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AN EXAMINATION AND COMPARISON OF CONVENTIONAL AND NON-CONVENTIONAL STREAM SALMON ANGLERS AT SIMILAR SITES

By

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ABSTRACT

AN EXAMINATION AND COMPARISON OF CONVENTIONAL AND NON-CONVENTIONAL STREAM SALMON ANGLERS AT SIMILAR SITES

By

Robert Timothy Slana

Knowledge of the characteristics and motivations of stream salmon anglers who use sites where legal snagging opportunities exist or similar sites where only conventional methods can be used is very limited. Knowledge of the multivariate relationships relevant in discriminating subgroups of these anglers is entirely non-existent. A continuing controversy concerning snagging envelops stream salmon anglers and has attracted special attention to the management actions directed at this fishery, complicates the study of this fishery, and adds additional importance to management enhancing knowledge.

Information from more than 2,000 personally interviewed stream salmon anglers was used to profile and compare groups based on their use of a non-conventional fishing method commonly known as "snagging". These stream salmon angler groups included: 1) non-conventional stream salmon anglers or "snaggers" who exclusively employed the non-conventional method known as snagging; 2) conventional stream salmon anglers who exclusively employed conventional fishing

methods; and 3) dual method stream salmon anglers who employed both conventional stream salmon angling methods and snagging. These segments of stream salmon anglers were profiled and then the two most different of these groups, conventional stream salmon anglers and snaggers, were compared.

Discriminant analysis was employed to assess any multivariate relationships or predictive capabilities which might be utilized by resource managers. The first of three discriminant analyses was performed on a function attempting to discriminate stream salmon angler segments based on their fishing method employed. In addition, because snagging is a controversial non-conventional method, two subsequent discriminant analyses were performed using: 1) conventional anglers with different viewpoints concerning the banning of snagging; and 2) "snaggers" with different expected salmon fishing behavior dependent on the banning of snagging.

The major results of this study include: 1) an extensive, managerially usable, profile of stream salmon anglers based on the use or exclusion of a non-conventional recreational method; 2) an extensive, managerially usable, comparison of stream salmon angler groups; and 3) significant discriminant functions providing multivariate relationships and classification rates usable to a limited extent in the management of a fishing opportunity restricted on the basis of type of method.

This dissertation is dedicated to anglers everywhere.

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CHAPTER 1

INTRODUCTION

Importance of Michigan's Sport Fishery

Why is the analysis of sport fishing in Michigan important? Substantial numbers of Michigan residents participate in angling. Sport fishing opportunities also attract significant numbers of out-of-state residents. Spending by anglers has an important effect on Michigan's economy. Angler spending generates substantial revenues for many businesses in this and related industries (e.g. boating, lodging, and many businesses in rural communities).

A recent Michigan Department of Natural Resources (M.D.N.R.) Fisheries Division report reveals the popularity of sport fishing in Michigan:

> Recreational fishing is the largest and highest-valued use of the state's fishery resources. Approximately two million Michigan residents and 334,000 non-resident tourists fish in Michigan each year. These anglers fish over 35 million angler days [an angler day is a calendar day during which an angler fished] per year. (Jester, 1988, p.1)

Many Michigan anglers own a boat used for fishing and this represents a significant portion of the states boating activity and expenditures. In a study of licensed Michigan anglers, Kikuchi (1986) reports that "over half (58.4%) own a boat and/or canoe that is used for fishing" (p. 75). Furthermore, Latta (1983) states that "over 50% of the boat usage in Michigan is attributable to fishing" (p. 4). Boat related spending is high. According to estimates of Michigan registered boat owner spending in Stynes, Brothers, Holecek and Verbyla's study (1983, p.70), boat owners spent more than one billion dollars annually.

A M.D.N.R. Fisheries Division report provides further information on the economic significance of sport fishing in Michigan:

> Net value of fishing to these fishermen has been estimated at $950 million. In fishing, anglers spend $850 million per year with a resulting impact on tourism and fishing equipment sectors of Michigan's economy of $1.4 billion per year. This produces value-added of $900 million annually with associated employment of 18,000 persons. Since some of these expenditures would have gone toward other uses in Michigan if not spent on fishing, net contribution to Michigan's economy is $210 million of economic activity, $140 million value-added annually, and 2,700 jobs. Much of the activity in excess of this net contribution, however, is in different economic sectors and geographical areas that would otherwise occur. Net contribution to tourism- and fishing-related businesses in rural areas and coastal towns is over $500 million per year and 12,000 jobs. In many northern Michigan communities, fishing and related tourism support as much as half of the local economy. (Jester, 1988, p. 1)

The recreational salmon fishery comprises an important component of the total recreational fishery in Michigan. According to 1981-1983 numbers tabulated by Kikuchi (1986, p. 81), 33.2% and 31.9% [of Michigan licensed anglers[1]] fished for chinook salmon and coho salmon respectively [in the Great Lakes and connecting waterways]. In 1987, according to the M.D.N.R.'s Comparative Statement of License Sales by Number, 363,362 Michigan trout [and salmon] stamps were sold (M.D.N.R., 1988, p.1). At $9.85 per stamp, 1987 sales provided over 3 million dollars in revenues.

A significant number of anglers fish for salmon during the fall spawning runs in inland streams, rivers and connecting waterways. This inland salmon fishery in Michigan is an important segment of Michigan's sport fishery. Results of a 1984 M.D.N.R. Fisheries Division survey conducted by Mahoney, Jester, and Stynes (1986) revealed that the following percentages of anglers fished for chinook salmon and coho salmon in streams, rivers or inland lakes within Michigan: chinook salmon in streams or rivers, 10.9% of resident anglers and 23.1% of non-resident anglers; coho salmon in streams or rivers, 10.1% of resident anglers and 21.1% of non-resident anglers; chinook salmon in inland lakes, 1.4% of resident anglers and 3.9% of

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[1] Kikucki's sample was taken from a sampling frame which did not include the spouses of licensed anglers or children not required to purchase a license.

non-resident anglers; and coho salmon in inland lakes, 1.5% of resident anglers and 5.2% of non-resident anglers.

Stream salmon anglers can be classified into three mutually exclusive groups according to fishing method employed. These groups are conventional anglers, non-conventional anglers, and anglers who use both conventional and non-conventional methods.

Conventional stream salmon anglers employ conventional methods and equipment to catch salmon. Conventional methods include trolling, casting, fly-fishing, or still-fishing with either lures or with bait (usually spawn, alewife, rainbow smelt, or worms).

Non-conventional stream salmon anglers only employ a liberalized method commonly known as "snagging" to catch salmon. Snagging is a fishing method in which anglers attempt to hook fish in any part of the body for capture. Capture is not dependent on whether the fish bites or strikes at a bait or lure. These anglers are commonly referred to as "snaggers". They will henceforth be referred to as snaggers in this dissertation.

Snaggers often utilize stout rods and strong fishing lines for a number of reasons. First, fish hooked away from the mouth are able to create additional resistance thereby putting more stress on the fishing tackle employed. Also, snag hooks often become lodged in rocks or debris; strong fishing lines and stout rods can reduce losses of terminal

tackle. Stout rods provide power necessary to set hooks into the body of the fish. Furthermore, heavy equipment reduces the time necessary to land fish. This is important because of the crowded conditions often found at snagging sites.

Dual method stream salmon anglers employ both conventional methods and snagging to catch salmon. These anglers appear to others as snaggers while they snag or conventional stream salmon anglers when they use conventional methods. They are actually a separate group who snag and utilize conventional stream salmon fishing methods.

Anglers who snag constitute a substantial portion of Michigan salmon anglers. Kikuchi's (1986, p. 81) tabulated results of 1981-1983 fishing activities indicated that 10.3% of the licensed Michigan anglers who fished for coho salmon and 11.1% of the Michigan anglers who fished for chinook salmon snag. The number of anglers purchasing a license (stamp) to legally snag totalled 17,833 in 1987 (M.D.N.R., 1988, p. 1). Sales of snagging stamps generated $131,072.55 in revenues. The M.D.N.R. Fisheries Division estimated that anglers participated in snagging during 72,321 days in 1983 (Gale C. Jamsen, personal communication, 1984).

Introduction of Salmon into the Great Lakes and the Development of Salmon Fishing Methods

Before the successful introduction of salmon, the volume and economic significance of Great Lakes sport fishing was insignificant. According to Tanner, Patriarche, and Mullendore (1980), "so relatively unimportant was the sport fishery that until 1970 no license was required to fish for sport in the Michigan waters of the Great Lakes" (p. 9).

During the 1960's, the Great Lakes ecosystem had significant problems related to the overabundance of exotic species. Lamprey had reduced populations of desirable species such as the lake trout. Alewife displaced more desirable species and littered beaches with large scale "die-offs".

Two types of Pacific salmon, both exotic species, were introduced and successfully filled a niche in the Great Lakes ecosystem. In Michigan, coho salmon were introduced into the Great Lakes in 1966, and chinook salmon were introduced the following year (Rybicki, 1973, p. 2). Calculations from tables in Rybicki (1973) indicate that in 1970, 4,233,000 coho salmon and 2,427,000 chinook salmon were planted in lakes Michigan, Superior, and Huron in the state of Michigan. The planted salmon were also caught outside Michigan's boundaries as well as in rivers other than those where they were originally planted. Combining

results from tables in Rybicki (1973, p. 4, 10, 13) reveal that in 1971, 720,000 coho salmon and 286,000 chinook salmon were caught in the Great Lakes and their tributaries in Michigan.

Coho and chinook salmon still make up the largest proportion of salmon caught by anglers in Michigan. Rakoczy and Rodgers (1988, p. 18) estimated that anglers in Michigan caught 523,115 (± 65,331) chinook and 165,905 (± 28,206) coho salmon during the 1987 license year (April 1, 1987 to March 31, 1988). Other types of salmon, Pink Salmon and Atlantic Salmon, have also been introduced in the Great Lakes with varying degrees of success.

The introduction of salmon also resulted in numerous problems, concerns, and controversies. These have included kidney disease, forage base depletion, pesticide contamination and debates concerning safe consumption levels, sale of salmon and salmon eggs, questions related to optimal levels and distribution of fish plants, and regulation of harvest (including snagging, Indian rights, and weir operations).

In the early years of the salmon program, Michigan's anglers were not adequately prepared to take advantage of salmon fishing opportunities created by the introduction of salmon. They were unaware of salmon fishing techniques and tackle. Anglers were accustomed to fishing for other fish species.

The M.D.N.R. was also relatively unprepared for the problems created by the introduction of salmon. According to Tanner et al. (1980):

> The sight of those large fish swimming in large schools brought out the worst in some people. There was a breakdown in self-control and sportsmanship. A rush ensued to capture the fish by any means -- fair-hooking, foul-hooking, spearing, pitch-forking, even barehanded grabbing. (pp. 48-49)

There were problems associated with trespass because of lack of public access. There was a shortage of boating facilities and harbors of refuge.

Acquisition of angling skills and development of techniques to catch stream salmon was even slower than for Great Lakes fishing. In 1977, Carl pointed out that "the special fishing techniques necessary to catch salmon in streams have not been learned, and the low fishing pressure needed for success is not present in many places" (p. 2). Although fish ladders and additional plants of salmon increased opportunities to catch salmon in streams and rivers, success rates remained low for many stream salmon anglers.

Even now, more than 20 years after the first salmon were introduced into Lake Michigan and after years of salmon fishing experience in the Great Lakes, many anglers fishing in streams using conventional fishing methods still find catching salmon in streams more difficult than in the open waters of the Great Lakes. Low success rates and high

numbers of very visible fish present often frustrate anglers. According to Tanner et al. (1980):

> Salmon in rivers will strike baits and lures fished in traditional ways, even though the fish do not feed after they have left open water and begun their spawning migration. However, salmon in rivers cannot be caught in a crowd. To be successful, anglers need some elbow room and a chance to fish over salmon that have not been unduly disturbed. A quality stream fishery undoubtedly requires restricting numbers of fishermen, much as in prime Atlantic salmon rivers in America and Europe. (p. 66)

It is evident that some conventional stream salmon anglers realize high success rates in certain sections of Michigan's rivers, lakes and streams in the fall. These anglers contend that catching stream salmon is not difficult once knowledge of the fish, their habitat, and appropriate techniques are learned. However, some anglers question whether it is as efficient as snagging. Carl (1977) contends that "anglers can fill their creel limit in a comparatively short time by snagging rather than trying to make salmon strike" (p. 2).

The early ineffectiveness (low catch rates) of open water and conventional stream salmon fishing methods, the M.D.N.R. Fisheries Division's need to deal with the substantial "die-offs" of salmon, and pressure from anglers led to the rise of snagging. A history of snagging in Michigan is presented in the next section.

History of Salmon Snagging in Michigan

Regardless of the viewpoints about snagging, it has been legal for a long time. The number of legal liberalized salmon fishing sites have fluctuated since legalization of snagging for stream salmon in 1969. Open season, hook size, weighting restrictions, and fees have also varied. Mahoney, Jester, and Slana (1985) reported:

> In 1969, snagging was permitted in all salmon rivers from August 1 to December 31. In 1972, area restrictions were imposed and snagging was only allowed at seven designated locations. The number of locations was increased to eight in 1974 and sixteen in 1975. Since 1978, the Natural Resources Commission has continuously reduced the number of liberalized fishing sites, shortened the length of the season and placed restrictions on the type of snagging gear. The number of sites was reduced to five by 1981. (p. 1)

A 1983 M.D.N.R. Commission Order made explicit the M.D.N.R.'s intention to completely ban snagging at all sites by the end of 1985.

A complete ban of snagging was not accomplished by the end of 1985. "Pro-snaggers" organized to support the enactment of Public Act 317. Basically, Public Act 317 included: (1) rights to snag at four sites; (2) a request for an eventual economic impact study of the elimination of what previously was the fifth site (Foote Dam on the Au Sable river); (3) an additional $7.25 fee for an annual salmon snagging stamp; (4) certain management stipulations for the Pere Marquette River; and (5) that the M.D.N.R.

should establish stocking programs to make sure salmon are available at the snagging sites.

At the present time (April 1, 1989 - March 31, 1990), the following liberalized salmon fishing regulations apply at specified sites according to the Michigan Fishing Guide 1989:

> Salmon snagging is legal in certain designated areas Sept. 10-Oct. 25 with artificial baits or unweighted hooks. (Hook size maximum limitations: treble or double pointed hooks-3/8-inch from point to shank; single-pointed hooks-1/2-inch from point to shank). Snagging stamp needed to snag salmon in snagging areas (see "Fishing License Fees.") Regular trout stamp not needed in snagging areas during snagging season when in possession of a snagging stamp. Snagging areas: Sable River (Mason Co.) between Hamlin Dam and Mouth; Pere Marquette River (Mason Co.) between signs located 1/4 mile upstream and 3/4 mile downstream from Scottville Bridge; Big Manistee River (Manistee Co.) between Tippy Dam and signs posted approximately 1 mile downstream; Muskegon River (Newaygo Co.) between Croton Dam and public access site located at Pine Ave. (p. 6)

In addition, the following fee pertains to snagging according to the Michigan Fishing Guide 1989:

> Salmon Snagging (required when taking salmon in designated salmon snagging areas during snagging season).....$7.35 (p. 2)

Michigan's Salmon Snagging Controversy

From its inception, salmon snagging has been a controversial subject. The rules of acceptable angling methods were changed in 1969. In Michigan salmon angling, the rules of competition had been changed and the means that could be legally used were expanded. However, many anglers were happy with former rules of fair play. In the case of snagging, the sport's **rules of fair play**[2] may have been changed by the government, but many traditional, organizational, and personal rules of fair play were not changed. Therefore snagging continued to be an unacceptable method to certain anglers. Anglers immediately expressed their opposing views on the appropriateness of this method. According to Webster's (1988) dictionary definition of controversy, it is "a discussion marked especially by the expression of opposing views" (p. 285).

Many persons and groups supported the "pro-snagging" viewpoint. Some of these were the businesses serving the needs of snaggers. Many of these businesses, anglers who engaged in snagging, and others sympathetic to the cause, became constituents of the "pro-snagging" viewpoint.

There were also many constituents of the "anti-snagging" viewpoint. These included many anglers and non-

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[2] Rules of fair play specifying acceptable means may be traditional, governmental, organizational, and personal (Hummel and Foster, 1986, p.41).

anglers who did not consider the use of this method appropriate for themselves or others.

What was the distribution of viewpoints toward snagging among all licensed Michigan anglers? G.C. Jamsen (personal communication, March 9, 1982) sent an interoffice memo to then Chief of the Fisheries Division, John Scott, containing results of an opinion survey conducted by National Family Opinion, Inc. including a breakdown of opinions of all licensed 1981 Michigan anglers toward salmon snagging: 1) 22% wanted more areas; 2) 24% wanted snagging banned; 3) 28% had no opinion; 4) 24% wanted the present system retained; and 5) 2% wanted snagging contained to fewer areas.

Although snagging is the only legal non-conventional method available to salmon anglers in Michigan, other non-conventional methods are legal for other species. Bow and arrow fishing, spearing, and underwater spearing also occur in Michigan. Spearing many other species (including some game fish) is legal in Michigan during special times and at specified places indicated in the Michigan Fishing Guide 1989.

The M.D.N.R. Fisheries Division has had to deal with the opposing views of different actors within the snagging controversy. Wayne Tody summed up the view of the M.D.N.R. Fisheries Division staff concerning stream salmon regulations in a memo to the M.D.N.R. Commission on July 9,

1974. He re-evaluated the angling ethic and re-evaluated sport fishing regulations. Tody (personal communication, July 9, 1974) suggested the existence of a fishing ethic:

> In Michigan, we have a fishing ethic governing all sport and commercial fishing activities. It's old. Based on tradition it has evolved slowly and stands the test of time. This fishing ethic is based on a combination of recreational and catch (food) values consistent with maintaining (without depletion) the standing stock. (p.2)

Through examples of types of fishing (e.g. trout, whitefish, bass and panfish fishing, pike spearing, smelt dipping, cisco netting, or sucker and carp fishing), Tody (personal communication, July 9, 1974) provided insight into specific fishing ethics:

> In all the above examples, it is quickly apparent that kinds of fishing are determined in a way that fits the species, its habitat, and <u>always</u> to optimize the combined values of recreation and food. There is no question that recreational values predominate both in economics and the angler's mind. Recreational values may indeed be manyfold greater than the food values involved. Nevertheless, in all cases, the principle of angling regulations is to optimize the combination of values for recreation and food. Using this approach Michigan has developed a broad array of fishing opportunities for its citizens.
>
> In addition, <u>the professional code of ethics of fisheries scientists and management biologists calls for providing a wide freedom of choice for individual angling opportunity</u> [italics added]. Different people enjoy different kinds of fishing. There is no fishing opportunity that we can define to meet a highly sophisticated ideal like the pure trout ethic and satisfy more than a small minority of our fishermen. I am sure that the more one reflects on this point the more logical it will appear. There is no better way to manage the resource to insure full utilization while avoiding depletion and providing maximum value to all our people. (p. 4)

Tody (personal communication, July 9, 1974, p.7) predicted that an attempt to restrict salmon snagging altogether and to substitute commercial removal would have negative consequences because of the lack of attention to recreational values. Not surprisingly, A M.D.N.R. Commission Order from the Natural Resources Commission at its meeting on May 13, 1983, calling for an end to snagging at Croton Dam and Scottville after 1984, and ending all snagging by 1985, brought negative consequences. The right to snag became a legislative issue, and as noted previously, a law was passed preserving the rights of snaggers on restricted areas. Although antagonists hoped that a "sunset clause" would end legal snagging, legal snagging occurs at the present time. Snagging has been and remains a controversial method to take salmon.

Problem Statement

The management of a fishery is a complex task. "The primary goal of sport fisheries management is to provide opportunities for quality recreational fishing while preventing unacceptable resource damage" (Driver and Cooksey, 1977, p. 27). The human use aspects of fisheries management is especially difficult for some fisheries managers to understand and consider. To some fisheries managers, the people who use fisheries resources remain an

additional consideration to be dealt with after the traditional animal population and habitat considerations. However, knowledge of stream salmon anglers' characteristics is necessary for integration with fish population and habitat knowledge as inputs in the management of the fishery. Analysis of the human use component of any form of recreation draws upon many fields (e.g. psychology, social-psychology, sociology, economics, etc.) and is a critical consideration in resource management decisions.

