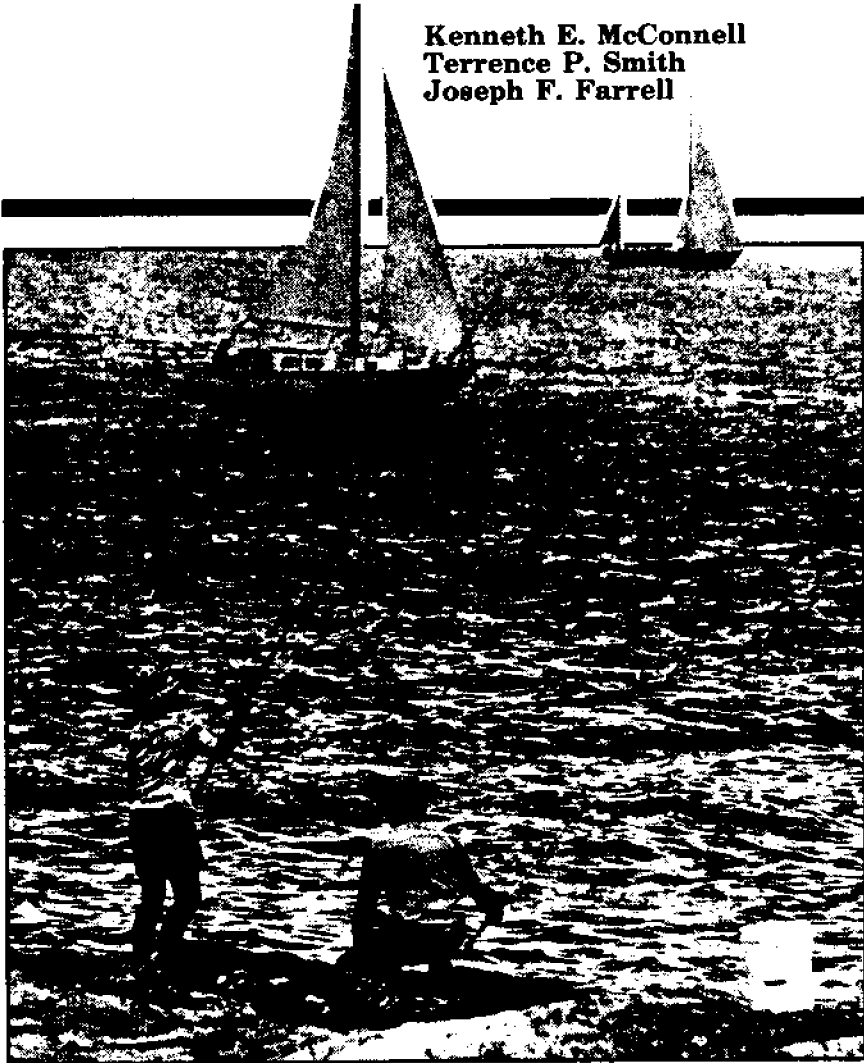


Marine Sportfishing in Rhode Island, 1978

Kenneth E. McConnell
Terrence P. Smith
Joseph F. Farrell



This publication is the result of research sponsored by NOAA Office of Sea Grant, U.S. Department of Commerce, under Grant #NA79AA-D-00096. The U.S. Government is authorized to produce and distribute reprints for governmental purposes notwithstanding any copyright notation that may appear hereon.

Additional copies of this publication are available from URI, Marine Advisory Service, Publications Unit, Bay Campus, Narragansett, RI 02882. Order No. P 917.

**8/81/1M URI
Publications Office**

MARINE SPORTFISHING IN RHODE ISLAND, 1978

Kenneth E. McConnell
Terrence P. Smith
Joseph F. Farrell

NOAA/Sea Grant
University of Rhode Island
Technical Report 83

1981

Kenneth E. McConnell and Terrence P. Smith are now at the University of Maryland. This survey was completed when both were in the Department of Resource Economics at the University of Rhode Island. Joseph F. Farrell is assistant coordinator of the Sea Grant Program at URI.

