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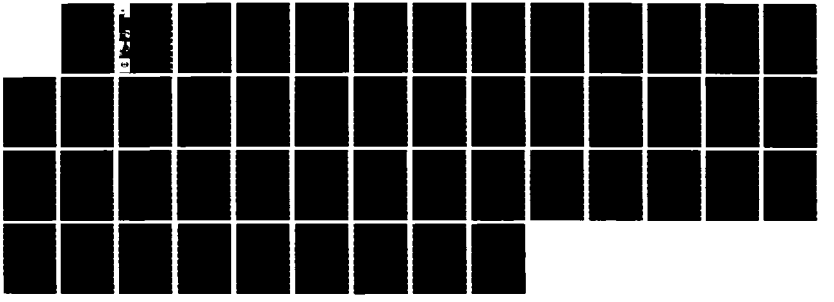

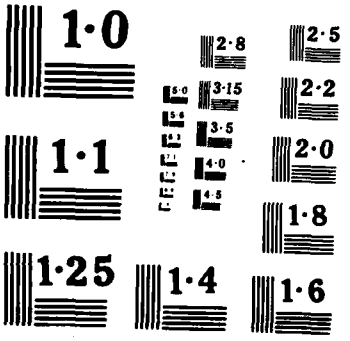
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NATURAL RESOURCES
RESEARCH PROGRAM

INSTRUCTION REPORT R-86-1

AN EXAMPLE OF A MAILED CONTINGENT VALUATION SURVEY METHOD IN A MARINA FEASIBILITY STUDY

by

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Feasibility analysis often requires estimates of potential monetary returns and economic benefits proposed projects will generate. In 1981 a study was conducted to provide demand data that could be used to make such estimates for a marina feasibility study at a Corps of Engineers lake in the Midwest. The study employed self-administered contingent valuation methods (CVM) to estimate consumer willingness to pay to rent mooring facilities. Because such methods

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20. ABSTRACT (Continued).

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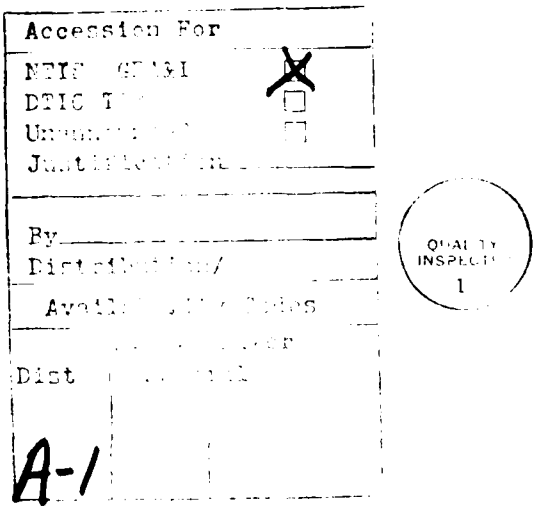

PREFACE

This report describes a method for estimating the demand for and value of water-based outdoor recreation resources using contingent valuation surveys. The method can be used to calculate potential monetary returns and consumer surplus for use in feasibility studies. The method was successfully employed in a marina feasibility study for a Corps of Engineers project in the Midwest. That example is used to illustrate use of the method.

Readers of this report will be able to recognize needs for feasibility studies and potential applications of the methods described. They will be able to describe the general outlines of self-administered contingent valuation methods and serve as project or District level managers of such studies. However, they will not necessarily be expected to actually conduct the study without qualified assistance in design and administration.

The author of this report was Dr. Ronald W. Hodgson. At the time this report was written, Dr. Hodgson was an Outdoor Recreation Planner (on an Intergovernmental Personnel Act agreement with California State University, Chico), Environmental Laboratory (EL), US Army Engineer Waterways Experiment Station (WES). Mr. Larry Lawrence, EL, was Project Monitor on the feasibility study. Mr. David Feltus, Park and Recreation Resources, Michigan State University, assisted with the feasibility study.

The work was supervised by Mr. William J. Hansen, Chief, Resource Analysis Group, and Dr. Conrad J. Kirby, Chief, Environmental Resources Division, EL. Dr. Adolph J. Anderson, EL, was Manager of the Natural Resources Research Program, EL. Dr. John Harrison was Chief, EL. The report was edited by Ms. Jamie W. Leach of the WES Publications and Graphic Arts Division. Ms. Nancy Tessaro and Mr. Andy Davison, DAEN-CWO-R, were Technical Monitors.

At the time of publication of this report, COL Allen F. Grum, USA, was Director of WES and Dr. Robert W. Whalin was Technical Director.

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CONTENTS

CONVERSION FACTORS, NON-SI TO SI (METRIC)
UNITS OF MEASUREMENT

Non-SI units of measurement used in this report can be converted to SI (metric) units as follows:

Multiply	By	To Obtain
feet	0.3048	metres
miles (US statute)	1.609347	kilometres

AN EXAMPLE OF A MAILED CONTINGENT VALUATION SURVEY METHOD IN A MARINA FEASIBILITY STUDY

PART I: COMPREHENSIVE SUMMARY

1. Feasibility analysis often requires estimates of potential monetary returns and economic benefits proposed projects will generate. In 1981 a study was conducted to provide demand data that could be used to make such estimates for a marina feasibility study at a Corps of Engineers lake in the Midwest. The study employed self-administered contingent valuation methods (CVM) to estimate consumer willingness to pay to rent mooring facilities. Because such methods have potential for application to many similar problems on Corps projects, this report was prepared explaining the self-administered CVM approach using the previous study as an example.

2. The purpose of this report is to aid the transfer of the analytical technology to others who face similar problems to which the method is applicable. Specific instructional objectives are as follows. Readers of this instruction report will be able to:

a. Recognize opportunities (needs) for economic feasibility studies.

b. Identify situations where the self-administered CVM is appropriate.

c. Describe the general outlines of the self-administered CVM.

d. Serve as the project or District level administrator of the survey but not necessarily be able to design and field such a study without qualified assistance.

e. Seek qualified assistance to design economic feasibility surveys and train surveyors.

f. Propose such studies when they are appropriate.

3. The previous study was conducted to determine whether there were sufficient numbers of consumers willing to pay the rental fees necessary to warrant expansion of existing facilities or the construction of a second marina at the study lake.

4. Additional marina facilities would be considered economically feasible if the benefits generated exceeded the benefits from any other use for the money and other resources. Because the marina was to be commercially operated, estimates of two kinds of benefits were important:

a. The potential revenues to the commercial operator.

b. Consumer surplus.

5. Potential revenue is the gross income the marina operator could expect from slip rentals. Consumer surplus is the value renters would experience in excess of the benefit paid. For example, if a boater pays $150.00 per season for a mooring buoy but would continue to rent even if the price were increased up to $216.00 per season, that boater is experiencing $66.00 of consumer surplus per season.

6. Both the potential revenue and consumer surplus can be estimated from demand curves. A demand curve is a curve showing the maximum number of rentals that could be made at various prices. As the price charged is increased, the number of slips that will be rented normally decreases.

7. A demand curve is constructed by adding up all the respondents who will pay the various prices that might be charged and plotting them on a graph where the vertical axis is the variable price that might be charged and the horizontal axis is the number of rentals. Figure 1 is an illustration of a demand curve.

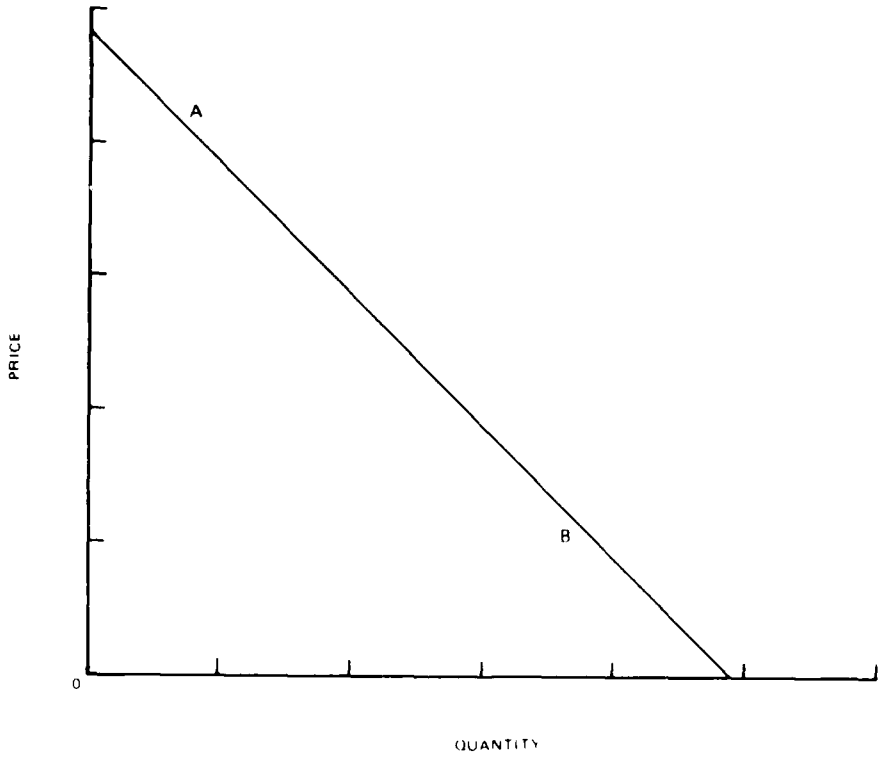

Figure 1. Form of a typical demand curve

8. One way to measure boaters' willingness to pay to rent marina space is to ask them directly using a survey method called contingent valuation methods (CVM). There are other approaches to the generation of demand curves but none is as useful as the CVM when resources being evaluated are not yet built as was the case for the proposed marina.

