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U.S. DEPARTMENT OF COMMERCE
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I. INTRODUCTION

This guideline on marine recreational fishery evaluation is intended to serve as an outline for reporting NMFS research and fishery management information regarding impacts of regulatory changes or projects on the quantity or quality of marine recreational fishing. It does not serve as a primer on economic analysis of recreation, but it does provide a rudimentary explanation of what an economic evaluation of recreation is all about. Throughout the following text I have attempted to use simple, common English terms as far as possible. However, to discuss a difficult technical problem, such as recreational valuation, without using any of the appropriate technical jargon would lead to greater misunderstanding. Hence some economic training is desirable, if not essential, for any serious attempt to implement the economic evaluation approaches described.

Moreover, the guidelines emphasize the <u>tactics</u> of producing a defensible statement of economic value rather than the quantitative techniques and theoretical models needed to actually measure the value. Consequently, standard works on recreational economics are referenced repeatedly. Familiarity with this literature is a prerequisite to top quality work. Among the more prominent references are the Water Resources Council Guidelines, A. Myrick Freeman's book, the monograph by J.F. Dwyer, J.R. Kelly and M.D. Bowes, and a recent draft handbook on benefit-cost assessment produced by the Research Triangle Institute for the Environmental Protection Agency. Full references are listed at the end of this document.

II. SCOPE

Procedures recommended in this report are appropriate for evaluating a variety of proposed rules, regulations or projects that incrementally change the quantity or quality of marine recreational fishing. Most such changes would stem from public decisions affecting the biological environment or the rules of access to the marine environment. Examples of such decisions include: (a) modified access to ocean fishing through construction of piers or artificial reefs; (b) changed recreational "quality" through fish stock enhancement, mitigation of environmental problems, and increased or decreased commercial fishing quotas; and (c) altered fishing rules like bag limits, gear requirements and area closures. All of these could affect the value of marine recreational fishing to the participants. Evaluation procedures described herein seek to assign a dollar value that is equivalent to the amount recreationists would be willing to pay (WTP) for increased marine angling or the amount recreationists would be willing to accept in compensation (WTA) for diminished marine angling.

It is important to note the limitations inherent in the scope of this discussion. First, major environmental alterations (such as widespread destruction of fisheries habitat or species extinction) cannot be completely evaluated by these procedures.

This is because these widespread environmental changes effect non-recreationists, as well as recreationists, and because large environmental effects may cause substantial redistributions in real income among citizens. Second, the procedures do not provide estimates of commercial economic impact or of the importance of marine recreation to a regional economy. Recreational evaluation procedures recommended below seek to develop dollar values representing the value of fishing to participants, not income generated in associated support industries. The economic impact of recreational expenditures on a regional economy, an important concern in many cases, may be estimated by use of an regional input-output model.

Occasionally, gross angler expenditures are incorrectly taken as a measure of the economic value of recreational fishing. While expenditures are prima facie evidence that recreationists place value on fishing and the underlying natural resources, the total quantity of such expenditures made on recreational trips is not a useful estimate of that value. There are three reasons for this. First, many of the expenditures made for equipment, food, transportation and lodgings during a fishing-related trip are not specifically attributable to fishing. Recreational trips are often multi-purpose in nature, and total expenditures are not a fair indicator of costs incurred specifically for fishing.

Second, the total level of such expenditures is largely independent of the quality of any specific fishing site. The location and composition of the expenditures made by recreationists will undoubtedly change when opportunities to fish improve or deteriorate. But to a large extent these changes cause compensating losses and gains among different fishing areas and among different categories of outdoor recreation. Finally and most importantly, to treat expenditures as a measure of value involves a simple logical fallacy. Expenditures represent costs of fishing. With falling fuel prices, for example, we might find striped bass fishermen spending less per fishing trip in 1983 than in 1981. Should we take this as evidence that striped bass fishing has fallen in value? No, just the opposite. With lower costs, fishermen are likely to make more fishing trips and net economic value of fishing should be even greater. Expenditures represent a cost that detracts from the net economic value of the recreational experience. It is this net economic value which we seek to measure.

One last point requires emphasis--the value of fishing is generally not the same as the value of fish. Fishing, like other recreational activities, has many dimensions. While the opportunity to catch a fish is an essential element, other elements are important, too. When we estimate the value of fishing, we get the value of a complex mixture of things, not all of which is strictly dependent upon the quantity or quality of fish available. Hence the economic value of a fishing day does not directly address the question of fish resource value. Nevertheless, economic value of a particular fish stock or of a prospective change in fish abundance can be estimated using some of the techniques suggested below.

III. CONCEPTUAL BASIS

(a) General. Economic benefits accruing from marine recreational angling are preferably measured in terms of (1) willingness to pay (WTP) for enhanced recreational opportunities, or (2) willingness to accept compensation (WTA) for diminished recreational opportunities. In most cases the prospective recreational fishing impacts will be small enough that the distinction between WTP and WTA will be insignificant. Willig (1976) provides the theoretical conditions under which the two measures of value are approximately the same, and the limitations to Willig's analysis are discussed by N. Bockstael and K.E. McConnell (1981). When Willig's approximation holds, the ordinary "consumer's surplus" (OCS), represented as the area under an individual's demand curve for recreation above the price, is an adequate approximation of economic benefit. In Figure 1 the downward sloping curve depicts a typical angler demand function for recreational fishing trips. With a price per trip of P1, the angler takes Q1 trips per year and enjoys a consumer's surplus represented by the cross-hatched area labelled "A".