CONTENTS

Summary 1

Introduction 3

Characteristics of Rhode Island
Sportfishing 6

Seasonal Estimates 12

Some Conclusions 18

Appendix 21

SUMMARY

This is a report on marine sportfishing in Rhode Island in 1978. Estimates are based on interviews of over 5,000 saltwater fishermen, about one-half of whom were from out of state, and on a telephone survey of about 9,000 households in the state. Estimates were made of the numbers, weight, and species of fish caught, by place of fishing (shore, dock, boat, etc.), by season, and by residency (in or out of state). Nine principal species of sportfish totalling over 5 million fish for a weight of over 14.5 million pounds were reported by these fishermen during the period February 1978 through January 1979 (Table 1). This was nearly 70% of the reported 21 million pounds of food fish landed by the Point Judith commercial fleet during that period. By far the greatest number of fish were caught from boats (Table 6). The catch was highly seasonal, with 90% of the fishing activity taking place from June to September. Out-of-pocket and travel costs for fishermen over the period were estimated to be \$18 to \$19 million (Table 12). Because Rhode Island relies on a quality marine and coastal environment and because of its size and diversity, recreational fishing is an important part of the state's ecology and economy. An appendix presents information on the field and telephone survey methods.

INTRODUCTION

This report on marine recreational fishing in Rhode Island is based on a joint University of Rhode Island Sea Grant and National Marine Fisheries Service (NMFS) project which began in July 1977. Only parts of the results of that study are covered in this report. A forthcoming technical paper will discuss sampling methodology used in the study and provide some economic analyses not covered here.

This summary paper presents basic findings from the study. We provide estimates of numbers and weight of fish by species, time, and type of fishing. We also show characteristics of Rhode Island resident and non-resident saltwater sportfishermen, the fishing effort of these people, and the fish they catch according to the places from which they fish and the variation in the catch between seasons (the year of observation divided into two-month periods). This report also makes estimates of costs of transportation to and from the fishing grounds, and the out-of-pocket expenses of the sportfishermen.

The health and vigor of saltwater sportfishing in the state is symptomatic of the health of the state's estuarine areas. Part of the monitoring of these areas requires some knowledge of the total biomass of fish. Estimates of biomass are highly variable and expensive to make. Knowing trends of total catch and catch per unit of effort by species can provide indirect evidence of the biomass, and hence the productivity, of these areas and of the biological impact of sportfishing. For effective fishery management, it is important to measure the relationships between fish stock densities and total catch by species.

In addition to the biological effects of sportfishing on fish populations, there are also effects on the user side. How many people engage in this form of recreation? Where do they come from? At what places (off the boat, off the dock, etc.) do they catch fish--if they catch any fish at all? How many catch no fish on a trip? How much do they spend in out-of-pocket expenses? Who benefits from this spending? These are some of the questions raised in any thoughtful consideration of the sport, and this report attempts to provide answers to them.

The numbers in this report were obtained from two surveys--a field survey of fishermen in Rhode Island made between February 1978 and January 1979 and a telephone survey made over the same period. A brief description of the methods used and the composition of the sample in each survey is given in Appendix A.

How important is the biological impact of marine recreational fishing in Rhode Island? The weight of the catch is surprising.

Table 1 shows the estimated numbers and weight of nine important species caught by resident and non-resident anglers during 1978. Since much of saltwater fish management is aimed at regulating commercial fishermen, it is interesting to note that the National Marine Fisheries Service statistics* show that the total commercial catch landed in Newport, R.I., during 1978 was 16.8 million pounds. This total, of course, includes mollusks and crustaceans, so it would be lower if finfish alone were measured. Thus, the catch of sportfish--and then of only nine species--was almost equal to the total commercial catch coming into one Rhode Island port, which is listed as a major fishing port of the United States by the NMFS. Again, the sportfishing catch was better than half (69%) of the food fish landed in Point Judith (~~21 million~~)--the major Rhode Island commercial fishing port--in the same year.**

(21 million pounds)

*Fisheries of the United States, 1979. U.S. Dept. of Commerce, NOAA, NMFS, April 1980. Table, p. 5.

