

Market Segmentation, Preferences, and Management Attitudes of Alaska Nonresident Anglers.

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(ABSTRACT)

Nonresident angler participation in Alaskan sport fisheries has increased at a higher rate than resident participation during the past decade. Popular sport fisheries have become crowded and stakeholder groups are increasingly concerned about the future direction of Alaska sport fisheries management. To address stakeholder concerns in an informed manner, the Alaska Department of Fish and Game (ADF&G) commissioned a market segmentation study to collect baseline information for assessing the impacts of projects and strategies that provide benefits to the angling public. I developed a 24-page mail questionnaire that was sent to a stratified random sample of 15,000 Alaska nonresident fishing license holders. Information was collected on fishing participation, fishing experience, activity-specific attitudes, motivations for fishing, as well as species and locations fished. In addition, information on setting preferences, guide use, fish exportation, and opinions on several management proposals was also collected. The response rate was 54% (exclusive of surveys that were undeliverable). A two-stage empirical clustering approach, employing Ward's method and UPGMA hierarchical clustering followed by k-means partitioning, identified five nonresident angler clusters. A combination of seven specialization and four motivation variables were used to identify angler groups. The angler segments ranged in size from 15% to 24% of the sample and had diverse characteristics including differences in frequency of participation, fishing experience and preferences, as well as motivations for fishing. Significant differences existed among angler segments with regard to Alaska fishing characteristics, such as number of days and locations fished in Alaska, number of fish transported from Alaska, attributes important in fishery site selection, and likelihood of returning to Alaska to fish.

Differences in fishing characteristics, resource dependency, and preferences with regard to fishery attributes also were found among anglers participating in selected Alaska sport fisheries, as well as anglers fishing for different species within a fishery location (e.g., Kenai River). Information provided by this study will allow ADF&G to assess the relative nonresident demand for different types of angling experiences in Alaska, estimate nonresident angler response to potential management actions, and focus planning and management activities in ways that are consistent with the interests of these different angler types. Results also demonstrate the potential for fishery-based segmentation to provide fisheries managers with a more detailed understanding of nonresident angler participation at the regional and fishery level.

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INTRODUCTION

During the past decade, total effort and participation in Alaska's sport fisheries has increased dramatically. Although this growth is due in part to increased effort among resident anglers, much of it can be attributed to a steady increase in nonresident sport fishing in Alaska. Since 1986, the number of nonresident anglers participating in Alaska's sport fisheries has increased a dramatic 121%, (from 109,754 to 243,960 anglers), or approximately 8% per year. Resident angler participation has decreased about 1% per year during the same period (Howe et al. 1998). As popular sport fisheries in Alaska become increasingly crowded, many stakeholder groups have become increasingly concerned about the future direction of Alaska's sport fisheries. Some sectors of the Alaskan public feel that too many nonresident anglers are participating in Alaska fisheries and that nonresidents are harvesting too many fish from Alaska. As a result, the Alaska Department of Fish and Game, Division of Sport Fish (ADF&G) has witnessed a dramatic increase in the number of proposals seeking to limit nonresident harvest and participation in Alaska's sport fisheries in recent years.

As the primary agency responsible for fisheries management in Alaska, ADF&G is required by law to examine the potential impacts of such proposals on fisheries management in Alaska and to provide management recommendations to fisheries decision makers. The Division of Sport Fish (Division) currently estimates harvest, effort, and participation for most of the state's sport fisheries to address the biological element of fisheries management. However, the Division lacks quantitative information on the angling behaviors, preferences, and management attitudes of its various angling publics—information that is necessary to effectively address the growing number of concerns related to sport fishing in Alaska.

In Alaska, as in other states, anglers pay for most of the costs of sport fisheries management through sales of fishing licenses and federal excise taxes on fishing gear. Continued support, both financial and political, for fishery resource programs in the state is dependent on public acceptance of management decisions and satisfaction with

available fishing opportunities. Currently, nonresident anglers make up a significant portion of Alaska's sport fishing effort and provide the majority of funds available for sport fisheries management in the state (as a result of higher license fees for nonresidents). For example, although nonresident anglers accounted for only 36% of the total days fished in Alaska in 1997, they outnumbered resident anglers (243,960 vs. 233,920 see Howe et al. 1998: Appendix A7), purchased more licenses (251,865 vs. 180,029 see Howe et al. 1998: Appendix A6), and provided more than twice the license revenue obtained from resident anglers (\$7.7 million vs. \$3.3 million) (Allen Howe, ADF&G, Anchorage, personal communication). Given the important role nonresident anglers play in the management of Alaska's sport fisheries, and the fact that nonresident participation continues to increase, it is important that ADF&G develop a better understanding of the preferences, activity patterns, and management attitudes of this primary stakeholder group. Similar information on resident anglers and other stakeholder groups is also needed, and is essential if the agency is to understand current issues related to growth in sport fishing and make informed decisions regarding future management of Alaska's sport fisheries.

Given the sheer number and diversity of sport fishing opportunities available in Alaska, and the fact that anglers visiting the state come from all over the United States as well as from dozens of foreign countries, it is unlikely that Alaska's nonresident angler population is a homogenous group. In fact, nonresident anglers in Alaska are likely to be quite diverse, ranging from the highly committed angler who takes a multi-day fishing vacation in Alaska to fish exclusively for trophy trout or salmon, to the occasional angler who may fish a day or two during a vacation or business trip to the state and who may have less-specific fishing preferences. Previous surveys conducted by the Division, as well as observations and anecdotal information collected by fisheries managers, suggest that resident and nonresident anglers (as well as subgroups within these broad categories) have different concerns related to sport fishing in Alaska and are likely to differ in terms of their angling motivations, setting and gear preferences, behaviors and management attitudes.

The notion that Alaska's angling population is diverse is hardly unique. Today, most fisheries managers recognize that anglers fish for a variety of reasons, vary in the types of species pursued, in consumptive behavior, avidity, and in setting and gear preferences. Most fisheries managers recognize that the "average angler" does not exist. Anglers participating in limited geographic areas, even the same fishery, can differ dramatically with regard to motivations for fishing, gear and setting preferences, consumptive orientation, and other factors (Driver et al. 1984; Chipman and Helfrich 1988; Hahn 1991; Ditton 1996). A growing number of researchers suggest that to understand and manage for a diverse angling public, natural resource agencies must adopt a "marketing" perspective which recognizes that angling constituencies consist of identifiable subgroups (market segments) sharing similar characteristics, behaviors and "product needs" that can be identified through market segmentation research (Ditton 1996).

Market segmentation is defined as the process of partitioning potential clients into groups that have similar characteristics and that are likely to exhibit similar behaviors (Backman 1994). It is widely used in the private sector to identify current and future outlets for private goods among a diverse population. Fish and wildlife agencies increasingly are using market segmentation to identify and enhance the experiences of identifiable angler groups, improve public recognition of the services and benefits provided by fish and wildlife agencies, assess the effect of regulatory changes, and to identify and resolve angler group conflicts (Ditton 1996). Anglers can be segmented in many ways: by species or water type preference, by socio-demographic variables, by management attitudes, by motivations for fishing, as well as by a variety of fishing-specific characteristics such as experience level, commitment and consumptive orientation. The type of market segmentation approach used depends upon the kind of information needed by an agency and how the information will be used. If, for example, an agency is interested in determining the economic contribution of anglers from various residence zones in a given waterway or region, geographic segmentation based on zip or postal codes is most useful. However, if an agency is interested in understanding the types of fishing experiences ("products") sought by different anglers, then segmentation

by the type of use (steelhead trout fishing, fly-fishing) or by the attributes and expectations of the fishing experiences sought is more appropriate (Pollock et al. 1994: 308). Chapter 2 provides an overview of the primary market segmentation approaches that can be used to identify and describe angling publics, as well as a review of two conceptual frameworks that are increasingly used to segment angling populations into meaningful subgroups.

In many cases, a combination of market segmentation approaches is desirable to meet the diverse information needs of state resource agencies. This is certainly the case in Alaska as very little currently is known about the anglers who participate in Alaska's recreational fisheries. Alaska Department of Fish and Game, Division of Sport Fish staff identified several information priorities and provided guidelines during the developmental phase of the project that helped determine the specific segmentation approach that would be used in this study. First, ADF&G was interested in collecting information on the angling characteristics and management attitudes of nonresident anglers. In addition, the agency wanted to develop a better understanding of the fishing experiences sought by anglers who visit Alaska and whether there were distinct groups of nonresident anglers that differed in terms of angling characteristics, behaviors, expectations, and management attitudes.

Since fisheries management in Alaska is conducted primarily at the fishery level (i.e., a specific species in a particular waterbody), it was important that information on nonresident anglers be collected in a way that would be useful to managers at the fishery level. However, ADF&G also recognized the importance of identifying larger segments within the nonresident angling public that shared angling characteristics, fishing preferences and management preferences. Identifying such groups, whether statewide or by region, would be particularly useful for describing and monitoring the activity patterns and participation of nonresident anglers in Alaska sport fisheries, and for targeting various angling publics for public involvement and education efforts.

To meet the information needs of the agency within these guidelines, I developed a combination of empirical and fishery-based segmentation approaches. Using this approach, I could describe a large variety of angler markets within the Alaska nonresident

angling population and at the same time provide angler profiles for specific recreational fisheries in Alaska. Once combined with similar information on the resident angling public, as well as from other stakeholders, this research will help ensure that future fisheries management decisions in Alaska reflect the concerns and desires of the state's angling publics and provide ADF&G and fisheries decision makers with necessary information needed to evaluate alternative management options and policies related to sport fishing in Alaska.

Study Objectives

The specific objectives of this study are:

1. To identify distinct subgroups within Alaska's nonresident angler population using a multi-measure, multi-attribute market segmentation approach consisting of empirically-tested variables within the recreational specialization and Recreation Experience Preference (REP) conceptual frameworks.
2. To determine if Alaska-specific angling preferences, activity patterns, and management attitudes vary across Alaska's nonresident angler sub-groups.
3. To construct descriptive profiles of nonresident anglers participating in major Alaska sport fisheries in terms of demographics, activity patterns, motivations, preferences and the participation of empirically-identified subgroups of nonresident anglers.
4. To estimate the opinions (proportional breakdown) of nonresident anglers with regard to several proposals to limit nonresident sport fishing in Alaska, and to estimate the effect of specific annual harvest limits on nonresident sport fishing behavior.

CHAPTER 1: REVIEW OF LITERATURE

In this chapter, I review the theories and concepts relevant to this study. The first section outlines the concept of market segmentation and describes the primary segmentation approaches that have been used to describe angling publics. The second and third sections provide overviews of the two conceptual frameworks that form the basis of the primary segmentation approach used in this study.

Market Segmentation

Market segmentation is the process of partitioning potential clients into groups that have similar characteristics and that are likely to exhibit similar behaviors (Backman 1994). An umbrella term for a variety of methods used in the private sector to identify current and future outlets for private goods among a diverse population, market segmentation is increasingly recognized as an important tool for natural resource managers who must manage for increasingly diverse constituent populations (Driver 1985). Although recreational fisheries managers have often classified anglers for management purposes—usually in terms of water type used (freshwater vs. saltwater, freshwater lakes, streams, etc.) or particular species sought—a growing body of research demonstrates that it is often more useful for fisheries managers to think of groupings of anglers with similar interests and “product needs” (Pollock et al. 1994; Ditton 1996). In the past two decades, a variety of market segmentation approaches have been developed to identify and describe relevant “subgroups” (segments) within angling populations using a larger array of variables including personal characteristics (social and economic), cognitive measures (motivations or benefits sought), measures of angler specialization, as well as preferences with regard to angling opportunities, settings, and management actions.

Pollock et al. (1994: 306-310) classified market segmentation efforts into four primary categories based on the types of variables used to define subgroups: 1) socio-demographic segmentation, 2) geographic segmentation, 3) product-related segmentation,

and 4) psychographic segmentation. Socio-demographic segmentation, one of the oldest types of segmentation commonly used in the private sector, involves defining subgroups on the basis of relevant socio-demographic variables such as age, sex, education, and income. Although potentially useful for projecting future changes in angling participation, socio-demographic variables are rarely used as the primary basis for segmentation because they have not proven to be particularly useful for separating people into groups that desire different fishing experiences (Pollock et al. 1994:307; Ditton, 1996). Geographic segmentation involves defining segments of a population on the basis of residence location (zip code, county, region, etc.). Although geographic segmentation does not provide fishery managers with an understanding of the types of fishing experiences (i.e., “products”) desired, it has proven useful in targeting specific geographic areas or demographic groups for information or education purposes. A preferred geographic approach, advocated by some researchers as well as marketing professionals, is to segment populations by media regions or areas of communication influence (Pollock et al. 1994: 308).

Because geographic and socio-demographic segmentation methods do not provide fishery managers with an understanding of the types of fishing experiences desired or information that can be used to predict angling behavior or management attitudes, product-related and psychographic segmentation methods often are used. Product-related market segmentation involves partitioning angler populations into subgroups based upon the type of angling preferred (e.g., bait fishing, flyfishing, ice fishing, fishing from a boat or shore), species and water type preferences (freshwater, saltwater, pond, lake, river, ocean), or other aspects of angling behavior or fishing experiences sought (Pollock et al. 1994: 308). Psychographic market segmentation is based on variables that reflect lifestyles and personalities, such as motivations for fishing, attitudes toward angling, satisfaction with aspects of the fishing experience or perceptions of quality. Both psychographic and product-related market segmentation approaches typically involve collecting information from anglers with regard to a number of different variables (e.g., water type and setting preferences, angling motivations, consumptive orientation, management attitudes) and using cluster analysis (or a similar analytical

procedure) to empirically group respondents according to the similarity of their multivariate profiles.

Empirical approaches employing several product-related or psychographic variables are typically more robust, producing angler groupings that are likely to be more stable and have more relevance to fisheries managers, depending upon the number and types of variables used (Sanyal and McLaughlin 1992). However, unlike geographic or socio-demographic segmentation, which typically produce clear segmentation categories (e.g., resident vs. nonresident anglers, male vs. female anglers), most psychographic and, to some extent, product-related segmentation efforts do not. Despite this limitation, product-related and psychographic segmentation approaches increasingly are being used to provide natural resource agencies with a better understanding of their angling publics because they provide information regarding the types of fishing opportunities and experiences sought by different angling groups, as well as information that can be used to evaluate the potential response of anglers toward management alternatives.

An alternative classification scheme for angler segmentation approaches that is based on how angler segments are ultimately defined, as opposed to the types of variables used, also has been suggested (Sanyal and McLaughlin 1992). Based upon their extensive review of the literature on angler satisfaction and classification, Sanyal and McLaughlin (1992) suggested that two basic approaches to market segmentation exist: 1) segmentation based on the application of explicit rules, and 2) the data-derived approach.

Explicit rule segmentation involves classifying anglers based on simple and observable differences (e.g., shore vs. boat anglers, bass vs. trout anglers, local vs. non-local). Although convenient, explicit rule segmentation tends to be relatively ineffective as a means for describing distinct angler sub-populations. In fact, according to Sanyal and McLaughlin (1992), there is little evidence to support this approach as a way of understanding angling publics since anglers often pursue multiple species or do not target specific species. In addition, anglers often participate in a variety of fisheries using different methods and means throughout the course of a season (Fedler and Ditton 1986).

Data-derived segmentation approaches are those that employ cluster analysis to segment anglers using several relevant product-related and/or psychographic variables.

There are two basic types of data-derived segmentation, *a-priori* and *empirical* (Sanyal and McLaughlin 1992). In a-priori clustering, the researcher decides prior to sampling and analysis which dimensions of the population will be used to define clusters and creates an instrument to do so. Empirical segmentation is based on multivariate analysis of multiple measures of several dimensions thought to be important to anglers. No prior hypotheses about the number and nature of the segments are stated.

Both a-priori and empirical approaches have been used extensively in previous angler research, but empirical clustering is typically considered more robust because it tends to provide relatively stable angler segments (Sanyal and McLaughlin 1992). Empirical segmentation is particularly useful when studying large, diverse or dispersed populations, while a-priori clustering is considered more useful for site-specific clustering of more homogenous populations for which some baseline data are already available (Sanyal and McLaughlin 1992).

Two primary conceptual frameworks that have been developed to describe participation in recreational activities form the basis of many empirical market segmentation studies conducted to date. The first is known as the recreation specialization framework conceived by Bryan (1977) and re-conceptualized by Ditton et al. (1992), which focuses on how a person recreates (e.g., how they fish). The second is Driver's (1977) recreation experience preferences (REP) approach, which is designed to measure the motivations (benefits sought) of participants in recreational activities, i.e., why a person recreates. The theoretical basis and development of these conceptual frameworks and their use in describing angling publics is outlined in the following sections.

Recreation Specialization

Bryan (1977) developed the conceptual framework of recreation specialization to describe trout anglers in Idaho, Montana and Wyoming. He suggested that diversity among participants in a recreational activity could be understood in terms of the degree of specialization exhibited by the participant within that activity. He defined specialization as "a continuum of behavior from the general to the particular reflected by equipment and skills used in the sport and activity setting preferences" (Bryan 1977: 175). Utilizing

equipment preference, orientation to the fish, resource orientation, management philosophy, angling history, social context of angling and vacation patterns of respondents, Bryan identified and described four basic types of trout anglers (occasional anglers, generalists, technique specialists and technique-setting specialists). The notion that angling publics could be differentiated and organized according to the degree of specialization they exhibit in their fishing activities (i.e., how they fish) stimulated other research to describe angler diversity (Graefe 1980; McGurrin 1986; Chipman and Helfrich 1988; Anderson 1990; Hase 1996; Fisher 1997).

Graefe (1980) was the first to empirically verify Bryan's conceptual framework using frequency of fishing participation (number of days fished in last 12 months) as a surrogate measure of specialization. Chipman and Helfrich (1988) quantitatively identified smallmouth bass angler types using a multidimensional, multi-item scale based on resource use, experience, investment, and centrality of fishing in anglers' lifestyles. Their multi-dimensional approach was considered a more robust measure of specialization and this approach has been used in other angler studies in the United States. Studies by Absher and Collins (1987), McGurrin (1986), and Anderson (1990) supplied additional empirical support for Bryan's original specialization framework and its use in classifying and describing angling publics. Researchers also have examined specialization in the context of other recreational activities, including backcountry hiking (Williams and Huffman 1986), vehicle-based camping (McIntyre and Pigram 1992), boating recreation (Kaufman 1984; Donnelly, Vaske, and Graefe 1986; Kuentzel and McDonald 1992), mountain biking (Hopkin and Moore 1994), and wildlife viewing (Martin 1997).

As a result of such research, a variety of conceptual and empirical indicators of specialization have emerged that can be used to identify angler types (or segments) within a population. Hahn (1991) reviews the early literature related to angler specialization with some useful observations on the discriminative power of various empirical indicators of specialization developed to that date, and on the specialization concept in general. For example, he noted that the number of specialization levels may differ across types of fisheries (saltwater, freshwater, or different species) and that the

individual angler may vary in specialization across seasons of the year and in different settings. In their extensive review of the literature related to angler motivations and classification, Sanyal and McLaughlin (1992) provided a brief overview of the specialization concept as well as other approaches used by various researchers to understand angler diversity.

Ditton et al. (1992) reconceptualized the specialization construct to address the tautological problems associated with Bryan's original conceptual framework (Bryan defined specialists as flyfishing anglers, and, not surprisingly, he found that specialists preferred flyfishing gear). Following the theoretical arguments of Unruh (1979), Ditton et al. (1992) suggested that recreational activities (particularly angling) represent "social worlds" consisting of several sub-worlds that can be organized (and divided) according to an underlying degree of specialization. Unlike Bryan, they presented a hypothesis of how these social worlds and subworlds segment and intersect, and they further hypothesized an ordered arrangement of these subworlds along an underlying continuum from low specialization to high specialization. Using this theoretical framework, they proposed several hypotheses related to the specialization construct, namely, that differences in resource dependency (importance of number and size of fish caught), level of mediated interaction, and activity-specific and activity-general motivations for fishing, were related to angler specialization level. They conducted tests of four of these hypotheses using data obtained from a survey of Texas saltwater anglers and found that resource dependency, activity-specific and activity-general motivations of anglers differed significantly across anglers with different levels of specialization (Ditton et al. 1992).

Subsequent studies by Fisher (1997) provided additional empirical support for the reconceptualized specialization framework and demonstrated that measures of specialization can provide a management-oriented approach to market segmentation by classifying angling publics into subgroups based on similarities in angling experience, skill level, consumptive orientation, and relative importance of number and size of fish to anglers. As a result, angler specialization has increasingly been advocated as a basis for

angler segmentation efforts conducted by natural resource agencies (Ditton 1996; Fisher 1997).

Motivations

While the recreation specialization approach to segmentation focuses on how an angler fishes, a second, complementary approach is based on the desired outcomes people seek from participating in a recreational activity, i.e., their motivations for fishing (Sanyal and McLaughlin 1992). This approach recognizes that people recreate to achieve a variety of specific rewards, and that participation in a specific recreational activity is multidimensional--reflecting the combination of several specific rewards (outcomes) sought by the participant (Hendee 1974; Driver and Cooksey 1977). By asking individuals to indicate the relative importance of various specific rewards that are possible from a particular recreational activity, the underlying motivational dimensions can be used to cluster together people who are recreating to achieve similar goals (Sanyal and McLaughlin 1992).

Typically, this segmentation approach uses the recreation experience preferences (REP) scales developed, operationalized, and tested by Driver (1977). The REP scales consist of many individual statements related to desired outcomes of recreation that are organized into scales based upon their intercorrelations. The specific scales also are organized into "domains" (e.g., escape/relaxation, learning and testing skills) that represent larger, motivational categories that often differ in importance across subsets of recreational participants.

During the past thirty years, many studies have been conducted to examine the concepts of multiple motivations/satisfactions (Hendee 1974) with regard to angling. Much of the early research illustrated the extremely diverse motivations of anglers (Knopf, Driver, & Bassett 1973; Driver and Knopf 1976; Hudgins 1984) and that additional research was necessary to better understand this heterogeneous group of recreationists (Wright and Sanyal 1998). Subsequent studies of angler populations have built upon Driver's early work on motivational characteristics, examining the motivations of various subpopulations of anglers, such as tournament anglers (Falk et al. 1989), anglers fishing certain water types (e.g., freshwater, saltwater) (Graefe and Fedler 1986;

Chipman and Helfrich 1988), those fishing for particular species (Ditton and Fisher 1990), and anglers using particular fishing methods (e.g., flyfishing) (Wright and Sanyal 1998). Comprehensive reviews of research related to angling motivations can be found in Fedler and Ditton (1994) and in a synopsis of over 100 studies related to angler motivation and satisfaction developed by Sanyal and McLaughlin (1992).

Although studies of angler motivations and satisfaction have employed a variety of approaches and methodologies and many are not directly comparable, past research suggests there are several “primary” motivational dimensions related to angling, and that the relative importance of these motivations (benefits sought) differs across subgroups of anglers (Fedler and Ditton 1994; Wright and Sanyal 1998). Based on their review of the literature, Sanyal and McLaughlin (1992) described nine general dimensions of angling motivations widely reported in the literature. These included:

1. To escape daily routine, for relaxation, or change
2. To experience nature, be outdoors, or in natural or “wild” settings
3. To get away from other people; experience solitude or the opportunity for introspection and privacy.
4. To be with family/friends, have social interaction
5. To develop skills, test equipment, have sense of achievement
6. For the challenge, thrill, excitement
7. To obtain fish to eat (consumption), or to obtain a trophy
8. To explore/learn more about fish or the environment of fish
9. To teach others about fishing or share knowledge with others

Most of these motivational domains are not exclusive to angling but represent a “core” set of rewards that have consistently been identified as important to various subgroups of individuals who participate in recreational fishing. Fedler and Ditton (1994) provide a similar set of core motivations organized into five general motive categories: (1) psychological and physiological, (2) natural environment, (3) social, (4) fishery resource, (5) skills and equipment.

No standardized approach to angler segmentation utilizing motivational scale scores exists. However, most research employing motivational scales as a means of

segmenting angler populations into meaningful subgroups use a subset of the original motivational items developed, operationalized, and tested by Driver (1977) or a set of standardized statements or scales developed by subsequent researchers to represent the primary motivational domains outlined above. (Loomis and Ditton 1987) Some researchers use a strictly empirical approach by providing study participants with a lengthy, multi-attribute, multi-measure list of motivational scales and then use multivariate analysis (usually factor analysis) of responses to identify the relevant motivational domains in the population of interest. Anglers are then grouped according to similarity in their responses across the identified motivational domains (Hudgins 1984; Sanyal and McLaughlin 1994, Wright and Sanyal 1998).

Other researchers have used simpler approaches that include using single- or multi-item measures of a specific subset of the motivational domains that have been shown in previous empirical studies to be important to anglers. Anglers having similar responses to the motivational statements are then clustered together and constitute relatively distinct subgroups. For example, Loomis and Ditton (1987) developed nine motive statements which were single-item measures of a subset of Driver's REP scales and found significant differences among four specialization groups on seven of the nine items. Although it is generally recognized that an empirical approach is likely to be more robust, a strictly empirical approach requires a lengthy survey instrument and necessarily limits the amount of other data that can be collected in any given survey instrument. As a result, many researchers opt for the simpler (albeit less rigorous) a priori approach.

Segmentation of anglers into subgroups on the basis of shared motivations for fishing has gained acceptance and is increasingly being used to categorize and describe angling publics (Holland and Ditton 1992; Sanyal and McLaughlin 1994; Wilde and Ditton 1994; Wright and Sanyal 1998). This is due in part to the growing interest in describing and understanding relatively distinct angling subpopulations (e.g., largemouth bass anglers, fly-fishing anglers) and the growing emphasis within state resource agencies on providing quality resource-related recreation opportunities for specific segments of the public—consumptive and nonconsumptive alike. Although managers see many

motivations of moderate or greater importance to anglers as outside of their control (Fedler and Ditton 1994), managers typically have some control over the nature of the physical and social setting in which fishing occurs. Managers control the regulatory process and they can provide fishing opportunities that are more likely to be consistent with the primary benefits sought by different angling publics. In fact, fish and wildlife agencies increasingly recognize that by designing programs and formulating regulations that address the major motivations of particular angler types, managers can greatly enhance the efficacy of their programs (Sanyal and McLaughlin 1992).

Increasing use of motivations as a means of segmenting angling populations also may reflect the fact that segmentation efforts based on specialization or other catch-related variables fail to capture the noncatch-related or “activity-general” aspects of fishing (nature, relaxation, social aspects) which are consistently ranked as higher in importance than catch-related aspects of fishing experiences. Although past angler studies often used either a catch-related or a motivational (benefits sought) approach to initially classify anglers, there is growing recognition that utilizing both the catch- and noncatch-related aspects of fishing experiences may provide a more robust segmentation (Sanyal and McLaughlin 1994; Wilde and Ditton 1994; Hase 1996).

Empirical Identification of Market Segments

Identification of market segments typically involves classification of consumers into a set of mutually exclusive and exhaustive groups with high levels of intragroup homogeneity and intergroup heterogeneity (Arndt 1974). When little is known about the number and nature of segments within a larger market but attribute data are available for units within the population, cluster analysis is commonly used to empirically identify distinct market segments. Cluster analysis is a generic name for a wide variety of procedures that reorganize a data set containing information about a sample of entities into relatively homogenous groups (Aldenderfer and Blashfield 1984). In general, using cluster analysis for market segmentation involves five basic steps that are briefly described in the following sections.

Step 1: Variable selection and preparation

Selection of a set of variables that will be used to classify objects or individuals and preparation of the data matrix containing measurements of such variables for a set of individuals or objects (i.e., cases) is the first step in cluster analysis. Selecting the variables used for market segmentation (i.e., the segmentation base) is crucial since one or two irrelevant variables may distort an otherwise useful cluster solution (Punj and Stewart 1983). In most instances, researchers suggest that selection of the basis for classification should be guided by an explicit theory or hypothesis (Punj and Stewart 1983; Aldenderfer and Blashfield 1984). The recreation specialization and recreation experience preference (REP) scales are two theoretical frameworks that are commonly used to classify anglers.

Step 2: Data standardization

The objective of standardization of the data matrix is to remove arbitrary effects caused by choice of measurement unit and/or to account for differences in measurement scales across variables (Romesburg 1990:78). Standardization is an optional step depending upon the goals of the research and whether measurement scales differ among the attributes (variables). However, researchers should understand that the decision to standardize or not could dramatically affect clustering results (Romesburg 1990).

Although there is not universal agreement that equal weighting of variables prior to cluster analysis is necessary or optimal (Milligan and Cooper 1988), applied researchers often standardize input variables prior to cluster analysis when the magnitudes or scales of the input variables differ significantly –particularly when the dissimilarity measure, such as Euclidean distance, is sensitive to such differences. The standardization function most familiar to social researchers and typically used in common statistical software is the z-score--standardization of each column (variable) to have a mean of zero and variance of one. However, numerous standardization functions exist (see Milligan and Cooper 1988; Romesburg 1990, Beaman and Vaske 1995), and recent studies suggest that z-score standardization may not be an optimal approach for cluster analysis (Milligan and Cooper 1988).

In an empirical study of the affect of seven standardization functions (including z-score standardization and no standardization) on the ability of hierarchical clustering methods to recover known cluster structure, Milligan and Cooper (1988) found that division of each variable by its range (possibly after subtracting the minimum value) gave consistently superior recovery of the underlying structure. This result held over a variety of controlled factors including different error conditions, separation distances, clustering methods, and coverage levels. A similar study by Schaffer and Green (1996) involving “real” data sets (as opposed to simulated data sets with known structure), suggested that there were fewer differences among the z-score function and division by the range of variable. However, in their study, the data sets had already been “row” standardized (i.e. attribute importances in each data set sum to 1.0), and a k-means partitioning algorithm was used as opposed to hierarchical clustering methods in the Milligan and Cooper (1988) study.

According to Milligan and Cooper (1988), several authors have argued that the best strategy is not to standardize across all elements (sample subjects) on each variable. Rather, standardization should occur within clusters on each variable because “total variability is not only a function of the within-cluster variances, but also of the distance between cluster means,” –the latter of which confounds the standardization process and reduces apparent separation between clusters (Milligan and Cooper 1988). However, this approach presupposes that one knows the clusters before they are actually identified by cluster analysis—which is essentially impossible in an applied setting.

Step 3: Selecting a resemblance coefficient

Selecting a coefficient that measures the resemblance between each pair of objects and calculating a resemblance or similarity matrix typically is the third step in cluster analysis. Although a large variety of similarity or resemblance coefficients are available (Aldenderfer and Blashfield 1984; Romesburg 1990), distance measures (e.g., Euclidean distance, Manhattan distance) and correlation coefficients (e.g., Pearson product moment correlation) are most commonly used. Although some studies comparing common similarity measures have indicated that choice of similarity measure can affect the performance of clustering methods, the number of such studies are fairly

limited and it is believed other factors such as cluster structure, degree of coverage, and cluster overlap may swamp most effects associated with choice of resemblance coefficient (Aldenderfer and Blashfield 1984:61). Beaman and Vaske (1995) suggest that one of several correlation-based measures of similarity should be used when the attributes being used to identify clusters of persons consist of responses to two or more attitudinal variables and ipsative biases are suspected.

Step 4: Choosing a clustering method

Selecting and executing a clustering method (e.g., Ward's minimum variance or average linkage) is the fourth step of cluster analysis. Choosing an appropriate clustering method(s) from the large number of methods available is one of the most critical issues in utilizing cluster analysis (Romesburg 1990). Each method has its advantages and inherent biases, as well as advocates and critics. Different types of clustering procedures have been shown to generate markedly different results for the same data set (Edelbrock 1979; Milligan 1980). Ultimately, choice of a clustering method depends upon several considerations, including characteristics of the various clustering techniques with respect to the given purpose of the research and characteristics of the data (i.e., whether the measurement scale of the variables measured for each entity are quantitative, qualitative, or a mixture of both) (Romesburg 1990).

Peterson (1974) discussed several characteristics that can be used to classify the various clustering techniques. These include whether a given technique is (1) single-level (reticulate) or hierarchical, (2) agglomerative or divisive, and (3) monothetic or polythetic. As described by Kikuchi (1986):

- (1) Hierarchical vs. Single-level (reticulate): In hierarchical clustering, groups formed at one level become subgroups at a higher level. The result is a tree-like structure representing various groups. In contrast, single level (reticulate) methods merely define groups separately on a single level, and 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 within the sample; hence it is aggregative in nature. A divisive method starts with all the sample units in one group that is

then partitioned into subgroups on the basis of the measured attributes; hence it is disaggregative.

- (3) Monothetic vs. Polythetic: A clustering method is considered monothetic if groups are formed on the basis of an “either/or” criterion: i.e., 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 an overall similarity measure (p. 31-32)

Hierarchical, agglomerative clustering methods are typically recommended for market segmentation since these methods are most consistent with the underlying theory of market segmentation (Peterson 1974). Paraphrasing Claycamp and Massy (1968), Peterson (1974) noted that optimal segmentation would involve treating each individual customer (i.e., angler) as separate and distinct, since each individual is likely to have a unique set of preferences. However, since it is not possible to profitably pursue such a strategy, the next best approach would involve aggregating individual consumers into larger segments on the basis of similarities in consumptive preferences or other relevant characteristics (i.e., market segmentation). Since hierarchical agglomerative clustering methods start by treating all cases as unique and then aggregate cases on the basis of a measure of similarity in the multivariate profiles of individuals, they are most consistent with the concept of market segmentation.

Finally, Peterson (1974) suggested that the clustering method(s) used in market segmentation should be polythetic, noting that:

...although a monothetic approach would produce purer groups, as the number of number of variables increases it becomes increasingly difficult to obtain absolute matches without an extremely large sample size. Even if a sufficiently large sample were available, a large residual pool of unclassified individuals would still remain. Thus, the only practical approach is a polythetic one (p. 252).

A large number of clustering methods have been developed, including several that satisfy the general criteria outlined by Peterson (1974) as appropriate for market segmentation applications. These include (1) single linkage (or SLINK), (2) complete linkage (CLINK), (3) average linkage (several variants), and (4) Ward's minimum variance method (Aldenderfer and Blashfield 1984; Romesburg 1990). Once again, selecting the most appropriate method(s) depends upon the goals of the particular analysis, the nature of the data, cluster structure and potential overlap, as well as the presence of outliers and choice of similarity measure (Aldenderfer and Blashfield 1984).

Many researchers recommend Ward's minimum variance and the average linkage methods since they have demonstrated superior performance in Monte Carlo studies using data sets with known structure and a variety of data types and error conditions (Milligan 1980; Punj and Stewart 1983; Scheibler and Schneider 1985; Milligan 1996). Ward's method is extensively used in the social sciences (Aldenderfer and Blashfield 1984) and has formed the basis of many market segmentation studies (Punj and Stewart 1983), while average linkage (specifically, the unweighted pair-group method using arithmetic averages or UPGMA) is more common in other fields (Romesburg 1990). Although each method has been shown to outperform the other under certain data conditions, the methods often produce roughly equivalent results when conditions of coverage are relaxed (i.e., all observations need not be classified) and all other factors are equal (Aldenderfer and Blashfield 1984).

However, Ward's and UPGMA are not free from problems. Like all hierarchical methods, both are sensitive to outliers--Ward's being somewhat more sensitive than average linkage (Milligan 1980). In addition, both methods make only one pass through the data and have no mechanism for reallocation of entities that may have been poorly classified at an early stage of clustering (Everitt 1980; Romesburg 1990). Elimination of likely outliers is recommended to address the outlier problem (Everitt 1980; Punj and Stewart 1983), while use of a reallocation (nonhierarchical) clustering method (e.g., k-means partitioning) in conjunction with a hierarchical method is typically recommended to address the problem of poor initial classification (Milligan 1980; Punj and Stewart 1983; Milligan 1996).

A two-stage clustering approach in which hierarchical clustering is used in conjunction with an iterative partitioning (reallocation) method is often considered an optimal way to perform classifications, primarily because this approach allows one to take advantage of the beneficial characteristics of both hierarchical and iterative methods (Punj and Stewart 1983; Milligan 1996). Unlike hierarchical clustering methods, iterative methods work directly on the raw data and do not require the calculation and storage of a large ($N \times N$) matrix of similarities among cases. Consequently, they allow researchers the opportunity to analyze substantially larger data sets than hierarchical methods (Aldenderfer and Blashfield 1984). More importantly, iterative methods make more than one pass through the data and can compensate for a poor initial partition of the data.

K-means analysis (or the “nearest centroid sorting pass”) is one type of iterative clustering procedure that involves reassignment of cases to the cluster with the nearest centroid. In general, k-means methods work in the following fashion (Aldenderfer and Blashfield 1984):

- (1) Begin with an initial partition of the data set into some specified number of clusters; compute the centroids of these clusters (i.e. determine “seed points”).
- (2) Allocate each data point to the cluster that has the nearest centroid.
- (3) Compute the new centroids of the clusters.
- (4) Alternate steps 2 and 3 until no data points change clusters (within some tolerance level = convergence criteria).

K-means passes can be either combinatorial (the centroid of a cluster is recalculated after each change in its membership) or noncombinatorial (cluster centroid is recalculated after an entire pass through the data) (Aldenderfer and Blashfield 1984). Although iterative procedures are known to be extremely sensitive to the initial partition, when the results of hierarchical clustering (Ward's method or average linkage) are used to provide an initial partition and “seed points,” the k-means procedure has been shown to provide excellent recovery of known data structure and can out-perform hierarchical methods (Milligan 1980; Helsen and Green 1991; Milligan 1996).

Step 5: Evaluation and validation of clusters

The fifth and final step of cluster analysis generally involves evaluation and validation of the resulting cluster solution. One way to validate a given clustering solution is to perform significance tests that compare the clusters on relevant variables not used to generate the cluster solution (Aldenderfer and Blashfield 1984; Milligan 1996). According to Aldenderfer and Blashfield (1984:66), “the power of external validation is that it directly tests the generality of a cluster solution against relevant criteria.” Although this approach requires identification of a set of relevant external criteria that must be measured simultaneously, external validation is commonly used by market segmentation researchers to evaluate the results of empirical angler segmentation efforts (Kikuchi 1986; Chipman and Helfrich 1988; Fisher 1997).

Another approach to validating the results of an applied clustering is to conduct a replication analysis--a procedure analogous to a cross-validation procedure in regression analysis where a larger data set is randomly divided into two (or more) sub-samples and the cluster solutions obtained from each data set are examined for agreement using Cohen's *k* or the Hubert and Arabie (1985) corrected Rand index (Milligan 1996). Recent studies by Breckenridge (1989), Helsen and Green (1991), and Humphreys and Rosenheck (1995) have demonstrated the importance of cluster validation and provided insight into the effectiveness of replication procedures.

In the context of market segmentation, evaluation of a cluster solution often involves several steps to determine whether the market segments defined meet four general criteria recommended in the marketing literature. These include: (1) identifiability--segments must be recognizable and accessible, (2) substantiality--there must be a sufficient number of people within each segment to make the subgroup worth treating separately, (3) variation in market response--segments must differ with respect to their needs/wants and in behavior so that “marketing” programs can be developed, and (4) actionability/exploitability--the degree to which effective programs can be formulated for attracting and serving the segments (Engel et al. 1972; Gultinan and Sawyer 1975; Kotler 1984). Determining whether a segmentation solution meets these criteria typically involves: (1) determination of the size of each segment, (2) examination of the

resulting cluster centroids (often through graphical presentations that allow for visual inspection of the relative locations of each cluster in multi-dimensional space) and the development of descriptive profiles of each cluster in terms of the segmentation variables, and (3) comparison of segments with regard to variables not used to generate segments to determine the degree to which angler segments differ with respect to fishing needs, behavior, and management attitudes.

Empirical Angler Segmentation Studies

Although only a handful of angler segmentation studies have employed cluster analysis to identify subgroups of anglers for management and marketing purposes, the use of cluster analysis to empirically identify angler segments has gained considerable acceptance in recent years. Based primarily on Peterson's (1974) recommendations regarding the use of hierarchical clustering for market segmentation, Kikuchi (1986) used Ward's minimum variance method to identify preliminary segments for a two-stage clustering approach that compared market segment solutions based on fishing attributes sought and actual fishing behavior (species-locations fished). Hierarchical cluster analysis (Ward's method) also was used to identify subgroups of Virginia river anglers on the basis of several angler specialization variables (Chipman and Helfrich 1988). In addition, Fisher (1997) used a combination of four different hierarchical clustering methods (Ward's, Average Linkage, Centroid, and McQuitty's method) along with nonhierarchical analysis to identify the number and relative size of segments of Texas anglers from verified measures of angler specialization.

A few angler segmentation studies have used other types of clustering methods (Driver et al. 1984; Sanyal and McLaughlin 1994). However hierarchical clustering methods, often in conjunction with iterative (reallocation) methods are becoming more common in the angler segmentation literature, possibly because these methods are now readily available in standard statistical software packages such as SPSS (SPSS Inc. 1997) and SAS (SAS Institute 1988).

Synthesis

A growing number of fisheries professionals and agencies recognize that effective recreational fisheries management requires a detailed understanding of the various fishing experiences and preferences desired by different angling publics, i.e., an understanding of the “markets” that exist for angling opportunities and services provided by fish and wildlife agencies (Witter and Adams 1994; Ditton 1996; Duda et al. 1998). Market segmentation is a fundamental step in the process of marketing within fish and wildlife agencies and a variety of market segmentation approaches have been developed in recent years to provide agencies with a better understanding of their diverse constituents. The goal of this review is to provide readers with a fundamental understanding of the primary approaches and methods used to segment angling populations into relevant subgroups for management purposes.

Although I emphasized use of empirical segmentation, it is important to note that a large variety of segmentation approaches are available to researchers, each method having particular benefits and drawbacks. Choosing the most appropriate segmentation method(s) requires consideration of the current information needs and management plans of an agency as well as other factors (Ditton 1996; Duda et al. 1998). If the primary goal of segmentation research is to provide targeted communications to users of specific fishery resources within a specific geographic area or within a particular demographic group, geographic and socio-demographic segmentation may be more appropriate. However, when the goal is to develop a better understanding of the “products” (sport fishing experiences) sought by anglers or to understand the relative impact of management actions on angling publics, data-derived approaches, particularly empirical segmentation efforts employing relevant product-related and psychographic variables, are recommended (Sanyal and McLaughlin 1992; Pollock et al. 1994).

The primary drawback to some empirical segmentation approaches is that they may not segment angler populations into subgroups that have direct managerial significance (Pollock et al. 1994, Ditton 1996). However, Ditton (1992, 1996) has suggested that the recreation specialization concept, as reconceptualized and operationalized in recent studies (Fisher 1997) can be used to provide a “management-

oriented” understanding of diverse angling publics by defining market segments according to managerially-relevant variables such as past experience, importance of size and number of fish caught, and consumptive orientation (resource dependency measures). In addition, a growing body of literature suggests that catch- and noncatch-related motivations for fishing also may provide a useful segmentation of anglers (Fedler and Ditton 1986; Holland and Ditton 1992; Wilde and Ditton 1994; Sanyal and McLaughlin 1994).

In recent years, an increasing number of studies have used angler motivations or the recreation specialization framework to identify segments of angler populations. However, in most of these studies only one of the two conceptual frameworks is typically used to segment anglers, despite evidence that there may be links between specialization measures and angling motivations. Studies by Chipman and Helfrich (1988) and Anderson (1990) suggest that links may exist between changes in specialization, the desired angling experiences (motivations), and preferences for management. A recent study by Hase (1996) that examined the relationship between angler specialization measures and the catch- and noncatch-related motivations for fishing among Arizona warmwater anglers provides additional evidence for a link between angler specialization measures and motivations for fishing. Such studies suggest that segmenting anglers using a combination of specialization and motivational variables (*how* and *why* anglers fish) may provide a more useful segmentation analysis than use of either framework alone. In this study, I explore this possibility by attempting to segment nonresident Alaska anglers into subgroups empirically using a combination of verified measures of specialization and motivational variables. A two-stage, cluster analytic approach is used to identify primary market segment segments within the Alaska nonresident angler population.

CHAPTER 2: METHODS

In this chapter I describe the study's research methodology in four sections. The first section describes the sampling procedure. The second section describes the design of the survey instrument. Data collection methods are described in the third section, and the chapter concludes with a detailed description of data analysis procedures used to meet each study objective.

Sampling Procedure

The sampling frame for this study consisted of Alaska visitors who purchased an Alaska sport fishing license between Jan 1 and Oct 1, 1997. Anglers under the age of 16 are not required to purchase a sport fishing license to fish in Alaska. As a result, the sampling frame consisted only of anglers over 16 years of age who purchased a 1997 nonresident sport fishing license. Since younger anglers are less likely to make decisions regarding whether to fish Alaska, and are likely to have fishing behaviors similar to their parents, sampling licensed anglers (adults) was considered most important. Obtaining information from Alaska visitors who did not sport fish, and anglers who might be planning to visit Alaska in the near future might also have been useful. However, this would have required additional staff and resources that were unavailable at the time of this study. Future studies by the Alaska Department of Fish and Game (ADF&G) may use more complex sampling designs targeting both anglers and nonanglers. Such efforts could be coordinated with the Alaska Division of Tourism, which conducts periodic surveys of Alaska visitors.

The sample used for this study was drawn from the incomplete 1997 Alaska sport fishing license file. The file was incomplete because (1) a time lag existed between the date of license purchase, entry of license data into the state license database, and the date when the license data had been "cleaned" and verified for use with Department surveys. "Cleaning" of the ADF&G sport fishing license file involved running a series of programs developed by ADF&G staff to identify duplicate records and those with missing data and invalid mailing addresses. Some of the names and/or addresses on the

sport fishing license list were incomplete or illegible to the degree that they could not be used for sampling. The target date for mailing of the nonresident survey was initially set for Jan 15, 1998 to ensure that 1997 anglers were contacted prior to the beginning of the 1998 fishing season. The license database, as updated through November 1997, was the most complete list of nonresident anglers available at the time of sampling. Given that sport fishing in most areas of Alaska is restricted to a relatively short season (primarily April through October), I assumed that the sampling frame would capture a majority of the 1997 nonresident licensed anglers. A review of the sampling frame indicated that it contained anglers who purchased a sport fishing license between January 1, and September 30, 1997. However, due to the time lag between when licenses are received, and processed by ADF&G as well as vendor delay in sending in their license receipts, the sampling frame did not include all nonresident anglers who purchased licenses in these months.

The mid-November 1997 Alaska sport fishing license file consisted of 314,968 unique license holders, 163,774 of which listed a non-Alaska mailing address, and were considered nonresident anglers for the purposes of this study. According to ADF&G, a total of 218,491 nonresident anglers were licensed to fish in Alaska in 1997 (Bob Walker, ADF&G, personal communication). Thus, the sampling frame used for this study (N=163,774) represented 75% of the total number of 1997 nonresident license holders.

The Sport Fish Division wished to develop descriptive profiles of anglers participating in specific fisheries throughout Alaska. I assumed that response rates would be similar to those observed during previous ADF&G harvest surveys (49-53%) (Howe et al. 1995, 1996, 1997, 1998), and consequently, that a relatively large sample of nonresident Alaska anglers would be necessary. Using procedures outlined by Thompson (1987), an ADF&G biometrician determined that the minimum number of responses necessary to estimate angler profiles for a particular fishery with a precision goal of each proportional estimate being within ± 5 percentage points of the true values 90% of the time to be 403.

Assuming that the distribution of respondents participating in specific fisheries across Alaska in 1997 would be similar to the distributions observed in previous

statewide harvest surveys, an ADF&G biometrician performed a simulation using participation data from the 1995 Alaska Statewide Harvest Survey to determine the number of responses that would be expected by fishing site, given a series of possible sample sizes. The goal of the simulation was to estimate the number of fisheries that would generate at least 403 responses at various sample sizes in order to select a sample size that represented the best balance between the number of fisheries meeting the precision criteria and cost of administering the survey. The simulation used a total sample size that was split evenly between residents and nonresidents since the harvest database included all anglers (resident and nonresident) and because a similar survey of Alaska’s resident anglers would be conducted concurrently with this study. A sample of 15,000 nonresident anglers (30,000 total anglers) yielded an estimate of 15 fishery locations (i.e., specific waterbody or area specified in the Alaska statewide harvest survey) that would meet the precision objectives, and therefore, was selected as the best compromise between cost and precision (Table 1).

Table 1. Simulated number of fisheries with the expected number of total responses equal to or greater than the goal of 403 for a series of possible total sample sizes.^a

Total Sample Size	Number of Fisheries with 403 or more Anglers Responding as Participating in the Fishery	Total Sample Size	Number of Fisheries with 403 or more Anglers Responding as Participating in the Fishery
20,000	5	30,000	15
21,000	6	31,000	15
22,000	7	32,000	16
23,000	8	33,000	16
24,000	9	34,000	17
25,000	9	35,000	17
26,000	11	36,000	18
27,000	11	37,000	18
28,000	12	38,000	18
29,000	13	39,000	19

^a All simulations split sample sizes equally between the nonresident and resident surveys.

Prior to sampling, nonresident anglers (N = 163,774) were stratified into three sub-groups:

1. Non-Alaska, U.S. residents (“Other USA Residents”);
2. Canadian residents; and
3. Other foreign residents.

Previous surveys conducted by ADF&G indicated that the response rates of these demographic groups differed sufficiently to justify this stratification. Consequently, a stratified, random sample of 15,000 nonresident anglers was taken with sampling proportional to the number of anglers in each stratum as estimated from the 1996 Alaska Statewide Harvest Survey (Allen Howe, ADF&G personal communication).

Table 2. Proportion of 1996 nonresident anglers and sample size by primary strata.