There is a shortage of information regarding the human use component of Michigan's stream salmon fishery (especially regarding snaggers). This shortage of scientific information and the preponderance of rhetoric, assumptions, value-laden statements, and accusations concerning snagging and snaggers has made management and marketing decisions regarding snaggers and snagging[3] difficult.

Fisheries managers need information on disaggregated stream salmon angler groups to increase angler satisfaction. Only by realizing the motivations and characteristics of the different subgroups can each group be managed with special attention to its unique characteristics and needs. There is a shortage of information on characteristics of each angler

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[3] Snagging is not unique to Michigan. Wisconsin allowed snagging until recently. According to the Guide to Illinois Fishing Regulations (1989, p. 11), Illinois anglers can snag for chinook salmon and coho salmon and also for several other species of fish.

group utilizing the stream salmon fishery. The information shortage relates to snaggers, dual method stream salmon anglers, and conventional stream salmon anglers who use this fishery and are presently being managed differently. Presently, the fee system for stream salmon anglers includes different charges for these three types of anglers.

The shortage of information concerning the motivations of users comprising the stream salmon fishery reduces the efficiency of users attempts to maximize the benefits they seek to achieve from sport fishing.

> Public information and education media can be used by managers to let users know what types of 'outcome opportunities' are being offered at a specific location. This can help bring supply and demand in closer agreement, give fishermen better market information on which to base their decisions, and enhance the credibility of the manager. (Driver and Cooksey, 1977, p. 39)

The lack of information related to the characteristics of users limits the resource manager's knowledge of factors, alone or in combination, affecting recreation behavior.

> It should be mentioned that an individual's characteristics can influence that person's choice of a recreation activity. For example, those characteristics (such as income, time available, age, point of origin, past recreation experience, etc.) can act either as constraints on participation or serve as facilitators of choice. (Driver and Cooksey, 1977, p. 38)

Policies concerning snagging have changed in the past and it is conceivable that there may be changes in the number or location of legal snagging sites in the future in

Michigan or elsewhere. There is a shortage of information which might be utilized to prepare for these types of policy changes. For example, how many of the snaggers would fish conventionally if snagging were banned?[4] What are the differences between these snaggers and snaggers who would not fish for salmon after a ban on snagging? What kind of changes in the characteristics of anglers at present snagging sites could be expected if they are supplanted by anglers who have characteristics and motivations of conventional stream salmon anglers? How are conventional stream salmon anglers different from snaggers, who, along with dual method stream salmon anglers, presently use these sites? Information useful in the event of a policy change would also include estimates of the direction of some of the effects from change. For example, information of the significant differences of characteristics such as per day spending in total and by specific categories could reveal expected spending increases or decreases if snaggers were supplanted by anglers exhibiting characteristics of present conventional stream salmon anglers. In addition, nothing is known of the multivariate relationship of motivations and characteristics of snaggers and their decision not to adapt a different method if snagging were banned.

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[4] This study describes and compares stream salmon anglers who were interviewed during a period of impending legislative action providing a unique opportunity to address hypothetical questions which were considered very possible at the time.

There is little use of discriminant analysis in the recreation field to address problems where it is an appropriate method. Management and marketing capabilities could be augmented by applying this method to this and similar appropriate research situations. This study provides the opportunity to demonstrate the use of this method in the analyses of anglers employing different fishing methods, anglers with different viewpoints on the banning of snagging, and anglers who differ with respect to expected salmon fishing behavior dependent on the banning of snagging. The author knows of no use of discriminant analysis on groups including recreationists with non-conventional method behavior or recreationists who expect to adapt to a new method after a policy change.

Management is unable to classify potential snaggers to direct any possible management or marketing efforts such as public information and education. In addition, how can the content of any informational messages be prioritized or efficiently directed if the relative importance of angler characteristics and motivations associated with this behavior is unknown?

Snagging is a controversial method, but nothing is known of any multivariate differences which may exist with respect to characteristics and motivations of conventional

stream salmon anglers with different viewpoints[5] concerning banning snagging. Snaggers were already separated by regulations, so what are the reasons for the continued anti-snagging viewpoints held by conventional stream salmon anglers? These reasons may provide the manager with information which might contribute to a more thorough understanding of conventional stream salmon anglers' viewpoints and may lead to any eventual targeting of regulation or information and education aimed at eliminating the negative effects of sport fishing associated with this viewpoint. These opposing viewpoints are an example of social conflict in a recreation setting, not recreational conflict. The social conflict occurring in a recreational setting is not necessarily recreation conflict. Jacob and Schreyer (1980) defined recreational conflict as "goal interference attributed to another's behavior" (p. 369). Earlier, Fink (1968) defined social conflict as:

> any social situation or process in which two or more social entities are linked by at least one form of antagonistic psychological relation or at least one form of antagonistic interaction. This emphasizes that while antagonism (which for the moment remains undefined) is the common element in all conflicts, there are a number of different kinds of psychological antagonisms (e.g., incompatible goals [italics added], mutually exclusive interests, emotional hostility, factual or value dissensus, traditional enmities, etc.)

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[5] Conventional stream salmon angler viewpoints were expressed during a period when political action concerning the right to snag existed, giving an assumed importance and relevance to questions regarding their viewpoint and the rationale for their viewpoint.

> and a number of different kinds of antagonistic interaction (ranging from the most direct, violent and unregulated struggle to the most subtle, indirect, and highly regulated forms of mutual interference), none of which is necessarily present in all instances of conflict. (p. 456)

This study includes the comparison of within activity (stream salmon fishing) groups with opposing viewpoints. These opposing viewpoints are an example of social conflict occurring in a recreation setting. Information leading to better understanding anglers with these opposing viewpoints may eventually lead to research that can help reduce this social conflict. The snagging controversy is a situation where effective management of stream salmon angling in Michigan and other states is limited by incomplete knowledge of conventional stream salmon anglers with opposing views concerning snagging and also their reasons for these views.[6] Because these anglers are in a social environment (where they can be affected by others), understanding the differences of conventional stream salmon anglers who feel the method should be banned and their rationalization for their views is an aid to future research which may help reduce or eliminate social conflict or potential recreational conflicts. These different viewpoints can reflect a basis for potential conflict. While reporting on winter recreational conflicts Wood (1979) clearly points out

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[6] Note that by analyzing only stream salmon anglers with opposing views, the angler's species orientation and any variables associated with this are held constant.

that: "conflicts of use are bound to occur due to the differences in attitude [italics added] and motivation of various user groups" (p. 25).

Finally, opportunities for analyzing non-conventional stream salmon anglers on legal sites may not exist in the future. The study of these anglers is an opportunity to study them in a societal setting which might not be legally available in the future.

Study Objectives

Five primary objectives guided this study. They are as follows:

OBJECTIVE 1: Report and compare the characteristics (e.g. socioeconomic, fishing experience, and spending) and motivations of conventional stream salmon anglers, dual method stream salmon anglers, and snaggers.

OBJECTIVE 2: Compare the characteristics and motivations of subgroups of conventional salmon anglers holding different viewpoints concerning the banning of snagging.

OBJECTIVE 3: Compare the characteristics and motivations of snaggers with different expected salmon fishing behavior if snagging were to be banned.

OBJECTIVE 4: Attempt to discriminate groups identified above in objectives 1, 2, and 3 using the application of multivariate statistical technique known as discriminant analysis.

OBJECTIVE 5: Provide conclusions relevant to the management of conventional and non-conventional stream salmon anglers from information obtained by accomplishing objectives one through four.

Hypotheses

HYPOTHESES 1A to 1K: There is a relationship between "a specific angler characteristic" and the exclusive use or exclusion of snagging by stream salmon anglers. These specific characteristics include: a) "Michigan residency"; b) "self-rating as an angler"; c) "years fished"; d) "years salmon fished"; e) "sex"; f) "race"; g) "education level completed"; h) "employment status"; i) "occupation"; j) "individual income level"; and k) "family income level".

HYPOTHESES 2A to 2I: There is a relationship between the importance level of a "specific motivation to fish" and the exclusive use or exclusion of snagging by stream salmon anglers. These "specific motivations to fish" includes: a) "to catch fish to eat" b) "for relaxation"; c) "for companionship"; d) "to enjoy nature; e) "for the challenge and excitement"; f) "to be alone"; g) "to improve my fishing skills"; h) "to get away"; i) "for exercise"; j) "family togetherness"; k) "to catch a trophy fish"; and l) "for a sense of achievement".

HYPOTHESES 3A to 3X: The snaggers' and conventional stream salmon anglers' means of "a specific trip characteristic" are different. The "specific characteristics" include: a) "travel distance"; b) "length of trip"; and c through x) "per day spending for each of several spending categories".

HYPOTHESES 4A to 4C: A statistically significant discriminant function can be constructed using characteristics and motivations obtained in this study discriminating between: a) snaggers and conventional stream salmon anglers; b) conventional stream salmon anglers with different viewpoints concerning the banning of snagging; and c) snaggers with different expected salmon fishing behavior if snagging were to be banned.

CHAPTER II

RESEARCH METHODS

This chapter includes a detailed description of the research methods used in this study of stream salmon anglers. Questionnaire design, sampling plan and interviewing schedules, survey administration, response rate, data preparation, and data analysis are presented in this chapter.

Questionnaire Design

On-site personal interviews were used to collect data from stream salmon anglers for a number of reasons. First, there was no currently available list of snaggers or conventional stream salmon anglers to serve as a sampling frame. Mailing questionnaires to a random sample of Michigan licensed anglers in an effort to identify a sufficient number of snaggers and conventional stream salmon anglers would have been very costly and inefficient. Telephone interviews would also have been costly and

similarly inefficient. Also, it would have been difficult to obtain a high response rate to a mail survey given the amount and complexity of the required data. According to Tull and Hawkins (1984, p. 138), personal interviewing is superior to both the mail survey method and the telephone survey method in its ability to handle large or complex questionnaires. Finally, on-site interviews of stream salmon anglers during their actual trips minimized recall bias associated with "after trip" mail or telephone surveys.

The two questionnaires were designed during the summer of 1983. Study objectives were finalized during June and July. Next, comparable studies and relevant literature were reviewed. Similar survey instruments were obtained and constructively criticized. Questions from Wilman's (1980) report were especially useful for constructing questions concerning alternate activities. Driver and Cooksey's (1977) "preferred psychological outcomes" were especially useful for deriving reasons for fishing to which anglers assigned importance levels. However, in this study, the attributes were ranked as to their importance level specifically concerning why they fish. It is further assumed that these data reflect the importance level of motivations of fishing behavior.

Although many of the questions were similar, two questionnaires were employed because some different information was needed from stream salmon anglers depending

on where they were interviewed. One questionnaire was designed to obtain information and views of persons snagging (see Appendix A) at the approved snagging sites. This "snagging questionnaire" was not administered at the conventional stream salmon locations even though some illegal snagging occurred at these sites. Only legal snaggers at approved snagging sites were interviewed with this form. The "conventional stream salmon fishing questionnaire" (see Appendix B) was administered to conventional stream salmon anglers at conventional stream salmon sites and to conventional stream salmon anglers encountered at approved snagging sites.

Drafts of the interview instruments were developed. During August of 1983, the Michigan State University (M.S.U.) Department of Parks and Recreation Resources faculty members and personnel from the M.D.N.R. Fisheries Division constructively criticized the questions. The questionnaires were subsequently reduced in length and changed to reflect the suggestions obtained.

A field test of the instruments was conducted between September 10th and September 14th, 1983. Although snagging and conventional stream salmon angling was low during this period, sufficient interviews were conducted to identify needed changes in the questionnaires. The primary change included an additional question on the amount of time respondents had fished the day of the interview before being

interviewed. This was necessary to estimate the amount of fishing time of each angler at sites fished during the trip.

The final questionnaire forms were nine pages in length. They included screening questions to insure that the proper form was administered. The first seven pages of questions were administered by interviewers. The last two pages included personal (e.g. income) and complex questions (e.g. importance levels of a set of motivations for fishing) which the respondents completed themselves. Self administration may have introduced some bias in that it appeared that literacy problems made it difficult for some to read and answer questions. As a result, interviewers or fishing partners were sometimes required to administer these questions.

The questionnaires included comparable information on:

(I) Fishing trip characteristics

- (A) Angler's state of residency
- (B) Trip time, length, and location (actual and planned)
- (C) Angling time and locations (actual and expected)
- (D) Trip purpose
- (E) Angling success
- (F) Party composition
- (G) Lodging used

(II) Spending (respondent's out of pocket)

- (A) Spending at home
- (B) Spending en route
- (C) Spending on site
- (D) Expected future spending

(III) Fishing experience characteristics

- (A) Angling success on-site
- (B) Years fished
- (C) Self-rating as an angler
- (D) Years fished for salmon
- (E) Years snagged for salmon
- (F) Methods used for salmon
- (G) Number of trips for snagging this year
- (H) Number of trips for conventional salmon angling

(IV) Alternative activity preference questions

(V) Socioeconomic characteristics

- (A) Sex
- (B) Race
- (C) Age
- (D) Education
- (E) Employment status
- (F) Occupation
- (G) Income
- (H) Family Income
- (F) Occupation

(VI) Motivations for salmon fishing

There were minor differences between the "snagging questionnaire form" and the "conventional stream salmon fishing questionnaire form". Alternative activity preference questions were based on snagging at approved snagging sites or on conventional stream salmon angling at conventional stream salmon fishing sites. Importance of motivations as reasons to fish were based on snagging at approved snagging sites or all salmon angling at conventional stream salmon fishing sites. The questionnaire administered to snaggers was used to collect additional information on willingness-to-pay for a snagging permit. The "conventional stream salmon fishing questionnaire form" was used to collect additional information on their viewpoint on the banning of snagging.

Sampling Plan and Interviewing Schedule

Interviewing was conducted during Michigan's 1983 salmon snagging season. This period extended from September 10 until October 25. Unseasonably cold weather and few anglers curtailed interviewing on October 24 and 25.

Although six sites[7] were open to snagging, interviewing was limited to the five locations which received the heaviest use. The Middle Channel from the

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[7] See "History of Snagging in Michigan" in Chapter 1 for a complete listing of 1983 snagging sites.

Causeway to Muskegon Lake received very little use and was not an interviewing site.

Five comparable conventional stream salmon fishing sites located near the approved stream snagging sites were also selected. Nearness to the approved stream salmon snagging sites was necessary given the budget available for data collection. In addition, the nearness of sites geographically reduced the possibility of locational bias. Comparability was determined in consultation with the M.D.N.R. Fisheries Division staff who were familiar with the sites and angling activity at the sites. However, these sites can not be considered representative of all conventional salmon locations[8] in Michigan. They were selected because they were comparable in terms of site characteristics, volume of salmon, general location, and accessibility. The five conventional stream salmon fishing sites chosen for sampling were:

Lower Au Sable River	The mouth to 1 and 1/2 miles upstream;
Platte River	Route 31 to Platte Lake;
Kalamazoo River	Allegan Dam;
Pere Marquette River	Gleason's landing to Route 37;
Muskegon River	Newago public access site.

Planned surveys at Newago were dropped because of minimal usage during the first week of questionnaire administration.

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[8] A previous study of Michigan stream salmon anglers by Carl (1977, p. 1) reported little variability in age, income, and occupation between 33 sites in the Lower Peninsula.

A schedule of the dates and times used to determine when interviewing was to be conducted at different sites was developed by a statistical expert employed by the M.D.N.R. Fisheries Division. The schedule of days, times, and sites was created using a systematic sample. Although systematic samples are not simple random samples, they are about the same except when periodicities occur (Sudman, 1976, p. 56). Interviewing took place between the hours of 8:00 a.m. and 9:00 p.m. or until darkness set in. Even though snagging occurred throughout the night, interviewing did not occur after dark because of concern for the safety of the interviewers, the problem of locating anglers, and difficulty associated with recording responses.

Interviewers traveling preselected circulation routes selected anglers using a systematic sampling scheme. Modifications of the circulation routes at Ludington State Park was necessary because of a lottery permit system administered by State Park officials. Snaggers at Ludington State Park were only allowed to fish during two hour periods if they were selected in the lottery administered by the State Park officials. As a consequence, snaggers were not willing to be interviewed as they snagged. As a result, snaggers were selected for interviewing and interviewed at the permit station.

After a snagger was selected, the interviewer proceeded with a series of screening questions to determine

eligibility to be interviewed. Only persons 16 or older who were engaged in, about to engage in, or had engaged in legal snagging or conventional stream salmon fishing during the same day of the interview were eligible. The interviewers were given the flexibility of curtailing[9] interviews if they determined that the respondent was not willing or incapable (e.g. intoxicated) of providing accurate responses. However, stream salmon anglers who were interviewed on a previous trip were not turned down if they were contacted on a subsequent trip.

Interviewers were instructed to conduct surveys away from anything that might interfere with the interviewing process. Interviews were conducted away from the waters edge or away from any direct traffic on heavily used walking routes. If necessary, fishing party members or interested others were told that it was not a group interview. Comments and answers offered by others were not recorded.

Survey Administration

A team of trained surveyors, coordinated by the author and headed by Dr. Edward Mahoney, administered the surveys. The team consisted mostly of college students. In addition, an experienced non-student interviewer was

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[9] Interviewers noted if there was a lack of what seemed to be a reasonable attempt or capability to accurately answer questions.

employed to administer surveys where and when students were unavailable.

Interviewers went through a multi-step training procedure. Initially, they were given an overview of the study and study objectives, provided with the two questionnaires, and given a detailed description of the contents and differences in the two questionnaire forms. They were instructed to practice administering the survey on their own. A series of group practice sessions was conducted during which members of the team simulated interviews with the project coordinators. Interviews were constructively critiqued. In addition, the first interviewers conducted on site were administered in the presence of the project coordinators and interviewers were critiqued.

Survey Response

During the period between September 14 and October 23, 2,106 salmon anglers were interviewed. Approximately 85.4% of the stream salmon anglers who were chosen to be interviewed were willing to participate in the survey.

Greater use levels at the approved salmon snagging sites was the major factor influencing the disproportionate

number of surveys taken at snagging versus the conventional stream salmon fishing sites. However, the decision to drop one of the conventional stream salmon fishing sites due to very low use was also a major factor contributing to this difference.

Data Preparation

The data for the survey were coded by students. Coding was completed by March 1984. Early on in the coding process, a sample of completed coding was checked for accuracy. Coding problems were identified and corrected. Subsequent checks determined a coding error rate of less than one percent.

The coded data were keypunched using the professional keypunching services available at Michigan State University's Computer Center. A check determined that the keypunching error rate was less than two percent.

Coded data were then transformed into a Statistical Package for the Social Sciences (SPSS) systems file for cleaning and analysis. A series of frequencies and crosstabulations were used to identify and correct coding mistakes or obviously incorrect data. Significantly incomplete cases and those with numerous suspected errors were eliminated from the analysis. Additional crosstabulations were performed to further check the

spending data. Outliers can cause possible difficulties in the interpretation phase of discriminant analysis (Klecka, 1980). A careful cleaning of the data set was deemed essential prior to discriminant analysis. This resulted in 2,074 cases including: 1) 1,432 salmon anglers at liberalized fishing sites; and 2) 642 salmon anglers at conventional salmon angling sites.

Subsequent data preparation included weighting cases to compensate for length-of-stay bias which occurs often in on-site recreation studies due to the increased probability of sampling persons with a greater length-of-stay during sampling periods. All respondents should have had equal probability of being sampled to insure that the sample is indeed an accurate representation of the population which uses the site. Wager and Thalheimer (1968) consider weighting appropriate in studies where individuals with different probabilities of being sampled have different characteristics. Lucas (1963) recognized the importance of correcting for length-of-stay bias by weighting cases by the inverse of the length-of-stay in on-site samples.

