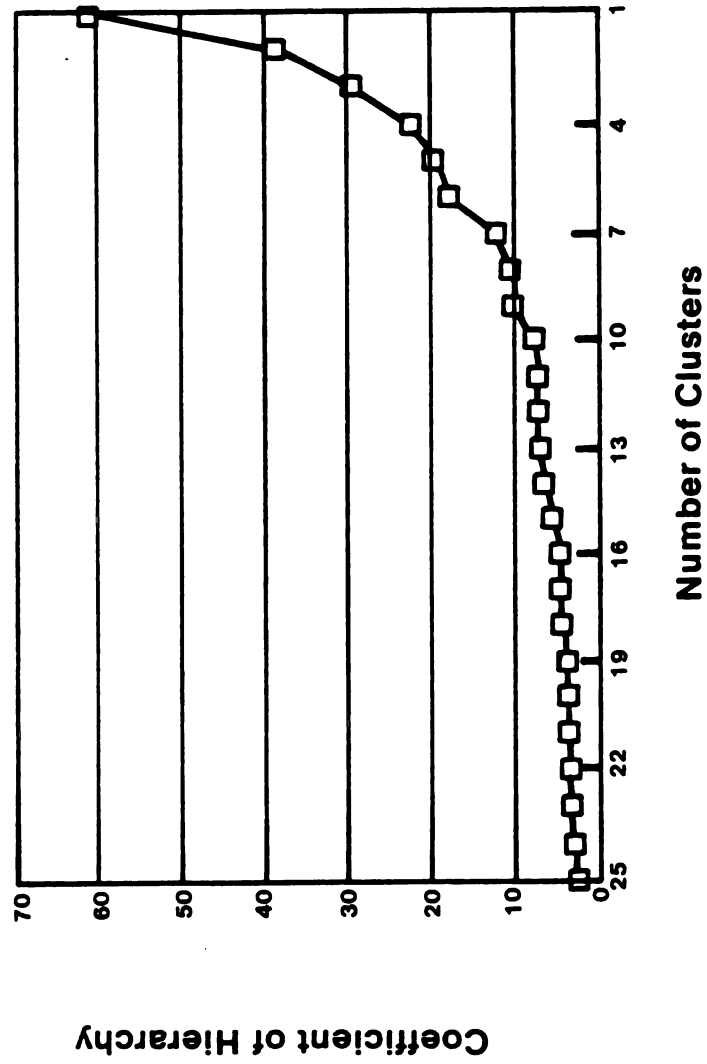


Table 15. Number of Respondents in Each of the Eight Attribute Sought Clusters*

Cluster	Number of Respondents	Relative Size (Percent)
1	47	16.7
2	39	13.9
3	34	12.1
4	23	8.2
5	21	7.5
6	40	14.2
7	38	13.5
8	39	13.9
Total	281	100.0

*Represents the final cluster solution obtained from reallocation at the eight cluster solution from Ward's minimum variance method.

Description of Clusters

Having decided on the final cluster solution, the next step was to describe each cluster or segment in terms of attribute factor scores on which the clustering was based. The clustering procedure provided basic statistical information on the derived classification. This included the information on cluster centroids (average factor scores for each cluster), within-cluster homogeneity (F-statistic), and between-clusters heterogeneity (T-statistic). This statistical information is presented in Table 16. Analyses of variance verified that the clusters significantly differed with respect to the mean factor scores (Table 17). Cluster centroids are graphically presented in Figure 5. An examination of the statistical information led to the following names and descriptions of each cluster. Percentages in parentheses indicate the relative size of cluster.

Cluster one (17%) is named the Crowding segment, because anglers comprising this segment place greater importance (than other anglers) on angler crowding and nature related site selection criteria. This is the largest segment.

Cluster two (14%) places importance on boating facilities, nature, and fish related factors, and therefore is named the Boating-Nature-Fish segment. The anglers in this segment are not too concerned with angler crowding and competition with other recreationists, and amenity-support facilities or services.

Cluster three (12%) is named the Fish segment. It consists of those anglers who place greater importance on fish related variables when selecting where to fish. They are relatively unconcerned with boating related factors.

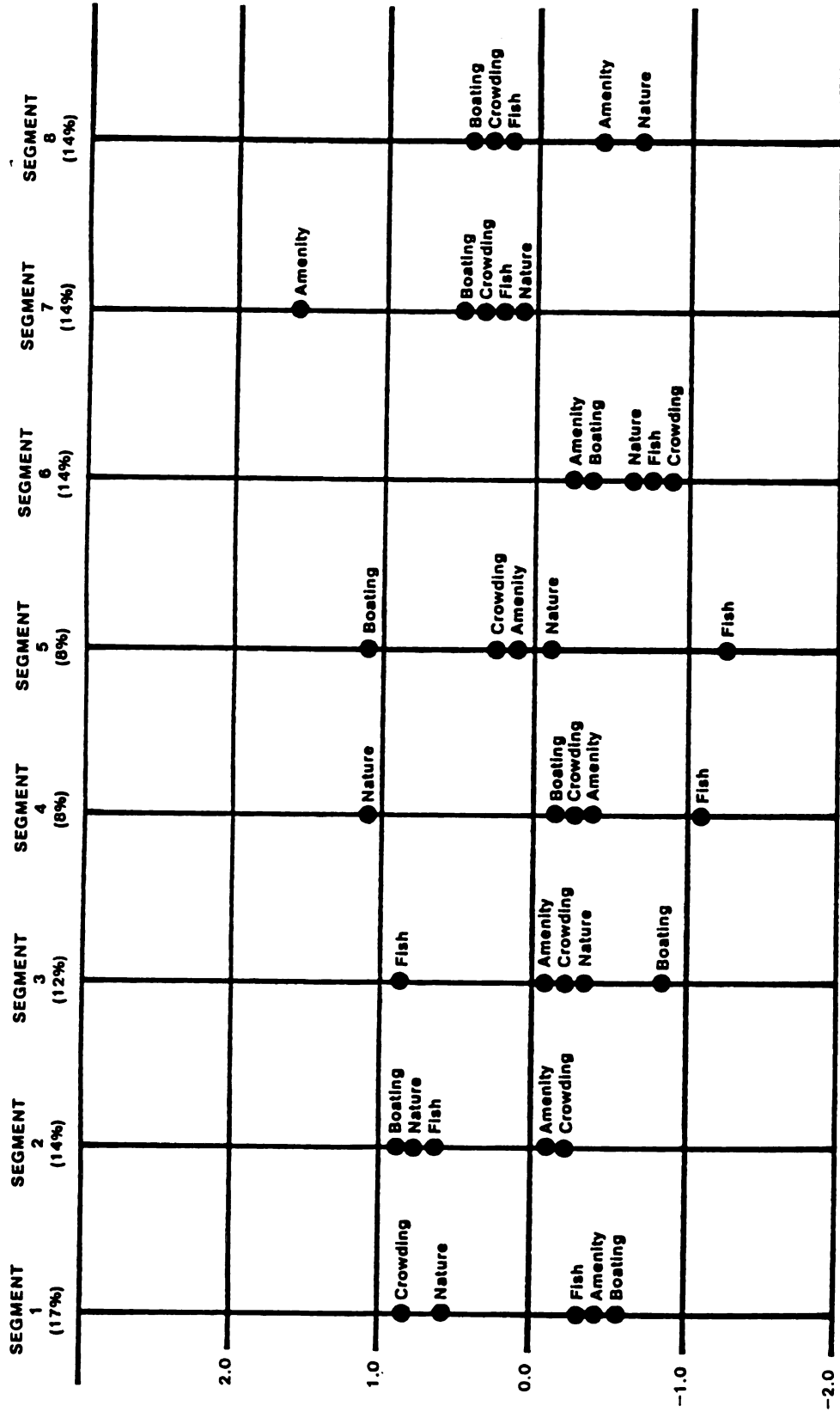
Table 17. Mean Attribute Sought Factor Scores by Attribute Sought Clusters

Attribute Sought Factors	clusters								Overall Mean** N=281	F-ratio
	1 (178)	2 (148)	3 (128)	4 (88)	5 (88)	6 (148)	7 (148)	8 (148)		
	----- mean factor scores -----									
Fish	-.287	.674	.863	-1.047	-1.289	-.762	.163	.153	-.097	48.972*
Support Facilities	-.373	.028	-.099	-.469	.168	-.207	1.579	-.464	.023	53.096*
Nature	.501	.702	-.217	1.047	-.191	-.718	.119	-.721	.040	43.220*
Boating	-.659	.892	-.914	-.219	1.099	-.416	.407	.444	.025	68.168*
Crowding	.809	-.242	-.171	-.325	.309	-.789	.221	.257	.031	26.696*

*Significant at .05 or higher level.

**Theoretically, overall mean factor scores are zero for factor scores are standardized. However, those presented on the table are not zero due to sampling (subsampling).

Figure 5. Attribute Sought Segments: Factor Centroids



Cluster four (8%) is the Nature segment. The anglers in this group are more concerned with nature related variables in their site selection. They are relatively less concerned with the other factors such as fish and amenity.

Cluster five (8%) is the smallest segment. They are more concerned with boating related variables including boat launching facilities and parking facilities than anglers in other segments. They, on the other hand, place less importance on fish related variables. It is called the Boating segment.

Cluster six (14%) Anglers in this segment are relatively indifferent, casual anglers. They are not concerned with any particular fishing attribute(s). When compared with those in other clusters, they place average or less importance on most of the fishing attributes sought. This cluster is named the Casual Angler segment.

Cluster seven (14%) is more concerned with amenity and support facilities than any of the other clusters. Boating related factors are also important for anglers in this segment. These anglers tend to place average importance on other fishing attributes. Because of its association with amenity and support facilities, this cluster is named the Amenity segment.

Cluster eight (14%) consists of anglers who are more concerned with boating facilities, angler crowding and competition, and to some extent fish related site selection criteria. Therefore it is named the Boating-Crowding segment. Nature and amenity related factors are less important to the anglers in this segment.

TESTING FOR SEGMENT DIFFERENCES

The step just presented identified 8 angler market segments. For these segments to act as true market segments, they need to exhibit differences that permit the organization's separate marketing efforts for each segment. That is, the segments are required to exhibit systematic between-group differences over various aspects, as well as within-group similarity. This section evaluates the between-group differences of the segments. The eight attribute sought segments are compared with respect to: (1) socioeconomic characteristics, (2) usage of fishing information sources, and (3) participation patterns and behavioral predispositions. These comparisons will serve to evaluate the identifiability and variation in market response of the attribute sought segments.

Socioeconomic Characteristics

In order to see if derived clusters (i.e. segments) exhibit different socioeconomic characteristics, differences between clusters were examined in terms of seven socioeconomic variables: (1) age, (2) marital status, (3) presence of children under 17 of age, (4) racial background, (5) family income, (6) education, and (7) occupational status. Table 18 summarizes the breakdowns of the socioeconomic characteristics by eight attribute sought segments. Chi-square tests of independence were used to test for statistically significant differences between segments for each of these characteristics. Although no statistically significant differences (at the .05 level) were found, some differences observed in the course of the analysis are worth noting here for they contribute to a more complete profile of the segments.

Table 18. Socioeconomic Characteristics by Attribute Sought Segments

	Crowding (17%)	Boating- Nature- Fish (14%)	Fish (12%)	Nature (8%)	Boating (8%)	Casual Angler (14%)	Amenity (14%)	Boating- Crowding (14%)	Anglers as a Whole N=281	Chi- Square Statistics
----- per cents -----										
Age										34.091 (NS)
17-24	11.6	16.7	14.7	9.5	9.5	5.1	16.7	8.1	11.6	
25-34	41.9	36.1	29.4	28.6	19.0	17.9	27.8	32.4	30.0	
35-44	11.6	19.4	26.5	38.1	23.8	28.2	19.4	29.7	23.6	
45-54	14.0	11.1	11.8	9.5	4.8	15.4	13.9	5.4	11.2	
55-64	11.6	11.1	8.8	9.5	38.1	15.4	11.1	10.8	13.5	
Over 64	9.3	5.6	8.8	4.8	4.8	17.9	11.1	13.5	10.1	
Marital Status										7.099 (NS)
Married	74.5	76.9	79.4	91.3	85.7	72.5	65.8	79.5	76.9	
Single	25.5	23.1	20.6	8.7	14.3	27.5	34.2	20.5	23.1	
Children under 17										5.344 (NS)
Yes	34.0	43.6	41.2	43.5	28.6	37.5	39.5	53.8	40.6	
No	66.0	56.4	58.8	56.5	71.4	62.5	60.5	46.2	59.4	
Race										8.055 (NS)
White	91.5	89.7	79.4	87.0	71.4	85.0	84.2	92.3	86.1	
Non-white	8.5	10.3	20.6	13.0	28.6	15.0	15.8	7.7	13.9	
Family Income (\$)										45.478 (NS)
Under 10,000	11.9	24.3	3.3	15.8	0.0	24.3	13.9	5.6	13.4	
10-19,999	19.0	13.5	30.0	21.1	29.4	24.3	38.9	13.9	23.2	
20-29,999	28.6	18.9	30.0	15.8	35.3	8.1	22.2	25.0	22.4	
30-39,999	9.5	24.3	26.7	26.3	17.6	18.9	13.9	22.2	19.3	
40-49,999	16.7	5.4	3.3	15.8	5.9	10.8	11.1	19.4	11.4	
50,000 & Over	14.3	13.5	6.7	5.3	11.8	13.5	0.0	13.9	10.2	
Education										23.170 (NS)
Grade School	0.0	5.3	6.5	10.0	9.5	7.9	2.8	2.6	4.9	
Some High School	11.4	10.5	6.5	5.0	9.5	5.3	22.2	7.9	10.2	
High School	34.1	42.1	35.5	45.0	28.6	44.7	33.3	28.9	36.5	
Some College	27.3	31.6	35.5	20.0	33.3	28.9	27.8	36.8	30.5	
College	18.2	7.9	12.9	15.0	14.3	10.5	11.1	18.4	13.5	
Beyond College	9.1	2.6	3.2	5.0	4.8	2.6	2.8	5.3	4.5	
Occupational Status										37.340 (NS)
White Collar	27.5	8.1	30.0	16.7	21.1	16.7	23.5	34.2	22.6	
Blue Collar	37.5	54.1	53.3	55.6	21.1	38.9	35.3	47.4	43.3	
Other	7.5	8.1	3.3	5.6	10.5	11.1	14.7	2.6	7.9	
Unemployed	5.0	16.2	0.0	0.0	5.3	8.3	8.3	0.0	4.0	
Retired	15.0	5.4	10.0	16.7	42.1	22.2	17.6	15.8	18.3	
Student	7.5	8.1	3.3	5.6	0.0	2.8	2.9	0.0	4.0	

The Casual Angler segment contains more elderly anglers than any other segments. Approximately half (48.7 percent) of the anglers in this segment are 45 years of age or older. On the other hand, the Boating-Nature-Fishing segment is the youngest angler segment with more than seventy percent (72.2 percent) of them being 44 years of age or younger.

More married anglers are found in the Nature segment than in any other segments. Over ninety percent (91.3 percent) of those in this segment are married. In contrast, more single (or unmarried) anglers are found in the Amenity segment.

More anglers in the Boating-Crowding segment belong to higher family income groups than those in any other segments. Sixty-five percent of those in this segment have family income of \$30,000 or higher, with 14 percent of them having \$50,000 and more. The Amenity segment, on the contrary, contains those in relatively lower family income groups. A relatively large portion (52.8 percent) of them belong to family income groups of less than \$20,000.

The Crowding segment contains more highly educated anglers. Approximately one third (27.3 percent) of this segment have completed college. The Boating segment contains more retired anglers than any other segment. The Boating-Nature-Fish segment contains more unemployed persons and more blue collar workers. The proportion of anglers who are white collar workers is greatest in the Boating-Crowding segment.

Fishing Information Sources

Significant between-segment differences were found in the use of four information sources: newspapers, magazine articles, bait/tackle shops,

and radio or TV (Table 19). Opinions of other anglers are the most popular source of information for all segments. More anglers in the Boating-Nature-Fish segment make use of the information provided by the Michigan Department of Natural Resources (80 percent) and newspapers (85 percent). Anglers in the Amenity segment made significantly more use of magazine articles than anglers of any other segments, with three-quarters of them consulting this information source. Bait/tackle shops are also popular source of information to the Amenity segment. Ninety percent of these anglers consult boat/tackle shops for fishing information. Finally, radio or TV is a more popular information source for those in the Boating-Nature-Fish segment, with two-third making use of the information source.

Participation Characteristics and Behavioral Predispositions

In order to see if derived angler segments exhibit different fishing behavior patterns, relationships between segment membership and fishing participation characteristics and behavioral predispositions were examined. Included as participation and behavior predisposition variables are (1) fishing skill level, (2) out-of-state fishing participation, (3) boat/canoe ownership, (4) second home ownership, (5) preferred catch species, (6) most frequented fishing sites, (7) preferred modes of fishing, (8) preferred methods of fishing, and (9) fishing benefits sought (Table 20).

(1) Fishing Skill: Anglers in the Boating and the Crowding segments are more experienced (via self-evaluation). Over 70 percent of those in the Boating segment rate themselves as experienced anglers. Approximately

Table 19. Use of Fishing Information Sources by Attribute Sought Segments

Info. Sources	Boating- Nature- Fish			Fish (12%)	Nature (8%)	Boating (8%)	Casual Angler (14%)	Amenity (14%)	Boating- Crowding (14%)	Anglers as a Whole N=281	Chi- Square Statistics
	Crowding (17%)	Fish (14%)	Nature- Fish (14%)								
----- percents -----											
Opinions of Anglers											16.773 (NS)
Often	29.8	51.3	35.3	39.1	33.3	25.0	52.6	43.6	38.8		
Occasionally	63.8	48.7	55.9	60.9	57.1	70.0	44.7	53.8	56.9		
Never	6.4	0.0	8.8	0.0	9.5	5.0	2.6	2.6	4.3		
DNR Information											12.199 (NS)
Often	6.4	15.4	5.9	13.0	14.3	10.0	21.1	10.3	11.7		
Occasionally	59.6	64.1	52.9	65.2	61.9	52.5	47.4	51.3	56.2		
Never	34.0	20.5	41.2	21.7	23.8	37.5	31.6	38.5	32.0		
Newspapers											28.739*
Often	2.1	15.4	5.9	13.0	14.3	2.5	13.2	15.8	9.6		
Occasionally	61.7	69.2	41.2	47.8	66.7	50.0	60.5	36.8	54.3		
Never	36.2	15.4	52.9	39.1	19.0	47.5	26.3	47.4	36.1		
Magazine Articles											28.113*
Often	8.5	7.7	2.9	8.7	19.9	0.0	7.9	10.5	7.5		
Occasionally	55.3	48.7	35.3	26.1	52.4	37.5	65.8	39.5	46.1		
Never	36.2	43.6	61.8	65.2	28.6	62.5	26.3	50.0	46.4		
Bait/Tackle Shops											24.705*
Often	25.5	25.6	23.5	8.7	23.8	15.0	47.4	18.4	24.3		
Occasionally	53.2	53.8	47.1	69.6	38.1	50.0	42.1	63.2	52.1		
Never	21.3	20.5	29.4	21.7	38.1	35.0	10.5	18.4	23.6		
Radio or TV											27.639*
Often	2.1	15.4	2.9	4.5	4.8	0.0	15.8	2.6	6.7		
Occasionally	34.0	51.3	38.2	31.8	57.1	42.5	47.4	43.6	42.9		
Never	63.8	33.3	58.8	63.6	38.1	57.5	36.8	53.8	51.1		

*Significant at .05 or higher level.

