Volume II: The Economic Value of New England and Mid-Atlantic Sportfishing in 1994

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U.S. Department of Commerce
National Oceanic and Atmospheric Administration
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Executive Summary

The National Marine Fisheries Service in 1994 asked a series of socio-economic questions of anglers in the Northeast United States in order to enable the estimation of models that yield (1) the value of access to fisheries (that is, what people are willing to pay for the opportunity to go recreational fishing in a particular area); and (2) the marginal value of catching fish (that is, what people are willing to pay to catch another fish). The questions were asked as part of the Marine Recreational Fisheries Statistical Survey (MRFSS). This volume presents these estimates of economic value.

The methodology used in this report follows closely that of McConnell and Strand (1994). Their report set the standard for conducting recreational valuation work in NMFS. The structure of their nested random utility models (RUM) is maintained, as are other important aspects of their methodology. The RUM methodology employed in this paper examines the choice of where to fish, what species to target, and in what mode to fish. The random utility model assumes that the fisherman compares all of the alternatives available to him and chooses the one yielding the highest level of utility.

The RUM model links economic choices made by anglers (the cost of travel to a site) to the biological conditions in a fishery (expected catch rate). By using information on how individuals might choose to incur a higher travel cost in order to enjoy a higher expected catch rate, the RUM models is able to predict the loss (or gain) in value resulting from a change in fishing conditions or regulations.

The report demonstrates that recreational fishing in the Northeastern United States is a very valuable resource. The results show that aggregate access values for states such as Massachusetts, Maine, New York, New Jersey, Maryland, and Virginia reach the hundreds of millions of dollars each year. Even states with relatively small numbers of fishing sites such as Connecticut, New Hampshire, and Delaware have aggregate access values that can be tens of millions of dollars.

The methodology used in this report is quite flexible in that it can be used to measure costs to anglers if specific counties are closed, or can be used to measure the benefits to anglers if expected catch rates improve. The versatility of the model will be useful to policy makers who want to consider the socio-economic impacts of management alternatives.

Chapter 1. Marine Recreational Fishing in the Northeast United States

As part of its effort to collect data on recreational fishermen around the United States, NMFS conducted an extensive socio-economic survey of anglers in 1994 in the Northeastern United States (Maine through Virginia). The main goals of the survey were to (1) collect demographic and economic data on marine recreational fishing participants, and (2) estimate statistical demand models for recreational fisheries that were under management in 1994 or were expected to be managed in the near future. As Steinback et al. (1999) report, most of the Northeast fishery management plans for recreational fisheries have not yet imposed restrictions that significantly affect catch, participation or effort by anglers. However, many of the traditionally important recreational stocks in the Northeast are experiencing declines, and more stringent management of these fisheries is expected.

Understanding how anglers make recreational fishing choices is critical to understanding how they will be affected when regulations are imposed. The behavioral models described in this report allow researchers to predict the impact on anglers due to changes in catch rates or in bag limits, or due to seasonal or area closures. Estimation of these models yields a baseline value of access to recreational fishing, as well as information about how changes in some characteristic of the fishing experience will affect the value of the fishing experience. Fisheries managers should be able to use this information to make informed decisions about management options and to develop a better understanding of how each option can be expected to affect recreational fishermen.

This volume presents the estimation of the demand models, and reports the estimated value of recreational fishing in the Northeast in 1994. It is one of a series being prepared by or for NMFS based on similar data collection and analysis efforts. This volume follows a report on the value of Mid- and South Atlantic fishing (McConnell and Strand 1994), and precedes similar reports on the value of South Atlantic and Gulf of Mexico fishing and West coast fishing, due in 2000. The demographic and socio-economic data collected in the survey are described in detail in Steinback et al. (1999).

1.1 An overview of recreational fishing in the Northeast region

Marine recreational fishing is a popular outdoor recreational activity in the Northeast region of the U.S. In 1992, the lowest level of participation in the Northeast during the last ten years, approximately 2.57 million residents of Northeastern coastal states participated in marine recreational fishing in their own state[1]. Participation increased approximately five percent in 1993 (2.7 million) and increased another 14 percent in 1994 (3.1 million), exceeding the ten-year average of 2.9 million. However, participation in 1994 remains the highest level estimated through 1997 for the 1990's (Figure 1.1); after dropping 15% in 1995, the estimated number of anglers in the Northeast increased by only 8% and 3% in 1996 and 1997, respectively.

[1] All recreational catch, effort and participation data used in this report were obtained through personal communication, National Marine Fisheries Service's Division of Fisheries Statistics and Economics.

While participation has slowly increased since 1995, the number of recreational fishing trips, increased approximately 13% between 1994 and 1997, with a high of 24.9 million

Figure 1.1

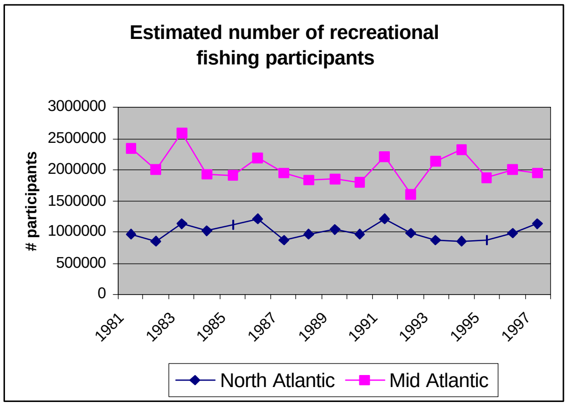
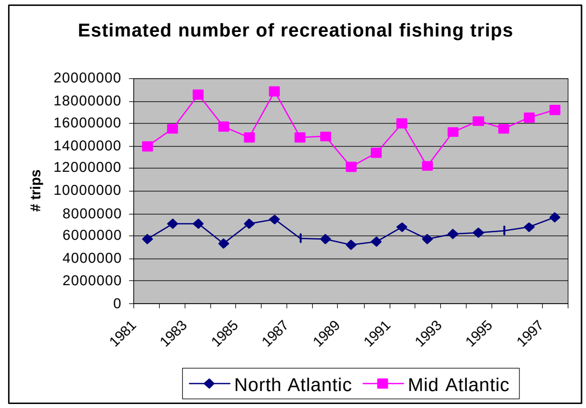


Figure 1.2



trips taken in 1997. An estimated 22.5 million fishing trips were taken in 1994.

As 1994 is the year upon which the demand models are based, it is useful to examine the basic catch and effort data from that year. Table 1.1 shows the numbers of estimated recreational fishing participants in the Northeast by 2-month period in 1994. Not surprisingly, in both the North Atlantic (Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut) and Mid-Atlantic (New York, New Jersey, Delaware, Maryland, and Virginia) regions, the highest levels of participation are experienced between May and August (waves 3 and 4). The MRFSS is not conducted in the Northeast in January-February due to extremely low fishing activity.

Table 1.1: Estimated Participants in 1994, by Wave and Sub-region

		Coastal Residents	**Non-Coastal Residents**	**Total**
North Atlantic	**Mar-Apr**	67,113	3,102	70,215
	May-June	539,298	77,914	617,212
	Jul-Aug	620,118	57,555	677,673
	Sep-Oct	273,688	25,806	299,494
	Nov-Dec	31,717	1,090	32,807
Mid Atlantic	**Mar-Apr**	527,421	9,602	537,023
	May-June	1,230,941	66,294	1,297,235
	Jul-Aug	1,709,730	100,343	1,810,073
	Sep-Oct	778,027	26,414	804,441
	Nov-Dec	289,945	16,642	306,586

Table 1.2 shows the distribution of fishing trips in 1994 by mode and subregion. In the North Atlantic states, angler trips are split almost evenly between the shore (45.1%) and private/rental boat (47.4%) modes, with a small percentage of trips taken on party or

charter boats (7.5%). In the Mid Atlantic states, the majority of trips are taken on private or rented boats (56%), followed by shore-based trips (32.7%) and party or charter boat trips (11.3%).

Table 1.2: Estimated number of trips in 1994, by mode and subregion

	North Atlantic	**Mid Atlantic**
Shore	2,833,781	5,302,010
Party/Charter boat	473,060	1,847,530
Private/Rental boat	2,973,691	9,087,425

Figures 1.2 and 1.3 show the estimated number of fish caught[2] for some important recreational species. Striped bass, scup, and bluefish were the most common recreationally caught species in 1994 in the North Atlantic. Together, these three species

Figure 1.3

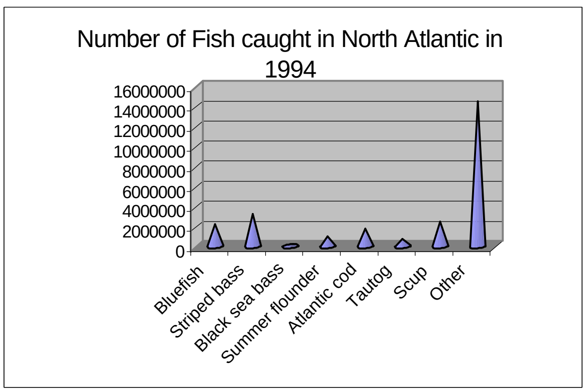
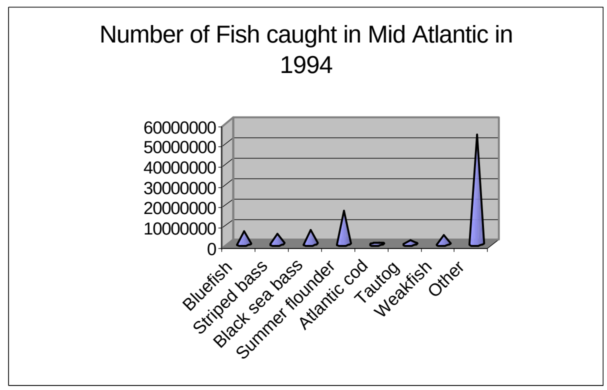


Figure 1.4



comprised roughly thirty percent of the total North Atlantic recreational catch. In the Mid-Atlantic, summer flounder, black sea bass, bluefish, and striped bass accounted for approximately thirty-seven percent of total recreational catches.