Stratum	Number of nonresident anglers in 1996 ^a	Percentage of all nonresident anglers in 1996 ^b	Provisional Sample Size (based on % of anglers in population)
Other USA Residents	225,111 ^a	93.0%	13,950
Canadian Residents	5,837 ^b	2.4%	360
Other Foreign Residents	11,099 ^b	4.6%	690
Total Nonresidents	242,047	100%	15,000

^a Howe et al. 1997.

^b Allen Howe, ADF&G personal communication

I expected that the response rates within strata would be similar to those observed in the most recent ADF&G statewide harvest survey. Total sample size and expected number of returns for each stratum are summarized in Table 3. The final sample size for each stratum was slightly lower than the original number selected due to the discovery of incorrect or undeliverable addresses, deaths, and participation refusals identified during administration of the 1997 Alaska Statewide Harvest Survey which used the same sampling frame and was conducted prior to this survey. Questionnaires were mailed to a total of 14,934 nonresident anglers who purchased a 1997 Alaska sport fishing license.

Table 3. Expected response rates by strata for the 1997 nonresident angler survey based on an initial sample size of 14,934 anglers.

Stratum	Number of Nonresident Anglers Mailed Survey	Expected Stratum Response Rate ^a	Expected Number of Nonresident Anglers Responses (all mailings combined)
Other USA Residents	13,895	52.0%	7,225
Canadian Residents	356	48.2%	172
Other Foreign Residents	683	39.5%	270
All Strata	14,934		7,667

^a Howe et al. 1997

Questionnaire Design

The primary purpose of this study was to identify and describe important subgroups (segments) of Alaska’s nonresident angler population using primary indicators of angling specialization and general motivations (desired outcomes) for fishing. This section describes how I defined each of these concepts as well as the design of the written survey instrument.

Specialization Variables

Angling specialization theory suggests that within an angling population there is “a continuum of behavior from the general to the particular” (Bryan 1977) usually reflected by differences in frequency of participation or past experience, skill level, investment in equipment, centrality of angling to lifestyle and other indicators. Anglers sharing similar characteristics along these dimensions typically represent distinct groups of anglers that often differ with regard to motivations for fishing, consumptive orientation, and management attitudes. A variety of specialization indicators have been used by researchers to differentiate among angler types (see Chapter 2). Although no consensus exists regarding the number or types of indicator variables that should be used to differentiate among angler types, past research suggests that a multi-dimensional

approach may provide a more reliable measure of specialization than any single measure of specialization (Chipman and Helfrich 1988; Hahn 1991; Fisher 1997). Those variables that seem to consistently discriminate among angler types include: measures of experience (e.g., years of fishing participation and/or frequency of participation), skill level, equipment investment and centrality of fishing to lifestyle. In addition, Ditton et al. (1992) and Fisher (1997) showed that measures of resource dependency (importance of number and size of fish caught) and activity-specific elements of fishing (disposition of catch and orientation toward catching “something”) also are valid measures of angler specialization.

I used the following specialization dimensions to segment nonresident Alaska anglers into subgroups:

1. Experience
2. Centrality of fishing to lifestyle
3. Resource dependency
4. Activity-specific elements of fishing

Each specialization dimension consisted of multiple indicator items (Table 4).

Experience is the most common dimension used to indicate angler specialization level. In most instances, it has been operationalized as total years of fishing experience. Some researchers also have used frequency of participation, (usually measured as the total number of days spent fishing during the previous 12 months) as an another measure of past experience. However, previous studies have found only marginal correlation between years of fishing experience and frequency of fishing participation (Chipman and Helfrich 1988), so these variables often are considered independent indicators of angler specialization level. In this study, experience was measured simply as total years of angling experience as reported by the respondent. Frequency of participation would seem to reflect the importance of fishing to an individual (relative to other potential recreational pursuits) and, thus, is included in the centrality of fishing to lifestyle domain described below.

Table 4. Specialization domains and associated indicator items.

DOMAINS	INDICATOR ITEMS
Experience:	Total years of angling experience
Centrality of fishing to lifestyle:	Self-rated importance of fishing as source of satisfaction ^a Total number of days spent fishing in 1997
Resource Dependency: ^b	(Fedler and Ditton 1986; Fisher 1997)
Importance of number of fish caught.	A full stringer is the best indicator of a good fishing trip The more fish I catch the happier I am A successful fishing trip is one in which I catch many fish
Importance of size of fish caught.	The bigger the fish I catch, the better the fishing trip Catching trophy fish is the biggest reward to me I'm happiest with a fishing trip if I catch fish that are hard to catch and land
Activity-specific Elements of Fishing: ^c	(Ditton 1992; Fisher 1997)
Catch disposition	I'm just as happy if I don't keep the fish I catch ^c Keeping the fish I catch is more enjoyable than releasing them Bringing fish home to the table is an important outcome of fishing ^c
Importance of catching	A fishing trip can be successful even if I catch no fish ^c When I go fishing I'm not satisfied unless I catch at least something When I go fishing, I'm just as happy if I don't catch a fish ^c

^a 10-pt number scale—"Not at all important" to "Extremely important"

^b Participants were asked to respond to each item on five-point, Likert scale, 1=strongly disagree--5= strongly agree.

^c For the calculation of summed scores and Cronbach alpha, item responses were reversed due to the negative wording of the items.

Centrality of fishing to lifestyle is another dimension of angling that is recognized as an indicator of specialization. Originally suggested by Bryan (1977), the centrality dimension includes measures of an activity's contribution to life satisfaction and

influence on career and vacation planning (Kaufman 1984; Absher and Collins 1987).

No standard set of items has been developed to define the centrality dimension.

However, common measures of centrality of fishing to lifestyle include: 1) self-evaluated importance of fishing to an individual, 2) the rank of fishing among other recreational activities pursued, 3) the degree of mediated interaction (e.g., the number of fishing club memberships, number of fishing magazine subscriptions, whether one watches televised fishing programs), and 4) the degree to which fishing is included in vacation plans (Absher and Collins 1987; Chipman and Helfrich 1988; Ditton et al. 1992). In this study, the centrality dimension consisted of two items commonly used to measure centrality of fishing to lifestyle. The first item asked anglers to rate the importance of fishing as a source of satisfaction in their life on a ten-point scale from 1 ("Not at all Important) to 10 ("Extremely Important"). The second variable was frequency of fishing participation and was measured as the total number of days spent sport fishing in the last 12 months. It is important to note that the centrality domain consists of two related variables that were used as distinct variables in subsequent multivariate analyses, i.e., unlike the domains of resource dependency or activity-specific elements of fishing, the scores of the centrality indicator items were not combined into a composite score for purposes of analysis.

Studies by Ditton et al. (1992) and Fisher (1993, 1997) have demonstrated that importance of the number and size of fish caught, an angler's inclination toward keeping or releasing fish caught, and the importance of catching "something" also are valid indicators of angler specialization and can be used to segment anglers into relevant subgroups. Ditton et al. (1992) and Fisher (1997) classified these variables into "resource dependency" and "activity-specific elements of fishing" domains, and suggest that segmentation based upon these variables may be more relevant to fisheries managers because they typically have more control over these aspects of fishing than the activity-general elements (relaxation, being outdoors, etc.).

I used measures of resource dependency and activity-specific elements of fishing similar to those used by Fisher (1997) as additional measures of angler specialization to identify and describe subgroups of nonresident Alaska anglers. Resource dependency was operationally defined by two sub-dimensions: the importance of the number of fish

caught and the importance of size of fish caught to the individual angler. Activity-specific elements of fishing included relative importance of keeping fishing and importance of catching “something” when fishing. I measured each sub-dimension (importance of size, importance of number, importance of catching and keeping fish) by three standardized indicator items (Table 4) originally developed by Graefe (1980) and refined through subsequent research (Fedler and Ditton 1986; Ditton et al. 1992; Fisher 1997). Anglers were asked to indicate the extent to which they agreed with each indicator item on a five-point Likert scale from 1= "strongly disagree" to 5= "strongly agree," with the mid-point of the scale being 3= "neither agree nor disagree."

Angling Motivations

A growing body of literature indicates that angler motivation and satisfaction are objective constructs that are influenced by variables other than those related to catch (Loomis and Ditton 1987; Sanyal and McLaughlin 1994; Wright and Sanyal 1998). Based on their review of over 100 angler segmentation studies, Sanyal and McLaughlin (1992: 16) stated that: “In general, studies for which the highest degree of confidence can be generated are largely empirical based clustering using *motivations* [my emphasis], angling history and management preferences to construct angler types.” Such studies explicitly recognize that participation in recreational activities is motivated by packages of several diverse motivational factors (Driver and Cooksey 1976) and that people seek to fulfill multiple goals when engaging in recreational activities.

I used a modified version of Sanyal and McLaughlin’s (1994) seven-dimensional, multi-measure inventory to determine if motivations for fishing would contribute to differentiation of nonresident Alaskan anglers into meaningful subgroups (Table 5). Because of space limitations on the questionnaire, I used only 15 of the 27 motivation indicator items developed by Sanyal and McLaughlin (1992), representing six of the seven motivational dimensions they identified in a study of Idaho anglers. Each motivational domain was operationalized by one or more individual indicator items under the assumption that these domains would capture nonresident Alaska anglers’ primary motivations for fishing. The subset of individual indicator items used to measure each of

the six dimensions were selected on the basis of the item's factor loading on the motivational domain as reported by Sanyal and McLaughlin (1994). Statements (indicator items) that had the highest factor loadings on a given motivational factor in their study were chosen to represent the a-priori motivational domains listed in Table 5. Factor loadings ranged from 0.51 ("Releasing or reducing built up tensions while I fish.") to 0.83 ("Being with friends and family while I fish"). In addition, the motivational domains of solitude, consumption, and compete with others/social recognition each included an additional indicator statement that represented standardized items used by other researchers to measure these particular motivational domains (Ditton 1989; Fedler and Ditton 1994; Hase 1996). Participants were asked to indicate the relative importance they placed on each reason for fishing using a Likert-type importance scale where responses ranged from 1= "Unimportant to 5= "Extremely important".

Table 5. Motivation domains and associated indicator items.

DOMAINS	INDICATOR ITEMS ^a
Developing and using fishing Skills	Testing and using my fishing equipment Developing my fishing skills Learning more about fish For the challenge or sport of fishing For the stimulation and excitement of fishing Sharing what I know about fishing with others
Consumption	Obtaining fish to eat ^b Catching any fish
Compete with others/social recognition	Catching trophy fish ^b Competing against other anglers
Nature/relax	Experiencing natural surroundings Releasing or reducing built up tensions while I fish
Social	Being with friends and family
Solitude	Getting away from other people ^b Being on my own

^a Participants were asked to respond to each item on five-point, Likert scale, 1=unimportant—5=extremely important.

^b Standardized item adapted from Fedler and Ditton (1994), Hase (1996).

Recognizing that nonresident anglers' motivations for fishing in Alaska may be somewhat different from their general motivations for fishing, anglers also were asked to indicate the relative importance they placed on eight possible reasons for fishing in Alaska (Table 6). This list of motives for fishing in Alaska included those found to be important in previous surveys conducted for ADF&G (Jones and Stokes 1987a, 1987b), as well as additional reasons based on the observations of fisheries managers at ADF&G. Unlike the scale designed to measure general motivations for fishing, the Alaska-specific fishing motivations were single-item measures of eight possible motivations that may have been important to anglers visiting Alaska. Although designed to recognize the multi-dimensional nature of motivations for fishing in Alaska, the list is not based on any known scales or theoretical concept. Thus, it represents an exploratory effort to identify a list of potentially important motivations for fishing in Alaska that can be examined and refined for use in future studies. Motivations for fishing in Alaska were not included in the list of variables used to segment nonresident Alaska anglers in primary subgroups.

Table 6. Alaska-specific fishing motivation items.

Reasons for fishing in Alaska:

- To fish with family and friends
- To obtain fish to eat
- To experience a new activity
- To fish waters surrounded by pleasant scenery
- To explore new fishing areas
- To catch new or unique types of fish
- To take fish home to share with family or friends
- To fish in a wilderness setting
- To catch trophy-size fish

Questionnaire Layout

The questionnaire consisted of four parts: (1) recent visits and fishing activity, (2) fishing experiences and preferences, (3) sport fishing management, and (4) demographics (see Appendix B). Section one was designed to collect information on nonresident anglers' recent fishing experiences in Alaska, including the number of visits made to

Alaska since 1995, dates and length of the most recent 1997 visit that included fishing, primary reason(s) for visiting, and the total number of days fished in Alaska and overall in 1997. In addition, this section included items that asked anglers to record the specific locations and species sought in Alaska during 1997, the number of guided days by fishery, and the number of fish they took or shipped outside Alaska in 1997 by species. The information collected from these (and other) questions were used to describe the angling history and behavior of 1997 nonresident anglers and to identify anglers who participated in specific sport fisheries across the state (fishery-based segmentation).

Section two contained questions that would be used to segment nonresident Alaska anglers into meaningful subgroups. It included questions designed to measure the primary dimensions of angling specialization (past experience, skill level, centrality to lifestyle, etc.), anglers' general motivations for fishing, as well as the relative importance of 21 fishery attributes (Appendix B, Question 22).

Section three was designed to collect information that could be used to estimate the possible effects on nonresident anglers of various management proposals currently being considered by the Alaska Board of Fisheries, ADF&G or the Alaska State Legislature. Previous recreation research has shown that recreational choices are influenced by the managerial setting in which the activity occurs and may differ among groups of recreationists (Virden and Shreyer 1988). However, the degree to which nonresident anglers' decisions to visit Alaska or to sport fish for certain species in specific locations or time periods are affected by the management setting (i.e., license fee structure, bag limits in effect, or other fishing regulations) is currently unknown. To estimate the effects of various management options on nonresident anglers' sport fishing decisions, section three included a series of contingency questions asking anglers to indicate how their Alaska sport fishing decisions might be affected by changes in license fees and the adoption of different levels of annual bag limits for certain species of fish. This section also included questions designed to assess nonresident angler attitudes toward the adoption of differential annual bag limits for resident and nonresident anglers, and the concept of establishing limits on the number of anglers who could participate in some fisheries to maintain or provide opportunities for high quality fishing experiences.

Section four included standardized questions for collecting basic demographic information on nonresident anglers, including state or country of permanent residence, age, gender, education level, race and income. Additional variables of interest to ADF&G (e.g., likelihood of returning to Alaska for sport fishing, satisfaction with their 1997 fishing experiences, ADF&G management rating) also were included in the questionnaire and placed in the appropriate order so that content was relevant to surrounding questions. Although not of central interest to my research, they are analyzed and reported along with other data.

Two pretests of the survey instrument were conducted during the survey development phase to obtain feedback on the design of specific questionnaire items and the overall instrument layout. The first pretest involved identifying and contacting individuals on the Virginia Tech campus who fished in Alaska during 1996 or 1997 using a snowball sampling approach (Henry 1990). Eleven individuals were ultimately contacted. Each person was asked to complete a copy of the draft survey and then attend a focus group interview to provide feedback on the instrument and answer questions regarding the design of specific questions in the survey instrument. Of the 11 individuals contacted, seven completed the written survey and five participated in a two-hour focus group interview.

A second, mailed pretest was conducted during November and December 1997 with a sample of 100 Alaska nonresident anglers drawn from the September 1997 version of the Alaska sport fishing license database. Selected anglers were mailed a copy of the draft questionnaire and a cover letter asking them to complete the survey and note any particular questions or concerns they may have had regarding individual questionnaire items. The primary intent of the mailed pretest was 1) to detect items having unusually high nonresponse, 2) to determine whether respondents followed specific questionnaire instructions, and 3) to identify other inconsistencies in angler responses. A one-time mailing was conducted, resulting in 4 undeliverables and 42 completed surveys, for an effective response rate of 43.8%. Both the focus group and mailed pretest resulted in substantial changes being made to survey questions, as well as changes in the final survey

layout. The nonresident anglers selected to participate in the pretests were subsequently removed from the sampling frame of nonresident anglers.

Table 7 outlines the specific questions included in each section of the survey instrument, as well as the question format, response scale used, and the type of data generated. Where possible, questions incorporated standardized phrasing and response scales that have been used in previous angler survey research to allow for comparison of results.

Data Collection

Administration of the mail survey followed a standardized procedure developed by the Alaska Department of Fish and Game for use with its annual Alaska Statewide Sport Fish Harvest Survey (Howe et al. 1998). This procedure involves conducting three separate mailings of the complete questionnaire package to selected anglers at approximately five-week intervals to allow sufficient time for responses to previous mailings given longer postal delivery times to and from Alaska. An initial mailing was sent to all 14,934 anglers identified through the sample selection procedures outlined above. The final nonresident survey packet consisted of a cover letter, a 24-page questionnaire booklet with two map inserts listing specific fishing locations for primary management areas in Alaska (see Appendices A, B, and C), and a postage-paid business reply envelope. Mailings to anglers living in foreign countries other than Canada were sent courtesy reply envelopes (no postage) as opposed to postage-paid business reply envelopes. Results of prior tests by ADF&G demonstrated that postage prepayment (International Reply Coupon) did not significantly increase response rates for these anglers (Allen L. Howe, ADF&G, personal communication).

Five weeks after the initial mailing, a second copy of the questionnaire and a reminder letter were sent to all anglers who had not responded to the first mailing. Ten weeks after the initial mailing all anglers who had not yet responded to a previous mailing were sent a letter emphasizing the importance of their participation in the study along with a third copy of the survey. For purposes of sorting and logging returns, the

Table 7. Alaska nonresident angler survey questions by section.

Variable/Question	Response Format	Data type	Scale ^a
SECTION 1—RECENT TRIPS AND FISHING ACTIVITY			
Number of visits to Alaska by purpose (1995-97)	Open-end (4 categories)	Ratio	N/A
License(s) purchased during most recent visit	Checkbox list (multiple answer.)	Nominal	N/A
King Stamp purchased?	Yes/No	Nominal	N/A
Type of King Stamp purchased?	Checkbox list (multiple answer)	Nominal	N/A
Arrival and departure date of most recent visit (length of visit)	Open-end	Ratio	N/A
Primary reason for visit to AK	Checkbox list (1 answer)	Nominal	N/A
Mode of transportation to AK	Checkbox list (multiple answer)	Nominal	N/A
Motivations for fishing in Alaska	List—9 reasons	Ordinal	Likert-type
Likelihood of returning in next three years	Checkbox scale	Ordinal	Scale
Total No. of days fished in AK, other states, near home in 1997	Open-end	Ratio	N/A
Sport fishing partners during visit to Alaska	Checkbox list (multiple answer)	Nominal	N/A
Exported fish from AK in 1997?	Yes/No	Nominal	N/A
No.of fish exported in 1997 by species (salmon and halibut)	Open-end	Ratio	N/A
1997 FISHERY PARTICIPATION GRID PAGE			
Total No. of days fished in each fishery by period of the year	Open-end	Ratio	N/A
Total No. of guided days fished in each fishery by period of the year	Open-end	Ratio	N/A
SECTION 2—FISHING EXPERIENCE AND PREFERENCES			
Total years of sport fishing experience	Open-end	Ratio	N/A
Angling expertise—self-rating	Checkbox scale	Ordinal	Scale
Type(s) of sport fishing engaged in during 1997	Checkbox list (multiple answer)	Nominal	N/A
Motivations for sport fishing—(6 dimensions, 15 items)	Rate 15 items	Ordinal	Likert-type
Importance of fishing as source of satisfaction	Checkbox scale	Ordinal	10-pt Scale
General satisfaction with 1997 AK fishing experiences	Checkbox scale	Ordinal	Scale
Own/operate sport fish guide/charter service? (specify type)	Yes/No	Nominal	N/A
Member of a fishing club or sportsmen's organization assoc.?	Yes/No	Nominal	N/A
Sport fishing magazine subscription(s)	Yes/No + open-end	Nominal	N/A
Characteristics of AK fisheries important in choice of fishing site	Rate 21 items	Ordinal	Likert-type
Importance of catching fish (size, number, harvesting, releasing)	Rate 13 items	Ordinal	Likert-type
SECTION 3—SPORT FISHING MANAGEMENT			
Willingness to pay question—license fees		Nominal	N/A
Basic choices (WTP \$10, \$20 more)	7 behavioral response categ.	Nominal	N/A
Maximum WTP?	Open-end	Ratio	N/A
Willingness to pay question—king stamp fees		Nominal	N/A
Basic choices (WTP \$10, \$20)	7 behavioral response categ.	Nominal	N/A
Maximum WTP?	Open-end	Ratio	N/A
Annual Harvest limits--			
<i>How would a statewide annual harvest limit of X chinook salmon, Pacific halibut, and all salmon combined have affected your sport fishing in 1997?</i>	Checkbox list-chose 1 of 3 behavioral responses.	Nominal	N/A
Differential bag limits by residency?	Rate 3 items/statements	Ordinal	Likert-type
Limit access to certain sport fisheries?	Y/N/Uncertain	Ordinal	N/A
Rating of ADF&G's management performance	Checkbox scale	Ordinal	Scale
SECTION 4—DEMOGRAPHIC INFORMATION			
State/country of permanent residence	Open-end	Nominal	N/A
Gender	Checkbox (M or F)	Nominal	N/A
Age (year that you were born)	Open-end	Ratio	N/A
Education level	Checkbox list	Nominal	N/A
Ethnic background	Checkbox list	Nominal	N/A
Income	Checkbox list	Nominal	N/A
Additional comments	Open end	N/A	N/A

^a See Appendix B for response choices and scale structure for specific questions.

survey booklets used for each mailing were printed in a unique color ink (1st mailing= blue, 2nd=brown, 3rd=green) and individually labeled with a unique 12-digit bar code.

A mailing agent was contracted to conduct the assembly and mailings of surveys with domestic addresses (USA residents). The unique angler identification and address labels were supplied to the mailing agent who affixed the labels to the printed questionnaires, inserted them into mailing envelopes along with business reply envelopes and cover letters, and then delivered them to the bulk mailing center at the General Mail Facility at Anchorage International Airport where they were mailed third class bulk business mail rate. Survey mailings to Canada and other foreign countries were conducted by ADF&G staff. Surveys destined for foreign addresses and those being forwarded to U.S. residents were metered and mailed first class (air mail) through the ADF&G mail room.

Although the first mailing date was originally scheduled for late January 1998, printing delays and underestimates by the contracted mailing agent regarding the amount of time necessary to assemble and mail the large volume of surveys pushed the mailing dates back. As a result, the initial mailing was ultimately conducted on 12 March 1998, with the second and third mailings occurring on 17 April and 22 May 1998, respectively. Questionnaires received after July 31, 1998 were excluded from the data processing.

Data Preparation

Completed surveys were returned to the Anchorage office of the Alaska Department of Fish and Game where Division of Sport Fish data entry personnel sorted and logged them into a computer database that kept track of anglers who returned surveys. Although I designed the survey instrument so that optical mark recognition technology could be used for a significant portion of data entry, time and personnel constraints were such that the optical scanning process could not be tested and refined prior to the time when data entry needed to begin. As a result, ADF&G data entry personnel keypunched survey responses into a Visual FoxPro database using customized data entry screens developed by an ADF&G computer programmer.

After the completion of data entry, I cleaned and edited the master database, which consisted of checking each variable's frequency distribution for out-of-range or extreme values and identifying inconsistencies in the response record (e.g., skip instructions not followed, multiple answers to single-answer questions). Identified keying mistakes and other inconsistencies were corrected where possible by examining the returned questionnaire.

Testing for Nonresponse Bias

Given the difficulty of obtaining phone numbers for study participants (phone numbers are not consistently recorded by anglers on the license form and thus, are not coded into the statewide license database), as well as the relative cost of contacting a percentage of nonresident anglers by telephone, a telephone follow-up with a subsample of nonrespondents was not used to assess potential nonresponse bias. Instead, I assessed possible nonresponse bias in two ways: 1) by examining differences between respondents and nonrespondents with regard to variables known for each group from the Alaska sport fishing license database (sex, age, and month license was purchased) and 2) by comparing the responses of anglers to each survey mailing with regard to selected survey variables (Table 8).

I used chi-square contingency tests to determine if respondents and nonrespondents differed significantly with regard to the proportions of males and females, proportions within various age classes, and period when license was purchased. In addition, I used a series of chi-square and analysis of variance tests to determine if there were significant differences in the characteristics of anglers responding to each survey mailing. The general form of these contingency tests included having categories of anglers (e.g., proportions of male, female, missing, proportions of those using/not using guides) on one dimension and mailing of response on the second dimension. The survey variables selected for comparison across survey mailings have been shown to be predictors of other variables measured in this survey in previous studies (Fisher 1997). An alpha (α) level of 0.05 was used for all tests.

Table 8. Survey variables and statistical tests used to determine the presence of nonresponse bias in the nonresident angler survey data.

Variable	Test
All respondents vs. all nonrespondents	
Gender	Chi-square
Age distribution (5-yr increments)	Chi-square
Period of license purchase	Chi-square
Respondents to mailings 1, 2, and 3	
Total days fished in 1997	ANOVA ^a
Total days fished in Alaska in 1997	ANOVA ^a
Years of fishing experience	ANOVA ^a
Fishing club membership	Chi-square
Self-rated fishing expertise	Chi-square
Gender	Chi-square

^a with multiple comparison tests between mailings

Data Analysis

Descriptive Findings

I constructed frequency distributions for all questions with nominal response categories, while frequency distributions and other summary statistics were produced for all continuous variables in the instrument. Descriptive findings for all nonresident respondents are reported in Chapter 4 along with the results of the angler segmentation and fishery profile analyses.

Procedures for Identifying Angler Segments

One of the primary objectives of this study was to identify relevant subgroups of nonresident Alaska anglers empirically using a combination of specialization and motivation variables that have been shown to differentiate anglers. Cluster analysis is a set of multivariate statistical methods commonly used to segment consumers (in this case, anglers) into distinct market segments.

As discussed in Chapter 2, cluster analysis generally involves five basic steps: (1) selecting a set of variables, (2) deciding whether to standardize the data to account for differences in measurement scales, (3) selecting a coefficient that measures the resemblance between each pair of objects (i.e., a similarity measure), (4) selecting a clustering method(s) and determining the number of clusters, and (5) validation and evaluation of the resulting cluster solution. In this section, I explain each step of the cluster analysis procedure used in this study to identify market segments within the Alaska nonresident angler population.

Variable selection and preparation

Previous empirical research related to the concept of recreation specialization and motivations for fishing provided a basis for selecting variables that would identify relevant subgroups of Alaska nonresident anglers. A set of seven specialization and six motivational variables were selected as the initial basis for segmentation of nonresident Alaska anglers. The specific specialization and motivation variables and the individual indicator items used to operationalize each variable are provided in Tables 4 and 5. Thirty individual questions (indicator items) representing 13 segmentation variables were presented to each study participant.

Following identification of the records that would be used in the segmentation analysis, responses to the multiple indicator items used to measure the specialization variables resource dependency and activity-specific elements of fishing, were checked for reliability using Cronbach's alpha statistic (Cronbach 1951). Reliability analysis indicated that the individual indicator items comprising these specialization domains contributed to the assigned domain (Table 9). Thus, for all respondents, a single measurement score for each variable within the resource dependency and activity-specific elements of fishing domains was developed using the sum of a respondent's responses to the individual attitude statements (indicator items). Each individual indicator item was measured on a five-point Likert scale, where 1 = strongly disagree, 2 = disagree, 3 = neither agree or disagree, 4 = agree, and 5 = strongly agree. Summed scores for each of the resource dependency and fishing-specific variables ranged from 3 to 15.

Table 9. Composition and statistics for resource dependency and activity-specific elements of fishing domains.

Domain	Domain Indicator Items ^a	Standardized Cronbach Alpha	Alpha if item deleted
Resource Dependency:			
	Importance of # of fish caught	0.72	
	The more fish I catch the happier I am		0.61
	A successful fishing trip is one in which I catch many fish		0.58
	A full stringer is the best indicator of a good fishing trip		0.68
	Importance of size of fish caught.	0.66	
	The bigger the fish I catch, the better the fishing trip		0.49
	Catching trophy fish is the biggest reward to me		0.47
	I'm happiest with a fishing trip if I catch fish that are hard to catch and land		0.7
Activity-specific Elements of Fishing:			
	Catch disposition	0.79	
	I'm just as happy if I don't keep the fish I catch ^b		0.75
	Keeping the fish I catch is more enjoyable than releasing them		0.65
	Bringing fish home to the table is an important outcome of fishing		0.74
	Importance of catching	0.76	
	A fishing trip can be successful even if I catch no fish ^b		0.66
	When I go fishing, I'm just as happy if I don't catch a fish ^b		0.69
	When I go fishing I'm not satisfied unless I catch at least something		0.7

^a Participants were asked to respond to each item on five-point, Likert scale, 1=strongly disagree--5= strongly agree.

^b For the calculation of Cronbach alpha, item responses were reversed due to the negative wording of the item.

The remaining specialization variables (years of angling experience, total days fished in 1997, and self-rated importance of fishing) were single-item measures included in the segmentation dataset.

Next, factor analysis was used to determine the primary motivational dimensions among nonresident Alaska anglers from the set of 15 motivation indicator items included in the survey instrument. Although the survey instrument included 15 standardized indicator items representing six reasons for fishing commonly found in previous angler research, I assumed that the primary motivations and the indicator items that represented those motivational domains might differ from previous studies. In addition, factor analysis would allow me to reduce the dimensionality of the data by identifying the most important motivational dimensions and eliminating motivational dimensions less likely to contribute much to the segmentation analysis.

Nonresident anglers' primary reasons for fishing were identified using principal axis factoring with varimax rotation. Principal axis factoring was selected because the technique tends to produce a factor structure that accounts for the most variance with the fewest number of factors. Four factors with eigenvalues greater than 1.0 and accounting for 57 percent of the variance in the data were identified (Table 10). Only items with factor loadings greater than 0.50 for a single factor were retained, reducing the chance that an item would load on more than one factor. A fifth potential factor having an eigenvalue of 0.95 was initially considered for inclusion. However, no items having factor loadings greater than 0.50 were associated with the factor and two items that had the highest loadings on this factor (0.45 and 0.46) loaded on at least one other factor. As a result, only four motivational dimensions were used in the subsequent segmentation analysis. These included:

1. Developing and using fishing skills
2. Solitude/Being in natural surroundings
3. Stimulation/Challenge of fishing
4. Social bonding

Table 10. Factor composition and statistics of motivational domains for nonresident Alaska anglers.

Factor	Scale Items ^{a, b}	Factor Loadings	Eigenvalue (% of variance)	Cronbach Alpha
<u>Developing and using fishing skills</u>			5.0 (33.4)	0.78
	Testing and using my fishing equipment	0.56		
	Developing my fishing skills	0.55		
	Learning more about fish	0.55		
	Sharing what I know about fishing with others	0.61		
<u>Solitude/Being in natural surroundings</u>			1.4 (9.1)	0.71
	Getting away from other people	0.71		
	Being on my own	0.71		
	Experiencing natural surroundings	0.5		
<u>Stimulation and challenge of fishing</u>			1.2 (7.7)	0.72
	For the challenge or sport of fishing	0.74		
	For the stimulation and excitement of fishing	0.67		
<u>Social bonding</u>				
	Being with friends and family	0.63	1.0 (6.9)	N/A

^a Participants were asked to respond to each item on five-point, Likert scale, 1=unimportant—5=extremely important

^b Five of the original 15 motivational scale items were not associated with those factors having an eigenvalue > 1 and were not used in further analyses.

Reliability analysis on the identified motivational dimensions produced Cronbach alpha coefficients that ranged from 0.71 to 0.78 (reliability was not determined for social bonding, a single item scale) (Table 10). Similar to the multi-measure specialization

variables, responses to individual scale items were then summed to produce a measurement score for each motivational domain.

Once all of the variables to be used in the segmentation analysis had been selected and summed scores for multi-item variables calculated, the variables were checked for intercorrelatedness using simple correlation analysis. Although uncorrelated variables is not a strict assumption of cluster analysis (Arabie and Hubert 1994; Milligan 1996), highly correlated variables will implicitly weight such variables and may distort the similarity measure between cases (Aldenderfer and Blashfield 1984). Thus, it is important to examine the degree of intercorrelation that exists among variables prior to cluster analysis. With only a few exceptions, the correlation between most variable pairs was less than 0.3, and many were negligible (< 0.1) (Table 11). Only four variable pairs had a correlation greater than 0.5, with the highest correlation between any variable pairs being 0.57 (between “importance of catching something” & “importance of number of fish” caught and between stimulation/challenge of fishing & developing and using fishing skills). Since importance of catching and importance of number of fish are sub-dimensions of an angler’s dependency on the fish resource (Ditton et al. 1992), some correlation between these variables is to be expected. The fact that there is not a higher correlation between the variables seems to suggest that they are separate (but related) variables.

The fact that the motivation variables “developing and using fishing skills” and “stimulation/challenge of fishing” were moderately correlated (0.57) also is not surprising since previous empirical studies of angler motivations have often found that these motivations for fishing constituted a single, multidimensional factor (Sanyal and McLaughlin 1994; Hase 1996). However, the results of factor analysis in this study indicated they are distinct motivational factors among nonresident Alaska anglers. I assumed that the moderate correlation exhibited by a few variable pairs would not substantially affect the outcome of the cluster analysis. Thus, all 11 variables (7 specialization measures and 4 motivation variables) were retained for cluster analysis.

Table 11. Correlations among segmentation variables used to identify market segments among Alaska nonresident anglers.

	Specialization Variables							Motivation variables			
	Days fished in 1997	Yrs of fishing experience	Importance of fishing	Importance of # of fish caught	Importance of size of fish caught	Importance of keeping fish	Importance of catching "something"	Developing and using fishing skills	Solitude/Being in natural surroundings	Stimulation\ Challenge of fishing	Social Bonding
Days fished in 1997	1.00										
Years of fishing experience	0.17 ^a	1.00									
Importance of fishing	0.42	0.29	1.00								
Importance of # of fish caught	-0.07	-0.03	0.03	1.00							
Importance of size of fish caught	0.10	0.08	0.27	0.45	1.00						
Importance of keeping fish	-0.16	-0.04	-0.09	0.49	0.09	1.00					
Importance of catching "something"	-0.11	-0.03	-0.05	0.57	0.27	0.38	1.00				
Developing and using fishing skills	0.27	0.13	0.51	0.07	0.28	-0.07	-0.06	1.00			
Solitude/Being in natural surroundings	0.17	0.04	0.31	-0.07	0.07	-0.17	-0.11	0.46	1.00		
Stimulation/Challenge of fishing	0.25	0.15	0.54	0.14	0.40	-0.09	0.07	0.57	0.42	1.00	
Social bonding	-0.01	-0.03	0.06	0.03	0.04	0.02	-0.04	0.28	0.25	0.24	1.00

^a Pearson correlation coefficient

Multiple imputation of missing data

In social and behavioral sciences, missing values frequently hamper statistical analyses. In the case of mailed questionnaires, subjects may be unwilling or unable to respond to some items, or may fail to complete sections of the questionnaire due to lack of time or interest. As noted by Schafer and Olsen (1998),

Until recently, the only methods widely available for analyzing incomplete data focused on “removing” the missing values, either by ignoring subjects with incomplete information or by substituting plausible values (e.g., means or regression predictions) for the missing items. These ad hoc methods, though simple to implement, have serious drawbacks which have been well documented (see, e.g., Little and Rubin 1987; Graham, Hofer & Piccinnin 1994) (p.546).

In many instances, researchers simply ignore cases with missing values when performing an analysis. However, unless the number of cases with missing values is relatively small, case-wise deletion procedures may bias the results if the subjects who provide complete data are unrepresentative of the entire sample. In multivariate analyses involving a large number of items (variables), case-wise deletion can be particularly inefficient, since most multivariate analyses require complete data for all subjects in the sample. Even if the number of missing values is relatively low per item, it is often the case that a substantial number of subjects may be missing one or more values and thus will be excluded from the analysis.

Of the 7,706 nonresident anglers that returned completed questionnaires in this study, 1,170 (15.2 %) were missing data for at least one of the 30 individual indicator items used to produce the 11 segmentation variables. In commonly used statistical software packages (i.e. SAS, SPSS), these subjects would have been excluded from cluster analysis since most cluster analytic procedures require a data matrix that is complete. To avoid the potential for bias due to case deletion and the pitfalls associated with ad hoc imputation procedures such as mean substitution, multiple imputation (Rubin

1987) was used to develop “complete” datasets (i.e. no missing values for all segmentation variables for all 7,706 cases) prior to cluster analysis.

Multiple imputation (MI) is the process of replacing each missing value with a set of $m > 1$ plausible values drawn from their prediction distribution. In most instances, only 3-5 imputations are needed to provide reasonably accurate estimates that incorporate uncertainty due to missing data (Schafer and Olsen 1998). The variation among the m imputations reflects the uncertainty with which the missing values can be predicted from the observed ones. Following multiple imputation there are m complete datasets, each of which can be analyzed by complete data methods and standard statistical software. After performing identical analyses on each of the m datasets, the results (estimates and standard errors of interest) are combined, using simple rules provided by Rubin (1987) and others, to produce overall estimates and standard errors that reflect missing data uncertainty (Schafer and Olsen 1998).

In this study, a data augmentation procedure developed by Tanner and Wong (1987) as implemented in the NORM software program (Schafer and Olsen 1998) was used to develop 5 complete nonresident angler segmentation datasets prior to cluster analysis. Since the fraction of missing information for most variables was relatively low (< 10%) and did not exceed 20 percent for any variable included in the analysis, 5 imputations provided highly efficient estimates (95-98% efficient) (Schafer and Olsen 1998: Table 1), and suggested that there was little advantage to producing and analyzing more than 5 imputed datasets. Each dataset contained all nonresident cases with complete data (N= 6,536) as well as cases containing imputed values for variables that were missing in the original dataset as drawn from the predicted distribution of each variable (N=1,076). Ninety-four cases were missing data for all 11 angler segmentation variables and were excluded from the multiple imputation procedure. Thus, each of the 5 complete datasets consisted of 7,612 unique anglers, or 98.7% of the total set of nonresident respondents.

To perform the multiple imputation procedure, I assumed that the 11 segmentation variables conformed to an approximately multivariate normal distribution and that missing values were missing at random (MAR) (Little and Rubin 1987). To

meet the assumption of approximate multivariate normality, the highly skewed variables “total days fished in 1997” and “total years of sport fishing experience” were transformed to approximately normal distributions using a logarithm function ($\log(x+1)$) for the data augmentation procedure and then transformed back to the original scale after imputation. Although real data rarely conform to models such as the multivariate normal and the model used to generate multiple imputations will at best be only approximately true, experience has shown that multiple imputation tends to be fairly robust to departures from the imputation model (Schafer 1997; Schafer and Olsen 1998).

To say that missing values in the sample data set were “missing at random” (MAR) means that the probabilities of missingness may depend on data values that are observed but not on the ones that are missing (Little and Rubin 1987). As explained by Schafer and Olsen (1998):

...consider a simple bivariate dataset with one variable X that is always observed and a second variable Y that is sometimes missing. Under MAR, the probability that Y is missing for a sample subject may be related to the subject’s value of X but not to his value of Y ...If MAR were satisfied, then one could regress Y on X for the respondents and then use the estimated relationship to obtain unbiased predictions of Y for nonrespondents...

Extensions of this simple example to more complex situations—for example, to where missing values occur on both X and Y —are less intuitive and more difficult to describe. Nevertheless, the prediction principle does carry over (p.552).

If missing values are MAR, then the mechanism (reason) for missingness is considered *ignorable* (Rubin 1987)—an assumption that must be met in order to obtain valid inferences using multiple imputation procedures.

Unfortunately, when data are missing for reasons beyond the control of the investigators, one can never be sure that MAR holds, since it is not possible to test the MAR hypothesis using the data at hand. In addition, the MAR assumption cannot be relaxed without replacing it with other equally untestable assumptions about the mechanism(s) behind the missingness in the data (Schafer and Olsen 1998). However,

Schafer and Olsen (1998) note that “even when the missing data are not precisely MAR. . . general ignorable procedures still tend to be better than ad hoc procedures such as case deletion.” In addition, practical experience with real data suggests that general ignorable procedures (e.g. multiple imputation) tend to perform well even when the MAR assumption is suspect, especially in multivariate settings. According to Schafer (1997):

The crucial assumption made by ignorable methods (*e.g. multiple imputation*) is not that the propensity to respond is completely unrelated to the missing data, but that this relationship can be explained by data that are observed. Whether ignorability is plausible in a particular setting is therefore closely related to the richness of the observed data (Y_{obs}) and the complexity of the data model $P(Y | \theta)$. . . In multivariate datasets where both the observed data and complete-data model are rich, general ignorable procedures tend to perform well in practice (p.27-28).

Lacking external information for each case or follow-up data from randomly-selected nonrespondents which could be used to test the MAR hypothesis, I proceeded with multiple imputation under the assumption that the data were MAR and that, if not MAR, the procedure would produce estimates that were better than alternative procedures such as case-wise deletion or mean imputation.

Multiple imputation of missing values in the nonresident data set using the software program NORM required several steps. First, an iterative procedure for fitting models to incomplete data, known as the EM algorithm (Dempster, Laird and Rubin 1977) was used to determine maximum likelihood estimates of the missing-data-model parameters. The observed data for the 11 segmentation variables were used to determine starting values for the EM procedure, and the number of iterations was left unspecified (program default). The procedure converged in 6 iterations and the resulting parameter estimates were saved and used as starting values for the data augmentation (DA) step. Data augmentation is an iterative procedure used to produce the multiple imputations of missing data. It alternately fills in the missing data and parameter estimates to make inferences about the unknown parameters (stochastically). The distribution of the

missing data stabilizes to a predictive distribution—the exact distribution one needs to draw from to create proper multiple imputations (Schafer and Olsen 1998).

In this study, 5,000 cycles (iterations) were initially specified for the data augmentation procedure to examine the convergence behavior of the parameter estimates. Examination of the time series plots of the parameter estimates and the autocorrelation function for each parameter resulted in horizontal bands without long upward or downward trends verifying that DA had converged relatively quickly (Figure 1) (Schafer and Olsen 1998). The estimates were fully stable well before 2,000th cycle. To produce the five complete data sets for cluster analysis, the data augmentation procedure was re-run for 10,000 cycles and a complete dataset was saved every $k=2,000$ cycles ($k, 2k, 3k, 4k, 5k$). Using large values of k ensured that the imputed datasets were truly independent and encompassed the true levels of missing data uncertainty (Schafer and Olsen 1998).

Standardization of the data matrix

Since the scales used to measure several of the input variables in this study were markedly different and squared Euclidean distance was used as a dissimilarity measure, potential existed for certain variables (i.e., total days fished and total years of sport fishing) to “overshadow” the role of other variables in the clustering procedure. Thus, a standardization procedure was performed on the 5 complete (imputed) datasets prior to clustering. On the basis of Milligan and Cooper’s (1988) results demonstrating the superiority of standardizing functions that divide each variable by its range, standardized data matrices were obtained by subtracting the minimum recorded value for a given attribute from the raw value and then dividing this number by the range of observed values for the attribute (Milligan and Cooper 1988: 185, Equation 6).

Clustering methods and determination of the number of clusters

A two-stage clustering approach, recommended by Punj and Stewart (1983) and Milligan (1996), and similar to that used by Kikuchi (1986) was used to identify relevant subgroups of nonresident Alaska anglers. The first stage involved using hierarchical

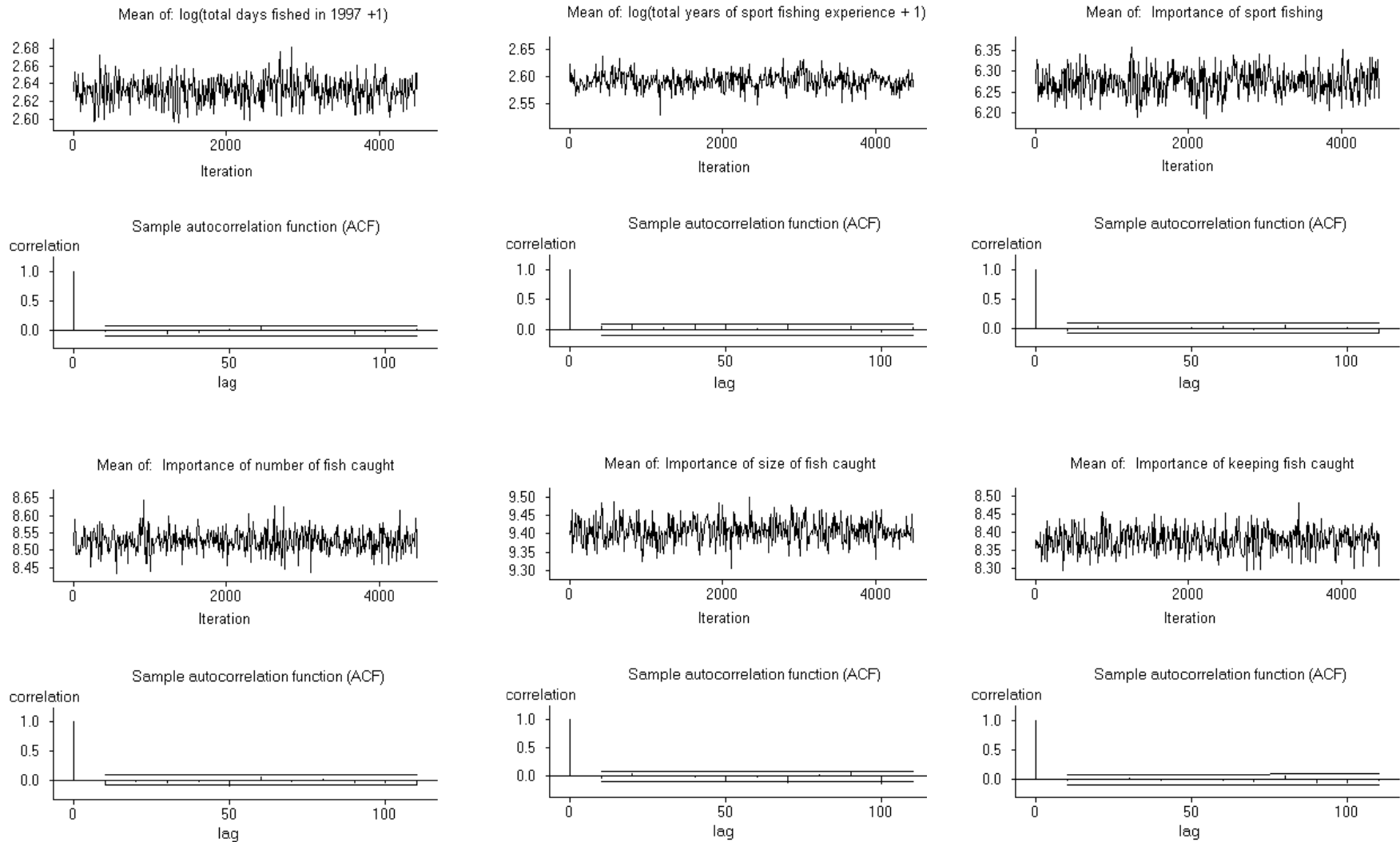


Figure 1. Time series plots of parameter estimates and sample autocorrelation functions from NORM data augmentation for the 11 angler segmentation variables.

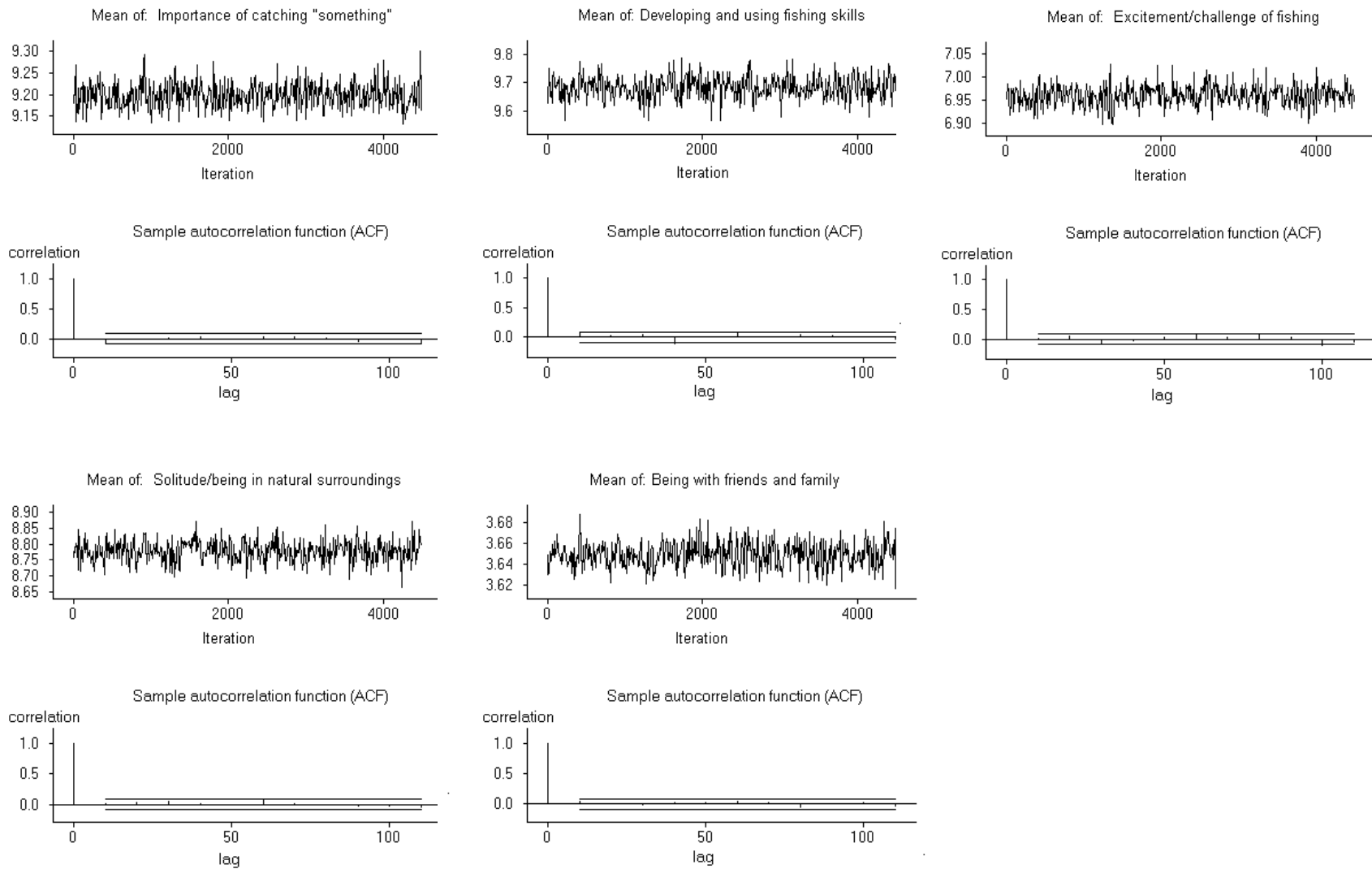


Figure 1 (cont.). Time series plots of parameter estimates and sample autocorrelation functions from NORM data augmentation for the 11 angler segmentation variables.

clustering methods to determine the number of angler groups within the complete data sets. The second phase involved performing non-hierarchical (k- means) cluster analysis on each data set using the centroids of clusters obtained from hierarchical analysis as initial seeds. The SAS statistical software (SAS 1990, version 6.12) was used to conduct both the hierarchical (PROC CLUSTER) and non-hierarchical clustering (PROC FASTCLUS).

