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Utilizing the Marine Recreational Fishery Statistics Survey for Recreational Economic Modelling: Problems and Suggestions

by:

Jonathan L. Platt
National Marine Fisheries Service
Southeast Regional Office
9450 Koger Boulevard
St. Petersburg, FL 33702

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U.S. Department of Commerce
Robert Mosbacher, Secretary

National Oceanic and Atmospheric Administration
John A. Knauss, Administrator

National Marine Fisheries Service
William W. Fox, Jr., Assistant Administrator
for Fisheries

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5258 Port Royal Rd.
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EXECUTIVE SUMMARY

The basic purpose of this paper is to review the data collected by the National Marine Fisheries Service's (NMFS) Marine Recreational Fishery Statistics Survey (MRFSS) in terms of its applicability to recreational economic modelling. A further objective is to make suggestions for modification of the survey or survey structure so as to specifically address recreational economic needs.

Recreational economic modelling covers a wide array of possible objectives - two of the major objectives being 1) valuation and 2) effort (trip) or participation (angler) estimation. Valuation modelling ultimately attempts to place an economic (dollar) value on recreational experiences based on such techniques as the travel cost and contingent valuation methods. Effort and participation modelling attempts to forecast number of trips or anglers for a given area, mode, and species as well as the possible impact of fishery management regulations on such estimates.

Despite the fact that the primary objective of the MRFSS has never been to collect economic data, the survey nevertheless does provide some data applicable to travel cost method economic valuation modelling under certain extreme assumptions. Some of the basic elements of travel cost modelling - e.g. demand (number of trips or days), cost, and catch are being collected in one form or another via the intercept survey and to a lesser extent by the telephone survey. This information has been used in the past (Milon, 1989 and Green, 1989) to develop experimental recreational economic valuation models. However, the modelling constraints associated with the use of the MRFSS data may limit the application of these experimental models. The basic conclusion of this paper is that despite the existence of certain economic data, the MRFSS is not an economic survey and cannot be easily converted to one with the addition of a few economic questions. To provide the detailed information necessary for economic modelling, economic surveys are required.

Economic surveys can however take advantage of the MRFSS intercept/telephone sampling structure. MRFSS recreational economic follow-up surveys have been successfully conducted in recent years. These surveys have subsampled a portion of the intercept survey population for subsequent follow-up economic information. While this approach allows for construction of valuation models, it unfortunately does not allow for the construction of effort and participation models. In order to estimate effort and participation models, samples are required from the general population (includes both anglers and nonanglers). The MRFSS telephone survey provides just such a sample but is currently too geographically limited (includes only households residing within 25 to 100 miles of the coast).

Based on the sampling limitations of each survey, a short-term suggestion is made to continue along the currently established path of using the intercept survey for the sampling base of economic follow-up surveys (valuation models). While the actual survey instrument could be conducted as either a telephone or mail follow-up, it is suggested that data be collected via a logbook procedure where the information is gathered for each trip taken over a given period of time. This allows for more complete coverage of fishing behavior as compared to single trip oriented surveys.

Given effort and participation modelling would not be possible with currently available data, MRFSS estimates of trips and participants would likely be applied to obtain aggregated recreational economic values. The trip and participant estimates would be required at various levels of detail - e.g. subregion, state, mode and species. This may require further consideration of the impact of missing cells and double-counting difficulties associated with subregional angler estimation.

In the longer term, effort and participation modelling objectives could be addressed. In order to provide nationwide data to construct effort and participation models, the MRFSS telephone survey would require a major geographic expansion so as to include inland areas. Given the substantial costs associated with such an expansion, a suggestion is made to link up with the US Fish and Wildlife Service's National Survey of Fishing, Hunting, and Wildlife Associated Recreation. The USFWS survey is a nationwide household survey conducted every five years. One of its purposes is to estimate marine recreational participation, therefore it has some common ground with the MRFSS. With the MRFSS telephone survey already set up to interview households up to 100 miles from shore, perhaps it could be expanded to cover the entire coastal state region with the USFWS survey providing coverage of the inland states. In this way, the surveys would be complimenting each other without duplicating effort. One problem with the USFWS survey is the lack of annual coverage. However, given that a majority of trips and participants originate from coastal states which would be sampled annually by the MRFSS, using USFWS data to adjust per capita effort and participation rates for inland states on a five year basis may not be problematic.

Once the expanded MRFSS telephone survey and USFWS survey linkage has been made, studies could then be conducted to determine the most cost effective way to gather the relevant effort and participation data (depending on whether individual or aggregate models are applied). There may even exist some potential to combine the data needs of both the economic valuation and effort/participation models into a single follow-up survey of the general population.

Obviously, the recommendations made in this paper will involve significant costs. However, given the MRFSS has a great deal of potential to users from many disciplines, an adequately funded data collection should prove invaluable. Funding must be made available on a consistent basis in order to expand the scope of the survey to meet needs beyond catch and effort/participation estimation.

INTRODUCTION:

The purpose of this paper is to consider how the National Marine Fisheries Service's (NMFS) Marine Recreational Fishery Statistics Survey (MRFSS) may be used to meet the data needs of recreational economic analyses.

Fishery management plans and their associated amendments require analysis of the social and economic impacts of each management alternative. To date, these analyses have been incomplete. Recreational economic researchers must be able to obtain the appropriate data in order to construct the necessary models to provide such analyses. Without reliable, ongoing recreational economic data collections, fishery management decisions will continue to be based upon insufficient or possibly misleading economic information. Given the recreational orientation of the MRFSS, the survey would seem to provide a logical avenue for collection of recreational economic data.

After some general discussion of the MRFSS, the paper is broken down into two main sections. Section one reviews the content and usefulness of MRFSS data collections (1979-1989) from the perspective of economic valuation modelling. Section two suggests some short and long-term modifications to the survey to better allow for the construction and estimation of both recreational economic valuation and effort/participation models via various approaches.

This paper is written mainly for economists, but should also provide NMFS data collection management with a flavor for some of the needs and related complexities associated with recreational economic modelling. Economists should be interested in both of the above mentioned sections. For NMFS data collection management, section two should be of primary interest.

ECONOMICS AND RECREATIONAL FISHERIES MANAGEMENT:

The following illustrate some basic areas of economic application in fishery management:

First, economic modelling can be used to estimate the overall value[1] of the fishery - that is, the value of the fishery as it currently stands.

Second, economics can be used to estimate the impacts on value of potential management actions (e.g. bag limits, size limits, etc.). Long-term values associated with the imposition of a regulation can be modelled and compared to the long-term without regulation values to determine the incremental benefits (losses) associated with imposing the regulation. These benefits can then be compared to the costs of the regulation to determine whether or not the action should be implemented.

Third, economics can play a role in selection of the most efficient allocation of TAC (Total Allowable Catch)[2] between commercial and recreational sectors. Estimation of the marginal value[3] of a fish or quantity of fish can be compared between competing sectors. By purely economic standards, that sector which values the fish the highest should receive the allocation. Various reallocations can be tested until the marginal value equates between the sectors (efficient allocation).

Economics can also play a role in estimating an efficient time path for TAC. This would require complex, dynamic bio-economic modelling approaches.

Needless to say, economic analyses can provide much by way of useful information to the resource manager. The application of economics to resource management has become standard practice in most agencies.

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[1] When estimating value, economists are referring to net benefits (consumer and producer surpluses) and not regional economic impacts (expenditures). Expenditures are ambiguous since they represent costs to the angler and revenues to the private sector (income transfers). Net benefits represent the difference between what an angler is willing-to-pay versus what (s)he actually pays in expenditures (assuming expenditures are an adequate reflection of opportunity costs).

[2] Assuming TAC is biologically derived.

[3] Marginal value reflects the value of the next fish or quantity of fish.

MARINE RECREATIONAL FISHERY STATISTICS SURVEY: (MRFSS)

The MRFSS is a nationwide coastal state survey conducted by the National Marine Fisheries Service to supply data for research and management of marine recreational fisheries. The survey was designed to provide estimates of catch and effort/participation (trips and anglers) at the NMFS subregional level.[4]

The MRFSS utilizes a complementary survey approach where certain information is gathered from household telephone interviews and other information by on-site intercept interviews. Information from both surveys are combined to generate estimates.

TELEPHONE SURVEY: The telephone survey contacts coastal county households within 25 to 100 miles of the coastline depending upon the state and year. This survey is derived from a random sample of the general coastal population. As such, the survey incorporates both anglers and nonanglers within the sample.

The telephone survey obtains information for each trip taken during the last two month time period (wave). The telephone survey therefore provides a more comprehensive time coverage than the exclusively current trip oriented intercept survey (see below).

INTERCEPT SURVEY: The intercept survey samples anglers only, normally at the end of the fishing trip[5]. Interviewers locate themselves at docks, piers, beaches, etc. in order to sample anglers as they exit the site (site as represented by the point where the angler accessed the water).

The intercept survey is designed to collect detailed information about the current fishing trip (note: certain non-trip specific data is also collected). Data collected includes number, size, and species of fish caught, target species, size of fishing party, length of fishing day, fishing mode(s) employed, area

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[4] NMFS divides the nation into subregions, each composed of large geographic areas (normally a series of states). This paper deals primarily with the review of the MRFSS in the southeast (Gulf and South Atlantic subregions).

[5] A trip reflects fishing by a given mode on a given day - it is possible the angler may fish more than one mode on the same day and therefore incur multiple trips during the same day - this does not correspond to the economic definition of a trip as a round-trip outing from one's residence (one or more days).

fished, gears used, etc. The reason trip specific data is collected via the intercept survey and not the telephone survey is to reduce identification and recall error[6].

ADVANTAGES OF THE MRFSS:

The survey has a number of advantages as a result of thorough design reviews conducted prior to its inception back in 1979 and periodically thereafter. The following provides a short list of its major advantages:

1) Comprehensiveness - The MRFSS is quite comprehensive in that coverage is nationwide - surveys are conducted for most coastal states, fishing modes, seasons, and major fish species.

From the perspective of recreational economic modelling, the comprehensive nature of the MRFSS is a definite plus. Fisheries are normally managed and regulated by NMFS at the subregional level. The analysis of subregion-wide management actions requires the development of regional economic models. The comprehensive nature of the MRFSS is conducive to this type of modelling.

2) Bias Avoidance - The survey designers went to great efforts to reduce bias whenever possible. For example, the two month wave was developed to minimize recall error and the on-site survey's use of fish measurement was designed to reduce identification and measurement errors.

3) Anglers and Nonanglers - Since the survey samples both anglers and nonanglers, economists may have some latitude in modelling both angler and nonangler behavior (model how fishery management activities may impact the number of anglers in the region via probability of participation models).

4) Personal Interviews - Personal interviews, either on-site or over-the-phone, tend to boost response rates as compared to mail surveys. Personal interviews also allow for substantial interviewer/respondent interaction, something impossible with mail surveys. This interaction can lead to improved responses since the interviewer can elaborate on the questions.

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[6] Recall error - If anglers were requested to provide trip specific data via the telephone survey, this would require a detailed recall of previous trips taken during the wave. Given that individuals may not recall accurately, this may result in error.

Identification error - Occurs when anglers misidentify fish species.