It was clear after preliminary frequency runs that to compensate for length-of-stay bias it was necessary to weight cases. Cases were weighted by the inverse of trip length to compensate for over sampling anglers with longer length of stays. Nie (1975) reports:

> The weighting is accomplished by means of fractional counters, so that any weighting factor may be used which can be expressed in terms of a decimal number, a whole number, or a whole number plus a decimal number. The weight given to a case determines the extent to which it adds to the totals being collected. (p. 130)

The weighted number of stream salmon anglers reported in SPSS frequency runs was 869 and included: 313 snaggers; 314 conventional stream salmon anglers (169 anti-snaggers, 145 pro-snaggers); and 242 dual method anglers. Because of the weighting, caution is advised when comparing the results of this study with similar studies which do not correct for length of stay bias or which use different weighting schemes.

Further data preparation consisted of classifying respondents into groups based on the salmon fishing methods they used. These groups included: 1) stream salmon anglers who exclusively used snagging to catch salmon; 2) stream salmon anglers who used conventional stream salmon fishing methods only and have never snagged, or if they have snagged are now against it; 3) stream salmon anglers who utilize both methods to catch salmon, or have snagged in the past with some prospect of snagging again.

Data Analysis

The data were analyzed using version X, release 3.0 of (SPSS) on M.S.U.'s IBM/CMS mainframe computer. Descriptive

statistics were calculated to determine comparative characteristics of method different anglers (conventional and non-conventional anglers). Univariate hypothesis testing using the t-test and the chi-square test was also performed. Separate discriminant analyses were employed in an attempt to discriminate between: 1) conventional stream salmon anglers and snaggers; 2) conventional stream salmon anglers with opposing viewpoints concerning banning snagging; and 3) snaggers with different expected behaviors in regard to continuing salmon fishing if snagging is banned.

CHAPTER III

LITERATURE REVIEW

Discriminant Analysis

Brown and Tinsley (1983, p. 291) proposed that knowledge of discriminant analysis and the additional use this knowledge may precipitate would improve leisure research. Fortunately, Brown and Tinsley (1983, p. 291) reported discriminant analysis is readily accessible on several widely available software packages including SPSS.

The statistical package used in this study, SPSS, utilizes Fisher's linear discriminant function. According to Klecka (1980):

> The easiest and most commonly used form of discriminant analysis employs a 'linear' discriminant function, which is a simple linear combination of the discriminating variables. This method is the easiest, because the assumption of equal group covariance matrices [italics added] allows a simplification of the formulas used to calculate the discriminant function and certain tests of significance. (p. 9, 10)

What is discriminant analysis used for? "Discriminant analysis is a statistical technique which allows the researcher to study the differences between two or more

groups of objects with respect to several variables simultaneously" (Klecka, 1980, p. 7). According to Morrison (1974), "The objective of discriminant analysis is very simple. On the basis of a set of independent variables, we wish to classify individuals or objects into one of two or more mutually exclusive and exhaustive categories or classes" (p. 2-442). Interpretation and classification are important uses of discriminant analysis.

Although discriminant analysis has been used in leisure research, it is difficult to find published studies detailing its use (e.g. Harris, Driver, and Bergersen (1984); Buchanan, Christensen, and Burdge (1981); Gramann and Burdge (1981); Tinsley and Kass (1980); and Lovinghead and Mitchell (1978). Gramann and Burdge (1981) used discriminant analysis to test Jacob and Schreyer's (1980) theory of recreation conflict using "recreation experience preference" (Driver and Cooksey, 1977) variables as predictor variables. Results of the discriminant analysis provided weak support to the goal interference conflict model. However, Gramman and Burdge (1981, p. 25) recognized the importance of additional investigations of conflict between user groups toward the goal of maximization of public benefits. Harris, Driver, and Bergersen (1984) employed discriminant analysis and reported "a moderately high degree of consistency between fishermen's choice of type of fishery and their preference for attributes

characterizing each type" (p. 50). Their analysis suggested "... that only a small number of area attribute dimensions may be central determinants of site choice ..." (p. 53). Buchanan, Christensen, and Burdge (1981) used discriminant analysis to support the idea that "some activities are viewed by differing social groups as providing a range of different experiences desired by all social groups while other activities may provide opportunities desired most strongly by a particular type of social group" (p. 263). Tinsley and Kass (1980) used discriminant analysis to compare the classification accuracy of alternative leisure questionnaire forms.

Application of discriminant analysis is sometimes improper. Goldstein and Dillon (1978) state:

> ... in the vast majority of applied research the application of Fisher's function has not been preceded by tests to determine if the conditions for its optimality are satisfied. The authors are of the opinion that researchers have apparently applied the technique in the hope of obtaining useful if not optimal results. (p. 4)

What are the assumptions which are required for discriminant analysis? Klecka (1980) reports the requirements for using discriminant analysis as follows:

g = number of groups
p = number of discriminating variables
n_i = number of cases in group i
n. = total number of cases over all the groups

The assumptions can be stated as:

(1) two or more groups: $g \geq 2$
(2) at least two cases per group: $n_i \geq 2$
(3) any number of discriminating variables, provided that it is less than the total number of cases minus two: $0 < p < (n. - 2)$
(4) discriminating variables are measured at the interval level
(5) no discriminating variable may be a linear combination of other discriminating variables
(6) the covariance matrices for each group must be (approximately) equal, unless special formulas are used
(7) each group has been drawn from a population with a multivariate normal distribution on the discriminating variables. (p. 11)

What if the assumptions are violated? Klecka (1980) reports that:

> The most difficult assumptions to meet are the requirements for a multivariate normal distribution on the discriminating variables and equal group covariance matrices. Several authors (see in particular Lachenbruch, 1975) have shown that discriminant analysis is a rather robust technique which can tolerate some deviation from these assumptions. In addition, not all of the aspects of discriminant analysis require these assumptions.... Lachenbruch (1975) has shown that discriminant analysis is not particularly sensitive to minor violations of the normality assumption. The consequence is some reduction in efficiency and accuracy. (p. 61)

Morrison (1974, p. 2-451) reports that linear discriminant function optimality sensitivity is greater to the equal covariance assumption than the normality assumption. SPSS contains Box's M test for testing the equal covariance assumption.

When assumptions have been violated, researchers should be aware of possible effects. Krzanowski (1977) reviewed Fisher's Linear Discriminant Function when assumptions were violated.

Continuous data for predictor variables is assumed. However, "Revo studied the performance of several rules for ordered discrete variables and found that LDF performed quite well" (Krzanowski, 1977, p. 193). Brown and Tinsley (1983) state "At minimum, the discriminator variables used in discriminant analysis should represent continuous dimensions and satisfy the requirements for ordinal level measurements" (p. 292). Gilbert (1968), using binary data recommended Fisher's linear discriminant function because "the simplicity and familiarity of Fisher's LDF, in addition to the possibility of combining discrete and continuous variables, makes its use seem desirable" (p. 1410).

The independent variables are assumed to be uncorrelated. If the independent variables are highly correlated, then the beta coefficients "will be unstable and hard to interpret" (Morrison, 1969, p. 160). A beta coefficient on a particular variable could be low because of a correlation with another variable. In this instance, the relative importance of the variable and others is not accurate.

In addition to the assumptions which are sometimes violated and create problems, there are other concerns.

Klecka (1980, p. 63) warns of effects of outliers and missing data on discriminant analysis.

However, in addition to all the concerns about violations of assumptions and warnings of various effects, the user should be aware that a primary concern is the objective of the research in which the statistics are to be used.

> For the researcher whose main interest is in a mathematical model which can predict well or serve as a reasonable description of the real world [italics added], the best guide is the percentage of correct classifications. If this percentage is high, the violation of assumptions was not very harmful. Efforts to improve the data or use alternative formulas can give only marginal improvements. (Klecka, 1980, p. 63)

Salmon Sport Fishing

Scientific studies specifically relevant to salmon sport fishing in the literature are uncommon. However, the following is a review of studies found by the author.

Salmon fishing is increasingly composed of salmon sport fishing. Historically there has been a tendency to move from commercial fishing to salmon sport fishing because it provides more social value. Smith (1981) reports that "comparisons of commercial and recreation fishing value usually show angling is more valuable (Fry 1962; Brown et al. 1964, 1976; Stoevener et al. 1972; Schuler 1974; Dwyer et al. 1977; and Talhelm 1979)" (p. 189).

Economic value is not the only determinant of the mix or trends in commercial and recreational salmon fishing. In commenting on Oregon's history of "fish fights", Smith (1974) states:

> Nearly one hundred years of historical records on various fish fights reveals no consistent pattern. Fish fights reflect more, the larger philosophic issues which continue to be debated in American society. Issues such as whether decisions should be made by elites or by broad participation, too many fishermen and too few fish, fish for food or fish for fun, allocation of rivers and streams among competing uses, and the meaning of the facts which explain a situation have all interacted to make fisheries management a complex social and economic problem, not just simply one of resource conservation. (p. 1)

Fights over rights to the salmon resource are inevitable and not limited to the commercial fishermen or angler. Because of the high value of sport fishing, and a finite and fluctuating supply of available fish, there may be an eventual reduction of commercial rights to salmon and baitfish, the rights of industry to destroy salmon and baitfish through water intakes, the rights to pollute the environment of the fish, in addition to a reduction of commercial fishing.

While it is possible that recreational fishing may continue to reduce commercial fishing levels, it may not be the only source of this reduction. Salmon ranching, because of its economical efficiency, may eventually remove any value of the commercial license (Cook and MCGaw, 1986, p. 62).

Sport fishing has the additional benefit of being able to, in part, utilize the same fish more than once. However, hooking mortalities from catch and release of Pacific salmon is a cost of this option. Wright (1972, p. 47) estimated that the mortality rate from sport caught salmon was 5 to 10 percent or less.

There is a limit to the number of salmon that can be harvested, even by sport fishing, if a sustained yield over time is to be achieved. In order to limit the number of salmon taken without adversely affecting the tourist industry, fisheries managers attempt to reduce harvest levels using sophisticated regulations. Walter's and Riddell (1986, p. 10) report that the Sport Fishing Advisory Board recommended a complex group of regulations (daily bags, seasonal bags, and spot closures) to meet an annual limit of 275,000 Chinook in the Strait of Georgia.

Salmon anglers fish for fun and for the value of the meat as food. We may assume that the emphasis of anglers, unlike commercial fishermen, is on recreation, but we would not be entirely accurate. Smith (1981) points out that "a group of part-time salmon fishermen emerges who fished for both pleasure and occupational satisfactions" (p. 182). Smith (1981, p. 188-9) states that this pleasure even provides interest for some in commercial fishing even though they are losing money.

One way of estimating the value of salmon sport fishing is by measuring expenditures. Stream salmon sport fisheries generate a high level of per day revenue. Brown (1976, p.20) points out that the Salmon River daily expenditure rate was a comparatively very high $19.61 in 1975. Mahoney, Jester, and Slana (1985) estimated approximately two million dollars worth of expenditures by stream salmon anglers at liberalized fishing sites in Michigan during 1983.

Salmon anglers obtain more than just recreational satisfaction from their activity. They obtain fish. This fish may be food for themselves (or others), bait for themselves (or others), or a variety of other uses. The fish is valuable and provides the angler material reward for his efforts. In this way, angling (and hunting) provide recreation in one of the most primitive work forms known to man.

The number of fish obtained from salmon angling vary among salmon anglers. Chinook salmon anglers' catch frequencies are not only unequal, but are highly positively skewed (West and Goode, 1986, p. 345). Although knowledge and effort (ceteris perabus) contribute to this, all things are rarely equal.

Although salmon and trout anglers are often studied as a single group, Carl (1977) specifically studied salmon anglers. In aggregate, Michigan stream salmon anglers

exhibited the characteristics shown by Carl (1977) in the following excerpt:

> The average age of anglers fishing for salmon on streams was 40 years. They reported an average income of about $12,000 and most were employed as craftsmen, foremen, laborers, or general factory workers. About 9 out of 10 anglers were white males. There was little variation in these personal data between 33 sites throughout the Lower Peninsula. (p.1)

CHAPTER IV

DESCRIPTIVE AND UNIVARIATE STATISTICS OF SNAGGERS, CONVENTIONAL STREAM SALMON ANGLERS, AND DUAL METHOD STREAM SALMON ANGLERS

This chapter begins with descriptive profiles and univariate statistics of the characteristics of snaggers, conventional stream salmon anglers, and dual method stream salmon anglers. The descriptive profiles were accomplished to: 1) better understand the aggregate characteristics of groups of stream salmon anglers in Michigan; and 2) find out about those aggregate characteristics useful in managing these groups of stream salmon anglers. Univariate statistical tests were performed to: 1) understand where differences in means exist between groups of stream salmon anglers; 2) find out what relationships between characteristics or motivations and method employed may exist; and 3) indicate variables likely to be good discriminators in subsequent discriminant analyses. This section will include descriptive profiles and univariate statistical tests using variables which were classified into the following groups: 1) fishing trip characteristics; 2) spending characteristics; 3) fishing experience characteristics; 4) alternate activity preferences; 5) socioeconomic characteristics; and 6) motivation importance.

In addition, this chapter will include the univariate statistical analysis of conventional stream salmon anglers with different viewpoints concerning the banning of snagging and also the statistical analysis of snaggers with different expected salmon fishing behavior if snagging were banned. Univariate statistical tests were performed to: 1) understand where differences in means may exist between groups; 2) find out what the relationships between variables (i.e. characteristics or motivations) and viewpoints or expected behavior may exist; and 3) indicate variables likely to be good discriminators during subsequent discriminant analyses.

Fishing Trip Characteristics of Snaggers and Conventional Stream Salmon Anglers

This section includes a comparison of the trip characteristics of conventional stream salmon anglers and snaggers. The trip characteristics in this section include "state of origin", "travel distance" (in miles one way), and "trip length" (in days).

Most snaggers' trips originated from far away and most snaggers' trips were more than one day in duration (see Table 1). Approximately one-third (35.9%) of snaggers were from out-of-state. Trips originating from Indiana (14.0%) and Ohio (15.7%) accounted for many of the snaggers' trips. Approximately one-third (35.7%) of the trips made by

Table 1.--Percentage distribution of fishing trip characteristics for snaggers and conventional stream salmon anglers.

Characteristic	Snagging Method	Conventional Methods
State of origin		
Illinois	00.9%	01.5%
Indiana	14.0%	01.7%
Michigan	64.1%	91.7%
Ohio	15.7%	03.3%
Other	05.3%	01.8%
Totals	100.0%	100.0%
Travel distance (in miles one way)		
Less than 100	35.7%	68.7%
100 - 199	17.4%	16.1%
200 - 299	19.6%	09.8%
300 - 399	12.1%	01.9%
400 - 499	08.4%	02.0%
More than 500	06.8%	01.5%
Totals	100.0%	100.0%
Mean	206.780	95.595
Trip Length (in days)		
1	31.9%	72.3%
2	18.0%	09.4%
3	21.4%	09.4%
4	12.9%	04.1%
5	06.5%	01.3%
6	02.9%	01.0%
7	01.6%	00.5%
8	01.2%	00.9%
9	01.4%	00.3%
10 or more	02.2%	00.8%
Totals	100.0%	100.0%
Mean	2.966	1.728

snaggers were less than 100 miles from a snagging destination. However, the mean "trip length" was over 200 miles. Approximately one-fourth (27.3%) of the trips involved 300 miles or more in travel. Less than a third (31.9%) of the trips made by snaggers were only one day in duration, while about half (50.1%) of the trips were three days long or more. The mean "trip length" was nearly three days.

Conventional stream salmon anglers' trips originated predominantly (91.7%) from Michigan and conventional stream salmon anglers' trips were mainly one day in duration. Some conventional stream salmon anglers were from out-of-state including many anglers from Ohio, Indiana, and Illinois. Conventional stream salmon anglers' trips originated relatively close to their fishing sites. Approximately 69% of conventional stream salmon anglers' trips originated less than 100 miles from the fishing site. The average "trip length" was approximately 96 miles. About 85% of conventional stream salmon anglers' trips originated less than 200 miles from their fishing site. Approximately five percent of conventional stream salmon anglers' trips originated 300 miles or more from their fishing site. Among conventional stream salmon anglers, mean "trip length" averaged approximately 1.7 days. Approximately 72% of conventional stream salmon anglers' trips were one day in duration.

Snaggers' and conventional stream salmon anglers' "state of origin" data was compared. The frequency distribution of "state of origin" by fishing method employed revealed differences in the percentage of Michigan residents participating in conventional stream salmon angling (91.7%) versus snagging (64.1%). However, "state of origin" data were then recoded into in-state and out-of-state categories and the variable was then relabelled "Michigan residency". A chi-square test of statistical independence was performed in an attempt to determine if there was a relationship between "Michigan residency" and choice of method. The chi-square probability of obtaining a value at least as high as 68.074 with one degree of freedom was 0.000 (significant[10] at the alpha = .05 level). This led to a rejection of the null hypothesis that there is no systematic relationship between "Michigan residency" and method. Thus, there is evidence that a relation between "Michigan residency" and method employed exists.

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[10] "Typical values for the significance level chosen in step 2 [choosing a significance level for testing the null hypothesis] are .05 or .01. The specific value of the significance level chosen is based on the seriousness of the type I error (rejecting H_0 when it is true) as opposed to type II error (accepting H_0 when it is false). The significance level is exactly the probability of rejecting H_0 when it is true. Thus, if type I error is very serious, the significance level would be set correspondingly low (.001 is sometimes used). On the other hand, if type II error has the worse consequence, the significance level could be raised, e.g., .10" (Nie, 1975, p. 268).

After visually examining the descriptive profile of the "travel distance" variable, a *t*-test was performed to statistically compare means of snaggers and conventional stream salmon anglers. The frequency distribution revealed that a higher (27.3) percentage of snaggers than conventional stream salmon anglers (5.4) travelled 300 miles or more from home to the fishing site. The mean of snaggers' travel distance was more than twice as large as that of conventional stream salmon anglers. A *t*-test was used to indicate if there was a significant difference between the samples of conventional stream salmon anglers and snaggers. The null hypothesis, that the population mean of conventional stream anglers is the same as the population mean of snaggers, was tested. "From the frequency distribution of the statistic is computed the probability of getting a more extreme value of the statistic. Intuitively, this is the probability of drawing two samples that differ more than the pair actually drawn" (Nie, 1975, p. 268). The *t* statistic was computed and resulted in a 2-tailed probability of 0.000 (significant at the alpha = .05 level) so the null hypothesis of same means of "travel distance" was rejected (see Table 2). This was evidence that the alternative hypothesis, that snaggers have different means of "travel distance", may be accepted.

Table 2.--Comparison of fishing trip characteristic means of snaggers and conventional stream salmon anglers.

Characteristic	Mean Snagging Method	Mean Conv. Methods	T value	Deg. of Freedom	2-tailed Prob.
Travel distance (in miles one way)	206.78	95.60	8.25	489.63	0.000*
Length of trip (in days)	2.97	1.73	7.00	556.47	0.000*

*significant at the alpha = .05 level

Descriptive statistics of snaggers' and conventional stream salmon anglers' "trip length" were examined before performing a statistical comparison of means. Approximately 72% of the conventional stream salmon anglers' trips were one day trips versus 31.9% one day trips for snaggers. The mean "trip length" was more than 50% greater for snaggers. A t-test was performed and used as evidence that a hypothesis of same mean "trip length" could be rejected at the alpha = .05 level. This result was evidence that snaggers' "trip length" was of different duration than that of conventional stream salmon anglers.

Spending Characteristics of Snaggers

Snaggers' expenditures were categorized according to location and type of expenditures. Snaggers spent significant sums of money at home preparing for their

snagging trip, while driving to and from snagging sites, and within ten miles of snagging sites. "Fishing supply" expenses (rods, reels, bait, fishing line, lures, hooks, weights and other fishing supplies) on site or on the entire trip were very high among snaggers. "Fishing supply" expenses surpassed all other spending categories combined excluding "groceries" and "automobile gas" (see Table 3).

Conventional stream salmon anglers did a relatively small portion of their spending within ten miles of the fishing site as compared to total spending. Spending averages revealed a high level of "fishing supplies" expenditures made at home or en route. In addition, "lodging" expenditures were very low.

Snaggers' and conventional stream salmon anglers' expenditure category means were compared. Visual comparison of categorical means revealed that snaggers spent more in every category listed except "boat gas" expenditures. Separate t-tests were performed to statistically test the hypotheses of same means for each of the categories and also for "total expenses". The hypotheses of same means was rejected for most categories, especially those with relatively high spending levels. These results are evidence that snaggers' daily spending levels were different than those of conventional stream salmon anglers.