Ward's minimum variance method and average linkage between groups (UPGMA) clustering algorithms using squared Euclidean distance as a similarity coefficient were performed on each of the five complete data sets. Ward's method and average linkage (UPGMA) were used because both have demonstrated superior performance in recovery of known cluster structure in Monte Carlo simulations, and have been shown to provide excellent starting points ("seeds") for non-hierarchical k-means clustering (Edelbrock 1979; Edelbrock and McLaughlin 1980; Milligan 1980; Scheibler and Schneider 1985; Milligan 1996).

Three methods ("stopping rules") were used to determine the number of angler groups (clusters) resulting from hierarchical analysis of each data set. First, a "scree" method that involved plotting the number of clusters versus the cubic clustering criterion (CCC) (Sarle 1983) and looking for departures from linearity was used (Aldenderfer and Blashfield 1984). The cubic clustering criterion (Sarle 1983) is based on R^2 , the proportion of the variance accounted for by the clusters, and identifies the value of c (# of clusters) which maximizes a function of R^2 (Gordon 1996). The maximum value of the CCC across hierarchy levels (or local "peaks" within the range of possible cluster solutions) indicates the optimal number of clusters. The scree method using the CCC is a useful rule of thumb, but the CCC has a tendency toward incomplete clustering of a data set (one too many clusters) according to Monte Carlo simulations (Milligan and Cooper 1985). Thus, the number of clusters for each hierarchical algorithm was also determined using the Calinski and Harabasz (1974) and Duda and Hart (1973) tests-- two stopping rules that have been shown to outperform other rules in simulation studies on data sets with known structure and different levels of introduced error (Milligan and Cooper 1985;

Cooper and Milligan 1988). These stopping rules are available in SAS (PROC CLUSTER) and are known as the “Pseudo F” and “Pseudo t^2 ” tests respectively (SAS 1990).

The Pseudo F test (Calinski and Harabasz 1974) (as well as the CCC) is considered a “global” stopping rule since it makes use of all the information contained in a partition into c clusters for each value of c (Gordon 1996). Like the CCC, the maximum value of the Pseudo F statistic across hierarchy levels (or local “peaks” within the range of possible cluster solutions) indicates the optimal number of clusters. The Pseudo t^2 (Duda and Hart 1973) test is a “local” stopping rule in that it is based on tests of whether or not a pair of clusters should be merged or remain separate. A small value for the t^2 statistic followed by a much larger t^2 value for the next cluster fusion suggests that two clusters should not be merged. A small value for the t^2 statistic *in combination with* local peaks of the CCC or Pseudo F suggest the optimal number of clusters in the data set (SAS 1990).

After determining a set of possible cluster solutions from hierarchical analysis of the five complete data sets, noncombinatorial k-means analysis (PROC FASTCLUS) using a convergence value of 0.02 was performed on the data sets for each possible hierarchical cluster solution to obtain a set of refined cluster solutions for consideration as final market segments. The centroids of clusters obtained from hierarchical clustering (Ward’s method) were used to provide the initial partition of each data set during the initial pass (Milligan 1980; Milligan 1996).

I used a combination of relative indices (internal indices used as “stopping rules”) (Jain and Dubes 1988, Ch. 4) and marketing criteria (Engel, Fiorillo, and Cayley 1972; Kotler 1984) to determine the final number of nonresident angler segments. Consistency in the number of clusters suggested by the cubic clustering criterion, Pseudo F and Pseudo t^2 statistics across clustering methods in hierarchical clustering provided an initial basis for selecting the final number of angler segments. The cubic clustering criterion and Pseudo F statistics are also produced by the PROC FASTCLUS procedure, and can provide an indication of the optimal number of clusters in a given data set if the variables used to develop a cluster solution are not highly correlated (SAS 1990) .

In addition, the cluster solutions resulting from non-hierarchical (k-means) analysis were evaluated with regard to whether they met two criteria considered particularly relevant in the context of market segmentation (Engel, Fiorillo, and Cayley 1972; Guiltinan and Sawyer 1975; Kotler 1984). These included: 1) the relative size of individual clusters (i.e., is there a sufficient number of anglers in each cluster to warrant attention?) and 2) variation in market response (i.e., are there clear differences among the angler groups with regard to fishing experience, involvement, preferences, and motivations for fishing?).

The total number of anglers in each segment was estimated by the mean of the individual totals obtained from non-hierarchical analysis of each of the five complete datasets. Standard errors were estimated using formulas provided by Little and Rubin (1987; Equation 12.20, page 257) that take into account both within- and between-imputation variance. To assess variation in market response, the mean characteristics of each angler segment (for the 11 segmentation variables) were estimated and compared to other segments within a given cluster solution. The mean characteristics were estimated by calculating the mean of the individual estimates from each imputed data set using the formula:

$$\bar{x}_c = \frac{1}{m} \sum_1^m \bar{x}_{c,m}$$

where m = number of imputations and c = cluster #. For the purpose of this study, I considered evidence of two (or more) angler segments having similar means on more than three dimensions (particularly with regard to fishing preferences or fishing behavior) as a strong indication of incomplete clustering.

Prior to estimating statistics for a given cluster solution (e.g., a 5-cluster solution), the individual cluster solutions resulting from analysis of each complete data set were examined to determine the consistency of cluster assignment and cluster labels across imputations. Since each analysis was independent, there was no guarantee that Cluster 1 identified in complete dataset #1 was the same as Cluster 1 in complete dataset #2. Assuming that records with *complete* data for the 11 variables would most likely be

assigned to the same cluster in repeated analyses, clusters having similar labels (1, 2, 3, etc.) AND similar means across the imputed data sets were considered the “same” cluster.

To assess the consistency of cluster assignment and labels across imputed datasets, the separate cluster solutions resulting from non-hierarchical (k-means) analysis of each data set were themselves subjected to a k-means reallocation procedure that used the final cluster centroids resulting from k-mean analysis as seeds. If, after this procedure, the cluster means and boxplots of the input variables for a given cluster differed markedly from clusters with the same label in other datasets, the cluster was not considered to be the “same” and its *label* was changed to the cluster number which had similar means and boxplots for the 11 segmentation variables. For example, a 6-cluster solution, consisted of 5 independent 6-cluster solutions from k-means analysis of complete datasets 1, 2, 3, 4, and 5. I assessed whether Cluster 1 resulting from complete data set #1 was roughly the same (in terms of its having a similar mean and boxplot for total days fished, total years fished, etc.) as Cluster 1 resulting from complete data sets #2-5. This step was repeated for each cluster (2-5), and cluster labels were changed if necessary so that all 5 Cluster 1’s (Cluster 2’s, etc.) had similar means and boxplot profiles for the 11 segmentation variables. Changes in cluster labels were few and relatively obvious upon examination of a matrix of boxplots showing cluster label by input variable.

Segmentation validation

Following selection of the final cluster solution, a descriptive profile of each angler segment was developed in terms of the primary segmentation variables to characterize each segment and highlight important characteristics. If the resulting clusters are to represent true market segments and be useful to fishery managers, the segments should exhibit within group similarity and systematic between-group differences with regard to segmentation variables as well as other managerially-relevant variables. Significance tests of several variables not used to form clusters were used to assess the validity of the cluster solution and to evaluate the between-group differences among the segments (Aldenderfer and Blashfield 1984; Milligan 1996). The segments

identified through cluster analysis were compared with respect to: (1) socioeconomic characteristics, (2) Alaska fishing behaviors and participation characteristics, (3) relative importance of 21 fishery attributes, and (4) attitudes toward several proposed management actions (Table 12). Kruskal- Wallis tests were used to test between-segment differences on nonnormal, continuous variables (e.g., days fished in Alaska, number fish exported from Alaska, etc.), while chi-square tests of independence were used to test for differences among categorical variables.

One-way analysis of variance (ANOVA) was used to test between-segment differences in mean importance scores for 21 fishery attributes. Final p-values for each statistical test were obtained by combining the p-values of the individual tests on each of the five complete (imputed) datasets using formulas provided by Schafer (1997; Equation 4.40, page 115). A 0.05 level of statistical significance was used for all significance tests. However, the large sample sizes for most tests were likely to result in statistically significant differences for many comparisons (i.e., $p < 0.05$), making it more difficult to assess whether meaningful differences existed among the clusters. Although nonsignificant results at the 0.05 level for a given variable certainly would indicate that clusters do not differ significantly with regard to the variable, a statistically significant difference at the 0.05 level may not demonstrate that clusters actually differ in a meaningful way. Thus, the size of the test statistic associated with each test and the relative degree of difference in means or proportions across segments was also used to assess whether there were meaningful differences among angler segments with regard to specific variables.

Procedures for Developing Fishery Profiles

As noted earlier in this report, there are a number of ways to segment an angler market. Given that fisheries management is typically conducted at the species and/or water body level, a potentially useful segmentation approach involves identifying and describing anglers who participate in specific fishery locations or fisheries. This approach not only can provide fisheries managers with a better understanding of the anglers who participate in a specific fishery, but would allow an agency to determine what type(s) of fisheries are used by different angler segments (markets). When combined with information with

regard to other aspects of the fishery (resource integrity, catch rates, physical setting, access, etc.) managers can develop a reliable description of the fishery which includes a description of its participating anglers, and the factors that make a given fishery appealing to specific angler markets.

Table 12. Segmentation validation variables and associated significance tests.

Variable	Significance Test
Socioeconomic and Demographic Characteristics	
Age	Chi-square
Income	Chi-square
Education level	Chi-square
Residence Strata	Chi-square
Participation Patterns and Fishing preferences	
No. of days fished in Alaska	Kruskal-Wallis test
No. of visits to Alaska 1995-97	Kruskal-Wallis test
Length of most recent visit to Alaska	Kruskal-Wallis test
No. of fish transported out of Alaska	Kruskal-Wallis test
No. of unique locations fished	Chi-square
No. of fisheries visited	Chi-square
Percent of anglers that came to Alaska primarily to fish	Chi-square
Percent of anglers that utilized a guide	Chi-square
Likelihood of returning to Alaska to fish	Chi-square
Percent of anglers that belong to a fishing club or sporting organization	Chi-square
Percent of anglers that went fly-fishing in 1997	Chi-square
Self-rated angling expertise	Chi-square
Fishery attributes sought	
relative importance of 21 fishery attributes	ANOVA
Management attitudes	
Attitude toward limits on the number of anglers in a fishery	Chi-square
Attitude toward differential annual harvest limits for resident & nonresidents	Chi-square
Effect of 1 king salmon annual limit on fishing activity	Chi-square
Effect of 3 king salmon annual limit on fishing activity	Chi-square
Effect of a 4 halibut annual limit on fishing activity	Chi-square

Constructing descriptive profiles of the anglers participating in major Alaska sport fisheries was an important objective identified by ADF&G during the planning phase of this project. The specific objective of this study was to construct descriptive profiles of *nonresident* anglers participating in major Alaska sport fisheries in terms of socioeconomic and demographic variables, fishing preferences and motivations, and empirically-identified angler markets.

To meet this objective, one section of the nonresident survey instrument (Question 12--Trip Record) asked nonresident anglers to report the specific locations they fished in 1997 along with the species targeted, number of days fished (guided and unguided), and period of visit to each location (Appendix B). To facilitate reporting of locations fished, anglers were provided with 2 maps displaying the primary management sub-areas in Alaska (A-Z) and short, coded lists of the primary fishing locations within each lettered sub-area (Appendix C).

The information was used to segment the nonresident angler sample into sub-groups that participated in fisheries at specific locations (e.g., Kenai River). The information collected from the trip record also can be used to segment and describe anglers 1) who fished for a particular species at a given location (e.g., Kenai River--king salmon anglers), 2) who fished for particular species within a larger management sub-area (e.g., Ketchikan Area--halibut anglers), or 3) who fished in certain types of fisheries (i.e., marine bottomfish fisheries, freshwater river-trout fisheries, etc.).

Although ADF&G is interested in developing profiles for as many fisheries as possible, the purpose of this thesis is to demonstrate the basic utility of fishery-based segmentation to fisheries managers and policy makers in Alaska. As such, only a selected number of fishery locations are profiled here. A more detailed report containing descriptive profiles for all fishery locations, specific fisheries (e.g., Kenai River rainbow trout, Kenai River late run chinook salmon), and other aggregates will be produced separately by ADF&G once data from an identical resident angler survey have been analyzed and combined with the nonresident data.

To demonstrate the utility of the fishery-based segmentation, it was considered important to provide profiles for a diversity of fishery types, i.e., those located in

different geographical areas, different water body types (fresh vs. saltwater systems, rivers vs. lakes, etc.), and comprised of different fish species. Although sampling procedures were designed to provide a minimum of 15 fisheries having > 403 respondents which would meet the objective criterion of having proportional estimates within $\pm 5\%$ of the true estimates, based on past Alaska Statewide Harvest Survey data (Howe et al. 1998), I expected that many of the fishery locations having >403 respondents would be concentrated within a limited geographical area (i.e., the Kenai Peninsula). Thus, for the purpose of this thesis, a subset of fishery locations representing a diversity of geographical areas and water types are profiled, rather than locations that simply met the criterion of having >403 respondents.

The number of respondents for a given location also was a consideration in selecting the subset of fishery locations. I selected fishery locations with a range of sample sizes so that I could examine the effect of respondent sample size on the relative precision of proportional estimates of selected survey variables. Since profiles of fisheries having fewer than 403 respondents will likely be developed and reported in a subsequent ADF&G report, this analysis provided a basis for determining the minimum number of respondents necessary to obtain fishery profile estimates having an acceptable level of precision for management purposes. Ten fishery locations were ultimately selected for profile analysis on the basis of the number of respondents and the diversity criteria specified above.

Structure of fishery profiles

A large number of variables were collected in this survey effort and could be reported by fishery. The emphasis in this study was on describing fisheries in terms of the characteristics of nonresident anglers who participated in the fishery in 1997. Specifically, each fishery is profiled in terms of variables that are likely to be important to the local fishery manager as well as policy makers who must consider the impact of management actions when making decisions regarding the fishery. In addition, one of the primary questions to be answered by this analysis is whether the general profile of a given fishery can be estimated (deduced) by examining the participation of empirically-identified nonresident angler segments in the fishery. If the angler segments identified

through cluster analysis have distinct characteristics (behavioral, preferences, management opinions, etc.) and can be associated with particular fisheries or fishery types, then statewide empirical segmentation using a combination of specialization and motivation variables may be particularly useful tool to ADF&G, reducing the need for separate, fishery-specific angler studies.

For the purposes of this study, the angler profile for a fishery is defined as the proportion of participating anglers who are categorized as certain types--for example, the proportion of nonresident anglers from each residence stratum (Other USA anglers, Canadian anglers, Other foreign anglers), the proportion of nonresident anglers who purchased specific license types, the proportion who indicated that size of fish caught is important or unimportant, etc. The proportion of anglers belonging to each of the five nonresident angler segments identified through cluster analysis also was reported as part of the descriptive profile of each fishery location. The complete list of variables that constitute the angler profile of a fishery location is shown in Table 13.

Table 13. Variables used to construct descriptive profiles of specific fishery locations in Alaska in terms of nonresident angler participation.

Variable
Fishery Location
Location name and code (e.g., Kenai River, P-08)
Water type (fresh/salt, river, lake, etc.)
Number of respondents
Distribution of angler types (from cluster analysis)
Socioeconomic and Demographic Characteristics
Residence strata (% Other USA, Canadian, Other foreign)
Income distribution
Age distribution
Angling participation characteristics
Fishing license type distribution
Proportion who came to AK primarily to fish
Average number of fish exported from Alaska
Angling Preferences and Motivations
Importance of keeping fish caught
Importance of number of fish caught
Importance of size of fish caught
Benefits sought from fishing in Alaska (motivations)
Fishery attributes important in selecting where to fish
Management Opinions
Establishing limits on the # of people in some fisheries
Annual harvest limits for resident and nonresident anglers
Satisfaction with 1997 sport fishing experiences

CHAPTER 3: RESULTS

Survey Response

A total of 14,934 nonresident anglers were mailed questionnaire packets during the initial mailing. Of this number, 675 did not reach sampled anglers due to address changes or incorrect addresses. Over the course of three mailings, 8,006 questionnaires were returned, 113 of which were duplicates (based on license number) which were removed from the database (Table 14). Of the 7,893 unique surveys returned, an additional 187 were removed from the database because they contained no data or were found ineligible for the nonresident survey due to incorrect residency status or other errors. Thus, a total of 7,706 completed surveys were returned, an effective response rate of 54.0%.

Table 14. Response to the Alaska nonresident angler survey.

	Mailing 1	Mailing 2	Mailing 3	Total
Date of mailing	3/12/1998	4/20/1998	5/25/1998	
Number mailed	14,934	11,690	8,608	35,239
Number returned nondeliverable	372	202	101	675
Number not returned	9,943	9,242	7,373	21,241
Number of responses	4,626	2,246	1,134	8,006
Response rate	31.8%	15.6%	8.0%	55.4%
Cumulative Responses	4,626	6,872	8,006	
Percent of 1st mailing not returned as nondeliverable	31.8%	47.4%	55.4%	
Duplicates	113			
Ineligibles	187			
Adjusted total number of responses				7,706
Effective response rate				54.0%

Tests for Nonresponse Bias

Results of chi-square tests indicated that return of the completed questionnaire was significantly dependent upon gender, age and month of license purchase (Table 15).

However, closer examination of the differences in proportional distributions of these variables suggests that there were only managerially-significant differences with regard to mean age, with older anglers being somewhat more likely to respond ($p = 0.006$). The low p -values that resulted from the chi-square tests on gender and period of license purchase are the result of the increased power of the test due to the relatively large sample size ($N = 7,706$), and do reflect large differences between respondents and nonrespondents.

Table 15. Results of comparisons of survey respondents and nonrespondents with regard to known external variables: gender, age, period of license purchase.

Variable	Respondents (%)	Nonrespondents (%)	χ^2	P
Gender				
Male	77.4	78.8		
Female	18.5	20.6	198.9	<0.001(ns)
Unknown	4.1	0.6		
Mean Age	50.2	43.6	7.7 ^a	0.006*
Period of license purchase				
Jan-Apr	1.6	1.8		
May	8.6	9.1		
June	31.0	29.1		
July	35.1	35.5	14.5	0.042 (ns)
Aug	21.4	22.5		
Sept	1.9	1.8		
Oct-Dec	0.0	0.0		
Missing	0.4	0.2		

^a F-statistic from T-test

* = most likely to be managerially-significant

ns = not likely to be managerially significant

There also were managerially-significant differences between mailing wave respondents on 5 of 6 selected survey variables (Table 16). Respondents to the first mailing differed from respondents to the second and third mailings with regard to total

number of days fished in 1997, number of days fished in Alaska, and total years of fishing experience, having fished significantly more than anglers responding to the 2nd and 3rd mailings. In addition, fishing club membership and self-rated expertise were higher among 1st mailing respondents. Respondents to the second and third mailings did not differ significantly from one another with regard to these characteristics.

Table 16. Results of nonresponse tests across mailing waves for selected nonresident survey variables.

Variable	Mailing			F	P
	1	2	3		
Mean of total days fished in 1997	25.9 ^a	21.3	21.8	15.9	<0.001*
Mean of total days fished in Alaska	6.2 ^a	5.1	4.7	23.8	<0.001*
Mean of total years of fishing experience	25.0 ^a	19.8	18.6	76.1	<0.001*
	(%)	(%)	(%)	χ^2	P
Fishing club membership					
Percent who indicated "Yes"	22.2 ^a	15.2	15.0	57.9	<0.001*
Self-rated fishing expertise					
Beginner	12.8	18.8	18.9		
Intermediate	45.1	45.6	44.1	108.0	<0.001*
Advanced	36.2	28.0	28.0		
Don't know	4.2	4.4	5.8		
Gender					
Male	80.6	77.1	75.0		
Female	17.7	20.0	21.7	29.1	<0.001 (ns)
Unknown	1.7	2.9	3.3		

^a Tukey's honestly significant difference test, $p < 0.05$. Means with different superscripts differ significantly

* = most likely to be managerially-significant

ns = not likely to be managerially significant

These results suggest that resulting survey estimates may need to be adjusted to compensate for the fact that more avid nonresident anglers are likely to respond to the survey. However, development of an appropriate adjustment procedure is relatively

complex given the number of survey variables (Drane et al. 1993), and is being pursued separately by the Sport Fish Division. Adjustments to survey estimates will be documented in a subsequent report developed for the Division.

Fortunately, the effect of bias on the survey estimates is likely to be relatively small (a few percentage points for proportional estimates), and should not significantly change the overall results. Preliminary analyses conducted by ADF&G in which exponential decay models were fit to number of anglers and days fished in Alaska by mailing to determine nonresponse adjustment weights (Drane et al. 1993) supported this general observation. For example, the unadjusted sample estimate of the average number of days fished by nonresidents in Alaska was 5.6 days, while the adjusted estimate (using adjustment weights developed from the regression models) was 5.4 days per year. Although the difference in these mean values could have an important effect on the calculation of population totals or other estimates, they are not extremely different.

Given the relatively large respondent sample, I assumed the nonresponse bias that may exist in the data would more likely affect the estimation of segment size (i.e., market share), rather than the types or nature of the market segments found. In particular, I am more likely to underestimate the size of the less-avid, casual or infrequent angler segment(s) since it appears that anglers with these characteristics were less likely to respond to the questionnaire. It is possible that a relatively distinct market segment (persons who have no interest in sport fishing, but went fishing in Alaska for some other reason?) may exist within the group of nonrespondents. However, without additional information on the characteristics of nonrespondents, it is difficult to make this determination.

Nonresident Angler Characteristics

In this section, I present an overall profile of nonresident anglers who fished in Alaska during 1997. The results provide an aggregate picture of the nonresident sport fishing market and some indication of its diversity. Although three strata (Other USA residents, Canadian residents, and other foreign residents) were identified for purposes of

sampling, Canadian and other foreign residents accounted for a relatively small proportion of the total number of nonresident respondents (<7 %). Consequently, the information presented in this section is based on all 7,706 nonresident anglers (all strata combined) who participated in the survey. I profile nonresident anglers in four parts: (1) socioeconomic and demographic characteristics, (2) angling background, (3) Alaska angling characteristics, and (4) fishing preferences.

Socioeconomic and Demographic Characteristics

Alaska’s nonresident anglers in 1997 were predominantly male (79%) and white (90%). Nonresident anglers averaged 50 years of age and 63% were older than 45 years of age (Table 17). However, it should be noted that tests for nonresponse bias indicated that older anglers were more likely to respond to the survey, so these estimates should be interpreted with caution. Incomes of nonresident anglers also were high compared to the general population. Sixty-one percent of nonresident anglers reported household incomes greater than \$50,000 per year, and one quarter (25%) earned more than \$100,000 in 1997 (Figure 2). In contrast, the median income in the United States in 1997 was \$37,005 (U.S. Bureau of Census 1998).

Table 17. Age distribution of nonresident anglers who fished in Alaska in 1997.

Age class	Frequency	Percent	Cumulative Percent
16-24	344	4.5	4.5
25-34	810	10.5	15.0
35-44	1,441	18.7	33.7
45-54	1,824	23.7	57.4
55-64	1,673	21.7	79.1
65-74	1,087	14.1	93.2
Over 75	277	3.6	96.8
Missing	249	3.2	100.0
Total	7,706	100.0	

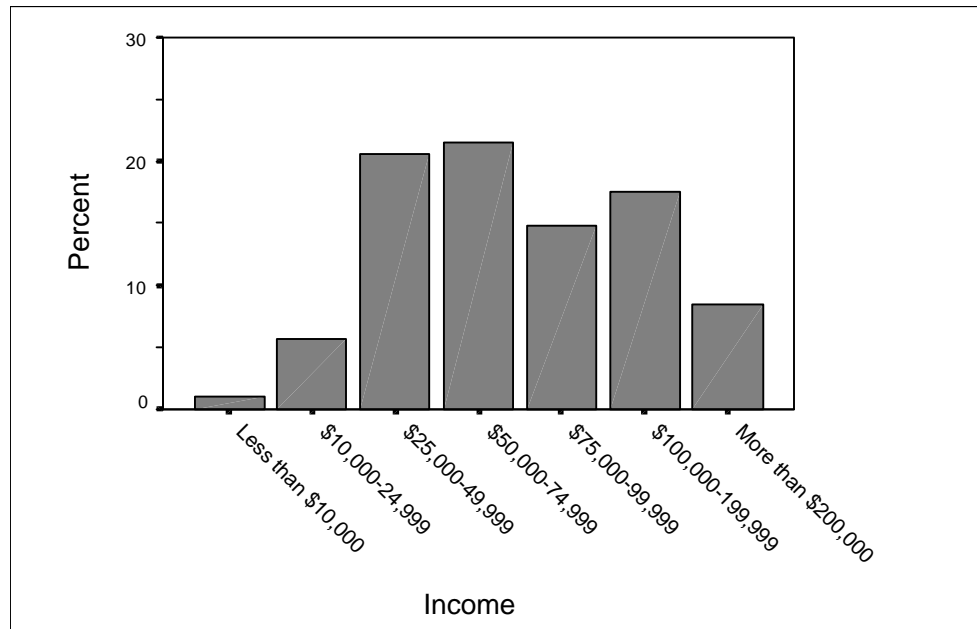


Figure 2. Income distribution of nonresident anglers who fished in Alaska in 1997.

Thirty-five percent of all nonresident anglers who visited Alaska in 1997 came from the Pacific coast states of Washington (14.2%), California (13.7%) and Oregon (7.2%). Although anglers from all 50 U.S. states and at least 29 foreign countries fished in Alaska in 1997, 10 U.S. states accounted for over 60% of the nonresident anglers (Table 18).

Angling Background

Years of angling experience

Nonresident anglers exhibited a wide range of angling experience. Nearly one-third of nonresident anglers (32%) had more than 30 years of fishing experience, while approximately 30 percent had less than 5 years of sport fishing experience. The average length of fishing involvement among nonresident anglers was 23 years with a median of 20 years. Anglers responding to the survey tended to report years of fishing experience in relatively even (5- or 10-year) intervals (Figure 3), so these statistics are less precise than if the actual (continuous) distribution were known. A large number of nonresident

Table 18. Number and percent of 1997 nonresident anglers responding to the survey by primary residence (U.S. states, Canada and other foreign countries).

State	Freq.	Percent ^a	Rank ^b	State	Freq.	Percent	Rank
Alabama	32	0.4%	40	Nevada	112	1.5%	18
Alaska ^c	24	0.3%	47	New Hampshire	25	0.3%	44
Arizona	218	2.8%	9	New Jersey	71	0.9%	23
Arkansas	29	0.4%	43	New Mexico	62	0.8%	25
California	1,053	13.7%	2	New York	118	1.5%	16
Colorado	296	3.8%	6	North Carolina	72	0.9%	22
Connecticut	43	0.6%	34	North Dakota	29	0.4%	42
Delaware	1	<0.0%	51	Ohio	99	1.3%	19
Dist. Of Columbia	4	0.1%	50	Oklahoma	62	0.8%	27
Florida	249	3.2%	7	Oregon	552	7.2%	3
Georgia	116	1.5%	17	Pennsylvania	138	1.8%	14
Hawaii	50	0.6%	33	Rhode Island	9	0.1%	49
Idaho	194	2.5%	11	South Carolina	43	0.6%	35
Illinois	118	1.5%	15	South Dakota	38	0.5%	36
Indiana	52	0.7%	31	Tennessee	53	0.7%	30
Iowa	70	0.9%	24	Texas	340	4.4%	4
Kansas	50	0.6%	32	Utah	243	3.2%	8
Kentucky	31	0.4%	41	Vermont	15	0.2%	46
Louisiana	33	0.4%	39	Virginia	74	1.0%	21
Maine	35	0.5%	38	Washington	1,093	14.2%	1
Maryland	35	0.5%	37	West Virginia	12	0.2%	48
Massachussetts	60	0.8%	28	Wisconsin	152	2.0%	12
Michigan	203	2.6%	10	Wyoming	62	0.8%	26
Minnesota	299	3.9%	5				
Mississippi	19	0.2%	45	Canada	199	2.6%	N/A
Missouri	79	1.0%	20	Other Foreign	252	3.3%	N/A
Montana	143	1.9%	13	Mult. answers	5	0.1%	N/A
Nebraska	53	0.7%	29	Unknown	187	2.4%	
				TOTAL	7,706		

^a Percent of total nonresident anglers that responded to the survey (N=7,706)

^b among 50 U.S. states + District of Columbia.

^c Persons who may have moved to Alaska subsequent to 1997 fishing license purchase or are Alaska residents who purchased a nonresident license by mistake. Respondents considered 1997 nonresident anglers for purposes of this study.

anglers indicated only one year of sport fishing experience (14%). This may be due to the fact that the question used to estimate total years of sport fishing experience (“How many years have you fished in Alaska or elsewhere”) may have been misinterpreted by some anglers. Some anglers may have understood the question to mean “How many years have you fished in Alaska?” instead of “How many years have you been involved in sport fishing”. Alternatively, the data from this question may suggest that a significant proportion of nonresident anglers are "beginners" or fish in Alaska because it is one of the primary recreational activities of visitors to Alaska. As a result, these data should be interpreted with caution.

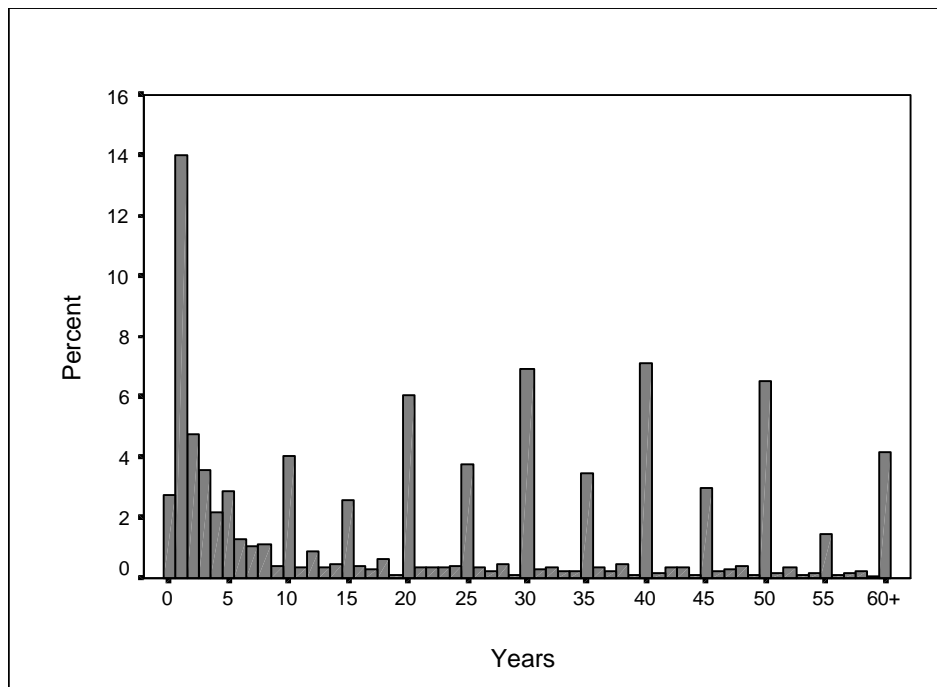


Figure 3. Years of sport fishing experience among 1997 nonresident anglers.

Frequency of angling

The distribution of the total number of days fished by nonresident anglers in 1997 was similar to years of fishing experience in that there were a substantial number of anglers

who had high and low levels of participation. Nonresident anglers fished an average of 24 total days in 1997. However, 45 percent of nonresident anglers fished less than 10 days during 1997, while nearly 26% fished more than 31 days (Figure 4).

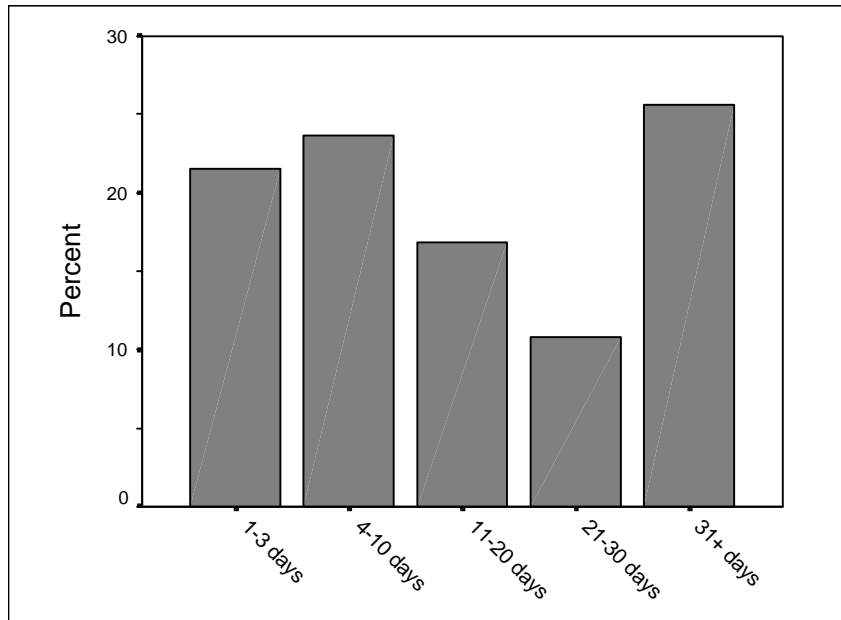


Figure 4. Distribution of total days spent fishing by nonresident anglers in 1997.

Alaska Angling Characteristics

Number of visits

The vast majority of nonresident anglers visiting Alaska during 1997 (94.4%) made only one trip to Alaska that included some type of sport fishing (Figure 5). In addition, about two-thirds (60%) of nonresidents who visited Alaska in 1997 had made only one trip to Alaska that included fishing during the past three years. However, 16 percent of nonresident anglers had made two or more trips to Alaska that included some sport fishing since 1995, and nearly 13 percent of 1997 nonresident anglers had made three trips to Alaska that included sport fishing since 1995 (Figure 6). When asked “How likely are you to return to Alaska to go sport fishing within the next three years?,” approximately 62 percent of 1997 nonresident anglers responded that they were very likely or likely to return (Table 19).

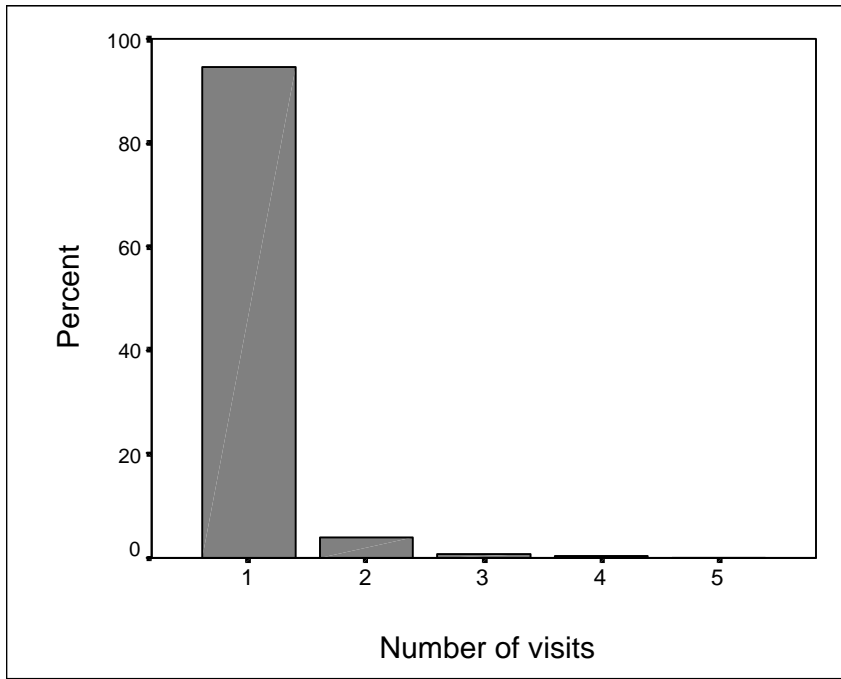


Figure 5. Number of 1997 visits to Alaska by nonresident anglers that included sport fishing.

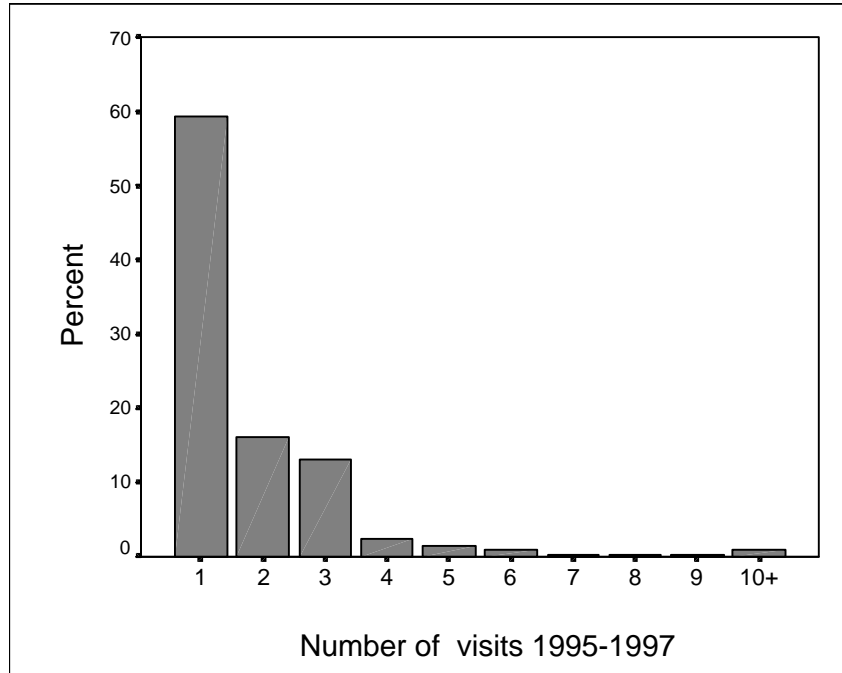


Figure 6. Number of separate visits to Alaska by nonresidents from 1995-1997 that included sport fishing.

Table 19. Nonresident anglers' likelihood of returning to Alaska to sport fish within the next three years.

Likelihood of returning to Alaska to sport fish in next three years	Frequency	Percent	Cumulative Percent
Very likely	3,189	41.4	41.4
Likely	1,573	20.4	61.8
Unsure	1,301	16.9	78.7
Unlikely	552	7.2	85.9
Very Unlikely	866	11.2	97.1
Blank/Missing	215	2.8	99.9
Multiple answers	10	0.1	100.0
Total	7,706	100.0	

Length of visit

During their most recent visit to Alaska, approximately 40 percent of nonresident anglers spent 7 or fewer days in the state and 75 percent of anglers spent 14 or fewer days in the state. The median length of stay for nonresident anglers was 9 days (Figure 7). About 8 percent of 1997 nonresident anglers spent 30 or more days in Alaska during their most recent visit.

Reasons for visiting Alaska

A plurality of nonresident anglers (41.7%) indicated that fishing was the primary reason for their most recent visit to Alaska (Table 20). Vacationing in Alaska to pursue other activities (26.1%) and visiting family or friends (21.4%) were the next most important reasons why nonresident anglers visited Alaska in 1997.

Number of days fished in Alaska

Nearly one-half of all nonresident anglers (47.6%) fished less than 3 days in Alaska during 1997 and 70 percent fished 6 or fewer days (Figure 8). The average number of days fished in Alaska by nonresident anglers in 1997 was 6 days.

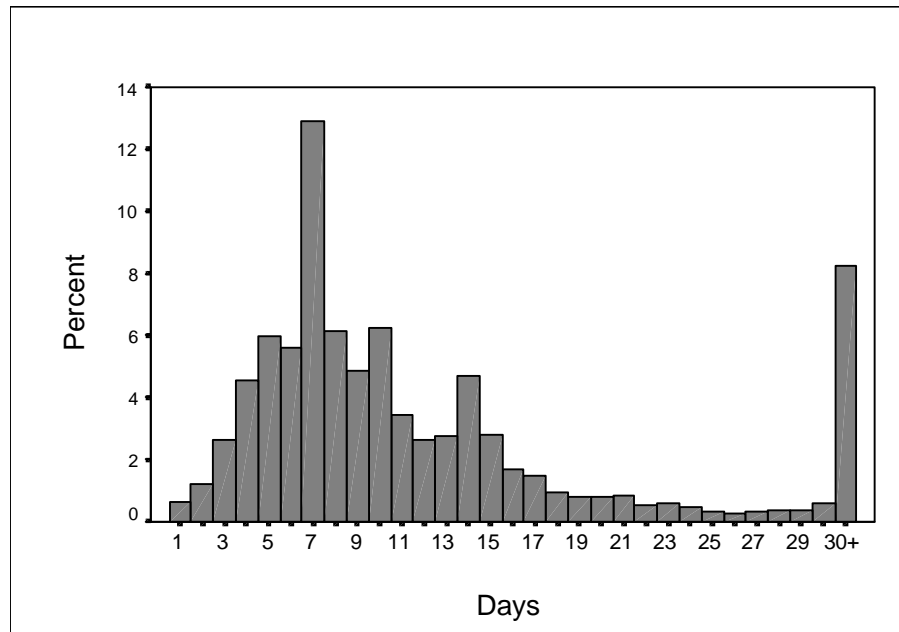


Figure 7. Total length of stay in Alaska by nonresident anglers during most recent 1997 visit.

Table 20. Number and percentage of nonresident anglers by primary reasons for their most recent 1997 visit to Alaska.

Primary reason for most recent visit to Alaska	Frequency	Percent	Cumulative Percent
Went to Alaska primarily to fish	3,213	41.7	41.7
Vacationed in Alaska primarily to do other things, fished while there	2,008	26.1	67.8
Went to Alaska primarily to visit relatives/friends, fished while there	1,647	21.4	89.2
Went to Alaska primarily on business--fished while there	559	7.3	96.5
Went to Alaska primarily to hunt-fished while there	110	1.4	97.9
I did not fish in Alaska during 1997	40	0.5	98.4
Blank/Missing	49	0.6	99.0
Multiple reasons	80	1.0	100.0
Total	7,706	100.0	

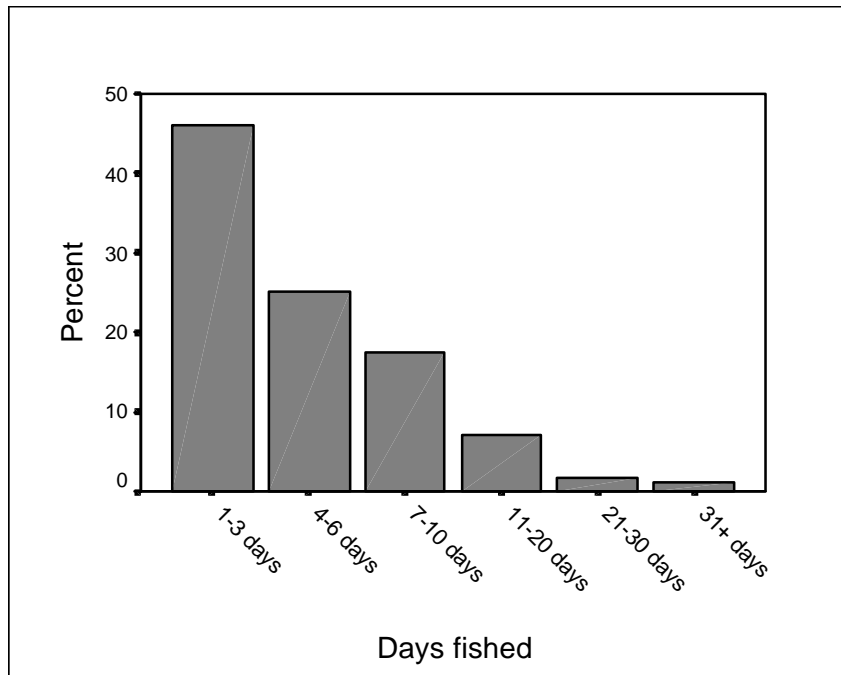


Figure 8. Distribution of the number of days fished in Alaska by 1997 nonresident anglers.

Fish exportation

Over 72 percent of nonresident anglers transported at least one fish of some kind out of Alaska in 1997. Anglers were asked to indicate the number of Pacific halibut (*Hippoglossus stenolepis*), chinook salmon (*Onchorhynchus tshawytscha*), coho salmon (*Onchorhynchus kisutch*), sockeye salmon (*Onchorhynchus nerka*), and other salmon (pink and chum salmon- *Onchorhynchus gorbuscha* and *Onchorhynchus keta*) they exported from Alaska. Of these species, anglers most frequently exported Pacific halibut (63.6 %), followed by chinook salmon (40.9%), coho salmon (35.3%), and sockeye salmon (26.8%) (Table 21). Seventy-nine percent of nonresident anglers who exported fish from Alaska exported two or fewer different species of fish during their most recent visit (Figure 9).

Table 21. Number and percent of nonresident anglers exporting primary species of fish from Alaska in 1997.

Species	Number of anglers	Percent ^a
Pacific halibut	3,487	63.6
Chinook salmon	2,244	40.9
Sockeye salmon	1,469	26.8
Coho salmon	1,937	35.3
Other salmon	648	11.8

^a percent of anglers who exported at least one fish from Alaska in 1997 (N= 5,485)

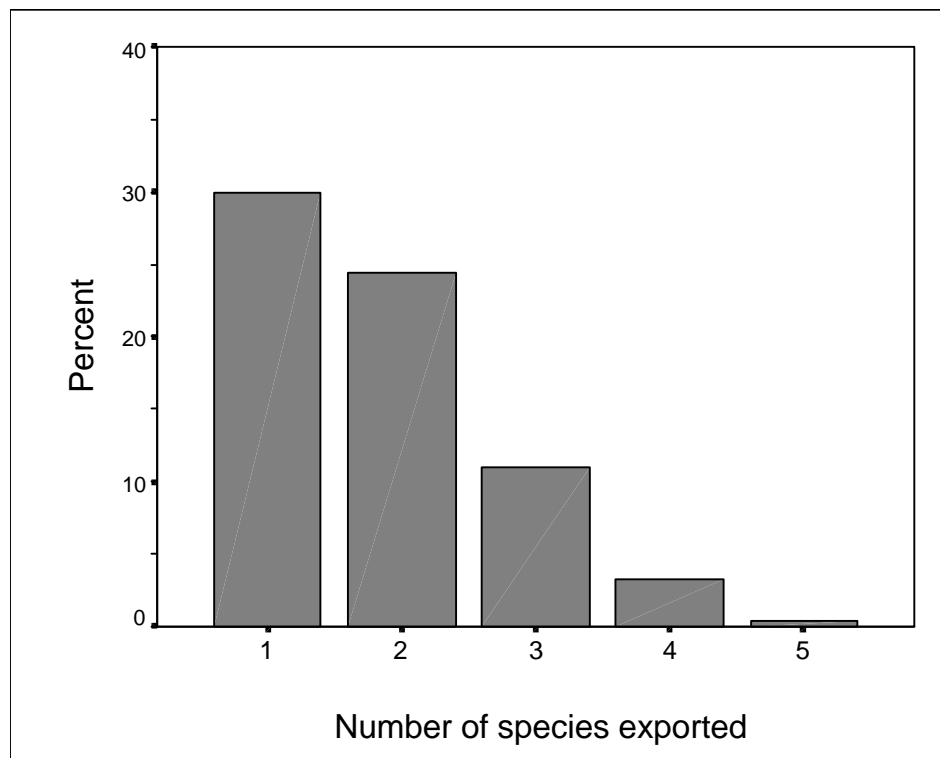


Figure 9. Percent of nonresident anglers exporting 1 or more different species of fish in 1997.

More than four out of five nonresident anglers who transported salmon or halibut exported 3 or fewer halibut (82.4%), and 3 or fewer chinook salmon (94.1%). Distributions of the number of coho, sockeye, and other salmon exported per nonresident angler were similar to those for Pacific halibut and chinook salmon, with the vast majority of anglers exporting 5 or fewer fish (Table 22).

