MARINE RECREATIONAL FISHING IN THE MIDDLE AND SOUTH ATLANTIC: A DESCRIPTIVE STUDY

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Chapter 1

THE PURPOSE OF THE RESEARCH

This report is the descriptive phase of a research project on the economics of marine recreational fishing along the Middle and South Atlantic coast of the U.S. It describes the data from three large surveys on sportfishing, surveys that will form the basis of a subsequent phase of the research project. This first phase provides a broad-brushed picture of saltwater fishing during the 1980's and serves as a foundation for a more comprehensive economic study yet to come.

Analysis of the data from the three surveys requires an appreciation for the ultimate use the data will serve. The next phase of the research involves a comprehensive economic study with two goals: to estimate the economic value of access to marine recreational fishing and to estimate some of the economic damages to marine recreational fishing from pollution of marine waters. In concept, economic value of access is simple. Like any other activity, recreational fishing has economic value, in the sense that anglers would be willing to pay for the opportunities that they enjoy. We accept this commonly used measure as the value of access. It will vary along the coast, among seasons, and depending on the kind of fish that anglers pursue.

The second goal of the research, measuring the economic damages from pollution, is more complex. Studying the links from increased pollution of marine waters involves physical, chemical, and biological oceanography. Effluents are emitted by firms, households, and other enterprises. These effluents are borne by water and air to water bodies. There, they affect

physical and chemical water quality and plant and animal life. Human well-being depends on both the quality of the water and the abundance of species that live in the water. Human well-being suffers when water quality declines, even when the robustness of species remains unchanged, because water quality directly influences activities like swimming. Well-being also suffers when the abundance of plant and animal populations declines even though water quality remains unchanged, because activities like recreational and commercial fishing become less productive. Species of fish may be affected directly by pollutants, such as heavy metals, or they may be affected indirectly by changes in the water quality. For example, excessive nutrients may lead to lower dissolved oxygen, which in turn impacts on some fishery stocks.

We address the final link in the causal chain: the effect of changes in fish stocks on human well-being. Changes in well-being are measured by the amount of money people will accept to avoid the loss in fish stocks. And to make our work even more manageable, we deal with the impact of changes in catch rates which result from changes in the availability of fish stocks.

The research is motivated by the idea that the economic value of marine recreational fishing is an important component in many resource management decisions that the public sector makes in the marine environment. Fishery management increasingly must deal with trade-offs between recreational and commercial fishing. Estuarine development which affects marine habitat ultimately influences the economic value of recreational fishing. This value, whether explicitly considered or not, plays a role in such development. Enhancement of stocks requires a budget and usually there is an accounting for the economic value of sportsfishing, whether implicitly or explicitly. Our research is motivated by the belief that the explicit consideration

of the economic value will lead to better resource use. The ultimate goal of this research is to provide a comprehensive set of economic values for marine recreational anglers in the Middle and South Atlantic and thus provide a foundation in which future recreational policies can be evaluated.

Consequently, while the research project deals broadly with the impact of marine pollution on human well-being, we investigate only the last link in this complex process: the effect of changes in catch rates on the economic value of recreational fishing to people who do the fishing. Given the nature of the available data, we can investigate issues that arise only at the state level or perhaps at the county level within a state. Our study area is the Atlantic coast from Long Island south through Florida, excluding the Keys. We thus have considered a large domain, but a small part of the potentially large geographical range of marine pollution. However it is an area which accounts for a substantial portion of the nation's marine recreational fishing and it is part of a larger strategy to document the economic value of marine natural resources.

Methods for estimating economic value blend statistical methods and economic models with data on how people have carried out their recreational fishing activities. Information on recreational fishing is not easy to come by. Marine recreational activity is a highly diverse activity. It occurs over wide geographic areas and in many different ways. In particular, anglers seek a sportfishing experience, a good not sold in a market, but available because of the existence of a natural resource and attainable through household decisions to allocate time and money for this purpose. The absence of a market not only necessitates a study to measure the economic damages, but it also requires special surveys to gather information on the behavior of recreational anglers. There is no market operating which would provide secondary statistics for

our study. Consequently, as part of this study we have engaged directly or indirectly in preparing survey data which can be used to infer both the economic value of marine recreational fishing and how this value changes with factors which depend on the quality of marine water, such as catch rates.

The necessity of gathering data for studying the economic value of marine recreational fishing explains the role of this particular report. In a study for an area as large as New York to Florida, a great many observations on behavior are needed. We have engaged in extensive construction of data sets from surveys conducted by and for the National Marine Fisheries Service over the last ten years. In this report, we describe these data sets. It is written with the hope that others may find the data that we have used of interest. But the work that went into the report is also a step along the way to measuring the economic value of recreational fishing.

As such, a gap in the current literature about marine recreational fishing is filled. There is relatively little comprehensive information about marine sportfishing. Local and state guides are meant to attract tourists and encourage the local anglers. Aggregate data from the national surveys conducted by the Department of Interior (Fish and Wildlife Service) and the Department of Commerce (National Marine Fisheries Service) are written to provide snapshots of the level of aggregate activity on a five year or one year basis. They have not been organized to reveal how the fisheries are changing over time, nor have they been used to compare the activities in different states. In this report, we provide descriptive information on sportsfishing from New York to Florida. This information is organized in terms of trends in participation and catch rates by state, as well as some current descriptive economic information. In addition to the data

description, a simple analysis of trends in participation and trips is presented. Although not rigorous in method, the results are provocative.

The Marine Recreational Fishing Surveys

In this report, marine recreational fishing on the Atlantic coast is analyzed with data from three surveys. Two of the surveys are part of the Marine Recreational Finfish Statistical Survey sponsored by the National Marine Fisheries Service (NMFS). They are the Intercept Survey and the Household Telephone Survey (Phone Survey for short). The third survey was conducted as part of this project at the University of Maryland, to provide information for the economic aspects of the study (called the UMCP survey for short). The UMCP survey was designed to generate information necessary for estimating economic models, and that remains its main attraction. However, the NMFS surveys were originally designed with the task of estimating total recreational catch in mind. Some understanding of these surveys can give an appreciation of the strengths and weaknesses of our statistical descriptions as well as the role these surveys play in estimating recreational catch.

The NMFS Surveys

Knowing how NMFS uses its survey to estimate total catch is essential to understanding the surveys themselves. The goal of the surveys is to estimate total catch. In principle, the procedures are clear. An estimate of the total catch of a species by geographical area and time period (say a year) can be made from the mean of the number of fish caught per trip times the number of trips. The principal goal of the Intercept Survey is to estimate the number of fish caught per trip. The Phone Survey is used to estimate the number of fishing trips in the area of

interest. The product of the mean catch rate and the number of trips is the estimate of total catch. These surveys are carried out independently of each other, by contractors for NMFS.

The Phone Survey

NMFS initiated the Phone Survey in 1979. The survey is conducted by a commercial contractor. It is a random-digit-dialing survey of households living near the coast. Households are interviewed at the end of a two-month wave and asked about their recreational fisheries activities during that previous two-month period. For most of the states in our study area, sampling is undertaken in only five two-month waves: March-April, May-June, July-August, September-October, and November-December. No surveys are conducted for the January-February wave except for Florida and Georgia. To standardize our results, this wave has been omitted from all state reports.

For the most part, calls are made only to households located in counties within 25 miles of the coast or of major bays or estuaries. The random digit dialing procedure accepts only households. The interviewer first asks whether anyone in the household has fished during the last two months. The interviewer then attempts to talk to all household members who had fished during the previous two months.

The survey includes questions about whether any member of the household fished within the last two months. Each member is asked the following questions about each trip taken within the last two months:

- from what fishing mode?
- using what gear?

- in what type of waterbody?

- how far from shore?

The questions have remained approximately the same over the life of the survey, although some revisions took place between the 1980 and 1981 survey. Starting in 1981, respondents were specifically asked for information only if they fished in-state, and since that time trip information has been coded only for in-state trips. Additionally, information has been coded since 1981 only for those households in which at least one member fished in the interview wave.

The telephone survey is critical to the entire survey scheme because it is the only instrument applied randomly to households residing in defined geographical areas. Without it, there would be no way to obtain participation rates or estimates of total numbers of sportfishing participants or trips. Since the telephone survey samples only coastal residents and includes only in-state trips, information from the field survey must be combined with the telephone survey results to extrapolate participation and trips of non-coastal and out-of-state residents.

The telephone survey is designed to elicit responses about fishing in the previous two months, because accurate recall beyond that period is considered questionable. However, the two-month wave design introduces some unusual problems for traditional economic analysis. which is typically based on yearly behavior. For example, it is not feasible to obtain good estimates of the annual participation rates by households or by individuals from the Phone Survey.

Variations in the range of households interviewed cause additional problems for the two-month participation rates. For the Mid-Atlantic region (New York, New Jersey, Delaware. Maryland and Virginia) only counties within 25 miles are called in all waves. For the South

Atlantic, excluding North Carolina (South Carolina, Georgia and Florida), households are sampled from counties within 25 miles of the coast during the March-April and November-December waves,[1] but from counties within 50 miles of the coast from May through October. The sampling in North Carolina was the same as the rest of the South Atlantic until 1987. Since 1987, households in North Carolina are sampled from 50 mile counties in March-April and November-December and from 100 mile counties in May through October. These complications are summarized in Table 1 below for reference. The variation in the sample frame raises difficulties in analyzing the trend in participation rates.

In the state reports that follow, the first five tables are based on the Phone Survey. These tables report on trips and participation by wave and mode at the state level. In using the Phone survey, we have modified the raw survey data to correct the original weighting scheme. In the original sample frame, the sample within a state was distributed among counties by a weight proportional to the square root of the county's population. We have reweighted so that the observations from different counties are proportional to the county's population, and not the square root of the population.

The percent of households called in which at least one individual sportfished for finfish within his state of residence during the wave is reported in the first table of each section. Only households residing in counties within 25 miles of the coast or major bays or estuaries are sampled for the mid-Atlantic states and during waves 2 and 6 for the South Atlantic states. During waves 3 through 5, counties within 50 miles of the coast or major estuaries and bays are

[1] Also during the January-February wave for Georgia and Florida. However, for consistency across states we have omitted this first wave from consideration.

called for the South Atlantic states. North Carolina data since 1987 represents the only exception, covering 50 miles in waves 2 and 6 and 100 miles 3 through 5.

The second table in each section is created to analyze the trends in the participation rates for the decade 1980-89. Each state's participation rate by wave is regressed against a time trend variable and the results presented in the table. In cases where the sampling frame changed, we have used binary variables to remove the effect of the change from our analysis.

The third, fourth and fifth table of each section show information on trips per household by wave and mode. This information is taken from the individual responses to the questions about the actual trips taken during the two month period. In the cases where an individual was recorded as having fished, but did not come to the phone, we have assumed his total trips to be equal to one. This method is the most conservative that we could devise in the absence of more information about the missing angler's trips.

The Intercept Survey

The Intercept Survey was also initiated in 1979. It is conducted by commercial contractors, but usually with substantial involvement from state fisheries agencies. The Intercept survey is organized along the same two month waves as the Phone survey. The Intercept survey is designed to be a random survey of fishing trips. Each state survey is sampled separately, because of the close working relationship with the state agencies. The survey is a type of cluster survey, where the basis of cluster is a site. The commercial contractor to NMFS typically keeps a list of fishing sites, the kinds of activities that occur there, the typical level of its use during different seasons, and other attributes. The sites to be sampled can then be chosen first, with a specified level of sampling effort assigned to each chosen site. The site list changes slightly over

time and keeping track of those changes is a challenge. There are over 1000 sites in our study area.

The Intercept survey protocol determines how anglers at a particular site are to be chosen. Those fishing from shore are interviewed as they are intercepted. Boat anglers are interviewed after their fishing trip (although occasionally interviewers accompany anglers on party boats and interview during the trip). The intercepts are sampled by mode. The four aggregate NMFS modes are party/charter boat fishing, private/rental boat fishing, beach/bank fishing, and fishing from artificial structures. This covers most recreational fishing, omitting only those anglers who moor their fishing boats at home or other moorings inaccessible to sampling. We have aggregated the beach/bank and artificial structures into a single mode, the shore fishing mode. The method of interview varies by mode. The aggregate sampling effort within a state varies by wave, with more effort naturally given to the waves when the angling effort is likely to be large.

The focus of the NMFS interview is on the current trip of the angler. In essence, it is a creel survey, with some additional social and economic data gathered. Each angler interviewed is asked

- place of residence
- length of trip
- target species
- number and species of fish caught.

In addition, the interviewer measures the weight and length of a sample of the fish caught by the angler. Anglers are also asked about the number of trips they have taken in the past twelve months and in the past two months.

The NMFS Intercept survey is an excellent method for gathering information about fish caught by individual anglers. The few weaknesses are inevitable and well known by the survey designers. Boat anglers pose problems, for example, because they tend to group catch together and so it is difficult to determine the fish caught by an individual angler. Fish which are caught and thrown back cannot be weighed and measured, and the species may not be known. One difficulty for the estimation of economic models from intercept data is that the random sampling of trips does not result in a random sample of individuals. This causes no damage to our descriptive report, but will require attention as we pursue our economic analysis.

The Intercept Survey is a substantial undertaking. Over the period from 1980 to 1989, over 200,000 anglers have been interviewed in the Middle and South Atlantic. Because the purpose the Intercept survey is to assess catch per trip of individual species, much effort has gone into accurately measuring the number and weight of fish caught by anglers. But this purpose is slightly different than ours, so modifications of the data have been made.

Our challenge is to utilize the data in a manner that will reflect those characteristics of a fishing trip which influence angler's behavior. The most obvious characteristic is the expectation of how many fish the angler can expect to catch on any given trip. Consequently our aggregation schemes group species in ways that reflect individuals' perceptions and targetting behavior.

In forming measures of catch rates which influence behavior, we aggregate because the site-wave-species combination provides data too sparse to allow good estimates of catch rates. There are at least 25 significant species that anglers seek in the study area. There are four modes, five waves, and ten years of sampling. Even if the distribution of fishing were uniform across the modes, waves, species, and sites, a uniformly distributed sample of 100,000 would encounter only one of every five mode-species-wave-year-site cells. Naturally the sample is not evenly distributed over sites. As a consequence of the diversity of these characteristics, we have been compelled to aggregate.

In the state sections that follow, we have aggregated in three significant ways:

1. Over modes: The two NMFS shore modes, bank/beach fishing and fishing from artificial structures, have been aggregated into one shore fishing mode.

2. Over sites: Instead of providing information by site, we have aggregated all the sites within each state to the state level. All of the catch information is provided at the state level.

3. Over species: The most important aggregation is over species. There are simply too many different species to present trends of catch rates and other information by species. Further, species have less significance for individual behavior than groups of species. Most anglers can only identify a small number of species. They cannot be expected to be motivated by the catch rate of species unfamiliar to them. We have aggregated the myriad of species into four groups:

    a. biggame
    b. smallgame
    c. flatfish
    d. bottomfish

The classification of the different species into the four groups is given in Table 3. All of our results are reported for these four groups of species.

Our second major modification of the NMFS Intercept survey data concerns the targeting of species. We are interested in the availability of these aggregate groups to anglers. We believe that averaging catch rates only of those anglers who target species in the particular aggregate

group provides a more accurate measure of abundance than averaging catch rates of all anglers for the species group. After all, the catch of biggame species for an angler in a small boat fishing for flatfish will not reflect the ease with which biggame species can be caught. Averaging catch only for anglers who target each species group reduces the number of observations (some times by as much as 60%) but improves the information content of the resulting catch rate estimates.

In the state sections, the data are presented graphically. The first figure in the state section (and most odd numbered figures) contains information, by fishing mode, on the catch rate of the relevant species groups for each year over the period 1980-1988. The numbers represent average catch rate for all species in the aggregate group. The data are not always available for all years, resulting in occasional gaps. The second figure (and most even numbered figures) shows the catch rate of the species groups, by mode, for each of the five waves. Because there are fewer waves than years, the number of observations associated with each data point is greater when the data is averaged by wave than by year, and hence the variance is smaller. Sometimes. averaging by wave provides the only reliable estimates.

The UMCP Survey

One survey was undertaken as part of this study. This survey gathered economic data not available from either of the NMFS surveys. The UMCP survey was designed to obtain information on the distribution of trips, the costs of those trips, and other household demographic information, for anglers who went saltwater fishing during a NMFS wave.

The UMCP survey was conducted from November-December 1987 to October-November 1988. The sample frame consisted of all people who were interviewed on the Intercept survey.

A portion of the intercepted anglers were asked if they would answer phone questions on their fishing activities during the current wave. They were then called at the end of the two month period. Some portion of those called were also contacted for information in the subsequent two month wave. During the phone call, respondents were asked about all of the trips they took during the two month period. The questions for each trip included

- trip destination
- whether the trip was a day trip or overnight
- mode of fishing
- species group targeted
- specific variable costs of the fishing activities
- travel time and distance data
- type of waterbody.

The interviewer also gathered data on the individual interviewed, including

- place of residence
- income and earnings data
- boat ownership
- second home ownership.

The interviewer also asked several hypothetical valuation questions.

For purposes of recording destinations, and for subsequent analysis, we have divided the study area into 69 sites, most of which are counties within states. In some cases, counties were divided into two sites, and sometimes more than one county was aggregated into one site. The delineation of sites involved several tradeoffs. From the perspective of providing policy analysis

for specific sites, it would have been preferable to have more and smaller sites. However, we are operating under two constraints. First, the angler must be able to recall where the trip was taken and the interviewer must be able to record this, all over the phone. Second, since we wished to use the NMFS catch rate data, the 69 sites represent the minimal amount of aggregation from which we could safely proceed. The sites are listed in Table 2.

Table 4 gives the sampling effort for the UMCP Survey. Each cell in this table contains two numbers. The upper number is the number of people intercepted in that state of residence, and wave, who were subsequently called to complete the economic survey. The lower number in parentheses is the number of "second" interviews - that is the number of people who were called in this wave but had been intercepted and called in the previous wave. For example, in wave 2 in Delaware, 56 of the people intercepted in the field were called and interviewed. Of those 56, 37 were also interviewed in the following wave, as can be seen from the figure in paratheses in the subsequent cell. Hence in wave 3 in Delaware, there were 119 interviews, 82 who were intercepted by NMFS in wave 3 and 37 who were intercepted in wave 2 and called both in wave 2 and wave 3. In total, the UMCP survey completed almost 10,000 interviews. While small in comparison to the NMFS survey, this is still a substantial survey.

In the state sections, there are three tables constructed from the UMCP survey. These tables are designed to give descriptive economic information on fishing trips. Table 6 in each section gives information on day trips and Table 7 gives information on overnight trips. The information is primarily expenditure data--the amount spent on the trip's fishing activities by mode. The final table in each section gives information on the targeting of species groups by mode.

regardless of the season and is most prevalent in mid-Atlantic states. In fact, the negative trends are greatest in New York and New Jersey and disminish as one proceeds southward, with no discernable trend for Florida.

Interestingly, there are no significant trends in the average number of fishing trips per household called. This anomaly could have as an explanation that population growth in the mid-Atlantic is not bringing new sportfishermen into the population but the existing fishermen are taking more fishing trips. Neither this nor alternative explanations have yet been explored, but it is an important area for future research.

While we are constantly reminded of the enormity of our task and data problems a picture of East Coast sportfishing is emerging. For example, the annual pattern of participation rates is quite consistent in the Middle Atlantic (Figure 1). The concave pattern observed in the Middle-Atlantic however, does not carry over to the South Atlantic (Figure 2). The warmer climates show less variability in sportfishing activity throughout the year and most often experience peaks in activity in September and October instead of July and August.

General observations can already be made as the result of our efforts in standardizing and evaluating these data. We hope that these observations, along with improvements in accessing the data, will encourage others to complete the picture.

Table 1

Telephone Sample Frame

Sample Range[a]	States	Years	Waves[b]
25 miles	New York	1980-1989	2 through 6
	New Jersey	1980-1989	2 through 6
	Delaware	1980-1989	2 through 6
	Maryland	1980-1989	2 through 6
	Virginia	1980-1989	2 through 6
	North Carolina	1980-1986	2 and 6 only
	South Carolina	1980-1989	2 and 6 only
	Georgia	1980-1989	2 and 6 only
	Florida	1980-1989	2 and 6 only
50 miles	North Carolina	1980-1986	3, 4, and 5
	North Carolina	1987-1989	2 and 6
	South Carolina	1980-1989	3, 4, and 5
	Georgia	1980-1989	3, 4, and 5
	Florida	1980-1989	3, 4, and 5
100 miles	North Carolina	1987-1989	3, 4, and 5

[a] The sample range refers to the distance between the coast or an estuary of the coast to the most distant county in the sample.

[b] The waves are occasionally referred to by number, where 2 is March-April, 3 May-June, 4 July-August, 5 September-October and 6 November-December.

Table 3

Aggregation of Species into Groups

Small Game		
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
Bottomfish	Croaker/Spot	Cunner
Kingfish	Mullet	Tautog
Butterfish	Nurse Shark	Brown Cat Shark
Porgy/Scup	Sheepshead	Pinfish
Snapper	Grouper	Perch
Black Drum		
Flatfish		
Summer Flounder	Winter Flounder	Southern Flounder
Sole		
Big Game		
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	
Other Fish		
Herring	Eel	Skate
Puffer	Blacktip Shark	Requiem Shark
Dusky Shark	Atlantic Sharpnose	Bull Shark
Smalltail Shark		

Table 4

Sampling Effort in the UMCP Survey

State of Residence	Wave 1	2	3	4	5	6	State Totals
Delaware	-- (22)	56 --	82 (37)	105 (62)	94 (80)	30 (78)	367 (279)
Florida	154 (121)	247 (97)	282 (179)	347 (203)	234 (253)	164 (180)	1,428 (1,033)
Georgia	36 (37)	37 (24)	33 (28)	34 (22)	49 (25)	51 (40)	240 (176)
Maryland	-- 8	41 --	119 (22)	170 (86)	50 (124)	9 (39)	389 (279)
New Jersey	-- (75)	27 --	244 (15)	330 (176)	174 (255)	92 (143)	867 (664)
New York	-- (93)	64 --	165 (39)	309 (105)	180 (212)	121 (139)	839 (588)
North Carolina	3 (96)	40 0	163 (30)	241 (120)	201 (176)	117 (154)	765 (576)
South Carolina	45 (41)	62 (19)	90 (38)	50 (68)	44 (34)	52 (31)	343 (231)
Virginia	-- (2)	27	220 (16)	180 (164)	100 (137)	2 (82)	529 (401)
WAVE TOTALS	214 (487)	601 (140)	1,398 (404)	1,766 (1,006)	1,126 (1,196)	638 (886)	5,734 (4,119)
							9,853

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Chapter 2

SPORTFISHING IN NEW YORK

Activity by New York Households

The overwhelming presence of New York City dominates the pattern of in-state marine recreational fishing by residents of the state of New York. The City is the predominant source of anglers for fishing in the Atlantic, on the south side of Long Island and in Long Island Sound on the north side of Long Island. Although there is substantial coastline in the immediate area of New York City and on Long Island, access to fishing for New York households who do not live on central or eastern Long Island is more difficult than for residents of other states. Another factor affecting fishing patterns in New York is its inclimate weather. Living in the northern-most state in the study area, and hence experiencing the harshest weather, New York residents can be expected to exhibit a greater response to seasons.

The NMFS telephone survey of New York is directed towards households with telephones which are located in counties within 25 miles of the coast or major bays and estuaries. According to the 1980 Census, 4,028,600 households met this requirement, about 64 percent of the total households in the state of New York as of that census year. Because the eligible households have much greater access to marine fishing than ineligible households, they can be expected to account for more of the sportfishing activity. According to NMFS estimates, over 96 percent of in-state participants in New York marine fishing are coastal county residents Understandably, few sportfishing from other states visit New York to fish. About 90% of participants are from in-state. In terms of numbers of sportfishing trips in New York marine

waters, between 90 and 95 percent are taken by New York coastal residents with another 1 or 2 percent taken by non-coastal county New Yorkers.

Participation and Quantity of Trips by Season

A detailed picture of fishing activity is given in Table NY.1, which provides participation rates by year and season. These rates show the kind of seasonal distribution one would expect. They are low -- between 1 and 3 percent -- for the early spring and late fall waves. The peak season is July-August, when the participation rate averages about 7 percent. The means for the five waves reflect this seasonal variation and are significantly different from one another.

The seasonal participation rates in New York demonstrate the same variability found in many other mid-Atlantic states: systematic differences across waves and considerable variation within waves. For example, in 1987 the rate increases from 1.3 percent in March-April to 4.6 percent in May-June and 7.3 percent in July-August and then declines to 2.1 percent in November-December. The variability within season is especially apparent for the March-April wave, when participation in the peak year (1980) is more than three times the rate in the low year (1987). Variability in waves encompassing May through October is notably smaller, reflecting the reduced influence of weather.

To see whether any trend in participation rates occurred over time, a linear time trend model was fitted to the participation rates for each wave. The results are presented in Table NY.2. Four of the five reported trends are negative, although only three are statistically significant at the 95% level of confidence. The trend indicates that from 1980 to 1989 participation rates from March through October were falling by about .3% per year. The highest estimated rate of decline was during the July through October period and the least was during

the May/June wave. Over the ten year period, a .3% annual fall amounts to about a 3% overall decline.

The participation rate measures the prevalence of the fishing activity over households called, but it gives no indication of the magnitude of the activity. The magnitude is reasonably measured by the total level of trips. This can be calculated by multiplying the number of fishing households by the number of trips per fishing household. The same measure can be calculated by multiplying the number of trips per household called by the number of households called.

Table NY.3 gives the number of trips per household called. The same temporal variation can be seen in trips as was evident in participation. Trips in the dominant wave (July-August) peak in 1981, 1984 and 1987. Annual total trips display a different pattern, peaking in 1983 and declining thereafter.

A sense of the seasonal variation can be derived by computing the proportion of mean annual trips taken in each wave. The mean trips per household called using all eight years of data are distributed as follows:

	Mean Trips	Percent of Annual Mean
March-April	.11	9.0
May-June	.31	26.3
July-August	.47	39.8
September-October	.22	18.6
November-December	.07	5.9

Between 80 and 90 percent of the annual activity occurs in the six-month period from May through October.

Linear trend analysis indicated no significant trends on any of the five waves. This information, combined with the negative trend in participation rate, points to an increased number of trips per participant. That is, trips per household called is computed as the product of (participants/household called) (trips/participant). If the participation rate is falling and there is no trend in trips per household called, the number of trips per participant must be rising over time. Likely, the occasional fisherman is no longer fishing and, perhaps, the frequent fisherman is taking more trips.

Sportfishing Activity by Mode

Compared to residents in other middle and south Atlantic stares, access to sportfishing for New York households is quite difficult. The greater New York area is highly developed, making the shoreline less accessible. Table NY.4 shows the distribution of fishing trips among the three different modes. These proportions are means for the period 1981 to 1988.

The proportion of fishing trips from shore is roughly constant for the first four waves, and then increases in the November-December wave. This increase in proportion reflects the decline in the use of private boats during the months of poor weather for boating. The proportion who use the party/charter mode is highest during off-season months. Party/charter use is quite high relative to other states, probably due to the limited shore access available to the public in the New York area. Long Island provides substantial shoreline, much of it is held privately. Public access becomes prevalent only as the distance from the population center declines. Hence, a larger portion of the demand for marine sportfishing is met through private services in the form of party/charter boats.

To get some insight into the magnitude of fishing by mode, we must expand the trips per household called to the total population of eligible households. Table NY.3 gives means of trips per household called by wave, averaged over the decade. For the 1980 Census, there were an estimated 4,028,600 households eligible to be called. For March-April, the mean trips per household called was .11. Hence for eligible New York households, one would predict 443,146 (= .11 * 4,028,600) trips as annual average for March-April. Table NY.4 shows the distribution of these trips. It suggests that there were in the order of 256,138 private/rental boat trips in March-April. The proportion of private/rental boat trips is almost the same in July-August (56.6 percent), but the aggregate level of trips for this wave is 1,893,442 (= .47 * 4,028,600). Hence the predicted level of private boat trips for the wave rises to over a million -- 1,071,688. Despite the relative constancy of the proportion of private/rental trips from March-April to July-August, there is a substantial increase in the number. The proportion of trips on the party/charter mode declines from about 22 percent in March-April to about 11 percent in May-June, and then rises to a bit more than 15 percent for the remainder of the year. But the magnitude of the changes is quite different from the proportions. The level of party/charter trips in March-April is predicted as 97,935, and this level rose to 217,746 in May-June. The seasonal variation in the party/charter fishing has substantial impact because it is a market activity and implies a considerable variation in the employment of party/charter services.

Sportfishing Activity by Waterbody

Table NY.5 gives details of the distribution of fishing trips by wave and waterbody. The principal waterbodies for marine sportfishing in New York are the Atlantic beaches, Long Island Sound, the small enclosed bays of Long Island, and the Hudson River. These waterbodies

correspond fairly well with subgroups of the NMFS categories: ocean, gulf, open bay, sound, river, enclosed bay, other, and mixed.

About half of the fishing is in the first category--ocean, gulf, and open bay. This means fishing south of Long Island. An additional 15 to 30 percent of trips occurs in sounds, which includes only Long Island Sound for New York. Fishing in enclosed bays is about 15 percent to 20 percent. In November and December, fishing in rivers jumps from an insignificant level to over 20 percent.

The predicted number of trips for the relevant population by wave and waterbody is calculated analogous to the wave and mode estimates. For March-April, the 443,146 trips are apportioned according to Table NY.5. The trips to ocean, bay, and open gulf increase greatly from March-April to July-August. In March-April, there were 222,459 trips to this type of waterbody, and this increased to over a million in July-August (1,022,459).

Catch Rates in New York Waters

Saltwater angling off New York's coast takes place largely in the Ocean, in Long Island and Block Island Sounds, and in Peconic and Gardiners Bays (on the eastern tip of the Island). Species caught in these areas vary as do the size/age of specimens of the same species. When considering waterbody, data presented are for Sound and Ocean fishing because there are not sufficient intercepts in the bays to produce reliable catch rates.

At sites in New York, most anglers are targeting species. Prior to 1985, only 13 percent of the intercepted anglers stated they were not seeking a species and the percent has fallen to 6 percent in the subsequent years. The predominant target of the anglers is flatfish, with 45 percent of the pre-1985 intercepts and 53 percent of the post-1984 intercepts seeking flatfish.

The next most common target is smallgame, representing about 30 percent in the early period and 25 percent in the latter period. Bottomfish were the target of between 10 and 15 percent of the anglers. Finally, only between 1 and 2 percent of the anglers targeted big game.

Smallgame Catch Rates

In New York, smallgame anglers target and catch bluefish, striped bass, mackerel, and weakfish, primarily. The relative importance of the three species has remained constant over the past ten years. Bluefish represent about eighty percent of the catch of anglers targeting smallgame whereas striped bass represent about ten percent and mackerel and weakfish about five percent each.

The trend in the catch rates of smallgame species for different fishing modes and areas is presented in Figure NY1. The four trends do not show a consistent pattern, although all four exhibit a sharp decline in 1988. The one consistent element in the figure is the relative ranking of catch rates across modes. Shore fishermen have almost always experienced the lowest catch rates and party/charter, the highest.

Catch rates during the year vary depending on both the mode of fishing and the water body fished (Figures NY2 and NY3). Shore fishermen tend to enjoy the highest catch rates in July and August and the lowest in November and December. Party/charter fishermen, however, have their highest average catches during the spring and early winter. On the other hand, catch rates for private boat fishermen fall during the year in Long Island Sound whereas they generally increase over the year in the Ocean.

Bottomfish Catch Rates

During the first half of the decade, the principal species of targeted bottomfish was tautog, representing about thirty percent of the anglers targeting bottomfish. Since the beginning of 1985, the importance of tautog has grown by two-thirds, so that fifty percent of all anglers targeting bottomfish are seeking tautog. Before 1985 Atlantic cod was an important bottomfish species, accounting for about twenty-five percent of the bottomfish anglers, but since 1985 cod's share has dropped to fifteen percent.

Scup has been targeted by a constant twenty-five percent of the bottomfish anglers. Porgies, prevalent prior to 1985, are rarely targeted and caught now. About five percent of the targeted catch is now black sea bass, a species which was not targeted and caught prior to 1985.

Unlike the small game situation, the catch rate of targeting fishermen on party/charter boats has been consistently lower than on private boats (Figure NY4). Bottomfish caught by private boat fishermen, both in the Sound and Ocean, appear to have been more abundant in the early and late eighties than during the mid-eighties. There is no similar pattern for party/charter fishing.

Flatfish Catch Rates

There are two primary species of flatfish targeted in New York waters, summer and winter flounder. Prior to 1985, 40 percent of the people targeting flatfish were seeking summer flounder and the remaining 60 percent were seeking winter flounder In the latter part of the eighties, those targeting summer flounder showed a moderate 5 percent increase.

Flatfish catch rates in the Atlantic Ocean also exhibit the unusual characteristic that fishermen from private boats on average catch more than those on party/charter boats (Figure

NY5). The ocean party/charter fisherman's catch rate, however, is generally higher than the ocean shore fisherman. Over the ten year period, the private/rental fisherman averaged about 5 fish/person/day, the shore fisherman about one and one-half fish, and the party charter fisherman about four. The level of catch rates in Long Island Sound were quite similar to those in the Ocean.

Although it is not easy to discern a time trend in the figure, the catch rates prior to 1984 were, on average, lower than those after 1984 for every mode of fishing. The low period seems to cover the years 1982/1983. Uniformly good fishing began in the 1984/1985 period and has remained strong for most modes of fishing since then.

Flatfishing varies across seasons. Peak catch rates for flatfish occur in the early and later parts of the year, with the November/December period exhibiting the highest catch rates for nearly every mode (Figure NY6). The worst catch rates appear uniformly in the September/October period.

Characteristics of Fishing Trips in New York

The previous descriptions pertain to aggregate fishing activity and the biological characteristics of fishing in New York. They were distilled from the two NMFS surveys for the years 1981-1988. We can consider other demographic data on the characteristics of fishing trips. These data, from the 1988-1989 telephone survey of households, help us understand what individual fishing trips are like.

Table NY.6 describes day trips taken in New York, by mode. There are six modes recorded in the UMCP survey: the shore modes are beach and pier; the boat modes are party, charter, private, and rental. Travel costs are highest for charter and rental, reflecting the fact

that people from further away take relatively more charter and rental trips. Bait costs are quite high compared to other states. The low bait costs for party boats probably reflect the nature of the party contract; bait is part of the price of admission. Bait costs are especially high for the rental and private modes. Tackle costs are similar for the three private modes: pier, beach, and private boat. They are lower for the hired-boat modes, where some part of the tackle costs may be included in the contract. Except for the rental mode, the travel costs and time are similar.

Table NY.7 describes fishing trips which are taken as part of overnight visits to New York. These trips are too few to disaggregate by mode. The overnight visits can be motivated by many factors, including vacations, business trips and visits to relatives. The travel cost is similar to the day trip travel cost for public modes. The tackle and cleaning costs are comparable to the day trips' costs. The bait cost is quite high, but not completely out of line with the bait cost for the day trips.

Table NY.8 shows the distribution of species sought by mode. The importance of flatfish stands out in this table, reflecting the relative importance of the summer and winter flounder fishing. In four of the six modes, it is the most important species. The rental sector is quite large in New York, relative to other states. This table shows the importance of flatfish for the rental sector. Fishing for big game is feasible only on the eastern tip of Long Island, and only a small proportion of trips are targeted at big game species.

Table NY.1

Two-Month Participation Rates*
by Wave and Year

Year	Wave				
	March-April	May-June	July-August	September-October	November-December
1980	4.4%	4.7%	8.9%	6.1%	1.1%
1981	3.7	6.5	10.8	5.4	1.6
1982	3.0	6.7	6.9	4.3	1.8
1983	3.1	6.5	7.9	4.5	1.2
1984	3.0	5.4	7.5	4.4	1.0
1985	2.7	4.8	4.9	4.2	2.7
1986	3.4	5.3	8.9	5.2	2.1
1987	1.3	4.6	7.3	4.1	2.1
1988	2.1	4.9	5.2	3.6	1.7
1989	1.4	3.7	7.6	2.0	1.3
Mean	2.8%	5.3%	7.6%	4.4%	1.7%

* Percent of New York coastal county households called who indicated they fished in New York marine waters in the previous two months.

Table NY.2

Linear Trend Analysis[1] New York Participation Rates,
By Wave, 1980-1989

	Constant	Linear Coefficient	$\bar{R}^2$
March/April	.041	-.0027	.72
	(13.29)	(-4.87)	
May/June	.063	-.0021	.35
	(13.50)	(-2.43)	
July/August	.089	-.0029	.17
	(9.54)	(-1.68)	
September/October	.057	-.0029	.60
	(13.87)	(-3.82)	
November/December	.014	.0006	.00
	(4.47)	(.085)	

[1] Estimated model was Part. rate = $\alpha_0 + \alpha_1$ time, with time defined as t = 0 for 1980. t = 1 for 1981 . . . and t = 9 for 1989.

[2] T-ratio in parentheses.

Table NY.3

Trips Per Household Called
By Year and Season*

Year	Total	Wave				
		March-April	May-June	July-August	September-October	November-December
1980	--%	.06%	--%	--%	--%	.03%
1981	1.01	.08	.23	.44	.23	.03
1982	1.01	.07	.27	.43	.19	.04
1983	1.52	.11	.62	.55	.21	.03
1984	1.47	.12	.36	.67	.26	.03
1985	1.18	.23	.28	.22	.25	.19
1986	1.19	.10	.25	.43	.32	.10
1987	1.15	.04	.32	.52	.22	.06
1988	1.18	.16	.31	.43	.20	.07
1989	.94	.04	.17	.54	.12	.07
Mean	1.18	.11	.31	.47	.22	.07

* trips taken within state of residence.

Table NY.4

Percent of Fishing Trips in Various Modes by Wave
Mean 1980-1988

Mode	Wave				
	March-April	May-June	July-August	September-October	November-December
Shore	26.1%	31.6%	27.9%	28.1%	42.6%
Party/Charter	22.1	11.5	15.5	17.6	18.7
Private/Rental	57.8	57.0	56.6	54.3	38.7

Table NY.5

Percent Fishing Households Who Fish in Various Areas, by Wave
Mean 1980-1988

Area	Wave				
	March-April	May-June	July-August	September-October	November-December
Ocean, Gulf, Open Bay	50.2%	44.8%	54.0%	53.2%	48.2%
Sound	32.1	30.1	21.4	28.5	14.5
River	1.6	2.3	1.7	1.3	22.7
Enclosed Bay	15.0	21.9	22.5	16.9	14.4

Table NY.6

Average Characteristics of Day Trips in New York, by Mode
(per trip averages)

Characteristic	Mode					
	Pier	Beach	Party	Charter	Rental	Private
Travel Cost	$ 5.78	$ 5.30	$ 8.73	$16.16	$17.24	$9.10
Costs for						
Bait	5.58	3.89	1.53	4.17	12.26	9.78
Tackle	3.48	4.07	1.19	.65	1.93	3.88
Cleaning	.58	.51	2.04	1.87	1.33	2.38
Fuel	--	--	--	--	3.47	19.24
Pier Fees	.67	--	--	--	--	--
Boat Fees[a]	--	--	29.86	37.03	41.96	--
Travel Time (in minutes)	30.9	32.0	42.4	44.2	69.1	32.77
Distance (in miles)	21.1	19.6	29.2	32.5	50.5	20.40
Boat Time to first site (in minutes)	--	--	52.5	65.1	21.5	31.3
Number of Observations	149	95	318	85	64	579

[a] Boat fees are charter and party fees or rental fees.

Table NY.7

Characteristics of Trips for Overnight Visits in New York

Characteristic	Mean	Number of Applicable Observations
Travel Cost	$6.87	143
Cost for		
Bait	17.99	147
Tackle	3.94	149
Cleaning	3.38	149
Fuel	42.15	73
Pier Fees	.87	12
Boat Fees	47.76	36
Boat Rental	[a]	[a]
Travel Time (in minutes)	10.9	136
Distance (one-way) (in miles)	6.4	143
Boat Time (in minutes)	72.4	110
Trip Length (in miles)	6.0	151

[a] Only one observation for boat rental

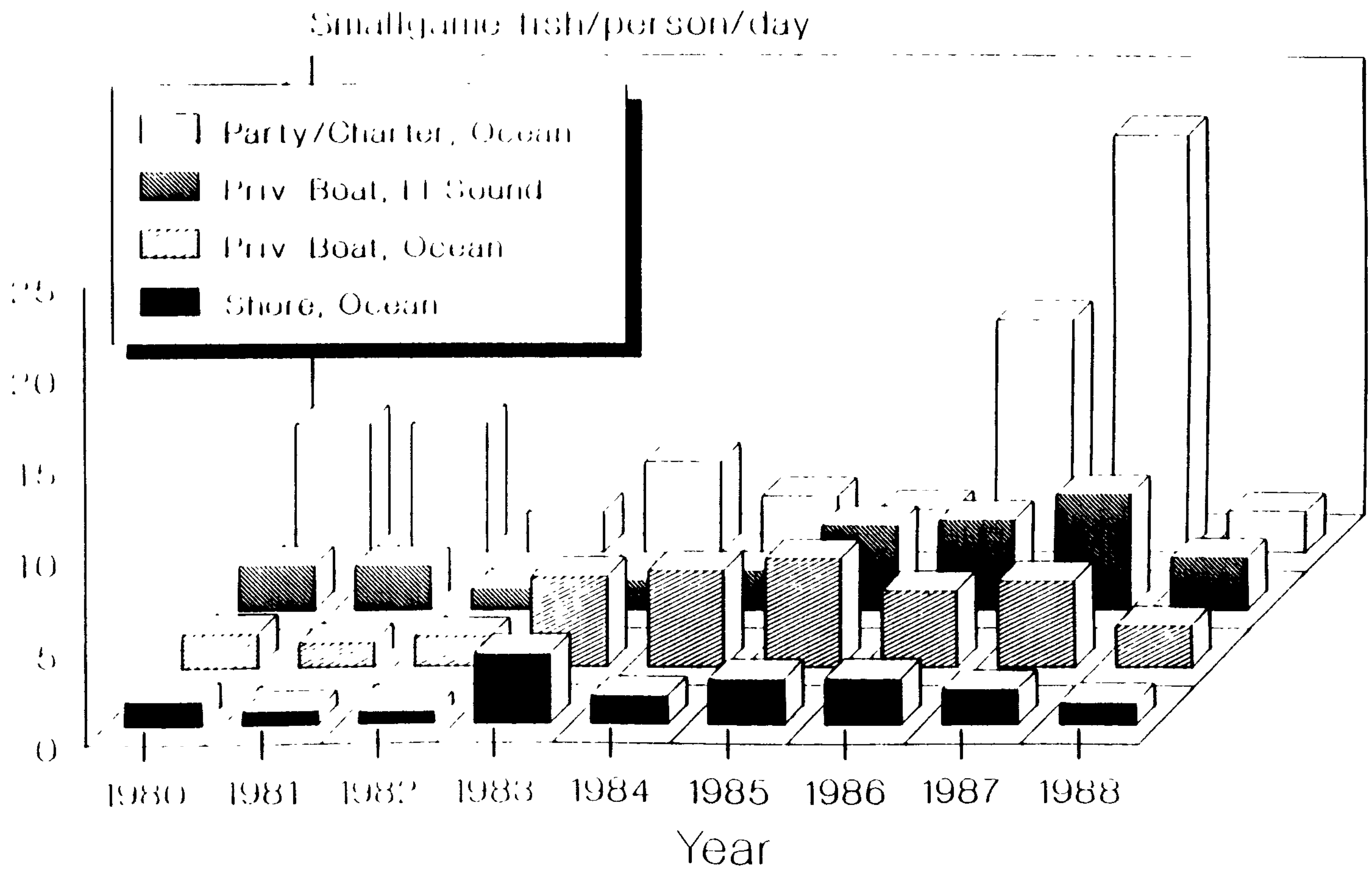
Table NY.8

Percent of Trips Seeking Different Species Groups, by Mode
for Day Trips

	Mode					
Species Group	Pier	Beach	Party	Charter	Rental	Private
Big Game	.8	0.0	2.9	18.8	3.3	12.2
Small Game	26.2	66.7	23.2	35.0	11.5	37.2
Flatfish	62.3	24.1	37.9	30.0	80.3	41.7
Bottomfish	9.8	9.2	36.0	16.3	4.9	8.7

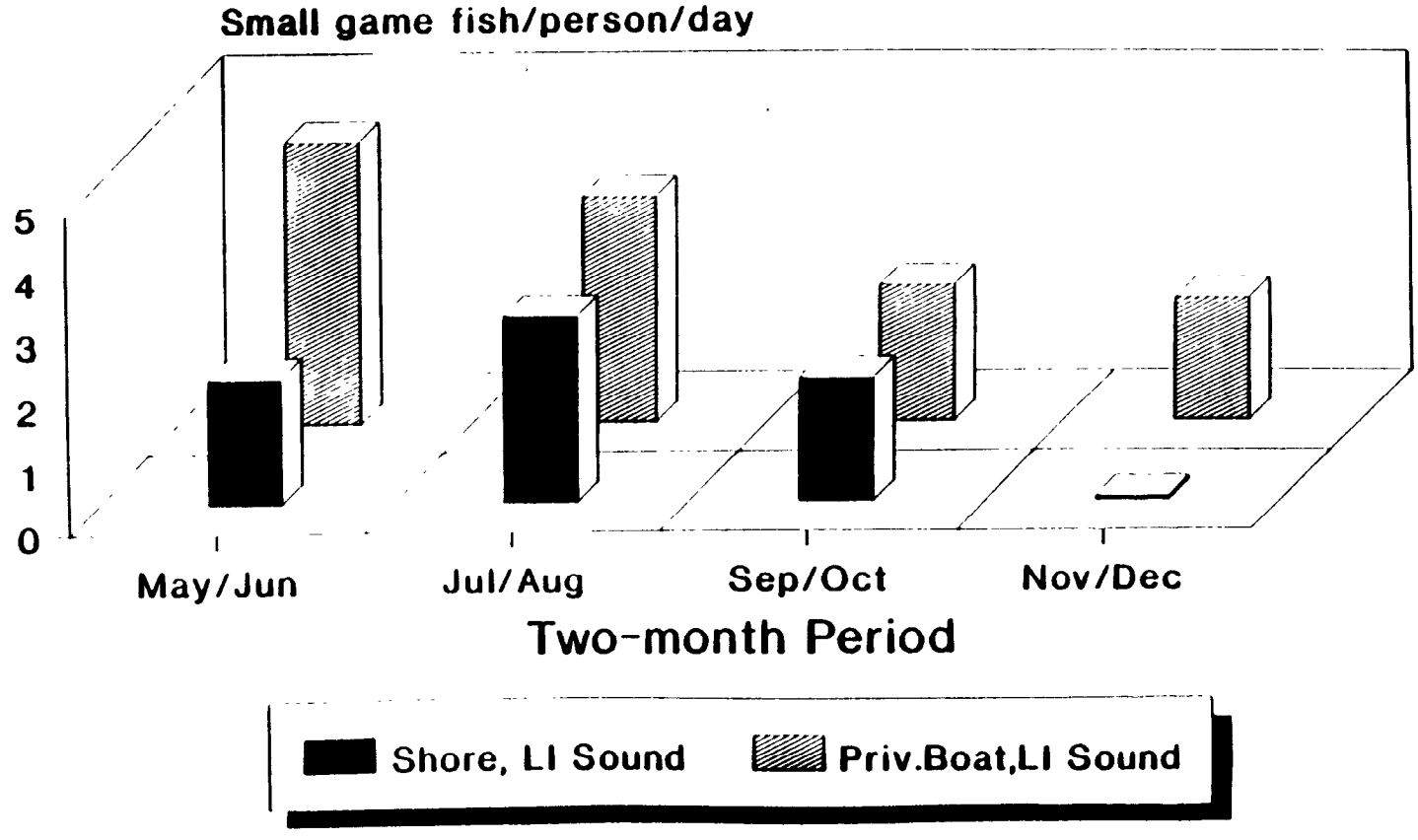
rfishny.wp/lt/8-21-91

Fig. NY1: Smallgame Catch Per Day,
New York, Long Island Sound and Ocean,
By Fishing Mode, 1980-1988



