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COMMISSION**



Proceedings of the Workshop on the  
Estimation of Saltwater Participation --  
Are You Being Counted?

March 1996



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Workshop on the Estimation of  
Saltwater Participation –  
Are You Being Counted?**

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## **Preface**

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## **Acknowledgements**

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## Table of Contents

|  |           |
|--|-----------|
| Preface .....  | ii        |
| Acknowledgements .....   | iii       |
| Table of Contents .....  | iv        |
| List of Tables .....   | v         |
| Executive Summary .....  | vi        |
| Introduction .....   | 1         |
| <b>Chapter I - Sources of Information on Participation .....</b>   | <b>2</b>  |
| <b>Chapter II - Alternative Survey Designs for Generating<br/>Fishing Participation Estimates .....</b>                            | <b>9</b>  |
| <b>Chapter III - Sources of Bias .....</b>   | <b>19</b> |
| <b>Chapter IV - Review of Current Survey Methods .....</b>   | <b>21</b> |
| <i>National Survey of Fishing, Hunting, and Wildlife-<br/>    Associated Recreation, 1996 Design and<br/>    Methodology .....</i> | <i>22</i> |
| <i>National Marine Fisheries Service Marine Recreational<br/>    Fishery Statistics Survey (MRFSS) .....</i>                       | <i>33</i> |
| <i>Resident Saltwater and Freshwater Fishing Participation<br/>    in Georgia .....</i>  | <i>34</i> |
| <b>Chapter V - Options for Estimating Saltwater Participation .....</b>  | <b>43</b> |
| <b>Appendix A - List of Participants .....</b>   | <b>46</b> |

## **List of Tables**

|          |   |    |
|----------|---|----|
| Table 1. | Confidence limits in proportions assuming 3% participation, for various sample sizes . . . . .  | 16 |
| Table 2. | Probability of distribution of results for a survey of 1,000 New York saltwater resident anglers when the true number of participants is hypothetically 414,084 . . . . . | 17 |
| Table 3. | Expected sample sizes for the screening and detailed samples for the 1996 FHWAR Survey . . . . .  | 25 |
| Table 4. | Georgia resident freshwater fishing participation by Inland Zone (regions) from November 1993 to November 1994 . . . . .  | 40 |
| Table 5. | Georgia resident freshwater fishing participation by Coastal Zone (county) from November 1993 to November 1994 . . . . .  | 40 |
| Table 6. | Georgia resident saltwater fishing participation by Inland Zone (regions) from November 1993 to November 1994 . . . . .   | 41 |
| Table 7. | Georgia resident saltwater fishing participation by Coastal Zone (county) from November 1993 to November 1994 . . . . .   | 41 |
| Table 8. | Georgia households that participated in both freshwater and saltwater sport fishing by Inland Zone (regions) from November 1993 to November 1994 . . . . .                | 42 |
| Table 9. | Georgia households that participated in both freshwater and saltwater sport fishing by Coastal Zone (county) from November 1993 to November 1994 . . . . .                | 42 |

## Executive Summary

A workshop on the estimation of saltwater participation rates was convened by the Atlantic States Marine Fisheries Commission (Commission) to address the issue of obtaining precise state-level estimates. This workshop was designed to evaluate the current methodologies used to estimate saltwater participation rates, examine the sampling frames used, examine potential biases, and provide guidelines to the Atlantic coastal states as to what their options are for estimating saltwater participation.

A presentation on general survey methodology provided background information for the workshop participants. Two general categories of surveys are on-site and off-site surveys. On-site surveys include access point surveys, bus route surveys, roving creel surveys and logbooks or diaries. Off-site surveys include personal interviews, telephone interviews and mail surveys. The method chosen is dependent on the desired data, its cost-effectiveness and any inherent bias, *i.e.* low response rates for mail surveys. Sample size and how that can affect precision levels was also discussed. Precision levels improve with increased sample sizes but at a declining rate. At some point it would not be cost effective to increase sample size and this needs to be determined on a case by case basis.

The first National Survey of Hunting and Fishing (National Survey) was conducted in 1955 and every five years or so since then. As now, it was conducted in two parts, a screening process to identify "substantial" participants, and the second to provide detailed information on those participants. The National Survey began to include some non-consumptive activities, such as wildlife observations, in its 1975 survey. In 1980, a greater effort was expended to provide detailed data at the state level, changes were made in some definitions such as the term "substantial", and the addition of more non-consumptive activities. Changes in survey methodology and definitions have caused some fluctuations in the estimates over the years with some major variations at the state level in 1991.

The National Marine Fisheries Service's (NMFS) Marine Recreational Fishery Statistics Survey (MRFSS) had its beginnings with the first Saltwater Angling Survey conducted in 1960. This was a supplement to the National Survey designed to estimate saltwater angler catches. This survey was continued in conjunction with the National Survey through 1970 with refinements in definitions and modes of fishing. The first actual MRFSS survey was conducted in 1979, and was originally designed to provide regional estimates of marine recreational catch and effort, and numbers of coastal, noncoastal and out-of-state participants. The survey consists of two complimentary surveys: a telephone interview survey of households in coastal counties to estimate the number of trips; and an intercept survey of anglers at access sites to estimate catch rates and species composition.

In response to the 1991 National Survey estimates the state of Georgia conducted an independent survey in 1994, to determine the relative number of resident fresh and saltwater sport anglers. The survey was conducted by telephone during a one week period in November and consisted of only five questions. The questionnaire was kept brief to encourage



participation and to keep costs at a minimum. The state was stratified on a coastal versus inland basis and the results compared.

Workshop participants discussed the similarities and differences of the three surveys and concluded that estimates from one survey were not comparable to another due to differences in the sampling frames of each along with differences in the intent of each, *i.e.* what questions each survey was designed to answer. It was pointed out to the group that when any single survey has multiple populations to estimate and multiple objectives, it may not provide the most efficient or most precise estimates of any one population.

Workshop participants developed a series of options for states to review for future estimation of participation rates. A state could rely on the estimates provided by the National Survey in its present form to determine the ratio of fresh and saltwater participation or possibly increase sample sizes to provide greater coverage within their state. A state could rely on the estimates of saltwater participation provided by the MRFSS but this does not give any estimate of the freshwater participation rate. A state would have to rely on some other measure of freshwater participation such as a license frame. A third alternative would be to conduct an independent survey similar to the one conducted by Georgia. These options were adopted by the Commission's Marine Recreational Fisheries Statistics Committee and forwarded to the Commission's Statistics Committee and Sportfish Restoration Committee for review and further action.

## Introduction

The first estimates of fishing participation were derived from the "National Survey of Hunting and Fishing" in 1955. This survey has been conducted with some minor variations in definitions and additional categories every five years since that time. In 1975, the National Survey began to include some nonconsumptive activities but this did not start in earnest until the 1980 survey. A Saltwater Angling Survey was conducted as a supplement to the National Survey in 1960 and again in 1965. This survey was designed to estimate saltwater catch in addition to participation. Responsibility for the Saltwater Angling Survey was given to the National Marine Fisheries Service (NMFS) in 1970 with more emphasis placed on catch and effort data. The first Marine Recreational Fisheries Statistics Survey (MRFSS) was conducted in 1979 by NMFS and incorporated data from the earlier Saltwater Angling Survey in addition to providing more detailed estimates at the state level. This survey is conducted in two month waves and has continued every year since 1979. Most states have only indirect measures to estimate participation such as population measures, boat ownership records and permits or license sales.

Federal Aid in Sportfish Restoration (Wallop-Breaux) funds allocated to Atlantic coastal states are currently required by law to be equitably allocated between fresh and saltwater fisheries projects in the same proportion as the estimated number of resident freshwater and marine anglers. Estimates from the USFWS National Survey of Fishing, Hunting, and Wildlife Associated Recreation (FHWAR) are currently the most common estimates used to determine the number of fresh and saltwater fishermen within a state. Changes in methodology for the 1991 National Survey, such as utilizing telephone interviews and a four (4) month recall period instead of twelve (12), led to concern among some states that saltwater participation was being underestimated at the state level. For example, the Georgia Department of Natural Resources (GADNR) began allocating funds in 1990 based on results from the 1985 National Survey on a 90.7:9.3 split between its fresh and saltwater divisions. Results from the 1991 National Survey indicated that the saltwater share would be approximately one-half that of previous years. The GADNR was concerned that although the National Survey might be adequate to address national trends, it might not give statistically accurate and precise estimates of saltwater participation in Georgia. This concern was based on: 1) the MRFSS had indicated a steady increase in resident saltwater participation; 2) boat registrations had increased 48% from 1988 to 1992 in the coastal counties; and 3) the estimate of saltwater participation in Georgia from the National Survey was based on a sample size of less than 30 individuals.

The ASMFC Workshop on the Estimation of Saltwater Participation Rates was coordinated by the Commission's Marine Recreational Fisheries Statistics Committee. Specific objectives of the workshop included: 1) the review and evaluation of current survey methodologies; 2) examination of the sampling frames used for each survey; and 3) evaluation of the biases of each methodology. The overall goal of the workshop was to provide guidelines for individual states in estimating precise saltwater participation rates.