Location of fishing effort

In general, nonresident anglers confined their fishing activities to a limited geographic area of Alaska and to relatively few specific locations within those areas. The majority of nonresident anglers (72%) fished in only one sport fishing management sub-area (see Appendix B for maps of areas) and nearly all (94.1%) fished in two or fewer management sub-areas (Table 23). Eighty percent of nonresident anglers visited 2 or fewer different fishing locations in Alaska, and only 9 percent of nonresident anglers fished 3 or more different locations. Although many fishing locations consisted of several different “fisheries” (i.e., several species of fish were present), most nonresident anglers also participated in relatively few fisheries. Approximately 58 percent of nonresident anglers participated in two or fewer distinct fisheries and nearly 80 percent participated in three or fewer specific fisheries. Less than seven percent of nonresident anglers participated in more than 6 different fisheries in 1997 (Table 23). These results are not particularly surprising given the relative size of Alaska and the fact that many sport fisheries in Alaska are coastal saltwater fisheries covering large geographical areas.

Table 22. Distribution of the number of fish exported by nonresident anglers in Alaska by species.

Species	Number of fish	Frequency of anglers exporting this number	Percent ^a	Cumulative Percent
Pacific Halibut	1	569	16.3%	16.3%
	2	1,213	34.8%	51.1%
	3	349	10.0%	61.1%
	4	609	17.5%	78.6%
	5	108	3.1%	81.7%
	6	293	8.4%	90.1%
	7	25	0.7%	90.8%
	8	116	3.3%	94.1%
	9	18	0.5%	94.6%
	10	83	2.4%	97.0%
	>10	104	3.0%	100.0%
Total	3,487	100.0%		
chinook salmon	1	938	41.8%	41.8%
	2	625	27.9%	69.7%
	3	228	10.2%	79.8%
	4	260	11.6%	91.4%
	5	70	3.1%	94.5%
	6	68	3.0%	97.5%
	7	5	0.2%	97.8%
	8	19	0.8%	98.6%
	>10	31	1.4%	100.0%
	Total	2,244	100.0%	
sockeye salmon	1 to 5	759	51.7%	51.7%
	6 to 10	389	26.5%	78.2%
	11 to 15	143	9.7%	87.9%
	16 to 20	86	5.9%	93.8%
	21 to 25	25	1.7%	95.5%
	>26	66	4.5%	100.0%
Total	1,468	100.0%		
coho salmon	1 to 5	1,118	57.7%	57.7%
	6 to 10	489	25.2%	83.0%
	11 to 15	186	9.6%	92.6%
	16 to 20	78	4.0%	96.6%
	21 to 25	28	1.4%	98.0%
	>26	38	2.0%	100.0%
Total	1,937	100.0%		
other salmon	1 to 5	421	65.0%	65.0%
	6 to 10	143	22.1%	87.0%
	11 to 15	37	5.7%	92.7%
	16 to 20	23	3.5%	96.3%
	21 to 25	9	1.4%	97.7%
	>26	15	2.3%	100.0%
Total	648	100.0%		

^a Percent of total number of anglers who exported one or more fish of this species (N= 5,485).

Table 23. Distribution of number of sub-areas, locations and fisheries visited by Alaska nonresident anglers in 1997.

Number of:	Number	Frequency	Percent	Cumulative Percent
Management sub-areas fished ^a	1	5,557	72.1	77.1
	2	1,226	15.9	94.1
	3	322	4.2	98.6
	4	68	0.9	99.5
	5	29	0.4	99.9
	6	6	0.1	100.0
	8	1	0.0	100.0
Unique locations fished ^b	1	3,933	51.0	54.6
	2	1,843	23.9	80.1
	3	822	10.7	91.5
	4	309	4.0	95.8
	5	149	1.9	97.9
	6	85	1.1	99.1
	7	37	0.5	99.6
	8	20	0.3	99.8
	9	2	0.0	99.9
	≥10	9	0.1	99.9
Unique fisheries visited ^b	1	2,492	32.3	34.6
	2	2,008	26.1	62.4
	3	1,214	15.8	79.3
	4	692	9.0	88.9
	5	329	4.3	93.4
	6	202	2.6	96.2
	7	87	1.1	97.4
	8	66	0.9	98.3
	9	49	0.6	99.0
	10	26	0.3	99.4
	>10 ^c	44	0.6	100.0
Total Response		7,209	93.6	
Missing		497	6.4	
Total		7,706	100.0	

^asee Appendix B for sub-area map

^bspecific species within a particular fishery location, e.g. Kenai River---rainbow trout

^crange = 11 through 24 fisheries

Guide use

More than one-half of nonresident anglers (57.8%) used fishing guides or charter services for at least one fishing trip during their 1997 visit(s) to Alaska (Table 24). Anglers who reported using a guide in 1997 (N=4,452) fished an average of 4.8 guided days (median = 2 days). The average degree of guide utilization among nonresident anglers who used a guide at least once in 1997 (measured as the percent of total days fished by an angler that were guided) was 38%. In other words, (for those who used guides) two out of every five days of fishing were guided.

Table 24. Degree of guide use among 1997 nonresident Alaska anglers.

Used a guide in Alaska in 1997?	Frequency	Percent	Cumulative Percent
Yes	4,452	57.8	57.8
No	2,757	35.8	93.6
No data reported	497	6.4	100.0
Total	7,706	100.0	

License purchases

The 14-day sport fishing license was the most common license type purchased by nonresident anglers in 1997 (41%), followed by the 3-day (27%), 1-day sport fishing licenses (22%), and an annual sport fishing license (13%) (Table 25). Less than 1% of nonresident anglers visiting Alaska in 1997 purchased an annual combination sport fishing/hunting license. Approximately 44% of the nonresident anglers that visited Alaska in 1997 purchased a nonresident king salmon tag during their most recent visit. Of those anglers who purchased a nonresident king salmon tag, 39% purchased a 14-day tag, 34% purchased a 3-day tag, and 25% purchased a 1-day king salmon tag (Table 26).

Table 25. Distribution of sport fishing licenses purchased by nonresident anglers during their most recent visit in 1997.

License type	Frequency ^a	Percent ^b
1-day sport fishing license (\$10)	1,691	21.9
3-day sport fishing license (\$15)	2,080	27.0
14-day sport fishing license (\$30)	3,135	40.7
Annual sport fishing license (\$50)	959	12.5
Annual sport fishing/hunting license (\$135)	65	0.8
Unknown	65	0.8

^a Counts sum to more than 7,706 since 280 anglers purchased more than 1 license.

^b Total percent > 100 since 280 anglers purchased more than 1 license.

Table 26. Distribution of nonresident king salmon tags purchased by nonresident anglers in 1997 during their most recent visit.

Nonresident king salmon tag	Frequency	Percent
Purchased a king salmon tag in 1997	3,365	43.7 ^a
Type of king salmon tag purchased		
1-day king salmon tag (\$10)	842	25.0 ^b
3-day king salmon tag (\$15)	1,144	34.0
14-day king salmon tag (\$35)	1,312	39.0
Purchased multiple tags	67	2.0

^a Percent of 7,706 anglers in nonresident sample

^b Percent of 3,365 anglers who purchased a king salmon tag

Fishing Preferences

Reasons for fishing in Alaska

The most important motivations for fishing in Alaska among 1997 nonresident anglers fishing were (1) to fish in waters surrounded by pleasant scenery (mean score = 3.72), (2) to fish in a wilderness setting (3.58), (3) to fish with family and friends (3.54), and (4) to explore new fishing areas (3.38) (Table 27). Catch-related benefits such as

taking fish home to share with family, obtaining fish to eat, and catching trophy-size fish were less important reasons why nonresident anglers fished in Alaska, with average importance scores of 2.83, 2.67, 2.65, respectively.

However, examination of the distribution of responses with regard to each reason for fishing in Alaska suggests considerable diversity of opinion within the nonresident angler population in terms of reasons for fishing in Alaska. For example, although nonresident anglers ranked “To catch trophy-size fish” last in mean importance, over 25 percent indicated that opportunity to catch trophy-size fish was a very or extremely important reason for fishing in Alaska. Similarly, although nearly 50 percent of nonresident anglers said that obtaining fish to eat was unimportant or only somewhat important, a substantial proportion (22 %) indicated that this was a very or extremely important reason for fishing in Alaska (Table 27). Overall, the distribution of responses for each reason for fishing in Alaska suggests that subgroups of nonresident anglers fish in Alaska for different reasons. This possibility is examined in the angler segmentation section of this report.

Importance of fishing site attributes

I also asked nonresident anglers to indicate the relative importance of 21 different fishery attributes when selecting where to fish in Alaska. Attributes considered most important to nonresident anglers as a whole included the natural beauty of the area (mean = 3.75 on a 5-pt Likert-type scale 1= "unimportant" to 5 = "extremely important"), opportunities to view wildlife (3.49), presence of favorite (preferred) types of fish (3.43), being in an area with few other anglers (3.39), and chance to catch wild fish (3.19) (Table 28). Almost all of the 6 most important attributes sought represent aesthetic characteristics of the physical setting of the fishery (natural beauty, solitude, presence of other wildlife, sense of being in wilderness) rather than fish- or catch-related characteristics. Catch-related attributes such as the chance to catch wild fish, a good chance to catch a daily bag limit, chance to catch a variety of fish and catch rates ranked next in importance (7th through 10th). Nonresident anglers were least concerned with

Table 27. Importance of nine reasons for fishing in Alaska to nonresident anglers ranked by mean importance score.

Reason for fishing in Alaska	Mean ^a	Unimportant	Somewhat Important	Important	Very Important	Extremely Important	Blank
To fish waters surrounded by pleasant scenery	3.72	3.4% ^b	10.1%	27.4%	33.0%	22.5%	3.4%
To fish in a wilderness setting	3.58	7.9%	12.5%	24.0%	28.3%	23.5%	3.8%
To fish with family and friends	3.54	10.5%	11.0%	24.2%	27.1%	23.6%	3.6%
To explore new fishing areas	3.38	11.1%	13.4%	27.1%	27.3%	16.8%	4.1%
To experience a new activity	3.34	14.3%	10.5%	28.0%	27.0%	15.2%	5.0%
To catch new or unique types of fish	3.14	18.2%	15.8%	24.3%	22.1%	15.3%	4.3%
To take fish home to share with family or friends	2.83	23.4%	20.5%	23.8%	18.0%	10.8%	3.5%
To obtain fish to eat	2.67	24.2%	24.8%	25.3%	14.6%	7.5%	3.5%
To catch trophy-size fish	2.65	32.5%	19.3%	18.8%	13.7%	11.7%	4.0%

^a On a five-point scale: 1= unimportant, 2= somewhat important, 3= important, 4= very important, 5= extremely important

^b Percent of all respondents (N = 7,706)

attributes related to angling facilities or services, such as availability of guiding services, campground/cabin facilities, bank fishing opportunity, boat launching facilities and fly-in access when choosing where to fish (Table 28).

Although ranking on the basis of mean importance score provides some information on the relative importance of the various attributes across all nonresident anglers, such aggregate information is not particularly useful since anglers are often quite diverse and differ with regard to the benefits they seek from fishing experiences. Examination of the distribution of importance scores for the individual attribute items (Table 28) shows considerable diversity of opinion among nonresident Alaska anglers.

For example, although 53% of nonresident anglers considered the chance to catch large or trophy-size fish unimportant or only somewhat important when selecting where to fish in Alaska, a substantial proportion (25 %) considered the chance to catch trophy-size fish to be very or extremely important when selecting where to fish. Similarly, although bank fishing opportunity and availability of guiding services and campground/cabin facilities were ranked relatively low across all anglers in terms of mean importance score, over 20 % of nonresident anglers considered these attributes very or extremely important when selecting where to fish in Alaska (Table 28).

These data illustrate the need to adopt a segmentation approach when attempting to understand and describe large angling populations. Not all anglers are concerned with the aesthetic aspects of the fishing location or in getting away from other anglers, or they may consider these factors less important than other anglers. Some actually may prefer fishing where guide services or camping facilities are available, or where trophy-size fish are present. In order to provide fishing opportunities that are consistent with the interests of various angling groups and to manage fishery resources effectively, fisheries managers must identify and describe subgroups within an angling population that share similar behaviors, interests, preferences, and management opinions.

Table 28. Relative importance of 21 fishery attributes among 1997 Alaska nonresident anglers ranked by mean importance score.

Fishing Location Attribute	Mean ^a	Unimportant	Somewhat Important	Important	Very Important	Extremely Important	Blank
Natural beauty of the area	3.75	2.5% ^b	9.2%	30.1%	33.1%	19.6%	5.4%
Opportunities to view wildlife	3.49	5.5%	14.1%	33.5%	25.2%	16.1%	5.5%
Presence of favorite (preferred) type(s) of fish	3.43	8.8%	11.7%	32.1%	28.7%	12.7%	6.0%
Being in area with few other anglers	3.39	9.3%	15.3%	28.5%	26.6%	14.4%	5.8%
Being in a wilderness area	3.37	10.1%	16.1%	28.4%	24.1%	15.6%	5.7%
Opportunity for solitude	3.21	13.3%	17.6%	28.9%	21.6%	12.4%	6.2%
Chance to catch wild fish	3.19	13.8%	15.1%	32.7%	21.5%	10.7%	6.2%
Having a good chance to catch a daily bag limit	3.15	15.1%	18.3%	26.2%	23.5%	11.3%	5.5%
Chance to catch a variety of fish	3.05	12.5%	20.9%	33.6%	21.0%	6.0%	5.9%
Catch rate of keepable fish	2.96	17.8%	19.8%	30.1%	19.2%	7.4%	5.7%

^a Based on a five-point scale where 1= unimportant, 2= somewhat important, 3= important, 4= very important, 5= extremely important

^b percent of all respondents (N= 7,706)

Table continued on next page. . .

Table 28. (cont.) Relative importance of 21 fishery attributes among 1997 Alaska nonresident anglers ranked by mean importance score.

Fishing Location Attribute	Mean ^a	Unimportant	Somewhat Important	Important	Very Important	Extremely Important	Blank
Accessibility	2.92	16.8%	19.7%	36.7%	14.5%	6.1%	6.2%
Chance to catch large or trophy-size fish	2.86	20.2%	23.1%	27.0%	15.9%	8.0%	5.6%
Catch rate of all fish	2.76	20.1%	24.5%	31.7%	12.7%	4.8%	6.3%
Availability of guiding services	2.73	30.0%	17.0%	22.5%	16.8%	7.7%	6.0%
Bank fishing opportunity	2.65	32.1%	17.2%	23.5%	14.3%	6.4%	6.5%
Availability of campground/cabin facilities	2.62	33.0%	18.1%	21.7%	14.6%	6.1%	6.4%
Not having to travel a long time	2.53	27.1%	27.4%	26.2%	10.4%	2.9%	6.0%
An area with fly-in access	2.29	46.8%	15.7%	16.8%	10.0%	4.3%	6.5%
Familiarity with the area	2.28	38.7%	24.2%	21.7%	6.9%	2.3%	6.2%
Boat launching facilities	2.05	53.2%	17.5%	15.5%	5.3%	2.1%	6.3%
Nearness to second home or cabin	1.90	62.4%	13.4%	11.1%	4.5%	2.0%	6.7%

^a Based on a five-point scale where 1= unimportant, 2= somewhat important, 3= important, 4= very important, 5= extremely important

^b percent of all respondents (N= 7,706)

Fishing satisfaction

The majority of nonresident anglers indicated that they were very satisfied with their sport fishing experiences in Alaska in 1997 (54.9%), and nearly 82% were either very or somewhat satisfied (Table 29). Approximately 16% of nonresident anglers were somewhat dissatisfied (8.8 %) or very dissatisfied (6.7%) with their 1997 sport fishing experiences in Alaska. An open-ended question was included in the survey instrument asking anglers to indicate what would have made their 1997 sport fishing experiences more satisfying. Content analysis of the keyed comments from nonresident anglers should be conducted to determine some of the primary reasons for dissatisfaction among nonresident anglers. However, analysis of these data was beyond the scope of this thesis.

Table 29. Nonresident anglers' satisfaction with their 1997 sport fishing experience.

How satisfied were you with your 1997 sport fishing experiences in Alaska?	Frequency	Percent	Cumulative Percent
Very satisfied	4,231	54.9	54.9
Somewhat satisfied	2,069	26.9	81.8
Somewhat dissatisfied	681	8.8	90.6
Very dissatisfied	515	6.7	97.3
Blank/missing	186	2.4	99.7
Multiple answers	24	0.3	100.0
Total	7,705	100.0	

Management Opinions

Nonresident Alaska anglers were asked to provide their opinions with regard to several sport fishing management actions that have been proposed to the Alaska Board of Fisheries, including: 1) establishing limits on the number of anglers who can participate in certain fisheries to maintain high quality fishing experiences, 2) establishing annual sport fish harvest limits for certain species of fish, and 3) whether annual harvest limits for resident and nonresident anglers should be the same or different. In this study, I attempted to measure the effect of specified statewide annual harvest limits for certain

species (king salmon, coho salmon, total salmon, and halibut) on nonresident angler fishing behavior. Finally, I asked nonresident anglers to provide their opinion with regard to how well they think ADF&G is doing its job of managing sport fisheries in Alaska.

Angler limits

Opinions were mixed with regard to setting limits on the number of anglers who could participate in some fisheries to provide opportunities for high quality sport fishing experiences. Forty-one percent of the nonresident anglers who responded were opposed to setting limits on the number of anglers in certain fisheries. However, 26% said ADF&G should consider such limits (Table 30). Nearly one-third of the nonresident anglers who responded (30%) were uncertain whether ADF&G should pursue limits on the number of anglers in certain fisheries.

Table 30. Nonresident angler opinions regarding whether ADF&G should establish limits on the number of anglers in some sport fisheries in Alaska to provide high quality sport fishing experiences.

Response category	Frequency	Percent
Yes	1,932	25.1
No	3,148	40.9
Uncertain	2,294	29.8
Blank/missing	323	4.2
Multiple answers	9	0.1
Total	7,706	100.0

Differential annual harvest limits

Opinions regarding whether annual harvest limits for residents and nonresidents should be the same or different were mixed. Thirty-six percent of nonresident anglers felt that annual harvest limits should be the same, while 40% did not (Table 31). Of those who felt that annual harvest limits should be different for residents and nonresidents, nearly all (>90%) said that resident harvest limits should be higher than nonresident harvest limits (Table 32). Thus, on this question nonresident anglers are

split into three primary groups: 1) those who think annual harvest limits should be the same for residents and nonresidents (40%), 2) those who think residents should have a higher annual harvest limit than nonresidents (approximately 35%), and 3) those who have no opinion (19%).

Table 31. Attitudes of Alaska nonresident anglers toward the statement: “Annual harvest limits for resident and nonresident anglers should be the same.”

Response category	Frequency	Percent	Cumulative Percent
Disagree	3,085	40.0	40.0
Neither agree or disagree	1,424	18.5	58.5
Agree	2,777	36.0	94.5
Blank/Missing	417	5.4	99.9
Multiple answers	3	0.1	100.0
Total	7,706	100.0	

Table 32. Attitudes toward differential annual harvest limits among nonresident anglers who indicated that annual harvest limits should be different for residents and nonresidents. Percent of nonresident respondents by response category.^a

Attitude Statement	Neither agree		Agree	Multiple answers	Blank	Total
	Disagree	or disagree				
Annual harvest limits for residents should be greater than harvest limits for nonresidents	5.6	1.9	92.2	0.0	0.2	100.0
Annual harvest limits for residents should be less than harvest limits for nonresidents	93.0	2.0	4.1	0.1	0.9	100.0

^aN= 2,777, or 36% of the 7,706 survey respondents

Effects of statewide annual harvest limits on nonresident angler behavior

Table 33 summarizes nonresident anglers’ opinions regarding how they would have responded to the implementation of various statewide annual harvest limits for chinook salmon, Pacific halibut, and total salmon if such limits had been in place during their 1997 visit(s) to Alaska. The majority of nonresident anglers indicated that all but

Table 33. Summary of how nonresident Alaska anglers would have responded to implementation of specific statewide annual harvest limits for chinook (king) salmon, halibut, and total salmon.^a Percent (cumulative percent) of total respondents marking each response category indicated.^b

Annual Harvest Limit	Would not have fished in Alaska %	Not have fished for king salmon %	No Effect %	Multiple answers %	Blank %	Total
king salmon						
6 king salmon	3.2	4.4	84.1	0.2	8.1	100.0
3 king salmon	4.9 (8.1)	5.7 (10.1)	71.3	0.1	18.0	100.0
1 king salmon	6.2 (14.3)	13.8 (23.9)	50.9	0.3	28.8	100.0
halibut						
12 halibut	3.1	2.4	88.2	0.1	6.1	100.0
8 halibut	2.5 (5.6)	2.2 (4.6)	82.2	0.0	13.1	100.0
4 halibut	6.1 (11.7)	6.0 (10.6)	69.8	0.1	18.1	100.0
total salmon						
50 salmon (all species)	2.3	4.9	85.5	0.2	7.1	100.0
30 salmon (all species)	2.2 (5.5)	6.7 (11.6)	80.8	0.1	10.2	100.0
10 salmon (all species)	10.2 (15.7)	14.0 (25.6)	63.0	0.1	12.6	100.0

^a Anglers were asked: "Thinking back on your 1997 visit(s) to Alaska, how would a statewide annual harvest limit of "X" species (e.g., 6 king salmon) have affected your sport fishing?"

^b N = 7,706

the most restrictive statewide annual limits would have had no effect on their sport fishing behavior. Within each species category, the number of anglers indicating they "would not have fished in Alaska" or "would have fished for other species" increased as the annual harvest limit decreased. However, only the most restrictive annual harvest limits (i.e., 1 king salmon, 4 halibut, and 10 total salmon) would have affected the fishing behavior of a substantial proportion of nonresident anglers. It is important to note that anglers who marked "would not have fished in Alaska" or "would not have fished for king salmon" (or halibut, etc.) to a given question were asked to skip to a subsequent

question under the assumption that a more restrictive limit would elicit a similar response. Thus, the response distribution reported for subsequent (i.e., lower) limits by species in Table 33 represent the responses of anglers who marked “no effect” to the previous harvest limit. For example, under a 3-king salmon limit, 4.9% of anglers who indicated “No effect” to a 6-king salmon limit would “not have fished in “Alaska”. The following sections provide a brief description of the results pertaining to each species category.

Chinook (King) Salmon

The vast majority of nonresident anglers (84 %) indicated that a statewide annual harvest of 6 king salmon would not have affected their Alaska sport fishing decisions (Table 33). However, approximately 7.6% of nonresident anglers said they would have changed their behavior—3.2 % would not have visited Alaska and 4.4 % would not have fished for king salmon. Under a statewide annual harvest limit of 3 king salmon, an additional 10.6% of nonresident anglers would have changed their sport fishing behavior, bringing the number of anglers who would not have fished in Alaska or not fished for king salmon to 8.1% and 10.1 % respectively. With an annual statewide limit of 1 king salmon, ADF&G could expect that approximately 14% of nonresident anglers would decide not to fish in Alaska (assuming they had prior knowledge of the harvest limit), and an additional 24% of nonresident anglers would not fish for king salmon (Table 33).

Halibut

Relatively few nonresident Alaska anglers (less than 5%) would have changed their fishing behavior under statewide harvest limits of 12 and 8 halibut per year. Under a 4 halibut per year limit, 12% of nonresident anglers indicated that they would not have fished in Alaska, while 11% indicated that they would not have fished for halibut.

All Salmon

The vast majority of nonresident anglers said their sport fishing behavior would not change under annual harvest limits of 50 and 30 salmon. In the face of statewide annual limits on the total number of salmon (all species) nonresident anglers are more likely to spend more time fishing for other species than to stay home. However, under a 10-salmon annual harvest limit ADF&G could expect a decrease of 16% in the number

of nonresident anglers coming to Alaska, as well as some increase in nonresident fishing effort for other species. (Table 33).

ADF&G management rating

Overall, most nonresident anglers (64%) felt that ADF&G is doing an excellent or good job of managing sport fisheries in Alaska (Table 34). Eleven percent of nonresident anglers said the agency was doing a fair job, and only a small number of anglers felt the Department was doing a poor or very poor job of managing the state’s sport fisheries (3%). However, one of five nonresident anglers were not sure how well ADF&G was managing sport fisheries in Alaska (Table 34).

Table 34. Nonresident angler opinions regarding how well ADF&G is doing its job of managing Alaska’s sport fisheries

	Frequency	Percent	Cumulative Percent
Excellent ("A")	1,691	21.9	21.9
Good ("B")	3,238	42.0	64.0
Fair ("C")	830	10.8	74.7
Poor ("D")	167	2.2	76.9
Very Poor ("E")	84	1.1	78.0
Not Sure	1,384	18.0	96.0
Blank/Missing	312	4.0	100.0
Total	7,706	100.0	

Angler Segmentation Results

Scree plots of the number of hierarchical clusters versus the cubic clustering criterion for both Ward’s and average linkage clustering suggested that 6 or 7 clusters existed within the nonresident angler sample (complete) datasets, with the most common solution being 6 clusters (Figures 10 and 11). A marked change in the value of the clustering criterion indicates two dissimilar clusters have merged; the number of clusters prior to the merger

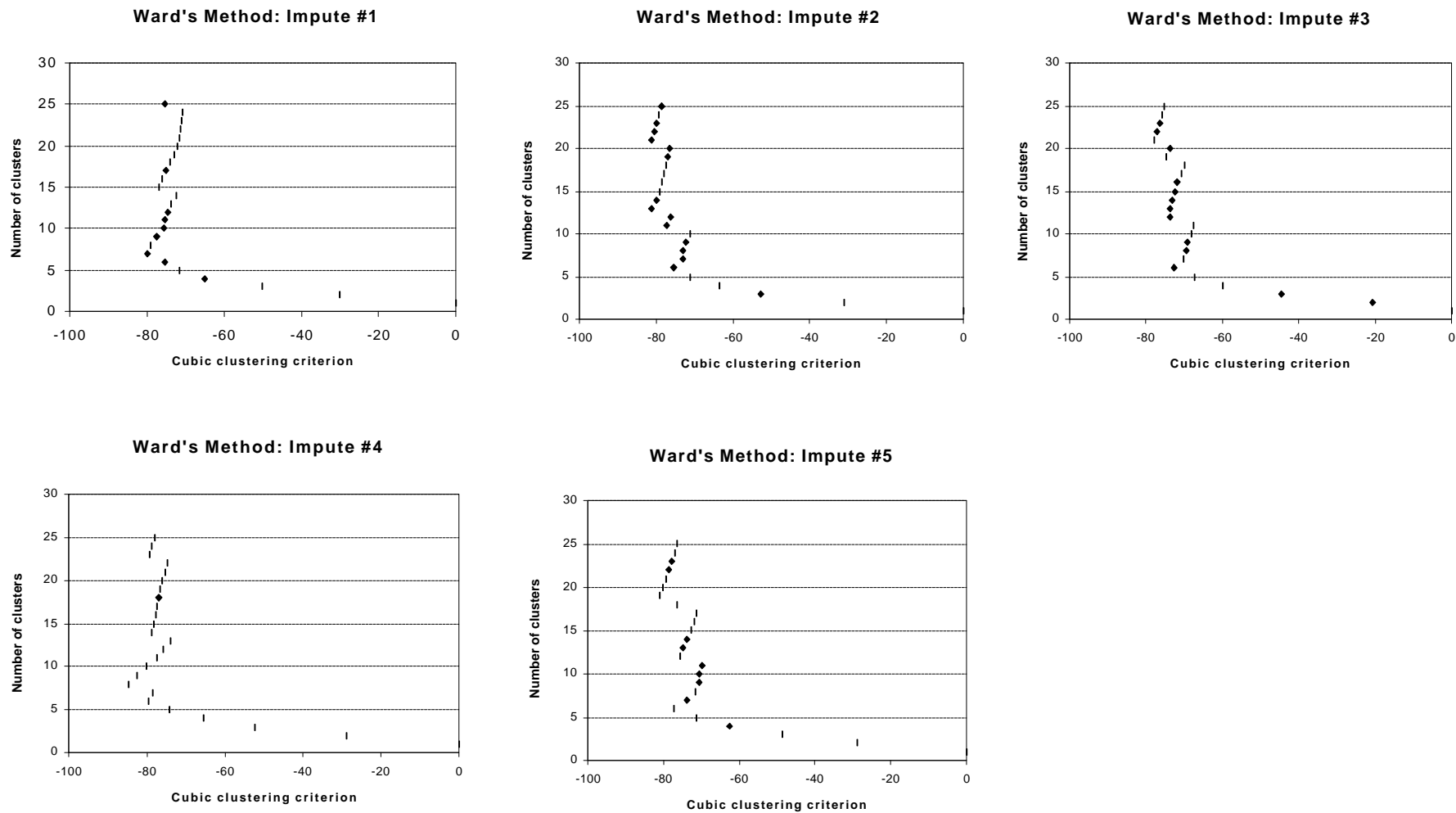


Figure 10. Relation between the cubic clustering criterion and the number of angler clusters (groups) identified by Ward's method.

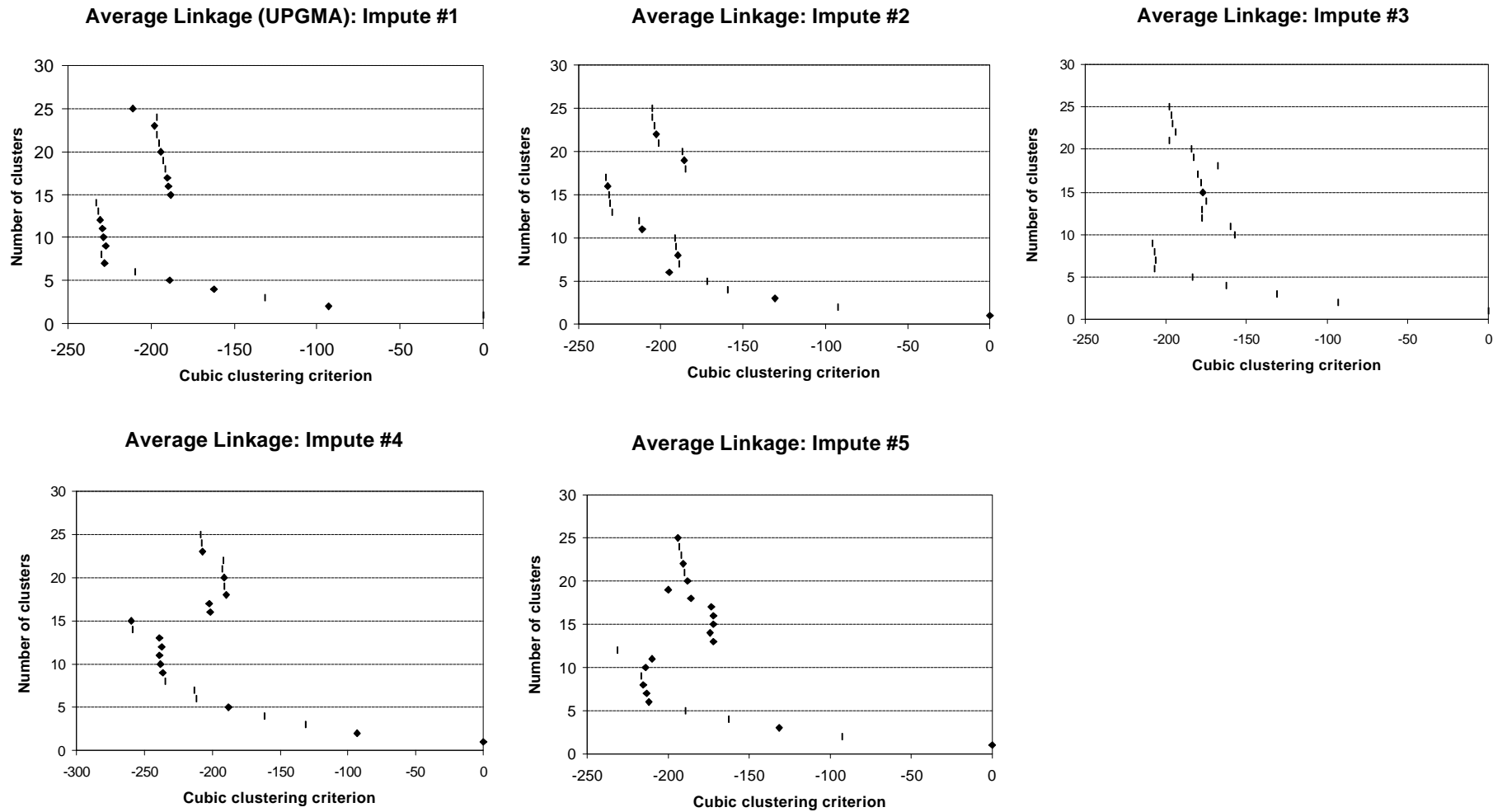


Figure 11. Relation between the cubic clustering criterion and the number of angler clusters (groups) identified by average linkage (UPGMA) clustering.

is the most probable number (Aldenderfer and Blashfield 1984). A horizontal slope suggests that subsequent mergers offer no greater separation between the groups; the most likely number of clusters is at the leftmost point (Everitt 1980).

The Calinski and Harabasz (1974) (Psuedo F) and Duda and Hart (Psuedo t²) stopping rules suggested that the nonresident angler sample consisted of 5 to 7 clusters, with 5 or 6 clusters being the more likely solutions (Table 35). The Psuedo F stopping rule provided no clear indication of the number of clusters under Ward's method as the value of the Psuedo F statistic always increased at each cluster merger, achieving a maximum value at the final merge (2-cluster solution) for all five datasets.

Table 35. Number of clusters recommended by 3 independent stopping rules for average linkage and Ward's method cluster analysis of the five complete (imputed) datasets.

Algorithm	Imputation	Distance measure	Number of clusters recommended		
			CCC ^a	Psuedo F ^b	Psuedo t ^{2c}
Average	1	Squared Euclidean	7	7	7
Linkage (UPGMA)	2	Squared Euclidean	6	5	5
	3	Squared Euclidean	6	5	5
	4	Squared Euclidean	6	5	5
	5	Squared Euclidean	6	6	6
Ward's	1	Squared Euclidean	7	? ^d	6
	2	Squared Euclidean	6	?	6
	3	Squared Euclidean	6	?	6
	4	Squared Euclidean	6	?	6
	5	Squared Euclidean	6	?	7

^a "cubic clustering criterion", Sarle (1983)

^b Calinski and Harabasz (1974)

^c Duda and Hart (1973)

^d no clear indication of the number of clusters from this stopping rule

Overall, there was considerable agreement among the three stopping rules regarding the number of clusters in each complete data set under the two clustering

methods (Ward's, average linkage). Based upon the scree plots, Psuedo F and Psuedo t^2 indices, it appeared that the nonresident angler sample consisted of either 5 or 6 clusters. However, a 7-cluster solution was also suggested in a few samples. Thus, k-means (non-hierarchical) clustering was performed on each complete data set for 5-, 6-, and 7-cluster solutions using the PROC FASTCLUS procedure in SAS. A convergence value of 0.2 was specified for all analyses and initial seed points consisted of the cluster centroids obtained from Ward's hierarchical analysis of the given dataset.

The Psuedo-F statistic and cubic clustering criterion produced by k-means clustering (PROC FASTCLUS) suggested that 5-clusters existed within the nonresident angler sample. For each of the five imputed data sets, the maximum value for both indices occurred under a 5-cluster solution (Table 36). The 5-cluster solution also required the least number of iterations for each of the five imputed datasets, ranging from 4 to 9 iterations. This indicated that the 5-cluster solution became stable sooner and required fewer reallocations of cases. The optimal number of clusters suggested by k-means (non-hierarchical) clustering differed somewhat from the results of the hierarchical analysis in which a 6-cluster solution was found most often (Table 35). However, this difference in and of itself is not sufficient to reject a 5-cluster solution. Milligan and Cooper (1985) have shown that the cubic clustering criterion tends to overestimate the true number of clusters in a data set in hierarchical clustering (Milligan and Cooper 1985)—a tendency that is reflected in the results of average linkage clustering in this study whereby the cubic clustering criterion always suggested one more cluster than the Psuedo F and Pseudo t^2 stopping rules.

With regard to relevant market criteria, all cluster solutions (7, 6, and 5 clusters) had a sufficient number of anglers in each cluster to warrant attention, so this criterion could not be used to eliminate any particular solution. However, examination of the mean characteristics of clusters under all three solutions indicated that the 7- and 6-cluster solutions contained clusters which had similar means for more than 4 segmentation variables indicating that clustering may be incomplete at the 7- and 6-cluster partition. For example, under a 6-cluster solution, clusters 4 and 6 had similar

Table 36. Iterations and stopping rule statistics from k-means cluster analysis of the 5 nonresident angler complete (imputed) datasets under a 7-, 6-, and 5-cluster solution (SAS FASTCLUS^a).

Number of Clusters	Imputation (dataset #)	Iterations to convergence	Pseudo-F statistic	Cubic clustering criterion
7-cluster solution	1	8	859.63	69.37
	2	13	906.31	71.08
	3	9	931.22	73.54
	4	6	879.72	70.05
	5	11	929.57	74.30
		Average	901.29	71.67
6-cluster solution	1	21	968.75	74.87
	2	11	991.94	69.33
	3	16	1,031.78	74.54
	4	7	1,000.77	76.68
	5	12	1,006.43	70.19
		Average	999.93	73.12
5-cluster solution	1	6	1,094.08	79.02
	2	8	1,133.86	76.50
	3	4	1,150.14	76.51
	4	5	1,116.81	78.33
	5	9	1,150.23	77.48
		Average	1,129.02	77.57

^aSAS (1990)

means on 6 of the 11 segmentation variables (importance of number and size of fish caught, importance of catching something, and three of the four motivation variables--developing/using fishing skills, challenge/excitement of fishing and solitude/nature experience) (Table 37). In addition, clusters 1 and 2 under a 6-cluster solution had similar means on 5 of the 11 segmentation variables, including similarities in the total

Table 37. Mean values of the 11 segmentation variables for each nonresident angler group under 7- and 6-cluster solutions resulting from k-means cluster analysis (standard errors in parentheses). Colors indicate similar clusters.

7-cluster solution											
Angler group	Specialization Variables							Motivation Variables			
	Days fished in 1997	Years of fishing	Sport fishing ^a	Importance of:				Importance of: ^f			
				Number of fish ^b	Size of fish ^c	Disposition of catch ^d	Catching "something" ^e	Developing/using fishing skills	Solitude/nature experience	Challenge/excitement	Social bonding ^g
1 (N= 860)	9.5 (2.8)	13.3 (0.8)	2.9 (0.6)	2.1 (0.1)	2.3 (0.1)	2.3 (0.1)	2.4 (0.1)	1.8 (0.3)	2.7 (0.4)	2.4 (0.3)	3.8 (0.1)
2 (N= 1,074)	20.1 (9.4)	25.2 (5.6)	5.6 (1.6)	3.0 (0.3)	3.0 (0.1)	3.1 (0.3)	3.3 (0.3)	1.9 (0.3)	2.2 (0.3)	2.9 (0.3)	2.5 (0.1)
3 (N= 1,058)	31.2 (11.4)	27.6 (9.4)	6.9 (1.5)	2.2 (0.2)	2.7 (0.1)	2.3 (0.1)	2.5 (0.1)	2.4 (0.3)	3.1 (0.2)	3.5 (0.1)	3.8 (0.2)
4 (N= 1,026)	41.2 (2.1)	25.0 (4.4)	8.3 (0.2)	2.9 (0.3)	3.6 (0.3)	2.3 (0.1)	3.2 (0.3)	2.7 (0.3)	3.2 (0.3)	4.1 (0.2)	2.9 (0.1)
5 (N= 1,139)	46.3 (4.3)	27.4 (1.3)	8.6 (0.3)	2.5 (0.2)	3.3 (0.2)	2.3 (0.1)	2.6 (0.2)	3.4 (0.1)	3.8 (0.1)	4.4 (0.1)	4.5 (0.1)
6 (N= 1,352)	24.9 (4.2)	23.3 (2.2)	7.4 (0.7)	3.6 (0.1)	3.6 (0.1)	3.7 (0.1)	3.7 (0.1)	2.8 (0.1)	3.0 (0.1)	4.0 (0.1)	4.2 (0.1)
7 (N= 1,102)	8.1 (2.5)	13.4 (3.6)	3.2 (0.8)	3.3 (0.2)	3.1 (0.2)	3.3 (0.1)	3.6 (0.2)	2.5 (0.4)	2.4 (0.3)	1.9 (0.4)	3.7 (0.2)
All (N=7,612)	26.4 (0.4)	22.5 (0.2)	6.3 (0.03)	2.8 (0.03)	3.1 (0.03)	2.8 (0.03)	3.1 (0.03)	2.4 (0.04)	2.9 (0.03)	3.5 (0.02)	3.7 (0.01)

6-cluster solution											
Angler group	Specialization Variables							Motivation Variables			
	Days fished in 1997	Years of fishing	Sport fishing ^a	Importance of:				Importance of: ^f			
				Number of fish ^b	Size of fish ^c	Disposition of catch ^d	Catching "something" ^e	Developing/using fishing skills	Solitude/nature experience	Challenge/excitement	Social bonding ^g
1 (N= 997)	10.0 (1.5) ⁵	13.6 (1.0)	3.0 (0.3)	2.1 (0.1)	2.4 (0.1)	2.3 (0.1)	2.4 (0.1)	1.8 (0.1)	2.7 (0.1)	2.5 (0.1)	4.0 (0.1)
2 (N= 1,225)	9.5 (1.8)	15.7 (3.4)	3.5 (0.3)	3.2 (0.1)	3.0 (0.0)	3.3 (0.1)	3.4 (0.1)	1.7 (0.1)	2.1 (0.1)	2.5 (0.1)	2.8 (0.1)
3 (N= 1,318)	38.1 (3.9)	27.3 (4.1)	7.8 (0.3)	2.4 (0.3)	3.0 (0.3)	2.3 (0.2)	2.6 (0.3)	2.4 (0.2)	3.0 (0.2)	3.5 (0.2)	2.9 (0.1)
4 (N= 1,224)	33.8 (4.4)	30.4 (8.7)	8.0 (0.7)	3.3 (0.3)	3.6 (0.2)	3.1 (0.2)	3.5 (0.3)	2.7 (0.6)	2.9 (0.5)	3.8 (0.3)	3.4 (0.2)
5 (N= 1,430)	43.7 (1.9)	27.0 (1.1)	8.4 (0.2)	2.5 (0.2)	3.3 (0.3)	2.2 (0.2)	2.6 (0.2)	3.2 (0.2)	3.7 (0.0)	4.3 (0.1)	4.4 (0.0)
6 (N= 1,418)	17.6 (4.3)	18.8 (1.8)	5.8 (1.2)	3.5 (0.3)	3.4 (0.2)	3.4 (0.3)	3.6 (0.2)	2.5 (0.3)	3.0 (0.2)	3.8 (0.2)	4.3 (0.1)
All (N=7,612)	26.4 (0.4)	22.5 (0.2)	6.3 (0.03)	2.8 (0.03)	3.1 (0.03)	2.8 (0.03)	3.1 (0.03)	2.4 (0.04)	2.9 (0.03)	3.5 (0.02)	3.7 (0.01)

^a 10-point scale: 1= Not at all important, 10= Extremely important

^b Avg. Likert score for 3-item scale regarding importance of catching a limit/many fish (see Table 4). Higher scores indicate more agreement that catch a limit/many fish is important.

^c Avg. Likert score for 3-item scale regarding catching large or trophy-size fish (see Table 4). Higher scores= more agreement that catching large fish is important

^d Avg. Likert score for 3-item scale regarding keeping fish caught (see Table 4). Higher scores= more agreement that keeping fish is important.

^e Avg. Likert score for 3-item scale regarding importance of catching (see Table 4). Higher scores= more agreement that catching fish is an important element of a satisfying trip.

^f Avg. importance scores for multi-item scales with 1= Unimportant, 2= Somewhat important, 3= Important, 4= Very Important, 5= Extremely important (see Table 10).

^g Single-item scale with 1= Unimportant, 2= Somewhat important, 3= Important, 4= Very Important, 5= Extremely important (see Table 10).

Table 38. Mean values of the 11 segmentation variables for each nonresident angler group (standard errors in parentheses).

Angler group	Specialization Variables							Motivation Variables			
	Days fished in 1997	Years of fishing	Sport fishing ^a	Importance of:				Importance of: ^f			
				Number of fish ^b	Size of fish ^c	Disposition of catch ^d	Catching "something" ^e	Developing/using fishing skills	Solitude/nature experience	Challenge/excitement	Social bonding ^g
1 (N= 1,394)	8.5 (0.93)	14.9 (1.43)	3.2 (0.19)	3.2 (0.04)	2.9 (0.04)	3.3 (0.04)	3.5 (0.04)	1.6 (0.03)	2.1 (0.03)	2.5 (0.03)	3.1 (0.03)
2 (N= 1,139)	12.3 (0.93)	15.7 (0.67)	3.6 (0.15)	2.1 (0.03)	2.4 (0.02)	2.3 (0.04)	2.4 (0.04)	2.0 (0.05)	2.9 (0.06)	2.8 (0.04)	4.1 (0.02)
3 (N= 1,595)	35.5 (2.45)	29.4 (1.56)	7.7 (0.18)	2.6 (0.09)	3.1 (0.04)	2.5 (0.08)	2.9 (0.10)	2.3 (0.09)	2.8 (0.1)	3.4 (0.05)	2.7 (0.02)
4 (N= 1,654)	45.3 (1.86)	27.6 (0.69)	8.5 (0.08)	2.5 (0.07)	3.3 (0.05)	2.2 (0.06)	2.6 (0.06)	3.2 (0.05)	3.7 (0.03)	4.3 (0.02)	4.3 (0.04)
5 (N= 1,830)	23.6 (0.85)	22.3 (0.91)	7.1 (0.10)	3.6 (0.02)	3.6 (0.02)	3.5 (0.03)	3.7 (0.02)	2.7 (0.07)	3.0 (0.06)	4.0 (0.03)	4.1 (0.02)
All (N=7,612)	26.4 (0.42)	22.5 (0.22)	6.3 (0.03)	2.8 (0.03)	3.1 (0.03)	2.8 (0.03)	3.1 (0.03)	2.4 (0.04)	2.9 (0.03)	3.5 (0.02)	3.7 (0.02)

^a 10-point scale: 1= Not at all important, 10= Extremely important

^b Avg. Likert score for 3-item scale regarding importance of catching a limit/many fish (see Table 4). Higher scores indicate more agreement that catch a limit/many fish is important.

^c Avg. Likert score for 3-item scale regarding catching large or trophy-size fish (see Table 4). Higher scores= more agreement that catching large fish is important

^d Avg. Likert score for 3-item scale regarding keeping fish caught (see Table 4). Higher scores= more agreement that keeping fish is important.

^e Avg. Likert score for 3-item scale regarding importance of catching (see Table 4). Higher scores= more agreement that catching fish is an important element of a satisfying trip.

^f Avg. importance scores for multi-item scales with 1= Unimportant, 2= Somewhat important, 3= Important, 4= Very Important, 5= Extremely important (see Table 10).

^g Single-item scale with 1= Unimportant, 2= Somewhat important, 3= Important, 4= Very Important, 5= Extremely important (see Table 10).

number of days fished in 1997, years of fishing experience, importance of sport fishing as a recreational activity, and the motivational variables developing/using fishing skills and challenge/excitement of fishing). Under the 7-cluster solution, clusters 1 and 7 as well as clusters 4 and 5 had similar means on 5 of 11 segmentation variables, suggesting that clustering was also incomplete at the 7-cluster level (Table 37).

In contrast, there were no clusters in the 5-cluster solution that had similar mean values for more than 4 of the 11 segmentation variables, with most cluster pairs having 2 or fewer mean values that were similar (Table 38). Clusters 3 and 4 were the most similar under the 5-solution, having similar means with regard to fishing preferences (number of fish, size of fish) and years of fishing experience. However, these clusters differed in motivations for fishing, sport fishing participation in 1997, importance of fishing, and the relative importance of keeping and catching fish. Based upon these results, as well as the stopping rule indices from k-means analysis, I determined that the nonresident sample consisted of 5 angler segments (groups). The number of anglers per group and the relative size of each cluster (percent of classified sample) are presented in Table 39.

Table 39. Number and percent of respondents in each of the five nonresident angler clusters.

Angler group	Number of Respondents (SE)	Percent of sample
1	1,394 (42)	18.3
2	1,139 (16)	15.0
3	1,595 (15)	21.0
4	1,654 (40)	21.7
5	1,830 (15)	24.0
Total	7,612	100.0

Descriptions of Clusters

Table 38 displays the mean scores of the 11 specialization and motivation variables for each nonresident angler group. The mean characteristics of the 5 angler groups demonstrate heterogeneity among the groups and form the basis of the following descriptions of each cluster. Percentages in parentheses indicate the relative proportion of the nonresident population represented by each cluster.

Cluster 1 (18.3%) had the least amount of sport fishing experience of all groups (mean = 14.9 years) and fished relatively few days in 1997 (mean = 8.5 days). Anglers in this group indicated that sport fishing was not particularly important as a source of satisfaction relative to other activities (mean of 3.2 on a 10-pt scale). This group also had the lowest scores of all groups with regard to the four primary motivation variables. Of the motivations listed, being with family and friends is the most important reason why these anglers go sport fishing (albeit not nearly as important as most groups). Developing and using fishing skills and the opportunity to experience solitude or natural surroundings, are not particularly important reasons why members of this group sport fish (means = 1.6 and 2.1 respectively) (Table 38). With regard to fishing preferences, these anglers expect to catch fish when they go fishing, and are likely to be dissatisfied with a fishing trip if no fish are caught. Catching a daily bag limit and keeping the fish they catch are also relatively important outcomes of a fishing trip for anglers in this group (means = 3.2 and 3.3 respectively) (Table 38). Based upon their experience, participation, and preference characteristics, this cluster was labeled the "*Occasional angler*" segment.