Public policy can affect the level of benefits by changing the cost of access to the fishery (represented as a decrease in price in Figure 1) or by changing the attractiveness or "quality" of the recreational activity. Facilities development, for example, may reduce the average cost of fishing trips from P1 to P2 as depicted in Figure 1. Angler's respond to this decrease by increasing the number of trips taken from Q1 to Q2, and the increase in WTP is estimated by the sum of areas B and C.

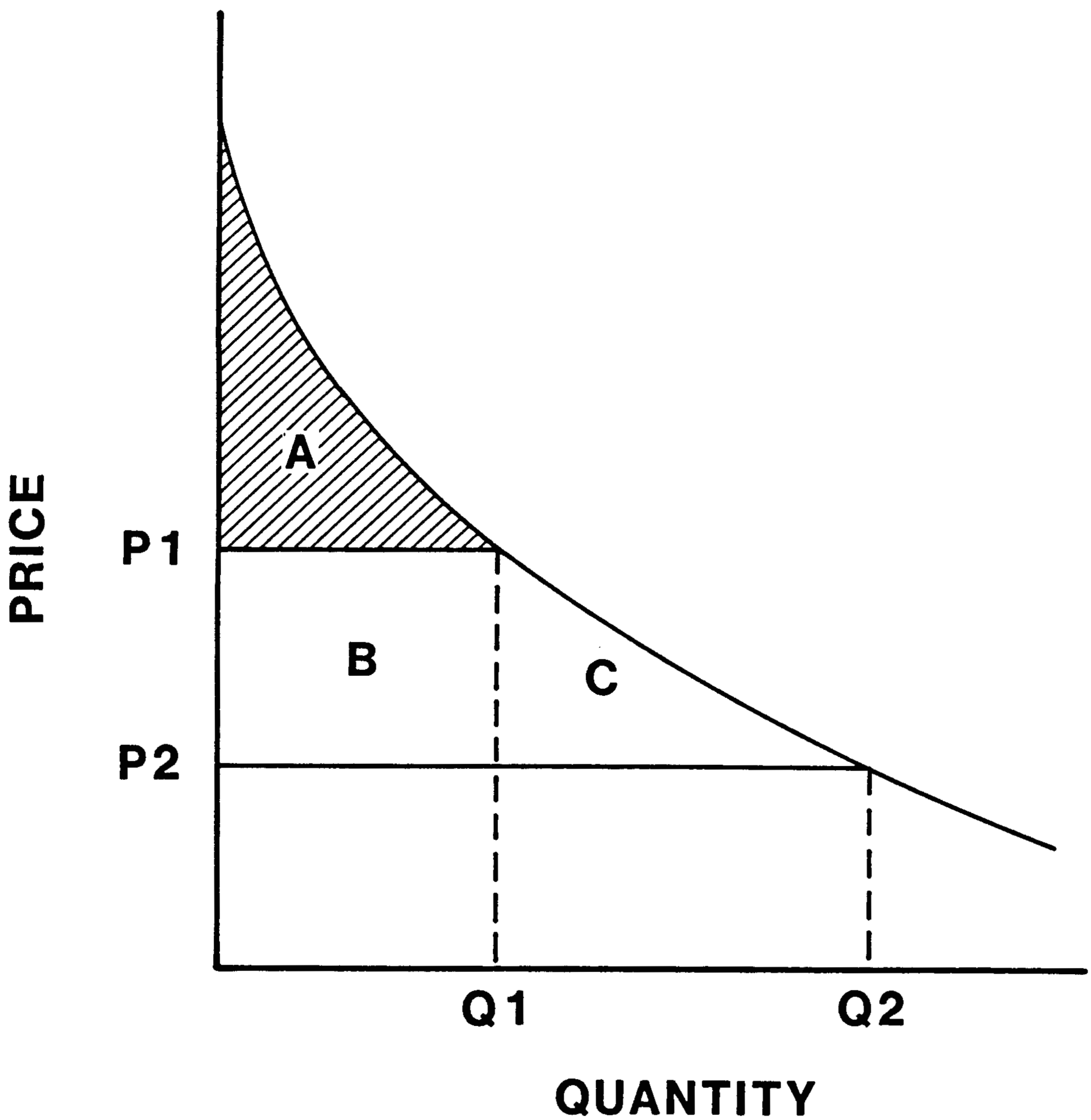

Figure 1. The demand curve and Consumer's Surplus.