9. When CVM is used, willingness to pay information is collected from people in a bidding game. Each person surveyed is asked, for example, "Would you pay $100.00 to rent a slip?" If the answer is "yes" the amount is gradually increased until the answer is "no." If the answer is "no" the amount is gradually decreased until the answer is "yes."

10. For large studies it is sometimes impractical to interview potential renters in person to conduct the bidding game. In those cases, it is desirable to use a self-administered form that can be mailed. Such a procedure was used for the study project. The method used is described in this report.

11. In summary, the process followed these steps. Each step is detailed more completely in the remainder of the report with specific recommendations on how to proceed.

a. A sample of 4,678 owners of registered sailboats or power boats 15 ft* long or longer was systematically drawn from the State boater registration records.

b. A questionnaire was developed that:

(1) Described the kinds of marina space that might be rented.

(2) Described the way renters would pay to use the marina.

(3) Asked respondents to state their maximum willingness to pay to rent marina space.

(4) Asked other information about boating behavior.

(5) Asked about the sorts of things boaters purchase on boating trips.

c. A system to handle the mailing, retrieval, and storage of questionnaires was organized.

d. A system was devised to code the returned questionnaires and prepare the data for machine analysis.

e. The resulting data were analyzed, interpreted, and reported.

12. Corps scientists and others continue to evaluate the validity and

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* A table of factors for converting non-SI units of measurement to SI (metric) units is presented on page 3.

potential biases of contingent valuation methods and, in particular, the self-administered question relative to the bidding process. The CVMs are continually being improved; it is important to seek advice from economists working with CVM in order to incorporate the recent advances into study designs.

PART II: ESTIMATING MONETARY RETURNS AND DIRECT BENEFITS: AN OVERVIEW

Introductory Summary and Definitions

13. When a feasibility study is conducted, estimates of two kinds of benefits are useful: the potential monetary returns to a concessionaire and the direct economic benefits to the Nation. Both can be estimated from demand curves. Before proceeding with a description of the process, several terms must be defined.

Economic demand

14. For economic analysis purposes, demand is the mathematical function relating the variety of prices that might be charged for a good or service (such as marina space) to the amount of that good or service that will be purchased within some specified time period. Usually a demand curve slopes downward to the right when plotted on a graph with the prices that might be charged on the vertical axis and the amount that will be purchased on the horizontal axis. A typical demand curve is illustrated in Figure 1.

15. It is important to be aware that "demand" as used here differs from the meaning of "demand" as it is commonly used in planning literature. Often, in planning, demand means the number of units of a good or service (marina spaces, for example) that would be rented if there were no shortage. The price and other costs to the user are generally explicitly or implicitly assumed to be unchanging. In this usage, demand is a single number; to the economist, demand consists of all the numbers that relate the prices asked and the quantity taken (line AB in Figure 1). A single number defining consumption is possible only when the price is specified. This has important consequences for the estimation of benefits and potential monetary returns.

Potential monetary returns

16. Potential monetary returns are the maximum amount of money a marina operator could expect to receive from the rental of marina space at a given price. This is estimated by multiplying the price charged by the number of spaces that would be rented at that price. The number that could be rented at the particular price is read from the demand curve. The lines WXYO in Figure 2 represent the potential monetary returns at price W given the demand represented by line AB. The maximum gross income the operator can expect

charging price W is price W times quantity Y or area WXYO.

Direct economic benefits

17. Direct economic benefits are the total value experienced by the Nation from the direct use of the resource. Direct economic benefits can also be estimated from a demand curve. Two other concepts are necessary to understand how this is done. They are "value as willingness to pay" and "consumer surplus."

18. If a person will give up one thing in order to acquire a second thing, it is fairly certain that the second thing is more valuable to that person than the thing being given up. The value of the second thing is at least that of the thing given up. Money represents things in the sense that it can be exchanged for them. If a person buys something for a dollar (gives up a dollar) that means that, at that moment, the thing purchased was more valuable than anything else the consumer could have traded the dollar for. In effect, the next best use of that dollar was traded for the thing purchased. In this sense, then, the value of a thing can be measured by a person's willingness to pay to acquire it.

19. Although willingness to pay may not measure all dimensions of the concept of value, it has the advantage of providing the same kind of information that market prices (a widely accepted measure of value for such things as automobiles, timber, and labor) provide and can be directly compared with monetary costs in project valuation.

20. Most people pay less than the maximum amount they would be willing to pay for things. The difference between what one actually pays and the price at which one would refuse to buy is the consumer surplus.

21. For example, suppose the going price for a marina space is $150 per season. However, you are able to bargain with potential users. You keep raising your price a little at a time until at $216 the particular customer you are dealing with cannot make up his mind whether it is worth it to stay and at your next increase, refuses to pay and leaves.

22. The customer's maximum willingness to pay was $216 (or a tiny amount less). The difference between the $150 going price (which is what the customer would actually pay) and the maximum $216 (which he would have paid) is consumer surplus. It represents the value the customer experienced without having to pay for it. Nevertheless, it is real value.

23. Consumer surplus is unimportant to a commercial operator because in

a market that is based on fixed prices rather than negotiations about price, the operator cannot capture that value. However, the value is captured by the government in the form of the satisfaction experienced by citizens.

24. Thus, it follows that the direct economic benefits from the marina are the monetary returns to the commercial operator plus the extra value users experience but do not have to pay for. In Figure 2 that is the area OZXY. Note that the area WXZ is consumer surplus.

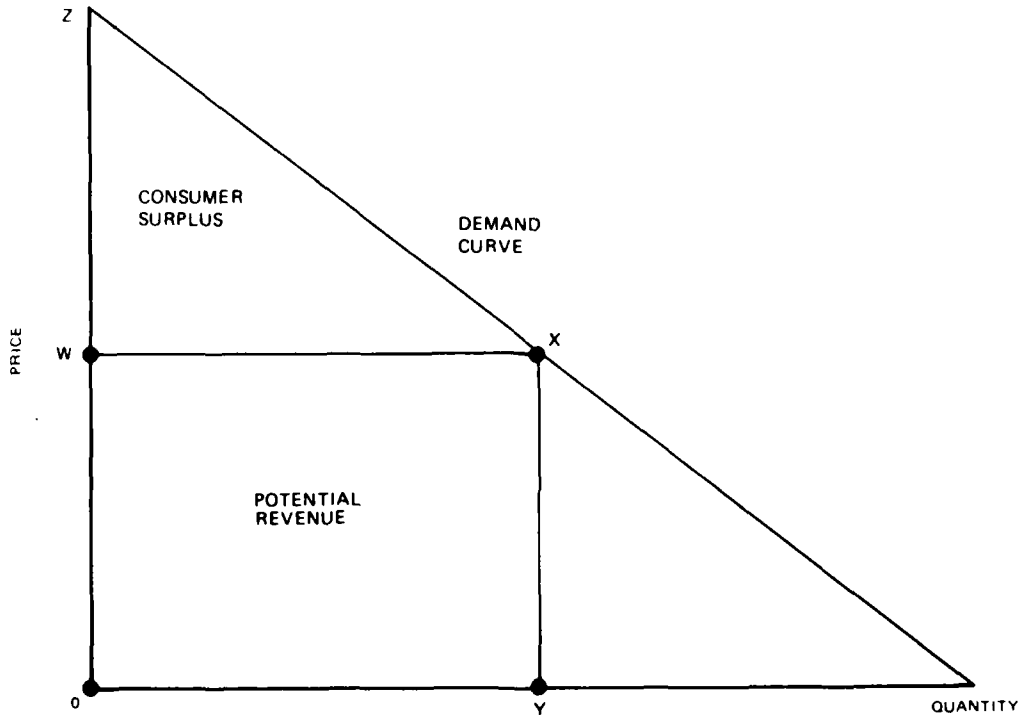

Figure 2. Potential revenue and consumer surplus in relationship to demand for a good

How to Estimate Demand Curves

25. Estimation of monetary returns and direct economic benefit, then, requires a demand curve for the resource (marina space). To estimate a demand curve one needs to estimate the maximum willingness to pay to use the resource of all potential customers. With that information, one simply adds up all those willing to pay a given price and more (say $150 per year) and plots that point, and so on until enough points have been estimated to fit a line. An

example is presented in Figure 3, where 254 potential customers were willing to pay $150, 141 customers $250, and so on.

