THE STATE CONSERVATION AGENCY AS A SURVEY ORGANIZATION

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Our objective is to call attention to the inherent capabilities of a state conservation agency as a survey organization. We will describe a kind of survey which exploits these capabilities. In illustration, we will use a survey based upon an area sampling frame which was carried out by the Florida Game and Fresh Water Fish Commission with the technical help of the Southeastern Cooperative Fish and Game Statistics Project. This enterprise united the method of sampling according to area of residence, the unique resources of a state agency for public contact and interview, and the ability of a cooperating university to provide the design for the survey and statistical analysis of the results.

A state conservation agency will often need to know something about its own state and find that this information is not available. The required knowledge may range over a broad spectrum from the routine to something far beyond the areas of special interest traditionally associated with game and fish work. In this instance, the state of Florida felt an acute need for reliable, if approximate, information on the numbers of legally unlicensed fishermen between the ages of 15 and 64. Other states might wish to know, for example, how many residents take fishing trips outside the state, or engage in bird watching, or, might need to know the kinds and amounts of pesticides used in the home and garden. Much of this information can be obtained by properly conducted surveys, but with two qualifications; first, that the agency wants the information enough to divert the money and manpower needed to obtain it, and second, that it is possible for a survey to obtain the desired knowledge from the public or from the environment. Further, if the information is to be obtained from the public, as it was in this survey, then one must be able to accept what people say as a useful approximation to reality. Although tests and cross-checks are occasionally possible, decision on this last question usually depends on judgment, not on statistics.

Use of an area sampling frame here meant that the residents of Florida were sampled according to the areas where they lived. Most persons have a single current residence located at some spot on the earth's surface. Thus if we sample this surface we can include any residence with known sampling probability. Area sampling has been widely used in the periodic federal census enumerations as well as in other studies (Kish, 1967). Area sampling has rarely been used by state conservation agencies, even though an apparently successful application of the method was made by Tennessee in 1951 with a comprehensive survey of land use and game distribution (Schultz, 1952, 1954). As ordinarily carried out, area sampling of the public requires use of personal interviews; perhaps for this reason the method has been avoided.

If we consider the problems of conducting a survey of the public over as large an area as a state we find that, given statistical competence, there are important practical questions in arranging for the specific interviews demanded by the survey design. A field staff is required, and the quality of this staff determines much of the value of the survey.

The state agency is uniquely able to provide interview capabilities within the borders of the home state. If we list the characteristics which would be desired in setting up a survey field staff to interview the public, we would ask that a member be intelligent, articulate and personally presentable. For operational economy, we would want staff members to be dispersed over the state, and for effectiveness each should be well acquainted with the geography of his own area and able to communicate with the local people. One would need practical arrangements for reimbursement for time, subsistence and travel, and provision for training meetings. In addition, a large staff would require a functioning supervisory network with a tradition of efficient response to a request for specific information. Beyond all this, we would be most fortunate if these staff members were well informed on the general subject being

investigated. All of these characteristics describe the usual state conservation agency and its professional staff. For questions in the broad area of conservation it is doubtful that any professional survey organization can match the potential of the average state resource agency in providing field staff.

Obviously, the information to be obtained must be important to the agency, for the staff members have many other duties, some of which must be set aside to accomplish the survey. Further, to maintain the morale necessary to the efficient accomplishment of unusual duties, the staff must realize the importance of the information and be persuaded that the methods are sound and the enterprise worthwhile.

METHODS

Aside from the field staff, the most important single feature of an area survey is the sampling frame which allows particular small areas to be drawn with know sampling probability. This property allows results from the series of sample areas to be expanded to a valid estimate of the total for the state. The sampling frame for this survey was set up, and the sample drawn, by Dr. Charles Proctor and Mr. Bill Stines and by those working under their direction at the Institute of Statistics, North Carolina State University.