1.2 The measurement of economic values using models of recreational demand

The socio-economic surveys were designed to enable the estimation of models that yield (1) the value of access to fisheries (that is, what people are willing to pay for the opportunity to go recreational fishing in a particular area); and (2) the marginal value of catching fish (that is, what people are willing to pay to catch another fish). The models assume that anglers have decided to take a recreational fishing trip (i.e., they have decided to 'participate'). Their next decision is what species of fish to target and which mode to use (e.g., to target striped bass from a private boat). Conditional on their species/mode choice, anglers then decide the site from which to fish. This kind of model is known as a nested random utility model (RUM) (the models are described in detail in Chapter 3) and it allows researchers to estimate the change in value to anglers when, for example, a fishing site is no longer available for fishing, or when the catch rate of a particular species

[2] Catch estimates include the number of fish released alive by anglers.

changes. Estimates of the value of access by state and two-month period are provided, as are estimates of the value to anglers of a change in the catch rate for species groups.

Both pieces of information are valuable to fisheries managers. The first tells managers the worth of the recreational fishery under the current (in this case 1994) conditions, and the loss in value if fisheries were closed down for a period of time. The second piece of information tells managers how anglers will be affected by policies that change the catch rate, for example, by enhancing the stock level or changing the allocation of fish between recreational and commercial fishermen.

The methodology used in this report follows closely that of McConnell and Strand (1994). Their report set the standard for conducting recreational valuation work in NMFS. The structure of their nested RUM models is maintained, as are other important aspects of their methodology. The basic structure of these models will also be employed using data collected in the Southeast United States in 1997, and on the West coast of the United States in 1998. An advantage of consistently using this approach is that parameter estimates can be compared across regions and over time as the surveys are repeated. This will yield important information about whether angler preferences are stable over time and space, and may give some insight regarding how often to survey and whether valuation estimates from one region can be used to describe the value of recreational fishing in another region.

1.3. Description of surveys

The Marine Recreational Fisheries Statistics Survey (MRFSS)
NMFS has operated a comprehensive coast-wide survey of marine recreational anglers since 1979 through its Marine Recreational Fisheries Statistics Survey (MRFSS). The MRFSS is a long-term monitoring program that provides estimates of effort, participation, and finfish catch by recreational anglers. The MRFSS survey consists of two independent, but complementary, surveys: a random digit-dial telephone survey of households and an intercept survey of anglers at fishing access sites.

The intercept survey distinguishes between the mode of fishing (shore, private/rental boat, party/charter boat), and is designed to elicit information about fishing trips just completed by anglers. The basic intercept survey collects information about anglers' home zip code, the length of their fishing trip, the species they were targeting on that trip, and the number of times anglers have been fishing in the past two and twelve months. Trained interviewers record the species and number of fish caught that are available for inspection and weigh and measure the fish. Anglers report the number and species of each fish they caught on the trip that are not available for inspection (released alive or used for bait, for example). The intercept survey provides species composition is to estimate the catch per trip of individual species.

The random telephone survey is used to estimate recreational fishing effort (trips) on a two-month basis (as opposed to annual participation) for coastal households. Effort estimates for coastal households are adjusted by a ratio from intercept data of coastal to non-coastal and out-of-state residents to calculate total effort. Households with individuals who have fished within two months of the phone call are asked about the mode of fishing, the gear used, and the type of water body where the trip took place for every trip taken within that period. The effort estimates are used in the economic valuation work to expand mean trip-level recreational fishing values to aggregate, population values for recreational fishing.

More details about the intercept and the random phone surveys can be found in the MRFSS Procedures Manual (NOAA, 1997).

The 1994 Economic Add-on to the MRFSS

NMFS collected additional socio-economic data from anglers in Maine through Virginia by supplementing the routine MRFSS in 1994. The economic survey was designed as an add-on to the MRFSS to take advantage of sampling, survey design, and quality control procedures already in place. Economic questions were added to the intercept survey and a follow-up survey conducted over the telephone was designed to elicit additional socio-economic information from anglers who completed the add-on economic intercept survey. Data were collected from May through December in 1994 (MRFSS waves 3 through 6). Data were not collected between January and April due to the small number of anglers fishing in the Northeast in these months. Allocation of sampling effort corresponded to the usual MRFSS sampling procedures: by wave, state, and mode, as well as type of day (weekend or weekday) and months within a wave.

The Intercept Survey

The economic field intercept survey of anglers solicited data about trip duration, travel costs, distance traveled, and on-site expenditures associated with the intercepted trip. The survey was conducted by a private survey firm and administered to all marine recreational anglers intercepted in the field that were at least 16 years of age. Data were collected according to the field sampling procedures specified in the MRFSS Procedures Manual. The economic questionnaire was administered either at the completion of the routine MRFSS questions (before inspection of fish) or after all available fish were identified and biological measurements had been obtained. As in the MRFSS, all survey participants, with the exception of beach-bank shore anglers, must have completed their fishing for the day.

A total of 33,117 economic intercepts were attempted in the Northeast Region. Of these, 22,594 (68%) economic intercepts were fully completed. Approximately 10 percent of the surveys (3,364) were terminated because of initial refusals or because interviewees were under the age of 16. The remaining 7,151 surveys were not completed because individuals refused to answer certain key questions. Thus, an overall completion rate of 53% was achieved. Steinback et al. (1999) provide details on the number of MRFSS interviews obtained by state and the subsequent number of associated economic interviews.

The Telephone Follow-up Survey:
Anglers were screened for willingness to participate in the telephone follow-up survey at the time of field intercept. The name and telephone number of individuals willing to participate in the follow-up were obtained at the time of the initial interview. If an angler agreed to participate in the follow-up phone survey, telephone interviewers contacted the angler within three weeks of the date of the intercept survey. Four attempts were made to contact an eligible angler intercepted in the field. Two versions (long and short) of the telephone follow-up survey were administered to participants. The entire version (long) was administered to first time participants. If an angler was intercepted in the field more than once and had previously completed the long telephone follow-up survey, the angler was asked a shorter version of the follow-up on subsequent calls.

The telephone follow-up survey was designed to elicit additional socio-economic information from anglers who completed the add-on economics field survey. The questionnaire targeted two distinct groups of anglers: (1) anglers who targeted -- not merely caught -- bluefish, striped bass, black sea bass, summer flounder, Atlantic cod, tautog, scup or weakfish, and (2) anglers that targeted other species and happened to catch any of these eight species. These species were chosen because they were either under management in 1994 or were expected to come under management in the near future. The telephone follow-up survey also solicited data and information about anglers' recreational fishing avidity, attitudes, and experience.

A total of 14,868 follow-up surveys were attempted in the Northeast Region, of which 8,226 (55%) were completed. Refusals, wrong numbers and households that could not be reached in four calls accounted for the 45% non-response rate. More extensive details regarding the final results of the telephone follow-up survey are provided in Steinback et al. (1999). The intercept survey instrument can be found in Appendix A, while the phone follow-up can be found in Appendix B.

1.4 Aggregation of the data

For tractability of the models estimated, the data are aggregated in two ways. First, while the intent of asking anglers specifically about the eight species listed above was to estimate species-specific demand models, time and data constraints do not allow for species specific models and valuation estimates here. Instead, the species groupings developed by McConnell and Strand (1994) for their analysis of the Mid- and South Atlantic data were maintained. These groupings are: small game fish, bottomfish, flat fish, big game fish, and all other fish. As McConnell and Strand show, their aggregate species group models can be used to value individual species.

The idea behind these groupings is that the decisions anglers make regarding when, where and how to fish for particular species is more similar within a group than across groups, and there may be more substitution of fishing effort within a group. For example, the recreational fishing experience of an individual fishing for striped bass is likely to be more similar to that of an individual fishing for bluefish (both species are included in the small game category), than to the experience of an individual fishing for bluefin tuna (a big gamefish). Similarly, if a regulation is imposed that restricts fishing for striped bass, anglers who would have targeted striped bass are probably more likely to switch their effort to fishing for bluefish (or another species within the small game category) rather than for bluefin tuna.

The individual species included in each of the five groups are listed in Table 1.3. The consequence of this aggregation for the demand models is that the estimates relate to the value of recreational fishing for the entire set of species, rather than for any particular species. For example, the models estimate the value of big game fishing, rather than the value of bluefin tuna fishing specifically.