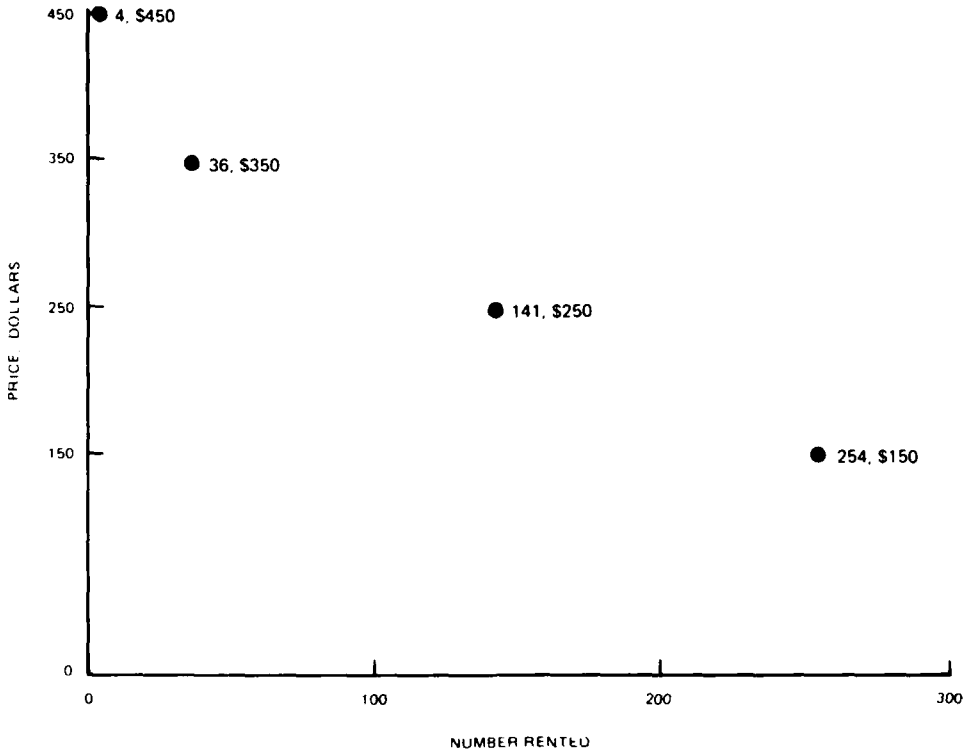

Figure 3. Demand for mooring space actually measured in a marina feasibility study

26. When contingent valuation methods are used, maximum willingness to pay is determined by directly questioning potential users. The CVM survey has three important elements: a clear and exact description of the resource for which demand is to be estimated, a specification of just how the user would pay, and a series of questions to elicit the user's maximum bid. How to prepare each of these is described in following sections.

27. Usually it is impossible to survey all potential users. Therefore, one typically selects a representative sample of users, surveys them, and multiplies the results to reflect the whole population. Often that requires designation of the geographic area of interest. Adequate lists are usually available in the form of such things as boater registration records or can be made up from directories. Careful attention must be paid to defining the relevant population because the numbers generated in the sample have to reflect the real demand in the whole population.

28. When an adequate sample has been drawn from a relevant population

and an appropriate questionnaire has been prepared, the next step is to administer the survey in a way that will produce unbiased response. Survey administration is not conceptually complex but it requires careful attention to details. Errors in survey administration can be more damaging than errors in drawing the sample or faulty questionnaire design because the potential effects usually cannot be judged.

29. The resulting demand curve can be used to estimate potential monetary returns and consumer surplus. Given the demand curve, one can also derive a marginal revenue curve. The marginal revenue curve can be used by potential operators to estimate the most profitable size for the marina operation.

PART III: SELECTING RESPONDENTS

30. This section describes how to select the respondents who will be asked to state their willingness to pay. The section is based on the problem of estimating the demand for marina space at the study lake and that example is extensively used. The illustration is typical enough to permit the users of this manual to generalize to their own situations. However, it is important to remember that representative sampling is essential to the accurate estimation of demand and, therefore, the determination of the value of a proposed resource development and the potential monetary returns an operator might expect to experience. When considering a new sampling situation it is wise to seek the assistance of a sampling expert. Such people can be located in the mathematics and statistics departments of most colleges and universities.

31. Most of this section addresses sampling. It is almost always necessary to take a sample rather than to survey all the potential users. Typically the populations of potential users are too large to survey completely. Even if that were possible, it would be unnecessary and not cost-effective to do so. Estimates of willingness to pay can be made within acceptable limits from a survey of only a fraction of the potential users. Sample estimates can be even better than those made from a census (survey of everyone in the population) because the logistical requirements of conducting a large study tend to introduce operational errors that cannot be corrected for or estimated.

The Relevant Population

32. The first step in selecting respondents is identification of the relevant population to be sampled. Alternatives should be carefully considered. It is important to include all the people who might reasonably wish to use the resource for which demand is to be estimated. In the example, the population sampled was the list of registered boats in the 24 counties surrounding and within 50 road miles of the study lake. Persons receiving the survey were those people listed as owners of those boats. The study was conducted to estimate the demand for marina space. Boat owners were assumed to be the persons making the decision to rent or not.

33. It was decided <u>not</u> to survey only those people using the lake at

the time of the study because there was a shortage of facilities. What was needed was an estimate of the numbers of people in the market area willing to rent at several possible prices, not just the willingness to pay of the people currently using the lake.

34. Current users could not be assumed to be representative of all potential users. They might be people from near the project who had greater opportunity to hear of rental possibilities. The population of all lake users probably did not include the larger boats in representative numbers because of the transportation difficulty relative to smaller boats.

35. Surveying lake users would also often produce invalid responses. The users of boats are often not the people who make decisions about renting marina space. Specifically, a substantial part of such a sample was expected to be made up of children of boat owners who would not be in a particularly good position to estimate the owner's willingness to pay.

36. Even surveying owners of registered boats has some difficulties. Some of these relate to multiple ownership. Lists of registered boats often contain not only recreational boats but also commercial craft. Marina space would not be rented by owners of such boats so they must be deleted from the list. Depending on the particular list, other nonrelevant listings may be included that should be purged before sampling.

37. Only boats registered in the surrounding 24 counties were sampled because other studies showed that very few boaters were willing to travel longer distances to boat. By ignoring boaters beyond those limits, the cost of collecting the data was reduced and the error was small. The error thus introduced was also conservative; that is, demand estimated was a little less than actual demand which is the safe side when deciding whether a marina should or should not be built.

38. The relevant population will depend upon several things and will vary from survey to survey. It is vitally important that the proper population be sampled. In all cases the proper population will be the population of persons or groups who would actually make the decision under question. In the example study, this was the population of persons who would actually make the decision to rent or not to rent. In another study, it might be those people who would decide whether to use one lake or another. If the study were investigating the value of proposed improvements in water quality, the relevant population would include not only those who are actually using the lake, but

also those who are not now using the lake but might if the water quality were improved. It is impossible to specify rules to identify the appropriate population to sample that would apply in all cases. However, the investigator must be alert to the danger of selecting a population because a list is available when the list is not of the desired decisionmakers.

Geography

39. When conducting studies of users or potential users of fixed point resources such as marinas, it is necessary only to survey a limited geographical area around the resource. That area will be defined by the longest distance users travel to use the resource.

40. People do not come in equal proportions from every distance to use a lake. As the distance from the lake increases, the number of users per 1,000 decreases until at some distance so few people would travel that far as to make surveying them unnecessary. Those from further away are usually willing to pay less than are those from nearer because they must incur greater travel costs to use the resource. In the case of marinas, this may be reversed within some distance because the cost of using the lake can be reduced if the boat is kept at the lake and does not have to be trailered. However, there will be a distance after which only an insignificant number of boaters would use the lake.

41. To determine the outer limit of the appropriate area to sample, one needs to map the origins of the potential users. One way to do this is to survey the users of the lake asking county of origin. (County is asked because boater registration lists are usually organized by county. If the available list is organized in some other manner, by ZIP CODE for example, that information would be asked). User origin information should be available from recent Use Estimation Surveys. If there is no information available on the lake in question, data from a similar lake serving a similar population can be used to determine the distances from which people will travel to use the resource.

42. Alternatively, travel distance information for the relevant population may be available from statewide outdoor recreation plans or needs analyses. Other published reports and graduate theses may also provide the necessary information. When designing a study of this type it is important to

determine what is already available in the literature. Literature reviews are more than formalities; they can save time, money, and embarrassment.

43. Travel distance information will usually be reported as the percentage of boaters willing to travel a given distance, from 100 to 150 miles for example. The total number that might use the lake from any distance is the important number in a feasibility study. Thus, if there is a large population center near the limit of travel distance, it would be wise to expand the limit to encompass the center. Even 5 percent of 10,000 boaters can be an important market.

44. It may be necessary to sample boaters from several states. In the study case, the project is so far removed from state lines that no important market was expected from out of state. However, many projects are near state lines or are located in two or three different states. In those cases, boater registration information from each state involved will have to be acquired. When this is the case, the relevant portions of boater registration lists from the several states should be combined before drawing the sample.