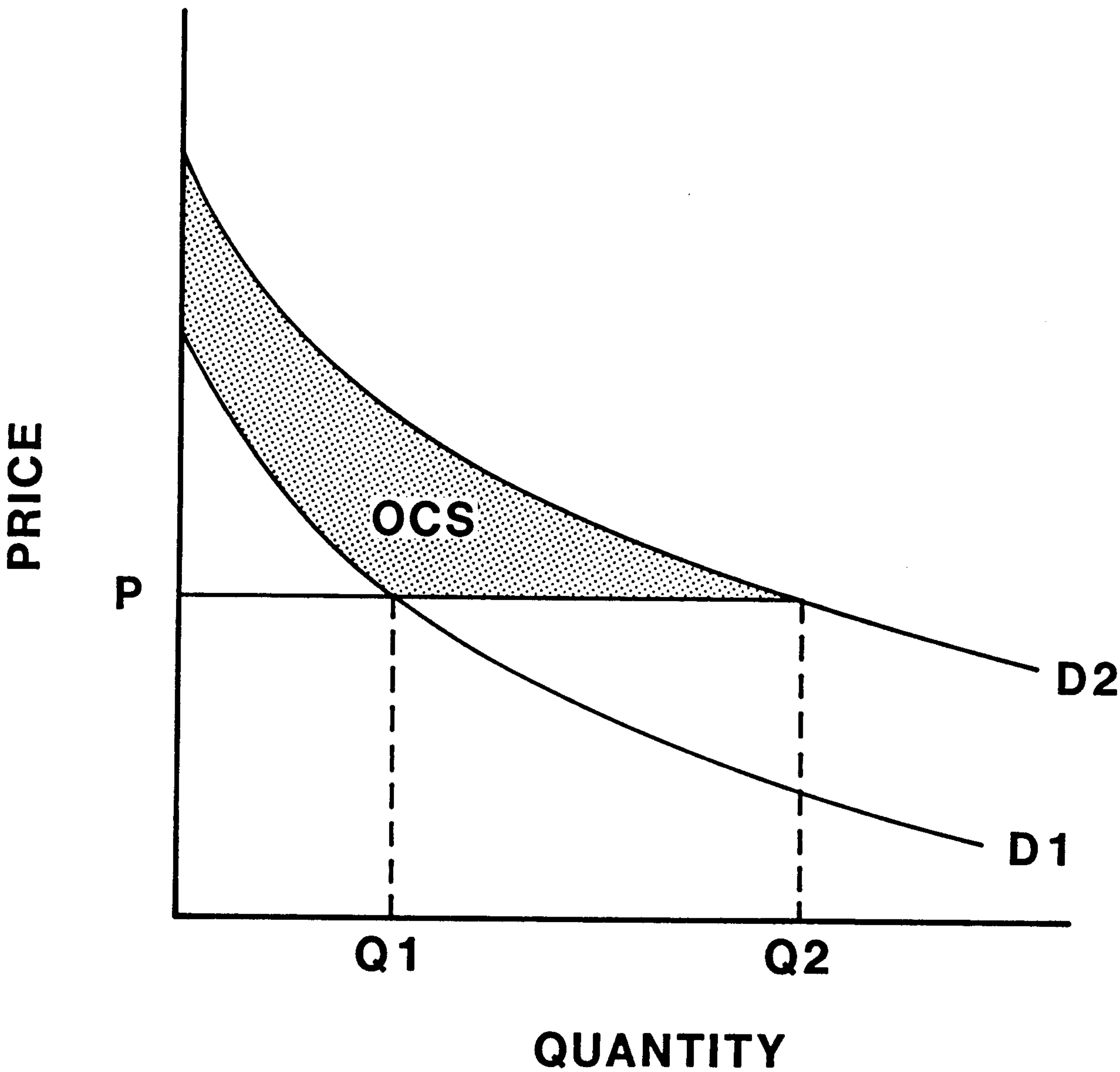

Figure 2. Effect of increased recreational "quality" on the demand curve and consumer's surplus.

Benefits for actions that alter the WTP through increasing the "quality" of the fishing experience are measured as the difference between the before and after WTP. This is approximated by the difference in areas under the before and after demand curves. In Figure 2 the effect of an increase in "quality" of fishing is depicted as a shift in the demand curve from D1 to D2. Assuming that the price paid for fishing remains at P in either case, the value of the increased quality of fishing is approximated by the area labelled "OCS". Both Freeman(1979) and the Research Triangle Institute(1982) provide more extensive treatment and examples of these concepts.

Because most marine recreational fishing occurs in the public domain, it is not possible to estimate demand curves directly from observed price and consumption data. These guidelines describe procedures for estimating the economic value of recreational fishing by indirect inference from travel behavior, participation rates and user surveys. These procedures will assure that evaluations are based on sound economic theory and have a valid empirical basis.

(b) Criteria for an acceptable evaluation procedure.

An acceptable evaluation procedure has the following characteristics:

(1) The procedure should provide a reasonable explanation of the physical relationship between the action taken and the impact on marine fishing.

(2) Evaluation should be based upon a recreational demand model for the particular fishery being affected or a closely

similar fishery in a different "study area".

(3) Estimates of demand should account for the socioeconomic characteristics of the market area populations, qualitative characteristics of the recreation resources under study, and substitutability of alternative existing recreation opportunities.

(4) Evaluation should account for both the value of gains and losses in recreational values in the study area resulting from the proposed action.

(5) Willingness to pay projections over time should be based upon projected changes in the underlying determinants of demand.