Cluster 2 (15.0%) was the smallest of the five angler segments and consisted of anglers who had roughly the same amount of experience and interest in sport fishing as anglers the Occasional angler segment (Group 1). However, anglers in this cluster fished more days in 1997 (mean = 12.3) than Occasional anglers. This group had relatively few preferences regarding their sport fishing activities, having the lowest scores of all five groups with regard to the importance of number and size of fish caught and the importance of catching "something" while fishing and keeping fish caught. For the most

part, anglers in this group are not concerned about the number of fish they catch, do not care about catching trophy fish, tend to release the fish they catch, and are just as happy with a fishing trip if they do not catch a fish. Being with family and friends is the most important reason why these anglers fish (mean = 4.1), followed by the opportunity to spend time in natural surroundings or experience solitude (mean = 2.9), and the challenge and excitement of fishing (mean = 2.8). Developing and using fishing skills is a relatively unimportant reason why these anglers fish (mean = 2.0) (Table 38). Anglers in this cluster were labeled "*Casual anglers*."

Cluster 3 (21.0%) consisted of anglers who had the most sport fishing experience (in years) of all five segments (mean = 29.4 years), and who fished a large number of days in 1997 (mean = 35.5 days) (Table 38). Unlike Occasional and Casual anglers (clusters 1 and 2), sport fishing is an important recreational activity and source of satisfaction for anglers in this segment (mean = 7.7 on a 10-pt scale). The challenge/excitement associated with sport fishing is the most important reason why these anglers sport fish, followed by experiencing natural surroundings or solitude. The social aspects of fishing ("being with family and friends") are secondary to the challenge/excitement of fishing. In fact, Group 3 gave being with family and friends the lowest importance rating of all five angler groups (mean = 2.7). Developing and using fishing skills was the least important reason why these anglers went fishing, possibly due to the fact that they already had a considerable amount of fishing experience (an average of 29 years) (Table 38). With regard to fishing preferences, catching large or trophy-size fish is more important to this group than catching and keeping a limit or large numbers of fish. Anglers in this group also are likely to be somewhat dissatisfied with a fishing trip if no fish are caught (although not to the extreme that Groups 1 and 5 exhibit). Anglers in this cluster were labeled "*Experience-setting Specialists*" since they are highly experienced and avid anglers who place considerable importance on the sport fishing experience and the setting in which it occurs.

Cluster 4 (21.7%) consists of highly experienced, extremely avid anglers who fished a large number of days in 1997 (mean = 45.5 days) and have relatively strong fishing preferences. They have been sport fishing for an average of 27.6 years, and

indicate that sport fishing is extremely important as a source of satisfaction (mean = 8.5 on a 10-pt scale). All four motivational variables were rated as important or very important by these anglers. According to mean importance scores, the challenge/excitement of sport fishing and spending time with family and friends are the most important reasons why these anglers sport fish (mean = 4.3). However, experiencing natural settings and getting away from others/solitude are also very important to these anglers (mean = 3.7), suggesting that they may prefer less-crowded, possibly remote, settings. Developing and using fishing skills is another important reason why these anglers sport fish, unlike the other four angler groups who considered it unimportant or only somewhat important. With regard to fishing preferences, catching a few, relatively large fish is more important to these anglers than catching large numbers of fish or keeping the fish they caught (Table 38). Anglers in this cluster are labeled "*Technique-setting Specialists*" since they place considerable importance on developing fishing skills and the aesthetic conditions of the setting(s) in which they fish

Cluster 5 (24.0%) was the largest of the five nonresident angler groups. It also consisted of fairly avid anglers having considerable sport fishing experience (mean = 22 years) as well as interest in sport fishing (mean of 7.1 on a 10-pt. Scale). Anglers in this cluster also have particularly strong fishing preferences. They have high expectations for catching fish when they go fishing (mean = 3.7) and, more than any other group, are likely to be disappointed with a fishing trip if no fish are caught. They place considerable importance on catching large or trophy-size fish (mean = 3.6), as well as catching a daily bag limit (mean = 3.6). In addition, anglers in this group tend to keep the fish they catch and, thus, may be less likely to engage in catch and release fishing than anglers in Group 4 (Table 38). The challenge/excitement of catching fish as well as being with family and friends are the most important reasons why these anglers sport fish, followed by being in natural surroundings or having opportunities to experience solitude. Developing and using fishing skills was the least important reason why these anglers fish, again, possibly due to the fact that they already have considerable fishing experience. Anglers in this cluster exhibit the characteristics of groups identified in previous angler segmentation research as "*Fishing Generalists*."

Segmentation Validation

For the five nonresident angler groups to be considered true market segments, they should also exhibit significant differences with regard to other variables relevant to fisheries managers that permit the development of separate marketing efforts for each segment. In this section, I evaluate the between-group differences of the segments with respect to: (1) socioeconomic and demographic characteristics, (2) Alaska fishing behavior and participation characteristics, (3) relative importance of 21 fishery attributes, and 4) attitudes toward various management options.

Socioeconomic and demographic characteristics

To determine if the derived clusters exhibit different socioeconomic and demographic characteristics, clusters were examined with regard to four variables: (1) age, (2) income, (3) education, and (4) residence strata (Other USA states, Canada, Other foreign countries). Table 40 summarizes the breakdowns of these variables among the five segments. Although the p-value for each test indicated statistically significant differences among the groups with respect to all socio-demographic variables, examination of the proportional distributions of the four variables for each group suggests that there were only managerially-significant differences among the groups with regard to age distribution. The small p-value for the other variable tests most likely are the result of a significant increase in the power of the test due to the large sample size (N= 7,612).

The Occasional and Experience-setting Specialist segments (Groups 1 and 3) contained larger proportions of older anglers than the other three angler segments. Almost half of all anglers in these groups (44.1% and 49.0 % respectively) were over the age of 55. Of these anglers, nearly one quarter (23%) of Experience-setting Specialists and over 21% of Occasional anglers were over the age of 65 (Table 40). In contrast, Casual anglers and Technique-setting Specialists (Groups 2 and 4) had larger proportions of anglers in younger age groups. Over 40 % of anglers in these segments were under the age of 45, and these groups had the largest proportions of anglers in the 16-34 age range (21.9% and 17.8%) respectively. Groups 2 and 4 also had the smallest proportions of anglers over 65 (12.1% and 11.9 %) respectively.

Table 40. Results of chi-square tests for differences in socioeconomic and demographic variables between nonresident angler groups. Percent of anglers by response category indicated.

Variable	Angler Group:					χ^2 ^a	<i>P</i> ^b
	1	2	3	4	5		
Age:							
	(%)						
16-24	3.8 ^c	6.6	2.7	5.4	4.5		
25-34	9.6	15.3	7.8	12.4	9.2		
35-44	16.0	18.8	15.7	22.8	20.1		
45-54	21.6	25.7	22.2	26.1	23.5	262.6	<0.001*
55-64	22.7	18.7	26.1	19.3	21.0		
65-74	17.0	9.7	18.5	10.2	14.1		
Over 75	4.4	2.4	4.4	1.7	4.7		
Missing	5.0	2.7	2.5	2.0	3.0		
Income:							
Less than \$10,000	1.2	1.3	0.9	1.0	1.1		
\$10,000--\$24,999	5.4	6.5	6.0	5.9	5.0		
\$25,000--\$49,999	23.6	20.3	22.1	19.5	18.6		
\$50,000--\$74,999	20.8	19.4	23.0	22.5	22.1	90.2	<0.001
\$75,000--\$99,999	13.0	16.0	14.9	15.4	15.3		(ns)
\$100,000--\$199,000	14.7	17.6	17.1	18.6	19.5		
\$More than \$200,000	7.8	7.9	6.6	9.5	10.1		
Missing	13.5	11.2	9.4	7.6	8.4		
Education:							
Some high school	4.0	2.4	3.1	2.8	4.6		
High school degree	16.1	15.9	18.0	15.0	15.4		
Vocational degree	5.8	6.2	7.5	6.7	6.0	60.1	<0.001
Some college	21.6	22.7	24.8	23.6	21.5		(ns)
College degree	24.2	26.0	22.6	26.3	26.8		
Post graduate study	24.4	24.3	21.7	24.1	22.7		
Missing	3.9	2.6	2.5	1.7	3.2		
Residence Strata							
Other USA	94.3	92.8	92.2	94.9	95.9		
Canadian	2.3	3.1	3.4	2.4	1.6	34.4	0.0001 - 0.001
Other Foreign	3.3	4.1	4.2	2.7	2.6		(ns)
Missing	0.1	0.0	0.0	0.1	0.0		

^a Average test statistic across the five complete data sets.

^b *p*-values for all five complete data sets were < 0.0001 for all variables except residence strata due to increased power of test with sample size N= 7,612.

^c Percents may not sum to exactly 100% due to rounding.

* Most likely to be managerially-significant.

ns = not likely to be managerially-significant.

The median household income category for all angler segments was \$50,000-\$74,999. There was relatively little difference in the income distributions of the five angler segments. Technique-setting Specialists and Generalists (Groups 4 and 5) had slightly larger proportions of anglers in the highest household income categories, with over one quarter of all anglers (28.1% and 29.6% respectively) having incomes greater than \$100,000 per year. The educational attainment distribution of the five groups was also highly similar with most segments being relatively well-educated. Nearly half of all anglers in each segment (with the exception of Experience-setting Specialists) had a college degree, and nearly one quarter of anglers in most segments had pursued postgraduate study. With regard to residence, Canadian anglers and anglers from other foreign countries comprised a relatively small proportion of most angler segments.

Alaska fishing behavior and participation characteristics

To determine if empirically-derived angler segments exhibited different Alaska fishing behavior patterns and preferences, the segments were compared with regard to 12 fishing participation variables including: 1) number of days fished in Alaska, 2) number of visits to Alaska in past three years (1995-97), 3) length of most recent visit (in days), 4) number of unique fishing locations visited, 5) number of unique fisheries (species at a location) fished, 6) total number of fish transported out of Alaska, 7) percent who came to Alaska primarily to fish, 8) percent who used a guide for at least one day of fishing in 1997, 9) percent who are members of a fishing club or sporting organization, 10) percent that engaged in fly-fishing in 1997, 11) self-rated angling expertise, and 12) the likelihood that they will return to Alaska to sport fish within the next three years. Table 41 summarizes the Alaska fishing characteristics of each angler segment and the results of statistical tests of the differences between the segments with regard to these variables.

Significant between-segment differences were found for 9 of the 12 fishing behavior and participation variables including: days fished in Alaska, number of fish exported from Alaska, number of locations and fisheries visited, percent who came to Alaska primarily to fish, percent who are members of fishing clubs or sporting organizations, percent that engaged in fly-fishing in 1997, self-rated angling expertise, and likelihood of returning to Alaska to sport fish (Table 41). The segments did not

differ significantly with regard to number of visits to Alaska in the last 3 years, length of most recent visit, and percent who used a guide. In the following sections I discuss the differences found among the five angler segments with regard to these fishing behavior and participation variables.

Days fished in Alaska

The average number of days fished in Alaska by each angler segment was significantly different ($\chi^2 = 735.5$, $p < 0.001$), and generally consistent with the total level of fishing participation in 1997 within each group (Table 41). Technique-setting Specialists (Group 4) fished more days in Alaska than any other group (mean = 7.9 days), while Occasional and Casual anglers (Groups 1 and 2) averaged the fewest days of fishing in Alaska (mean = 3.5 and 4.3 days respectively). Of particular interest is the fact that days fished in Alaska accounted for over one-third of the total days fished in 1997 among Occasional and Casual anglers (on average), while other segments fished less than a third of their total days of sport fishing while in Alaska (Table 41).

Number of locations and fisheries visited

There also were significant differences across angler segments with regard to the number of unique fishing locations visited and the number of specific fisheries (species at a given location) in which they participated ($\chi^2 = 366.7$ and $\chi^2 = 524.2$, $p < 0.001$, respectively) (Table 41). In general, the more avid and specialized segments (Experienced-setting Specialists, Technique-setting Specialists, Generalists) fished more locations and in more specific fisheries than Occasional and Casual anglers (Groups 1 and 2). More than 65% of Occasional anglers (Group 1) and 58% of Casual anglers (Group 2) fished at only 1 location in Alaska, and more than two-thirds of anglers in these groups fished in 2 or fewer locations (Table 41). Very few Occasional and Casual anglers fished more than 3 locations in Alaska during their most recent visit (2.7% and 4.9%, respectively). Although the majority of anglers in Groups 3, 4, and 5 also fished one or two locations, a larger proportion of anglers in these segments fished at three or more locations during their most recent visit. For example, over 27% of Technique-setting specialists (Group 4) fished 3 or more different locations and 7% fished 5 or more locations. A slightly smaller proportion of Experience-setting

Table 41. Results of Kruskal-Wallis and chi-square tests for differences in Alaska fishing behavior and other characteristics between nonresident angler groups.

Fishing Characteristics	Means/percentages for group:					χ^2 ^a	P ^b
	1	2	3	4	5		
No. of days fished in AK in 1997	3.5	4.3	6.3	7.9	6.0	735.5	<0.001*
No. of visits to Alaska 1995-97.	1.8	2.1	2.3	2.4	2.4	174.5	<0.001 (ns)
Length of most recent visit	15.1	16.2	16.5	15.2	13.8	25.9	<0.001 (ns)
No. of fish transported from AK	6.4	7.1	8.4	9.2	10.6	190.4	<0.001*
No. of unique locations visited							
1	65.5	58.1	49.5	43.0	46.9	366.7 ^c	<0.001*
2	18.8	20.1	25.0	27.0	27.7		
3	5.3	9.9	12.4	13.4	11.7		
4	1.5	2.7	4.2	6.8	4.3		
5 or more locations	1.2	2.2	4.4	7.0	4.0		
Missing	7.7	7.1	4.5	2.8	5.4		
No of fisheries visited							
1	47.4	41.6	30.9	22.4	27.0	524.2 ^c	<0.001*
2	26.1	24.4	26.5	25.7	28.4		
3	10.6	13.4	17.0	18.8	18.2		
4	5.2	7.4	10.4	12.2	9.2		
5 or more fisheries	3.0	6.2	10.8	18.1	12.0		
Missing	7.7	7.1	4.5	2.8	5.4		
Percent that came primarily to fish	23.4	24.0	44.9	53.9	54.8	573.3 ^c	<0.001*
Percent that utilized a guide in 1997	57.7	49.0	61.5	57.8	63.0	107.9 ^c	<0.001 (ns)
Percent that are members of fishing club or sporting organization	4.7	6.3	27.1	35.9	16.4	694.0 ^c	<0.001*
Percent that went fly-fishing in 1997	11.4	24.3	40.9	53.8	28.1	730.4 ^c	<0.001*
Self-rated level of expertise ^d							
Beginner	39.4	34.8	3.3	2.3	7.7	2,216.1 ^c	<0.001*
Intermediate	46.7	49.0	45.5	34.5	53.0		
Advanced	6.0	10.1	45.2	59.3	34.5		
Don't know	6.7	4.9	4.9	3.1	3.7		
Likelihood of returning to Alaska:							
Percent Unlikely or Very Unlikely	32.1	22.4	15.8	11.6	13.6	483.0 ^c	<0.001*
Percent Unsure	22.4	21.3	17.6	10.8	14.7		
Percent Likely or Very Likely	42.1	53.4	63.9	75.1	69.6		
Missing	3.4	2.4	2.6	2.9	2.1		

^a Average test statistic across the five complete data sets.

^b p-values for all five complete data sets were < 0.001 for all variables due to increased power of test with sample size N= 7,612.

^c Chi-square test

^d Anglers asked: "How would you rate your expertise as an angler?"

* Most likely to be managerially-significant.

ns = not likely to be managerially-significant.

Specialists and Generalists (Groups 3 and 5) fished 3 or more locations (21% and 20%). However, the proportion of anglers fishing multiple locations in these groups was significantly higher than the Occasional and Casual angler segments (Groups 1 and 2). A similar pattern was observed for the number of fisheries (specific species in a given location) fished by each angler segment (Table 41).

Number of fish transported from Alaska

There were also differences between the nonresident angler groups with regard to the number of fish they transported from Alaska in 1997 ($\chi^2 = 190.4$, $p < 0.001$). Generalists (Group 5) transported the largest number of fish from Alaska in 1997 (mean = 10.6), followed by Technique-setting and Experience-setting Specialists (Groups 4 and 3). Occasional anglers (Group 1) transported the fewest number of fish from Alaska (mean = 6.4) (Table 41). Although the differences among the groups in the number of fish transported from Alaska were not extreme, it seemed clear that Generalists and Technique-setting Specialists tended to transport more fish from Alaska than Occasional and Casual anglers.

Percent who came to Alaska primarily to fish

The majority of Technique-setting Specialists and Generalists (Groups 4 and 5) indicated that they came to Alaska primarily to sport fish (53.9%, 54.8%) (Table 41). In contrast, less than one quarter of Occasional and Casual anglers (Groups 1 and 2) indicated that they came to Alaska primarily to fish. Experience-setting Specialists (Group 3) were similar to Technique-setting Specialists and Generalists with a significant proportion of anglers stating they came to Alaska in 1997 primarily to sport fish (44.9%). These differences were significant ($\chi^2 = 573.3$, $p < 0.001$).

Fishing club membership

Membership in fishing clubs or sporting organizations also differed significantly across the nonresident angler segments ($\chi^2 = 694$, $p < 0.001$). Not surprisingly, Technique-setting Specialists (the most specialized angler segment) had the highest fishing or sporting club membership rate at 35.9% (Table 41). Club membership was also relatively high among Experience-setting Specialists (Group 3) at 27.1%. Occasional anglers were the least likely to be members of fishing clubs or sporting

organizations (4.7%), followed by the Casual angler segment which had a 6.3% fishing club membership rate.

Self-rated expertise

Differences in the self-rated fishing skill level of anglers (on a 3-point scale from "Beginner" to "Advanced") are particularly notable among the five nonresident groups. Over 80% of anglers in the Occasional and Casual angler segments classified themselves as "Beginner" or "Intermediate" anglers, with Occasional anglers (Group 1) having the largest proportion of "Beginners" (39%). In contrast, less than 5% of anglers in the Experience-setting and Technique-setting Specialist segments, and less than 8% of Generalist anglers (Group 5), classified themselves as "Beginners" (Table 41). Consistent with the number of years of experience and participation (days fished in 1997), the Technique-setting Specialist group (Group 4) had the highest proportion of anglers who classified themselves as "Advanced" (59%), while Generalists (Group 5) had the highest proportion of "Intermediate" anglers (53%). The Experience-setting Specialists (Group 3) consisted of nearly equal proportions of "Intermediate" and "Advanced" anglers (46% and 45% respectively) (Table 41). These differences were statistically significant ($\chi^2 = 2,216.1$, $p < 0.001$) (Table 41).

Percent that engaged in fly-fishing in 1997

The type of sport fishing or angling method(s) used by anglers has also been shown to differ among anglers having different levels of specialization and motivations for fishing. Fly-fishing, in particular, is generally associated with highly specialized and avid anglers who often have strong fishing preferences and management opinions. In this study, the proportion of anglers within each nonresident angler group that engaged in fly-fishing in 1997 also differed significantly ($\chi^2 = 730.4$, $p < 0.001$). Over half of all anglers in the Technique-setting Specialists segment (Group 4) (54%) and 40% of anglers in the Experience-setting Specialists segment indicated that they went fly-fishing in 1997. In contrast, only one of four Casual and Generalist anglers (Groups 2 and 5) indicated that they engaged in fly-fishing in 1997, and only 1 of 10 Occasional anglers (Group 1) (11%) went fly-fishing in 1997 (Table 41).

Likelihood of returning to Alaska to sport fish

With the exception of Occasional anglers (Group 1), the majority of anglers in each segment said they were “likely” or “very likely” to return to Alaska to go sport fishing within the next 3 years. However, a significantly larger proportion of anglers in Groups 3, 4, and 5 indicated they were likely or very likely to return (63.9%, 75.1% and 69.6% respectively) than anglers in Group 1 or 2 (42.1% and 53.4%) ($\chi^2 = 483$, $p < 0.001$) (Table 41). Of all groups, Occasional anglers (Group 1) were the least likely to indicate that they would return to Alaska to sport fish, with approximately one third indicating they were unlikely or very unlikely to return. In contrast, only 12% of Technique-setting specialists (Group 4) and 14% of Generalists (Group 5) indicated they were unlikely or very unlikely to return to Alaska to sport fish in the next three years.

As noted above, there did not appear to be significant differences among the nonresident angler groups with regard to the number of visits made to Alaska since 1995, length of their most recent visit to Alaska, and guide utilization. The mean number of trips to Alaska since 1995 ranged from 1.8 (Occasional anglers) to 2.4 (Technique-setting Specialists and Generalists), and the average length of stay ranged from 13.8 days (Generalists) to 16.5 days (Experience-setting Specialists) (Table 41). Roughly one half of the anglers in each segment used a guide for at least one day of fishing while in Alaska, although the proportion of anglers that used a guide in 1997 was somewhat larger among Experience-setting Specialists and Generalists (Groups 3 and 5) (61.5% and 63.0% respectively).

Attributes important in fishing site selection

Table 42 displays the average importance ratings by group of 21 different attributes anglers might take into consideration when selecting a location to fish in Alaska. Analysis of variance tests yielded statistically significant differences among the angler segments with regard to the importance of 13 of the 21 attributes including: the natural beauty of the area, presence of favorite/preferred types of fish, opportunities to view wildlife, being in an area with few other anglers, being in a wilderness area, having a good chance to catch a daily bag limit, chance to catch wild fish, opportunity for

Table 42. Results of one-way ANOVA tests for differences between nonresident angler groups in mean importance ratings for 21 fishery attributes.

Attribute	Angler Group ^a					F ^b	p ^c
	1	2	3	4	5		
Natural beauty of the area	3.1	3.7	3.4	4.1	3.7	260.3	<0.001*
Presence of favorite or preferred type(s) of fish	2.7	2.6	3.2	3.7	3.8	384.6	<0.001*
Opportunities to view wildlife	2.7	3.5	3.1	3.9	3.5	264.3	<0.001*
Being in an area with few other anglers	2.6	3.0	3.1	3.9	3.4	285.1	<0.001*
Being in a wilderness area	2.5	3.3	3.0	3.9	3.2	267.6	<0.001*
Having a good chance to catch a daily bag limit	2.8	2.3	2.7	3.0	3.8	323.8	<0.001*
Chance to catch wild fish	2.3	2.5	2.9	3.7	3.3	399.4	<0.001*
Opportunity for solitude	2.3	3.0	2.9	3.8	3.1	335.4	<0.001*
Chance to catch a variety of fish	2.6	2.1	2.5	2.8	3.5	290.1	<0.001*
Catch rate of keepable fish	2.3	2.5	2.8	3.4	3.1	327.1	<0.001*
Accessibility	2.4	2.5	2.6	2.8	3.1	95.5	<0.001 (ns)
Chance to catch large or trophy size fish	2.1	1.9	2.7	3.1	3.1	357.9	<0.001*
Availability of guiding services	2.4	2.4	2.4	2.6	2.8	22.6	<0.001 (ns)
Catch rate of all fish	2.2	2.0	2.4	2.8	3.1	277.2	<0.001*
Campground/cabin facilities	2.1	2.2	2.3	2.6	2.6	57.2	<0.001 (ns)
Not having to travel long	2.2	2.1	2.2	2.3	2.6	52.4	<0.001 (ns)
Bank fishing opportunity	1.9	2.2	2.3	2.9	2.7	155.3	<0.001*
Familiarity with the area	1.7	1.8	1.9	2.3	2.3	114.2	<0.001 (ns)
An area with fly-in access	1.6	1.8	1.9	2.4	2.2	114.9	<0.001 (ns)
Boat launching facilities	1.6	1.7	1.6	1.9	2.0	48.3	<0.001 (ns)
Nearness to second home/cabin	1.5	1.5	1.5	1.7	1.8	38.2	<0.001 (ns)

^a Mean scores based on respondents' answer for the following categories: 1= unimportant, 2= somewhat important, 3= important, 4= very important, 5= extremely important

^b Average test statistic across five complete data sets.

^c p-values for all five complete data sets were < 0.001 for all attribute comparisons due to large sample size (N= 7,612)

* Most likely to be managerially-significant

ns = not likely to be managerially-significant

solitude, chance to catch a variety of fish, catch rate of keepable fish, chance to catch large or trophy size fish, catch rate of all fish, and bank fishing opportunity, presence of preferred types of fish, being in an area with few other anglers, catch rate of keepable fish, and opportunity for solitude.

The differences found among the segments with regard to these fishery attributes are largely the result of one (or more) angler segments placing more importance on a particular fishery attribute than another segment(s). For example, the presence of favorite or preferred type(s) of fish is relatively important to Technique-setting Specialists and Generalists (Groups 4 and 5) (mean scores = 3.7 and 3.8 on a five-point scale from 1 = "unimportant" to 5 = "extremely important"), but is considerably less important to Occasional and Casual anglers (Groups 1 and 2) (mean scores = 2.7 and 2.6) (Table 42.). Similarly, being in an area with few other anglers is much more important to Technique-setting specialists (mean = 3.9) than to Occasional and Casual anglers (mean = 2.6 and 3.0 respectively).

Table 43 presents a list of attributes for each angler group that had average importance scores greater than 3.0, representing those attributes rated most important by each group. Differences among the five angler segments with regard to the types and relative importance of fishery attributes become more apparent in this representation. For example, natural beauty of an area was relatively important to most angler segments. In fact, it had the highest importance score of any attribute for Groups 1, 2, 3, and 4. However, the relative importance *within* each segment was significantly different; The mean importance score for natural beauty of an area among Technique-setting Specialists (Group 4) was 4.1 (on a five-point scale with 1 = unimportant and 5 = extremely important), while Occasional and Experience-setting Specialists (Groups 1 and 3) rated it somewhat less important (mean scores of 3.1 and 3.4 respectively). The list of most important attributes, rank and relative importance differed among the five groups and are described below.

Table 43. Factors most important to nonresident angler groups when selecting where to fish in Alaska ranked by mean importance score.

Group	Fishery Attribute	Mean ^a
1	Natural beauty of the area	3.1
	Having a good chance to catch a daily bag limit ^b	2.8
	Presence of favorite or preferred type(s) of fish ^b	2.7
	Opportunities to view wildlife ^b	2.7
2	Natural beauty of the area	3.7
	Opportunities to view wildlife	3.5
	Being in a wilderness area	3.3
	Opportunity for solitude	3.0
	Being in an area with few other anglers	3.0
3	Natural beauty of the area	3.4
	Presence of favorite or preferred type(s) of fish	3.2
	Being in an area with few other anglers	3.1
	Opportunities to view wildlife	3.1
	Being in a wilderness area	3.0
4	Natural beauty of the area	4.1
	Being in an area with few other anglers	3.9
	Opportunities to view wildlife	3.9
	Being in a wilderness area	3.9
	Opportunity for solitude	3.8
	Presence of favorite or preferred type(s) of fish	3.7
	Chance to catch wild fish	3.7
	Catch rate of keepable fish	3.4
	Chance to catch large or trophy size fish	3.1
	Having a good chance to catch a daily bag limit	3.0
5	Having a good chance to catch a daily bag limit	3.8
	Presence of favorite or preferred type(s) of fish	3.8
	Natural beauty of the area	3.7
	Chance to catch a variety of fish	3.5
	Opportunities to view wildlife	3.5
	Being in an area with few other anglers	3.4
	Chance to catch wild fish	3.3
	Being in a wilderness area	3.2
4 items: catch rates, trophy, solitude, accessibility all rated	3.1	

^a Mean scores based on respondents' answer for the following categories: 1= unimportant, 2= somewhat important, 3= important, 4= very important, 5= extremely important.

^b Mean score less than 3.0, but included to develop list of "most important" attributes.

Group 1 ("Occasional Anglers"): Very few fishery attributes were rated as important by this group. Natural beauty of the area was the only attribute to have an average importance score greater than 3.0, suggesting that anglers in this groups may not possess particularly strong fishery setting preferences. Beyond the natural beauty of the setting, those attributes that ranked highest among these anglers (albeit with scores less than 3.0 on the importance scale) were primarily catch-related items, such as having a good chance to catch a daily bag limit, and the presence of preferred type of fish (mean = 2.8 and 2.7 respectively). The opportunity to view wildlife was also among the four most important factors considered by anglers in this group when selecting a fishing location.

Group 2 ("Casual Anglers"): The natural characteristics and aesthetic aspects of the fishery setting are the most important factors influencing selection of a fishing location(s) among anglers in this group. Five attributes had average importance scores greater than 3.0, and all attributes were related to the setting in which the fishing experience occurs (as opposed to catch-related or services available attributes). Natural beauty of the area, opportunities to view wildlife, and being in a wilderness area were the most important factors within this group, followed by having an opportunity to experience solitude and uncrowded conditions ("being in an area with few other anglers") (Table 43). Catch-related factors such as catch rate, chance to catch large or trophy size fish, having a chance to catch a daily bag limit were not particularly important factors among anglers in this group (means = 2.0, 1.9, 2.3, respectively) (Table 42).

Group 3 ("Experience-setting Specialists"): is similar to Occasional anglers in that relatively few fishery attributes had high average importance scores. The natural beauty of an area had the highest importance score of all attributes, followed by whether a fishing location had their preferred or favorite type of fish. The latter result suggests that anglers in this group may exhibit strong species preferences. Being in an area with few other anglers (i.e., uncrowded conditions) is also important to anglers in this group, along with opportunities to view other wildlife and fish in wilderness settings. Results indicated that anglers in this group place more importance on several catch-related attributes such as chance to catch wild fish (mean = 2.9), catch rate of keepable fish

(mean = 2.8), and chance to catch large or trophy size fish (mean = 2.7) than Occasional and Casual anglers (Groups 1 and 2) (Table 42). However, the average importance scores for these attributes are not nearly as high as the average scores for anglers in groups 4 and 5, which appear to have much stronger preferences with regard to these attributes (Table 42).

Group 4 ("Technique-setting Specialists"): Nonresident anglers that comprised group 4 have very strong preferences with regard to the importance of various fishery attributes. Ten attributes had average importance scores of 3.0 or higher, and five attributes had average importance scores greater than 3.7 indicating that they were “very important” to anglers in this group. The characteristics and aesthetic conditions of the fishery setting such as the natural beauty of an area, being around relatively few other anglers, opportunities to view other wildlife, wilderness settings, and opportunity for solitude are the most important factors considered by anglers in this group when selecting a fishing location (Table 43). However, catch-related attributes such as the presence of preferred fish and catching wild fish are also very important to this group of anglers, as evidenced by relatively high importance scores for these attributes (mean = 3.7 respectively). Other catch-related attributes such as catch rates, and the chance to catch large or trophy size fish also were rated important by this group (Table 43). These results are largely consistent with the experience, participation and fishing preference characteristics of this group as outlined above.

Group 5 ("Fishing Generalists"): Anglers in this group are similar to Technique-setting Specialists (Group 4) in that they rated a large number of fishery attributes as relatively “important” (mean = 3.0 or higher). Thirteen of the 21 fishery attributes had mean importance scores greater than 3.0. However, unlike Technique-setting Specialists, catch-related factors were ranked most important to this group when choosing where to fish. Three of the four most important attributes to included whether there was a good chance to catch a daily bag limit (mean = 3.8), whether their preferred or favorite type of fish was present (mean = 3.8), and whether there was a chance to catch a variety of fish (mean = 3.5). In addition, unlike all other groups, the natural beauty of an area was *not* the most important factor among these anglers, although it was still relatively important

(mean = 3.7). Characteristics and aesthetic conditions of the fishery setting, such as opportunities to view wildlife, being in an area with few other anglers, and chance to catch wild fish appear secondary to the catch-related attributes among these anglers. However, these attributes are still relatively important when it comes to selecting a fishing location (means = 3.5, 3.4, and 3.3) (Table 43).

Setting the natural beauty of an area aside (which was generally important to most groups), the following general observations can be made about the nonresident angler segments with regard to the factors important in selecting where to fish in Alaska. First, attributes related to fishing services and facilities, such as the availability of guiding services, campground cabin facilities, boat launching facilities, nearness to second home or cabin were consistently the least important factors among all groups when it comes to selecting a fishing location in Alaska (Table 42). Second, it appears that catch-related attributes such as the presence of preferred types of fish, having a good chance to catch a daily bag limit, catch rate of keepable fish, chance to catch large or trophy size fish, chance to catch a variety of fish, were generally more important to Generalists and the Technique-setting and Experience-setting Specialists than to Occasional and Casual anglers. The results also show that Casual anglers and the Experience-setting and Technique-setting Specialists (Groups 2, 3, and 4) placed more importance on the characteristics and aesthetic conditions associated with a fishery setting than Occasional anglers and Generalists (Groups 1 and 5). These factors include the opportunity to view other wildlife, being in an area with few other anglers, being in a wilderness area, and opportunity for solitude.

Attitudes toward management options

In addition to differences in Alaska sport fishing behavior and importance of different fishery attributes, the five nonresident angler groups also differed in their attitudes toward several sport fishing management options (Table 44). The angler groups differed with regard to how annual harvest limits on chinook (king) salmon and Pacific halibut would affect their sport fishing behavior, and whether they supported differential annual harvest limits for resident and nonresident anglers. The groups did *not*

Table 44. Results of chi-square tests for differences in attitudes toward sport fishing management options across nonresident angler groups.

Management option	Angler Group:					χ^2 ^a	P ^b
	1	2	3	4	5		
Limits on angler participation:							
	(%)						
Yes (%)	20.4	26.9	25.1	30.6	23.6		
No	39.0	34.8	42.1	40.5	47.2	144.1	<0.001 (ns)
Uncertain	35.0	34.4	30.2	27.0	26.4		
No response	5.6	3.7	2.4	1.7	2.7		
Effect of 3 king salmon annual limit: ^c							
Would not have fished in AK	3.5	1.5	4.9	4.5	8.5		
Would not have fished for KS	4.5	3.7	5.0	5.2	9.1	218.9	<0.001*
No effect	70.7	81.3	74.3	75.7	62.5		
Effect of 1 king salmon annual limit: ^c							
Would not have fished in AK	5.3	3.7	6.2	5.3	9.6		
Would not have fished for KS	13.0	11.3	14.8	12.0	17.3	341.3	<0.001*
No effect	52.1	65.6	53.2	58.04	35.2		
Effect of 4 halibut annual limit: ^c							
Would not have fished in AK	4.4	2.9	6.1	5.3	10.4		
Would not have fished for HA	5.9	5.1	6.3	5.6	7.0	224.8	<0.001*
No effect	72.0	79.9	72.7	74.5	58.6		
Annual harvest limits should be the same for residents & nonresidents							
Strongly agree	7.6	7.5	13.8	19.3	18.6		
Agree	19.7	19.5	27.5	21.0	23.1		
Neither agree or disagree	24.3	18.8	18.9	15.4	17.3	306.5	<0.001*
Disagree	31.7	34.8	29.8	30.2	26.4		
Strongly disagree	9.6	14.3	7.0	11.5	10.5		
Missing	7.1	5.1	3.1	2.6	4.1		
Resident limits > nonresident limits							
Strongly agree	9.0	12.8	7.5	13.6	10.8		
Agree	39.5	40.5	36.8	34.4	34.5		
Neither agree or disagree	20.9	14.9	15.7	14.3	14.6	211.8	<0.001*
Disagree	15.3	18.1	22.9	18.7	19.9		
Strongly disagree	7.6	8.6	13.0	16.0	15.3		
Missing	7.7	5.1	4.1	3.0	4.9		
Nonresident limits > resident limits							
Strongly agree	0.9	1.4	1.2	1.6	2.7		
Agree	2.0	1.9	2.0	2.2	2.7		
Neither agree or disagree	20.7	14.4	14.3	12.5	13.2	179.1	<0.001 (ns)
Disagree	42.8	43.6	48.5	40.1	41.6		
Strongly disagree	25.1	32.8	29.1	39.8	34.2		
Missing	8.6	5.8	4.9	3.7	5.6		

^a average test statistic across the five complete data sets.

^b p-values for all five complete data sets were < 0.001 for all variables due to increased power of test with sample size N= 7,612.

^c Percents do not sum to 100. "Missing response not shown since participants were asked to "skip" if they marked a category other than "no effect" to a (higher) limit.

* most likely to be managerially-significant.

ns = not likely to be managerially-significant.

differ in attitudes toward the concept of limiting the number of anglers that can participate in some sport fisheries to provide opportunities for high quality sport fishing experiences (Table 44).

Limits on angler participation to provide high quality sport fishing

The largest proportion of anglers in each group did not support limits on participation for this purpose (35-47%). However, a substantial proportion of each group indicated they were uncertain about the concept of establishing limits on participation for this purpose. Only one of four anglers in each segment supported the idea of limiting participation in some fisheries to provide opportunities for high quality fishing experiences (Table 44). Technique-setting Specialists (Group 4) were the most likely to support limits on participation in fisheries (30.6 %).

Effect of statewide annual harvest limits

Although the majority of anglers in each angler segment indicated that a 3- or 1-king salmon annual harvest limit would not have influenced their 1997 sport fishing activities, there were some differences among the groups with regard to the percent of anglers who said they “would not have fished in Alaska” and “would not have fished for king salmon” under these annual harvest limits. Under a 3-king salmon annual harvest limit, relatively few anglers in most groups indicated they would not have fished in Alaska or would not have fished for king salmon. Less than 10% of anglers in Groups 1, 2, 3, and 4 indicated that they would have changed their fishing behavior under a 3-king salmon annual limit. However, twice as many Generalists (Group 5) (18%) said they would have changed their fishing behavior under this limit, with 9% indicating they would not have fished in Alaska and 9% indicating they would not have fished for king salmon (Table 44).

Under a 1-king salmon annual harvest limit, the proportion of anglers who would not have fished in Alaska increased only slightly from a 3-king salmon limit. However, there was a modest increase in the proportion of anglers within in each segment who indicated that they would not have fished for king salmon under a 1-king salmon annual limit. For example, whereas only 3.7% of Occasional anglers (Group 1) said they would not have fished for king salmon under a 3-fish annual limit, 11.3% of these anglers said

they would not have fished for king salmon under a 1-fish annual limit—a three-fold increase. A similar increase in the percent of anglers who would not have fished for king salmon occurred for all five angler groups (Table 44), although the total proportion of anglers indicating that they would have changed their fishing behavior differed across some groups. Generalists (Group 5) were the most likely to change their fishing behavior (27%) under a 1-king salmon annual harvest limit, with nearly 10 percent indicating they would not have fished in Alaska, and 17.3 percent indicating they would not have fished for king salmon. A modest proportion of anglers in Groups 1, 3, and 4 also indicated they would have changed their fishing behavior under a 1-king salmon annual harvest limit (18%, 21%, and 17% respectively). Casual anglers (Group 2) were least likely to change their fishing behavior under the 1-king salmon limit (15%) (Table 44).

Fewer differences were found between angler groups with regard to whether they would change their fishing behavior if they had been limited to a harvest of only 4-halibut in 1997. The vast majority (>70%) of anglers in each group except Generalists (Group 5) said they would not be affected by a 4-halibut annual limit. Generalists were somewhat different than other segments in that a larger proportion of anglers indicated they would not have fished in Alaska or for halibut had this limit been in effect in 1997 (17%) (Table 44).

Differential annual harvest limits for residents and nonresidents

The opinions of nonresident angler groups with regard to whether annual harvest limits should be different for resident and nonresident anglers were somewhat mixed. Anglers were asked to indicate whether they agreed with 3 related statements relative to this issue: 1) "Annual harvest limits for residents and nonresidents should be the same," 2) "Annual harvest limits for resident anglers should be higher than annual harvest limits for nonresident anglers," and 3) "Annual harvest limits for resident anglers should be lower than annual harvest limits for nonresident anglers" (Table 44).

Results indicated that there were some differences among the angler groups with regard to questions 1 and 2, but not with regard to question 3. A plurality of Technique-setting Specialists, Experience-setting Specialists, and Generalists (Groups 3, 4 and 5) agreed or strongly agreed with the statement "Annual harvest limits for residents and

nonresidents should be the same" (41%, 40.3%, and 41.7% respectively), whereas a plurality of Occasional (Group 1) and Casual (Group 2) anglers (41.3% and 49.1%) disagreed or strongly disagreed with this statement (Table 44). A substantial proportion of anglers within all segments (15-24%) also indicated a neutral position on this question (neither agree or disagree), with the Occasional angler segment having the largest proportion with no opinion (24.3%).

Differences in attitudes among the groups toward statement (2): "Annual harvest limits for resident anglers should be higher than annual harvest limits for nonresidents" were harder to discern since opinions within each group were somewhat mixed. A plurality of anglers in all five segments agreed or strongly agreed with the notion that resident anglers should have higher annual harvest limits than nonresident anglers. However, over a third of the more specialized and avid segments (Experience-setting Specialists, Technique-setting Specialists, and Generalists) disagreed or strongly disagreed with this statement, suggesting that there are opposing opinions among members of these groups with regard to this management option. For comparison, only 22.8% and 26.7 % of Occasional and Casual anglers (Groups 1 and 2) disagreed or strongly disagreed with the idea of higher resident angler limits, indicating that these groups might be less likely to oppose implementation of differential annual harvest limits for resident and nonresident anglers (Table 44). The vast majority of anglers within all segments (68-80%) disagreed or strongly disagreed with the third statement: "annual harvest limits for resident anglers should be lower than annual harvest limits for nonresident anglers" or had no opinion (77-84%). Thus, no groups supported the idea of higher annual harvest limits for nonresident anglers (Table 44).

Overall, the consistency of group differences in Alaska fishing behaviors, club membership, angling preferences, and, to some extent, management opinions, suggest that the angler groups formed by cluster analysis have validity. The results of external validation tests are not only consistent with the general descriptions of each segment in the previous section, but also add to the information contained in the segment descriptions. The primary characteristics of each nonresident angler segment are summarized in Table 45.

Table 45. Summary characteristics of Alaska nonresident angler segments

Angler Group	Total days fished in 1997 (days fished in AK)	Fishing Experience	Importance of Fishing Elements		Importance of Fishing Motivations		Fishery Attributes Most Important ^b	Participation Characteristics
			High	Low	More important	Less important		
Occasional Anglers (18.3%) ^a	9 (4)	15 yrs	Catching fish Keeping fish	Size of fish	Being w/ family & friends	Develop/use skills Solitude/Nature	opportunity to catch limit preferred fish present	fewest days fished in AK fewest locations fished fewest fish exported low fishing/sport club membership (5%) least likely to return to fish (32%) beginner/intermediate anglers (39/47%)
Casual Anglers (15.0%)	12 (4)	16 yrs		Catching fish Size of fish Keeping fish Number of fish	Being w/ family & friends Solitude/Nature	Develop/use skills	wilderness setting opportunity for solitude few other anglers	few locations fished most did not come to AK primarily to fish lowest guide usage low fishing/sport club membership (6%) intermediate/beginner anglers (49/35%)
Experience-setting Specialists (21.0%)	36 (6)	30 yrs	Size of fish Catching fish	Keeping fish Number of fish	Challenge/excitmnt. of catching fish Solitude/Nature	Develop/use skills Being w/ family & friends	preferred fish present few other anglers wilderness setting catch wild fish	above avg. days fished in AK above avg. # of locations fished likely to return to fish (64%) high fishing/sport club membership (27%) intermediate/advanced anglers (45/45%)
Technique-setting Specialists (21.7%)	45 (8)	28 yrs	Size of fish	Catching fish Number of fish Keeping fish	Challenge/excitmnt. Being w/ family & friends Solitude/Nature Develop/use skills		few other anglers wilderness setting opportunity for solitude preferred fish present catch wild fish large or trophy fish	came to AK primarily to fish highest # locations visited above avg. fish exportation most likely to return to AK (75%) highest fishing club membership (36%) advanced anglers (60%) 54% engaged in fly-fishing in 1997
Fishing Generalists (24.0%)	24 (6)	22 yrs	Catching fish Number of fish Size of fish Keeping fish		Being w/ family & friends Challenge/excitmnt. of catching fish	Develop/use skills	opportunity to catch limit preferred fish present catch a variety of fish few other anglers catch wild fish	came to AK primarily to fish highest # of fish exported highest guide usage likely to return to AK (70%) intermediate/advanced anglers (53/35%)

^a percent of nonresident sample ("market size").

^b Beyond those universally important to most segments (i.e., natural beauty and opportunities to view wildlife) and relative to other angler groups.

Fishery-based Segmentation

Of the 7,706 nonresident anglers who returned completed questionnaires, 7,208 (93.6%) provided information in Question 12 (Trip Record) regarding the area(s) and specific location(s) they fished while in Alaska. The number of respondents who reported fishing within each management sub-area in Alaska (A-Z) is shown in Table 42. One-half of all nonresident anglers responding to Question 12 (3,274) indicated that they fished the Kenai Peninsula area. The Ketchikan, Sitka and Juneau areas in southeast Alaska had the next highest numbers of respondents with 686 (9.6%), 576 (8.8%), and 497 (7.6%) respectively.

Table 56 (Appendix A) summarizes the number of unique respondents who reported fishing at each fishery location listed on the map sheets that accompanied the nonresident angler survey. Of the 166 fishery locations listed (a small subset of the total number of sport fishing locations in Alaska), only 6 had more than 403 unique respondents and all of them were located on the Kenai Peninsula. Eight fishery locations had more than 300 respondents, while 11 fishery locations had more than 200 respondents and 29 locations had more than 100 respondents (Table 56, Appendix A). The Kenai River had the highest number of respondents, with 1,735 anglers (24% of the overall sample) indicating that they fished this location in 1997.

Fishery Location Profiles

In this section, I provide descriptive profiles of ten different fishery locations within Alaska in terms of characteristics of the nonresident anglers who participated in those fisheries in 1997. The list of selected fishery locations includes at least one fishery within each of the four major geographical regions of Alaska (Southeast, Southcentral, Southwest, Interior), and represents a variety of water types (freshwater rivers and creeks, saltwater), settings (urban, road system, remote), and fish species (chinook, coho, sockeye, and pink salmon, rainbow trout, arctic grayling, halibut and other marine groundfish). In addition, the selected fishery locations represent a range of respondent sample sizes to provide a basis for examining the relationship between fishery location sample size and relative precision of the proportional estimates for the selected survey variables.

Table 46. Number and percent of unique nonresident respondents who fished in each Alaska management sub-area (A-Z).

Alaska Survey Area	Area Code	Number of Respondents	% of Total Respondents ^{a, b}
Southeast Region			
Ketchikan Area	A	628	9.6%
Prince of Wales Island	B	306	4.7%
Kake/Petersburg/Wrangell/Stikine Area	C	173	2.6%
Sitka Area	D	576	8.8%
Juneau Area	E	497	7.6%
Haines-Skagway Area	F	183	2.8%
Glacier Bay Area	G	121	1.9%
Yakutat Area	H	174	2.7%
Southcentral Region			
Glenallen Area	I	272	4.2%
Prince William Sound	J	513	7.8%
Knik Arm Drainage	K	183	2.8%
Anchorage Area	L	269	4.1%
East Susitna River Drainage	M	428	6.5%
West Cook Inlet/West Susitna River Drainages	N	344	5.3%
Kenai Peninsula	P	3,274	50.1%
Southwest Region			
Kodiak Area	Q	243	3.7%
Naknek River Drainage--Alaska Peninsula Area	R	208	3.2%
Kvichak River Drainage Area	S	200	3.1%
Nushagak Area	T	203	3.1%
Interior Region			
Tanana River Drainage Area	U	217	3.3%
Kuskokwim River Drainage Area	V	115	1.8%
Seward Peninsula--Norton Sound Area	W	55	0.8%
Northwest Alaska Area	X	19	0.3%
Yukon River Drainage Area	Y	50	0.8%
North Slope--Brooks Range Area	Z	16	0.2%

^a N = 7,208

^b The percentages do not sum to 100% since some anglers fished in more than one management area.

To allow comparisons among the fishery profiles, the angler characteristics of all ten fishery locations are summarized in Tables 47-50. Table 47 provides information on the region, water type, number of respondents, participation of angler segments, and selected socio-demographic characteristics of anglers who visited each fishery location in 1997. Table 48 displays the importance of various reasons for fishing in Alaska among anglers visiting the selected fishery locations, as well as the distribution of fishing licenses purchased, the proportion of anglers who came to Alaska primarily to sport fish, and average number of fish transported from Alaska. Several fishing-related variables such as consumptive orientation (relative importance of keeping fish caught), importance of the number and size of fish caught, as well as the relative importance of 21 fishery location attributes to anglers participating in each fishery are summarized in Table 49, while fishing satisfaction and distribution of opinions toward several fisheries management options are shown in Table 50.

Boxed values represent estimates that are different from the overall sample estimates by more than the largest standard error observed for any estimate of selected survey variables for the fishery with the 2nd lowest sample size (Naknek River, 90 anglers). Proportional estimates that differed by more than 6.0% for proportions, more than 0.3 for means, and more than 0.13 for standardized means were boxed. In most cases, the standard errors of selected variables for these fisheries were much less than these criteria, and, for fisheries with greater than 200 respondents, standard errors were less than one-half of these values. As a result, the “greater-than-largest-standard error” criterion is likely to be a fairly conservative approach, identifying only those values that would most likely be different if statistical comparison tests had been conducted. This approach allowed quick identification of potential differences in the angler profiles of the selected fisheries locations without having to perform dozens of statistical tests among all possible pairs of fishery locations. This approach also allowed me to identify specific characteristics that might be used to describe the anglers participating in a given fishery, and thus, determine whether fishery location might be a useful basis for segmenting Alaska nonresident anglers.