Snaggers were asked about their willingness to purchase daily and annual permits to snag. About one-fourth (27.3%)

Table 3.--Comparison of mean expenditures of snaggers and conventional stream salmon anglers.

Category	Mean Snagging Method ($s)	Mean Conv. Methods ($s)	T value	Deg. of Freedom	2-tailed Prob.
Expenditures on site					
Fishing supplies	9.37	3.78	2.17	625	0.030*
Charters	.01	.00	0.61	625	0.543
Lodging	3.09	1.74	2.02	583.82	0.044*
Restaurants	2.92	2.42	1.00	611.92	0.319
Groceries	4.08	1.94	5.19	625	0.000*
Boat gas	.10	.29	-1.46	369.29	0.144
Auto gas	2.51	1.52	2.23	615.41	0.026*
Boat equipment	.11	.05	0.93	471.30	0.352
Entertainment	.32	.04	1.40	586.24	0.161
Other expenses	1.09	.48	2.01	402.99	0.045*
Total expenses	23.60	12.26	4.32	625	0.000*
Expenditures on trip					
Fishing supplies	13.75	10.24	5.28	464.17	0.000*
Charter	.01	.00	0.38	625	0.702
Lodging	3.23	1.93	2.01	575.99	0.045*
Restaurants	4.38	3.73	0.83	625	0.409
Groceries	8.06	3.94	3.30	625	0.001*
Boat gas	.17	.56	-0.81	336.82	0.420
Auto gas	9.88	7.92	1.81	575.80	0.072
Boat equipment	.13	.06	0.76	471.57	0.449
Entertainment	.40	.16	2.21	355.29	0.028*
Other expenses	1.66	.63	2.03	435.04	0.043*
Total expenses	41.67	29.16	5.12	606.41	0.000*

Note. Data were average daily spending levels for individuals.

*significant at the alpha = .05 level

of the snaggers (see Table 4) would not be willing to purchase a daily permit. Similarly, many (26.2%) would not be willing to purchase an annual permit. The modal non-zero range was $4.01 - $5.00 for a daily permit and $5.01-$10.00 for a yearly permit. The M.D.N.R. eventually adopted a special annual salmon snagging stamp at a cost in this range. As mentioned in Chapter 1, the price of a snagging stamp (an annual permit) is now $7.35.

Fishing Experience Characteristics of Snaggers, Conventional Stream Salmon Anglers, and Dual Method Stream Salmon Anglers

This section includes the discussion of three types of fishing experience characteristics for stream salmon anglers: 1) years fished; 2) self-rating as an angler; and 3) years salmon fished. All of the snaggers' and conventional stream salmon anglers' descriptive statistics are discussed. Only descriptive statistics of dual method stream salmon anglers in which frequency percentages lie outside those of snaggers or conventional stream salmon anglers will be discussed.

Snaggers' fishing experience characteristics are exhibited in Table 5. A predominance (91.2%) of stream salmon anglers who exclusively snagged had ten or more years of angling experience. There were more snaggers with at least 50 years of angling experience than snaggers who had

Table 4.-- Percentage distribution of snaggers' willingness-to-pay for a daily or annual snagging permit.

Willingness-to-pay for a daily permit	Percent
$00.00	27.3
$00.01-01.00	12.4
$01.01-02.00	19.7
$02.01-03.00	07.7
$03.01-04.00	04.6
$04.01-05.00	20.2
$05.01 plus	08.1
Total	100.1[a]
Willingness-to-pay for an annual permit	
$00.00	26.2
$00.01-05.00	19.2
$05.01-10.00	26.3
$10.01-15.00	05.5
$15.01-20.00	08.6
$20.01 plus	14.2
Total	100.0

[a]any deviation from 100.0 is due to rounding

Table 5.--Percentage distribution of fishing experience characteristics for snaggers, conventional, and dual method stream salmon anglers.

Characteristics	Snagging Method	Conventional Methods	Dual Method
Years of angling experience			
<10	08.8%	08.7%	05.4%
10 - 19	23.0%	25.0%	18.8%
20 - 29	25.9%	27.3%	30.4%
30 - 39	19.6%	19.1%	20.0%
40 - 49	12.5%	09.7%	14.2%
50 or more	10.2%	10.2%	11.2%
Totals	100.0%	100.0%	100.0%
Mean	26.872	26.267	28.561
Self-rating as an angler			
Beginner	05.4%	04.4%	01.5%
Somewhat Experienced	34.6%	28.1%	25.6%
Experienced	50.7%	56.9%	55.7%
Expert	09.4%	10.6%	17.2%
Totals	100.1%[a]	100.0%	100.0%
Mean	2.641	2.737	2.885
Years of salmon angling experience			
1	17.6%	16.9%	07.2%
2	12.7%	12.7%	08.1%
3	13.3%	12.0%	07.8%
4	10.2%	09.6%	10.1%
5	11.1%	10.8%	10.0%
6 - 10	19.2%	22.6%	35.0%
11 or more	15.9%	15.4%	21.8%
Totals	100.0%	100.0%	100.0%
Mean	5.738	5.827	7.307

[a]any deviation from 100.0 is due to rounding

less than ten. Snaggers averaged almost 27 years of angling experience. When they were asked to subjectively judge their own level of fishing experience or expertise ("self-rating as an angler"), more than half (60.1%) snaggers considered themselves either "experienced" or "expert" anglers. Approximately five percent considered themselves "beginners". This may raise questions related to opinions of some that snaggers are at an early stage of angling through which they will eventually progress. While 17.6% of the snaggers have only snagged one year, 46.2% of the snaggers surveyed have snagged five or more years, raising the snaggers' mean of "years fished" to nearly six years.

Conventional stream salmon anglers were also asked to reveal their fishing experience characteristics. Conventional stream salmon anglers had many years of angling experience. Approximately eight percent of the conventional stream salmon anglers had less than ten years of experience. A majority (66.3%) had 20 or more years of angling experience. Conventional stream salmon anglers averaged more than 26 years of angling experience. More than half (56.9%) of the anglers rated themselves as experienced anglers. More than half (62%) had five years or less of salmon angling experience. Approximately 15% had 11 or more years of salmon angling experience.

After visually comparing the descriptive statistics of fishing experience characteristics for snaggers and

conventional stream salmon anglers, univariate statistical tests were performed. When the percentages of categories for the "years fished" variable were compared, snaggers had a slightly greater number of anglers in the more experienced (30-39 years, 40-49 years) categories than conventional stream salmon anglers. However, the group means were nearly equal and a *t*-test of these data (see Table 6) indicated that at the alpha = .05 level, the hypothesis that they have the same means was accepted. The group of conventional stream salmon anglers included mostly (67.5%) anglers who proclaimed themselves as "experienced" or "expert" as an angler while the group of snaggers included less (60.1%) anglers in these groups. A chi-square value of 3.716 with three degrees of freedom and a .294 significance level led to the acceptance of the null hypothesis of no systematic relationship between self-rating and method. The salmon angling experience variable had some small differences between groups in the 6-10 year category as revealed in the percentage distribution frequency. Conventional stream salmon anglers had 22.6% in this category while snaggers had 19.2%. However, the means were very close for these two groups and a *t*-test performed on these data obtained a .827 2-tailed probability providing evidence to accept the hypothesis of same means at the alpha = .05 level.

Table 6.--Comparison of fishing experience characteristics means of snaggers and conventional stream salmon anglers.

Characteristic	Mean Snagging Method	Mean Conv. Methods	T value	Deg. of Freedom	2-tailed Prob.
Years fished	26.87	26.27	0.52	624.00	0.606
Self-rating as an angler[a]	2.64	2.74	---	---	---
Years salmon fished	5.74	5.83	-0.22	612.04	0.827

[a]ordinal-level variable for which 1 = beginner, 2 = somewhat experienced, 3 = experienced, and 4 = expert. T value, degrees of freedom, and 2-tailed probability does not apply to ordinal variables.

The most obvious distinguishing characteristics of dual method stream salmon anglers is their level of experience. Dual method stream salmon anglers were experienced anglers. Fewer (5.4%) of these anglers have less than ten years of angling experience than snaggers (8.8%) or conventional stream salmon anglers (8.7%). A majority (75.8%) have 20 years or more of angling experience. The average number of years of experience is about two years longer for dual method stream salmon anglers when compared to either snaggers or conventional stream salmon anglers. Dual method stream salmon anglers rated themselves highly as anglers with 17.2% rating themselves as "expert" anglers compared to 9.4% for snaggers and 10.6% for conventional stream salmon anglers. Some (1.5%) of the dual method stream salmon

anglers considered themselves beginners. Dual method stream salmon anglers have fished for salmon for an average of more than seven years. This was higher than results of less than six years for either snaggers or conventional stream salmon anglers.

In addition, although data were not collected on the number of total angling days during the year, the "number of trips"[11] by dual method stream salmon anglers (on average, 22.00, consisting of nine snagging and 13 conventional salmon angling trips) was higher than snaggers (7.00 trips), conventional stream salmon anglers for banning snagging (18.16 trips), or conventional stream salmon anglers against banning snagging (11.69 trips).

Alternate Activity Preferences of Snaggers and Conventional Stream Salmon Anglers

A series of questions was asked to ascertain what activities anglers would engage in if snagging opportunities were not available. These questions were directed to determine impacts of banning snagging on future salmon fishing and at snagging sites. Most (63.9%) of the snaggers (see Table 7) would discontinue salmon angling if

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[11] This variable indicates the number of past and expected trips for salmon and is limited in its use as an approximation for intensity because of obvious variations which occur between anglers in average trip length and the highly questionable assumption that trip length is the average trip length for the angler over the fishing year.

Table 7.--Percentage distribution of alternate activity preferences for stream salmon anglers if snagging opportunities were not present.

Alternate activity preferences	Percent
Snaggers' level of salmon angling	
Would not fish at all for salmon	63.9
Would fish more for salmon	03.3
Would fish less for salmon	15.5
Would fish the same amount for salmon	17.2
Total	99.9[a]
Levels of salmon angling at snagging sites by snaggers who would continue to fish for salmon	
Would not fish at all at sites	53.2
Would fish more than now at sites	01.0
Would fish less than now at sites	13.9
Would fish the same amount as now at sites	31.9
Total	100.0
Snaggers' length of present trip	
Would have been shorter	01.1
Would have been the same length	10.7
Would have been longer	00.8
Would not have taken the trip	87.5
Total	100.1[a]
Snaggers' alternate activity	
Working	23.4
Fishing in Michigan (for Salmon 8.4%, other 9.1%)	17.5
Fishing outside of Michigan	09.8
Other Recreation Activities	21.3
Other	28.0
Total	100.0
Conventional angler's use of snagging sites	
Would not fish more	65.4%
Would fish more	34.6%
Total	100.0%

[a]any deviation from 100.0 is due to rounding

snagging were banned. About one-third (32.9%) of those who would continue salmon fishing would do so at the snagging sites at least as often as they do now. A preponderance (87.5%) of snaggers wouldn't have made their trip if snagging opportunities were not available. In contrast to the negative impacts of discontinuing snagging, 34.6% of the conventional stream salmon anglers stated they would fish more at the snagging sites if snagging were banned.

Socioeconomic Characteristics of Stream Salmon Anglers

Snaggers were asked questions aimed at revealing their socioeconomic characteristics. A preponderance (94.4%) of snaggers were males (see Table 8). A similar percentage (94.5%) were white[12]. About one-fourth (26%) of the snaggers had been to college. About three-fourths (76.0%) of the snaggers were employed. Professional, managerial, and sales workers made up 27.3% of all snaggers. Almost one-fourth (24.9%) had individual incomes below $10,000. However, 4.1% reported "family income" levels that low.

Conventional stream salmon anglers were also asked several questions aimed at determining their socioeconomic characteristics. Conventional stream salmon anglers were predominantly (96.6%) male. Conventional stream salmon

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[12] Statistics of Michigan licensed anglers in a table by Kikuchi (1986, p. 70) revealed that non-whites represented approximately 12% of all anglers in his sample.

Table 8.--Percentage distribution of socioeconomic characteristics for snaggers, conventional stream salmon anglers and dual method stream salmon anglers.

Characteristic	Snagging Method	Conventional Methods	Dual Method
Sex			
Male	94.4%	96.6%	96.4%
Female	05.6%	03.4%	03.6%
Totals	100.0%	100.0%	100.0%
Race			
White	94.5%	96.2%	94.9%
Black	03.3%	02.3%	03.9%
American Indian	00.4%	00.6%	00.6%
Hispanic	01.3%	00.3%	00.4%
Oriental	00.5%	00.5%	00.1%
Totals	100.0%	99.9%[a]	99.9%[a]
Education level completed			
Grade School	08.0%	04.1%	06.4%
Some High School	19.3%	11.0%	16.4%
High School	46.7%	37.2%	37.3%
Some College	17.0%	25.9%	26.4%
College	06.2%	13.7%	08.8%
Some Graduate School	01.4%	02.2%	01.9%
Advanced Degree	01.4%	05.8%	02.8%
Totals	100.0%	99.9%[a]	100.0%
Employment status			
Retired	13.9%	13.2%	13.8%
Unemployed	08.1%	06.3%	06.1%
Student	02.0%	03.3%	02.0%
Employed	76.0%	77.2%	78.1%
Totals	100.0%	100.0%	100.0%

[a]any deviation from 100.0 is due to rounding

Table 8.--Continued.

Characteristic	Snagging Method	Conventional Methods	Dual Method
Most recent occupation			
Professional	14.4%	22.9%	16.0%
Managerial	09.8%	12.3%	12.2%
Sales	03.1%	06.0%	02.9%
Clerical	00.7%	01.2%	00.7%
Craftsman	15.4%	16.3%	16.6%
Operator	15.4%	10.2%	16.8%
Laborer	37.6%	26.9%	32.6%
Unemployed	02.2%	00.3%	01.4%
Student	01.4%	04.0%	00.8%
Totals	100.0%	100.1%[a]	100.0%
Individual income level (in dollars)			
Below 10,000	24.9%	21.1%	20.0%
10,000-14,999	14.1%	15.3%	16.5%
15,000-19,999	17.5%	15.7%	16.5%
20,000-24,999	15.5%	14.1%	16.0%
25,000-29,999	13.4%	10.7%	13.4%
30,000-34,999	06.6%	08.8%	05.8%
35,000-39,999	03.9%	06.5%	04.5%
40,000-44,999	02.1%	03.0%	04.1%
45,000-49,999	01.2%	01.9%	00.7%
50,000 plus	00.8%	02.9%	02.4%
Totals	100.0%	100.0%	99.9%[a]
Family income level (in dollars)			
Below 10,000	04.1%	00.0%	03.2%
10,000-14,999	07.4%	04.0%	07.2%
15,000-19,999	09.8%	13.0%	07.7%
20,000-24,999	12.9%	13.7%	15.2%
25,000-29,999	12.0%	15.7%	14.1%
30,000-34,999	13.9%	13.8%	10.4%
35,000-39,999	12.3%	12.1%	16.1%
40,000-44,999	08.4%	08.9%	05.9%
45,000-49,999	08.2%	06.5%	07.7%
50,000 plus	11.0%	12.3%	12.4%
Totals	100.0%	100.0%	99.9%[a]

[a]any deviation from 100.0 is due to rounding

anglers were predominantly (96.2%) white. About 85% obtained at least a high school education, 47.6% were college educated, and 8.0% were educated beyond a bachelor's degree. More than three-fourths (77.2%) worked while 19.5% were either retired (13.2%) or unemployed (6.3%). The occupational category with the largest percentage of conventional stream salmon anglers was laborers (26.9%). However, professionals (22.9%), craftsmen (16.3%), and managers (12.3%) were also represented. More than half (52.1%) of the conventional stream salmon anglers had individual incomes under $20,000. More than half (53.6%) had family incomes of $30,000 or above. While 21.1% had individual incomes under $10,000, no (0%) family incomes under $10,000 were reported.

Following a visual comparison of socioeconomic characteristics of snaggers and conventional stream salmon anglers, univariate tests were performed to indicate whether any statistical relationships existed between these characteristics and method employed. Although these two groups were very similar with respect to socioeconomic variables, some differences did exist. More than one-fourth (27.3%) of the snaggers had not finished high school while fewer (15.1%) of the conventional stream salmon anglers had not finished. While 9.0% of the snaggers had at least a bachelor's degree, 21.7% of the conventional stream salmon anglers did. The difference in education level seemed

apparent. A chi-square value of 37.598 with 6 degrees of freedom and a significance level of 0.000 (significant at the alpha = .05 level) indicated that the null hypothesis of no systematic relationship between "education level completed" and method could be rejected (see Table 9). This is evidence that a relationship exists between "education level completed" and method. When asked about their most recent occupation, stream salmon anglers revealed that in the white collar occupations (professionals, managers, and salespersons) conventional stream salmon anglers had 22.9%, 12.3%, and 6.0% respectively versus 14.4%, 9.8% and 3.1% respectively for snaggers. In blue collar occupations, results were mixed. A small percentage (2.2%) of snaggers had unemployed as their last occupation compared to none (0%) of the conventional stream salmon anglers. A chi-square value of 23.596 with 9 degrees of freedom and a 0.005 significance level provided evidence to reject the null hypothesis that there is no relationship between "occupation" and method. This is evidence that a relationship exists between "occupation" and method.

Table 9.--Tests of statistical independence of socioeconomic characteristics and methods (conventional stream salmon angling and snagging).

Characteristic	Chi-square	D.F.	Significance
Sex	1.276	1	0.259
Race	3.104	5	0.684
Education level completed	37.598	6	0.000*
Employment status	7.658	9	0.569
Occupation	23.596	9	0.005*
Income level	9.639	9	0.380
Family income level	7.773	9	0.557

*significant at the alpha = .05 level

Importance of Motivation Variables to Stream Salmon Anglers

Another major category in which snaggers and conventional anglers were profiled and statistically tested was the importance levels of motivations for fishing. Anglers were asked to separately indicate the importance level for each of several fishing motivations. The anglers were asked to rate these reasons from "very important" to "not important" (very important, important, somewhat important, and not important). Surprisingly, there are some results where dual method stream salmon anglers have frequency percentages which lie outside either snaggers or conventional stream salmon anglers. There is only one variable on which dual method stream salmon anglers' mean importance level is not in between or extremely close to the

other groups' means. This is the only variable on which descriptive statistics will be discussed for dual method stream salmon anglers.

These data indicate that there are other important motivations for snagging other than "to catch fish to eat". Among available reasons, more (57.2%) anglers thought "for the challenge and excitement" was "very important" than occurred in any other reason. Because some conventional stream salmon anglers may feel that snagging is "too easy" it may be surprising to them that challenge was so important to snaggers (see Table 10). "To enjoy nature" is close behind in the percentage of snaggers who picked a particular motivation as "very important" in why they snag. Although known as "slobs" to some, snaggers as a group find "to enjoy nature" "important". Although some people may suspect that snaggers would pick "to catch fish to eat" as "very important" in why they snag more often than occurred with any other motivation, this variable was third at 42.2%. In addition, "to get away" was very important to 39.6% of the snaggers in the sample. In contrast, 4.9% of the snaggers felt that "to be alone" was a "very important" reason to snag. Furthermore, 10.7% of the snaggers indicated that improving fishing skills was a "very important" reason to snag.

Conventional stream salmon anglers were also asked to indicate the importance level of various motivations as

Table 10.--Percentage distribution of motivation importance levels for snaggers, conventional stream salmon anglers, and dual method stream salmon anglers.