**Pt. Judith Fishermen's Co-operative, personal communication.

Table 1. Estimated Annual Catch (Number and Weight) for Marine Recreational Fishermen Fishing in R.I. Waters, February 1978 through January 1979

Species	Numbers of Fish Caught		Weight (Metric Tons)	
	Residents (% of Total)	Non-Residents (% of Total)	Total	
Scup	839,013 (58%)	620,035 (42%)	1,459,048	540
Winter flounder	654,542 (54%)	592,052 (47%)	1,246,594	760
Bluefish	394,408 (49%)	410,588 (51%)	804,996	2,809
Tautog	430,568 (67%)	214,340 (33%)	644,908	851
Mackerel	114,226 (25%)	347,198 (75%)	461,424	364
Cod	59,767 (23%)	203,189 (77%)	262,956	805
Summer flounder	47,919 (50%)	46,986 (50%)	94,905	89
Striped bass	45,076 (89%)	5,695 (11%)	50,771	315
Weakfish	6,978 (45%)	8,445 (55%)	15,423	67
Total numbers	2,592,497	2,448,528	5,041,025	
Total weight (equivalent in pounds = 14,546,400)				6,600 mt

CHARACTERISTICS OF RHODE ISLAND SPORTFISHING

Estimating the level and impact of sportfishing activity is difficult for two reasons. The first is the diversity in the sportfishing activity. Sportfishing trips occur at all times of the day and night throughout the year from shore, from bridges and jetties or docks, from private boats, and from charter or party boats. People fish for many reasons. They may want to catch fish, enjoy the outdoors, or "get away from it all." They may fish every day or once a year. They may have invested less than \$10 in equipment or thousands of dollars. They may sell their catch or release all hooked fish. This tremendous diversity in the characteristics and motivations of sportfishermen leads to large variability in the estimation of characteristics of the population.

The sample year began on February 1, 1978, and continued through January 31, 1979. During that period, 2,961 Rhode Island resident anglers and 2,485 non-resident fishermen were interviewed. From this sample and from the results of the telephone survey, it is estimated that Rhode Island residents made a total of 726,405 fishing trips, while non-residents participated slightly less, with an estimated total of 558,291 trips. Rhode Island residents caught a total of 3,117,000 fish, while non-residents caught 2,276,000 finfish. These results are summarized in Table 2. Total spending by sport anglers is a rough measure of the economic impact of marine sportfishing.

As a first attempt at quantification of out-of-pocket expenditures by these fishermen, one can take \$9 out-of-pocket cost per trip (Table 4) and the number of trips (Table 2: 1,284,696) and arrive at an annual out-of-pocket expenditure of over \$11.5 million. This measure excludes a large part of spending by sport anglers. For example, lodging and expenditures on tackle would not be included in this figure.

During the field survey, the interviewers identified, measured, and weighed 35 different marine species (Table 3). Several of these were relatively rare and hence are not reported in the catch by species, although they were used to produce an overall catch rate and a total catch. The total catch for the most common and most important of these species is given in Table 4. (Two species which are relatively common inshore and two species which are relatively common offshore have been omitted from Table 1 because they are not sought by fishermen. These, sometimes called "nuisance species," are: inshore--the cunner, Tautoglabrus adspersus, or choggie, and the common sea robin, Prionotus carolinus; and offshore--the dogfish, Squalus acanthias, and the ocean pout, Macrozoarces americanus.)

The species in Table 1 are ordered by total catch in numbers. The total weights shown were calculated from the mean weight for fish in the creel, which were weighed by interviewers.

One objective of the study was to provide descriptive measures of sportfishermen. For an understanding of the workings of the sport-fishery, we gathered information on age, income, years of saltwater fishing experience, size of household, leisure time available, and certain cost variables such as distance traveled to the fishing site and the direct expenditures for the trip. The means of these variables are grouped under the heading "Characteristics of Anglers." They demonstrate the central tendencies of the fishing population. These are shown for both Rhode Island residents and non-residents in Table 4.

There are some differences between resident and non-resident recreational fishermen in Table 4, but, except for distance traveled, these differences were found to be statistically insignificant. Therefore, we can describe the representative recreational fisherman as being 40 years of age with about 19 years of saltwater fishing experience, a household income of \$18,000 to \$19,000 (1978 dollars), spending about \$9 for each fishing trip. This representative fisherman would be expected to catch slightly more than one fish per hour. Knowing that the mean catch is one fish per hour is cold comfort for the angler who spends a lot of time with nothing to show for his effort. Hence, it is of interest to ask how many catch no fish, how many catch 10 fish per hour, and if there is a better chance of catching a fish on a boat, from shore, or from a pier.