Table 20. Participation Characteristics by Attribute Sought Segments

	Boating- Nature- Fishing		Fish (12%)	Nature (8%)	Boating (8%)	Casual Angler (14%)	Amenity (14%)	Boating- Crowding (14%)	Anglers as a Whole N=281	Chi- Square Statistics
	Crowding (17%)	Nature- Fishing (14%)								
----- percents -----										
Fishing Skill Level										24.999 (NS)
Beginner	0.0	7.7	0.0	4.5	9.5	10.3	5.4	7.7	5.4	
Somewhat Exprncd	31.9	53.8	44.1	45.5	14.3	46.2	48.6	41.0	41.7	
Experienced	61.7	35.9	55.9	45.5	71.4	43.6	43.2	46.2	49.6	
Expert	6.4	2.6	0.0	4.5	4.8	0.0	2.7	5.1	3.2	
Out-of-State Fishing										9.517 (NS)
Yes	28.9	25.6	26.5	21.7	42.9	20.0	44.7	36.8	30.6	
No	71.1	74.4	73.5	78.3	57.1	80.0	55.3	63.2	69.4	
Boat/Canoe Ownership										7.187 (NS)
Yes	65.9	57.9	56.7	52.4	70.0	54.1	45.9	70.3	59.0	
No	34.1	42.1	43.3	47.6	30.0	45.9	54.1	29.7	41.0	
2nd Home Ownership										18.151*
Yes	46.8	16.2	52.9	22.7	47.6	26.3	32.4	42.1	36.1	
No	53.2	83.8	47.1	77.3	52.4	73.7	67.6	57.9	63.9	
Most Frequented Sites										42.302 (NS)
Inland lakes	32.6	21.1	48.5	40.0	30.0	43.6	41.2	48.7	38.3	
Great Lakes	23.9	68.4	33.3	20.0	50.0	30.8	44.1	46.2	39.8	
Streams/Rivers	43.5	10.5	18.2	40.0	20.0	25.6	14.7	5.1	21.9	
Preferred Catch Species										
Perch	12.8	17.9	5.9	8.7	4.8	5.0	13.2	15.4	11.0	
Panfish	6.4	2.6	5.9	4.3	4.8	17.5	10.5	17.9	9.3	
Bass	17.0	15.4	17.6	17.4	19.0	7.5	15.8	15.4	15.3	
Walleye	6.4	35.9	20.6	21.7	14.3	15.0	18.4	17.9	18.5	
Pike	6.4	7.7	5.9	4.3	4.8	5.0	5.3	10.3	6.4	
Lake Trout	2.1	7.7	0.0	0.0	4.8	0.0	0.0	2.6	2.1	
Steelhead	10.6	0.0	5.9	4.3	19.0	2.5	5.3	5.1	6.0	
Rainbow Trout	4.3	0.0	5.9	0.0	0.0	2.5	0.0	0.0	1.8	
Brown Trout	12.8	0.0	5.9	13.0	0.0	7.5	2.6	0.0	5.3	
Brook Trout	19.1	0.0	2.9	8.9	4.8	10.0	0.0	0.0	7.7	
Trout	2.1	0.0	2.9	8.7	0.0	5.0	7.9	0.0	3.2	
Chinook Salmon	0.0	10.3	14.7	4.3	14.3	17.5	15.8	5.1	10.0	
Coho Salmon	0.0	2.6	0.0	0.0	4.8	0.0	2.6	2.6	1.4	
Catfish	0.0	0.0	2.9	0.0	0.0	2.5	2.6	0.0	1.1	
Carp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Smelt	0.0	0.0	2.9	0.0	0.0	2.5	0.0	0.0	0.7	

(Table continued)

Table 20 (Cont'd.).

	Crowding (17%)	Boating- Nature- Fish (14%)	Fish (12%)	Nature (8%)	Boating (8%)	Casual Angler (14%)	Amenity (14%)	Boating- Crowding (14%)	Anglers as a Whole N=281	Chi- Square Statistics
----- percents -----										
Preferred Modes										46.824*
Shore/Wading	45.7	8.1	26.7	40.0	13.3	30.6	8.1	14.3	23.8	
Pier/Dock	4.3	5.4	6.7	0.0	6.7	11.1	5.4	2.9	5.5	
Private Boat	39.1	81.1	63.3	55.5	80.0	55.6	83.8	74.3	65.2	
Charter Boat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.4	
Ice Fishing	10.9	5.4	3.3	5.0	0.0	2.8	2.7	5.7	5.1	
Preferred Methods										53.292*
Casting	15.9	15.8	15.2	21.7	5.0	10.8	18.4	16.7	15.2	
Spin/Spincasting	25.0	21.1	27.3	30.4	20.0	16.2	21.1	22.2	22.7	
Bait	29.5	28.9	36.4	21.7	30.0	29.7	28.9	38.9	30.9	
Trolling	6.8	28.9	15.2	4.3	35.0	24.3	31.6	16.7	20.1	
Fly	22.7	0.0	6.1	17.4	10.0	13.5	0.0	5.6	9.3	
Spearing	0.0	5.3	0.0	4.3	0.0	2.7	0.0	0.0	1.5	
Dipping	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0	0.4	
Snagging	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

*Significant at .05 or higher level.

60 percent of those comprising the Crowding segment rated themselves as experienced anglers, with 6.4 percent claiming themselves as expert anglers. No beginners or expert anglers are found in the Fish segment. Compared with other segments, a greater proportion of anglers in the Casual Angler segment are beginners.

(2) Out-of-State Fishing Participation: More anglers in the Amenity, Boating, and Boating-Crowding segments have participated in fishing outside Michigan. Out-of-state fishing participation rates for these segments are 44.7, 42.9, and 36.8 respectively, while the average participation rate is approximately 30 percent for the sample as a whole.

(3) Boat/Canoe Ownership: The percentage of boat or canoe ownership is highest in the Boating and the Boating-Crowding segments. Seventy percent of anglers in these segments own boats or canoes used for fishing as compared with a population average of 59 percent.

(4) Second Home Ownership: Anglers in the Fish, Boating, and Crowding segments are more likely to own a second home or cottage near fishing sites. Over one half (52.9 percent) of anglers in the Fish segment, for example, own second homes near a lake or stream.

(5) Most Frequented Fishing Sites: A statistically significant relationship was found between segment membership and types of the most frequented fishing sites. More anglers in the Boating-Crowding and the Fish segments fished on inland lakes than those in other segments. Approximately half (48.7 percent) of anglers in these segments report that most of the time their fishing occurred on inland lakes. In contrast, anglers in the Boating-Nature-Fish segment fished more on the Great Lakes than those in any other segments. Approximately seventy percent (68.4

percent) of anglers in this segment fished most of the time on the Great Lakes. Finally, proportions of those who fished on streams or rivers are greater in the Crowding and the Nature segments, indicating that anglers in these two segments are more likely to fish on streams than anglers in any other segments.

(6) Preferred Catch Species: Brook trout and brown trout are more popular catch species for anglers in the Crowding segment. Walleye is more popular to those in the Boating-Nature-Fish segment and the Fish segment. The Fish segment also prefers fishing for bass and chinook salmon. Anglers in the Nature segment are more likely to prefer brown trout, walleye, and bass. Those in the Boating segment prefer fishing for steelhead, chinook salmon, and bass. Most coolwater species, especially panfish and pike, are preferred by anglers in the Boating-Crowding segment. Finally, a relatively large proportion of those in the Casual Angler segment prefer fishing for chinook salmon and panfish. A statistical test was not conducted for these differences because of the small sample size and a relatively large number of response categories.

(7) Preferred Modes of Fishing: Fishing from private boats is a popular fishing mode across the sample. As expected, this tendency is strongest for those segments seeking boating attributes. In contrast, fishing from shore or wading is more popular to those in the Crowding and the Nature segments. Forty percent or more of anglers in these segments report that they prefer fishing from shore or wading. Finally, ice fishing is more popular to those in the Crowding segment. A Chi-square test is significant at the .05 level.

(8) Preferred Methods of Fishing: Greater proportions of anglers in the Crowding and the Nature segments prefer fly fishing. Trolling is more popular to those in the Boating and the Amenity segments. Bait fishing is more preferred by anglers in the Boating-Crowding and the Fish segments. However, no statistically significant relationship was detected at the .05 level.

(9) Fishing Benefits Sought: For each segment Table 21 presents average importance scores that anglers place on 12 different fishing experience benefits (i.e. reasons for fishing). The eight attribute sought segments differ in the average importance scores assigned to ten benefit sought items. For example, to be alone is a more important reason for fishing for those in the Crowding segment, while catching fish to eat is a more influential factor for anglers in the Boating-Nature-Fish segment. As expected, to enjoy nature and to get away are more important reasons for fishing for anglers in the Nature segment. Anglers in the Amenity segment assign higher scores to such fishing benefits as relaxation, companionship, excitement, catching trophy fish, and sense of achievement than those in any other segments.

PROFILES OF ATTRIBUTE SOUGHT SEGMENTS

Factor analysis of 22 attribute sought variables identified 5 orthogonal dimensions (i.e. factors) underlying the attribute sought data. Anglers were then grouped into segments according to the overall similarities on their factor scores. Because of the cost and limitation of a cluster analysis computer program, factor scores of a random sample

Table 21. Average Importance Scores on Attributes and Benefits Sought by Attribute Sought Segments

	Crowding (17%)	Boating- Nature- Fish (14%)	Fish (12%)	Nature (8%)	Boating (8%)	Casual Angler (14%)	Amenity (14%)	Boating- Crowding (14%)	Anglers as a Whole N=281	F-ratio
----- mean ratings** -----										
Attributes Sought										
Crowding	3.23	1.97	2.00	2.08	2.62	0.93	2.39	2.36	2.21	13.89*
Competition	3.06	1.92	1.38	1.09	2.29	0.53	2.37	2.23	1.91	19.56*
Shore	1.38	2.23	1.50	1.87	1.81	1.10	1.92	1.49	1.63	2.79*
Boat Facility	1.36	3.08	1.21	1.83	3.14	1.15	2.87	2.28	2.05	22.57*
Marina	0.38	1.82	0.53	0.61	1.76	0.77	2.55	0.74	1.12	26.53*
Parking	0.83	3.28	0.62	1.17	3.00	0.98	2.82	2.41	1.84	62.30*
Restaurant	0.15	0.51	0.47	0.08	0.52	0.28	2.21	0.18	0.56	39.19*
Bait	0.89	1.92	1.15	0.52	1.38	0.65	2.66	0.89	1.28	19.53*
Motel	0.43	0.95	0.47	0.61	1.52	0.55	2.39	0.56	0.90	19.29*
Beauty	2.94	3.03	1.76	3.39	1.81	1.28	2.55	1.15	2.22	30.47*
Solitude	3.06	2.46	2.23	2.69	1.61	0.90	2.68	1.44	2.16	20.51*
Water	2.74	3.54	2.23	3.30	2.23	1.70	2.79	1.77	2.52	21.93*
Contamination	3.09	3.71	3.38	3.39	2.29	2.45	3.34	2.97	3.18	5.29*
Keep Fish	2.17	3.13	3.18	0.91	0.90	1.45	2.61	2.38	2.21	36.34*
All Fish	1.81	2.82	2.85	1.09	1.19	1.45	2.55	2.21	2.07	18.71*
Favorite Fish	2.64	3.21	3.09	2.48	2.09	1.63	2.79	2.82	2.62	13.19*
Fish Size	1.94	2.82	2.79	1.57	0.71	1.43	2.50	2.26	2.09	22.49*
Diversity	1.47	2.56	2.26	1.00	1.52	0.98	2.53	1.74	1.79	17.16*
Distance	1.19	2.15	2.06	1.35	1.19	1.48	2.29	1.54	1.69	7.21*
Information	1.23	2.59	2.06	1.04	1.71	1.25	2.55	1.61	1.78	11.70*
Second Home	0.85	0.85	1.12	0.48	0.62	0.65	2.03	0.56	0.93	7.84*
Chance	1.68	1.87	2.12	0.96	1.00	0.90	2.39	1.64	1.63	7.49*
Benefits Sought										
Eat	1.68	2.15	1.94	1.08	1.14	1.40	2.05	1.56	1.68	4.03*
Relax	2.96	2.92	2.76	2.87	2.90	1.98	3.13	2.69	2.77	5.59*
Company	1.51	2.05	1.38	1.96	1.71	1.23	2.42	1.41	1.69	5.01*
Nature	3.04	3.21	2.50	3.26	3.00	1.98	3.00	2.28	2.75	10.01*
Excitement	2.45	2.71	2.65	2.39	2.52	1.90	3.03	2.46	2.51	3.86*
Alone	1.83	1.08	1.53	1.69	0.95	0.40	1.24	1.05	1.22	5.71*
Skill	1.66	1.69	1.44	1.43	1.14	0.85	1.84	1.36	1.45	2.83*
Get Away	2.49	2.36	2.68	2.69	2.09	1.35	2.37	2.41	2.29	4.76*
Exercise	1.19	1.36	1.18	1.39	1.23	0.78	1.47	0.74	1.15	1.93
Family	1.38	1.89	1.38	1.78	1.81	1.33	1.79	1.46	1.58	1.31
Trophy	1.15	1.44	1.47	0.83	0.67	0.60	1.55	1.18	1.15	3.27*
Achieve	1.28	1.56	1.79	0.96	1.05	1.03	2.05	1.36	1.42	4.25*

*Significant at .05 or higher level.

**Scale of response: 0 Not Important, 1 Somewhat Important, 2 Important, 3 Very Important, 4 Crucial.

of 281 anglers were used in the grouping process. The cluster analysis resulted in 8 angler segments with differing attribute seeking orientation. Based upon its orientation, each segment was given a unique descriptive name. These segments and their relative sizes are: (1) Crowding (17%), (2) Boating-Nature-Fish (14%), (3) Fish (12%), (4) Nature (8%), (5) Boating (8%), (6) Casual Angler (14%), (7) Amenity (14%), and (8) Boating-Crowding (14%). These segments were then evaluated for their between-segment differences with respect to: socioeconomics, media usage, fishing participation patterns, and behavioral predispositions. The information furnished from this process led to the following segment profiles.

The Crowding Segment (17%) Anglers of this segment are concerned with angler crowding and nature related site selection criteria. A relatively large proportion of these anglers are experienced or expert anglers. Two-thirds of them are boat or canoe owners. A relatively high percentage (43.5 percent) of anglers in this segment fish on streams or rivers. They like to fish for brook trout, brown trout, and bass, primarily from shore or wading. The average age of this angler group is 39.3 years old, with a large portion (41.9 percent) 25 to 34 years of age. They are the most highly educated segment.

The Boating-Nature-Fish Segment (14%) is the youngest group of anglers, with an average age of 37.9 years old. This angler group places relatively more importance on boat facilities, nature, and fish related factors in deciding when and where to fish. Contamination of fish is also

an important site selection criterion for these anglers. They fish more often on the Great Lakes (68.4%) than any other segments. Walleye and yellow perch are their favorite catch species, and they like to fish them from boats. Trolling and fishing with bait are their primary methods of fishing. They more greater importance on catching fish to eat than any other segments.

The Fish Segment (12%) consists of anglers who place greater importance on fish related variables when selecting where to fish. Catch rate of keepable fish and presence of favorite species are important for this group. Inland lakes are the place where they are most likely to fish. They prefer to fish for walleye, bass, and chinook salmon from boats with bait. They are mostly of intermediate skill levels with beginners and expert anglers relatively scarce in this segment. The majority (90 percent) of these anglers have family incomes of less than \$40,000, and over one half (52.9 percent) own a second home or cottage by a lake or stream.

The Nature Segment (8%) contains anglers who are concerned with nature related factors. These anglers assign relatively more importance to natural beauty of the area, water clarity, and contamination of fish. They are less concerned with other site selection criteria. Their most important reasons for fishing are to enjoy nature and to get away. They would like to fish primarily for walleye, bass, and brown trout. They prefer spincasting and fishing with bait to other methods. A relatively large portion of the Nature segment are fly fishermen. Inland lakes and streams/rivers are their primary fishing locations.

The Boating Segment (8%) is more concerned with boating facilities, especially boat launching facilities and availability of parking spaces. A relatively large proportion (70 percent) own boats or canoes used for fishing. Over 75 percent of them are advanced anglers (i.e. experienced or expert anglers). As expected, their favorite mode of fishing is from boats. They fish more often on the Great Lakes. Their favorite catch species are steelhead, bass, and chinook salmon. Trolling and fishing with bait are the methods they most prefer. Almost one half (47.6 percent) own a cottage or second home by a lake or stream. Forty-two percent of the Boating is retired.

The Casual Angler Segment (14%) is relatively indifferent over a range of site selection criteria (i.e. attributes sought). Within the segment itself, however, they place relatively more importance on amenity/support facilities and boating related factors than on other fishing attribute. These anglers are older than those in any other segments, averaging 47 years of age. They are less skilled anglers, with more beginners than any other segment. Only twenty percent participate in fishing outside Michigan, the lowest of any segment. Their favorite catch species are panfish and chinook salmon. They prefer fishing these species from boats or from shore or wading.