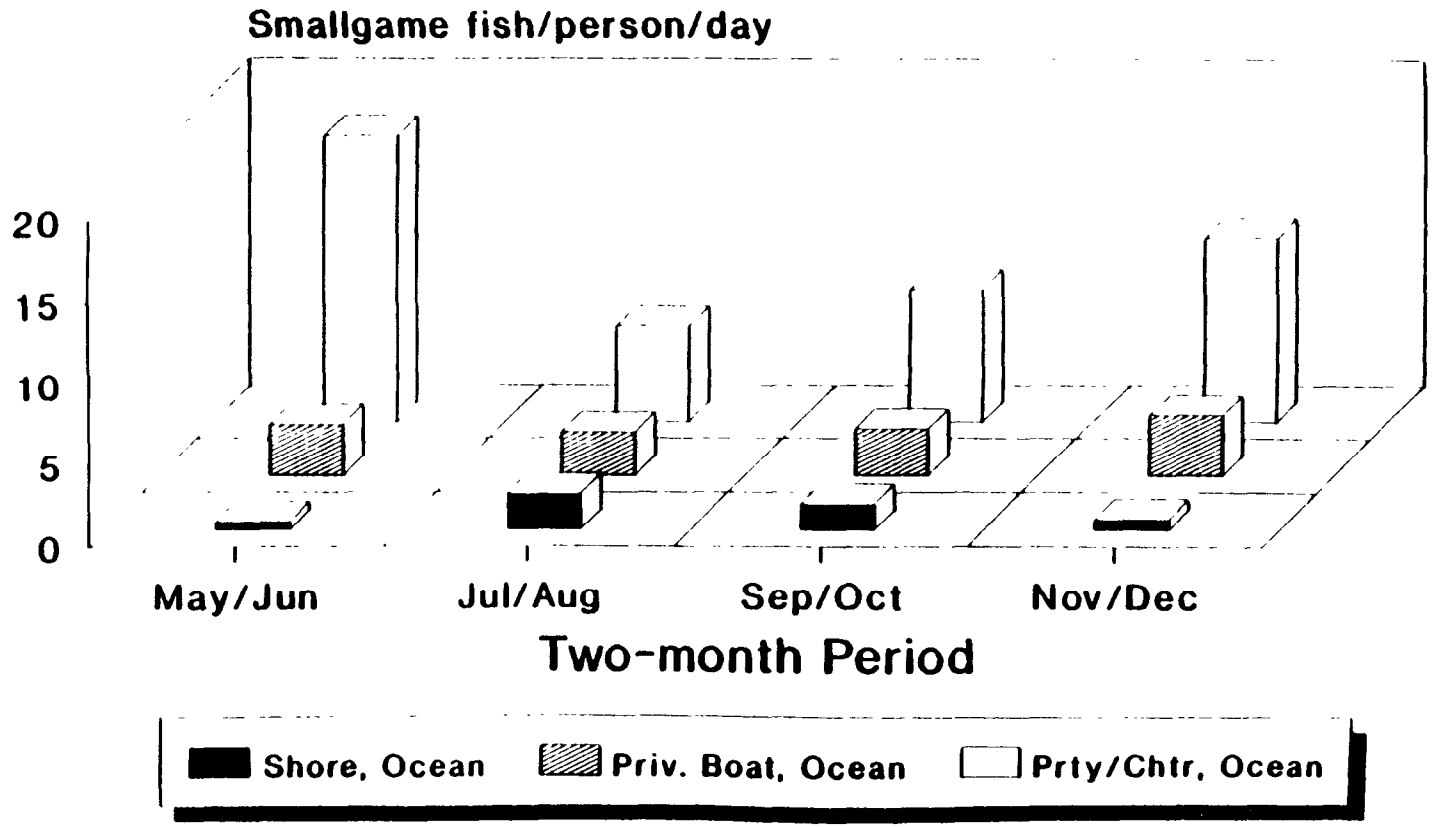
For individuals targeting Smallgame

Fig. NY2: Small Game Catch Per Day,
New York, Long Island Sound,
By Wave and Mode



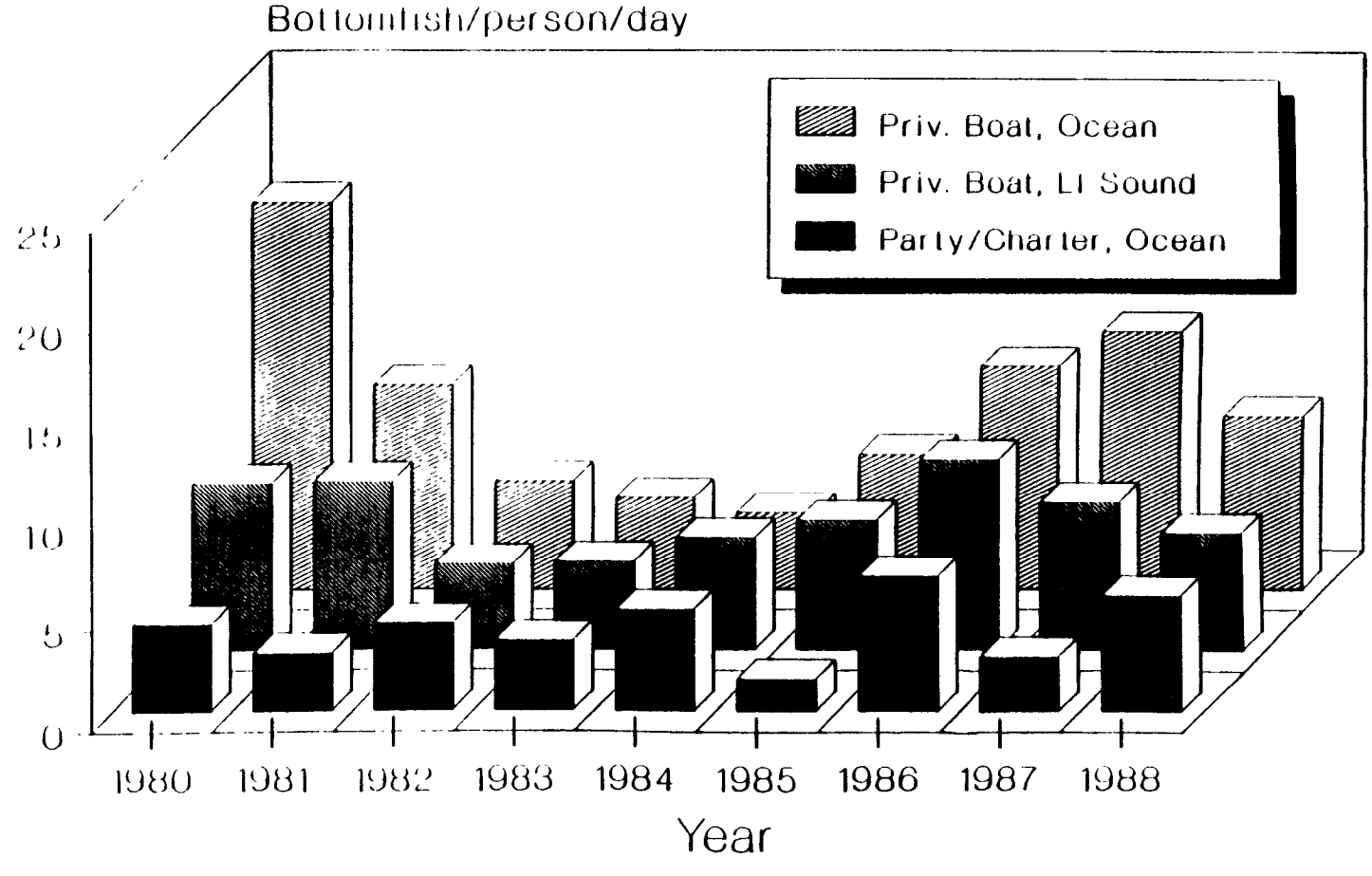
Average for individuals targeting small game, 1980-1988.

Fig. NY3: Small Game Catch Per Day,
New York, Atlantic Ocean,
By Wave and Mode



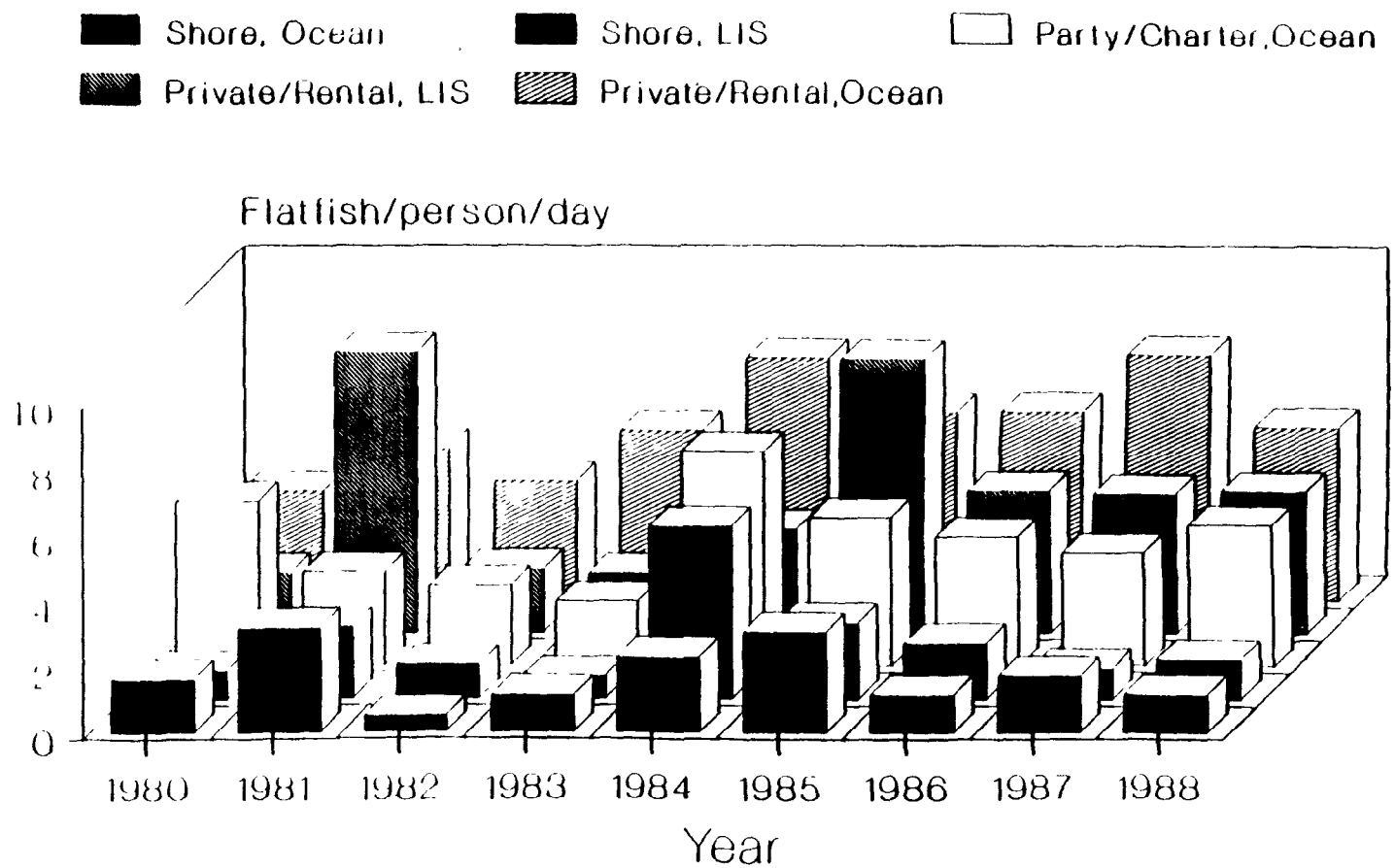
Average for individuals targeting small game, 1980-1988.

Fig. NY4: Bottomfish Catch Per Day,
New York, Ocean and Long Island Sound
By Fishing Mode, 1980-1988



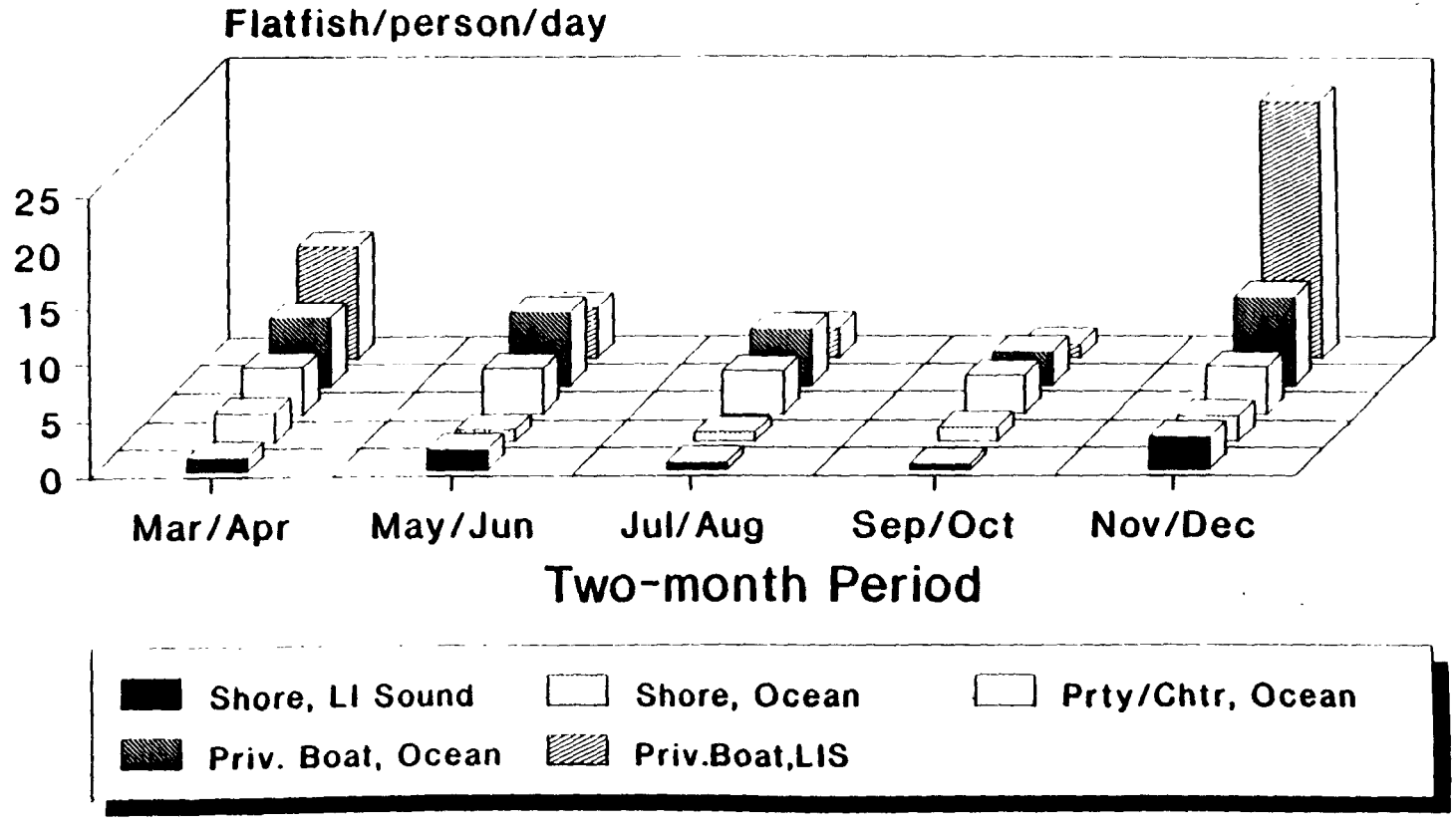
For individual , targeting bottomfish

Fig. NY5: Flatfish Catch Per Day,
New York, Ocean and Long Island Sound,
By Fishing Mode, 1980-1988



For individuals targeting flatfish

Fig. NY6: Flatfish Catch Per Day,
New York, Atlantic Ocean,
By Wave and Mode



Average for individuals targeting flatfish, 1980-1988.

Chapter 3

SPORTFISHING IN NEW JERSEY

Activity by New Jersey Households

The New Jersey coast stretches from the heavily populated suburbs of New York City to the north, past the New York barrier islands, around the tip of Cape May to the mouth of the Delaware Bay. The coast provides quite a variety of types of waterbodies for fishing. The climate is inhospitable for fishing from late fall through early spring. But there is a large population of potential fishermen living relatively close to the New Jersey shore. Many of these potential users are residents of other states, in particular those living in New York City and in Philadelphia.

Unfortunately, NMFS telephone data does not permit consideration of out-of-state users. The NMFS telephone survey of New Jersey is directed toward households who live in counties within 25 miles of the coast or of major bays or estuaries, for all waves, March through December. According to the 1980 Census this includes 2,478,500 households. In the first half of the decade, between 55 and 65 percent of the participants in New Jersey marine waters were from in-state coastal counties. But that percentage appears to have dropped to about 40 percent in later years. Over the years about two-thirds of the sportfishing trips to New Jersey waters were taken by these coastal county residents. Almost all of the remaining Participation and trips are attributable to out-of-state residents.

Sportfishing Activity: Household Participation Rates and Quantity of Fishing Trips

Results of the telephone survey give a detailed picture of the seasonal and temporal variation in sportfishing by New Jersey households. Table NJ.1 gives participation rates by wave and year for the ten years from 1980 through 1989. The participation rates show the percent of households called in a wave that fished during the designated two months. These rates show the dispersion of fishing activity over the population of households, not the magnitude. Although the rates are larger in New York, they show similar seasonal patterns. In early spring and late fall -- March-April and November-December, participation rates are quite low, varying from 1.0 percent in March-April, 1989 to 4.7 percent in March-April, 1986. The mid-summer wave of July-August has a relatively high rate, averaging about 10 percent. The sample sizes for these waves vary from a low of 568 to a high of 4988, but all samples are large enough to give confidence in the participation rate estimates.

The participation rates by wave and year show considerable variation within and among seasons. The seasonality is obvious from the means. The rate in July-August is more than three times the rate in early spring or late fall. Consider 1987. The number of households who sportfish increased four-fold from March-April to July-August. Within season variability is not as great as with other states. November-December shows the greatest proportional variation, probably due to weather systems moving up the coast.

There is evidence of trend, depending on the wave (Table NJ.2). In all waves, the trend coefficient is negative and it is statistically significant in the March-April and July-August wave. The July-August pattern is particularly pronounced, with an average annual decline of .7%. This means that by the end of the ten-year period, nearly 7% less of the population was participating

in marine angling. This could be the result of many factors, including differing preferences of the new additions to New Jersey's population, the changing fish populations, or increasing costs of fishing.

The magnitude of sportfishing is better expressed in number of trips than in participation rates. Table NJ.3 shows trips per household called by wave and year over the period of the telephone survey. These measures can be used to calculate aggregate trips simply by multiplying trips per household called by the number of eligible households. (Aggregate trips could also be calculated by the product of trips per fishing household, the proportion of fishing households, and the number of eligible households.) Using all eight years of data, we can compute the proportion of trips taken in each season as follows:

	Mean Trips	Percent of Annual Trips
March-April	.09	5.8
May-June	.35	22.6
July-August	.67	43.2
September-October	.33	21.3
November-December	.11	7.1

Over 85 percent of the trips by coastal residents of New Jersey are taken in the period May through October. And in the peak summer wave, July-August, 43 percent of the sportfishing activity occurs.

There is more variability within and among seasons in the trips data than in the participation rate data. For example, the trips in March-April more than double from a low of .04 per household called in 1989 to a high of .15 in 1983. In the July-August wave, the range

is from .30 to .88. This shows great variability, with activity levels being reduced by more than 50 percent from one year to the next.

As with the New York data, there were no statistically significant time trends in the number of trips per household called. This, continued with the failing participation rate, implies an increasing number of trips per participant. Thus, the infrequent participant is likely to have stopped participating whereas the frequent participant likely increased marine fishing.

Sportfishing Activity by Mode

The data in Tables NJ.1-3 are quite superficial, revealing little about the nature of the fishing activity. A better sense of fishing activity comes from knowing something about the household's fishing activities. Table NJ.4 gives the distribution of fishing trips by the three primary modes. These proportions are means for the years 1981 through 1988. They show the impact of seasonality on the kinds of fishing, as well as the basic structure of the fishery. Shore fishing and private/rental boat fishing are inversely proportional. Shore fishing is more popular in early spring and late fall. The proportion of fishing trips in the private/rental mode peaks at about 60 percent in July-August. The proportion of trips in the party/charter mode, about 12 to 20 percent over the year, is quite high relative to other states.

Table NJ.4 provides information on the distribution of trips over modes and seasons. To gain some appreciation of the magnitudes, we can use information on the number of households who live in coastal counties and the number of trips per household called in Table NJ.3. By the 1980 census, 2,478,500 households lived in the coastal counties of New Jersey. Table NJ.3 shows mean trips per household called for March-April to be .09. Aggregate trips for coastal county residents would be 223,065 (=.1 * 2,478,500). From Table NJ.4, 20.5 percent or

45,728 of these trips would be attributed to the party/charter mode. In July-August, there were .67 trips per household called, implying 1,660,595 total trips by coastal county residents. Of these an estimated 12.9 percent or 214,217 trips were party/charter trips. This level of party/charter trips requires a considerable infrastructure to support the production of services. Thus calculations do not consider people who fish in New Jersey who are not coastal county residents. About two thirds of all trips in New Jersey are taken by coastal county residents.

Sportfishing Activity by Waterbody

The nature of sportfishing in New Jersey is also characterized by the kinds of waterbodies in which people fish. The telephone survey asked households about fishing in four types of water: ocean, gulf and open bay; sound; river; and enclosed bay. Table NJ.5 shows the proportion of fishing trips in each type of waterbody by season. This table gives the mean proportions for the eight year sample period. As is true for other states, the waterbodies are ambiguous. But they show some of the seasonality in the sportfishery.

In New Jersey, the principal fishing areas are the Atlantic and the bays and estuaries protected by barrier islands. Households responses overwhelming favor the ocean, gulf and open bay alternative. The proportion of trips to this type of waterbody rises over the year from about 70 percent to almost 90 percent in the fall. The high rate in the fall may be in response to the fall migration of bluefish. Enclosed bay is the second most popular area in all but the early spring wave and late fall wave when a larger portion of the fishing trips are taken in rivers.

Aggregate trips for different waterbodies can be computed just as for different modes. Of the 223,065 estimated trips on average in March-April, 74.3 percent or 165,737 would be attributed to ocean, gulf, or open bay waters.

Catch Rates in New Jersey

New Jersey's long shoreline on the Atlantic plus two large bays at its northern and southern extremities deserve special attention. Raritan Bay lies at the north, being a portion of the entrance to New York harbor, and the southern boundary of New Jersey is the Delaware Bay. We chose to consider the catch rates for sites adjacent to the ocean and for the sites adjacent to the two Bays. Unfortunately there was insufficient data to consider the Delaware Bay independently.

The percentage of anglers intercepted in New Jersey who did not target species is larger than in New York, rising from 18 percent in years prior to 1985 to 20 percent in subsequent years. However, like New York, flatfish are the most targeted species. About 42 percent of New Jersey's anglers target flatfish, regardless of the period. Smallgame were the next most targeted species, with 26 percent of the anglers prior to 1985 and 33 percent in subsequent years. The targeting of bottomfish fell from 12 percent to 6 percent over the periods. Finally, biggame is targeted by less than 1 percent of the anglers.

Smallgame Catch Rates

The predominant species of smallgame targeted from New Jersey sites are bluefish, striped bass, weakfish and Atlantic mackerel. Weakfish and Atlantic mackerel were targeted by about 20% and 5%, respectively, of smallgame anglers over both the pre- and post-1985 period. Prior to 1985, striped bass and bluefish were targeted by about 10% and 65% of smallgame

anglers, respectively. This percentage changed in the 1985 and later period to about 5% for striped bass and 70% for bluefish.

Figure NJ1 shows the catch rate of smallgame by site and year for people targeting smallgame. There is remarkable consistency in these catch rates over modes, particularly over the party/charter and the private boat mode. In general, the figure gives the impression of high catch rates in the mid-eighties (1983-1986) and much lower catch rates at the beginning and end of the decade. The 1982 values are low, similar to the dip experienced in New York in this year. The values of the catch rates suggest that the shore mode is the least effective, experiencing approximately one-third the catch rate of party/charter fishers and one-half the rate of the private boat anglers.

Catch rates for smallgame in counties bordering the ocean vary dramatically over the year (Figure NJ2). Those individuals who brave the colder weather and use party/charter modes of fishing in March/April or November/December tend to have more success than those fishing at other times. The shore mode yields high catch rates in the March/April period but is not as productive in the winter. Finally, the private boat catch rates are high in the summer months and in November/December. No one targeting smallgame was interviewed in the private boat mode during March/April.

Although there were not sufficient data from sites on Raritan Bay to study trends in smallgame catch rates over the decade, there were sufficient data to observe seasonal variation (Figure NJ3). No one who was targeting smallgame was intercepted at these sites in March/April. The remainder of the year shows substantial variation across seasons and mode of fishing. The peak catch rate of smallgame for private boat fishing is May/June, the peak wave

for shore fishing is July/August and for party/charter fishing it is September/October. The highest catch rates are obtained by the party/charter mode.

Bottomfish Catch Rates

Popularity of targeted bottomfish in New Jersey waters has varied over the decade. The first five years saw anglers targeting silver hake (28%), tautog (26%), black sea bass (18%) and red hake (15%). In the latter half of the eighties, silver hake was not as frequently targeted while the other three species increased in popularity. During the latter period, tautog (38%) has been the dominant species, with black sea bass (23%) and red hake as the other popular species.

Not as many anglers target bottomfish and thus the data are not as abundant nor as meaningful. However, there were sufficient fishermen intercepted to examine the catch rates from ocean sites for shore fishermen and party/charter fishermen.

Figure NJ4 shows how the catch rates have changed over the eighties. For shore fishermen, the beginning of the eighties offered poor catch rates for bottomfish, whereas the mid-eighties offered better fishing. There was a drop-off in 1986 followed by a steady rise for the remaining period. Party/charter fishing showed more of a steady progression of improving fishing from 1980 to 1985, followed by the same drop in catch rate in 1986. An upward swing is also observed since 1986.

Seasonal variation in bottomfish catch race is evident from Figure NJ5. For the party/charter boats, fishing begins in March/April with low catch which increases to a high in September/October. November and December also offer a reasonably high catch rate. Shore fishermen first appear targeting bottomfish in May/June, and catch rates rise in September/October and fall in November/December.

Flatfish Catch Rates

As in New York, the predominant flatfish targets are summer and winter flounder. However, the summer flounder is the most popular flatfish in New Jersey, sought by 78% of the targeting flatfish anglers in the pre-1985 period and 83% in the 1985-1988 period. The percentage of anglers targeting flatfish who seek winter flounder has fallen from 19% in the pre-1985 period to 14% in the 1985-88 period.

Catch rates of flatfish from ocean sites (Figure NJ6) reflect poor fishing in 1982, a pattern also apparent in New York data. The general trend in shore catch rates is downward over the decade, but there is not much evidence of a trend in catch rates from private boats. If anything, the middle of the decade showed higher catches for private boat fishermen.

On Raritan Bay sites (Figure NJ7), the lowest catch rate was experienced by party/charter fishermen in 1983 and the highest by private boat fishermen in 1985. The final three years (1986-1988) show relatively constant catch rates, similar to the New Jersey ocean and the New York ocean/sound patterns.

The seasonal variation in catch rates is also similar to New York's. The largest catch per day often occurs either in the March/April period or the November/December period (Figure NJ8). The November/December period is most important for the ocean sites, and the March/April period shows high catch for the Raritan Bay sites. The worst period for the ocean sites appears to be July/August.

Characteristics of Fishing Trips in New Jersey

The economic aspects of fishing trip pertain to costs of travel and services as well as the catch rates and destinations of trips. The UMCP survey of anglers gives some of the important economic characteristics of trips taken to fishing spots in New Jersey in 1988, but which may originate anywhere. The following section describes some of these data.

Table NJ.6 characterizes one day trips taken to New Jersey sites for marine sportfishing by mode. There are six modes: pier and other artificial structure, beach, party boat, charter boat, rental boat and private boat. Each mode is reasonably well represented for New Jersey. The travel costs are lowest for the beach trips, because fishing sites on beaches are more broadly dispersed than other modes. The rental mode has the highest travel cost. The bait costs for the charter mode are quite high, suggesting that some of these costs are not included in the fee for boat and other services. Cleaning fees for pier and beach fishing are lower than for private and rental boats, and may be due to a lower catch rate for shore fishing. The pier fee is low because most of the fishing from artificial structures takes place on jetties, where no fees are charged.

Trips which are taken in conjunction with overnight visits have different characteristics. Overnight visits can include vacations, business trips, visits to relatives, and visits for other purposes. Table NJ.7 gives some trip characteristics for trips which are part of overnight visits. Comparing the travel costs and time and distance traveled shows that these trips which are taken as part of overnight visits are much shorter. Travel cost is less than half that of the day trip travel costs. And the time traveled is much less, about 15 minutes per trip as opposed to more than 40 minutes. However, the costs of fishing services are similar. Bait costs average $6.80.

similar to one day trips. Trips taken as part of overnight visits appear to be similar except for the distance travelled.

The UMCP survey also gives interesting information on the species group sought by mode. Some of this information is presented in Table NJ.8. Only trips taken by charter mode tend to seek big game. Flatfish are quite important as they are in New York. The rental mode is frequently used to pursue flatfish in the northern waters. The only mode where small game are the most important species is the beach mode. Flat fish are also sought frequently from piers and jetties.

Table NJ.1

Two-Month Participation Rates*
by Wave and Year

Year	Wave				
	March-April	May-June	July-August	September-October	November-December
1980	3.5%	9.4%	12.2%	6.9%	2.1%
1981	3.5	7.6	12.6	6.8	2.4
1982	4.0	5.6	12.1	4.9	2.7
1983	3.2	6.1	10.8	5.4	3.1
1984	2.7	4.9	9.9	6.2	2.8
1985	3.3	6.5	8.7	5.9	2.4
1986	4.7	10.1	10.4	9.1	2.8
1987	2.1	6.2	8.4	5.3	2.9
1988	1.9	5.8	7.2	4.7	3.0
1989	1.0	5.0	6.3	5.8	1.5
Mean	3.0%	6.8%	9.9%	5.9%	2.6%

* Percent of New Jersey coastal county households called who fished in New Jersey marine waters in the designated two months.

Table NJ.2

Linear Trend Analysis[1] of Participation Rates,
By Wave, 1980-1989

Wave	Constant	Linear Trend Coefficient	$\bar{R}^2$
March - April	.040 (7.94)[2]	-.0022 (-2.33)	.33
May - June	.080 (8.31)	-.0026 (-1.43)	.10
July - August	.129 (29.20)	-.0068 (-8.18)	.88
September - October	.067 (7.86)	-.0018 (-1.13)	.03
November - December	.026 (8.64)	-.0001 (-0.16)	.00

1 Estimated model. was participation rate = $\alpha_0 + \alpha_1$ time, with time defined as t = 0 for 1980, t = 1 for 1981 . . . , and t = 9 for 1989.

2 T-ratio in parentheses.

Table NJ.3

Trips Per Household Called
By Year and Season*

Year	Total	Wave				
		March-April	May-June	July-August	September-October	November-December
1980	.--	.06	.--	.--	.--	.03
1981	1.07	.10	.33	.37	.24	.03
1982	1.52	.10	.25	.79	.28	.09
1983	1.69	.15	.25	.88	.23	-20
1984	1.60	.08	.22	.88	.31	.11
1985	1.61	.11	.35	.69	.37	.10
1986	2.26	.11	.57	.85	.57	.16
1987	1.70	.07	.47	.55	.41	.21
1988	1.46	.10	.40	.57	.29	.10
1989	1.13	.04	.30	.46	.29	.04
Mean	1.56	.09	.35	.67	.33	.11

* Trips taken within state of residence.

Table NJ.4

Percent of Fishing Households Who Fish in Various Modes by Wave
Mean 1981-1988

Mode	Wave				
	March-April	May-June	July-August	September-October	November-December
Shore	41.1%	32.9%	25.9%	38.0%	48.4%
Party/Charter	20.5	16.3	12.9	15.4	23.5
Private/Rental	38.5	50.7	61.2	46.6	28.1

Table NJ.5

Percent Fishing Households Who Fish in Various Areas, by Wave
Mean 1981-1988

Area	Wave				
	March-April	May-June	July-August	September-October	November-December
Ocean, Gulf, Open Bay	74.3%	69.4%	74.2%	73.1%	87.9%
Sound	1.7	.5	.4	.9	1.1
River	11.0	4.3	3.2	5.5	7.4
Enclosed Bay	10.3	25.8	21.9	16.7	3.2

Table NJ.6

Characteristics of Day Trips in New Jersey, by Mode
(per trip averages)

Characteristic	Mode					
	Pier	Beach	Party	Charter	Rental	Private
Travel Cost	$7.39	$6.07	$10.37	$11.86	$19.58	$11.72
Costs for						
Bait	4.01	3.43	1.06	16.75	7.45	8.52
Tackle	8.85	6.20	5.27	2.16	8.46	3.95
Cleaning	.53	.62	2.35	11.09	1.76	1.66
Fuel	--	--	--	--	8.21	15.08
Pier Fees	.32	--	--	--	--	--
Boat Fees[a]	--	--	26.31	104.8	46.95	--
Travel Time (in minutes)	46.27	43.92	55.9	59.6	52.3	46.9
Distance (in miles)	33.7	30.9	4.3	44.82	40.0	31.7
Boat Time to first site (in minutes)	--	--	49.73	88.54	33.0	29.4
Number of Observations	126	107	346	53	48	687

[a] Boat fees are charter and party fees or rental fees.

Table NJ.7

Characteristics of Trips for Overnight Visits in New Jersey

Characteristic	Mean	Number of Applicable Observations
Travel Cost	$3.79	139
Cost for		
Bait	6.89	143
Tackle	9.43	142
Cleaning	1.04	143
Fuel	19.42	59
Pier Fees	.53	22
Boat Fees	94.12	30
Boat Rental	--	--
Travel Time (in minutes)	15.38	139
Distance (one-way) (in miles)	5.3	141
Boat Time (in minutes)	60.43	87
Trip Length (in miles)	15.68	144

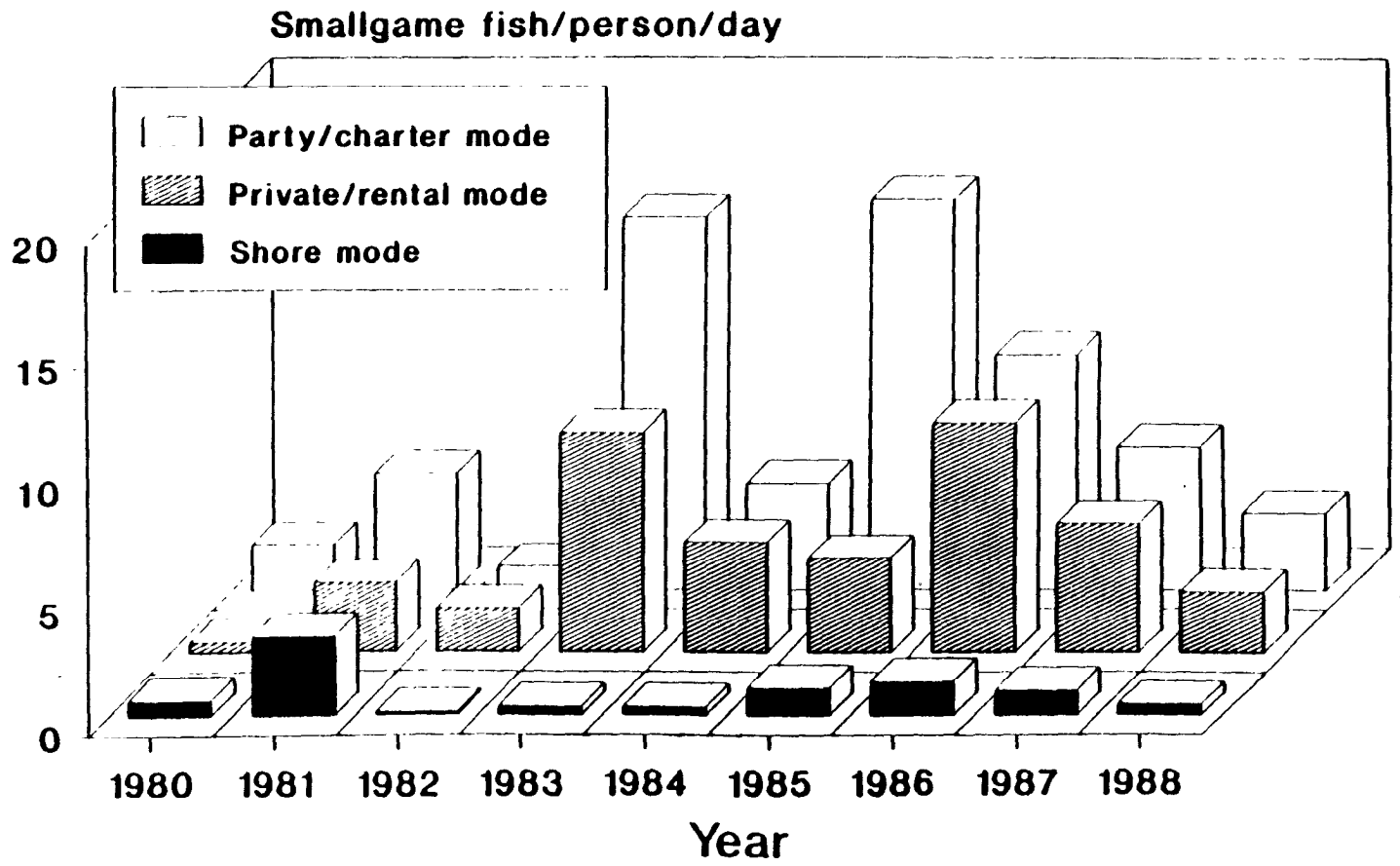
Table NJ.8

Percent of Trips Seeking Different Species Groups, by Mode
for Day Trips

	Mode					
Species Group	Pier	Beach	Party	Charter	Rental	Private
Big Game	4.7%	0	3.1%	20.4%	2.1%	5.7
Small Game	32.9	71.7	35.8	46.9	23.4	35.7
Flatfish	47.1	25.0	30.6	20.4	70.2	54.7
Bottomfish	15.3	3.3	30.6	12.2	4.3	4.0

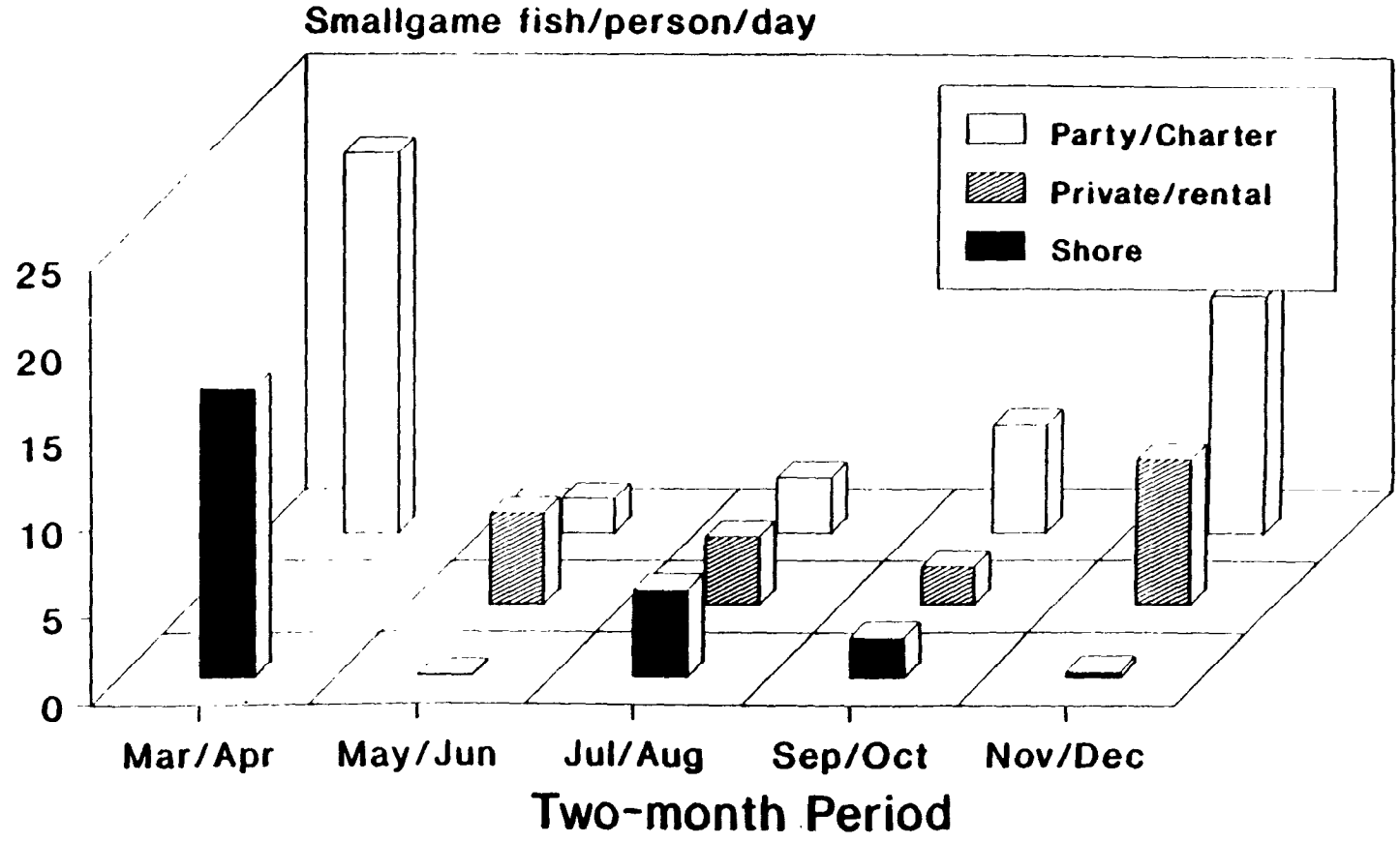
rfishnj.wp/ct/8-28-91

Fig. NJ1: Smallgame Catch Per Day, New Jersey, Ocean, By Fishing Mode, 1980-1988



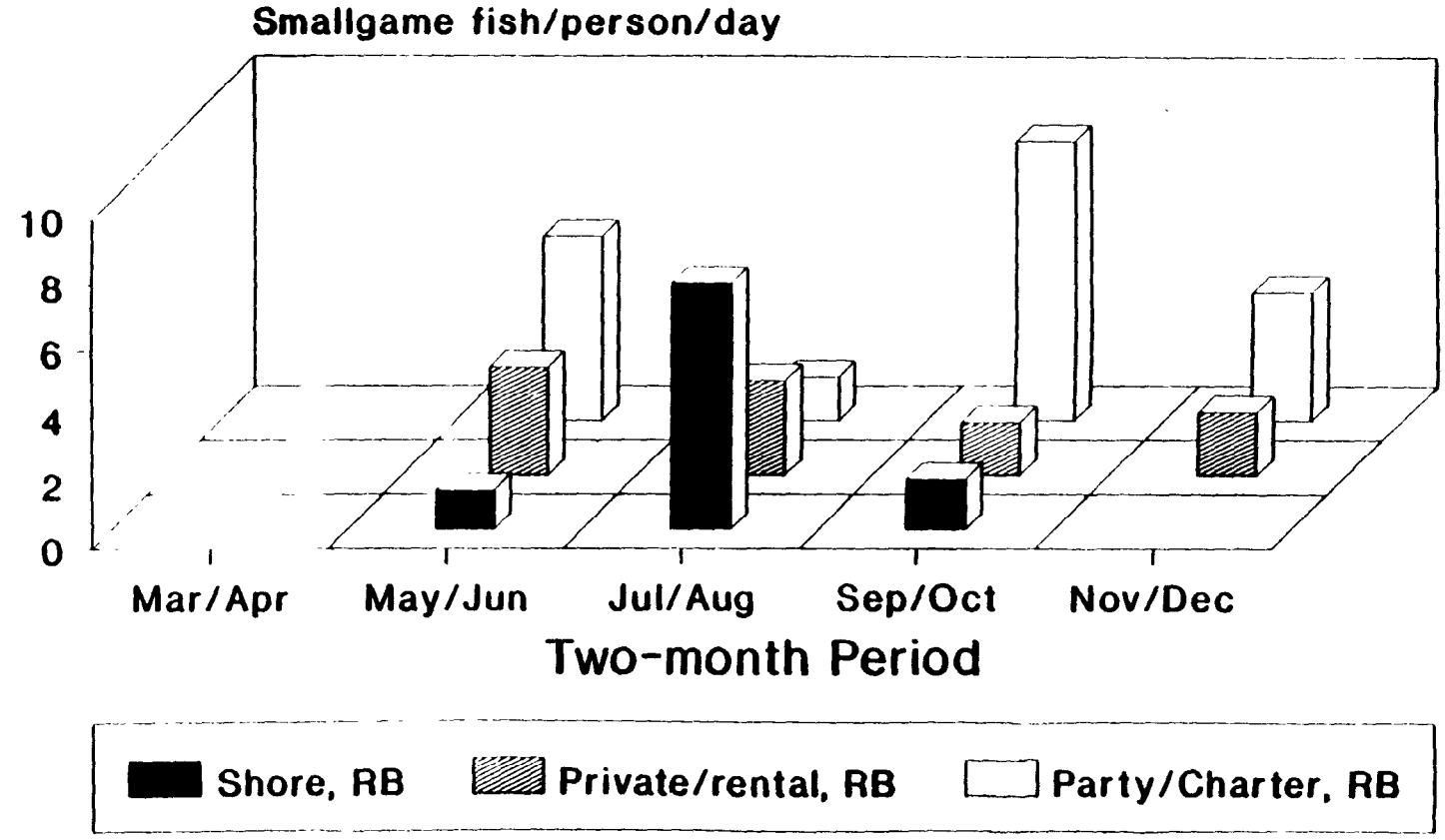
For individuals targeting smallgame.

Fig. NJ2: Smallgame Catch Per Day,
New Jersey, Ocean,
By Wave and Mode



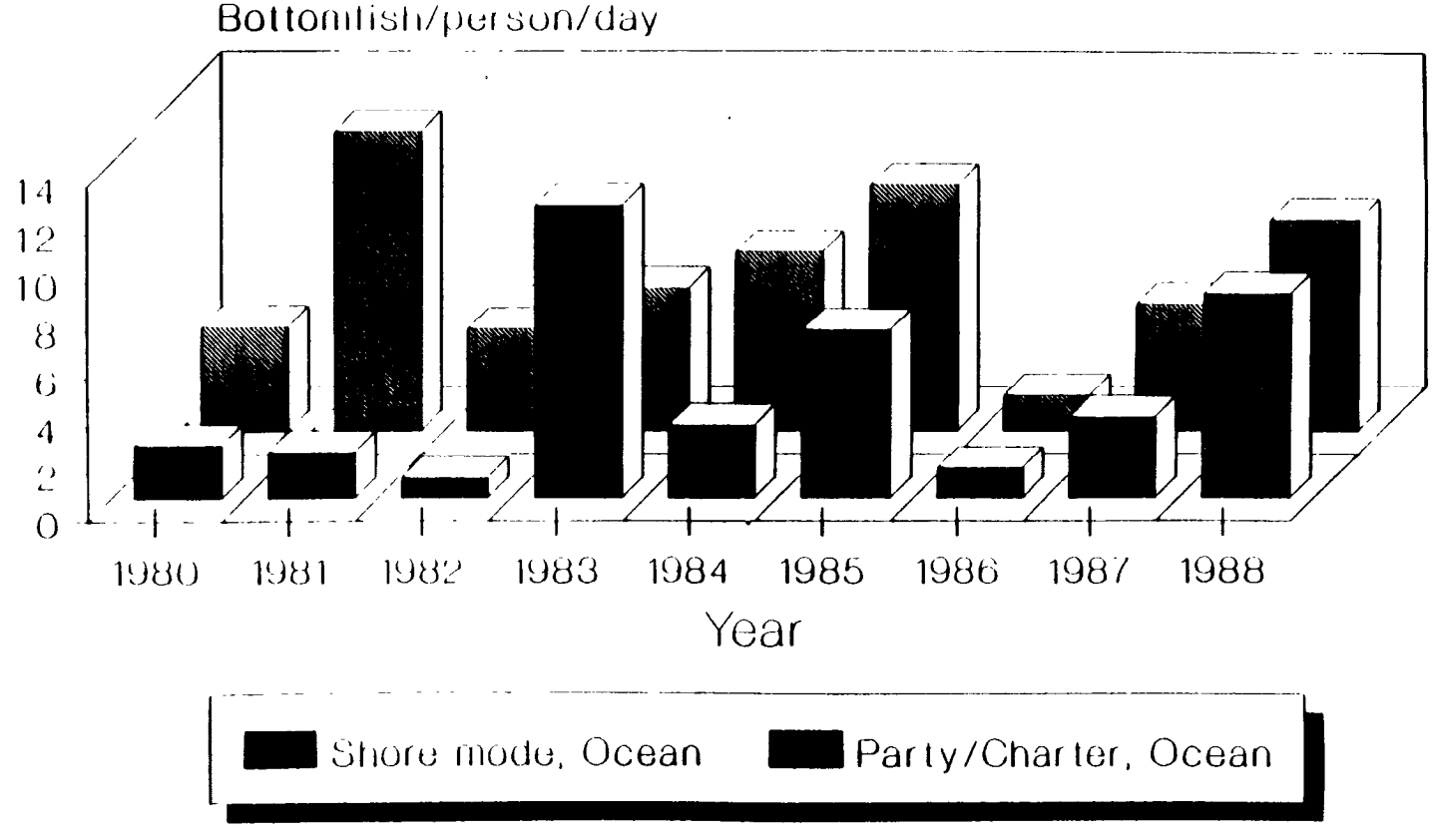
Average for individuals targeting small game, 1980-1988.