Questions about the distribution of catch per unit of effort can be answered by referring to Table 5. There are four columns showing the frequency distribution of catch per unit of effort (fish/hour). On an annual basis, Table 5 shows the relative success rate for resident fishermen for each of four places of fishing. (Differences between Rhode Island residents and non-residents are minor, while substantial differences exist among places. Thus, the non-resident distributions are not shown.) At the two shore-based places (surf, beach bank) and at man-made structures (pier, dock, jetty, etc.) 60 to 70% of the fishermen catch no fish. Less than ten percent of the fishermen catch one-half fish per hour, and so forth. For the private boat fisherman, the success rate is much higher. About 40 to 50% of these fishermen catch no fish and the proportion who catch at low or moderate rates (one-half to four fish/hour) is higher than the two shore modes. A few private boat fishermen are very successful, with catch rates up to ten fish per hour. For the party boat and charter boat sector, success rate is high (65-70%), and the proportion of fishermen who catch at low to moderate rates is also high. In summary, getting "shut out" is most likely on the shore, and least likely on the party or charter boat. Catching a lot of fish is most likely aboard a boat.

Table 2. Interviews and Estimated Trips and Catch: R.I. Resident and Non-Resident Marine Recreational Anglers, February 1978 through January 1979

	Interviews	Estimated # of Trips	Estimated Catch (# of Fish All Species)
R.I. resident (% of total)	2,961 (54%)	726,405 (57%)	3,117,000 (53%)
Non-resident (% of total)	2,485 (46%)	558,291 (43%)	2,726,000 (47%)
Total	5,446	1,284,696	5,843,000

Table 3. Species Encountered in Field Survey of Marine Recreational Fishermen in Rhode Island

Common Name	Scientific Name*	Other Commonly Used Names
Alewife	<u>Alosa pseudohavengus</u>	buckeye, herring
Bass, common sea	<u>Centropristis striatus</u>	black sea bass, blackfish
Bass, striped	<u>Morone saxatilis</u>	striper, rock, rockfish
Bluefish	<u>Pomatomus saltatrix</u>	blue, chopper, snapper (juvenile)
Butterfish	<u>Poronotus triacanthus</u>	
Cod	<u>Gadus morhua</u>	rock cod
Cunner	<u>Tautoglabrus adspersus</u>	choggie, bergall, perch
Dogfish, spiny	<u>Squalus acanthias</u>	doggie, sandshark
Eel, American	<u>Anguilla rostrata</u>	snake
False albacore	<u>Euthynnus alletteratus</u>	bonito, little tunny
Flounder, summer	<u>Paralichthys dentatus</u>	fluke
Flounder, winter	<u>Pseudopleuronectes americanus</u>	flounder, blackback

Table 3 (Continued)

Common Name	Scientific Name*	Other Commonly Used Names
Hake, silver	<u>Merluccius bilinearis</u>	whiting, frostfish (winter)
Hake, white	<u>Urophycis tenuis</u>	mud hake, Boston hake, ling
Herring, common	<u>Clupea harengus</u>	sardine, sperling
Herring, blueback	<u>Ponolobus aestivalis</u>	
Mackerel	<u>Scomber scombrus</u>	
Menhaden	<u>Brevoortia tyrannus</u>	pogy bunker
Mummichog, common	<u>Fundulus heteroclitus</u>	mummy, killifish, chub
Ocean pout	<u>Macrozoarces americanus</u>	eelpout, yellow eel
Perch, white	<u>Morone americana</u>	
Pollock, American	<u>Pollachius virens</u>	Boston bluefish
Sandshark	<u>Odontaspis taurus**</u>	
Sea robin, common	<u>Prionatus carolinus</u>	
Scup	<u>Stenotomus versicolor</u>	porgy
Shad	<u>Alosa sapidissima</u>	
Skate, little	<u>Raja erinacea</u>	
Silverside	<u>Menidia menidia</u>	shiner
Squid	<u>Loligo pealei</u>	
Tautog	<u>Tautoga onitis</u>	blackfish
Toadfish	<u>Opsanus tau</u>	
Tomcod	<u>Microgadus tomcod</u>	frostfish (fall, winter)
Trigger fish	<u>Balistes carolinensis</u>	
Tuna, bluefin	<u>Thunnus thynnus</u>	
Weakfish	<u>Cynoscion regalis</u>	sqqueteague, sea trout

*Bigelow & Schroeder, 1953.