The Amenity Segment (14%) places significantly more importance on amenity/support facilities and boating related factors. Almost one half (45.9 percent) of these anglers own boats or canoes used for fishing, and 32.4 percent own a cottage or second home near by a stream or lake. They

are the most active in out-of-state fishing, with over forty percent (44.7%) fishing outside Michigan within the past two years. Their favorite species include walleye, bass, and chinook salmon. Relatively few fish for yellow perch and panfish. Their preferred mode of fishing is from boats. Trolling and bait fishing are their favorite methods.

The Boating-Crowding Segment (14%) consists of those who are relatively more concerned with both boating and angler crowding-competition related factors in selecting where to fish. Relaxation, excitement, and to get away are their most important reasons for fishing. This segment includes more anglers with children under 17 years of age and are more likely to belong to higher family income groups. Over one half (55.5 percent) have family incomes of \$30,000 and over, with 14 percent of them having \$50,000 or more. A large proportion (70.3 percent) own boats or canoes used for fishing. Anglers in this segment are relatively more interested in fishing coolwater species. Walleye, panfish, yellow perch, and bass are their favorites. They prefer fishing from boats with bait. Their primary fishing locations are the Great Lakes and inland lakes.

Table 22. Summary of Attribute Sought Segments

Segment	Attributes Sought Importance Scores		Benefits Sought Importance Scores		Socioeconomic Characteristics	Participation Characteristics	Size of the Segment (Market Share)
	High	Low	High	Low			
Crowding	Crowding Nature	Boating Amenity	Nature Relax	Trophy Exercise	More whites More college grads	Advanced anglers More boat owners Fish trout and bass on streams	17%
Boating- Nature- Fish	Boating Nature Fish	Crowding Amenity	Nature Relax Eat	Alone	Youngest segment (38 yrs old) More unemployed	Fish walleye and perch on the GLs. Trolling and bait are preferred.	14%
Fish	Fish Get away	Boating Skill	Relax Excitement	Exercise Family	Younger	Intermediate anglers Fish walleye, bass, and chinook in inland lakes w/ bait More 2nd home owners	12%
Nature	Nature	Fish	Nature Get away	Trophy Achievement	More married anglers More blue collars	Fish walleye, bass and chinook in inland lakes and streams w/ spincasting	8%
Boating	Boating	Fish	Nature Relax	Trophy Alone	More non-whites More retirees Fewer children	More advanced anglers Steelhead, bass, and chinook in the GLs Trolling and bait are preferred	8%
Casual Angler		Crowding	Nature Excitement	Alone Trophy	Oldest segment (47 yrs old)	Less skilled Least active in out-of-state fishing	14%
Amenity	Amenity		Relax Nature Excitement	Alone	More singles	More boat owners Most active in out-of-state fishing Fish for walleye, bass, and chinook on the GLs and inland lakes	14%
Boating- Crowding	Boating Crowding Fish	Nature Amenity	Relax Excitement	Exercise	More whites Higher family income More college grads	More boat owners Fish for most of coolwater species from boat	14%

CHAPTER VI

THE SPECIES-LOCATION SEGMENTATION

This chapter presents the results of the species-location segmentation analysis performed on the same random sample of 281 anglers that was used in the attributes sought segmentation. The species-location segmentation is presented in four parts; (1) specie-location factors, (2) forming specie-location segments, (3) testing for segment differences, and (4) profiles of segments.

SPECIES-LOCATION FACTORS

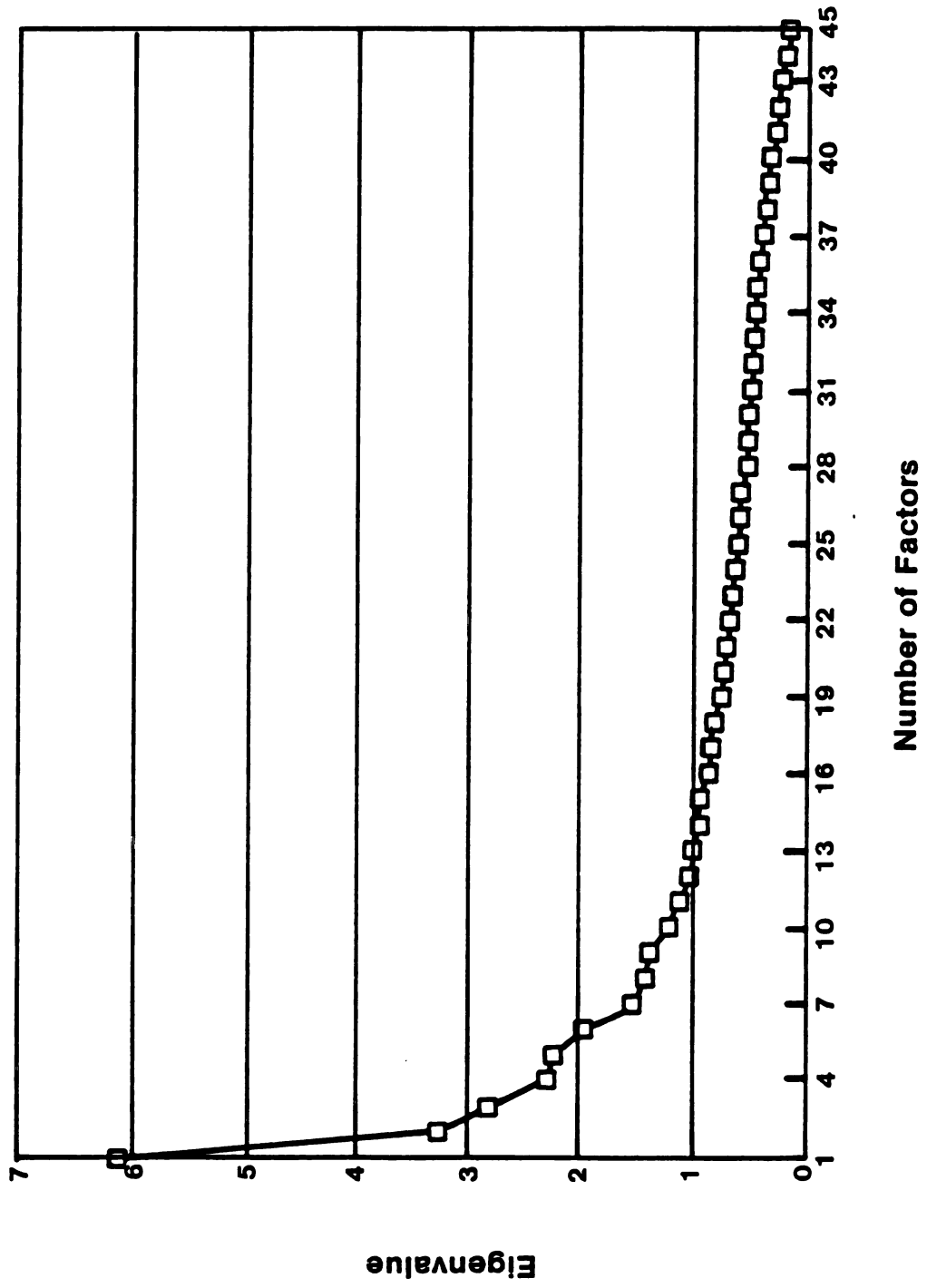
A principal axes factor analysis was performed on the species-location variables to identify basic dimensions that underlied these variables, and at the same time to reduce the number of variables. The original species-location data set consisted of 45 species-location variables (15 species by 3 types of location). Table 23 presents the results from the factor analysis before rotation including; eigenvalues, percent of variance explained, and cumulative percent of variance explained. A scree test is graphically displayed in Figure 6 .

Nine species-location factors were obtained. Each of these nine factors had an eigenvalue of greater than one. Altogether they accounted for 51.3 percent of the variance in the original 45 variables. The nine

Table 23. Statistical Information from Initial Factoring
on Species-Location Data

Factor	Eigenvalue	Percent of Variance Explained	Cum. Percent of Variance Explained
1	6.13933	13.6	13.6
2	3.29018	7.3	21.0
3	2.84067	6.3	27.3
4	2.29557	5.1	32.4
5	2.25392	5.0	37.4
6	1.96924	4.4	41.8
7	1.52333	3.4	45.1
8	1.42075	3.2	48.3
9	1.37171	3.0	51.3
10	1.20477	2.7	54.0
11	1.12066	2.5	56.5
12	1.02735	2.3	58.8
13	.99764	2.2	61.0
14	.96919	2.2	63.2
15	.93811	2.1	65.2
16	.87543	1.9	67.2
17	.84191	1.9	69.1
18	.82983	1.8	70.9
19	.74756	1.7	72.6
20	.73291	1.6	74.2
21	.71295	1.6	75.8
22	.68181	1.5	77.3
23	.65443	1.5	78.8
24	.63546	1.4	80.2
25	.60726	1.3	81.5
26	.60448	1.3	82.9
27	.59494	1.3	84.2
28	.53611	1.2	85.4
29	.53357	1.2	86.6
30	.51337	1.1	87.7
31	.50490	1.1	88.8
32	.50066	1.1	89.9
33	.47392	1.1	91.0
34	.46935	1.0	92.0
35	.45128	1.0	93.0
36	.43638	1.0	94.0
37	.41168	.9	94.9
38	.38910	.9	95.8
39	.36827	.8	96.6
40	.33312	.7	97.3
41	.29500	.7	98.0
42	.27403	.6	98.6
43	.24982	.6	99.2
44	.20422	.5	99.6
45	.17397	.4	100.0

Figure 6. Scree Test for Species-Location Factors



factors were then submitted to a Varimax orthogonal rotation procedure. Table 24 presents the factor pattern matrix after rotation, where variables loading at .35 or higher are highlighted in parentheses.

Nine Species-Location Factors

The first factor accounts for 13.6 percent of variance of the species-location variables. It is labeled the 'Great Lakes-salmonid' factor. The variables loading on this factor include chinook salmon, coho salmon, steelhead, lake trout, brown trout, and rainbow trout on the Great Lakes.

The second factor is named the 'streams-trout' factor. Four variables, brown trout, brook trout, rainbow trout, and steelhead trout all on streams load on this factor. This 'streams-trout' factor accounts for 7.3 percent of the original variance.

Variables related to coolwater species on the Great Lakes load on the third species-location factor. Included in the coolwater species are bass, walleye, pike, panfish, perch, and catfish. This factor is named the 'Great Lakes-coolwater' factor. Six percent of the total variance is explained by this factor.

The fourth factor is called the 'stream-coolwater' factor. Variables related to coolwater species (i.e. bass, yellow perch, panfish, pike, and walleye) on streams or rivers contribute to this factor. It explains 5.1 percent of the total variance.

The fifth factor consists of variables related to coolwater species (i.e. panfish, bass, pike, yellow perch, and walleye) on inland lakes. The factor is labeled 'inland lakes-coolwater' factor. Five percent of the total variance is explained by this factor.

Table 24. Species-Location Factor Pattern Matrix After Varimax Rotation

Variables	Varimax Rotated Factors								
	F1	F2	F3	F4	F5	F6	F7	F8	F9
Chinook-Great Lks	(.83)	.01	.04	.00	.05	.11	-.01	.04	-.07
Coho-Great Lks	(.81)	.02	.05	.01	.09	.11	-.00	.05	-.05
Steelhead-Great Lks	(.74)	.08	.07	.02	.07	.07	.06	.06	.01
Lake T-Great Lks	(.73)	.13	.07	.00	-.00	.03	.10	.01	-.02
Brown T-Great Lks	(.69)	.09	.08	-.00	-.02	.04	.11	-.04	.11
Rainbow T-Great Lks	(.40)	.16	.17	-.00	-.03	.03	.17	.06	.24
Brown T-Streams	.11	(.83)	-.01	.04	.04	.14	.09	.03	.01
Brook T-Streams	.09	(.79)	-.00	.04	.04	.14	.09	.03	.01
Rainbow T-Streams	.09	(.79)	.01	.07	.14	.14	.09	-.01	.04
Steelhead-Streams*	.25	(.39)	.01	.08	.11	.45	.11	-.01	.04
Bass-Great Lks	-.01	.03	(.62)	.11	.07	-.01	.01	.04	-.07
Walleye-Great Lks	.09	.00	(.61)	.02	-.05	-.02	-.05	.04	-.07
Pike-Great Lks	.03	.09	(.55)	.13	.08	.02	.06	.01	-.01
Panfish-Great Lks	-.03	-.04	(.56)	.06	.02	.03	.06	.06	.01
Perch-Great Lks	.20	-.01	(.54)	.06	-.01	.05	-.08	-.05	-.08
Catfish-Great Lks	.03	-.01	(.43)	.02	-.06	.03	.03	-.03	.20
Bass-Streams	.03	.06	.09	(.68)	.04	.07	-.00	.00	.09
Perch-Streams	-.06	-.03	.13	(.58)	.01	-.02	-.00	.04	.05
Panfish-Streams	-.02	-.02	.04	(.57)	.04	-.02	-.03	.05	.18
Pike-Streams	.03	.10	.11	(.55)	.11	.06	.08	-.03	.10
Walleye-Streams	-.06	-.03	.13	(.54)	.04	.24	.06	-.00	-.05
Catfish-Streams*	.02	-.02	-.04	(.39)	-.00	.09	-.04	.02	.43
Panfish-Inland lks	-.01	.02	-.04	.02	(.67)	.01	-.04	.01	.14
Bass-Inland lks	-.01	.03	-.03	.03	(.65)	.01	.02	.04	.12
Pike-Inland lks	.06	.07	.05	.06	(.55)	.08	.10	-.00	.11
Perch-Inland lks	-.01	.04	.04	.06	(.55)	-.00	.09	.01	.00
Walleye-Inland lks	.13	.04	.05	.06	(.44)	.10	.17	.05	-.07
Chinook-Streams	.12	.14	.01	.09	.08	(.86)	.08	.06	.07
Coho-Streams	.11	.13	.06	.13	.07	(.73)	.10	.07	.11
Steelhead-Streams*	.25	.39	.01	.08	.11	(.45)	.11	-.01	.04
Brown T-Inland lks	.09	.07	.01	.09	.05	.04	(.69)	.05	-.03
Rainbow T-Inland lks	.11	.14	-.04	.04	.10	.09	(.61)	-.00	.02
Brook T-Inland lks	.05	.17	.06	-.00	.01	.06	(.46)	.02	.00
Lake T-Inland lks	.02	.03	.08	.01	.07	.03	(.44)	.09	.05
Steelhead-Inland lks	.12	.07	.08	.00	.07	.04	(.36)	.29	.02
Chinook-Inland lks	.05	-.01	.04	.05	.05	.07	.20	(.90)	.04
Coho-Inland lks	.06	.02	.05	.04	.03	.04	.13	(.81)	.04
Catfish-Inland lks	.00	-.01	.03	.08	.27	.04	.05	.01	(.47)
Carp-Streams	.01	.05	.03	.31	.09	.17	-.02	.01	(.43)
Catfish-Streams*	.02	-.02	-.04	.39	-.00	.09	-.04	.02	(.43)
Carp-Inland lks	.02	.04	.00	.19	.16	.02	.12	.04	(.40)

Unfactored Variables:

Lake T-Streams, Brook T-Great Lks, Carp-Great Lks, Smelt-Streams,
Smelt-Great Lks, and Smelt-Inland lks.

*This variable loads on two factors.

The sixth factor represents the 'stream-salmon' factor. Variables, chinook salmon, coho salmon, and steelhead trout on streams load on this factor with factor loadings of .86, .73, and .45, respectively. It accounts for 4.4 percent of the total variance.

The seventh factor is named the 'inland lakes-trout'. Five variables related to trout (brown trout, rainbow trout, brook trout, lake trout, and steelhead trout) on inland lakes comprise the factor.

The eighth factor represents the 'inland lakes-salmon' factor. Two variables chinook salmon on inland lakes and coho salmon on inland lakes load on this factor. This factor accounts for 3.2 percent of the original variance.

The ninth and the last factor is called 'catfish/carp' factor. Four variables, catfish on inland lakes, carp on streams, catfish on streams, and carp on streams, load highly on this factor. Three percent of the original variance is explained for by this factor.

Reliability of Factors

Since the original species-location variables are in dichotomous form, the reliability (i.e. internal consistency/unidimensionality) of each species-location factor was assessed using the KR-20 (Kuder-Richardson 20) reliability coefficient. Reliability coefficient KR-20 is a special version of Cronbach's alpha for dichotomous data. If the data are in dichotomous form, alpha becomes equivalent to KR-20 (Nunnally, 1978). The KR-20 coefficients for the species-location factors are presented in Table 25. All the factors possess a .61 or higher level of reliability, suggesting a relatively high degree of unidimensionality (i.e. internal consistency) of these obtained factors.

Table 25. Species-Location Factors After Varimax Rotation

Factors and Items	Factor Loadings	KR-20*
<u>Factor 1: Great Lakes-Salmonid</u>		.86
Chinook -Great Lakes	.83	
Coho -Great Lakes	.81	
Steelhead-Great Lakes	.75	
Lake T -Great Lakes	.73	
Brown T -Great Lakes	.69	
Rainbow T-Great Lakes	.39	
<u>Factor 2: Streams-Trout</u>		.83
Brown T -Streams	.83	
Brook T -Streams	.79	
Rainbow T-Streams	.79	
Steelhead-Streams	.39	
<u>Factor 3: Great Lakes-Cool Water</u>		.71
Bass -Great Lakes	.62	
Walleye -Great Lakes	.61	
Pike -Great Lakes	.59	
Panfish -Great Lakes	.59	
Perch -Great Lakes	.54	
Catfish -Great Lakes	.43	
<u>Factor 4: Streams-Cool Water</u>		.73
Bass -Streams	.68	
Perch -Streams	.58	
Panfish -Streams	.57	
Pike -Streams	.55	
Walleye -Streams	.54	
<u>Factor 5: Inland Lakes-Cool Water</u>		.72
Panfish -Inland lakes	.67	
Bass -Inland lakes	.65	
Pike -Inland lakes	.55	
Perch -Inland lakes	.54	
Walleye -Inalnd lakes	.45	

(Table continued)

Table 25 (Cont'd.).