Acquiring the Appropriate List

45. When sampling boat owners, state boater registration lists will be useful. When other kinds of users are to be sampled, acquisition of a list will often be difficult. The most important concern should be that the list will actually lead you to the person whose willingness to pay you wish to determine. Lists can be found in many places from lodging registration records to telephone books. Other lists can be made by observation. For example, in a recent study, automobile license plate numbers were recorded and a list of potential respondents was generated from automobile registration records. It pays to look around to see what kinds of lists are available that might serve the purposes of the study.

46. When potential lists have been identified, the following questions should be asked:

a. Are the people whose willingness to pay is to be measured listed? If not, can the desired respondents be reached through the people on the list?

b. Are all the people to be surveyed listed? If not, how serious will failure to survey those not on the list be? How can those not on the list be contacted?

c. How current is the list? Using old lists will result in many undeliverable surveys. Those people who move frequently will be underrepresented in the final returns. They are likely to be different from other boaters, perhaps younger, and in occupations that lead them to move frequently. Many such differences are associated with differences in willingness to pay.

d. Will a person be listed more than once? On boater registration lists, a single individual may be listed for each boat owned. Owners of multiple boats will have a higher probability of being sampled than owners of fewer boats. Sometimes that must be adjusted for either in the sampling or in the analysis.

e. Is sufficient information listed with the name to allow a complete mailing address to be obtained?

f. Are people listed who are not to be surveyed? For example, some boater registration lists include commercial boats as well as recreation boats. Can inappropriate persons be eliminated from the list? If not, can they be sorted out by the survey or in the analysis?

g. Can the Corps of Engineers have access to the list or can an arrangement be made to generate a sample and provide it to the Corps? It is not always easy to access other agencies' lists.

Sampling

47. In demand and feasibility studies such as these, where different groups of respondents (e.g., owners of larger boats) may have different willingness to pay, a stratified random sample will usually produce the desired information at the lowest cost. A stratified random sample is taken by first dividing the population into groups or strata and then taking random samples from each stratum. This has the effect of reducing the variance and thus permitting more precise estimates with a given sample size and confidence.

48. The first step is to acquire a list of the boater registrations in the appropriate geographical area. This can often be done by securing a copy of the boater registration tapes from the State agency. Registrations from within the relevant counties are then extracted. Inappropriate registrations such as commercial boats are eliminated. These registrations are divided by boat type into sailboats and other boats. Most states code boat type on the registration record. All of this can most easily be done using computers, of course.

49. Usually the number of sailboats is so small that they should be treated as one stratum. The non-sailboats will be stratified by length. The

shorter lengths may be irrelevant in studies of demand for marina space. An 8-ft rowboat is not likely to be kept at a marina, for example. The decision on the minimum size to include in the sample must be made on the merits of the particular situation.

50. The records of boats between the minimum size and the maximum length are divided into strata. Generally, when a linear relationship exists between variables, the more strata used the greater the precision but also the greater the cost. Three strata were used in the study project. The first step is to produce a cumulative distribution of the square root of the frequencies in the various length categories. The following tabulation illustrates such a distribution. The width of the categories is arbitrary; 5 ft seems appropriate but any category width may be used as long as about eight to ten categories are produced.

Length	Freq	Freq	Cum Freq
10-14	240	15.49	15.49
15-19	380	19.49	34.98
20-24	289	17.00	** 51.98
25-29	210	14.49	66.47
30-34	150	12.24	** 78.71
35-39	112	10.58	89.30
40-44	81	9.00	98.30
45-50	10	3.16	101.46

51. The three strata in the above example are 10-24 ft, 25-34 ft, and 35-50 ft. These strata are arrived at by dividing the cumulative distribution of the square root of the frequencies into three approximately equal parts. This is achieved by subtracting the cumulative square root corresponding to the minimum length from the cumulative square root corresponding to the maximum length and dividing that by the number of strata desired. That number is then added to the minimum length to find the first division point. In the above example, the maximum (101.46) minus the minimum (15.49) is 85.97. That divided by three is 28.66; 15.49 plus 28.66 is 44.15. The number closest to 44.15 is 51.98 so that is the first breaking point. The second breaking point is found by adding 28.66 to 44.15 and finding the number in the cumulative

distribution of the square root of the frequencies that is closest to the sum.*

52. The raw list is now divided into sailboats, powerboats under 10 ft in length (which are not to be sampled), and three strata for boats 10 ft and over. The final sample is drawn by taking a simple random sample of each of the four strata.

53. Determining the sample size requires stating in advance the limits on acceptable error and the acceptable probability of errors greater than those bounds. The necessary precision depends on how far from the real willingness to pay the estimated values can be and still be useful. The acceptable probability depends on how often serious errors can be made. These limits should be considered within the context of making investment decisions in the particular case under study. Consultation with economists who will use the result is recommended.

54. The appropriate sample size is estimated by the following formula.* The variance can be estimated by conducting a pilot CVM study with a small sample of boaters either selected from the registration records and contacted by telephone or a sample selected from current lake users with boats within the appropriate sizes. If a pilot study cannot be conducted, a rough estimate of variance is made by dividing the range of best guesses of the lowest and highest willingness to pay scores by 4 and then squaring that number. The letter "D" in the formula represents the acceptable limits for the estimate of willingness to pay. It may be acceptable to estimate willingness to pay to within plus or minus $50.00 per season, for example. The value of "D" is calculated by squaring this value and dividing the result by the square of the approximate Z value for the desired confidence interval

$$n = \frac{\sum_{i=1}^{L} \frac{N_i^2 \sigma_i^2}{W_i}}{N^2 D + \sum_{i=1}^{L} N_i \sigma_i^2} \qquad (1)$$

where

$D = \frac{B^2}{4}$ for a 95-percent confidence

* Richard L. Schaeffer, William Mendenhall, and Lyman Ott. 1979. Elementary Survey Sampling, 2nd ed., Duxbury Press, North Scituate, Mass.

B = desired confidence interval

4 = The interval square of the approximate Z value for a 95-percent confidence

W_i = the fraction of the population allocated for stratum i

L = the number of strata

σ_i^2 = the variance for stratum i

N_i = population size in stratum i

55. Larger sample sizes reduce the uncertainty associated with estimates and increase their precision. One will not want to take samples larger than necessary because it would waste money and the respondents' time. On the other hand, it is often necessary because of financial limitations to take a sample smaller than determined. In those cases, it is seldom feasible to do anything but take the largest possible sample, allocate it as efficiently as possible to the several strata, and calculate and report the confidence limits.

56. Making the assumptions that the average cost of collecting data is the same for each stratum and that the variances in willingness to pay within the strata are similar, the best approach is to take a sample from each stratum that is proportionate to the size of the stratum. The number to sample from each stratum is computed by multiplying the total sample size by the total number of registrations in that stratum divided by the total number of registrations in the population.

$$\text{Total Sample } n \times \frac{\text{Registration in Stratum i}}{\text{Total Registrations in Population}} = n \text{ Stratum i} \qquad (2)$$

57. Actual selection of the sample from the strata can usually be accomplished by computer programs for simple random sampling. Names and addresses from the registrations can be printed on adhesive labels for mailings and even used to address cover letters that are typed on word processors. The full record for each sampled registration should be written on a sample tape for later access. The names and addresses will be required again for follow-up mailings. Other information on the records can be used to test the representativeness of the sample. The possibilities depend on the data processing resources available; surveyors should consult closely with programmers to determine the capabilities of their particular systems.

PART IV: THE CONTINGENT VALUATION QUESTIONNAIRE

58. A contingent valuation questionnaire consists of three parts: the scenario, the payment vehicle, and the bidding question. Other information needed to interpret the results may be collected as well.

59. The scenario is a careful and detailed description of the resource the respondent will be expressing a willingness to pay to use. It is not necessarily a verbal description only. The idea is to create an image of the resource for the respondent that is complete and accurate in the relevant characteristics. Images of the resource should be as close as possible to the same for all respondents. Photographs, drawings, maps, and other visual, auditory, and other aids may be appropriate.

60. A well-prepared scenario is essential. The reliability of the demand estimates depends upon it to a large degree. Reliability is the degree to which one will get the same results if one measures the same thing repeatedly. An elastic yard stick would produce unreliable results; so would a contingent valuation question with a vague scenario. Unless a complete and detailed description is provided, one time the respondent may imagine one kind of situation and at other times different situations. Under these circumstances one would not expect the same willingness to pay.

61. A well-written scenario increases the validity of demand estimates as well. Validity is the degree to which the questionnaire actually measures the demand for the resource in question. The validity of the CVM procedure obviously requires that the respondents have a clear picture of the resource for which they are bidding.

62. One cannot describe every characteristic of a resource. Details to include in the scenario are selected from among thousands of possible resource characteristics. This presents a problem especially when the description must be concise enough to present in a mailed questionnaire. When written, such descriptions can be no more than a short paragraph or two. Otherwise, the respondent may not take the time to read the scenario carefully.