**American Fisheries Society, 1970.

Table 4. Characteristics of Anglers, February 1978 through January 1979

Variable	Resident	Non-Resident	All Fishermen
Fish caught per hour (CPUE)*	1.17	1.25	1.20
Age	39.2	40.9	39.9
Marine recreational fishing experience (years)	19.7	17.4	18.7
Household income	\$17,800	\$19,600	\$18,600
One-way distance traveled (miles)	15.3	51.1	30.9
Out-of-pocket cost per trip	\$5.97	\$12.96	\$9.01

*Catch per unit of effort.

Table 5. Success Rates of Sportsfishermen: Percentage Distribution of Fishermen Catching 0 to 4 Fish per Hour by Place of Fishing

Place Where Fish Caught	NO NO Fish	More Than 0, Less Than 2	2 to Less Than 4	4 and Over
Man-made structure	65-70	15-20	4	6
Shore	70	15-18	6-8	3-4
Private boat	50	35	6-8	4-6
Party/charter boat	35	51	9	5

Fishing in different places not only influences the number of fish an angler can expect to catch; it also determines the species caught. For example, most of the cod are caught from private boats or party boats, since this is by and large an offshore or ocean fishery. Most mackerel were caught from man-made structures, as fishermen seeking mackerel tend to choose this place. In general, however, the private boat fishery accounts for most of the total catch of each species, and for most of the trips taken. In fact, the private boat sector accounted for 50% of the recreational trips taken by Rhode Island resident anglers (Table 6) and 78.5% of the total catch (for the species listed in Table 6). In light of these numbers, the substantial investment some fishermen make in boats is not surprising.

Differences among places are also reflected in the fishermen's or anglers' characteristics (Table 7). The party boat fisherman travels farther, is younger, has less experience, more income, and spends more than fishermen in the other places. In a sense, he is paying for the experience of the party boat captain.

SEASONAL ESTIMATES

Sportfishing in Rhode Island is a highly seasonal form of recreation. When the year is divided into six two-month periods, this seasonality can be clearly demonstrated. From Table 8, for example, during the four-month period December to March, total trips are about 3% of their level during the four-month period June to September. Despite this seasonality, Rhode Island residents predominate over the entire year. The distribution of trips by residency is shown in Table 9 and in Table 10 (distribution by season and by place of fishing). The relatively low proportion of Rhode Island residents in the December-January sample is probably not indicative of true populations but a result of the small sample size (total of 45 persons, all areas).

While the distance traveled to the fishing place on the launching spot has been shown as one of the characteristics of the fishermen, the costs of this travel have not been taken into consideration. Using a conservative estimate of nine cents per mile travel costs, one can find the estimate of total transportation costs for residents and non-residents. These estimates are made from the distance-traveled figures of Table 4, and the number of trips of Table 10. They are presented in Table 11.

Table 12 was generated by using the seasonal trip totals for residents and non-residents from Table 10 and assigning an estimated cost per trip for residents of \$5.97 and \$12.96 for non-residents (both figures from Table 4) to arrive at estimated seasonal out-of-pocket trip costs for the groups. To these totals have been added the transportation cost estimates for each of the two groups from Table 11. The total direct outlay on fishing trips for fishing is between \$18 to \$19 million. This figure is not the total spending by anglers because it does not include annual investment in tackle, boats, or other expenses paid for fishing purposes but not paid on fishing trips. Nor can this figure be used as a measure of the economic value of marine sportfishing. The concepts of cost and value are often confused. If people allocate their money wisely, then the value they receive for an expenditure would be equal to or greater than the cost of it. Economists frequently measure value through studies of people's willingness to pay. That was done in the present study, but the results will be reported elsewhere.

