

SAMPLING DESIGN AND CONSIDERATIONS

There are many different strategies to collect recreational fishing data and many things must be considered before choosing the right method. Different surveys have different biases and will have different effects on the precision and accuracy of sampling estimates. Choosing the correct survey type and properly setting up and executing the sampling design will result in more reliable survey results.

Things that must be considered include:

1. Defining goals and objectives
2. Information to be gathered
3. Need for direct observation
4. Sampling frame
5. Cost
6. Who will conduct the survey
7. Desired statistical precision

It will be much easier to choose a survey design and sampling strategy to best suit your needs once you have answers to those questions. Two publications contain valuable information on how to set up and conduct fishing surveys and were used extensively in preparing this document. These publications are *Creel and Angler Surveys in Fisheries Management* (Guthrie *et al.*, 1990) and *Angler Survey Methods and Their Applications in Fisheries Management* (Pollock *et al.*, 1994). The *Special Report # 37 of the Atlantic States Marine Fisheries Commission* (MRFSS Users Manual) was also used extensively to develop this document.

Once a survey design and sampling strategy have been chosen, there are many ways to increase the accuracy and precision of the results. The following sections suggest methods to reduce variance for different types of surveys.

ACCESS POINT ANGLER INTERCEPT SURVEYS

Access point surveys are on-site, intercept surveys, typically consisting of a personal interview with the fishermen at the completion of their fishing trip. The interview should take place at a common egress point from the fishing area. These surveys are used primarily to collect effort, catch, and harvest data, and secondarily to collect economic or social information. Biological information of the animals harvested is also usually collected.

A. SURVEY PERSONNEL PROCEDURES

1. Interviewer Qualifications

The interview typically consists of two separate but equally important parts. There is a personal interview of the fisher to collect personal and fishing activity information and a creel survey to collect biological data on the retained catch. Each part of the interview requires a unique set of skills.

Interviewers should have substantial fish/shellfish identification skills. They should be able to identify, by direct observation, the most frequently occurring species in his/her geographic sampling area. Therefore, initial training might be necessary to verify the ability of the interviewer to identify fish or shellfish species in the area where they will sample. Training with fresh specimens is preferred; however if not available, slides, photos, or other reference guides can be used.

While interviewers are typically selected for their skills in fish or shellfish identification, these are not the only skills required to be a successful interviewer. Interviewers should also have good people skills as they may have a direct impact on the results of the survey. A good interviewer not only identifies fish accurately, but can also approach strangers with little reluctance, can conduct interviews in a professional manner, and can diplomatically handle touchy situations.

Interviewers must also be very organized. Specific tasks often include locating sites in sometimes remote areas, completing site assignments, having all necessary equipment available and in proper working order (e.g. calibration of scales) while interviewing, looking up codes in reference manuals, and completing and submitting all forms accurately and in a timely fashion. In addition, interviewers should wear appropriate attire and present themselves in a professional manner at all times while in the field.

Initial testing may be required to assess interviewer's interpersonal and organizational skills, as well as their ability to follow specific directions. These people skills will have a direct impact on the results of the survey. An interviewer who is friendly and conducts an interview in a professional

and organized manner will generate more respect from the fishermen. This also generates respect for the survey, and the responses fishermen give will be more reliable.

2. Interviewer Training

Interviewers must be trained in proper procedures for conducting surveys. Training programs must be designed to ensure quality and consistency of the overall sampling process. This includes site selection, selection of fishermen to interview, conducting the interview, recording and coding responses, and proper editing procedures. They should have good directional and organizational skills for locating intercept sites in remote areas, maintaining all necessary equipment, referencing codes, and submitting forms on schedule. Subjects addressed in the intercept survey training sessions must include, but are not necessarily limited to:

1. An introduction to the goals and objectives of the survey, operation of the survey, and uses of the data. This will educate interviewers on appropriate responses to general questions from fishermen in the field
2. Procedures for setting up, including information sources on local fishing activity
3. Procedures for selecting primary and alternate interview sites, setting up an interview station, calibrating field equipment, and updating site lists
4. Supplemented by a discussion of sources of local information on fishing activity to aid in these tasks
5. Proper procedures for selecting respondents, conducting the interview and coding the intercept data form. This should include an item-by-item explanation of the data collection instrument and a review of all materials used in the conduct of the interview
6. Identification of the most frequently occurring fish/shellfish species in the interviewer's geographic sampling area without the aid of reference materials
7. The effective use of taxonomic keys and other reference materials, such as Peterson's *Field Guide of Atlantic Coast Fishes of North America* or American Fisheries Society's (AFS) *A List of Common and Scientific Names of Fishes for the United States and Canada*, to identify other less common species in the interviewer's sampling area
8. A review of local names for fishes or shellfishes, identification aids for local species commonly misidentified, and the use of the NODC species list
9. Principles and techniques of random sampling, so that decisions on subsampling fish or shellfish for measurement and on subsampling interviewees at high use sites can be properly determined under a variety of field conditions
10. Correct techniques for length and weight measurements, and biological materials, (e.g., otoliths, gonads, blood, etc.) for each species of fishes or shellfishes

11. General overview of fishery(s) to be encountered and most commonly caught species that might be seen

3. Supervisors and Interview Supervision

In the process of conducting a survey the supervisor plays a very important part in ensuring quality data. Regular feedback from supervisors to interviewers provides one of the most important means of quality control. A supervisor not only provides training and guidance but should also be involved in monitoring interviewer performance, checking for accuracy and consistency of the data, and verifying data.

Field supervisors should have all the skills required of the interviewers, but on a more extensive level. They should be completely familiar with all the survey goals and procedures, common mistakes encountered, and how to overcome such problems. This should include the theory behind the survey design and sampling strategy. Supervisors should have extensive field experience identifying local fish, especially those that are commonly misidentified. They must also have strong teaching and communication skills to allow them to train new interviewers effectively. Supervisors should be highly organized and have strong managerial and motivational skills.

All interviewers should have their performance evaluated on a regular basis. During an evaluation, supervisors should focus on the interviewer's knowledge of the purposes of the survey, their abilities to deal effectively with people, properly and consistently conduct interviews (including selecting interviewees and properly identifying eligible interviewees), accurately code interview forms, and correctly identify, measure, and weigh species. New interviewers should be evaluated more frequently and more extensively, until the supervisor is certain interviews are being conducted properly and consistently. Each new interviewer should be observed in the field during one of his/her initial assignments.