Demand for recreational fishing trips is essentially a schedule of participation levels corresponding to actual or hypothetical prices charged for the recreation. For any given fishery or fishing site a demand model should predict the number of fishing trips (or fishing days) that would be forthcoming with various prices and under various conditions.

(c) <u>Demand Estimation Methods</u>

To analyze the demand for various fishing activities it is useful to treat the recreationist's decision as a sequence of choices. First, the person chooses whether or not to go saltwater angling. Second, the person selects the types of fishing (surf, beach, small boat, partyboat, pier, scuba, etc.) to participate in. Finally, the person must choose his preferred level of participation (i.e. how many trips of each type to make). Each stage of this decision process may be influenced by a variety of economic and environmental factors. Prominent among these factors are the individual's socio-economic circumstances, costs of participation, and the physical characteristics of the fishing site or type.

Prevalence of saltwater fishing in the population at large represents the Stage I decision made by individuals. Thus lower saltwater fishing participation rates (i.e. saltwater anglers per 1000 population) in inland areas relative to coastal areas reflects choices made by individuals based upon the cost of saltwater fishing to them, the costs and attractiveness of other alternative recreational opportunities, and family income levels (among other factors). Similarly, the proportion of saltwater fishing trips falling into different types presumably reflects choices based upon relative costs and relative attractiveness of the alternatives. Number of trips taken per year per angler (avidity) is an empirical measure of the final choice stage.

Statistical analysis of recreational data can proceed by examining the probability of being a fisherman , P, the conditional probability of engaging in fishing type i given that one is a fisherman , Pi, and the number of fishing trips per year by fishermen engaging in type i, Ti. In symbols the relationship is

TRIPS per year = Population x P xPi xTi.

Since all three of the choice elements may be influenced by economic costs, economic research may focus on either the total demand (TRIPS) or individual sub-components. Participation models are sometimes used to predict prevalence of fishermen (P) or prevalence of participants in a particular type of fishing (Pi) independently of an overall demand prediction. (See Russell and Vaughan, 1982).

Most recreational demand models, however, address the total number of trips for a particular site or type of activity. There are essentially three empirical approaches in current use: travel cost, contingent valuation (also known as "bidding games" or the "survey method"), and hedonic price analysis. Travel cost has the longest history of application to outdoor recreation (see Clawson and Knetsch, 1966). In its simplest form travel cost methodology requires only on-site sampling of participants to determine round-trip travel distances, trip characteristics (length, purpose, etc.) and ancillary socio-economic data on marine anglers. Given the frequency and travel costs of recreational trips from various distance zones, the demand curve for recreation at the site is estimated under the assumption that access costs are equivalent to a price of entry to the fishery. The simple travel cost study produces a demand curve showing recreation trips (or fishing days, depending upon whether the site is primarily used for day trips) as a function of simulated price. It will yield estimates of total consumer's surplus enjoyed by recreationists at the study site and average net value per angler-trip. A good example of the standard travel cost model is W.G. Brown, A. Singh and E.N. Castle (1964).

More sophisticated versions of the travel cost methodology introduce multiple sites (O.R. Burt and D. Brewer, 1971), or focus on values of different categories of fishing experience (Vaughan and Russell, 1982) or incorporate more comprehensive multi-market models with hedonic pricing (G.M. Brown and R. Mendelsohn, 1981). All three directions of development are motivated by the need to estimate values for "environmental commodities" (e.g. clean air, freedom from encroachment of civilization, or different species of fish) rather than aggregate value of a recreation site or a recreation-day. Clearly, these more complicated models are pertinent to NMFS's marine recreational fishing valuation objectives.

A simplified approach to introducing fishing characteristics or "quality" into the demand curve was developed at the NMFS Economists Workshop in Orlando, Florida (November 3-5, 1982). To determine the incremental value of a change in species or average catch rate one needs to estimate the magnitude of the shift in the angler demand curve for fishing trips due to the change. To estimate such a curve requires that data be collected from a variety of sites which consistently offer different catch rates or species. Alternatively, one could examine participation at a given site under different fishing conditions. (See J.B. Stevens, 1967). The typical catch rates and species types at different sites or times are then entered as independent variables in an estimated demand curve. That is, each observation at a given site (including number of trips per year, travel cost and socio-economic characteristics) is augmented by the variables representing site characteristics. With the resulting "representative fisherman's" demand for fishing trips a unit shift in the quality variable will cause a shift in demand curve, and the change in OCS is measured as the change in area under the demand curve as depicted in Figure 2. Application of this single-equation technique is warranted where data are insufficient to implement a multi-equation travel cost model.

Contingent valuation methods have been developed primarily for valuing public goods and for estimating values of potential environmental changes. In these instances, specific behavior and expenditure patterns are not observed. Thus, travel cost methods cannot be applied. A contingent valuation study requires asking individuals about their willingness to pay (or willingness to accept compensation) for different levels of the environmental commodity involved. There are a variety of survey formats (direct question, bidding game, payment card), each requiring a specific survey instrument and interviewing strategy. A key consideration in survey design is the avoidance of various sources of error and bias. Whether or not the sources of bias are more pernicious in contingent valuation than in travel cost studies is a matter of controversy. Readers are referred to Freeman (1979) or Research Triangle Institute (1982) for a review of the methodological issues.