Table 6. Total Catch of Certain Finfish Species (Numbers of Fish) and Total Trips by Place of Fishing, R.I. Residents, February 1978 through January 1979

Species, Catch	Fixed Structure	Shore	Private Boat	Party/Charter Boat	Total
Cod	255	113	27,139	32,260	59,767
Winter flounder	75,710	174,350	472,160	522	654,542
Tautog	29,140	51,507	349,274	647	430,568
Summer flounder	2,393	1,232	44,294	-	47,919
Mackerel	70,845	11,123	32,258	-	114,226
Striped bass	407	2,815	41,854	-	45,076
Weakfish	169	2,238	4,571	-	6,978
Scup	47,700	57,880	731,944	1,489	839,013
Bluefish	4,399	38,344	331,652	20,013	394,408
Total catch	231,018	339,602	2,035,146	54,931	2,592,497
Total trips	92,359	249,192	370,013	16,174	733,805

Table 7. Anglers' Characteristics by Place of Fishing, February 1978 through January 1979

	Fixed Structure	Shore	Private Boat	Party/Charter Boat
Rhode Island Anglers				
One-way distance traveled (miles)	18.3	13.6	14.9	31.7
Age	37.4	38.9	40.1	35.1
Cost per trip	\$2.28	\$2.21	\$8.64	\$23.91
Marine recreational fishing experience (years)	17.6	18.8	21.0	17.1
Household income	\$15,600	\$15,500	\$19,800	\$21,300
Fish caught per hour (CPUE)	1.33	0.87	1.35	0.82
Non-Resident Anglers				
One-way distance traveled (miles)	36.7	38.0	47.0	82.7
Age	38.2	42.0	41.4	39.9
Cost per trip	\$2.96	\$4.15	\$16.50	\$30.22
Marine recreational fishing experience (years)	16.2	17.1	18.7	15.6
Household income	\$19,500	\$17,900	\$20,200	\$21,700
Fish caught per hour (CPUE)	1.13	0.64	1.81	1.02

Table 8. Seasonal Catch, All Finfish, and Seasonal Trips, R.I. Resident and Non-Resident Anglers, February 1978 through January 1979

	Feb.- March	Apr.- May	June- July	Aug.- Sept.	Oct.- Nov.	Dec.- Jan.
<u>R.I. Resident Fishermen</u>						
Catch, all finfish	13,829	147,653	1,214,391	1,287,300	454,069	a
Trips	10,418	55,470	284,328	267,898	108,411	7,280
<u>Non-Residents</u>						
Catch, all finfish	21,023	231,018	1,337,423	858,644	277,585	a
Trips	6,299	34,389	233,574	206,258	81,019	7,580
<u>All Fishermen</u>						
Catch, all finfish	34,852	378,671	2,551,814	2,145,944	731,654	a
Trips	16,717	89,859	517,902	474,156	189,430	14,860

a. Not estimated, catch rate not significantly different from zero.

Table 9. Seasonal Distribution of Trips by Residency in R.I. Recreational Saltwater Fishery

Residency	Feb.- Mar.	Apr.- May	June- July	Aug.- Sept.	Oct.- Nov.	Dec.- Jan.
Rhode Island	62	62	55	57	57	49
Connecticut	15	15	19	20	22	44
Massachusetts	12	19	17	14	13	2
New York	6	2	4	5	4	4
Other	5	2	5	5	4	0

Table 10. Estimated Fishing Trips of R.I. Resident and Non-Resident Recreational Marine Fishermen by Season and Place of Fishing*

Residents					
Season	Fixed Structure	Shore	Private Boat	Party/Charter Boat	Seasonal Totals
Feb.-Mar.	4,982	2,265	1,812	1,359	10,118
Apr.-May	10,329	27,353	16,832	956	55,470
June-July	29,463	74,014	175,797	5,054	284,508
Aug.-Sept.	25,425	110,799	124,716	6,958	267,898
Oct.-Nov.	22,160	34,761	49,643	1,847	108,411
Place totals	92,059	249,192	368,800	16,174	726,225
Non-Residents					
Season	Fixed Structure	Shore	Private Boat	Party/Charter Boat	Seasonal Totals
Feb.-Mar.	1,993	503	1,812	2,823	7,131
Apr.-May	6,997	9,959	8,767	26,290	52,013
June-July	29,038	51,753	107,526	16,337	204,654
Aug.-Sept.	21,461	81,351	73,731	23,260	199,803
Oct.-Nov.	14,546	26,388	40,431	13,325	94,690
Place totals	74,035	169,954	232,267	82,035	558,291

*Trips by place of fishing were not estimated for Dec.-Jan., as the extremely small field and telephone samples do not provide for meaningful estimates.