4. Interviewer Evaluations

Routine interviewer evaluations should continue even after an interviewer has met all the field training requirements. Supervisors should conduct at least two site visits with interviewers annually. Supervisors should also randomly check forms filled out by the interviewers. These should be checked for completeness, accuracy, and consistency. Species codes, lengths and weights should be reasonable for the species and area. In addition, supervisors should verify fishermen responses on a portion of the forms using alternative methods. The main purpose of this validation is to independently verify that the interviewer was at work where and when he/she was supposed to be. It also provides project managers with feedback on interviewer conduct in the field.

5. Other Supervisor Duties

Supervisors are expected to routinely verify that the site list for their area is accurate. The sampling frame should include all possible interview sites, even if fishing pressure at some sites is low. Information from intercept interviewers, field supervisors, and other fisheries personnel should be used to continually update the sampling frame.

Field supervisors are expected to communicate frequently with interviewers in their area. Newsletters or meetings with groups of on-board interviewers (focus groups) to review data collection procedures, site-specific sampling problems, species identification and new recreational fishery developments would be highly desirable.

Supervisors should attempt to coordinate sampling with personnel from other management agencies when overlapping surveys exist. Field supervisors will also be expected to take the lead role in verifying that the site list for their area is as accurate as possible.

B. SURVEY PROCEDURES

1. General

Interviewers should gather information on fishing activity to aid in their sampling productivity. Newspaper and weekly magazine fishing reports are useful in monitoring activity and the seasonal opening and closing of fishing piers, marinas, for-hire operations, etc. Other useful information can be derived from for-hire boat captains, pier managers, marina owners, and local fishermen. This sort of information gathering will strengthen the relationship between the interviewers and the fishermen, and will increase the reliability of, and the confidence in, the survey results.

2. Sample Frame Maintenance

A proper sampling frame will include all possible interview sites, even if fishing pressure at certain sites is very low. Since fishing activity is constantly changing, sampling frames usually are not static. Sampling frames must therefore be as up to date as possible. Information from intercept interviewers, field supervisors, and federal/state fisheries personnel should be used to revise the current sampling frame. Types of revisions that could be made include sites being added or deleted, and descriptions of existing sites being changed. These revisions should be made continuously, and the master sampling frame should be updated regularly, such as once per sampling period.

Sampling frames should also contain as much information as possible to help interviewers locate each site and sample it most productively, as well as reduce variability from two interviewers sampling one site differently. For example, information that could be provided includes names and

telephone numbers for for-hire vessel sites, vessel schedules or periods of peak fishing activity, and best location to set up an interviewing station. Interviewers and field supervisors should maintain contacts with local fishermen, residents, state/federal fisheries personnel, law enforcement officers, marina operators, and bait shop owners, etc., in order to update sampling frames.

For programs using a stratified sampling design, sampling pressure should be distributed relative to the fishing pressure at each site. In these instances, a standardized method for estimating fishing pressure should be devised and used over the entire region being sampled. Estimates of fishing pressure will need to be made before each sampling period begins, but these could be revised during the sampling period. Information for these revisions could come from many places. The most reliable would be for interviewers to make estimates of fishing pressure during each visit to each site. In addition, field supervisors should visit all sites, at least once in a specified time period, for the purpose of updating the sampling frame, regardless of whether or not a site was assigned during the survey period.

When determining fishing pressure from estimates submitted by different interviewers, field supervisors must make the final determination of the "best" values to use in updating the sampling frame. More weight should be placed on pressure estimates for sampling periods during which sites were visited and empirical data were gathered, as opposed to pressures estimated well in advance. Field supervisors should also consider the experience of interviewers submitting pressure estimates for the same site. Data from newer interviewers may not be as reliable as that from more experienced interviewers.

3. Sample Assignments

The unit of effort to be sampled is angler trips, so fishing pressure should be based on the number of angler trips, not boat or group trips that are taken at a given site. Similarly, sample size (number of interviews) should be based on the number of anglers, not groups to be interviewed.

If there is little variation in fishing pressure among modes, sites, days, sampling periods, etc. or if there is little information regarding the amount of variation in fishing pressure, it may be most appropriate to designate sampling pressure using a random sampling design. However, if there is sufficient variability in the amount of fishing pressure among sites, modes, days, etc., if used properly, a stratified sampling design may increase the precision of the survey estimates.

If a stratified sampling design is used, sampling pressure should be allocated with respect to fishing pressure. This is important not only within

each sampling period, but also across sampling periods. For example, if sampling takes place quarterly, and one half of the fishing activity is during the third quarter, then one half of the sampling activity should also take place in the third quarter.

Within a given sampling period, for each fishing mode, sampling effort should be distributed between sites relative to fishing pressure within that period. The assignments should also be spread within periods so that there is a representative distribution of intercepts relative to effort, and intercepts are not clustered at the beginning or end of a sampling period. This could be done, for example, by limiting the number of days with multiple assignments or limiting the number of interviews collected at one site.

Once sampling effort has been allocated, a base level of interviews (i.e., a minimum sample size) should be determined for each unique stratification combination, or cell (e.g., region X sampling period X fishing mode X day type, meaning weekday/weekend), to assure that sufficient data are available to produce estimates. Larger sample sizes may be needed for certain boat modes (for-hire) to reduce the clustering effect of group catches. Sampling allocations beyond the base level should be proportional to the fishing effort by cell.

For some surveys it may not be appropriate to set a specified starting time. The time of day selected for sampling should reflect daily fishing activity. A set of criteria should be established to help the interviewer decide on the best time to sample. These criteria might include information from the site register, boat schedules, tide schedules, periods of peak fishing activity, presence of night fishing, and information from pier owners, marina operators, newspapers, etc., Fishermen should be interviewed at the completion of their fishing trips.

The interviewer must start an assignment at the assigned site. When possible the interviewer should do some advance checking with the person in charge at that site before going on an assignment. This is especially true for assignments at private marinas, boat rental locations, head boat docks, and the like, where it is important to know the hours of operation.

On some occasions, it may not be possible for an interviewer to obtain the sampling goal in the assigned mode at the assigned site. This may occur, for example, during bad weather (a small craft warning and no boats going out) or if a tournament is being conducted at the site and tournaments are excluded from the sampling frame. A standardized set of procedures should be established to assist the interviewer in deciding what to do in such instances. If alternate sites are an option, guidelines should also be

established to assist the interviewer in choosing an alternate site. These guidelines should have restrictions, which prevent interviewers from choosing the same alternate site too often. If alternate sites are not an option, guidelines must be established to determine how to make up the lost sample.