Factors and Items	Factor Loadings	KR-20*
<u>Factor 6: Streams-Salmon</u>		.77
Chinook -Streams	.86	
Coho -Streams	.73	
Steelhead-Streams	.45	
<u>Factor 7: Inland lakes-Trout</u>		.67
Brown T -Inland lakes	.69	
Rainbow T-Inland lakes	.61	
Brook T -Inland lakes	.46	
Lake T -Inland lakes	.44	
Steelhead-Inland lakes	.36	
<u>Factor 8: Inland lakes-Salmon</u>		.87
Chinook -Inland lakes	.90	
Coho -Inland lakes	.81	
<u>Factor 9: IL/SR-Catfish/Carp</u>		.61
Catfish -Inland lakes	.47	
Carp -Streams	.43	
Catfish -Streams	.43	
Carp -Inland lakes	.40	
Unfactored items		
Lake T -Streams		
Brook T -Great Lakes		
Carp -Great Lakes		
Smelt -Streams/Great Lakes/Inland lakes		

*Kuder-Richardson 20 reliability coefficient. This is equivalent to Cronbach's alpha for continuous data.

FORMING SPECIES-LOCATION SEGMENTS

Species-location market segments are groups of anglers who are homogeneous with respect to the species and locations they fish. In order to create a classification of anglers based upon the species-location information, cluster analysis was performed on the nine species-location factor scores. The species-location factor scores of a random sample of 281 anglers were used in the clustering process. To assure comparability of the results of the two segmentation analyses, clusters were formed from the same random sample used in the attribute sought segmentation analysis.

A two-step clustering procedure was employed. Ward's method of hierarchical clustering was performed on the nine species-location factor scores, followed by a reallocation procedure for cluster refinement. The same criteria that were used in deriving the attribute sought clusters were used in determining the number of clusters throughout the analysis. These criteria included the increase in coefficient of hierarchy and the management considerations.

Preliminary Clustering: Ward's Method

Upon examination of the outcome from Ward's method, it became obvious that a few outliers existed. Outliers are a major threat for forming a classification since most clustering algorithms including Ward's method are sensitive to extreme values (Everitt, 1980; SAS Institute Inc, 1985). The authorities in the field of classification (Everitt, 1980; Zupan, 1982; Punj and Stewart, 1983) recommend eliminating outliers whenever possible. As a consequence, the identified four outliers were eliminated from further analysis. The remaining 277 anglers in the sample were then subject to the segmentation analysis.

Ward's method was performed again on the factor scores of the 277 anglers. The increase in the coefficient of hierarchy resulting from hierarchical fusion of anglers is plotted against the number of clusters in Figure 7. Primarily based upon the increase in the coefficient of hierarchy criterion, three cluster solutions were retained for cluster refinement via a reallocation procedure. These solutions included the 7-cluster solution, the 8-cluster solution, and the 10-cluster solution. These numbers coincidentally match the number of clusters selected in the previously discussed attribute sought segmentation. However, this decision was totally independent of the decision made in the attribute segmentation.

Refining Clusters: Reallocation

A reallocation method (i.e. an iterative partitioning method) was performed on each of the three solutions retained from Ward's method. The resulting refined 7-cluster, 8-cluster, and 10-cluster solutions were then candidates for the final cluster solution. As in the attribute sought segmentation, it was primarily managerial considerations that led to the selection of the best solution. The eight cluster solution appeared the most promising among the three with respect to the interpretability and size of clusters. It was therefore selected as the final species-location clusters. The reallocation process for this 8 cluster solution required a total of 5 iterations. Reallocations during the process are descending in number from 33 at the initial iteration to 2 at the fifth iteration. Clusters were stable at Iteration 6, and no further reallocations were made. The number of anglers in each species-location cluster and the relative sizes of the eight clusters are presented in Table 26.

Figure 7. Coefficient of Hierarchy by Number of Species-Location Clusters

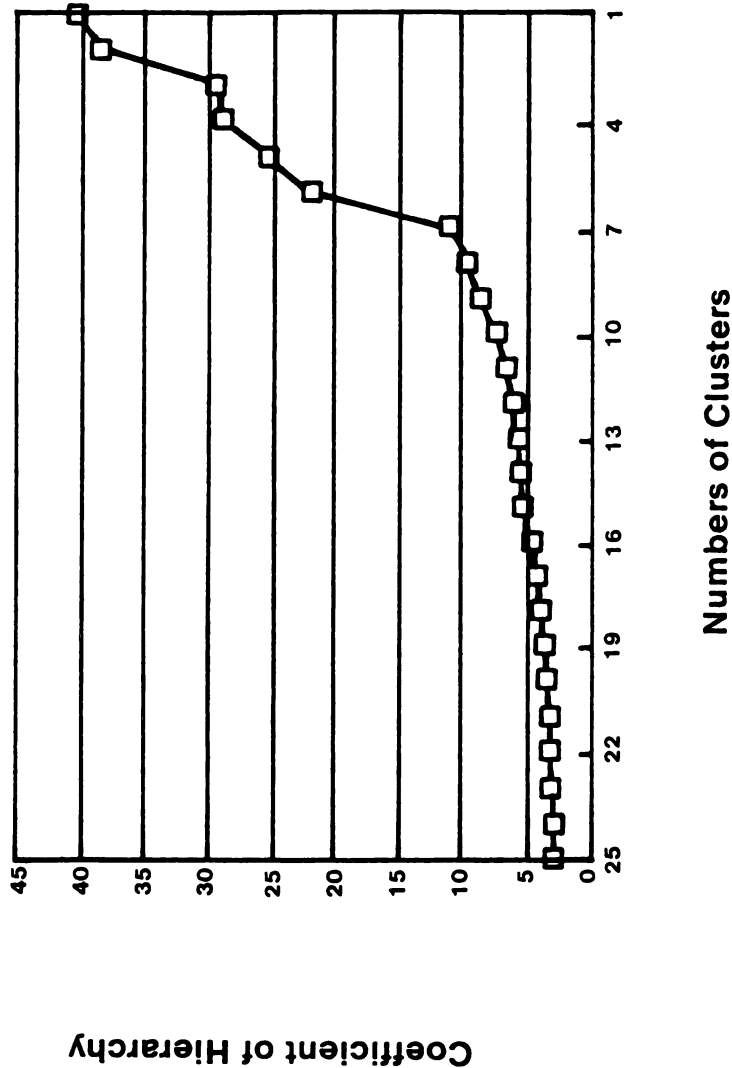


Table 26. Number of Respondents in Each of the Eight Species-Location Clusters*

Cluster	Number of Respondents	Relative Size (Percent)
1	28	10.1
2	30	10.8
3	26	9.4
4	62	22.4
5	37	13.6
6	59	21.3
7	24	8.7
8	11	3.9
Total	277	100.0

*Represents the final cluster solution obtained from reallocation at the eight cluster solution from Ward's minimum variance method.

Description of Clusters

Basic statistical information concerning the eight species-location clusters is presented in Table 27. Analyses of variance test confirmed significant differences in the mean factor scores between clusters (Table 28). Cluster centroids for the species-location factor scores are graphically displayed in Figure 8. Examination of cluster centroids led to the following descriptions of clusters.

Cluster one (10%) The anglers in this segment fish more for coolwater species in the Great Lakes than other anglers. They also fish for coolwater species in inland lakes to some extent. This segment is named the Coolwater/Great Lakes segment.

Cluster two (11%) is called the Salmonid/Great Lakes segment. More of these anglers fish for salmonids on the Great Lakes.

Cluster three (9%) More anglers in this cluster fish for salmon on streams or rivers. More of these anglers also fish for trout on streams or rivers. This cluster is labeled the Salmon/Streams segment.

Cluster four (22%) is the largest species-location segment. More of these anglers fish for coolwater species in inland lakes. This largest group of anglers is termed the Coolwater/Inland Lakes segment.

Cluster five (14%) is called the Trout/Streams segment. More of these anglers fish for trout on streams or rivers than anglers in other clusters.

Cluster six (21%) is the second largest group of anglers. The anglers in this cluster do not exhibit a strong propensity for any particular specie(s)-location combination. The cluster is named Casual Angler segment.

Table 27. Cluster Diagnostic Statistics for Species-Location Clusters

Segment	Factor 1 (GL-Salmonid)		Factor 2 (SR-Trout)		Factor 3 (GL-Coolwater)		Factor 4 (SR-Coolwater)		Factor 5 (IL-Coolwater)						
	Mean	F-value	T-value	Mean	F-value	T-value	Mean	F-value	T-value	Mean	F-value	T-value			
1	.034	1.024	-.022	.017	.643	-.076	1.812	.550	1.969	-.132	.486	-.169	.226	1.024	.193
2	1.866	.197	1.904	-.555	-.089	-.657	-.243	.250	-.375	-.219	.275	-.273	.027	1.412	-.048
3	.033	1.088	-.023	.729	1.477	.646	.021	.943	.074	-.098	.898	-.128	.194	1.288	.154
4	-.405	.163	-.484	-.439	.019	-.539	-.241	.204	-.373	-.354	.135	-.434	.578	.269	.618
5	.014	.832	-.043	1.899	.219	1.833	-.341	.461	-.487	-.207	.403	-.255	.191	.756	.150
6	-.355	.117	-.431	-.353	.048	-.451	.044	.400	-.048	-.145	.299	-.184	-.826	.183	-1.078
7	-.458	.193	-.540	-.278	.281	-.376	.261	1.381	.199	2.016	.882	2.407	.289	.918	.269
8	1.269	.509	1.276	.655	1.560	.571	-.130	1.423	-.247	.438	1.060	.515	.469	.860	.486

Segment	Factor 6 (SR-Salmon)		Factor 7 (IL-Trout)		Factor 8 (IL-Salmon)		Factor 9 (Catfish/Carp)					
	Mean	F-value	T-value	Mean	F-value	T-value	Mean	F-value	T-value			
1	-.343	.052	-.374	-.200	.364	-.207	-.128	.429	-.012	-.470	.773	-.531
2	-.385	.047	-.422	-.107	.491	.093	-.155	.702	-.140	-.139	.838	-.073
3	2.430	.339	2.726	-.035	.702	-.005	-.259	.661	-.619	-.053	.903	.045
4	-.221	.040	-.238	-.154	.052	-.149	-.059	.122	.309	.155	.920	.333
5	-.482	.070	.53	-.349	.137	-.390	-.007	.325	.548	-.121	1.216	-.050
6	-.151	.039	-.159	-.085	.151	-.066	-.043	.085	.380	-.120	.356	-.047
7	-.417	.161	-.458	-.356	.063	-.400	-.129	.299	-.017	.003	2.040	.122
8	.565	2.650	.640	3.373	1.205	4.173	-.926	.914	-3.709	-.286	2.435	-.277

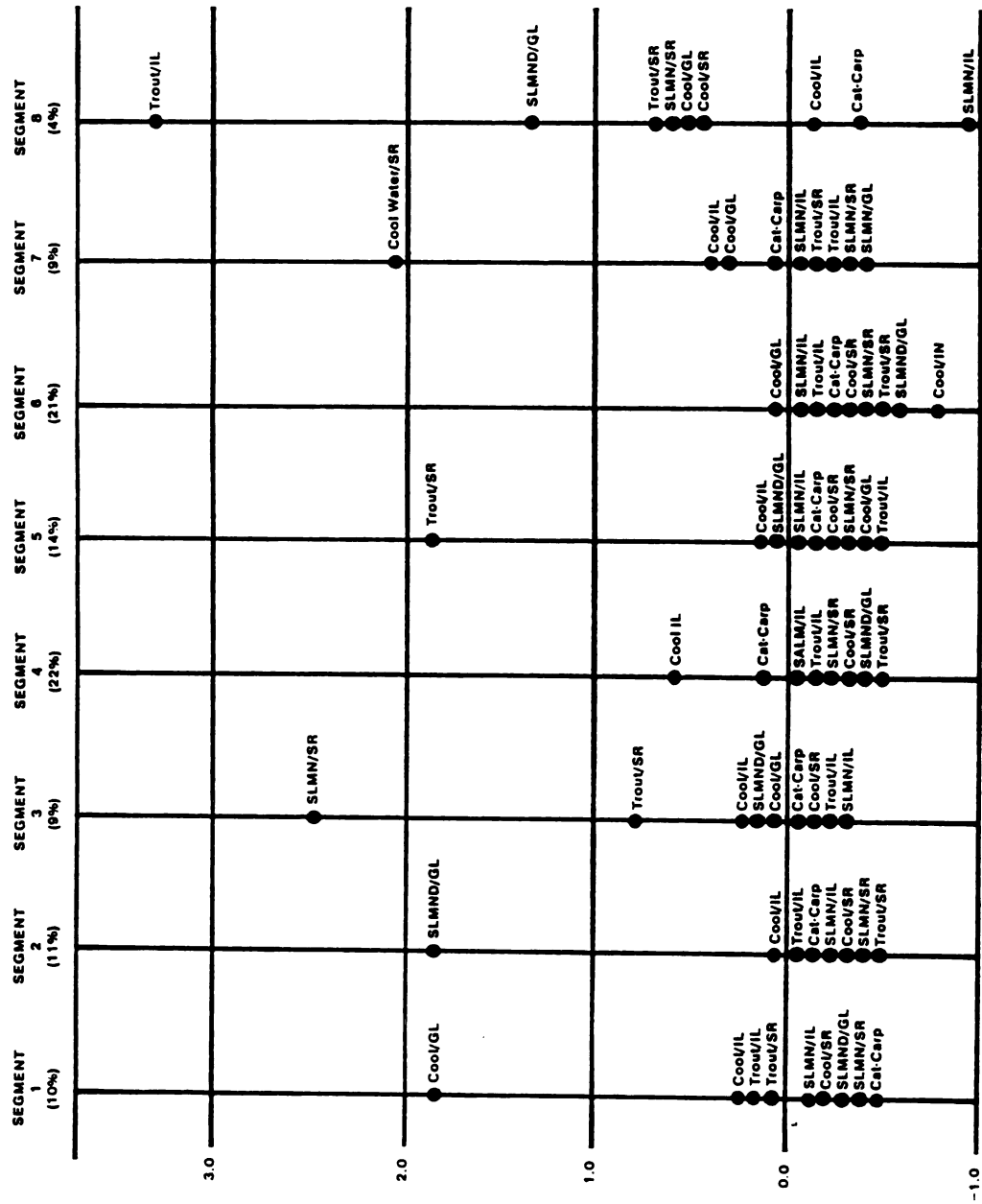
Table 28. Mean Species-Location Factor Scores by Species-Location Clusters

Species-Location Factors	clusters								Overall Mean** N=277	F-ratio
	1 (108)	2 (118)	3 (98)	4 (228)	5 (148)	6 (218)	7 (98)	8 (48)		
	mean factor scores									
Salmonid/GL	.034	1.867	.033	-.405	.014	-.355	-.458	1.269	.055	52.419*
Trout/SR	.017	-.555	.729	-.439	1.899	-.353	-.278	.655	.093	78.421*
Coolwater/GL	1.812	-1.243	.021	-.241	-.341	.044	.261	-.130	.086	35.253*
Coolwater/SR	-.132	-.219	-.098	-.354	-.204	-.145	2.016	.438	.008	54.179*
Coolwater/IL	.226	.027	.194	.577	.191	-.826	.289	.469	.066	21.531*
Salmon/SR	-.343	-.385	2.429	-.221	-.482	-.151	-.417	.565	-.008	179.614*
Trout/IL	-.200	-.107	-.035	-.154	-.349	-.085	-.358	3.373	-.031	109.016*
Salmon/IL	-.128	-.156	-.258	-.059	-.007	-.043	-.128	-.926	-.125	81.322*
Catfish/Carp	-.471	-.139	-.053	.155	-.121	-.119	.003	-.286	-.086	2.425*

*Significant at .05 or higher level.

**Theoretically, overall mean factor scores are zero for factor scores are standardized. However, those presented on the table are not zero due to sampling (subsampling).

Figure 8. Species-Location Segments: Factor Centroids



Cluster seven (9%) is labeled the Coolwater/Streams segment. More anglers in this segment fish for coolwater species on streams or rivers. They also fish for coolwater species on inland lakes and the Great Lakes, but not so heavily as on streams.

Cluster eight (4%) is the smallest species-location segment. The majority of anglers in this segment fish for trout on inland lakes. More also fish for salmon on the Great Lakes. This cluster is named the Trout/Inland Lakes segment.

TESTING FOR SEGMENT DIFFERENCES

In order to evaluate between-group differences, the eight species-location segments were compared with respect to: (1) socioeconomic characteristics, (2) usage of fishing information sources, (3) participation patterns, and (4) behavioral predispositions. As in the attribute sought segmentation, these comparisons serve to evaluate the identifiability and variation in market response of the segments.

Socioeconomic Characteristics

The eight species-location segments were examined for differences with respect to 7 socioeconomic variables: age, marital status, presence of children under 17 of age, racial background, family income, education, and occupational status. Table 29 displays distributions of these characteristics by segments. Chi-square tests of independence failed to identify statistically significant relationships (at the .05 level) between segment membership and these socioeconomic characteristics.