## **CHAPTER I**

### **Sources of Information on Participation**

## Sources of Information on Participation

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The three basic elements that fishery managers need to help them assess the various fisheries under their jurisdiction at the state and federal level are good estimates of catch, effort and participation. Over the years, a fair amount of attention has been given to how catch and effort are collected, how good the numbers are, and how they can be improved or refined to make them more useful. It has only been recently that some of this attention has been shifted to looking at how we estimate participation and questioning how is it done, how realistic are the estimates and is it good enough for what it is needed for?

I've been asked to talk briefly about some of the various estimates on fishing participation and look at some of the definitions that have been used to describe fishing participation, and maybe put this in perspective.

In order to do this we need to go back and look at the history of some of the surveys themselves to see what has been done, who did it, how the surveys themselves and definitions have changed to bring us to this point. I intend to look at a slightly broader picture than just participation.

At the National level, the earliest estimates of fishing participation were derived as part of the "National Survey of Hunting and Fishing" referred to as simply the National Survey. The National Survey was first conducted in 1955. As now it was conducted in two parts. Part one was a screening survey that included a broad range of individuals 9 years old and above. Part two covered activities of people who participated "substantially" in hunting and fishing activities. Based on the 1955 survey there were 20,813,000 individuals who were substantial participants in fishing activities. This included 4,557,000 saltwater anglers and 18,420,000 freshwater fishermen. Substantial fishermen included anyone over age 12, represented about 60% of all participants, and accounted for 95% of the effort. Saltwater fishing was defined as fishing from oceans, bays, estuaries or tidal parts of rivers.

Leading up to the 1960 National Survey the Bureau of Sport Fisheries and Wildlife of the United States Fish and Wildlife Service began its National Marine Game Fish Research Program. As a result, a plan was included in the 1960 National Survey to have a supplemental Saltwater Survey to estimate saltwater angler catches. This effort was the 1st Saltwater Angler Survey conducted in 1960 by John Clark. He continued defining participation in terms of substantial and incidental. This first Angler Survey only included individuals over age 12, excluded the Hawaiian Islands and military and institutionalized people. This first effort included the use of fishing modes and we see the U.S. divided into

subregions such as the South Atlantic, Mid-Atlantic, and Gulf. Estimates of 25.5 million fishermen with 6.292 million saltwater and 21.677 million freshwater anglers were derived.

The Saltwater Angling Survey was repeated in 1965 by Clark with the help of David Deuel. The 1965 effort saw some refinements in the definition of fishing modes. We begin to see the more familiar terms for party-charter, private-rental, beach-bank etc. Deuel and Clark also included some discussion and self evaluation related to the types of bias or error that may have effected the survey. It is interesting to note that some of the things we will probably touch on today such as recall bias, and sampling error were of concern to Clark and Deuel 20 years ago. Sampling error especially related to the catch estimates and sample size were discussed as well as response error, things like exaggeration, prestige bias and recall bias. They also made an attempt to compare (ground truth) the results of their survey with a similar state survey of party/charter boats in California and noted large differences between the two efforts in the estimates of the charterboat catch. Deuel and Clark report that there were 28.3 million substantial fishermen of which 8.3 million were saltwater and 23.9 million freshwater anglers.

By 1970, the responsibilities for marine sport fish was transferred to the National Marine Fisheries Service, when NOAA was created. The 1970 Saltwater Angling survey was conducted under the guidance of David Deuel and carried out by the Statistics and Market News Division of the NMFS. With this effort we begin to see a definite shift of emphasis being placed on catch and effort data. We see a refinement in the definition of a substantial participant to include only those that fished during part of at least 3 days or spent \$7.50 or more on the sport. It is now specified that commercial fishermen and their catches are excluded from the survey. Again, Deuel includes in this report a discussion of the potential sources of bias. We see more comparisons made with the California partyboat survey. We see recommendations for improving the survey by reducing recall bias by limiting recall to a 2 month period, improving species identification and the possibility of initiating a program that would result in annual estimates, with the possibility of expansion to the state level if funding permits. Deuel reported that there were 33.1 million substantial angler in the U.S. of which 9.4 million were saltwater and 29.3 million were freshwater anglers.

In 1975 the National Survey began to expand to include some non-consumptive activities, including wildlife observations and sportsman preferences. We see the name changed to include wildlife associated recreation. The idea of a substantial participant/sportsman was dropped. The 1975 effort include anyone 9 or older that had a phone in their household. This effort estimated that there were 53,829,000 fishermen of which 16,374,000 were saltwater fishermen. Freshwater was divided into groups.

In 1979 we see the first of the NMFS Marine Recreational Fisheries Statistics Surveys (MRFSS). This effort was a spin-off from the earlier Saltwater Angler Surveys but included detailed estimates at the state level including the numbers of coastal,

noncoastal and out-of-state participants. Estimates are shown above for the So Atlantic. MRFSS estimates include active fishermen age 5 and above.

In 1980 The National Survey made it's first real attempt to gather non-consumptive information. We see more state and wildlife agency involvement. It was the first national survey to look at detailed data at the state level. We see participation redefined to include those 16 years of age or older, we see fishing now including gigging, archery, seining and netting, but not shellfishing or crabbing. We see emphasis being placed on resident vs non-resident participation. Information in this survey not only includes fishing activity in a particular state, but how many out-of-state visitors come in and fish and how many resident go out-of-state to fish. We also see a new category that includes fishermen that fish in both fresh and saltwater.

The 1985 National Survey saw continued emphasis being placed on state level data. We see the definitions changed slightly. They still include those 16 and above, but now fishing includes catching or gathering shellfish and crabs. We see the term substantial used again to refer to a household that fished or hunted for 30 days or more or spent more than \$500, but the term is used as a mechanism to group households into sampling strata to aid the selection process rather than to qualify participation. There continues to be detailed estimates of participation for resident vs. nonresident in-state activities.

The 1991 National Survey had a significant change in methodology. A telephone interview was conducted and a recall period of 4 months was used. The definition of a participant however was consistent with the 1985 survey in that it included those 16 and above, as well as crabbing and shellfishing.

Aside from the National Survey and MRFSS, most states including South Carolina, only have indirect measures to measure participation. Using South Carolina as an example, it is a relatively small state with a population of about 3.7 million. About 18% of the population lives in the 6 coastal counties that border the Atlantic. Trends show both the total population and the coastal population growing at a slow but steady pace. One would expect a certain percentage of the population, especially coastal residents, to participate in saltwater fishing. Boat ownership is another indirect source. Past studies have shown (Vismor, McGill and Bell, Inc (1984) that boat ownership in S. C. is among the highest on the east coast. There are about 266,000 registered boats in S. C. In the coastal counties, this equates to 10% of the population or about one registered boat for every 10 people. As with population growth, growth in the numbers of registered boats shows a slow steady increase over time. Again one would expect a certain percentage of boat owners to fish. In terms of state fishing licenses or permits, S.C. has regulated a night time recreational shrimping activity known as shrimp baiting. Since 1988, at least one participant in the boat has had to possess a \$25 permit. In addition, a saltwater fishing stamp has been required since 1992 for those fishing from a boat or gathering shellfish. We only have 3 years of sales, but both the baiting permit and stamp sales show slow, steady increases in participation. Freshwater license sales show the same pattern. In terms of definitions, we should mention a new category when it come to

permits and licenses, and that is the passive participant. The person that purchases a license but then does not actively participate.

Now if you look at this picture, you are left with the impression of slow, steady growth, and stability.

If you look at the various estimates from the National Survey and the MRFSS, and compare them to the indirect measures they reflect anything but stability. This is why there is some concern and confusion regarding participation estimates recently. It is very difficult for states to explain and defend some of these fluctuations, even when they are due to changes in methodology and they obviously limit the utility of this information. I won't presume to speak for other states but just for S.C. I think our needs are simple. We need consistency first of all (attempts need to be made to smooth out the annual/temporal fluctuations). Things simply are not changing to that degree. And secondly, a lot of attention has been given to theoretical statistical considerations, and this is good, but I think the time has come to balance this with discussions of fishery realities to see how well estimates fit a particular situation and how realistic they are.

So with this in mind I am looking forward to the presentations by the various participants in the workshop to learn more about their particular efforts and hopefully we can all come away with a better understanding of how fishermen are being counted and what factors affect these estimates?

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## **CHAPTER II**

### **Alternative Survey Designs for Generating Fishing Participation Estimates**

## **Alternative Survey Designs for Generating Fishing Participation Estimates**

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This paper presents a brief discussion of possible angler survey designs, with strengths and weaknesses. Little attention is given, however, to designs that have little or no feasibility for a survey of saltwater fishing at the state level or some broader geographic area. The paper then discusses the question of sample size, which may be at least as great a problem as survey method in developing accurate and reasonably precise estimates of saltwater fishing.

### **On-Site Methods**

There are many references for most angler survey methods, but many of these are conveniently presented in Pollock et al. (1994). This reference is especially useful for discussion of the bus route survey, which is newer and therefore has less documentation and application elsewhere in the literature.

### **Access Point Surveys**

The access point survey is an on-site intercept survey in which anglers are interviewed at access points at the conclusion of their fishing trip (at that site, at that time). This is a traditional creel and angler survey method. Given a randomized sampling design, this method can produce unbiased efforts of catch, effort, and catch per unit effort, as well as characteristics of fish caught (e.g., species, length, weight). The method does not work well for fisheries with large areas of open access to the water, such as a highway that parallels the shore for 50 miles, where a great deal of dispersed fishing from shore occurs. The access point survey, like any other on-site method, is not a good method for obtaining expenditure data or any evaluative measure of the entire fishing trip (experience). Anglers often do not anticipate incidental or larger unplanned expenditures when being interviewed as part of an access point survey. Similarly, time to reflect upon the trip and discuss it with others is an important process of evaluating it. An on-site survey combined with a mail or telephone survey conducted roughly one week after the conclusion of the trip is the best means of obtaining expenditure and evaluative measures of a fishing trip, such as satisfaction.