SOME CONCLUSIONS

The size of the marine recreational fishing activity in Rhode Island is impressive. The number of trips per annum (733,000 for residents; 558,000 for non-residents) may have substantial economic impact on local communities around Narragansett Bay.

The marine recreational fishing sector is intricately woven with the ecology and economy of Rhode Island. Fishing could be profoundly affected by disturbances in the ecology of the Bay or surrounding waters. Similarly, fishermen and their activity could affect the ecology as well as the economy of a region.

The distribution of catch across place of fishing and season is quite uneven and has important implications for policy. Almost 80% of all fish are caught from private boats. This proportion holds for most species. About 50% of all trips are taken on private boats. Any attempt to regulate the catch of a particular species must reckon with this distribution. Very little impact on total catch can be achieved by regulating the anglers fishing from shore.

The number of out-of-state anglers who visit Rhode Island to fish is substantial, and may have a large impact on local economies. There were over a half-million trips taken by non-residents during the period of the survey (Tables 2 and 10), with the estimated spending by this group at over \$12 million (Tables 11 and 12).

In conclusion, the recreational marine fishery is large and diverse, with potential for substantial impact. Marine sportfishing provides a large number of people a valuable recreational opportunity, and it is likely to increase. The fishing activity was costly to survey and, because of its diversity, probably would be exceedingly costly to regulate. If regulation is biased toward the non-resident fisherman, substantial income to the state could be lost.

Table 11. Estimated Travel Costs of R.I. Resident and Non-Resident Marine Sportfishermen to the Fishing Grounds

	Resident	Non-Resident	Total Costs
Number of trips	726,225*	558,291*	-
Round-trip distance traveled (miles)	30.6**	102.2**	-
Cost per trip (@ 9¢/mile)	\$2.75	\$9.20	-
Total travel costs (number of trips x cost per trip)	\$1,997,119	\$5,136,277	\$7,133,396

* From Table 2.

** From Table 4.

Table 12. Estimated Out-of-Pocket and Travel Costs by Season, R.I. Resident and Non-Resident Marine Sportfishermen

Season	Out-of-Pocket Costs		
	R. I. Resident	Non-Resident	Seasonal Totals
Feb.-Mar.	\$ 60,404	\$ 92,418	\$ 152,822
Apr.-May	331,156	674,088	1,005,244
June-July	1,698,513	2,652,316	4,350,829
Aug.-Sept.	1,599,351	2,589,447	4,188,798
Oct.-Nov.	647,214	1,227,182	1,874,396
Totals	\$4,336,638	\$7,235,451	\$11,572,089
Travel costs	1,997,149	5,136,277	7,133,396
Grand totals	\$6,333,757	\$12,371,728	\$18,705,485

Note: Number of trips, costs, and costs per trips are from Table 4, travel costs from Table 11.

APPENDIX

The sampling approach used here to gather sportfishing data is new and relatively untested, but it is designed to deal with the particular problems of sportfishing. It is, in part, based on sampling research sponsored by NMFS, and is designed, in part, to test this research with a large sampling effort.

Following the 1970 Salt Water Angling Survey (SWAS), the need for improvements in the collection of marine recreational fishing statistics was recognized. The major shortcomings perceived in the SWAS were response-biased due to an inability of the respondents to recall catch accurately beyond a period of one or two months and the inability of the anglers to identify species correctly. In response, the NMFS funded a number of studies which examined alternative ways of data collection, including the door-to-door interviewing technique and the telephone interview method. They also looked at the ability of fishermen to recall catch and effort over time, concluding that the maximum recall period for plausible trip information was 60 days. The final report recommended that a dual-frame approach be used, which involves two concurrent but independent sample surveys. The first is an on-site intercept survey. Recreational fishermen are contacted at the fishing site by trained interviewers and asked questions pertaining to the current or just completed fishing trip. Information collected includes the type of fishery, state and country of residency, frequency of participation in saltwater fishing, trip length, and observations on simple economic variables. The interviewer then examines the fisherman's catch, identifies, measures, and weighs the fish available, and collects information on fish caught but not available for identification. The data collected in this field survey can be used to estimate central tendencies of the fishing trip; i.e., mean trip length, mean catch rates, and the like.