Table 47. Participation of angler segments, socio-demographic characteristics of anglers participating in selected Alaska sport fisheries.^{a, b}

Variable	Sitka Sound Vitskari Is.	Situk River	Ship Creek	Montana Creek	Resurrection Bay	Kachemak Bay	Kenai River	Naknek River	Chena River	Kanektok River	Sample
Region	Southeast	Southeast	Southcentral	Southcentral	Southcentral	Southcentral	Southcentral	Southwest	Interior	Interior	
Water Type	Saltwater	Fresh/River	Fresh/River	Fresh/River	Saltwater	Saltwater	Fresh/River	Fresh/River	Fresh/River	Fresh/River	
No. of Respondents	317	129	159	111	595	460	1,735	90	92	41	7,705
Angler Groups											
Occasional Anglers	21.2%	5.1%	8.7%	7.6%	18.0%	20.9%	13.6%	16.9%	8.5%	0.0%	18.3%
Casual Anglers	9.9%	5.3%	13.5%	10.4%	14.8%	12.1%	13.3%	13.1%	15.2%	2.4%	15.0%
Experience-setting Specialists	23.2%	27.6%	24.7%	14.9%	20.1%	19.5%	21.6%	21.8%	31.7%	15.6%	21.0%
Technique-setting Specialists	21.4%	34.1%	31.6%	46.4%	22.7%	20.3%	23.7%	27.6%	28.9%	65.8%	21.7%
Fishing Generalists	24.2%	27.9%	21.6%	20.5%	24.4%	27.3%	27.8%	20.7%	15.6%	16.1%	24.0%
Residence Strata											
Lower 49	96.2%	90.8%	96.2%	98.2%	95.6%	96.8%	95.1%	94.4%	95.6%	95.1%	94.1%
Canadian	2.2%	0.0%	1.3%	0.9%	1.7%	1.5%	1.3%	0.0%	1.1%	2.4%	2.6%
Other Foreign	1.6%	8.5%	2.5%	0.9%	2.5%	1.3%	3.5%	5.6%	3.3%	2.4%	3.3%
Age											
16-24	2.8%	3.8%	7.5%	5.4%	5.9%	4.3%	3.9%	7.8%	4.3%	4.9%	4.5%
25-34	5.7%	6.2%	20.1%	19.8%	12.9%	11.5%	12.2%	8.9%	17.4%	12.2%	10.5%
35-44	18.3%	17.7%	23.9%	18.0%	18.8%	22.1%	20.0%	13.3%	22.8%	19.5%	18.7%
45-54	25.9%	24.6%	18.2%	25.2%	22.0%	21.9%	23.2%	17.8%	20.7%	26.8%	23.7%
55-64	24.3%	26.2%	15.7%	14.4%	19.0%	20.3%	20.7%	25.6%	19.6%	22.0%	21.7%
65+	20.8%	19.2%	11.9%	11.7%	18.7%	17.1%	17.1%	21.1%	14.1%	12.2%	17.7%
Income											
\$0--\$24,999	4.7%	5.4%	9.4%	10.8%	8.1%	1.3%	7.3%	8.9%	8.7%	7.3%	7.9%
\$25,000--\$49,999	15.5%	16.9%	31.4%	24.3%	26.2%	6.5%	23.6%	10.0%	29.3%	4.9%	20.6%
\$50,000--\$74,999	18.6%	19.2%	24.5%	30.6%	24.5%	24.7%	23.2%	23.0%	28.3%	19.5%	21.6%
\$75,000--\$99,999	17.7%	17.7%	13.8%	7.2%	16.3%	24.7%	15.9%	12.2%	14.1%	7.3%	14.8%
\$100,00 --\$199,999	22.4%	21.5%	12.6%	16.2%	13.9%	15.2%	15.6%	17.8%	14.1%	29.3%	17.6%
More than \$200,000	12.6%	13.1%	0.6%	2.7%	3.4%	15.8%	5.6%	12.2%	1.1%	22.0%	8.4%

^a Boxed values indicate proportions that are different from the overall sample by > 6.0 % (i.e > than the highest standard errors of proportional estimates for sample sizes > 90). They do not represent the results of statistical tests but are relative differences that may be used to characterize the participants in a specific fishery.

^b Percentages may not sum to 100% as "missing" and "multiple" responses are not displayed.

Table 48. Motivations, license characteristics, and fish exportation of anglers participating in selected Alaska sport fisheries.^a

Variable	Sitka Sound Vitskari Is.	Situk River	Ship Creek	Montana Creek	Resurrection Bay	Kachemak Bay	Kenai River	Naknek River	Chena River	Kanektok River	Sample
Motivations for fishing in AK											
Fish with family or friends	3.42 ^b	3.67	3.43	3.49	3.58	3.61	3.56	3.38	3.11	3.76	3.54
Obtain fish to eat	2.65	2.47	2.60	2.30	2.76	3.05	2.79	2.34	2.20	1.73	2.67
Experience a new activity	3.22	3.17	3.34	3.24	3.39	3.37	3.30	3.10	3.28	3.76	3.34
Fish waters surrounded by pleasant scenery	3.58	3.77	3.59	3.85	3.73	3.68	3.66	3.48	3.77	3.85	3.72
Explore new fishing areas	3.30	3.43	3.52	3.71	3.34	3.29	3.41	3.38	3.63	3.88	3.38
Catch new/unique types of fish	2.84	2.84	3.44	3.37	3.21	3.21	3.18	2.82	3.51	3.39	3.14
Take fish home to share with family or friends	3.04	2.77	2.77	2.38	2.99	3.18	2.94	2.40	2.08	1.68	2.83
Fish in a wilderness setting	3.38	3.86	3.47	3.89	3.49	3.39	3.55	3.57	3.72	4.51	3.58
Catch trophy-size fish	2.63	2.78	2.82	2.75	2.54	2.61	2.76	2.92	2.29	3.46	2.65
License types^c											
1-day	32.8%	1.5%	12.6%	8.1%	20.1%	19.7%	11.3%	10.0%	6.5%	0.0%	21.9%
3-day	39.1%	16.9%	27.7%	11.7%	29.4%	28.4%	25.7%	27.8%	22.8%	2.4%	27.0%
14-day	22.4%	67.7%	44.7%	64.0%	36.9%	42.0%	49.6%	44.4%	45.7%	75.6%	40.7%
Annual fishing	11.4%	16.9%	20.8%	19.8%	17.3%	14.0%	17.6%	17.8%	28.3%	19.5%	12.4%
Annual fish/hunt	0.3%	0.8%	0.0%	0.0%	8.0%	0.6%	0.6%	1.1%	1.1%	2.4%	0.8%
% of anglers that visited Alaska primarily to fish	51.1%	90.8%	27.7%	45.9%	32.6%	37.9%	47.9%	58.9%	9.8%	95.1%	41.7%
# of fish exported from AK	7.8 (0.5)	11.9 (1.0)	5.0 (0.5)	5.5 (0.7)	7.5 (0.5)	7.0 (0.4)	8.2 (0.3)	5.3 (0.7)	2.8 (0.5)	5.4 (1.9)	6.3 (0.2)

^a Boxed values indicate means that are different from the overall sample mean by > 0.3 and proportions different from the overall sample proportions by > 6.0% (i.e. > highest std. error for sample sizes >90). They do not represent the results of statistical tests but are relative differences that may be used to characterize the participants in a fishery.

^b Mean scores based on 5-point Likert-type scale 1 = "unimportant, 2 = somewhat important, 3 = important, 4 = very important, 5 = extremely important.

^c Sum of percentages may be > 100% since some anglers purchased more than one license type.

Table 49. Fishing preferences and relative importance of 21 fishery attributes in fishing site selection among nonresident anglers participating in selected Alaska sport fisheries.^a

Variable	Sitka Sound Vitskari Is.	Situk River	Ship Creek	Montana Creek	Resurrection Bay	Kachemak Bay	Kenai River	Naknek River	Chena River	Kanektok River	Sample
Importance of:											
Keeping fish caught	0.16 ^b	-0.05	-0.23	-0.46	0.11	0.19	0.04	-0.37	-0.38	-0.89	0.000
Number of fish	0.06	-0.02	-0.05	-0.16	0.07	0.07	0.05	-0.15	-0.15	-0.16	0.000
Size of fish	0.11	0.06	0.12	0.06	0.06	-0.01	0.09	0.18	-0.06	0.34	0.000
Fishery Attributes											
Large or trophy-sized fish	2.98 ^c	2.98	2.84	2.93	2.78	2.80	2.93	3.02	2.49	3.56	2.86
Natural beauty of area	3.65	3.77	3.50	3.83	3.66	3.61	3.67	3.48	3.76	3.95	3.75
Few other anglers	3.22	3.57	3.33	3.71	3.17	3.19	3.30	3.44	3.47	4.39	3.39
Variety of fish	3.11	2.75	3.08	3.23	2.95	2.91	3.01	2.90	2.87	3.78	3.05
Guiding services	3.07	2.18	2.14	1.89	2.53	2.75	2.53	2.44	1.87	2.63	2.73
Being in a wilderness area	3.19	3.32	3.14	3.59	3.11	3.16	3.19	3.41	3.34	4.32	3.37
Chance to catch a limit	3.27	3.05	3.22	2.91	3.13	3.22	3.19	2.71	2.46	2.63	3.15
Campground/cabin facilities	2.23	2.60	2.69	2.91	2.81	2.67	2.75	2.40	2.64	1.88	2.62
Favorite type(s) of fish	3.45	3.80	3.42	3.43	3.35	3.48	3.47	3.49	3.16	3.83	3.43
Opportunity for solitude	3.01	3.33	3.16	3.52	3.02	3.01	3.09	3.09	3.35	4.15	3.21
Catch rate of keepable fish	3.08	2.83	2.90	2.66	2.97	3.05	3.01	2.50	2.41	2.34	2.96
Catch rate of all fish	2.82	2.64	2.72	2.52	2.66	2.71	2.80	2.68	2.47	2.90	2.76
An area with fly-in access	2.28	2.56	1.81	1.77	1.80	1.92	1.99	2.70	1.65	3.44	2.29
Not having to travel long	2.65	2.40	2.51	2.24	2.40	2.29	2.43	2.29	2.33	1.85	2.53
Familiarity with the area	2.17	2.57	2.35	2.18	2.17	2.18	2.29	2.01	2.04	2.12	2.28
Boat launching facilities	1.89	1.83	1.64	1.53	1.89	1.95	2.02	1.93	1.84	1.56	2.05
Chance to catch wild fish	3.05	3.52	3.14	3.37	3.03	3.05	3.17	3.37	3.36	4.34	3.19
Bank fishing opportunity	1.86	3.21	3.40	3.50	2.75	2.62	3.01	2.47	3.22	2.90	2.65
Nearness to 2nd home/cabin	1.69	1.85	1.82	1.66	1.72	1.89	1.93	1.71	1.63	1.12	1.90
Accessibility	2.77	2.97	3.10	2.97	2.96	2.97	3.06	2.47	3.04	2.24	2.92
Opportunities to view wildlife	3.18	3.24	3.32	3.49	3.48	3.39	3.46	3.42	3.61	3.63	3.49

^a Boxed values indicate means that are different from the overall sample mean by > 0.3 and, for standardized means, that are different by > 0.13 (i.e., > highest std error for sample sizes >90). They do not represent the results of statistical tests but are relative differences that may be used to characterize the participants in a specific fishery.

^b Average scores from multiple indicators standardized to mean = 0 and unit variance to allow for comparisons within and across fisheries.

^c Mean scores based on 5-point Likert-type scale 1 = unimportant, 2 = somewhat important, 3 = important, 4 = very important, 5 = extremely important.

Table 50. Management opinions and satisfaction of anglers participating in selected Alaska sport fisheries in 1997.^a

Variable	Sitka Sound Vitskari Is.	Situk River	Ship Creek	Montana Creek	Resurrection Bay	Kachemak Bay	Kenai River	Naknek River	Chena River	Kanektok River	Sample
Limit # anglers in some fisheries:											
Yes	17.4% ^b	30.8%	23.9%	23.4%	21.6%	23.2%	25.2%	25.6%	23.9%	56.1%	25.1%
No	46.7%	36.2%	44.0%	36.0%	43.6%	44.4%	44.5%	43.3%	42.4%	24.4%	40.9%
Uncertain	33.8%	30.0%	29.6%	35.1%	32.6%	29.9%	27.6%	26.7%	30.4%	17.1%	29.4%
Harvest limits same for residents and nonresidents:											
Agree/strongly agree	36.6%	42.3%	29.6%	38.7%	36.7%	40.9%	37.8%	45.6%	35.9%	39.0%	36.0%
Neither agree or disagree	19.6%	26.9%	12.6%	18.9%	19.1%	14.9%	17.5%	11.1%	16.3%	22.0%	18.5%
Disagree/strongly disagree	41.0%	28.5%	45.3%	36.9%	41.4%	41.1%	41.4%	38.9%	46.7%	39.0%	40.0%
Harvest limits higher for residents:											
Agree/strongly agree	51.7%	35.4%	50.9%	45.0%	52.0%	46.3%	47.9%	42.2%	57.6%	48.8%	46.9%
Neither agree or disagree	13.2%	19.2%	13.8%	19.8%	14.9%	13.2%	14.7%	8.9%	12.0%	29.3%	15.8%
Disagree/strongly disagree	30.9%	42.3%	32.1%	30.6%	29.7%	37.4%	33.6%	44.4%	28.3%	22.0%	31.3%
Fishing Satisfaction											
Very satisfied	65.9%	55.4%	48.4%	61.3%	55.9%	64.1%	48.6%	51.1%	38.0%	92.7%	54.9%
Somewhat satisfied	21.1%	28.5%	35.2%	21.6%	27.2%	23.2%	31.4%	34.4%	40.2%	2.4%	26.8%
Somewhat dissatisfied	6.3%	6.9%	10.7%	14.4%	10.7%	6.7%	11.8%	6.7%	13.0%	0.0%	8.8%
Very dissatisfied	5.4%	5.4%	4.4%	1.8%	5.4%	4.1%	7.0%	6.7%	6.5%	4.9%	6.7%

^a Boxed values indicate proportions that are different from the overall sample by > 6.0 % (i.e. > highest standard errors of proportional estimates for sample sizes > 90). They do not represent the results of statistical tests but are relative differences that may be used to characterize the participants in a specific fishery.

^b Percentages may not sum to 100% as "missing" and "multiple" responses are not displayed.

For 13 of the 19 variables that constitute the descriptive profile of a fishery location, differences from the overall sample mean and between fishery locations were found. The proportional distributions of angler types (Occasional, Casual, etc.), income, and types of licenses purchased differed across the selected fishery locations (Tables 47 and 48). For example, participation of Occasional anglers across the selected locations ranged from 0% (Kanektok R.) to 21% (Sitka Sound/Vitskari Is.), while the participation of Casual anglers ranged from 2% (Kanektok R.) to 15% (Chena R.) across the fishery locations. Technique-setting Specialists had the widest range of participation rates across the ten fishery locations, comprising only 20% of Kachemak Bay, but 46% and 66% of anglers visiting Montana Creek and the Kanektok River respectively (Table 47). Some fishery locations such as Montana Creek, the Situk, Kanektok, and Chena Rivers could be characterized largely by the participation of a couple of primary angler groups, while other locations (Resurrection Bay, Kenai River, Kachemak Bay) had proportional distributions of angler types that were similar to the overall sample (Table 47).

Differences in the age and income distributions were also found between the selected fishery locations. For example, the Chena River, Montana Creek, and Ship Creek had a higher proportion of younger age groups, than the Sitka Sound. Approximately 25 percent of anglers participating in these fisheries were less than 35 years of age, whereas only 10 percent of anglers participating in the Sitka Sound and Situk River locations were under the age of 35 (Table 47). In terms of income differences, anglers fishing the Situk and Kanektok Rivers, as well as Sitka Sound had a higher percentages of households with annual incomes over \$100,000 than anglers who visited the Chena River, Montana Creek, and Ship Creek (Table 47).

Anglers participating in different fishery locations also differed with regard to the mean number of fish exported, importance of size and number of fish caught, importance of keeping fish caught, primary motivation for coming to Alaska, and relative importance of 21 fishery setting attributes (Tables 48 and 49). For example, with regard to the importance of keeping fish caught, anglers who fished Sitka Sound, Resurrection and Kachemak Bay were more likely to indicate that keeping fish was an important outcome of fishing, than anglers who fished Montana Creek, Ship Creek, and the Naknek, Chena,

and Kanektok Rivers (Table 49). Catching large or trophy-size fish was more important among Kanektok and Naknek River anglers than anglers who fished Kachemak Bay, Chena River, and other fisheries. Relatively large differences were observed in the proportion of anglers who indicate they came to Alaska primarily to sport fish. For example, over 90% of anglers visiting the Situk and Kanektok Rivers said they came to Alaska primarily to fish, while relatively few anglers who fished the Chena River and Ship Creek indicated that sport fishing was their primary reason for visiting Alaska in 1997.

The response distributions for the three management opinion questions did not differ significantly from the overall sample distribution for most of the fisheries profiled. However, there were some exceptions. Kanektok River anglers, for example, were unlike anglers in most fisheries in that a clear majority indicated that they supported the idea of limiting the number of anglers that could participate in some fisheries to maintain opportunities for high quality sport fishing experiences. In most other fisheries, a plurality did not support this idea, and nearly one third were uncertain about such limits (Table 50). Regarding the question of differential annual harvest limits for residents and nonresidents, anglers in most fisheries were generally split (as in the overall sample), with nearly equal proportions agreeing and disagreeing with the statement that annual harvest limits should be the same for residents and nonresidents. However, in some fisheries such as the Chena River, Resurrection Bay, and Sitka Sound, a higher proportion of anglers believed that residents should have higher annual harvest limits than nonresident anglers, while anglers visiting the Situk and Naknek Rivers were somewhat more likely to support equal harvest limits for resident and nonresident anglers (Table 50). Fishing satisfaction was generally high within most fishery locations, with the vast majority of anglers being somewhat or very satisfied. However, somewhat larger proportions of anglers fishing the Chena River, Ship Creek and Kenai River indicated they were “somewhat dissatisfied” or “very dissatisfied” with their angling experiences (20%, 15%, and 19% respectively).

The fact that the proportional distribution of empirically-identified angler segments differed across several of the fishery locations suggests that participation of the

empirically identified angler segments might provide a useful method for categorizing and describing participants in specific fishery locations. Although no fishery location was dominated by a single angler segment, several locations could be characterized primarily by the participation of two or three segments. For example, the Kanektok River is predominantly fished by Technique-setting Specialists who accounting for 66% of all anglers, and 2 of 3 anglers that visit Montana Creek are Technique-setting Specialists and Fishing Generalists (46 % and 21% respectively). Similarly, the Situk River and Ship Creek were fished primarily by Experience-setting Specialists, Technique-setting Specialists, and Generalists (Table 47). Occasional and Casual anglers accounted for a relatively small proportion (< 15%) of the participation within most of the ten fishery locations profiled. However, a somewhat larger proportion of Occasional anglers visited some locations such as the Sitka Sound/Vitskari Island area.

The proportional distributions and mean characteristics of anglers participating in larger or less geographically-specific fishery locations (e.g., Kenai River, Resurrection Bay, Kachemak Bay) were less likely to differ from the overall sample distributions and means. Such results may be due to the fact that these fisheries appeal to a broader spectrum of anglers. However, since these fishery locations also contain a variety of fish species, it is possible that the results represent the characteristics of a conglomeration of anglers fishing for different species within the fishery location. Since it is possible that anglers fishing for different species within a fishery location may have different characteristics, preferences, and attitudes, providing profiles of anglers who fish for each species within these locations may provide managers with a clearer understanding of nonresident angler participation in these fishery locations. Descriptive profiles of the anglers participating in each of the ten fishery locations are provided below.

Sitka Sound/Vitskari Island

Sitka Sound/Vitskari Island is a saltwater area in southeast Alaska near the town of Sitka on the western side of Baranof Island. A variety of angler types visited this fishery area in 1997 including relatively equal proportions of all angler types except Casual anglers. Of the ten fishery locations profiled, this location had the highest

proportion of Occasional anglers in 1997. Casual anglers were the least likely to fish in this location (10%) (Table 47).

Thirty-five percent of anglers visiting Sitka Sound/Vitskari Island had incomes greater than \$100,000 per year and more than one-half had incomes greater than \$75,000 per year (Table 47). Nearly 72% of the anglers who fished this location purchased 1- or 3-day sport fishing licenses, a finding in contrast with the overall sample population in which 14-day licenses were most commonly purchased. Only 22% of anglers participating in this fishery purchased 14-day fishing licenses compared to nearly 41% for the overall sample (Table 48).

Fishing waters surrounded by pleasant scenery and fishing with family and friends were the two most important reasons cited for fishing in Alaska among Sitka Sound/Vitskari Island anglers. Obtaining fish to eat and catching trophy-size fish were least important to nonresident anglers that visited this fishery location in 1997. Nonresident anglers participating in this fishery were similar to most nonresidents in that natural beauty of the area and the presence of preferred types of fish were two of the most important factors in their choice of fishing site selection. However, aside from those attributes that appear to be universally important to most anglers visiting Alaska (i.e., natural beauty of the area, opportunities to view wildlife, presence of preferred types of fish), it appears that the availability of guiding services and the chance to catch a limit of fish are more important to nonresident anglers participating in this fishery than to anglers in other fisheries (Table 49). In addition, unlike anglers in several other fisheries, bank fishing opportunities and campground/cabin facilities were relatively unimportant to anglers participating in this fishery location.

Relatively few anglers visiting Sitka Sound/Vitskari Island (17%) supported limiting the number of anglers who can participate in some fisheries in Alaska to provide opportunities for high quality fishing opportunities. The distribution of angler opinions with regard to establishing differential annual harvest limits for residents and nonresidents was similar to the overall sample with a slight majority (51%) supporting higher annual limits for resident anglers.

Situk River

Technique-setting Specialists, Experience-setting Specialists, and Fishing Generalists comprised the vast majority of anglers who visited the Situk River in 1997 (34%, 28%, and 28% respectively). Relatively few Occasional and Casual anglers visited the location (5% respectively) (Table 47.) Nearly all anglers who visited the Situk River (90%) indicated that they visited Alaska primarily to sport fish, and the vast majority (68%) purchased 14-day sport fishing licenses in 1997. Overall, these anglers did not exhibit strong preferences with regard to the importance of keeping fish caught or the importance of size or number of fish caught. However, the lack of strong fishing preferences among Situk River anglers may be the result of offsetting opinions among the primary angler segments. For example, Groups 3 and 4 indicated that the number of fish caught and keeping fish caught were relatively unimportant compared to catching large or trophy-size fish (Table 38). However, Group 5 anglers considered the number of fish caught and keeping fish particularly important factors when fishing.

Anglers that visited the Situk River transported nearly twice the number of fish from Alaska in 1997 (mean = 12 fish) than the average nonresident angler (mean = 6.3). However, this does not mean that fish caught in the Situk River were those exported, since some anglers may have fished more than one fishery in Alaska and participants were not asked to report the number of fish exported by location visited.

Fishing in a wilderness setting and in waters surrounded by pleasant scenery were the most important reasons for fishing in Alaska to anglers participating in the Situk River. Having the opportunity to catch wild fish and their preferred species were particularly important factors in the selection of a fishing site among these anglers. In addition, anglers fishing the Situk River attached greater importance to bank fishing opportunity and less importance to the availability of guides and the variety of fish available than anglers in other fisheries and the overall sample population (Table 49). Although a substantial number of anglers expressed a neutral opinion (i.e., neither agree or disagree), Situk River anglers were less likely to support differential annual harvest limits for residents and nonresidents

Ship Creek

Ship Creek is an urban salmon fishery located on the northern edge of Anchorage, Alaska's largest city. Technique-setting Specialists, Experience-setting Specialists, and Fishing Generalists had the highest participation rates in this fishery (32%, 25%, and 22% respectively). The fact that Technique-setting Specialists accounted for nearly a third of all visitation to this location in 1997 was a somewhat surprising result given the fishery location (urban setting) and the fishing preferences stated by this group (being in natural surroundings/wilderness, catch and release angling, uncrowded conditions). Only 27% of anglers who visited Ship Creek indicated that they came to Alaska primarily to fish. However, 21 percent of Ship Creek anglers purchased an annual sport fishing license in 1997, higher than the overall sample rate (Table 48). This apparent contradiction may be explained by the fact that nearly 22% of anglers who visited Ship Creek came to Alaska primarily for business purposes (compared to only 7% for the nonresident angler sample as a whole), suggesting that a substantial proportion of anglers that fish Ship Creek may be business travelers or military personnel who fish the location due to its proximity to nearby Elmendorf Air Force Base. Business travelers who may make several trips to Alaska in a given year and military personnel who are temporarily stationed in Alaska may be more inclined to purchase an annual license than other nonresident anglers.

The income distribution of anglers visiting Ship Creek also differed somewhat from the overall sample distribution and other fisheries having a larger proportion of anglers with household incomes less than \$50,000 per year (Table 47). Forty percent of the anglers who visited Ship Creek in 1997 had incomes less than \$50,000, compared to only 27 percent for the whole sample.

The presence of preferred types of fish, bank fishing opportunity, and being in an area with few other anglers were the most important fishery attributes to Ship Creek anglers (beyond natural beauty of an area which was universally important) (Table 49). Ship Creek anglers differed from anglers visiting other fishery locations and the overall sample in indicating that bank fishing opportunity was particularly important in their selection of sport fishing location, while boat launching facilities, fly-in access, and

availability of guiding services were not (Table 49). Anglers visiting this fishery location indicated that keeping fish caught was not particularly important, and the distribution of angler opinions with regard to establishing differential annual harvest limits for residents and nonresidents was similar to the overall sample distribution with a slight majority (51%) supporting higher annual limits for resident anglers. A lower percentage of Ship Creek anglers (48%) were very satisfied with their sport fishing experiences in Alaska compared to participants in other fisheries (Table 50).

Montana Creek

Montana Creek is a small, clearwater tributary of the Susitna River located along the Parks Highway approximately 2.5 hours north of Anchorage, near Talkeetna. Nearly half of all nonresident anglers who visited Montana Creek in 1997 were Technique-setting Specialists, the most experienced and avid angler segment. Generalists (experienced anglers with strong fishing preferences for number, size and keeping fish) had the next highest participation rate in this fishery (21%). Together, these groups accounted for the majority of nonresident angler visitation at Montana Creek (Table 47).

Anglers fishing Montana Creek typically purchased longer term sport fishing licenses, with 64% having purchased a 14-day license and 20% an annual sport fishing license. One-third of all Montana Creek anglers had annual household incomes between \$50,000 and \$75,000 and over one-half had annual incomes between \$25,000 and \$75,000. The proportion of anglers in this fishery that came to Alaska primarily to fish and number of fish exported by these anglers reflected the overall nonresident angler sample values.

Montana Creek anglers indicated that they tend to release the fish they catch and were less concerned with catching large numbers of fish (Table 49). Fishing areas with few anglers and that provide accessible bank fishing and opportunities for experiencing solitude are particularly important to these anglers in choosing where to fish, while fishing services and facilities such as guides, boat ramps, and fly-in access are less important. Fishing in a wilderness setting, in areas surrounded by pleasant scenery, and exploring new fishing areas, were particularly important reasons why these anglers fished in Alaska (Table 48). Montana Creek anglers' opinions with regard to establishing limits

on angler participation in some fisheries and differential annual harvest limits for residents and nonresidents did not appear to differ from the overall sample.

Resurrection Bay, Kachemak Bay, and Kenai River

Resurrection Bay, Kachemak Bay and the Kenai River are located in southcentral Alaska on the Kenai Peninsula--an area that receives the highest amount of sport fishing effort of any area in Alaska. Resurrection Bay is located on the southeastern side of the Kenai Peninsula and supports recreational fisheries for halibut, lingcod (*Ophiodon elongatus*), and rockfish (*Sebastes* spp.) in the Gulf of Alaska, as well as coho and chinook salmon. The small town of Seward serves as the primary port for these sport fisheries which occur in Resurrection Bay and the central Gulf of Alaska. Kachemak Bay is another popular saltwater sport fishing area that occurs in southern Cook Inlet on the southwestern side of the Kenai Peninsula. Similar to Resurrection Bay, the area supports a large sport fishery for halibut and other groundfish, as well as saltwater sport fisheries for chinook and coho salmon. The primary port is the town of Homer, approximately 5 hours drive south of Anchorage. Finally, the Kenai River is the most heavily visited fishery location in Alaska. Located in west central Kenai Peninsula, approximately 2.5 hours south of Anchorage, it is known for producing trophy-size chinook salmon and for the large runs of sockeye salmon that migrate upstream each summer. The river also supports a moderate coho salmon run and a popular rainbow trout (*Oncorhynchus mykiss*) fishery.

The characteristics of nonresident anglers who fished Resurrection Bay, Kachemak Bay and the Kenai River in 1997 closely reflected those of the overall nonresident angler sample, with Fishing Generalists generally accounting for one-quarter of the visitation, followed by Technique-setting and Experience-setting Specialists (each accounting for approximately 21% of anglers). Occasional and Casual anglers together accounted for the remaining third of nonresident anglers visiting these areas. (Table 47). The distributions of common socio-demographic variables such as residence strata, age, and income for participants in these fisheries did not differ significantly from the overall sample distributions (with the exception of Kachemak Bay anglers who appeared to have a larger proportion of anglers with higher annual incomes). There were also relatively

few distinguishing characteristics of anglers who visited these fishery locations. Kachemak Bay anglers appeared to place more importance on obtaining fish to eat and taking fish home to share with family and friend as evidenced by mean importance scores for the importance of obtaining fish to eat and opportunity to catch a bag limit. However, overall, it was difficult to characterize anglers who visited these locations in 1997.

These results suggest that segmentation at the level of fishery location may not be a useful approach for describing nonresident anglers who visit fishery locations that are geographically large or that consist of highly-developed fisheries for different species of fish. Rather, describing anglers who fish for specific species at a particular location is likely to be more useful for these types of fishery locations. An example of species-location segmentation approach is provided in the next section for the Kenai River--one of the few fishery locations with a sufficient number of nonresident respondents to allow development of relatively accurate profiles of nonresident anglers fishing for specific species.

Naknek River

The Naknek River flows out of Naknek Lake in southwestern Alaska near the western boundary Katmai National Park. It is off the Alaska road system so visitors must fly from Anchorage to the small town of King Salmon to visit this fishery. A large variety of fish species are present in the river, including all five species of Pacific salmon, rainbow trout, Arctic char (*Salvelinus alpinus*), Arctic grayling (*Thymallus arcticus*), and whitefish (*Coregonus spp*).

The socio-demographic and fishing behavior characteristics of nonresident anglers who fished the Naknek River in 1997 did not seem to differ from the overall sample of nonresident anglers. Most anglers were from the Lower 48 states, the largest proportion of anglers were 45-55 years of age, the median income category was \$50,000-\$74,999 dollars, and a 14-day sport fishing license was the most commonly purchased license type. The proportions of each nonresident angler group visiting this fishery location were also somewhat similar to the overall nonresident sample, with Technique-setting Specialists, Experience-setting Specialists, Fishing Generalists accounting for

two-thirds of all nonresident anglers and Occasional and Casual anglers accounting for the remaining one-third of visiting anglers (Table 47).

Catching large numbers of fish and keeping fish caught were less important to Naknek River anglers than anglers participating in other fisheries (Kachemak Bay, Resurrection Bay, Sitka Sound) (Table 49). These preferences also were reflected in the mean importance scores for 21 fishery setting attributes which showed that Naknek anglers placed lower than average importance on the chance to catch a limit and catch rate of keepable fish. Accessibility also was less important to this group than anglers participating in several other fisheries, while fly-in access was more important. With regard to management attitudes, Naknek River anglers appeared somewhat more likely to oppose differential annual harvest limits for residents and nonresidents (Table 50).

Chena River

The Chena River is located in the interior region of Alaska. It flows southwest from the Chena Hot Springs area through Fort Wainwright Military Reservation before emptying into the Tanana River in downtown Fairbanks. A variety of fish species are present in the system including Arctic grayling, northern pike (*Esox lucius*), chinook and chum salmon (*Oncorhynchus keta*), burbot (*Lota lota*) and whitefish.

Although anglers from all five nonresident angler segments fished the Chena River, Experience-setting Specialists and Technique-setting Specialists accounted for more than 61% of all anglers who visited the area in 1997. Substantially fewer Occasional and Generalist anglers visited this fishery in 1997 than were present in the overall sample (Table 47). The residence strata and age distribution of Chena River anglers was similar to the overall sample, however, a larger proportion of nonresident Chena River anglers had annual incomes in the \$25-50,000 and \$50-\$75,000 ranges (Table 47).

More than one-fourth of Chena River anglers (28%) purchased an annual sport fishing license in 1997, (the highest proportion among the ten locations profiled), while relatively few (6%) held 1-day licenses. This large number of annual license purchases among Chena River anglers may reflect the proximity of the Chena River to a military base (Fort Wainwright) that likely employs a number of nonresident military personnel

who are stationed in Alaska for substantial length of time. Chena River anglers were somewhat unique in that they exported relatively few fish from Alaska in 1997, and less than 10% indicated that they came to Alaska primarily to sport fish (compared to 42% for the overall sample). In addition to fishing waters surrounded by pleasant scenery and fishing in wilderness settings, Chena River anglers indicated that catching new/unique types of fish was an important reason for fishing in Alaska. Chena River anglers were less likely to be concerned with keeping fish, the number of fish caught, or the size of fish (Table 49). Examination of the relative importance of 21 fishery setting attributes revealed a similar pattern with Chena River anglers having somewhat lower mean importance scores for attributes such as catch rate of keepable fish, chance to catch a limit, and presence of large or trophy-size fish (Table 49). Availability of guides and fly-in access also were less important to Chena River anglers than to anglers participating in other fisheries and nonresidents as a whole. Similar to anglers fishing Ship Creek and Montana Creek, bank fishing opportunity was a particularly important factor in fishing site selection for these anglers.

Among the 10 fishery locations profiled, Chena River anglers had the lowest percentage of anglers who were “very satisfied” with their sport fishing experiences in 1997 (38%), although a somewhat larger proportion (40%) indicated they were “somewhat satisfied.” (Table 46). Finally, Chena River anglers were most likely to support differential annual harvest limits for residents and nonresidents, with 58% favoring higher annual limits for resident anglers.

Kanektok River

The Kanektok River is a remote river system located in the Togiak National Wildlife Refuge in western Alaska. It flows west from the Eek Mountains and empties into Kuskokwim Bay near the native village of Quinhagak. The river is accessible only by floatplane and is generally fished as part of a multi-day float trip. All five species of Pacific salmon as well as rainbow trout, Arctic char, Arctic grayling, northern pike, sheefish (*Stenodus leucichthys*), and whitefish are present in the system.

The angler profile for the Kanektok River was quite different than most of the fisheries profiled, although the number of respondents was relatively small. Technique-

setting Specialists were the predominant nonresident angler type that visited the fishery in 1997, accounting for 66% percent of visiting anglers. The income distribution of Kanektok River anglers was significantly different from the overall nonresident distribution and other fisheries with over 50% of participants having annual household incomes greater than \$100,000. Ninety-five percent of the anglers who fished the Kanektok River came to Alaska primarily to fish, and 76% purchased 14-day sport fishing licenses (Table 48). The opportunity to fish in a wilderness setting was a very important reason why these anglers fished in Alaska, followed closely by exploring new fishing areas and fishing waters surrounded by natural beauty. The opportunity to catch trophy-size fish also was an important reason why Kanektok River anglers fished in Alaska.

Consistent with the description of Group 4 anglers, those who fished the Kanektok River were primarily concerned with catching large fish. Keeping fish caught was not important, nor was catching large numbers of fish. Being in an area with few other anglers, catching wild fish, and fishing in a wilderness area were the three most important factors to Kanektok anglers when choosing a fishing site (Table 49). Opportunity for solitude and the variety of fish present also were important factors in fishing site selection among Kanektok anglers, while factors such as accessibility, travel time, and boat launching facilities were relatively unimportant (Table 49).

Unlike anglers in most of the fisheries profiled, the majority of Kanektok River anglers (56%) supported establishing limits on the number of anglers who can participate in some fisheries to maintain high quality fishing opportunities. Kanektok River anglers also generally supported higher annual harvest limits for resident anglers. Nearly all anglers who visited the Kanektok River (93%) indicated that they were very satisfied with their sport fishing experiences in Alaska in 1997. (Table 50).

Species-location Profiles: Kenai River sport fisheries

I developed separate profiles of nonresident anglers fishing for chinook salmon, sockeye salmon and rainbow trout on the Kenai River to explore whether there were differences in the characteristics of anglers pursuing different species at this location.

Tables 51-54 summarize the angler group composition, socio-demographic characteristics, fishing preferences, and management opinions of anglers who fished for rainbow trout, chinook and sockeye salmon on the Kenai River in 1997.

Relatively few differences were observed in the socio-demographic characteristics and management opinions of anglers participating in these different fisheries (Table 51). However, there were differences in angler segment composition, consumptive orientation, number of fish exported, and importance of various fishery setting attributes among anglers participating in these fisheries. For example, Kenai River rainbow trout anglers consisted largely of Technique-setting Specialists (43%) and relatively few anglers from Occasional and Casual anglers, whereas a larger proportion of these groups participated in the Kenai River chinook and sockeye salmon fisheries along with Fishing Generalists who accounted for the largest proportion of anglers (approximately 30%) (Table 51).

Kenai River sockeye anglers exported the largest number of fish from Alaska (mean = 12.2), nearly twice the number exported by the average nonresident angler and those who fished for chinook salmon or rainbow trout. Kenai River sockeye anglers also purchased a larger proportion of annual sport fishing licenses (25 %) than anglers participating in the other fisheries, although a 14-day license was the most common license type purchased by anglers in all three fisheries (Table 53).

Keeping fish caught was considerably more important to anglers fishing for chinook and sockeye salmon than to those fishing for rainbow trout on the Kenai River (Table 52). Anglers fishing for rainbow trout and chinook salmon were particularly interested in catching large fish. Catching large numbers of fish did not appear to be particularly important among anglers in each fishery, but it was least important among rainbow trout anglers (Table 52). Sockeye salmon anglers placed considerable importance on accessibility and bank fishing opportunity and less importance on guiding services and fishing in wilderness areas than anglers in the other fisheries. Rainbow trout anglers were different from sockeye and chinook salmon anglers in that they preferred fishing areas having few other people, wild fish, and that provided greater opportunities for solitude. Catch rates and chance to catch a limit of fish were least important to

Table 51. Angler segment composition and socio-demographic characteristics of nonresident anglers participating in the Kenai River chinook salmon, sockeye salmon and rainbow trout fisheries.^a

Variable	Kenai River chinook salmon	Kenai River sockeye salmon	Kenai River rainbow trout	Sample
No. of Respondents	960	782	168	7,706
Angler Group				
Occasional Anglers	13.4% ¹	11.1%	7.9%	18.3%
Casual Anglers	10.1%	13.8%	13.0%	15.0%
Experience-setting Specialists	21.7%	21.8%	17.9%	21.0%
Technique-setting Specialists	23.2%	23.5%	42.9%	21.7%
Fishing Generalists	31.7%	29.7%	18.4%	24.0%
Residence Strata				
Other USA	96.5%	95.0%	94.6%	94.1%
Canadian	1.0%	1.3%	0.0%	2.6%
Other Foreign	2.5%	3.6%	5.4%	3.3%
Age				
16-24	3.5%	4.2%	7.7%	4.5%
25-34	12.0%	12.0%	18.5%	10.5%
35-44	20.9%	20.1%	20.8%	18.7%
45-54	23.1%	22.1%	25.0%	23.7%
55-64	20.6%	21.4%	16.7%	21.7%
65+	16.8%	17.8%	10.1%	17.7%
Income				
\$0--\$24,999	7.4%	8.2%	8.3%	7.9%
\$25,000--\$49,999	21.7%	25.6%	20.2%	20.6%
\$50,000--\$74,999	22.8%	23.6%	19.6%	21.6%
\$75,000--\$99,999	16.0%	15.7%	13.1%	14.8%
\$100,00 --\$199,999	17.2%	13.3%	23.2%	17.6%
More than \$200,000	6.5%	5.2%	9.5%	8.4%

^a Percentages may not sum to 100% as "missing" and "multiple" responses are not displayed.

Table 52. Fishing preferences and relative importance of 21 fishery attributes in fishing site selection among nonresident anglers who participated in the Kenai River chinook salmon, sockeye salmon and rainbow trout fisheries.^a

Variable	Kenai River chinook salmon	Kenai River sockeye salmon	Kenai River rainbow trout	Sample
Importance of: ^b				
Keeping fish caught	0.10	0.11	-0.63	0.00 ^b
Number of fish	0.09	0.07	-0.09	0.00
Size of fish	0.26	0.04	0.23	0.00
Attributes Sought ^c				
Large or trophy-sized fish	3.22	2.74	3.14	2.86
Natural beauty of area	3.68	3.61	3.99	3.75
Few other anglers	3.26	3.27	3.60	3.39
Variety of fish	3.03	2.98	3.26	3.05
Guiding services	2.84	2.16	2.73	2.73
Being in a wilderness area	3.15	3.09	3.57	3.37
Chance to catch a limit	3.26	3.19	2.74	3.15
Campground/cabin facilities	2.68	2.82	2.51	2.62
Favorite type(s) of fish	3.51	3.54	3.39	3.43
Opportunity for solitude	3.06	3.08	3.40	3.21
Catch rate of keepable fish	3.08	3.03	2.33	2.96
Catch rate of all fish	2.86	2.78	2.83	2.76
An area with fly-in access	2.09	1.84	2.17	2.29
Not having to travel long	2.46	2.39	2.29	2.53
Familiarity with the area	2.26	2.39	2.18	2.28
Boat launching facilities	2.12	1.98	1.97	2.05
Chance to catch wild fish	3.18	3.18	3.55	3.19
Bank fishing opportunity	2.81	3.36	2.93	2.65
Nearness to 2nd home/cabin	1.92	1.97	1.70	1.90
Accessibility	2.99	3.22	2.92	2.92
Opportunities to view wildlife	3.45	3.43	3.69	3.49

^a Boxed values indicate means that are different from the overall sample mean by > 0.3 and, for standardized means, that are different by > 0.13 (i.e. > std error for sample sizes >41). They do not represent the results of statistical tests but are relative differences that may be used to characterize the participants in a specific fishery.

^b Mean scores from multiple indicators standardized to mean = 0 and unit variance to allow for comparisons within and across fisheries

^c Mean scores based on 5-point Likert-type scale 1 = unimportant, 2 = somewhat important, 3 = important, 4 = very important, 5 = extremely important.

Table 53. Motivations, license characteristics, and fish exportation of nonresident anglers who participated in the Kenai River chinook salmon, sockeye salmon and rainbow trout fisheries.^a

Variable	Kenai River chinook salmon	Kenai River sockeye salmon	Kenai River rainbow trout	Sample
Motivations for fishing in Akb				
Fish with family or friends	3.66	3.59	3.74	3.54
Obtain fish to eat	2.82	2.89	2.36	2.67
Experience a new activity	3.36	3.21	3.49	3.34
Fish waters surrounded by pleasant scenery	3.64	3.67	4.04	3.72
Explore new fishing areas	3.42	3.33	3.76	3.38
Catch new/unique types of fish	3.24	3.09	3.49	3.14
Take fish home to share with family or friends	3.04	2.98	2.56	2.83
Fish in a wilderness setting	3.56	3.49	3.96	3.58
Catch trophy-size fish	3.07	2.62	2.96	2.65
License types^c				
1-day	12.9%	6.4%	14.3%	21.9%
3-day	29.0%	17.5%	19.0%	27.0%
14-day	50.4%	54.6%	57.7%	40.7%
Annual fishing	13.5%	25.1%	16.1%	12.4%
Annual fish/hunt	0.5%	0.6%	0.6%	0.8%
Visited Alaska primarily to fish	53.9%	49.1%	47.6%	41.7%
No. of fish exported from AK	8.0 (0.45) ^d	12.2 (0.63)	6.7 (1.63)	6.3 (0.2)

^a Boxed values indicate means that are different from the overall sample mean by > 0.3 and proportions that are different from the overall sample proportions by > 6.0% (i.e. > std error for sample sizes >90). They do not represent the results of statistical tests but are relative differences that may be used to characterize the participants in a specific fishery.

^b Mean scores based on 5-point Likert-type scale 1 = "unimportant, 2 = somewhat important, 3 = important, 4 = very important, 5 = extremely important.

^c Sum of percentages may be > 100% since some anglers purchased more than one license type

^d Standard errors in parentheses.

Table 54. Management opinions and satisfaction of Kenai River anglers fishing for chinook salmon, sockeye salmon and rainbow trout.^{a, b}

Variable	Kenai River chinook salmon	Kenai River sockeye salmon	Kenai River rainbow trout	Sample
Limit # anglers in some fisheries				
Yes	26.6%	23.3%	29.2%	25.1%
No	43.0%	49.6%	41.7%	40.9%
Uncertain	28.1%	24.7%	27.4%	29.8%
Harvest limits same for residents and nonresidents:				
Agree	38.7%	42.4%	32.7%	36.0%
Neither agree or disagree	19.3%	15.3%	21.8%	18.5%
Disagree	43.1%	42.4%	45.5%	40.0%
Harvest limits higher for residents:				
Agree	50.4%	49.8%	49.1%	46.9%
Neither agree or disagree	15.8%	11.6%	18.2%	15.8%
Disagree	33.9%	38.6%	32.7%	31.3%
Fishing Satisfaction				
Very satisfied	49.6%	48.4%	60.7%	54.9%
Somewhat satisfied	31.0%	32.7%	26.8%	26.8%
Somewhat dissatisfied	10.7%	11.8%	6.0%	8.8%
Very dissatisfied	7.4%	6.3%	6.0%	6.7%

^a Boxed values indicate proportions that are different from the overall sample by > 6.0 % (i.e > than standard errors of proportional estimates for sample sizes > 90). They do not represent the results of statistical tests but are relative differences that may be used to characterize the participants in a specific fishery.

^b Percentages may not sum to 100% as "missing" and "multiple" responses are not displayed.

rainbow trout anglers. Kenai River chinook salmon anglers had preferences that were similar to sockeye anglers except that availability of large or trophy-size fish and guiding services were more important factors for chinook anglers in choosing fishing sites in Alaska.

Fishing waters surrounded by pleasant scenery, fishing with family and friends, and fishing in a wilderness setting were the top three motivations for fishing in Alaska among participants in all three fisheries. However, there were some differences in the relative importance of nine reasons for fishing in Alaska as indicated by differences in

mean importance scores (Table 53). For example, obtaining fish to eat and taking fish home to share with family and friends were somewhat more important reasons for fishing among chinook and sockeye anglers than among rainbow trout anglers. In addition, chinook salmon and rainbow trout anglers had greater interest in pursuing trophy-size fish than anglers fishing for sockeye salmon (Table 53). No differences were observed in the management attitudes of nonresidents anglers participating in the different Kenai River sport fisheries.

Precision of proportional estimates for fishery profiles

Calculated standard errors of proportional estimates for a subset of fishery profile variables ranged from 0.6% for the Kenai River (1,735 respondents) to 8.8% for the Kanektok River (41 respondents) (Table 55). A plot of the largest standard error of any proportional estimate for three profile variables versus the number of respondents per fishery location indicated that standard errors of proportional estimates would likely be 3% or less for fishery locations with more than 300 respondents and 5% or less for locations with 100-300 respondents (Figure 12). Below a sample size of 90, the standard errors of proportional estimates increased dramatically, indicating that proportional estimates for fishery profiles with less than 90 respondents would likely be considerably less precise. Consequently, I recommend a minimum sample of 90 respondents per fishery for developing angler profiles of fishery locations with acceptable levels of precision.

Table 55. Proportional estimates and standard errors of selected profile variables for each of the ten Alaska fishery locations.

Variable	Sitka Sound Vitskari Is.		Situk River		Ship Creek		Montana Creek		Resurrection Bay		Sample	SE
Region	Southeast		Southeast		Southcentral		Southcentral		Southcentral			
Water Type	Saltwater		Fresh/River		Fresh/River		Fresh/River		Saltwater			
No. of Respondents	317		129		159		111		595		7,706	
Angler Groups												
Occasional Anglers	21.2%	2.5%	5.1%	2.3%	8.7%	2.6%	7.6%	3.0%	18.0%	1.7%	18.3%	0.4%
Casual Anglers	9.9%	1.8%	5.3%	2.4%	13.5%	3.0%	10.4%	3.4%	14.8%	1.5%	15.0%	0.4%
Experience-setting Specialists	23.2%	2.5%	27.6%	4.3%	24.7%	3.7%	14.9%	3.8%	20.1%	1.7%	21.0%	0.5%
Technique-setting Specialists	21.4%	2.5%	34.1%	4.6%	31.6%	4.0%	46.4%	5.2%	22.7%	1.8%	21.7%	0.5%
Fishing Generalists	24.2%	2.6%	27.9%	4.4%	21.6%	3.6%	20.5%	4.3%	24.4%	1.8%	24.0%	0.5%
License types^a												
1-day	32.8%	2.8%	15.0%	3.5%	12.6%	3.0%	8.1%	3.1%	20.1%	1.7%	21.9%	0.5%
3-day	39.1%	2.9%	16.9%	3.7%	27.7%	3.9%	11.7%	3.5%	29.4%	2.0%	27.0%	0.5%
14-day	22.4%	2.5%	67.7%	4.5%	44.7%	4.3%	64.0%	5.0%	36.9%	2.1%	40.7%	0.6%
Annual fishing	11.4%	1.9%	16.9%	3.7%	20.8%	3.5%	19.8%	4.2%	17.3%	1.6%	12.4%	0.4%
Annual fish/hunt	0.3%	0.5%	8.0%	2.8%	0.0	0.3%	0.0	0.5%	0.8%	0.4%	8.0%	0.3%
Income												
\$0--\$24,999	4.7%	1.3%	5.4%	2.4%	9.4%	2.6%	10.8%	3.4%	8.1%	1.2%	7.9%	0.3%
\$25,000--\$49,999	15.5%	2.2%	16.9%	3.7%	31.4%	4.0%	24.3%	4.5%	26.2%	1.9%	20.6%	0.5%
\$50,000--\$74,999	18.6%	2.3%	19.2%	3.9%	24.5%	3.7%	30.6%	4.8%	24.5%	1.8%	21.6%	0.5%
\$75,000--\$99,999	17.7%	2.3%	17.7%	3.8%	13.8%	3.1%	7.2%	2.9%	16.3%	1.6%	14.8%	0.4%
\$100,00 --\$199,999	22.4%	2.5%	21.5%	4.0%	12.6%	3.0%	16.2%	4.0%	13.9%	1.5%	17.6%	0.4%
More than \$200,000	12.6%	2.0%	13.1%	3.4%	0.6%	0.9%	2.7%	2.0%	3.4%	0.8%	8.4%	0.3%
% of anglers that visited Alaska primarily to fish	51.1%	3.0%	90.8%	2.9%	27.7%	3.9%	45.9%	5.2%	32.6%	2.0%	41.7%	0.6%
# of fish exported from AK	7.8	0.5	11.9	1.0	5.0	0.5	5.5	0.7	7.5	0.5	6.3	0.2

^a Sum of percentages may be > 100% since some anglers purchased more than one license type

Table 55 (cont.) Proportional estimates and standard errors of selected profile variables for each of the ten Alaska fishery locations.