Just as in a travel cost study, the contingent valuation survey must attempt to account for incremental changes in value due to shift variables of interest. Fish and Wildlife Service's National Survey of Hunting, Fishing and Wildlife Associated with Recreation included a battery of contingent valuation questions in 1975 and again in 1980. Estimates of wildlife values based upon the 1975 survey have been disappointing with respect to statistical significance of coefficients related to fish catch and hunters "bag", and the resulting incremental value estimates seem to be unreasonably low (G.M. Brown and J.J. Charbonneau, 1978). Problems regarding survey design and strategy may be resolved in the 1980 survey. For the present, application of contingent valuation to marine recreational fishing is a permissible approach; but, it requires expert guidance from experienced researchers, and its results tend to raise controversies concerning biases and errors inherent to the hypothetical questioning procedures.

Hedonic pricing models have traditionally utilized geographical variations in either property values or wages to infer "prices" for associated variations in environmental amenities. The incremental value of house or neighborhood characteristics derived from such models are presumably consistent with typical preferences, buying habits and budget constraints of consumers. Thus the hedonic method, like the travel cost method, relies more upon observed behavior than upon interview responses to questions. This is presumably a strong point. To derive demand curves for environmental commodities from the estimated hedonic prices and observed participation data, however, involves a two-stage process fraught with theoretical and econometric difficulties. G.M. Brown and R. Mendelsohn have synthesized the travel cost and hedonic models to solve a theoretical problem in estimating demand for characteristics from "hedonic prices". Their method requires that recreational characteristics (or qualities) vary among fishing sites and that recreational demand curves be estimated for several "markets". Thus solution of a problem in hedonic pricing introduces the difficulties of a multi-market analysis. For now, it is recommended that application of the hedonic technique await further development and professional consensus regarding its applicability and correctness.

Selection of specific valuation methods should satisfy the general criteria outlined above, and the application of the recommended procedures should result in a written report that can be reviewed and referenced by "outside" experts. Both the travel cost models of recreational demand and models using "contingent valuation" procedures are acceptable approaches. Whenever possible, evaluations should use the travel cost approach or the more complex models developed from the travel cost approach, because they do not rely so heavily on interpretation of answers to hypothetical questions. (But see Schulze, et.al. or Brookshire, et. al. for a more sanguine view of contingent valuation mechanisms.)

IV. EVALUATION PROCEDURES

To determine the economic benefit from a proposed action affecting marine recreational fishing, it is necessary to follow a five-step process. Table 1 lists the five steps, and the following paragraphs explain each step in detail. The amount of effort devoted to each step may vary from one application to another, depending upon the nature of the proposed action, the difficulty of establishing the physical linkage between the action and the recreational experience, and the sensitivity of the evaluation to the formulation of the demand model. In every case, however, the procedure seeks to determine the condition of the fishery without the action, the probable effect of the action on the fishery, and effect that the action has on the demand for recreational fishing. The net economic value is then reckoned as the change in economic benefit occurring in the defined fishery due to the proposed action.

Step 1. Define the Affected Fishery

Changes in recreational activity due to proposed actions will typically be concentrated in some geographical or "market" area. The impacts should be related to (1) actual and potential recreationists drawn from identified locations and (2) a particular set of fishing locations, species, stocks and/or modes of fishing. Description of the subject fisheries and an inventory of biological resources involved should be included in this first step. Also needed is a definition of particularly important fishing sites, description of the qualities of recreational fishing alternatives available, and an explanation of significant constraints to ocean access, if any. Reference to statistical evidence regarding volume of recreational activities (e.g. angler days by mode of fishing) and spatial distribution of subject angling population is encouraged.

Step 2. Determine How Physical Conditions Affect Recreational "Quality" and Quantity.

Fishery management and development actions often cause physical changes not directly experienced by marine recreational fishermen. And many of these physical changes will directly or indirectly impact important characteristics or "quality" factors without directly augmenting or diminishing the potential quantity of recreational opportunities. For example, the average size, species composition or number of fish available within a region may be altered. The effect of these on fishing characteristics important to anglers should be assessed. That is, linkages between objective conditions in the biological realm and perceived recreational "quality" need to be established.

A change in catch per angler day is one useful measure of recreational "quality". Other measures developed should be justified by reference to source data, existing published studies, etc. Quantitative relationships between the important physical conditions (like fish stock size) and recreational quality components (like angler catch rate) may be derived from statistical models for the subject fishery or from studies of closely similar fisheries. Or a hypothesized relationship may be developed from accepted theory with specific adaptation to the subject fishery.

As an example of the latter approach, suppose population biologists determine that the angler catch rates are proportional to fish stock abundance. A particular fishery project is expected to increase the stock by 10 percent. The observable consequence for the angler would be a 10 percent increase in catch per day of fishing. The pertinent issue for the economic valuation exercise is whether the value of recreational fishing is significantly enhanced by the higher catch prospects.

STEP 3. Estimate Baseline Recreational Activity and Value of Recreational Fishing.