Motivation	Snagging Method	Conventional Methods	Dual Method
To catch fish to eat			
Very Important	42.2%	15.6%	35.2%
Important	32.0%	24.5%	32.2%
Somewhat Important	17.9%	31.5%	20.0%
Not Important	07.9%	28.4%	12.6%
Totals	100.0%	100.0%	100.0%
Mean	1.916	2.726	2.100
For relaxation			
Very Important	35.6%	49.3%	37.6%
Important	38.5%	37.0%	35.2%
Somewhat Important	16.2%	10.2%	17.2%
Not Important	09.8%	03.5%	10.0%
Totals	100.1%[a]	100.0%	100.0%
Mean	2.002	1.680	1.996
For companionship			
Very Important	22.4%	23.5%	23.4%
Important	30.5%	34.1%	31.0%
Somewhat Important	23.1%	19.7%	20.8%
Not Important	24.1%	22.8%	24.8%
Totals	100.1%[a]	100.1%[a]	100.0%
Mean	2.489	2.418	2.470
To enjoy nature			
Very Important	43.9%	51.6%	49.2%
Important	37.6%	36.9%	32.4%
Somewhat Important	11.8%	07.9%	13.0%
Not Important	06.6%	03.6%	05.4%
Totals	99.9%[a]	100.0%	100.0%
Mean	1.812	1.636	1.746

Note. Motivation variables are ordinal-level data with values: 1 = very important; 2 = important; 3 = somewhat important; and 4 = not important.

[a]any deviation from 100.0 is due to rounding

Table 10.--Continued.

Motivation	Snagging Method	Conventional Methods	Dual Method
For the challenge and excitement			
Very Important	57.2%	60.3%	57.4%
Important	28.3%	27.5%	29.2%
Somewhat Important	09.4%	08.6%	07.4%
Not Important	05.1%	03.6%	06.0%
Totals	100.0%	100.0%	100.0%
Mean	1.642	1.554	1.621
To be alone			
Very Important	04.9%	06.6%	06.6%
Important	07.8%	13.3%	09.3%
Somewhat Important	16.0%	21.9%	14.5%
Not Important	71.2%	58.2%	69.6%
Totals	99.9%[a]	100.0%	100.0%
Mean	3.535	3.316	3.471
To improve my fishing skills			
Very Important	10.7%	14.5%	12.3%
Important	17.7%	20.3%	19.2%
Somewhat Important	26.5%	31.2%	21.8%
Not Important	45.1%	34.0%	46.6%
Totals	100.0%	100.0%	99.9%[a]
Mean	3.061	2.848	3.028
To get away			
Very Important	39.6%	42.3%	38.9%
Important	28.6%	31.4%	28.0%
Somewhat Important	16.5%	12.1%	15.3%
Not Important	15.3%	14.2%	17.8%
Totals	100.0%	100.0%	100.0%
Mean	2.075	1.983	2.120

Note. Motivation variables are ordinal-level data with values: 1 = very important; 2 = important; 3 = somewhat important; and 4 = not important.

[a]any deviation from 100.0 is due to rounding

Table 10.--Continued.

Motivation	Snagging Method	Conventional Methods	Dual Method
For exercise			
Very Important	23.5%	16.4%	22.9%
Important	27.1%	23.6%	23.7%
Somewhat Important	23.6%	23.5%	23.8%
Not Important	25.8%	36.5%	29.7%
Totals	100.0%	100.0%	100.1%[a]
Mean	2.519	2.801	2.602
Family togetherness			
Very Important	24.8%	18.5%	21.9%
Important	20.5%	24.1%	24.0%
Somewhat Important	16.2%	14.4%	17.0%
Not Important	38.5%	42.9%	37.1%
Totals	100.0%	99.9%[a]	100.0%
Mean	2.683	2.818	2.693
To catch a trophy fish			
Very Important	16.9%	19.1%	19.3%
Important	17.3%	15.9%	16.1%
Somewhat Important	15.4%	18.2%	17.8%
Not Important	50.4%	46.8%	46.8%
Totals	100.0%	100.0%	100.0%
Mean	2.993	2.928	2.922
For a sense of achievement			
Very Important	22.5%	19.5%	20.2%
Important	26.2%	30.1%	24.5%
Somewhat Important	21.8%	19.9%	19.7%
Not Important	29.5%	30.5%	35.7%
Totals	100.0%	100.0%	100.1%[a]
Mean	2.583	2.614	2.709

Note. Motivation variables are ordinal-level data with values: 1 = very important; 2 = important; 3 = somewhat important; and 4 = not important.

[a]any deviation from 100.0 is due to rounding

reasons why they fished for salmon. Among the available reasons presented, conventional stream salmon anglers also assigned "very important" most frequently (60.3%) to "for the challenge and excitement" as a reason to fish. Close behind "for the challenge and excitement" was "to enjoy nature" and "for relaxation" with 51.6% and 49.3% respectively indicating these motivations were "very important". In contrast, some motivations as reasons to salmon fish were "not important" to many conventional stream salmon anglers. More than half (60.3%) felt that being alone was "not important" as a reason to salmon fish. Similarly, "to catch a trophy fish" or "family togetherness" were "not important" to 64.8% and 42.9% of conventional stream salmon anglers respectively.

Among reasons to fish, dual method stream salmon anglers' mean importance levels are consistently in between or extremely close to snaggers and conventional stream salmon anglers with the exception of "for a sense of achievement" as a reason to fish. Approximately 35.7% of dual method stream salmon anglers consider achievement as "not important" as a reason to salmon fish compared to 29.5% of snaggers and 30.5% of conventional stream salmon anglers.

In addition to the visual comparison of percentage frequencies, chi-square results are presented for each variable where a significant raw chi-square provides

evidence of a relationship between the variable and method. The percentage of snaggers who rated "to catch fish to eat" as "not important" was 7.9%. In contrast, 28.4% of the conventional stream salmon anglers expressed that "to catch fish to eat" was "not important". About 15% of the conventional stream salmon anglers versus almost half (42.2%) of the snaggers felt "to catch fish to eat" was "very important". The chi-square value of 88.229 (see Table 11) led to the rejection of the null hypothesis that there is no relationship between this motivation and method. Thus, there is evidence of the existence of a relationship between this motivation and method.

The second variable of the reasons for fishing group was "for relaxation" as a reason to fish. The most noticeable difference between snaggers and conventional stream salmon anglers was in the percentage frequency who regarded "for relaxation" as a "very important" reason to fish. Among snaggers, 35.6% stated that "for relaxation" was "very important" while almost half (49.3%) of the conventional stream salmon anglers felt that this was a "very important" reason to fish. A chi-square value of these two groups on the "for relaxation" variable was 20.239 with three degrees of freedom and a 0.000 significance level which led to the rejection of the null hypothesis that there is no relationship between this motivation and method.

Table 11.--Tests of independence of motivations and methods (conventional stream salmon angling and snagging).

Characteristic	Chi-square	D.F.	Significance
To catch fish to eat	88.229	3	0.000*
For relaxation	20.239	3	0.000*
For companionship	1.646	3	0.649
To enjoy nature	7.106	3	0.069
For the challenge and excitement	1.213	3	0.750
To be alone	12.021	3	0.007*
To improve my fishing skills	8.263	3	0.041*
To get away	2.871	3	0.412
For exercise	10.220	3	0.017*
Family togetherness	4.801	3	0.187
To catch a trophy fish	1.742	3	0.628
For a sense of achievement	1.756	3	0.624

*significant at the alpha = .05 level

Thus, there is evidence that a relationship exists between the "for relaxation" motivation and method.

Although univariate statistical analysis of "to enjoy nature" was insignificant at the alpha = .05 level, there was a large difference between the percentage of snaggers (43.9%) and conventional stream salmon anglers (51.6%) who felt this reason was "very important". A chi-square value of 7.106 with three degrees of freedom was not significant (0.069) at the alpha = .05 level but significant at the alpha = .10 level. The null hypothesis, that there is no relationship between this motivation and method can be rejected with less that 10% chance of a making a Type I error. Thus, there is "weak" evidence that a relationship between this motivation and method exists.

As in the case of the "for relaxation" variable, more conventional stream salmon anglers found it "very important" "to be alone" than snaggers. However, most snaggers (87.2%) and conventional stream salmon anglers (80.1%) found "to be alone" only a "somewhat important" or "not important" motivation as a reason to fish. The chi-square value of 12.021 with three degrees of freedom and a significance level of 0.007 resulted in the rejection of the null hypothesis that there is no systematic relationship between the motivation "for relaxation" and method. Thus, there is evidence that a relationship exists for this motivation and method.

The percentage frequencies of "to improve my fishing skills" as a reason to fish revealed that many (71.6%) snaggers and conventional stream salmon anglers (65.2%) stated that this was "not important" or a "somewhat important" reason to fish. A chi-square value of 8.263 with a 0.041 significance level resulted in the rejection of the hypothesis that no systematic relationship exists between the motivation "to improve my fishing skills" and method. Thus, there is evidence that a relationship exists between "to improve my fishing skills" and method.

More snaggers (23.5%) than conventional stream salmon anglers (16.4%) found "for exercise" as "very important". The results of the chi-square test with a 0.017 significance level provided evidence to reject the null hypothesis that there is no systematic relationship between the motivation "for exercise" and method. Thus, there is evidence that a relationship between this motivation and method exists.

Univariate Statistical Analysis of Characteristics of Conventional Stream Salmon Anglers with Different Viewpoints on Banning Snagging and the Reasons for these different viewpoints

I employed chi-square and *t*-test as inferential statistics to study any evidence of relationships of variables to viewpoints and to study differences in group means. At the alpha = .05 significance level, there was no instance where the null hypothesis of no systematic relationship between a variable and viewpoint could be rejected (see Table 12). At the alpha = .05 significance level, there was no instance where a hypothesis of same means of a interval or ratio-level variable could be rejected (see Table 13). Because of this, a complete descriptive profile of these angler subgroups has been omitted. See the profile of conventional stream salmon anglers for a close approximation of either of these two groups. The small differences in these groups usually occur with the anglers in favor of banning snagging exhibiting characteristics less similar to snaggers see Table 14).

Members of these groups gave reasons to support their viewpoints. This section reveals the reasons given by conventional stream salmon anglers to support viewpoints for (53.3%) or against (46.7%) the banning of snagging.

Most of the reasons for conventional stream salmon anglers' viewpoints for the banning of snagging may be

Table 12.--Tests of statistical independence of variables (characteristics and motivations) and conventional stream salmon anglers' viewpoints on banning snagging.

Characteristic or Motivation	Chi-square	D.F.	Significance
Michigan residency	1.517	1	0.218
Self-rating as an angler	1.323	3	0.724
Sex	0.000	1	1.000
Race	4.013	5	0.548
Education level achieved	5.002	6	0.544
Employment status	7.173	9	0.619
Occupation	6.396	9	0.700
Individual income level	6.094	9	0.730
Family income level	3.981	8	0.859
To catch fish to eat	2.174	3	0.537
For relaxation	1.675	3	0.643
For companionship	0.359	3	0.949
To enjoy nature	0.255	3	0.968
For the challenge and excitement	2.050	3	0.562
To be alone	1.553	3	0.670
To improve my fishing skills	3.701	3	0.296
To get away	3.818	3	0.282
For exercise	1.919	3	0.589
Family togetherness	2.390	3	0.496
To catch a trophy fish	0.909	3	0.823
For a sense of achievement	0.502	3	0.918

Table 13.--Comparison of user characteristic means of conventional stream salmon anglers with different viewpoints on banning snagging.

Characteristic	Favor Ban Mean	Oppose Ban Mean	T value	Deg. of Freedom	2-tailed Prob.
Travel distance	88.89	103.44	-1.10	306	0.273
Length of trip	1.71	1.75	-0.19	312	0.852
Years fished	26.48	26.02	0.28	311	0.781
Years salmon fished	6.17	5.43	1.37	311	0.171

Table 14.--Motivation means of conventional stream salmon anglers with different viewpoints on banning snagging.

Motivation	Favor Ban Mean	Oppose Ban Mean
To catch fish to eat	2.80	2.63
For relaxation	1.65	1.72
For companionship	2.39	2.46
To enjoy nature	1.62	1.66
For the challenge and excitement	1.50	1.61
To be alone	3.30	3.34
To improve my fishing skills	2.75	2.97
To get away	1.92	2.06
For exercise	2.77	2.84
Family togetherness	2.80	2.84
To catch a trophy fish	2.88	2.99
For a sense of achievement	2.59	2.64

Note. Motivation variables are ordinal-level data with values: 1 = very important; 2 = important; 3 = somewhat important; and 4 = not important.

classified into two groups. These are: 1) snagging is unsportsmanlike (80.4%); and 2) there are crowding problems that often occur at snagging sites (13.1%).

"Unsportsmanlike" was heard time and time again by interviewers when asking whether or not snagging should be banned. Many conventional stream salmon anglers consider the behavior of snaggers as unsportsmanlike. "They catch too many", "it's too easy", and "they catch all the fish" are common complaints which seem to exhibit feelings of unfair competition. Unsportsmanlike behavior stated explicitly (44.6%) or reasons associated with unsportsmanlike behavior by the author accounted for the great majority (80.4%) of reasons for banning snagging[13].

Unsportsmanlike or non-fair play concerns about snagging may also be the result of imposing the fair play rules of the "trout ethic" on stream salmon angling. This may be the basis for reasons such as "not fishing" or "use the skilled way". Concern over the "fragility" and "weakness" of salmon in streams as a reason against snagging may be further evidence of the imposition of the trout ethic or different rules of sportsmanship.

Some anglers argue that snagging, like netting fish, is not sport fishing. Hummel and Foster (1986) report:

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[13] A listing of reasons for and against snagging obtained in this study is available.

> Historically, the genesis of fishing was part of a subsistence economy. Fish were caught to eat, and method was irrelevant. The notion of fair play only emerged as fishing became a non-subsistence activity for the leisure classes. Ancient Egyptian and Chinese royalty fished for recreational pleasure and sport, using angling techniques (i.e. hook, rod and line) some 3000 years ago (Rundell, 1984), while the peasantry [italics added] caught fish for food by any successful means. Later, the land-owning nobility of the Renaissance reserved the better fishing streams for their personal use, excluding the masses (Gabrielson, 1963, p. 623). Thus, sport fishing began as a leisure class recreation ....(pp. 41-42)

Perhaps, the label of unsportsmanlike is a concern over the protection of the integrity of fishing as a sport while an assumed peasantry catches food by any means possible.

A second major classification of reasons against salmon snagging centers around problems associated with crowding; "dangerous", "litter", "discourteous" and "environmental damage" seem to be mainly (although not exclusively) a result of the crowded conditions of snagging sites rather than because of the activity per se.

In addition, there were some reasons which seemed to be emotional outbursts and reflect viewpoints based more on feelings than any other rationale. These responses were often very colorful.

However, many conventional stream salmon anglers don't feel that snagging should be banned. Their reasons can be grouped into four general categories. A majority of these anglers (56.5%) reported reasons categorized into the general reason that people be allowed to utilize the

resource because the fish will soon die anyway. Minor general categories included: 1) people should be allowed to do it if they want to (6.8%); 2) it is a comparatively efficient method to catch salmon and should be available (5.4%); and 3) those who engage in snagging need the salmon for food and snagging provides a means to obtain it (5.4%). However, in addition to these reasons for not banning snagging, 13.7% of the conventional stream salmon anglers who felt snagging should be allowed indicated a concern for control (including management of both the crowded conditions on legal sites and/or policing illegal snagging).

On average, anglers who were against snagging made and planned 55% more trips (18.16 versus 11.69) than those who were not. However, because the number of angler days would reflect angler intensity much more accurately and these data were not obtained, number of trips was not statistically compared or used in subsequent discriminant analysis.

Univariate Statistical Analysis of Snaggers with Different Expected Behavior with Regard to Continuing Salmon Fishing if Snagging were Banned

Chi-square and *t*-test were the inferential statistics used to study any evidence of relationships of variables and continuing salmon fishing if snagging were banned or to study differences in group means among snaggers who would and would not continue to salmon fish if snagging were

banned. At the alpha = .05 level, there was no instance where the null hypothesis of no systematic relationship between a variable and expected salmon fishing behavior could be rejected at the alpha = .05 significance level (see Table 15). At the alpha = .10 significance level, there was only one instance ("years fished") where a null hypothesis of same means for an interval ratio-level variable could be rejected and evidence existed for the alternative hypothesis of different means (see Table 16). Because of the similarity of these subgroups of snaggers, see the profile of snaggers for a close approximation of either of these subgroups. The small differences in these groups usually occur with the snaggers who would discontinue salmon fishing exhibiting characteristics less similar to conventional stream salmon anglers (see Table 17).

Table 15.--Tests of independence of variables and adoption of method (Chi-square Analysis of snaggers with different expectations of continuing salmon fishing if snagging were banned.

Characteristic or Motivation	Chi-square	D.F.	Significance
Michigan residency	1.999	1	0.157
Self-rating as an angler	2.648	3	0.449
Sex	0.766	1	0.381
Race	1.748	4	0.782
Education level completed	1.376	6	0.967
Employment status	5.438	9	0.794
Occupation	6.949	8	0.542
Individual income level	2.170	9	0.988
Family income level	4.797	9	0.852
To catch fish to eat	4.985	3	0.173
For relaxation	1.882	3	0.597
For companionship	0.604	3	0.895
To enjoy nature	3.461	3	0.323
For the challenge and excitement	4.495	3	0.213
To be alone	5.505	3	0.138
To improve my fishing skills	2.434	3	0.487
To get away	0.492	3	0.921
For exercise	1.394	3	0.707
Family togetherness	1.951	3	0.583
To catch a trophy fish	1.946	3	0.584
For a sense of achievement	2.162	3	0.539

Table 16.--Comparison of user characteristic means of snaggers with different expectations of continuing salmon fishing if snagging were banned.

Characteristic	Mean Will Not Fish	Mean Will Fish	T Value	Deg. of Freedom	2-Tail Prob.
Travel distance	220.19	182.85	1.52	307	0.130
Length of trip	3.07	2.77	1.00	308	0.317
Years fished	27.85	24.82	1.75	308	0.081
Years salmon fished	5.67	5.79	-0.18	306	0.855

Table 17.--Motivation means of snaggers with different expectations of continuing salmon fishing if snagging were banned.

Motivation	Will Not Fish Mean	Will Fish Mean
To catch fish to eat	1.84	2.06
For relaxation	1.97	2.07
For companionship	2.47	2.54
To enjoy nature	1.82	1.81
For the challenge and excitement	1.60	1.64
To be alone	3.59	3.47
To improve my fishing skills	3.12	2.96
To get away	2.11	2.03
For exercise	2.56	2.44
Family togetherness	2.69	2.68
To catch a trophy fish	2.97	3.03
For a sense of achievement	2.60	2.57

Note. Motivation variables are ordinal-level data with values: 1 = very important; 2 = important; 3 = somewhat important; and 4 = not important.

CHAPTER V

DISCRIMINANT ANALYSES OF GROUPS OF STREAM SALMON ANGLERS

The findings of the descriptive statistics and univariate statistical analyses were presented in the preceding chapter. These findings were important to the discriminant analyses of different groups of stream salmon anglers. Specifically, the univariate statistical analyses were used in identifying variables likely to be discriminators of groups of stream salmon anglers.

This chapter contains the results of the discriminant analyses of groups of stream salmon anglers. The chapter is divided into three sections. Each section includes the results of the study of differences between two groups of stream salmon anglers with respect to several angler characteristics and motivations considered simultaneously. The first section includes the results of the study of multivariate differences between snaggers and conventional stream salmon anglers. The next section includes the results of the study of multivariate differences between conventional stream salmon anglers with a viewpoint that snagging should be banned and conventional stream salmon anglers with a viewpoint that snagging should not be banned.

The final section includes the results of the study of multivariate differences between snaggers who expect to discontinue salmon fishing if snagging were banned and snaggers who expect to continue salmon fishing if snagging were banned.

In order to study the differences between groups of anglers in each section, it is necessary to complete several steps. These steps include: 1) examination of the Linear discriminant function (L.D.F.) with respect to its satisfaction of the equality of group covariance matrices assumption; 2) initial interpretation of the L.D.F. concerning its ability to significantly discriminate groups using a set of several predictor variables; 3) further interpretation of the L.D.F. concerning relationships between individual predictor variables and the L.D.F.; and 4) examination of the effectiveness of the L.D.F. with respect to its classification capability.

L.D.F.s are utilized in this study for a number of reasons. Linear discriminant functions, as compared to more complex discriminant functions, are easier to interpret because of the ease of isolating predictor variable effects (Morrison, 1969, pp. 156-157). "Furthermore, more complicated functions may not be feasible if the dimensionality is large" (Hand, 1981, p. 94).