DISADVANTAGES OF THE MRFSS:

While the survey has a number of strengths, from an economics perspective, it also suffers from certain weaknesses:

1) Sampling Objective: From the perspective of economics, the survey's focus on primarily catch and effort estimation is a limiting factor. This is not an insurmountable problem since the MRFSS was designed to be flexible. Despite the lack of economic focus, there has been a history of economic data collection within the MRFSS framework:

- In 1981, NMFS conducted a socioeconomic survey in conjunction with the MRFSS;
- On occasion (e.g. 1987, 1990), a few economic questions have been added to the survey;
- In recent years (e.g. 1988, 1991), recreational economic follow-up surveys have been conducted through contract funding.

While the addition of a few economic questions may address certain modelling needs, they are by no means a substitute for planned, periodic, full-scale recreational economic surveys.

2) Geographic Focus: As mentioned above, the survey was designed to provide data only to the subregion level. For many federal regulations, subregional detail is sufficient. However, for those instances where information is required on a less aggregated level (e.g. area closures), appropriate estimates may not be readily available or may be of questionable accuracy (due to missing cells - areas within the region where no samples were obtained).

Conversely, angler estimates are currently being provided at the state level but not the subregional level. The angler estimation procedure may result in double counting of anglers should state estimates be summed.

3) Sampling Time Frame: Intercept surveys are conducted continuously and telephone surveys are conducted during a two week period at the end of each two month wave. Since telephone survey responses as to the number of trips taken in the past two months are utilized to estimate coastal trips, there is a slight timing differential (between those contacted at the beginning of the two week telephone sampling period compared to those contacted at the end of the period).

For anyone interested in using raw intercept data on number of trips in the past two months, a substantial timing differential may exist. Anglers contacted at the beginning of the wave would be discussing trips during the previous wave whereas anglers contacted at the end of the wave would be referring to trips

during the current wave. At the extremes, there could be a four month time period reflected in the number of trips associated with one wave (angler A contacted on January 1st discussing trips back to November 1st, and angler B contacted on February 28th discussing trips back to January 1st).

4) Avidity Bias: Users of the raw intercept data should also be aware of the potential avidity bias associated with the intercept survey. Avidity bias refers to the likelihood of oversampling those individuals who angle frequently. The intercept survey may include a disproportionately high percentage of avid anglers - this will likely bias the results of any behavioral models developed from the data unless specifically corrected for.

Use of raw data from the current telephone survey may be even more questionable due to the geographic limitation. Since the survey contacts only coastal households, and these households are liable to have more fishermen fishing more often than noncoastal households, extrapolation of coastal behavior to the entire angler population would be inappropriate.

Section I: MRFSS AND RECREATIONAL ECONOMIC MODELLING: 1979-89

Recreational economic modelling covers a wide array of possible objectives. Two of the major objectives are (1) valuation and (2) effort (trip) or participation (angler) estimation. Valuation modelling ultimately attempts to place an economic (dollar) value on recreational experiences based on such techniques as the travel cost and contingent valuation methods. Effort and participation modelling attempts to estimate/forecast number of trips or anglers for a given area, mode, and species as well as the possible impact of fishery management regulations on such estimates.

This section presents the relevant data collected by the MRFSS in the southeast from 1979 to 1989 from the perspective of modelling recreational economic value. The discussion centers around potentially useful data (referenced by variable number to the tables at the end of this section) as well as the annual availability of that data.

Effort and participation modelling is not discussed due to the difficulty involved in model construction with currently available data. While the telephone survey provides the appropriate sampling of the general population necessary for effort or participation modelling (i.e. sample includes both anglers and nonanglers), the geographic scope of the survey is too limited (i.e. includes coastal counties only).

RECREATIONAL ECONOMIC VALUATION MODELLING APPROACHES:

Marine recreational fishing is a highly valued leisure time activity normally not bought and sold through a market setting. Economists have devised benefit estimation approaches to place dollar values on such activities despite lack of market information. The two most commonly applied nonmarket valuation techniques used in recreational economics are the Travel Cost and Contingent Valuation methods. Without getting into detailed discussions of each technique, the following briefly states the basic conceptual approach taken by each method.

Travel Cost Method (TCM): This approach estimates value based upon observations of actual angler behavior. Demand curves are constructed where visitation (number of trips) is modelled as a function of travel distance among other things. The basic premise of the approach is that number of trips vary inversely with travel distance all else equal. The area under this demand curve represents the maximum amount the individual would be willing-to-pay for the activity (value).

Contingent Valuation Method (CVM): This approach involves surveying a cross-section of the relevant population. Direct questions are asked to determine the maximum amount the average individual would be willing-to-pay (value) rather than give up the activity. Often additional questions are asked to determine the average individual's willingness-to-pay for changes to the current situation (e.g. a change in catch rates). Willingness-to-pay information from respondents can be combined with other respondent specific data in order to model value (Bid Functions).

MRFSS INTERCEPT SURVEY: Application to Economic Modelling

The intercept survey provides some information useful for estimating individual[7] Travel Cost Method (TCM) fishery demand models. Given that the Contingent Valuation Method requires specially designed questions not currently collected by the MRFSS, the CVM approach cannot be applied.

The following discussion is intended mainly for economists. It presents data availability for construction of both TCM dependent and independent variables for the general demand model:

Dependent Variable: Independent Variables:

$$\text{Annual Demand}_{ijk} = f\ (\text{Price}_{ij}, \text{Socioeconomics}_{i}, \text{Quality}_{ijk}, \text{Substitutes}_{ijk})$$

where i = individual, j = site, and k = species

It is important to realize that all trip related information gathered by the intercept survey pertains exclusively to the interviewed angler on the interviewed trip (except where more than one member of the same fishing party is approached - type 4 record). No information is collected from anglers about prior trips in the past 2 or 12 months.

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[7] In recent years, the individual approach has gained acceptance within the economics community in contrast to the zonal approach. The individual approach requires detailed information on each angler interviewed as opposed to using zonal averages as does the aggregate (zonal) approach.

I. **Dependent Variable(s)**: Demand Concepts

1. **Number of in-state finfishing days in the past 12 months or two months** (Variable number(s): 38 & 39, under type 1 record, see tables at the end of this section).

Note that demand is measured in days and not trips.

Availability: all years.

a. **Fishing Time per Day** (Variable number: 34, 35, 36, 37 under type 1 record).

Two focuses have arisen in the past:
1) trip time in terms of total fishing time per day, and
2) trip time in terms of total fishing time with gear in the water. This data could be used to separate trips according to length or devise a dependent variable based upon annual fishing time (fishing time per day times number of fishing days).

Availability: 1) Total time: 1983-1985.
2) Gear time: 1979-1982, 1986-89.

2. **Number of out-of-state finfishing days in the past 12 or two months** (Variable number(s): 40 & 41, type 1 record).

Could be combined with in-state trips to estimate total fishing effort, unfortunately it is impossible to know whether the trips were taken within the region or not.

Availability: 1979 only.

3. **Trip Length in Days** (Variable number: 4 under type 5 record).

Data could be used to convert fishing days into fishing trips.

Availability: 1987 only.

II. **Independent Variables**:

A. Price Variable Information:

1. **Mode**: (Variable number: 14 under type 1 record).

Price element: Fees.

Party and charterboat fishing modes require the payment of a fee. Perhaps a fee could be estimated as a function of the trip's launch point and trip length.

Availability: Mode is available in all years. Party boat mode has not been available since 1986 (data collection for party/head boats has been transferred to the NMFS head boat survey).

2. **Area**: (Variable number(s): 25-31 under type 1 record).

Price element: Travel cost.

Area information can help in categorizing an open water site. The open water site concept is gaining acceptance in lieu of the traditional launch point site.

A number of questions pertaining to the actual area fished have been included in the MRFSS. Some questions provide general information, such as: did you fish beyond the state territorial waters (see 1 below); did you fish in the ocean, bay, river, etc. (2); did you fish near an oil/gas platform or over an artificial reef (3)? Other questions were more specific allowing the respondent to indicate specific estuaries (4), rivers, and sounds by name (5).

Availability:
(1) > 3 miles: all years.
> 10 miles: 1980, 1982-1989.
(2) all years.
(3) 1984-1989.
(4) 1988.
(5) 1989.

Once the open water site is identified, this information could be used to estimate on-water travel distance. If we then knew the type of boat, engine, etc. we could estimate on-water travel costs.

3. **Travel Miles from Last Night's Lodging:** (Variable number: 42 under type 1 record)

Price element: Travel cost and Time cost.

A problem in estimating travel costs results when the trip involves multiple purposes or multiple recreation sites. In these instances, not all travel costs are reflective of the interviewed site. For example, if an individual visits a region for business and decides to go fishing as well, it would be inappropriate to apply the full travel costs to the region to the fishing trip.

To combat this situation, economists have tried to determine what proportion of travel costs are reflective of the fishing trip. One approach is to use the distance from the previous night's lodging.

This travel distance from the previous night's lodging is also applicable to those individuals residing in the region temporarily - e.g. seasonal residents. It would be inappropriate to use the seasonal resident's travel distance from his permanent address as reflective of travel costs for each trip.

In both cases, we do have a problem in terms of the duration of region access. Despite incurring travel costs as if a local, the individuals annual visitation may be significantly less given their restricted time in the region (conversely, they may have a high usage rate during their period of stay).

In addition, mileage can be used to estimate travel time in order to calculate opportunity and/or travel disutility costs.

Availability: 1979-1981, 1987.

4. **Main Purpose of the Trip:** (Variable number: 1 under type 5 record)

Price element: Travel cost.

Useful for determination as to whether or not to consider full or partial travel costs in the price term.

Availability: 1987.

5. **Miles from residence:** (Variable number: 43 under type 1 record)

Price Element: Travel cost and time cost.

For those trips with the exclusive purpose of fishing, travel costs based upon miles from one's permanent residence (if not a seasonal resident) may be appropriate.

Economists have gone one step further in suggesting use of full travel costs for those trips where fishing was the main purpose.

Time cost statement under price element 3 is also germane.

Availability: 1986, 1987.

6. **Total Cost of the Fishing Day (exclusive of gasoline):** Variable number: 44 under type 1 record)

Price element: Total trip costs except mileage (assumes individual travels by automobile).

The development of a price variable is a difficult task, one must consider a multitude of price components. This variable presents the respondent's perception of applicable trip costs.

Since the question doesn't have the individual categorize costs, it is quite possible the individual may be making more of a general estimate. One has no idea which costs the individual may be including.

Availability: 1979-1981.

7. **Residence:** Variable number(s): 45 & 46.

Price element: Travel cost and time cost.

Some researchers are quite apprehensive as to the accuracy of mileage estimates provided by respondents, especially for those with distant residences. As an alternative, determining the location of one's residence (city, county or better yet zip code) provides a frame of reference for calculating travel distance.

Of course this is subject to error given individuals are spread throughout a county. Additionally, the individual may not have taken the most direct route. Time cost statement under price element 3 is again germane.

Availability: 1) county of residence was asked every year, if the individual didn't know, the city was asked.
2) zip code: 1987-1989.

8. **Fishing time per day:** (Variable number: 34, 35, 36, 37 under type 1 record).

Price element: Time cost.

Fishing time is useful for construction of a time cost price element. Some researchers construct their opportunity costs based upon travel time and time on-site. Fishing time reflects time on-site (travel time costs were discussed above).

The hours planning to fish (variable 36 or 37) question could be used to estimate time costs for trips in progress at the time of the interview.