Table 1.3: Species included in each species group

	Small gamefish	
Striped Bass	Bluefish	Jack
Pompano	Seatrout	Bonefish
Bonito	Snook	Red Drum
Barracuda	Mackerel	
	Bottomfish	
Sandbar Shark	Dogfish Shark	Cat Shark
Sand Tiger Shark	Smooth Dog Shark	Carp
Catfish	Toadfish	Cod/Codfish
Pollack	Hake	Sea Robin
Sea Bass	Sawfish	Grunt
Kingfish	Mullett	Tautog
Butterfish	Nurse Shark	Brown Cat Shark
Porgy/Scup	Sheepshead	Pinfish
Snapper	Grouper	Perch
Black Drum		
	Flatfish	
Summer Flounder	Winter Flounder	Southern Flounder
Sole	Flounders	
	Big gamefish	
Blue Shark	Tuna	Marlin
Thresher Shark	Great Hammerhead	Swordfish
Shortfin Mako Shark	Tiger Shark	White Shark
Smooth Hammerhead	Scalloped Hammer	Tarpon
Billfish	Sailfish	Dolphin
Cobia	Wahoo	

The other significant way in which the data are aggregated is over fishing sites. The MRFSS maintains a highly detailed list of sites at which intercept interviews occur. There may be hundreds of fishing sites, by MRFSS definitions, within a state. Again, for tractability of the models estimated here, sites are aggregated to the county level, for the most part, resulting in 63 sites from Maine through Virginia. The list of aggregate sites is presented in Appendix C.

This paper proceeds as follows. Chapter 2 explains how the fisherman's expected catch rate is calculated. This expected catch rate is an important determinant in the angler's choice of where and how to fish; consequently, it is the important link between the economic behavior of anglers and the natural resource being valued. Chapter 3 describes the RUM and valuation model applied to sportfishermen in the Northeast United States. This chapter details the nested choice structure of mode, species, and location choice made by recreational anglers, and concludes with a discussion of results from the valuation model. Chapters 2 and 3 provide a detailed yet summarized description of the methods. For a more complete description see McConnell and Strand (1994). In Chapter 4, the findings are summarized and there is a discussion of how the results might be useful to policy makers and fishery managers.

Chapter 2. Modeling an Angler's Expected Catch

The RUM methodology employed in this paper examines the choice of where to fish, what species to target, and in what mode to fish[3]. The random utility model assumes that the fisherman compares all of the alternatives available to him and chooses the one yielding the highest level of utility. One important component of this comparison is the daily catch that the fisherman expects to encounter for each alternative available to him. It is assumed that the fisherman does not know with certainty the exact number of fish he would catch under each alternative when deciding how and where to fish, but that he is knowledgeable about past activity that could provide information to him about catch for available alternatives. This assumption is in accord with some basic realities regarding marine recreational angling: fishing is an uncertain activity and even experienced anglers can not be sure how many fish they will catch for a given trip.

There are perhaps other components of a recreational fishing trip that are important to anglers, such as the size of the fish, catch variability, congestion, quality of the surroundings, and other amenities at the recreational site. While these factors are undoubtedly important, daily catch is probably the most important factor for recreational anglers, and it is the only measure of fishing quality used in this study.

In general, there have been three approaches used in the literature to model an individual's daily catch rate (see Freeman, 1995, for an excellent review of this literature). The first method uses subjective information about the fishing alternatives to rank them. This subjective information is elicited from either the anglers or from a person knowledgeable about recreational angling (see for example Wegge, T.C., R. T. Carson and W. M. Hanemann). The second method, often referred to as the historic catch rate method (Morey, Rowe, and Shaw; and McConnell and Strand), uses information about past fishing activity for a fishing alternative to calculate the fisherman's daily catch by averaging the number of fish caught for each angler in a particular strata[4]. The final method, referred to as the expected catch rate method (McConnell and Strand, 1994), uses the historic catch rate and information about each angler (e.g., experience and hours fished) in order to estimate a daily catch rate. This method provides a measure that captures two sources of variability when calculating daily catch: variability across fishing alternatives and across anglers.

For this study, only the historic catch rate and expected catch rate methods were considered. All models are estimated using both types of catch rates. Differences in the results across catch rates were similar to those reported in McConnell and Strand. Only the results from the historical catch model are presented in this report. Our findings showed that the historical catch model provided more conservative estimates of value across all of the scenario changes listed in the report- a finding consistent with the McConnell and Strand report. Since the intent of this report is to convey aggregate estimates of the value of sportfishing, we present the more conservative estimates of that value here.

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[3] Hereafter, the angler's choice among sites, species, and modes is referred to as the choice among fishing alternatives.

[4] Other studies have used variations of this approach. For example, some studies have used the average catch per hour as a measure of the fisherman's expectations.

The use of historic catch information

In the random utility model it is assumed that individuals compare their utility across all of the fishing sites they consider. Clearly, one of the key components of this comparison is the catch rate they expect to encounter at a given site. The statistical model requires that data be available on their expected catch at all sites considered. Further, we assume that catch rates can differ by wave, species group targeted, and mode. Essentially, this requires that we have a data matrix of historical catch rates for 4 waves, 5 species groups, 3 modes, and 63 sites for a total of 3,780 expected catch rates estimates. An incredibly large number of catch rates need to be calculated. Fortunately, the MRFSS data has a very good historical time series of catch data by wave, mode, and county, collected since 1979. That is, we can use historical data to calculate an average catch per trip, by target species, wave, mode, and county.

Even with this extensive database, missing values were encountered for numerous alternatives defined by wave, mode, target species. We calculated historic catch rates per trip by averaging actual catches by wave, mode, target species, and site over the period 1990-1994. We chose not to go further back than 1990 because some major changes were occurring for some important recreational fisheries, most notably striped bass. To give the reader some idea of the magnitude of the problem, over fifty percent of our database contained missing values for a wave, target species, mode, and site.

McConnell and Strand encountered this problem also. Their strategy was to use as long a time series as possible, recognizing that too long a time series might obscure more current trends in average catch per trip. They handled missing values using an *ad hoc* method assigning values from neighboring sites where it made sense to do so. If no sensible proximity based assignment could be made**,** a value of zero was assigned to the site. Further, their method varied by mode. For example shore fishing, is perhaps the most geographic specific mode of fishing, compared to boat modes. The assignment of nearby catches to alternatives containing missing values proceeded based upon common sense knowledge of the fishery and geographic proximity.

Other strategies are equally *ad hoc*. For example, one might assign a catch rate of zero to those wave, mode, target species, and sites having missing values. This strategy implicitly assumes that fishermen might consider the site, but recognize at least for that particular mode and species that the site is probably not very productive. Another approach is to assume that if there was no activity for a given wave, mode, species, and site, over some historic time period, then the site is not a viable alternative and is not considered by anglers. This approach is the most restrictive in its treatment of choice set definition.

For this paper, all estimations were performed using two treatments of missing values. In the first case, a catch rate of zero was assigned to any wave, mode, target species, and site that had missing values. Missing values were also handled by assigning the catch rate of nearby sites, when it made sense to do so. Fortunately both methods provided consistent results. That is, the treatment of missing values did not significantly affect the findings reported here. The results presented here are based upon assigning missing values a value of zero since it seemed to require less arbitrary judgements by the researcher.

Chapter 3. The Nested Random Utility Model Of Recreation Demand

In this chapter, the expected catch rate information is combined with revealed choices made by anglers: where and how to fish. The information is used to estimate a RUM of recreation demand for saltwater angling in the Northeast United States (Maine through Virginia). The RUM model is then used to describe how anglers react to changes in expected catch rates, and other important factors. The RUM is used to calculate the expected change in economic welfare from area closures and changes in catch rates at the state and wave level.

An important feature of the RUM model is that it implicitly acknowledges that anglers have substitutes and can substitute away from area closures and changes in catch rates by choosing to fish in another area, choosing to target another species, or choosing to fish in a different mode. A failure to account for substitutes in models of recreation demand tends to overstate the economic welfare from the resource by failing to recognize that people have other choices open to them. Using Monte Carlo simulations, Kling (1987) demonstrates that the RUM approach yields value estimates that are the most accurate when substitution considerations are a critical component of choice**.**

The RUM's treatment of substitutes comes with a cost. The RUM as applied to the Northeast data requires a careful definition of the choice structure, which then dictates the data requirements of the model. In this study the choice structure developed in McConnell and Strand (1994) is implemented. Individuals are assumed to choose a mode/species to target and then conditional on that choice, they choose where to fish. Given the definition of mode, species, and sites described in Chapter 1, an individual could be faced with deciding among 945 alternatives.

This study examines only choices made by fishermen that reported being on single-day fishing trips. Consequently, one constraint on the angler's choice set is that the site must be within a one-day roundtrip drive from the person's home. The choice set is narrowed by using a distance-based choice set approach used in McConnell and Strand. If the closest site is within 30 miles from the angler's home then all sites within 150 miles are assumed to be in their choice set; otherwise, all sites within 400 miles are assumed to be in their choice set.

To properly apply the RUM model, data are needed for the actual choice made by the individual (choice of site, mode, and species) and for all other alternatives considered. Even after limiting the choice sets of individuals there are numerous alternatives open to them.

Because the RUM approach requires data for all alternatives in the person's choice set, we use the historical catch rate as described in Chapter 2 across all alternatives. Distances to each of the sites are calculated by PC-Miler based on residence-site zip code pairs.   Based on these distances, travel times and time costs can be calculated.

Table 3.1 details the mode/species combinations modeled in this study. As in McConnell and Strand, the Shore/Big Game combination is not considered a feasible choice and is omitted. The private rental/bottom fish mode was also omitted from the analysis. There were very few observations for this group.