Fig. NJ3: Smallgame Catch Per Day,
New Jersey, Raritan Bay
By Wave and Mode



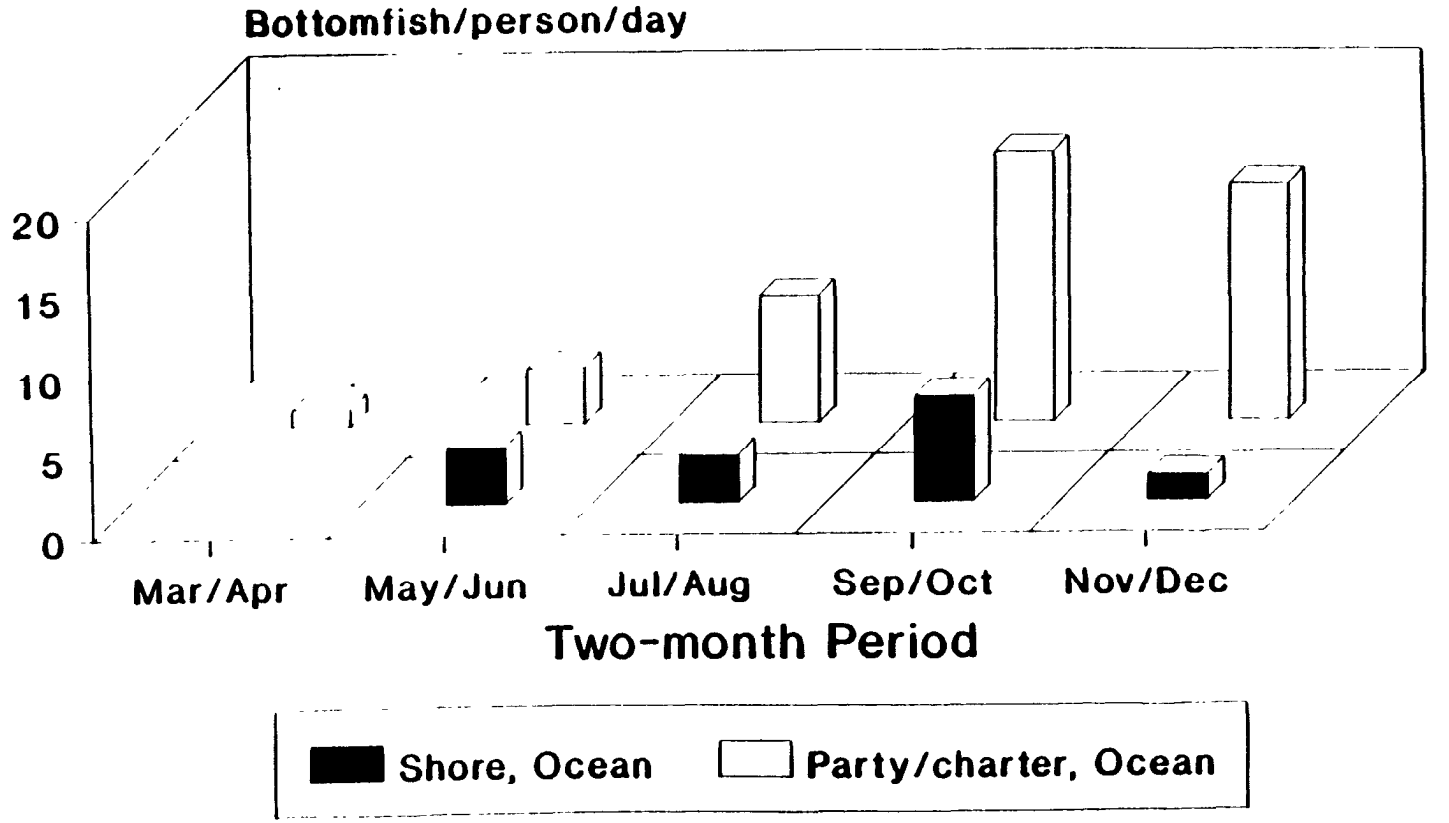
Average for individuals targeting small game, 1980-1988. No one who targeted smallgame was intercepted Mar/Apr.

Fig. NJ4: Bottomfish Catch Per Day,
New Jersey, Ocean Sites,
By Fishing Mode, 1980-1988



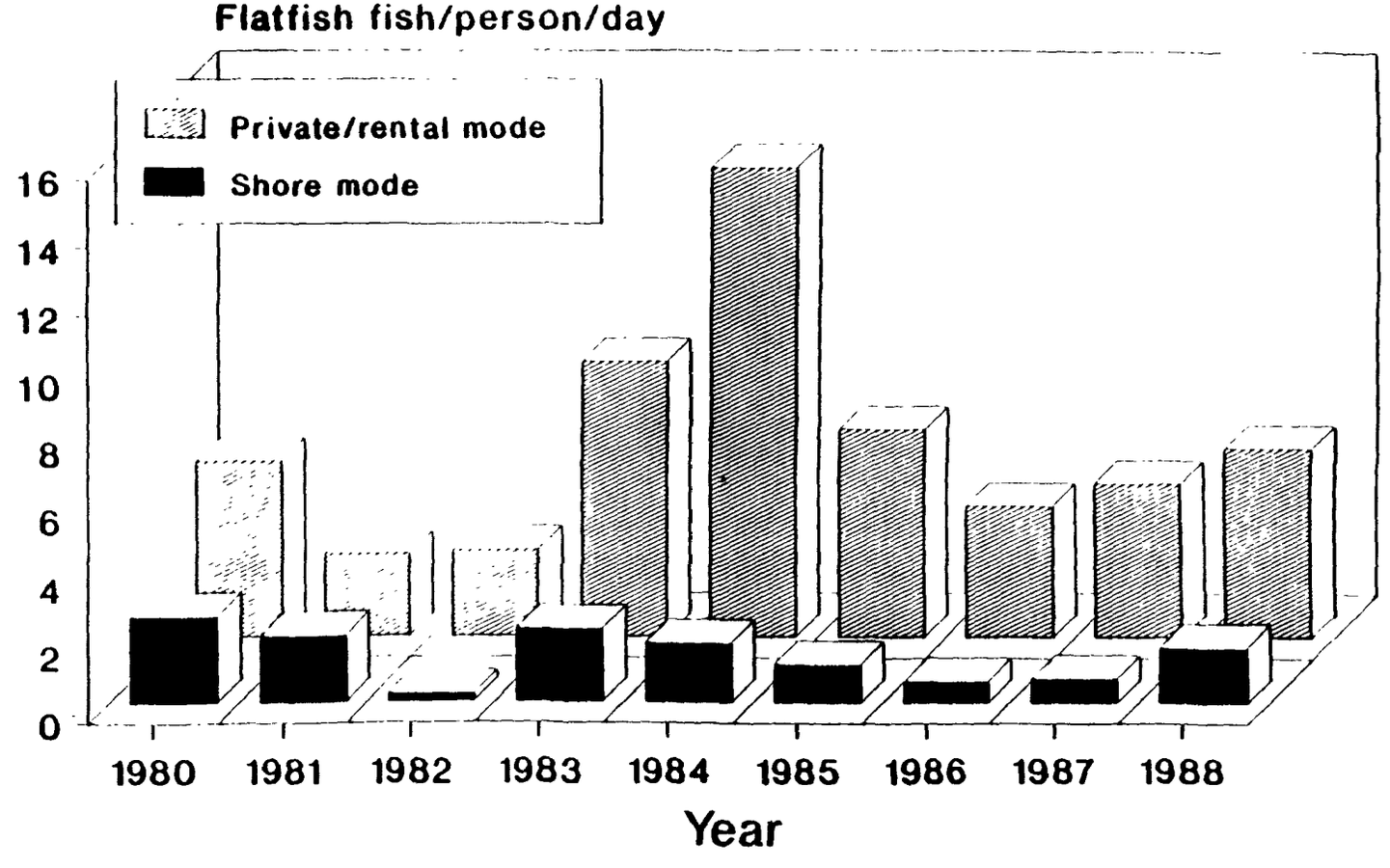
For individuals targeting bottomfish.
Because of small sample, 1981 P/C figure
is an average of 1980-82.

Fig. NJ.5: Bottomfish Catch Per Day,
New Jersey, Ocean Sites
By Wave and Mode



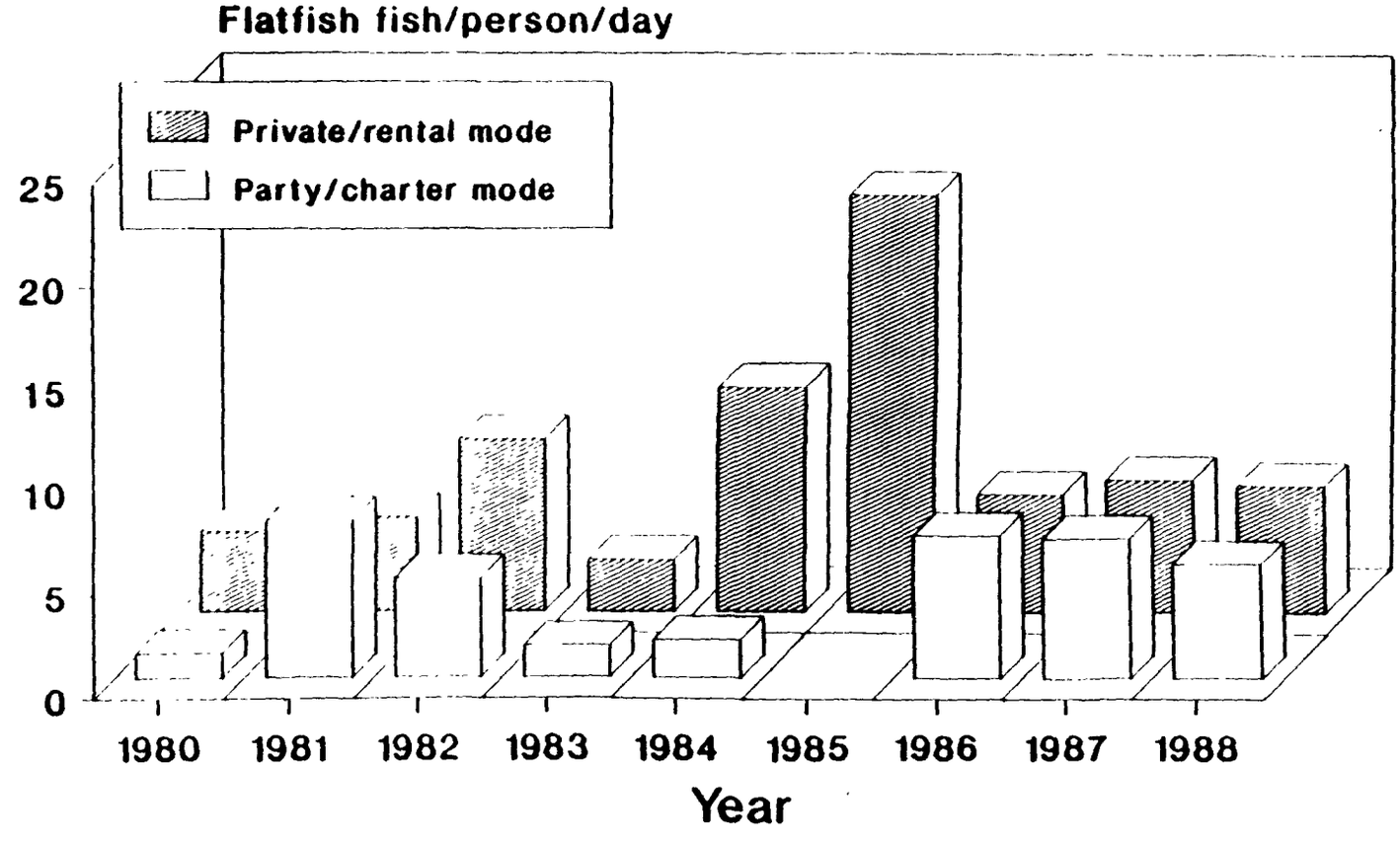
Average for individuals targeting bottom fish, 1980-1988. No one who targeted smallgame was intercepted Mar/Apr.

Fig. NJ6: Flatfish Catch Per Day, New Jersey, Ocean, By Fishing Mode, 1980-1988



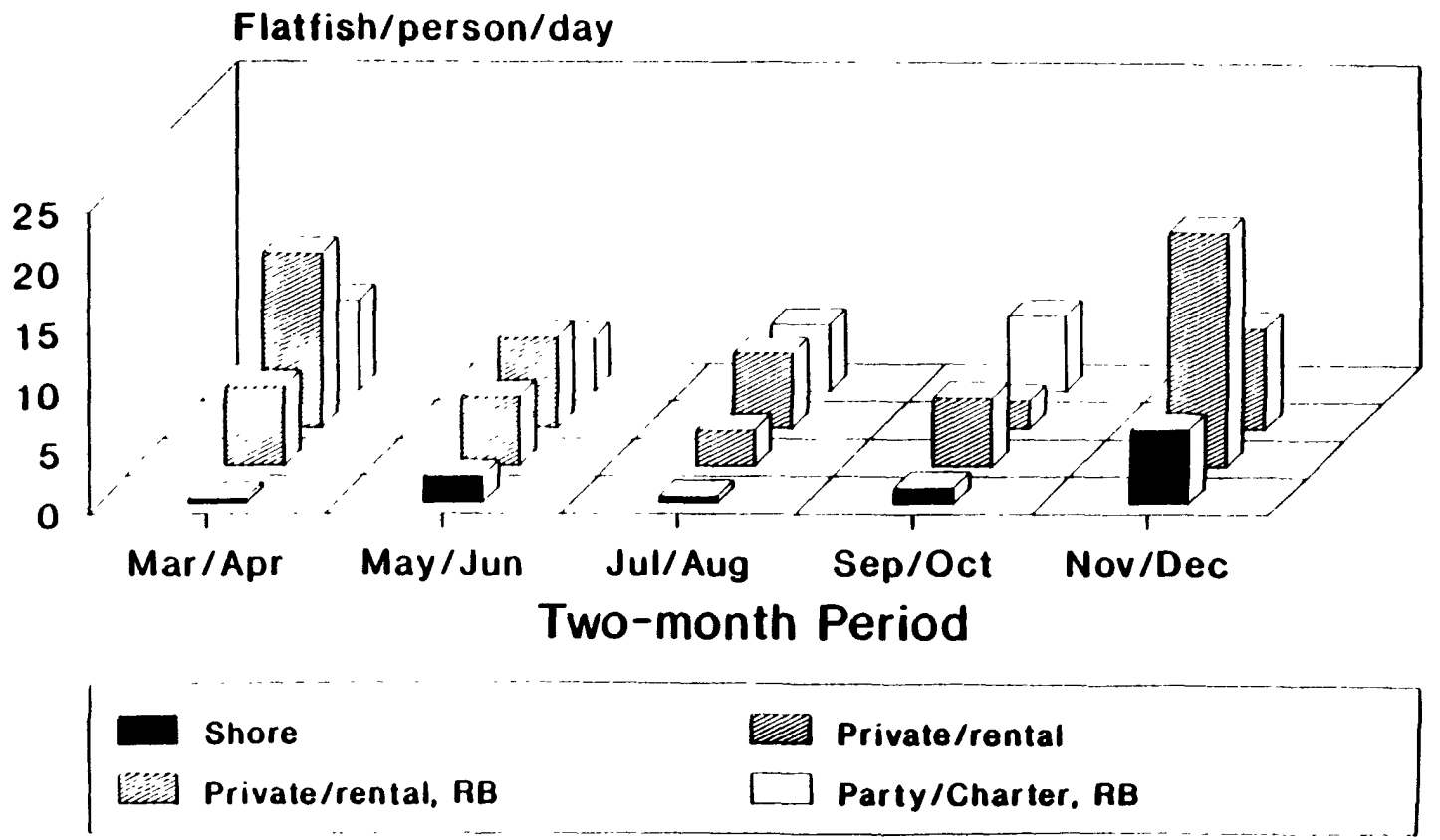
For individuals targeting flatfish

Fig. NJ7: Flatfish Catch Per Day, New Jersey, Raritan Bay, By Fishing Mode, 1980-1988



For individuals targeting flatfish
No observations for 1985 party/charter.

Fig. NJ8: Flatfish Catch Per Day, New Jersey, Ocean and Raritan Bay, By Wave and Mode



Average for individuals targeting flatfish, 1980-1988.

Chapter 4

SPORTFISHING IN DELAWARE

Activity by Delaware Households

Sportfishing is available on the Delaware Bay and the short strip of the Atlantic Ocean south of the Bay. There is also a small amount of well protected bay between Bethany and Rehoboth on the Atlantic coast. The population of Delaware is located northwest of the Atlantic, closer to the Delaware Bay, making sportfishing on that waterbody more accessible for most of the population. As with other middle Atlantic states, the climate of Delaware affords good fishing weather from late April through November. Migratory patterns of important species also induce some seasonality in the fishery.

The NMFS telephone survey is directed at all counties in Delaware, because all three border the coast. According to the 1980 Census, there were 211,500 households in Delaware and all were eligible to be called. The only fishing activity that occurs in Delaware that is not represented in the NMFS survey data is that enjoyed by non-residents of Delaware. This is fairly substantial because of the proximity of Maryland, Pennsylvania, and New Jersey. NMFS estimates that between 65 and 75 percent of the participants in Delaware's marine waters are from out-of-state, and about half of the trips taken to these waters are taken by out-of-staters.

Sportfishing Activity: Household Participation Rates and Quantity of Sportfishing Trips

A detailed picture of the seasonal and temporal participation rates by households is provided in Table DE.1. These figures give the percent of households called who had a least one person take a fishing trip in Delaware in the previous two months. The participation rates

vary from about 3 percent in the spring to about 12 percent in the mid-summer and back to about 2 percent in the late fall. The sample sizes range from a low of 178 for November-December 1986 to a high of 778 for July-August 1988. These sample sizes are generally large enough to assert that the wave participation rates are different from zero. Further, the means of participation rates by wave are significantly different from one another.

There is considerable variation, both across seasons and within season, in the participation rates. The mean July-August rate of 11.9 percent is quite high relative to other states in the Mid-Atlantic, and the 1.8 percent mean for November-December is relatively low. In some years, the seasonal variation is especially large. For example, in 1980, the proportion of households who fish ranges from about 2 percent in November-December to over 15 percent in July-August. The variation within seasons is also quite substantial. In May-June, the range is 6.9 percent, from a low of 5.3 percent in 1987 to a high of 12.2 percent in 1984 and 1986 while in September-October the range is 5.4 percentage points.

There is a very little trend pattern to the rates, although they appear to peak in the mid-1980's. A general characteristic of the trend coefficients in Table DE.2 is to be negative, although only the May-June wave's coefficient is statistically significant. The coefficients on the March-April and July-August waves are of similar magnitude to those estimated in New York and New Jersey. The May-June estimate is relatively large (in absolute value terms) compared with values observed in other states. It implies that the expected change in participation rate during May-June fell by 8 percentage points from 1980 to 1989.

The participation rates give information about the extensive margin--what is the distribution of fishing among households. They tell nothing about the intensive margin--how

frequently do households fish? The number of trips people take determines the magnitude of fishing, in terms of its use of people's time and its impact on the fish stocks. Table DE.3 gives trips per household called, by wave and year. These estimates are conservative in that they impute one trip to household members who are known to fish but who are not interviewed by phone. To extrapolate to the state of Delaware, simply multiply the trips per household called by the number of eligible households, which was 211,500 in the 1980 Census.

The seasonal variation is clear when the mean annual trips are apportioned among the seasons. For nine years of data, the mean trips are distributed as follows:

	Mean Trips	Percent of Annual Mean
March-April	.12	6.3
May-June	.50	26.3
July-August	.81	42.6
September-October	.41	21.6
November-December	.06	3.2

There is strong seasonality. Over 85 percent of the trips by Delaware households are taken in the period from May through October.

The trends in trips per household are similar to those in the participation rates. The annual rate peaks in 1984, and again in 1986 but fluctuates without clear trend the other years, although recovery towards the end of the period is evident. The individual waves are similar to the annual trip data, both in the tendency to peak in 1984 and 1986 and in the absence of clear trends elsewhere. As in Maryland, trips per household are lowest in 1985, the year of the striped bass moratorium.

Sportfishing Activity by Mode

The distribution of fishing trips among modes describes where fishing activity takes place. Table DE.4 gives this distribution by mode and wave, averaged over the years 1981 through 1988. Modes differ in their perceived productivity of fish and their exposure to inclement weather over the seasons, leading fishing households to vary the choice of mode over the seasons. The proportion of fishing in the shore mode is high in the months of cooler weather, and declines substantially in the three mid-year waves. The private/rental boat mode increases as the weather improves, and peaks in the May-June wave. The party/charter mode also shows some seasonality, and accounts for quite a high proportion of trips relative to other middle Atlantic states in the summer months.

Table DE.4 gives the proportional distribution of trips among modes, not the aggregate level. To calculate the aggregate level of trips by mode and season, it is necessary to expand trips per household called (Table DE.3) to the population of households in the coastal counties of Delaware. The 1980 Census estimated 211,500 households in Delaware. According to Table DE.3, the mean number of trips per household in May-June was .5. Together these imply 103,635 trips by Delaware residents in Deleware May-June. Table DE.4 gives their distribution, implying for example that 64.1% of these trips, or 66,430 were private/rental boat trips. In July-August, Delaware households averaged .75 trips per household, or 158,625 total trips. Of these, 53.3 percent would be attributed to the private/rental mode, a total of 84,547. So even though the percent of trips in the private/rental mode falls from 64.1 in May-June to 53.3 in July-August, the aggregate quantity of trips rises from 66,430 to 84,547. These aggregate figures exclude fishing by households who do not live in Delaware.

Sportfishing Activity by Waterbody

The categories of waterbodies included in the NMFS survey are given in Table DE.5. The figures in this table show the proportion of fishing trips in different water bodies. The category "enclosed bay" is especially troublesome for Delaware, because households can place fishing trips to the small bay along the Atlantic coast as well as in the Delaware Bay in this category.

To calculate numbers of trips to each type of water body, we first calculate the aggregate number of trips by wave. This expansion is accomplished by multiplying the mean number of trips per household called per wave by the number of eligible households - 211,500. For March-April the mean trips (from Table DE.3) is .12 and aggregate trips are 25,380 (= .12 x 211,500). From Table DE.5, 56.6 percent of them, or 14,365 are estimated to be taken in rivers. For May-June, mean trips per household called is .5, and aggregate trips are 105,750 (= .5 x 211,500). Of these trips, 5.5 percent or an estimated 5,816 are taken on rivers. Hence there is a substantial absolute decline in fishing on rivers from March-April to May-June.

Catch rates in Delaware

Delaware's small size and hence small sample size permitted consideration of only one area. Because such a large percentage of the sportfishing activity is in the Delaware Bay and Atlantic Ocean, catch rates reflect the availability of fish in those areas more than in the tributaries or enclosed bays.

The proportion of saltwater anglers who did not target a species is far greater in Delaware than the states to its north. In the five year period 1980-1984, 42 percent of the anglers intercepted in Delaware were not targeting a species. This percentage fell to 28 percent for the

period 1985-1988. Smallgame was the favorite target of Delaware anglers, with 33% of the anglers in the first period and 44% in the last period. The next favorite group was the flatfish. Although not nearly as popular as in New York and New Jersey, flatfish were the target for 23% and 18% of anglers in 1980-1984 and 1985-1988, respectively. Bottomfish dropped from 6% in the early period to 1% in subsequent years. Finally, big game was less than 1 percent consistently.

Smallgame Catch Rate

There were two dominant species and one minor species of smallgame sought in Delaware waters during the decade. Sixty-three and seventy-three percent of anglers seeking smallgame were after weakfish in the pre-1985 and later period, respectively. The other major species was bluefish, attracting twenty-eight and twenty-two percent of the anglers in the respective periods. Finally, Atlantic mackerel was sought by six and four percent of the smallgame anglers in the pre-1985 and later periods, respectively.

Data permitted considering time trends only for the party/charter and private/rental boat modes (Figure DE1). Catch per day estimates were of similar magnitude, averaging around two fish per day, for the two modes. Also, the time trend in the two modes are quite consistent with one another, showing poor catch per day from 1980 to 1982 and in 1986. The middle of the decade and 1988 were the peak periods in availability.

The seasonal variation in catch rate is quite apparent the data (Figure DE2). The March and April period has abundant supplies of smallgame, if one is willing to brave the weather to get to them. After that period, catch rates drop off in May and June, only to rise again in the July through October period.

Bottomfish

There were only about 500 anglers intercepted in Delaware during the study period who targeted bottomfish. Of those, fifty percent targeted tautog in pre-1985, a figure that rose to sixty percent in the 1985-1988 years. Black sea bass was also a choice in both periods, although the percent fell from around 20% before 1985 to around 8% after 1984. White perch and sandbar shark were important in the early period but were less important later.

The small numbers of targeting anglers meant no trends could be observed, but there were sufficient data to observe interseasonal catch rates for individuals on private/rental boats. The catch rates do not vary too dramatically over the year. The lowest was in November/December, around three fish per day per angler, and the highest was in May/June and September/ October, with about six per angler. This may have more to do with variability in number of hours spent fishing than availability of fish.

Flatfish

The overwhelming species selected by anglers targeting flatfish in Delaware was summer flounder. Over ninety-seven percent of these anglers sought summer flounder over the decade. This compares with around 80% in New Jersey and only 40% in New York.

Because of the preponderance of summer flounder in the catch rate data, the trends shown in Figure DE3 for flatfish are really the trends in availability of summer flounder. They reflect a similar pattern to New Jersey, with the prime catch rates in the 1983-84 period and poor catch rates particularly in 1986.

The catch rate of shore fishermen targeting flatfish was generally less than one fish per day, uniformly less than anglers on party/charter boats and nearly always less than private/rental

boat fishermen (Figure DE4). The party/charter fishermen generally had the highest catch rates (< 3 fish per day) although the private rental boat fishermen were not too dissimilar. Fishing for flatfish is confined, probably by weather and availability, to the months from May to October. The best fishing from shore is in the May/June period whereas for the other two modes it comes in the July/August wave.

Characteristics of Fishing Trips in Delaware

NMFS survey data from the phone survey and the intercept survey are gathered with the principal purpose of estimating total catch of fish for important species. They include basic information on trips and their distribution, but there is little information on the economic characteristics of trips. The UMCP survey allows us to describe some of the economic aspects of trips taken in Delaware. The following section describes some of this trip data for single day trips and trips taken as part of overnight visits to Delaware.

The economic characteristics of single day trips to Delaware are described in Table DE.6. These characteristics pertain to trips taken regardless of state of residence. The UMCP survey includes six modes: pier and other artificial structure, beach, party boat, charter boat, rental, and private boat. There are too few observations to make estimates for the rental mode. The travel costs for Delaware are quite high for all modes relative to other states. Anglers travel a considerable distance, and many come from out of state. The costs of services are roughly in line with the costs for other states (with the exception of tackle costs for the beach mode, which probably include a piece of durable tackle). Pier fees are quite low, reflecting the large number of jetties and small number of piers in the state. Payment for cleaning varies across the modes, but tends toward the two to five dollar range of other states.

The characteristics of trips taken as a part of overnight visits to Delaware are given in Table DE.7. These visits can be taken for many reasons, including vacation, business, etc. The Atlantic shore of Delaware is a popular vacation destination for people from Philadelphia, Baltimore, and Washington, and so it is likely that many of the overnight visits are for vacation. The travel costs for these trips ($5.83) is naturally much lower, because people travel only from their overnight lodging. The costs of fishing services (bait, tackle, and cleaning) are similar to the single day costs. Basically, the costs appear to differ only with regard to the travel components.

Table DE.8 gives the distribution of trips by species sought and mode. Big game are of small importance for any mode. Flat fish are sought on a large percent of trips from party boats. Most of the trips are directed toward smallgame and flatfish.

Table DE.1

Two-Month Participation Rates*
by Wave and Year

Year	Wave				
	March-April	May-June	July-August	September-October	November-December
1980	3.3%	-- %	15.3%	8.3%	1.6%
1981	4.9	12.1	12.3	5.0	1.0
1982	2.8	10.6	8.2	8.4	1.7
1983	4.6	7.8	14.5	9.2	1.7
1984	5.1	12.2	14.7	10.4	2.0
1985	2.4	8.5	10.2	6.4	2.7
1986	4.5	12.2	11.0	7.1	2.4
1987	3.0	5.3	9.9	9.7	2.3
1988	1.9	6.7	13.1	7.1	1.0
1989	2.4	9.5	9.7	5.8	1.7
Mean	3.5%	10.3%	11.9%	7.7%	1.8%

* Percent of Delaware coastal county households called who fished in Delaware marine waters in the designated two months.

Table DE.2

Linear Trend Analysis[1] of Delaware Participation Rates,
By Wave, 1980-1989

Wave	Constant	Linear Trend Coefficient	$\bar{R}^2$
March - April	.043 (6.75)	-.0019 (-1.57)	.14
May - June	.139 (8.21)	-.0080 (-2.52)	.37
July - August	.133 (9.56)	-.0031 (-1.18)	.04
September - October	.081 (7.42)	-.0007 (-0.34)	.00
November - December	.017 (4.90)	.0004 (0.55)	.00

[1] Estimated model was participation rate = $\alpha_0 + \alpha_1$ time, with time defined as t = 0 for 1980, t = 1 for 1981 ..., and t = 9 for 1989.

[2] T-ratio in parentheses.

Table DE.3

Trips Per Household Called
By Year and Season*

Year	Total	Wave				
		March-April	May-June	July-August	September-October	November-December
1980	--	--	--	--	--	--
1981	1.61	.39	.43	.59	.16	.06
1982	1.44	.07	.50	.40	.44	.03
1983	1.81	.06	.50	.69	.53	.03
1984	2.49	.11	.52	1.15	.59	.13
1985	1.33	.17	.33	.60	.18	.05
1986	2.66	.14	.85	1.18	.43	.06
1987	1.46	.06	.29	.78	.26	.06
1988	1.90	.03	.53	.88	.44	.02
1989	2.37	.08	.56	1.00	.66	.07
Mean	1.90	.12	.50	.81	.41	.06

* Trips taken within state of residence.

Table DE.4

Percent of Fishing Trips in Various Modes by Wave
Mean 1981-1988

Mode	Wave				
	March-April	May-June	July-August	September-October	November-December
Shore	57.5%	26.3%	34.2%	35.6%	49.2%
Party/Charter	3.7	9.6	12.5	13.4	11.1
Private/Rental	38.9	64.1	53.3	51.0	39.8

Table DE.5

Percent of Fishing Trips in Various Areas, by Wave
Mean 1981-1988

Area	Wave				
	March-April	May-June	July-August	September-October	November-December
Ocean, Gulf, Open Bay	33.4%	56.0%	55.1%	62.0%	85.2%
Sound	6.7	.2	.4	1.0	0.0
River	56.6	5.5	9.1	13.6	7.5
Enclosed Bay	8.7	37.7	34.9	23.1	7.3

Table DE.6

Characteristics of Day Trips in Delaware, by Mode
(per trip averages)

Characteristic	Mode					
	Pier	Beach	Party	Charter	Rental	Private
Travel Cost	$28.96	$12.72	$25.49	$22.96	[b]	$13.81
Costs for						
Bait	2.47	4.24	2.80	1.07		6.98
Tackle	1.94	19.23	5.99	1.62		3.51
Cleaning	.68	8.25	1.22	3.51		1.88
Fuel	--	--	--	--		14.15
Pier Fees	.10	--	--	--		--
Boat Fees[a]	--	--	31.19	44.50		--
Travel Time (in minutes)	54.7	59.7	98.4	123.4		69.5
Distance (in miles)	68.9	44.4	59.8	90.2		48.9
Boat Time to first site (in minutes)	--	--	62.0	58.5		31.8
Number of Observations	33	64	55	46		237

[a] Boat fees are charter and party fees or rental fees.

[b] Not enough observations for precise estimates.

Table DE.7

Characteristics of Trips for Overnight Visits in Delaware

Characteristic	Mean	Number of Applicable Observations
Travel Cost	$5.61	110
Cost for		
Bait	3.66	112
Tackle	1.63	112
Cleaning	1.56	112
Fuel	8.71	54
Pier Fees	.15	17
Boat Fees	66.42	20
Boat Rental	[a]	[a]
Travel Time (in minutes)	15.6	111
Distance (one-way) (in miles)	10.7	110
Boat Time (in minutes)	35.3	74
Trip Length (in days)	14.8	112

Table DE.8

Percent of Trips Seeking Different Species Groups, by Mode
for Day Trips

	Mode					
Species Group	Pier	Beach	Party	Charter	Rental	Private
Big Game	0.0%	8.0%	2.1%	9.4%	?	4.9%
Small Game	65.4	80.0	51.1	71.9	?	54.2
Flatfish	23.1	10.0	46.8	12.5	?	35.6
Bottomfish	11.5	2.0	0.0	6.3	?	5.4

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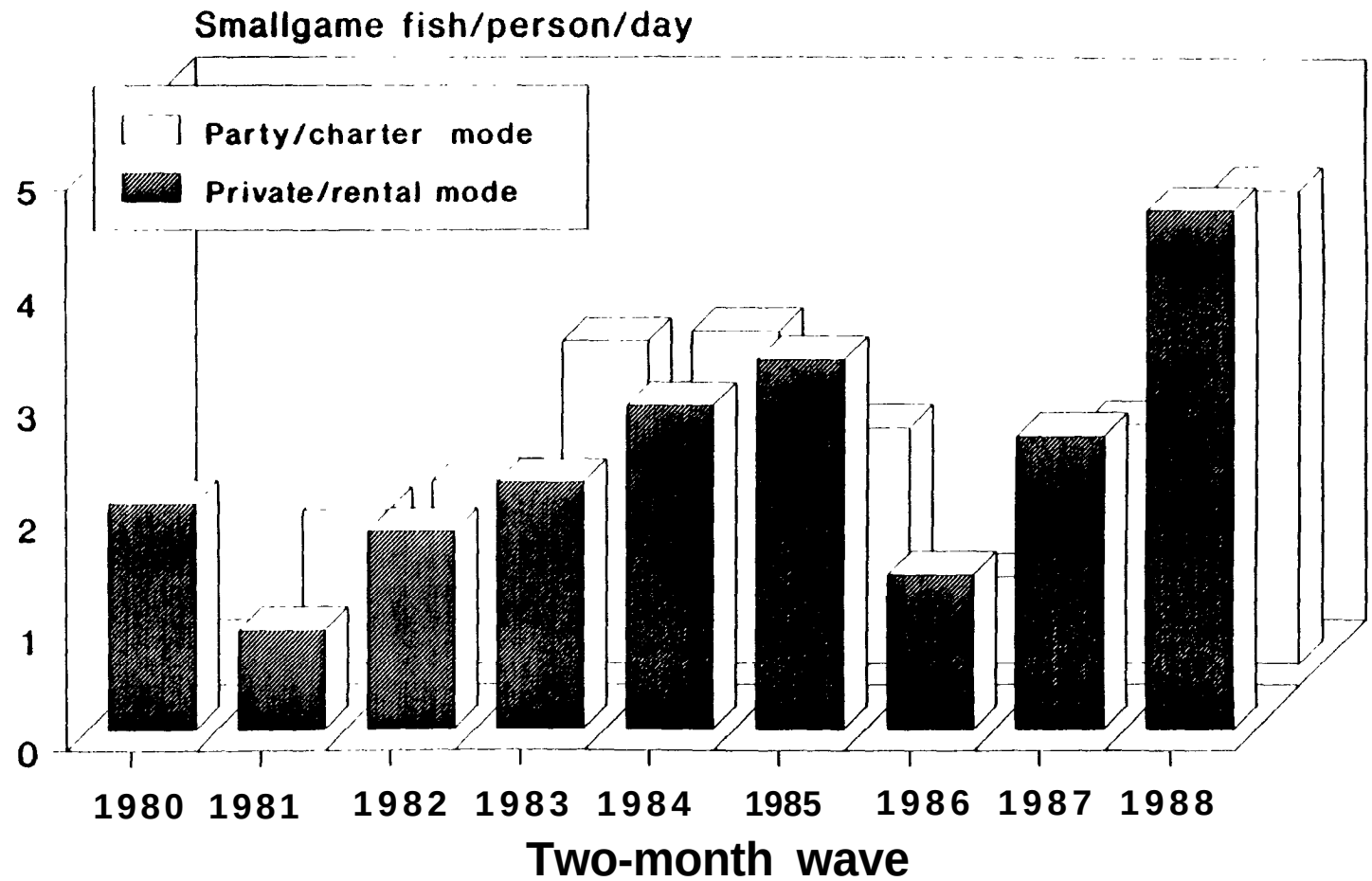
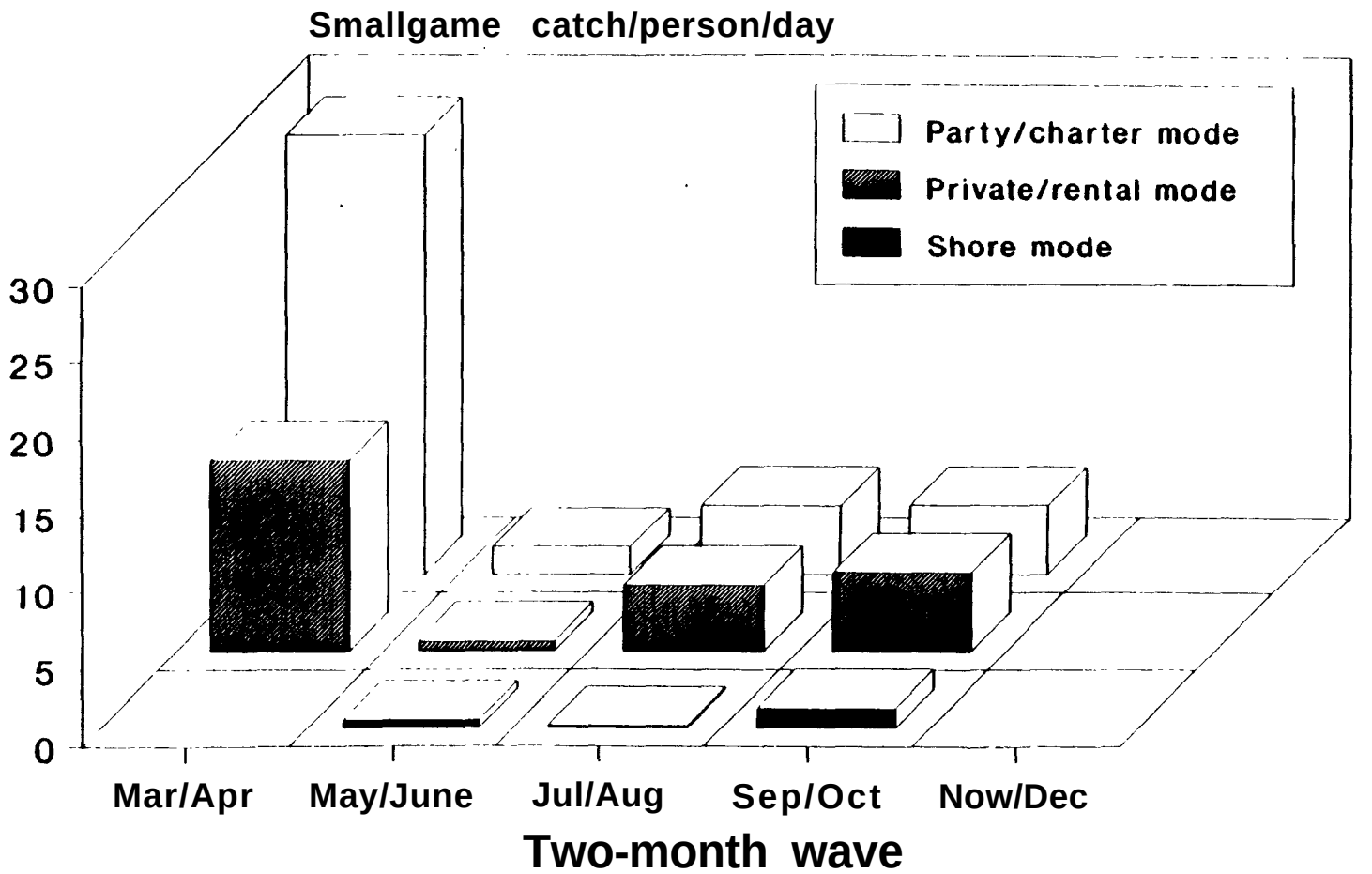
Fig. DE1: Smallgame Catch per Day, Delaware, By Mode and Year



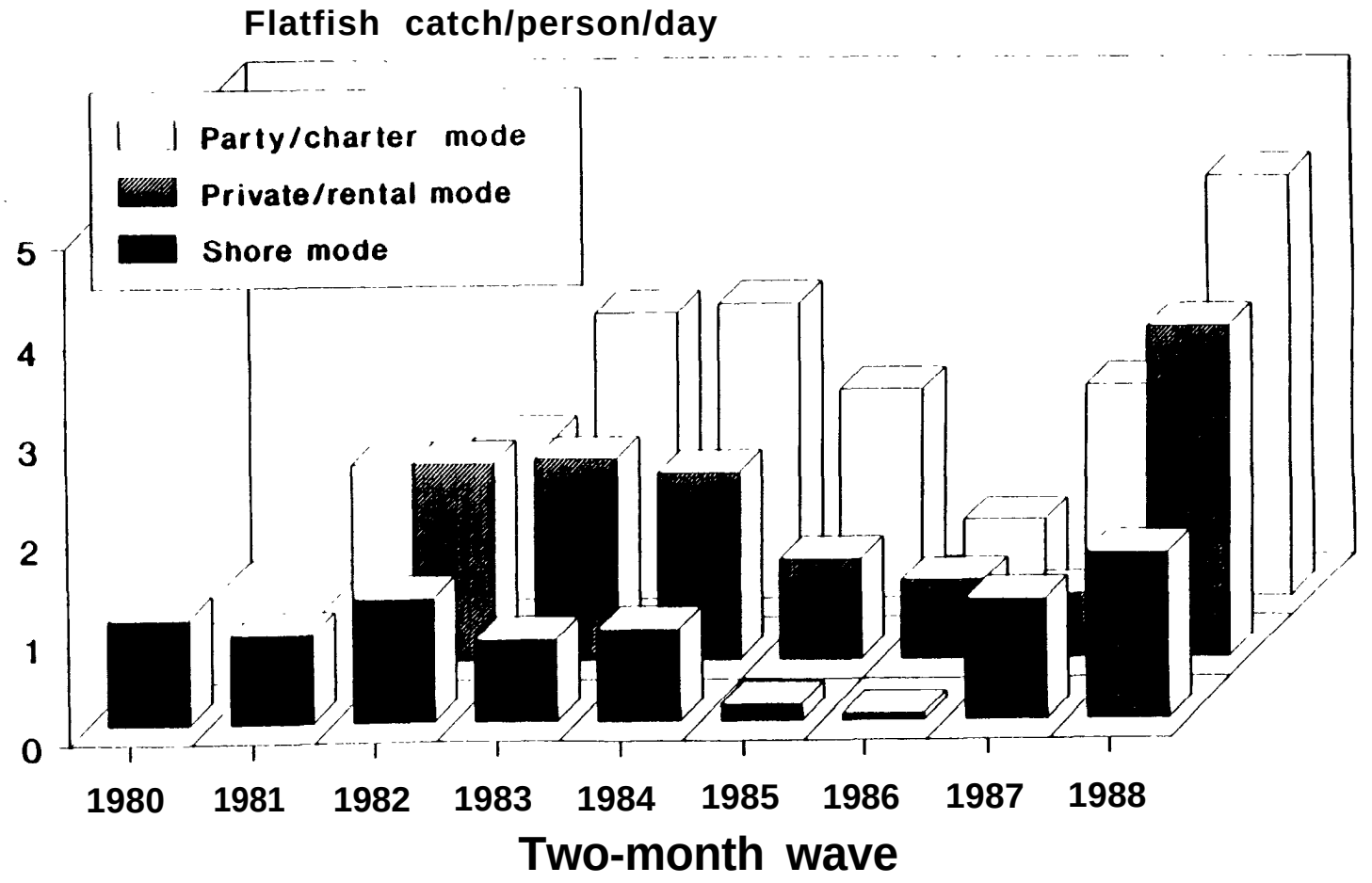
Average for anglers targeting smallgame, 1980-1988

Fig. DE2: Smallgame Catch per Day Delaware, By Wave and Mode



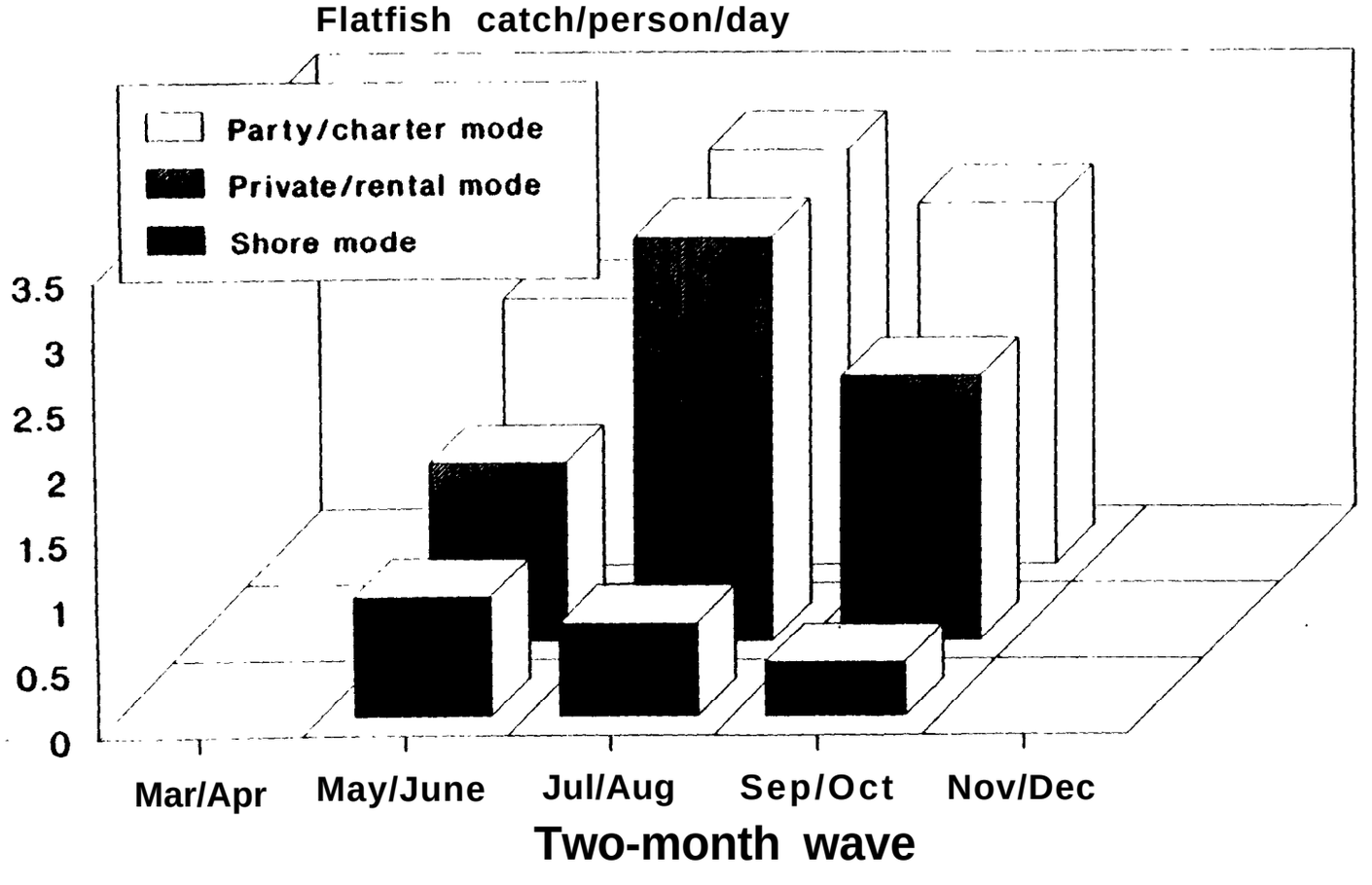
Average for anglers targeting smallgame, 1980-1988

Fig. DE3: Flatfish Catch per Day Delaware, By Mode and Year



Average for anglers targeting flatfish, 1980-1988

Fig. DE4: Flatfish Catch per Day Delaware, By Wave and Mode



Average for anglers targeting flatfish, 1980-1988

Chapter 5

SPORTFISHING IN MARYLAND

Activity by Maryland Households

Participation in marine recreational fishing in Maryland is determined largely by the mid-Atlantic climate, the location of fishing in the Bay and ocean, and the distribution of the population in metropolitan areas. The relatively mild climate provides pleasant fishing days from April through November. A large proportion of the population of Maryland is located in the Baltimore-Washington corridor and the Chesapeake Bay is by far the most accessible water body for residents of this corridor. Seasonal and annual participation in sportfishing can be expected to vary because of the large variation in abundance of sportfishing target species.