Availability: 1) Total time: 1983-1985.
2) Gear time: 1979-1982, 1986-89.

9. **Trip length in days:** (Variable number: 4 under type 5 record).

Price element: Time cost.

Estimation of opportunity costs of time and disutility time costs are subject to debate, these concepts have not been resolved by the economics community.

Another approach to calculating opportunity costs would involve the entire length of the trip, hence this variable could be relevant.

Note: One cannot assume all the days involved fishing.

Availability: 1987.

10. **Number of anglers:** (Variable number: 53 under type 1 record)

Price element: general.

When developing a price term, an important factor to consider is the distribution of expenses as well as their magnitude. Is the cost incurred by a head of household or are the costs divided amongst group members. To test the idea of divided costs, one must know the number of paying members in the party. This variable represents a proxy to that idea.

Availability: All years. Unfortunately, this information is only collected in certain instances (when the angler cannot separate out his catch from that of the rest of the fishing party).

B. Socioeconomic/Demographic Variable Information:

1. **Sex:** (Variable number: 11 under type 1 record)

There may be a significant variation in visitation patterns based upon sex.

Availability: 1979-1981, 1986-1989.

2. **Age:** (Variable number: 12 under type 1 record)

Age may also be a useful explanatory variable for predicting visitation.

Availability: 1979-1980, 1986-1989.

C. Trip Quality Variable Information:

1. **Individual angler's keep:** (Variable number: 4 under type 3 record, and variable number 52 under type 1 record)

Trip quality element: Keep quality.

Keep rate may have a significant impact on trip demand, generally the higher the keep - the greater the demand. Considering we are modelling individual demand, it is useful to estimate keep by individual.

To determine one's individual keep rate, the individual must be able to separate out his keep from the group's keep. If the individual cannot separate his keep, the best we can do is develop an average keep rate for the party (see below).

Availability: All years.

2. **Av rage angler's keep:** (Variable number: calculated from variable 53 under type 1 record and variable number 4 under type 3 record)

Trip quality element: Keep quality.

For those instances where separation of keep is impossible, one can either consider the fishing party as one unit (eg. a family) or separate keep between members based upon an average. Total keep for the intercepted angler is recorded as well as the number of anglers contributing to the keep.

Availability: All years.

3. **Individual and Averag angl r's catch:** (Variable numbers - individual catch: may be calculated from variable number 4 under type 3 record, variable number 4 under type 2 record, and variable 52 under type 1 record; average catch: may be calculated from variable number 4 under type 3 record, variable number 4 under type 2 record, and variable number 53 under type 1 record).

   Trip quality element: Catch quality.

Catch is broader than keep since it includes number of fish caught but released, discarded dead, used as bait, etc. Could be considered as a better indication of the quality of the site since it includes all fish caught. For those fish caught but not kept, it is not possible to determine an individual catch rate when a party is involved.

Availability: All years.

4. **Catch target species:** (Variable numbers: 23 and 24 under type 1 record, variable number 1 under both type 3 and type 2 records).

   Trip quality element: Catch success.

Variable indicates whether or not the angler was successful in landing his target species. A separate variable could be constructed for the top two or three target species.

Availability: All years (top 3 target species only in 1979, otherwise only the top two.

5. **Keep Biomass:** (Variable numbers: combine individual or average angler's keep with variable number 5 under type 3 record - measurement of species weight on a per fish basis).

   Trip quality element: Keep quality.

Biomass may be a better indication of keep quality since it reflects both number of fish kept and size. It is quite possible there exists a tradeoff between sheer numbers of fish kept and the size of fish kept.

Availability: All years.

6. **Keep Size:** (Variable numbers: combine individual or average angler keep with variable number 5 under type 3 record - measurement of species length on a per fish basis).

Trip quality element: Keep quality.

Fish length may also be important to the angler (although fish weight and length are normally highly correlated). A keep size variable could be useful in estimating the impacts of size limits.

Availability: All years.

7. **Sea Turtles:** (Variable number: 22 under type 1 record)

Trip quality element: Environmental quality.

There are numerous other factors besides catch which can affect trip satisfaction. Environmental quality in terms of scenic beauty, lack of congestion, clean air and water, quiet, etc. can lead to a satisfying trip despite poor catch.

Observing nature is another environmental quality factor of value as indicated by individual willingness-to-pay to see whales, to swim with dolphins, etc. Observance of threatened or endangered sea turtles may fall into this category.

Availability: 1989.

D. Substitution Variable Information: Two important areas of substitution relevant to recreational anglers are site and species substitution.

1. **Site substitution:** The first problem which arises in the estimation of site substitutes is how to define a site. The traditional method is to use the launch point as the site, however this approach is coming under fire since anglers can visit the same area of the ocean from different launch points. As a result, recent thinking has progressed to the open water site. Unfortunately, open water sites are difficult to define in many cases due to nebulous boundaries (exceptions being artificial reefs and oil/gas platforms). A solution to this problem has yet to be found.

To adequately reflect an angler's set of site substitutes one really needs to be aware of the angler's level of knowledge regarding the presence and quality of sites. If an individual is unaware of a site, it is not a true alternative.

To determine the level of knowledge for each angler would obviously be very difficult, hence modelers often assume perfect knowledge and therefore incorporate all sites into the angler's choice set. Alternatively, some modelers use only those sites visited in the past year as the angler's choice set. Neither one of these approaches is very precise.

The MRFSS intercept survey only reflects the current trip, therefore it is impossible to determine the other sites visited by that individual in the past year. However, we could construct site substitution variables based upon all sites or all sites visited by individuals within our sample.

Substitution variables are often based upon distance or catch quality of each site. Either or both of these could be determined based upon the information gathered in this survey.

Availability: All years.

2. **Species Substitution:** Species substitution involves switching between different fish species on site (switching species and sites could be considered as site substitution).

Species substitution could be modelled by including in the model non-targeted species caught. This could be based upon non-targeted species caught by that individual on the interviewed trip or based upon the average catch on-site within the sample.

Availability: All years.

3. **Other Substitution:** Other substitutions are likely in recreational fishing but have received much less ink - they include activity, mode, and seasonal substitution. Given the orientation of the MRFSS, it is possible one might be able to construct modal and seasonal substitutes. Activity substitution may be addressed via modelling the movement of anglers into and out of the fishery (see probability of participation model in the section II).

Availability: All years.

INTERCEPT SURVEY

Variable Number	Variable Description	Analysis of Variables in MRFSS (1979 - 1989)										
		1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
(SCREENING SURVEY)												
1	Primary purpose of trip (recreation, income)	-	-	-	-	-	-	-	-	X	X	X
2	Saltwater fishing?	-	-	-	-	-	-	-	-	X	X	X
3	Finfish Fishing?	-	-	-	-	-	-	-	-	X	X	X
4	Catch anything?	-	-	-	-	-	-	-	-	X	X	X
5	Finished trip?	-	-	-	-	-	-	-	-	X	X	X
6	Going elsewhere to fish?	-	-	-	-	-	-	-	-	X	X	X
7	By same mode?	-	-	-	-	-	-	-	-	X	X	X
(TYPE 1 RECORD)												
1	Variation in Form Type (finfish, shrimp, spiny lobster)	X	X	X	-	-	-	-	-	-	-	-
2	Interviewer	X	X	X	X	X	X	X	X	X	X	X
3	Interview number	X	X	X	X	X	X	X	X	X	X	X
4	Time of interview	X	X	X	X	X	X	X	X	X	X	X
5	Date of interview	X	X	X	X	X	X	X	X	X	X	X
6	State	X	X	X	X	X	X	X	X	X	X	X
7	County	X	X	X	X	X	X	X	X	X	X	X
8	Site Code	X	X	X	X	X	X	X	X	X	X	X
9	Interview status	X	X	X	X	X	X	X	X	X	X	X
10	Respondent Language	X	X	X	-	-	-	-	-	-	-	-
11	Sex	X	X	X	-	-	-	-	X	X	X	X
12	Age	X	X	-	-	-	-	-	X	X	X	X

Variable Number	Variable Description	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
13	Mod (observed)	X	X	X	X	-	-	-	-	-	-	-
14	Mode (ask d)	X	X	X	X	X	X	X	X	X	X	X
15	Use any oth r mode ?	X	X	X	X	-	-	-	-	-	-	-
16	Other modes used (list)	-	X	-	X	X	-	-	-	-	-	-
17	Number of places fished	X	-	-	-	-	-	-	-	-	-	-
18	Can you separate fish caught by mode?	-	X	X	X	X	-	-	-	-	-	-
19	Total number modes used	-	X	X	X	X	-	-	-	-	-	-
20	If boat mode, involved in a fishing tournament?	-	-	-	-	-	-	-	-	-	-	X
21	Tournament < 7 days, Targeting: Gamefish?	-	-	-	-	-	-	-	-	-	-	X
22	See any sea turtles?	-	-	-	-	-	-	-	-	-	-	X
23	Targeting	X	X	X	X	X	X	X	X	X	X	X
24	Which species (top 2, except for 1979, top 3 otherwise)?	X	X	X	X	X	X	X	X	X	X	X
25	Mainly fishing in what area (ocean, bay, river)?	X	X	X	X	X	X	X	X	X	X	X
26	Estuaries by name	-	-	-	-	-	-	-	-	-	X	-
27	Rivers and sounds by name	-	-	-	-	-	-	-	-	-	-	X
28	If ocean & boat, > 3 miles	X	X	X	X	X	X	X	X	X	X	X
29	", 3-10 miles in FL & TX	-	X	-	X	X	X	X	X	X	X	X
30	State boat fished the most	X	X	X	X	X	X	X	-	-	-	-
31	Near oil/gas platform or artificial reef?	-	-	-	-	-	X	X	X	X	X	X
32	Gear	X	X	X	X	X	X	X	X	X	X	X
33	# gears used simultaneously	X	-	-	-	-	-	-	-	-	-	-

Variable Number	Variable Description	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
34	Fishing Time	-	X	X	X	X	X	X	-	-	-	-
35	Fishing Time (with gear in the wat r)	X	X	X	X	-	-	-	X	X	X	X
36	If incomplete trip, add'l hours planning to fish	X	X	X	X	X	X	X	-	-	-	-
37	" " hours planning to fish with gear in the water	-	-	-	-	-	-	-	-	X	X	X
38	# days in state in last 12 months (exclude today)	X	X	X	X	X	X	X	X	X	X	X
39	" " 2 months (exclude today)	X	X	X	X	X	X	X	X	X	X	X
40	# days from other states in last 12 months	X	-	-	-	-	-	-	-	-	-	-
41	" " last 2 months	X	-	-	-	-	-	-	-	-	-	-
42	Miles from last night's lodging (1987: see type 5 record)	X	X	X	-	-	-	-	-	X	-	-
43	One way miles from residence to site (1987: see type 5 record)	-	-	-	-	-	-	-	X	X	-	-
44	Total cost of fishing here today (exclusive of gas)	X	X	X	-	-	-	-	-	-	-	-
45	City, county, and state of residence	X	X	X	X	X	X	X	X	X	X	X
46	Zip code of residence (1987: see type 5 record)	-	-	-	-	-	-	-	-	X	X	X
47	Private residence?	-	X	X	X	X	X	X	X	X	X	X
48	Have phone?	X	X	X	X	X	X	X	X	X	X	X
49	Name & phone or name & address	X	X	X	X	X	X	X	X	X	X	X