### **Bus Route Surveys**

The bus route survey is a special case of an access point survey and was designed for situations where many access points need to be covered across a wide geographic area.

This method was initially used in combination with other methods in a 1984 creel survey of New York's Great Lakes system, including the New York portions of Lakes Erie and Ontario, the Upper and Lower Niagara Rivers, and the Salmon River.

The bus route survey treats several contiguous access sites as a group and samples the group on a predetermined time schedule over a one or two day period. The route is often a loop, although this is not a requirement. A pre-determined sampling schedule allocates given periods of time for both sampling and traveling. For example, a 5-site bus route might specify that one hour be spent at each site and one-half hour be allocated for travel between sites. During the one-hour blocks the creel clerk takes effort counts and interviews anglers who complete their fishing during the hour.

The bus route survey provides improvement over the regular access point survey for surveying large geographic areas. As a variation or special case of the access point survey, the bus route survey has the same weaknesses noted above for access point surveys.

### **Roving Creel Survey**

The roving creel survey is used primarily in situations of widespread access in which a large portion of anglers would be missed by selecting only primary access points such as boat ramps. Roving creel surveys interview anglers at some point in their fishing trip rather than at the conclusion of the trip; the method assumes that the catch rate up to the time of interviews equals the catch rate for the remainder of angler trips. As with other creel survey methods, the sampling frame used for a creel survey should include the universe of all legal fishing times, and beginning points and direction traversed should be randomly chosen. The roving creel survey is subject to length of stay bias.

A limited number of factual or opinion questions can be asked of anglers in addition to catch and effort data. However, it is important to remember that the angler is somewhere in the middle of the fishing trip. Thus, it is inappropriate to ask questions that refer to the entire trip (e.g., total expenditures, satisfaction).

### **Diaries, Logbooks**

Diaries and logbooks are useful because they provide an immediate means for the angler to record data, and thus memory recall errors should be minimized. Diaries and logbooks can provide fishery managers useful information about the age and size characteristics of a fishery based on careful recording of data on fish caught by anglers. The primary disadvantage of these methods is that the more casual, inexperienced angler is less willing to participate over time in a diary or logbook effort. As a result, catch and catch per unit effort provided by diary participants is likely to be higher than for nonparticipants.

## **Off-Site Methods**

Off-site methods generally include face-to-face or personal interviews, telephone interviews, and mail surveys. Each of these methods has individual advantages and disadvantages. A potential problem or bias that interfaces each method, however, is memory recall. Some past research has shown that specific memory recall of many fishing trips lasts no more than two months, on average. Memory of the specifics of a trip (e.g., number of fish caught, by species) will vary by how unusual or unique the trip was. The details of trips made to an outstanding fishery and one fished only rarely are typically remembered for longer periods than a specific trip to a nearby water body that an angler fishes often. Thus, to obtain highly accurate recall data, anglers need to be surveyed soon after the completion of their fishing trip.

There is general consensus that response rates to at-home surveys have declined in recent years. The number of telephone sales and telemarketing ploys in use, and increases in the use of telephone message recorders to screen calls make it more difficult to complete telephone interviews. Similarly, the volume of catalogues and "junk mail" make it more difficult to obtain the attention and interest of residents for answering a mail survey. Thus, additional effort is required to complete a high proportion of sampling frames for at-home surveys. For complementary surveys in which an at-home survey follows up on an on-site survey, the rapport developed during the on-site survey is very beneficial to completing a high proportion of follow-up surveys at anglers' residences.

## **Personal Interviews**

Personal interviews at anglers' residences are rarely used because of their cost. Particularly for fisheries where anglers are attracted from long distances, personal interviews are not likely to be cost-feasible. Otherwise (than for cost considerations), personal interviews are superior to mail or phone surveys. The rate of cooperation is typically high for personal interviews. An interviewer (whether in person or via phone) has the advantage of being able to explain any question that may be vague. Personal interviews generally can be longer than phone interviews or mail surveys. Personal interviews allow the widest possible variation in question mediums. In addition to a stated question, a photograph or other exhibit can be used, for example.

Personal and telephone interviews are both subject to a number of interviewer biases. The way in which an opinion question is asked, including even differences in inflections when the exact same wording is used, can affect the response given to an attitudinal question. Thus, where more than one interviewer is involved, training and coordination are important to ensure that questions are asked similarly and that responses are interpreted and coded similarly.

## **Telephone Interviews**

Many at-home surveys can be conducted effectively by telephone. Random samples of households in any geographic area are now available commercially at reasonable cost. Telephone interviews of up to 10 to 12 minutes are typically conducted with little resistance from respondents, once they have agreed to be interviewed.

The primary limitation to telephone interviews is that respondents can not see the question; therefore a simple format is required. Telephone respondents can not be expected, for example, to rank in order a preference list of more than about five categories, and many respondents will need some of those choices repeated. In addition, telephone respondents are under more pressure to provide quick responses to questions. Therefore, the telephone is not as amenable to questions requiring substantial memory recall or other thought processes as a mail survey.

People with a general knowledge of survey methods have some familiarity with nonresponse bias to mail questionnaires. An analogous problem that has received less attention with telephone surveys is the challenge of completing a high proportion of the sampling frame. In a list of randomly generated telephone numbers, the rationale is often used that every name and phone number is randomly generated; therefore it is appropriate to dial as many numbers as are needed to reach the desired sample size; one should still have a "random" sample. The fallacy of using this strategy is that there are often correlations between study variables of interest and the likelihood of finding a respondent at home. Someone who spends a very high proportion of total nonwork hours fishing, for example, is not as likely to be reached at home as someone who watches a lot of television. Thus, some survey organizations who are particularly concerned about this type of bias make as many as 8 to 10 attempts to reach each individual chosen in the sample.

## **Mail Surveys**

Mail surveys have been used frequently to reach anglers at home. Usually mail surveys are the least expensive of any off-site method, and they are very flexible in terms of allowing for a wide range of question formats. There is no immediate time pressure to answer a given question, which makes mail a good format for questions that require some thought or record checking.

The primary disadvantage of mail surveys is they elicit the lowest response rate of any type of survey. Response rates vary by survey audience, salience of the topic, and several other factors (Brown et. al 1989). However, even the standard methods of the original survey plus up to three reminder notices often provide return rates of 50% or less for surveys of the general public and 60% or so for anglers. Salant and Dillman (1994) have recommended the use of a cash incentive to increase response rates. In addition, they recommend an initial letter notifying respondents that they have been selected for the

survey and enclosure of the survey in the second mailing as superior to the previous approach of enclosing the survey in the first mailing.

In surveys about fishing, respondents are more likely to participate and to participate more frequently than nonrespondents (Brown and Wilkins 1978). Therefore, a telephone follow-up survey of a sample of nonrespondents is important to obtaining accurate estimates of total participation.

### **Synthesis: Toward Estimating Participation**

My understanding of the challenge at hand is to be able to derive accurate estimates of marine fishing participation, or to more accurately compare the total number of saltwater anglers with the total number of freshwater anglers who fish in each state. The fact that we are gathered here to search for a solution to this problem after trying to estimate saltwater fishing participation for several decades should immediately suggest that obtaining accurate estimates must be no easy or inexpensive task, I want to emphasize that indeed this is the case. There is no easy or inexpensive solution that I can see. However, if we understand the problem more clearly, perhaps we can work toward a solution that provides improved estimates over the ones we currently have.

For the most part we have relied upon two databases to estimate marine recreational fishing. One is provided by the U.S. Fish and Wildlife Service's (FWS) 5-year surveys of fishing, hunting, and wildlife-associated recreation (FHWAR) (USFWS 1993). These data are derived from a general population survey. The second is the National Marine Fisheries Service's Marine Recreational Fishery Statistics Survey (MRFSS), which combines a site-intercept survey with a telephone survey of residents of coastal areas (NMFS 1986).

I won't critique these surveys in any detail because people directly associated with both surveys are on this program and have more specific knowledge of the surveys than I. My colleagues and I in the Human Dimensions Research Unit (HDRU) at Cornell University have used the USFWS survey a number of times. We have been an advisor and consultant to the development of previous surveys, and we have the data tapes at Cornell for the 3 most recent surveys. We have encouraged FWS to continue to use the Bureau of the Census to conduct the surveys both because of the survey expertise of the Bureau and because of the trust the Bureau has with the public. Because HDRU has not dealt very frequently with saltwater fishing issues, I should note that we have not used the FHWAR survey in any detail for this purpose. I should also add that when any single survey has multiple populations to estimate and multiple objectives, it may not provide the most efficient or most precise estimates of any one population. We really ask the FHWAR survey to do a lot.

While I have not studied marine recreational fishing extensively, I have examined the survey design used in the MRFSS survey at several points and find no obvious source of bias associated with how the survey estimates participation.