This step attempts to establish a base condition from which the proposed action will cause changes. The base condition may or may not be equivalent to recent past conditions. If some recent shift in the physical or economic setting has occurred, or a trend can be reliably extrapolated, the base condition could be established by predicting the near future. Whatever procedure is used, this base condition must include (1) an estimate of the number and types or recreational fishing trips that will occur in the subject fishery, and (2) the net economic value (WTP,WTA or OCS) aggregated for the whole fishery. Both components may be derived from a comprehensive model of demand for recreational fishing. Or the two components might be developed from separate, but consistent, empirical models.

(1) Estimating Volume of Recreational Activity.

If no change from recent socioeconomic and institutional conditions are expected to occur in the absence of the proposed action, the estimated level of recreational fishing may be equal to recent historical levels. This is the simplest approach. On the other hand, a better prediction may be derived from a model which accounts for differing recreational participation rates across travel distance zones and socioeconomic strata. Given per capita participation (e.g. fishing trips per year per angler) by residence zone and socioeconomic strata of anglers, future participation can be extrapolated based on population growth and other trends. To implement an extrapolation such as this requires extensive survey information revealing the geographic distribution and socioeconomic characteristics of marine recreational fishermen. Data collected for a travel cost study may provide the necessary information.

A more sophisticated analysis might account for the effects of anticipated trends in recreational fishing conditions or fishing quality. For example, an established trend in fish availability, ocean access, or cost of participation (e.g. increasing cost of travel) may be expected to have an important influence upon future participation in fishing independently of general demographic trends. To account for these kinds of effects in the base condition requires a quantitative model linking recreational participation to the qualities or characteristics that are expected to be trending.

Such a linkage may be developed as part of a recreational fishing demand model, wherein the changing characteristics are represented as "shift" variables in the demand curve. Travel cost demand studies may introduce these shift variables when multiple sites are surveyed and fishing characteristics vary among sites. For example, the per capita demand (expressed as number of fishing days or trips per year) for a particular fishery may be expressed as a function of travel distance, catch per angler day, and other socioeconomic factors. The equation must be estimated using a data set that includes trips from a variety of distance zones to a cross-section of fishing sites offering a variety of catch opportunities. The effect of changing the typical catch rate at a given site or group of sites can then be computed by extrapolating the per capita change in fishing trips across the entire population from which marine anglers are drawn. This is essentially a matter of multiplying the change in trip frequency at each distance and in each socioeconomic strata by the number of people in each such strata.

(2) Estimating Value of Recreational Fishery.

As in the previous section, the baseline economic value can be either an estimate of value in the recent past (i.e. the present condition) or an estimate of future value based upon a quantitative model of changing conditions and changing recreational demand. In either case the basic notion of economic value is the WTP, WTA, or OCS concept discussed in Section III above. The recommended procedure is to estimate value per recreational fishing day or trip based upon a percapita recreational demand equation. Demand equations can be developed using any of the suggested models described in the References. A simple travel cost recreational demand model will support an estimate of net economic value (ordinary consumer's surplus) per fishing day or fishing trip. This value will vary with distance travelled, so that the aggregate economic value must be computed by weighting the value per day in each distance zone by the population of anglers in each distance zone.

Similarly, a Contingent Valuation Mechanism may be used to develop a percapita WTP for recreational fishing in the base condition. Here one must be careful to get a per capita value per unit of recreation and to provide the ancillary information necessary to relate the WTP to socioeconomic and demographic variables. Again, an aggregate value should be calculated based upon weighting the percapita values associated with different socioeconomic and demographic strata by the size of population occurring in those strata.

STEP 4 Estimate Changes in Recreational Activity and Economic Value.

This step should be a simple matter of combining results from Step 2, concerning mechanisms by which proposed actions affect recreational fishing, with those of Step 3, developing the economic model of recreational demand that incorporates the relevant "shift" variables. Per capita participation ("demand") in the subject fishery will rise or fall, and the value per day or trip may change due to the proposed action. The relative size and importance of these two components will vary markedly from case to case.

An example is the case of improved fish availability in a specific fishery. The analysis in Step 4 should indicate the level of participation (demand) and WTP (or OCS) per angler as of the baseline condition. Furthermore, it is necessary that the analysis focus on the effects of fish availability (possibly measured as catch per angler-day) on the demand curve. If the underlying methodology is a travel-cost model, this might be accomplished by developing the model from a cross-section of fishing sites having different catch rates (see C.S. Russell and W.J. Vaughan, 1982), or from a time series on participation and angling success (see J.B. Stevens). In a contingent valuation approach, interviewees would be presented with alternative fishing conditions. In either case, the change in recreational value per angler is estimated by the change in area (positive or negative) under the demand curve.

Since the estimated demand curve pertains to a representative angler facing specific conditions and alternatives (including travel distance), computation of the aggregate change in economic value may be fairly complicated. For instance, in a travel-cost framework, the change in consumer's surplus per angler will vary across distance zones. Thus the aggregate change in value equals the sum of the changes in each zone; and the change in each zone equals the change in value per representative angler times number of anglers.

The proposed project or regulatory action may cause a complex change in fishing qualities, as when availability of some species is affected by the stock of another species. Or, a project might increase the amount of reef-related fishing while decreasing the opportunities for or aesthetic quality of troll fishing. In these cases, the analyst must make an effort to estimate the negative effects as well as the positive effects. This may require that demand models be developed for more than one fishery.