Variable Number	Variable Description	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
50	Catch any inspectible fi h?	X	X	X	X	X	X	X	X	X	X	X
51	Catch fish your elf?	X	X	X	X	X	X	X	X	X	X	X
52	If multiple anglers, can you separate your catch?	X	X	X	X	X	X	X	X	X	X	X
53	Number of anglers who have fish here	X	X	X	X	X	X	X	X	X	X	X
54	Number of type 2, 3, and 4 records (1987: type 5 record)	X	X	X	X	X	X	X	X	X	X	X
	(TYPE 2 RECORD: Unavailable catch)											
1	Species Name	X	X	X	X	X	X	X	X	X	X	X
2	Species Code	X	X	X	X	X	X	X	X	X	X	X
3	Disposition	X	X	X	X	X	X	X	X	X	X	X
4	Number Caught	X	X	X	X	X	X	X	X	X	X	X
	(TYPE 3 RECORD: Identified Catch)											
1	Species Name	X	X	X	X	X	X	X	X	X	X	X
2	Species Code	X	X	X	X	X	X	X	X	X	X	X
3	Planned Disposition	-	-	-	-	-	-	-	-	-	X	X
4	Number Caught	X	X	X	X	X	X	X	X	X	X	X
5	Length	X	X	X	X	X	X	X	X	X	X	X
6	Weight	X	X	X	X	X	X	X	X	X	X	X
	(TYPE 4 RECORDS: Catch on another angler's form)											
1	Date	X	X	X	X	X	X	X	X	X	X	X
2	Interviewer number	X	X	X	X	X	X	X	X	X	X	X
3	Interview number	X	X	X	X	X	X	X	X	X	X	X

Variable Number	Variable Description	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
(TYPE 5 RECORDS: Economic)												
1	Primary purpose of trip is fishing?	-	-	-	-	-	-	-	-	X	-	-
2	One way miles from residence for those with primary purpose of fishing	-	-	-	-	-	-	-	-	X	-	-
3	One way miles from last night's lodging for those with nonfishing primary purpose	-	-	-	-	-	-	-	-	X	-	-
4	Trip length in days	-	-	-	-	-	-	-	-	X	-	-
5	Zip code of residence	-	-	-	-	-	-	-	-	X	-	-

MRFSS TELEPHONE SURVEY: Application to Economic Valuation Modelling

The screening portion of the telephone survey solicits each angler in the household or a responsible adult when the household is composed of children. Additionally, the trip survey portion of the telephone survey questions each angler about each trip taken in the last two months. As a result, the telephone survey is much more comprehensive in its coverage of anglers and trips as compared to the intercept survey. However, the telephone survey asks fewer questions and covers a smaller geographic area as compared to the intercept survey.

Like the intercept survey, the telephone survey is limited in application to travel cost demand modelling. A major drawback is the lack of catch and keep data. Catch and keep data is collected exclusively by the intercept survey due to the potential recall and identification biases associated with an after-the-fact survey like the telephone survey. Catch and keep data is absolutely critical for the construct of quality variables. These variables are a necessary component for analyzing regulatory impacts.

The following variables (data elements) are available for all years and are potentially useful for individual Travel Cost Method fishery demand modelling:

I. **Dependent Variable**:

Number of Trips/Days in the last 2 months: (variable #(s): 1 & 4 of the trip survey)

II. **Independent Variables**:

A. Price Variable:

1. **Mode** (variable #(s): 3 of the trip survey)

Price Element: Fees

2. **Area**: (variable #(s): 6-8 of the trip survey)

Price Element: Travel Cost

Site: Launch point (if boat mode) via variable 8.

Site: Shoreline or Open Water via variables 6 & 7. Not defined by launch site as recorded in the intercept survey.

3. **County or Town of Residence:** (variable #(s): 1 & 2 from the screening survey)

Price Element: Travel Cost

Defines initiation point of travel cost, unfortunately unless a launch point or open water site is locationally defined, we cannot calculate a travel cost.

B. Socioeconomic Variables: None

C. Trip Quality Variables: None

D. Substitute Variables:

Telephone survey does provide information on all trips taken during the two month wave. These trips could include visits to other "sites", unfortunately we don't have data for construction of quality variables for the potential substitute sites.

TELEPHONE SURVEY (composed of the screening and trip questionaire)

Variable Number	Variable Description	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
(Scr ning Survey)												
1	County	X	X	X	X	X	X	X	X	X	X	X
2	Town	X	X	X	X	X	X	X	X	X	X	X
3	Permanent Residence	X	X	X	X	X	X	X	X	X	X	X
4	Anyone in household fished in state within the past 12 months?	X	X	X	X	X	X	X	X	X	X	X
5	Number of household anglers in past 12 months	X	X	X	X	X	X	X	X	X	X	X
6	" " who were shrimping	X	X	-	-	-	-	-	-	-	-	-
7	Number of household anglers in the past 2 months	X	X	X	X	X	X	X	X	X	X	X
(Trip Survey)												
1	Date of last trip	X	X	X	X	X	X	X	X	X	X	X
2	Finfishing/shrimping trip?	X	X	-	-	-	-	-	-	-	-	-
3	Mode of trip	X	X	X	X	X	X	X	X	X	X	X
4	Number of trips in the past two months if angler can't recall trip dates	X	X	X	X	X	X	X	X	X	X	X
5	Primary gear used	X	X	X	X	X	X	X	X	X	X	X
6	Area utilized (ocean, bay, river, etc.)	X	X	X	X	X	X	X	X	X	X	X
7	If ocean and boat mode, > 3 miles offshore?	X	X	X	X	X	X	X	X	X	X	X
8	For boat mode, state and county where you returned	X	X	X	X	X	X	X	X	X	X	X

Note: Ask questions for each trip in the past two months.

Section II: **MODIFICATIONS TO THE MRFSS FOR ECONOMIC MODELLING**:

Given the review of the economic usefulness of the current survey, we can now consider possible modification. Modifications will be discussed in two phases: short-term (prior to 1995) and long-term (1995 and beyond).

PHASE I: SHORT-TERM MODIFICATIONS FOR ECONOMIC MODELLING

The short-term discussion will focus primarily upon improving the information collected within the MRFSS structure from the perspective of modelling recreational economic value. While some consideration is given to effort and participation, the purpose is mainly to improve estimates for aggregation and not necessarily to allow for modelling/forecasting. Short-term modifications will be suggested in three general areas: sampling procedures, survey coverage, and questionnaire content.

AREA ONE: **SAMPLING PROCEDURES:**

Two basic approaches are considered to provide data for the modelling of economic value within the MRFSS structure - expansion of current questionnaires and utilization of periodic follow-up surveys.

Survey Expansion: Survey expansion would involve the posing of additional questions on either the intercept or telephone survey. To provide maximum modelling flexibility, economic questions should be asked via one survey to insure the data being collected is for the same sample of individuals.[8]

A problem in trying to expand either the intercept or telephone survey is that both are already fairly long. A substantial expansion of either survey, along the lines of what is necessary to provide for comprehensive regional economic modelling, would greatly increase the interview lengths. It is unlikely that many anglers would be willing to respond to such an instrument in one sitting. Survey instrument expansion is therefore not recommended as a viable approach to providing recreational economic data.

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[8] Collecting all relevant data from a sample of individuals allows for the construction of both individually based and zonal based valuation models.

Follow-up Surveys: Instead of trying to expand the number of questions on already lengthy questionnaires, perhaps a more reasonable option is to utilize follow-up surveys. With this approach, a subsample of intercept or telephone survey respondents would be requested to participate in a follow-up economic survey. Given the substantial size of the intercept and telephone survey respondent population, the follow-up surveys should obtain sufficient sample sizes despite the increased levels of nonresponse associated with a second contact of the same group of individuals. The follow-up approach should prove quite useful in that the questionnaire would be designed specifically to meet recreational economic needs.

The frequency of recreational economic follow-up surveys would depend on the comprehensiveness of the survey. With the trend in marine recreational economic valuation modelling toward development of models on a species by species basis, it may be difficult to design a questionnaire capable of gathering all necessary information across all species of interest. In the Southeast (Gulf and S. Atlantic), the number of highly managed recreational species has grown to the point where a comprehensive survey would necessarily be quite lengthy. To alleviate this problem, it is suggested to survey the various species groups (e.g. reef fish) separately, and rotate the follow-up survey annually. For regions with only a few highly managed recreational species, the follow-up could be periodic, perhaps on a 5 year basis to conform with long-term modifications.

A question then surfaces as to which sample population should the follow-up survey be applied, the intercept or telephone sample?

A. The intercept sample is comprised exclusively of anglers; therefore, it provides a useful population base if we already have estimates as to the total number of anglers or trips (including how these totals may be impacted by management activities).

The intercept survey covers a broader spectrum of anglers as compared to the telephone survey (i.e. not limited to anglers within 100 miles of the coast).

The intercept survey population can be linked with information gathered on the intercepted trips. This provides some very useful catch information while eliminating or minimizing recall and species identification errors.

One problem with the intercept survey is that it isn't purely random. Those anglers who take lots of trips are more likely to be sampled as compared to those that do not (avidity bias). From an average angler perspective, this sample is biased given that each angler does not have an equal probability of being selected.

B. As noted previously, the telephone survey only contacts the general population within 25 to 100 miles of the coast, and, therefore does not provide coverage of the full user region[9].

The telephone survey is based from a random sample of the general coastal population, therefore we are just as likely to contact an avid as a nonavid angler (no avidity bias). While the telephone survey has no avidity bias in terms of selection of coastal anglers to be interviewed, it currently has a built-in avidity bias due to its geographic focus on exclusively coastal anglers. It is likely that coastal anglers participate more than non-coastal anglers, therefore a sample of purely coastal anglers will likely misrepresent the entire population of anglers.

Because the current telephone survey provides a geographically limited sample of both anglers and nonanglers it may not be useful for modelling angler value.

Based upon current sampling, the intercept survey provides a more comprehensive geographic coverage as compared to the telephone survey. Therefore, it is recommended to utilize the intercept sample as a base for economic follow-up surveys.

Another question which arises is how should the follow-up survey be issued - as a telephone or mail survey?

The telephone survey has two primary advantages - it generally results in higher response rates and it allows for interaction between interviewer and respondent (provides for more accurate answers since the interviewer can explain questions). However, telephone surveys are expensive.

Mail surveys may be more cost efficient since they do not require the use of an enumerator, however they require a very well written survey due to the lack of personal interaction.

A related question to the selection of survey type addresses the utility of single trip versus multiple trip surveys. Controversy currently exists as to whether recreational economic data is best collected via single trip or multiple trip surveys. Typically, economic surveys gather information on only one trip via either on-site or follow-up survey methods. Recently, researchers have noted that single trip surveys may provide insufficient information to model angler behavior. As a result, multiple trip surveys have surfaced to gather information on all trips taken over a given period of time.

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[9] User region reflects the entire area from which anglers (or "users") using the site reside.

An advantage of the multiple trip surveys stems from the concept that by not limiting the information gathered to one trip, researchers can generate independent variable estimates for the average trip instead of assuming the interviewed trip data was reflective. A drawback of the multiple trip survey is that it must be conducted as a follow-up survey as opposed to an on-site survey. Follow-up surveys may therefore result in recall and identification errors.