Currently, states are challenged with accurately estimating the number of freshwater versus saltwater anglers, in part for properly allocating and utilizing Wallop-Breaux funds. At this point, my understanding is that how this estimate is accomplished is left to each state, and thus a given state has several options: (1) use the FWS survey estimates, (2) use the MRFSS estimates for saltwater and some other estimate for freshwater, such as a fishing license database, or a statewide survey of licensed freshwater anglers that some states conduct, or (3) conduct an independent survey to determine both marine and freshwater fishing participation.

While I was asked to address alternative survey designs, I don't want to stop at this point because I don't think survey design is the only factor we need to deal with. We now have two "national" surveys, at least for all of the east coast states, and I have already indicated that while the designs differ somewhat, I don't think there is a major problem with either design, at least for estimating participation of residents of a particular state. I think the major problem we are faced with may be one of sample size and the precision of the estimates. This therefore, in my view, deserves some attention. Below I will attempt to clearly illustrate that sample size is a major consideration to accurately estimating saltwater fishing participation.

### **Sample Size and Participation Estimates**

I will use New York data to illustrate the "sample size problem" and argue that New York is an appropriate state to use. New York has more saltwater anglers than most east coast states but fewer than Florida or North Carolina and only about 15% more than Maryland. I will use USFWS data in this illustration. To make my point, it is not necessary to assume that these data are precise estimates, only that they are of the correct order of magnitude. From the 1991 FHWAR survey, the total population of New York aged 16 years and older was 13,802,800 million. New York had 1,835,800 total anglers - 1,206,300 freshwater anglers excluding the Great Lakes, 458,200 Great Lakes anglers, and 491,100 saltwater anglers. These numbers include 398,000 resident and 94,000 nonresident anglers who fished in New York in 1991. Obviously the freshwater-saltwater components add to more than the total because many anglers fish in more than one type of system.

Roughly 2.9% of New York's population went saltwater fishing, according to these estimates. Except for Florida, this proportion is quite similar to that of other east coast states, using USFWS data. I don't have the most recent MRFSS survey results, but I believe that for most states their estimates would be somewhat higher. Assume for the sake of argument that 3% of a state's population participating in saltwater fishing is a typical estimate for most east coast states. If we did a simple random sample survey of



any state where we would expect 3% of the population to have fished, what would our confidence limits look like for various sample sizes? This is shown in Table 1. I realize that the Bureau of the Census CPS samples are much more sophisticated in terms of its sampling, and that the MRFSS study stratifies by population along the immediate coast versus farther inland, but this simplified illustration is still broadly applicable.

Table 1. Confidence limits in proportions assuming 3% participation, for various sample sizes.

| <u>Sample Size</u> | <u>Confidence Limit in Absolute %, + or</u> |              |
|--------------------|---|--------------|
|                    | <u>P=.68</u>                                | <u>P=.95</u> |
| 840                | 0.59%                                       | 1.18         |
| 1,000              | 0.54  | 1.08         |
| 2,000              | 0.38  | 0.76         |
| 3,000              | 0.31  | 0.62         |
| 4,000              | 0.27  | 0.54         |
| 5,000              | 0.24  | 0.48         |
| 10,000             | 0.17  | 0.34         |

In New York, 3,920 households were interviewed for the screening survey and 840 sportsman interviews were conducted. Estimates of resident saltwater fishing participation were made based on the sportsman survey. Additional data from other states, particularly nearby states, were used in the nonresident estimates. At this point, I want to leave the specifics of the FHWAR survey and return to generalities. Assume that in reality, we knew 3.0% of those 16 years of age and over participated in saltwater fishing in New York. Using the above data, this would mean that New York has 414,084 anglers, again hypothetically. The standard error data above tells us that if we do repeated samples of 1,000 New Yorkers ad infinitum, assuming no other survey biases, 95% of the time the survey results will produce estimates between 1.92% and 4.08%. Translated into saltwater fishing licenses, 95% of the samples will show a range of between 265,014 and 563,154. Table 2 puts this into a bit more perspective.

Table 2. Probability of distribution of results for a survey of 1,000 New York saltwater resident anglers when the true number of participants is hypothetically 414,084.

| <u>Estimate Range</u> | <u>P</u> |
|-----------------------|----------|
| <265,014              | 2.5%     |
| 265,014 - 339,549     | 13.5%    |
| 339,549 - 414,084     | 34.0%    |
| 414,084 - 488,619     | 34.0%    |
| 488,619 - 563,154     | 13.5%    |
| >563,154              | 2.5%     |

For many kinds of study purposes where we want a reasonable estimate, this level of precision would be quite satisfactory. However, when apportioning funds of the magnitude of Wallop-Breaux, one might not want to take the risk inherent in this level of precision. Using New York as an example, in a survey of 800 to 1,000 individuals, one would incur a probability of about one in six of underestimating fishing participation by 18% or more. Of course, one incurs the same probability of an overestimate of the same magnitude. Put another way, at any point in time, of the east coast states from Maine to Florida, if all used the FHWAR study or a similar study, it is likely that two states would be underestimating their marine recreation participation by 18%. Furthermore, these two states are stuck with this low estimate for five years if they use a survey that is conducted only every five years. And the "fact" that these states are underestimating participation currently does not mean that the next survey will be kind to them and give them an overestimate of the same magnitude. The next survey represents a new draw with the same probabilities, if it is conducted in the same way with the same sample size. So, how large should the sample size be? There is no magic answer; as Table 1 suggests, for each additional 1,000 people we sample, our precision is improved at a declining rate. A level of 2,000, however, would be a substantial improvement over a sample of 1,000. With a sample of 2,000, the analogous one in six probability of an underestimate drops from an underestimate of 18% to an underestimate of at least 13%. Or, if we increased to a sample of 3,000, we would have a one in six chance of an underestimate of at least 10%.

### Alternative Survey Designs

I have suggested above that we need to increase sample size just to get a more reasonably precise estimate of resident anglers. In all of the east coast states, according to the 1991 FHWAR study, nonresident anglers comprise at least 19% of total saltwater anglers, and in Delaware and Rhode Island, the majority of saltwater anglers are nonresidents. Accurately estimating the number of nonresidents is more difficult than estimating the number of residents, unless one is conducting a national study.

The primary alternative survey designs I see are the ones currently in use, or slight variations of them. Generically, they are:

1. National survey with sufficient size to provide state-level data. The survey would be conducted primarily by telephone. In the case of the FHWAR survey, it would be desirable if the saltwater fishing participation study could be ascertained from the larger screening sample. Hopefully, sample size could be expanded somehow from the number of sportspeople contacted in each state.
2. Resident telephone survey of anglers combined with data from site-intercept studies from which nonresident participation is estimated. If extensive site intercept studies are being conducted to gain other information about effort and harvest, this method holds promise. However, nonresident participation is not uniform either temporally or between species fished for. Thus, substantial sampling effort throughout the year would be required to derive an unbiased or minimally biased estimate of the number of nonresident participants.

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## **CHAPTER III**

### **Sources of Bias**

## **Sources of Bias**

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Presentation not available at time of publication,  
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## **CHAPTER IV**

### **Review of Current Survey Methods**

## **United States Fish and Wildlife Service's National Survey of Fishing, Hunting and Wildlife Associated Recreation**

### Introductory Remarks by Sylvia Cabrera

Thank you for inviting us to participate in your workshop. We welcome the opportunity to brief you on the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation and discuss its methodology.

I will give you some background on the Survey, and the issues that have concerned us in terms of reliability and design. Tom Moore, from the Bureau of Census, who has been the chief statistician for the survey, will provide a detailed description of the Survey's design and methodology.

### Background & Purpose of the FHWAR Survey

The Survey's main purpose is to provide reliable state estimates on the number of participants, days of participation, and expenditures for fishing (including saltwater, freshwater, and Great Lakes fishing), as well as for hunting, and nonconsumptive wildlife-related recreation such as bird watching.

The Survey has been conducted at about 5-year intervals since 1955. The last survey was conducted in 1991 and the next survey, which will be the 9th in the series, will be conducted in 1996. It is the most comprehensive wildlife-related recreation survey in the Nation, and provides comparable state level estimates.

The Survey is conducted at the request of the 50 state fish and wildlife agencies through the International Association of Fish and Wildlife Agencies. They evaluate options for conducting the survey and recommend a preferred option. We consult with survey users on content and products of each survey, and with technical experts on survey design and methodology.

### Key Issues

Major issues that have been addressed in planning and designing recent surveys include: reliability of estimates, priority information to collect, timeliness in getting results to users, and the Survey cost. Some of the reliability issues that we have addressed in planning include adequate population coverage, minimization of recall bias, and good response rates.

# **National Survey of Fishing, Hunting and Wildlife-Associated Recreation 1996 Design and Methodology**

Thomas F. Moore  
U. S. Bureau of the Census

## **Introduction**

The 1996 National Survey of Fishing, Hunting and Wildlife-Associated Recreation (FHWAR) is designed to get reliable estimates of the number, activities, and expenditures of anglers, hunters, and nonconsumptive wildlife-related recreation participants in the U.S. and the 50 States. The Survey consists of a screening sample of households from the general population and three detailed interview waves of sportsmen and nonconsumptive users (NCU). This report describes the design and methodology of the Survey.

The Survey is conducted in two major operations. The first is a **screening operation** of households from the general population to identify sportsmen and nonconsumptive participants. The second is the **detailed interview operation** to collect information on their activities and expenditures. Three detailed interview waves are conducted at about 4-month intervals.