63. The characteristics selected for description should be those that bear directly on the ability of the resource to provide satisfaction in the use the respondent would make of them. In the study marina case, mooring space was the important feature. There were several kinds available: covered slips, open slips, buoys, and dry storage. Because these are quite different

and are very likely not of equal value to boaters, it was important to describe exactly which one the respondent was being asked to bid on.

64. Also, the boating characteristics of the study site relative to the boaters' alternative sites could be important. The nature of winds, water depth, crowding, and location are examples of lake characteristics that might be important. Of course, if respondents are familiar with the resource through personal experience, the need for detail will be less. Such knowledge should not be assumed, however.

65. The payment vehicle refers to the process by which the respondent will be charged for use of the resource. In the example, the marina was to be operated by a commercial firm. Therefore, an annual rent paid to the concessionaire was the obvious way to charge for resource use.

66. In other circumstances, an annual use permit, a license fee, a daily fee, or taxes may be the appropriate way to collect the charges. The way in which charges are to be collected can influence how much a person is willing to pay. For example, some people may object to fees collected as taxes but would not object to paying a daily or annual fee. Some may object to the use of general taxes to support the activity but find taxes on recreational equipment acceptable. The payment vehicle described should be realistic. If charges are actually to be collected, the most likely means of collecting them should be described.

67. The questions used to elicit the users' maximum willingness to pay bids must be carefully worded. Three alternative questions for use with mailed surveys are described in the next section.

68. When users are interviewed directly, their maximum willingness to pay is approached gradually from an initial bid provided by the interviewer or suggested by the respondent, depending on the way the question is presented. When willingness to pay is asked in a self-administered questionnaire, the bidding process must be foregone. The effect of that is still uncertain. However, in field situations when interviewers ask, "What is the maximum amount you would be willing to pay ---," then negotiate upward, it is usual to find that respondents ultimately state willingness to pay higher than their initial bids.

69. The question used to elicit the willingness to pay bid should be designed to account for the apparent undervaluing of the initial bid. Two question formats presented here are designed to do that.

Question Format

70. The following question simulates the bidding process by requiring the respondent to make yes and no decisions to a range of prices. The range of prices is selected to cover the most likely bids. If a reasonable guess can be made of the average bid, that price should be about at the center of the price sequence. The sequence should be open ended at the top and bottom.

> What is the maximum amount that you would be willing to pay to rent a covered slip for one boating season at Lake _____? (Please mark [X] YES or [X] NO for each price listed below. Mark one answer for each price.)
>
> YES NO
>
> [ ] [ ] Less than $300 per season. If less, how much per season $ _____
>
> [ ] [ ] $300 per season
>
> [ ] [ ] $350 per season
>
> [ ] [ ] $400 per season
>
> [ ] [ ] $450 per season
>
> [ ] [ ] $500 per season
>
> [ ] [ ] More that $500 per season. If more, how much per season $_____

71. The center price can sometimes be guessed from market prices for similar goods or services at other areas. Sometimes demand or value information is available for nonmarket goods and services from travel cost and CVM studies done for similar resources.

72. The range of bids offered to the respondent should be great enough to cover about 80 to 90 percent of the bids. Studies of similar resources can provide information about the range as well as the center value.

73. The interval between bids depends upon the range. The number of points required to estimate the demand curve depends upon its shape. Usually six to ten points will be adequate. More than ten response categories will demand too much from the respondent and reduce the reliability of answers.

74. The intervals between bids do not have to be equal. However,

respondents may expect them to be and thus make errors in responding unless they read each category carefully. On the other hand, it may be desirable to make the intervals narrower around the expected average bid in order to have better information in that important area.

A Second Format

75. A second design that may be especially useful where one suspects the respondents might exaggerate or underestimate their willingness to pay in order to influence a development decision involves asking several different samples of users to decide yes or no to a single price. This type of question imitates the market for most other goods where consumers must decide to buy or not given a fixed price.

> Would you pay $350 to rent a covered slip for one boating season at Lake _____?
>
> [ ] YES
> [ ] NO

76. A center price and range should be established in the same way described for the previous question. Separate questionnaires are printed for each price. For practical reasons the number of prices (and therefore, the number of different questionnaires) would be around five or six.

77. The sample of respondents is divided into the same number of groups as there are different questionnaires (prices); each person sampled is asked to accept or reject the one and only price.

A Third Format

78. A third question format simply asks the respondents to state directly their maximum willingness to pay. This has the apparent advantage of providing more exact data. However, during actual face-to-face interviews where respondents are asked such questions and then bargained with, they frequently agree to somewhat higher prices than their initial bid. This format may underestimate willingness to pay.

What is the maximum amount you would pay to rent a covered slip for one boating season at Lake _____?

_____ DOLLARS PER BOATING SEASON.

Other Information

79. Other information in addition to willingness to pay may be important for administrative and marketing purposes. For example, it may be useful to know how the willingness to pay of owners of large boats compares with that of owners of smaller craft. It costs more to provide space for larger boats. Similarly, information about number of trips per season, alternative boating opportunities, the kinds of purchases regularly made, use of media that could carry information, and plans by owners for equipment purchases might be asked.

80. It is desirable to keep questionnaires as short and uncomplicated as possible to ensure adequate response rates and data quality. Therefore, each proposed question should be carefully considered. Before any question is asked, the exact way the answers will be used should be known.

81. On the other hand, one should be just as careful to collect all the necessary information. One can seldom if ever go back to those who were surveyed and ask additional information forgotten by those designing and administering the survey.

82. The appropriate information to collect depends upon what will be done with the survey results. If one is evaluating the market for marina slips, boater expenditure patterns may be appropriate. Concessionaires often also market boating supplies. The feasibility of an operation to an entrepreneur may depend as much upon projected sales of supplies and repairs as upon rental of slips. However, if one is evaluating a proposed change in water quality, boater expenditure patterns may be irrelevant.

83. Whatever the additional questions to be asked, there are general guidelines for writing them that help improve the quality of responses. The guidelines are too many to present here. Many references have been published that include guidelines for question writing and questionnaire design.

PART V: ORGANIZING THE CVM QUESTIONNAIRE

84. The wording of the scenario, the choice of payment vehicle, and the wording and format of questions all influence the quality of data the survey will generate. Equally important is the organization and presentation of the questionnaire to the respondent. Organization and presentation influence both the correctness of responses and the response rate.

85. Low response rates reduce the confidence one can place in the sample. The response rate is the proportion of the questionnaires mailed that are returned completed and in usable form. Both the sample size and the response rate influence the confidence in the data. Other things being equal, a larger random sample increases confidence that the data from the sample adequately reflects the characteristics of the population. However, this is only true if a large proportion of those sampled actually complete and return the questionnaire. A low response rate cannot be compensated for by taking a large sample to force up the final number of returned questionnaires.

86. When response rates are low, there is the possibility of response bias; some kinds of respondents may have been less likely to return the survey than others, making the results less representative of the population. If the degree of nonresponse is associated with characteristics that influence willingness to pay (such as income, family size, or distance of the residence from the lake), the estimates of demand will be inaccurate.

87. Questionnaire design, the cover and follow-up letters, and the presentation of the survey all influence response rate. A carefully designed and administered survey can achieve very high response rates. Poor design and administration can result in unusable, low rates. A survey based on the following guidelines should achieve acceptable response rates under most circumstances.

Question Order

88. The first questions in a survey strongly influence the likelihood that the survey will be returned. The first questions must be obviously relevant to the respondent, easy to answer, and interesting. It is usually necessary to begin the questionnaire with a few sorting questions to make certain that the respondent is a member of the population sampled. For example, one

might have to ask, "A boat registration number is printed on the label at the top of this form. Do you own the boat with that number?"

89. However, immediately after these few sorting questions, the contingent valuation question should be asked. The scenario is presented, ending with a description of how the charges will be collected (payment vehicle). This is followed immediately by the question asking willingness to pay.

90. Questions about income, education, occupation, and other personal characteristics that respondent may be reluctant to answer will always be placed at the end of the questionnaire if these kinds of questions are asked. When such questions appear earlier in the questionnaire, they may cause the respondent to stop answering and fail to return the survey.

91. It is not always necessary to ask socioeconomic questions in a survey. Because such questions can adversely affect response rates, each one should be carefully considered before it is incorporated. When potentially objectionable questions must be asked, there are ways of wording them to lessen the undesirable impacts.* Socioeconomic attributes are often important predictors of willingness to pay and may, therefore, be relevant to demand studies. Although extra care must be taken, these types of questions should not be ruled out.

92. Other questions to be included in the survey should be organized into sections in which all the questions are about the same sort of thing and are of similar format. Within each section the questions should be ordered from most to least interesting to the respondent. The most potentially objectionable questions in each section should be placed near the end of the section. Although socioeconomic questions and related potentially objectionable topics are placed in the final section, should sensitive items relate logically to another section, they are placed toward the end of that section and are not reserved for the final section.

93. The sections, themselves, are ordered from the most interesting and relevant (to the respondent) to the least interesting and relevant. Each section should be given a descriptive title. A short paragraph should introduce the subject of each section and explain why the information is needed.