Multiple trip information could be collected by either a telephone or mail follow-up approach. The telephone approach again would encourage response but would require a substantial amount of recall on the part of the respondent. Unfortunately, the nature of many of the questions asked would not lend themselves well to recall. Conversely, multiple trip mail surveys could be issued as logbooks where data would be recorded just after completion of each trip. In this way, recall error should be minimized. The length of the logbook recording period could vary, but optimally the logbook would be maintained for a full year to coincide with the normal time frame of recreational economic models. The tradeoff then becomes one of comparing the advantages of multiple trip information versus the disadvantages of potential identification error associated with a follow-up survey. By providing participants with species identification lists (illustrations of pertinent species), the identification problem may be reduced. Based upon this discussion, it would seem that a mail logbook procedure, assuming reasonable response, could provide the most information at the least cost.

In summary, to estimate recreational economic valuation models, the overall approach suggested would utilize a mail logbook follow-up survey based from the MRFSS intercept survey population.

AREA TWO: **SURVEY COVERAGE:** Estimate Improvement

With the short-term focus on improving recreational economic valuation modelling and not effort and/or participation modelling/forecasting, it is likely that MRFSS estimates of effort and participation will be heavily used. Therefore it becomes very important to obtain estimates to the necessary level of both aggregation and detail.

The MRFSS was designed to estimate catch, trips, and anglers at the subregion level. In addition, MRFSS data is routinely used to develop estimates to the state level. Given that fishery management regulations may be imposed in various formats (e.g. by species and geographic area; by species, geographic area, and mode), it would prove useful to have access to estimates at

various corresponding levels of detail.[10] A current NMFS/EPA contract to the University of Maryland funds development of an interactive computer program to provide such estimates. The program is presently set up to utilize east coast data (i.e. New York to Florida), it would be extremely useful if this program could be expanded to include other regions.

Assuming the expanded computer program would be readily available, evaluations would then need to be made as to the reliability of estimates at the various levels of detail. For example, estimates for small geographic regions (e.g. substates) may be questioned due to sampling coverage. Budgetary constraints have restricted sampling coverage to the point where "holes" may occur for areas within a state. These "holes" or missing cells are areas from which no observations were obtained. It has been hypothesized that these "holes" may result in estimate inaccuracy.[11]

Initially, studies could be conducted to determine the importance of the missing cells, their prevalence, and their impact upon estimates. Should missing cells prove to be a major problem, sampling could then be increased to the point where confident estimates can be made. Any proposed sampling increases would have to consider the accuracy/cost tradeoff - at some point, the additional sampling cost may not justify the improvement in estimate accuracy or precision.

On another topic, the current angler estimation procedure does not provide estimates at the subregion level. Anglers are estimated by state but not for the subregion as a whole due to the possibility of double-counting (same angler counted twice when sampled outside of home state). It would be useful to come up with a procedure to allow for subregional estimation. Again, it may be worthwhile to conduct a study to determine the degree of double-counting associated with the current estimation procedures. Perhaps suggestions could be made to reduce or adjust for the possibility of double-counting.

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[10] Note that estimates of catch are currently made on a species, mode, area, catch type, and wave basis by state.

[11] Inaccuracies are only speculated since we do not know if missing cells provide much by way of unique information, one could assume the missing cells were similar to neighboring cells.

AREA THREE: **QUESTIONNAIRE CONTENT:**

The following section presents ideas and problems associated with developing a follow-up survey for the MRFSS. The discussion presents general data needs for both travel cost and contingent valuation modelling approaches. Consideration is given to the use of both the intercept and telephone survey samples as a follow-up survey population base - availability is noted for each item in terms of both surveys.

Modifications to the MRFSS: Travel Cost Method

The following discussion follows the format of the basic model presented in section I. Data needs are discussed in terms of the general Travel Cost Method with demand (trips, days, time) considered as a function of price, socioeconomics, quality, and substitutes.

Survey references pertain to the **1989 intercept and telephone surv y instruments for the S. Atlantic & Gulf** (see appendix A). Although questionnaires do vary by year, the comments are generally characteristic of all years.

I. **Dependent Variable**: Demand Concepts

A series of questions need to be asked to determine the number and types of fishing trips or days taken by each angler. This procedure should be followed for each trip during the relevant time period. One cannot assume that the interviewed trip is representative of all trips taken during the period.

Relevant Fishing Period: Day versus Trip

The MRFSS intercept survey focuses primarily in on fishing days. One problem with focusing on days is that certain costs may not be incurred on a daily basis for extended, multiple day trips (eg. round-trip travel to the fishing site from one's permanent residence). This creates substantial problems for determination of the price variable.

An alternative to using days as the TCM dependent variable, is to use trips. However, the trip perspective is not without problems as well. Trips can be of varying length (single vs multiple day[12]) and varying purposes (fishing, business, visiting family/friends, etc.). Trips involving multiple sites or

[12] Multiple day trips may involve the use of multiple sites, another problem area.

purposes, make cost determination difficult since not all costs are associated with the specific site or fishing purpose. Focusing upon fishing days reduces some of these problems - variation in length of fishing day is less drastic than variation between single and multiple day trips, also the purpose of a single day trip is more likely to be solely for fishing. A final point worth consideration is the fact that the MRFSS aggregate demand estimates are made on a per day not per trip basis. For sake of presentation, the remainder of this paper will utilize the more traditional trip orientation, however one should note that days could be substituted for trips.

1. **Number of Trips** - The number of trips represents visitation during the period. A trip is defined as a visit where marine fishing was pursued. From an economic perspective, a trip involves one round-trip excursion from the angler's residence (permanent or seasonal) regardless of its length (single or multiple day).

Availability:
Intercept Survey: The number of <u>days</u> in the past 2 and 12 months is obtained via the intercept survey questions #19 & 20 (see Appendix A). These days refer exclusively to in-state fishing.

Telephone Survey: Questions are asked about each fishing <u>trip</u> in the last 2 months. We therefore need to sum up the number of trips (Q3 trip questionnaire).

To model <u>trips</u> one needs to be able to convert days into trips. This would require another survey question in order to indicate how many of the days were part of the same trip. This would allow modelling flexibility from the perspective of either trips or days.

Note: Whenever a trip or day involves multiple options (eg. gear type, mode, location of open water site, etc.) data could be gathered for the dominant option - the option pursued the majority of the time.

<u>Per Trip Information</u> - For each trip in the previous two months, we need to ask more specific information in order to categorize the trip.

2. **Trip Purpose** - Determine if fishing was the primary purpose of the trip, if so, consider all trip costs in the price term. If not, determine if the angler would still have made the trip if marine fishing was the trip's exclusive purpose. If so, the exclusive purpose trip could also reflect all trip costs (need to know how length of trip might be affected by the exclusive fishing purpose). If the trip would not have been made, we

cannot assume all trip costs are reflective of the fishing purpose (perhaps we could calculate costs from the previous night's lodging or use some cost allocation scheme). An alternative procedure is to simply discard those observations where fishing was not the primary purpose (less acceptable).

Availability:
Intercept Survey: The intercept screening survey begins to answer this via question #1, however it falls short (to be fair, the intent of the question was to verify recreation purpose as opposed to revenue from the sale of the fish). The question determines whether or not the main purpose of the trip was for recreation - it is possible that nonfishing recreational purposes could be involved, this could be adjusted to reflect recreational fishing as opposed to simply recreation.

Telephone Survey: Not considered in the telephone survey.

3. **Trip Site** (including Multiple Site Trips) - Determine the county and town from which the angler fished. For multiple day trips, determine if the angler used the same site. If not, a procedure similar to that for trip purpose could be employed.

Availability:
Intercept Survey: The shoreline site or launch point is recorded by the enumerator prior to the interview (data element #9).

Telephone Survey: For shoreline mode the survey determines state and county of site. For boat mode, the survey asks state and county where the boat returned (Q7 of trip questionnaire).

4. **Trip Fishing Location** (Federal vs State waters) - For boat modes, determine the trip's primary open water fishing location (determine the most frequently used location for multiple day trips). To best distinguish trips by open water site, a map of the region could be provided.

Availability:
Int rcept Survey: Questions 12-14 address the open water site concept although more definition would be useful. Certain estuaries are asked by name, use of a map would better represent a region.

Telephone Survey: Questions 5 & 6 of the trip questionnaire begins to address the open water site concept by providing information as to general area of fishing (ocean, sound, river, bay) and state or EEZ waters.

5. **Trip Mode** - Determine the mode utilized (for multiple day trips, indicate the mode utilized most often).

- charterboat
- party boat
- private/rental boat
- shore or manmade structure.

Availability:
Intercept Survey: Mode information is presented via question 11.

Telephone Survey: Mode information is gathered via Q2 of the trip questionnaire.

6. **Gear** - Type of gear utilized would be important for evaluating the impact of gear restrictions. The analysis would also require aggregated trip (day) estimates by gear type.

Availability:
Intercept Survey: Question 16 provides a comprehensive coverage of gear type options.

Telephone Survey: Question 4 of the trip questionnaire addresses gear types.

7. **Species Target** - Recent research work has focused on the modelling of fisheries on a species by species basis. Species categorization is often based upon target species. Categorizing trips on a per species basis is made more difficult in the southeast due to the prevalence of non-target trips. To assist in trying to categorize non-target trips, information on open water site, gear type, and type of fishing could be useful to perhaps imply a target group if not an individual species.

As an alternative to categorizing trips when target species are not chosen, one could infer something from those species actually caught. In either case, a single trip could fall under a number of categories if multiple species were targeted or caught. At the other extreme, trips could also receive no categorization if no species were targeted or caught.

Availability:
Intercept survey: Question 15 addresses target species. See trip quality section for catch availability.

Telephone survey: Not available.

8. **Trip Length** - Trip length may be utilized to convert demand from trips or days into a more defined unit of time (eg. fishing hours). A fishing hour is a consistent time unit which doesn't vary for each angler the way a day or trip may (however, fishery management regulations are not imposed on a per hour basis).

Trip length is also important for calculation of trip costs both in terms of opportunity costs and travel time disutility costs.

Determine the amount of time spent in days and hours for the following categories of trip time:

Time spent fishing (hours)
Time spent in the region not fishing (days, hours)
Time spent traveling to and from the site (days, hours)

Availability:
Intercept Survey: Time spent fishing (either in terms of time with gear in the water or overall fishing time depending upon year) is collected via question 17.

Telephone Survey: Not collected via the telephone survey.

II. <u>Independent Variables</u>:

As noted above, the Travel Cost Method applies a number of explanatory variables in order to predict demand. These are grouped into four general categories: socioeconomics/ demographics, price, quality, and substitution. Price, quality, and substitutes may vary with each trip and therefore should be collected for all trips during the wave.

A. <u>Socioeconomic/Demographic Variable Information</u>:

1. **Income (annual & hourly) & Recreational Budget** - Accumulated wealth is the funding source tapped to finance fishing trips. As a proxy for accumulated wealth modelers often use annual income (not strictly appropriate for certain groups, eg. retirees). To be more precise, disposable income remaining for recreational purposes may be more useful (remaining after coverage of necessities: food, shelter & utilities, clothing, etc.). This recreational budget therefore constrains ability to take trips.

Availability: No income related questions are currently being posed by either survey.