The 1996 Survey will conduct the screen and first detailed interview concurrently beginning in April. Computer-assisted interviewing will permit us to conduct the two together for the first time. We believe this will improve the efficiency of data collection and reduce the number of false positive predictions by respondents who intend to go fishing or hunting that year but end up not going. In 1991, the screen was conducted in January and many people did not accurately predict whether they would participate. By beginning the 1996 screen in April, we will identify more persons who have already gone fishing, and they will only have to predict their participation for the next 8 months. The result will be more actual participants in the sample.

## **Screening Operation**

### **General**

The main purpose of the screener is to identify persons who engage in wildlife-related recreation activities so that we can select a sample of these persons for more in-depth interviews of their activities. Census field representatives ask screening questions of the U.S. civilian noninstitutional population aged six years and older and military personnel not residing in barracks.



### **Sample Size and Source**

The 1996 screening operation uses a national sample of 77,142 households. It is a subsample of the 1991 FHWAR screening sample and a sample of newly constructed housing units. The 1991 screening sample was selected from former Current Population Survey (CPS) housing units where the final CPS interview fell between November 1986 and March 1990. The CPS samples were selected from census files with coverage in all 50 States and the District of Columbia. These CPS samples, while active, were continually updated to reflect new construction. The samples are located in 729 areas comprising 1,973 counties, independent cities, and minor civil divisions. Units identified in the CPS as vacant are included, but demolished units or units converted to nonresidential use are not.

The Census Bureau has redesigned the CPS sample several times to improve the quality and reliability of the data and to satisfy changing data needs. Both the 1991 and 1996 FHWAR surveys are based on a CPS design which was implemented in 1985. This design, which is more efficient for state estimates than previous designs, required that we select new primary sampling units (PSUs), counties or groups of adjacent counties. Thus, the areas in the sample in each state changed from earlier FHWAR surveys.

The 1996 FHWAR is a subset of both the 729 areas and the roughly 120,000 housing units in the former survey.

The following table shows the expected sample sizes for the screening and detail samples. The figures shown for the screener represent households and the detail sample figures represent persons. The samples are discussed in detail below.

Table 3. Expected sample sizes for the screening and detailed samples for the 1996 FHWAR Survey.

| 1996 FHWAR Screener and Detail Sample Sizes |               |                     |             |
|---|---------------|---------------------|-------------|
|   | CATI Workload | Subsampled Recycles | Sample Size |
| Screener Housing Units                      | 77,142        |                     |             |
| Completed by CATI                           | 47,442        |                     |             |
| Screener Recycle Rate                       | 38.5%         |                     |             |
| Recycles                                    | 29,700        | 19,000              | 66,442      |
| First Detail (Sportsmen)                    | 11,070        | 4,433               | 15,503      |
| First Detail (NCU)                          | 5,712         | 2,288               | 8,000       |
| Second Detail (Sportsmen)                   | 7,370         | 0                   | 7,370       |
| Second Detail (NCU)                         | 4,000         | 0                   | 4,000       |
| Third Detail (Sportsmen)                    | 22,873        | 4,575               | 22,873      |
| Third Detail (NCU)                          | 12,000        | 2,400               | 12,000      |

### **Procedures**

The screening sample is interviewed over a 14-week period beginning in April 1996.

The initial screening interviews are conducted from Computer Assisted Telephone Interviewing (CATI) facilities. Cases not resolved at the CATI facility are "recycled" for Computer Assisted Personal Interviewing (CAPI). CAPI is done with a laptop computer at the respondent's home or by telephone from a field representative's home. Information collected in previous surveys was recorded with pencil and paper.

Because of the relatively high cost of CAPI, the CAPI portion of the sample is limited to about 19,000 housing units. Recycles from CATI will be subsampled to reach that number.

## Questionnaire

The questions for the 1996 FHWAR will be incorporated into a computer-assisted instrument. As with past FHWAR surveys, prior to telephone contacts a letter will be sent to all households informing them about the survey and encouraging them to cooperate when called. We refer to this as a "warm" contact versus a "cold" contact when people have no knowledge about a survey before being called. We believe this results in better cooperation from the public.

The household respondent for the screening phase of the survey will be a knowledgeable household member at least 18 years of age. The respondent will answer questions for all household members. We will collect information on household members' participation in wildlife-related recreation in 1995 and previous years and whether they have already participated or intend to participate in 1996.

## The Detailed Operation

### Sample Selection

The detailed operation of the 1996 Survey begins in April 1996, immediately following screening interviewing, and continues through February 1997. It starts with the information collected on household members' participation in wildlife-related recreation and intentions to participate. Two independent detail samples are chosen from the screening sample. One sample includes sportsmen, persons who hunt or fish. The other sample is of persons who enjoy nonconsumptive wildlife-related recreation activities including wildlife observation, photography, and feeding.

The detail sample respondents are contacted up to three times to collect data for 1996.

### Sample Design

We select the detail samples based on information reported during the screening phase. Every person 16 years old or older is assigned to a category based on time devoted to hunting/fishing or nonconsumptive recreational activity in the past or plans to participate in 1996.

These categories help us to select a more efficient sample. We select the more active participants at higher rates than less active participants.

### The Sportsmen Sample

The three sportsmen categories are active, inactive, and nonparticipants.

**Active sportsmen** are persons who:

- a. already participated in hunting/fishing in 1996 by the time of the screener OR
- b. have not yet participated in 1996 but participated in 1995 OR
- c. did not participate in 1995, have not yet participated in 1996, but are likely to participate sometime in the remainder of 1996.

Active sportsmen who participated in 1995, but not in yet 1996, are further divided into avid and nonavid subcategories based on expenditures on hunting or fishing and the number of days of participation in 1995. The two subcategories are:

**Avid**—a person who hunted at least 30 days or fished at least 30 days OR spent at least \$600 on hunting or on fishing.

**Nonavid**—a person who hunted or fished at least one day but not more than 29 days AND did not spend more than \$600 on either hunting or fishing.

**Inactive sportsmen** are persons who did not participate in hunting or fishing in 1995 or 1996, did participate in 1991-1994, AND are not likely to participate in the remainder 1996.

**Nonparticipants** are everyone else. We assume they do not participate in hunting or fishing.

Only the active and inactive groups are eligible for interview in the sportsmen detail sample.

All 1996 participants and all avid sportsmen will be interviewed. Nonavid sportsmen and those sportsmen who did not participate in 1995 are subsampled to yield the desired number of sportsmen.

The Sportsmen sample will include about 23,000 potential participants. About 15,500 sportsmen will already have participated by the time of the screener and will receive the first detail interview. The remaining 7,400 sportsmen will receive the second detail interview. Only CATI interviewing will be done for the second detail interview. The full sample will receive the final detail interview. Cases not completed by CATI will be followed up by CAPI.

#### The Nonconsumptive Users Sample

There are two nonconsumptive user categories: active and nonparticipants.

**Active nonconsumptive users** are persons who:

- a. already participated in 1996 by the time of the screener OR
- b. have not yet participated in 1996 but participated in 1995 OR
- c. did not participate in 1995, have not yet participated in 1996, but are likely to participate sometime in the remainder of 1996.

**Nonparticipants** are everyone else, that is, persons who did not participate in a nonconsumptive activity in 1995-6 AND are not likely to participate in 1996.

Only the active group is eligible for interview within the nonconsumptive users detail sample.

We stratify those who participated in 1995 but not 1996 into two subcategories based on the distance traveled by the individual to participate in the nonconsumptive activity. The subcategories are:

**Primary Nonresidential**—a person who took a trip of 1 mile or more to participate in a nonconsumptive activity; and

**Primary Residential**—a person who participated in a nonconsumptive activity less than 1 mile from home.

The first stratum, primary nonresidential, is then further classified into two substrata based on the expenditures on the nonconsumptive activity and the number of days of participation in the nonconsumptive activity. Therefore, the primary nonresidential stratum is further stratified by:

**Avid**—a person who participated at least 30 days OR spent at least \$300 on nonconsumptive activities; and

**Nonavid**—a person who participated between 1 and 29 days AND spent less than \$300 on nonconsumptive activities.

The Nonconsumptive Users sample will include about 12,000 potential participants. About 8,000 nonconsumptive users will already have participated by the time of the screener interview and will receive the first detail interview. The remaining 4,000 nonconsumptive users will receive the second detail interview beginning in September. Avids will be selected at a higher rate than nonavids. Only CATI interviewing will be done for the second detail interview. The full sample will receive the final detail interview. Cases not completed by CATI will be followed up by CAPI.

### Movers

We follow respondents who move. Since respondents are interviewed up to three times to obtain a full year's data, new respondents cannot be substituted into the sample. Therefore, instead of losing sample persons, we follow respondents to their new residence.

es to complete the interviews. An exception occurs if the respondent moves beyond 50 miles of any sample area and could not be reached by telephone.

To adjust for those cases that the field staff cannot interview, the sample design includes a noninterview adjustment in the estimation procedure.

### Procedures

The first detail interview wave will take place immediately following the screening interviews, between April and early July, 1996; the second detail interviews will occur from September through mid-October; and the third detail interviews will occur from January through the end of February, 1997.