Each L.D.F. was developed and tested using the same process. Initially, anglers were separated into two

mutually exclusive groups. Next, a number of different independent variables were specified for inclusion in the L.D.F.. These independent variables were submitted in a stepwise fashion and tested for their contribution to the discriminating ability of the L.D.F.. The stepwise procedure was utilized because the contribution of the independent variables in a multivariate function was not known. In addition, this procedure eliminated variables which did not contribute to the discrimination of the groups resulting in a more parsimonious function than might have been obtained otherwise. Wilk's lambda was the statistic used as a test for variable inclusion into the L.D.F.. Wilk's lambda was considered appropriate to test for inclusion because it takes into account the distance between groups and also within group homogeneity when testing variables for inclusion. Wilk's lambda was used in the calculation of two of the three tests for inclusion used during the stepwise procedure. Wilk's lambda was used in the calculation of the partial multivariate F statistics "F-to-enter" and "F-to-remove". Klecka (1980) states:

> The F-to-enter is a partial multivariate F statistic which tests the additional discrimination introduced by the variable being considered after taking into account the discrimination achieved by the other variables already entered (Dixon, 1973: 241).... The F-to-remove is also a partial multivariate statistic, but it tests the significance of the decrease in discrimination should that variable be removed from the list of variables already selected. (p. 57)

A test of the degree of linear association between the independent variables in the L.D.F. was measured as another test of variable inclusion used in the stepwise procedure. If this association, known as "tolerance"[14], was high (tolerance was below .001), then the additional variable was not included. Also, if the inclusion of an additional variable reduced the tolerance of a variable already included in the L.D.F. (tolerance was below .001), then the additional variable was not included.

A Box's M test of the equality of group covariance matrices was performed. This test results in a significance probability. If the significance probability is below alpha = .05, then the null hypothesis that there is equality of group covariance matrices is rejected. Thus, there is evidence that the assumption of equality of group covariance matrices is violated. The equality of group matrices assumption, as mentioned in the literature review chapter, is an important assumption of L.D.F.'s. If this assumption is violated, then the L.D.F. does not minimize the probability of misclassification.

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[14] "For the ith independent variable, it is 1 - R_i^2, where R_i^2 is the squared multiple correlation coefficient when the ith independent variable is considered the dependent variable and the regression equation between it and the other independent variables is calculated. Small values for the tolerance indicate that the ith independent variable is almost a linear combination of the other independent variables" (Norusis, 1985, p. 94).

The L.D.F.'s were also tested for significance. The null hypothesis was that group means calculated by the L.D.F. were equal. To test this, a Wilk's lambda was calculated, transformed into a chi-square value, and a significance level was reported. If this level was below the alpha = .05 significance level, then the null hypothesis was rejected. Thus, there would be evidence that group centroids (average group scores along a dimension in discriminant space) calculated by the L.D.F. were unequal. If group centroids were statistically unequal, then discrimination is occurring via the L.D.F.. Otherwise, further interpretation of the L.D.F. would be unnecessary.

The contributions of individual variables to the L.D.F. were examined during the interpretation phase of the discriminant analysis. Coefficients of standardized variables[15] (standardized discriminant function coefficients) were examined to determine relative contribution of standardized variables to L.D.F. scores. Variables with the highest absolute value of their standardized discriminant function coefficients were the best discriminators (i.e. a unitary change in the standardized discriminant function coefficient had a greater affect on the discriminant score). The standardized

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[15] Standardized variables are variables which have been adjusted to compensate for measurement scale. Standardized variables have the same means (0) and standard deviations (1).

discriminant function coefficients were also examined with respect to the direction[16] of predictor variable relationships to the discriminant score. Positively related standardized discriminant function coefficients increase the discriminant score for positive variable values[17]. Negatively related standardized discriminant function coefficients increase the discriminant score for negative variable values. High discriminant scores are associated with group membership in one of the groups.

In order to assess the accuracy of the coefficients of the standardized variables, it is necessary to examine the relationships between predictor variables. When predictor variables are correlated, the magnitude of the standardized discriminant function coefficients may not be an accurate measure of the relative contribution of the predictor variables on the discriminant scores. Even the sign of the standardized discriminant function coefficients may be incorrect. The standardized discriminant function coefficients of two correlated predictor variables will be affected because one of the variables will take out some of the effect of the other on the L.D.F.. Because of this, the

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[16] If the group centroid of the group that is to be explained is negative, the signs of the standardized discriminant function coefficients must be reversed when interpreting the direction of relationships of the predictor variables on the discriminant scores.

[17] These values are Z scores where, for example, a "0" is the equivalent of the value of the unstandardized "grand mean" value.

bivariate correlation between predictor variables were examined to get an understanding of the extent of the correlations between the predictor variables.

In addition, because of the interpretive difficulties associated with predictor variable correlation, it is also useful to examine pooled within-groups correlations. Bivariate correlations between each variable and the L.D.F. were examined. These correlations are not affected by the existence of a relationship between the predictor variables. The pooled within-groups correlations were calculated by combining within-group correlations between the L.D.F. and variable values for each group.

The effectiveness of the L.D.F. was based on its classification capability. The L.D.F. was effective based on its classification capability if it provided an increased classification accuracy over chance.[18]

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[18] "A proportional reduction in error statistic, tau, which will give a standardized measure of improvement regardless of the number of groups, is:

$$\text{tau} = \frac{n_c - \sum_{i=1}^{g} p_i n_i}{n. - \sum_{i=1}^{g} p_i n_i}$$

where n_c is the number of cases correctly classified and p_i is the prior probability of group membership." (Klecka, 1980, p. 50-51)

Discriminant Analysis of Conventional Stream Salmon Anglers and Snaggers

Stream salmon anglers were separated into two mutually exclusive groups based on salmon fishing methods they utilized. The first group consisted of anglers who employed only conventional methods to catch stream salmon. The other group included anglers who employed only snagging to catch stream salmon.

Among all variables obtained, 19 independent variables were available for inclusion in the L.D.F.. These potential predictor variables were made available for inclusion because they were judged as contributory to the interpretation, effectiveness, and use of the L.D.F.'s analysis because of the known relationships between both user characteristics and motivations with behavior. Variables available for inclusion were: fishing experience characteristics such as "years fished", "angler self rating", and "years salmon fished"; and socioeconomic variables including "education level completed", "individual income level", and "family income level". Twelve different motivation (for fishing) variables were available for inclusion: 1) "to catch fish to eat"; 2) "for relaxation"; 3) "for companionship"; 4) "to enjoy nature"; 5) "for the challenge and excitement"; 6) "to be alone"; 7) "to improve my fishing skills"; 8) "to get away"; 9) "for exercise"; 10) "family togetherness"; 11) "to catch a trophy fish"; and

12) "for a sense of achievement". In addition, a fishing trip variable, "travel distance", was also included.

After an initial discriminant analysis, "family income level" was eliminated because many stream salmon anglers did not provide this information. Including "family income level" would have reduced (by 810 unweighted cases) and possibly altered the sample since only cases with valid values for all available independent variables can be included.

"Travel distance" was not included because there was no theoretical evidence to believe that travel distance per se and choice of method is related. The limited supply of snagging opportunities relative to conventional stream salmon opportunities and the resulting situation in which "travel distance" and method is related was not enough to justify the inclusion of this variable. Using this variable would have produced a function reflecting differences in groups dependent on supply considerations unique to this situation, not user characteristics, and would affect general applicability of the function.

Initially, the L.D.F. was calculated. Box's M test of the equality of group covariance matrices was performed. Since the significance probability (0.0389) which resulted from this test was below the alpha = .05 significance probability, the null hypothesis, that there is equality of the group covariance matrices, was rejected. Thus, there is

evidence that the assumption of the equality of group covariance matrices is violated.

The null hypothesis, that the group centroids calculated by the L.D.F. were equal, was rejected because the significance level (0.0000) of the test was below the alpha = .05 significance level. Thus, there was evidence that the group centroids were unequal. If group centroids were statistically unequal, then discrimination is occurring via the L.D.F.. Although this L.D.F. violated a very important assumption of Linear Discriminant Analysis (L.D.A.), it is important to note that there were only motivation variables among the four largest standardized canonical discriminant function coefficients. Furthermore, the classification accuracy of the L.D.F. was 71.96%. However, because of the violation of the equality of group covariance matrices assumption, an assumption necessary to minimize the probability of misclassification, an additional L.D.F. was calculated.

In an attempt to find a L.D.F. which did not violate the equal covariance assumption and minimize the probability for misclassification, the discriminant analysis of snaggers and conventional stream salmon anglers was repeated. Only motivation variables were available for possible inclusion because: 1) they comprised all of the highest four standardized canonical discriminant function coefficients; 2) using only motivation variables resulted in

equal covariance matrices; and 3) the relationship between motivation and method choice behavior seemed more straightforward than that of user characteristics and behavior.

Again, the equality of group covariance matrices assumption was tested using the Box's M test. The significance probability was 0.1715 (above the alpha = .05 significance probability). The null hypothesis that there is equality of the group covariance matrices was accepted.

The null hypothesis, that the group centroids calculated by the L.D.F. were equal, was rejected because the significance level (0.0000) of the test was below the alpha = .05 level. Thus, there was evidence that the group centroids were unequal. If group centroids (snaggers =-0.54145, conventional stream anglers = 0.53103) were statistically unequal, then discrimination is occurring via the L.D.F.

The classification rate was 71.16%, only a fraction of a percent lower than the previous function. The new L.D.F. had satisfied the equal covariance matrices assumption necessary in L.D.A. including fewer predictor variables in a more parsimonious function.

The standardized discriminant function coefficients of the L.D.F. were analyzed to determine the relative contribution of standardized variables to the L.D.F. scores. These standardized discriminant function coefficients were

also examined to provide information on the direction of predictor variable relationships to the discriminant score. Because the group centroid of the group of snaggers was a negative value, the sign of the standardized discriminant function coefficients must be reversed when interpreting the direction of relationships of the predictor variables on the discriminant scores. The relatively high absolute value of the standardized discriminant function coefficient (.83356) on "to catch fish to eat" indicated the higher relative importance of this variable on the L.D.F. scores (see Table 18). The positively related standardized discriminant function coefficients for specific variables, including "to catch fish to eat" and "for exercise", increase the L.D.F. scores when Z scores of the specific variable is positive. The negatively related standardized discriminant function coefficients for specific variables, including "for relaxation" and "to improve my fishing skills" and "to be alone", increase the L.D.F. scores when Z scores of the specific variable is negative. High discriminant scores are associated with membership of the group of stream salmon anglers which employ snagging.

Bivariate correlations among predictor variables were examined (see Table 19) to indicate how much caution should be exercised when interpreting standardized discriminant function coefficients. However, none of the correlations between variable pairs were above .30.

Table 18.--Discriminant function form of L.D.F. #1 using standardized discriminant function coefficients.

L.D.F.#1 Discriminant Score =	+ 0.83356	To catch fish to eat
	- 0.45245	For relaxation
	+ 0.43837	For exercise
	- 0.43724	To improve my fishing skills
	- 0.16212	To be alone

Table 19.--Correlation matrices of predictor variables in L.D.F. #1.

	M1	M2	M6	M7	M9
M1	1.00				
M2	.07	1.00			
M6	.04	.18	1.00		
M7	.24	.11	.20	1.00	
M9	.10	.28	.16	.29	1.00

Predictor variables included: "to catch fish to eat", (M1); "for relaxation", (M2); "to be alone", (M6); "to improve my fishing skills", (M7); "for exercise", (M9).

Table 20.--Pooled within-groups correlation between predictor variables and L.D.F. #1.

Variable	Correlation
To catch fish to eat	0.73512
For relaxation	-0.35204
For exercise	0.24536
To be alone	-0.22374
To improve my fishing skills	-0.19238

In addition, because some correlation does exist (indicating that the predictor variables are then not actually independent) pooled within-group correlations between discriminating variables and the canonical discriminant function were examined (see Table 20). Results indicated that the highest correlation between an independent variable occurred between the "to catch fish to eat" (0.73512) variable and the L.D.F.. The only significant change was a reversal in the rank order of variables four and five. This substantiated earlier interpretation.

The effectiveness of the L.D.F. used to discriminate snaggers from conventional stream salmon anglers is based upon it classification capability. Based on the criteria that an effective L.D.F. provides a classification accuracy which is an improvement over chance prediction, then this L.D.F. is effective. The L.D.F. provides a classification rate which is a 42.29% improvement over chance. The classifying accuracy of snaggers (72.4%) is high (see Table 21).

Table 21.--L.D.F. #1 classification results

Actual Group	Cases	Predicted Group Membership	
		Conventional stream salmon anglers	Snaggers
Conventional stream salmon anglers	309	216 69.9%	93 30.1%
Snaggers	301	83 27.6%	218 72.4%

Percentage of grouped cases correctly classified: 71.2%

Tau: Conventional stream salmon anglers 39.0%
Snaggers 45.6%
Conventional stream salmon anglers and snaggers 42.3%

Discriminant Analysis of Conventional Stream Salmon Anglers with Different Viewpoints on Banning Snagging

Conventional stream salmon anglers were separated into two mutually exclusive groups based on their viewpoint on whether snagging should be banned. One group consisted of conventional stream salmon anglers who expressed the viewpoint that snagging should be banned. The second group consisted of conventional stream salmon anglers who stated that snagging should not be banned.

In addition to those angler characteristics and motivations initially included in the preceding analysis, one other angler characteristic was included in this analysis. "Travel distance" was made available for inclusion into this L.D.F. because proximity to a site could be related to viewpoint via feelings of possession.

Initially, a L.D.F. was calculated. The significance probability 0.4961 which resulted from Box's M test was above the alpha = .05 probability level. This led to accepting (failing to reject) the null hypothesis that there is equality of the group covariance matrices. Thus, there is evidence that the assumption of the equality of group covariance matrices is satisfied. The null hypothesis, that the group centroids calculated by the L.D.F. were equal, was rejected because the significance level (0.0073) of the test was below .05. Thus, there was evidence that the group centroids were unequal. If group centroids (snagging should be banned = - 0.26619, snagging should not be banned = 0.22103) were statistically unequal, then discrimination is occurring via the L.D.F.

The standardized discriminant function coefficients of the L.D.F. were analyzed to determine the relative contribution of standardized variables to the L.D.F. scores. The standardized discriminant function coefficients were also examined to provide information on the direction of predictor variable relationships to the discriminant score. Because the group centroid of the group of conventional salmon anglers with an expressed viewpoint that snagging should be banned was a negative value, the sign of the standardized discriminant function coefficients must be reversed when interpreting the direction of relationships of the predictor variables on the discriminant scores.

The relatively high absolute value of the standardized discriminant function coefficient (-0.61400) on "to improve my fishing skills" indicated the higher relative importance of this variable on the L.D.F. scores. The positively related standardized discriminant function coefficients for specific variables, including "to improve my fishing skills", "educational level achieved", and "years salmon fished", increased the L.D.F. scores when Z scores of the specific variable is positive (see Table 22). The negatively related standardized discriminant function coefficients for specific variables, including "to catch fish to eat" and "travel distance", increase the L.D.F. scores when Z scores of the specific variable is negative. High discriminant scores are associated with membership of the group of conventional stream salmon anglers which express a viewpoint that snagging should be banned.

Examples of the bivariate correlations among predictor variables revealed that none of the correlations between variable pairs were above .30 (see Table 23).

In addition, because some correlation does exist and the predictor variables are then not actually independent, pooled within-group correlations were examined (see Table 24). Results indicated that the highest correlation occurred between the "education level achieved" (0.53011) variable and the L.D.F.. Analysis of both Tables 22 and 24 indicate slight ambiguity with respect to the relative

Table 22.--Discriminant function form of L.D.F. #2 using standardized discriminant function coefficients.

L.D.F.#2 Discriminant Score =	-	0.61400	To improve my fishing skills
	+	0.59941	Education level completed
	+	0.46078	To catch fish to eat
	-	0.43516	Travel distance
	+	0.28422	Years salmon fished

Table 23.--Correlation matrices of predictor variables in L.D.F. #2.

	F1	F4	S1	M1	M7
F1	1.00				
F4	-.11	1.00			
S1	.27	.03	1.00		
M1	-.02	.06	.12	1.00	
M7	.01	.07	.03	.30	1.00

Predictor variables included: "Travel distance", (F1); "years salmon fished", (F4); "education level achieved", (S1); "to catch fish to eat", (M1); "to improve my fishing skills" (M7).

Table 24.--Pooled within-groups correlation between predictor variables and L.D.F. #2.

Variable	Correlation
Education level achieved	0.53011
To improve my fishing skills	-0.44725
To catch fish to eat	0.37579
Years salmon fished	0.33633
Travel distance	-0.31916

importance level of predictor variables in L.D.F. #2. However, results are nearly the same with the exception of two examples of one order rank changes.

The effectiveness of the L.D.F. used to discriminate conventional stream salmon anglers who expressed a viewpoint that snagging should be banned and conventional stream salmon anglers who expressed a viewpoint that snagging should not be banned is based upon it classification capability. But does this classification accuracy indicate that the L.D.F. is effective. Based on the criteria that an effective L.D.F. provides a classification accuracy which is an improvement over chance prediction, then this L.D.F. is effective. The L.D.F. provides a classification rate which is a 22.39% improvement over chance. The classifying accuracy of conventional stream salmon anglers with an expressed viewpoint that snagging should be banned is 62.5% (see Table 25).

Table 25.--L.D.F. #2 classification results

Actual Group	Cases	Predicted Group Membership	
		For a ban	Against a ban
Conventional stream salmon anglers for a ban on snagging	163	98 60.2%	65 39.8%
Conventional stream salmon anglers against a ban on snagging	138	52 37.5%	87 62.5%
Percentage of grouped cases correctly classified:			61.2%
Tau: Conventional stream salmon anglers for a ban on snagging			13.0%
Conventional stream salmon anglers against a ban on snagging			31.8%
Conventional stream salmon anglers for and against a ban on snagging			22.4%

Discriminant Analysis of Snaggers with Different Expected Behavior with Regards to Continuing Salmon Fishing if Snagging were Banned

Snaggers were separated into two mutually exclusive groups based on expected salmon fishing behavior if snagging were banned. The first group included snaggers who stated they would not continue to fish for salmon if snagging were banned. The second group was snaggers who stated they would continue to fish for salmon even if snagging were banned. Initially, a L.D.F. was calculated using the same variables available for inclusion in the discriminant analysis of conventional stream salmon anglers with opposing viewpoints on the banning of snagging. Next, Box's M test, was

performed resulting in a significance probability of 0.8193 (above alpha = .05 probability level) providing evidence that the assumption of the equality of group covariance matrices was satisfied. The null hypothesis, that the group centroids calculated by the L.D.F. were equal, was rejected because the significance level (0.0216) of the test was below the alpha = .05 significance level. Thus, there was evidence that the group centroids were unequal. If group centroids (did not expect to salmon fish = 0.18264, did expect to salmon fish = - 0.30524) were statistically unequal, then discrimination is occurring via the L.D.F.

The standardized discriminant function coefficients of the L.D.F. were analyzed to determine the relative contribution of standardized variables to the L.D.F. scores. The standardized discriminant function coefficients were also examined to provide information on the direction of predictor variable relationships to the discriminant score. The relatively high absolute value of the standardized discriminant function coefficient (- 0.63154) on "to catch fish to eat" indicated the higher relative importance of this variable on the L.D.F. scores (see Table 26). The positively related standardized discriminant function coefficients for specific variables ("to catch fish to eat", "for the challenge and excitement", "travel distance", and "years fished") increase the L.D.F. scores when $\underline{Z}$ scores of the specific variable is positive. The negatively related

Table 26.--Discriminant function form of L.D.F. #3 using standardized discriminant function coefficients.

L.D.F.#3 Discriminant Score =	- 0.63154	To catch fish to eat
	+ 0.55272	To improve my fishing skills
	+ 0.49120	Number of years fished
	+ 0.46760	Travel distance
	- 0.43303	Self-rating as an angler
	- 0.29442	For the challenge and excitement

Table 27.--Correlation matrices of predictor variables in L.D.F. #3.