Determine the angler's annual disposable income (use income ranges). If the individual budgets income, ask the recreational budget (unlikely), if not calculate the discretionary income

(aggregate income minus necessities by asking questions about estimated monthly costs of the necessities).

Ask if the individual is on hourly wage or salary, this may affect the calculation of opportunity costs (see price section).

2. **Leisure Time** - Income may not be the only constraint upon the angler, the availability of leisure time may also be a factor.

To determine annual leisure time, one needs to know the individual's average number of working hours per week, the number of holidays per year, and the number of vacation days per year.

Availability: No information of this sort is currently being collected by the survey.

To complicate the matter of the time constraint, one must consider the fact that leisure time is not available on a continuum. One may have 6 hours of leisure time per workday (or 30 hours per work week), yet this time obviously could not be used to take a 30 hour fishing trip since we cannot accumulate time. Modelling leisure time requires further research.

3. **Work Schedule Flexibility** - For those able to control their own work schedules, an opportunity cost of time in terms of forgone wages may be calculated.

Availability: No information currently being gathered by the survey.

Determine if the angler has complete flexibility over the amount and distribution of work time. If so, information on hourly wage rate (calculated from annual income and work week information) and trip length could be used to calculate opportunity costs based upon lost wages (assuming work is the next best alternative).

For those without work schedule flexibility (eg. on salary), the determination of opportunity costs would be much more difficult. An option may be to not try and calculate opportunity costs for this group, use trip time as a separate independent variable.

Another option is to ask what the individual would likely be doing if not fishing and try and value that activity (use it as the opportunity cost - may be quite difficult to accomplish).

4. **Seasonal Resident** - Anglers who live in the region part-time during the year are likely to experience different fishing patterns as compared to year-round residents or nonresidents.

The most obvious difference between seasonal residents and nonresidents with similar permanent addresses is the travel cost per trip. Seasonal residents site access costs are based from their seasonal residences as opposed to their permanent addresses.

Seasonal resident demand could be modeled separately from those traveling from permanent residences. This would require an estimate of the number of seasonal anglers and the number of trips per seasonal angler.

One must categorize an angler as a seasonal resident. A possible approach would be to determine if the individual owns property in the region. Alternatively, a question could specifically ask as to seasonal residence/stay based on some logical annual length of stay in the region. The length of stay would also be useful in explaining demand.

Availability:
Intercept Survey: No information.

Telephone Survey: Question 2 of the screening questionnaire asks whether or not the assigned address is the individuals permanent address. If not, we may be talking with a seasonal resident.

5. **Boat Ownership** - Boat owners may have different visitation patterns than non-owners. In addition, boat characteristics (size, power, type of hull, type of fuel and fuel efficiency, gear and equipment available) may influence the type of fishing, species sought, and on-water travel costs.

Availability: No information of this type is currently being collected by either survey.

6. **Years of Marine Fishing Experience** - Habitual fishermen may be more avid fishermen.

Availability: Currently not being collected via either survey.

7. **Ag** - Currently collected via the intercept survey (Q25) only.

8. **Sex** - Recorded via the intercept survey (Q26) only.

B. Price Variable Information: Collect for each trip.

The price of a fishing trip represents the direct out-of-pocket costs incurred by the individual or household. This individual

or household orientation implies that group costs must be allocated between paying party members. One method of distributing costs is to gather information on total group costs and divide it by the number of paying party members. Given that trip costs may not be divided equally, perhaps a better approach would be to simply ask the individual to indicate his own share (in dollars) of trip costs. As with the dependent variable information, this category must also be gathered on each trip during the wave.

Availability:
Intercept Survey: Question 31 of the intercept survey asks the number of anglers contributing to fish catch. This could be used as a proxy for number of party members despite the potential error (miss anglers who haven't caught anything that day and party members who were not fishing but who were contributing to trip expenses). Unfortunately, this is only collected when the individual cannot separate his catch from the catch of the rest of the party.

Telephone Survey: Not being collected.

1. **Travel Miles** - For each trip to a different site, determine the round-trip travel miles from the angler's permanent or seasonal residence.

Two options exist to determine mileage - (1) directly ask the angler his approximate mileage and (2) ask the zip code or town name of the angler's residence (permanent or seasonal) in order to calculate mileage.

Asking the angler travel mileage may be subject to considerable error especially if the individual lives far away. The angler may not recall or simply have no idea of the distances involved.

Calculating travel miles based upon residence zip code or town name will likely be far more accurate. Zip code areas are normally relatively small making the identification points fairly precise.

Comparing the approaches, the zip code idea is generally preferred. However, zip code information would be used to calculate distance by the most direct route - this may or may not be the actual route taken. Justification of the direct route zip code approach can be made on the grounds that less direct routes are normally taken to meet alternative trip purposes (sightseeing, visiting friends, etc.). The cost of these alternative purposes are not reflective of the fishing purpose. Data on zip codes or town names could also be used for seasonal residents as well.

Availability:
Intercept Survey: The intercept survey currently asks about one's state and county of residence (Q21), we also get zip code information from Q22. State and county of residence would obviously be less accurate a reference than the zip code.

Telephone Survey: Screening survey Question 1 gathers town and county of residence, Trip survey Question 7 provides county of fishing site.

2. **Travel Costs** - Determine the individual angler's portion of round-trip travel costs (includes both transportation and in-transit food/lodging expenses).

Transportation costs can be calculated from estimated travel miles if one assumes access via automobile. This assumption is too restrictive given usage of the nation's saltwater resources by non-coastal anglers (air travel likely).

A better approach may be to ask the angler to identify his dollar portion of trip travel costs.

Availability: Travel costs are not collected via either survey.

In addition to trip travel costs, a number of other costs may affect the demand for fishing trips. The following presents a few of these "other" costs...

3. **Stay Costs** - Determine the individual angler's portion of food and lodging while in the region (do not collect for seasonal residents). Controversy exists as to if and how "stay" costs should be handled. Information could be gathered to provide the modeler flexibility to utilize this component.

4. **Equipment Rentals** - Determine the individual angler's share of the costs of rental equipment.

5. **Professional Services** - Determine the individual angler's share of the costs of professional services (eg. charterboat fees).

6. **Fu l** - For boaters, determine the individual angler's share of the costs for fuel.

7. **Maintenance** - Per trip cost of equipment (boat) maintenance.

8. **Time Costs** - Time costs in terms of opportunity costs and disutility costs of travel could be calculated from information already gathered.

Opportunity costs could be based upon the work schedule flexibility concept, value of the next most likely pursued alternative, a percentage of hourly wage, minimum wage, etc.

Disutility costs could be calculated for travel time based upon a percentage of hourly wage (25 - 50%), etc. The disutility idea considers travel time as a negative factor. For many people, travel time may involve sightseeing value, not a travel cost.

Again, considerable controversy exists over the handling of opportunity and disutility costs. An objective of this database should be to provide researchers as much modelling flexibility as possible.

Availability: Generally speaking, none of the "other" costs data is collected via either survey.

C. Trip Quality Variable Information: Collect for each trip.

Trip quality is likely to influence the number of trips taken by the individual. A number of factors can contribute to the quality of a fishing trip. A potentially influential factor often being catch and keep rates.

To be useful for recreational economic modelling of certain management regulations (bag limits, size limits) catch and keep data should be obtained on an individual basis per day by species. Catch and keep rates are estimated per day to coincide with management regulations.

Availability: The data for construction of the six catch/keep variable concepts presented in section one are currently being collected via the intercept survey.

D. Substitution Variable Information: Collect for each trip.

Substitutional concepts can be quite diverse. For saltwater angling, possible substitution may reflect any of the following: site substitution, species substitution, modal substitution, gear substitution, seasonal substitution, and activity substitution. The following represent ideas as to possible substitutional concepts.

1. **Site Substitution:** Catch rates for same species (or all species) at different sites. The sites used in the past could be used as possible substitute sites. Information as to price

(distance) and catch quality could be used to construct the appropriate site substitutes.

2. **Species Substitution:** Catch rates for other species at the same site could be used for species substitution. Definition of which species may represent species substitutes is unclear.

It has been suggested to ask specifically what sites and species each angler considers as a potential substitute.

3. **Modal Substitution:** Catch rates for similar species (or all species) via different modes at the same site could be constructed to reflect modal substitutes. Depending upon how we choose to define our sites, it is possible there could be modal options at the same site.

4. **Gear Substitution:** Catch rates for similar species (or all species) via different gears at the same site could be constructed to reflect gear substitution (hook & line vs nets vs traps vs spearing, etc).

5. **Seasonal Substitution:** Catch rates for similar species (or all species) via same site for different seasons (waves) during the year. Unless we utilize some sort of logbook system, we will not be able to collect data on seasonal variation for the same individual.

6. **Activity Substitution:** Activity substitution involves the movement of individuals into and out of the angling population. This substitutional option is normally modeled separately via a probability of participation model (see probability of participation section).

The MRFSS uses a participation percentage for coastal residents as an anchor point for estimates of trips and anglers (ratio expansions are then applied). Perhaps coastal resident probability of participation models could be constructed (by species) as a function of catch rates to allow for estimation of the impact of management regulations on the number of anglers (requires expansion of the telephone survey).

Availability: All Substitution Areas
Intercept Survey: Catch and price data useful for construction of substitute variables is currently obtained only for the current fishing day. Data on site, species, mode, gear, and season is also collected.

Telephone Survey: Data on site, species, mode, gear, and season is being collected. However, no data as to price and catch is collected.

Modifications to the MRFSS: Contingent Value Method

All model and variable discussion thus far has centered on development of Travel Cost models. The Contingent Valuation Method (CVM) represents a potentially useful alternative approach. While the Travel Cost Method is a behavioral model which attempts to explain observed angler demand, the Contingent Valuation Method probes anglers to determine how they would respond (in terms of willingness-to-pay (WTP)) to changing conditions initiated by fishery management. Since the approach is not limited to studying behavioral reactions of past situations, the Contingent Valuation Method allows for greater flexibility in terms of analytical potential.

Instead of modelling demand and estimating WTP as with the Travel Cost Method, with Contingent Valuation we model WTP for the representative angler per year (or per trip) directly. The general willingness-to-pay "bid" function can be written as follows:

$$WTP_{ij} = f(Distance_{ij}, Socioeconomics/Demographics_i, Quality_{ij}, \text{ and } Substitutes_{ij})$$

where i = individual and j = site.

The explanatory variables are analogous to those already discussed under the travel cost method. The dependent variable is quite different however. The WTP_{ij} is meant to represent the maximum net willingness-to-pay for angler i to site j.

A number of willingness-to-pay (WTP) bid formats are currently available: open-ended, iterative bidding, and close-ended. The use of both closed and open ended WTP formats (start off with a close-ended dichotomous choice question followed by an open-ended question) has been applied in recent studies (Ditton/Stoll, 1989) to provide flexibility for estimating "bid" functions as well as calculating simple WTP averages.

With a bid function constructed based on quality variables (eg. catch/keep rates), one could estimate the impact on WTP as a result of fishery management regulations. These impacts could then be expanded to the total angler population (or trip population depending on the model) in order to estimate total impact.

In addition to the fishing based use values described thus far, the CVM provides the only approach for measuring nonuse values. Nonuse values represent benefits derived by individuals unrelated to current use. Nonuse values can be categorized as option, existence, and bequest values. Option value represents an individual's WTP to guarantee the possibility of future use. Existence value represents WTP for the satisfaction of simply

knowing the resource is currently being protected (even if one never intends to use the resource). Finally, bequest values represent WTP for the satisfaction of knowing the resource is being protected for future generations. These final two categories are especially relevant for valuing endangered species.