4. Conducting Intercept Interviews

It must be remembered that conducting the interview is only a portion of the survey. The overall objective of the survey is to get reliable results. How the interviewer acts in the field, and how he or she conducts the interview, may have a significant impact on the responses he or she gets, and therefore on the results of the survey. While on assignment, an interviewer should always be on his/her best behavior. Friendliness, courtesy, and professionalism (including proper attire), will prove very helpful in getting cooperation from the fishermen. In the interest of professionalism, interviewers should never fish during an intercept survey.

5. Station Setup

Upon arriving at a site, the interviewer should first check in with the person in charge (or the person previously contacted). Many sites, especially public beaches, will have no such person, but privately owned or closely supervised public operations will have a manager in charge. Both for permission and as a courtesy, the interviewer should introduce him/her and give a summary of the purpose of the survey.

Interview setup procedures may differ slightly for different modes and areas. The following subsections describe the typical procedures for each mode. If sampling pressure is not stratified by fishing mode, the next sections will at least describe some of the common problems associated with each mode.

6. All Sites

In general an interviewer should set up the interviewing station so that all fishermen leaving the site can be easily seen and approached. For a survey designed to obtain catch and effort information for finfish, the station should not be near an area that could potentially bias the information being collected. For example, the station should not be near a fish cleaning stand since usually only fishermen with fish will stop at the stand.

To reduce variability between visits to the same site by the same or different interviewers, interviewers should write down a detailed description of how and where they set up an interview station at each site they visit. This information should be included with the site list to give interviewers new to the site an idea on how to best set up their station.

7. Shore

If the survey is being conducted from a pier, jetty or bridge, the interviewer should be stationed at a point of access to the site. If a beach or bank site is being sampled, the interviewer may have to cover a rather extensive stretch of coast fished by scattered clusters of fishermen or solitary fishermen at remote spots. If there is a predominant point of exit from the site (e.g., a central parking facility) the interviewer should be positioned there. If no such point exists, the interviewer should be positioned so that the majority of fishermen are within sight and easily accessible. Close observation of the fishing activity is required since the interviewer must be alert to fishermen leaving the site. If no suitable observation spot can be found and the fishermen' completion times cannot be determined other options (e.g., roving survey) should be considered.

8. Headboat Only Sites

The ability to get an adequate number of interviews depends on how many head boats are located at the same site and the schedules of those head boats. If an interviewer does not think that he/she can get enough interviews by waiting at the access point other survey options should be considered.

If problems such as these arise on a regular basis a set of options should be developed to assist the interviewer on deciding what to do. Possible options include dropping or rescheduling the sample, changing the form of the survey (e.g. changing to a logbook survey), boarding the vessel and conducting interviews onboard, or just doing what is possible under the circumstances. Whatever the decision, sampling protocol must be established beforehand.

9. Charter Boat Only Sites

Interviewers should generally not board a charter boat to conduct interviews during a trip. Intercept procedures for charter boats resemble those for private and rental boats. With charter boat sites it is well worth the effort to call the site or charter boat captains in advance to find out the schedule of the boats. With this information, the interviewer can plan to arrive at the dock just prior to the scheduled returns.

10. Private and Rental Boats

Because there are large differences between one boat landing/docking facility and another the best procedure for a particular site must be determined by the interviewer. Descriptions on how previous interviewers set up interviewing stations can provide useful interview station locations. Often the offer of assistance to the boat operator in handling a boat line or loading the boat onto a trailer is a good way to obtain cooperation for the interview.

11. Canvassing Introduction

At some sites it is possible and advisable to build rapport with the people fishing prior to conducting any interviews. Fishermen who have had the opportunity to meet the interviewer and discuss the survey tend to be more cooperative when asked for an interview at the end of a fishing trip. A key factor in gaining the respondent's initial cooperation and confidence in the study lies in assuring him/her that the interviewer is not part of any enforcement effort and briefly informing the respondent about the basic research nature of the survey. When explicitly given the purpose and scope of the survey very early in the introduction, the initial reluctance and misgivings usually dissolve and the interview will proceed in an atmosphere of confidence and cooperation.

The canvassing introduction is also a useful tool for the interviewer to determine the most productive time and place to conduct interviews. By determining in advance the estimated times that individuals anticipate their fishing trips will be completed, the interviewer can decide whether or when it will be necessary to visit alternate sites. At beach/bank sites especially, a preliminary canvass to determine the number and location of fishermen on-site and a rough approximation of the duration of their trips can be a useful tactic. With this information the interviewer is able to maximize intercept coverage by planning his/her movements around those of the respondents.

The canvassing process should be very informal and as unobtrusive as possible. At all times, the interviewer must avoid any actions or statements which would disrupt the fisherman's normal fishing habits. While canvassing the interviewer might mention that he/she will want to identify, weigh, and measure the fish caught. This alone often provides an incentive for the interview. Also, the interviewer might begin to look at the fish being caught so that identification time is kept to a minimum during the interview. If deemed appropriate, the interviewer might also suggest that each fisherman keep his/her catch separated.

12. Non-biological Portion

For most surveys, final interviewing should begin as soon as the fishermen have completed their fishing trip and return to the dock or leave the fishing area. In some cases it may be appropriate to sample partially completed trips. Policy and procedure on when this is appropriate should be determined before such sampling occurs.

Under optimum circumstances, all fishermen will be interviewed; however, some form of subsampling may be necessary. Under no conditions should the interviewer just approach the more friendly fishermen. The sample must be conducted with an unbiased selection process. For example, if fishermen are leaving a site, or boats are returning to dock, faster than an

interviewer can conduct an interview, a systematic sample (e.g., interviewing every third fisherman or boat) may be appropriate. The interviewer may also just conduct an interview as often as possible while keeping count of how many fishermen are missed.

Interviewers should strive to complete individual interviews and catch records for each member of a group. However, this may be difficult for charter boats, since fishermen often have little control over the handling of their fish, which are often stored together. Captains and mates should be consulted to determine the actual water area fished.

13. Screening for Eligible Respondents

Screening serves to introduce the interviewer and the survey and determine if the respondent is eligible for an interview. While interviewers should be given a list of eligibility requirements, it should not be needed on a routine basis if the survey background and eligibility requirements are fully understood.