In Maryland, the NMFS survey is directed toward households with telephones in counties within 25 miles of the coast or major bays and estuaries. This criterion encompassed 1,314,345 occupied housing units as of the 1980 Census, which represented about 90 percent of the total occupied housing units in Maryland. Because this criterion includes households with closer access to fishing, these households are likely to account for more than 90 percent of the total fishing activity by Maryland households in Maryland. NMFS estimates that of those individual participants who both reside and fish in Maryland, 95 percent live in these coastal counties.

The NMFS telephone survey does not include information on household fishing trips out-of-state. The telephone survey does not provide information on sportfishing activity by Maryland residents in other states, nor does it include information about fishing within Maryland waters by residents from other states. By considering only in-state participants from coastal counties.

NMFS estimates that the sample is representative of about 55 to 60 percent of the participants in Maryland sportfishing activities and about 70 percent of the sportfishing trips taken in Maryland. Another 2 to 3 percent of both the participants and the trips are attributable to non-coastal county Maryland residents. These percentages have remained fairly stable throughout the 1980's.

Sportfishing Activity: Household Participation Rates and Quantity of Sportfishing Trips

The seasonal (by wave) participation data from the telephone survey provide a detailed picture of recreation fishing activity by Maryland households. Table MD.1 gives these household participation rates for each year and each wave. Household participation rates are typically about three percent in early spring, about nine percent in mid-summer and only about two percent in late fall. The sample sizes for these rates vary considerably, ranging from a minimum of 241 for March-April 1982 to a maximum of 2969 for July-August 1988. With these large sample sizes, the mean participation rates are all significantly different from zero. Additionally, the means are typically different across seasons at a high level of significance.

Two facets of Table MD.1 are interesting. First, there is considerable variability in participation rates, both across seasons in a year and across years for a given season. For example, participation rates in 1982 vary from 10.5 during July-August to 1.6 in the November-December wave; and the July-August participation rate varies from a high of 13.7 percent in 1981 to a low of 5.0 percent in 1989.

The pattern for most waves shows a decline from high participation rates in early years of the decade, with a slight resurgence in the 1986-1987 period. This is followed by further

declines towards the end of the decade. The across season variation, especially in the period from May through September, is no doubt due to variations in weather.

The linear trend analysis of the Maryland participation rates is dramatic. In all waves, the trend coefficient is negative and statistically significant. The least estimated change comes in the November/December wave (-.2 percentage points per year) and the March/April period (-.3 percentage points per year). The greatest estimated change occurs in July/August (-.7 percentage points per year) and September/October (-.4 percentage points per year). The July through October period is important because the majority of participation occurs then and because the trips/participant is largest then.

A sense of the magnitude of fishing activity can be obtained by multiplying the number of fishing households by the level of activity (typically measured by number of trips) per fishing household. If we wish to extrapolate to the population, it is sometimes more useful to think of trips per household called multiplied by number of households called. Table MD.3 gives trips per household called. The seasonal variation in fishing is apparent here. The mean trips per household called using all ten years of data, are distributed as follows:

	Mean Trips	Percent of Annual Mean
March-April	.12	8.8
May-June	.35	25.5
July-August	.51	37.2
September-October	.33	24.1
November-December	.06	4.4

Over 85 percent of the activity occurs in the six-month period May-October, and probably much of that in the months June-September.

The data on trips per household sampled by wave, presented in Table MD.3, are not consistent with any clear temporal pattern. Annual trends are being masked by variability across the seasons. When we sum trips per household sampled over the waves for each year, trends emerge which match those for participation rates. Trips per household called are highest in 1983 and 1986 and except for 1989, lowest in 1985, the first year of the striped bass moratorium.

Linear trend analysis on the trip/household called data indicated a significant negative trend in the March/April wave and the September/October wave. These are the periods of time during which the striped bass runs occur in Maryland. The moratorium could have been responsible for the trends.

Sportfishing Activity by Mode

Much of the character of fishing in a state can be determined by how and where people fish. Although shore fishing is typically the cheapest and most accessible mode, it is not always the most popular in Maryland. Table MD.4 shows the proportion of fishing to the three major modes--shore, party/charter, and private/rental. These proportions are means for the period 1981-1988 and show the distribution of fishing trips over modes for each season. Shore fishing is especially popular in early spring and late fall because boat use is low in seasons of cool and unsettled weather. Private boat use is more strongly influenced by inclement weather than other modes. Besides fishing, swimming, boating and sunbathing from a boat require good weather. There is an especially big increase from March-April to May-June.

The proportions show when households tend to use each mode, but they do not give any indication of the magnitude of fishing activity. To illustrate the magnitude, we need to estimate the aggregate quantity of trips for the season. From Table MD.3, we obtain estimates of the quantity of trips per household called. For example, the mean number of trips per household called for March/April is .12. The number of eligible households in the coastal counties in 1980 was 1,314,345. Together these imply 157,721 trips in March-April by coastal county residents. Table MD.4 shows the distribution, implying that 38.6 percent or 60,880 private/rental boat trips were taken by coastal county households. In July-August, estimated trips per household rose to .52 so that aggregate trips were estimated to be 683,459. Of these 56.3 percent of 384,788 (= .563 * 683,459) were private/rental boat trips. Thus there is great seasonal variability in boat activity; it expands from about 60,000 trips in March-April to over 380,000 trips in July-August. These trips include only those taken by residents of the coastal counties, but as noted in the introduction to the Maryland section, coastal county participants account for over 90 percent of all participants in Maryland.

Sportfishing Activity by Waterbody

The NMFS phone survey classifies waterbodies into four types. Table MD.5 gives the mean proportion of fishing trips to each of these waterbodies. These means are calculated over the period 1981-1988. The categories of waterbodies used for the telephone survey are broadly enough defined so as to be applicable for fishing up and down the East and West Coasts of the U.S. Consequently, they do not conform especially well to the particular circumstances in any one region.

NMFS area classifications include a) ocean, gulf and open bay, b) sound, c) river, d) enclosed bay and e) other. In Maryland, the principal fishing areas are rivers, the Chesapeake Bay and its inlets, the coastal bays and the Atlantic Ocean. There is potential for different interpretations of the NMFS areas by people who fish in Maryland. The Chesapeake Bay may be considered an open bay by some and a closed bay by others. Consequently, it is difficult to distinguish the Chesapeake Bay and Atlantic Ocean fishing activity.

Recognizing these potential ambiguities, the patterns of fishing as reported are presented in Table MD.5. Table MD.5 shows, for example, that river fishing is important in early spring when rivers offer more protected fishing than other areas. Additionally it is during the spring when anadromous fish such as shad are regularly sought in the rivers. Not surprisingly, the open areas and enclosed bays (Atlantic Ocean and Chesapeake Bay) attract more fishing (over 60 percent) in the heart of the fishing season.

To understand the magnitude of fishing in different waterbodies by coastal county residents, we use the aggregate level of fishing trips per wave. For example, fishing in rivers in March-April is estimated at 54.7 percent of the 157,721 trips, or 86,273 trips. In July-August it is 21.9 percent of 683,459 trips, a total of 149,677. Thus the proportion declines, but the absolute level increases substantially.

Catch Rates in Maryland Waters

Maryland has two major bodies of water in which saltwater angling occurs. The Chesapeake Bay and the Atlantic Ocean are considered separately because the nature of the fishing and the species caught can vary dramatically. In the Chesapeake, the principal species are bluefish, striped bass, and perch whereas bluefish, mackerels, and weakfish are more

predominant in the Atlantic Ocean. Fish are most often pursued from privately owned boats in the Chesapeake. Party and charter boats are available but not used as frequently as at the Atlantic Ocean sites.

The trend of less targeting as one moves south from New York continues when Maryland is considered. The early period (1980-1984) saw almost half (46%) of the intercepted Maryland anglers not targeting a species. This percentage fell to 36 percent in the years after 1984. Those targeting a species, most often chose as their target smallgame, representing 35% of all Maryland anglers in early period and 54% in the latter years. Flatfish consistently drew ~ 8 percent of the sample. The only other species group with significant targeting was bottomfish, which attracted 11% of the pre-1985 anglers and < 1 percent in subsequent years.

Smallgame Catch Rates

Over the last ten years, the principal smallgame species sought and harvested in Maryland has been bluefish, accounting for nearly 70 percent of all persons targeting smallgame. Striped bass (rockfish), the second most frequently sought smallgame species, has accounted for about 15 percent of the total. Weakfish has been the next most important species (12 percent), and except for spotted seatrout (2 percent), no other smallgame species contributed more than one percent.

Since 1985, the contribution of bluefish has risen to nearly 85% and the contribution of striped bass has declined to less than 1%. The reason for the shift is the imposition in 1985 of a moratorium on the commercial and recreation harvest of striped bass. Possession of an illegal fish is punishable by fines.

Figure MD1 illustrates for the period 1980-1988 the average catch of smallgame by fishing mode for individuals who were fishing in Maryland and targeting smallgame. Although smallgame catch per day by party/charter fishermen was about three times that of private/rental boat fishermen, the time trends in catch rates for both modes were remarkably similar, with poor years in 1984 and 1986 and the highest during 1985. Both displayed an increasing trend for the 1986-1988 period. Shorefishing for smallgame is not nearly as productive, with the average number of smallgame caught per day averaging between one-half and one-third of the value of the private/rental mode and between one-sixth and one-ninth of the party/charter mode. Trends in the smallgame catch by shore fishermen are not consistent with the other modes, but are not as reliable because substantially fewer fishermen targeting smallgame choose the shore mode.

Figure MD2 displays smallgame catches per day by wave and mode. The dominant feature of this figure is the extremely high catch of party/charter anglers in the March/April period. Although this is a reasonably good period for private/rental boat anglers, their catch rare is one-fourth the party/charter fishermen. The other good fishing occurs in the July through October wave, a feature common to all modes. The poorest catch rates are in May/June and November/December.

Bottomfish Catch Rates

The bottomfish most frequently sought in Maryland is white perch, sought by over 40 percent of the individuals seeking bottomfish. The next most important species is spot, making up over 20 percent of the total. Catfish, yellow perch and croaker are other important Bay bottomfish while the sea bass family and black drum are the important Ocean bottomfish. Most individuals seeking bottomfish, however, are fishing in the Chesapeake Bay.

Catch rates for bottomfish in the Bay have remained stable, if not increasing during the 1980's (Figure MD4). For the private/rental mode, the peak catch of over twenty fish per day was recorded in 1988. However,the peak for the shore mode (about 5 fish per day) was recorded in 1980. Since then, shore fishermen have settled for less but the trend suggests that shore catch rates are once again nearing their 1980 levels (about 4 fish per day in 1988).

Bottomfish catch rates vary substantially over the year (Figure MD4). Again, the best fishing occurs in the July through October period, with catch rates nearly double the rest of the year. The absolutely poorest period for bottomfish catch rate is in the March/April wave.

Flatfish Catch Rates

Nearly all fishermen targeting flatfish in Maryland are seeking summer flounder. Moreover, most flatfish fishing trips originate in Worcester County, on the oceanside of Maryland. Although some of the fishing takes place in the Atlantic Ocean, a large percentage takes place in Assawoman Bay, located west of Ocean City, Maryland.

Anglers seeking flatfish most often choose either the private/rental mode or the shore mode. Figure MD5 shows the catch rates for these modes over the selected period. Shore fishermen catch rates are similar to those for private boat fishermen, especially in the 1980-1983 period. In subsequent years, however, private boat catch rates exceeded shore catch rates, but the former exhibited greater variation across years than the latter. Finally, the low point in catch rate, the years 1985 and 1986, correspond to the same years Delaware exhibited poor catch. This suggests that the same summer flounder population was being exploited in both states.

There is a seasonal variation in flatfish catch rates also (Figure MD6). The season begins with poor availability in the March/April period, followed by the peak catch rates in May and June. The catch rates gradually decline for the rest of the year.

Characteristics of Fishing Trips in Maryland

The previous descriptions pertain to the distribution and biological aspects of fishing activities in Maryland for the years 1981-1988. There are other aspects of fishing which help in understanding the sportfishery. The UMCP survey contains considerable information on the economic characteristics of individual fishing trips for the year 1988. The following section describes these data by mode for the state of Maryland.

Table MD.6 describes one-day trips taken to Maryland for salt water sportfishing by mode of fishing. The UMCP survey includes six modes: two from shore (pier and beach) and four boat modes (party, charter, rental,[1] and private.) The figures in Table MD.6 when compared across modes seem reasonable. Travel costs are higher for the party mode than for others, reflecting further distance and more travel time. The fishing costs--those items related directly to the activity and not travel--are also consistent with reasonable explanations. Both bait costs and cleaning costs are higher for charter activities, reflecting greater use of live bait and higher catch rates. Tackle costs are roughly equal across modes. The average pier fee is low because the "pier" category includes many structures (such as bridges and jetties) which do not require fees. There are few commercial fishing piers in Maryland.

Table MD.7 gives information on trips taken in Maryland by people who are on overnight visits. This includes people on vacation as well as on business trips. There are only 163 of

[1]For the rental mode, the number of observations is too mall to warrant any confidence in the results.

these trips, too few to disaggregate by mode. The mean travel cost is lower than for one-day trips because this measures the cost from the temporary abode. The costs of fishing services are similar to costs for day trips. The costs for fishing activity related items are in line with those for day trips.

Table MD.8 gives the distribution of species sought by mode. This table shows the importance of smallgame--primarily bluefish. Over 60 percent of each mode's trips are directed toward smallgame. Flatfish are also important, though only fishermen who fish from piers (any artificial structure) or private boats devote much effort to flatfish.

Table MD.1

Two-Month Participation Rates*
by Wave and Year

Year	Wave				
	March-April	May-June	July-August	September-October	November-December
1980	5.9%	6.6%	10.5%	9.0%	3.4%
1981	4.7	10.6	13.7	7.8	2.8
1982	3.9	7.3	10.5	5.6	1.6
1983	3.9	7.5	8.8	4.8	1.2
1984	2.3	5.5	8.1	6.0	1.6
1985	2.6	6.0	7.0	6.3	.6
1986	2.5	8.4	6.5	6.5	2.6
1987	2.3	5.5	7.9	4.0	1.3
1988	1.8	4.8	7.8	5.1	1.3
1989	3.9	5.4	5.0	3.7	0.7
Mean	3.38%	6.76%	8.58%	5.89%	1.71%

* Percent of Maryland coastal county households called who fished in Maryland marine waters in the designated two months.

Table MD.2

Linear Trend Analysis[1] of Maryland Participation Rate

By Wave, 1980-1989.

Wave	Constant	Linear Trend Coefficient	$\bar{R}^2$
March/April	.047 (8.36)	-.0030 (-2.86)	.44
May/June	.083 (9.48)	-.0035 (-2.11)	.28
July/August	.116 (13.69)	-.0068 (-4.26)	.66
September/October	.078 (12.07)	-.0042 (-3.48)	.55
November/December	.026 (6.00)	-.0020 (-2.46)	.36

[1] Estimated model was Part. rate = $\alpha_0 + \alpha_1$ time, with time deferred as t = 0 for 1980, t = 1 for 1981 ... and t = 9 for 1989.
[2] T-ratio in parentheses.

Table MD.3

Trips Per Household Called
By Year and Season*

Year	Total	Wave				
		March-April	May-June	July-August	September-October	November-December
1980	1.54	.12	.33	.68	.43	.08
1981	1.34	.17	.44	.37	.32	.04
1982	1.49	.17	.31	.58	.40	.03
1983	1.66	.14	.40	.70	.38	.03
1984	1.26	.10	.28	.45	.38	.04
1985	1.14	.16	.24	.37	.35	.02
1986	1.62	.11	.55	.58	.28	.10
1987	1.32	.10	.33	.56	.23	.10
1988	1.23	.04	.34	.45	.35	.05
1989	1.11	.10	.33	.33	.22	.12
Mean	1.37	.12	.35	.51	.33	.06

* Trips taken within state of residence.

Table MD.4

Percent of Fishing Trips in Various Modes by Wave
Mean 1981-1988

Mode	Wave				
	March-April	May-June	July-August	September-October	November-December
Shore	55.5%	28.2%	31.4%	31.3%	30.8%
Party/Charter	5.9	6.8	12.3	11.9	12.9
Private/Rental	38.6	64.9	56.3	56.8	56.2

Table MD.5

Percent Fishing Trips in Various Areas, by Wave
Mean 1981-1988

Area	Wave				
	March-April	May-June	July-August	September-October	November-December
Ocean, Gulf, Open Bay	26.5%	28.1%	24.8%	31.0%	34.8%
Sound	1.0	2.4	1.5	1.7	3.5
River	54.7	15.1	21.9	18.7	19.6
Enclosed Bay	14.8	51.3	50.2	46.1	41.3

Table MD.6

Characteristics of Day Trips in Maryland, by Mode
(per trip averages)

Characteristic	Mode					
	Pier	Beach	Party	Charter	Rental	Private
Travel Cost	$13.27	$15.30	$24.92	$11.60	$17.67	$12.28
Costs for						
Bait	$5.37	$5.66	$3.06	$15.89	$6.50	$8.85
Equip. Rental	0	0	.63	.50	0	.28
Tackle	1.80	1.30	1.30	1.95	2.00	2.50
Cleaning	.96	1.05	2.20	4.28	.16	2.48
Fuel	--	--	--	--	0	14.39
Pier Fees	.31	--	--	--	--	--
Launch Fees	--	--	--	--	--	.41
Boat Fees[a]	--	--	25.16	146.86	25.92	
Travel Time (in minutes)	63.8	83.2	109.6	71.2	178.18	55.97
Distance (in miles)	47.8	66.1	88.1	51.0	144.8	38.98
Boat Time to first site (in minutes)	--	--	66.6	86.7	23.3	30.51
Number of Observations	68	53	33	39	4	258

[a]Boat fees are charter and party fees or rental fees.

Table MD.7

Characteristics of Trips for Overnight Visits in Maryland

Characteristic	Mean	Number of Applicable Observations
Travel Cost	$4.20	149
Cost for		
Bait	6.98	152
Equipment Rental	.22	154
Tackle	4.04	153
Cleaning	1.42	155
Fuel	29.61	70
Pier Fees	1.08	47
Launch Fees	.85	67
Boat Fees	48.88	20
Boat Rental	29.42	5
Travel Time (in minutes)	12.03	146
Distance (one-way) (in miles)	5.60	155
Boat Time (in minutes)	45.02	92
Trip Length (in miles)	8.89	156

Table MD.8

Percent of Trips Seeking Different Species Groups, by Mode
for Day Trips

	Mode				
Species Group	Pier	Beach	Party	Charter	Private
Big Game	2.4%	6.2%	12.5%	31.4%	13.9%
Small Game	65.8	78.1	75.0	68.6	57.4
Flatfish	26.8	9.4	8.3	0	22.2
Bottomfish	4.9	6.3	4.2	0	5.6

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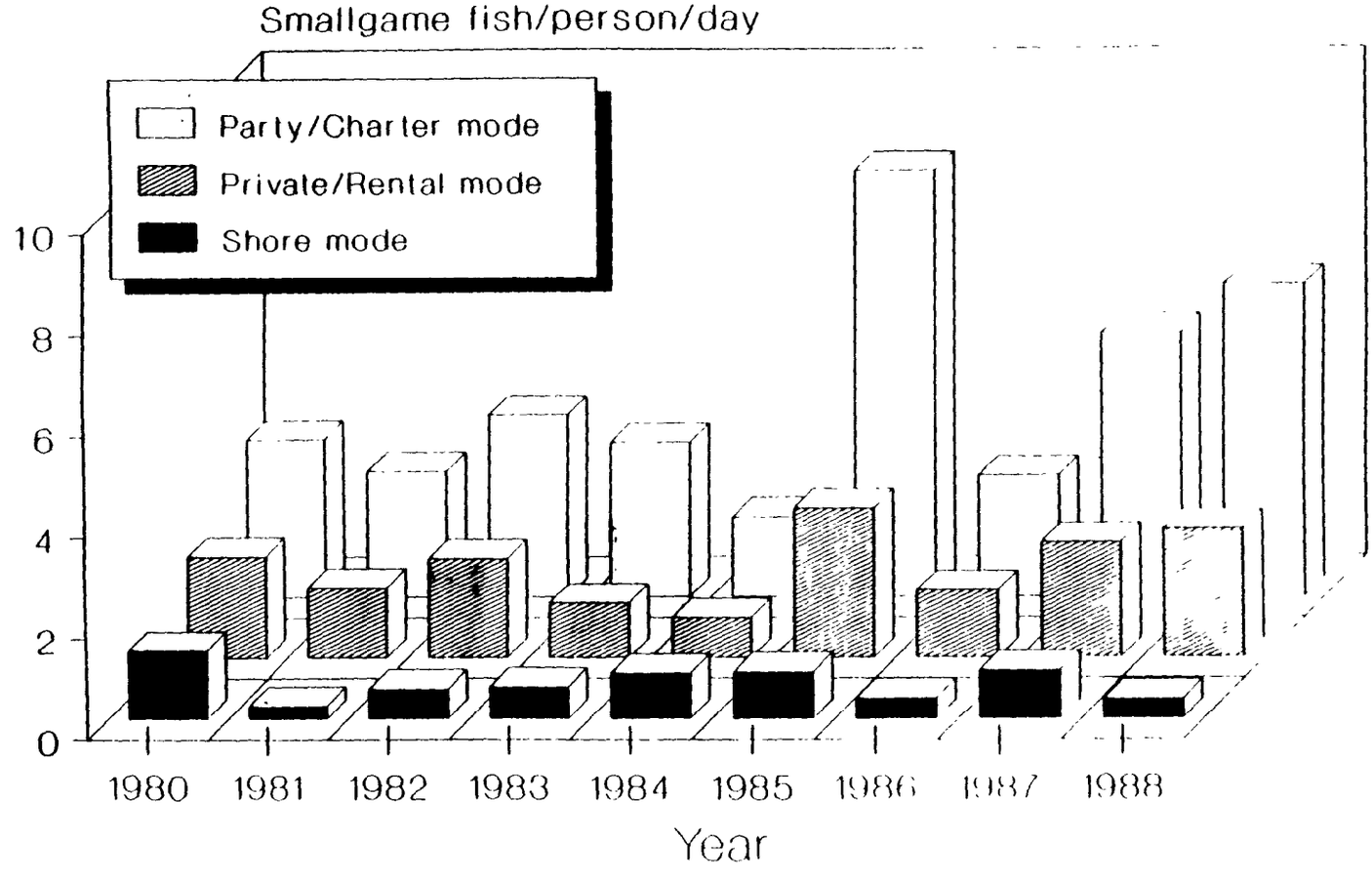
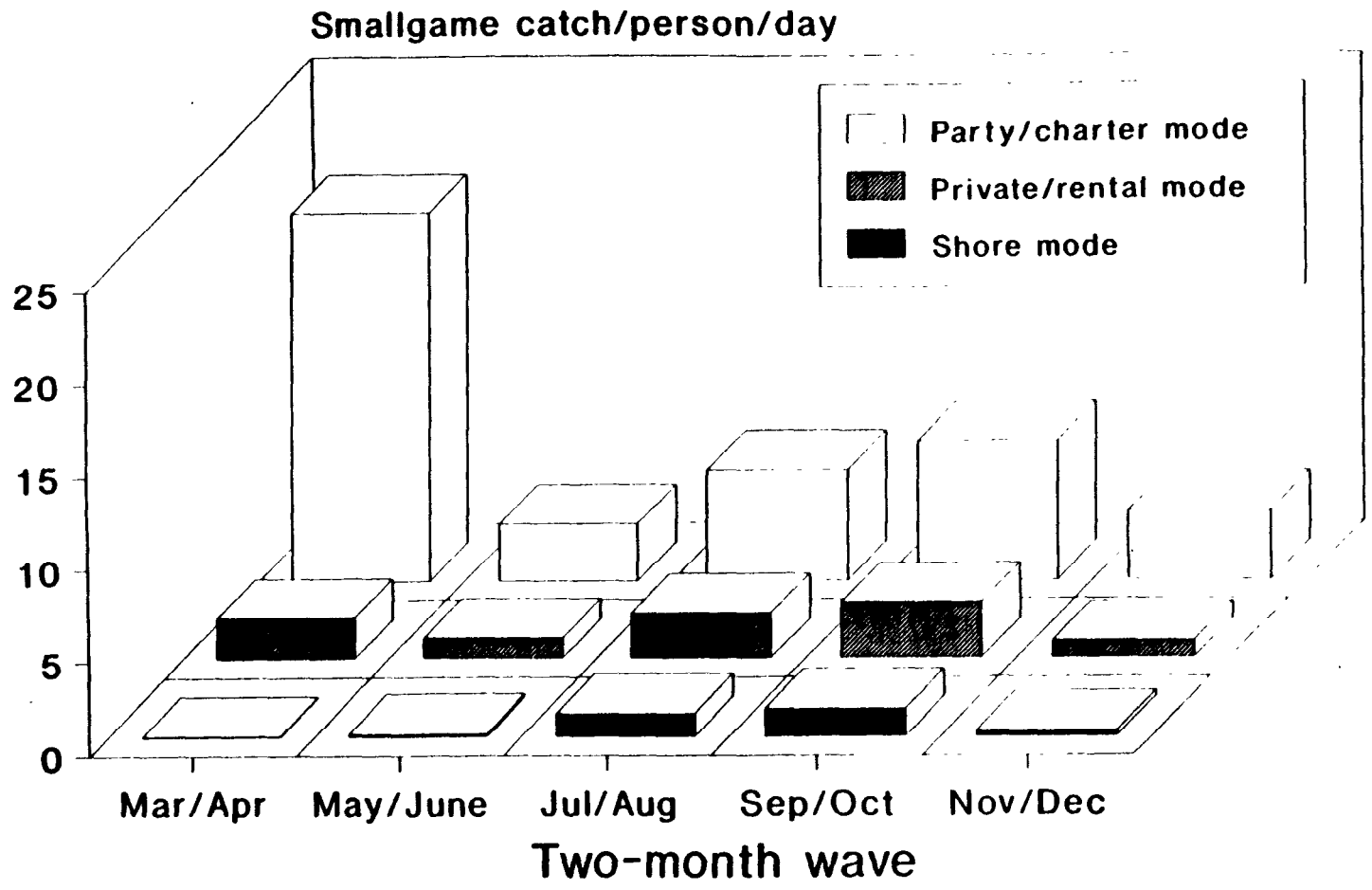
Fig. MD1: Smallgame Catch Per Day, Maryland, Chesapeake, By Year and Mode



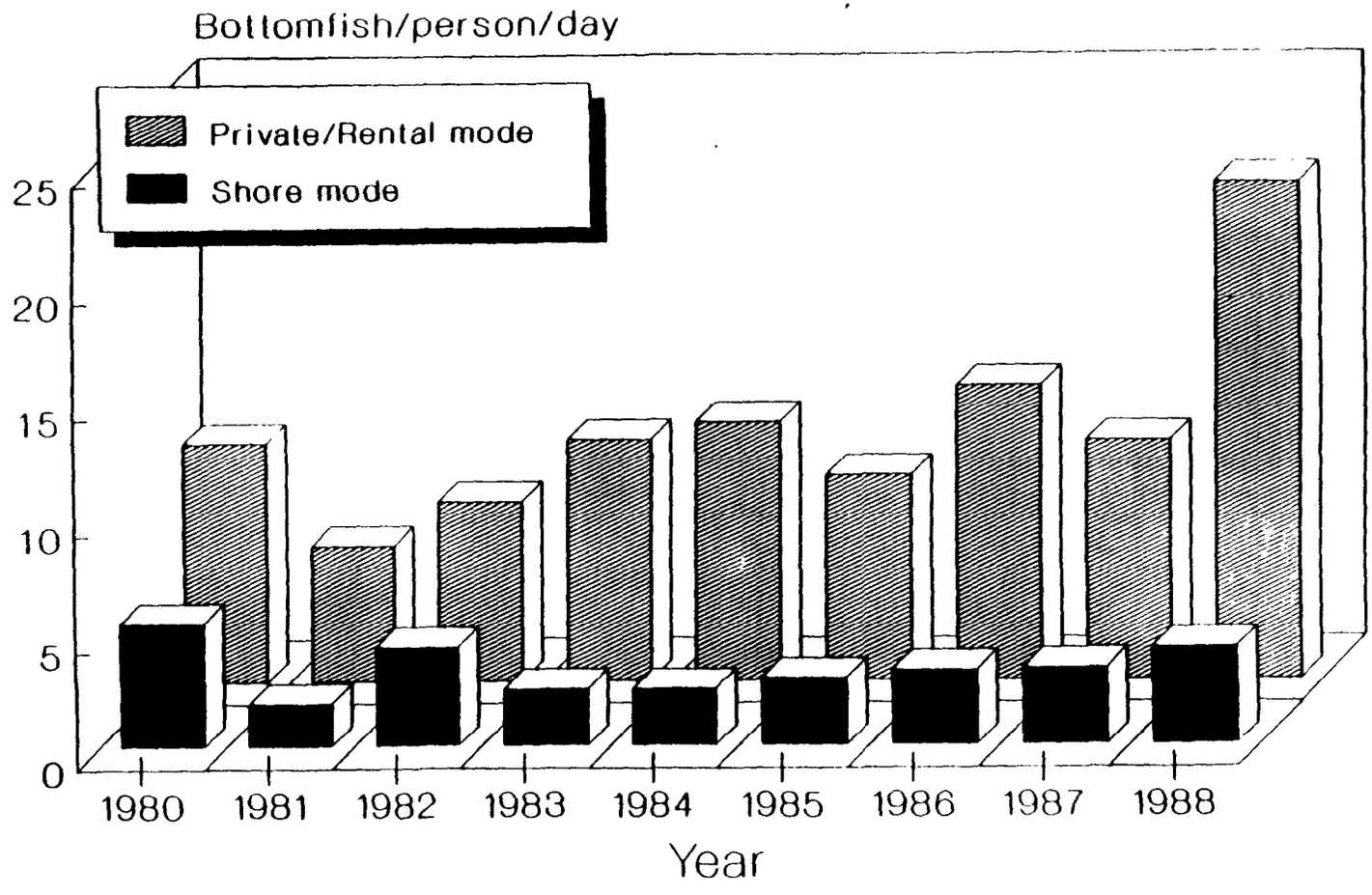
For individuals targeting smallgame
1980-1988

Fig. MD2: Smallgame Catch per Day Maryland, By Wave and Mode



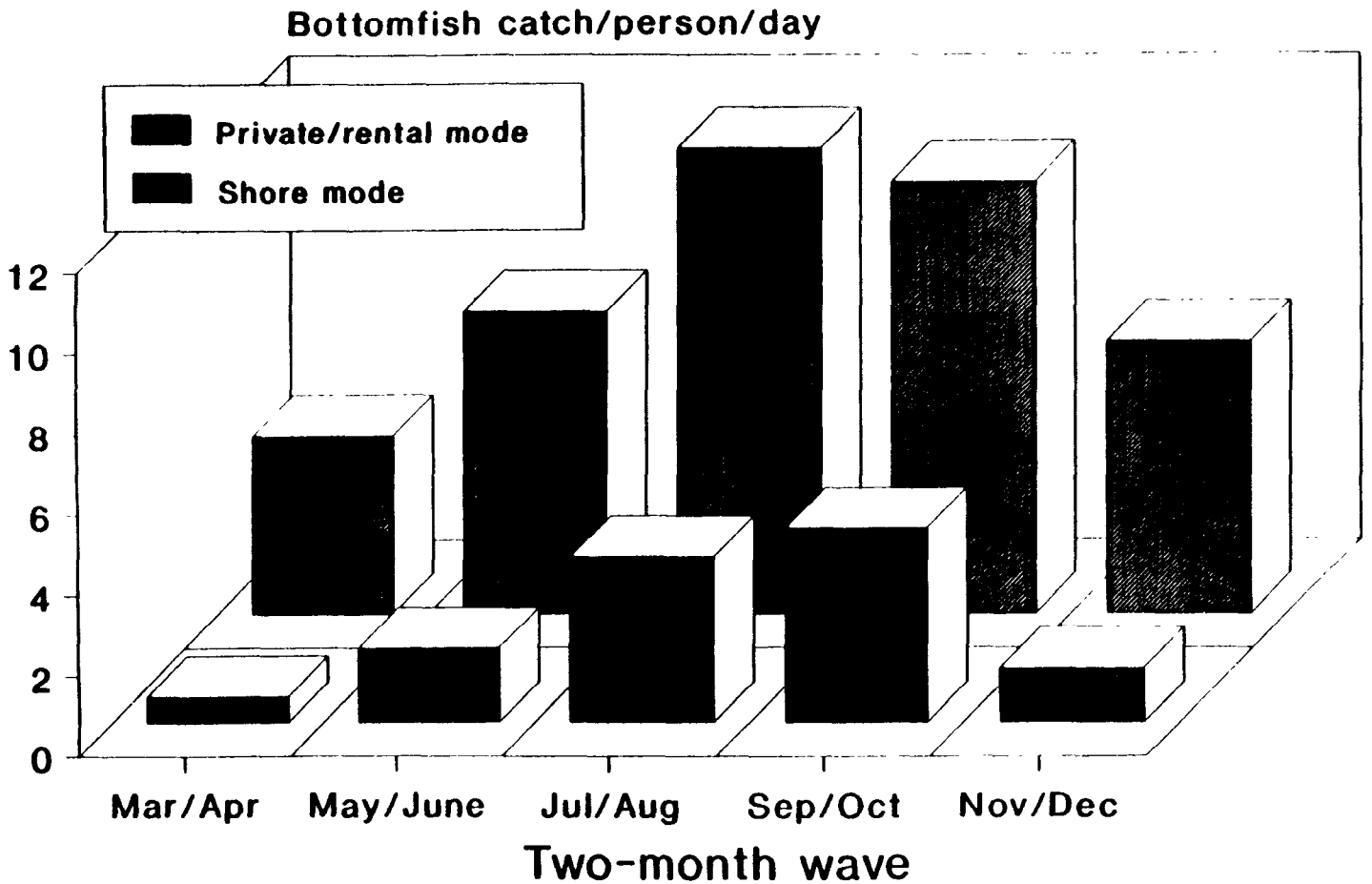
Average for anglers targeting smallgame, 1980-1988

Fig. MD3: Bottomfish Catch Per Day, Maryland, Chesapeake, By Year and Mode



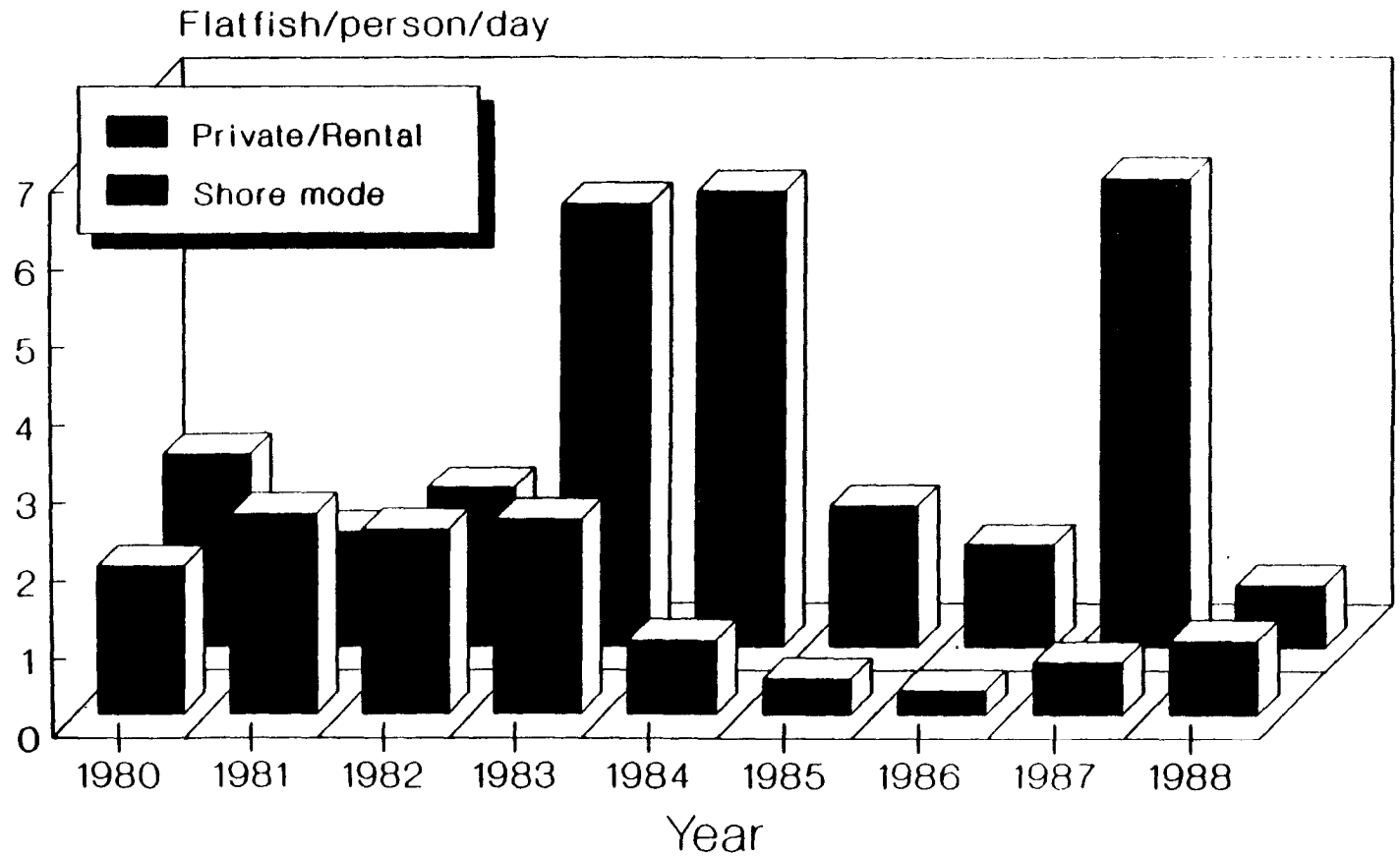
For individuals targeting bottomfish
1980-1988

Fig. MD4: Bottomfish Catch per Day Maryland, By Wave and Mode



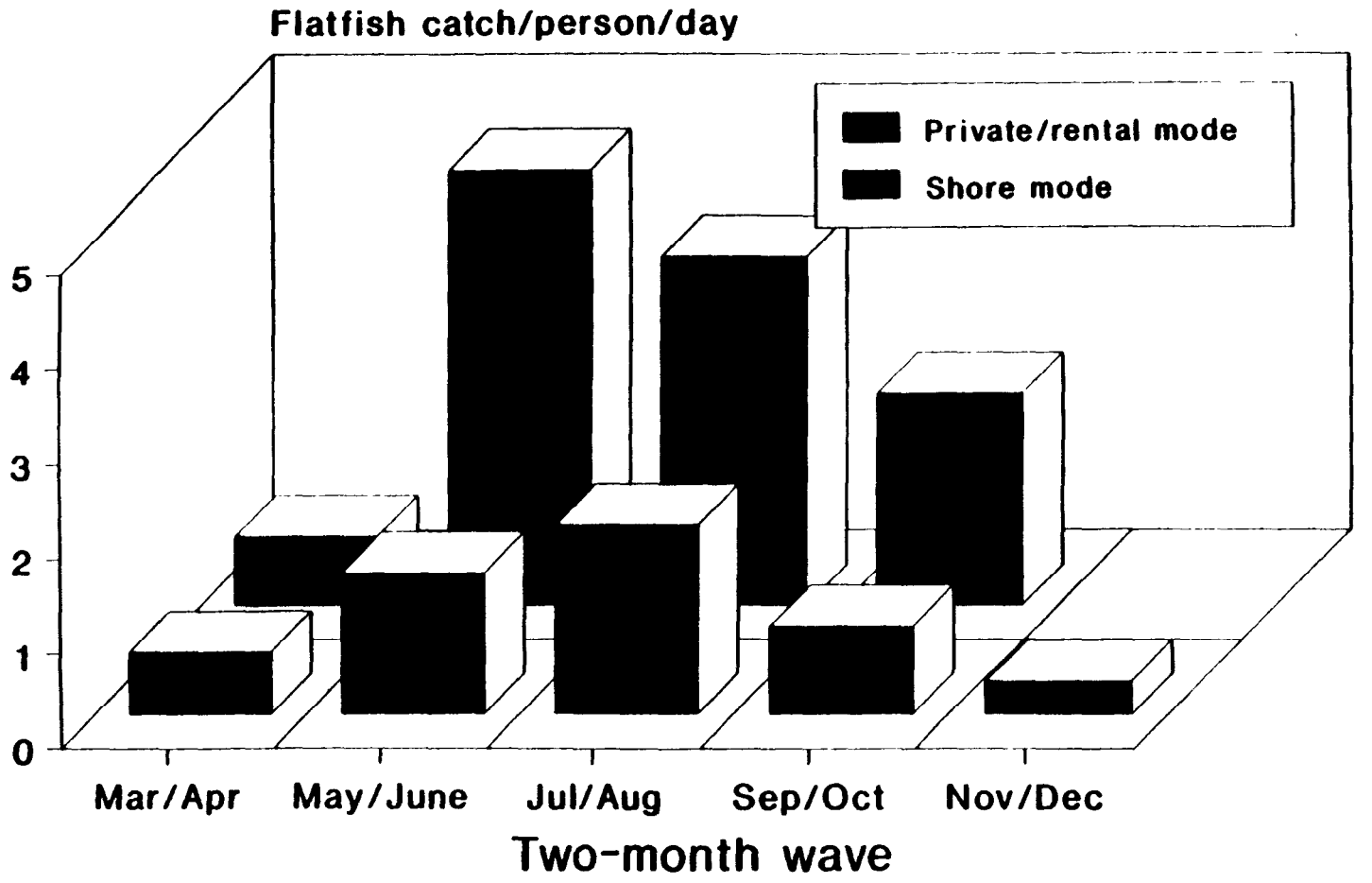
Average for anglers targeting bottomfish 1980-1988.

Fig. MD5: Flatfish Catch Per Day, Maryland, Oceanside, 1980-88, By Fishing Mode



For individuals targeting flatfish, Worcester County

Fig. MD6: Flatfish Catch per Day
Maryland, By Wave and Mode



Average for anglers targeting flatfish, 1980-1988

Chapter 6

SPORTFISHING IN VIRGINIA

Activity by Virginia Households

Participation in marine recreational fishing by Virginia households is influenced by the accessibility of waterbodies, the mild climate, and the distribution of households. Along Virginia's coastline, a series of estuaries empty into the southern part of the Chesapeake Bay. Parts of Virginia border the Atlantic Ocean at the mouth of the Chesapeake Bay.

The population of Virginia is broadly dispersed across the large state. Richmond, the Norfolk/Hampton/Newport News area and the northern Virginia suburbs of Washington, DC are large population centers. Because they are located within 25 miles of the coast or major estuaries and bays, they are sampled by the NMFS telephone survey. But there is considerable population in more western locations, such as Roanoke, Lynchburg, and Charlottesville, and these populations are not represented in the sample. The Chesapeake Bay and the Potomac River are the most accessible marine waters for the northern Virginia population, but the growing population of the Norfolk/Hampton/Newport News area has direct access to the ocean, and the lower reaches of the James River and the Chesapeake Bay.

The population from which the telephone survey draws includes close to 1.2 million households as of the 1980 census. This represents about 63 percent of the population of Virginia as of that census. NMFS estimates that between 88 and 92 percent of the sportfishing participants who both reside and fish in Virginia live in these coastal counties. State residents appear to account for about 60 to 65 percent of the sportfishing participants and between 60 and

75 percent of the sportfishing trips in Virginia marine waters. The proportion of activity attributable to state residents seems to have been growing slowly but steadily over the decade.

Sportfishing Activity: Household Participation Rates and Quantity of Sportfishing Trips

The seasonal participation rates for Virginia give a detailed picture of fishing activity by households. Table VA.1 shows temporal and seasonal variation across the years and the two-month waves. The sample sizes for these participation rates vary from 260 in the November-December wave of 1980 to 4111 in the summer wave of 1988. Sampling in Virginia has expanded over the decade by a factor of six, with much of the expansion coming in recent years.

Looking at the row of mean participation rates over time for each wave gives a good sense of the variation in seasonal participation. The proportion of households fishing in July-August (10.2 percent) is about four times the proportion in March-April (2.7 percent) or November-December (2.4 percent).

Over the 1980-1989 years, within two-month periods, there is considerable variation in the participation rate. The rate for March-April goes from a low of one percent in 1983 to a high of 4.2 percent in 1985 and 1986. Some of these variations are likely due to weather, especially in early spring and late fall when weather can be quite unstable and vary considerably from year to year. The participation rates for the summer are somewhat more stable. Especially for July-August, there appears to be a decline in participation rates.

The linear trend analysis (Table VA.2) indicated statistically significant decreases in participation rates for the two waves from July through October. The estimated parameters suggest that participation rates for the July/August period fell by 5.5 percentage points over the

decade and for the September/October period by 3.3 percentage points. The May/June period also indicated a decline, although not statistically significant.

Participation rates describe the prevalence of fishing among households, but not the magnitude of fishing. Magnitude is best described by the total number of fishing trips, which depends on the number of households fishing and the number of trips per fishing household. Equivalently, the magnitude may be calculated as the product of households and trips per households. Table VA.3 gives trips per household called. It incorporates information on participation rates and trips per fishing households.

The trip figures show substantial variation across and within season. Even stable seasons like July-August show as much as two-fold variations between years (see, for example, 1984 and 1985). The temporal pattern in trips as a whole is erratic. The linear trend analysis of trips per household called indicated no significant trends.