	F1	F2	F3	M1	M5	M7
F1	1.00					
F2	.03	1.00				
F3	-.01	.24	1.00			
M1	.03	.09	-.08	1.00		
M5	-.06	.06	-.13	.12	1.00	
M7	-.10	.07	.01	.21	.25	1.00

Predictor variables included: "Travel distance", (F1); "years fished", (F2); "self rating as an angler", (F3); "to catch fish to eat", (M1); "for the challenge and excitement", (M5); "to improve my fishing skills", (M7).

Table 28.--Pooled within-groups correlation between predictor variables and L.D.F. #3.

Variable	Correlation
To catch fish to eat	-0.45924
Travel distance	0.42960
Years fished	0.36411
To improve my fishing skills	0.33082
Self-rating as an angler	-0.22062
For the challenge and excitement	-0.17612

standardized discriminant function coefficients for specific variables, including "to improve my fishing skills" and "self rating as an angler" increase the L.D.F. scores when Z scores of the specific variable is negative. High discriminant scores are associated with membership of the group of snaggers who do not expect to salmon fish if snagging is banned.

Bivariate correlations among predictor variables were examined (see Table 27) to indicate how much caution should be exercised when interpreting these standardized discriminant function coefficients. However, none of the correlations between variable pairs were above .30.

In addition, because some correlation does exist and the predictor variables are then not actually independent, pooled within-group correlations were examined (see Table 28). Results indicated that the highest correlation between an independent variable occurred between the "to catch fish to eat" (-0.45924) variable and the L.D.F.. However, simultaneous analysis of Tables 26 and 28 reveal ordering differences which do not allow substantiation of much of the ranking information in Table 26 (with the exception of "to catch fish to eat) as the most important).

The effectiveness of the L.D.F. used to discriminate snaggers who did not expect to fish for salmon if snagging is banned and snaggers who did expect to fish for salmon if snagging were banned is based upon it classification

capability. Based on the criteria that an effective L.D.F. provides a classification accuracy which is an improvement over chance prediction, then this L.D.F. is effective. The L.D.F. provides a classification rate which is a 15.15% improvement over chance. However, the improvement over chance prediction of snaggers who don't expect to continue salmon fishing if snagging is banned is negative. Thus, in this respect, the classification capability of this L.D.F. is ineffective (see Table 29).

Table 29.--L.D.F. #3 classification results

Actual Group	Cases	Predicted Group Membership	
		Expect to Discontinue	Expect to Continue
Snaggers who expect to discontinue salmon fishing if snagging were banned	189	114 60.2%	75 39.8%
Snaggers who expect to continue salmon fishing if snagging were banned	110	42 38.8%	67 61.2%
Percentage of grouped cases correctly classified:			60.6%

Tau:	Snaggers who expect to discontinue salmon fishing if snagging were banned	-7.9%
	Snaggers who expect to continue salmon fishing if snagging were banned	38.2%
	Snaggers who expect to discontinue and snaggers who expect to continue salmon fishing if snagging were banned	15.6%

CHAPTER VI

SUMMARY AND CONCLUSIONS

Summary

This section includes a brief summary of the findings of this study. First, a summary is presented of the descriptive profile of snaggers, conventional stream salmon anglers at similar sites, and dual method stream salmon anglers. Next, a summary is presented of univariate and multivariate statistical differences among three sets of groups of stream salmon anglers including: 1) snaggers and conventional stream salmon anglers; 2) conventional stream salmon anglers with different viewpoints on the banning of snagging; and 3) snaggers who would continue salmon angling if snagging was banned and snaggers who would not.

Snaggers' provide a significant source of tourist dollars. They spend a large portion of their money on fishing equipment and supplies (rods, reels, bait, fishing line, lures, hook, weights, and other fishing supplies). More than 90% have ten years or more of angling experience. Only 5.4% considered themselves as beginners. Almost half (46.2%) have fished for salmon five or more years. They

indicated a willingness-to-pay for a permit to snag rather than be denied rights to snag (the modal amount reflected the amount the D.N.R. has since charged for this right). Almost two-thirds (63.9%) of the snaggers would not fish for salmon if snagging were banned. Of those who would adapt to another method, only 46.8% of these anglers would continue to fish at the sites where snagging has been legal. Most snaggers have at least a high school education and a majority work in blue collar occupations. Snaggers rated "to catch food to eat" as important. However, on average, they rated the importance of "for the challenge and excitement" and "to enjoy nature" even more highly. Conversely, only 10.7% of the snaggers stated that "to improve my fishing skill" was a "very important" motivation.

Although the conventional stream salmon anglers in this study were not intended to be representative of all Michigan stream salmon anglers, they exhibit some interesting characteristics. Only 5.4% of these anglers traveled 300 miles or more (one way) on their salmon fishing trip. Less than half of their trip expenditures occurred near (within ten miles) their fishing site. Among those with viewpoints that snagging should be banned, approximately 80% gave reasons having to do with what they considered a lack of sportsmanship. The reason to ban snagging, "it is unsportsmanlike", was often accompanied by concerns about the fish themselves, proper method, and

unfair competition. There were many conventional stream salmon anglers who do not favor a ban on snagging. However, even some (13.6%) of the many conventional stream salmon anglers who did not favor a ban on snagging felt that there was a need for additional control or regulation of snagging.

Dual method stream salmon anglers often exhibit characteristics between those of snaggers and conventional salmon anglers. However, dual method anglers were relatively experienced anglers. Their "self-rating as an angler" was relatively high. In addition, these anglers are relatively experienced salmon anglers (7.3 years compared to 5.7 years for snaggers and 5.8 years for conventional stream salmon anglers).

There were several relationships revealed when statistically testing snaggers and conventional stream salmon anglers. Statistically, snaggers travelled greater distances one way on their fishing trip, had longer trips, and spent more per day in many spending categories[19]. There was a systematic univariate relationship between "Michigan residency", "education level completed", "occupation", and several motivation variables ("to catch fish to eat", "for relaxation", "to be alone", "to improve my fishing skills",

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[19] An examination of the signs of T values and 1-tailed probabilities (computed by halving 2-tailed probabilities), indicate evidence that a number of "greater than" relationships exist between means of the two groups.

and "for exercise") tested individually with method employed. Snagging is associated with a higher percentage of blue collar workers and higher importance levels of two motivations for fishing ("to catch fish to eat" and "for exercise") than conventional stream salmon angling. Snagging is associated with a lower percentage of Michigan residents, lower levels of education, and lower importance levels of three motivations for fishing ("for relaxation", "to be alone", and "to improve my fishing skills") than conventional stream salmon angling.

Univariate statistical tests were also performed on conventional stream salmon anglers with different viewpoints on the banning of snagging. There were no statistical differences in the group means for interval or ratio-level variables. There were no statistical relationships between nominal or ordinal-level variables and viewpoint on the banning of snagging.

Univariate statistical tests were performed on snaggers with different expectations of continuing salmon fishing if snagging were banned. There were no statistical differences in the group means of interval or ratio-level variables. Also, there were no statistical relationships between nominal or ordinal-level variables and intention of continuing salmon fishing if snagging were banned (however, the means of these groups were significantly different at the alpha = .10 significance level in "years fished").

The L.D.F. discriminating conventional stream salmon anglers and snaggers resulted in a high (over 70%) classification accuracy. Predictor variables included "to catch fish to eat", "for relaxation", "for exercise", "to improve my fishing skills", and "to be alone". "To catch fish to eat" had the relatively highest contribution to the L.D.F..

In the discriminant analysis of groups of conventional stream anglers, a significant L.D.F. effectively discriminated conventional stream salmon anglers with different viewpoints that snagging should be banned and resulted in a classification accuracy of over 60.0%. Predictor variables included "to improve my fishing skills", "education level completed", "to catch fish to eat", "travel distance", and "years salmon fished". "To improve my fishing skills" had the relatively highest contribution to the L.D.F..

A third discriminant analysis revealed a significant L.D.F. which effectively discriminated snaggers with different expected salmon fishing behavior if snagging is banned and resulted in a classification accuracy of over 60.0%. Predictor variables included "to catch fish to eat", "to improve my fishing skills", "number of years fished", "travel distance", "self-rating", and "for the challenge and excitement". "To catch fish to eat" had the relatively highest contribution to the L.D.F..

Conclusions and Discussion

This study successfully achieved its objectives and tested relevant hypotheses concerning different groups of stream salmon anglers. It has provided a descriptive profile of snaggers, dual method stream salmon anglers, and conventional stream salmon anglers at similar sites. This study also identified statistical differences among three groups of stream salmon anglers including: 1) snaggers and conventional stream salmon anglers; 2) conventional stream salmon anglers with different viewpoints on the banning of snagging; and 3) snaggers who would continue salmon angling if snagging were banned and snaggers who would not. All of these results were summarized in the previous section. This section includes conclusions and discussion of these findings relevant to management and future research.

Many management options exist with which to deal with snagging. Law enforcement levels, user costs, regulations, stocking changes, and information & education are just a few of the many management options available to most fisheries managers, but these options are constrained by Public Act 317 (see "History of Salmon Snagging in Michigan"). While this study does not advocate changes in any of these alternatives <u>in this or other states</u>, this study does reveal information useful when considering those options.

The descriptive information in this study can be used to improve present management of snaggers and other stream salmon anglers at similar sites. As is the case of any segment of anglers, understanding snaggers can contribute to the use of management practices which better satisfy this group. Because of snaggers' willingness to pay for a permit to snag to keep their rights to snag and the importance level of "to enjoy nature" they reported as a group, it may be advantageous[20] to use funds for site improvement to maintain an environment which may better satisfy this motivation. Since "to catch fish to eat" is an important motivation to snaggers, it may be beneficial to present suggestions for cleaning salmon (to maximize removal of toxic chemicals deposited in fat) and for cooking salmon on site in the form of signs or pamphlets. "For the challenge and excitement" was the most important motivation for snaggers. Managers can seek to satisfy this motivation at present sites to create a satisfying experience and to increase the level of benefits snaggers obtain by maintaining equipment regulations which provide challenges to snaggers while snagging. Awards (patches) could be made

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[20] This may also help to reduce the recreational conflict that occurs. Goal interference between snaggers and others, even when separated during snagging season, can still occur. Thick line and underwater debris left on snagging sites can provide interference to other anglers long after the snagging season is over.

available for an individuals "first salmon snagged" or a salmon surpassing a minimum size to provide a more exciting atmosphere and to increase satisfaction of the motivation "for a sense of achievement".

Knowledge of the demographic characteristics of snaggers are useful management and marketing tools. Managers may find this information useful when considering changed or increased product (snagging opportunities) distribution. Presently snagging opportunities are distributed in a restricted geographic area while large number of snaggers are from out-of-state areas such as Ohio and Indiana and have high travel costs.

Dual method stream salmon anglers exhibit several characteristics which make them unique. It is incorrect to manage dual method stream salmon anglers as a group of anglers who always exhibit characteristics somewhere in between snaggers and conventional stream salmon anglers. Policy decisions such as salmon stamp cost (which is an additional cost beyond the basic fishing license and the trout and salmon stamp for these anglers) should consider their characteristics. This group is experienced and makes the most salmon fishing trips among stream salmon anglers. Higher levels of use (assuming more actual and expected trips also mean more angler days) may justify their added user cost.

Knowledge of the statistical differences of snaggers and conventional stream salmon anglers is useful in understanding the direction of change in user characteristics at sites in the event of establishing snagging at new sites or banning snagging at existing sites (assuming conventional anglers have characteristics typical of anglers who would use these sites in the event of a policy change; and assuming that present snaggers have characteristics typical of anglers who would use new snagging sites). For example, if snagging were ever banned completely, the percentage of stream salmon anglers from out-of-state at snagging sites would decrease and mean per day spending of stream salmon anglers at snagging sites would decline. This decline would affect some businesses (e.g. those selling fishing supplies) to a greater extent as evident from the differences in categorical spending (see Table 3).

Discriminant analyses provided information which may prove useful. Successful discriminant analyses includes information useful to effectively design marketing strategies. With knowledge of the relative motivations levels associated with snagging, anglers could be classified as "potential snaggers" (or informed of levels associated with snagging) so they could be aware of this activities potential to benefit themselves. Brown and Tinsley (1983, p. 305,306) contend that individual

classification as to leisure activity, using raw-score discriminant function coefficients from earlier analysis, can be used toward maximizing individual happiness. This is especially applicable to stream salmon anglers who are interested in salmon angling and have not yet tried it. Requests for information about stream salmon angling could be responded to with information of motivation importance levels associated with snagging as opposed to levels associated with conventional stream salmon angling. This information could be ascertained using five questions in which the angler uses responses to ascertain (71.16% classification accuracy) if an individual is classified as a "potential snagger". The L.D.F. may also be useful to classify "potential snaggers" among licensed Michigan anglers in order to target marketing information (location of snagging sites and benefits associated with snagging) to them in an efficient manner and to rank the order of information messages (in accordance with their relative importance in the L.D.F.) as a possible means of increasing state revenues by increased sales of snagging stamps. Thus, using several motivation variables simultaneously in a L.D.F. is an effective and exploitable method for predicting group membership of stream salmon anglers when actual group membership is based on the exclusive use or exclusion of snagging.

A second L.D.F. resulted in a 61.22% classification accuracy (see Table 21). This L.D.F. was obtained to predict expressed viewpoint on banning snagging given information of certain motivations of stream salmon anglers. Using several motivation variables simultaneously in a L.D.F. was an effective method (more accurate than chance) for predicting group membership of conventional stream salmon anglers when actual group membership is based on viewpoint concerning the banning of snagging. In the event a decision is made to attempt to influence conventional stream salmon angler viewpoints concerning banning snagging, using information and education, anglers could be targeted more efficiently with this L.D.F. than by chance. However, Langenau and Peyton (1982) point out:

> Anglers who have strong values concerning the importance of sportsmanship may form negative attitudes in spite of their knowledge that regulated snagging does not harm the fish populations and prevents the resource from being "wasted". A strong value position may even cause an individual to screen and reject information concerning the biology of the snagging issue, because it is inconsistent with values. (p. 130)

Therefore, because the classification capability was only moderate, the additional cost of necessary data inputs, and the difficulty of changing the sportsmanship value (which may be a substantial factor influencing this viewpoint), management applications of this discriminant analysis, other than the knowledge of the results to managers involved with snagging, is not highly recommended.

A third L.D.F., with a 60.56% classification accuracy, was used to predict expected behavior given information on certain characteristics and motivations of snaggers. This L.D.F. was effective (more accurate than chance) for predicting group membership of snaggers when actual group membership is based on expected salmon fishing behavior dependent on a policy change (the banning of snagging). Because only moderate classification accuracy was achieved, the additional cost of necessary data inputs, and because of the well known discrepancies between expected and actual behavior, management or marketing application of the results of this L.D.A. is not highly recommended.

Discriminant analyses revealed a number of relationships in a multivariate context. These relationships took into account intercorrelations which exist between predictor variables. These relationships were not considered in univariate analyses. Discriminant analyses reveals associations between predictor variables and groups when variables are considered simultaneously.

In addition, discriminant analyses revealed a number of L.D.F.'s which could effectively classify groups of stream salmon anglers. However, it is up to managers themselves, to ascertain if the results merit use.

Study Limitations

All studies, including this one, have limitations. This section discuses the limitations of this study.

Purdue (1986) reports the occurrence of both participation bias and visits bias in visitor surveys. This study merely corrected length-of-stay bias.

The amount of salmon fishing was measured as the number of salmon angling trips[21]. Total days would have been a more precise measure. However, only data on past and expected trips were obtained.

One site used in this study has since been discontinued. The characteristics of snaggers in aggregate are still representative if this change has not affected the population of legal snaggers.

The 4-point scale for the motivations variables is narrow. There is no midpoint on this scale and no room for don't know responses. A larger scale might have revealed more information on motivations for stream salmon angling.

The procedure of the discriminant analysis routine in SPSS limited the number of variables that could be used for inclusion without changing sample size or creating a fictional value for values which were missing. There were

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[21] This variable indicates the number of past and expected trips for salmon and is limited in its use as an approximation for intensity because of obvious variations which occur between anglers in average trip length.

many people who did not respond to "family income level". The omission of "family income level" meant the loss of information pertaining to this variables' multivariate relationship in all the L.D.F.'s.

There are also many unasked questions which may be important to consider. There are many questions which could be used to provide additional relevant variables which could improve the discriminating ability of the L.D.F.'s obtained in this study. Also, there is information beyond the statistical findings of this study which is important to management decision making such as the characteristics of non-active stream salmon anglers. However, the depth of this study was constrained by financial considerations, leaving several opportunities for further research.

Recommendations for Further Research

Snagging is not the only non-conventional angling method which occurs whose clientele is relatively poorly understood preventing effective management. Efforts toward the examination and comparison of other non-conventional recreational activities would improve management and marketing of these user segments.

Further research of other groups characteristics and differences of stream salmon anglers could increase knowledge toward effective management of these anglers.

Each of the subgroups of stream salmon anglers could be better understood if additional research was conducted to improve the discriminatory capability of the L.D.F.'s by the introduction of additional variables. For example, further discriminant analyses of stream salmon anglers with different viewpoints might provide a L.D.F. which accounts for a greater proportion of the variance between groups and improves the discriminatory power of the L.D.F. if the past behavior, values, beliefs, and emotions associated with the importance level of motivations or other characteristics were explicitly measured instead of indirectly measured or not measured at all. Further research of this kind may also provide insight into the values of a clientele group which will assist state agencies in providing opportunities in accordance with those values. This may help to provide a L.D.F. whose canonical correlation coefficient is higher and thus explains a greater level of the variance between conventional stream salmon anglers with opposing viewpoints. This would lead to additional understanding of social conflict occurring in a recreation setting involving non-conventional recreation. Present results indicate that the use of several user characteristics and motivations are of limited effectiveness in discriminating viewpoint and not strongly associated with viewpoint among conventional stream salmon anglers. Peyton (personal communication, 1984) suggests that belief systems and value systems are related

to attitudes. These systems may be necessary to be aware of and quantify if good discrimination is to take place. However, because values influence the importance levels of motivations, it is surprising that the present use of motivations importance levels did not result in a greater level of discrimination.

Dual method stream salmon anglers are more experienced anglers than either of the more specialized groups of salmon anglers. Time series analysis of these groups may provide information indicating factors affecting the initial use or discontinuation of snagging over a stream salmon fishing career.

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APPENDICES

APPENDIX A (Snagging Questionnaire)

Location_____
Day_____Date_____Time_____

Greeting: Hello, I am participating in a survey of salmon fishermen being conducted by Michigan State University. I would appreciate it if you could take a few minutes to answer some questions. All the responses you provide will remain strictly confidential. Will you participate in this survey?

1) What is your permanent home address-city, town, state, zip code?
   City/Town_____
   State_____
   Zip Code_____

2) When (day,date, & time) did you leave home on this fishing trip? If today is part of a trip which is more than 1 day in length, we want to know <u>when the trip began</u>.
   Day_____
   Date_____
   Time_____<u>am/pm</u>

3) What time did you <u>arrive here today</u> to go fishing?_____
   A) How much time have you fished here so far today?__<u>hrs/min</u>

4) How much longer do you plan to fish here today?_____<u>hrs/min</u>

5) While on this trip have you fished at any other locations?
   ____Yes ____No

   V

   How many <u>miles</u> is it <u>(one way) from home to here</u>?____miles
   How long did it take you to travel here including stops?_____hrs/min
   (go to 6)

Location in order of when fished (nearest city)	# hrs fished	Distance one way from home to first site	Travel time from home to the first site

6) Have you fished at this site previously to today on this trip?

____Yes ____No (go to 7)

V

How many hours?___

7) Do you plan to fish any other locations before your return home?

____Yes ____No (go to 8)

V

What other locations will you likely fish on this trip before returning home?

Location (nearest city)	# of hours planning to fish	Distance from the last location you will fish to home	Estimated travel time from the last location you will fish to home

8) Do you plan to fish at this location on this trip after today?

____Yes ____No (go to 9)

V

Number of hours____

9) When do you expect to arrive back home from this trip?

Day_____

Date_____

Time_____am/pm

10) Which of the following best describes the purpose of this trip?