All fishermen approached should be told the interviewer's name and the name of the study sponsor, if there is one. If the fisherman is willing to cooperate, the interviewer would then ask the eligibility questions. An important point to determine is, how much fishing should the fisherman have completed before he/she is eligible for an interview. Actual interviewing begins after eligibility is established. It may be necessary or appropriate to read other documents prior to conducting an interview (e.g. the Privacy Act statement is read during a MRFSS interview).

14. Key Items

For each interview, some unique identifying information should be provided by the interviewer and should include sample information such as interviewer code, date, geographic area (e.g., region, state, sub-state area, etc.), site, time (i.e., local military time should be used to prevent confusion), unique interview identification number, and interview status.

Depending on the survey, certain data items are critical to the data expansion routines and are termed key items. If a response to any of the key items is missing, then the interview is not valid. Key items often include mode and area of fishing, distance from shore, state and county of residence, group catch questions, catch disposition, number, length and weight of catch by species, and head information. Other variables may not be critical to the survey. Interviews should be coded as to the status of the interview (e.g., good, incomplete, refused, etc.).

Below are general instructions for conducting interviews for most surveys:

a. Wording

The questions to be put to the fisherman should be written out in full, and the interviewer should always read each item on a questionnaire exactly as it is written. Methodological studies have shown that even slight changes in wording, for example, "should" versus "could", drastically influence item response.

b. Provide Definitions, Not Answers

If the fisherman asks for the interviewer's opinion about an item, the interviewer should provide a definition for the item in question, rather than supply the actual response. For example, if the fisherman is unsure about whether he was fishing from a head boat or a charter boat, the interviewer should explain the difference and let the fisherman decide.

c. Codes for Not Applicable Questions

Items on a questionnaire that are not applicable to a particular fisherman (i.e., items falling out in skip patterns) are coded with a specified number, as indicated on the questionnaire.

d. Codes for Refused Questions

If a fisherman refuses a key (or critical) item, the interviewer should code the item with specified number, as indicated on the questionnaire and terminate the interview. If the fisherman refuses a non-key item, the interviewer should code the item with specified number, as indicated on the questionnaire and continue with the next question.

e. Codes for 'Don't Know'

Items that the fisherman does not know the answer to are coded with a specified number(s), as indicated on the questionnaire.

f. Other (Specify)

For some data items the response codes are not exhaustive. At these items there are codes designated **Other (Specify)**. If a fisherman gives a response not covered by the pre-coded responses, the interviewer should enter the "other" code and write out the exact response next to the coding boxes.

g. Notes/Footnotes

For some items, footnotes will be required under some conditions. MRFSS examples are: if weight and/or length measurements are missing, if a site code is needed, if a state and/or county code is needed, or if a species code is needed. In such cases the interviewer should place an asterisk (*) by the item and provide a footnote explaining the situation near the bottom of the form.

h. Best Use of Time

There will be times during the day when the interviewer will seemingly have little to do. This time can be used to fill in the identifying information on forms that will be used later at the site. This time can also be spent reviewing and editing completed coding forms.

If an item allows for multiple choices, such as species preference, and the respondent mentions only one species, he/she should not be pressed for two. The first answer mentioned would be coded in the first set of boxes and the second set would be left blank.

For species preference questions the interviewer should note that species are desired. If the fisherman names a family of fish, the interviewer should probe to determine whether he/she preferred a particular species in that family (For example "Any particular kind of drum you're looking to catch?"). If the fisherman has no preference within the family of fish and several species are possible within that family the interviewer should enter the family code. If, however, the interviewer knows that the fisherman could only be going after one species within that family, he/she should enter that species code. For this item, knowledge of how local names translate to exact species is very important. If the fisherman uses a local name, the interviewer should also enter the accepted common name from the species list for the species or family so that field supervisors can check the species code entered.

Interviewers should only record reasonable responses to species preference items. If a fisherman responds that he/she was fishing for a species not found in his/her area, this response should not be coded.

The interviewer may have to work with a fisherman to come up with a specific answer to some questions. Fishermen are likely to say something like "every week", "once a month", or "a few". In these instances the interviewer should translate the response to a number and verify that number with the fisherman.

Coding forms for most intercept surveys should contain information that allows data users to link interviews and catches by head and by sample in order to allow for group catches and cluster analyses.

C. BIOLOGICAL PORTION

1. Fish Identification

Interviewers must strive to identify and verify all available catch to the lowest taxonomic level required using approved field guides. The interviewer should not rely on the fisherman to identify his/her own catch.

Other references may include more local information on the region to be

sampled, such as additional descriptive information on species with common identification concerns in a specific region. Interviewers should also be provided a species list sorted alphabetically by common name. Accepted common names are not necessarily those used by local fishermen, and interviewers should know how to translate local names to accepted common names.

A list of those found in the area to be sampled should also be provided to the interviewers.

Guidelines should be set on what to do with fish that cannot be identified. For example, should the interviewer just identify the fish to the lowest level possible, take a picture of the fish, or ask for the fish to bring back to the lab.

Species code lists may not be exhaustive. Interviewers may occasionally identify a species that does not appear on the list, particularly species that occur primarily in freshwater. When this situation occurs the interviewer should write out the scientific and accepted common name of the species and leave the coding boxes blank. A field supervisor will then find the species code and fill it in the blank.

2. Weight and Length Measurements

Ideally, all fish species in a fisherman's catch will be measured and weighed unless refused by the fisherman. Under some circumstances, however, it may be necessary to subsample. Protocol must be established on when to subsample, how to subsample (random, systematic, etc.), and a minimum number of fish to sample if it is necessary to subsample.

Weights versus lengths priority may vary from survey to survey. There may be occasions when length and/or weight measurements are missing. As a general rule, when weights and/or lengths are missing, the interviewer should code the appropriate coding boxes with a missing code and provide a footnote explaining why the data are missing.

a. Weight Measurements

Depending on the survey target interviewers should be provided with appropriate scales (i.e., a large scale for 20 kg and/or a small scale for 1 - 5 kg scale). The scale capacity should be selected based on the average sizes and range of sizes of fish in a region. The appropriate capacity scale will be used for differently sized fish to ensure accuracy. Fish weights should all be recorded in the same metric units and to the same level of accuracy.