The general pattern of seasonal variation also follows that of participation, with highest levels coming in the late spring and summer waves. This pattern can best be revealed by the proportion of mean trips occurring in each seasonal wave. As these are trips per household called, this data reflects the proportion of aggregate sportfishing activity that occurs in each period.

	Mean Trips	Percent of Annual Mean
March-April	.10	6.1
May-June	.47	28.8
July-August	.62	38.0
September-October	.30	18.4
November-December	.14	8.6

About 85 percent of mean trips, and hence 85 percent of aggregate activity, occurs in the six-month period from May to October.

Sportfishing Activity by Mode

The character of fishing in Virginia can be discerned in part by the distribution of fishing trips among the three fishing modes included in the NMFS survey. These proportions are mean participation rates for the 1981-1988 period.

The importance of the private/rental mode in Virginia is apparent from Table VA.4. In all seasons the private/rental mode accounts for at least 50% of trips and therefore a greater proportion of fishing participation than any other mode. Because of inclement weather, anglers are less likely to use private boats in early spring and late fall when boat use is lowest. Table VA.4 also illustrates the relative unpopularity of charter/party boat fishing in Virginia. Only about 10% of fishing trips are taken on this mode, with this percentage rising to almost 13% in the early spring when private boating declines.

Table VA.4 can be combined with estimates of total trips by coastal county residents per wave to show the magnitude of fishing in each mode. From the 1980 Census, there were about 1,300,00 households living in coastal counties in 1980. From Table VA.3, mean trips per

household called in March-April was .10. Hence total trips by coastal county residents would be estimated at 130,000 (=.10 * 1,300,000). Of these, 53.6 percent or 69,680 would be attributable to private/rental boat trips. In July-August, mean trips per household called were .62, and aggregate trips by coastal county residents were 806,000 (=.62 * 1,300,000). The proportion of trips predicted to be private/rental trips also rises in July-August, to 62.4 percent. Hence total private/rental boat trips are 502,944. This includes, of course, the trips by coastal county residents only.

The party/charter mode is rather small in Virginia. During July-August, there were almost 50,000 party/charter trips by coastal county residents. During March-April, there were less than 20,000. Much of the party/charter activity may come from households outside the coastal counties. But for the coastal counties, there appears to be less activity than some northern states.

Sportfishing Activity by Waterbody

The NMFS telephone survey defines fishing activity by four types of waterbodies. Table VA.5 shows the distribution of fishing trips to these waterbodies across seasons. The interpretation of these proportions is confused by the likely variation among respondents about the precise definition of these terms and by the failure of some respondents to be able to accurately classify the areas in which they fish. Like Maryland and other states on the East Coast, the NMFS categories may not conform to the actual circumstances as perceived by anglers.

While mindful of the potential for ambiguities, we can see from Table VA.5 the reported patterns for Virginia coastal county households. The largest proportion of trips is in the ocean,

gulf and open bay category. This suggests that households perceive the Chesapeake Bay as an open bay. This proportion declines in the summer as the proportion of fishing trips in enclosed bays and rivers increases, probably because of small boat activity. The magnitude of activity by waterbody for residents of coastal counties can be calculated analogously with the magnitude by mode. For example, in July-August there were 806,000 total trips. Table VA.5 shows that 38.7 percent or 311,922 were trips taken to ocean, gulf or open bay.

Catch Rates in Virginia

Like Maryland, Virginia sportfishing involves two major bodies of water, the Chesapeake Bay and the Atlantic Ocean. The species sought and caught in these water bodies are often distinct. For example, bluefin tuna may be sought in the Atlantic but obviously not in the Chesapeake. In the Chesapeake, the major species sought are spot, croaker, bluefish and summer flounder. In the Atlantic, bluefish, mackerel, weakfish are often targeted. Unlike Maryland, a large percentage of Virginia's fishing from Ocean counties is by private/rental boats rather than party/charter.

The percentage of persons targeting species in Virginia is quite similar to Maryland. Overall, about 41 percent of the intercepted anglers had no specific target. This rose from around 35% in the first half of the decade to 43% in the latter half of the decade.

Unlike Maryland, Virginians most popular target was bottomfish, capturing a consistant 26% of the anglers in both periods. Smallgame is less popular in Virginia but still is the target of around 15 percent of the sample. Flatfish were a frequent target for anglers in the first half of the decade (~ 25%) but were substantially less popular in the latter half (~ 12%). Finally. biggame is targeted by less than 1 percent of the sample.

Smallgame Catch Rates

Bluefish is the most important smallgame species in Virginia, consistently representing about fifty percent of the targeted catch of anglers who seek smallgame. The second most important species is weakfish, which represents about thirty-five percent of the targeted smallgame catch, Spotted seatrout represents about five percent of the targeted catch. Thus, three species account for ninety percent of the targeted catch of smallgame. The remaining catch is comprised of amberjack, red drum and mackerels.

Figure VA1 shows the trend in smallgame catch rates of Virginia anglers who target smallgame. Like Marylanders, Virginians who target smallgame on party/charter boats tend to enjoy larger catch rates than anglers using other modes. Over the 1980's, Virginians using the party/charter mode in Virginia's Chesapeake Bay averaged more than eight times the catch rate of those using the shore mode and nearly three times the catch rate of those using the private/rental mode. The superiority of the party/charter mode is also evident in the Atlantic Ocean although the numbers of intercepted people who were seeking smallgame in the Atlantic is substantially smaller than in the Chesapeake, and therefore not shown in Figure VA1.

The trends exhibited in the figure are not nearly as consistent as those shown for Maryland, most likely because of the smaller number of people seeking smallgame who were intercepted in Virginia. Because of sample size, the private boat mode provides the most meaningful data. Here, like Maryland, there is a slow but general upward trend in landings, after a decade low experienced in 1983. In contrast. the party/charter catch rates show a decline after 1984, but this may simply be randomness in a small sample.

Seasonally, the best Virginia catch rates of smallgame occur in the September/October period (Figure VA2). These months provide the highest catch rates for both the private/rental and party/charter mode. The catch rates for shore fishermen in the July/August period are slightly higher than the September/October period but the difference is not statistically significant. It is interesting, however, that the people who target smallgame in Virginia are predominantly intercepted in the May/June period, even though fishing for small game may be better at other times of the year.

Bottomfish Catch Rates

The most targeted and caught bottomfish in Virginia is spot, representing sixty-three percent of the pre-1985 catch of targeted bottomfish and forty-six percent of the catch since then. The next most important bottomfish is croaker, representing around twenty percent prior to 1985 and thirty percent since. Black sea bass, tautog, and black drum are the remaining targeted bottomfish. White perch, which is Maryland's predominant bottomfish, was targeted by only three intercepted anglers in the nine years of interviewing in Virginia.

The catch rate of bottomfish in Virginia appears cyclical over the 1980's (Figure VA3), both for shore fishermen and private boat fishermen. After an initial decline, catch rates peak in 1983, drop in 1984, recover in 1985 and then slowly decline for the remainder of the decade. The middle of the decade yielded reasonably good fishing, but recent catch rates have been low. Since 1983, the catch rates for the shore and private boat fishermen have moved in a consistent pattern, but one which is not consistent with that in Maryland.

Flatfish Catch Rates

As with Maryland, the overwhelming species of flatfish targeted and caught in Virginia is summer flounder. Prior to 1985, about eighty-five percent of the flatfish targeted and caught was summer flounder. Twelve percent was unidentified flounder and the other two percent was mostly southern flounder. Since 1985, ninety-three percent of the flatfish were summer flounder, five percent unidentified, and one percent winter flounder, A few left-eyed flounder and southern flounder were caught in the latter period.

Catch rates of flatfish in the Virginia's portion of the Chesapeake Bay have been lower in the latter 1980's than the earlier years (Figure VA4), both for the private boaters and shore fishermen. Catch rates in counties abutting the Atlantic have been higher on average, but with much more variation. These trends are very similar to the Delaware and Maryland experience (Figures DE4 and MD5).

Characteristics of Fishing Trips in Virginia

Previous sections pertain to participation rates, catch rates and targeted species of the Virginia sportfishery for 1981-1988. Information about fishing trips is also useful in understand the sportfishery. The UMCP survey provides considerable information on the economic aspects of fishing trips. The following section describes aspects of fishing trips by mode and state.

Table VA.6 gives cost and travel information for single-day trips by six fishing modes for day trips in Virginia. The travel costs are roughly similar for different modes, except for the rental mode, which has only 24 observations. Travel time and distance are also much higher for the rental mode. Tackle costs are higher because tackle is typically provided as part of the basic service on party and charter boats. Other costs conform with the nature of the fishery.

Cleaning costs are higher for the private and charter modes, where catch rates are higher. Bait costs are roughly similar across mode. The mean pier fee is high relative to other states, reflecting a high proportion of fees for artificial structures.

Table VA.7 gives characteristics of fishing trips taken by people who stay overnight. Such visits could be vacations, business trips, or family visits. The mean travel cost for this mode is low because visitors are travelling only from their previous night's lodging. There are 175 trips by overnight visitors, and their means are given irrespective of mode. The costs of fishing services are similar to day trip means. For example, mean bait costs are $5.53 for the overnight visitors and range from $4.45 to $7.26 for day trips. From the distance and time travelled means, it is clear that the fishing trips by overnight visitors are taken quite close to the lodging.

Table VA.8 shows the distribution of effort by species sought and mode. Only charter and private boats seek big game to any extent. The presence of a small percent on pier suggests ocean piers.

Table VA.1

Two-Month Participation Rates*
by Wave and Year

Year	Wave				
	March-April	May-June	July-August	September-October	November-December
1980	2.0%	7.8%	10.4%	7.8%	4.6%
1981	2.5	11.4	13.7	9.4	2.2
1982	4.1	9.0	10.9	6.4	2.1
1983	1.0	11.6	12.3	5.9	1.3
1984	2.6	8.5	11.2	6.5	2.2
1985	4.2	7.6	8.4	5.2	1.7
1986	4.2	11.7	12.5	8.1	3.7
1987	1.4	7.1	9.0	5.6	3.1
1988	2.7	7.5	8.0	5.7	3.0
1989	2.5	6.3	6.0	4.2	0.2
Mean	2.7	8.8	10.2	6.4	2.4

* Percent of Virginia coastal county households called who indicated having fished in Virginia marine waters in the previous two months.

Table VA.2

Linear Trend Analysis[1] or Virginia Participation Rates,

By Wave, 1980-1989.

Wave	Constant	Linear Trend Coefficient	$\bar{R}^2$
March/April	.026 (3.71)	.0002 (0.16)	.00
May/June	102 (9.22)	-.0030 (-1.48)	.12
July/August	.127 (12.14)	-.0055 (-2.82)	.44
September/October	.079 (10.67)	-.0033 (-2.38)	.34
November/December	.030 (3.97)	-.0013 (-0.89)	.00

1 Estimated model was Part. rate = $\alpha_0 + \alpha_1$ time, with time defined as t = 0 for 1980, t = 1 for 1981 . . . and t = 9 for 1989

2 T-ratio in parenthesis.

Table VA.3

Trips Per Household Called
By Year and Season*

Year	Total	Wave				
		March-April	May-June	July-August	September-October	November-December
1980	1.06	.03	.22	.47	.23	.11
1981	1.85	.08	.63	.66	.43	.05
1982	1.21	.10	.29	.52	.25	.05
1983	2.05	.01	.58	1.11	.26	.03
1984	2.01	.09	.44	.84	.30	.44
1985	1.67	.23	.70	.41	.20	.11
1986	2.03	.16	.68	.72	.33	.14
1987	1.38	.05	.36	.51	.28	.17
1988	1.67	.16	.44	.41	.40	.26
1989	1.19	.10	.32	.46	.30	.01
Mean	1.63	.10	.47	.62	.30	.14

* Trips taken within state of residence.

Table VA.4

Percent of Fishing Trips in Various Modes by Wave
Mean 1981-1988

Mode	Wave				
	March-April	May-June	July-August	September-October	November-December
Shore	33.5%	36.8%	31.7%	25.3%	47.5%
Party/Charter	12.9	4.7	6.0	8.7	2.7
Private/Rental	53.6	58.5	62.4	66.0	49.7

Table VA.5

Percent Fishing Trips in Various Areas, by Wave
Mean 1981-1988

Area	Wave				
	March-April	May-June	July-August	September-October	November-December
Ocean, Gulf, Open Bay	50.0%	30.6%	38.7%	44.3%	51.1%
Sound	1.3	1.0	1.1	1.0	1.7
River	16.0	31.2	25.7	23.3	11.5
Enclosed Bay	29.9	36.4	33.9	31.4	32.5

Table VA.6

Average Characteristics of Day Trips in Virginia, by Mode
(per trip averages)

Characteristic	Mode					
	Pier	Beach	Party	Charter	Rental	Private
Travel Cost	$7.04	$7.29	$9.65	$14.48	$33.85	$10.63
Costs for						
Bait	5.88	5.11	5.72	4.45	6.51	7.30
Tackle	3.14	2.19	1.63	.39	19.41	5.77
Cleaning	.69	.61	1.06	2.54	1.01	2.07
Fuel	-	-	-	-	.57	19.73
Pier Fees	3.39	-	-	-	-	-
Boat Fees[a]	-	-	17.94	52.14	61.12	-
Travel Time (in minutes)	29.8	40.5	66.8	81.66	180.5	37.20
Distance (in miles)	20.5	29.3	50.6	67.65	142.0	22.8
Boat Time to first site (in minutes)	-	-	33.6	41.64	27.95	34.02
Number of Observations	195	36	63	55	24	384

[a] Boat fees are charter and party fees or rental fees.

Table VA.7

Characteristics of Trips for Overnight Visits in Virginia

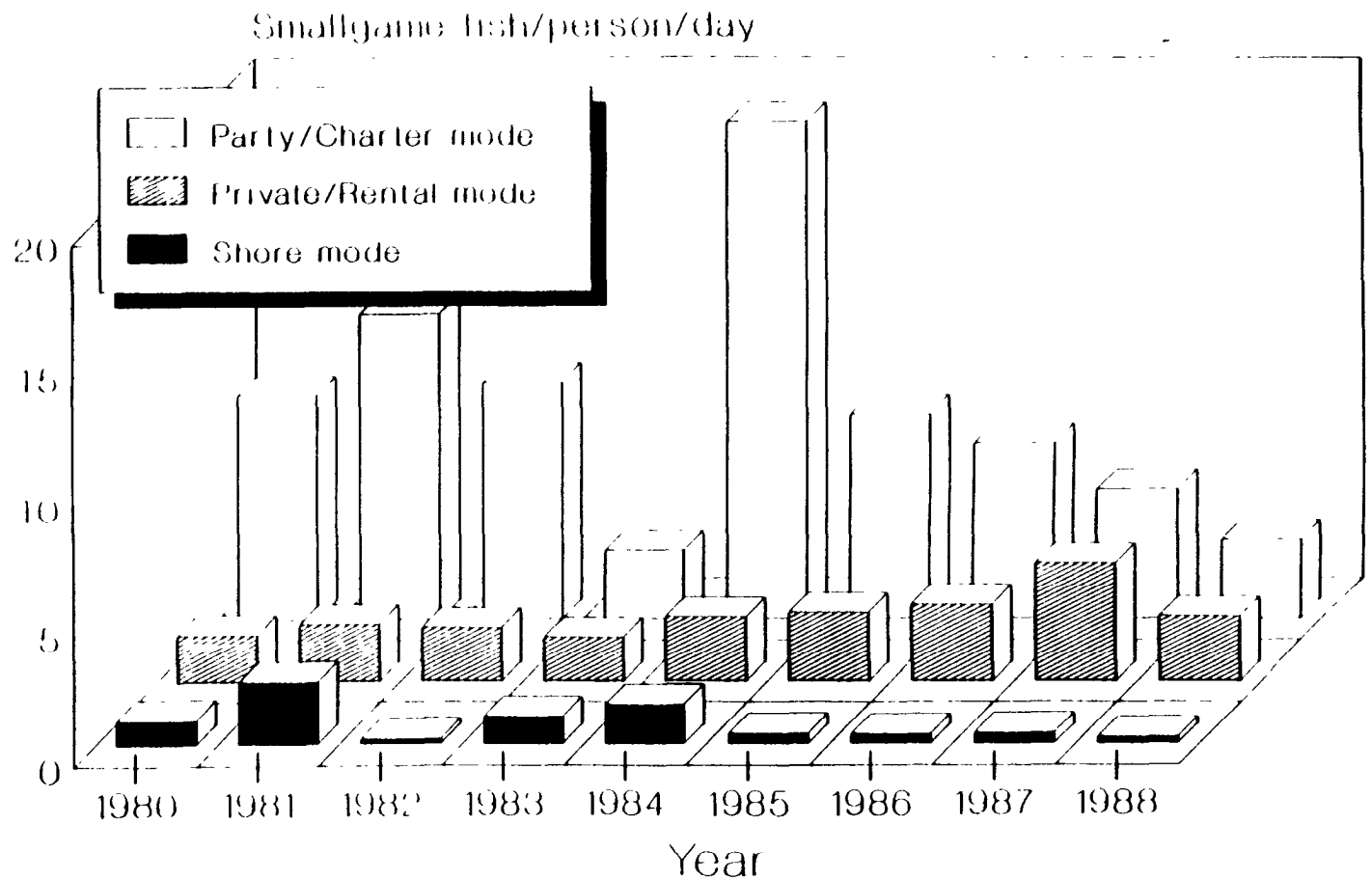
Characteristic	Mean	Number of Applicable Observations
Travel Cost	$3.33	163
Cost for		
Bait	5.57	167
Tackle	2.50	170
Cleaning	1.22	169
Fuel	11.94	81
Pier Fees	5.19	46
Boat Fees	74.35	22
Boat Rental	41.15	12
Travel Time (in minutes)	13.62	159
Distance (one-way) (in miles)	5.18	167
Boat Time (in minutes)	26.38	103
Trip Length (in miles)	14.65	171

Table VA.8

Percent of Trips Seeking Different Species Groups, by Mode
for Day Trips

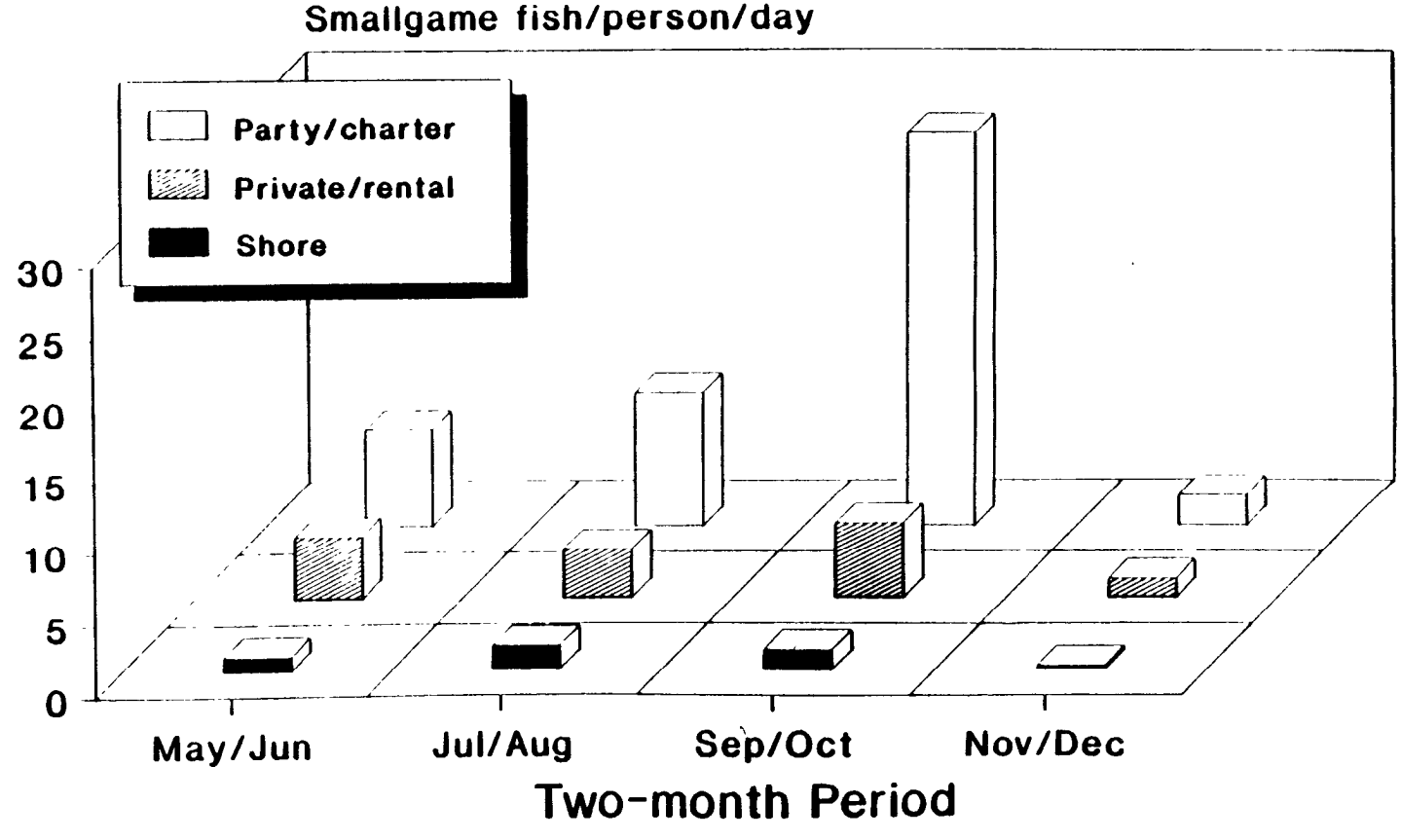
	Mode					
Species Group	Pier	Beach	Party	Charter	Rental	Private
Big Game	5.9	0.0	0.0	24.2	0.0	16.8
Small Game	23.8	60.9	42.9	45.4	17.6	33.6
Flatfish	36.6	17.4	10.7	12.1	58.8	24.2
Bottomfish	33.7	21.7	46.4	18.2	23.5	25.5

Fig. VA1: Smallgame Catch Per Day,
Virginia, Chesapeake Bay, 1980-88,
By Fishing Mode



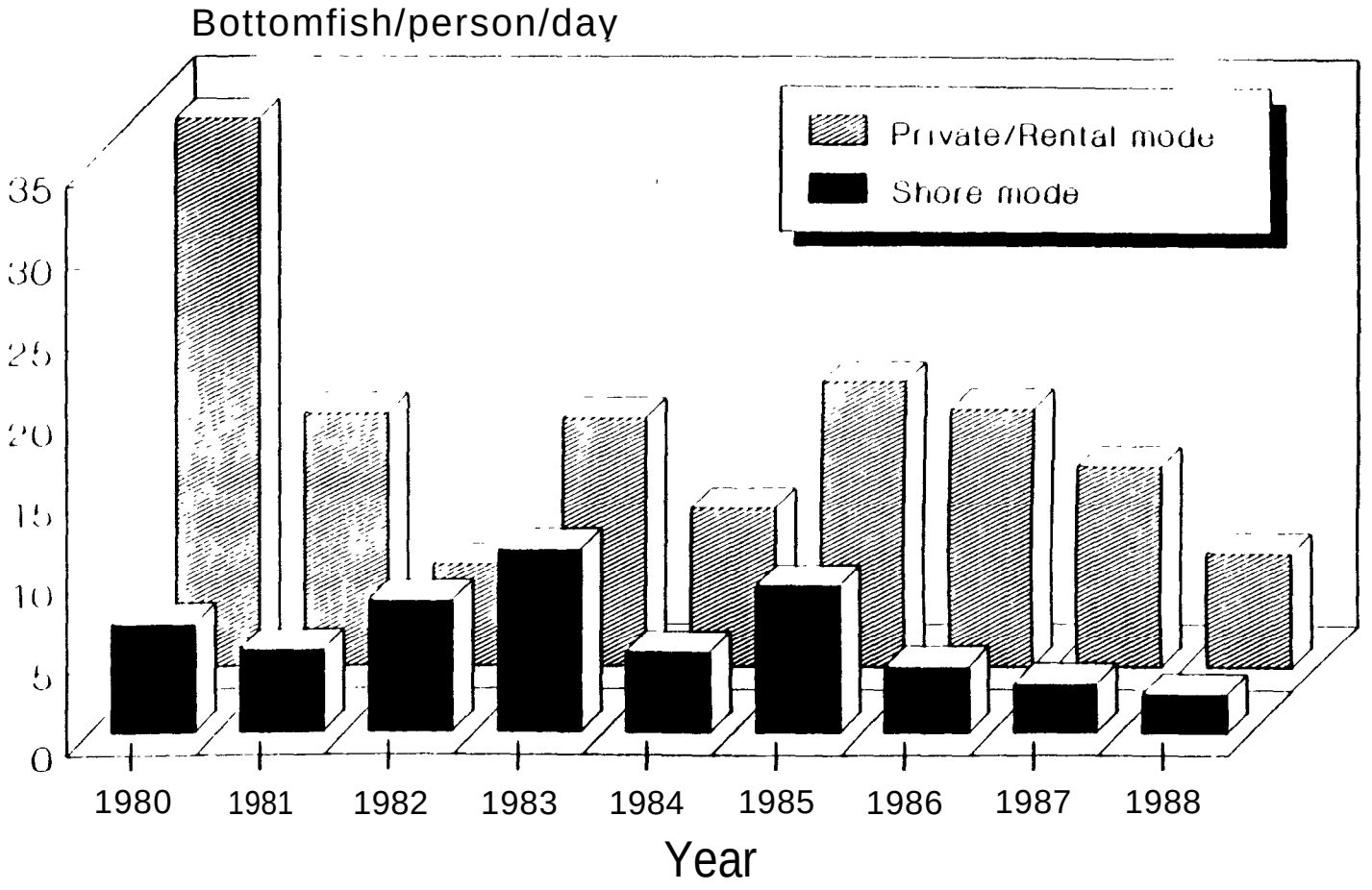
For individuals targeting smallgame

Fig. VA2: Smallgame Catch Per Day, Virginia, Bay and Ocean, By Wave and Mode



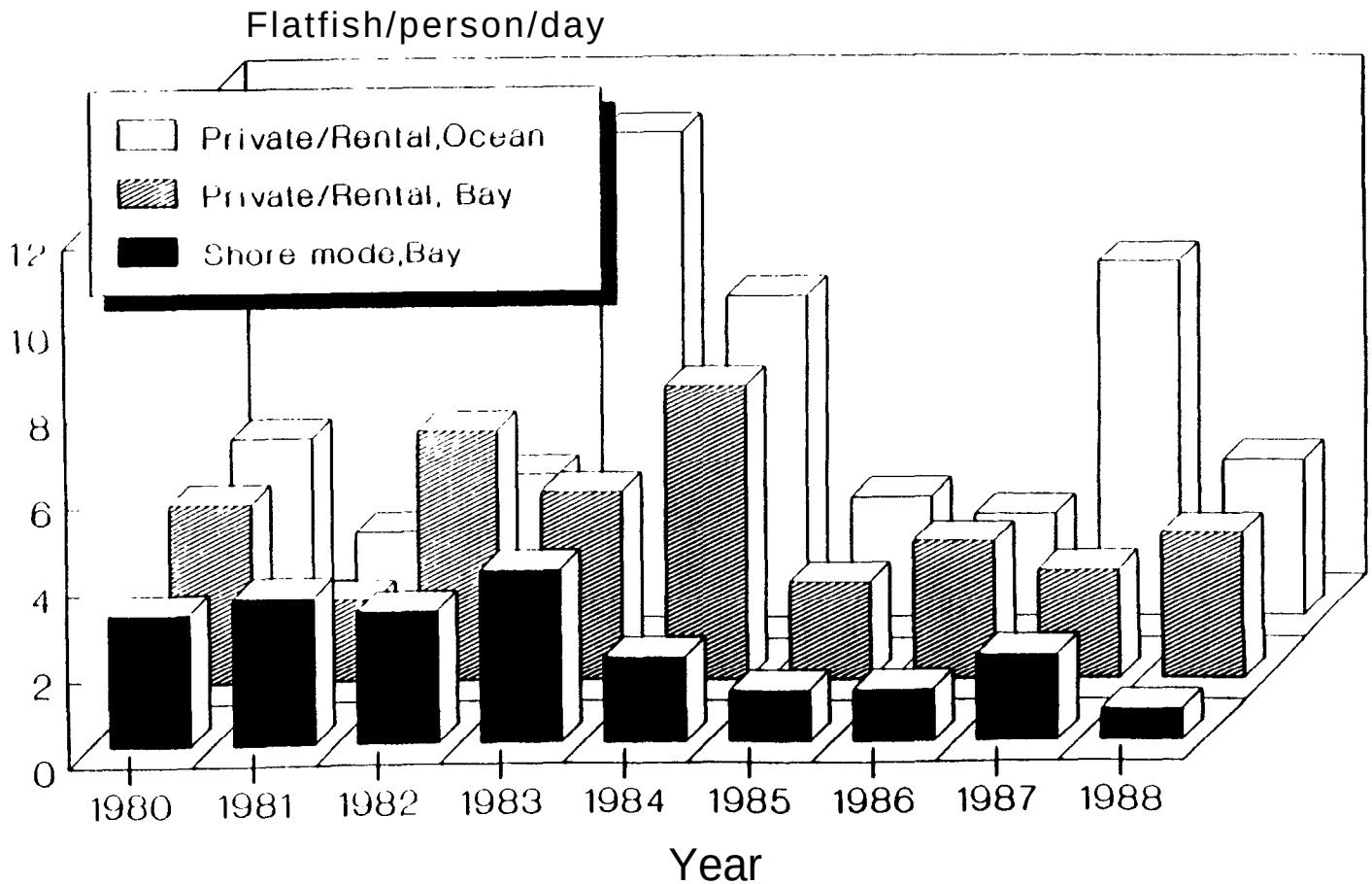
Average for individuals targeting small-game, 1980-1988.

Fig. VA3: Bottomfish Catch Per Day, Virginia, Chesapeake Bay, 1980-88, By Fishing Mode



For individuals targeting bottomfish

Fig. VA4: Flatfish Catch Per Day, Virginia, Bay and Oceanside, 1980-88, By Fishing Mode



For individuals targeting flatfish

Chapter 7

SPORTFISHING IN NORTH CAROLINA

Activity by North Carolina Households

Anglers in North Carolina can choose among a wide variety of marine recreational fishing opportunities. Fishing takes place in the two large sounds, the Pamlico and the Albemarle, numerous brackish rivers, the bays created by the barrier islands, and the Outer Banks. The weather is fairly mild, with good fishing days available all year round. The population, however, is not distributed close to the coast as it is for many other states. North Carolina's population centers of Raleigh, Greensboro, Winston-Salem and Charlotte are located inland, more than 50 miles from the coast.

The NMFS telephone survey has two types of coverage. For wave two (March-April) and wave six (November-December) from 1980 through 1986, the telephone survey samples households who live in counties within 25 miles of the coast or estuary. This includes about 296,500 households or 15 percent of the households in the state. For waves two and six for years 1987-1989 and for waves three through five (May through October) for years 1980-1986. the survey covers households who live in counties within 50 miles of the coast. This range is sufficient to include cities such as Rocky Mount, Wilson, and Greenville and expands the sample population to about 460,700 households or 23 percent of the households in the state. Since 1987, the sampling frame for waves 3 through 5 has been expanded to 100 miles. This dual sampling frame must be borne in mind as we consider seasonal variation in participation rates and trips. While neither captures a significant portion of North Carolina's population, May through October

data reflect activities of half again as many people. Consequently, differences in the participation rates and trips per household in different waves reflect both seasonal differences in the fishery and different population sizes.

Because the sampled counties are closer to the coast, we expect residents of these counties to be more active in sportfishing. NMFS's estimates of the proportion of in-state sportfishery participants who are coastal county residents (according to the relevant definition of "coastal county" for the given year) has fluctuated radically over the decade, ranging from a low of 28 percent in 1985 to a high of 55 percent in the subsequent year. The estimates of the proportion of North Carolina sportfishing participants who are state residents has also varied, with percentages in the 50's and 60's toward the beginning of the decade but dropping to about 38 percent toward the end. This may reflect a growing tourist industry highlighting sportfishing opportunities along North Carolina's extensive coast. The proportion of trips attributable to in-state fishermen has declined also, but less dramatically as would be expected, from about 70 percent in the early eighties to between 55 and 65 percent in later years.

Participation and Quantity of Trips by Season

Table NC.1 gives the participation rates by wave and year. The first column, for March-April, and the last column, for November-December, are not comparable with the rest because the sample frame includes a different number of counties. For the May-October periods, the rate varies from a low of 7.8 percent in July-August 1988 to a high of 19.6 percent in July/August 1981. Remember, however, that the sample was expanded in 1987 to include an additional 50 miles and one would expect lower participation rates as more distant counties are added to the

sample. Because the sample sizes are large, the participation rates are significantly different from zero. The means are also typically different from one another.

Some decline in participation over time is evident here. While the decline is not uniform, the participation rate appears to have trended downward since 1983 especially in the July-October periods. The trend is not established statistically, but is quite evident in the rates for 1987, 1988 and 1989, when participation rates have been uniformly lower than the mean participation rates for the decade. The effect of changing the sampling scheme, however, cannot be separated from a potential real decline in participation rates.

The seasonal pattern of participation rates remains consistent over the years. Despite the redefinition of population, which favors the March-April and November-December waves, participation rates in these waves are substantially lower than in the waves from May through October. The similarity of rates from May to October suggests a more accessible fishery than for more northern states in the study.

Linear trend analysis of North Carolina was more complicated than for other states. For years prior to 1987, participation rates include the counties within 25 miles for March-April and November-December and the counties within 50 miles for May-October. In later years, the sample coverage changed. To account for the different sample sizes, we included in the linear trend analysis a sample size variable which reflected the change to a larger area. The results (Table NC.2) indicate no significant trend except for a marked decline of about 1 percentage point per year in the September/October wave. The sampling area change, however, always had a negative effect, as would be expected, although the short duration (3 years) was not long enough to make the parameter significant except in November/December.

The actual levels of the participation rate, in the range of 5 to 14 percent, are however high relative to more northern states. Perhaps this is due to the smaller urban population in North Carolina's telephone sample.

The participation rates tell only about the distribution of fishing among households. To learn about the magnitude of fishing in North Carolina, we need information about visits. This information is given in Table NC.3. These figures show the number of fishing trips per household called. The linear trend analysis of trip rates also was modified to adjust for the sampling area change. There were no significant trends except for a positive increase during March/April. This increase suggested that during Wave 2 trips per household called rose by .7 trips over the decade.

Figures below show that 74 percent of annual activity occurs in the months May-October. While this may understate the proportion attributable to the summer months, it is probably still less than the 85 to 90 percent that the more northerly states experience.

	Mean Trips	Percent of Annual Mean
March-April	.30	9.7
May-June	.63	20.5
July-August	.86	27.9
September-October	.81	26.3
November-December	.48	15.6

The temporal patterns that appear in the total trips data of Table NC.3 differ slightly from the participation data. Trips per household peak in 1984 and decline subsequently. This pattern is picked up more or less faithfully in each of the waves, with a few aberrations. For most of

the waves, 1987 through 1989 trips tend to be less than the wave mean over all nine years. But again this is to be expected since a more distant population was included in the sample from 1987 on. The variability within any wave is considerable even if we consider only the pre-1987 years. For example, from 1981 to 1983, trips in May-June increase by a factor of 3.4. Trips in the high year for March-April (1985) are more than three times the trips in the low year (1982).

Sport Fishing Activity by Mode

Table NC.4 provides information on the distribution of fishing trips by wave and mode. These figures are proportions of fishing trips to different modes and are means for the eight-year period.

Shore fishing, which is typically the most accessible, appears to be the most common mode in North Carolina except in the July-August period. In all waves, more than 40 percent of trips are shore trips. In four of the five waves, that figure is around 50 percent or more. The relatively mild weather probably accounts for the small change in the proportion of shore fishing trips over the seasons.

Another interesting feature of this table is the low proportion of fishing trips in the party/charter mode, in the neighborhood of one to six percent, lower than states to the north. Further, the private/rental proportion of trips is relatively constant except for the peak in July-August, and it too always exceeds 40%.

Table NC.4 is useful in conjunction with estimates of the aggregate level of trips, which is the product of mean trips per household called (from Table NC.3) and the number of eligible households. From the 1980 Census there were 296,500 households in the 25 mile zone, which was the telephone target zone in March-April and November-December for pre-1987 years.

There were 460,700 households in the 50 mile zone, the phone target in May through October for pre-1987 years. Mean trips per household called for March-April in the pre-1987 period is .34. Hence, for the phone population in March-April, we could predict about 100,810 trips (= .34 x 296,500). From Table NC.4, 43,046 trips (42.7% of aggregate trips) could be attributed to private/rental boat trips. In May-June, trips per household (pre-1987) were .62, implying aggregate trips of 285,634 (= .62 x 460,700). From Table NC.4, 42.4 percent or 121,109 trips could be attributed to the private/rental mode. The increase from March/April to May/June stems from the seasonally induced increase in activity from spring to early summer as well as the increase in the eligible population. Both figures omit the effect on fishing by households who live outside the relevant coastal county definition, and in North Carolina these omissions account for between 45% and 75 % of North Carolina fishing households.

Sportfishing Activity by Waterbody

Table NC.5 gives information on the distribution of fishing trips among the various waterbodies by wave. The majority of fishing trips take place in ocean, gulf and open bay. But a significant proportion of the trips, about 20 percent, occur in sounds. The Pamlico and the Albemarle provide considerable fishing opportunities. There is an increase in the proportion of trips in ocean, gulf and open bay in the fall. This is partly due to seasonal habits of species such as the drum.

With estimates of aggregate trips, we can determine the number of trips covered by the phone survey directed towards each type of waterbody. For example, there are an estimated 100,810 trips by households in the 25 mile counties in March-April. 53.7 percent of them or 54,135 are in ocean, gulfs or open bays. In September-October, households called took .92

trips, averaged over the pre-1987 years. For the 460,700 eligible households, this implies 423,844 trips. According to Table NC.5, 64.7 percent or 274,227 of these trips were taken in the ocean, gulf or open bay waterbodies. This is about a five-fold increase over March-April, but part of the increase is simply the greater coverage by the phone survey. Furthermore, the activities of non-coastal county residents are not measured. Nevertheless, there is likely a large seasonal variation in sportfishing activities on different waterbodies in North Carolina.

Catch Rates in North Carolina Marine Waters

Because of North Carolina's diverse fishing grounds, variety of species, and the relatively small sample of intercepted anglers during the decade, it is unwise to generalize greatly from the catch rate data. The ease and variety of access to North Carolina's Sounds and Ocean presents a statistical sampling nightmare. The variety of species also makes it unlikely that anglers will target species. Finally, the State of North Carolina has only funded additional samples in the basic NMFS sample population within the last few years.

About one-half of all anglers intercepted by NMFS surveyors in North Carolina were not targeting any particular species. For those targeting species, anglers seeking smallgame represented about one-half (or 25 % of all intercepted anglers), seeking bottomfish about one-sixth (8% overall), seeking flatfish about one-seventh (7% overall), and biggame about one-eighth (6% overall). These percentages were not stable over the period with the non-targeting percentage dropping from 65% prior to 1985 to 45% in the period after. The shift from non-targeting resulted in smallgame targeting increasing from 17% to over 27% and in biggame targeting rising from 1% to nearly 8%. The percentage of anglers seeking flounder and bottomfish remained reasonably constant.

Smallgame Catch Rates

The principal species of smallgame targeted in North Carolina waters in the decade are bluefish, seatrout (spotted and silver), red drum, spanish and king mackerel. With the exception of silver seatrout which was not targeted significantly after 1984, the species were targeted both prior to 1985 and subsequently. However, there was a substantial shift away from bluefish after 1984 and a concomitant shift toward king and spanish mackerel. The percent of anglers targeting bluefish fell from over 50% of the smallgame anglers to less than 30%. Simultaneously, the percentage targeting king and spanish mackerel rose from under 25% to over 50%.

As with most sportfishing activity, the reported party/charter catch per day dominated both the shore and private/rental boat mode (Figure NC1). Data on shore fishing for the entire period suggest catch rates vary between one and two smallgame per day whereas, party/charter anglers capture between five and six smallgame per day. Private/rental boat fishermen's catch rates are more similar to the shore fishermen's.

There are no apparent trends in the reported data. This could be due to switching among the variety of species in North Carolina, the relatively small sample of anglers in North Carolina, or the lack of any major trend in availability of smallgame. However, catch rates do systematically vary within the year, with July/August and November/December being the worst months for all modes and the March through June period being the best (Figure NC2). The spring and fall peaks are likely due to migratory movements of bluefish and mackerel.

Bottomfish Catch Rates

Anglers targeting bottomfish are usually seeking spot. Prior to 1985, spot was the target species of 57% of bottomfish anglers, a percentage which fell to 45% in subsequent years.

When not seeking spot, they will seek croaker (~15%), black sea bass (~6%), sheepshead (~7%) or snapper (~5%). There was a shift to the pursuit of croaker and sheepshead in the latter half of the decade.

Bottomfish are most often sought by shore anglers, although private/rental boaters often target them. During the eighties, catch rates of shore fishermen were the highest in the 1983-1985 period, averaging between 5 and 20 fish per day (Figure NC3). Private/rental boaters who targeted bottomfish were most successful in the latter half of the decade, when they averaged between 8 and 15 fish per day.

Private boaters and shore fishermen obtain their greatest catch rates in the months of September and October, averaging well in excess of ten fish per day (Figure NC4). The worst period for private boaters is March/April, which corresponds to the second-best period for the shore fishermen. Shore fishermen tend to find bottomfishing the worst in July/August.

Flatfish Catch Rates

The summer flounder is the predominant species sought by flatfish anglers, representing 85% of the reporting flatfish anglers prior to 1985 and 75% in the subsequent years. The decline appears to be related to an increase in anglers seeking southern flounder (~10%) in the later period. The only other category of note is the "unspecified flounder" that represents about 10% of the anglers.

Because the sample sizes for annual catch rates were small, it is difficult to perceive a trend during the decade (Figure NC5). The best catch rates for shore fishermen have occurred since 1984, with the highest occurring in 1985. The private/rental boat fishermen, however, do

not reflect the same movements in availability, although the last three years, 1986-1988, were all at least average years.

The period for flatfish availability from the shore is November/December, with average catch per day between three and four fish (Figure NC6). This level of catch is available to the private/rental boater for a longer period, from July through December. The peak for boaters occurs in September/October.

Characteristics of Fishing Trips in North Carolina

The survey data gathered by UMCP gives information on some of the economic details of fishing trips to North Carolina. These trips include those taken by anglers from a number of states, including North Carolina, during 1988.

Table NC.6 describes one day fishing trips by mode of fishing. There are six modes: two from shore (pier and beach) and four boat modes (party, charter, rental and private). The number of observations from the rental mode is too small to make any inferences, so the discussion will focus on the other five modes.) The variation in travel costs among modes is similar to other states, being higher for the party and charter modes. In general, the travel costs are higher for North Carolina because the main population centers are farther from the coast than in other states. The bait costs are similar for pier, beach and private boat modes. The bait costs for the party and charter are quite disparate, suggesting differences in what is covered by the fee. The distances traveled reflect the travel costs. The boat time suggests the value of trailering boats. The steaming time in the boat before fishing for the public modes is about one and a half hours, while for the private boats, most of which are trailered, it is about a half an hour. The

average pier fee is higher than in other states, because there are quite a number of piers for fishing on the coast of North Carolina.

Table NC.7 gives information on trips taken in North Carolina by people who are on overnight trips. The trips may be for a variety of purposes, including business and vacation. Travel costs, travel time and distance travelled are lower than for the single-day trips because households on vacation have already done their travelling. The costs of fishing services on the trips appear reasonably in line with the single-day trips costs.

Table NC.8 gives the distribution of species sought by mode for day trips. There is a clear divergence by mode. Small game tends to be sought by trips to the pier, beach, and private boat modes. Large game species tend to be sought by households on the party and especially charter modes. The proportions seeking flatfish are similar to other states in the mid-Atlantic.

Table NC. 1

Two-Month Participation Rates*
by Wave and Year

Year	Wave				
	March-April	May-June	July-August	September-October	November-December
1980	8.2%	13.9%	15.7%	18.2%	8.0%
1981	7.4	11.3	19.6	18.9	5.5
1982	7.4	11.0	14.4	16.5	8.0
1983	8.6	18.0	16.5	14.3	8.2
1984	5.3	13.4	15.5	16.1	6.9
1985	9.1	11.7	10.3	12.8	7.9
1986	9.4	14.8	18.1	12.6	8.6
1987	5.1	11.3	11.2	11.5	6.2
1988	8.9	11.2	7.8	9.2	5.8
1989	1.5	8.3	8.1	8.5	5.1
Mean	7.1	12.5	13.7	13.9	7.0

* Percent of North Carolina coastal county households called who indicated having fished in North Carolina marine waters in the previous two months.

Table NC.2

Linear Trend Analysis[1] of North Carolina Participation Rates, By Wave, 1980-1989.

Wave	Constant	Linear Trend Coefficient	Sampling Area Change	$\bar{R}^2$
March/April	.077 (4.97)	.000 (.10)	-.030 (-1.10)	.09
May/June	.132 (8.07)	.001 (.22)	-.028 (-1.31)	.15
July/August	.171 (9.27)	-.004 (-.88)	-.045 (-1.41)	.55
September/October	.189 (28.02)	-.011 (-5.85)	-.005 (-.43)	.92
November/December	.071 (11.02)	.001 (.83)	-.026 (-2.35)	.42

1 Estimated model was Part. rate = $\alpha_0 + \alpha_1$ time + α_2 change, with time defined as t = 0 for 1980, t + 1 for 1981 ... and t = 9 for 1989 and "change" defined as 1 in 1987, 1988 and 1989, 0 otherwise.

2 T-ratio in parentheses.

Table NC.3

Trips Per Household Called
By Year and Season*

Year	Total	Wave				
		March-April	May-June	July-August	September-October	November-December
1980	3.27	.16	.42	.78	1.06	.85
1981	2.57	.18	.40	.85	.78	.35
1982	3.06	.16	.42	1.14	.94	.40
1983	4.07	.37	1.28	.92	.88	.63
1984	4.08	.21	.52	1.49	1.33	.53
1985	3.22	.57	.65	.53	.81	.66
1986	3.66	.64	.65	1.33	.64	.39
1987	2.83	.22	.82	.70	.76	.34
1988	1.99	.41	.63	.31	.35	.28
1989	2.01	.11	.50	.53	.55	.32
Mean	3.08	.30	.63	.86	.81	.48

* Trips taken within state of residence.

Table NC.4

Percent of Fishing Trips in Various Modes by Wave
Mean 1981-1988

	Wave				
Mode	March-April	May-June	July-August	September-October	November December
Shore	51.2	53.3	42.1	49.6	51.4
Party/Charter	6.1	4.3	4.4	3.4	1.3
Private/Rental	42.7	42.4	53.6	47.0	47.3

Table NC.5

Percent Fishing Trips in Various Areas, by Wave
Mean 1981-1988

Area	Wave				
	March-April	May-June	July-August	September-October	November-December
Ocean, Gulf, Open Bay	53.7	49.1	57.6	64.7	67.6
Sound	19.7	21.3	23.9	21.2	18.9
River	14.0	14.8	11.2	6.7	8.8
Enclosed Bay	9.7	3.2	3.8	4.9	2.9

Table NC.6

Average Characteristics of Day Trips in North Carolina, by Mode
(per trip averages)

Characteristic	Mode					
	Pier	Beach	Party	Charter	Rental	Private
Travel Cost	$11.25	12.61	42.03	34.45	45.91	16.68
Costs for						
Bait	$ 4.22	3.38	1.88	11.00	.60	4.92
Tackle	5.11	1.72	3.88	2.07	0.0	5.66
Cleaning	.79	.98	18.25	4.79	8.30	2.48
Fuel	-	-	-	-	2.78	23.40
Pier Fees	3.48	-	-	-	-	-
Launch Fees		-	-	-	-	.89
Boat Fees[a]	-	-	70.96	170.50	179.44	-
Travel Time (in minutes)	66.1	71.6	150.5	50.5	166.8	59.45
Distance (in miles)	53.55	52.9	122.4	38.0	137.1	43.07
Boat Time to first site (in minutes)	-	-	86.97	82.8	96.8	31.19
Number of Observations	137	79	15	74	9	411

[a] Boat fees are charter and party fees or rental fees.