Table 3.1. Mode/Species Combinations, Mnemonics, Proportion of Total Trips

Mode	**Species Group**	**Mnemonic**	**Proportion of Total Trips**
Party/Charter	Big Game	PCBG	0.4 %
	Small Game	PCSG	3.6
	Bottomfish	PCBF	4.5
	Flatfish	PCFF	3.6
	Not Targeting	PCNT	4.1
Private Rental	Big Game	PRBG	1.0
	Small Game	PRSG	25.5
	Flatfish	PRFF	17.0
	Not Targeting	PRNT	9.4
Shore	Small Game	SHSG	13.1
	Bottomfish	SHBF	3.0
	Flatfish	SHFF	5.4
	Not Targeting	SHNT	9.5

3.1 The model

The random utility model of recreation demand employed here models the choice of where and how to target fish given that an individual has chosen to go fishing. The participation decision is not investigated here.

For each fishing trip, the fisherman chooses the best fishing alternative by comparing his indirect utility function for each alternative and choosing the one that maximizes his utility. Following McConnell and Strand, it is assumed that the individual first chooses mode and species and then conditional on this choice, chooses the recreation site. Let the indirect utility function for site a, mode m, and species s be given by

$$V_{ams} = \beta z_{ams} + \gamma w_{ms} + \varepsilon_{ams}$$

Notice that the individual's indirect utility function has several components: z_{ams} is a vector of attributes that is specific to area, mode, and species, while w_{ms} contains variables which are specific to only mode and species. The indirect utility function also contains parameter vectors, β and γ, and an error component ε_{ams}. This error is part of the individual's indirect utility function not observed by the researcher. The model presented above is consistent with the nested logit model with appropriate restrictions on the error term (see Domencich and McFadden, 1975, and McFadden, 1978).

Figure 3.1 shows a simplified example of the nested choice structure used in this study. An individual chooses among 2 species, 2 modes, and 2 sites giving rise to eight distinct alternatives. The individual first chooses the species and mode to fish and then decides the site.

Given the nested structure of the individual's choice set, one can write the probability of an individual choosing site *a* conditional on the mode/species choice ms as

$$P(a \mid ms) = \frac{\exp\left(\dfrac{\beta z_{ams}}{(1-\sigma)}\right)}{\sum_{b \in A} \exp\left(\dfrac{\beta z_{bms}}{(1-\sigma)}\right)}$$

The probability of choosing the mode/species combination ms is

$$P(ms) = \frac{\exp(\gamma w_{ms} + (1-\sigma) I_{ms})}{\sum_{ij \in A} \exp(\gamma w_{ij} + (1-\sigma) I_{ij})}$$

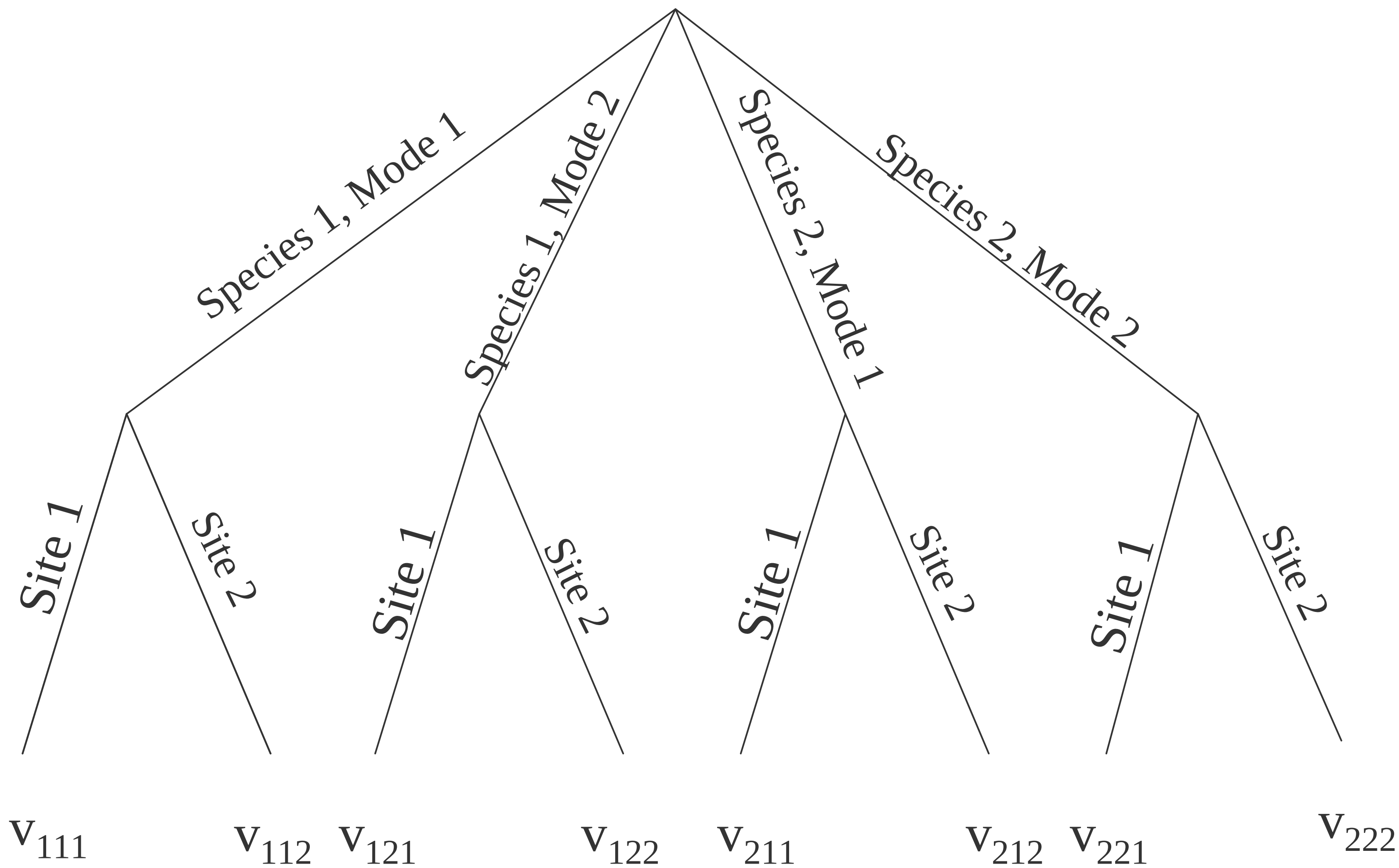
where

$$I_{ms} = \ln\left(\sum_{b \in A} \exp\left(\frac{\beta z_{bms}}{(1-\sigma)}\right)\right).$$

The term I_{ms} is called the inclusive value for mode/species choice ms, and captures information about the sites conditional on the choice of ms.

Several assumptions are implicit in the above specification. Behavior is modeled on a trip-by-trip basis. The model as presented so far does not allow the individual to modify the number of trips taken during a season. Similarly, each choice occasion is independent of the next. In the model above, the unobservable component of the individual's indirect utility function is independent of any other trips taken by the individual. These assumptions are used to make the empirical model tractable.

Figure 3.1 The Nested RUM Model



3.2 Estimating the model

A limited information maximum likelihood technique is employed that estimates the conditional site utility model and the mode/species choice model in a sequential manner[5,6]. The variables used in the analysis are given in Table 3.2. Because there is probable heterogeneity among the different species groups, a different catch coefficient is estimated for each group. This allows the marginal utility of catching an additional fish to vary with species groups. For example, one might expect the marginal utility of catching an additional big game fish to be different from catching an additional flatfish.

Also included in the utility functions are variables describing costs to the individual of participating in the recreation trip. These costs can be broken into two components: travel costs and time costs. It is hypothesized that all other things equal, an individual will choose a site with a lower travel cost (including fuel and depreciation of the vehicle). Additionally, time is valuable to individuals. By choosing to participate in a recreational fishing trip, an individual is foregoing additional wages or some other leisure activity. The specification of travel cost and travel time takes into account the opportunity cost of time, and distinguishes between those persons having a flexible work schedule (who can trade time-off for foregone wages) and those with fixed schedules (see Bockstael, Hanemann, and Strand, 1986).

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[5] The limited information maximum likelihood estimator used for this paper provides consistent though inefficient estimates for the standard errors for the mode/species choice model (see McFadden (1982)).

[6] Attempts at estimating a full information maximum likelihood (FIML) version of this model proved unsuccessful. Examples of FIML estimations of which the authors are aware have significantly smaller choice sets than this model.

Table 3.2 Variables used in the analysis

Variable	Definition
TC	Travel Cost = $.30*distance + wage*time*interior[7] Distance: roundtrip distance calculated from PC Miler Wage: annual income/2040 hours Interior: dummy equaling 1 if the person can work extra hours for extra pay, 0 otherwise Time: roundtrip travel time, predicted from self reported time and calculated travel time (distance/40)
TT	Travel Time = time*(1-interior)
$Q_{s,m,i}$	Historical catch rate per trip for species group s, mode m, and site i
Ln(M)	Log of the number of NMFS interview sites in aggregated sites
PRDUM	Equals 1 if private/rental mode and individual owns a boat, otherwise zero
CPRDUM	Cold Private/Rental boat ownership dummy. Equals 1 if PRDUM=1 and wave=6, otherwise zero.

The other variable in the conditional site utility model describes the number of MRFSS intercept sites contained within the aggregate sites. This variable is included to account for possible aggregation bias. All other things equal, a person may be more likely to visit a county if there are more recreation sites within that county.