Table 29. Socioeconomic Characteristics by Species-Location Segments

	Coolwater GL (108)	Salmonid GL (118)	Salmon SR (98)	Coolwater IL (228)	Trout SR (148)	Casual Angler (218)	Coolwater SR (148)	Trout IL (48)	Anglers as a Whole N=277	Chi- Square Statistics
----- Percent -----										
Age										27.356 (NS)
17-24	11.1	6.9	15.4	10.7	11.4	13.8	9.5	18.2	11.8	
25-34	40.7	24.1	38.5	23.2	42.9	22.4	28.6	27.3	29.7	
35-44	25.9	24.1	23.1	26.8	22.9	20.7	14.3	36.4	23.6	
45-54	0.0	13.8	11.5	12.5	5.7	15.5	23.8	0.0	11.4	
55-64	11.1	17.2	3.8	17.9	8.6	12.1	19.0	18.2	13.3	
Over 64	11.1	13.8	7.7	8.9	8.6	15.5	4.8	0.0	10.3	
Marital Status										6.793 (NS)
Married	64.3	86.7	80.8	82.3	78.4	74.6	79.2	63.6	77.6	
Single	35.7	13.3	19.2	17.7	21.6	25.4	20.8	36.4	22.4	
Children under 17										4.908 (NS)
Yes	28.6	30.0	46.2	41.9	45.9	39.0	50.0	36.4	40.1	
No	71.4	70.0	53.8	58.1	54.1	61.0	50.0	63.6	59.9	
Race										7.387 (NS)
White	96.4	88.9	100.0	86.4	88.2	93.0	82.6	90.0	90.5	
Non-white	5.6	11.1	0.0	13.6	11.8	7.0	17.4	10.0	9.5	
Family Income (\$)										36.358 (NS)
Under 10,000	11.1	4.2	15.4	10.7	20.0	16.4	13.6	9.1	13.2	
10-19,999	14.8	33.3	34.6	21.4	33.3	11.1	31.8	18.2	23.2	
20-29,999	29.6	33.3	11.5	26.8	6.7	18.5	22.7	45.0	22.4	
30-39,999	22.2	16.4	19.2	16.1	20.0	29.6	9.1	0.0	19.2	
40-49,999	14.8	8.3	11.5	8.9	10.0	14.8	9.1	18.2	11.6	
50,000 & Over	7.4	4.2	7.7	16.1	10.0	9.3	13.6	9.1	10.4	
Education										23.730 (NS)
Grade School	0.0	7.4	3.8	1.7	9.1	7.0	9.1	0.0	5.0	
Some High School	7.1	11.1	7.7	8.6	12.1	8.8	22.7	9.1	10.3	
High School	46.4	37.0	42.3	34.5	30.3	36.8	27.3	36.4	36.3	
Some College	32.1	25.9	38.5	41.4	21.2	24.6	27.3	27.3	30.5	
College	10.7	14.8	7.7	12.1	21.2	15.8	9.1	18.2	13.7	
Beyond College	3.6	3.7	0.0	1.7	6.1	7.0	4.5	9.1	4.2	
Occupational Status										43.339 (NS)
White Collar	16.0	22.2	13.0	15.5	20.7	29.1	27.3	60.0	22.5	
Blue Collar	52.0	37.0	47.8	48.3	55.2	40.0	27.3	20.0	43.4	
Other	12.0	7.4	13.0	10.3	6.9	1.8	4.5	20.0	8.0	
Unemployed	4.0	0.0	8.7	3.4	0.0	3.6	13.6	0.0	4.0	
Retired	12.0	29.6	8.7	17.2	13.8	25.5	18.2	0.0	18.0	
Student	4.0	3.7	8.7	5.2	3.4	0.0	9.1	0.0	4.0	

(Despite the absence of statistically significant differences (some of which are a result of the small sample size), some of distributional patterns are worth noting for they are helpful in understanding the segments.)

The Casual Angler segment contains more elderly anglers, with the average age of 44.3 years old. Fifteen percent of anglers in the segment are 64 years of age or older. On the other hand, relatively large proportions of those in the Salmon/Streams and the Trout/Inland Lakes segments are in younger age groups. The average ages of the two angler segments are 35.7 and 35.5 years old, respectively.

The probability of having children under 17 years of age is highest with those in the Coolwater/Stream segment. One out of two anglers in this segment has at least one child under 17 years of age.

More anglers in the Salmon/Great Lakes and the Trout/Streams segments are in lower family income groups. Over one half of the anglers comprising these two segments have family incomes of less than \$20,000.

The Trout/Inland Lakes segment has the highest educational levels. Approximately 30 percent of the anglers in this segment have completed college.

The Trout/Inland Lakes has the highest proportion of white collar workers. More retired anglers are found in the Salmon/Great Lakes segment, while the Coolwater/Streams segment contains more who are unemployed.

Fishing Information Sources

Table 30 summarizes usage levels of six fishing information sources by the eight species-location segments. Although there was no

Table 30. Use of Fishing Information Sources by Species-Location Segments

Info. Sources	Coolwater GL (10%)	Salmonid GL (11%)	Salmon SR (9%)	Coolwater IL (22%)	Trout SR (14%)	Casual Angler (21%)	Coolwater SR (9%)	Trout IL (4%)	Anglers as a Whole N=277	Chi- Square Statistics
----- percents -----										
Opinions of Anglers										6.594 (NS)
Often	50.0	46.7	42.3	32.3	37.8	33.9	37.5	45.5	38.6	
Occasionally	46.4	50.0	57.7	62.9	56.8	59.3	58.3	54.5	57.0	
Never	3.6	3.3	0.0	4.8	5.4	6.8	4.2	0.0	4.4	
DNR Information										17.044 (NS)
Often	14.3	3.3	15.4	4.8	10.8	13.6	25.0	18.2	11.6	
Occasionally	64.3	53.3	61.5	51.6	62.2	55.9	45.8	63.6	56.3	
Never	21.4	43.3	23.1	43.5	27.0	30.5	29.2	18.2	32.1	
Newspapers										20.843 (NS)
Often	10.7	10.0	11.5	4.9	5.4	13.6	12.5	9.1	9.4	
Occasionally	71.4	50.0	53.8	41.0	56.8	52.5	70.8	72.7	54.7	
Never	17.9	40.0	34.6	54.1	37.8	33.9	16.7	18.2	35.9	
Magazine Articles										17.716 (NS)
Often	7.1	16.7	3.8	4.9	2.7	8.5	8.3	9.1	7.2	
Occasionally	57.1	43.3	50.0	34.4	51.4	39.0	54.2	72.7	45.7	
Never	35.7	40.0	46.2	60.7	45.9	52.5	37.5	18.2	47.1	
Bait/Tackle Shops										10.901 (NS)
Often	35.7	26.7	23.1	24.6	24.3	18.6	20.8	18.2	23.9	
Occasionally	50.0	53.3	65.4	42.6	51.4	55.9	58.3	45.5	52.2	
Never	14.3	20.0	11.5	32.8	24.3	25.4	20.8	36.4	23.9	
Radio or TV										16.879 (NS)
Often	17.9	10.0	3.8	4.8	2.8	5.1	4.2	0.0	6.2	
Occasionally	53.6	43.3	46.2	33.9	38.9	47.5	37.5	54.5	42.8	
Never	28.6	46.7	50.0	61.3	58.3	47.5	58.3	45.5	51.1	

statistically significant between-segment differences, some of differences in use patterns are worth reporting here.

Anglers of the Salmonid/Great Lakes and the Trout/Inland Lakes segments make more use of opinions of other anglers. Every member of these segments consulted the opinions for obtaining fishing information. Newspapers are popular among those in the Coolwater/Streams segment, with over 80 percent consulting newspapers in deciding where to fish. Magazine articles are used more frequently by anglers in the Trout/Inland Lakes segment. Bait/tackle shops are relatively popular to anglers in the Salmon/Streams segment, with almost 90 percent consulting the information source.

Participation Characteristics and Behavior Predispositions

In order to see if different segments exhibit distinguishable fishing behavior patterns, the relationship between segment membership and several participation and behavioral predisposition variables were examined. Included as participation and predisposition variables are fishing skill level, out-of-state fishing participation, boat/canoe ownership, second home ownership, most frequented fishing sites, preferred catch species, modes, and methods of fishing, fishing attributes sought, and fishing benefits sought (Table 31). Chi-square test of independence confirmed significant between-segment differences on 6 of 8 participation characteristics, while analysis of variance tests confirmed significant differences between the segments in 13 of 34 mean importance ratings for behavioral predisposition items (22 attributes and 12 benefits sought).

(1) Fishing Skill Level: A statistically significant differences was observed between segment membership and skill level. More of those in the

Table 31. Participation Characteristics by Species-Location Segments

	Coolwater GL (10%)	Salmonid GL (11%)	Salmon SR (9%)	Coolwater IL (22%)	Trout SR (14%)	Casual Angler (21%)	Coolwater SR (9%)	Trout IL (4%)	Anglers as a Whole N=277	Chi- Square Statistics
----- percents -----										
Fishing Skill Level										44.638*
Beginner	3.7	0.0	0.0	8.1	5.6	12.1	0.0	0.0	5.5	
Somewhat Exprncd	37.0	43.3	23.1	56.5	27.8	50.0	41.7	9.1	41.6	
Experienced	55.6	50.0	69.2	35.5	63.9	37.9	54.2	72.7	49.6	
Expert	3.7	6.7	7.7	0.0	2.8	0.0	4.2	18.2	3.3	
Out-of-State Fishing										28.232*
Yes	57.1	50.0	23.1	16.4	36.1	17.2	37.5	18.2	29.6	
No	42.9	50.0	76.9	83.6	63.9	82.8	62.5	81.8	70.4	
Boat/Canoe Ownership										19.836*
Yes	57.1	66.7	42.3	68.4	48.5	46.3	71.4	100.0	58.8	
No	42.9	33.3	57.7	31.6	51.5	53.7	28.6	0.0	41.2	
2nd Home Ownership										8.317 (NS)
Yes	21.4	34.5	42.3	46.6	37.8	26.3	33.3	36.4	35.2	
No	78.6	65.5	57.7	53.4	62.2	73.7	67.7	63.6	64.8	
Most Frequented Sites										108.039*
Inland lakes	14.3	22.2	20.8	83.3	34.3	27.6	25.0	22.2	38.1	
Great Lakes	78.6	66.7	25.0	11.7	25.7	51.7	41.7	33.3	39.6	
Streams/Rivers	7.1	11.1	54.2	5.0	40.0	20.7	33.3	44.4	22.3	
Preferred Catch Species										
Perch	25.0	3.3	0.0	11.3	0.0	16.9	12.5	18.2	10.8	
Panfish	0.0	3.3	0.0	24.2	0.0	13.6	4.2	9.1	9.4	
Bass	14.3	13.3	3.8	32.3	13.5	6.8	20.8	0.0	15.4	
Walleye	32.1	6.7	19.2	14.5	5.4	25.4	29.2	18.2	18.4	
Pike	10.7	0.0	0.0	9.7	8.1	0.0	20.8	0.0	6.1	
Lake Trout	0.0	10.0	0.0	0.0	2.7	3.4	0.0	0.0	2.2	
Steelhead	14.3	3.3	11.5	0.0	13.5	3.4	4.2	0.0	5.8	
Rainbow Trout	0.0	0.0	7.7	0.0	5.4	0.0	0.0	9.1	1.8	
Brown Trout	0.0	6.7	3.8	0.0	18.9	1.7	4.2	27.3	5.4	
Brook Trout	0.0	3.3	23.1	0.0	21.6	5.1	0.0	18.2	7.2	
Trout	0.0	3.3	0.0	1.6	8.1	5.1	4.2	0.0	3.2	
Chinook Salmon	3.6	40.0	19.2	3.2	2.7	11.9	0.0	0.0	10.1	
Coho Salmon	0.0	6.7	3.8	0.0	0.0	1.7	0.0	0.0	1.4	
Catfish	0.0	0.0	7.7	1.6	0.0	0.0	0.0	0.0	1.1	
Carp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Smelt	0.0	0.0	0.0	1.6	0.0	1.7	0.0	0.0	0.7	

(Table continued)

Table 31 (Cont'd.).

	Coolwater GL (108)	Salmonid GL (118)	Salmon SR (98)	Coolwater IL (228)	Trout SR (148)	Casual Angler (218)	Coolwater SR (98)	Trout IL (48)	Anglers as a Whole N=277	Chi- Square Statistics
	----- percents -----									103.093*
Preferred Modes										
Shore/Wading	19.2	8.3	48.0	1.7	70.6	18.2	5.0	50.0	23.8	
Pier/Dock	0.0	8.3	8.0	3.4	0.0	12.7	5.0	0.0	5.6	
Private Boat	76.9	75.0	40.0	89.7	26.5	65.5	80.0	30.0	65.1	
Charter Boat	0.0	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.4	
Icefishing	7.7	4.2	4.0	5.2	2.9	3.6	10.0	20.0	5.2	
Preferred Methods										104.982*
Casting	11.1	3.4	16.0	13.1	18.9	15.1	34.8	20.0	15.5	
Spin/Spincasting	18.5	24.1	48.0	23.0	16.2	13.2	30.4	20.0	22.6	
Bait	37.0	13.8	20.0	45.9	21.6	37.7	17.4	30.0	30.9	
Trotting	33.3	51.7	4.0	8.2	8.1	26.4	17.4	10.0	19.6	
Fly Fishing	0.0	6.9	8.0	8.2	35.1	1.9	0.0	20.0	9.4	
Spearing	0.0	0.0	4.0	1.6	0.0	3.8	0.0	0.0	1.5	
Dipping	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.4	
Snagging	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

*Significant at .05 or higher level.

Trout/Streams and the Salmonid/Streams segments rated themselves as advanced anglers. Over 90 percent of anglers in the Trout/Streams segment and 76.9 percent of those in the Salmon/Streams segment are either experienced or expert anglers according to the self-evaluation. The Casual Angler angler segment contains more beginners than any other segment.

(2) Out-of-State Fishing Participation: Over 50 percent in the Coolwater/Great Lakes and the Salmonid/Great Lakes segments have participated in out-of-state fishing, as compared with 29.6 percent for all anglers. Conversely, those in the Casual Angler segment are least active with an out-of-state participation rate of 7 percent.

(3) Boat/Canoe ownership: The percentage of boat or canoe ownership is highest in the Trout/Inland Lakes (100.0), the Coolwater/Streams (71.4), the Coolwater/Inland Lakes (68.4), and the Salmonid/Inland Lakes segment (66.7). Overall, 58.8 percent of anglers own a boat.

(4) Second Home Ownership: No statistically significant difference was found. The Coolwater/Inland Lakes segment reports the highest ownership rate (46.6 percent) and the Coolwater/Great lakes segment reports the lowest (21.4 percent)

(5) Most Frequented Fishing Sites: Types of the most frequented fishing sites match the orientation of the species-location segments. For example, approximately 80 percent of those in the Coolwater/Great Lakes segment report that most of their fishing on and around the Great Lakes. Over eighty percent of those in the Coolwater/Inland Lakes report that their fishing mostly took place on inland lakes. A greater proportion of those in the stream-oriented angler segments (i.e. the Salmon/Streams, the Trout/Streams, and the Coolwater/Streams segments) fish on streams.

(6) Preferred Species: As its name indicates, species-location segments were defined in terms of species fished and types of locations where fishing took place. It is therefore reasonable to assume that the species anglers fished are more likely to be the anglers' preferred species. The distribution of preferred species by segments appears to support this hypothesis (Table 31). For example, chinook salmon is the most preferred catch specie for those in the Salmonid/Great Lakes segment, while brook trout is the most preferred by anglers in the Trout/Streams segment. Similarly, walleye is the most preferred by those in the Coolwater/Great Lakes segment, while bass is more popular among the anglers in the Coolwater/Inland Lakes segment.

(7) Preferred Modes of Fishing: Fishing from private or rental boats is most popular to five segments; the Coolwater/Inland Lakes, the Coolwater/Streams, the Coolwater/Great Lakes, the Salmonid/Great Lakes, and the Casual Angler segments. Sixty-five percent or more of anglers in these segments prefer fishing from boats. In contrast, greater proportions of anglers in the remaining three segments (i.e. the Trout/Streams, the Salmon/Streams, and the Trout/Inland Lakes segments) prefer fishing from shore or wading.

(8) Preferred Methods of Fishing: For those in the Coolwater/Great Lakes segment, bait fishing and trolling are popular methods. More anglers in the Salmonid/Great Lakes segment prefer trolling to other methods. Spin or spincasting are more popular for anglers in the Salmon/Streams segment, while bait fishing is more preferred by those in the Coolwater/Inland Lakes segment. Fly fishing is more preferred by anglers in two trout-oriented segments (i.e. the Trout/Streams and the Trout/Inland Lakes segments) than any other segment.

(9) Fishing Attributes Sought: For each segment, Table 32 presents the average importance ratings for different fishing attributes. Analysis of variance tests yielded statistically significant differences (at the .05 level) between segments on 10 out of 22 attributes sought: angler crowding, competition with other recreationists, boat facilities, marina facilities and services, availability of parking space, nearness to bait and tackle shops, natural beauty, solitude, diversity of fish species, and information about the area.

Anglers in the Trout/Inland Lakes segment display more concern about angler crowding and competition than any other type of anglers. The Trout/Inland Lakes anglers also place more importance on solitude and water clarity. Boat facilities, marina facilities, parking space, and information about the area are important factors for anglers in the Coolwater/Great Lakes segment when deciding where to fish. Nearness of bait and tackle shops is important to Coolwater/Stream anglers. Finally, anglers of three coolwater-oriented segments (i.e. the Coolwater/Streams, the Coolwater/Great Lakes, and the Coolwater/Inland Lakes segments) assign more significance to the diversity of fish species that can be caught when they select a place to fish.

(10) Fishing Benefits Sought: Statistically significant differences (at the .05 level) were observed between segments with respect to their average scores on three of 12 benefit items, relaxation, to enjoy nature, and to get away (Table 32). Anglers in the Trout/Inland Lakes segment assigned more importance to these three benefits than those in any other angler segments.