Occasionally an interviewer may come across a fish that weighs less than the level of accuracy measured. Depending on the survey, protocol must be set on how to handle this situation. If individual

weights are not required, it might be appropriate to weigh a counted number of the fish. If individual weights are necessary, the interviewer could weigh a counted number of fish of the species, and distribute the weight among the fish in increments of the lowest level of accuracy measured. For example, if fish are weighed to the nearest 0.1 kg and fifteen fish weigh a total of 0.6 kg, six fish would be recorded as weighing 0.1 kg, and nine fish would be recorded as weighing 0.0 kg. The fish of longer length should be given the 0.1 kg, while fish of shorter length should be given the 0.0 kg.

b. Length Measurements

Fish lengths must be taken with standard measuring boards and recorded in the same metric units and to the same level of accuracy. Interviewers should also carry a tape measure for fish longer than the measuring board.

c. Tournaments

Fishing tournaments are often a good source of length and weight information for a single or a few species. It is suggested that tournaments are sampled as a supplement to the length and weight data collected by the other modes of fishing. However, sampling tournaments for catch and effort information is not recommended since they are not representative of typical fishing activity. Including tournaments in the estimates of catch and effort would require a substantial increase in the sample size to offset the effects of clustering that tournaments introduce.

D. INTERVIEWING IN OTHER MODES

For surveys that stratify by fishing mode, it is often possible to conduct interviews in modes other than the assigned mode. Guidelines should be established to determine when to sample other modes than those assigned. For example, interviews in other modes could be conducted during nonproductive time spent while waiting to interview in the assigned mode, after an interviewer obtains their quota of interviews, or if the interviewer determines that the assigned mode is not active in the interviewer's sampling area on the assigned day.

E. SUMMARY

In general, surveys should be as standardized as possible. Protocol and guidelines should be established for as many aspects of the survey as possible. This includes the overall activities conducted on a regular basis (e.g., what questions to ask, how to ask them, and how to weigh and measure the fish) as well as the less frequently encountered tasks such as subsampling, what to do if there is no fishing activity, or what to do with hard to identify fish.

Successful surveys also require extensive feedback and general communication between the interviewers and the supervisors. Interviewers

should be encouraged to ask questions and bring problems to their supervisor. Supervisors should make an effort to visit all interviewers in the field, or at least contact all interviewers, on a regular basis to assist with any problems and point out and try to rectify any deficiencies the interviewer has.

There must also be strong communication among the interviewers. Discussions could include identification of certain fish, where to set up a station at a particular site, or other common problems that interviewers might have. These sorts of discussions will reduce the variability of results between different interviewers.

Finally, it must be reiterated that friendly and professional interviewers will generate more respect from the fishermen, and they will get more reliable results. All interviewers must be on their best behavior at all times when in the field.

TELEPHONE SURVEYS

Telephone surveys are off-site surveys consisting of a telephone interview after fishing has been completed. These are typically much cheaper than on-site surveys, and can produce results very quickly. Telephone surveys are used to collect a variety of data such as effort data and economic information, but are not always reliable for collecting information on catch.

A. INTERVIEWERS

Phone interviewing survey methodology often requires that sampling occur during discrete dialing periods throughout the duration of a survey. This approach may require a large pool of part-time interviewers because of the non-continuous nature of the work.

B. INTERVIEWER QUALIFICATIONS

Interviewers must have strong communications skills and be able to interact with people in a friendly and professional manner. Experience in telephone interviewing is desirable to effectively deal with a variety of situations while conducting the interview. An interviewer who is friendly and conducts the interview in a professional and organized manner will generate more respect from the fishermen. This also generates respect for the survey, and the responses given will be more reliable. It is often necessary to have at least one interviewer per shift who is bilingual who would be used as necessary.

C. INTERVIEWER TRAINING

Extensive training sessions must be held for all personnel who have not previously worked on a phone survey. These sessions should be designed to ensure quality and consistency of the overall sampling process. This training must cover general telephone interviewing procedures as well as procedures specific to the survey. Subjects addressed in the telephone survey training sessions must include, but are not necessarily limited to:

1. Overcoming respondent resistance and discouraging refusals
2. Recording call attempts and completions
3. Screening respondents for eligibility
4. Setting appointments and making call backs
5. Assuring confidentiality of responses
6. Reading the questionnaire verbatim
7. Recording answers
8. Obtaining complete answers
9. Proper probing and clarifying imprecise or confusing responses
10. The sampling frame used
11. Generation of a random list of households (if applicable)
12. Awareness of sampling quota systems
13. Call backs to verify unusual responses

Training sessions must include a general overview of the background, purpose and design of the sampling survey. Questions and discussion

should be encouraged to ensure that all interviewers understand the importance and overall purpose of the study. This overview must be followed by an item-by-item explanation of the data collection instruments and a review of all materials used in conduct of the interview.

Each training session should contain periods of role playing to result in good interviewing technique. All trainees must conduct practice interviews with supervisors to allow first-hand criticism of their interviewing technique.

All interviewers, including those employed during previous sampling periods, must receive a final briefing before the start of each sampling period's dialing period. This briefing will refresh techniques established in previous sampling periods, review the basic details of the study, explain the exclusions in questionnaires that are applicable to that sampling period and point out any changes in forms. Questions would be strongly encouraged during these final briefings.

D. SUPERVISORS AND INTERVIEW SUPERVISION

In the process of conducting a survey, the supervisor plays a very important part in ensuring quality data. Regular feedback from supervisors to interviewers provides one of the most important means of quality control. A supervisor not only provides training and guidance, but should also be involved in monitoring interviewer performance, checking for accuracy and consistency of the data, and verifying data.

Telephone supervisors should have all the skills required of the interviewers, but on a more extensive level. They should be completely familiar with all the survey goals and procedures, common mistakes encountered and how to overcome such problems. This should include the theory behind the survey design and sampling strategy. Supervisors must also have strong teaching and communication skills to allow them to train new interviewers effectively. Supervisors should be highly organized and have strong managerial and motivational skills.

Supervisors should brief all interviewers before the start of a new dialing period to review basic details of the study and explain any changes in forms. Supervisors should silently monitor ten percent of the interviews as they occur and provide guidance. Any apparent mistakes or inconsistencies should be checked with interviewers and, if necessary, respondents should be contacted again for clarification. Supervisors should routinely evaluate interviewers. During evaluations, supervisors should focus on the interviewers' understanding of the survey, their ability to consistently conduct useful interviews and their accuracy in coding interview forms. New interviewers should be evaluated more frequently.