Two variables are included to explain how individuals choose among the mode/species combinations. First, individuals who own boats may be more likely to choose any of the private/rental modes. This variable is then interacted with a variable that indicates if the fishing activity is occurring during the cold months (November-December). This cold variable is likely to dampen the effect of owning a boat and choosing the private rental mode. The probability model also requires the estimation of an inclusive value parameter, $(1-\sigma)$. This parameter describes how information in the conditional site choice utility model influences the choice of mode/species. *A priori*, it is expected that individuals will prefer mode/species combinations with a higher expected utility from the conditional site utility model, all other things equal.

Table 3.3 shows the specification of the utility functions for each mode/species combination. Variables and parameters of the utility function are divided into those that are in the conditional site choice utility model and those that are in the mode/species choice utility model. Only those alternatives pertaining to the Private Rental mode explicitly contain variables for the mode/species choice. An inclusive value term will also be estimated for the mode/species choice level of the model.

[7] The Federal Travel Regulations set the reimbursement rate at $.30 per mile in 1994.

Table 3.3 The Maximum Likelihood Utility Model: Utility Specification

Variables in the conditional site choice utility model					Variables in the mode/species choice utility model	
V(i,PC,BG)=	$\beta_1 TC_i$ +	$\beta_2 TT_i$ +	$\beta_3 \ln(M_i)$+	$\beta_4 Q^{1/2}_{BG,PC,i}$		
V(i,PR,BG)=	$\beta_1 TC_i$ +	$\beta_2 TT_i$ +	$\beta_3 \ln(M_i)$+	$\beta_4 Q^{1/2}_{BG,PR,i}$ +	β_9PRDUM+	β_{10}CPRDUM
V(i,PC,SG)=	$\beta_1 TC_i$ +	$\beta_2 TT_i$ +	$\beta_3 \ln(M_i)$+	$\beta_5 Q^{1/2}_{SG,PC,i}$		
V(i,PR,SG)=	$\beta_1 TC_i$ +	$\beta_2 TT_i$ +	$\beta_3 \ln(M_i)$+	$\beta_5 Q^{1/2}_{SG,PR,i}$ +	β_9PRDUM+	β_{10}CPRDUM
V(i,SH,SG)=	$\beta_1 TC_i$ +	$\beta_2 TT_i$ +	$\beta_3 \ln(M_i)$+	$\beta_5 Q^{1/2}_{SG,SH,i}$		
V(i,PC,FF)=	$\beta_1 TC_i$ +	$\beta_2 TT_i$ +	$\beta_3 \ln(M_i)$+	$\beta_6 Q^{1/2}_{FF,PC,i}$		
V(i,PR,FF)=	$\beta_1 TC_i$ +	$\beta_2 TT_i$ +	$\beta_3 \ln(M_i)$+	$\beta_6 Q^{1/2}_{FF,PR,i}$ +	β_9PRDUM+	β_{10}CPRDUM
V(i,SH,FF)=	$\beta_1 TC_i$ +	$\beta_2 TT_i$ +	$\beta_3 \ln(M_i)$+	$\beta_6 Q^{1/2}_{FF,SH,i}$		
V(i,PC,BF)=	$\beta_1 TC_i$ +	$\beta_2 TT_i$ +	$\beta_3 \ln(M_i)$+	$\beta_7 Q^{1/2}_{BF,PC,i}$		
V(i,SH,BF)=	$\beta_1 TC_i$ +	$\beta_2 TT_i$ +	$\beta_3 \ln(M_i)$+	$\beta_7 Q^{1/2}_{BF,SH,i}$		
V(i,PC,NS)=	$\beta_1 TC_i$ +	$\beta_2 TT_i$ +	$\beta_3 \ln(M_i)$+	$\beta_8 Q^{1/2}_{NS,PC,i}$		
V(i,PR,NS)=	$\beta_1 TC_i$ +	$\beta_2 TT_i$ +	$\beta_3 \ln(M_i)$+	$\beta_8 Q^{1/2}_{NS,PR,i}$ +	β_9PRDUM+	β_{10}CPRDUM
V(i,SH,NS)=	$\beta_1 TC_i$ +	$\beta_2 TT_i$ +	$\beta_3 \ln(M_i)$+	$\beta_8 Q^{1/2}_{NS,SH,i}$		

Model estimates are reported in Table 3.4. The signs of all of the parameters met with prior expectations. Anglers preferred sites with smaller time and travel cost components holding all other things equal. Similarly, anglers preferred sites with higher expected catch rates regardless of what species group was targeted.

Table 3.4 Parameter Estimates from Expected Catch Model.

Variable	**Mean of Variable**	**Parameter**	**Estimate (t-statistic)**
Conditional Site Choice Model			
Travel Cost (Dollars)	61.84	$\beta_1/(1-\sigma)$	-.036 (-10.46)
Travel Time (Hours)	3.69	$\beta_2/(1-\sigma)$	-1.141 (16.12)
Ln(M)	3.11	$\beta_3/(1-\sigma)$	1.247 (33.99)
Big Game Catch	.003	$\beta_4/(1-\sigma)$	.974 (2.69)
Small Game Catch	.39	$\beta_5/(1-\sigma)$	.579 (8.68)
Bottomfish Catch	.19	$\beta_6/(1-\sigma)$	.572 (100.68)
Flatfish Catch	.26	$\beta_7/(1-\sigma)$	.665 (58.23)
Non-seeking Catch	.20	$\beta_8/(1-\sigma)$	.324 (15.23)
χ^2 (all parameters=0)			2780.15
Mode/Species Choice Model			
Inclusive Value	4.90	$(1-\sigma)$	.612 (19.99)
Private Rental Dummy	.15	β_9	2.490 (42.02)
Cold*Private Rental Dummy	.020	β_{10}	-.553 (4.08)
χ^2 (all parameters=0)			2172.46

3.3 Welfare estimation

The above results, combined with properties of the RUM model, can be used to describe how an angler's behavior might change with a change in any of the variables in the utility function given above. The flexibility of the model allows the estimation of welfare changes from policies that may close a particular fishery or improve the expected catch rates, for example. Welfare measures can be a valuable policy tool because they describe how potential policy measures may benefit or cost recreational anglers. By considering the welfare of anglers before enacting policy measures in a fishery, managers can make informed decisions to meet biological management objectives while maximizing the net benefits to the nation.

The welfare measure used here compares the indirect utility after a policy change, $V(P^1)$, with a baseline level of indirect utility $V(P^0)$, and converts the difference in utility levels into dollar measures. The baseline level of utility is measured by evaluating the individual's utility function at the variable levels found at the time of data collection. Two policy changes, P^t, are considered in this report. First, all sites in a state are closed to measure the access value of fishing in the state for all anglers. Second, the expected catch rate is increased for all anglers to measure the marginal willingness to pay for an increase in the expected catch by one fish at all sites. We also increase the historic catch rates at each site by 1 fish. Define the expected utility under situation t as

$$V(P^t) = \ln\left[\sum_{ij\in A}\left\{\sum_{b\in A}\exp\left(\frac{V_{bij}^t}{(1-\sigma)}\right)\right\}^{1-\sigma}\right],$$

where

$$V_{bij}^t = \beta_1 TC_b{}^t + \beta_2 TT_b{}^t + \beta_3 \ln(M_b)^t + \beta_i Q_{bij}^{\frac{1}{2}\,t} + \beta_4 PRDUM_{ij}{}^t + \beta_5 CPRDUM_{ij}{}^t$$

Using this notation, the welfare change from situation 0 to 1 can be written as

$$W = \frac{V(P^0) - V(P^1)}{\beta_1}.$$

The measure given above describes changes in well-being relative to other substitutes open to the individual. For example, if the person's choice set is small it is likely that closing a state will impact him significantly leading to a relatively large willingness to pay for fishing in the state. Because the RUM model measures well-being relative to remaining substitutes, the model is not equipped to handle policy changes that might eliminate all fishing alternatives for individuals. Consequently, the total value of sportfishing for the Northeast United States cannot be measured with this model. However, one could measure the economic value of a component of sportfishing such as striped bass fishing. In general, as long as there are alternatives remaining in the individual's choice set following the policy change, the RUM model can estimate the individual's change in welfare.

Table 3.5 shows, on average, what anglers are willing to pay for a one-day fishing trip, by state and wave. Values derived in this table were calculated across all anglers in the Northeast sample. These values demonstrates that any angler, even those not intercepted in the state being closed, might be willing to pay for a one-day fishing trip in the state as long as sites in that state enter his choice set. On average, Virginia had the highest willingness to pay, with New York following closely behind.

The magnitude of the values in Table 3.5 reflect both the relative fishing quality of a state and the ability of anglers to choose substitute sites. Closures of large states will tend to lead to large welfare estimates, since anglers residing in that state may need to travel significant distances to visit alternative sites.

Because the valuation estimates are contingent upon the remaining substitutes in the model, there are several factors that should be considered when examining the values in Table 3.5. Note that Virginia has relatively high willingness to pay estimates given its relative size and fishing quality characteristics. Virginia defines the southern geographic boundary for a person's choice set, a definition that is arbitrary in nature. For example, an angler in southern Virginia is likely to have a choice set that contains sites in North Carolina. The regional focus of the survey effort ignores these potential substitutes and therefore the valuation estimates may be biased upward.