_____Fishing was the primary and only purpose of the trip. (go to 12)

_____Fishing was the primary but not only purpose for the trip. What was the secondary purpose?_____
Would you have made the trip to this location if fishing opportunities were not available nearby?___Yes___No

_____The trip was primarily for another purpose but I planned to fish when I left home. What was the primary purpose?
_____
Would you have made the trip to this location if fishing opportunities were not available nearby?___Yes___No

_____The trip was primarily for another purpose, and even though I fished, I did not plan to do so before I left home. What was the primary purpose?_____

11) What percent (%) of the reason for making this entire trip could be attributed to fishing?_____%

12) How many other people accompanied you on this trip whether or not they fished?___(If they went alone, go to question 13)

Relationship	Are they 16 or younger	Did they fish on the trip?	Was fishing the primary activity they engaged in on the trip?
Son (example)	__Yes __No	__Yes __No	__Yes __No
_____	__Yes __No	__Yes __No	__Yes __No
_____	__Yes __No	__Yes __No	__Yes __No
_____	__Yes __No	__Yes __No	__Yes __No
_____	__Yes __No	__Yes __No	__Yes __No

13) If it was an overnight trip: (If not, go to 14)

A) What lodging have you used and do you expect to use over the duration of this trip? (your second home, relatives or friends home, hotel or motel, lodge or resort or rental cottages, campgrounds, other?
B) How many nights will you have spent at each location by the end of the trip?
C) Where are they located? (nearest town/city)
D) Which one did you stay at last night?
E) How many miles is it from where you stayed last night to here?

TYPE	LOCATION	# OF NIGHTS	LAST NIGHT	MILES FROM HERE	TRAVEL TIME FROM HERE

14) On this trip was the time you spent traveling enjoyable___, unenjoyable,___, or neither enjoyable or unenjoyable___.
A) If you could pay to have your travel time reduced by one hour, how much would you be will to pay? $_____
B) How about for a two hour reduction? $_____

15) Next, we would like to know your out-of pocket expenses for goods and services, including travel, on this entire trip. This includes purchases at home made especially for this trip. By out-of-pocket, we mean all your expenditures whether you spent money for yourself or others in your party.
No matter what your age, we only want your expenditures. Do not include what other persons (e.g., father) spent on you. For example, if you paid for the gas and someone else in your travel party paid for the motel room, then tell me the amount you paid for the gas (and anything else you bought), but not the cost of the motel.
Include all of your trip expenditures whether or not they relate to fishing.

Category	Amount spent at home for this trip	Amount spent on the trip to the area	Amount spent so far near the fishing site (within 10 miles)
Rods,reels, down-riggers, bait, fishing line, lures, hooks, weights & other fishing supplies			
Charter fees			
Lodging - motels, hotels, resorts, cottage rentals, or camping fees			
Restaurants			
Groceries-food & snacks, take-out beverages (including alcohol)			
Boat gas and oil			
Auto gas and oil			
Boat rentals, daily transient slip fees, launching fees			
Entertainment & other recreation (including bars, night clubs)?			
Other trip expendi-tures (e.g. parking, shopping)			

16) Would you estimate how much more you will spend before the end of this trip? $_____

17) Have you had any luck here today?
____Yes ____No (go to 18)

V

What kind and how many?
Chinook_____
Coho_____

Have you or do you intend to sell the eggs from these fish?
Yes____ No____
(go to 18)

How much do you expect to get from the sale of these eggs including any sales you might have made already today? $____

18) How many years have you fished?_____

19) How would you rate yourself as an angler?
____Beginner
____Somewhat experienced
____Experienced
____Expert

20) How many years have you fished for salmon?____years
21) How many years have you snagged?____years
22) Do you fish for salmon using methods other than snagging on streams or the Great Lakes?
____No ____Yes

V

V

Which Methods	Favorite Method	Method Used Most Often
____Trolling	_____	_____
____Casting	_____	_____
____Bait fishing	_____	_____
____Fly fishing	_____	_____

23) How many trips have you made on which you snagged so far this season?
to this site____
to all other sites_____

24) How many more snagging trips will you probably make during the rest of the season?
____to this site
____to all other sites

25) How many trips have you made this year (since 1/1/83) on which you fished for salmon using methods other than snagging?____

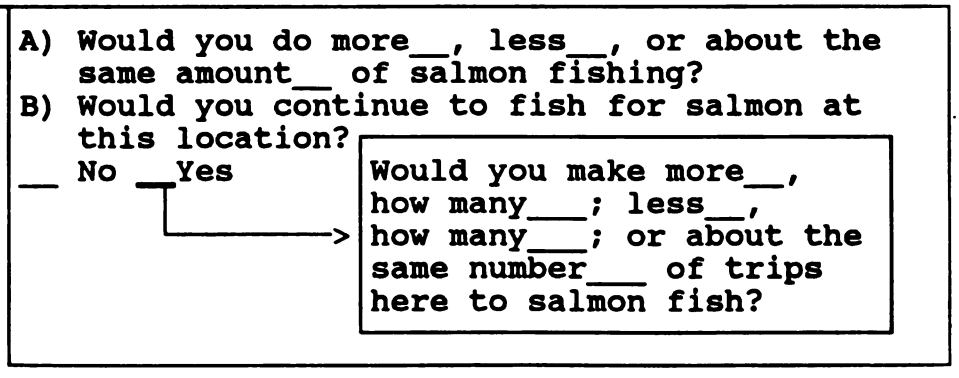
26) How many more trips this year (before 12/31/83) will you probably fish for salmon using methods other than snagging?____

As you may know, the Natural Resources Commission has decided to terminate (legalized?) snagging at this site after 198_. There is support among many fishermen for banning snagging. However, others argue that snagging has substantial economic value.

27) What is the most you would be willing to pay for a daily snagging permit in addition to your regular license? It is important that you are honest. If the value of snagging is low, snagging will certainly be terminated. If your estimate is too high, any fee charged may be higher than you will be willing to pay.
$_____

28) What is the most you would be willing to pay for an annual snagging permit (in addition to the present fishing license and trout-salmon stamp) to be able to continue snagging? Again, it is important that you give an honest answer for the same reasons as before.
$____

29) If snagging were banned would you continue salmon fishing?
__No __Yes



30) If snagging was not permitted, would you still have made this trip?

____Yes

Would the trip have been:

- shorter;_____days/hours → What one activity would you primarily be doing instead of snagging?
  ____working - regular time main job;
  ____working - overtime at main job; overtime hourly rate $____hr.
  ____working - a second job; hourly rate $____
  ____fishing at this location
  ____for salmon
  ____for other species
  ____fishing somewhere else; location-_____
  ____for salmon
  ____for other species
  ____engaged in another recreation activity-_____)
  ____other (specify activity-_____)
- same length of time___
- longer;_____days/hours

____No → What one activity would you primarily be doing instead of snagging?
____working - regular time main job;
____working - overtime at main job; overtime hourly rate $____hr.
____working - a second job; hourly rate $____
____fishing at this location
____for salmon
____for other species
____fishing somewhere else; location-_____
____for salmon
____for other species
____engaged in another recreation activity-_____)
____other (specify activity-_____)

What one activity would you primarily be doing instead of snagging?
____fishing at this location
____for salmon
____for other species
____fishing somewhere else; location-_____
____for salmon
____for other species
____engaged in another recreation activity-_____)
____other (specify activity-_____)

(DO NOT READ THE NEXT TWO QUESTIONS ALOUD.)

31) (SEX) ____Male ____Female

32) (RACE) ____White ____Black ____American Indian ____Hispanic
____Oriental ____Other (Please specify _____)

THE REMAINING QUESTIONS ON YOURSELF AND YOUR FAMILY ARE NEEDED SO THAT WE CAN GENERALIZE OUR FINDINGS TO ALL OTHER ANGLERS. AGAIN BE ASSURED THAT THE INFORMATION YOU PROVIDE WILL REMAIN STRICTLY CONFIDENTIAL.

33) What is your age?____

34) What is the highest level you achieved in school?

___ Grade school
___ Some high school
___ High school diploma
___ Some college
___ College degree
___ Some graduate, medical or law school
___ Advanced degree (M.S., Ph.D., M.D., D.O., D.D.S., D.V.M., J.D.)

35) Please indicate when you work:

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

What is your present primary occupation? If you are unemployed or retired, please tell us your last occupation.

_____

36) What is your <u>individual income</u> before taxes?

____under $10,000
____$10,000 to $14,999
____$15,000 to $19,999
____$20,000 to $24,999
____$25,000 to $29,999
____$30,000 to $34,999
____$35,000 to $39,999
____$40,000 to $44,999
____$45,000 to $49,999
____$50,000 or over

37) If there is more than one wage earner in your household, what is your <u>total family income</u> before taxes?

____under $10,000
____$10,000 to $14,999
____$15,000 to $19,999
____$20,000 to $24,999
____$25,000 to $29,999
____$30,000 to $34,999
____$35,000 to $39,999
____$40,000 to $44,999
____$45,000 to $49,999
____$50,000 or over

38) Why do you snag?

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

APPENDIX B (Conventional Stream Salmon Fishing Questionnaire)

Location_____

Day_____Date_____Time_____

Greeting: Hello, I am participating in a survey of salmon fishermen being conducted by Michigan State University. I would appreciate it if you could take a few minutes to answer some questions. All the responses you provide will remain strictly confidential. Will you participate in this survey?

What is the primary species you are fishing for during this trip?

☐ Salmon ☐ Other (survey ends)

1) What is your permanent home address-city, town, state, zip code?

City/Town_____

State_____

Zip Code_____

2) When (day,date, & time) did you leave home on this fishing trip? If today is part of a trip which is more than 1 day in length, we want to know <u>when the trip began</u>.

Day_____

Date_____

Time_____<u>am/pm</u>

3) What time did you <u>arrive here today</u> to go fishing?_____

A) How much time have you fished here so far today?__<u>hrs/min</u>

4) How much longer do you plan to fish here today?_____<u>hrs/min</u>

5) While on this trip have you fished at any other locations?

____Yes ____No

V

How many <u>miles</u> is it <u>(one way) from home to here</u>?_____miles

How long did it take you to travel here including stops?_____hrs/min

(go to 6)

Location in order of when fished (nearest city)	# hrs fished	Distance one way from home to first site	Travel time from home to the first site

6) Have you fished at this site previously to today on this trip?

____Yes ____No (go to 7)

V

How many hours?___

7) Do you plan to fish any other locations before your return home?

____Yes ____No (go to 8)

V

What other locations will you likely fish on this trip before returning home?

Location (nearest city)	# of hours planning to fish	Distance from the last location you will fish to home	Estimated travel time from the last location you will fish to home

8) Do you plan to fish at this location on this trip after today?

____Yes ____No (go to 9)

V

Number of hours____

9) When do you expect to arrive back home from this trip?

Day_____

Date_____

Time_____am/pm

10) Which of the following best describes the purpose of this trip?

_____Fishing was the primary and only purpose of the trip. (go to 12)

_____Fishing was the primary but not only purpose for the trip. What was the secondary purpose?_____
Would you have made the trip to this location if fishing opportunities were not available nearby?___Yes___No

_____The trip was primarily for another purpose but I planned to fish when I left home. What was the primary purpose?
_____
Would you have made the trip to this location if fishing opportunities were not available nearby?___Yes___No

_____The trip was primarily for another purpose, and even though I fished, I did not plan to do so before I left home. What was the primary purpose?_____

11) What percent (%) of the reason for making this entire trip could be attributed to fishing?_____%

12) How many other people accompanied you on this trip whether or not they fished?___(If they went alone, go to question 13)

Relationship	Are they 16 or younger	Did they fish on the trip?	Was fishing the primary activity they engaged in on the trip?
Son (example)	__Yes __No	__Yes __No	__Yes __No
_____	__Yes __No	__Yes __No	__Yes __No
_____	__Yes __No	__Yes __No	__Yes __No
_____	__Yes __No	__Yes __No	__Yes __No
_____	__Yes __No	__Yes __No	__Yes __No

13) If it was an overnight trip: (If not, go to 14)

A) What lodging have you used and do you expect to use over the duration of this trip? (your second home, relatives or friends home, hotel or motel, lodge or resort or rental cottages, campgrounds, other?
B) How many nights will you have spent at each location by the end of the trip?
C) Where are they located? (nearest town/city)
D) Which one did you stay at last night?
E) How many miles is it from where you stayed last night to here?

TYPE	LOCATION	# OF NIGHTS	LAST NIGHT	MILES FROM HERE	TRAVEL TIME FROM HERE

14) On this trip was the time you spent traveling enjoyable___, unenjoyable,___, or neither enjoyable or unenjoyable___.
A) If you could pay to have your travel time reduced by one hour, how much would you be will to pay? $_____
B) How about for a two hour reduction? $_____

15) Next, we would like to know your out-of pocket expenses for goods and services, including travel, on this entire trip. This includes purchases at home made especially for this trip. By out-of-pocket, we mean all your expenditures whether you spent money for yourself or others in your party.
No matter what your age, we only want your expenditures. Do not include what other persons (e.g., father) spent on you. For example, if you paid for the gas and someone else in your travel party paid for the motel room, then tell me the amount you paid for the gas (and anything else you bought), but not the cost of the motel.
Include all of your trip expenditures whether or not they relate to fishing.

Category	Amount spent at home for this trip	Amount spent on the trip to the area	Amount spent so far near the fishing site (within 10 miles)
Rods,reels, down-riggers, bait, fishing line, lures, hooks, weights & other fishing supplies			
Charter fees			
Lodging - motels, hotels, resorts, cottage rentals, or camping fees			
Restaurants			
Groceries-food & snacks, take-out beverages (including alcohol)			
Boat gas and oil			
Auto gas and oil			
Boat rentals, daily transient slip fees, launching fees			
Entertainment & other recreation (including bars, night clubs)?			
Other trip expendi-tures (e.g. parking, shopping)			

16) Would you estimate how much more you will spend before the end of this trip? $_____

17) Have you had any luck here today?
____Yes ____No (go to 18)

V

What kind and how many?
Chinook_____
Coho_____
Stealhead or Rainbow Trout_____
Brown Trout_____
Other (list)_____

Have you or do you intend to sell the eggs from these fish?

Yes____ No____
(go to 18)

How much do you expect to get from the sale of these eggs including any sales you might have made already today? $____

18) How many years have you fished?_____

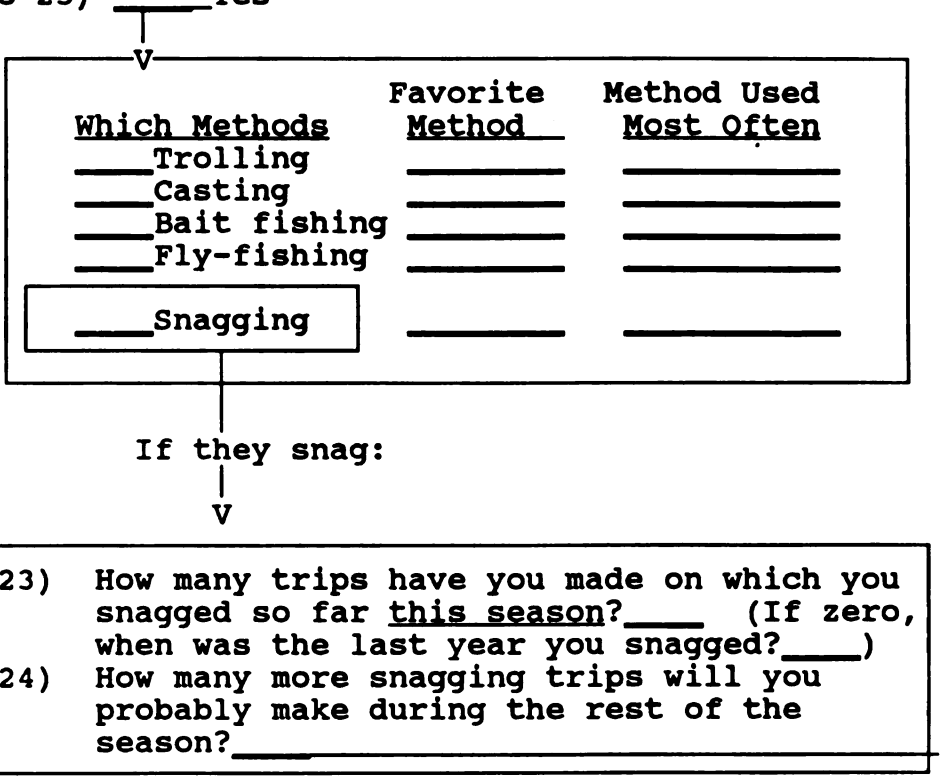
19) How would you rate yourself as an angler?

____Beginner
____Somewhat experienced
____Experienced
____Expert

20) How many years have you fished for salmon?____years

21) What method(s) are(did) you using(use) today?
____casting
____bait fishing
____fly fishing
____snagging

22) Do you fish for salmon using methods other than (the one (s) mentioned above on streams or in the Great Lakes?
____No (go to 25) _____Yes



23) How many trips have you made on which you snagged so far this season?____ (If zero, when was the last year you snagged?____)
24) How many more snagging trips will you probably make during the rest of the season?_____

25) How many trips have you made this year (since 1/1/83 on which you fished for salmon using methods other than snagging?_____

26) How many more trips this year (before 12/31/83) will you probably fish for salmon using methods other than snagging?_____

27) Do you think that snagging should be banned?
____No List why not:_____
_____
_____
____Yes List why:_____
_____
_____

28) If snagging were banned would you do more__, less__, or about the same amount__ of salmon fishing?

29) If snagging were banned, would you fish more at the five sites where it is currently legal to snag?
____Yes ____No

30) If salmon fishing was not permitted, would you still have made this trip?

____Yes

Would the trip have been:

- shorter;_____days/hours → What one activity would you primarily be doing instead of salmon fishing?
  ____working - regular time main job;
  ____working - overtime at main job; overtime hourly rate $____hr.
  ____working - a second job; hourly rate $____
  ____fishing at this location ____for some other species
  ____fishing somewhere else; location-_____
  ____engaged in another recreation activity-_____)
  ____other (specify activity _____)
- same length of time___
- longer;_____days/hours

____No → What one activity would you primarily be doing instead of salmon fishing?
____working - regular time main job;
____working - overtime at main job; overtime hourly rate $____hr.
____working - a second job; hourly rate $____
____fishing at this location ____for some other species
____fishing somewhere else; location-_____
____engaged in another recreation activity-_____)
____other (specify activity _____)

What one activity would you primarily be doing instead of salmon fishing?
____fishing at this location for some other species

____fishing somewhere else; location-_____
_____

____engaged in another recreation activity-
_____

____other (specify activity-
_____)

(DO NOT READ THE NEXT TWO QUESTIONS ALOUD.)

31) (SEX) ____Male ____Female

32) (RACE) ____White ____Black ____American Indian ____Hispanic
____Oriental ____Other (Please specify _____)

THE REMAINING QUESTIONS ON YOURSELF AND YOUR FAMILY ARE NEEDED SO THAT WE CAN GENERALIZE OUR FINDINGS TO ALL OTHER ANGLERS. AGAIN BE ASSURED THAT THE INFORMATION YOU PROVIDE WILL REMAIN STRICTLY CONFIDENTIAL.

33) What is your age?____

34) What is the highest level you achieved in school?

___ Grade school
___ Some high school
___ High school diploma
___ Some college
___ College degree
___ Some graduate, medical or law school
___ Advanced degree (M.S., Ph.D., M.D., D.O., D.D.S., D.V.M., J.D.)

35) Please indicate when you work:

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

What is your present primary occupation? If you are unemployed or retired, please tell us your last occupation.

_____

36) What is your <u>individual income</u> before taxes?

____under $10,000
____$10,000 to $14,999
____$15,000 to $19,999
____$20,000 to $24,999
____$25,000 to $29,999
____$30,000 to $34,999
____$35,000 to $39,999
____$40,000 to $44,999
____$45,000 to $49,999
____$50,000 or over

37) If there is more than one wage earner in your household, what is your <u>total family income</u> before taxes?

____under $10,000
____$10,000 to $14,999
____$15,000 to $19,999
____$20,000 to $24,999
____$25,000 to $29,999
____$30,000 to $34,999
____$35,000 to $39,999
____$40,000 to $44,999
____$45,000 to $49,999
____$50,000 or over

38) Why do you salmon fish?