All interviewers should have their performance evaluated on a regular basis. During an evaluation, supervisors should focus on the interviewer's knowledge of the purposes of the survey, their abilities to deal effectively with people, properly and consistently conduct interviews (including identifying eligible interviewees), and accurately code interview forms. New interviewers should be evaluated more frequently and more extensively than more experienced interviewers, until the supervisor is certain interviews are being conducted properly and consistently.

Upon successful completion of the initial training, additional training of interviewers should be conducted by the supervisor until he or she is certain that interviews are being conducted properly. It is important that response forms be checked and interviews be monitored and tracked for the first few days of a new interviewer's assignment.

Interview monitoring requires the supervisor to listen to an interview in progress and record the responses on a separate response form. The supervisor must never interrupt the interview, at any time, for any reason. Following the interview, the two response forms (one from the interviewer and one from the supervisor) are compared, and any discrepancies are resolved. Supervisors should also give suggestions to improve interviewing technique. Interviews conducted by new interviewers should be monitored extensively until the supervisor is certain that interview procedures are being carried out properly.

Tracking of interviews by re-contacting the respondent allows the supervisor to verify that an interview actually took place, that responses were coded correctly, and that the interview was conducted professionally and courteously. A minimum set of data elements and interview quality checks should be determined prior to conducting the survey, and these should be used for each re-contact. Additional questions may be asked but the minimum elements should be asked of every point of contacting again. Extensive tracking of interviews should be employed until the supervisor is sure that interviewers are conducting complete, accurate, and professional interviews.

Routine interviewer evaluations should continue even after the supervisor has determined all interviews are being conducted properly. This will ensure better quality data. A minimum number or percentage of interviews to be evaluated should be established prior to conducting the survey, and this amount of interviews should be tracked and/or monitored on a regular basis (e.g., daily, weekly). This will allow supervisors to determine problems with the questionnaire or the interviewers and make suggestions to the interviewers on how to overcome these problems.

Supervisors should review all completed questionnaires on a daily basis during the dialing period. They must check to see that coding forms are

completed fully and accurately. Any apparent mistakes or inconsistencies must be checked with interviewers and, if necessary, the respondent would be re-contacted to clarify an answer. Respondents who report an abnormally high number of trips should be re-contacted for verification.

E. SURVEY PROCEDURES

1. Sample Frame

The type of sampling frame chosen for a telephone interview survey will determine how the survey is conducted. Three commonly used methods to structure a telephone survey sampling frame include random digit dialing, directory frames, and special registration lists. Each type has certain advantages and disadvantages, and should be chosen carefully to meet the needs and fit the goals of the survey.

Random digit dialing (RDD) frames contain all possible telephone numbers, but are usually restricted to residential numbers in certain area codes and prefixes. One benefit of RDD is that it allows you to contact all possible telephone numbers, including unlisted numbers. A drawback is that positive response rate can be very low.

Directory frames provide more information about each of the subscribers, and are specific to geographic areas, but do not include unlisted numbers. Positive hit rate can also be very low.

Special frames include club membership lists, license holders, or boat registration lists. The positive response rate for these frames is typically much higher than for the other frames, but can be biased, for example, if only the more avid fishermen join an angling club. Both directory and special frames can become outdated very quickly and should be used as soon after being published as possible since many people change addresses and phone numbers between updates of a given directory.

The type of sampling frame used for a given survey should depend on the goals and objectives of the study, as well as cost and timing of the survey, sample size, and population size of the area to be sampled.

2. Sample Allocation

To ensure that sufficient data are available to produce estimates and achieve the precision and accuracy of the survey, a base level of interviews (i.e., a minimum sample size) should be determined and allocated to each sampling block (e.g., each county X month combination). Allocation of effort within each block can then be determined. If fishing activity is uniform throughout the entire sampling block, or if there is insufficient evidence to determine variations in effort, it may be most appropriate to designate sampling pressure using a random sampling

design. However, if there is sufficient variability in fishing activity between sub-areas or sampling periods, and if used properly, a stratified random sample may increase precision of the survey estimates.

Sample allocation may be stratified based on variables such as effort, actual population size, relative population size (e.g., the number of angling club members per county, or the number of households with a certain telephone exchange, which may not be indicative of true population distribution), or a combination of any of these.

Protocol must be set prior to conducting the survey to account for phone numbers that have been disconnected or reassigned. In many instances, procedures will be dictated by the survey design. Using RDD, the sampling unit is not the actual resident or household, but the random phone number and the results that are generated when that number is used. In this case, the new number should not be dialed as a replacement. However, if using a subscription list, the random unit may be a certain fisherman, and if possible, the new number should be used to reach the fisherman. In instances where no new number is given, procedures should be determined if and how to replace the lost sample.

Similar problems arise when there are multiple fishermen at a given telephone number, and procedures should be determined how to handle such cases. Again, survey design may determine proper procedures. Using RDD, the sampling unit is the phone number, and all fishermen at that phone number should be interviewed if possible. Using a subscription list, the unit may be a certain fisherman, though there may be multiple fishermen at the same number. These fishermen may be interviewed as extras beyond the minimum sample size. However, these interviews may introduce bias into the results through clustering of trips if they always fished together, or whether their effort was significantly higher than the mean (especially if sample size is low).

When using random sampling of any kind, it is possible to contact the same household more than once, especially in areas with low population. Within a given sampling block, it must be made certain that no household is included in the survey more than once. In addition, a maximum acceptable level of attempting contacts again should be determined for a given time period and should not be exceeded.

F. CONDUCTING PHONE INTERVIEWS

1. Sampling Periods and Dialing Period

Sampling periods should be determined for each survey based on the goals of the survey and the acceptable level of bias. One of the major forms of bias in telephone surveys is recall bias. Longer sampling periods

increase recall bias because information about less recent trips is often forgotten or confused with other trips.

Once the sampling periods have been determined, the dialing periods should be determined. All households to be sampled for that period must be contacted within this dialing period. Telephone calls must be made during the time of day that maximizes the potential to contact individuals. When each number is dialed, the telephone should be allowed to ring a previously determined number of times before the interviewer classifies it as a "no answer." Acceptable levels of "no answer" or "busy" results should be determined and not exceeded.