Table 3.5 Closure Of All Fishing Sites In A State: Mean Loss Per Trip for all anglers

State	May-June	July-Aug.	Sep.-Oct.	Nov.- Dec.	Mean for All Waves	% Change in Choice Set
Virginia	$27.26	$35.12	$41.66	$86.24	$42.33	- 15%
Maryland	13.63	11.53	14.06	7.36	12.09	- 12
Delaware	1.81	1.60	0.83	1.43	1.43	- 07
New Jersey	16.68	13.54	13.73	11.84	14.12	- 13
New York	20.86	20.86	21.36	24.79	21.58	- 18
Connecticut	3.48	3.29	2.71	2.54	3.07	- 08
Rhode Island	3.82	4.51	4.73	3.42	4.23	- 08
Massachusetts	8.54	8.58	9.90	5.04	8.38	- 11
New Hampshire	1.11	1.07	0.78	0.01	0.85	- 02
Maine	7.90	8.06	6.47	0.00	6.40	- 05

Note that values cannot be added across states, since values are calculated contingent upon all of the other states being available to the angler. Suppose one wished to know the willingness to pay for a fishing trip within Virginia and Maryland for all anglers. One cannot add the per wave estimates in Table 3.5. To calculate the loss in value for this case, the welfare measure would need to be recalculated while simultaneously closing the states of Maryland and Virgina. The reader should note that welfare estimates of access value can be calculated by county, groups of counties, or even groups of states.

McConnell and Strand detail several methods for aggregating per-trip values. In general, it is expected that anglers might adjust the number of trips taken during a two-month period as a result of a change in the fishing experience (for example, a change in catch rates, or a site closure). The RUM model, which models behavior on a per-trip basis, has never been explicitly linked to changes in the number of trips per season in utility theoretic way. Consequently, aggregation methods presented in McConnell and Strand are *ad hoc,* and one is not preferable to the others based on theoretical grounds. In this report, values are aggregated by assuming that anglers will not adjust their trip-taking behavior as a result of policy changes. This assumption yields more conservative aggregate values than the other methods outlined in McConnell and Strand. Table 3.6 shows the estimated total number of trips taken by anglers by state and by wave.

Table 3.6. Number of trips in the Northeast United States in 1994 (as estimated by the MRFSS).

Wave	Total Trips (1000's)
May-June	5,296
July August	9,453
September-October	5,133
November-December	1,491
Total	21,373

Table 3.7 shows the aggregate access values by state and by wave for all anglers in the Northeast. The table also reports a total aggregate value for each state. The results indicate that Virginia has the highest aggregate value followed again by New York.

Table 3.7 Aggregate Willingness to pay for a one-day fishing trip, by wave, 1994. $1000's (Total Trips by wave x per trip access value).

State Closed	May-June	July-Aug.	Sep.-Oct.	Nov.- Dec.	All Waves
Virginia	$ 144,369	$ 331,989	$ 213,841	$ 128,584	$ 904,719
Maryland	72,184	108,993	72,170	10,974	258,400
Delaware	9,586	15,125	4,260	2,132	30,563
New Jersey	88,337	127,994	70,476	17,653	301,787
New York	110,475	197,190	109,641	36,962	461,229
Connecticut	18,430	31,100	13,910	3,787	65,615
Rhode Island	20,231	42,633	24,279	5,099	90,408
Massachusetts	45,228	81,107	50,817	7,515	179,106
New Hampshire	5,879	10,115	4,004	15	18,167
Maine	41,838	76,191	33,211	0	136,787

Table 3.8 presents welfare measures for a one fish change in catch rates for each species group by state of intercept. For example, the big game values for Virginia represent Virginia intercepted anglers' willingness to pay for a one fish increase in the big game expected catch rate across all sites in their choice set. Note that the highest average value is attributed to big game fish while the lowest is bottom fish.

Table 3.8 An Increase Of +1 Fish In Historic Catch Rates at all sites: Gains Per Trip by state and species group.

State	Big Game	Small Game	Bottom Fish	Flat Fish
Virginia	$4.57	$2.46	$1.79	$3.36
Maryland	6.51	3.44	2.44	5.30
Delaware	5.58	3.00	2.06	4.24
New Jersey	5.03	2.69	1.73	3.48
New York	4.61	2.43	1.63	3.10
Connecticut	5.99	3.29	2.25	4.43
Rhode Island	5.73	3.13	2.11	4.40
Massachusetts	5.91	3.09	2.04	4.33
New Hampshire	6.20	3.25	2.14	4.77
Maine	6.61	3.74	2.62	5.75
All States	5.39	2.89	1.97	4.01

Assuming that anglers will not adjust their trip taking behavior when catch rates at all sites increase by one fish, we can aggregate by multiplying the average value across all states times the number of participants in 1994. This shows (Table 3.9) that an improvement in big game and flat fish conditions will lead to the highest welfare gain.

Table 3.9 Aggregate Willingness to pay for a 1 fish increase in the historic catch rate, by wave, 1994 (Total Trips by wave x average per trip value).

Species	$'s per choice occasion Mean	Aggregate ($1000's) Total Trips x Mean
Big Game	$ 5.39	$ 115,200
Small Game	2.89	61,768
Bottom Fish	1.97	42,105
Flat Fish	4.01	85,706

The reader should note that the welfare measures presented in this report are meant to be measures of large changes in either access or fishing conditions since the aim of this paper is to give the reader a sense of the value of recreational fishing in the Northeast in an aggregate sense. The model is capable of measuring a myriad of other changes in fishing conditions. For example, the model is well suited for analyzing the welfare changes associated with changes in fishing conditions at specific counties, closures of counties, and simultaneous closures and changes in fishing conditions. Additionally, the model can be used to measure the effects of extremely large changes in fishing conditions such as closures across multiple states, or a complete moratorium on fishing for a particular species groups, etc.

Chapter 4. Conclusions

This report demonstrates that recreational fishing in the Northeastern United States is a very valuable resource. The results show that aggregate access values for states such as Massachusetts, Maine, New York, New Jersey, Maryland, and Virginia reach the hundreds of millions of dollars. Even states with relatively small numbers of sites such as Connecticut, New Hampshire, and Delaware have aggregate access values that can be in the tens of millions of dollars range.

The methodology used in this report is quite flexible in that it can be used to measure costs to anglers if specific counties are closed, or can be used to measure the benefits to anglers if expected catch rates improve. The versatility of the model will be useful to policy makers who want to consider the socio-economic impacts of management alternatives.

It is important to note that this reports only captures one component (though perhaps the most significant) of value attributable to recreation fishing in the Northeast. This type of value is often referred to as the use value since it measures the value of recreational fishing to users of the resource. There are certainly other types of value that could be categorized as non-use value. For example, persons who do not fish recreationally may derive value knowing that there is a recreational fishery and that they have the option to participate. Similarly, others who may never desire to fish recreationally, may derive value knowing that there is a recreational fishery based on ethical or environmental concerns. These non-use values are not captured in this report.

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APPENDIX A: INTERCEPT SURVEY INSTRUMENT

Add-On Intercept Survey Instrument

(IF INTERVIEWER IS NOT CERTAIN RESPONDENT IS AT LEAST 16 YRS OF AGE, SIMPLY ASK RESPONDENT IF HE/SHE IS AT LEAST 16 YRS OF AGE. IF < 16 YRS OF AGE, THEN TERMINATE AND THANK RESPONDENT.)

1*. Are you on a one-day fishing trip or was this day of fishing part of a longer trip in which you spent/plan to spend at least one night away from your residence?

One day	1))▸ **GO TO Q.7.**
Longer	2
Don't Know	8
Refused	9

2. How many days will you be away from your residence on this trip?

ENTER NUMBER	
Don't Know	88
Refused	99

3. How many days of this trip will be spent fishing?

ENTER NUMBER	
Don't Know	888
Refused	999

4*. How much did you, <u>personally</u>, pay for lodging on this trip?

ENTER NUMBER	
Don't Know	888
Refused	999

5. How long did it take you to travel one-way from your residence to those lodgings?

ENTER NUMBER	
Don't Know	888
Refused	999

6. Would you have made this trip if you did not go fishing?

Yes	1
No	2
Don't Know	8
Refused	9

7*. How long did it take you to travel from where you stayed last night to the fishing or boat launch site?

ENTER NUMBER	
Don't Know	888
Refused	999

8. **(If fished by boat, PC or PR--Q.11. MRFSS)** How long did it take you to travel from the boat launch site to the first fishing site?

ENTER NUMBER

Don't Know 888
Refused 999

9*. How much did you, personally, spend to travel from your residence to the fishing or boat launch site (one-way costs)? Please consider expenditures on travel fares, gas, tolls, ferry and parking fees.

ENTER NUMBER
Don't Know 8
Refused 9

10*. I appreciate your time for this interview. There is another part to this survey that involves a short follow-up interview by telephone. Would you be willing to participate in this follow-up survey?

Yes 1
Don't Know 8
Refused 9

IF ANGLER DID NOT RELEASE NAME/AND OR PHONE NUMBER DURING MRFSS PORTION OF THE SURVEY (Q.24. MRFSS), STATE: TO PARTICIPATE, MAY I HAVE YOUR NAME AND A PHONE NUMBER?

Thank you for your time !