Fisheries Valuation Modelling Research Needs: TCM and CVM

A likely priority for research in fisheries valuation modelling in the future will reflect the need for bioeconomic modelling. Bioeconomic modelling involves the utilization of biological parameters within economic models (and vice versa). Economic models will need to be constructed which consolidate the influences of changing fish populations, fishery management activities, etc.

The following simple model illustrates the interaction and possible feedback mechanisms involved:

1) Trips = f(price, keep rate, socioeconomics, substitutes)

2) Keep Rate = f(fish population, management activity, number of trips, etc.)

Note how keep rate influences number of trips taken and how number of trips taken influences keep rate. This feedback situation must be addressed.

PHASE II: LONG-TERM MODIFICATIONS FOR ECONOMIC MODELLING

From the long-term perspective (1995 and beyond), not only is the intent to improve the potential for construction of recreational economic valuation models, but also for effort (trips) and participation (anglers) modelling/forecasting.

Effort and participation modelling/forecasting is critical for aggregation purposes in the field of recreational economics. Recreational economic valuation models often focus upon the average trip or angler. In order to calculate total economic value from these models for a state or subregion, the value from the average trip or angler must be expanded by the appropriate estimate of trips or anglers. Estimates of trips and anglers are therefore a necessary component of the overall equation.

There are various methods for forecasting effort and participation (e.g. trend analysis, ratio methods, behavioral modelling, percent of capacity). The approach taken depends on such factors as the length of the forecast period and the availability of data. Federal guidelines (Water Resources Council, 1983) recommend the use of behavioral modelling, especially for long-term forecasts. These behavioral models are useful from the fisheries management perspective since they allow for analysis of the impact of management regulations on effort and participation in both the short and long-term.

One common characteristic of virtually all of the effort and participation forecasting approaches is the need to gather information from the general population (i.e. population of both anglers and nonanglers). The MRFSS telephone survey provides just such a sample but is limited geographically to households residing within 25 to 100 miles of the coast. To allow for effort and participation modelling, the telephone survey would require a major geographic expansion.

Given the substantial cost involved in telephone survey expansion, any attempt to reduce the financial burden would be worth considering. A possible solution may be to link the MRFSS telephone survey with the U.S. Fish and Wildlife Service's National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. The USFWS survey is conducted every five years (next survey: 1995) and involves a nationwide screening of the general population. Like the MRFSS, an objective of the USFWS survey is to estimate effort and participation for various recreational activities - including marine recreational fishing. A combined effort could be initiated where the NMFS survey was used to gather coastal state data and the USFWS survey used to gather data from noncoastal states. For the MRFSS to provide geographically complete data by coastal state, an expansion of the telephone survey would be required.

Certain inconsistencies between the surveys would have to be addressed, but the potential cost savings for both agencies could be significant. Perhaps the most obvious inconsistency is the frequency of each survey. The MRFSS is conducted annually and the USFWS survey every 5 years. However, according to the MRFSS, the residents of coastal states account for the majority of trips and anglers. Given the MRFSS coastal state portion of the combined survey would be conducted annually, the five year intervals associated with the USFWS survey may not be too restricting. During "off years" (when no USFWS survey is conducted), the MRFSS coastal state estimates could be supplemented by noncoastal state estimates derived from USFWS population based usage rates developed every five years.

FORECASTING EFFORT AND PARTICIPATION: Behavioral Modelling

Within the classification of behavioral modelling, there exists a multitude of modelling options depending upon whether individual or aggregate methodologies (or some combination of both) are applied. Individual approaches utilize data from each angler and nonangler as opposed to aggregated approaches which utilize grouped data by origin zone, age group, etc. Both approaches have their advantages and disadvantages with neither receiving a consensus of support from the research community.

The ultimate objective of these models is to estimate/forecast total number of trips and/or anglers by species, site, mode, season, etc. depending on the aggregation needs of the valuation models. For example, if one estimates value per reef fish trip, one would need an estimate of the number of reef fish trips in order to calculate total value. Conversely, if one estimates value per reef fish angler, one needs estimates of the total number of reef fish anglers. Forecasting becomes critical to estimate effort and participation both with and without proposed fishery management regulations so as to determine the incremental impacts of such regulations.

The sequence and levels of modelling vary depending upon whether individual or aggregate methodologies are utilized. The following illustrates the components of both approaches:

Individual Modelling Format: Overall model estimates both number of anglers and number of trips.

$$\frac{\text{Anglers}}{\text{Population}}^{*} \times \text{Total Population} = \text{Total Anglers} \times \frac{\text{Trips}}{\text{Angler}}^{**} = \text{Total Trips}$$

* Individual angler model: (Numeric range of dependent variable: zero or one)

The angler rate per capita (anglers/population) is modelled using individual data by a probability of participation model. The probability of participation represents the probability an individual from the general population is an angler.

** Individual trips per angler model: (Numeric range of dependent variable: ≥ 1)

The angler frequency of use rate (trips/anglers) estimates the average number of trips per angler.

Aggregate Modelling Format:

A. $\frac{\text{Anglers}}{\text{Population}}^{*} \times \text{Population} = \text{Total Anglers}$ (Overall model estimates number of anglers only)

* Aggregate angler model: (Numeric range of dependent variable: zero to one)

The angler rate per capita (anglers/population) can also be modelled using aggregate data. The angler rate represents the percentage of anglers in the general population by origin zone or age class.

B. $\frac{\text{Trips}}{\text{Population}}^{**} \times \text{Population} = \text{Total Trips}$ (Overall model estimates number of trips only)

** Aggregate trips per capita model:

Frequency of use rate per capita (trips/population) estimates the average number of trips per member of the general population by origin zone or age class (accounts for zero use by nonanglers).

The information necessary to develop angler or trip models varies by model type. The same independent variables used to estimate number of anglers may not be used to estimate number of trips. In addition, while the information useful for modelling anglers or trips by either individual or aggregate methods are similar, the form of that information varies. The following illustrates the types of data useful for construction of angler and trip models to a given site for a given species.[13]

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[13] Note that models for the activity level as opposed to the site level could require somewhat different independent variables.

Less time has been devoted by the economic research community to the theory and construction of effort and participation models as compared to valuation models. Consequently, modelling requirements are less well defined in terms of the appropriateness of selected independent variables - especially the inclusion of management related variables. As a result, this discussion should be considered a general overview, more research will likely be required in this area in the future (see research needs).

Angler Modelling Design: (Individual and aggregate approaches)

Probability of Participation$_{ijk}$ (individual)* or Angler Rate per Capita$_{ijk}$ (aggregate)** = f(Distance to site$_{ijk}$; Annual costs of fishing$_{ik}$; Socioeconomics$_i$; Quality of site$_{ijk}$; Distance and quality of alternative sites$_{ijk}$; etc.)

* Individual model: i = individual, j = site, k = species
** Aggregate model: i = residence zone, j = site, k = species

The form of the independent variables varies by methodology. For the individual models, the variables reflect individual observations whereas for the aggregate models, the variables reflect zonal averages. For example, the socioeconomic variable of an individual model reflects the age, sex, income, leisure time, etc. for each individual in the sample whereas in an aggregate model this information reflects the averages of the factors for each origin zone or age class.

Trip Modelling Design: (Individual and aggregate approaches)

Trips per Angler$_{ijk}$ (individual) or per Capita$_{ijk}$ (aggregate) = f(Distance/trip costs$_{ijk}$; Quality of site$_{ijk}$; Socioeconomics$_i$; Distance and quality of alternative sites$_{ijk}$; etc.)

- subscripts as above.

Again, the form of the independent variables varies by methodology (individual or aggregate). Note, however, that the independent variables used do vary as compared to the angler model. For example, the annual costs of fishing by species (e.g. equipment, licenses/permits) are no longer relevant to the angler's frequency of participation. That is, once an individual decides to angle and purchases the appropriate equipment and authorizations, these costs are irrelevant (sunk) to the frequency of use decision.

In order for the above models to estimate the impact of fishery management regulations, the quality variables for both the focus site and alternative sites must be designed to be responsive to management activities (e.g. catch rates can be adjusted to reflect imposition of bag limits).

The dependent variable information for either the angler or trip models (individual or aggregate) could come from the expanded MRFSS telephone survey discussed previously. Depending upon whether the individual or aggregate approach was applied, the independent variable data could possibly be obtained from outside (non-MRFSS telephone survey) sources. If an aggregate approach was used, the independent variable data should reflect the origin zone or age class. Certain socioeconomic data may be available from the Department of Commerce, regional/local governments, distance information could be calculated, and catch (quality variable) information could be obtained from MRFSS intercept survey data. Conversely, if an individual approach was used, all of the data would have to be collected by survey. Given the length of the current MRFSS telephone survey, the use of follow-up surveys would again seem warranted. However, a follow-up survey may prove to be lengthy depending upon the number of sites and species involved.

There may however be potential to combine the follow-up survey needs of both valuation and angler/trip modelling. This depends on the appropriateness of using the telephone survey population as the basis for the follow-up valuation survey - i.e. does the telephone survey provide enough angler observations by mode, site, and species to estimate valuation models. If so, a potential for combination may exist. In addition, using the telephone survey random population for the follow-up valuation survey provides a further advantage by eliminating the avidity bias associated with utilizing the intercept survey population.

Once the telephone survey has been expanded and linked with the Fish and Wildlife Service's survey, studies can be conducted to determine the potential for using the telephone population for follow-up surveys. Additionally, the availability of aggregated information from outside sources could be explored. These studies should indicate the most cost effective way of obtaining the information necessary to model effort and participation.

Fish ries Effort Modelling Research Needs:

More research needs to be conducted in the area of effort (trip and angler) modelling. Basic information as the model design needs to be addressed. As with valuation models, these effort models will also need to incorporate the bioeconomic concepts (fish population and management activity influences).

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Appendix A:

1989 Intercept & Telephone Questionnaires

(Atlantic & Gulf)

2.	ASSIGNMENT NO:	ENTER "1" IF FIRST ASSIGNMENT FOR DAY, "2" IF SECOND ASSIGNMENT FOR DAY.
3.	INTERVIEWER CODE:	ENTER YOUR 4-DIGIT CODE.
4.	YR/MO/DAY:	ENTER MONTH AND DAY OF INTERVIEW.
5.	INTERVIEW NO:	CONSECUTIVE NUMBER OF THIS INTERVIEW FOR THE ASSIGNMENT.
6.	HOUR:	TIME INTERVIEW WAS COMPLETED. USE 24-HOUR TIME.
7.	STATE:	ENTER STATE CODE WHERE INTERVIEW TOOK PLACE.
8.	COUNTY:	ENTER COUNTY CODE WHERE INTERVIEW TOOK PLACE.
9.	SITE:	ENTER SITE CODE WHERE INTERVIEW TOOK PLACE.
10.	INTERVIEW STATUS:	

Questionnaire complete . . . . 1 — Language barrier, etc. 4
Refused non-key items . . . . . 2 — Refused key item 5
Initial refusal 3

This study is being conducted in accordance with the Privacy Act of 1974. You are not required to answer any question that you consider to be an invasion of your privacy.