Table 32. Average Importance Scores on Attributes and Benefits Sought by Species-Location Segments

	Coolwater GL (10%)	Salmonid GL (11%)	Salmon SR (9%)	Coolwater IL (22%)	Trout SR (14%)	Casual Angler (21%)	Coolwater SR (9%)	Trout IL (4%)	Anglers as a Whole N=277	F-ratio
----- mean ratings** -----										
Attributes Sought										
Crowding	2.75	1.96	2.19	2.08	2.37	1.91	2.17	3.27	2.21	2.57*
Competition	2.29	1.63	1.85	1.95	2.19	1.46	2.00	2.73	1.92	2.21*
Shore	1.75	1.43	2.00	1.48	1.68	1.58	1.50	2.36	1.64	0.99
Boat Facilities	2.71	2.36	2.00	2.00	1.51	1.92	2.13	2.45	2.06	2.53*
Marina	1.57	1.50	1.12	0.90	0.68	1.29	1.08	0.82	1.12	2.38*
Parking	2.39	2.07	1.69	1.92	1.05	1.86	2.08	1.73	1.84	3.06*
Restaurant	0.57	0.77	0.58	0.56	0.16	0.64	0.71	0.55	0.56	1.29
Bait	1.54	1.13	1.23	1.27	0.70	1.49	1.58	1.18	1.27	2.06*
Motel	0.75	1.13	0.76	0.95	0.83	0.66	1.17	1.55	0.89	1.38
Beauty	2.43	2.03	2.46	2.09	2.05	2.00	2.79	3.00	2.23	2.37*
Solitude	2.39	1.76	2.30	2.27	2.43	1.77	2.21	2.73	2.16	2.10*
Water	3.00	2.50	2.53	2.56	2.51	2.37	2.54	2.18	2.53	1.16
Contamination	3.32	3.13	2.96	3.22	3.05	3.24	3.50	2.73	3.18	0.94
Keep Fish	2.50	2.13	2.26	2.45	2.10	2.20	2.45	1.55	2.22	1.55
All Fish	2.32	2.10	2.38	2.19	1.78	2.03	2.00	1.64	2.09	1.25
Favorite Fish	2.82	2.60	2.58	2.65	2.73	2.49	2.71	2.55	2.63	0.41
Fish Size	2.21	2.00	1.96	2.34	1.97	2.10	2.34	2.00	2.09	1.02
Diversity	2.11	1.83	1.65	2.02	1.41	1.59	2.13	1.64	1.79	2.18*
Distance	1.46	1.77	1.69	1.82	1.24	1.93	1.79	1.45	1.69	1.66
Information	2.54	1.57	1.81	1.66	1.54	1.66	1.97	2.00	1.77	2.34*
Second Home	1.04	1.10	1.04	0.92	0.84	0.81	0.88	0.91	0.92	0.28
Chance	1.64	1.97	2.00	1.47	1.68	1.56	1.48	1.55	1.64	0.85
Benefits Sought										
Eat	1.96	1.50	1.69	1.71	1.22	1.88	1.83	1.55	1.69	1.60
Relax	2.68	2.67	2.58	2.92	3.00	2.41	3.13	3.27	2.76	2.85*
Company	1.71	2.00	1.62	1.69	1.43	1.76	1.63	1.64	1.69	0.62
Nature	2.96	2.56	2.65	2.74	2.97	2.36	2.97	3.45	2.76	3.87*
Excitement	2.61	2.90	2.58	2.29	2.75	2.27	2.58	2.91	2.52	2.03
Alone	1.50	0.90	1.15	1.19	1.41	1.07	1.33	1.82	1.23	1.11
Skill	1.71	1.40	1.46	1.44	1.70	1.37	0.92	1.82	1.46	1.32
Get Away	2.75	2.10	2.50	2.65	2.29	1.78	1.88	2.82	2.29	3.69*
Exercise	1.43	1.20	1.35	0.82	1.32	1.10	1.08	1.54	1.15	1.28
Family	1.57	1.37	1.81	1.82	1.29	1.49	1.58	1.64	1.58	0.91
Trophy	0.89	1.57	1.35	1.02	1.14	1.15	0.96	1.27	1.14	0.97
Achieve	1.29	1.63	1.54	1.45	1.43	1.37	1.00	1.91	1.42	1.00

*Significant at .05 or higher level.

**Scale of responses: 0 Not Important, 1 Somewhat Important, 2 Important, 3 Very Important, 4 Crucial.

PROFILES OF SPECIES-LOCATION SEGMENTS

Factor analysis performed on the 45 species-location variables identified 9 orthogonal dimensions (factors) in the species-location data. The anglers were then grouped into segments on the basis of the overall similarities on their factor scores. The same random sample of anglers (N=281) used in the attribute segmentation was used to assure compatibility of the results. Since outliers are a threat for forming a classification, those with extreme values on any of the factor scores were omitted from the analysis. This resulted in the sample size of 277 for a classification. Cluster analysis resulted in eight segments of anglers with differing orientation of fishing participation (i.e. fish species and fishing locations): (1) Coolwater/Great Lakes (10%), (2) Salmonid/Great Lakes (11%), (3) Salmon/Streams (9%), (4) Coolwater/Inland Lakes (22%), (5) Trout/Streams (13%), (6) Casual Anglers (21%), (7) Coolwater/Streams (9%), and (8) Trout/Inland Lakes segments. These segments were then tested for their between-segment differences with respect to: socioeconomics, media usage, fishing participation patterns, and behavioral predispositions. The information furnished from this analysis led to the following segment profiles.

The Coolwater/Great Lakes Segment (10%) Anglers in this segment fish more for coolwater species in the Great Lakes than other anglers. Their favorite catch species include walleye, yellow perch, and bass, and to lesser extent for steelhead. Their preferred mode of fishing is from boats. Fishing with bait and trolling are their favorite methods. Almost sixty percent of these anglers have fished outside Michigan, the highest

rate of all segments. This segment places considerable importance on boating and marina related site selection criteria when deciding where to fish. Information about fishing sites is also an important factor for them. Over a third of these anglers are single.

The Salmonid/Great Lakes Segment (11%) consists of anglers who fish more for salmonids on the Great Lakes. Their favorite catch species are chinook salmon, lake trout, and bass. They like to fish these species from boats, and two-thirds (66.7 percent) of these anglers own boats or canoes used for fishing. Trolling and spincasting are their favorite methods of fishing. The presence of their favorite species, boat facilities, and availability of parking space are among the most important factors in deciding where to fish. This segment also places relatively more importance on the chance to catch a trophy fish. Members of this segment are more likely to be married and retired.

The Salmon/Streams Segment (9%) contains anglers who fish more for salmon on streams/rivers. They also fish for trout on streams/rivers. Their favorite catch species include chinook salmon, brook trout, and walleye. They prefer fishing these species from shore or wading, using spincasting or bait. When they select a place to fish, they pay more attention to the chance to catch a trophy fish and presence of favorite species. A large portion (76.9 percent) of these anglers are experienced or expert anglers; half have fished outside Michigan. Over forty percent own a cottage or second home by a lake or stream.

The Coolwater/Inland Lakes Segment (22%) is the largest angler segment. These anglers fish for coolwater species on inland lakes. Relatively few fish on the Great Lakes. A large portion (64.6 percent) of these anglers are either beginners or somewhat experienced. They are less active in out-of-state fishing. Their favorite catch species include bass, panfish, and walleye. Over two-thirds (68.4 percent) of them own boats or canoes used for fishing. Almost half (46.8 percent) own a second home or cottage near a lake or stream. Fishing from boats is their favorite mode of fishing. They prefer fishing with bait or spincasting to other methods. Sixteen percent of these anglers have family income of \$50,000 or more.

The Trout/Streams Segment (13%) consists of anglers who fish more for trout on streams/rivers, and to lesser extent trout on inland lakes. Brook trout and brown trout are their favorite catch species. They like to fish these species primarily from shore or wading. Fly fishing and bait fishing are their preferred methods. They are relatively unconcerned with catching fish to eat, but place more importance on experiencing nature and excitement as reasons for fishing. Solitude and size of fish are important criteria when they select where to fish. A relatively large proportion (66.7 percent) of these anglers are advanced anglers (i.e. experienced or expert anglers). This segment contains the largest proportion of college graduates (21.2 percent), and the largest proportion of blue collar workers (55.2 percent).

The Casual Angler Segment (21%) is the second largest angler segment. Casual Anglers exhibit no clear species-location preferences.

Anglers in this segment are older than those of any other segment, averaging 44.3 years old. They are relatively less skilled, less active in out-of-state fishing, and less likely to own a boat or canoe. Their favorite catch species include walleye, yellow perch, panfish, and chinook salmon. Bait fishing and trolling are preferred methods by this group. They place relatively more importance on catching fish to eat as a reason for fishing. Contamination of fish, presence of favorite species, and nearness to bait or tackle shops are more likely to be influential factors in deciding where to fish.

The Coolwater/Streams Segment (9%) Anglers in this segment fish for coolwater species on streams/ivers. Among coolwater species their favorites are walleye, bass, and pike. They like to fish these species from boats. Casting and spincasting are their most preferred fishing methods. Over seventy percent (71.4 percent) of these anglers own boats or canoes used for fishing. These anglers place relatively more importance on diversity of fish species that can be caught and nearness to bait or tackle shops when they select a place to fish. Contamination of fish is also an influential site selection criterion for them. To relax and enjoy nature are important motivational factors for this segment. They are less concerned with improving fishing skills and catching a trophy fish. This segment contains the largest proportion (17.4 percent) of non-whites; half of the anglers have children under 17 years of age.

The Trout/Inland Lakes Segment (4%) is the smallest segment. Anglers in this segment fish for trout on inland lakes. Brown trout and brook trout are their favorite catch species. Relatively few fish for walleye

and yellow perch. These anglers prefer bait fishing from shore or wading. They are relatively more concerned with angler crowding, competition with other recreationists, natural beauty of fishing sites, and solitude. They are relatively less concerned with catch rate. Their primary reasons for fishing are to enjoy nature, relax, and get away. This segment is the youngest angler group averaging 35.5 years of age. this segment is the most highly skilled segment. Everyone in the sample classified in the Trout/Inland Lakes segment own a boat. They are not very active in out-of-state fishing.

Table 33. Summary of Species-Location Segments

Segment	Attributes Sought		Benefits Sought		Socioeconomic Characteristics	Participation Characteristics	Size of the Segment (Market Share)
	High	Low	High	Low			
Coolwater/ Great Lakes	Boat Marina Parking	Motel	Get away Nature	Trophy	More whites More singles More high school grads	Most active in out-of-state fishing	10%
Salmonid/ Great Lakes	Favorite Boat Parking Chance		Excitement Trophy		Older More retirees More married	More boat owners Trotting and spincasting	11%
Salmon/ Streams	Chance Favorite		Get away		Younger More whites	More skilled Active in out-of-state fishing More 2nd home owners	9%
Coolwater/ Inland Lakes	Diversity	Marina	Get away Relax	Exercise	Higher family income More married	Less skilled More boat owners More 2nd home owners Fish from boat with bait or spincasting	22%
Trout/ Streams	Crowding Solitude	Marina	Nature Excitement	Eat	More blue collars More college grads	More skilled Fish from shore with fly or bait	14%
Casual Angler	Contamination		Excitement	Alone	Oldest segment (44 years)	Less skilled Least active in out-of-state fishing	21%
Coolwater/ Streams	Bait Contamination Diversity		Relax Nature	Skill Trophy	More children under 17 More non-whites	Intermediate (skill) anglers More boat owners Fish from boat with casting or spincasting	9%
Trout/ Inland Lakes	Crowding Competition Beauty Solitude	Marina	Relax Nature Get away		Youngest segment (36 years) More singles More college grads More white collars	More boat owners Fish from shore with bait	4%

CHAPTER VII

COMPARISON OF TWO SEGMENTATION APPROACHES

Two different segmentation bases have been applied separately to identify distinguishable groups of anglers comprising Michigan's sport fishing market. This resulted in two different sets of classification of Michigan anglers, attribute sought segments and species-location segments. For each segmentation approach, angler segments were evaluated based upon three criteria and detailed segment profiles were developed. This chapter directly compares the two segmentation approaches with respect to four criteria: identifiability, substantiality, variation in market response, and exploitability.

IDENTIFIABILITY

Identifiability of segments concerns the degree to which segments are recognizable and accessible so that marketing efforts may be directed at the target groups. Hence, it is assessed in terms of segment differences observed on: (1) socioeconomic characteristics and (2) media usage.

Socioeconomic Characteristics

Seven socioeconomic characteristics were evaluated: age, marital status, presence of children under 17, racial background, family income, education, and occupational status. Although some weak relationship were observed, none of these characteristics were found to be significantly related to segment membership. (Table 34). Both segmentation approaches failed to relate differences in segment membership to differences in the socioeconomics at .05 level of statistical significance. Socioeconomics are not helpful for identifying or discriminating between angler segments derived from either of the two approaches.

Table 34. Evaluation of Segments' Identifiability

	<u>Attribute Sought Segmentation</u>		<u>Species-Location Segmentation</u>	
	Chi-Square	Significance Level	Chi-Square	Significance Level
Socioeconomics				
Age	34.091	.5118	27.356	.8183
Marital Status	7.099	.4187	6.793	.4507
Children under 17	5.344	.6180	4.908	.6711
Race	8.055	.3278	7.387	.3897
Family Income	45.478	.1106	36.358	.4814
Education	23.170	.9373	23.730	.9257
Occupational Status	37.340	.3618	43.340	.1574
Information Sources				
Opinions of Anglers	16.773	.2685	6.594	.1057
DNR Information	12.199	.5903	17.044	.2200
Newspapers	28.739	.0113*	20.843	.6938
Magazine Articles	28.113	.0137*	17.716	.2200
Bait/Tackle Shops	24.705	.0376*	10.901	.6938
Radio or TV	27.639	.0159*	16.879	.2627

Note: Significance at .05 or higher level is highlighted by asterisk (*).

Fishing Information Sources

Relationships between segment membership and usage levels of six selected fishing information sources were tested: (1) opinions of anglers, (2) information from DNR, (3) newspapers, (4) magazine articles, (5) bait/tackle shops, and (6) radio or TV. Comparative analyses found some significant differences for attribute sought segmentation, but none for species-location segmentation (Table 34). Attribute sought segments varied in their use of four information sources: newspapers, magazine articles, bait/tackle shops, and radio or TV.



SUBSTANTIALITY

The substantiality of segments is assessed via their relative size. The attribute sought segments range in size from 8 percent to 17 percent, while species-location segments range from 4 percent to 22 percent. Based on the 1984 Michigan Department of Natural Resources estimate of 1,170,085 Michigan annual licensed anglers, this translates into the attribute sought segments ranging in size from 93,607 to 198,915 individuals and the species-location segments ranging from 46,804 to 257,419 individuals. Attribute sought segments are more even-sized, while species-locations segments tend to vary in size a bit more. Overall, however, it can be said that both approaches yielded segments of reasonable size.

VARIATION IN MARKET RESPONSE

Variation in market response is the degree to which angler segments differ with respect to their fishing needs, behavior, or behavioral

predispositions. Distinct marketing and management programs can not be developed without such differences. Variation in market response is assessed via segment differences observed on: (1) fishing participation patterns and (2) attribute and/or benefit sought orientations.

Participation Characteristics

Several behavior characteristics were tested: (1) fishing skill level, (2) out-of-state fishing participation, (3) boat/canoe ownership, (4) second home ownership, (5) most frequented fishing sites, (6) preferred fishing modes, and (7) preferred fishing methods. Of these characteristics, all but second home ownership were found to be significantly associated with species-location segment membership. Segments derived through the attributes sought approach differed with respect to only three of these characteristics, second home ownership, most frequented fishing sites, and preferred fishing modes (Table 35). Species-location segments explained more in fishing participation patterns than attribute sought segments.

Fishing Attributes and Benefits Sought

Since attribute sought segments were defined in terms of importance scores attached to specific attributes, it is no surprise to see that attribute sought segmentation performs better than the species-location segmentation in discriminating anglers' attribute sought orientation. The attribute sought segments differed with respect to the average importance scores attached to all the 22 attributes. Since classification of anglers was based on factor scores rather than original attribute variables, significant differences found on all the 22 original variables lends

Table 35. Variation in Market Response - Part 1 -
(Fishing Behavior Characteristics)

Behavior Characteristics	Attribute Sought Segmentation		Species-Location Segmentation	
	Chi-Square	Significance Level	Chi-Square	Significance Level
Fishing Skill Level	24.999	.2472	44.638	.0019*
Out-of-state Fishing	9.517	.2177	28.232	.0002*
Boat/Canoe Ownership	7.187	.4096	19.836	.0059*
2nd Home Ownership	18.151	.0113*	8.317	.3055
Most Frequented Sites	42.302	.0001*	108.039	.0000*
Preferred Species	—	—	—	—
Preferred Modes	46.824	.0143*	103.093	.0000*
Preferred Methods	53.292	.1136	104.982	.0000*

Note: Significance at the .05 level or higher is highlighted by asterisk (*). Statistical test was not available for testing differences in preferred species due largely to a small sample size and a relatively large degree of freedom.

support to the effectiveness of classification based on the factor scores. Segments derived through the species-location segmentation, on the other hand, differed with respect to 10 attributes sought out of 22 (Table 36).

The attribute segmentation also performed better in explaining differences in importance ratings on fishing benefits sought. Ten out of 12 benefits sought were found to be significantly associated with attribute sought segment membership. On the other hand, the average importance scores were significant across species-location segments for only 3 of 12 benefits sought (Table 36).

Table 36. Variation in Martet Response - Part 2 -
(Fishing Attributes and Benefits Sought)

	Attribute Sought Segmentation		Species-Locations Segmentation	
	F- Ratio	Significance Level	F- Ratio	Significance Level
Attributes Sought				
Crowding	13.891	.0000*	2.566	.0142*
Competition	19.564	.0000*	2.209	.0338*
Shore	2.798	.0079*	.994	.4360
Boat Facilities	22.565	.0000*	2.530	.0155*
Marina	26.532	.0000*	2.384	.0222*
Parking	62.302	.0000*	3.063	.0040*
Restaurant	39.193	.0000*	1.285	.2577
Bait/Tackle Shops	19.529	.0000*	2.062	.0479*
Motels	19.292	.0000*	1.382	.2130
Natural Beauty	30.466	.0000*	2.365	.0232*
Solitude	20.509	.0000*	2.104	.0434*
Water Clarity	21.925	.0000*	1.165	.3234
Contamination	5.286	.0000*	.934	.4763
Keep Fish	36.344	.0000*	1.550	.1505
All Fish	18.718	.0000*	1.252	.2747
Favorite Fish	13.194	.0000*	.415	.8924
Fish Size	22.492	.0000*	1.018	.4191
Diversity	17.157	.0000*	2.178	.0364*
Distance	7.209	.0000*	1.664	.1179
Information	11.704	.0000*	2.338	.0248*
Second Home	7.841	.0000*	.282	.9607
Chance	7.497	.0000*	.854	.5440
Benefits Sought				
Eat	4.029	.0003*	1.602	.1347
Relax	5.589	.0000*	2.851	.0070*
Companion	5.008	.0000*	.622	.7374
Nature	10.009	.0000*	3.874	.0005*
Excitement	3.861	.0005	2.027	.0520
Alone	5.712	.0000*	1.113	.3550
Skill	2.832	.0073*	1.323	.2392
Get Away	4.758	.0000*	3.696	.0008*
Exercise	1.934	.0644	1.278	.2617
Family Togetherness	1.305	.2477	.779	.5866
Trophy	3.273	.0023*	.972	.4520
Achievement	4.248	.0002*	1.008	.4255

Note: Significant at .05 or higher level is highlighted by asterisk (*). One-way fixed model of analyses of variance were used for testing differences of means of attribute and benefit importance ratings.

EXPLOITABILITY

Exploitability refers to the degree to which the segments assist management decision-making. Relative to the management of Michigan's sport fisheries, the exploitability is assessed in terms of the utility of segmentation approaches for decisions regarding: (1) fish populations, (2) regulations, (3) promotion of support-amenity facilities development, (4) access programs, and (5) information dissemination/angler education/promotion. Unlike evaluation of other three segmentation criteria, that of exploitability is external in nature and more subjective: the utility of segmentation approaches is evaluated by management, rather than evaluated solely on the basis of the segmentation results. The staff of the Fisheries Division evaluated the utility of each approach in terms of the five categories of decisions on a scale: very useful, considerably useful, somewhat useful, a littel useful, and not useful (see Appendix C).