94. If possible the questionnaire should be prepared so as to appear to

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* Don A. Dillman. 1978. Mail and Telephone Surveys: The Total Design Method, John Wiley & Sons, New York.

be typeset. However, it may be typed. If it is typed, the type should be bold faced, 10 pitch. Typed pages are photographically reduced so that they will fit easily on a booklet page. At this time, dot matrix printers should not be used; computers are not accepted by many people and the dot matrix printer may be associated with computers.

95. Pages should be organized so the flow of question and answer is vertical. Response categories should be ordered above and below one another rather than across the page. Writing should not be crowded; much white space should be left. The page must appear orderly and be easily comprehended at a glance.

96. Questions are typed or printed in capitals and lower case letters; response categories are typed or printed in all capital letters.

97. When respondents are to mark choices among several alternatives presented in the questionnaire, a box should be provided to the left of each alternative. Boxes are preferred to lines or parentheses for ease of marking and reduced confusion. Parentheses can be acceptable. The manner for responding should be consistent.

98. Further guidelines and examples are described in Dillman's (1978) book and other recent references on survey research. Question wording and questionnaire construction should be approached seriously. The questionnaire and its questions are measurement instruments of behavioral research. Considerable knowledge and craftsmanship are needed to invent effective, reliable, and valid instruments. Poorly designed instruments often produce faulty and even unusable data.

Questionnaire Design

99. The questionnaire should be prepared as a booklet (Dillman 1978). When printed, the booklet is approximately the size of an 8-1/2 by 11 sheet folded in half (8-1/2 × 5-1/2). Refer to Dillman (1978) for exact details. The front cover should carry a graphic illustration relevant to the subject being studied, a drawing of a marina scene, perhaps. Official designation of the Corps of Engineers as the sponsor and a brief message stating the purpose of the study and encouraging response should also appear on the front cover. A name, address, and telephone number of a responsible contact who can explain the survey and answer questions should be prominently displayed on the front

cover. No questions should appear on the front cover of the booklet. The back cover is blank.

100. The questionnaire should be printed on white or off-white paper using a colored ink. A cobalt blue, dark green, or brown may produce the best response. Red, yellow, violet, and pale colors should be avoided. Black inks may be used but will have less effect than dark, colored inks.

101. The overall effect one seeks is that of a carefully thought-out questionnaire that is attractive, efficient, easy to complete, and interesting to the respondent. It should not appear to be excessively time-consuming. It should not demand a great deal from the respondent to understand or answer. It should appear neatly and competently done but should not appear "slick." A questionnaire should be recognized as a legitimate inquiry from a credible source and not be confused with advertising and promotional material which might be discarded without reading.

Letters and Follow-up

102. The questionnaire is only one part of the system that generates responses to mailed surveys. That system also includes cover letters, follow-up postcards, and, occasionally, telephone calls and even media publicity.

103. If an important fraction of the sample does not respond, a telephone survey of nonrespondents may be required to evaluate potential nonresponse bias.

104. The envelope is the first "message" the respondent will receive about the survey. The envelope should catch the respondents' attention and arouse enough curiosity to motivate them to open it and read the cover letter.

105. An official Corps of Engineers envelope is usually enough to achieve sufficient interest and motivation. The envelope should not be labeled as a survey. The official government envelope containing only the respondent's name and address and a code to identify the proper office to receive returned, undelivered mail is sufficient.

106. It is convenient to use computer-generated address labels to administer a survey. This is especially true when large samples are generated from boating registration tapes. This will be the usual procedure. However, an envelope with an individually typed address is more likely to be opened

than an envelope with the address typed automatically on an adhesive label. When feasible, addresses should be typed directly on the envelope. When labels are used, the address should be clearly typed with a new ribbon and a clean element; the address must be crisp and unsmudged.

107. The outgoing envelope must be large enough to easily contain the questionnaire, the cover letter, and an addressed, postage paid return envelope. When the packages arrive at the respondents' mailboxes, they must not appear stuffed. A stuffed appearance may lead the respondent to believe the completion of the survey will be long and difficult, discouraging response at a critical moment. An increased initial response reduces the need for and the cost of follow-ups and is worth the small additional cost for an envelope large enough to accommodate the required contents neatly.

108. When the respondents open the envelopes, their interest should be immediately aroused. Attention should be directed to the cover letter which will explain the survey and motivate the readers to respond. Nothing else should distract attention from the cover letter. That is why there are no questions on the front or back of the questionnaire. The graphic on the front of the survey serves to stimulate interest.

109. The cover letter should be on official letterhead stationary. It is now feasible to generate individually typed cover letters quickly using word processing equipment. The cover letter should only be printed rather than individually typed when word processing is not available. A printed cover letter does not convey the importance each person's response really has to the survey's success.

110. The cover letters should be individually signed with a ball-point pen firmly pressed so the signature is clearly recognizable as an original. The ball-point pen should be a dark ink that contrasts with the ink used to print the questionnaire, usually blue or black. It should be of broad or medium point. Letters should be signed on a surface such as a desk blotter or posterboard so that the ball point will make an impression in the stationary. Of course, the pen used should produce a clean signature without the stray ink clots that some pens leave.

111. There is no doubt that individually signing several thousand cover letters is a substantial task and a boring one. It is a task that can be divided among several persons, each signing his or her own name, "for" the project director or other official if that official will delegate the

authority to do so. It is this sort of attention to detail that generates high rates of response and results in cost-effective research.

112. The cover letter should fill one page. In that one page, it must:

a. Convince the reader that the study is important.

b. Direct the survey to the proper respondent.

c. Convince the respondent that his or her answers are important.

d. Reassure the respondent that the responses are confidential and will only be used for the purposes of the study.

e. Make clear the purposes of the study.

f. Make clear the sponsorship of the study.

g. Express a willingness to answer questions about the study and to provide a summary of the results.

113. Effective cover letters must be carefully constructed with the above objectives and the respondent fully in mind. Every word of the cover letter is important. Cover letters should be written by persons familiar with the survey objectives, the respondents, and survey methods. The cover letter is an integral part of the questionnaire, not just a transmittal note.

114. Respondents will believe the study is important when they understand how the results will influence their own particular welfare. The value of the study to the Corps of Engineers is relatively unimportant to respondents. The writer must work from the respondents' point of view. The particulars will differ from study to study but these general kinds of things will usually be seen as important by respondents.

a. User safety.

b. Convenience.

c. Freedom of choice and control.

d. Opportunities.

e. Costs.

115. An extensive literature exists describing the motivations and needs of people at leisure. The authors of questionnaires and cover letters should be familiar with that literature, especially the research on the kind of user (i.e. boaters) being sampled.

116. Cover letters must be written to motivate respondents but care must be taken not to bias responses by what is said. The contingent valuation method may be particularly sensitive to certain biases that could be introduced in the cover letter and scenario.

117. It is especially important not to imply in the cover letter and scenario that a finding of high value will cause a desirable improvement to be built or that a low value will prevent or reduce charges. Every effort must be made to encourage the respondents to carefully consider their bids and to answer as honestly as possible.

118. The initial paragraph of the cover letter must communicate the importance of the study to anyone who might open the letter. If that person is not the intended respondent, the questionnaire must appear sufficiently important so that it will be passed promptly to the intended respondent.

119. The second paragraph should state who the appropriate respondent is, and explain why that person and only that person should respond. One of the best ways to achieve that is to address the envelope and the cover letter to the correct person by name.

120. Respondents who have been told they were selected "at random" sometimes find it difficult to understand why they specifically must answer the questionnaire. This may result from the general belief that "at random" means the same as "just anyone, without any particular reason." The intended respondent, believing this, may pass the questionnaire to someone else to complete. That, of course, introduces errors and alters the representativeness of the sample in unknown ways making the results suspect.

121. Unless those people sampled can be expected to give the phrase "at random" its statistical meaning, some other phrase should be used "...in a scientific sample to represent boaters who might rent at Lake _____..." is an example.

122. The intended respondent should be persuaded that his or her responses will make a difference and that the results of the survey will influence the way that things are done. The agency's reputation for responsiveness to the public and concern for the welfare of people the respondent identifies with will have the greatest effect here. The letterhead and obvious official nature of the survey will identify the sponsor and lend the credibility of the Corps of Engineers to the study.

123. Nevertheless, it is often useful to remind the respondent of the magnitude of the Corps' contribution to water-based recreation in the relevant area. In many locations, nearly the entire boating resource is on Corps of Engineers lakes. Awareness of that can increase the significance of a boating survey in the eyes of the potential respondent.

124. Response to the survey will be confidential. Answers to questionnaires are aggregated during analysis and only summary statistics are reported. Respondents' names should never appear on the questionnaire itself. Identification numbers should be placed on the return envelope but not on the questionnaire. The identification number is used to remove names from the mailing list so that respondents will not receive follow-up mailings. When the data have been coded and coding errors have been corrected, the completed questionnaires are shredded or otherwise completely destroyed. While the data are being coded, the completed surveys are kept in a secure place and access is limited to only those who are preparing the data for analysis.