Variable	Kachemak		Kenai		Naknek		Chena		Kanektok		Sample	SE
	Bay	SE	River	SE	River	SE	River	SE	River	SE		
Region	Southcentral		Southcentral		Southwest		Interior		Interior			
Water Type	Saltwater		Fresh/River		Fresh/River		Fresh/River		Fresh/River			
No. of Respondents	460		1,735		90		92		41		7,705	
Angler segments												
Occasional Anglers	20.9%	2.0%	13.6%	1.0%	16.9%	5.0%	8.5%	5.1%	0.0%	8.4%	18.3%	0.5%
Casual Anglers	12.1%	1.6%	13.3%	0.8%	13.1%	4.0%	15.2%	3.9%	2.4%	6.6%	15.0%	0.4%
Experience-setting Specialists	19.5%	2.0%	21.6%	1.0%	21.8%	4.7%	31.7%	4.4%	15.6%	7.6%	21.0%	0.5%
Technique-setting Specialists	20.3%	2.0%	23.7%	1.0%	27.6%	4.6%	28.9%	4.5%	65.8%	5.4%	21.7%	0.5%
Fishing Generalists	27.3%	2.2%	27.8%	1.1%	20.7%	5.5%	15.6%	5.6%	16.1%	8.8%	24.0%	0.5%
License types^a												
1-day	19.7%	2.0%	11.3%	0.8%	10.0%	3.7%	6.5%	3.1%	0.0%	1.2%	21.9%	0.5%
3-day	28.4%	2.2%	25.7%	1.1%	27.8%	5.3%	22.8%	4.9%	24.0%	8.0%	27.0%	0.5%
14-day	42.0%	2.4%	49.6%	1.2%	44.4%	5.8%	45.7%	5.8%	75.6%	8.0%	40.7%	0.6%
Annual fishing	14.0%	1.7%	17.6%	0.9%	17.8%	4.6%	28.3%	5.3%	19.5%	7.5%	12.4%	0.4%
Annual fish/hunt	0.6%	0.5%	0.6%	0.2%	11.0%	3.9%	11.0%	3.8%	2.4%	3.6%	8.0%	0.3%
Income												
\$0--\$24,999	1.3%	0.6%	7.3%	0.7%	8.9%	3.6%	8.7%	3.5%	7.3%	5.3%	7.9%	0.3%
\$25,000--\$49,999	6.5%	1.3%	23.6%	1.0%	10.0%	3.7%	29.3%	5.3%	4.9%	4.6%	20.6%	0.5%
\$50,000--\$74,999	24.7%	2.1%	23.2%	1.0%	23.3%	5.0%	28.3%	5.3%	19.5%	7.5%	21.6%	0.5%
\$75,000--\$99,999	24.7%	2.1%	15.9%	0.9%	12.2%	4.0%	14.1%	4.2%	7.3%	5.3%	14.8%	0.4%
\$100,00 --\$199,999	15.2%	1.8%	15.6%	0.9%	17.8%	4.6%	14.1%	4.2%	29.3%	8.4%	17.6%	0.4%
More than \$200,000	15.8%	1.8%	5.6%	0.6%	12.2%	4.0%	1.1%	1.6%	22.0%	7.8%	8.4%	0.3%
% of anglers that visited Alaska primarily to fish	37.9%	2.4%	47.9%	1.2%	58.9%	5.8%	9.8%	3.7%	95.1%	4.6%	41.7%	0.6%
# of fish exported from AK	7.0	0.4	8.2	0.3	5.3	0.7	2.8	0.5	5.4	1.9	6.3	0.2

^a Sum of percentages may be > 100% since some anglers purchased more than one license type

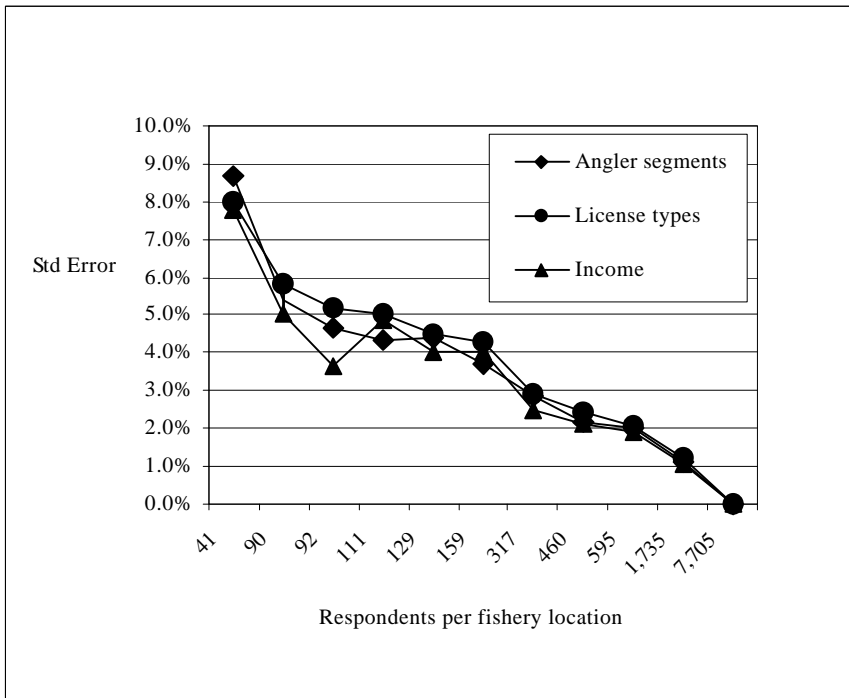


Figure 12. Relationship between number of respondents per fishery and standard errors of proportional estimates for selected survey variables. The “worst case” or largest standard error for each survey variable is displayed.

CHAPTER 4: DISCUSSION

The primary goal of this study was to provide the Alaska Department of Fish and Game, Division of Sport Fish with a better understanding of the behaviors, preferences, and management opinions of anglers who come to Alaska to sport fish. I used a market segmentation approach consisting of both empirical and fishery-based segmentation methods to meet all four objectives outlined in Chapter 1. In this chapter, I discuss some of the most important findings of this study and their management implications. I also note study limitations and provide recommendations for future research.

Nonresident Angling Market

Anglers from all 50 US states, the District of Columbia, as well as at least 29 foreign countries visited Alaska in 1997, and the majority of them (65%) were first time visitors. However, over one-third of all nonresident anglers fishing in Alaska in 1997 were from the Pacific coast states of Washington, Oregon, and California, suggesting that anglers from this region constitute an important market segment within the nonresident Alaska population.

Growth in nonresident sport fishing in Alaska during the past two decades is likely the result of several factors, however, this study suggests that an increasing number of nonresident anglers returning to Alaska may be part of the reason for this growth. Although the majority of nonresident anglers in 1997 were visiting Alaska for the first time, over 35% of 1997 nonresident anglers were “repeat customers” who had made two or more visits to Alaska for sport fishing since 1995. In addition, although most nonresident anglers (94%) made only one trip to Alaska that included sport fishing in 1997, nearly 62% indicated they were likely or very likely to return to Alaska to sport fish within the next three years. These results suggest that nonresident participation in Alaska sport fisheries will continue to increase in the near future.

Although only 40% of 1997 nonresident anglers came to Alaska primarily to fish, almost 75% of nonresident anglers harvested and transported at least one fish out of Alaska during 1997. These findings are in contrast with information on the nonresident

angling behavior of nonresident in western states such as Montana, and Wyoming which indicate that nonresident anglers (particularly guided anglers) tend to harvest a relatively small percent of the fish they catch (Wenzel and Hubert 1995; Wright and Sanyal 1998). The fact that the majority of nonresident Alaska anglers transport fish from Alaska may be due to the fact that many of Alaska's primary sport fisheries are for salmon and marine species, such as Pacific halibut, and that harvesting these fish may be more acceptable in these fisheries than in the trout fisheries of Montana and Wyoming. At least one study has shown that marine anglers place greater importance on catching, retaining and consuming fish than others (Fedler and Ditton 1986). The fact that halibut was the most frequently exported species among nonresidents, followed by king salmon, seems consistent with this general interpretation—although it must be remembered that anglers were only asked to report the number of halibut and salmon exported, not the number of trout or other species. Examination of nonresident angling behavior in Pacific coast states such as Washington and Oregon may show similar results which would support this interpretation, and should be pursued.

Aesthetic characteristics of fisheries such as the natural beauty of the area, opportunities to view wildlife, being in an area with few other anglers, and fishing in a wilderness area, were generally more important to nonresident anglers fishing in Alaska than fishing or catch-related attributes (i.e., catch rates, opportunity for a bag limit, variety of fish types present). These results are similar to previous research findings on angling motivations and consistent with findings on nonresident anglers visiting other Western (Intermountain) U.S. states (Reid 1989; Wenzel and Hubert 1995). Although further analysis indicated that catch-related attributes, as well as other aesthetic aspects of the fishery setting, were relatively important to certain subgroups of nonresident Alaska anglers, the summary results suggests that ADF&G should try to maintain the aesthetic qualities of sport fisheries in Alaska in addition to their biological integrity, if the agency wants to maintain fishing satisfaction among nonresident anglers.

Summary statistics for the entire nonresident sample provide a general overview of the nonresident angler population that can be used to identify trends in angler participation by various demographic groups or to calculate population estimates for

various fishing participation variables (e.g., total days fished in Alaska, total guided days fished). In addition, the summary information can be used to estimate the total amount of support or opposition that exists for management actions that affect nonresident anglers (e.g., license fees). However, these summary statistics mask significant differences in Alaska fishing behavior, preferences, and management opinions among primary subgroups of nonresident anglers who fished in Alaska in 1997. In addition, the summary statistics do not reflect the fact that there are differences in the characteristics, preferences, and management attitudes of anglers participating in different sport fisheries across the state.

Since the “average nonresident Alaska angler” does not exist, identifying and describing important subgroups of nonresident anglers that fish in Alaska provides a more detailed understanding of the Alaska nonresident angling population and allows ADF&G to develop management strategies that take into account differences in fishing characteristics and preferences among nonresident anglers fishing in Alaska and/or in different fisheries. For these reasons, I place more emphasis on the results of empirical and fishery-based segmentation which are discussed below.

Nonresident Angler Segments

The results of this study are consistent with previous research which shows that there are sub-groups of anglers seeking different fishing experiences (Loomis and Ditton 1987; Chipman and Helfrich 1988; McGurrin 1988, Fisher 1997) and that measures of specialization and motivations for fishing can be used to segment large angling populations into subgroups having managerial significance (Chipman and Helfrich 1988; Ditton 1996; Fisher 1997). Cluster analysis of seven specialization and four motivational variables identified five nonresident angler segments in the nonresident angler sample. The five angler groups represent a spectrum of angler types having differing levels of experience, interest and participation in sport fishing as well as different fishing preferences and Alaska fishing characteristics. These results indicate that the segments are a useful way to categorize and describe nonresident anglers who fished in Alaska in 1997.

The five nonresident angler groups were generally similar to those found by previous researchers (Chipman and Helfrich 1988; Fisher 1997), representing a range of specialization from those who are less-specialized (Occasional and Casual anglers) to those who are more-specialized (Experience-setting and Technique-setting Specialists). Although the methodology and scope of previous angler segmentation studies differed somewhat from this study, both Chipman and Helfrich (1988) and Fisher (1997) identified highly specialized angler segments that had considerable years of sport fishing experience, fished frequently, and had different preferences with regard to the importance on catching large or trophy-size fish--characteristics similar to the Groups 4 and 5 identified in this study. They also identified angler groups that differed in participation and experience but were less specialized, having similar characteristics with regard to centrality of sport fishing, motivations for fishing, and resource use, similar to Occasional and Casual anglers in this study.

The relative importance of primary fishing motivations among the five nonresident angler segments also were consistent with previous angler segmentation studies. I found, as did Graefe (1980) and Chipman and Helfrich (1988), that catch-related motivations such as developing and using fishing skills or the challenge and stimulation of fishing were generally more important among the more specialized segments (Technique-setting and Experience-setting Specialists) than among the less specialized angler segments (Occasional and Casual anglers). In addition, certain nonactivity-specific motivations, such as getting away from other people and experiencing natural surroundings, were more important to the angler segments with more experience, higher participation rates, and greater interest in fishing (i.e., the more specialized segments) (Chipman and Helfrich 1988; Ditton et al. 1992). Social or family-related motivations for fishing, (i.e., being with friends and family), were generally important to all nonresident angler segments. However, this reason for fishing was ranked most important among the less specialized groups (Occasional and Casual anglers), findings that are also generally consistent with previous angler specialization research (Manfredo and Anderson 1982; Loomis and Ditton 1987; Chipman and Helfrich 1988).

Resource dependency and the relative importance of activity-specific elements of fishing (i.e., importance of number, size, keeping, and “catching” something) among the five nonresident angler segments were also consistent with previous research on angler specialization. Catching and keeping fish were generally more important to the nonresident groups with less experience and participation (i.e., less-specialized) segments than to groups considered more specialized (higher participation rates, experience, interest in sport, etc.) (Chipman and Helfrich 1988; Anderson 1990; Fisher 1997). In addition, unlike the less-specialized angler segments, the more specialized anglers (Experience-setting and Technique-setting Specialists) placed considerable importance on catching large, distinctive, or trophy fish, were less inclined to keep fish, and had higher fishing club membership rates, similar to finding by (Ditton et al. 1992). Anglers in Group 5 (Fishing Generalists) were somewhat different in having considerable experience and participation rates but also having high resource dependency ((i.e., placed considerable importance on most catch-related aspects of a fishing experience (size, number, keeping, and catching something)). However, both Fisher (1997) and Chipman and Helfrich (1988) identified an "intermediate" angler group with considerable fishing experience and relatively high participation whose members considered catching and keeping a limit of fish a particularly important aspect of the fishing experience.

I identified fewer angler segments in this study than have been found in previous angler segmentation studies employing the specialization and motivation frameworks (Chipman and Helfrich 1988; Fisher 1997). However, this is not particularly surprising given the nature of the population of interest. Despite being geographically diverse, it is reasonable to expect that the Alaska nonresident angler population may be composed of fewer angler types than might exist within the entire angling population within a given state. This particular analysis does not include anglers who live in Alaska, only anglers who visited Alaska from another state or country. It is likely that anglers who fish primarily to obtain fish to eat may be less likely to travel to Alaska to fish. In fact, a truly consumptive angler segment (a segment identified in studies by Fisher (1997) and Chipman and Helfrich (1988)) was absent in the Alaska nonresident angler population (or such anglers were mixed into the existing groups which exhibited high preferences for

keeping fish (Generalists?). In addition, the fact Alaska is a long distance from other states and a relatively expensive travel destination may prevent certain groups of anglers with lower incomes and/or less vacation time from visiting the state.

In addition to having fewer angler types, the Alaska nonresident population appears to contain a larger proportion of more specialized anglers than has been found in previous research. Although direct comparisons to other states are difficult because few states have examined nonresident angling separately, and none (to my knowledge) have used empirical segmentation to identify nonresident angler subgroups, the results of several studies in western U.S. states, suggest that Alaska is not unique in having a substantial number of more avid and experienced nonresident anglers participating in sport fisheries in the state. Studies in Idaho (Reid 1989), Wyoming (Wenzel and Hubert 1995), and Montana (Taylor and Reilly 1991) that reported characteristics and preferences of nonresident anglers who fished in these states, found nonresident anglers to exhibit characteristics of fairly specialized anglers (higher involvement in fishing organizations, larger % of fly-fishing anglers, generally more support for fishing restrictions, particularly catch and release regulations, artificial lures, and regulations favoring wild and trophy trout populations). Although a substantial number of nonresident Alaska anglers were also less-specialized (approximately 33%), the majority of Alaska nonresident anglers (66%) were fairly specialized anglers who had a high interest in sport fishing, fished many days per year, and were interested in catching large or trophy-size fish. In general, these angler groups also had particularly strong preferences with regard to the nature of the fishery settings in which they fished--most preferring to fish areas they consider wilderness settings which have opportunities to view other wildlife, few other anglers, and wild fish.

The substantial proportion of less-specialized nonresident anglers in Alaska (33%) may be due to the fact that fishing is one of Alaska's primary tourist-related activities. Persons visiting Alaska who may not normally fish in their home state (or who do so only occasionally), may be more likely to go fishing in Alaska simply because it is a unique experience to fish in Alaska for large salmon, halibut, or other unique fish.

The variability in resource dependency (importance of number and size of fish caught) as well as activity-specific elements of fishing (importance of keeping fish and importance of catching “something”) suggests that the angler segments are likely to differ in basic management attitudes. However, in this study, assessment of nonresident anglers’ opinions regarding a few, relatively specific types of management actions took precedence over measuring attitudes toward more general management actions examined in previous angler segmentation studies (e.g., gear restrictions, bag/size limits, catch and release areas). Although I did not assess differences in the attitudes of nonresident angler segments toward these common management actions, based upon previous angler specialization research (Chipman and Helfrich; Fisher 1997) and information on the resource dependency of each angler segment, I draw some general conclusions.

For example, sport fishing was relatively unimportant as a recreational activity to the Occasional and Casual angler segments, and relatively few anglers in these groups came to Alaska primarily to fish or were active in fishing clubs or sporting organizations. These characteristics suggest that these anglers may be relatively unconcerned with changes in management regulations in Alaska and are least likely to become actively involved in sport fisheries management issues in the state. They also might be expected to sport fish regardless of the management regime in place at the time of their visit as long as there is a reasonable chance of catching fish.

In contrast, Technique-setting Specialists, Experience-setting Specialists, and Fishing Generalists, the majority of whom came to Alaska primarily to fish and who tended to have relatively specific fishing preferences, are more likely to be interested in sport fisheries management in Alaska, and to find ways to become involved in or influence management decision-making. On the basis of stated fishing preferences, the most-specialized segments (Technique-setting and Experience-setting Specialists) might be expected to support conservation-related management actions or regulations that favor maintaining wild or trophy fisheries, particularly minimum length limits, catch and release regulations, bait restrictions, and limitations on the number of anglers. Fishing Generalists are more difficult to characterize since they placed considerable importance on size, number, and keeping of fish. The relative importance of catching “something”

and keeping fish caught within this segment suggests that they might be more likely to oppose catch and release regulations, favor less restrictive bag limits, and lower minimum size limits. Although more information needs to be collected to confirm these generalizations, based upon stated preferences with regard to several aspects of the sport fishing experience (importance of number, size, keeping and "catching" something while fishing), one can conclude that the Fishing Generalists, Technique-setting Specialists, and Experience-setting specialists are more likely to be affected by changes in sport fish management in Alaska than the Occasional or Casual angler segments.

Socioeconomic and demographic variables were not particularly effective in identifying nonresident angler segments having different participation characteristics and angling preferences. Although the segments appeared to differ to some extent with regard to age, there were no significant differences with regard to residence strata (Lower 48 states, Canadian, Other foreign), income, or education level. Previous research suggested that standard socioeconomic variables were not reliable criteria for identifying nonresident anglers sharing similar participation characteristics and Alaska angling preferences (Kikuchi 1986). Consequently, these factors may not be particularly useful for marketing fishing opportunities in Alaska.

Although Technique-setting and Experience-setting Specialists indicated that keeping fish caught was generally unimportant, anglers in these groups actually transported a larger number of fish from Alaska (on average) than anglers in groups who indicated that keeping fish caught was a relatively important outcome of fishing. The higher number of fish exported by these groups may reflect the fact that these anglers generally participated in more fisheries during their 1997 visit(s) to Alaska. It also may reflect that fact that the angling behavior of these groups varies across fishery types. For example, the same anglers may be more likely to keep a salmon or halibut when participating in fisheries where these species are available because keeping and consuming fish may be viewed as more acceptable in these fisheries, as opposed to a trout fishery. Further analyses should examine this possibility. Regardless of the reason for higher numbers of fish being exported by the more-specialized angler segments, however, it is important to recognize that the more specialized nonresident angler

segments may harvest more fish than other groups and account for a larger proportion of the sport-caught fish exported from Alaska.

Finally, the results show that guide services are especially important to all nonresident anglers groups in Alaska. Although guide use was slightly higher among some groups (Experience-setting Specialists and Generalists), the majority of anglers in all subgroups used a guide for at least one day of fishing during their 1997 visit(s) to Alaska. This is not surprising given the fact that most anglers visiting Alaska (80%) arrive by commercial airline and many sport fisheries in Alaska occur in saltwater or are difficult to access without a boat. High guide utilization among nonresident anglers is also generally consistent with the result of studies other western states which showed a higher proportion of nonresident anglers using guides than resident anglers (Taylor and Reilly 1991; Wright and Sanyal 1998). These results clearly suggest that restrictions on the number of guides that can operate in Alaska or that can operate in particular fisheries will likely have a direct effect on nonresident participation in these fisheries.

Management Preferences of Nonresident Anglers

The Alaska Department of Fish and Game was particularly interested in estimating the opinions of nonresident anglers with regard to several proposals to limit nonresident sport fishing in Alaska, as well as estimating the effect of specific annual harvest limits on nonresident sport fishing behavior. Overall, nonresident anglers' opinions regarding several sport fisheries management proposals were mixed. More nonresident anglers opposed the concept of limiting the number of anglers that can participate in some fisheries to maintain high quality fishing opportunities (41%), than supported it (25%). However, nearly one-third of respondents indicated they were uncertain whether ADF&G should pursue participation limits. The proportion of anglers supporting, opposing, and uncertain about limits on angler participation was relatively consistent across all five angler subgroups, suggesting that there are 3 relatively distinct nonresident angler groups who have different opinions on this question, and that opinions on this question are not associated with the primary angler types.

Examining the distribution of opinions among anglers participating in ten selected sport fisheries suggests that anglers participating in more remote fishery settings where angler density is likely to be relatively low may be more likely to support the idea of limiting the number of anglers that can participate, while those participating in larger, saltwater fisheries are more likely to oppose limits on angler participation. For example, the majority of Kanektok River anglers (56%) were found to support the concept of limiting angler participation, while only 17% of Sitka Sound anglers and 22% of Resurrection Bay anglers were in favor of angler limits. Although the Kanektok River sample was relatively small compared to Sitka Sound and Resurrection Bay and more fishery profiles need to be developed, these results provide some evidence that limits on angler participation may be supported for some sport fisheries in Alaska.

The lack of specificity in the question with regard to which fisheries and how such limits might be imposed may have contributed to the large number of “uncertain” responses. It is not known whether “uncertain” was used as a neutral response by respondents or reflects actual uncertainty of opinion. Future research on this issue should specify what is meant by “high quality” (does it mean uncrowded conditions, more pristine natural conditions, larger fish, or a combination of these characteristics?), and focus on obtaining angler opinions with regard to specific proposals for how participation limits might be imposed (i.e., limits on party size, number of boats, number of guides, lotteries).

On the question of statewide annual harvest limits, nonresident anglers were almost evenly split between those who felt resident and nonresident harvest limits should be the same and those who felt that limits should be higher for residents than for nonresidents. Once again, a substantial portion of respondents (23%) did not have an opinion or failed to provide an answer. Results also indicated that Technique-setting Specialists, Experience-setting Specialists and Generalists were more likely to support equal annual harvest limits for residents and nonresidents, while the less-specialized (Occasional and Casual) anglers tended to support higher annual harvest limits for resident anglers.

My findings suggest that instituting statewide annual harvest limits would not affect the vast majority of nonresident anglers who fish in Alaska. Only for the most restrictive annual harvest limits of 1 king salmon, 4 halibut, and 10 total salmon did a significant proportion (>10%) of nonresident anglers indicate they would not have fished in Alaska or would have spent more time fishing for other species. Under the most restrictive annual limits of 1 king salmon, 4 halibut, and 10 total salmon, less than 15% of nonresident anglers said they “would not have fished in Alaska.” The management opinions of anglers within most angler segments generally reflected the distribution of opinions in the overall sample. However, a higher proportion of Generalists indicated that they would not have fished in Alaska or would not have fished for king salmon if a 3- or 1-king salmon annual harvest limit had been in place in 1997. Although statewide annual limits would likely reduce the total harvest of some anglers who tend to fish more days and sites in Alaska, and would likely cause some anglers interested in harvesting many fish to stop fishing in Alaska or spend more time fishing for other species, it is unlikely that statewide annual harvest limits would significantly reduce the number of nonresident anglers coming to Alaska to fish.

However, despite the fact that relatively few anglers within most segments would have changed their fishing behavior under the various annual harvest limits, these changes in behavior would directly impact the sale of sport fishing licenses and, thus, total revenue available to the Division for sport fish management. If the changes in fishing choices indicated by nonresident anglers under these annual harvest limits directly translate into changes in the license-buying behavior of nonresident anglers, then the cumulative effect of implementing annual harvest limits (in license revenues) may be significant. In addition, implementing annual harvest limits may have a greater effect on some individual fisheries (e.g., Kachemak Bay, Situk River) which are visited by a substantial number of Generalists who place considerable importance on the number of fish caught and kept. As a result, such limits must be carefully considered before implementation.

Fishery-based Segmentation

Exploration of fishery-based segmentation indicated that there were differences in the fishing characteristics, consumptive orientation, resource dependency, and relative importance of fishery attributes among nonresident anglers who visited selected sport fisheries in Alaska during 1997. Although I examined a limited number of fishery locations in this report, I found that some fisheries appeared to contain a broad mix of angler types having a variety of fishing preferences, while others were visited predominantly by two or three nonresident angler segments. These results suggest that certain fisheries appeal to a variety of anglers having different fishing preferences and characteristics, while others appear to attract fewer angler types, often sharing similar fishing preferences and characteristics. For example, the Kanektok and Situk Rivers were primarily visited by more specialized anglers (Technique-setting and Experience-setting Specialists) who shared an interest in catching large or trophy-fish, being in areas with few other anglers, fishing in wilderness settings, and catching wild fish. In contrast, large saltwater sport fisheries such as Sitka Sound/Vitskari Island and Kachemak Bay, as well as the Naknek and Kenai Rivers tended to reflected the overall nonresident market with Occasional and Casual anglers accounting for nearly one-third of visiting anglers, and nearly equal percentages of Generalists, Technique-setting Specialists, and Experience-setting Specialists accounting for nearly two-thirds of the nonresident participation.

Comparing the response distributions of the 19 profile variables of each fishery location (e.g., Kachemak Bay) to those of the overall sample and other fisheries indicated that profiles at the level of fishery location would likely be sufficient for many sport fisheries in Alaska, particularly those with relatively few species of fish and/or low to moderate effort. However, for fishery locations covering large geographical areas, having multiple species and moderate to high effort, segmentation by species within the fishery location (e.g., Kenai River rainbow trout anglers) should provide fisheries managers with a clearer picture of nonresident participation at such locations. For example, in this study, anglers fishing for rainbow trout, chinook and sockeye salmon in the Kenai River were found to differ in consumptive orientation, number of fish exported,

importance of fishery attributes, and participation of empirically identified angler segments. Specifically, anglers fishing for rainbow trout on the Kenai River were more likely to be highly specialized Technique-setting Specialists, while Generalists comprised the largest proportion anglers who fished for chinook and sockeye salmon at the Kenai River, followed by nearly equal proportions of Technique-setting and Experience-setting Specialists. In addition, while catching large or trophy-size fish was important to rainbow trout and chinook salmon anglers, sockeye anglers were more interested in keeping fish caught.

More fishery location profiles need to be developed to determine the extent to which differences exist among different fishery locations and to draw more specific conclusions about the types of fisheries preferred by the different angler segments. Specifically, future analyses should examine the list of fisheries (and fishery types) visited by individual nonresident anglers during their visit(s) to Alaska to provide a clearer picture of the fishing patterns of the various nonresident segments. However, these preliminary results suggest that fishery-based segmentation can provide ADF&G with a more detailed picture of the fishing behavior, preferences, and attitudes of nonresident anglers participating in specific fishery locations or by species within locations. In addition, the information collected from this study will allow ADF&G to aggregate data and compare the characteristics of anglers participating in different areas or regions of Alaska (e.g., interior vs. southeast), in different fishery types (Kenai Peninsula lakes vs. Kenai Peninsula rivers), as well as anglers fishing for specific species at the statewide, regional, or fishery level.

If, for example, there is an insufficient number of respondents to a specific fishery location, or it is found that anglers participating in similar fisheries (e.g., remote, freshwater rivers in southwest Alaska) or in certain areas (e.g., fisheries along the road system in interior Alaska) share similar characteristics, then it may make sense to describe angler participation within these larger aggregates rather than at individual fishery locations. Similarly, based on previous angler segmentation research (Ditton 1996), it may be useful to examine the characteristics of anglers fishing for specific species (e.g., king salmon, grayling, halibut) at the statewide, regional, or area level and

determine whether anglers fishing for certain species share similarities or differ in fishing characteristics or preferences.

Examination of the relative precision of proportional estimates for different respondent sizes suggested that proportional estimates for locations or fisheries with as few as 100 respondents should be sufficiently precise for ADF&G management purposes (i.e., \pm 5-8% of true values). Once the results of this study are combined with similar data collected from resident anglers and with relevant biological data, a fairly complete profile of the anglers participating in particular locations, fisheries, or regions could be developed.

Study Limitations

All research endeavors have limitations that restrict the ability of researchers to make generalizations about the results. The primary limitation in this study was the response rate. Although the final survey response rate of 54% was slightly higher than recent statewide harvest surveys conducted by ADF&G, it was approximately 8-15% lower than similar statewide segmentation studies conducted in other states (Anderson 1990; Sanyal and McLaughlin 1994; Hunt and Ditton 1996; Fisher 1997) which increased the potential for bias in the resulting survey estimates. Survey nonresponse was likely due to several factors including the overall length of the survey instrument and the relative complexity of some of the questionnaire items. The large number of questions as well as the complexity of certain items, such as the grid requesting information on days and specific locations fished in Alaska, may have discouraged participation among nonresident anglers for whom sport fishing is less important (i.e., Groups 1 and 2). However, since anglers were asked to report detailed information on the fisheries visited, species targeted, and number of days fished by month at fisheries visited, it is also possible that anglers who fished the most while in Alaska were discouraged from participating due to the burden of responding (i.e., Groups 4 and 5).

Tests for nonresponse bias on selected survey variables across the three survey mailings revealed that persons who fished fewer days in 1997, fewer days in Alaska, and having fewer years of fishing experience were less likely to respond to the first survey

mailing. These results are generally consistent with previous research (Fisher 1997), and suggest that the survey results may underestimate the proportion of less specialized (Group 1 and 2) anglers, and that aggregate estimates may be somewhat biased toward the characteristics of the more specialized and avid angler segments (Groups 3, 4, 5). Given the results of the nonresponse tests, I recommended that survey estimates be adjusted for nonresponse bias—a step that is currently being pursued by ADF&G. Reducing the number of items in the instrument, as well as complexity of certain items, should also help to improve the overall response rate as well as response among less avid anglers if the survey is administered in the future.

The period that the surveys were mailed also could have contributed to survey nonresponse and increased the potential for bias in the survey estimates. Although mailings were originally scheduled for December 1997 through February 1998, the initial mailing date was pushed back to mid-March 1998 for several reasons including pretest revisions, printing and assembly delays, and conflicts with other ADF&G data collection efforts during the same period. Since most nonresident anglers visit between May and September, most participants did not receive a questionnaire until 6-9 months after their visit to Alaska and some may have received a questionnaire as much as a 12 months after their visit to Alaska. Delay of the survey mailings probably did not affect the number or types of nonresident angler subgroups identified in the survey, since most of the questions used to identify angler segments requested information on general fishing preferences and behaviors. However, the 2-3 month delay could have led to increased item nonresponse for those questions requesting relatively specific information regarding an anglers' Alaska sport fishing activities (i.e., number of fish exported, number of days fished, specific locations fished, dates visited). Despite the fact that a trip to Alaska is likely to be a rather memorable event for most nonresidents, some anglers may have had difficulty recalling such information or may have provided inaccurate information. Others may have considered the burden of providing this detailed information too great given the amount of elapsed time since their visit, and, thus, may have refused to answer such questions or to participate in the study.

Over 500 nonresident anglers (7%) failed to provide data regarding locations and species fished in Alaska although they were known to have purchased a sport fishing license. Sending the surveys sooner (as well as reducing the number of items and overall length of survey) would likely have improved both the overall survey response and item response rates for the Alaska fishing items. This could have resulted in a greater number of individual fisheries having a sufficient number of respondents for profile analysis and greater precision of the resulting fishery profile estimates. However, it is also possible that the question requesting information on number of days fished in specific locations and species targeted may have been a primary cause of nonresponse. Thus, simplifying this particular item in future data collection efforts may provide the greatest potential for increasing overall survey response.

The clustering approach used to identify and validate the nonresident angler segments was fairly robust. However, more sophisticated cluster validation procedures have been developed (Breckenridge 1989; Helsen and Green 1991; Humphreys and Rosenheck 1995) and could be applied to empirical market segmentation studies of this type. Replication of the cluster results within a given sample of anglers, as outlined by Milligan (1996) or by Helsen and Green (1991) would be particularly appropriate and provide additional information with which to judge whether the resulting angler clusters are natural partitions of the population or simply the artifacts of the clustering procedure.

Finally, these results reflect only a cross section of 1997 nonresident anglers, and may not accurately depict composition of the nonresident angler market in future years. The fact that over one-third of 1997 nonresident anglers had visited Alaska at least one other time since 1995 suggests that the types of nonresident anglers visiting Alaska in the near future should be similar to those who visited in 1997. However, the majority of 1997 nonresident anglers were “new” or 1st-time visitors to Alaska, and consequently, the relative size of the various market segments may be different in subsequent years. Market segments may change in nature and size over time because anglers change, the characteristics of fisheries and the regulatory environment changes, and marketing efforts by sport fishing businesses change. Such changes could have significant effects on fisheries management and related policy formulation over time. Thus, the nonresident

angler population should be periodically re-assessed to determine the stability of derived market segments and their participation in Alaska over time.

Management Implications and Recommendations

Many field biologists know through observation and experience that some anglers are more specialized than others, and that anglers differ with regard to behavior, fishing preferences and management attitudes. Biologists also may have a general idea of the characteristics of nonresident anglers who participate in certain fisheries in Alaska. However, prior to this study, empirical data that could be used to assess the validity of biologists' observations were lacking. The findings of this study provide empirical evidence to test the assumptions fisheries managers might have about the behavior and preferences of Alaska nonresident anglers.

Specifically, this study provides quantitative estimates of the number and size of nonresident angler groups that fish in Alaska, their fishing behaviors, angling and setting preferences, and attitudes toward several management proposals. Although not all of the survey results are presented in this report, this study also provides quantitative information on the characteristics of nonresident anglers who fished in different management areas, regions, and specific fishery locations in Alaska, as well as those who fished for particular species in 1997. This information is useful to fishery managers at various levels within ADF&G as well as the Board of Fisheries which regulates and allocates fishery resources in Alaska.

Regional or program managers should find the study useful because it begins to provide a picture of the relative demand for different types of sport fishing experiences among nonresident anglers who fish in Alaska, and can be used to provide similar information for particular regions, management sub-areas, and fisheries in the state. This information will allow the agency to determine how to allocate sport fishing opportunities in Alaska among different angler types and to focus project planning in accordance with the interests of the different angler types that participate in sport fisheries across the state.

For example, the survey results suggest that some nonresident Alaska anglers are less specialized anglers who fish relatively few days and locations while in Alaska, place

more emphasis on catching and harvesting fish, and have less interest in catching large or wild fish than other angler segments who fish in Alaska (Occasional and Casual anglers). In addition, fishing in wilderness areas or areas with few other anglers are not particularly important to these segments. These characteristics suggest that these anglers may prefer fishing areas that are easily accessed and that provide opportunities to catch and harvest fish. Thus, maintaining easily accessible fishing opportunities that allow some harvest will most likely satisfy one third of the nonresident anglers fishing in Alaska.

Similarly, there is also a substantial number of more specialized anglers (e.g., Technique-setting and Experienced-setting Specialists), who fished a significant number of days in Alaska, prefer to catch large or trophy-size, wild fish and to fish in wilderness settings having their preferred type(s) of fish and few other anglers. These anglers might be expected to prefer different fisheries than Occasional and Casual anglers and may constitute the majority of anglers participating in certain areas of Alaska (e.g., southwest Alaska), certain fishery types (e.g., remote, fly-in sport fisheries), or who fish for certain species (e.g., rainbow trout). The fishery-based segmentation provides some evidence that indicates this might be the case. Further analysis will provide a clearer picture of angler participation by fishery and area, however, these limited data already suggest that remote, freshwater fisheries may be a distinct nonresident angler market consisting primarily of more specialized angler types.

Regional managers will be able to use this information to determine what are the primary angler markets in particular areas of the state, and to determine the most appropriate mix of fishing opportunities to provide in those areas. In addition, the study provides a baseline for detecting shifts in the characteristics of anglers fishing in a particular region, area or fishery over time.

The information collected in this study is also useful to district or individual area managers who are charged with the management of a particular set of fisheries located within a specific area of Alaska. These managers are likely to be more interested in understanding nonresident angler participation within the specific fisheries they are responsible for managing, and this study provides quantitative information on the angling

behaviors and preferences of nonresident anglers participating in specific fishery locations—including the participation of primary angler groups in these fisheries.

Fishery managers have some control over size, number and disposition of catch, and they can develop opportunities for anglers to catch “something.” In addition, managers often have control over certain aspects of the fishery setting, such as number of other people or watercraft encountered and water quality. They can also influence attributes of the fishery setting through restrictions on the amount and types of access and (in many areas) participation in land-use planning and management around a fishery. As a result, fishery managers often can design management schemes for specific fisheries that meet the interests of different angler subgroups within the biological limits of the fishery.

For example, this study shows that the Situk and Kanektok Rivers appeal primarily to Technique-setting Specialists. Since these anglers place considerable importance on catching large, wild fish, prefer fishery settings having few other anglers, and have less interest in harvesting fish, fishery managers may want to manage these fisheries to maintain these qualities (in addition to their biological integrity). Given the characteristics of participants in this fishery, managers could expect less opposition among these anglers to management changes intended to preserve the characteristics of these fisheries (e.g., harvest restrictions, catch and release or artificial lure restrictions) than in fisheries such as Montana Creek which had a wider array of angler types, more of whom prefer to harvest the fish that they catch.

The quantitative information collected on the opinions of nonresident angler segments with regard to statewide annual harvest limits, differential harvest limits for residents and nonresidents, and participation limits may be used by ADF&G as well as the Board of Fisheries to determine the potential response of different nonresident angler subgroups to these management actions. For example, the results of this study suggest that instituting statewide annual harvest limits for halibut and salmon will not significantly reduce the number of nonresident anglers coming to Alaska to fish, but may increase effort for other species or change participation in specific fisheries.

Information on the consumptive orientation and resource dependency (importance of size, number and catching fish) among the different angler subgroups and among participants in specific fisheries also will help ADF&G determine the potential response of nonresident anglers to management actions not specifically addressed in this study. For example, knowing that the majority of nonresident anglers fishing the Kanektok River or fishing for rainbow trout on the Kenai River are more specialized Group 4 anglers, and that these anglers place less importance on keeping fish caught, managers could expect that catch and release regulations or a decrease in bag limits in these fisheries would likely face less opposition than similar restrictions in Kachemak Bay which contained a larger proportion of anglers who place considerable importance on keeping fish caught. If biological conditions warrant restrictions on angling in certain fisheries, the information collected on nonresident anglers can be used to identify management actions that may be most effective in meeting management goals and have the least impact on participating anglers.

From a methodological standpoint, the results of this study provide additional empirical support for the use of verified measures of specialization and motivations to segment large angling populations into subgroups having managerial significance (Chipman and Helfrich 1988; Ditton 1996; Fisher 1997). In addition, my results highlight the benefits of using a multivariate approach to angler segmentation when little prior knowledge exists for a given angler population. Although previous research suggests that the level of participation (days fished) in the past twelve months and number of years of sport fishing experience may be the most important specialization dimensions (Graefe 1980; Ditton 1992), Chipman and Helfrich (1988) and Fisher (1997) suggest that neither dimension accounts for enough variability on its own to accurately define specialization, and advocate using a multivariate approach to angler segmentation. By utilizing a combination of several verified measures of specialization as well as primary fishing motivation variables to identify angler groups, the multivariate approach taken in this study allowed me to identify angler groupings that are likely to be more robust (Fisher 1997) and to provide ADF&G with a more complete understanding of the nature of the angler segments.

Combining empirical-based segmentation with a fishery-based approach in the same study is another important aspect of this research effort. By using this approach, I was able to provide ADF&G with a description of the overall nonresident angler market as well as information on nonresident participation at the fishery level. Ditton (1996) noted that integration of angler segmentation and marketing with the species-specific orientation of most fisheries is one of the most difficult problems currently facing management agencies that recognize the need for a marketing perspective. This study demonstrates that combining empirical segmentation with a fishery-based approach may be one way to address this problem.

Although the number of fisheries that can be described using a statewide mail survey approach is limited by overall sample size and will be limited to fisheries with the greatest amount of use, this approach has particular merit when compared to the expense of on-site creel surveys. It is unlikely that this approach will eliminate the need for on-site angler surveys in Alaska, particularly for intensively-managed fisheries. However, this approach may reduce the need for such surveys and provide the agency with more information and greater flexibility to examine angler participation on a variety of scales (i.e., statewide, by region, fishery, species, or other aggregates of fishery location, species). Once the information gathered in this survey is combined with similar data on resident anglers, ADF&G will have a more complete picture of the relative demand for various types of fishing experiences sought in Alaska and the characteristics of anglers fishing in particular regions or fisheries in the state which can be used to inform management decisions.

Suggestions for Future Research

This study represents the first step toward a more comprehensive understanding of the angling public in Alaska. Future research should be pursued to determine the number and relative size of *resident* angler segments and examine: a) the extent to which resident subgroups differ with regard to fishing behaviors, motivations, preferences, management attitudes, and other characteristics, b) whether resident and nonresident anglers participating in specific fisheries share similar fishing behaviors, preferences, and

management attitudes, and c) whether resident and nonresident anglers participating in the same fishery share similarities regarding the importance of various fishery attributes. This information will provide ADF&G with a more complete understanding of the diversity that exists within the Alaska sport fishing market and allow the agency to determine an appropriate mix of fishing opportunities for the different anglers fishing in Alaska.

Additional analyses also need to be conducted to determine if there are specific gear, species, or location preferences among the different nonresident angler segments. Species preference(s) could be assessed by examining the species different angler types targeted at fishing sites they visited. Location preference might be assessed by examining fisheries locations most frequently visited by each segment and should help identify groups of fisheries that share similar characteristics and appeal to particular angler segments. Additional analyses also should be performed to examine the mix of fishery types visited by anglers who participated in more than one fishery in Alaska. Much of the information needed for these analyses was collected in this research effort. However, limitations on time and resources prevented me from pursuing these analyses, so they are not included in this report. Future reports prepared for ADF&G will include these analyses.

Finally, additional analyses should be conducted to identify which specialization dimensions are most important in identifying angler segments having different fishing behaviors and preferences. Although a multivariate approach is still recommended, it is likely that some variables contributed relatively little to the differentiation of nonresident angler segments and could be eliminated in subsequent studies. This would help to reduce the overall length and complexity of future surveys, which may improve survey response and lower costs.

Conclusion

The results of this study demonstrate that Alaska's nonresident sport fishing market is fairly diverse, consisting of at least five different angler segments with distinct participation characteristics, varying resource dependency, and distinguishable fishing

preferences. The study provides ADF&G with empirical data that can be used to evaluate the potential effects of management actions at statewide, regional and fishery levels. When combined with similar information on resident anglers, other stakeholders, and relevant biological information, the data provided by this study will help the agency evaluate current and future management actions, and assist the agency's planning and policy decisions.

Although the interests of nonresident anglers are likely to be secondary to the interests and concerns of resident stakeholders in the fishery management process in Alaska, ADF&G can only benefit from managing sport fisheries in Alaska in ways that are consistent with the interests and preferences of both resident AND nonresident anglers, particularly the various subgroups that exist within these larger populations. A marketing approach aimed at providing different groups of anglers with fishing opportunities that are consistent with their interests should be encouraged. This approach will not only lead to greater satisfaction among anglers, but a more efficient and effective allocation of the sport fishery resources in Alaska.

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APPENDIX A. Respondents by Fishery Location

Table 56. Number of unique respondents per Alaska fishery location organized by survey area.

Alaska Survey Area	Site Code	Location	Unique Respondents
Ketchikan Area			
A	0001	East/West Behm Canals	104
A	0002	Clarence Strait	114
A	0003	Revilla Channel	158
A	0004	Thomas Basin	5
A	0005	Mountain Point	19
A	0006	Clover Pass	54
A	0007	Carrol Inlet	5
A	0008	Neets Bay	17
A	0009	Bell Island	21
A	0010	Other saltwater areas (specify)	52
A	0011	Freshwater (specify)	36
Prince of Wales Island			
B	0001	Sumner Strait (west of Zarembo Is.)	26
B	0002	West Prince of Wales Island	137
B	0003	Other saltwater (specify)	88
B	0004	Thorne River	37
B	0005	Klawock River	14
B	0006	Karta River	7
B	0007	Other freshwater (specify)	17
Kake/Petersburg/Wrangell/Stikine Area			
C	0001	Frederick Sound	55
C	0002	Wrangell Area-Clarence Strait	44
C	0003	Wrangell Narrows	28
C	0004	Blind Slough	24
C	0005	Other saltwater (specify)	35
C	0006	Freshwater (specify)	13
Sitka Area			
D	0001	Sitka Sound/Vitskari Is.	317
D	0002	Salisbury Sound	81
D	0003	Other saltwater (specify)	151
D	0004	Sitka road system freshwater	4
D	0005	Other Freshwater (specify)	13

Table 56. (cont.). Number of unique respondents per Alaska fishery location organized by survey area.

Juneau Area			
E	0001	Doty Cove to Berners Bay	149
E	0002	Other Juneau road system saltwater	46
E	0003	Gastineau Hatchery DIPAC	29
E	0004	Other saltwater (specify)	171
E	0005	Turner Lake	5
E	0006	Hasselborg Lake	3
E	0007	Juneau road system freshwater	18
E	0008	Other freshwater (specify)	32
Haines-Skagway Area			
F	0001	Taiya Inlet (Skagway)	73
F	0002	Chilkat Inlet	14
F	0003	Chilkoot Inlet	20
F	0004	Other Saltwater (specify)	20
F	0005	Chilkoot River	52
F	0006	Chilkat River	22
F	0007	Other freshwater	16
Glacier Bay Area			
G	0001	Glacier Bay	53
G	0002	Icy Straits	65
G	0003	Other saltwater (specify)	5
G	0004	Freshwater (specify)	7
Yakutat Area			
H	0001	Yakutat Bay	75
H	0002	Cape Suckling to Cape Fairweather saltwa	19
H	0003	Situk River	129
H	0004	Tsiu River	11
H	0005	Lost River	36
H	0006	Alsek River	7
H	0007	Other freshwater (specify)	15

Table 56. (cont.). Number of unique respondents per Alaska fishery location organized by survey area.

Glenallen Area			
I	0001	Gulkana River	114
I	0002	Klutina River	75
I	0003	Tonsina river	13
I	0004	Lake Louise	22
I	0005	Paxson Lake	10
I	0006	Other freshwater (specify)	76
I	0000	Bremner River (see J 0275)	10
Prince William Sound			
J	0001	Valdez Bay	245
J	0002	Passage Canal	20
J	0003	Other Prince William Sound saltwater	224
J	0004	Eyak River	13
J	0005	Other freshwater (specify)	47
Knik Arm Drainage			
K	0001	Little Susitna River	122
K	0002	Big Lake	13
K	0003	Other freshwater lakes (specify)	33
K	0004	Other rivers/streams (specify)	14
K	0005	Saltwater (specify)	1
Anchorage Area			
L	0001	Ship Creek	159
L	0002	Bird Creek	65
L	0003	Campbell Creek	8
L	0004	Twentymile River	12
L	0005	Eagle River	20
L	0006	Other freshwater (specify)	36
L	0007	Saltwater (specify)	7
East Susitna River Drainage			
M	0001	Willow Creek	139
M	0002	Montana Creek	111
M	0003	Talkeetna River and Tributaries	172
M	0004	Sheep Creek	45
M	0005	Other freshwater (specify)	58

Table 56. (cont.). Number of unique respondents per Alaska fishery location organized by survey area.