Step 5. Display Gains and Losses

To promote understanding by non-economists and to facilitate access by economists it is recommended that a summary display be attached to any report on recreational evaluation. The following items should be included in the display:

(1) Definition of Fishery or Fisheries Impacted.

*Location (major sites, States, etc.)
*Species of fish involved.
*Typical number of participants broken down by mode fishing.

(2) Short Statement of Proposed Action

(3) Predicted physical effects on recreational quality, accessibility, etc. (i.e. what change in catch rate, species mix, or quantity of fishing grounds is expected)

(4) Quantitative summary of positive and negative impacts, including estimated changes in participation and value per angler day.

(5) Aggregate net impact of proposed action on recreational fishing value.

This final display should take the form of a one-to-two page Table or Figure.

To illustrate, a summary display (Table 2) has been created from information reported by Cliff Russell and William Vaughan in their assessment of the recreational fishing benefits from the Federal Water Pollution Control Act. They use existing biophysical models to predict increased acreage of suitable water habitat, and develop participation models to predict the effects of increased fishable water on levels of recreational fishing. Increased aggregate value of recreation is related to increased participation in freshwater angling by applying "willingness to pay" estimates generated from an independent study of fee fishing sites. No losses are shown here because all recreational impacts are predicted to be positive overall. Underlying the aggregate gain, however, is a predicted shift of relative proportions of fishing categorized as "rough" (e.g. carp, catfish) and "gamefish". A full cost-benefit analysis would, of course, include estimated capital and operating costs associated with the "best practicable technology" used to meet the clean water standards.

An approach such as that demonstrated by Russell and Vaughan could be profitably applied to marine recreational fishing. The summary Table 2 illustrates some useful points regarding application of economic analysis to recreational value questions. First, impacts of policy changes affect aggregate recreational value through its affects on (1) number of people that choose to participate in the activity at any level, (2) the level of participation by active anglers in various modes of fishing, and (3) the "willingness to pay", or "recreational day value" pertaining to different modes of fishing. In the Russell and Vaughan study, the predicted change in number of anglers was very small while the predicted increase in number angler fishing-days was somewhat larger. The economic value per day of fishing was assumed constant regardless of the amount of acreage of habitat or level of participation.

Second, the authors acknowledge the lack of agreement in the economics profession on how to incorporate the value of time in a travel-cost model and the uncertainty on whether fees at fishing sites represent pure land rents or compensation for real costs. This results in a "low" and a "high" estimate of value per recreation day. Since the resulting aggregate value estimates range from $319 million to $683 million, this gap in knowledge may leave an indeterminacy in any cost-benefit analysis utilizing this valuation study. But this is a fair and honest presentation, and there is no necessity for the study to pretend to greater precision than can actually be achieved.

V. DATA AVAILABILITY

Three major surveys have been conducted in recent years that obtained economic data elements on a national scale: (1) the ongoing NMFS Marine Recreational Fishery Statistics Survey (MRFSS), (2) the 1981 NMFS Socioeconomic Survey (S/E Survey) and (3) the 1980 U.S. Fish and Wildlife's National Survey of Fishing and Hunting. The MRFSS program fielded the first of a series of new surveys in 1979 with the objective of obtaining catch, effort participation data at the Regional Council level of detail.
In addition to catch data, travel cost data elements were obtained during 1979 and 1980. Table 3 lists the types of data collected by the MRFSS. During 1981 the S/E survey covered a broader range of socioeconomic data elements. These are described in Table 4.

Both the MRFSS and S/E Survey are based on a combination of intercept and telephone contacts. The MRFSS survey is structured so that detailed catch, species, fishing mode and location information is collected at the fishing site through intercept interviews. A separate telephone survey, which provides a canvass of the general population in coastal areas, collects data pertaining to level of fishing activity by mode of fishing and residence location. During 1979 and 1980 the economic data on travel cost were collected during the intercept surveys. During 1981 the S/E Survey utilized both intercept and telephone follow-ups. That is, an angler contacted at the fishing site was also telephoned later with additional questions concerning expenditures, satisfaction level, disposition of catch, employment status and income. For analytical purposes, data from either of the NMFS surveys must be weighted by the proportion of the total saltwater fishing population falling into the pertinent region/mode. These weights are computed from the MRFSS telephone survey information.

U.S. Fish and Wildlife Service's National Survey of Fishing and Hunting (NSFH) collects annual information concerning saltwater angling activities. Table 5 lists the types of data collected. Major differences between this survey and the NMFS surveys are:

(1) The NSFH surveys occur at five year intervals rather than annually;

(2) The NSFH canvasses the U.S. population by telephone and conducts personnel interviews with a subsample in order to obtain statistically reliable results at the State level. The MRFSS canvasses the population only in a "coastal strip" and collects detailed species information by on-site intercept.

(3) The NSFH asks anglers to recall the previous year's experience, while the MRFSS is conducted at two-month intervals.