A minimum number of attempts to contact a household should be established. At least this number of attempts must be made on each household. Another minimum number of attempts should be established to reach additional fishermen in the household who are not present during the initial interview. This number might be attempts per household, or per eligible fisherman in the household. The interviewer should attempt to set up appointment times for call backs. The pattern of dialing to reach a household may be stratified by day/evening or weekday/weekend.

2. Screening for Eligible Respondents

Screening serves to introduce the interviewer and the survey and determine if the respondent is eligible for an interview. All contacts should be told the interviewer's name and the name of the study sponsor. The interviewer should then determine if there are any fishermen in the household before the more specific screening are asked. If fishermen do reside there and are willing to cooperate, the interviewer would then ask the eligibility questions. Actual interviewing begins after eligibility is established. The screening introduction must be repeated for each fisherman interviewed. The survey design should include the types of households eligible for an interview.

3. Conducting the Interview

Some general instructions for conducting the interview are:

a. Wording

The questions to be put to the fisherman are written out in full for a purpose. Methodological studies have shown that even slight changes in wording, for example, "should" versus "could", drastically influence item response. The interviewer should always read each item on the Telephone Household Questionnaire exactly as it is written. Instructions to interviewers that are not to be read during the interview should be written in capital letters on the telephone questionnaire. The questions should also be very simple and straightforward. If the

questions are obscure and hard to follow, the fisherman may get confused or frustrated and give inaccurate responses.

b. Provide Definitions, Not Answers

If the fisherman asks for the interviewer's opinion about an item, the interviewer should provide a definition for the item in question, rather than supply an opinion or the actual response. For example, if a fisherman is unsure about whether he was fishing from a head boat or a charter boat, the interviewer should explain the difference and let the fisherman decide.

c. Codes for Not Applicable Questions

Items on the questionnaire that are not applicable to a particular fisherman (i.e., items falling out in skip patterns) are coded with a specified number, as indicated on the questionnaire.

d. Codes for Refused Questions

Items on the questionnaire that are refused are coded with a specified number, as indicated on the questionnaire.

e. Codes for 'Don't Know'

Items on the questionnaire that the fisherman does not know the answer to are coded with a specified number(s), as indicated on the questionnaire.

f. Other (Specify)

The response codes for some data items are not exhaustive and include codes designated Other (Specify). If a fisherman gives a response not covered by the precoded responses, the interviewer should enter the "other" code and write out the fisherman's exact response next to the coding boxes.

g. Notes/Footnotes

Unusual responses require explanation through the use of footnotes on the coding form. For example, more than two or three head/charter trips by a single fisherman during a sampling period would not be common and would require a note. In such cases the interviewer should place an asterisk (*) by the item and provide a footnote explaining the situation near the bottom of the coding form.

h. Terminate

Some responses are followed by the instruction to "Terminate." When the respondent answers with a response which has the "Terminate" instruction following it, the interviewer must thank the respondent pleasantly and say goodbye.

4. Maps

Maps for the state being dialed must be available to help interviewers determine the county in which cities are located and to help locate areas of fishing. Saltwater cut-off points for rivers are particularly useful to help determine if the respondent was fishing in fresh or saltwater.

In some cases, all fishermen in the household must be interviewed separately about their fishing trips for a particular time period. There are exceptions to this rule. If the initial respondent indicates that all household trips were made as a group then their responses can be applied to the remaining household fishermen without separate interviews (i.e., If the desired sampling unit is the individual fisherman, then it must be made certain he or she is not speaking about a group catch.). Also, an adult can speak for a small child if he/she is knowledgeable of the child's fishing trips. Other occasions that would require responses from an individual about another household member's trips would include language barriers, extended travel away from the household, hospitalization, or even death. If more than the minimum number of callback attempts fail to reach a particular member of the household, it may be necessary to ultimately gather the best information available on that person's trips from another household member. However, a maximum acceptable level of these indirect interviews should be established and not exceeded.

All fishermen are asked to recall their trips made in the specified time period starting with the most recent trips and working backwards in time. Interviewers must have a calendar available to help respondents with dates, particularly with weekend dates.

If a fisherman cannot recall all the trips within the sampling period, the interviewer must note the date they stopped counting. The fisherman must then be asked to estimate the number of trips and mode of fishing during the period between their last reported trip date and the beginning of the sampling period.

5. Callback Procedures

If the initial contact indicates that any members of the household are marine recreational fishermen, every effort must be made to complete interviews with all possible eligible fishermen in the household, if appropriate. Follow-up calls should be made to the household to interview fishermen who were not available when the initial contact was made. The most efficient approach is to schedule times for these call backs that are convenient for fishermen in the household.

G. SUMMARY

Proper survey design is essential in getting the best results out of a survey. There are many possible sampling methods for telephone surveys, and much

research should be done to determine the most appropriate one for the goals to be achieved and the questions to be answered. Without the proper survey design, results from the survey may not be reliable and accuracy and precision may be very low.

In general, a survey should be as standardized as possible. Protocol and guidelines should be established for as many aspects of the survey as possible. This includes the overall activities conducted on a regular basis (e.g., what questions to ask, how to ask them) as well as the less frequently encountered tasks such as replacement of lost samples (i.e., disconnected numbers).

Successful surveys also require extensive feedback and general communication between the interviewers and the supervisors. Interviewers should be encouraged to ask questions and bring problems to their supervisor. Supervisors should make an effort to contact all interviewers on a regular basis to assist with any problems and point out and try to rectify any deficiencies the interviewer has.

Finally, it must be reiterated that friendly and professional interviewers will generate more respect from the fishermen, and they will get more reliable results. All interviewers must be on their best behavior at all times when conducting the survey.

POST INTERVIEW PROCEDURES

Once the interviews have been conducted and the data collected, it must be edited and analyzed to get the estimates and survey results. The survey should also be critiqued to locate and attempt to fix any possible deficiencies in the sample design.

In addition to manual checks of interview forms, Partners should incorporate automated checks to catch remaining mistakes for each data element. A double-entry system or other quality assurance techniques should be employed. For telephone interviewing, Computer Assisted Telephone Interviewing systems (CATI) should be employed to ensure the highest quality data collection and entry. Outlier adjustments should not be made to raw data files, but during estimation. Estimation programs should provide results both with and without outlier adjustment for evaluation purposes.