125. All this is done to protect the respondents' right to privacy. Continued cooperation by the public depends upon the trust they place in surveyors. In the fourth paragraph of the cover letter, the respondents are assured the information given will be confidential. That means the survey sponsor accepts the responsibility to ensure that no one ever knows exactly what any particular respondent said and will take the necessary measures to be certain that confidence is not violated.

126. The final paragraph of the cover letter expresses a willingness to answer any questions the respondent may have about the study and provides the name and telephone number of someone that can correctly and politely answer questions. Some callers may express hostility or wish to register complaints about the survey or other matters. The person receiving the calls should be in a position and have the disposition to handle such complaints.

127. The respondent should be offered an opportunity to receive a summary of the survey results. Those wanting a copy are asked to complete an address card which they may return with the survey or mail separately. Names and addresses should never be asked for on the survey itself.

128. The offer of a summary is important. It is an incentive to complete and return the questionnaire. Summaries must be sent to those who ask for them if credibility is to be maintained. The summary is an inexpensive reward that is meaningful to the respondent.

129. The address card to be completed by those wishing a copy of the summary report should be postcard size with one side printed with the address of the office administering the survey and a clear indication of who in the office, exactly, is to receive it and what it is for. The opposite side is printed with blanks for respondent's name and address. When these cards are

received, they are filed until the summary has been prepared for mailing.

130. The return envelope must be large enough to easily accommodate the questionnaire and the address card. It must be addressed to the office administering the survey and clearly labeled with the survey title and the specific person responsible. The system of follow-up mailing requires that returned questionnaires be promptly delivered to the office so respondents' names can be removed from mailing lists. There should be no vagueness in the return address that might result in delays in the mail room.

131. The way in which the questionnaire, cover letter, address/reply card, and return envelope are placed in the envelope for mailing can influence return rates (see Dillman 1978, p 181). The questionnaire is folded in thirds so the title shows at the top. The bottom of the questionnaire is tucked into the flap of the return envelope. The questionnaire and return envelope are placed on top of the address/reply card and the cover letter is folded around the package so that when opened, the letterhead will be visible. All this is then slipped into the mail-out envelope. This organization ensures the respondent will see the several pieces in the desired sequence.

PART VI: MANAGING THE SURVEY

132. A survey involving several thousand potential respondents is a major project and requires careful management. The dates for mailings are fixed and important; failure to meet the dates or to mail follow-ups without having cleared the mailing list of the names of persons who have already responded can seriously affect response rates and costs. Careless handling of the returned questionnaires or imprecise data preparation can negate the gains of well done designs. Competent managers should be assigned to organize and oversee the survey.

Timing

133. Completion of a mail survey from first mailing to last follow-up can require 8 weeks. It is important to choose the starting date with that in mind. For example, it would be unwise to begin a survey around the first of November because many respondents would be traveling during the holidays and the survey would have to compete with the heavy Christmas mails. It is especially important that the initial mailing arrive at a time when the respondent is interested in the subject. The week after Memorial Day might be an especially good time for boaters who have just returned from the first big boating weekend. The first warm weeks of the year when anticipation of boating is high may be another excellent time. Survey planners should consider the relationship between the respondents' motivation level and the timing of the questionnaire.

134. Dillman (1978, p 180) recommends mailing early in the week so that the respondent will receive the survey soon after it is mailed. The survey should probably arrive on Wednesday or Thursday to avoid the delay in response that might be caused by weekend activities.

135. A mailed survey consists of the first questionnaire and cover letter, a postcard reminder, a second questionnaire and cover letter a third questionnaire and final cover letter, and, finally, a telephone or in person interview of a sample of nonrespondents if the response rate is less than 80 percent.

136. One week, exactly, after the first mailing, a postcard is sent to all potential respondents. The postcard states that a survey was mailed last

week and describes the nature of the survey. Those who have responded are thanked. Those who have not are asked to respond immediately and told again why their response is important. A telephone number is given where respondents may call to have another questionnaire sent to them if they have misplaced the first one or to have questions answered about the survey. The card is signed in contrasting colored ink with a ball-point pen that will leave an indentation in the surface of the card showing that it has been individually signed.

137. Three weeks, exactly, after the first mailing, a follow-up questionnaire and cover letter are sent to all who have not yet responded. This requires that the mailing list be exactly up to date. If the mailing list is maintained on computer, records can be deleted up to the last moment then mailing labels can be printed. It is a waste of money and time, both the respondents' and the agency's to mail follow-ups to those who have responded, not to mention a sign of less than careful management.

138. The follow-up letter is worded politely, but more insistently than was the first letter. The first paragraph states that a questionnaire was mailed 3 weeks ago and that the response has not been received. The second paragraph should emphasize the usefulness to the study and that the respondent's views are important to the success of the survey and the representativeness of the results. Next the respondent is reminded of who should respond in the household (the owner of the boat numbered CQ 23487, for example). Finally, appreciation of the respondent's effort and help is expressed. The letter is signed by hand in contrasting ink with a ball-point pen so that an impression is left in the paper.

139. Five weeks after the first mailing, a final follow-up is mailed. The cover letter accompanying the final mailing reminds the respondents that a questionnaire was mailed to them. The respondent is told that the survey is nearing an end and that most who were sent questionnaires have answered. The respondent is reminded that his or her response is important to complete the study and provide a representative description of the demand for the proposed development or service. The respondent is reminded that a copy of the results will be available upon request and the method of requesting a copy is restated. Appreciation for the interest and assistance of the respondent is stated and the letter is signed as usual.

140. Seven weeks after the initial mailing, if the response rate is

less than 80 percent of relevant respondents, a sample of nonrespondents should be drawn. A telephone version of the CVM question should be developed and the sample of respondents telephoned. The CVM questions and other crucial information are asked by telephone.

141. The telephone survey of a sample of nonrespondents will tell several things. First, it will increase the response rate, bringing it up to or at least closer to the minimum desirable rate. Second, it will allow the surveyors to determine what proportion of the nonrespondents were inappropriate. A larger proportion of unreturned questionnaires went to people who for one reason or another should not have received them than is true of returned questionnaires. These should not be treated as nonrespondents when determining the response rate. Finally, it will be possible to estimate how the nonrespondents might differ, if in any way, from the respondents. If the nonrespondents do not differ in any important way, nonresponse will not cause serious difficulties with analysis.

Handling Returns

142. Returned questionnaires must arrive at the survey office as quickly as possible. It may be necessary to make special arrangements with the mail room to collect and deliver surveys. The survey manager should develop a system for handling returns to speed their delivery to the person in charge of maintaining the mailing list.

143. As soon as the returns are received by the person maintaining the mailing list, the names of respondents are removed from the list by checking the identification numbers on the return envelopes against the numbers on the mailing list. Returned questionnaires are then passed to the person in charge of coding them for data processing.

144. A filing system will be established to hold just returned surveys, surveys that have been coded but not yet sent to data processing, surveys that have been returned from data processing, unusable returns, and undeliverables. Careful filing must be done to avoid double entry of the data, loss of data, and security. Only those who must see the questionnaires for data preparation should have access to the files.

145. The coder will code the questionnaires and send them to data processing for data entry. That person will also make certain that the filing

system is maintained and unusable returns are properly stored.

146. Someone must be assigned to deal with the undeliverable returns. In some studies, the percent of mailed out questionnaires not delivered by the post office can be large enough to seriously affect the quality of the data. Efforts should be made to locate the person to whom the questionnaire was mailed. Often this can be achieved by telephoning the address. If the person has moved, the present occupant may know where he or she can be reached. Other methods such as looking up the name in the telephone directory for the city may produce results. The post office may still have records of forwarding addresses or be able to help in other ways.

147. Usable work space is important. Flat tables and filing cabinets are necessary. Preparation of the packets for mailing and labeling requires space. Assignment of the work to crowded or cluttered space can result in errors or unacceptable delays in the processing of mailings and the handling of returns. Adequate space and well-organized work areas are not luxuries; they are essential to quality work.

148. A special file must be maintained for names and addresses of persons requesting copies of the summary report. Those requests must not be ignored. The time between their receipt and the preparation of the summary report can be several months. Therefore, special care must be taken not to misplace them when the filing system is broken down at the end of the survey administration period.

PART VII: ANALYSIS

149. A great many statistical procedures are appropriate to the analysis of the results of a feasibility study. Regression analysis may be used, for example, to predict boaters' willingness to pay from information about the size of boat owned, distance from the lake, and other attributes. Frequency distributions will be used to display data about kinds of purchases. The appropriate analytical procedures depend upon the purposes of the study, kinds of questions asked, measurement levels, and other criteria. Each study will be somewhat different.

150. Only the procedures for converting the data into demand curves are described here. Other procedures are described in marketing, statistical, and econometric reference texts.

151. In the example study, demand points were developed for four types of moorage. Respondents were asked to declare their willingness to pay for the type of moorage they preferred. Predictions of quantities that could be rented at various prices were summed across the four types to determine the total demand at the lake at those prices. In other studies, the product or service may be less complex, requiring the development of only one demand curve.