The screen and first detail interviews will be conducted concurrently. Only persons who have already participated will get the detailed interview. Detail interviews will be conducted following the screener if the detail sample person is available. Otherwise, the interviewer will arrange for a call-back.

### Recall Period

In the 1985 and earlier surveys, Census Bureau field representatives conducted a screening interview at the beginning of the year that followed the survey period. For example, screening and detailed interviews for the 1985 survey began in early 1986, over 12 months after some fishing and hunting activity took place. We were concerned about how accurately people could remember their activity in that long of a recall period. One could easily forget a fishing trip that occurred during the year or report a trip that happened the year before.

We introduced an important improvement in 1991. We still conducted the screening interview at the beginning of the year, but this time we identified persons who had participated recently or planned to in 1991. Then we returned to a sample of those persons at four month intervals over the year. This reduced the recall period, and each detail interview was bounded by the screener or by the previous detail interview. The shorter recall period and the bounding both reduce bias attributable to imperfect recall.

In 1996, we will try to maintain the 4-month recall period, but it will be longer in some cases. If we are not able to obtain a detail interview we attempt to interview the person in the next interview period.

### Questionnaires

We use two basic questionnaires for the detailed interviews—the Hunting and Fishing Questionnaire and the Nonconsumptive User's Questionnaire. We use separate versions of the questionnaires for each interviewing period. Each version of the detailed questionnaires contains similar questions about type and amount of activity, location

(state-level), and expenses. We expand the third detail interview questionnaires to ask about special activities, expenses, and related information. For example, these questionnaires obtain information on special fishing methods, licenses and tags, land leasing and ownership, economic evaluation of specific fishing activities, and expenses that usually occur once during the year.

To prevent sample persons from reporting the same activity more than once, we will include in subsequent questionnaires information from the previous interview. For example, if in the second interview the person saltwater fished, we will include in the third wave questionnaire the name of the state and the last month the person saltwater fished. Before asking this series of questions, the interviewer will remind the sample person about this fishing. We provide similar information for each type of fishing and on equipment expenditures. This interviewing technique is called bounding. It prevents the person from telescoping an event from a previous reference period into the reference period of the current interview.

### Estimation

The estimation procedure for the screening and detail samples follow the usual statistical principles used for other surveys. The final weight for each sample case is the product of the inverse of the selection probability, a weight adjustment to account for noninterviews, a first-stage weighting factor to reduce the variance due to the selection of primary sampling units, and a second-stage weighting factor to bring sample estimates into agreement with independent population controls by age, sex, and race.

#### Screening Sample.

Every interviewed person in the screening sample receives a weight that is the product of the following factors:

- CPS base weight (BW)
- Weighting control factor (WCF)
- 1996 subsampling factor (96SSF)
- Type A household noninterview adjustment factor (HNIAF)
- First-stage ratio adjustment factor (FSF)
- Second-stage ratio adjustment factor (SSF)

BW is the same base weight that was used for CPS estimates. WCF is also used for A CPS to reflect subsampling that occurred when the CPS field representatives found many more units than expected. 96SSF accounts the subsampling of the 1991 FHWAR for the 1996 survey. HNIAF adjusts weights assigned to interviewed records to account for households eligible for interview but for which no interview is obtained. It is calculated by dividing the weighted number of eligible housing units within a noninterview adjustment cell by the number of interviewed ones. FSF reduces the variance due to

sampling PSUs. SSF brings the estimates of the total population in each state into agreement with census-based estimates of the civilian noninstitutional population in each state. This also accounts for the fact that the screener did not use the same number of CPS rotation groups as CPS did (a rotation group is one-eighth of the sample). It also accounts for a small number of person noninterviews.

#### Detail Samples.

Every interviewed person in the detail sample receives a weight that is the product of the following factors:

FHWAR weight (FHWAR)

Sportsman or nonconsumptive user stratum adjustment factor (SSAF or NCUSAF)

Noninterview adjustment factor (NIAF)

Ratio adjustment factor (RAF)

FHWAR is the weight from the screening interview. SSAF and NCUSAF are the inverses of the sampling intervals used to select the subsample within sampling group. The noninterview adjustment factor adjusts the weights of interviewed persons to account for persons selected for the detail sample but not interviewed. A person is considered a noninterview if he or she is not interviewed in the third wave of interviewing. The final step, RAF, is a ratio adjustment of the detail sample to the screening sample within the sportsman sampling group. This adjustment brings the estimates of persons age 16 or more from the detail sample into agreement with the same estimates from the screening sample, which is a much larger sample.

We also make an adjustment for a subgroup of the population that is not eligible for selection for the detail sample. Persons who hunt in 1996, but in the screener said they had not hunted in the previous five years and were not likely to hunt in 1996, were not eligible for selection for the detail sample as hunters. Some of these are selected because of their fishing activity or plans. We assume the participation rate in hunting of those in sample is the same as those not in the sample. We then adjust the weights of those who hunted in 1996 but not in 1995 to account for them.

We make a similar adjustment for persons who fished in 1996 but in the screener said they had not fished in the previous five years and were not likely to fish in 1996.

#### Accuracy

We estimate that the overall degree of accuracy of these collection methods will meet the U.S. Fish and Wildlife Service objectives of accuracy. This is measured in terms of the coefficient of variation (CV), the standard error divided by the estimate, expressed



as a percentage. For example, if the average number of days fishing for some state were 20, and the standard error 2 days, the CV would be 10%.

The CV is a way of standardizing standard errors. For example, an estimate of 50 with a standard error of 3 (CV = 6%) is considered for many purposes more precise than an estimate of 20 with a standard error of only 2 (CV = 10%). To see why, consider confidence intervals. The 95% confidence interval about an estimate is the estimate plus or minus twice the standard error. Thus, the 95% confidence interval around the estimate of 50 ranges from 44 to 56 while the confidence interval around 20 ranges from 16 to 24.

The CV on the number of anglers in 1996 in the U.S. will be about 1.3% versus 1% in 1991. The CV on the number of anglers by State will range from about 6.4% to 8.6%. In 1991 it ranged from 3.9% to 7.4%. Although CVs will increase, we believe the 1996 FHWAR sample is large enough to provide reliable estimates.

### **Coastal Counties**

We understand that some coastal States are concerned that large enough samples of coastal residents are included in the Survey so that saltwater anglers are adequately represented. The subsampling of the previous sample reduces the number of residents, in both coastal and noncoastal areas, in the sample. Bad sampling luck could eliminate all the coastal areas in a state that were in the sample last time. Here's what we did to address that possibility. First, we kept all large metropolitan areas in the sample. Second, before subsampling, we sorted smaller metropolitan areas and rural areas by coastal and noncoastal status. That prevents coastal areas from being disproportionately affected by the subsampling. For example, if a state had two coastal and two noncoastal areas in the 1991 sample and we could only keep a total of two in the 1996 survey, bad sampling luck could have eliminated both of the coastal areas. Our sort would ensure that we kept one coastal and one noncoastal area.

### **Tabulations and Reports**

The data collection for the 1996 FHWAR will be completed at the end of February, 1997. The information from the 3 interview waves will be combined and edited. Tabulations will be provided to the U.S. Fish and Wildlife Service to release in preliminary reports in June, four months after the data are collected. The final National Report will be issued in October. The 50 State Reports will be issued on a flow basis from October, 1997 to March, 1998.

**National Marine Fisheries Service  
Marine Recreational Fisheries Statistics Survey**

Dr. David Van Voorhees  
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Presentation not available at time of publication,  
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## **Resident Saltwater and Freshwater Fishing Participation in Georgia**

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### **Problem**

Being a coastal state, Georgia is required by law (FWS, 16 USC 777-777k, as amended) to equitably allocate its Sport Fish Restoration (SFR) funds between freshwater and marine fisheries "...projects in the same proportion as the estimated number of resident marine anglers and the estimated number of resident freshwater anglers." The most common method to determine this ratio is to use the results of the U. S. Fish and Wildlife Service (FWS) National Survey of Fishing, Hunting and Wildlife-Associated Recreation. Beginning in 1990, the Georgia Department of Natural Resources (GADNR) began using the 1985 National Survey data to allocate 90.7% of the state's apportionment to Wildlife Resources Division (WRD) and 9.3% to Coastal Resources Division (CRD). This ratio continued to be used through 1994. Results from the 1991 National Survey, however, indicated a change in CRD's share to approximately half that of the 1985 share. GADNR was concerned that while having its merits in addressing national trends, the National Survey did not give statistically accurate and precise estimates of saltwater participation in Georgia. This concern was based on the following reasons:

- 1) the Marine Recreational Fishing Statistics Survey, conducted annually by the National Marine Fisheries Service since 1979, had indicated a steady increase in resident saltwater participation;
- 2) between 1988 and 1992, boat registrations in the coastal counties had increased by 48%; and,
- 3) saltwater participation in Georgia in the (FWS) National Survey was based on a sample size of less than 30 individuals, statewide, making the precision of the estimate questionable.

### **Need**

In 1993, GADNR decided that a better estimate of fishing participation was needed to equitably allocate the State's SFR apportionment between its freshwater and marine fisheries programs. Since an acceptable FWS alternative to using the National Survey data is for states to perform their own survey to generate statistically valid estimates, GADNR convened an interdivisional team of WRD and CRD associates to design and implement a statewide survey that would provide a more accurate and precise estimate of the relative number of saltwater and freshwater anglers.