APPENDIX C: PHONE FOLLOW-UP SURVEY INSTRUMENT

Telephone Follow-Up To Intercept Survey Instrument

Hello, may I speak with __________ **(IF RESPONDENT IS NOT AVAILABLE, ASK FOR BEST TIME TO CALL BACK)**

Hello, I'm _______ calling long distance from KCA Research Division in Alexandria, VA. I'm calling about your fishing trip on _________ (ENTER DAY/DATE). As you recall, after that trip you participated in a survey conducted for the National Marine Fisheries Service. Your participation in this follow-up survey is very important since only a limited number of households have been selected to participate. The information you give will be coded with the answers of others to ensure your confidentiality. **(IF IT IS OBVIOUS THAT THE RESPONDENT HAS BEEN CONTACTED BY TELEPHONE BEFORE TO DISCUSS ANOTHER TRIP, PROCEED WITH INTERVIEW BUT TERMINATE AFTER Q.9.)**

IF INTERCEPTED TRIP WAS THE ONLY TRIP TAKEN WITHIN THE PAST 2 MONTHS (Q.19. MRFSS), SKIP TO 4.**

1. Counting the day you were interviewed you stated that you had fished ______ days within the past 2 months (Q.19. MRFSS). On how many of those days did you target either bluefish, striped bass, black sea bass, summer flounder, Atlantic cod, tautog or scup (substitute weakfish for scup in the Mid-Atlantic). **(IF RESPONDENT HESITATES, STATE: WE ONLY HAVE A FEW QUESTIONS ABOUT THOSE TRIPS; WE'RE NOT GOING TO ASK DETAILED QUESTIONS ABOUT EACH INDIVIDUAL TRIP.)**

ENTER NUMBER	
Don't Know	888
Refused	999 ► **GO TO 4**.**

*2 . On the day that you were interviewed you stated that you targeted ______ on that trip (Q.14. MRFSS). On how many days within the past 2 months did you target ______ (insert target species).

ENTER NUMBER	
Don't Know	888
Refused	999

*3 . On how many days within past 2 months did you fish at the site where the interview took place?

ENTER NUMBER	
Don't Know	88
Refused	99

4. On how many of those days (fished at site where interview took place) did you target _______ (Q.2., target species).

ENTER NUMBER	
Don't Know	88
Refused	99

4. (IF TRIP WAS ONE-DAY TRIP--Q.1. ADD-ON INTERCEPT SURVEY = 1 SKIP TO Q.6.
IF TRIP WAS MULTIPLE DAY TRIP--Q.1. ADD-ON INTERCEPT SURVEY = 2 GO TO Q.5.
IF DIDN'T KNOW OR REFUSED Q.1. = 8 OR 9 SKIP TO Q.6.)**

5. How many overnight trips did you take during the past 2 months?

ENTER NUMBER	
Don't Know	88

Refused	99

6. What would you say is the main reason why you chose to fish at that site where you were interviewed?

I always go there	1
Better catch rates (access to species)	2
Convenient	3
Less Congestion	4
Weather or Water Conditions	5
Scenic Beauty at the Site	6
Access to pier, jetty, bridge, beach/bank	7
Boat Ramp (Quality of or existence of)	10
Pre-paid Access Fee	11
Combination of (up to 3)	? ? ?
Other (Specify)	12
Don't Know	8
Refused	9

*
7 . **(If fished from party/charter or rental boat)** How much did you, personally, spend on boat fees for that trip?

ENTER NUMBER	
Don't Know	888
Refused	999

8. How many years have you been saltwater recreational fishing?

ENTER NUMBER	
Don't Know	88
Refused	99

9. Compared to your other outdoor recreation activities during the last two months (such as swimming, tennis, golf, etc.), would you rate fishing as:

Your Most Important Outdoor Activity	1
Your Second Most Important Outdoor Activity	2
Only One Of Many Outdoor Activities	3
Don't Know	8
Refused	9

10. People list many different reasons why they like to go saltwater fishing. Please rate each, of the following items I state as Not Important, Somewhat Important, or Very Important.

Not Important	1	Somewhat Important	2	Very Important	3
		Don't know	8		
		Refused	9		

A. To spend quality time with friends and family
B. To enjoy nature and the outdoors
C. To catch fish to eat
D. To experience the excitement or challenge of sport fishing
E. To be alone
F. To relax and escape from my daily routine
G. To fish in a tournament or when citations are available
H. Other (specify)

11. Considering the species you typically fish for, indicate whether you support or oppose the following conservation measures used to restrict total catch.

Support	1	Oppose	2
Don't Know	8	Refused	9

A. Limits on the minimum size of fish you can keep
B. Limits on the number of fish you can keep
C. Limits on the times of the year when you can keep the fish you catch
D. Limits on the areas you can fish

VERSION 1

12*. The current daily bag limit for striped bass in (ENTER STATE) ____ is (ENTER STATE BAG LIMIT) ____ fish. Suppose you could choose to buy a special license that would increase your daily bag limit from (ENTER STATE BAG LIMIT) ____ to (ENTER STATE BAG LIMIT + 1) ____ fish. If you chose not to buy the license, your daily bag would still be (ENTER STATE BAG LIMIT) ____ fish. What would be the maximum amount of money you would be willing to pay for this special license?

ENTER NUMBER		► **IF $0 GO TO Q.12A.**
Don't Know	888	
Refused	999	► **IF > $0 GO TO Q.13.**

STRIPED BASS BAG LIMIT BY STATE

ME	1	RI	1
CT	1	NH	1
MA	1	DE	1
MD	1(Rec) 2(Charter)	NY	1
NJ	1	VA	2

12a*. **(IF RESPONDENT ANSWERS $0 TO Q.12.)** Which of the following statements best describes why you feel the way you do?

You don't fish for striped bass	1
You already keep all the fish you care to	2
You don't want to pay any more to fish than you do now	3
You don't know how much a one fish change is worth to you	4
Other (describe)	5
Don't Know	8
Refused	9

13*. The current daily bag limit for bluefish in (ENTER STATE) ____ is 10 fish. In the future it may be necessary to decrease the bag from 10 fish to 8 fish. Suppose you could choose to buy a special license that would allow you to maintain the current bag of 10 fish. If you chose not to buy the license, your daily bag would be 8 fish. What would be the maximum amount of money you would be willing to pay for this special license?

ENTER NUMBER		► **IF $0 GO TO Q.13A.**
Don't Know	888	
Refused	999	► **IF > $0 GO TO Q.14.**

BLUEFISH BAG LIMIT BY STATE

ME	10	RI	10
CT	10	NH	10
MA	10	DE	10
MD	10	NY	10
NJ	0	VA	10

13a*. **(IF RESPONDENT ANSWERS $0 TO Q.13.)** Which of the following statements best describes why you feel the way you do?

You don't fish for bluefish	1
You already keep all the fish you care to	2

You don't want to pay any more to fish than you do now	3
You don't know how much a 2 fish change in the bag limit is worth to you	4
Other (describe)	5
Don't Know	8
Refused	9

VERSION 2

12*. The current daily bag limit for striped bass in (ENTER STATE) ____ is (ENTER STATE BAG LIMIT) ____ fish. Suppose you could choose to buy a special license that would increase your daily bag limit from (ENTER STATE BAG LIMIT) ____ to (ENTER STATE BAG LIMIT + 1) ____ fish. If you chose not to buy the license, your daily bag would still be (ENTER STATE BAG LIMIT) ____ fish. What would be the maximum amount of money you would be willing to pay for this special license?

ENTER NUMBER ──► **IF $0 GO TO Q.12A.**
Don't Know 888
Refused 999 ──► **IF > $0 GO TO Q.13.**

STRIPED BASS BAG LIMIT BY STATE

ME	1	RI	1
CT	1	NH	1
MA	1	DE	1
MD	1(Rec) 2(Charter)	NY	1
NJ	1	VA	2

12a*. **(IF RESPONDENT ANSWERS $0 TO Q.12.)** Which of the following statements best describes why you feel the way you do?

You don't fish for striped bass	1
You already keep all the fish you care to	2
You don't want to pay any more to fish than you do now	3
You don't know how much a one fish change is worth to you	4
Other (describe)	5
Don't Know	8
Refused	9

13*. The current daily bag limit for bluefish in (ENTER STATE) ____ is 10 fish. In the future it may be necessary to decrease the bag from 10 fish to 6 fish. Suppose you could choose to buy a special license that would allow you to maintain the current bag of 10 fish. If you chose not to buy the license, your daily bag would be 6 fish. What would be the maximum amount of money you would be willing to pay for this special license?

ENTER NUMBER ──► **IF $0 GO TO Q.13A.**
Don't Know 888
Refused 999 ──► **IF > $0 GO TO Q.14.**

BLUEFISH BAG LIMIT BY STATE

ME	10	RI	10
CT	10	NH	10
MA	10	DE	10
MD	10	NY	10
NJ	0	VA	10

13a*. **(IF RESPONDENT ANSWERS $0 TO Q.13.)** Which of the following statements best describes why you feel the way you do?

You don't fish for bluefish	1

You already keep all the fish you care to	2
You don't want to pay any more to fish than you do now	3
You don't know how much a 4 fish change in the bag limit is worth to you	4
Other (describe)	5
Don't Know	8
Refused	9

VERSION 3

12*. The current daily bag limit for striped bass in (ENTER STATE) ____ is (ENTER STATE BAG LIMIT) ____ fish. Suppose you could choose to buy a special license that would increase your daily bag limit from (ENTER STATE BAG LIMIT) ____ to (ENTER STATE BAG LIMIT + 1) ____ fish. If you chose not to buy the license, your daily bag would still be (ENTER STATE BAG LIMIT) ____ fish. What would be the maximum amount of money you would be willing to pay for this special license?