(11) Would you say you were fishing from (SPECIFY APPROPRIATE MODE COMBINATION)?

SH - Pier, dock. 1
Jetty, breakwater, breachway . . . 2
Bridge, causeway. 3
Other man-made structure (SPECIFY). 4
Beach or bank 5

PC - Partyboat 6
Charter boat. 7
PR - Private or rental boat. 8

(12) Was most of your (SPECIFY MODE) fishing effort today in the ocean/gulf, a sound, river, bay or inlet? IF SOUND, RIVER or BAY, ASK: What (sound/river/bay) was that? PROBE TO DETERMINE CORRECT AREA.

Open water (ocean/gulf, open bay) . 1

Sound (other than those specified) . 2
River (other than those specified) . 3
Bay (other than those specified) . . 4
Other (SPECIFY) 5
Biscayne Estuary . . . . . G
Whitewater Estuary . . . . . H
Sarasota/Tampa Estuary . . . . . J
Mobile Estuary . . . . . K

→ (CODE Q. 13 AS "8", GO TO Q. 14.)

(13) IF SH, CODE "3", GO TO Q. 14.
IF PC or PR, ASK: Was that ten miles or less from shore, or more than ten miles?

Ten miles or less 3
More than ten miles 4

14. IF SH, CODE "88", GO TO Q. 15.
IF PC or PR, ASK:
Was most of your boat fishing today within 200 feet of an oil or gas platform, or within 200 feet of an artificial reef? IF YES, ASK: Which?

No . . . . . 01 Near oil/gas platform . 02 Near artificial reef . . 03

15. Were you fishing for any particular kinds of fish today? IF YES, ASK: What kinds?

16. Have you been fishing here today primarily with a hook and line?

Yes . . . 01 IF NO, ASK: What type of gear have you been using primarily?

Dip net, A-frame net . 02	Seine 05	Spear 08	
Cast net 03	Trawl 06	Hand 09	
Gill net 04	Trap 07	Other (SPECIFY) 10	

17. To the nearest half-hour, how many hours have you spent (SPECIFY MODE) fishing today? That is, how many hours have you actually spent with your gear in the water?

18. IF COMPLETE TRIP, CODE "88.8", GO TO Q. 19. How many additional hours do you expect to shore fish today? That is, how many more hours will you actually have your gear in the water today?

19. Not counting today, within the past 12 months, how many days have you gone saltwater sport finfishing in this state, or from a boat launched in this state? [DON'T KNOW = 998; REFUSED = 999]

20. Not counting today, how many days within the past two months? [DON'T KNOW = 98; REFUSED = 99]

(21) What is your state and county of residence? IF COUNTY IS UNKNOWN, ASK: What city or town do you live in?

23. Do you live in a private residence, or in some other type of housing such as a dorm, barracks, nursing home or rooming house?

Private residence 1
Institutional housing unit 2 ⟶ (CODE Q. 24 AS "8", GO TO Q. 25.)

24. Does your home have a telephone? Yes . . . 1 No . . . 2

25. How old were you on your last birthday? [DON'T KNOW = 98; REFUSED = 99]

26. CODE SEX: MALE . . . 1 FEMALE . . . 2

27. In the event that my supervisor wishes to verify that I have been conducting interviews here today, may I have your name and a phone number? WRITE NAME AND PHONE ON LINE.

Name and phone given . . . 1
Name and phone not given . 9

(28) Did you catch any fish while you were (SPECIFY MODE) fishing today that I might be able to lo k at?

Yes . . 1 NOTE: MUST HAVE AT LEAST ONE TYPE 3 RECORD.
No . . 2 ⟶ (CODE Qs. 29-31 AS "8" OR "88", GO TO Q. 32. NOTE: NO TYPE 3 OR 4 RECORDS.)
Fish on another person's form . . 3 ⟶ TYPE 3 FISH ON ANOTHER PERSON'S FORM. CODE Qs. 29-31 AS "8" OR "88", GO TO Q. 32. NOTE: MUST HAVE A TYPE 4 RECORD.

(29) Did you catch these yourself or did someone else catch some of them?

All caught by fisherman . . 1 ⟶ (CODE Qs. 30-31 AS "8" OR "88", GO TO Q. 32.)
Other contributors 2

(30) Can you separate out your individual catch?

Yes . . 1 ⟶ (CODE Q. 31 AS "88", GO TO Q. 32.)
No . . 2

(31) How many fishermen including yourself have their catch here? Please don't include anyone who did not catch anything. Only count those people who have their catch here.

(32) UNAVAILABLE CATCH Did you land any fish that are not here for me to look at? For example, any you may have thrown back or used for bait. IF YES, COMPLETE TYPE 2 RECORDS BY ASKING: What type of fish did y u land? What did you do or do you plan to do with the (SPECIES)? How many (SPECIES) (did you/will you) (DISPOSITION)? NOTE: FILLETED FISH ARE UNAVAILABLE CATCH.

(33) AVAILABLE CATCH COMPLETE TYPE 3 RECORDS BY ASKING: May I look at your fish? What do you plan to do with the majority of the (SPECIES)?

DISPOSITION CODES FOR Qs. 32 and 33

Thrown back alive 1	Used for bait/Plan to use for bait 4
Thrown back dead/Plan to throw away . 2	Sold/Plan to sell 5
Eaten/Plan to eat 3	Plan to use for some other purpose (SPECIFY) 6

(34) TYPE 4 RECORD. CATCH ON ANOTHER PERSON'S FORM. IF AVAILABLE CATCH FOR THIS FISHERMAN HAS BEEN RECORDED ON ANOTHER FISHERMAN'S FORM, COMPLETE THE TYPE 4 RECORD. THE DATA IS FROM Qs. 3 - 5 ON THE OTHER FISHERMAN'S FORM.

35. NUMBER OF TYPE 2 RECORDS: ENTER NUMBER OF LINES FILLED OUT FOR CATCH UNAVAILABLE FOR INSPECTION.
36. NUMBER OF TYPE 3 RECORDS: ENTER NUMBER OF LINES FILLED OUT FOR CATCH AVAILABLE FOR INSPECTION.
37. IS THERE A TYPE 4 RECORD? YES . . . 1 NO . . . 0

38. IF SH, CODE "8", THANK RESPONDENT FOR TIME.
IF PC or PR, ASK:

Were you fishing in a tournament today?

N 2
IF YES, ASK: Was that a tournament lasting seven or fewer days directed at ne or more gamefish? Gamefish would includ King Mackerel, Spanish Mackerel, Dolphin, Tuna, Sharks, Wahoo and Billfish.

1989

RECREATIONAL FISHING QUESTIONNAIRE
SCREENING QUESTIONNAIRE
Fish - #680

Alabama, Louisiana, Mississippi

Hello. I'm calling long distance for a survey being conducted for the National Marin Fisheries Service of the U.S. Department of Commerce. We're surveying r creational fishermen in various gulf coast counties. Your telephone numb r has been selected at random.

Q1. To help me assign your information to the correct location, do you liv in _____ county? (WRITE COUNTY # ON COUNTY LINE)

Q2. Is this your permanent, year-round residence? (CHECK PERMANENT RESIDENCE BOX)

Q3a. Does anyone in this household go fishing? (IF NONE, THANK AND TERMINATE)

Q3b. We want to gather information from people who have been saltwater sportfishing for finfish, not shellfish, in the last 12 months. Saltwater fishing includes fishing in oceans, including the Gulf of Mexico, s unds or bays, or in tidal or brackish portions of rivers. How many people in your household have been saltwater sportfishing in the last 12 months in this state or from a boat launched from this state? (RECORD IN 12-MONTH BOX; IF NONE, THANK AND TERMINATE)

Q4. Thinking just about the month of December, how many people in your household have been saltwater sportfishing in this state or from a boat launched from this state? (RECORD IN 1-MONTH BOX; IF NONE, THANK AND TERMINATE)

(ARE YOU THAT FISHERMAN/ONE OF THE FISHERMEN?)

(INTRODUCTION WHEN RESPONDENT IS FISHERMAN)

I'd like to ask you a few questions about your most recent finfishing trips. This survey is being conducted in accordance with the Privacy Act of 1974, therefore you are not obligated to answer any question if you find it to be an invasion of your privacy.

(INTRODUCTION WHEN OTHER FISHERMAN IN HOUSEHOLD COMES TO THE PHONE)

Hello, I'm conducting a survey on saltwater sportfishing for the National Marine Fisheries Service. By saltwater fishing, I mean fishing in oceans, sounds or bays, or in tidal or brackish portions of rivers. For the purpose of this survey, it includes only fishing for finfish, not shellfish. I understand that you'v been saltwater fishing in the month of December, and I'd like to ask you a few questions about your most recent trips. This survey is being conducted in accordance with the Privacy Act of 1974, therefore you are not obligated t answ r any question if you find it to be an invasion of your privacy.

Alabama, etc.

Again, w 're interested in th s trips wher you went after finfish, whether you caught any or not, and in those trips where y u might have be n going after shellfish but caught finfish. We're not interested in any trips where your main purpose was to catch fish which you would sell to make money. Please list the dates of your saltwater sportfishing trips for the month of December, starting with y ur most recent trips and working backwards in time. I have a calendar here in front of me so I can help you with the dates.

Q1. When did you last go finfishing? (ASSIGN TRIP # AND RECORD DATE OF TRIP ON TRIP FORM)

Q2. Were you fishing from a pier, a jetty, a bridge, a beach, a bank, or a boat? (IF MORE THAN ONE MODE WITHIN A MODE CATEGORY, CODE THE ONE USED LAST THAT DAY)

Q3. And what was the date of your finfishing trip before that? (REPEAT Q1 & Q2 UNTIL ALL TRIPS FOR THE MONTH OF DECEMBER HAVE BEEN COVERED)

Now, I'd like a little more information about each of the trips you just mentioned. (STARTING WITH THE 1ST TRIP MENTIONED, ASK Q4-7 FOR EACH TRIP BEFORE GOING ON TO THE NEXT TRIP)

Q4. On (date), when you were fishing from a _____, what kind of gear were you primarily using, a hook and line, dip net, or what? (IF MORE THAN ONE, ASK WHICH WAS ACTUALLY IN THE WATER MORE, THAT IS, WET MORE OFTEN)

Q5. Was most of your finfish effort for fish that day in the ocean, a s und, a river, or a bay? (IF A RIVER, ASK IF FISHING IN THE LOWER PART OF THE RIVER WHICH IS BRACKISH OR AFFRECTED BY THE TIDE; IF ABOVE, DISREGARD TRIP)

(PROBE BAY:) Was that an open bay or an enclosed bay?

(PROBE INLET:) Were you more toward the outside or more toward the inside f the inlet?

(IF NOT OCEAN/GULF AND BOAT, SKIP TO Q7)

Q6. (IF OCEAN AND BOAT, ASK:) Was most of your fishing effort more than thr miles from shore, or three miles or less from shore?

Q7. (IF BOAT, ASK:) To what county did your boat return?
(IF NO BOAT, ASK:) In what county were you fishing?

(ASK Q8 IF OCEAN/GULF AND BOAT; IF NOT, CIRCLE ZERO FOR NOT APPLICABLE)

Q8. Was most of your fishing during this trip within 200 feet of an oil r gas platform, or within 200 feet of an artificial reef?

(VERIFY PHONE # AT END)