## **Design**

The State of Georgia was initially divided into two major stratigraphic zones: Inland and Coastal. The Inland zone was further divided into six regions (corresponding closely to WRD Regions I through VI) while the Coastal zone consisted of nine counties. For the purposes of this survey, sampling was to be conducted at the household level. To ensure adequate sample size, the number of target households with anglers was selected at 500 for both the Inland and Coastal zones.

A stratified random sampling technique was employed for each zone. For the Inland zone, the sample size (number of angler households) of each region was proportionately determined according to the number of households in the region, and the sample size of each county in the region was determined proportional to the number of households in the county. The sample size for each county in the Coastal zone was determined in the same manner. Both random digit dialing and directory sampling techniques were used in each zone. For directory sampling, telephone numbers were randomly selected from the 1994 edition of the Georgia Residential Phone Directories (available on CD-ROM). A random digit dialing technique was used as a supplement to the directory sampling technique for Atlanta, Columbus, Macon and Savannah. Due to the high rate of unlisted numbers in these cities, 20% of the calls were randomly dialed and 80% were selected from the directory. Towns and cities within each county were identified on a Georgia map to ensure geographic representation of the random dial sample. To ensure regional representation, the number of valid calls for each region was checked at the end of each interview day. The number of calls on each subsequent day were assigned to reflect the running totals targeted in a given region.

The telephone survey for Georgia resident households was conducted by students with the Department of Recreation and Leisure Services at Georgia Southern University during November 1-8, 1994. Thirteen telephone lines were utilized during the survey period. A training manual and a two-hour training session was provided to all interviewers. The training manual included information on the survey instrument, directions on how to deal with the answers, survey procedures, and answers to possible questions from respondents. Personnel from GADNR attended the training session to provide technical assistance and answered questions from the trainees. Feedback from the session was used to make a one-page interview guideline which was incorporated into the interview training manual.

To avoid interviewer bias, telephone numbers from both zones and regions were randomly assigned to the interviewers. No interviewer was allowed to cover one region. Interviews were performed on weekdays from 6 to 9 p.m. and on weekends from 2 to 5 and 6 to 9 p.m. To ensure quality of data, the interviewing procedure and data collection were closely supervised and examined each night. When observing an interview, supervisors corrected errors immediately and feedback was provided to the interviewers to improve their interview technique. Interviewers attempted to call back households up to

five times to complete an interview. Interviews in each region/county were stopped when the designated number of sample households was successfully obtained.

The survey instrument was based on a collaborative design between GADNR and the contractor. To encourage participation, the survey instrument was intentionally kept brief and concise. The survey instrument started with a brief introduction that identified the interviewer by name, institution, and purpose of the survey. The potential respondent was informed that the survey would take less than 2.5 minutes to conduct. The first question screened out non-residents, and the second question located the county of residence (needed for regional representation in the random digit dialing technique). The third and fourth questions identified the number of residents age 6 or older within the household that either freshwater or saltwater fished in the last 12 months, respectively. The fifth and final question identified the number of residents age 6 or older within the household that did both. Recall is a major area of concern with many surveys but due to the simplistic nature of the questions, it was felt that with this survey recall bias would not be a problem.

Data analysis and expansion were performed for each type of fishing (freshwater, saltwater, and both) at the 95% confidence interval for the Inland and Coastal zones. First, the percentage of households participating in each type of fishing was calculated. This percentage was then multiplied by the number of resident households in the given zone, resulting in the number of angler households for a type of fishing. Multiplying the number of angler households by the average number of anglers per household for a type of fishing yielded the number of anglers for a type of fishing in a zone. Finally, the number of anglers from the two zones were combined to obtain the total angler population for freshwater, saltwater, and both types of fishing.

## **Results**

### **Estimation of Freshwater Sport Anglers**

#### **A. Inland Zone**

A total of 2,247 households were successfully contacted within the Inland Zone. Of those 2,247 households, 786 households had residents age six or older that engaged in freshwater sport fishing in the state of Georgia within the last 12 months. This resulted in a 35.0% "household" fishing participation rate (Table 4). The Inland Zone averaged 2.1 anglers per household. Therefore, the number of Inland freshwater sport anglers was estimated at 1,627,861 (2,214,777 households x 0.35 participation rate x 2.1 anglers).

#### **B. Coastal Zone**

Of the 1,855 households successfully contacted within the Coastal Zone, 644 households had residents age six and older that engaged in freshwater sport fishing in

Georgia within the last 12 months. This resulted in a 34.7% "household" fishing participation rate (Table 5). The average number of freshwater fishing participants per household in the Coastal Zone was also 2.1 anglers. The Coastal Zone had 151,838 households, so the number of Coastal freshwater sport anglers was estimated at 110,642 ( $151,838 \times 0.347 \times 2.1$ ).

#### **C. Total Estimated Number of Georgia Freshwater Sport Anglers**

When combining the number of freshwater anglers in the Inland and the Coastal zones, the population of Georgia's freshwater sport anglers age six and older was estimated at 1,738,503 ( $1,627,861 + 110,642$ ). This freshwater angler population represents 29.5% of the population age six or older (5,883,574).

### **Estimation of Saltwater Sport Anglers**

#### **A. Inland Zone**

Of the 2,247 inland households contacted, 198 had residents age six or older that engaged in saltwater sport fishing in the state of Georgia within the last 12 months. This resulted in a 8.8% "household" fishing participation rate (Table 6). The average number of Inland saltwater sport anglers per household was 1.8 anglers. Therefore, the number of Inland saltwater sport anglers age six or older was estimated at 341,075 ( $2,214,777$  households  $\times 0.088 \times 1.8$  anglers).

#### **B. Coastal Zone**

Of the 1,855 households successfully contacted within the Coastal Zone, 627 households had residents age six and older that engaged in saltwater sport fishing in Georgia within the last 12 months. This resulted in a 33.8% "household" fishing participation rate (Table 7). The average number of saltwater fishing participants per household in the Coastal Zone was 2.0 anglers. The number of Coastal saltwater sport anglers was estimated at 102,642 ( $151,838$  households  $\times 0.338 \times 2.0$  anglers).

#### **C. Total Estimated Number of Saltwater Sport Anglers**

When combining the number of saltwater anglers in the Inland and Coastal zones, the population of Georgia saltwater sport anglers age six and older was estimated at 443,717 ( $341,075 + 102,642$ ). This saltwater angler population represents 7.5% of the population age six or older (5,883,574).

## **Estimation of Sport Anglers Who Fished Both Freshwater and Saltwater**

### **A. Inland Zone**

Of the 2,247 households successfully contacted in the Inland Zone, 149 had residents age six or older that engaged in both freshwater and saltwater sport fishing in the state of Georgia within the last 12 months. This resulted in a 6.6% "household" fishing participation rate (Table 8). The average number of Inland freshwater sport anglers per household was 1.5 anglers. Therefore, the number of Inland sport anglers who fished in both freshwater and saltwater age six or older was estimated at 220,724 ( $2,214,777 \text{ households} \times 0.066 \times 1.5 \text{ anglers}$ ).

### **B. Coastal Zone**

Of the 1,855 households successfully contacted within the Coastal Zone, 399 households had residents age six and older that engaged in both freshwater and saltwater sport fishing in Georgia within the last 12 months. This resulted in a 21.5% "household" fishing participation rate (Table 9). The average number of participants per household in the Coastal Zone that sport fished in both freshwater and saltwater was 1.8 anglers. The number of Coastal sport anglers who fished in both freshwater and saltwater was estimated at 57,455 ( $151,838 \text{ households} \times 0.251 \times 1.76 \text{ anglers}$ ).

### **C. Total Estimated Number of Sport Anglers**

The number of residents age six or older who participated in both freshwater and saltwater sport fishing in the Inland and the Coastal Zones was estimated at 278,179 ( $220,724 + 57,455$ ). This sport angler population represents 4.7% of the State's population of age six or older residents (5,883,574).

## **Estimation of the Total Number of Georgia Residents by Fishing Type**

As stated above, 29.5% (1,738,503) of all Georgia residents age six or older participated in freshwater fishing and 7.5% (443,717) fished in saltwater. However, these estimates include 278,179 anglers that fished in both freshwater and saltwater. The number of anglers that fished exclusively freshwater was estimated by subtracting the number of freshwater anglers by the number of anglers who fished both types ( $1,460,324 = 1,738,503 - 278,179$ ). The number of anglers that fished exclusively saltwater was estimated in the same manner ( $165,538 = 443,717 - 278,179$ ).

## **Management Decisions**

Estimating the number of Georgia anglers that **only** saltwater fished or **only** freshwater fished was relatively simple. The problem was proportioning the 278,179 anglers who did **both** kinds of fishing. After examining several alternatives, the DNR Survey Team agreed that there were two acceptable methods for determining the

freshwater:saltwater ratio: 1) the "single-count" method, which simply divides the **both** category in half and proportions it equally between each side of the freshwater and saltwater ratio; and 2) the "double-count" method which applies the **both** category equally to the freshwater and saltwater fishermen. The first method generated an estimate of 1,599,413 (1,460,324 + 139,089) Georgia freshwater anglers and 304,628 (165,538 + 139,090) saltwater anglers, corresponding to an 84% : 16% ratio, respectively. The second method gave an estimate of 1,738,503 (1,460,324 + 278,179) freshwater and 443,717 (165,538 + 278,179) saltwater anglers, corresponding to a 79.7% : 20.3% ratio, respectively.