Estimating Numbers Willing to Pay at Various Prices

152. Information from the sample must be expanded to the population in order to determine the numbers of persons willing to pay various prices and thus to construct demand curves. The procedure is to determine the proportion of the sample willing to pay a given price or more and then to multiply the population total by that proportion to produce an estimate of the numbers in the population. These numbers are then plotted against the price. The procedure is repeated until enough points exist to produce a demand curve.

153. Estimates of the numbers in the population willing to pay some value are made by estimating numbers in each of the strata and then summing across the strata. The numbers in the strata are estimated by first calculating the proportion of the sample for each stratum willing to pay a given price or more. The total number in the stratum is then multiplied by the proportion in the sample to estimate the number for that price in that stratum.

154. If the proportion willing to pay that price in the total population is wished, the sum across the strata is divided by the total number in the population. This figure is not needed to plot demand curves but might be useful information to potential contractors.

155. When computing the proportion of the sample, one counts all respondents who report willingness to pay a specified price as well as those willing to pay all higher prices. This is done because persons willing to pay a higher price, say $200, would also be happy to pay a lower price, say $150; therefore, they would rent at $150. This count is then divided by the total usable returns for that stratum to give the proportion of the sample willing to pay that price.

Constructing a Demand Curve

156. A demand curve is drawn on a set of coordinates with price on the vertical axis and quantity on the horizontal axis. The quantities listed will be the numbers of slips of a particular type that might be rented each year. The prices listed will be those used in the CVM questionnaire.

157. To plot the quantity that will be rented at any price, sum the numbers who will rent at the price or more from each stratum and plot that quantity horizontally to the right of the price on the coordinates. Repeat this for each of the relevant prices. A plot similar to the one shown in Figure 3 will appear.

158. The procedure must be adapted if the design that asks each respondent to answer yes or no to a single price is used. In that case, the proportion in each stratum that report they would not pay the price is calculated. This proportion is then subtracted from one to give the proportion that would pay that price or more. This proportion (1 - p) is then multiplied times the number in the stratum to produce the number in that stratum who would pay that price or more. The procedures are identical from that point.

Confidence Limits

159. One now has a demand curve. It is useful to also plot confidence limits around the demand curve. The values on the demand curve represent the data from the sample which is the best estimate of the values in the

population. However, sampling error virtually ensures that these values will not exactly match the population values. It is possible, however, to know the limits of that sampling error and, therefore, the probable maximum errors that will be made in making estimates using the demand curves.

160. To plot the confidence limits around the demand curve, one first calculates the bound on the error of estimation for the proportion for each of several possible prices. This is done using the following formula. The confidence limit is approximately the 95-percent limit; that is, one can say one is 95-percent certain that the actual demand curve is between the rightmost and leftmost curves.

$$I_i = 2\sqrt{\frac{\hat{P}_i \hat{q}_i}{n}} \tag{3}$$

where

I_i = length of the 95-percent confidence interval at price i

$\hat{P}_i$ = proportion in the sample who would pay the specified price i or more

$\hat{q} = 1 - \hat{P}_i$

n = total number of respondents on which $\hat{P}_i$ is calculated (usable sample size)

2 = t value for 95-percent confidence limit

161. The bound is a proportion. The value calculated in the above formula is multiplied times the total number of boaters in the population. The resulting number is added to the estimates of numbers willing to pay each price to plot the rightmost limit and subtracted to plot the leftmost limit. Confidence limits should be computed for each price of interest, because as the proportions vary along the curve, so will the width of the confidence interval. A hypothetical example is shown in Figure 4.

Using the Demand Curve

162. If the price an entrepreneur will charge for a slip for a year is known, it is possible to estimate the maximum gross revenue the entrepreneur will receive by drawing a line across from the price to the demand curve and

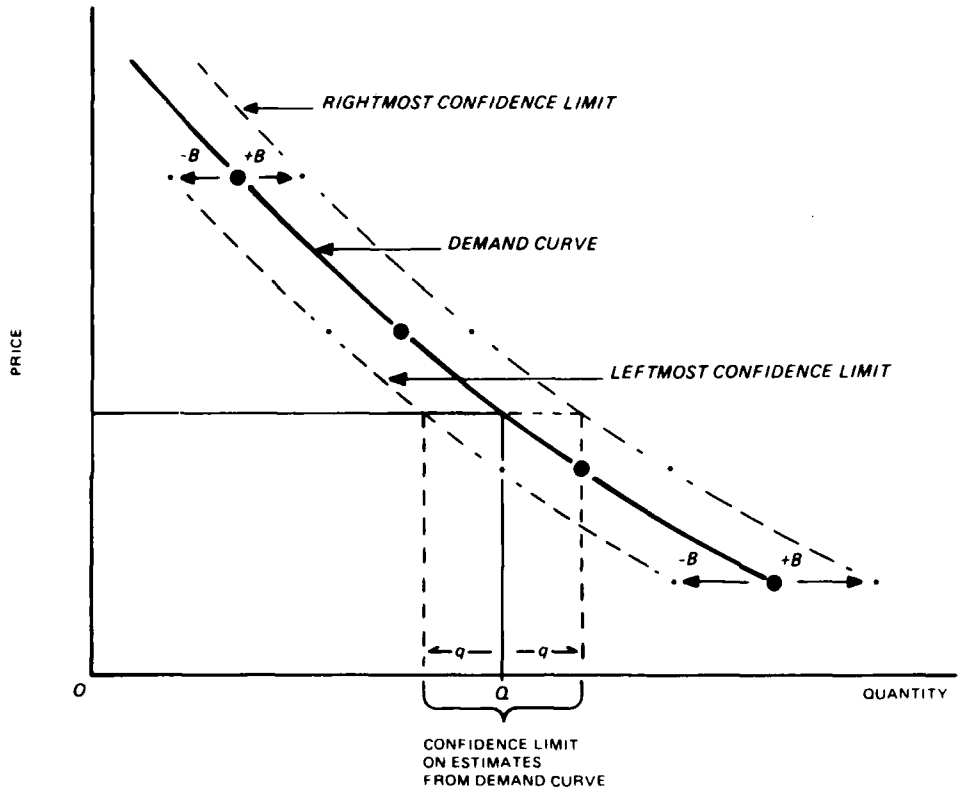

Figure 4. A hypothetical demand curve with confidence limits

then down to the quantity axis where the maximum number of sites that will be rented at that price can be read. Gross revenues will be the price times the quantity.

163. If one wants to know the probable limits of error for that estimate, one makes similar readings and calculations using first the leftmost then the rightmost curve. One can then report that the rentals will be between the low value and the high value and most probably will be the value estimated from the demand curve itself. This is illustrated in Figure 4.

164. The gross value of the resource to the public at large is the potential revenue plus the consumer surplus. This depends on the price charged. Given the price, one computes the potential revenue (used by potential concessionaires to determine their feasibility) as described above. Then, one estimates the area under the demand curve above the price. This number is the consumer surplus which is used (plus any rent paid by the concessionaire) in benefit-cost analysis to determine the feasibility of government investment. The area under the curve can be estimated mathematically

given an equation for the demand curve; practically, it is estimated by counting squares or with a planimeter.

Analyzing Nonresponse

165. When the survey of nonrespondents is completed, there will be two means for the value of the resource, the mean of the initial survey and the mean from the survey of nonrespondents. The nonrespondents can be assumed to be the same as the respondents if the nonresponse mean is within ±0.1 of the standard deviation of the respondent survey mean. If the means are much different than 0.1 of a standard deviation, the results of the survey of nonrespondents should be weighted appropriately and incorporated with the data. A statistician should be consulted. If the means are within 0.1 of a standard deviation of each other, the nonrespondent results can be simply included with the respondent results. Alternatively, the results of the nonresponse survey can be weighted, added to the responses, and the effects observed on estimates of demand and value. The effects may be small enough to be operationally insignificant even when means are quite different.

PART VIII: SUMMARY

166. The demand for and value of proposed resource developments can be estimated using a process called "contingent valuation method." A means of conducting contingent valuation using mail surveys has been described. Contingent valuation involves questioning a representative sample of potential consumers to determine each one's maximum willingness to pay. These responses are then aggregated to produce demand curves. The demand curves can be used to estimate potential revenues for a commercial operation and consumer surplus, a measure of value.

167. The conduct of effective surveys is a complex process requiring careful attention to detail at every stage. Although this report contains enough detail to permit the elaboration and conduct of a CVM mail survey, a certain level of sophistication is assumed. Users should expect to consult survey research methods references for further depth. Many such references are available. The references cited in this report are useful but certainly do not constitute the body of available literature on the subject.

168. The methodology of CVM is actively under study. It would be wise to consult with scientists familiar with the CVM process before initiating a major study to be certain that the latest advancements can be incorporated. Statistical advice can be had from consultants at local college and university mathematics and statistics departments.

169. The apparent complexity of CVM studies should not discourage their use. The information provided can be extremely useful to planners and decisionmakers facing important resource development choices. At the same time, such studies should be undertaken with the appropriate sense of caution and carefulness that any complex technical task requires.

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