In setting up the sampling frame, the land area of the entire state of Florida was subdivided into 175,450 area segments. These were grouped into 25 zones, each with 7,018 segments (for discussion of the zone as a feature of sampling design, see Deming, 1960). The zones were laid out over the state in a serpentine manner. A simple random sample of 2 segments from the 7,018 was drawn in each zone. A definite number of segments was assigned to every city, to every non-city place listed in the population census of 1960, and to every county's remaining area. The number assigned was equal to one tenth the number of housing units reported in the 1960 *Housing Census.*

After the sample of 50 area segments was drawn, the location of each was marked on an aerial map and on a county or city road map, with precise field directions for each segment. The random selection number had indicated only the census enumeration district (ED), the town, or the census tract within which the sample segment lay. It was then necessary to order a census ED map, or to send for an aerial photograph, or to consult the census block statistics. In almost all cases the last stage was an aerial photograph, usually 5 years old, on which houses could be counted, allowing the area to be subdivided into segments. With liberal use of aerial photographs, most of the selection of sampling segments could be done in the office, but in apartment house areas or with out-of-date aerial photography, part of this stage of the sampling process had to be carried out in the field within a designated larger area. In these cases, the field instructions directed that an area be subdivided into a stated number of segments and that one of these be chosen at random.

In the stage of drawing the sample segment and of preparing the packet of field materials for each, the limiting process was the obtaining of the census maps and the census counts from the 1960 census along with the corresponding aerial maps and county highway maps. The whole survey was extended two or three weeks by delays in obtaining these materials; we make this comment only to recommend special attention to this step when time is limited.

With the type of area sampling used here, the field operations included both the counting of the number of housing units present in an area segment which had been selected as part of the sample, as well as the designation of units for interview. On the average, 8 to 10 interviews were carried out at housing units in each segment, but at the planning stage it is impossible to know exactly how many housing units there are in a segment, for this number may change from day to day. Specific directions were furnished to the field crew for counting the total number of units currently in a segment and for selecting particular housing units for interview (for a copy of these directions, see Appendix A-1). Where a choice or a use of random number tables was required, the field man was instructed to call his supervisor who would make this selection, thus preventing subjective choice in the field.

The field interviews were carried out during the first two weeks of February by a field staff of about 40 fishery men, all employees of the Florida Game and Fresh Water Fish Commission. These included fishery biologists, hatchery and hyacinth control personnel, and fishery aides. Since there were 50 segments for 40 field men, most had only one segment. Direct contact between the University at Raleigh and the field work was maintained through the five regional supervisors. Each field man sent the summary of segment information and the completed questionnaires to his own regional supervisor. The supervisor reviewed the material, completed anything missing, and then sent the results to Raleigh. Further questions were settled by telephone.

The field procedure was carried out in three steps; first, the segmenting of a larger area, if necessary, and the listing of all housing units in the area segment to be covered; second, the selection of particular housing units for interviews; and third, the completion of a questionnaire at each of the selected housing units. This usually required at least two trips to the segment, and more if the occupants of any housing unit were not home to be interviewed at the first attempt. But most of the men were assigned only a few interviews and apparently the work was completed without serious interference with other duties. Interviews were completed at 489 housing units.

An important step in the process was the two-day training session (25-26 January 1967). All the field men were assembled at Orlando, Florida, and the nature and usefulness of the study were explained. The methods of drawing segment boundaries and of selecting the housing units for interviews were illustrated and discussed fully. Segments were assigned to individual interviewers, and maps and other materials were distributed; then specific questions were settled. The first day of training concluded with each man completing two questionnaires on a trial basis in the Orlando area, choosing a rural or urban area according to the nature of his own assigned segment. In retrospect, we consider this training session to have been extremely important for the success of the entire operation, both in providing information on procedures and in generating morale. This last came about through discussion of the survey and its objectives and in particular through the actual experience of trial interviews. The field men learned that the public was not hostile to uniformed Commission interviewers but in contrast, was anxious to help them.