West Cook Inlet/West Susitna River Drainages			
N	0001	Lake Creek	76
N	0002	Deshka River	27
N	0003	Alexander Creek/Lake	37
N	0004	Other freshwater (specify)	159
N	0005	Saltwater (specify)	40
Kenai Peninsula --Saltwater Areas			
P	0001	Resurrection Bay (Seward)	595
P	0002	Anchor River, Whiskey Gulch, Deep Creek, and Ninilchik-Saltwater	643
P	0003	Homer Spit-shoreline	367
P	0004	Other Kachemak Bay	460
P	0005	Other Cook Inlet-West of Gore Point	442
P	0006	Gulf of Alaska-East of gore Point	95
Kenai Peninsula --Freshwater Areas			
P	0007	Russian River	439
P	0008	Kenai River	1735
P	0009	Kasilof River	266
P	0010	Anchor River	95
P	0011	Ninilchik River	105
P	0012	Deep Creek	121
P	0013	Other rivers/streams (specify)	75
P	0014	Other lakes (specify)	89
Kodiak Area			
Q	0001	Chiniak Bay saltwater	51
Q	0002	Afognak Island saltwater	42
Q	0003	Other saltwater (specify)	77
Q	0004	Buskin River	42
Q	0005	Ayakulik River	17
Q	0006	Karluk River and Lagoon	34
Q	0007	Pasagshak River	38
Q	0008	Other freshwater (specify)	41

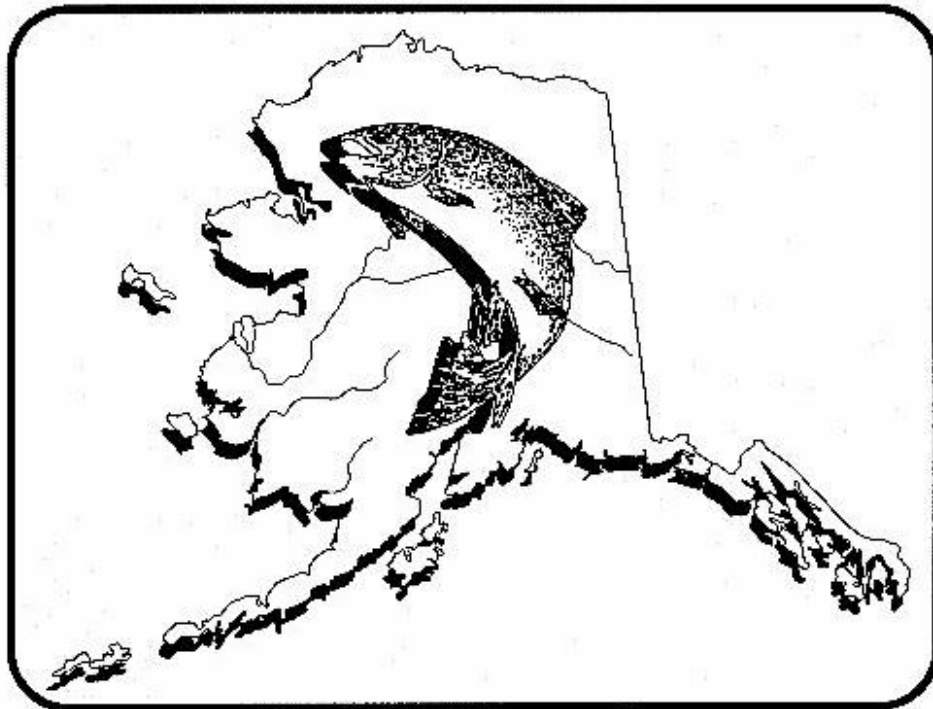
Table 56 (cont.). Number of unique respondents per Alaska fishery location organized by survey area.

Naknek River Drainage--Alaska Peninsula Area			
R	0001	Naknek River	90
R	0002	Brooks River	45
R	0003	Brooks Lake	9
R	0004	Other freshwater (specify)	74
R	0005	Saltwater (specify)	36
Kvichak River Drainage Area			
S	0001	Alagnak (Branch) River	81
S	0002	Newhalen River	28
S	0003	Kvichak River	42
S	0004	Talarik Creek	15
S	0005	Lake Clark drainage	29
S	0006	Other freshwater (specify)	68
S	0007	Saltwater (specify)	4
Nushagak Area			
T	0001	Nushagak River	101
T	0002	Wood River Lakes System	43
T	0003	Mulchatna River	33
T	0004	Other freshwater (specify)	55
T	0005	Saltwater (specify)	2
Tanana River Drainage Area			
U	0001	Chena River	92
U	0002	Piledriver Slough	7
U	0003	Salcha River	13
U	0004	Quartz Lake	16
U	0005	Birch Lake	11
U	0006	Other rivers/creeks (specify)	72
U	0007	Other lakes (specify)	56
Kuskokwim River Drainage Area			
V	0001	Aniak river	29
V	0002	Kanektok River	41
V	0003	Goodnews River	13
V	0004	Kisaralik River	7
V	0005	Other freshwater (specify)	28

Table 56 (cont.). Number of unique respondents per Alaska fishery location organized by survey area.

Seward Peninsula--Norton Sound Area			
W	0001	Nome River	5
W	0002	Unalakleet River	15
W	0003	Other freshwater (specify)	18
W	0004	Saltwater (specify)	13
Northwest Alaska Area			
X	0001	Kobuk River	7
X	0002	Noatak River	7
X	0003	Other freshwater (specify)	4
X	0004	Saltwater (specify)	1
Yukon River Drainage Area			
Y	0001	Yukon River (Fort Yukon to Canadian border)	3
Y	0002	Yukon River (Koyukuk River to Fort Yukon)	5
Y	0003	Yukon River (downstream from Koyukuk R.)	4
Y	0004	Other rivers/streams (specify)	29
Y	0005	Other lakes (specify)	7
North Slope--Brooks Range Area			
Z	0001	Sagavanirktok River	3
Z	0002	Other Haul Road Streams (specify)	5
Z	0003	Other freshwater (specify)	7

FISHING IN ALASKA



NONRESIDENT ANGLER PREFERENCES AND OPINIONS

It is very important that this questionnaire be completed by the person to whom it is addressed. Please try to answer what you believe to be true for you. The best answers are the ones which most closely reflect your own feelings, opinions, experiences, and knowledge.

Please return your completed questionnaire in the enclosed envelope.

INSTRUCTIONS

This questionnaire has four sections:

- Section 1: Recent Visits and Fishing Activity
- Section 2: Fishing Experience and Preferences
- Section 3: Sport Fishing Management
- Section 4: Demographic Information

Instructions for Completing this Questionnaire

Most of our questions ask about your recent sport fishing activities in Alaska. What we are looking for is your **best recollection** of these sport fishing activities. We are also interested in knowing your fishing preferences and opinions regarding the management of sport fishing in Alaska. Please answer all questions to the best of your ability.

Your Participation is Needed to Maintain Sport Fishing Opportunities in Alaska

SPORT ANGLERS LIVING OUTSIDE THE UNITED STATES: The postage permit that we have for return mail is good only in the United States. However, it is very important that anglers who do not live in the United States return their surveys to us. Therefore, we ask that you supply your own postage in order to return the survey questionnaire. We hope that you will consider this postage as an additional contribution towards sound management of Alaska's sport fisheries. Thank you for your cooperation and support.

Mark all checkboxes in this survey by placing an "x" in the appropriate box. Please do not allow marks to stray into other boxes if possible.

SECTION I Recent Visits and Fishing Activity

Q--1. How many separate visits have you made to Alaska each year since 1995? (For each year, please write in below, the total number of visits in column 1 and then the number of visits by purpose in columns 2, 3, and 4. For years in which NO visits were made, please enter "0" in column 1.)

Year	Alaska Visits by Purpose			
	(1) TOTAL ALASKA Visits	(2) Visits <u>without</u> fishing	(3) Visits <u>primarily</u> for fishing	(4) Visits primarily made for other purposes (business, hunting, sightseeing) <u>but</u> fished while there
1997				
1996				
1995				

The following questions refer to your most recent visit to Alaska that included time spent sport fishing. A visit begins when you enter the state and ends when you leave the state.

Q--2. When was your most recent visit to Alaska that included time spent sport fishing?
 a. Date (or approximate date) arrived in Alaska _____
 (month/day/year)
 b. Date (or approximate date) departed from Alaska _____
 (month/day/year)

Q--3. Which mode(s) of transportation were used to get to Alaska on this particular visit? (Mark as many boxes as apply. DO NOT include transportation after you arrived in Alaska.)

<input type="checkbox"/> Commercial airplane	<input type="checkbox"/> Cruise ship
<input type="checkbox"/> Private airplane	<input type="checkbox"/> Camper/RV
<input type="checkbox"/> Ferry	<input type="checkbox"/> Personal vehicle
<input type="checkbox"/> Private boat	<input type="checkbox"/> Other: _____

Q--4. What type(s) of sport fishing license did you use during your most recent visit to Alaska that included time spent sport fishing? (If you used more than one license during this visit, please mark all boxes that apply.)

<input type="checkbox"/> 1-day fishing license--\$10	<input type="checkbox"/> Annual nonresident fishing license-\$50
<input type="checkbox"/> 3-day fishing license--\$15	<input type="checkbox"/> Annual nonresident fishing and hunting license--\$135
<input type="checkbox"/> 14-day fishing license--\$30	

Q--5. Did you use a king salmon tag during your most recent visit to Alaska that included time spent sport fishing?

No → If "No", Skip to Question 6.
 Yes

↓

If "Yes", please indicate what type of king salmon stamp you used (or purchased):

<input type="checkbox"/> Nonresident 1-day tag--\$10
<input type="checkbox"/> Nonresident 3-day tag--\$15
<input type="checkbox"/> Nonresident 14-day/annual tag--\$35

Q--6. How likely are you to return to Alaska to go sport fishing within the next three years?

	Very Unlikely	Unlikely	Unsure	Likely	Very Likely
.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q--7. Which of the following best describes the primary reason for making your most recent visit to Alaska that included time spent sport fishing? (Mark the box next to the one most appropriate answer.)

- Went to Alaska primarily to fish
- Went to Alaska primarily to hunt--fished while there
- Went to Alaska primarily on business--fished while there
- Went to Alaska primarily to visit relatives/friends--fished while there
- Vacationed in Alaska primarily to do other things--fished while there
- I did not fish in Alaska during 1997



If you did not sport fish in Alaska in 1997, please skip to Section 4 (page 22)

Q--8. With whom did you fish during your most recent visit to Alaska that included time spent fishing? (Mark all that apply.)

- Family/friends who live in Alaska.
- Family/friends traveling with me.
- People I work with/business associates.
- I fished alone.
- Other: _____

Q--9. Below is a list of possible reasons for sport fishing in Alaska. Please indicate how important each one was in your decision to sport fish in Alaska. (Please mark one box for each reason.)

REASON FOR FISHING IN ALASKA	UNIMPORTANT	SOMEWHAT IMPORTANT	IMPORTANT	VERY IMPORTANT	EXTREMELY IMPORTANT
To fish with family or friends .	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To obtain fish to eat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To experience a new activity .	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To fish waters surrounded by pleasant scenery	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To explore new fishing areas .	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To catch new or unique types of fish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To take fish home to share with family or friends	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To fish in a wilderness setting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To catch trophy-size fish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q--10. Did you take or ship home (out of Alaska) any fish that you caught in 1997?

- No → If "No", Skip to Question 11.
- Yes

If "Yes", for the following types of fish, please write in the approximate number of fish transported (or shipped) out of Alaska. (If no fish of a given type were transported please enter "0" for that type of fish.)

	<u>NUMBER OF FISH transported/shipped out of Alaska</u>	
King (chinook) salmon	_____	
Sockeye (red) salmon	_____	(Please record <u>number of fish</u> , not pounds)
Silver (coho) salmon .	_____	
Other salmon	_____	
Halibut	_____	

Q--11. Please estimate the total number of days you spent sport fishing in each of the following locations during the past year (Jan-Dec 31, 1997). (Count each partial day of fishing as one day and write in the estimated total on the blank line.)

Number of days fished in Alaska . _____

Number of days fished in other states/provinces/countries _____

Number of days fished near home _____

Q—12. Please tell us about your 1997 Alaska sport fishing. For each fishery you visited, please record the following.

- 1) In the **FISHERY RECORD** grid: Write the area and the specific location fished and the type of fish targeted.
 - 2) In the **ANNUAL DAYS FISHED** grid: Write the total number of days fished and total guided days fished by fishery under the appropriate period (Jan-Apr, May, June, etc.).
- A FISHERY is defined as a location plus a target species, for example: Kenai River—king salmon or Kenai River—rainbow trout. Please use one line for each target species at the same location.
 - A GUIDED DAY includes fishing on a charter boat or in the company of an individual who assisted you in the taking of sport fish in exchange for a fee.

EXAMPLE: J. Fisher made two visits to Alaska in 1997—one in late May and another in early September. During her May visit, she spent three days at the Kenai River. The first day, she fished for king salmon with a local guide. The remaining two days were spent fishing for rainbow trout with friends. Following a business trip in September, Ms. Fisher spent an additional two days fishing the Kenai River for rainbow trout. Her Alaska sport fishing experiences are recorded in the example lines in the table below.

*Please record your total days fished and guided days fished in the appropriate monthly periods below (May, June, etc.).

FISHERY RECORD

Use one line per fishery (target species + location). If no target at a given location, use “X” = “no target”.

TARGET SPECIES Fill in one species per line (see codes below)	AREA FISHED (see maps)	LOCATION FISHED (use map codes or write in the location if not listed)	
Example:			→
Example:			
			→
			→

ANNUAL DAYS FISHED (for each Fishery listed on the facing page)

JAN-APR		MAY		JUNE		JULY		AUGUST		SEPT-DEC	
Total Days	Guided Days	Total Days	Guided Days	Total Days	Guided Days	Total Days	Guided Days	Total Days	Guided Days	Total Days	Guided Days

TARGET SPECIES CODES

KS = King (Chinook) Salmon
 RS = Red (Sockeye) Salmon
 SS = Silver (Coho) Salmon
 PS = Pink (Humpback) Salmon
 CS = Chum (Dog) Salmon
 S = Any Sea-run Salmon

HA = Halibut
 LC = Lingcod
 RF = Rockfish (“Sea Bass”)
 LL = Land-Locked Salmon
 SH = Steelhead trout
 RT = Rainbow trout

CT = Cutthroat Trout
 BT = Brook Trout
 DV = Dolly Varden/Arctic Char
 LT = Lake Trout
 GR = Arctic Grayling

TARGET SPECIES CODES (CONTINUED)

BB = Burbot
 WF = Whitefish
 SF = Sheefish
 NP = Northern Pike
 SM = Smelt/Hooligan/Capelin
 OF = Other fin fish
 RC = Razor Clams
 OS = Other Shellfish
 X = No target

Continue on the following page, if necessary.

SECTION 2

Fishing Experience and Preferences

Next, we would like to ask you a few questions about your sport fishing background and preferences related to sport fishing in Alaska. This information will help the Alaska Department of Fish and Game provide sport fishing opportunities that match the desires of Alaska's diverse angling interests.

Q--13. How many years have you fished in Alaska or elsewhere? (*Write in total number of years.*) . . . _____Years

Q--14. What types of sport fishing did you engage in during the past year (in Alaska or elsewhere)? (*Mark as many as apply.*)

- | | |
|--|---|
| <input type="checkbox"/> Ice fishing | <input type="checkbox"/> Shore/bank fishing |
| <input type="checkbox"/> Fly fishing | <input type="checkbox"/> Fishing from a boat or raft |
| <input type="checkbox"/> Artificial lure/spin casting | <input type="checkbox"/> Float tube |
| <input type="checkbox"/> Bait fishing | <input type="checkbox"/> Other (please specify) _____ |
| <input type="checkbox"/> Saltwater fishing from a boat | |

Q--15. On a scale of 1 to 10, how important is fishing as source of satisfaction in your life? (*Please circle the most appropriate number.*)

NOT AT ALL IMPORTANT 1 2 3 4 5 6 7 8 9 10 EXTREMELY IMPORTANT

Yes No

Q--16. Are you a member of a fishing club or sporting organization? . . .

Q--17. Do you subscribe to any sport fishing magazines?

Q--18. How would you rate your expertise as an angler?

Beginner Intermediate Advanced Don't Know

- .

Q--19. In general, how satisfied were you with your 1997 sport fishing experiences in Alaska?

- Very Dissatisfied
- Somewhat Dissatisfied
- Somewhat Satisfied
- Very Satisfied

Q-20. What would have made your Alaska sport fishing more satisfying?

Q--21. Do you own or work for a sport fishing-related business in Alaska?

- No \longrightarrow If "No," Skip to Question 22.
- Yes

If "Yes," what type(s) of business(es) do you own or work for? (*Mark all that apply.*)

- Guide service
- Sport fishing lodge
- Charter boat
- Other: _____

Q--22. In order to improve fishing opportunities, we need to know what factors are important to you in selecting where to sport fish in Alaska. (For each characteristic below, please mark one box indicating how important the characteristic is to you when selecting where to fish.)

In deciding where to sport fish during my recent visit(s) to Alaska, I considered . .

	UNIMPORTANT	SOMEWHAT IMPORTANT	IMPORTANT	VERY IMPORTANT	EXTREMELY IMPORTANT
Chance to catch large or trophy-sized fish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Natural beauty of the area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Being in an area with few other anglers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chance to catch a variety of fish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Availability of guiding services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Being in a wilderness area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Having a good chance to catch a daily bag limit . . .	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Availability of campground/cabin facilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Presence of favorite (preferred) types of fish. .	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Opportunity for solitude . .	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Catch rate of keepable fish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

In deciding where to sport fish during my recent visit(s) to Alaska, I considered . .

	UNIMPORTANT	SOMEWHAT IMPORTANT	IMPORTANT	VERY IMPORTANT	EXTREMELY IMPORTANT
Catch rate of <u>all</u> fish . .	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
An area with fly-in access	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not having to travel a long time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Familiarity with the area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Boat launching facilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chance to catch wild fish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bank fishing opportunity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nearness to second home or cabin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Accessibility	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Opportunities to view wildlife	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q--23. Below is a list of possible reasons for fishing. Please tell us how important each one is to you as reason for fishing. (*Please mark the most appropriate box for each reason.*)

Reason for Fishing	UNIMPORTANT	SOMEWHAT IMPORTANT	IMPORTANT	VERY IMPORTANT	EXTREMELY IMPORTANT
Testing and using my fishing equipment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Experiencing natural surroundings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Obtaining fish to eat.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Developing my fishing skills.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
For the stimulation and excitement of fishing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Releasing or reducing built-up tensions while I fish.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competing against other anglers (e.g. fishing tournaments or derbies).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Being on my own.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Catching <i>any</i> fish.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Being with friends or family	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sharing what I know about fishing with others.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Learning more about fish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Getting away from other people.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Catching trophy fish.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
For the challenge or sport of fishing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q--24. How important is catching fish for you? For each of the following statements about catching fish please tell us how strongly you agree or disagree? (*Please mark one box for each statement*)

Statement	STRONGLY DISAGREE	DISAGREE	NEITHER AGREE OR DISAGREE	AGREE	STRONGLY AGREE
A successful fishing trip is one in which I catch many fish.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I like to fish where there are several kinds of fish to catch.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Keeping the fish I catch is more enjoyable than releasing them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Catching a trophy fish is the biggest reward for me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A fishing trip can be successful even if I catch no fish.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A full stringer is the best indicator of a good fishing trip.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
When I go fishing, I'm not satisfied unless I catch at least something.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bringing fish home to the table is an important outcome of fishing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The more fish I catch, the happier I am.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I'm just as happy if I don't keep the fish I catch.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The bigger the fish I catch, the better the trip.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
When I go fishing, I'm just as happy if I don't catch a fish.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am happiest with a fishing trip when I catch fish that are hard to catch and land.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SECTION 3

Sport Fishing Management

If you purchased a 1997 king salmon tag in 1997, please answer the following questions. (If you did not fish for king salmon, please skip to Question 27 on the next page.)

Q--25. Which type of 1997 nonresident sport fishing license did you purchase? (if more than 1 type, check the most expensive.)

- 1-day license.....\$10
- 3-day license.....\$15
- 14-day license.....\$40
- Annual fishing.....\$50
- Annual hunting and fishing...\$135

a. If the fee for each license type was \$10 more, would you have (check one box)?

- Not visited Alaska---**please skip to Question 26.**
- Visited Alaska, but not purchased a fishing license---**please skip to Question 26.**
- Purchased a 1-day license for \$20
- Purchased a 3-day license for \$25
- Purchased a 14-day license for \$50
- Purchased an Annual fishing for \$60
- Purchased an Annual hunting and fishing for \$145

b. If the fee for each license type was \$20 more, would you have (check one box)?

- Not visited Alaska---**please skip to Question 26.**
- Visited Alaska, but not purchased a fishing license---**please skip to Question 26.**
- Purchased a 1-day license for \$30
- Purchased a 3-day license for \$35
- Purchased a 14-day license for \$60
- Purchased an annual fishing for \$70
- Purchased an annual hunting and fishing for \$155

c. What is the maximum amount more you would be willing to pay for the type of Alaska sport fishing license you purchased in 1997? \$ _____MORE

Q--26. Which type of 1997 king salmon tag did you purchase? (if more than 1 type, check the most expensive.)

- 1-day tag.....\$10
- 3-day tag.....\$20
- 14-day/annual tag....\$35

a. If the fee for each king tag type was \$10 more, would you have (check one box)?

- Not visited Alaska---**please skip to Question 27.**
- Visited Alaska, but not purchased a king tag---**please skip to Question 27.**
- Purchased a 1-day tag for \$20
- Purchased a 3-day tag for \$30.
- Purchased a 14-day/annual tag for \$45.

b. If the fee for each king tag type was \$20 more, would you have (check one box)?

- Not visited Alaska---**please skip to Question 27.**
- Visited Alaska, but not purchased a king tag---**please skip to Question 27.**
- Purchased a 1-day tag for \$30
- Purchased a 3-day tag for \$40
- Purchased a 14-day/annual tag for \$55

c. What is the maximum amount more you would be willing to pay for the type of Alaska king salmon tag you purchased in 1997? \$ _____MORE

The following questions ask you to indicate if specific annual harvest levels for certain types of fish would affect your decision to sport fish in Alaska. (These proposals would limit the total number of fish one could keep each year, not the number of fish one could catch and release.)

Q--27. In some areas of Alaska, there are currently limits on the number of king salmon an angler can harvest in a year. However, there is no statewide annual harvest limit for king salmon (or any other type of fish). Thinking back on your 1997 visit(s) to Alaska, how would a statewide annual harvest limit of 6 king salmon have affected your sport fishing? (Please mark only one box.)

- Would not have fished in Alaska → Skip to Question 28.
- Would not have fished for King Salmon → Skip to Question 28.
- No effect



a) How would a statewide annual harvest limit of 3 king salmon have affected your sport fishing in 1997? (Mark one box.)

- Would not have fished in Alaska → Skip to Question 28.
- Would not have fished for King Salmon → Skip to Question 28.
- No effect



b) How would a statewide annual harvest limit of 1 king salmon have affected your sport fishing in 1997? (Mark one box.)

- Would not have fished in Alaska
- Would not have fished for King Salmon
- No effect

Q--28. The following questions ask you to indicate whether specific limits on the total number of all salmon you could harvest would have affected your decision to sport fish in Alaska. (These proposals would limit the total number of salmon one could keep each year, not the number one could catch and release.)

a) Thinking back on your 1997 visit(s) to Alaska, how would a statewide annual harvest limit of 50 total salmon have affected your sport fishing? (Please mark only one box.)

- Would not have fished in Alaska → Skip to Question 29.
- Would have spent more time fishing for other types of fish
- No effect



b) How would a statewide annual harvest limit of 30 total salmon have affected your sport fishing in 1997? (Mark only one box.)

- Would not have fished in Alaska → Skip to Question 29.
- Would have spent more time fishing for other types of fish
- No effect



c) How would a statewide annual harvest limit of 10 total salmon have affected your sport fishing? (Mark only one box.)

- Would not have fished in Alaska
- Would have spent more time fishing for other types of fish
- No effect

Q--29. Thinking back on your 1997 visit(s) to Alaska, how would a statewide annual harvest limit of 12 halibut have affected your sport fishing? (Please mark only one box.)

- Would not have fished in Alaska → Skip to Question 30.
- Would not have fished for halibut → Skip to Question 30.
- No effect



a) How would a statewide annual harvest limit of 8 halibut have affected your sport fishing in 1997? (Mark one box.)

- Would not have fished in Alaska → Skip to Question 30.
- Would not have fished for halibut → Skip to Question 30.
- No effect



b) How would a statewide annual harvest limit of 4 halibut have affected your sport fishing in 1997? (Mark one box.)

- Would not have fished in Alaska
- Would not have fished for halibut
- No effect

Q--30. Next, we would like to know your opinion on how limits on sport fishing should be implemented in Alaska. (For each of the following statements, please mark one box that indicates the degree of your agreement or disagreement with the statement.)

	STRONGLY DISAGREE	DISAGREE	NEITHER AGREE OR DISAGREE	AGREE	STRONGLY AGREE
Annual (sport) harvest limits for <u>residents</u> and <u>nonresidents</u> should be the same. . .	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Annual (sport) harvest limits for <u>resident anglers</u> should be <u>higher</u> than annual harvest limits for <u>nonresident anglers</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Annual (sport) harvest limits for <u>resident anglers</u> should be <u>lower</u> than annual harvest limits for <u>nonresident anglers</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q--31. The number of anglers participating in Alaska's sport fisheries has increased considerably in the past decade. As a result, some anglers have requested that limits be set on the number of people that may participate in some fisheries in Alaska to provide opportunities for high quality sport fishing experiences.

Do you think limits should be set on the number of people that can participate in certain sport fisheries in Alaska in order to provide opportunities for high quality sport fishing experiences?

- Yes
- No
- Uncertain

Q--32. What is your general impression of how well the Alaska Department of Fish and Game is doing its job of managing Alaska's sport fisheries? (Please check one box.)

- Excellent ("A")
- Good ("B")
- Fair ("C")
- Poor ("D")
- Very Poor ("F")
- Not Sure

SECTION 4 Demographic Information

Q--33. In which U.S. state, Canadian province, or country do you permanently reside?



Q--34. In what year were you born? _____

Any additional comments you may have will be greatly appreciated:

Please return your completed questionnaire in the enclosed
postage-paid envelope to:

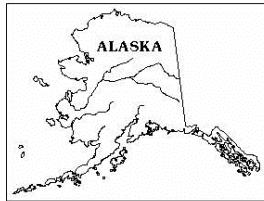
Alaska Department of Fish and Game
Division of Sport Fish
Research and Technical Services
333 Raspberry Road
Anchorage, AK 99518-1599
attn: Allen Howe



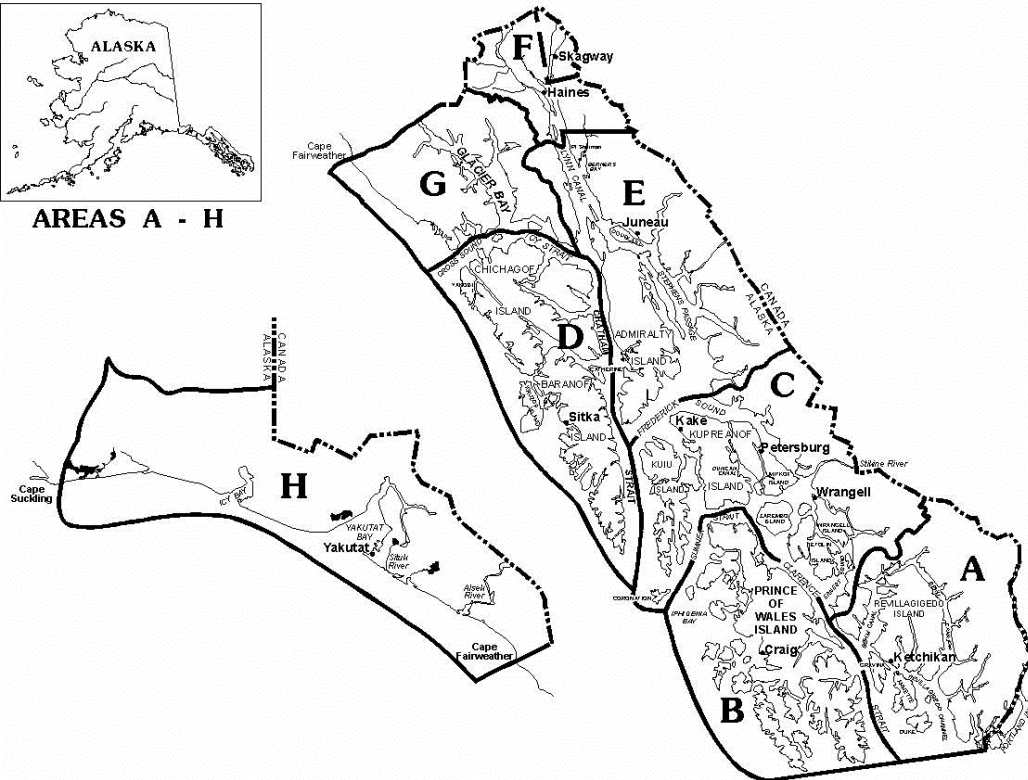
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APPENDIX C. Map and Fishing Site Inserts

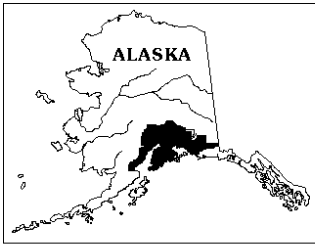
SOUTHEAST ALASKA



AREAS A - H

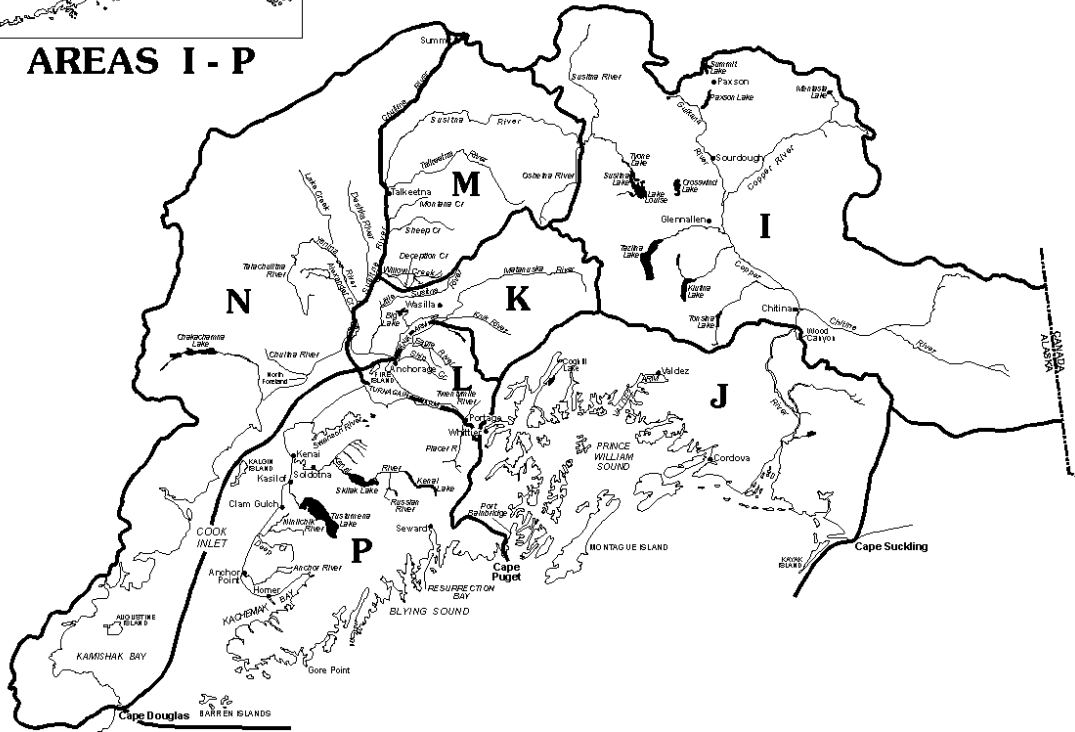


Area Codes	Southeast Alaska Fishing Locations	
<p>A Ketchikan Area</p> <ul style="list-style-type: none"> A-1 East/West Behm Canals A-2 Clarence Strait A-3 Revilla Channel A-4 Thomas Basin A-5 Mountain Point A-6 Clover Pass A-7 Carrol Inlet A-8 Neets Bay A-9 Bell Island A-10 Other saltwater areas (specify) A-11 Freshwater (specify) <p>B Prince of Wales Island</p> <ul style="list-style-type: none"> B-1 Sumner Strait (west of Zarembo Island) B-2 West Prince of Wales Island B-3 Other saltwater (specify) B-4 Thorne River B-5 Klawock River B-6 Karta River B-7 Other freshwater (specify) 	<p>C Kake/Petersburg/Wrangell/Stikine Area</p> <ul style="list-style-type: none"> C-1 Frederick Sound C-2 Wrangell Area--Clarence Strait C-3 Wrangell Narrows C-4 Blind Slough C-5 Other saltwater (specify) C-6 Freshwater (specify) <p>D Sitka Area</p> <ul style="list-style-type: none"> D-1 Sitka Sound/Vitskari Is. D-2 Salisbury Sound D-3 Other saltwater (specify) D-4 Sitka road system freshwater (specify) D-5 Other Freshwater (specify) <p>E Juneau Area</p> <ul style="list-style-type: none"> E-1 Doty Cove to Berners Bay (specify) E-2 Other Juneau road system saltwater (specify) E-3 Gastineau Hatchery DIPAC E-4 Other saltwater (specify) E-5 Turner Lake E-6 Hasselborg Lake E-7 Juneau road system freshwater (specify) E-8 Other freshwater (specify) 	<p>F Haines-Skagway Area</p> <ul style="list-style-type: none"> F-1 Taiya Inlet (Skagway) F-2 Chilkat Inlet F-3 Chilkoot Inlet F-4 Other Saltwater (specify) F-5 Chilkoot River F-6 Chilkat River F-7 Other freshwater (specify) <p>G Glacier Bay Area</p> <ul style="list-style-type: none"> G-1 Glacier Bay G-2 Icy Straits G-3 Other saltwater (specify) G-4 Freshwater (specify) <p>H Yakutat Area</p> <ul style="list-style-type: none"> H-1 Yakutat Bay H-2 Cape Suckling to Cape Fairweather saltwater H-3 Situk River H-4 Tsiu River H-5 Lost River H-6 Alsek River H-7 Other freshwater (specify)



SOUTHCENTRAL ALASKA

AREAS I - P



Southcentral Alaska Fishing Locations

Area Codes

I Glennallen Area

- I-1 Gulkana River
- I-2 Klutina River
- I-3 Tonsina River
- I-4 Lake Louise
- I-5 Paxson Lake
- I-6 Other freshwater (specify)

J Prince William Sound

- J-1 Valdez Bay
- J-2 Passage Canal
- J-3 Other Prince William Sound saltwater
- J-4 Eyak River
- J-5 Other freshwater (specify)

K Knik Arm Drainage

- K-1 Little Susitna River
- K-2 Big Lake
- K-3 Other freshwater lakes (specify)
- K-4 Other rivers/streams (specify)
- K-5 Saltwater (specify)

L Anchorage Area

- L-1 Ship Creek
- L-2 Bird Creek
- L-3 Campbell Creek
- L-4 Twentymile River
- L-5 Eagle River
- L-6 Other freshwater (specify)
- L-7 Saltwater (specify)

M East Susitna River Drainage

- M-1 Willow Creek
- M-2 Montana Creek
- M-3 Talkeetna River and Tributaries
- M-4 Sheep Creek
- M-5 Other freshwater (specify)

N West Cook Inlet--West Susitna River Drainages

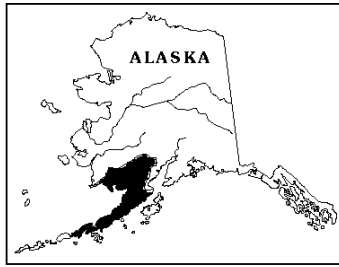
- N-1 Lake Creek
- N-2 Deshka River
- N-3 Alexander Creek/Lake
- N-4 Other freshwater (specify)
- N-5 Saltwater (specify)

P Kenai Peninsula--Saltwater Areas

- P-1 Resurrection Bay (Seward)
- P-2 Anchor River, Whiskey Gulch, Deep Creek, and Ninilchik--saltwater
- P-3 Homer Spit--shoreline
- P-4 Other Kachemak Bay
- P-5 Other Cook Inlet--West of Gore Point.
- P-6 Gulf of Alaska--East of Gore Point.

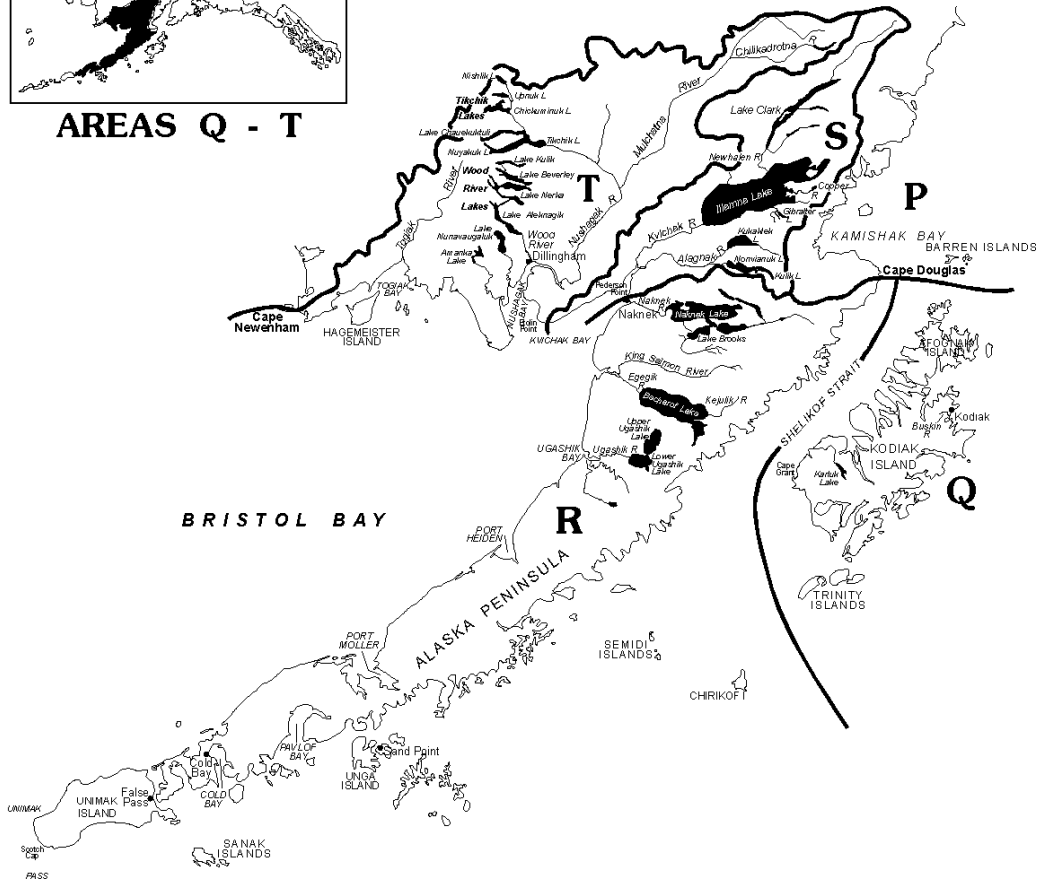
Kenai Peninsula--Freshwater Areas

- P-7 Russian River
- P-8 Kenai River
- P-9 Kasilof River
- P-10 Anchor River
- P-11 Ninilchik River
- P-12 Deep Creek
- P-13 Other rivers/streams (specify)
- P-14 Other lakes (specify)



AREAS Q - T

SOUTHWEST ALASKA



Southwest Alaska Fishing Locations

Area Codes

Q Kodiak Area

- Q-1 Chiniak Bay saltwater
- Q-2 Afognak Island saltwater
- Q-3 Other saltwater (specify)
- Q-4 Buskin River
- Q-5 Ayakulik River
- Q-6 Karluk River and Lagoon
- Q-7 Pasagshak River
- Q-8 Other freshwater (specify)

R Naknek River Drainage--Alaska Peninsula Area

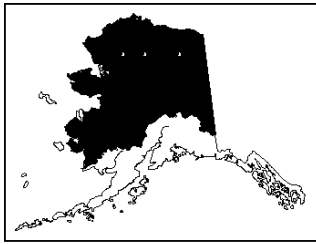
- R-1 Naknek River
- R-2 Brooks River
- R-3 Brooks Lake
- R-4 Other freshwater (specify)
- R-5 Saltwater (specify)

S

- S-1 Kvichak River Drainage Area
- S-2 Alagnak (Branch) River
- S-3 Newhalen River
- S-4 Kvichak River
- S-5 Talarik Creek
- S-6 Lake Clark drainage
- S-7 Other freshwater (specify)
- Saltwater (specify)

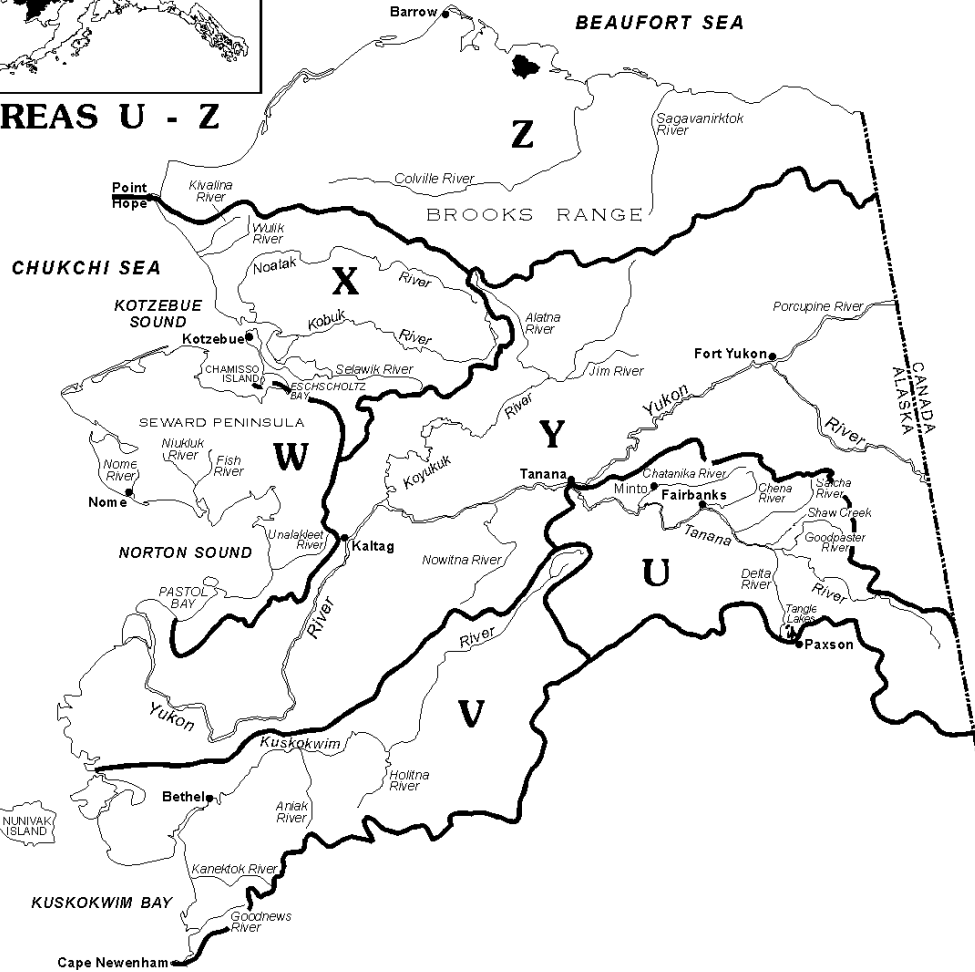
T

- T-1 Nushagak Area
- T-2 Nushagak River
- T-3 Wood River Lakes System
- T-4 Mulchatna River
- T-5 Other freshwater (specify)
- Saltwater (specify)



INTERIOR ALASKA

AREAS U - Z



Interior Alaska Fishing Locations

Area Codes

U Tanana River Drainage Area

- U-1 Chena River
- U-2 Piledriver Slough
- U-3 Salcha River
- U-4 Quartz Lake
- U-5 Birch Lake
- U-6 Other rivers/creeks (specify)
- U-7 Other lakes (specify)

V Kuskokwim River Drainage Area

- V-1 Aniak River
- V-2 Kanektok River
- V-3 Goodnews River
- V-4 Kisaralik River
- V-5 Other freshwater (specify)
- V-6 Saltwater (specify)

W Seward Peninsula-Norton Sound Area

- W-1 Nome River
- W-2 Unalakleet River
- W-3 Other freshwater (specify)
- W-4 Saltwater (specify)

X Northwest Alaska Area

- X-1 Kobuk River
- X-2 Noatak River
- X-3 Other freshwater (specify)
- X-4 Saltwater (specify)

Y Yukon River Drainage Area

- Y-1 Yukon River drainages (Fort Yukon to Canadian Border) (specify)
- Y-2 Yukon River drainages (Koyukuk River to Fort. Yukon) (specify)
- Y-3 Yukon River drainages (downstream from Koyukuk River) (specify)
- Y-4 Other rivers/streams (specify)
- Y-5 Other lakes (specify)

Z North Slope-Brooks Range Area

- Z-1 Sagavanirktok River
- Z-2 Other Haul Road Streams (specify)
- Z-3 Other freshwater (specify)
- Z-4 Saltwater (specify)

APPENDIX D. Mail Survey Cover Letters

1st Mailing Cover Letter

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

**TONY KNOWLES,
GOVERNOR**

333 Raspberry Road
Anchorage, AK 99518-
PHONE: (907) 267-2218
FAX: (907) 267-2422

[Date]

Dear Alaska Angler:

Alaska's sport fisheries are attracting an ever-growing number of anglers. Although the department routinely collects information on harvest and participation in Alaska sport fisheries, little is known about motivations, preferences, and opinions of Alaska anglers. To address this information need, the Division of Sport Fish is conducting this survey of a representative sample of anglers who purchased an Alaska sport fishing license in 1997. This information will be used to develop plans, policies, and projects to provide the diversity of opportunities the public wants.

Please take a few minutes to complete and return the enclosed questionnaire. Since a limited number of anglers have been chosen to participate, your response is very important. Even if you did not fish in 1997 or do not intend to fish Alaska in the future, the information you provide will help maintain and improve sport fishing opportunities in Alaska. Be assured that your responses will be considered confidential.

A summary of the results of this study will be available from the Alaska Department of Fish and Game following completion of the project in the winter of 1998. If you have any questions regarding this survey, please feel free to contact me at (907) 267-2369 or by e-mail at SFPub@fishgame.state.ak.us.

Sincerely,

Frank Rue
Commissioner, Alaska Dept. of Fish and Game

2nd Mailing Cover Letter

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

**TONY KNOWLES,
GOVERNOR**

333 Raspberry Road
Anchorage, AK 99518-
PHONE: (907) 267-2218
FAX: (907) 267-2422

[Date]

Dear Alaska Angler:

About six weeks ago, a questionnaire seeking input regarding your Alaska fishing activities and fishing preferences was mailed to you. However, we have yet to receive your response.

If you have recently completed and returned it to us, please accept our sincere thanks. If not, I am enclosing another copy of the questionnaire and ask that you take a few minutes to complete the survey and return it to us. Because the questionnaire has been sent to only a small, but representative, sample of persons, it is extremely important that yours also be included in the study if the results are to accurately represent the opinions of Alaska anglers.

Your name was drawn as part of a random sample of Alaska sport fishing license holders, and your answers will be reported as part of summary statistics only. If you have any questions please feel free to contact me at (907) 267-2369 or by e-mail at SFPub@fishgame.state.ak.us.

Thanks in advance for your participation.

Sincerely,

Kevin Delaney
Director, Division of Sport Fish
Alaska Dept. of Fish and Game

3rd Mailing Cover Letter

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

**TONY KNOWLES,
GOVERNOR**

333 Raspberry Road
Anchorage, AK 99518-
PHONE: (907) 267-2218
FAX: (907) 267-2422

[Date]

Dear Alaska Angler:

In March, I sent you a letter and questionnaire seeking information about your 1997 Alaska fishing experiences and preferences with regard to Alaska sport fishing and management. However, at the time of this mailing, I had not received your completed questionnaire. If you have recently sent your questionnaire, please accept my sincere thanks.

If not, I have enclosed another copy of the questionnaire and would encourage you to respond. Your name was drawn through a scientific sampling process in which only a small, representative portion of the angling population was selected. In order for the responses of this study to be representative of the opinions of all Alaska anglers, it is essential that each person in the sample return their questionnaire. It should only take a small amount of time to complete, but will be extremely valuable to the overall study.

Thank you in advance for your participation.

Sincerely,

Kevin Delaney
Director, Division of Sport Fish
Alaska Dept. of Fish and Game

VITA

William J. Romberg was born in Mt. Clemens, Michigan on April 14, 1969. He grew up on farm in Ubly, Michigan and graduated from Ubly Community Schools in 1987. William ("Bill") attended Kalamazoo College, a small, liberal arts college in Kalamazoo, Michigan, and received a B.A. in Political Science with a concentration in Environmental Studies in June of 1991.

After receiving his degree, Bill moved to Alaska to begin work as a volunteer for Alaska State Parks. From 1991 to 1996, Bill worked as a seasonal fisheries technician with the Alaska Department of Fish and Game, Division of Sport Fish in Seward, Alaska, collecting biological data on sport-caught marine bottomfish. During this time, he also worked for Alaska State Parks, U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Refuge, and the Center for Alaskan Coastal Studies.

In 1996, Bill moved to Blacksburg, Virginia to pursue a M.S. in Fisheries Science in the Department of Fisheries and Wildlife Sciences at Virginia Polytechnic Institute and State University under a cooperative agreement between the University and the Alaska Department of Fish and Game. He completed his M.S. degree in December, 1999 and returned to Alaska where he continues to work for the Alaska Department of Fish and Game, Division of Sport Fish.