Table NC.7

Characteristics of Trips for Overnight Visits in North Carolina

Characteristic	Mean	Number of Applicable Oservations
Travel Cost	$7.32	521
Cost for		
Bait	4.99	526
Tackle	8.45	529
Cleaning	2.97	529
Fuel	24.04	188
Pier Fees	7.60	130
Launch Fees	1.01	191
Boat Fees	202.22	79
Boat Rental	[a]	3
Travel Time (in minutes)	23.7	523
Distance (one-way) (in miles)	15.6	524
Boat Time (in minutes)	41.1	271
Trip Length (in days)	9.3	532

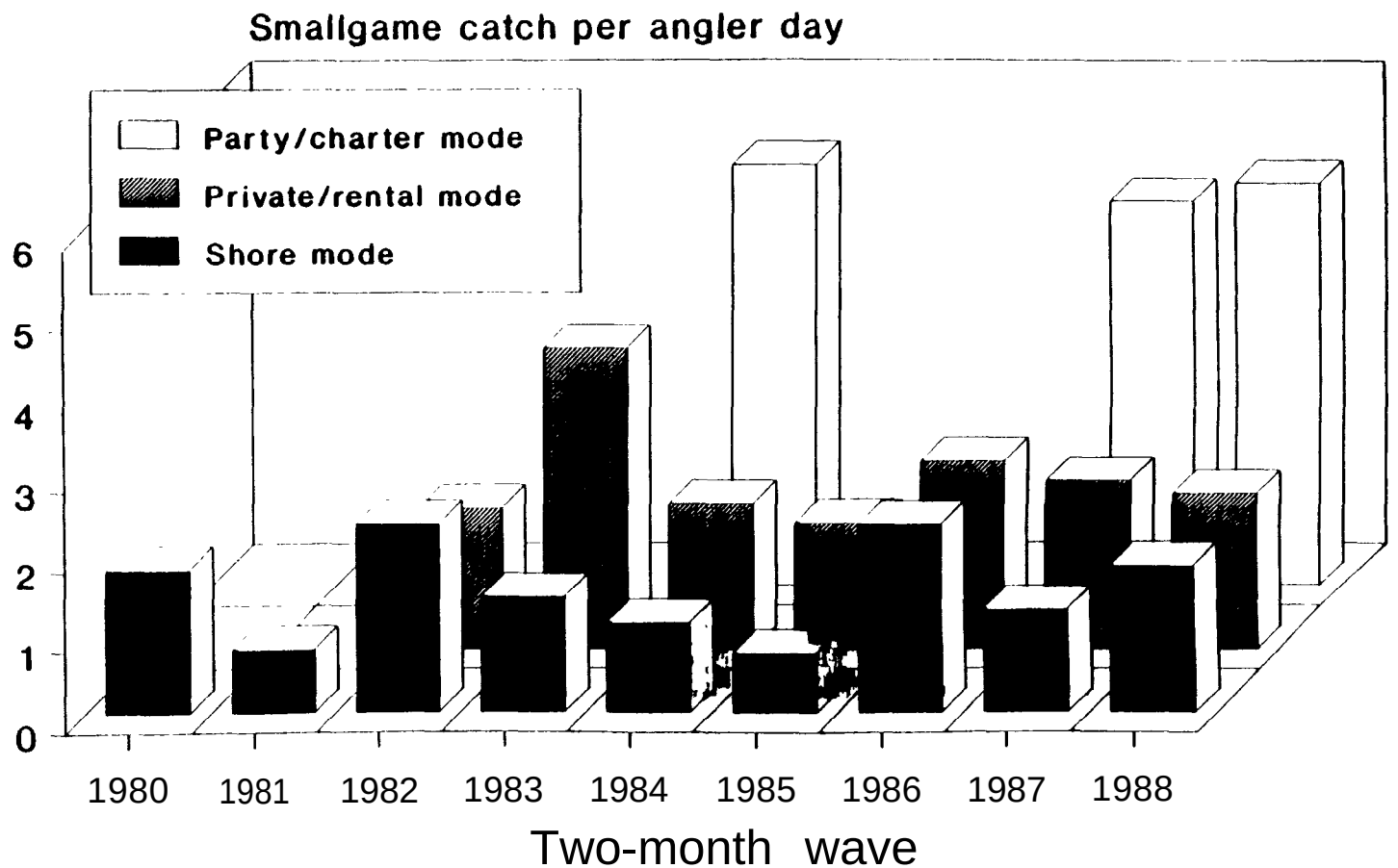
[a] Not enough observations to make a reliable estimate.

Table NC.8

Percent of Trips Seeking Different Species Groups, by Mode
for Day Trips

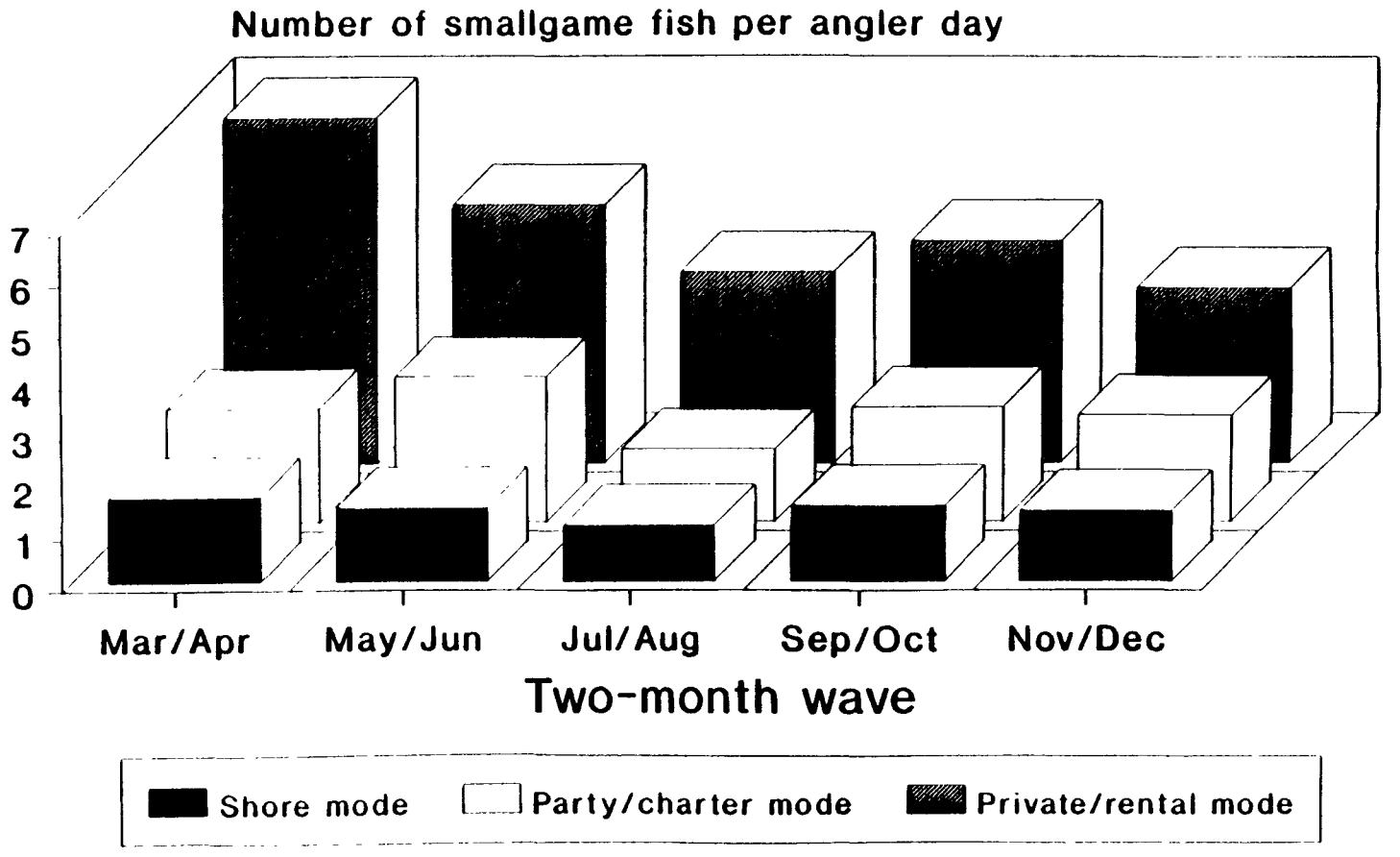
	Mode				
Species Group	Pier	Beach	Party	Charter	Private
Big Game	3.0%	5.9%	28.6%	54.7%	12.6%
Small Game	63.6	72.6	28.6	22.6	55.4
Flatfish	12.1	15.7	14.29	1.9	20.8
Bottomfish	21.2	5.9	28.6	20.8	11.2

Fig. NC1: Smallgame Catch per Day North Carolina, Morehead City and North By Year, 1980-1988



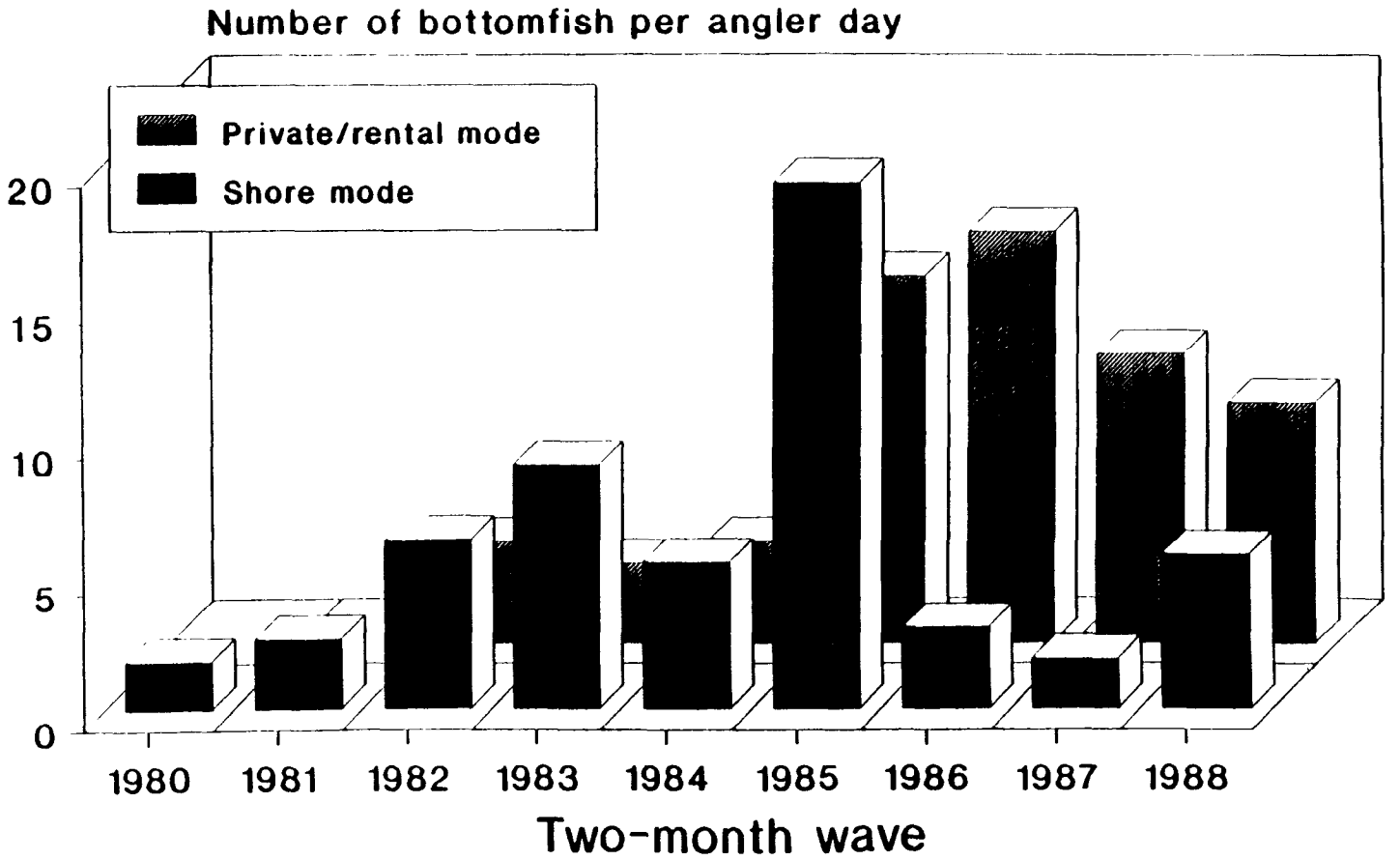
Average for anglers targeting smallgame at sites from Morehead City northward

Fig. NC2: Smallgame Catch Rate
North Carolina, Morehead City and North
By Wave, 1980-88



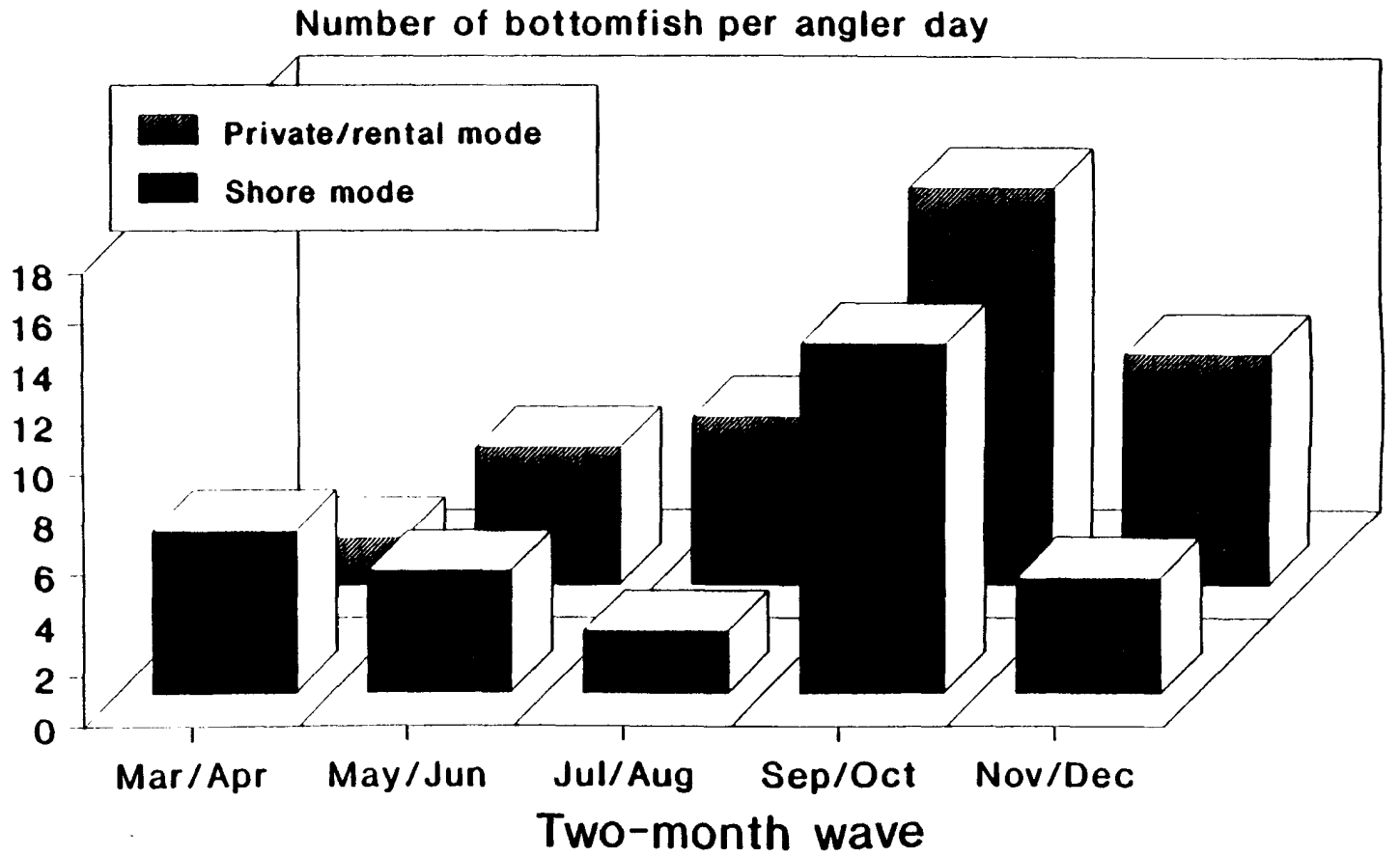
Ave. for anglers targeting smallgame
at sites from Morehead City northward.

Fig. NC3: Bottomfish Catch per Day
North Carolina, Morehead City and North
By Year, 1980-1988



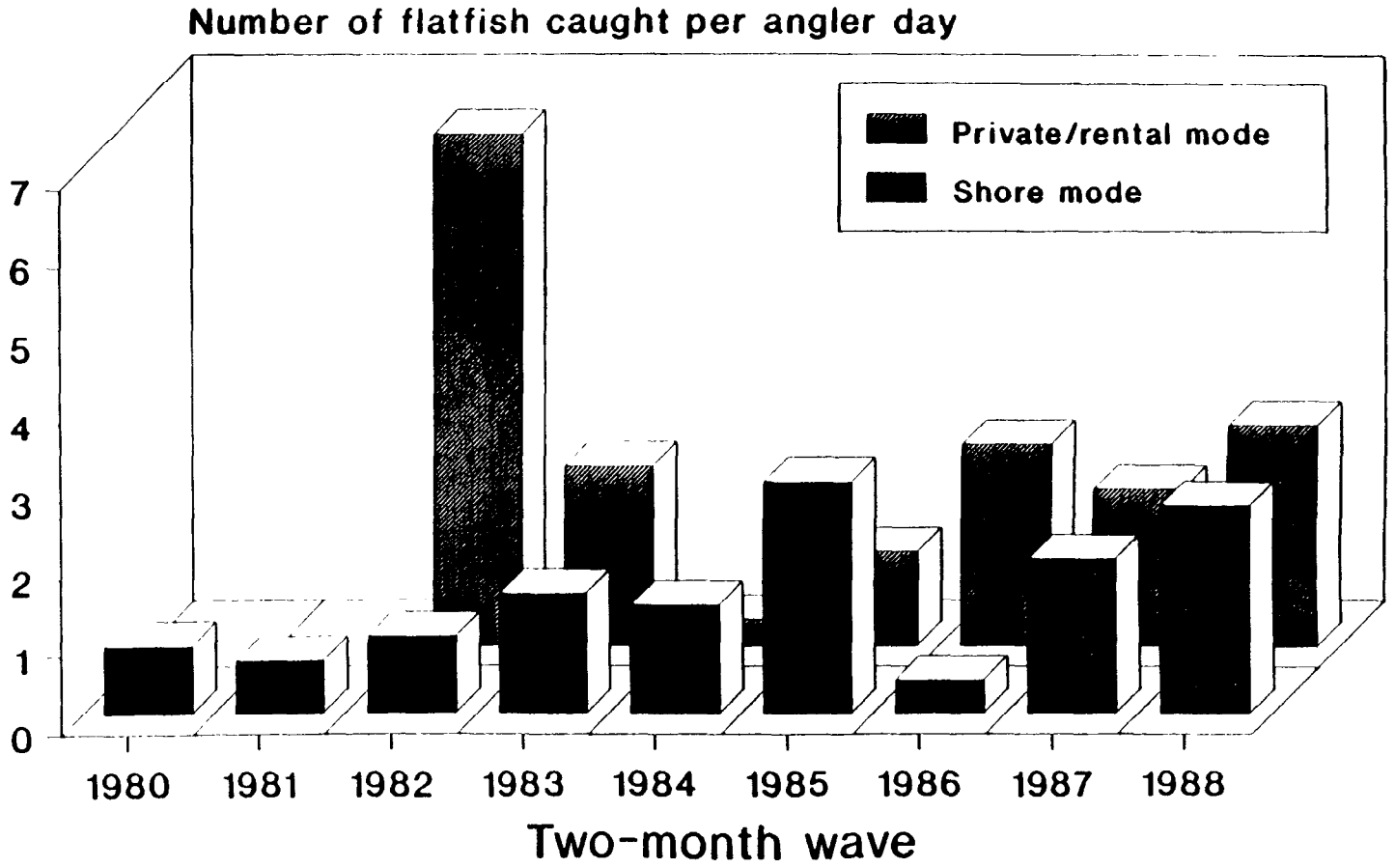
Average for anglers targeting bottomfish at sites from Morehead City northward.

Fig. NC4: Bottomfish Catch Rate, North Carolina, Morehead City and North By Wave, 1980-1988



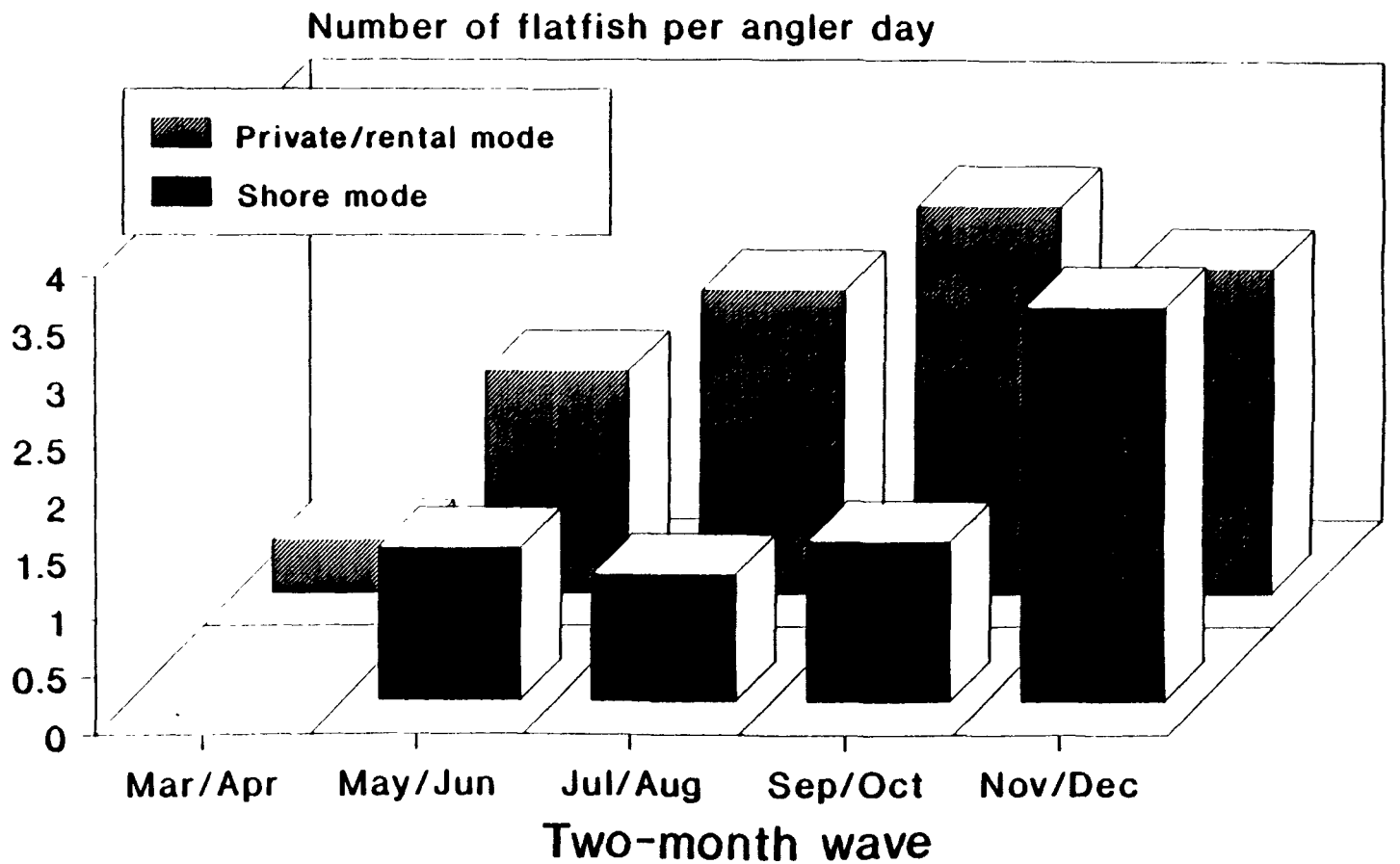
Ave. for anglers targeting bottomfish at sites from Morehead City northward.

Fig. NC5: Flatfish Catch per Day
North Carolina, Morehead City and North
By Year, 1980-1988



Average for anglers targeting flatfish at sites from Morehead City northward.

Fig. NC6: Flatfish Catch Rate
North Carolina, Morehead City and North
By Wave, 1980-1988



Ave. for anglers targeting flatfish
at sites from Morehead City northward.

Chapter 8

SPORTFISHING IN SOUTH CAROLINA

Activity by South Carolina Households

The extent of South Carolina's coastline is relatively short as compared with its northern neighbor. And there is a limited variety of waterbodies in which to saltwater fish. The majority of the state's population lives far from the coast, although the South Carolina coastal counties do account for a larger population share than in North Carolina, primarily because of Charleston. The largest city, Columbia, and four of the remaining six cities of any size are located more than 50 miles from the coast. Florence is located more than 25 but less than 50 miles from the coast. The climate in South Carolina permits fishing throughout the year, with heat spells during the summer months perhaps being as inclement as cold spells during the winter. Consequently, seasonal variation in fishing activity will likely be influenced by factors other than weather.

During the second and sixth waves (March-April and November-December) the sample frame encompasses only those households who live in counties within 25 miles of the coast or an estuary. According to the 1980 Census, this includes approximately 293,000 households or 28 percent of the state's population. During the remaining waves (May through October) the sample frame includes all households with telephones who live in counties within 50 miles of the coast. For 1980, the number of eligible households in this category was 346,500, only about 20 percent more than the 25-mile coastal county household count or 34 percent of the households in the state.

Over the eighties, NMFS has calculated widely varying estimates of the proportion of participants in South Carolina marine sportfishing who come from in-state coastal counties. The proportions have ranged from 20 to 40 percent, but hit a low of 9 percent in 1982. Non-coastal state residents have made up about 15 percent of participants over time.[1] The proportion of South Carolina marine sportfishing trips attributable to state residents has varied from 50 to 75 percent. These facts suggest that the nature of sportfishing participation in South Carolina has been quite variable; but it also suggests that out-of-state residents (possibly tourists) play a major role in the sportfishery.

Participation and Quantity of Trips by Season

Seasonal data on trips and participation in South Carolina give a detailed picture of the fishery. Table SC.1 reports the two-month participation by wave and year. Once again, recall that for March-April and November-December, the sample frame includes only the 25-mile counties, while for May-June through September-October, households in 50-mile counties are called.

There is a good deal of variation among years for the two-month waves, although in the summer months, the rates are fairly steady. While there is variation over the years for all waves, no trends were revealed from the linear trend analysis (Fig. SC.2).

Seasonal patterns are easier to discern in these data. The means for March-April and November-December are lower than for May-October. And this difference is somewhat understated because the March-April and November-December waves include only the 25-mile

[1] The exception is 1982, when NMFS estimated that only 8.8 percent of the participants in the South Carolina marine sportfishery were residents of the coastal counties, while the estimate for percentage coming from the non-coastal counties was particularly high (at 22.6 percent).

counties. These participation rates would likely be lower in the sample frame extended to the 50-mile counties. Within the May-October waves, participation in the summer wave of July-August appears lower than in early summer or fall. The participation rates for the May-October period seem more stable than for the other two waves.

These participation rates give only a sense of the distribution of fishing among the population, not of the magnitude of fishing--that is, how much fishing effort is expended. One measure of the magnitude of fishing is given by the number of trips. This can be calculated in various ways. One way is to multiply the number of eligible households by the number of trips per household called. The product is the total number of trips in the wave. Table SC.3 gives the mean number of in-state trips per household called.

The data from Table SC.3 give some insight into the seasonal variation in activity. The mean trips per household called using all ten years of data are distributed seasonally as follows:

	Mean Trips	Percent of Annual Mean
March-April	.34	13.3
May-June	.60	23.5
July-August	.67	26.3
September-October	.55	21.6
November-December	.39	15.3

About 70 percent of the mean trips occur in the May to October waves. This is probably a slight underestimate of the proportion of activity in the summer months because of the sampling scheme. Comparing these three waves, we see that activity in May-June and July-August are

similar. The July-August summer peak, prevalent in the data for more northern states, is again found as far south as South Carolina.

There is substantial variation among years for the wave and for the annual means. The annual mean trips per household called were at a decade low of 1.17 in 1981, with mean trips for other years as much as three times higher. In individual waves there is, of course, even more variation. The high in March-April (.71 in 1985) is over six times the low (.11 in 1983). The relative variation in other waves is less, but the absolute variation is greater. For example, in May-June, trips per household called range from .33 in 1981 to .92 in 1984, an increase of .65 trips per household in 3 years.

Sportfishing Activity by Mode

Table SC.4 gives the distribution of fishing trips by coastal county residents by mode and wave. This information is useful for understanding how fishing activities change. The proportions are relatively stable over the year. The proportion of fishing trips to the shore mode lies in the 30 to 45 percent range and the proportion of trips on private boats is 50 to 65 percent. While there is some decline in the summer, it is slight. The proportion of trips accounted for by the party/charter mode falls between four and ten percent. One interesting aspect of these figures is the proportion of trips on boats. It is highest in November-December, providing additional evidence that "inclement" boating weather in South Carolina may be most prevalent in the summer.

To illustrate variations in the magnitude of fishing by wave and mode, we can expand the trips per household called to the population of coastal county residents. According to the 1980 Census, for the 50 mile counties, there were about 346,500 households, and for the 25 mile

counties, there were 293,000 households. From Table SC.3, we can get information on trips per household called. Using means from Table SC.3 implies 99,620 trips in March-April (.34 293,000) by residents of the 25 mile counties. Table SC.4 gives the distribution of these trips, implying that there were on average 38,354 shore trips and 61,622 boat trips. In May-June, the telephone survey contacted 346,500 households and they averaged .60 tips, implying 207,900 trips by households in the 50 mile counties. Of these, 37 percent or 76,923 could be attributed to shore trips by households residing in the 50 mile counties. The increase in shore trips is partly a result of more trips per household called and partly a larger population of eligible households.

Sportfishing by Waterbody

The South Carolina coast features islands, ocean beachfront, and rivers. The barrier beaches which dominate the coastline to the north are less prevalent in South Carolina. The waterbodies conform roughly to the four NMFS categories of ocean, gulf and bay; sound; river; and enclosed bay. Table SC.5 shows the distribution of fishing trips among the NMFS waterbodies.

Most fishing trips occur in rivers or the ocean, gulf and open bay category. Across the seasons, at least 80 percent of households fish in these waterbodies. Some seasonal variability is evident from Table SC.5. The proportion of trips in sounds declines in the summer months.

The aggregate quantity of trips for the sample frame in each of the waterbodies is calculated just as the trips in various modes. For example, there were an estimated 99,620 trips in March-April by residents of the 25 mile coastal counties. Of these trips, 42,235 are predicted to be in the ocean, gulf or open bay. Recall however, that this omits the trips by households

who do not live in the 25 mile coastal counties. NMFS has estimated that as few as nine percent of participants may come from the coastal counties.

Catch Rates in South Carolina's Marine Waters

South Carolina's sportfishing primarily takes place either in the Atlantic Ocean or in the river systems leading to it. In this sense, it is substantially more homogeneous than the fishing in North Carolina, Virginia or Maryland. Also, the sportfish are not as available as in North Carolina. This has led to a State program to provide artificial reefs and other attracting devices in an effort to enhance catch rates.

Because of these actions, a greater variety of species tend to be located around places anglers frequent and the ability for anglers to target species is diminished. This is manifest in a large percentage of South Carolina anglers not targeting species. In the pre-1985 period, only one in three marine anglers responded that they were targeting a species. The rate rose to one in two after 1984. The major recipient of the new targeters was smallgame, with a change from 15% of the intercepted anglers to 35 % of them. The percentage of anglers seeking biggame, flatfish and bottomfish remained reasonably constant over the two periods at ~ 2 %, ~ 4 % and ~12%, respectively.

Smallgame Catch Rates

Five species of smallgame represent over 90% of the total anglers seeking smallgame: red drum, king mackerel, spotted seatrout, bluefish and spanish mackerel. Over the decade, red drum (~26%) and spotted seatrout (~22%) captured a relatively constant share of the smallgame anglers. Bluefish on the other hand fell in importance, going from 15 percent of the smallgame anglers in the 1980-1984 period to 5 percent in the post-1984 period. The major

gainers in share were the mackerel targets, with king mackerel rising from 27 percent to 34 percent and spanish mackerel rising from 6 to 10 percent.

The reason for the increase in targeting of smallgame over the last half of the decade can be seen in Figure SC1. For both the shore mode and the private/rental mode, the catch rates in the latter half of the decade are usually better than in the first half. This and the apparent growing popularity of mackerel may have accounted for the targeting.

Among the modes of fishing, there are interesting differences in the seasonal pattern of catch rates (Figure SC2). The private/rental catch rates appear to begin the year at a low rate and then build consistently over the year, reaching nearly three fish per day in the November/December period. Catch rates of shore fishermen, on the other hand, appear to begin in a similar manner to the private boat catch but then peak in the July/August period. The party/charter mode is also the reverse of the shore fishing, with the lowest rates in the July/August period and the higher rates at the beginning and end of the year.

Bottomfish Catch Rates

There are three primary species sought by bottomfishermen in South Carolina: black sea bass, spot and sheepshead. Black sea bass were the target of 33 percent of the bottomfishermen in the pre-1985 period, a proportion which fell to 21 percent in the subsequent years. Spot, on the other hand, rose in share from 29 percent to 41 percent. Finally, the proportion of bottomfishermen targeting sheepshead doubled from 7 percent in the first half of the decade to 14 percent in the latter period.

Bottomfish, the only other target of any importance, appear to vary dramatically in availability from year to year (Figure SC3). This is likely as much the result of small samples

as natural variation. Although there is not a clear pattern to the catch rates, some of the highest catch rates for both the shore and private boat fishermen were observed during the latter half of the decade.

The seasonal patterns of catch rates are similar for the private and shore fishermen and, like the South Carolina smallgame fishermen, different for the party/charter boat anglers (Figure SC4). The private boat and shore fishermen highest catch rates are usually in the November/December and the March/June period and lowest in the summer. The party/charter fishing is the opposite, with the best fishing occurring in the summer.

Characteristics of Fishing Trips in South Carolina

Many aspects of fishing are not revealed by looking at catch and trips. The UMCP survey provides information on individual fishing trips with sites in South Carolina as destinations. This information typically has economic implications or can be used in the estimation of economic models. It is based on fishing trips taken in 1988.

Table SC.6 describes one-day trips taken to South Carolina by mode of fishing. There are six modes: pier, beach, party, charter, rental, and private boat. However, the party and rental modes have too few observations for reliable estimation of mean trip characteristics. The travel costs for the pier, beach and private boat modes are similar--about $10. The charter boat travel cost is naturally higher because there are fewer locations where charter boat fishing is available. Bait costs are similar for pier, beach and private boat modes. Evidently, the charter fees cover the price of bait and tackle. The higher cleaning fees for charter boats probably reflects a higher catch rate. The travel time and distance show the relative dispersion of sites

among modes. On average, people travel more for piers than for beaches because they are scarcer. The same is true for charter vs. private boats.

Information on fishing trips which are part of overnight visits is given in Table SC.7. These trips are taken by people who visit South Carolina for a variety of reasons--vacation, business, family. The travel is only from the night's lodging to the fishing site, and hence it is shorter than for the single-day trips. Costs of fishing services--bait, tackle, and cleaning--are similar to the costs for day trips. The overnight trips are aggregated by mode because the small number of observations precludes estimation of mean characteristics by mode.

Table SC.8 shows the distribution of targeted trips by species groups and modes. This table is of limited value because the number of observation in the party, charter and rental modes is so small that these modes cannot be analyzed. Pier fishing is distributed roughly equally among the four groups. Beach fishing is predominantly small game and flatfish. Private boat fishing is principally small game. It is unusual that anglers target a higher proportion of their pier trips towards big game than they target for big game on private boats.

Table SC.1

Two-Month Participation Rates*
by Wave and Year

Year	Wave				
	March-April	May-June	July-August	September-October	November-December
1980	11.2%	10.1%	18.8%	12.1%	11.2%
1981	5.8	10.7	8.1	9.0	3.0
1982	7.0	11.6	7.0	12.7	7.0
1983	5.0	9.3	9.4	9.2	7.2
1984	7.6	9.7	7.9	16.1	7.6
1985	8.1	6.1	8.0	12.8	10.4
1986	7.2	11.4	11.1	10.9	9.2
1987	6.6	9.5	9.7	11.5	8.7
1988	7.4	11.0	8.0	9.2	5.5
1989	7.2	7.5	6.1	8.5	5.7
Mean	7.3	9.7	9.4	11.4	7.6

* Percent of South Carolina coastal county households called who indicated having fished in South Carolina marine waters in the previous two months.

Table SC.2

Linear Trend Analysis[1] of South Carolina Participation Rates, By Wage, 1980-1989.

Wave	Constant	Linear Trend Coefficient	$\bar{R}^2$
March/April	.078 (7.89)	-.0012 (-0.64)	.00
May/June	.105 (10.29)	-.0018 (-0.94)	.00
July/August	(6.20)	-.0058 (-1.61)	.15
September/October	.122 (8.40)	-.0018 (-0.67)	.00
November/December	.082 (5.78)	-.0012 (-0.47)	.00

[1] Estimated model was Part. rate = $\alpha_0 + \alpha_1$ time, with time defined as t = 0 for 1980, t = 1 for 1981 ... and t = 9 for 1989.

[2] T-ratio in parentheses.

Table SC.3

Trips Per Household Called
By Year and Season*

Year	Total	Wave				
		March-April	May-June	July-August	September-October	November-December
1980	4.09	.67	.67	1.25	1.09	.41
1981	1.17	.18	.33	.28	.30	.08
1982	2.32	.22	.68	.65	.61	.16
1983	2.18	.11	.47	.63	.50	.47
1984	2.98	.59	.92	.48	.53	.36
1985	2.71	.71	.39	.54	.60	.47
1986	3.16	.19	.90	.84	.54	.69
1987	2.45	.25	.43	.74	.49	.54
1988	2.14	.18	.77	.39	.52	.28
1989	2.15	.25	.41	.86	.32	.31
Mean	2.55	.34	.60	.67	.55	.39

* Trips taken within state of residence.

Table SC.4

Percent of Fishing Trips in Various Modes by Wave
Mean 1981-1988

Mode	Wave				
	March-April	May-June	July-August	September-October	November-December
Shore	38.5%	37.0%	37.8%	43.3%	31.2%
Party/Charter	9.2	6.5	5.3	6.3	4.3
Private/Rental	52.3	56.5	56.9	50.4	64.5

Table SC.5

Percent Fishing Trips in Various Waterbodies, by Wave
Mean 1981-1988

Area	Wave				
	March-April	May-June	July-August	September-October	November-December
Ocean, Gulf, Open Bay	43.4	56.8	54.1	56.8	40.5
Sound	11.4	4.8	5.9	6.7	7.9
River	35.8	31.9	30.4	27.9	40.1
Enclosed Bay	3.7	4.8	7.9	7.0	7.4

Table SC.6

Characteristics of Day Trips in South Carolina, by Mode
(per trip averages)

Characteristic	Mode					
	Pier	Beach	Party	Charter	Rental	Private
Travel Cost	$9.97	$13.27	[b]	$28.00	[b]	$9.82
Costs for						
Bait	5.15	4.86	-	0	-	3.01
Tackle	1.28	1.85	-	0	-	3.33
Cleaning	1.07	.93	-	3.86	-	1.35
Fuel	-	-	-	-	-	10.30
Pier Fees	2.10	-	-	-	-	-
Boat Fees[a]	-	-	-	-	-	-
Travel Time (in minutes)	68.6	47.7	-	95.1	-	31.7
Distance (in miles)	59.0	39.4	-	102.6	-	21.6
Boat Time to first site (in minutes)	-	-	-	63.8	-	22.6
Number of Observations	49	26	2	15	3	289

[a] Boat fees are charter and party fees or rental fees.

[b] Not enough observations to estimate means reliably.

Table SC.7

Characteristics of Trips for Overnight Visits in South Carolina

Characteristic	Mean	Number of Applicable Observations
Travel Cost	$1.99	100
Cost for		
Bait	5.32	105
Tackle	1.62	104
Cleaning	1.01	106
Fuel	11.86	48
Pier Fees	2.70	33
Boat Fees	-	17
Boat Rental	-	2
Travel Time (in minutes)	12.4	105
Distance (one-way) (in miles)	6.1	105
Boat Time (in minutes)	30.9	69
Trip Length (in days)	17.6	106

Table SC.8

Percent of Trips Seeking Different Species Groups, by Mode
for Day Trips

	Mode		
Species Group	Pier	Beach	Private
Big Game	25.0%	0%	15.6%
Small Game	18.8	53.3	59.6
Flatfish	37.5	26.7	14.8
Bottomfish	18.8	20.0	10.0

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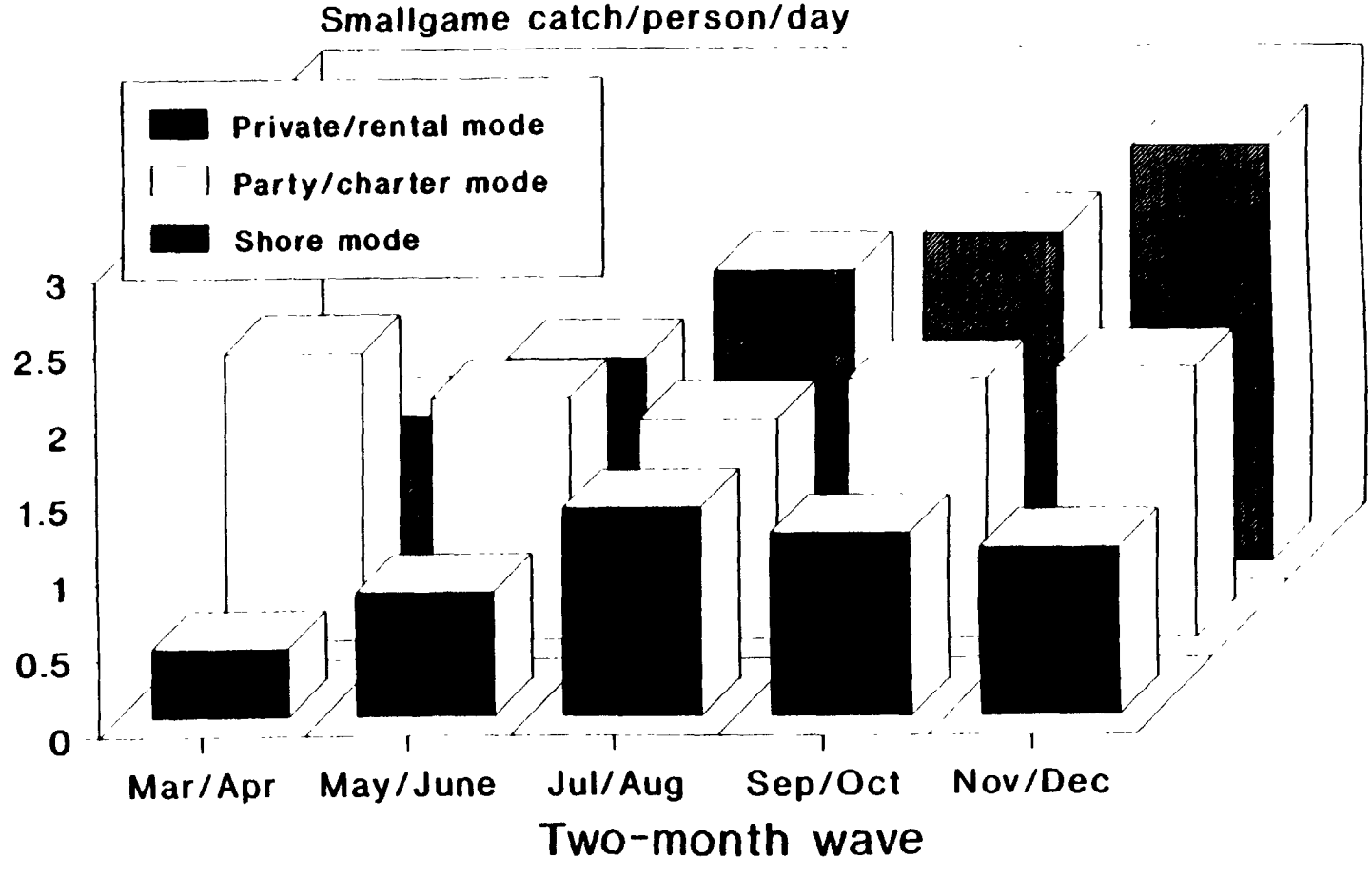
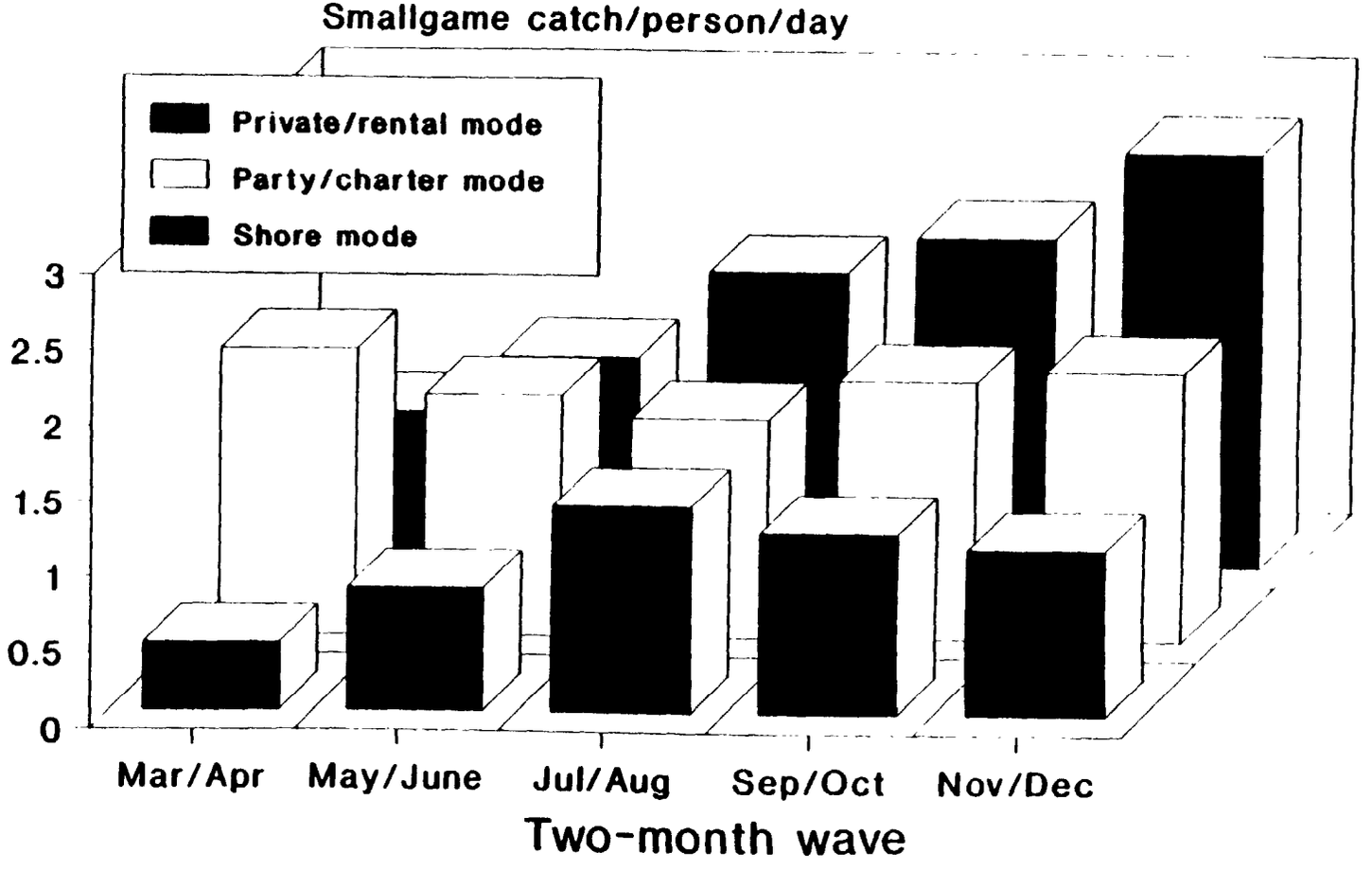
Fig SC1: Smallgame Catch per Day
South Carolina, By Year and Mode