A trial questionnaire was drawn up before the training session and was modified following the experience of a trial and the following discussion. The final form is shown in Appendix A4. The primary objective was to obtain information on the numbers of resident fishermen active in fresh water without a license who were between the ages of 15 and 64. In this age bracket anything except "cane-pole" fishing in the home county requires a license. Enough other questions on fishing were included to prevent undue emphasis on this one point; otherwise the questionnaire was kept short and to the point. A count was made of all persons in the household, whether or not any fishing was done. Thus, as a test of the survey it would be possible to estimate the total state residential population for comparison with the census reports.

The questionnaire responses were summarized at Raleigh. The first step was to expand the information from the selected housing units to estimate totals for the particular area segments. For any one characteristic, the sum of such estimates for all 50 segments, multiplied by 3,509, provided an estimate of the State total. Estimates of sampling variance were computed on the basis of the differences between the two segments within each zone. We believe that it will be clear how each question can be expanded directly into a state total, with the possible exception of Question 4, on preference for fish species (See Appendixes A-3, A-4). Here the interviewer determined the respondent's opinion about the favorite species in his housing unit and this preference was credited to all fishermen of that unit, since it was impractical to interview each separately. Totals were then estimated for fishermen "voting" for each species.

RESULTS

We can report that this kind of survey is practical. The entire operation in Florida was planned and carried out under the pressure of administrative need for the information in the early spring of 1967. First discussions on the possibility of the survey were held in mid-November 1966, with the preliminary report on the results made in early March and a final report in mid-May, 1967. In the interval the largest block of time was required for setting up the sampling frame; the rate at which this could be accomplished was limited by the time required to obtain maps, census counts and other materials from various sources. Almost all the field interviews at 489 dwelling units in 50 widely scattered segments were completed within two weeks after the training session in late January.

The final estimates from this study are shown in Table 1. Although the main emphasis of this paper is on the method and the potential of the state agency, these results may be of interest. The Bureau of Census had estimated the Florida total resident population as 5,893,000 as of 1 July 1966 (Anon. 1967). The estimate from this survey, 5,939,000, is much closer to the Census figure than the standard error should lead us to expect for an average performance. On the other hand, the total number of license buyers in the state was considerably over-estimated, at 627,000 for the 1966 calendar year, as compared to the average for license sale during the fiscal years of 1965-66 and 1966-67, which was about 415,000. We believe some overestimation was to be expected. Part of the discrepancy may represent a reaction to being questioned by a uniformed interviewer; we suspected, in fact, that a cautious person might tend to claim a known legal status under these conditions, if uncertain

TABLE 1.

Characteristics of Florida Fishermen as Determined from Interviews in a Survey Using an Area Sampling Design.

Category	*Estimated Number*	*Percentage Standard Error*
Freshwater Fishermen		
No License, Age 15-64	432,000	23
License Buyers, Total	627,000	18
License Buyers, Male	420,000	
License Buyers, Female	201,000	
License Buyers, Age over 64	15,000	62
Males, Age under 15	219,000	
Females, Age under 15	137,000	
Males, Age 15-64	600,000	
Females, Age 15-64	408,000	
Males, Age over 64	44,000	
Females, Age over 64	14,000	
Prefer Bass	510,000	26
Prefer Bream	463,000	30
Prefer Speckled Perch	82,000	41
Prefer Catfish	121,000	53
Prefer Other Species	0	
No Preference Among Species	241,000	24
Total Freshwater Fishermen	1,420,000	17
Total Saltwater Fishermen	1,399,000	16
Total Non-Fishermen	3,753,000	9
Total Florida Residents	5,938,000	9
Freshwater Fishing Trips	30,570,000	32
Saltwater Fishing Trips	28,398,000	24

No all subclasses add to the same totals because of the effect of missing information. Standard error not calculated where not shown.

of the exact intentions of the questioner. But there is another factor. Fishing licenses in Florida are valid on a fiscal year basis. Therefore, the total number of individuals buying fishing licenses in one or both of two different years will ordinarily exceed the number buying licenses in either year because not every person buys a license every year. Our estimate of license buyers for 1966 is thus a complex figure, including the resident surviving purchasers of a 1965-66 license, , plus those who purchased a 1966-67 license before the survey, minus those who had bought both licenses. This problem was acticipated but was not considered important enough to justify more questions.