On the basis of the evaluation, both approaches are especially useful when making decisions regarding fish populations, promotion of support facilities, and access programs, with none of the Fisheries staff questioning the usefulness (Table 37). As the Fisheries staff see, the two segmentation approaches exhibit almost equal degree of usefulness or applicability in making decisions regarding the management of fish populations. However, results of the evaluation also indicate that the attribute sought segmentation approach is slightly superior or at least as useful as the species-location approach with respect to the remaining types of decisions (e.g. regulations, promotion of support facilities, access programs, and fishing information dissemination/promotion/angler education).

Table 37. Evaluation of Segments' Exploitability

TYPE OF DECISION Segmentation Approaches	Very Useful	Considerably Useful	Somewhat Useful	A Little Useful	Not Useful
FISH POPULATIONS	absolute frequencies				
Attribute Sought	2	1	2	1	0
Species-Location	3	1	0	2	0
REGULATIONS					
Attribute Sought	3	0	1	1	1
Species-Location	0	2	2	0	2
SUPPORT FACILITIES					
Attribute Sought	1	2	1	2	0
Species-Location	1	0	1	4	0
ACCESS PROGRAMS					
Attribute Sought	3	1	1	1	0
Species-Location	3	0	0	3	0
PROMOTION/INFO. DISSEMI.					
Attribute Sought	2	1	2	1	0
Species-Location	1	2	1	1	1
OVERALL DECISION*					
Attribute Sought	11	5	7	6	1
Species-Location	8	5	4	10	3

Note: Total number of respondents is six.

*For each segmentation approach, scores on the overall decision are obtained through summing up the numbers of responses for the same response category across five types of decision, assuming that the five decisions are equally important (i.e. weighted).

Assuming that these management decisions are equally important (i.e. equally weighted), a measure of overall actionability (applicability) can be obtained by summing up the number of responses for the same response category across five decisions. The results of this are also presented in Table 37. As expected from its performance on individual decision context, the overall actionability or applicability is again slightly in favor of the attribute sought segmentation approach.

SUMMARY

Attribute segments were somewhat more identifiable than species-location segments. Attribute sought segments are differentially accessible through some media sources, while species-location segments are not. Both approaches failed to relate differences in segment membership to socioeconomic variables.

Both approaches performed well in terms of substantiality, although the attribute segmentation produced more even-sized segments than the species-locations approach. Attribute sought segments vary in size from 8 percent to 17 percent, while species-location segments vary from 4 percent to 22 percent.

The two segmentation approaches produced mixed results in terms of variation in market response. The species-location segmentation performed better than the attribute sought segmentation in relating the segment membership to fishing participation patterns. However, the attribute sought segmentation performed better in terms of anglers' behavioral predispositions including fishing benefits and attributes sought.

Finally, the attribute sought segmentation approach received higher ratings than the species-location approach from fisheries managers with respect to exploitability. The attribute sought segments were deemed slightly more useful for four of five types of management decisions. Both approaches received similar evaluation for application to management of fish populations.

CHAPTER VIII

CONCLUSIONS

Two major interests led the course of this study: the practical application of market segmentation techniques to Michigan's sport fishing market and methodological problems associated with the development and evaluation of the segments. Three study objectives were: (1) to develop and evaluate segments based upon anglers' behavioral predispositions (e.g. psychological factors), (2) to develop and evaluate segments based upon anglers' actual fishing (use/purchase) behavior, and (3) to evaluate and compare the two approaches based upon both statistical criteria and applicability to fisheries management. As Chapters V, VI, and VII report the study's results for accomplishing these objectives, all three objectives were successfully achieved. This concluding chapter summarizes the study, discusses some of the most important study results, reminds the reader of major study limitations, and provides some directions for future segmentation research.

SUMMARY OF THE STUDY

Six alternative segmentation bases were identified, four dealing with fishing behavior and two representing behavioral predispositions: (1) species fished, (2) species fished and the corresponding fishing

locations, (3) modes, and (4) methods, (5) fishing attributes sought, and (6) fishing benefits sought. Data on the segmentation bases were obtained through the Michigan Sport Fishing Survey conducted at the Fisheries Division, Michigan Department of Natural Resources. Preliminary analyses of these six segmentation bases indicated that two bases were more promising in terms of statistical criteria and interpretability: attributes sought in a fishing location and species-location. These two segmentation bases were therefore examined in detail.

The attribute segmentation produced eight angler segments: (1) Crowding, (2) Boating-Nature-Fish, (3) Fish, (4) Nature, (5) Boating, (6) Casual Angler, (7) Amenity, and (8) Boating-Crowding segments. The relative size of these segments ranged from 8% to 17%. The attribute sought segments differed with respect to their media usage, fishing participation characteristics, and fishing benefits sought.

The species-location segmentation yielded 8 segments: (1) Coolwater/Great Lakes, (2) Salmonid/Great Lakes, (3) Salmon/Streams, (4) Coolwater/Inland Lakes, (5) Trout/Streams, (6) Casual Angler, (7) Coolwater/Streams, and (8) Trout/Inland Lakes segments. These segments varied in size from 4% to 22%. The eight segments exhibited several potentially exploitable behavioral differences and attribute preferences.

Detailed profiles were developed for the attribute sought and species-location segments. Profiles based on socioeconomic, media habits, fishing behavior, and behavioral dispositions, help to more clearly identify these segments and are of particular use for developing marketing programs aimed at these groups.

After the completion of each segmentation, the two segmentations were compared with respect to four segmentation criteria: identifiability,

substantiality, variation in market response, and exploitability. The attribute sought segments were more identifiable, while both approaches yielded segments of substantial size. The attribute sought approach yielded more exploitable differences on behavior predispositions, while the species-location approach better discriminated actual behaviors (e.g. participation patterns). Management evaluation of the exploitability of the two approaches favored the attribute sought approach.

CONCLUSIONS AND DISCUSSION

Six major conclusions can be drawn from the study, three managerial and the other three methodological. In brief, these conclusions concern: (1) heterogeneous nature of the sport fishing market, (2) associations between socioeconomic and segment membership, (3) usefulness of both attribute and species-location segmentations, (4) effectiveness of factor analysis prior to cluster analysis, (5) the two-stage clustering method, and (6) use of multivariate statistical techniques for planning and management purposes.

Above all, Michigan's sport fishing market is a diverse, heterogeneous conglomeration of angler segments. The study empirically uncovered in a relatively comprehensive manner the heterogeneous nature of the demand-side of the sport fishing market, showing that there are groups of anglers with distinguishable preferences on attributes sought (i.e. behavioral predispositions) and with distinct participation characteristics (i.e. behavior). Given this fact, it is unlikely that an undifferentiated management strategy will succeed in satisfying the fishing needs and wants of Michigan's sport fishing market. Thus, the

study provides further support for the adoption of a segmented strategy for marketing and managing fishery resources. Management actions aimed at providing different groups of anglers with different fishing opportunities should be encouraged. Such management actions should lead to greater satisfaction of anglers as well as more efficient and effective allocations of the fishery resources.

Secondly, socioeconomics are not effective in identifying attribute sought and species-location segments. For both segmentations, no significant differences were found between segments with respect to their socioeconomic characteristics including: age, marital status, presence of children, racial background, family income, education, and occupational status. This suggests that standard socioeconomic variables are not reliable criteria for identifying the angler segments. This failure to identify socioeconomic differences parallels research findings for other outdoor recreation activities (Tatham and Dornoff, 1971; Romsa and Girling, 1976) as well as research conducted in marketing (Bieda and Kassarian, 1969; Sheth, 1977; Sewall, 1978) which also failed to link segment membership to socioeconomic-demographic variables.

The findings raise questions of both theoretical and managerial interest. Are socioeconomic characteristics close correlates of product preferences and/or use-purchase behavior? Can we rely on socioeconomics as identifiable customer (user) traits? The results of the angler segmentations lend support to those claiming that socioeconomics are more likely to be a moderator rather than a determinant of behavior or behavior predispositions. In the present case, for instance, anglers' socioeconomic characteristics are weakly correlated with boat ownership or second home ownership which in turn are more strongly associated with

segment membership. More research is needed to further clarify these associations.

Thirdly, both attribute and species-location variables are useful bases for segmenting the sport fishing market. These two ways of segmenting the market revealed different kinds of information and have differing degrees of relevance to different types of marketing and/or management decisions. They can and should be used for different decisions. Species-location segments are directly relevant to biological management of the fishery and fish populations (e.g. stocking in terms of fish species and locations). This segmentation approach is more likely to fit better into a more traditional fisheries management program. In contrast, the attribute segments are not species or location specific, and therefore are less directly relevant to a particular program for managing fish populations, except for managing for trophy fish versus high catch rates. The attribute segmentation helps more traditional biologically inclined fishery managers view the market in a broader light. Many studies have found that catching fish is only a part of the total fishing experience and many factors other than fish play a major role in a successful fishing experience (e.g. Moeller and Englken, 1972; Knopf, et al, 1973; Adams, 1979; Hudgins, 1984). The attribute segmentation provides a fresh insight into what constitutes a successful fishing experience and how the angler's total fishing experience can be managed.

On the basis of the segmentation results, a number of marketing and management strategies can be developed. For example, the study indicates that there are groups of anglers concerned with boat launching and marina facilities/services. To better serve these anglers, the Fisheries Division may want to increase cooperative efforts with the Waterways

Division who is responsible for the development of boat launching, harbors of refuge, and transient marina slips. With the increased cooperation, the Fisheries Division should be able to offer fishing opportunities that more closely match the needs of anglers who fish from boats. In a similar manner, the Fisheries Division may establish a cooperative relationship with communities and the private sector in meeting the needs of the Amenity segment. Development and promotion of amenity and support facilities for anglers are better coordinated in the cooperative efforts.

The segmentation results can also serve as a basis for more comprehensive angler-oriented management plans. The information furnished from the segmentation analyses should enable the Fisheries Division to formulate more precise and rational management plans. The species-location segmentation is specie- and location-specific, and will be particularly useful in developing plans for managing fish populations (e.g. fish stocking and allocation plans). On the other hand, the attribute segmentation will be of more use for planning and developing support facilities that better match the needs and wants of different anglers.

The segmentation analyses also provide information to enable the Fisheries Division to better communicate with various angler segments. Study results provide some useful insights for the development of promotional strategies. Most importantly, separate and precise promotional themes and efforts can be created and targeted at different angler segments. For example, it will be more successful to provide Crowding conscious anglers with information on low-use fishing areas (e.g. brook trout fishing in the Upper Peninsula), rather than providing more general information. Promotional effort may also be directed to Casual

Angler segment in an effort to convert these anglers into more committed anglers. Promotional themes aimed at increasing levels of involvement of the casual anglers may be developed. Point-of-purchase display (e.g. posting signs at/near fishing sites) and direct mail advertising to first-time license purchasers may be useful for this purpose.

Fishing from private boat is the most popular mode of fishing and over half (58 percent) of anglers own boats used for fishing. Also, 3 of 8 attribute sought segments were boating related. Given these facts, it is highly recommended that DNR fishing information (e.g. brochures) include boat launching, and access information. Information on amenity and support facilities may also be incorporated into general fishing brochures.

These are just a few examples of how the segmentation results can be used. They indicate how the two segmentations are useful and can be utilized in managing and planning the sport fisheries at various levels of decision-making.

Three methodological conclusions follow the above managerial conclusions. The first of these concerns the use of factor analysis. The factor analysis of variables prior to cluster analysis works well and is strongly recommended, if no clear a priori way (e.g. theories or hypotheses) is available to select variables to form segments. Researchers (Punj and Stewart, 1983) suggest the selection of variables be guided by an explicit theory or hypothesis. However, often times these theories or hypotheses are not established and available for a particular subject matter under investigation. Factor analysis can be of great help in such situations, as it identifies the basic dimensions underlying a given data set. In this study, factor analysis uncovered a fairly clean

dimensional structure within each data set which greatly simplified the interpretation of clusters. In addition to the variable selection issue, factor analysis is useful in preparing variables for cluster analysis. It can serve to eliminate multicollinearity (intercorrelations among variables) as well as for standardizing diverse scales of measurement. It also reduces the number of variables that go into the clustering process. During the preliminary analysis, attempts to cluster on the original sets of variables were far less successful than clustering on factor scores due largely to intercorrelation among the variables, the existence of variables with different means and variances, and a large number of variables.

Another highlight of the research methods is the two-stage clustering method. The combination of a hierarchical method (e.g. Ward's method) and non-hierarchical method (e.g. the iterative partitioning method) employed in the study has a solid theoretical base (Hartigan, 1975; Milligan, 1980, Punj and Stewart, 1983). The two-stage clustering performed fairly well on the empirical data, complementing each other's characteristics and helping identify outliers. This provides strong empirical support for their use recommended by Punj and Stewart (1983).

Finally, the present study has demonstrated how more sophisticated multivariate statistical procedures can be used in planning and management purposes. Both cluster analysis and factor analysis were useful in understanding the complexity of the angler market. Factor analysis identified the basic dimensions underlying the data, while cluster analysis was used to identify various user types (i.e. market segments). The two procedures produced intuitively understandable and managerially useful results. Planners and managers often collect and analyze large

sets of data. With the proper use of these and other multivariate techniques, however, complex patterns and relationship can be identified and converted into a more understandable and, at the same time, manageable set of data without a significant loss in information. The performance of the methods used in this study provides further support for the potential of these multivariate statistical procedures to help managers and planners better understand market behavior, and consequently make better planning and management decisions.

STUDY LIMITATIONS

All research is subject to limitations, and the present study is no exception. There are several limitations underlying the present study that should be acknowledged.

First, the study only included licensed Michigan anglers. Daily license holders were not considered, due to difficulties inherent in the current license registration system. Daily license holders account for 13 percent of the market. Compared with annual license holders, daily license holders are considered to be less active and less committed anglers. In that sense, a larger casual angler segment might have emerged if a representative sample of daily licensees were included in the study. Information on daily license holders would complement the present investigation and permit a more comprehensive analysis of Michigan's sport fishing market. This should be kept in mind for future research.

Another study limitation concerns the timing of the data collection and sampling. Sampling for the survey was done August 10, 1985. Anglers do not appear on computer license lists until 2 to 3 months after a

license is purchased. Thus, sampled anglers must have purchased licenses during June of 1984 or earlier in the year. As a consequence, those who were sampled and studied are more likely to represent annual license holders who purchased licenses relatively early in the year. Although there is no evidence with regard to differences between early license purchasers and late purchasers, interpretation of the results from the study should be made with this in mind. Additional research effort focusing on the relationship between early and late license purchasers is recommended.

Thirdly, a relatively small sample size was used in the segmentation analyses. This was largely because of the costs and limitations of computer programs for executing cluster analysis. More comprehensive analysis of the segments is possible with a larger sample size. For example, estimation of each segment's size relative to the total market (i.e. market share) would be more accurate and reliable with larger sample sizes. In addition, statistical analysis of the market segments including tests for between-segment differences would also be further facilitated. In this study, for instance, some difficulties were encountered in obtaining statistics (e.g. Chi-square statistics) for testing between-segment differences on preferred species, due to small sample sizes and a high degrees of freedom. To some extent, this problem can be reduced with a larger sample size.

The fourth limitation concerns attribute sought segmentation, especially, the identification of attributes sought. Although a considerable amount of thought was given to identify relevant attributes that anglers seek when they decide where to fish, there is no assurance that the attributes appearing on the questionnaire are a complete list of

all the relevant attributes sought. The problem of identifying relevant attributes is not unique to the present study, but is rather inherent in segmentation studies employing attribute and/or benefit sought approaches. Continuous research effort is needed to determine a battery of attributes relevant to the management and planning of the fishery resource.

The last study limitation concerns the stability of derived segments over time. People change, the environment changes, and therefore market segments are likely to change over time. In this sense, all segmentation studies employing cross-sectional study designs have time limits on their usefulness. The present study is no exception. Because of its cross-sectional nature, there is no assurance that the derived segments are stable over time. For example, the bundle of attributes sought used in the attribute sought segmentation may change as environmental characteristics change. Even if the attributes remain relatively stable, the size of each attribute sought segment may change over time. These possible changes could have significant effects on fisheries management and related policy formulation over time. Therefore, the findings of the present study should be taken as depictions of phenomena during the specified period of time in the study, and interpreted with that in mind. Periodic updating and retesting are necessary.

RECOMMENDATIONS FOR FURTHER RESEARCH

The major purpose of the study has been accomplished. During the process of the research, additional questions arose which may merit future investigation. Six recommendations for future research are briefly discussed here.

First, a follow-up study should be conducted to further evaluate the stability of the empirical classifications of anglers. Three approaches to cross-validation of cluster solution are recommended here. One is to complete the same segmentation analysis on a holdout sample. Descriptive statistics of the two sets of clusters can be compared to determine the degree to which similar clusters have been identified. Another procedure involves the use of a different clustering method, perhaps average linkage which is also considered to be a highly accurate classification procedure. Thus, instead of Ward's method another algorithm can be used in obtaining a preliminary cluster solution, followed by a reallocation method for cluster refinement to see if a similar cluster solution emerges. The third procedure is to use discriminant analysis with cluster membership as the group membership variable. Using the cluster solution developed in the present study, discriminant functions can be estimated and then applied to a holdout sample. The degree to which the assignments made with the discriminant functions agree with assignments made by a cluster analysis of the holdout sample serves as an estimate of reliability of the cluster solution.

Secondly, it is recommended that the unclassified anglers in the survey sample be assigned to segments. There is no single widely accepted procedures for assigning new cases to pre-defined segments. Two approaches are worth investigation. A discriminant functions can be developed to predict group membership. The discriminant functions can then be applied to the non-classified cases in order to assign them to the pre-specified groups (i.e. segments). Alternatively, unclassified members may be assigned to existing segments based upon their similarity or proximity to the (multidimensional) segment centroids. While holding the

segment centroids constant, each member of the unclassified sample is compared with centroids of each segment and is assigned to the segment with the nearest centroid. Because of the costs and limitations of classification procedures, it is often difficult to use a large sample size for the initial classification. Assignment of unclassified anglers to the segments will be of significant use here, and more research is needed for that.