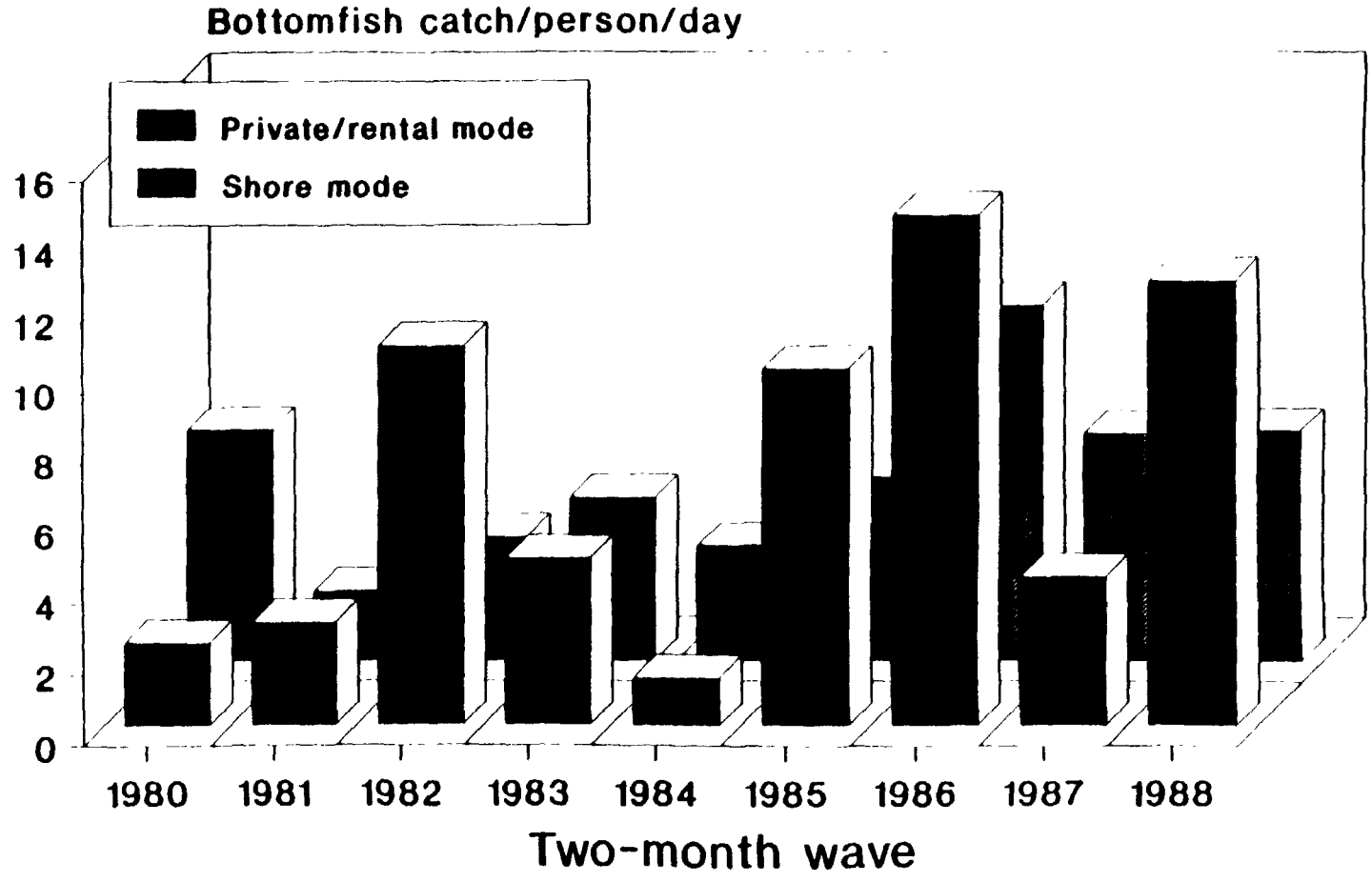
Average for anglers targeting smallgame, 1980-1988

Fig. SC2: Smallgame Catch per Day South Carolina, By Wave and Mode



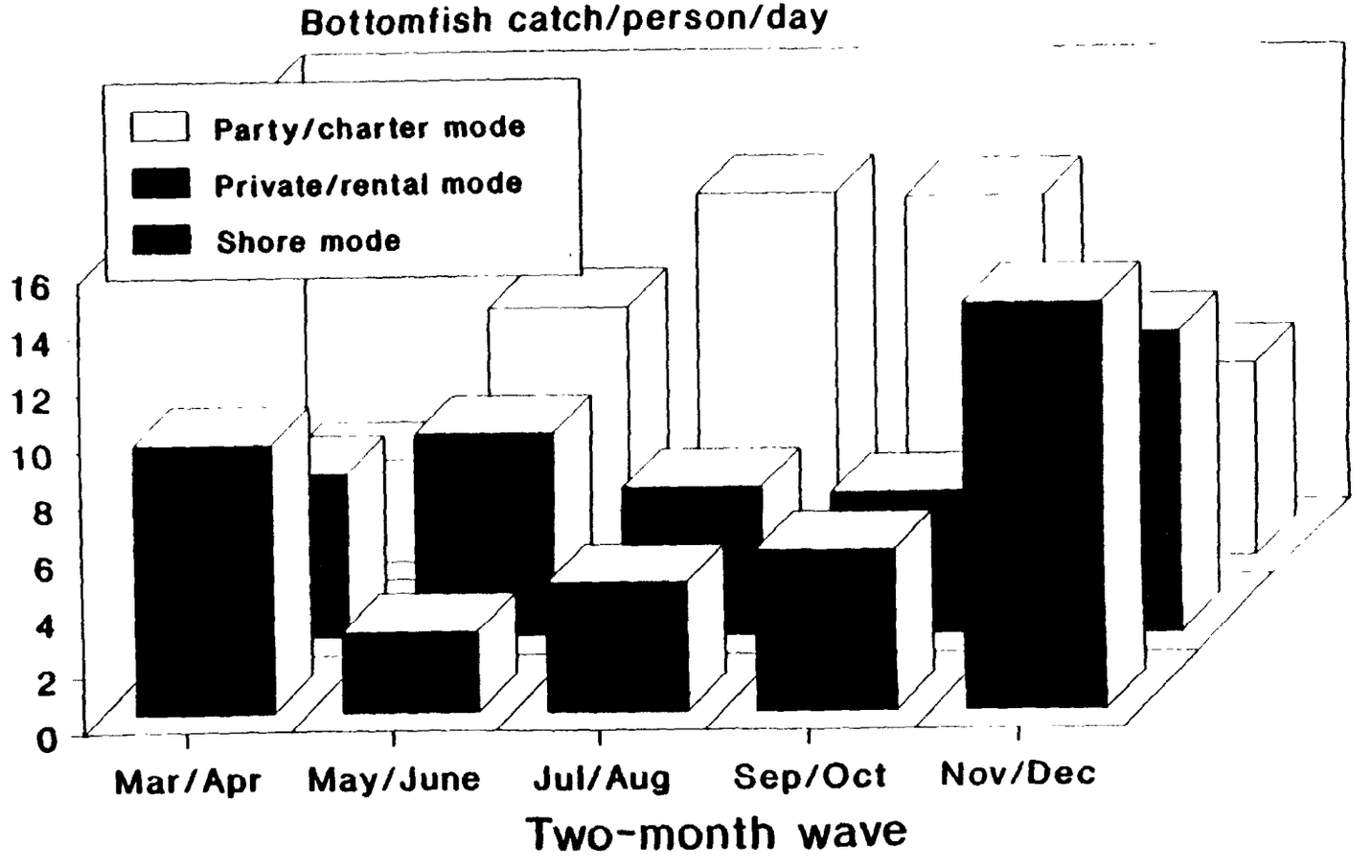
Average for anglers targeting smallgame, 1980-1988

Fig. SC3: Bottomfish Catch per Day South Carolina, By Wave and Mode



Average for anglers targeting bottomfish
1980-1988

Fig. SC4: Bottomfish Catch per Day South Carolina, By Wave and Mode



Average for anglers targeting bottomfish
1980-1988

Chapter 9

SPORTFISHING IN GEORGIA

Activity by Georgia Households

The pattern of marine recreational fishing in Georgia is dominated by the nature of the coastline and the distribution of population in the state. The coastline is dotted with small islands and river mouths, and lacks the long barrier islands of the states farther to the north. Except for Savannah, which has a population of about 70,000, major population centers are located well inland. The coastal population is predominantly rural. The mild climate affords fishing opportunities throughout the year.

The phone survey conducted in Georgia by the NMFS has two sample frames. For waves two and six, March-April and November-December waves, the sample frame includes counties within 25 miles of the coast or an estuary. The 1980 Census recorded about 133,300 households in this sample frame. For waves three through rive, May-June, July-August, and September-October, the sample frame includes countries within 50 miles. According to the 1980 Census. there were 180,500 households in this sample frame. These represent 7 and 10 percent. respectively, of the state's population as of that census. Only about 20 to 30 percent of the sportfishing participants in Georgia marine waters have been non-coastal residents. The estimated proportion of participants who are coastal residents has varied dramatically, from a low of 33 percent in 1985 to a high of 67 percent in 1981. According to NMFS estimates. the proportion of participants coming from out-of-state has grown since the early 1980's and was especially high in 1985.

A far more stable proportion of marine sportfishing trips can be attributed to coastal county Georgia residents. Except for the low 1985 estimate of 60 percent, coastal county residents took between 70 and 80 percent of the sportfishing trips in Georgia marine waters. The proportion of trips attributable to out-of-state residents has increased over the decade from about 6 percent to 12 percent, but in 1985 this proportion jumped to 20 percent.

Sportfishing Activity: Household Participation Rates and Quantity of Fishing Trips by Season

Participation rates across seasons and years are reported in Table GA.1. The sample sizes range from a low of 98 households in wave six of 1980 to a high of 1576 households for wave four in 1988. The March-April and November-December waves are based on the sample frame that includes only households who live in the 25 mile counties. As is the case in other states, the March-April rate shows more variability than the rate for other waves. The rate varies from a low of 5.6 percent in 1985 to a high of 12.4 percent in 1981. The rates for wave six are higher on average than for wave two. The late fail weather is less unsettled and the water temperatures are higher than in the spring Even in the fall, however, there is considerable variability as the rate goes from a low of 5.9 percent in 1983 to a high of 12.9 percent in 1986.

Table GA.1 shows both the variation across years for a given season and the variation across seasons. The means indicate the nature of the seasonal variation, but because waves two and six are based on a different population, these means can not be compared with those for waves three through five. Nonetheless, the interseasonal variation is small relative to more northern states. The mean of the lowest wave, 9.0 percent, is only about one percent smaller than the mean of the highest wave, 10.2 percent.

The linear trend analysis of participation rates (Table GA.2) is suggestive of the negative trend seen in the more northern states. All of the estimated trend coefficients are negative with only the March/April period statistically significant. For that wave, the estimated loss in participation rates over the decade is nearly 5 percentage points. In each of the other waves, the estimated loss is less.

The participation rates tell about the distribution of fishing activity among households, not about the amount of fishing activity. We typically measure the magnitude of fishing activity by the quantity of trips. One method of estimating the quantity of trips for the sample frame is to multiply the number of trips per household called by the number of households in the frame. Table GA.3 gives the mean number of trips per household called in the coastal county by wave and year. Another way of describing these means is that they embody the number of trips per household, conditional on fishing, and the fishing participation rate, as given in Table GA.1.

The seasonal variation in trips per household is slight. Consider the mean trips per wave as a proportion of the mean annual trips.

	Mean Trips	Percent of Annual Mean
March-April	.52	20.9
May-June	.56	22.5
July-August	.48	19.3
September-October	.48	19.3
November-December	.45	18.1

These figures suggest behavior remarkably lacking in seasonality. If there were no seasonality each wave would encompass 20 percent of the annual trips. The absence of seasonality also

appears when comparing the annual variation for a wave with the seasonal variation among waves. It appears that there is more variation within season over years than across seasons. These figures are a bit misleading, however, because the March-April and November-December samples include only 25 mile counties. Presumably households in those counties would take more trips on average than households in the 50 mile counties, raising the percent of the annual mean. That is, if only the 25 mile counties were considered for all waves, more seasonality would be apparent.

Table GA.3 shows no striking trends in the trips data. The pattern that does emerge on close inspection is similar to that seen in the participation rates. Annual trips per coastal county household peak in 1983. This is followed by a decline to a decade low and subsequent recovery by 1986 and a decline to a decade low in 1988. Annual variability within wave exceeds variability across waves. As an illustration, the March-April wave exhibits both the highest trips per household (1.24 in 1983) and the lowest (.16 in 1985). There is less variability over time for other waves, but it still exceeds the variability across waves in any one year.

Sportfishing Activity by Mode

The proportion of fishing trips in various modes are given in Table GA.4. These proportions are means over the nine year period of the sample. The 35.6 percent figure for March-April shore fishing means that of the fishing trips in March-April, 35.6 percent are shore fishing trips. Although shore fishing is typically the cheapest and most accessible mode, it is not the most popular. In all waves, private boat fishing is the most popular mode in Georgia marine waters. The relative lack of seasonality is apparent from the private/rental boat participation rate

which remains relatively constant across the year. The proportion of fishing households who use the party/charter mode is rather small, varying from 6.4 percent to a low of 3.7 percent in November-December.

The magnitude of fishing by wave and mode illustrates both the behavior of the anglers and the impact of their fishing. The best measure of magnitude typically available is the quantity of trips. To estimate the aggregate quantity of trips, we use the Census information on the number of households in coastal counties. In 1980, the Census total was 133,300 households in the 25 mile counties and 180,500 households in the 50 mile counties. From Table GA.3, tips per household called in March-April averaged .52, implying an estimated 69,316 trips by 25 mile coastal county residents in this wave. From Table GA.4, 60.4 percent or 41,867 are attributable to the private/rental boat mode. The estimated number of trips by 50 mile coastal county residents in July-August equals the number of eligible households (180,500) times trips per household (.48) or 86,640. From Table GA.4, 62.7 or 54,323 would be attributable to the private/rental boat mode. Almost all of the increase in coastal county boat trips from March-April to July-August can be explained simply by the a larger eligible population.

Because the sample frame varies between the middle three waves and the early spring and late fall waves, the extremes of seasonal variation cannot be examined. Comparisons are legitimate only among the middle three waves. And there is little seasonality from May through October. The aggregate estimated trips by coastal county residents vary from 101,080 in May-June to 86,640 in July-August and September-October. These estimates of aggregate trips show remarkably little seasonal variation.

Sportfishing Activity by Waterbody

On the NMFS telephone survey, there are four types of waterbodies: ocean, gulf and open bay; sound, river; and enclosed bay. Table GA.6 gives the distribution of fishing trips among these four modes. These percents are means for the nine year sample period. There is naturally some ambiguity among these waterbody types, especially in distinguishing among sounds, open bays and enclosed bays. But keeping this in mind, we can gain a limited sense of where fishing trips are directed. The proportion of fishing trips in rivers is the most remarkable figure from Table GA.6. Ranging from 60.7 percent in March-April to 33.2 percent in May-June, this proportion is quite a bit higher than for other states in the study. In fact, for most of the year, the proportion of fishing in rivers exceeds the proportion in the ocean, gulf, open bay. The two together account for almost 80 percent of the trips throughout the year.

When combined with aggregate trip information, Table GA.5 can provide estimates of the quantity of trips by wave and area. For example, from the previous section there were an estimated 71,982 trips in March-April by 25 mile coastal county residents. Table GA.5 shows that 60.7 percent of these trips or 43,693 would be river trips. Because trips per household called decline slightly from May-June to September-October, the slightly rising proportion of river trips implies roughly constant aggregate river trips by the households in the 50 mile coastal counties.

Catch Rates in Georgia Marine Waters

Georgia has a rather unique coast line, which dictates the nature of its sportfishing. A continuous stream of small coastal islands begin at its southern border with Florida and extend into the Carolinas. The extensive wetlands which result from the barrier/reef/back-bay environment greatly restricts entry for non-boating fishermen. Boat launching ramps are available and used almost exclusively by local participants. Fishermen seldom venture into the ocean but instead fish in the rivers of the back-bay.

There is not a substantial amount of data on Georgia fishing, probably due to the relatively small coastline, lack of defined entry points and lack of targeting by the Georgia fishermen, especially in the latter half of the decade. In the years from 1985-1988, two-thirds of the intercepted anglers were not targeting their fishing. This was a substantial increase from the first half of the decade, during which only 25 percent were not seeking a designated species. Concurrently there was a shift away from targeting smallgame in particular. In the pre-1985 period, over 50 percent of the anglers were targeting smallgame. This proportion fell to 25 percent for the subsequent years. The only other significant target group is bottomfish and the percentage of anglers targeting them dropped from 17 percent to 7%.

Smallgame Catch Rates

The most popular targeted smallgame species in Georgia is the spotted sea-trout or "specks" as they are called by the locals. Over 60% of the anglers targeting smallgame named spotted sea-trout as their target. The other top choices were red drum (23% of pre-1985 anglers and 29% of 1985-1988 anglers) and king mackerel (11% pre-1985 anglers and 4% of 1985-1985

anglers), The changing preference away from mackerel may be due to declining availability of the king mackerel.

The aggregate catch rate of small game has not exhibited a clearly defined trend during the decade (Fig. GA1). As with most states, the catch rate of private boat fishermen is greater than that of shore fishermen. However, there is no apparent correlation over time between the two, suggesting much 'noise' in the data. Perhaps private and shore fishermen are targeting different species or different age-classes of the same species.

Figure GA2 lends some credence to this hypothesis. Catch per day for shore fishermen peaks in the March through August period whereas the private boat anglers experience their greatest catches during the July through December period.

Bottomfish Catch Rates

In the early eighties, the primary bottomfish species targeted by Georgia anglers were sheepshead (28%), southern kingfish (24%). Atlantic croaker (10%), spot (8%) and black sea bass (8%). Most of these species were still targeted in the period 1985-1988 although their relative importance changed. The most popular species was the southern kingfish (39%). sheepshead (16%), striped mullet (13%), black sea bass (9%), and the Atlantic croaker (7%). The percent targeting spot had fallen to 3%.

Because the data are rather sketchy, it is hard to discern any pattern in the yearly catch rates over the decade. The 1980-1981 period had so few observations that these years were not include in Figure GA3. The only consistent trend observable is an improvement in harvests from about 1984 onward. This trend is clear for the shore fishermen and, in the absence of the anomalous 1985 year, it is also true for the private boat mode.

Seasonal catch rates enjoyed by private boat and shore anglers are quite similar (Fig. GA4). The poorest harvests per day occur in the May through August period and the colder months appear to yield the best creel. For the shore fishermen, the September through December period is best. The September/October and March/April catch rates are the highest for the private boat mode.

Characteristics of Fishing Trips in Georgia

To gain insight into the nature of fishing trips, we turn to the UMCP survey. This survey obtained not only the origin and destination of fishing trips by known anglers, but important economic characteristics of the trips. Table GA.6 summarizes some of these characteristics for single day fishing trips taken in Georgia. These characteristics are by mode and pertain to fishing in 1988. The bottom row of this table shows the number of trips in each mode. The travel costs are similar across mode, with the pier travel costs being slightly higher. There are 15 fishing piers in the coastal counties of Georgia. But many of the trips reported on the UMCP survey must have been on docks or other structures, and not fee-fishing on piers because the mean pier fee is very low. The mean costs for the fishing services are roughly comparable with other states and across modes. Bait costs are high for the charter mode, suggesting that this component is not part of the contracted charter price. Most observations pertain to private boat fishing. The travel costs, distance and time for this mode are typically smaller than for other modes because many people trailer their boats, and plan to travel smaller distances. For both the charter and private boat modes, the boat time to the first fishing site is low relative to other states. Since much fishing takes place in rivers, preferred fishing sites are evidently located close to ramps.

Table GA.7 pertains to trips which are taken by households who are on overnight visits to the Georgia coastal area. These visits may be taken for many reasons--vacation, business or simply travelling through. The modes are aggregated because there are not enough observations to estimate means separately by mode. These means are consistent with the costs for single day trips and the travel costs are about the same. This is different from many states, where the travel costs for trips associated with overnight visits are less, because people stay close to where they will fish. In Georgia apparently, residents and visitors travel about the same distance. While it is speculative, both groups probably travel from Savannah to fishing areas. The costs of fishing services are also comparable to the single day trip costs. Fuel is about $11 for both types of trips.

Table GA.8 gives the distribution of trips targeted towards the four major species groups by mode. These figures are only robust for pier and private boat modes. There are too few observations for the beach, party, and charter modes to be confident about the percents. Flatfish are important for piers and artificial structures, but not for private boats.

Table GA. 1

Two-Month Participation Rates*
by Wave and Year

Year	Wave				
	March-April	May-June	July-August	September-October	November-December
1980	12.2%	11.9%	10.1%	10.4%	13.1%
1981	12.4	12.7	14.4	12.5	8.6
1982	10.0	12.2	7.5	12.1	11.9
1983	8.1	6.1	11.7	8.9	5.9
1984	8.8	5.2	13.0	7.2	7.3
1985	5.6	8.4	6.0	9.4	10.6
1986	10.6	11.0	10.6	13.0	12.9
1987	6.9	8.9	13.4	9.3	10.6
1988	7.6	7.7	7.5	8.2	7.2
1989	8.3	9.2	7.8	8.2	9.2
Mean	9.0%	9.3%	10.2%	9.9%	9.7%

* Percent of Georgia coastal county households called who fished in Georgia marine waters in the designated two months.

Table GA.2

Linear Trend Analysis[1] or Georgia Participation Rates, By Wave, 1980-1989.

Wave	Constant	Linear Trend Coefficient	$\bar{R}^2$
March/April	.112 (10.75)	-.0048 (-2.48)	.36
May/June	.109 (7.42)	-.0035 (-1.27)	.06
July/August	.116 (6.72)	-.0030 (-.94)	.00
September/October	.113 (10.11)	-.0030 (-1.44)	.10
November/December	.104 (6.86)	-.0016 (-0.58)	.00

[1] Estimated model was Part. rate = $\alpha_0 + \alpha_1$ time. with time defined as t = 0 1980, t = 1 for 1981... and t = 9 for 1989.

[2] T-ratio in parentheses.

Table GA.3

Trips Per Household Called
By Year and Season*

Year	Total	Wave				
		March-April	May-June	July-August	September-October	November-December
1980	2.00	.33	.65	.25	.46	.31
1981	2.16	.56	.40	.41	.30	.49
1982	2.79	.83	.47	.49	.48	.52
1983	2.87	1.24	.58	.40	.48	.17
1984	2.41	.49	.64	.56	.35	.37
1985	2.07	.16	.33	.40	.62	.56
1986	3.33	.50	.67	.59	.80	.77
1987	2.98	.27	.80	.80	.61	.50
1988	1.91	.77	.53	.42	.41	.28
1989	2.42	.55	.54	.47	.32	.54
Mean	2.65	.52	.56	.48	.48	.45

* Trips taken within state of residence.

Table GA.5

Percent Fishing Trips in Various Areas, by Wave
Mean 1980-1988

Area	Wave				
	March-April	May-June	July-August	September-October	November-December
Ocean, Gulf, Open Bay	22.6%	36.7%	38.9%	26.6%	27.1%
Sound	11.9	27.7	17.4	18.1	18.1
River	60.7	33.2	38.7	48.5	50.6
Enclosed Bay	3.5	0.0	4.5	2.8	2.5

Table GA.6

Characteristics of Day Trips in Georgia, by Mode
(per trip averages)

Characteristic	Mode					
	Pier	Beach	Party	Charter	Rental	Private
Travel Cost	$10.06	$7.55	[b]	$7.59	[c]	$6.29
Costs for						
Bait	4.52	2.30	-	8.72	-	5.49
Tackle	1.51	4.43	-	0	-	2.34
Cleaning	1.67	2.04	-	0	-	1.09
Fuel	-	-	-		-	10.96
Pier Fees	.07	-	-		-	-
Boat Fees[a]	-	-	-	112.72	-	-
Travel Time (in minutes)	59.9	46.6	-	42.7	-	26.6
Distance (in miles)	46.0	36.4	-	28.6	-	16.3
Boat Time to first site (in minutes)	-	-	-	15.0	-	23.6
Number of Observations	64	12	-	8	-	220

[a] Boat fees are charter and party fees or rental fees.
[b] Not enough observations in this mode to estimate means reliably.
[c] No observations for this mode.

Table GA.7

Characteristics of Trips for Overnight Visits in Georgia

Characteristic	Mean	Number of Applicable Observations
Travel Cost	$7.52	51
Cost for		
Bait	4.11	51
Tackle	1.29	50
Cleaning	1.35	51
Fuel	11.02	33
Pier Fees	.17	10
Boat Fees	89.06	12
Boat Rental[a]	[a]	[a]
Travel Time (in minutes)	15.7	50
Distance (one-way) (in miles)	7.2	51
Boat Time (in minutes)	23.4	37
Trip Length (in days)	10.1	51

Table GA.8

Percent of Trips Seeking Different Species Groups, by Mode
for Day Trips

	Mode					
Species Group	Pier	Beach	Party	Charter	Rental	Private
Big Game	3.9%	0	0.1%	40.0%	NA	7.9
Small Game	50.0	66.7	100.0	20.0	NA	72.7
Flatfish	30.8	0.0	0.0	40.0	NA	4.2
Bottomfish	15.4	33.3	0.0	0.0	NA	14.6

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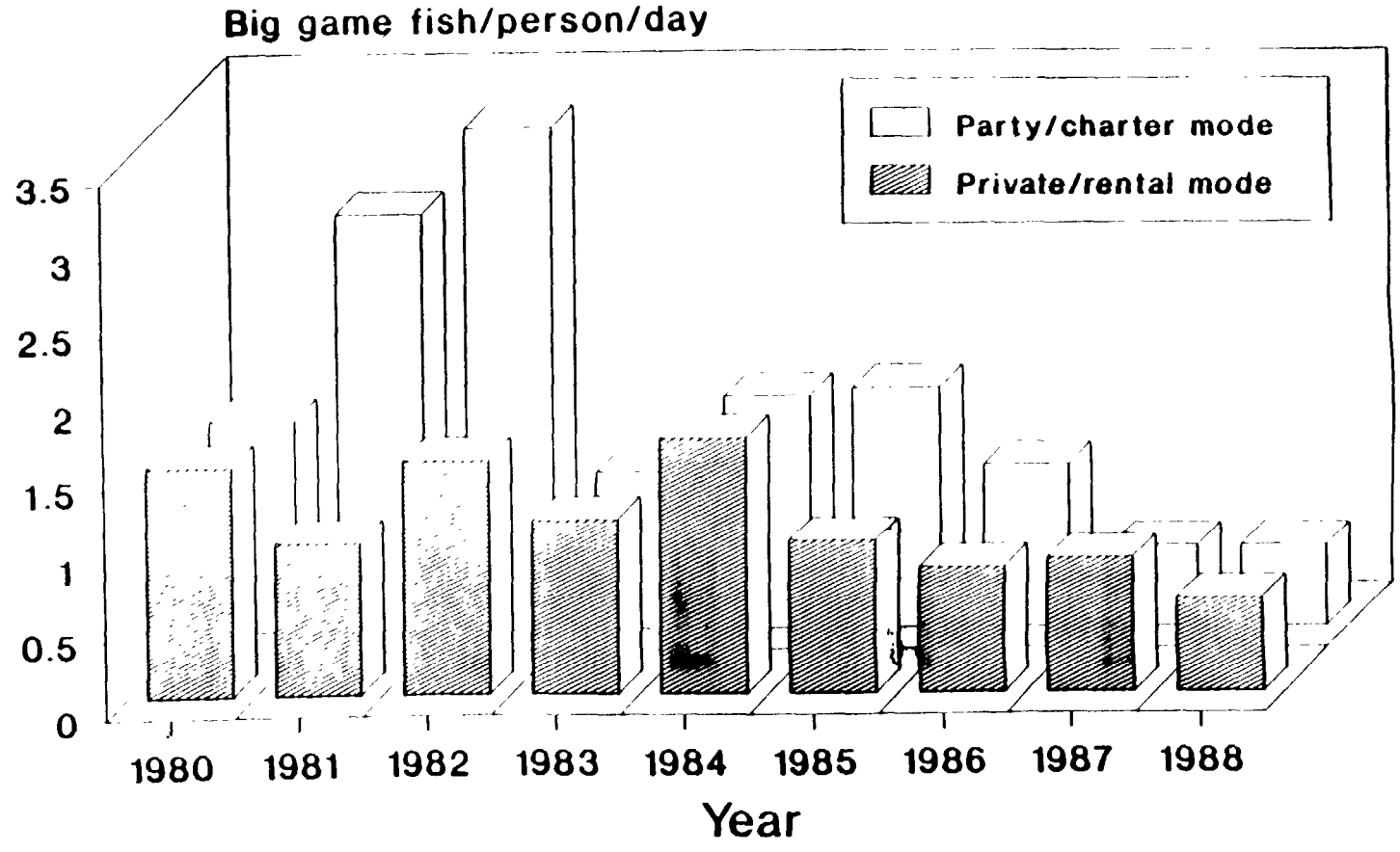
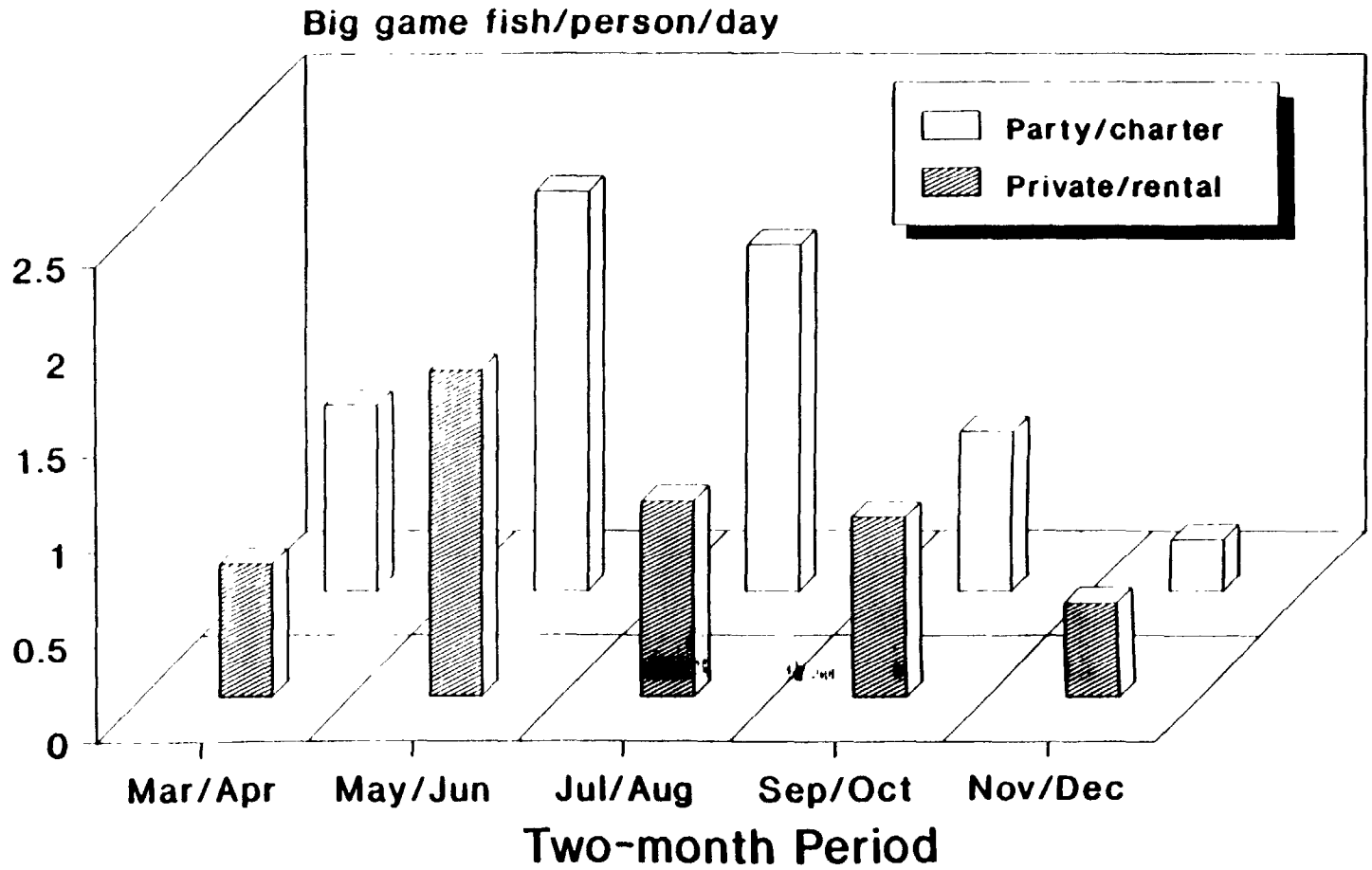
Fig. FL1: Big game Catch Per Day, South Florida, By Year and Mode



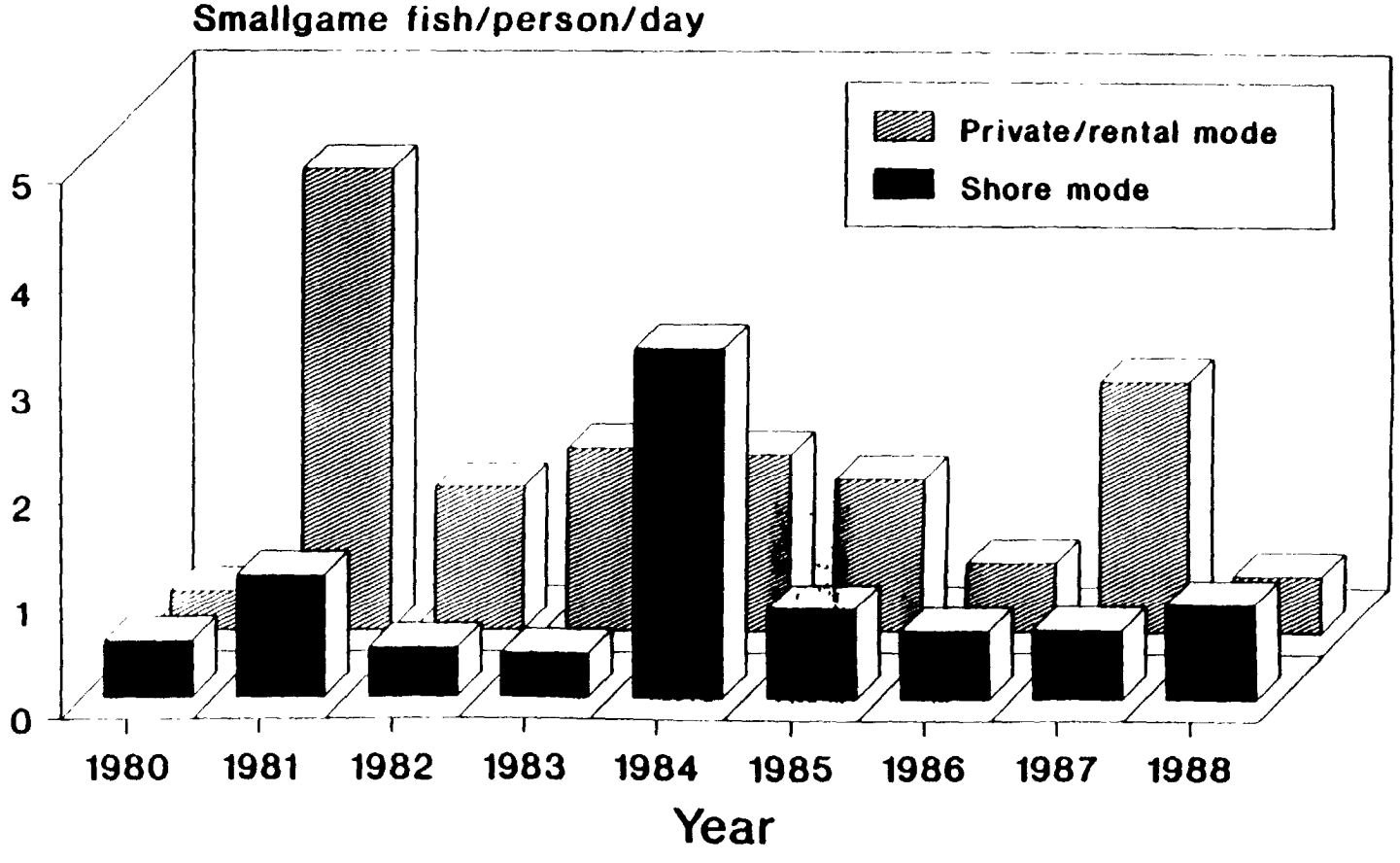
For individuals targeting big game.
Counites south of Volusia County.
1980-1988

Fig. FL2: Big game Catch Per Day, South Florida, By Wave and Mode



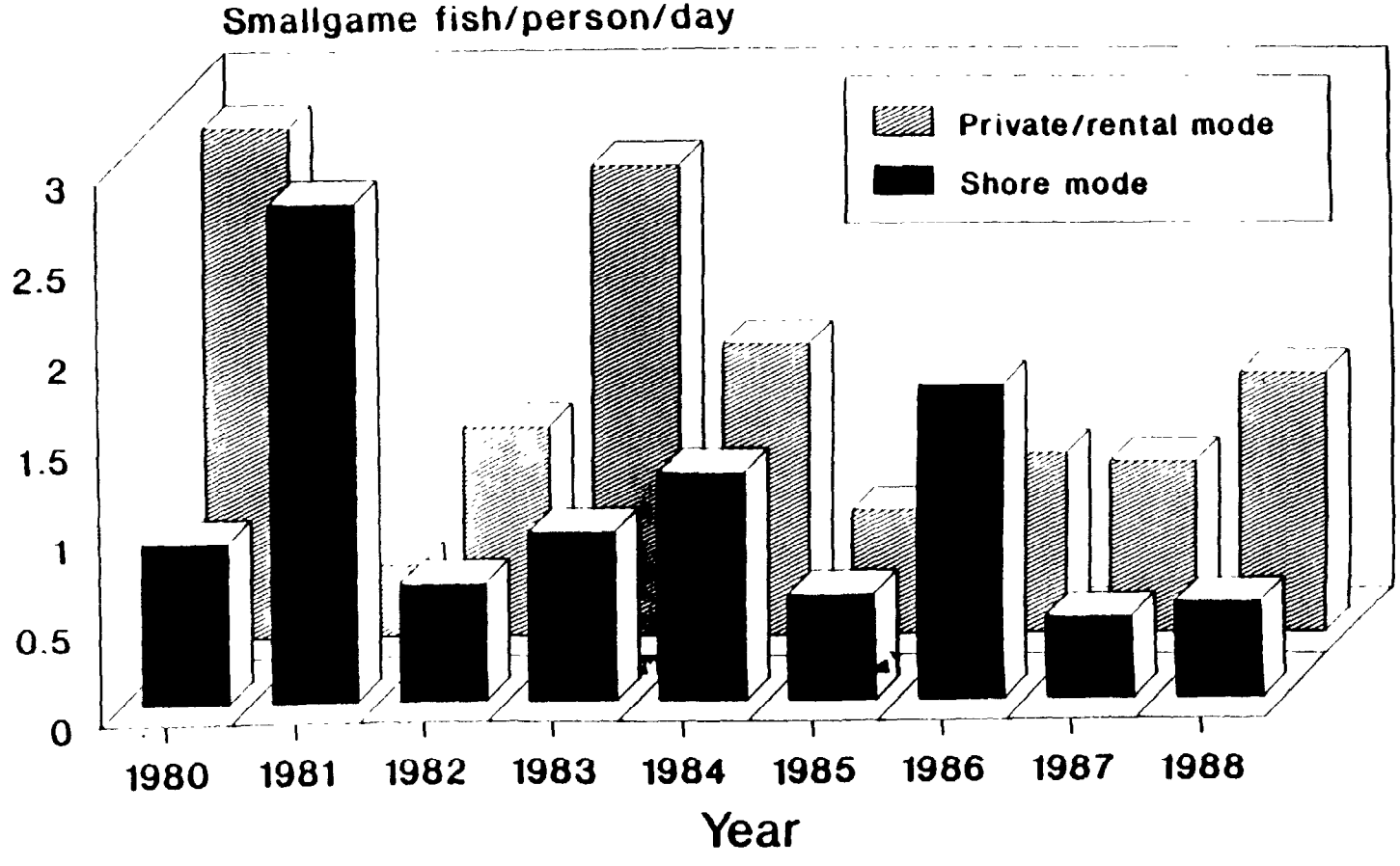
Average for individuals targeting big game, 1980-1988.

Fig. FL3: Smallgame Catch Per Day, North Florida, By Year and Mode



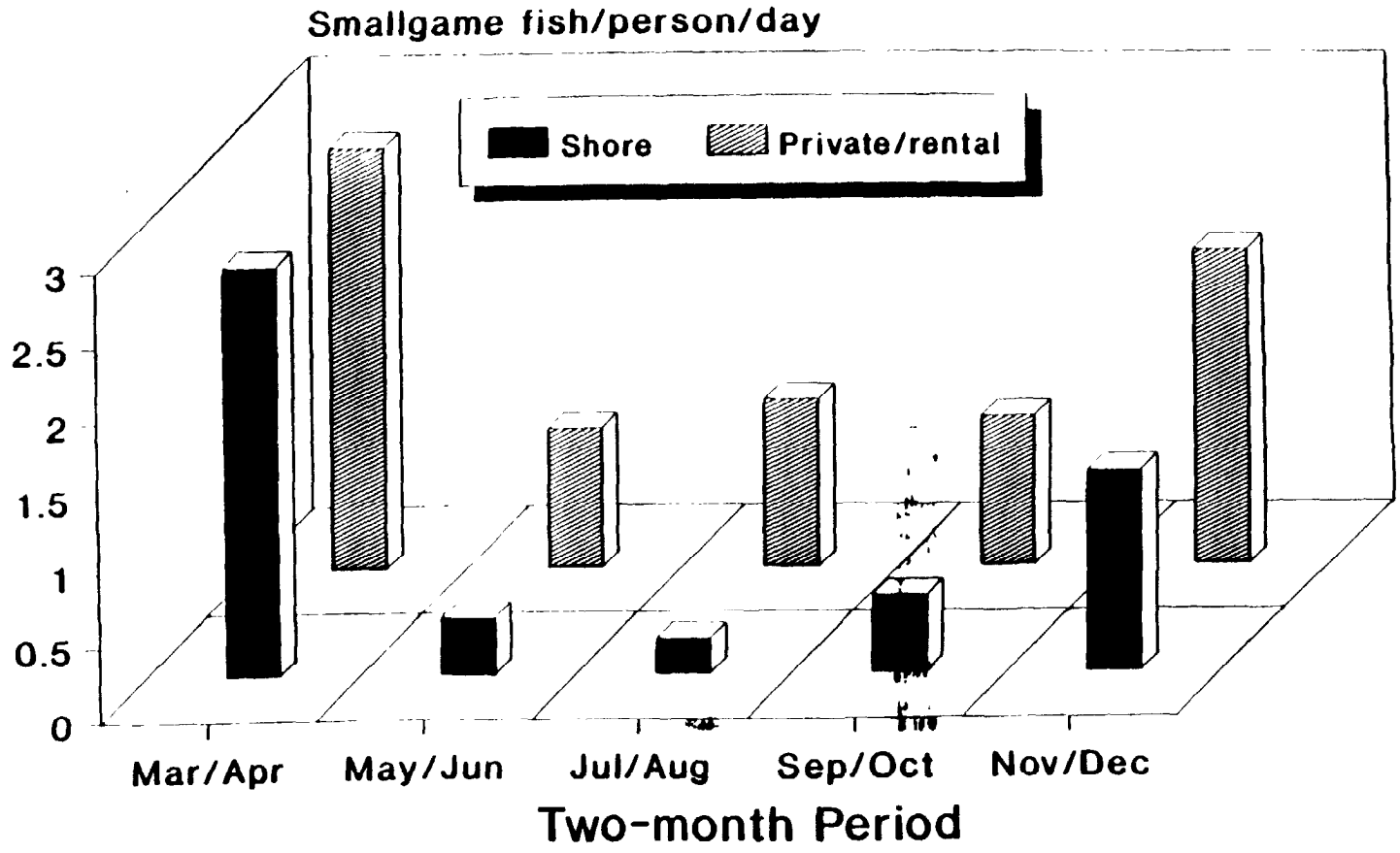
For individuals targeting smallgame.
Volusia County and north.
1980-1988.

Fig. FL4: Smallgame Catch Per Day, South Florida, By Year and Mode



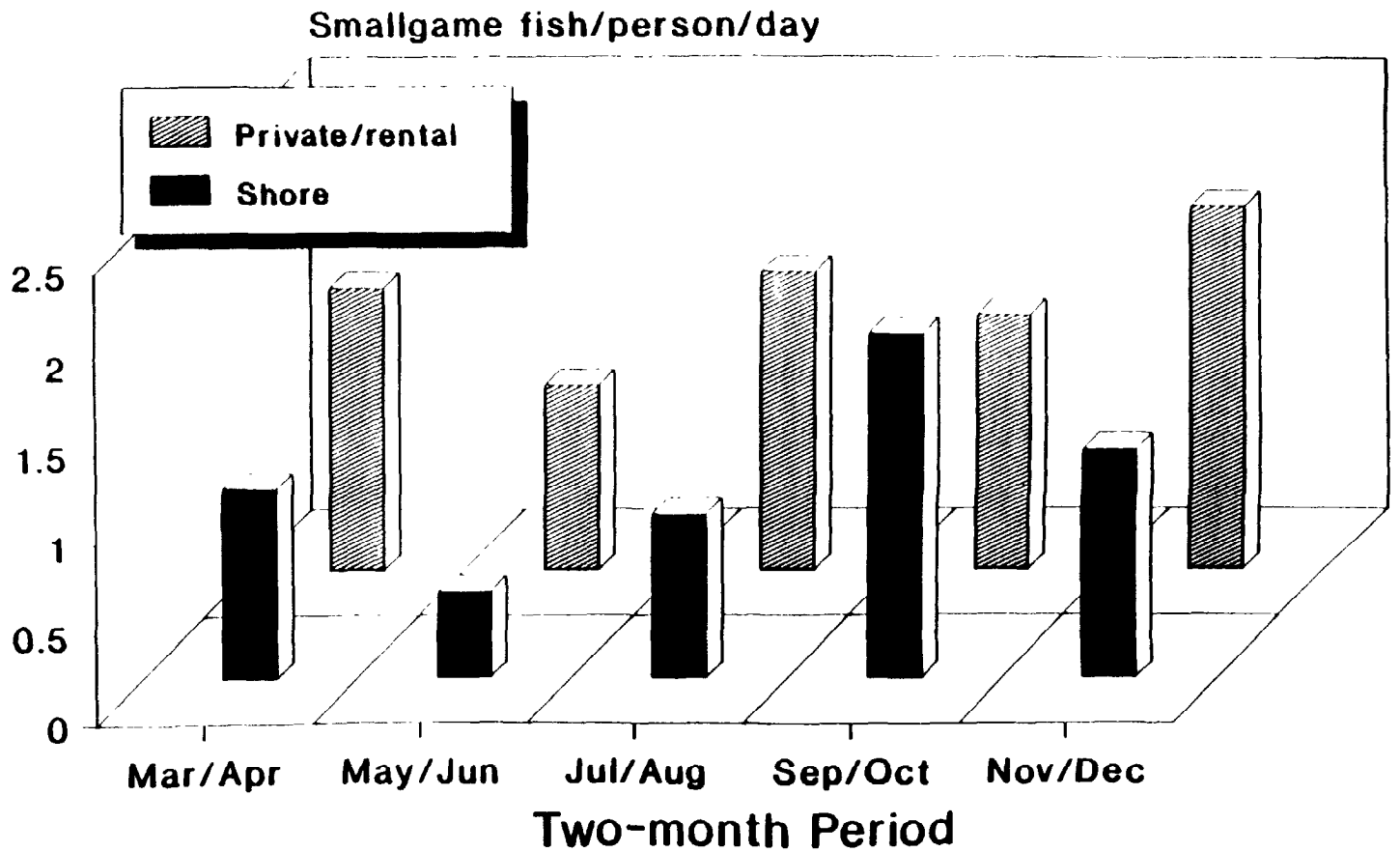
For individuals targeting small game.
Counties south of Volusia County.
1980-1988.