Estimates based upon responses indicate that 432,000 persons between the ages of 15 and 64 would acknowledge fishing without a license. This figure is considered a conservative minimum because of the possibility that some of the unlicensed fishermen claimed a licensed status. It is clear that females are an important part of the angling population, both licensed and unlicensed. Total numbers of fishing trips to fresh and to salt water approach 60 million, a remarkable figure for a state with a resident population of about 6 million, but these estimates are in substantial agreement with those made for 1961 by another agency, using a survey based upon a telephone frame (Kidd, 1963).

DISCUSSION

This survey was successful on several counts. It provided the desired information within the required time limits. The statistical precision was probably adequate for the immediate administrative use. The field operations progressed smoothly and according to plan, and without evidence of stress on either the interviewers or the public. The most vexing difficulties were in obtaining information for setting up the sampling frame and drawing the sample, and these problems came about mostly because of the short time limit.

A state agency can carry out such a survey, given the following requirements:

1. That the information can be obtained from the public through an interview.
2. That the agency needs the information enough to devote the necessary money and manpower to the project.
3. That the field force is motivated and informed both as to need for the information and in the technical procedure of the survey.
4. That a competent statistical unit is available to furnish the design, to help in training, and to complete the analysis.

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APPENDIX

The form of various instructions which were provided to the interviewers, and the questionnaire used, are reproduced here.

A1. (The following instructions on field procedures were provided to each interviewer).

INSTRUCTIONS FOR INTERVIEWERS
FLORIDA FISHING SURVEY
JANUARY 1967

There are three main steps to be carried out for your part in this survey. These are:

1. Break up the area marked on the map into segments (where necessary) and choose one of these. Record on segment summary sheet the total number of segments and the segment chosen.
2. List all housing units in the segment and select those to be interviewed. Record on the summary sheet the total number and the number selected for interview.
3. Complete interviews for the selected housing units. Use at least 4 calls before giving up on a unit. Record on the summary sheet the total number completed.

1. *Breaking up the marked area* into segments. In many cases this step is not necessary. Where it is necessary the maps will have instructions to "Break into (some number) segments". To do this, first *sketch* a map showing boundaries within those already marked, to form the required number of area segments. Use relatively permanent landmarks to lay out boundaries of segments, and try to have about an equal number of housing units in each segment. Then a random selection will be made of one segment, and this is to be done by another person, the "supervisor". This should be done with a coin toss for two, or rolling one die, for up to six, or by use of random numbers. It is important that *another person* do this selecting.
2. *Listing all housing units.* Here make a real list so that each housing unit has a number, and so that for any number you can go to the list, then go out into the field and find that particular housing unit. It is suggested that you take a sheet of paper and make a real list, numbering 1, 2, 3, etc. and listing each unit, perhaps by street number, or in some way so that you end up with every housing unit on the list once. "Housing unit" is discussed later. Then select the housing units to be interviewed. Make the selections this way:

   A. If there are *15* housing units or fewer, then interview every one.
   B. If there are *16 to 29* housing units, then the supervisor will tell you whether to start with the first or the second unit, and you will take every other one after that.
   C. If there are *30 to 50* housing units, then the supervisor will tell you whether to start with number 1, 2, or 3, and you will take every third one after that.
   D. If there are *more than 50* housing units, then the supervisor will work out a method to give you a sample of about 20 units to interview.

      Supervisor: Divide the total number of housing units on the list by 20, and round to the nearest whole number. This will give you the "gap". Then select at random a starting point in the first gap and take every gap number after that. Example – say the number of housing units is 77. Dividing this by 20 we get 3.8, so the nearest whole number is 4 and this is the gap. Choose at random one number of 1, 2, 3, 4 for a starting point; say this is 2. Then check number 2 on the list, number 6, number 10, and every 4th number until you have a sample of 20, or until you go through the list, whichever happens first.