ENTER NUMBER → **IF $0 GO TO Q.12A.**
Don't Know 888
Refused 999 → **IF > $0 GO TO Q.13.**

STRIPED BASS BAG LIMIT BY STATE

ME	1	RI	1
CT	1	NH	1
MA	1	DE	1
MD	1(Rec) 2(Charter)	NY	1
NJ	1	VA	2

12a*. **(IF RESPONDENT ANSWERS $0 TO Q.12.)** Which of the following statements best describes why you feel the way you do?

You don't fish for striped bass	1
You already keep all the fish you care to	2
You don't want to pay any more to fish than you do now	3
You don't know how much a one fish change is worth to you	4
Other (describe)	5
Don't Know	8
Refused	9

13*. The current daily bag limit for bluefish in (ENTER STATE) ____ is 10 fish. In the future it may be necessary to decrease the bag from 10 fish to 4 fish. Suppose you could choose to buy a special license that would allow you to maintain the current bag of 10 fish. If you chose not to buy the license, your daily bag would be 4 fish. What would be the maximum amount of money you would be willing to pay for this special license?

ENTER NUMBER → **IF $0 GO TO Q.13A.**
Don't Know 888
Refused 999 → **IF > $0 GO TO Q.14.**

BLUEFISH BAG LIMIT BY STATE

ME	10	RI	10
CT	10	NH	10
MA	10	DE	10
MD	10	NY	10
NJ	0	VA	10

13a*. **(IF RESPONDENT ANSWERS $0 TO Q.13.)** Which of the following statements best describes why you feel the way you do?

You don't fish for bluefish	1
You already keep all the fish you care to	2

You don't want to pay any more to fish than you do now	3
You don't know how much a 6 fish change in the bag limit is worth to you	4
Other (describe)	5
Don't Know	8
Refused	9

VERSION 4

12*. The current daily bag limit for striped bass in (ENTER STATE) ____ is (ENTER STATE BAG LIMIT) ____ fish. Suppose you could choose to buy a special license that would increase your daily bag limit from (ENTER STATE BAG LIMIT) ____ to (ENTER STATE BAG LIMIT + 1) ____ fish. If you chose not to buy the license, your daily bag would still be (ENTER STATE BAG LIMIT) ____ fish. What would be the maximum amount of money you would be willing to pay for this special license?

ENTER NUMBER		**IF $0 GO TO Q.12A.**
Don't Know	888	
Refused	999	**IF > $0 GO TO Q.13.**

STRIPED BASS BAG LIMIT BY STATE

ME	1	RI	1
CT	1	NH	1
MA	1	DE	1
MD	1(Rec) 2(Charter)	NY	1
NJ	1	VA	2

12a*. **(IF RESPONDENT ANSWERS $0 TO Q.12.)** Which of the following statements best describes why you feel the way you do?

You don't fish for striped bass	1
You already keep all the fish you care to	2
You don't want to pay any more to fish than you do now	3
You don't know how much a one fish change is worth to you	4
Other (describe)	5
Don't Know	8
Refused	9

13*. The current daily bag limit for bluefish in (ENTER STATE) ____ is 10 fish. In the future it may be necessary to decrease the bag from 10 fish to 2 fish. Suppose you could choose to buy a special license that would allow you to maintain the current bag of 10 fish. If you chose not to buy the license, your daily bag would be 2 fish. What would be the maximum amount of money you would be willing to pay for this special license?

ENTER NUMBER		**IF $0 GO TO Q.13A.**
Don't Know	888	
Refused	999	**IF > $0 GO TO Q.14.**

BLUEFISH BAG LIMIT BY STATE

ME	10	RI	10
CT	10	NH	10
MA	10	DE	10
MD	10	NY	10
NJ	0	VA	10

13a*. **(IF RESPONDENT ANSWERS $0 TO Q.13.)** Which of the following statements best describes why you feel the way you do?

You don't fish for bluefish	1
You already keep all the fish you care to	2

You don't want to pay any more to fish than you do now	3
You don't know how much a 8 fish change in the bag limit is worth to you	4
Other (describe)	5
Don't Know	8
Refused	9

Continuation of Questionnaire

14. Do you or does anyone living in your household own a boat that is ever used for recreational saltwater fishing?

Yes	1	
No	2),	
Don't Know	8 /)▸	**GO TO Q.16.**
Refused	9)-	

15. What is the length of the boat? **(IF MORE THAN ONE BOAT, ASK ABOUT PRIMARY FISHING BOAT.)**

Less than 10 feet	1	10 to 14 feet	2
15 to 19 feet	3	20 to 24 feet	4
25 to 29 feet	5	30 to 39 feet	6
40 feet or more	7	Don't Know	8
Refused	9		

16. Would you describe your ethnic background as:

White	1	Other(specify)	5
Black	2	Refused	8
Hispanic	3	Don't Know	9
Asian	4		

17. How old were you on your last birthday? **(IF RESPONDENT HESITATES, QUICKLY GO TO Q.17A.)**

ENTER NUMBER))))))))))))▸		**GO TO Q.18.**
Don't Know	888)),	
Refused	999))2)▸	**GO TO Q.17A.**

17a. That is, in which of the following age groups do you belong:

16 to 25	1	56 to 65	5
26 to 35	2	66 and over	6
36 to 45	3	Don't Know	8
46 to 55	4	Refused	9

18. Code Gender:

Male	1)),
Female	2))1

▼

IF UNCERTAIN, SIMPLY ASK WHAT IS YOUR GENDER?

19. Including yourself, how many people reside in your household?

ENTER NUMBER	
Don't Know	88
Refused	99

20. What was the last grade of formal education you completed?
(IF RESPONDENT HESITATES, READ LISTED ALTERNATIVES)

Less than a high school degree	1
High school graduate	2
Vocational or community college	3

Some college	4
College graduate	5
Post-graduate/professional degree	6
Don't know	8
Refused	9

21*. Are you personally employed outside the home?

Yes	1))))▸ **GO TO Q.23.**
No	2))))▸ **GO TO Q.22.**
Don't Know	8)),
Refused	9))2)▸ **GO TO Q.27.**

22. Are you currently not employed as a result of your own choice, ... are you retired, ... or are you unemployed but looking for work.

Not employed by choice	1
Retired	2
Unemployed & looking	3
Don't Know	8
Refused	9

(GO TO Q.30.)

23. And are you self-employed?

Yes	1))))▸ **GO TO Q.25.**
No	2
Don't Know	8
Refused	9

24. Do you work for an hourly wage or for a salary?

Hourly Wage	1
Salary	2
Commission only	3
Other (Specify)	5
Don't Know	8
Refused	9

25. How many hours a week do you usually work?

ENTER NUMBER	
Don't Know	888
Refused	999

26. Can you choose to work more or fewer hours a week?

Yes	1
No	2
Don't Know	8
Refused	9

27. During this fishing trip were you on a paid vacation?

Yes	1
No	2
Don't Know	8
Refused	9

28. Did you forgo any wages by taking this trip?

Yes	1	
No	2	
Don't Know	8	**GO TO Q.30.**
Refused	9	

29. About how much money could you have earned if you hadn't taken this trip?

ENTER NUMBER
Don't Know 888
Refused 999

30*. Is your total annual household income before taxes over or under $45,000?

And is it over or under $60,000?
IF OVER ► And is it over or under $85,000?
IF OVER ► And is it over or under $110,000?
IF OVER ► And is it over or under $135,000?
IF OVER ► And is it over or under $160,000?

And is it over or under $30,000?
IF UNDER ► And is it over or under $15,000?

Less than $15,000	1
$15,001 to 30,000	2
$30,001 to $45,000	3
$45,001 to $60,000	4
$60,001 to $85,000	5
$85,001 to $110,000	6
$110,001 to $135,000	7
$135,001 to $160,000 or more	10
Don't Know	8
Refused	9

Appendix C. Site Definitions

- Maine: Cumberland | Kennebec and Sagahadoc
  Hancock | Penobscott and Waldo
  Knox | York
  Lincoln | Washington
- New Hampshire: Rockingham and Hudson
- Massachusetts: Barnstable | Nantucket
  Bristol | Norfolk
  Dukes | Plymouth
  Essex | Suffolk
- Rhode Island: Bristol | Providence
  Kent | Washington
  Newport
- Connecticut: Fairfield | Middlesex
  New Haven | New London
- New York: Bronx
  Nassau sound side | Kings
  Nassau oceanside | Queens
  Suffolk soundside | Richmond
  Suffolk oceanside | Westchester
  Suffolk internal
- New Jersey: Atlantic | Cape May bayside
  Cumberland | Cape May oceanside
  Middlesex | Monmouth bayside
  Ocean | Monmouth oceanside
- Delaware: Kent | Sussex north of Lewes
  New Castle | Sussex south of Lewes
- Maryland: Anne Arundel | Charles and St. Marys
  Calvert | Dorchester and Somerset
  Worcester | Baltimore, Cecil, and Hartford
  Caroline, Kent, Queen Annes, and Talbot
- Virginia: VA Beach | Accomack and North Hampton
  Essex, Gloucester, King William, Mathews, Middlesex, Caroline, and Fredericksburg
  Hampton City, Newport News, and Poquoson
  Isle of Wight, Suffolk, and Surry
  James City and York
  King George, Lancaster, Northumberland, Richmond, and Westmoreland
  Norfolk and Portsmouth