There are advantages and disadvantages to both methods. The mathematical properties of the "single-count" method are easy to understand and use an accurate representation of the total number of resident anglers in the ratio. However, the number of anglers who saltwater or freshwater fish is inaccurate, since those who participate in both kinds of fishing have 1/2 of their weight applied to each side of the ratio. The mathematical properties of the double-count" method are more difficult to understand, but the number of anglers on either side of the ratio accurately represents the number of saltwater and freshwater fishermen. However, applying the full weight of the **both** category to each side of the ratio inflates the total number of resident anglers used in the formula.

In its presentation to the WRD and CRD Directors on February 21, 1995, the DNR Survey Team stated that neither method was exclusively correct, and left the final decision regarding Georgia's allocation of SFR apportionments between saltwater and freshwater to both Directors. On April 4, 1995, an agreement was reached whereby WRD and CRD would receive 84% and 16% of the State's apportionment, respectively, until FFY 99 or some earlier point in time when changes in licensing laws or other events necessitate that both Divisions reassess the arrangement.



Table 4. Georgia resident freshwater fishing participation by Inland Zone (regions) from November 1993 to November 1994.

| Regions | Households<br>Contacted | Households |         |
|---------|-------------------------|------------|---------|
|         |                         | Fished     | Percent |
| I       | 201                     | 88         | 43.8    |
| II      | 89                      | 43         | 48.3    |
| III     | 1,240                   | 367        | 29.6    |
| IV      | 343                     | 127        | 37.0    |
| V       | 177                     | 74         | 41.8    |
| VI      | 197                     | 87         | 44.2    |
| Total   | 2,247                   | 786        | 35.0    |

Table 5. Georgia resident freshwater fishing participation by Coastal Zone (county) from November 1993 to November 1994.

| County   | Households<br>Contacted | Households |         |
|----------|-------------------------|------------|---------|
|          |                         | Fished     | Percent |
| Brantley | 79                      | 50         | 63.3    |
| Bryan    | 78                      | 38         | 48.7    |
| Camden   | 85                      | 32         | 37.6    |
| Chatham  | 919                     | 243        | 26.4    |
| Glynn    | 197                     | 76         | 38.6    |
| Liberty  | 281                     | 117        | 41.6    |
| Long     | 38                      | 16         | 42.1    |
| McIntosh | 71                      | 25         | 35.2    |
| Wayne    | 107                     | 47         | 43.9    |
| Total    | 1,855                   | 644        | 34.7    |

Table 6. Georgia resident saltwater fishing participation by Inland Zone (regions) from November 1993 to November 1994.

| Regions | Households<br>Contacted | Households<br>Fished | Percent |
|---------|-------------------------|----------------------|---------|
| I       | 201                     | 20                   | 10.0    |
| II      | 89                      | 6                    | 6.7     |
| III     | 1,240                   | 84                   | 6.8     |
| IV      | 343                     | 29                   | 8.5     |
| V       | 177                     | 22                   | 12.4    |
| VI      | 197                     | 37                   | 18.8    |
| Total   | 2,247                   | 198                  | 8.8     |

Table 7. Georgia resident saltwater fishing participation by Coastal Zone (county) from November 1993 to November 1994.

| County   | Households<br>Contacted | Households<br>Fished | Percent |
|----------|-------------------------|----------------------|---------|
| Brantley | 79                      | 33                   | 41.8    |
| Bryan    | 78                      | 30                   | 38.5    |
| Camden   | 85                      | 38                   | 44.7    |
| Chatham  | 919                     | 278                  | 30.3    |
| Glynn    | 197                     | 85                   | 43.1    |
| Liberty  | 281                     | 89                   | 31.7    |
| Long     | 38                      | 13                   | 34.2    |
| McIntosh | 71                      | 26                   | 36.6    |
| Wayne    | 107                     | 35                   | 32.7    |
| Total    | 1,855                   | 627                  | 33.8    |

Table 8. Georgia households that participated in both freshwater and saltwater sport fishing by Inland Zone (regions) from November 1993 to November 1994.

| Regions | Households<br>Contacted | Households<br>Fished | Percent |
|---------|-------------------------|----------------------|---------|
| I       | 201                     | 17                   | 8.4     |
| II      | 89                      | 5                    | 5.6     |
| III     | 1,240                   | 58                   | 4.7     |
| IV      | 343                     | 22                   | 6.4     |
| V       | 177                     | 20                   | 11.3    |
| VI      | 197                     | 27                   | 13.7    |
| Total   | 2,247                   | 149                  | 6.6     |

Table 9. Georgia households that participated in both freshwater and saltwater sport fishing by Coastal Zone (county) from November 1993 to November 1994.

| County   | Households<br>Contacted | Households<br>Fished | Percent |
|----------|-------------------------|----------------------|---------|
| Brantley | 79                      | 30                   | 38.0    |
| Bryan    | 78                      | 21                   | 26.9    |
| Camden   | 85                      | 18                   | 21.2    |
| Chatham  | 919                     | 162                  | 17.6    |
| Glynn    | 197                     | 57                   | 28.9    |
| Liberty  | 281                     | 66                   | 23.5    |
| Long     | 38                      | 10                   | 26.3    |
| McIntosh | 71                      | 14                   | 19.7    |
| Wayne    | 107                     | 21                   | 19.6    |
| Total    | 1,855                   | 399                  | 21.5    |

## **CHAPTER V**

### **Options for Estimating Saltwater Participation**

## Options for Estimating Saltwater Participation

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A question and answer session followed the presentations by the state and federal representatives. Most of the participants were interested in more details of the Georgia survey. The total cost of the Georgia survey was less than \$10,000 although they thought it would run as high as \$30,000. The cost per interview was a little over \$1 per interview, compared to the MRFSS which was about \$3-4 per contact. The sample size was about 7,000 attempts and only included those households with telephones. The saltwater participation rate estimated from the Georgia survey was fairly close to that from the MRFSS but was not compared to the National Survey. In terms of freshwater anglers, the estimates from the Georgia survey were a lot larger than the numbers of freshwater licenses sold, due in part to the exemptions for over age 65 and under 16. Shellfishing and crabbing activities were not identified during the course of the interview.

The discussion then centered around the various surveys and their intended purposes. Both of the federal surveys are fairly broad based and have multiple objectives. At a national or regional level they may perform fairly well in estimating participation rates but sample sizes are much lower at the state and within state levels. It is at these levels that questions have been raised concerning the precision of the estimates. The states have always had the option to use another statistically reliable survey that would provide estimates of both fresh and saltwater participation. An independent survey conducted at the state level such as the 1994 Georgia survey, could possibly address some of the questions not answered by the national surveys.

Although there has been some comparison between the National Survey and the MRFSS in terms of their estimates of saltwater participation, comparing the numbers may not be statistically valid. Historically, the estimates from both surveys have been fairly close with the MRFSS estimates higher, but following the 1991 National Survey the MRFSS estimates were much higher. Again, to use the MRFSS estimates of saltwater participation instead of the National Survey estimates, a state would have to prove to the U. S. Fish and Wildlife Service that it was statistically valid to compare these estimates. The two national surveys were designed for different purposes and this comparison might not be statistically valid. Participants agreed that if there was a way to design a survey that met the needs of both surveys, then it probably would have been done already but that the cost of doing so would probably be prohibitive.

The participants then discussed various options available to each state to refine their estimates of saltwater participation rates. A state could rely on the estimates provided by the National Survey in its present form to determine the ratio of fresh and saltwater participation or they could supplement the sample size to provide greater coverage within their state. A state could rely on the estimates of saltwater participation provided by the MRFSS but this would not give an estimate of the freshwater participation rate, and this survey only samples

the coastal counties. A third alternative would be to conduct an independent state survey to provide an estimate of fresh and saltwater participation similar to the one conducted by Georgia. The following is an outline of the options to address the question of estimating the ratio of fresh and saltwater participation:

- I. Estimates of Overall Participation in Fishing Activities (fresh and saltwater, including out-of-state participants)
  - A. USFWS National Survey
    - 1. Base level of sampling
    - 2. Base level of sampling + State add-on (supplement to increase sample size)
- II. Estimates of Total Saltwater Participation (including out-of-state participants)
  - A. USFWS National Survey
    - 1. Base level of sampling
    - 2. Base level of sampling + State add-on (supplement to increase sample size)
  - B. NMFS Marine Recreational Fisheries Statistics Survey
    - 1. Base level of sampling
    - 2. Base level of sampling + State add-on (supplement to increase sample size)
- III. Estimating the Ratio of Freshwater to Saltwater Participation (state residents only)
  - A. USFWS National Survey
    - 1. Base level of sampling
    - 2. Base level of sampling + State add-on (supplement to increase sample size)
  - B. NMFS Marine Recreational Fishing Statistics Survey
    - 1. Base level of sampling
    - 2. Base level of sampling + State add-on (supplement to increase sample size)
  - C. Design and conduct an independent state survey (similar to Georgia's 1994 survey)

These options were adopted by the Commission's Marine Recreational Fisheries Statistics Committee and will be forwarded to the Commission's Statistics Committee and the Sportfish Restoration Committee for review.

## Appendix A

## **Appendix A**

### **List of Participants**

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