Definition of housing unit. A housing unit is separate living quarters, usually a house, apartment or flat but it may be a trailer or room in a hotel, if this is the permanent residence. We do not include transient quarters. Watch out for single

housing units associated with business, like the living quarters of the motel manager or the watchman's residence in a warehouse, or a merchant living in the back of his shop. List these as single housing units. With an apartment house, list each apartment as a separate housing unit.

Both vacant and occupied housing units are to be listed, except that you are to exclude buildings under construction or being destroyed, unfit for human habitation, or being used for non-residential purposes.

A2. (The interviewer was instructed to prepare a copy of this summary sheet for each segment covered).

FLORIDA FISHING SURVEY
JANUARY 1967
SEGMENT SUMMARY SHEET

Segment ID Number_____
Segment Interviewer_____
Total Number of Segments in Area_____
Segment To Be Covered_____
Total Number of Housing Units on the List Made for the Segment_____
Number of Housing Units to be Interviewed_____
Number of Housing Units Completed_____

A3. (The following suggestions on interviewing were provided to each interviewer).

SURVEY OR FLORIDA FISHING
FLORIDA GAME AND FRESH WATER FISH COMMISSION
JANUARY-FEBRUARY 1967

Instructions on use of questionnaire:

Specific Points

1. If family is not resident, circle NO and terminate interview.
2. Ask about licenses the last of all, even though you record the answers under question 2.
3. Question 3 refers to an estimate of total fisherman-trips for the household in 1966, separately listed for freshwater and saltwater. Use a zero if there were no trips.
4. Question 4 on the preference for fish refers to overall household preference.
5. Space for special comments is to use only if you have need for it.

General Comments

6. When mentioning this work, use the word "study" rather than "survey" because the last has been so much used in selling.
7. Don't make it too easy for people to refuse the information. Of course, quit before you create a bad impression for the Commission. But in many cases, a little extra effort will overcome the inertia of some people who are slow to reply. There is nothing personal here, it is the Commission asking for the information and help, not you.
8. Try to emphasize by what you say and how you say it, that in this study there is absolutely no interest in names or individuals. Everything is looked at on the average and individual records are lost in the process. But we do need the information and the only way to get it is by the cooperation of these people.
9. *Complete all possible information.* Try to complete all the blanks you can and don't leave anything to our judgment. For each person, fill in sex, age bracket, fishing and license information even if there is no fishing.

A4. (Form of questionnaire used).

Survey of Florida Fishing
Florida Game and Fresh Water Fish Commission
January – February 1967

Segment ID No._____
Housing Unit No._____
Interviewer_____

Region No._____

Suggested Call-Back Time_____
Time of Calls_____ _____ _____ _____

(Greetings) I am with your Florida Game and Fresh Water Fish Commission. We are trying to find out something about fishing in Florida. Will you help us by answering a few questions?

1. Was this family resident in Florida for 6 months or more of 1966?
   (Circle) YES NO

2. Will you tell me for everybody who lives in this house whether or not he fished for fun in Florida during 1966. *We don't need to know his name* but we would like to know whether he is a youngster, adult or older, and whether we are talking about a man or woman. It is important to us to know who did not fish at all, as well as those who did.

Sex	Age in 1966 (X)			Fished (X)			License (X)	
(M or F)	–15	15-64	+65	Fresh Water	Salt Water	Did Not	Yes	No

3. About how many trips did everyone make in total? Freshwater_____
   Saltwater_____

4. Now we would like to ask a few questions about freshwater fishing only. (Ask only if there are freshwater fishermen).
   What type of freshwater fish does your family prefer to catch? (Circle One)
   Bass, Bream, Speckled Perch, Catfish, Other, No Choice.

5. Now we would like to ask about buying licenses. Some people buy a fishing license even if they don't go fishing. Some people don't have to buy a license, but a few of these buy one anyway. Will you tell us who had a fishing license and who did not?