None of the data from these surveys is ideal for economic evaluation, but they should provide a first line of attack for specific recreational evaluation studies. At the very least, the general nationwide data can provide the analyst with an appreciation for the total numbers likely to be involved in marine fishing, broken down by region and mode of fishing. For some widespread fisheries, the MRFSS plus S/E survey may provide sufficient coverage and sample size to conduct an economic evaluation. In other cases, an examination of the available data will assist the development of a more in-depth local survey.

Further information on the NMFS surveys is available from Dr. Mark Holliday, NMFS F/SR1, 3300 Whitehaven St. N.W., Washington D.C. 20235. For more information on the National Survey of Fishing and Hunting contact Dr. M.J. Hay, U.S. Fish and Wildlife Service, Room 2556, Dept. of Interior, 18th and C Streets N.W., Washington, D.C. 20240.

Table 1. Recommended Steps in Economic Evaluation Procedure.

1. Define the Affected Fishery
2. Determine How Physical Conditions Affect Recreational "Quality" or Quantity
3. Estimate Baseline Recreational Activity and Economic Value.
4. Estimate Changes in Recreational Activity and Economic Value.
5. Display the Gains and Losses in Economic Value

Table 2. Example of Fishery Value Impact Display. (Derived from C.S. Russell and W.J. Vaughan, 1982b)

I. IDENTIFICATION OF FISHERY IMPACTED:

* All U.S. freshwater recreational fishing

* Baseline Participation Levels

Pre-cleanup fishable waters in U.S. - 30,615,000 acres

Pre-cleanup U.S. freshwater anglers - 59,160,000

Pre-cleanup distribution of angling activities:

Coldwater gamefish	20.4%
Warmwater gamefish	68.4%
"Rough" fishing	11.2%

II. PROPOSED ACTION: Improve Water Quality to be consistent with "Best Practicable Technology" as required under the 1972 Amendments to the Federal Water Pollution Control Act.

III. PREDICTED PHYSICAL EFFECTS:

Increased amount of water fit for gamefish and "rough" fish, and increased total amount of fishable water to 30,721,000 acres. After water is improved and fish adjust to new water habitat, the proportions of fishing in different categories is estimated to be:

Coldwater gamefish	22.7%
Warmwater gamefish	73.6%
Rough fish	3.7%

TABLE 2. Continued

IV. GAINS AND LOSSES DUE TO WATER POLLUTION CONTROL (BPT)

Quantitative Measure	Before	After	Change
Number of Anglers (millions)	59.16	59.18	0.02
Days of fishing per year (millions)			
-Coldwater gamefish	301.8	319.3	17.5
-Warmwater gamefish	737.4	741.4	4.0
-Rough fish	209.8	220.8	11.0
Recreational Value per Year ($millions)			
-Low Estimate*	11,962.5	12,281.4	318.9
-High Estimate	26,410.5	27,093.8	683.4

* Estimated values per day for fishing are:

	Low	High
Coldwater gamefishing	$11.1	$24.1
Warmwater gamefishing	$ 9.7	$21.4
Rough Fishing	$ 7.0	$16.0

The low estimates do not include value of travel time in the day-value model, and they assume fees paid at site represent real costs. High estimates include travel time valued at average wage rates and assume entry fees are pure transfers.

TABLE 3. DATA ELEMENTS FROM MRFS SURVEY

1. Fishing location and Mode (pier, jetty, beach, boat,etc.)

2. Activity level

   a. hours fishing on day of intercept interview
   b. number of fishing trips taken in past 2 months and past year

3. "Economic data" (not collected after 1980)

   a. miles traveled to fishing site
   b. expenses for fishing trip (bait, ice, clothing, food sundries, lodging, etc.)

4. Demographic data (sex, language, age, county of residence)

5. Fish catch by species and disposition.

TABLE 4. DATA ELEMENTS FROM S/E SURVEY, 1981

1. Age, sex, Catch(Identical to MRFSS) and household size

2. Distance traveled

3. Complete trip expenditures for

- boat rental	- lodging
- food	- fuel
-sundries	- bait
-processing catch	- misc. equipment
-tackle	-tolls/parking
-fees/licenses	

4. 1980 pre-tax income and employment status at time of telephone interview.

5. motivational categories and years of saltwater fishing experience.

6. Level of satisfaction (ranked 1 - 4) and reasons.

TABLE 5. DATA ELEMENTS IN SALTWATER FISHING PORTION OF U.S. FISH AND WILDLIFE SERVICE'S NATIONAL SURVEY OF FISHING AND HUNTING.

1. Regions in which interviewee fished
2. Number of trips to each region during previous year
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4. Days fished and average number of fish caught per day by regions for shad, salmon, steelhead, striped bass.
5. One-way travel distance to "usual" place of fishing
6. Fishing trip expenditures (food, transportation, lodging, fees, equipment rental)
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Table 2. Example of Fishery Value Impact Display. (Derived from C.S. Russell and W.J. Vaughan, 1982b)

I. IDENTIFICATION OF FISHERY IMPACTED:

* All U.S. freshwater recreational fishing
* Baseline Participation Levels

Pre-cleanup fishable waters in U.S. - 30,615,000 acres

Pre-cleanup U.S. freshwater anglers - 59,160,000

Pre-cleanup distribution of angling activities:

Coldwater gamefish	20.4%
Warmwater gamefish	68.4%
"Rough" fishing	11.2%

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