A. DATA PROCESSING

1. Editing

Interviewers and supervisors must follow strict guidelines while editing coding forms before submission for data entry. Coding problems should be resolved at the field level. Interviewers should be required to review forms during their down time between interviews, or have established review times when they can edit check their own work. These guidelines are meant to ensure that all items on the coding form are completed with valid entries and that the data are consistent and accurate.

All forms from the same assignment should have the same and accurate assignment number, interviewer code, date, interview number, geographical area, site and interview status, and other pertinent information. Refused items and items with responses of "don't know" must be coded with unique codes signifying refusal or lack of knowledge.

2. Intercept Interview Field Edits

All species codes must be checked against written names. Unusual species must be verified. Lengths and weights must be checked for reasonableness and ensure they are in the appropriate metric units. Maximum sizes should be compared to published values.

3. Phone Interview Field Edits

Upon completion of interviewing for the day, interviewers must review their questionnaires for completeness and accuracy. Supervisors must review all questionnaires daily. Any apparent mistakes or inconsistencies must be checked with interviewers and, if necessary, the respondent should be contacted to clarify an answer.

4. Data Entry Edit Checks

Protocol should be set to determine a maximum acceptable error level for data entry, and data entry procedures must be designed to achieve this level of accuracy. Dual data entry or other error checking data entry techniques should be employed.

Error checking must be accomplished through the use of table lookups during data entry or editing routines on the complete data set after data entry is completed for a sampling period. All checks described in the field editing guidelines must be incorporated into machine edits. Every data element must be checked for data entry errors, reasonableness in falling within an acceptable range, and logic in relation to other data elements. Duplicate identification numbers must also be identified and corrected.

B. DATA STORAGE

All data should be stored on magnetic or optical storage media, with complete documentation (current and historical) of record formats and variable codes. All files should have creation dates imbedded in the files so users can be sure of using the most current files. Back-up procedures should be in place to protect the database. Original and/or duplicate data sheets should be archived.

C. ESTIMATION PROCEDURES

1. Outlier Analyses

One method of outlier adjustment involves an examination of frequency distributions of pooled data from a specified number of the most recent years (and excluding the current year) for a particular cell combination.

Outlier adjustment should never cause changes to the raw data files, but occurs during the estimation procedure. Estimation programs should provide results both with and without outlier adjustment to allow for evaluation.

2. Intercept Interview Outliers

In some surveys the number of intercepted fishermen with catches of a particular species can be relatively small in certain estimation cell combinations. If sample sizes are small, unusually large reported numbers of fish caught can result in unrealistic expanded estimates of the catch of a species. Other intercept data elements that should be checked for outliers include hours fishing, number of fishing trips in the previous sampling period.

3. Phone Interview Outliers

The number of fishermen contacted in a telephone household survey can be relatively small in several states and sampling periods. Unusually large

reported numbers of trips (given small sample sizes) can result in unrealistic expanded estimates of trips, and then catch.

D. ESTIMATION PROCEDURE DOCUMENTATION

All estimation procedures and programs should be well documented to allow for replication of results. Documentation should include all steps involved in preparing raw data for estimation procedures, steps to adjust outliers and to substitute values in cells where data are missing, and estimation and variance equations.

E. DOCUMENTATION OF PERFORMANCE

Periodic data reports concerning survey operations are needed by survey personnel on a regular basis to effectively monitor the conduct of surveys. Included are such items as completion of quotas, interviewer productivity, and sampling frame updates. Timely submission of these performance data is necessary to maintain data collection quality through identification of problem areas and adjustment of procedures as necessary.

F. INTERCEPT PERFORMANCE

In addition to quota completion results of all supervisory activities should be fully documented. These include initial field observations of newly hired interviewers, follow-up field observations and species identification training, focus group sessions, and agency sampling coordination. Other reporting categories include a complete accounting of all assignments drawn for each subregion, state, mode and sampling period, and for each interviewer, including:

1. Numbers and percentages of ineligible people intercepted as determined by screening questionnaire results
2. Numbers and percentages of eligible fishermen not interviewed by reason for exclusion
3. Numbers and percentages of primary assignments not completed by reason for failure
4. Numbers and percentages of completed assignments that include visits to alternate sites, as well as numbers and percentages of completed interviews obtained at alternate sites
5. Numbers and percentages of assignments where no interviews were attempted
6. Numbers of potentially eligible fishermen not intercepted due to inability of interviewer to intercept while interviewing another fisherman
7. Distribution of interviews obtained and fishing effort and estimated fishing effort as recorded in the site register among counties within each state and fishing mode
8. Results of supervisory field visits
9. Results of telephone validation of intercept interviews
10. Tabulations of the residence of intercepted fishermen by sampling strata

Summaries of selected variables from the intercept survey showing means for the following: hours fished per trip, days fished in this state in the sampling period and telephone ownership by state and subregion for each sampling period.

Ranked summaries of the numbers of the top 25 species caught and total number of fish caught by subregion and sampling period and the minimum and maximum lengths of each species caught.

Recommendations and proposals for change based on intercept survey results. This includes plans to increase sampling efficiency, minimize variance, enhance participation and cooperation of respondents and/or coastal states, or increase the visibility and usefulness of the survey to the public.

G. PHONE INTERVIEW PERFORMANCE

In addition to quota completion results, dialing results should be documented. Dialing results include (but are not necessarily limited to):

1. Line busy
2. No answer
3. Answering service
4. Answering machine
5. Not in service/disconnected number/dead line
6. Connected to wrong number
7. Household previously called on different number
8. Business/coin phone/time/weather/computer tone, etc.
9. Institutional housing (dormitory/barracks/nursing home)
10. Part-year housing
11. Wrong county
12. Initial refusal
13. Communication problem (deaf, foreign language)
14. Could not answer 12 month question
15. Refused to answer 12 month question
16. No fishing in last 12 months
17. Could not answer sampling period question
18. Refused to answer sampling period question
19. No fishing in last sampling period
20. Number first-time contacts who indicated marine fishing activity but turned out to be non-fishing households
21. Number of fishermen who refused to provide trip information
22. Number of fishermen not available to be interviewed
23. Number of ineligible fishermen (e.g., not in sampling universe)
24. Eligible households (one or more people fishing in the previous sampling period)
25. Complete interview
26. Incomplete interview by reason of refusal
27. Other (such as language barrier)

Also of critical importance to quality control is regular reporting from supervisors on interview validation results. These include observations of in-progress interviews, follow-up counseling after in-progress monitoring that identifies problem areas and improves interview technique, and counseling on problem areas following callback verification.