Fig. FL5: Smallgame Catch Per Day, North Florida, By Wave and Mode



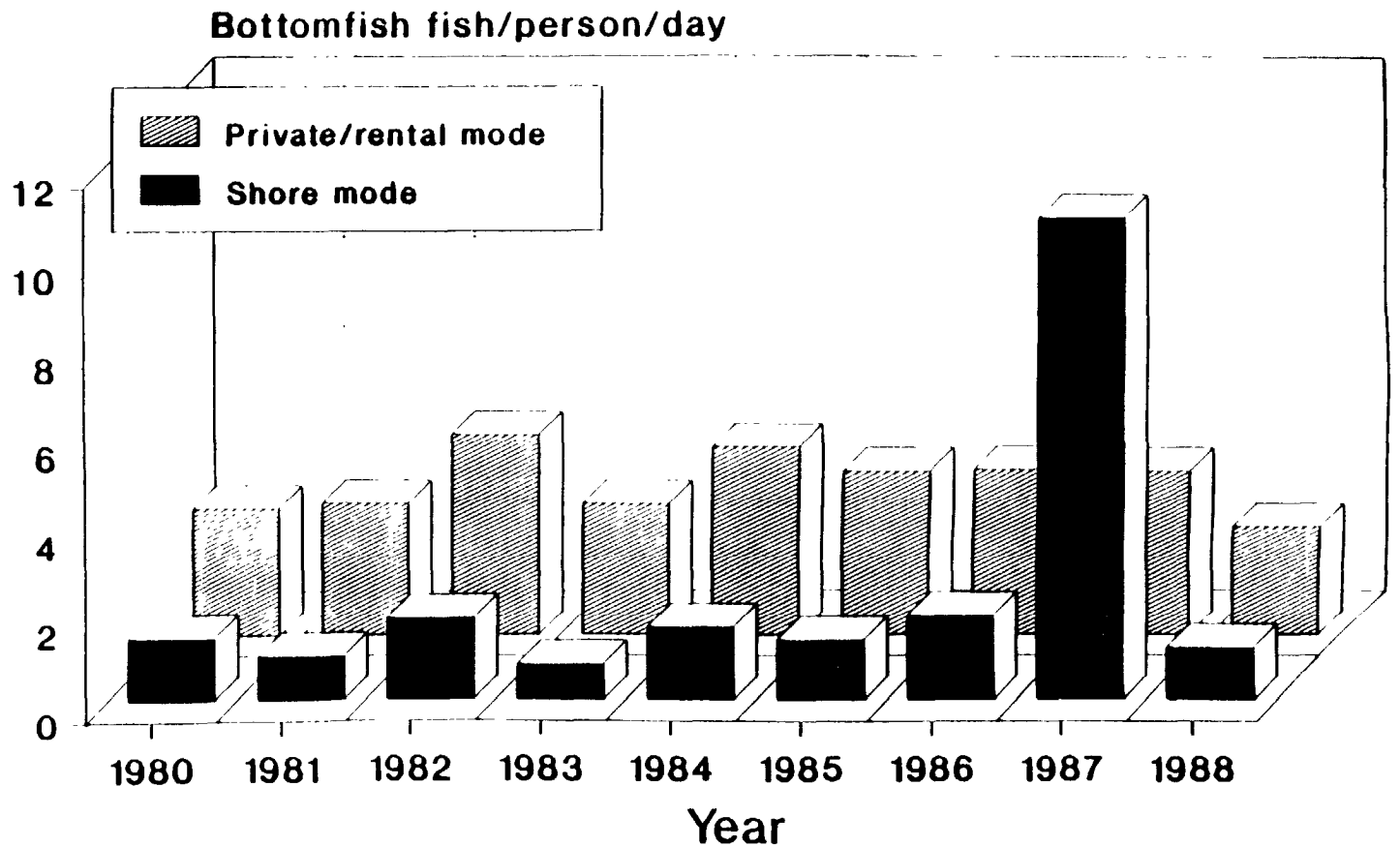
Average for individuals targeting small game, for Volusia County and north. 1980-1988.

Fig. FL6: Smallgame Catch Per Day, South Florida,By Wave and Mode



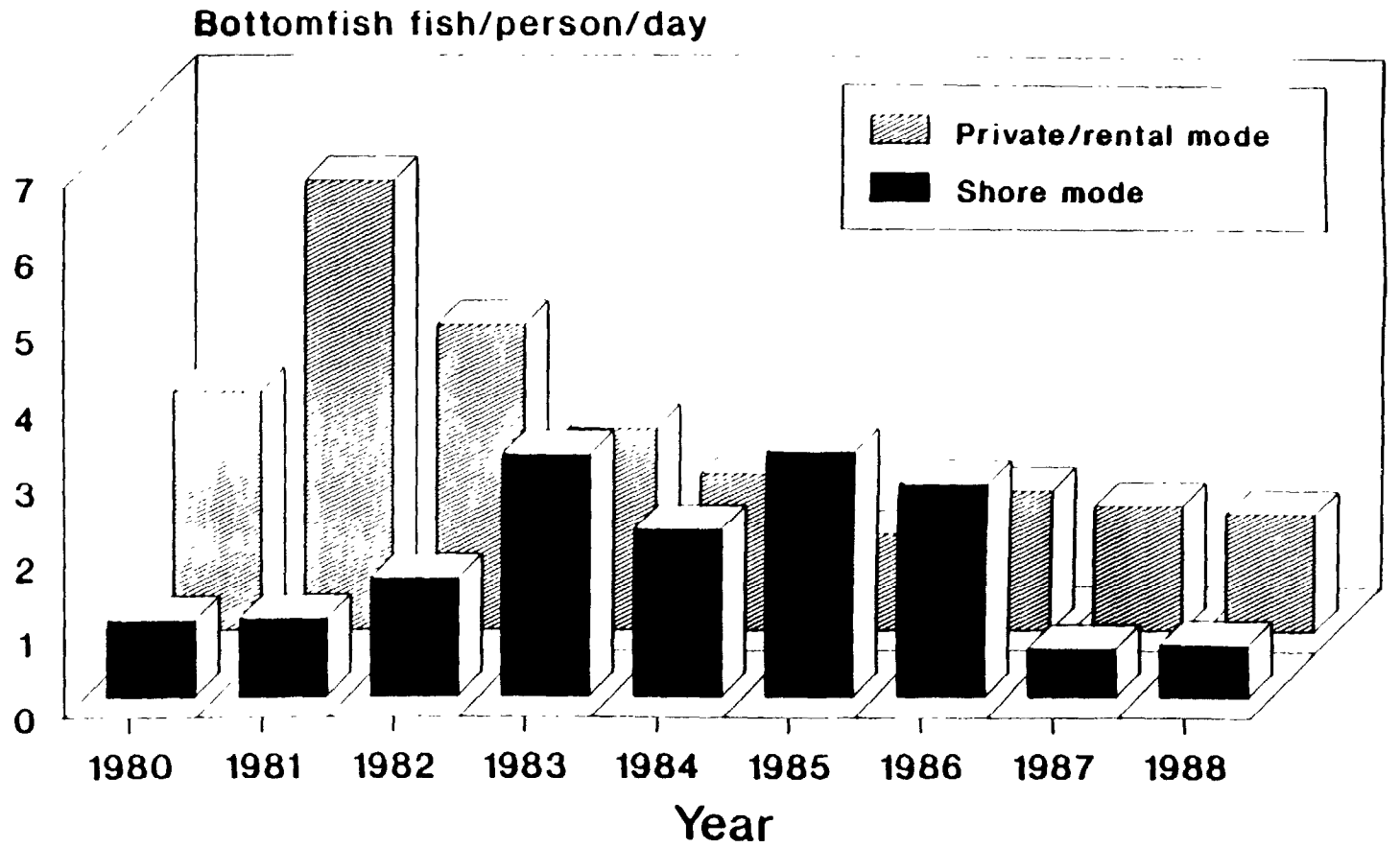
Average for individuals targeting small game, counties south of Volusia County, 1980-1988.

Fig. FL7: Bottomfish Catch Per Day, North Florida, By Year and Mode



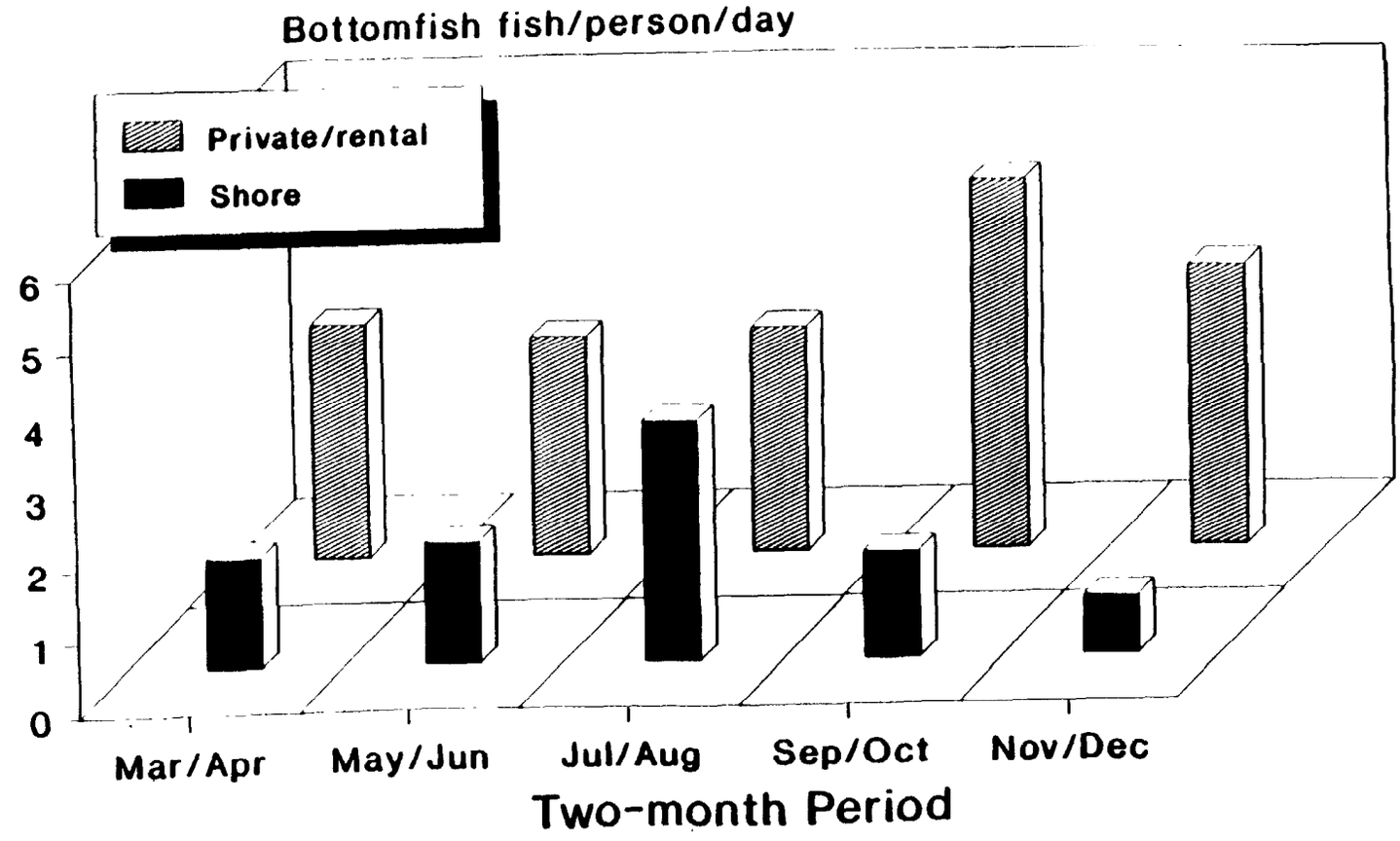
For individuals targeting bottomfish.
Volusia County and north.
1980-1988.

Fig. FL8: Bottomfish Catch Per Day, South Florida, By Year and Mode



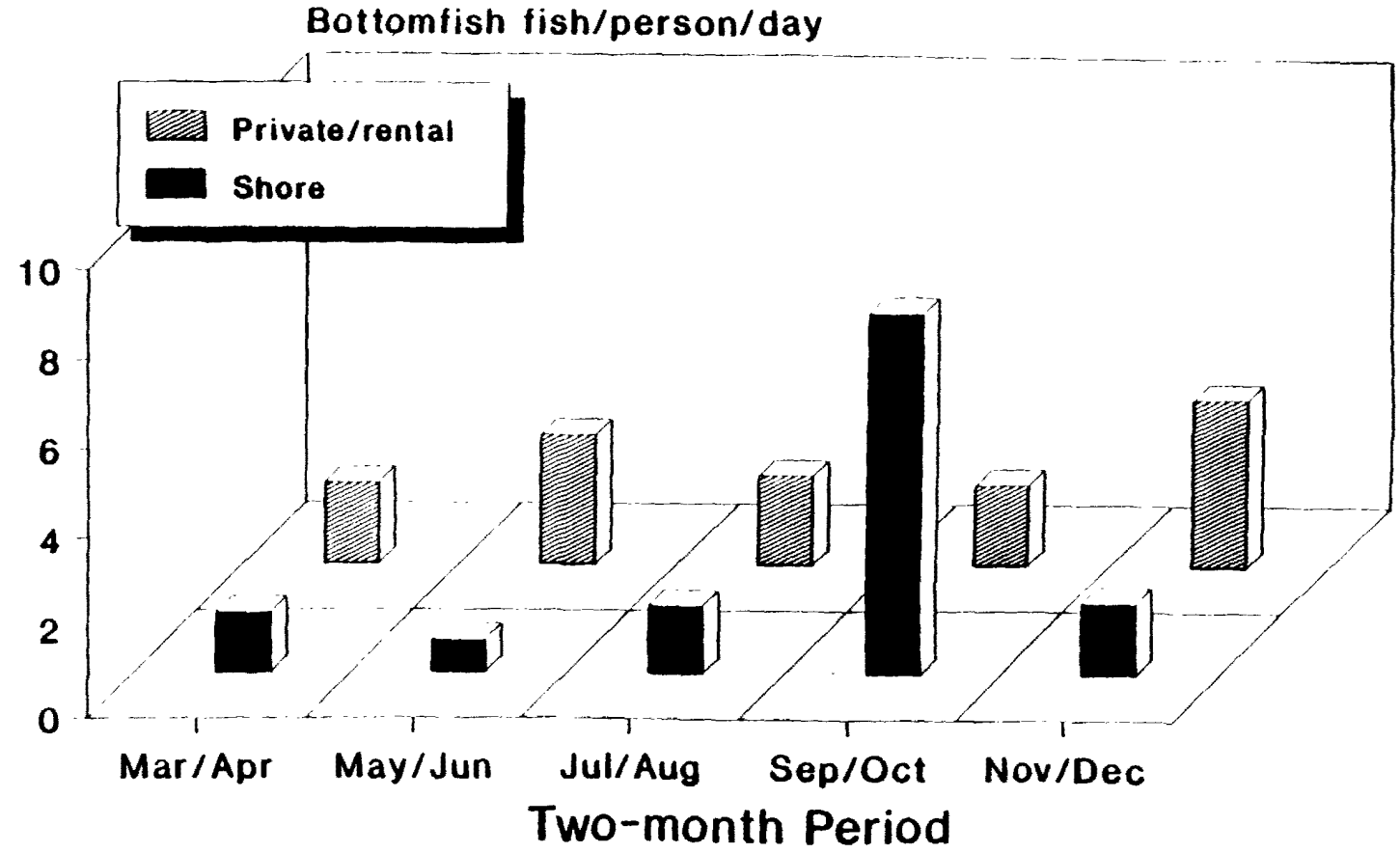
For individuals targeting bottomfish.
Counties south of Volusia County.
1980-1988.

Fig. 9: Bottomfish Catch Per Day, North Florida, By Wave and Mode



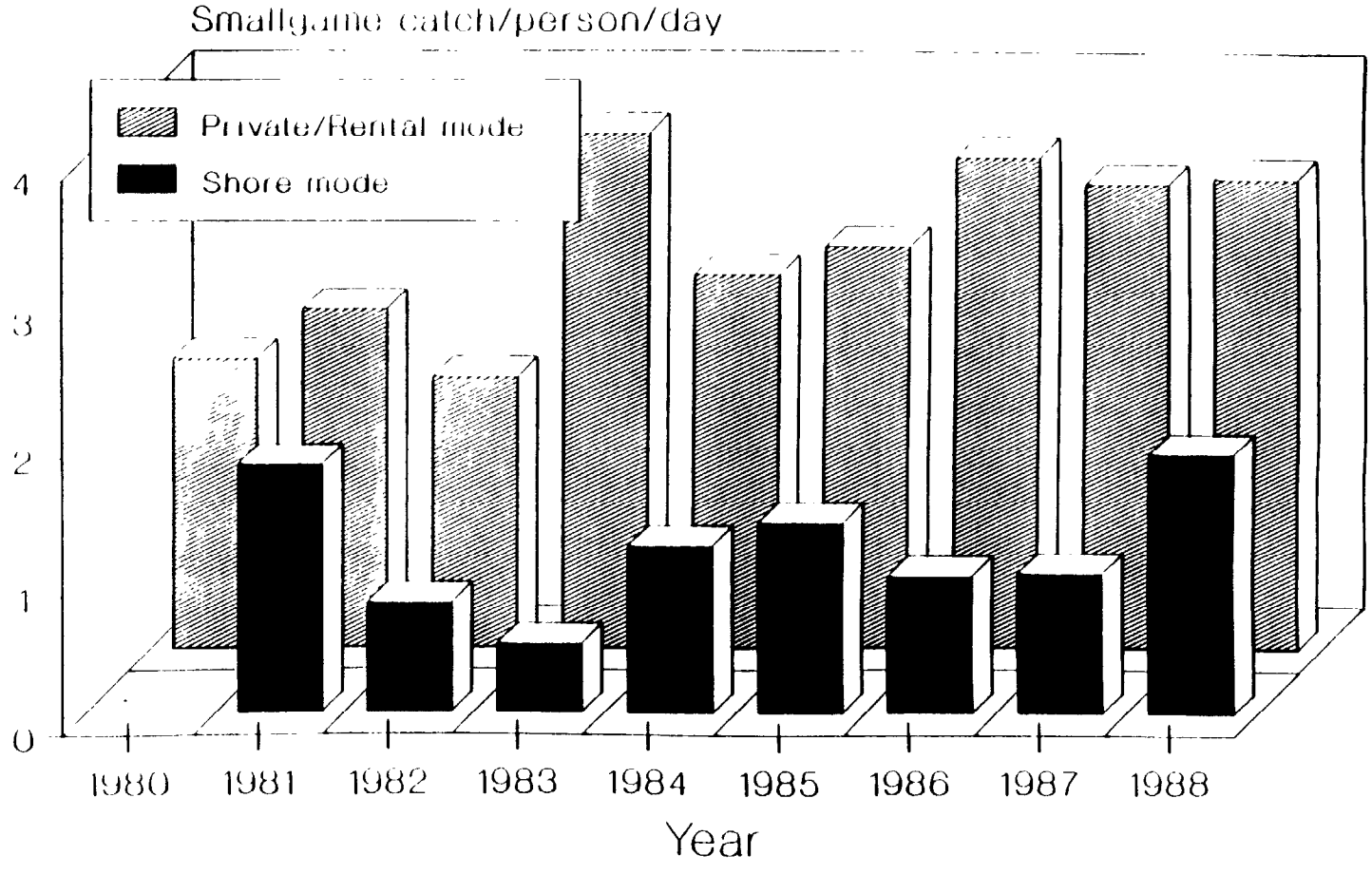
Average for individuals targeting bottom fish. Average for Volusia County and northward. 1980-1988

Fig. FL10: Bottomfish Catch Per Day, South Florida, By Wave and Mode



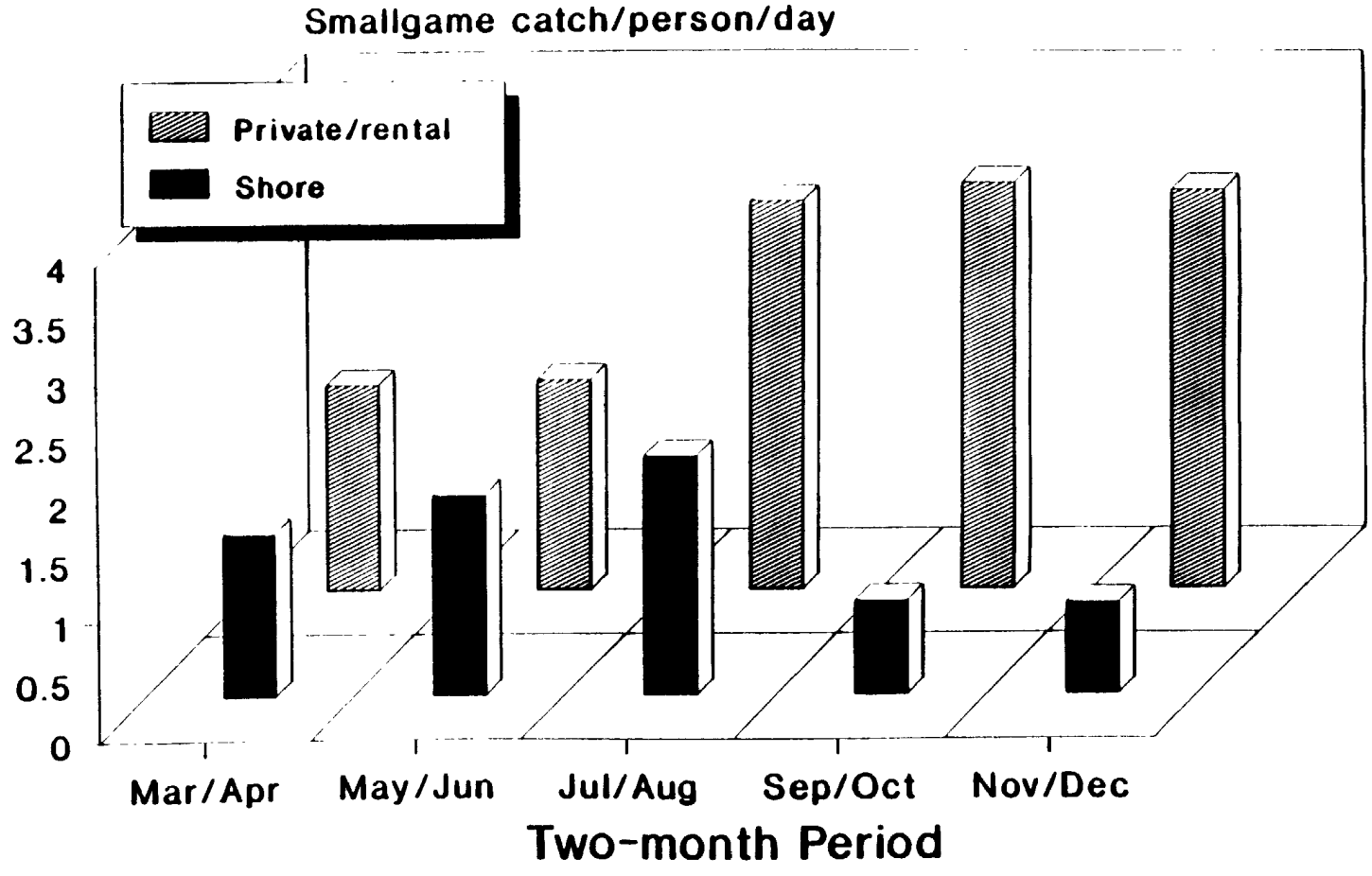
Average for individuals targeting bottom fish. Average for counties south of Volusia County. 1980-1988.

Fig. GA1: Smallgame Catch Per Day, Georgia, By Year and Mode



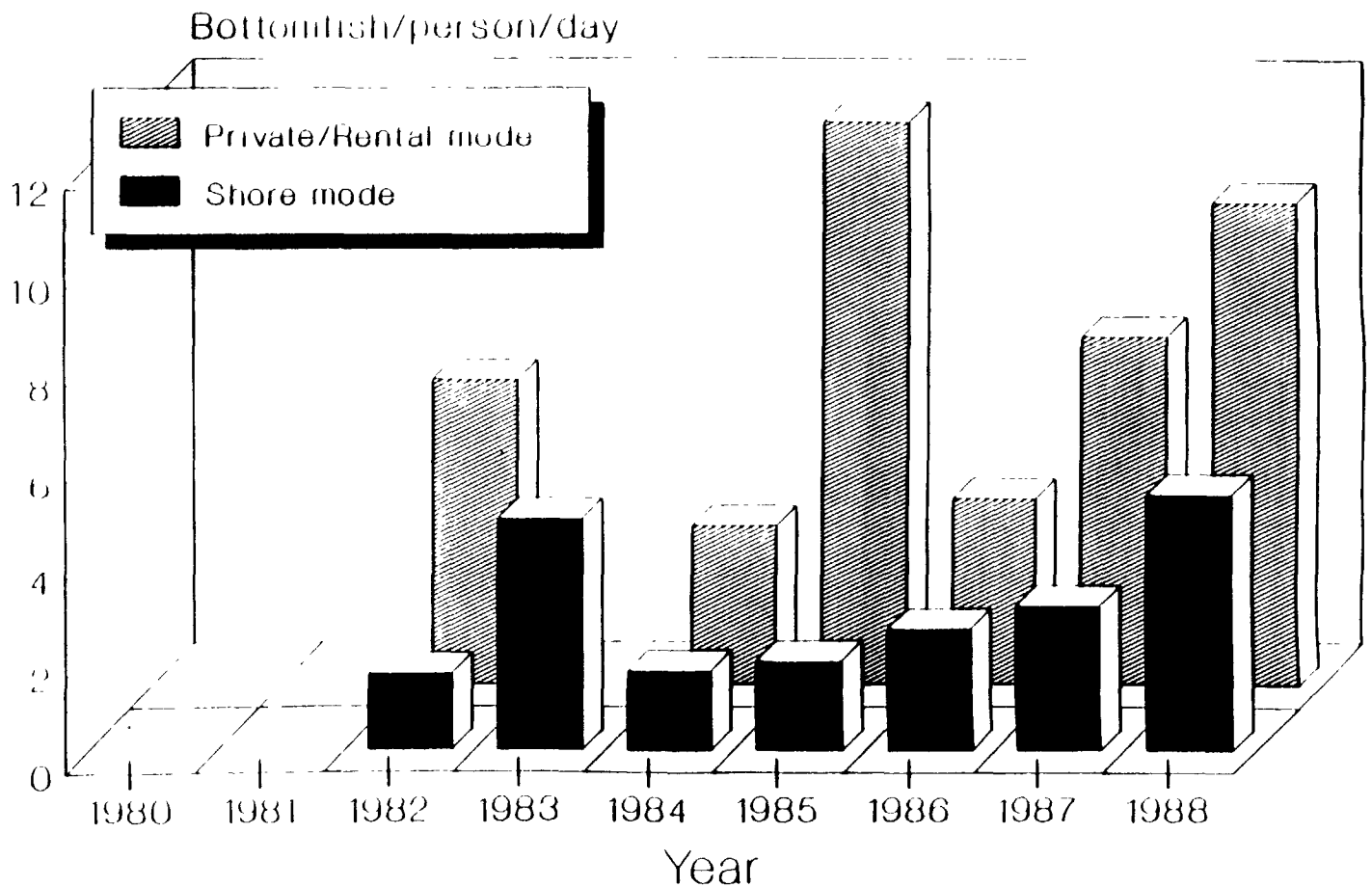
For individuals targeting smallgame
1980-1988

Fig. GA2: Smallgame Catch Per Day, Georgia, By Wave and Mode



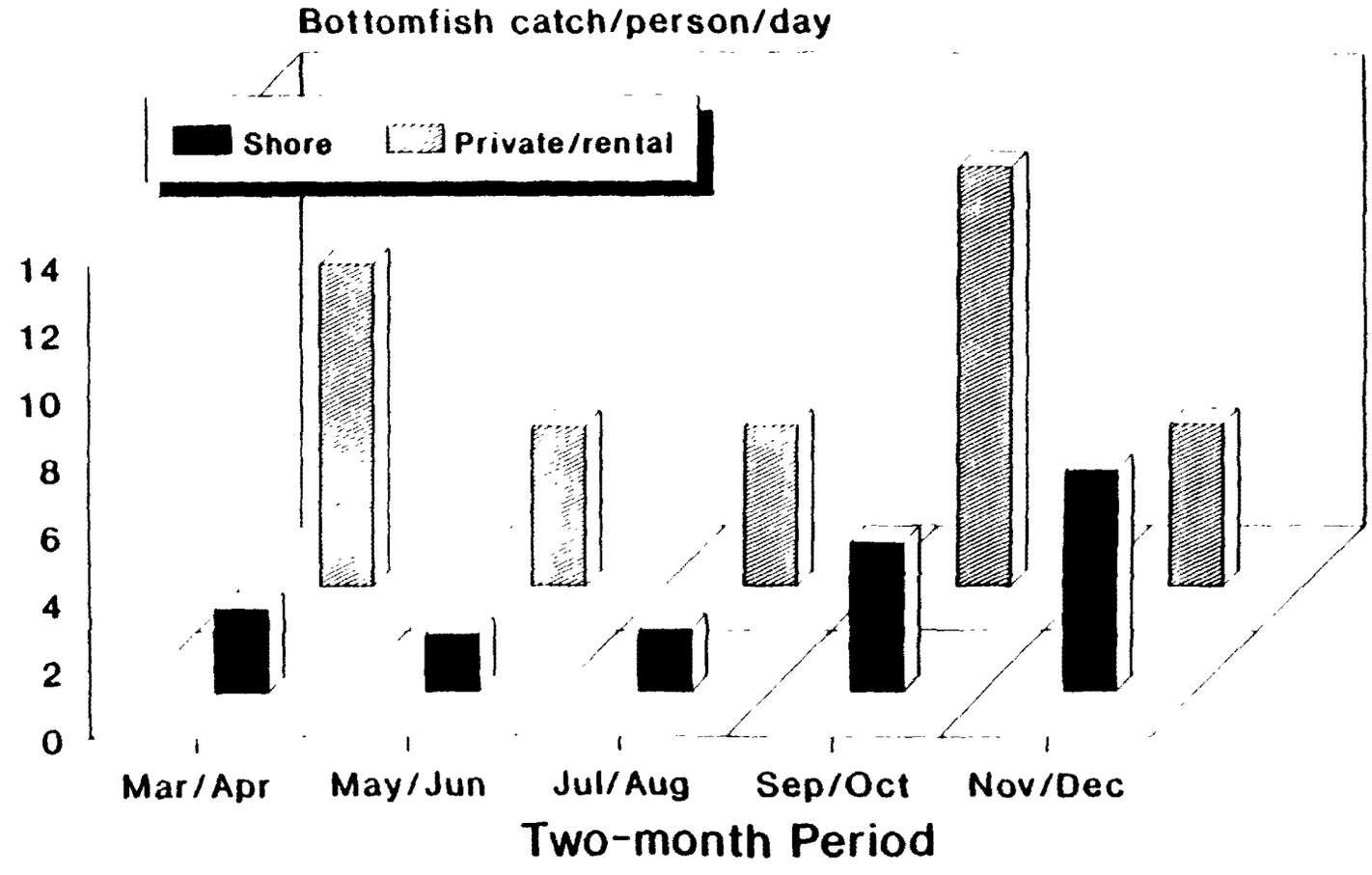
Average for individuals targeting small game, 1980-1988.

Fig. GA3: Bottomfish Catch Per Day, Georgia, By Year and Mode



For individuals targeting bottomfish
1980-1988

Fig. GA4: Bottomfish Catch Per Day
Georgia, By Wave and Mode



Average for individuals targeting bottom fish, 1980-1988.

Chapter 10

SPORTFISHING IN FLORIDA

Activity by Florida Households

The coast of Florida offers many varieties of marine recreational fishing. Florida's east coast alone, from the Georgia border through Dade County, encompasses over 500 miles of coastline. This report deals only with the east coast, excluding the Florida Keys south of Dade County and the Gulf coast. The coastline is sufficiently long that fishing experiences vary greatly from one end of the state to the other. Fishing along the coast of northern Florida is similar in character to fishing along other south Atlantic states. But southern Florida can be quite different. with coral reef and other tropical fishing accessible by boat from Dade County. The length of the state is sufficient that seasonal factors which affect fishing in the northern part of the state may not be felt farther down the coast.

The marine waters and the attractive winter climate originally attracted people to Florida. Consequently, most of the population is located close to the coast and is eligible for the NMFS phone survey. The sample frames vary according to the wave. For March-April and November-December, only households who live in counties within 25 miles of the east coast or an estuary of the east coast are eligible. But from May through October, households who live in countries 50 miles from the coast are eligible. There are 2,170,200 households eligible in the 25 mile counties according to the 1980 Census and only about three percent more (2,226,400) in the 50 mile counties. The proportion of Florida marine sportfishing participants who reside in Florida coastal counties has remained exceptionally stable over the decade, at about 60 percent. Virtually

all the remaining participants come from out-of-state. A similar stable pattern exists in trips, with coastal county residents accounting for over 80 percent of the trips taken in marine waters on the east coast of Florida.

Sportfishing Activity: Household Participation Rates and Quantity of Trips by Season

The participation rates by wave and year are given in Table FL.1. These rates vary from a high of 20.5 percent in July-August 1987 to a low of 6.1 percent in September-October 1983. These rates have small standard errors, typically less than one percent. The sample sizes range from a high of 5267 for July-August 1988 to a low of 833 for November-December 1986. There is substantial variation over the years within seasons and some seasonal variation. All of the rates in 1989 and all but one in 1988 are less than the means.

The seasonal variation is not pronounced, although participation rates in September-December are almost always below those of other waves. The mean rate for July-August is the highest, but in seven of the ten years, the highest seasonal rate occurs in March-April or May-June. The intra-seasonal variation is quite a bit different from the northern states. In many states, the July-August wave exhibits the least variability, but in Florida it is the least stable with a range of 11.4 percentage points from 1987 to 1988.

It is not apparent that any trend exists in the Florida participation rates (Table FL.2). It is true that the 1988 and 1989 rates are nearly all less than the mean rates. But the waves behave differently. The linear trend analysis shows no significant systematic movements in participation for any of the waves.

Trends and variability can also be inferred from data on trips. Aggregate trips can be estimated as the product of trips per household called and the number of eligible households. (It could also be calculated as the product of trips per fishing household, the participation rate of households called, and the number of eligible households.) Table FL.3 gives the trips per household called by wave and year. The mean trips per household called using all nine years of data are distributed seasonally as follows:

	Mean Trips	Percent of Annual Mean
March-April	.58	19.7
May-June	.65	22.1
July-August	.73	24.8
September-October	.49	16.7
November-December	.50	17.0

These figures suggest the same pattern of declining activity in September through December. As with participation rates, however, interpretation of seasonal behavior is complicated by the changing sample frame. Participation and trips are both likely to be overestimated in waves 2 and 6 relative to waves 3 through 5 because the latter include some households farther from the coast. But since the difference between the two sample frames is minimal for Florida, we can largely ignore this complication.

The trips per household called in Table FL.3 do not show any obvious annual trend except that trips per household are low in 1988. There is considerable variability in the trips by wave, both within and among seasons.

Sportfishing Activity by Mode

The distribution of fishing trips among the various modes of fishing helps illustrate the nature of the fishing activity and the impact the seasons have on it. Table FL.4 gives these measures by wave and mode, averaged over the nine years of the telephone survey. These percents, means for nine years, are relatively constant over seasons. About 90 percent of the fishing trips are from shore or from private/rental boats. The latter claims a distinctly larger percent of trips in all but the March-April wave. The usual effect from inclement weather, found in the more northerly states, is absent in Florida. The percent allocated to private/rental boats is lowest in early spring and early fall.

To gain some sense of how the magnitude of fishing changes by wave and mode, we exploit Table FL.3, which gives trips per household per wave, along with information on the number of eligible households. According to the 1980 census, there were 2,226,400 in the 50 mile counties. (Because the difference between the 25 mile coastal counties and the 50 mile coastal counties is so slight, we will use the 50 mile households throughout.) From Table FL.3, there were an average of .58 trips per household called during March-April implying aggregate trips of 1,291,312. Of these 45.2 percent or 538,673 would be attributed to boat trips. During July-August. aggregate trips were 1,625,272 (= .73 * 2,226,400) of which 51.7 percent or 840,265 were private/rental boat trips. This is a considerable level of fishing effort, even for the extensive coast of Florida. These show that even when the seasonal shifts in trips and proportions are small, large changes in fishing activity emerge because of the large number of participants.

Sportfishing Activity by Waterbody

Table FL.5 gives information about fishing by coastal households in different waterbodies. The percents are averaged over the nine year sample. The NMFS waterbodies - ocean, gulf and open bay; sound; river; enclosed bay - are not well suited for Florida. For example, there is a great deal of fishing in the Indian River, but it is not really a river, simply a bay or part of an estuary and it is not clear how households would categorize it. Similarly, households' differing interpretations of enclosed bay and open bay/ocean will affect responses.

Despite the ambiguities, some useful information is revealed by the data. The importance of ocean, gulf and open bay is evident from Table FL.5. Over 60 percent of the fishing occurs in the ocean, gulf, and open bay category. The proportion in the ocean, gulf and open bay increases only slightly during the summer. The second most popular type of waterbody is river but whether this includes much of the fishing on the Indian River is difficult to say. Table FL.5 can be used in conjunction with trips per household and the number of eligible households to calculate the number of total trips in different areas at different times. For example, of the 1,625,272 coastal county trips in July-August, 69.7 percent or 1,132,815 could be attributed to ocean/open bay. This information, when combined with the information on the number of boating trips suggests that the bulk of the boating trips are in seaworthy boats, at least capable of venturing into open bays.

Catch Rates in Florida

Because the East Coast of Florida is so long and has such diverse fishing, we chose to examine the catch rates based on a northern division (sites from Volusia county northward) and a southern division (sites south of Volusia County, to and including Dade County). The

distinction is important for two reasons: the species availability/abundance varies by area and the type of fisherman differs. In the south, there are more out-of-state fishermen, and more party/charter activity. The closeness of the Atlantic Ocean's Gulf stream in southern Florida alters the species composition.

Florida is similar to Georgia in the large proportion of saltwater anglers who do not target a species. For the decade, Florida had the largest percentage of anglers not targeting (-62 %). Like Georgia, this percentage grew during the decade, from 55 percent in the first half to 66 percent in the latter half. The rise came at the expense of the big game and bottomfish targets. The percentage of anglers targeting big game fell from 16 percent to 8 percent while the fall in bottomfish targeting was from 12 to 9 percent. Smallgame attracted a constant 16 percent in both halves of the decade. Flatfish were targeted by only 1 percent of the anglers.

Big game

In southern Florida, there is significant activity directed towards big game both from party/charter boats and from private/rental boats. The nearness of the gulf stream brings many of the highly migratory billfish and tuna into areas easily accessible by these boats. In recent years, dolphin has been the principal target species, sought by 60 percent of the anglers targeting big game. The other important targeted species are sailfish (26%) and wahoo (8%). This represents slightly more targeting of sailfish and wahoo than was experienced in the early 80's.

The trends in big game catch rates over the decade are shown in Figure FL1 for private/rental and party/charter fishermen. The highest catch rates were experienced during the early 1980's for both modes of fishing. The last several years show a significant decline in catch

rates. From this aggregated data, it is impossible to determine whether this represents a shift in targeted species towards less abundant species or a general decline in availability.

Catch rates vary substantially through the year (FL2). The highest catches per day are experienced during the summer months, from May through August. The lowest daily harvests occur in the November/December period. The March/April and September/October catch rates are similar but low.

Smallgame

The small game targeted in Florida are primarily bluefish, spotted seatrout, king and spanish mackerel, red drum, snook, and pompano. The primary modes of fishing smallgame are shore and private/rental boat. Bluefish was sought by 30% of the targeting smallgame anglers in the 80-84 period but its share has fallen to less than 18% in the recent years. King mackerel and spotted seatrout have increased in importance, rising from around 17% to around 25%.

The relative importance of different species varies from north to south. The red drum and spotted seatrout are particularly important in the north, whereas snook is only targeted in southern Florida. Bluefish, spanish and king mackerel are important in both areas, with slightly higher shares of targeting anglers found in the south.

Catch rates in northern Florida over the decade have varied with no apparent trend (Fig. FL3). The best year for fishing from shore was 1984, and the best year from a private/rental boat was 1981. The same lack of trend was evidenced in southern Florida (Figure FL4). Here, shore anglers experienced unusually high catch per day in 1981, while

private/rental fishermen were most successful during 1980 and 1983. It may be noteworthy that most of the high catch rate years occurred prior to 1985.

Catch rate of smallgame in the north is highest in the November/December and March/April periods (Fig. FL5) for both the shore and private/rental modes. The months from May through October generally yield less than one-half the catch per day experienced in the better waves. This is similar to, but far more pronounced than, the pattern observed in southern Florida (Fig. FL6) where there is not a great deal of difference across waves. The worst period for catching smallgame in southern Florida appears to be in May and June. This is coincidentally the period of highest big game harvest.

Bottomfish

There are a variety of bottomfish species targeted in Florida, with no one species attracting a dominant share of anglers. The snapper group, however, has been consistently sought by between 30% and 35% of directed targeting fishermen. Many anglers target a "generic" snapper, not focusing on any particular variety. Fishermen who do seek a specific snapper species are most likely to target red snapper or yellowtail snapper. Gray and mutton snappers have become popular in the period 1985-1988. The other important bottomfish are sea basses, gag, sheepshead, southern kingfish and Atlantic croaker. Once again, the importance of the species varies from north to south. In the north, the sheepshead, kingfish and croaker are relatively more important whereas snapper and gag are more important in the south.

There does not appear to be an annual trend in the catch rate of bottomfish in northern Florida for either the shore or private/rental boat mode (Fig. FL7). The shore fishing mode had

an unusually high catch in 1987. The private/rental mode of fishing produced a consistent catch rate in the range of two to four fish per day. In southern Florida, the best shore fishing for bottomfish occurred during the middle of the decade and the worst during 1987 and 1988 (Fig. FL8). The only discernible trend in Florida bottomfishing is evidenced in the catch rate of private/rental boat fishing. Here, a peak occurred in 1981 with a steady decline through 1988.

No strong seasonal variation exists in catch rates per day by private/rental boat fishermen (Fig. FL9 and Fig. FL10). The best catches in the north occur in the September/October period, although the differences between months are minor. In the south, private boat fishermen experience the highest catches in the November/December period. Shore fishermen appear to have more dominant seasons, with the July/August period being the best in the north and the September/October period the best in the south.

Characteristics of Fishing Trips in Florida

In addition to the previous information on the distribution and biological aspects. information about individual trips can be useful in understanding the sportfishery. The survey by UMCP gathered information about the nature of fishing trips in Florida waters in 1988. This section describes some of the economic characteristics.

Table FL.6 gives characteristics for one day fishing trips by mode in Florida regardless of origin. There are six modes in the UMCP survey: pier (artificial structure), beach, party boat, charter boat, rental boat, and private boat. However, there were not enough observations for the rental mode to make reliable estimates of the mean characteristics of rental trips For the other modes, low travel costs suggest closeness of residences to the water. Many of the fishing

trips in Florida are made by households who live along the shore. The charter travel cost is higher, because charter outlets are less widely distributed than beach and other fishing modes. The higher costs for bait on charter and private boats stems from more intensive fishing, and perhaps longer fishing trips. The high tackle costs for charter fishing may mean that in some cases the service is not covered by the basic charter fee. Basically the costs of fishing services--costs separate from the travel costs--appear reasonable within, and consistent across, mode.

People also take fishing trips in Florida as part of overnight trips. Because they are then typically lodged close to the marine waters, the characteristics of their trips are likely to be different. Table FL.7 gives the characteristics of trips which are part of overnight visits to Florida. These trips are closer to the fishing, as the travel time and distance show, being smaller than for the day trips. The costs for fishing services are similar to the costs for the single day trips. The trip length, the number of days of the visit to Florida, is 22.5, quite long compared to other states.

Table FL.8 shows the distribution of fishing trips among different species groups by mode. Big game fishing is more important for Florida than for other states. The percents for boat fishing are quite high. Small game fishing is less important. For example, less than a third of boat trips are directed towards small game.

Table FL.3

Trips Per Household Called
By Year and Season*

Year	Total	Wave				
		March-April	May-June	July-August	September-October	November-December
1981	2.43	.51	.64	.50	.36	.43
1982	3.13	.84	.67	.67	.41	.54
1983	2.85	.40	.66	.83	.47	.48
1984	3.20	.48	.64	.89	.62	.58
1985	3.22	.71	.84	.66	.55	.17
1986	2.87	.51	.57	.86	.56	.38
1987	3.69	.67	.64	.97	.63	.78
1988	2.13	.50	.56	.45	.29	.33
1989	NA	NA	NA	NA	NA	NA
Mean	2.94	.58	.65	.73	.49	.50

* Trips taken within state of residence.

Table FL.4

Percent of Fishing Trips in Various Modes by Wave
Mean 1981-1988

Mode	Wave				
	March-April	May-June	July-August	September-October	November December
Shore	45.9%	38.6%	42.0%	47.3%	41.2%
Party/Charter	8.9	9.7	6.3	7.6	7.4
Private/Rental	45.2	51.7	51.7	45.1	51.4

Table FL.5

Percent Fishing Trips in Various Areas, by Wave
Mean 1981-1988

Area	Wave				
	March-April	May-June	July-August	September-October	November-December
Ocean, Gulf, Open Bay	64.8%	66.7%	69.7%	63.9%	64.9%
Sound	6.4	2.1	3.5	2.6	3.0
River	17.0	17.4	14.4	16.7	21.4
Enclosed Bay	9.7	9.2	6.7	12.6	6.4

Table FL.6

Average Characteristics of Day Trips in Florida, by Mode
(per trip averages)

Characteristic	Mode					
	Pier	Beach	Party	Charter	Rental	Private
Travel Cost	$4.43	$3.68	$5.03	$9.35		$6.85
Costs for						
Bait	3.25	4.05	3.58	7.33		6.83
Tackle	4.14	2.37	3.02	14.31		5.29
Cleaning	.75	7.49	.63	2.06		1.72
Fuel	-	-	-	-		15.42
Pier Fees	1.17	-	-	-		-
Boat Fees[a]	-	-	3 1.52	117.43		-
Travel Time (in minutes)	24.5	24.0	35.7	30.5		24.3
Distance (in miles)	14.6	14.4	25.4	17.5		13.2
Boat Time to first site (in minutes)	-	-	64.4	33.9		23.8
Number of Observations	364	146	33	107		1421

[a] Boat fees are charter and party fees or rental fees.

Table FL.7

Characteristics of Trips for Overnight Visits in Florida

Characteristic	Mean	Number of Applicable Oservations
Travel Cost	$7.33	257
Cost for		
Bait	5.96	259
Tackle	6.62	266
Cleaning	.92	268
Fuel	17.07	133
Pier Fees	.89	56
Boat Fees	221.29	46
Travel Time (in minutes)	16.9	262
Distance (one-way) (in miles)	6.9	262
Boat Time (in minutes)	26.0	177
Trip Length (in days)	22.4	270

Table FL.8

Percent of Trips Seeking Different Species Groups, by Mode
for Day Trips

	Mode				
Species Group	Pier	Beach	Party	Charter	Private
Big Game	4.7%	2.3%	25.0%	69.1%	43.6%
Small Game	59.7	60.7	25.0	14.6	32.8
Flatfish	8.7	13.5	0.0	1.8	2.2
Bottomfish	25.5	22.5	50.0	12.7	21.2

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