A third recommendation is that angler segments be examined on a geographic basis. The present segmentation study has been conducted on a statewide basis. Profiles and shares represent the entire Michigan sport fishing market. No attempt has been made to systematically relate the segmentation results to specific geographic areas (e.g. management districts). Since the Fisheries Division's management and planning actions are designed and implemented at the district level, a geographic analysis of the results should provide more relevant information for formulating marketing and management strategies and allocating resources at the district level. To perform geographic analyses, however, a larger sample must be classified. This will again necessitate an assignment of anglers in the unclassified sample to the segments.

Fourth, segmentation analyses using the other four segmentation bases should be completed and the results should be compared with those from the present study for improved knowledge of Michigan's sport fishing market. Segment Congruence Analysis proposed by Green and Carmone (1979) may be useful when several segmentation bases need to be compared. The design of segment congruence analysis involves the use of multidimensional contingency analysis to evaluate which set of variables should constitute the base from which segments are formed. Test or evaluation of mutual

association across the separate bases of segmentation can be carried out by means of log-linear models, specifically, logit analysis. This method appears to be especially useful in that alternative segmentations can be tested or evaluated for mutual association without the linearity assumptions that other methods (e.g. generalized canonical correlation) require.

Fifth, a research effort should be directed to periodically monitor market segments. Numerous internal and external factors have an effect on the demand-side of the sport fishing market. Demands for fishing are by no means static, but rather dynamic. A periodic study would greatly help management in better understanding the dynamic and complex nature of the sport fishing market. A similar segmentation study should be conducted probably once two to three years.

Finally, identification of relevant attributes sought are critical in performing attribute sought segmentation. As mentioned in the study limitation section, even after the researcher's careful selection of attributes sought, there is always a possibility of some other important attributes being left out. In addition, the changing nature of the market and the environment may have an effect on the relevance of different attribute: once relevant attributes sought simply may not be so at some other point in time. Continuous research is therefore necessary for the identification of specific attributes. The search for specific attributes should be based on considerations of whether attributes capture important dimensions of fishing behavior, and whether they can be of use when formulating specific management actions.

In all, the study's success in achieving its objectives has led to a new and more comprehensive understanding of Michigan's sport fishing

market. The study has been especially successful in providing useful information and insight that will help in better understanding the heterogeneous nature of the angler market and classifications (or typologies) of anglers. They will be of particular use in identifying and deciding on kinds of management actions for providing the public with better fishing opportunities in Michigan. Also, the information furnished here can be of further use in broader planning and/or coordinating efforts for various uses of water resources in the Great Lakes region. More informed decision-making contributes to greater fishing opportunities and enjoyment of anglers.

APPENDIX A

THE MICHIGAN SPORT FISHING SURVEY QUESTIONNAIRE

MICHIGAN SPORT FISHING SURVEY

Dear Angler:

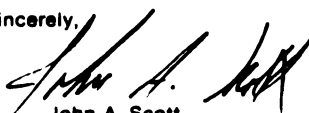
Each year the Department of Natural Resources (DNR) must gather information on recreational fishing in Michigan. One of the best methods is to obtain information directly from the angler. This information will be used to improve fishing opportunities and document the importance of fishing to the state's economy.

Your name has been selected at random from fishing license records. Would you please take a few minutes to answer all the questions. A prompt return of your questionnaire in the postpaid return envelope will be appreciated.

Questionnaires are being sent to a number of anglers but there can be no substitute for the information you, yourself, provide. Your response is needed even if you did not fish or did not catch anything. Be assured that your reply is confidential and will be used only for better management of Michigan's fish resources.

Thank you for your cooperation.

Sincerely,



John A. Scott
Chief, Fisheries Division

1. a. Where is your permanent residence? County _____ State _____ Zip Code _____
b. How long have you lived there? _____ years. c. How long have you lived in Michigan? _____ years.

2. Are you married? ☐ Yes (go to question 2a) ☐ No (go to question 2b)

2a. Does your spouse fish? ☐ Yes ☐ No

2b. Do you have any children age 16 or younger? ☐ Yes ☐ No (go to question 3)

2c. Please indicate their ages and whether or not they fish:

Ages	Male	Female	Do they fish?	
			Yes	No
_____	☐	☐	☐	☐
_____	☐	☐	☐	☐
_____	☐	☐	☐	☐
_____	☐	☐	☐	☐

3. Please indicate when you work:

☐ Full-Time Days ☐ Full-Time Nights ☐ Part-Time Days ☐ Part-Time Nights ☐ Retired ☐ Unemployed ☐ Student

4. How long have you been fishing? _____ years. How long have you fished in Michigan? _____ years.

5. How do you rate yourself as an angler? ☐ Beginner ☐ Somewhat experienced ☐ Experienced ☐ Expert

6. Did you fish in any other state or foreign country last year? ☐ Yes ☐ No

If yes, where? _____

and for what species? (e.g. trout) _____

7. Please check one box indicating with whom you fish most often:

☐ Alone ☐ Spouse ☐ Son(s) ☐ Daughter(s) ☐ Other Relatives ☐ Friends

8. Do you own a boat(s) or canoe(s) used for fishing in Michigan? ☐ No ☐ Yes Please complete table below.

		Length In Feet	Total Days Used Per Year	Days Per Year For Fishing
Boats	#1			
	#2			
Canoes	#1			
	#2			

- 9 Over the last two years, we would like to know (1) what species did you fish, (2) where did you fish for these species, (3) modes of fishing, eg shore, pier, and (4) fishing method(s) you used. If you fished in more than one location or used more than one method, check all appropriate boxes (see example). Please answer only for the last two years.

Did you fish for these species over the last two years?			Location of Fishing			Mode of Fishing				Fishing Method							
Fish	Yes	No	Inland Lakes	Great Lakes	Shoreline	Shore or Pier or Dock	Boat or Private Boat	Charter Boat	Ice Fishing	Castling	Spicecasting	Bait Fishing	Trotting	Fly Fishing	Spearing	Dipping	Snagging
(EXAMPLE) Bass	☒	☐	☒	☐	☐	☒	☐	☐	☐	☐	☐	☒	☐	☐	☐	☐	☐
Yellow Perch	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Panfish	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Bass	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Walleye or Sauger	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Pike or Musky	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lake Trout	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Steelhead	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Rainbow Trout	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Brown Trout	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Brook Trout	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Chinook Salmon	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Coho Salmon	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Calfish or Bullhead	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Suckers or Carp	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Smelt	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

- 10 Which one of the above species do you most prefer to catch? (name one only)
- 11 Please name the one mode (listed above) of fishing you most prefer (name one only)
- 12 Please name the one method (listed above) of fishing you most prefer (name one only)
- 13 What one location in Michigan do you do most of your fishing?
Name of Lake or Stream County or nearest Town City
- 14 Do you own a home or cottage camp by a lake or stream? ☐ Yes ☐ No

(name one only)

CONTINUE

15 In order to improve fishing opportunities, we need to know what factors are important to you in selecting where and when to fish. Please check one box indicating the importance you place on the factors shown in the table below.

	Crucial	Very Important	Somewhat Important	Not Important
Angler crowding	☐	☐	☐	☐
Competition with other recreationists, e.g., canoes, sailboats	☐	☐	☐	☐
Places to fish from shore	☐	☐	☐	☐
Boat launching facilities	☐	☐	☐	☐
Marina facilities and services	☐	☐	☐	☐
Availability of parking facilities	☐	☐	☐	☐
Nearness of restaurants	☐	☐	☐	☐
Nearness of bait and tackle shops	☐	☐	☐	☐
Nearness of overnight accommodations, e.g., motels, campgrounds	☐	☐	☐	☐
Natural beauty of the area	☐	☐	☐	☐
Solitude	☐	☐	☐	☐
Water clarity	☐	☐	☐	☐
Presence of contaminants in fish	☐	☐	☐	☐
Catch rate of keepable fish	☐	☐	☐	☐
Catch rate of all fish	☐	☐	☐	☐
Presence of favorite fish (species)	☐	☐	☐	☐
Size of fish	☐	☐	☐	☐
Diversity of fish species which can be caught	☐	☐	☐	☐
Nearness to home (travel distance)	☐	☐	☐	☐
Information about the area, e.g. catch rates, best fishing methods, hot spots	☐	☐	☐	☐
Nearness to second home cottage camp	☐	☐	☐	☐
The chance to catch a large or trophy fish	☐	☐	☐	☐

16 We would also like to know some of the reasons why you fish. Please indicate the importance of the following reasons. Please check the box indicating the importance you place on each reason.

	Crucial	Very Important	Somewhat Important	Not Important
To catch fish to eat	☐	☐	☐	☐
For relaxation	☐	☐	☐	☐
For companionship	☐	☐	☐	☐
To enjoy nature	☐	☐	☐	☐
For the challenge and excitement	☐	☐	☐	☐
To be alone	☐	☐	☐	☐
To improve my fishing skill	☐	☐	☐	☐
To get away	☐	☐	☐	☐
For exercise	☐	☐	☐	☐
Family togetherness	☐	☐	☐	☐
To catch a trophy fish	☐	☐	☐	☐
For a sense of achievement	☐	☐	☐	☐

17 What sources of information do you use in selecting where and when to fish?

	Often	Occasionally	Never
Comments and opinions of other anglers	☐	☐	☐
Information provided by the DNR	☐	☐	☐
Newspaper articles	☐	☐	☐
Magazine articles	☐	☐	☐
Bait and tackle shops	☐	☐	☐
Radio or TV	☐	☐	☐

CONTINUE ➡

Now we would like to ask you some questions about the LAST TIME you went fishing in Michigan, even if fishing wasn't the primary purpose of the trip. We are interested in your last trip even if you walked to a fishing site located near or adjacent to your home.

18. When did you leave home on this trip?

	Month	Day	Year	Time
(Example)	June	5	1983	8 a.m.

19. When did you arrive back home from this trip?

	Month	Day	Year	Time
(Example)	June	6	1983	9:30 p.m.

20. Where did the majority of fishing on this trip take place? It is important that you are as specific as possible.

Name of Lake or Stream _____ County _____ Nearest Town or City _____

21. How many total hours did you fish at this location while on this trip? _____ hours.

22. Approximately (your best estimate) how long did it take you, including rest stops to travel (one way) to this location from your permanent home? _____ hours _____ minutes

23. Approximately (again your best estimate) how many miles is the one-way driving distance from your permanent home to this location? _____ miles one way (enter 0 if you walked to the site from home).

24. Did you fish at any other location(s) while on this trip?

☐ Yes (if yes, please answer 24a) ☐ No

24a.	Name of Lake/Stream	County	Nearest Town/City	Hours Fished There
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____

25. Which of the following best describes the purpose of this trip?

- ☐ Fishing was the primary and only purpose of the trip.
- ☐ Fishing was the primary but not only purpose for the trip. What was the secondary purpose? _____
Would you have made the trip to this location if fishing opportunities were not available nearby? ☐ Yes ☐ No
- ☐ The trip was primarily for another purpose but I planned to fish when I left home. What was the primary purpose? _____
Would you have made the trip to this location if fishing opportunities were not available nearby? ☐ Yes ☐ No
- ☐ The trip was primarily for another purpose, and even though I fished, I did not plan to do so before I left home. What was the primary purpose? _____

26. What percent (%) of the reason for making this trip could be attributed to fishing _____%.

27. How many other people accompanied you on this trip whether or not they fished? _____
(If you went alone, go to question 28.)

Relationship	Are they 16 or younger?		Did they fish on the trip?		Was fishing the primary activity they engaged in on the trip?	
	Yes	No	Yes	No	Yes	No
(Example) Son	☒	☐	☒	☐	☒	☐
_____	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐

CONTINUE ➡

28 If it was an overnight trip, what type of lodging did you use?

Type of Lodging	Number of Nights	Type of Lodging	Number of Nights
☐ Hotel or motel		☐ Rental cottage	
☐ A second home/cottage/ camp that you own		☐ Lodge	
☐ Relative's or friend's home or second home		☐ Campground	
		☐ Other, please specify:	

29 What was the primary species you were fishing for while on this trip?

☐ Yellow Perch	☐ Lake Trout	☐ Chinook Salmon
☐ Panfish	☐ Steelhead	☐ Coho Salmon
☐ Bass	☐ Rainbow Trout	☐ Catfish or Bullhead
☐ Walleye or Sauger	☐ Brown Trout	☐ Suckers or Carp
☐ Pike or Musky	☐ Brook Trout	☐ Smelt
		☐ Anything that was biting

30 During what time was the trip taken?

☐ Regularly scheduled time off (e.g., week-ends, after work)	☐ Other time off with pay (e.g., sick time, personal time)
☐ Time off without pay	☐ Other, please specify:
☐ Vacation time (off with pay)	

31 If you hadn't taken this trip to this location, what would you have likely done instead?

☐ Worked—regular time at main job	☐ Participated in another recreation activity please specify:
☐ Worked—over-time at main job	
☐ Worked—a second job	☐ Worked around the house
☐ Fished somewhere else	☐ Other, please specify:

32 Which mode of fishing did you use a majority of the time on this trip?

☐ Shore or Wading	How long was the boat used on this trip? ft. Was the boat: ☐ Transported to the fishing site ☐ Moored or stored near the fishing site
☐ Pier or Dock	
☐ Private Boat	
☐ Charter Boat	
☐ Rented Boat	
☐ Ice Fishing	

33 Which fishing method did you use most frequently on this trip?

☐ Casting	☐ Bait Fishing	☐ Fly Fishing	☐ Dipping
☐ Spin or Spin Casting	☐ Trolling	☐ Spearing	☐ Snagging

CONTINUE ➡

34. Next, we would like to know your out-of-pocket expenses for goods and services, including travel, on this entire trip. This includes purchases at home made especially for this trip. By out-of-pocket we mean all your expenditures whether you spent money for yourself or others in your party.

No matter what your age, we only want your expenditures. Do not ask other people (e.g., father) what they spent for you. For example, if you paid for the gas and someone else in your travel party paid for the motel room, then record the amount you paid for the gas (and anything else you bought) but not the cost of the motel.

Include all of your trip expenditures whether or not they relate to fishing.

Category	At Home For This Trip	On The Trip To And From The Area	Near The Fishing Site
Rods, reels, downriggers, bait, fishing line, lures, hooks, weights and other fishing supplies	\$	\$	\$
Charter fees			
Lodging—motels, hotels, resorts, cottage rentals, or camping fees			
Restaurants			
Groceries, food & snacks, take-out beverages (including alcohol)			
Boat gas and oil			
Auto gas and oil			
Boat rentals, daily transient slip fees, launching fees			
Entertainment and other recreation (including bars, night clubs)			
Other trip expenditures (e.g., parking, shopping)			

The remaining questions on yourself and your family are needed so that we can generalize our findings to all other anglers. Again be assured that the information you provide will remain strictly confidential.

35. What is your race? ☐ White ☐ Black ☐ Native American ☐ Hispanic ☐ Oriental
☐ Other, please specify _____
36. What is the highest level you completed in school?
☐ Grade School ☐ High School Diploma ☐ College Degree (B.S. or B.A.) ☐ Advanced Degree (M.S., Ph.D., M.D., D.O., D.D.S., D.V.M., J.D.)
☐ Some High School ☐ Some College ☐ Some Graduate Medical or Law School
37. What is your present primary occupation? If you are unemployed or retired, tell us your last occupation: _____
38. What is your individual income before taxes?
☐ Under \$10,000 ☐ \$20,000 to \$24,999 ☐ \$35,000 to \$39,000 ☐ \$50,000 or over
☐ \$10,000 to \$14,999 ☐ \$25,000 to \$29,999 ☐ \$40,000 to \$44,999
☐ \$15,000 to \$19,999 ☐ \$30,000 to \$34,999 ☐ \$45,000 to \$49,999
39. If there is more than one wage earner in your household, what is your total family income before taxes?
☐ Under \$10,000 ☐ \$20,000 to \$24,999 ☐ \$35,000 to \$39,000 ☐ \$50,000 or over
☐ \$10,000 to \$14,999 ☐ \$25,000 to \$29,999 ☐ \$40,000 to \$44,999
☐ \$15,000 to \$19,999 ☐ \$30,000 to \$34,999 ☐ \$45,000 to \$49,999

APPENDIX B

POST CARD REMINDER

Sport Fishing Survey
 Department of Natural Resources
 Box 30028
 Lansing, Michigan 48909

First Class Mail
 U.S. POSTAGE
PAID
 Lansing, Mich.
 PERMIT 1200



R 6296-c

REMINDER

Dear Angler:

Recently a copy of the Michigan Sport Fishing Survey Questionnaire was mailed to you.

Please accept my thanks if you have filled it out and put it in the mail. If you have not sent in the survey questionnaire, I would appreciate your filling it out and mailing it in our postpaid envelope as soon as possible. I realize that it will take some time and effort, but it is important that you reply, even if you did very little fishing or none at all.

Thanks again for your cooperation.

Sincerely,

John A. Scott
 Chief, Fisheries Division

APPENDIX C

EVALUATION FORM FOR SEGMENTS' EXPLOITABILITY

Dear Fisheries Staff

We would like to have your input regarding the segmentation studies, primarily the attribute sought segmentation and the species-location segmentation. We'd like to know how you evaluate them in terms of fisheries management. Please take a moment to fill out the questionnaire.

Dept. of Park and Recreation Resources
Michigan State University

1. Evaluate usefulness of the attribute sought segmentation approach in making following management decisions:

	Very Useful	Considerably Useful	Somewhat Useful	A Little Useful	Not Useful
(a) Fish Populations (size/type/location) ...	()	()	()	()	()
(b) Regulations (catch & release/tackle)	()	()	()	()	()
(c) Support Facilities (bait-tackle shops)	()	()	()	()	()
(d) Access (boat launch/ shore access)	()	()	()	()	()
(e) Promotion/ Information Dissemination	()	()	()	()	()

2. Evaluate usefulness of the species-location segmentation approach in making following management decisions:

	Very Useful	Considerably Useful	Somewhat Useful	A Little Useful	Not Useful
(a) Fish Populations (size/type/location) ...	()	()	()	()	()
(b) Regulations (catch & release/tackle)	()	()	()	()	()
(c) Support Facilities (bait-tackle shops)	()	()	()	()	()
(d) Access (boat launch/ shore access)	()	()	()	()	()
(e) Promotion/ Information Dissemination	()	()	()	()	()

This concludes the evaluation. Thank you very much for your cooperation.

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