The second survey is a random sample of households taken by telephone. Telephone numbers are generated randomly for an area and fishing households are identified. If the household responds that at least one member has participated in saltwater fishing in the last 60 days, detailed information is collected, including data on each finfish and shellfish trip taken by each fisherman residing in the household.

The telephone survey allows one to estimate, for the area sampled, participation rates and trips per participating household for various types of fishing for a 60-day period. Given the number of households from the U.S. Bureau of Census and the participation rates and trips per household, one can estimate the number of trips taken in an area over this period.

These results, when integrated with the field survey, allow one to calculate total catch, total effort, total weight of a species, etc., by multiplying the appropriate total trips by the corresponding mean.*

Procedures for the Field Survey

The basic survey design is a stratified random sample. The primary sampling unit of the field survey is the fishing trip. Trips are distributed unevenly according to season, time of day, and type of fishing area.

Because of the expected variation in costs of sampling and in catch rates, the following strata were defined:

- 1) six seasons (two-month periods)
- 2) four places of fishing
 - a) man-made structures (bridges, jetties, piers)
 - b) shore
 - c) private boats
 - d) party and charter boats
- 3) five regions, based on distance from the University of Rhode Island
- 4) two times a week: weekend vs. weekday
- 5) three times of day: morning, midday, evening
- 6) three types of expected site use: heavy, medium, or light.

Using the sample design decided upon, the interviewers were given assignments and told the sites to sample and the time period for

*For example, to calculate total catch of all finfish, regardless of species, for private boat recreational fishing in the months of June and July, one would multiply the total trips taken by recreational boat fishermen by the mean catch rate per trip for all species for boat fishermen; i.e., number of trips x fish per trip = total catch.

sampling. Fishermen were interviewed either upon completion of the fishing trip or during the trip. The interview was divided into four sections. The first was concerned with residency, time spent fishing, one-way distance traveled to the fishing site, and the non-travel expenditures of the trip. The second involved species sought, and then, for that species, the number of trips taken annually, the mean catch rate, the mean cost, and some gaming questions relating to declining catch rates and increasing costs which allowed the investigators to estimate willingness to pay for the right to fish. The third section collected data on striped bass and bluefish participation, and costs and catch rates for all fishermen regardless of what species they were seeking. This section was included so that substitution relationships between the two species might be evaluated. The fourth section collected socioeconomic information such as number of years of saltwater fishing experience, age, family size, number of saltwater anglers in the family, family income, and weekly leisure time. Finally, the interviewer identified, weighed, and measured the catch, and ascertained if there were other fish caught which were not in the creel and which were not returned to the water alive. If this were the case, the fisherman was asked to list the species and numbers of each. The total of these available and unavailable fish is fishing mortality.

A total of 5,441 marine recreational anglers were interviewed fishing in Rhode Island waters between February 1, 1978, and January 31, 1979. Of these, 2,960, or 54%, were Rhode Island residents (Table A1). The numbers of interviews made by mode are listed in Table A2.

Table A1. Recreational Finfishers Contacted by Field Survey, 1978-79

Season	R.I. Residents	Non- Residents	Total
Feb.-Mar.	84	53	137
Apr.-May	392	247	639
June-July	886	822	1,708
Aug.-Sept.	761	651	1,412
Oct.-Nov.	815	688	1,503
Dec.-Jan.	23	24	47
Total	2,961	2,485	5,441

Table A2. Field Survey: Number of Interviews by Place of Fishing and by Season

Season	Number of Interviews by Place of Fishing					Totals
	Man-Made Structure	Shore	Private Boat	Charter/ Party Boat	Other	
Feb.-Mar.	63	33	2	40	-	138
Apr.-May	260	266	73	57	1	657
June-July	689	661	166	182	9	1,707
Aug.-Sept.	485	522	253	152	10	1,412
Oct.-Nov.	482	723	176	115	3	1,499
Dec.-Jan.	10	4	8	24	1	47

The Telephone Survey

The second survey in the dual-frame sampling methodology is the telephone survey. The field survey previously outlined allows us to estimate means associated with the primary sampling unit, fishing trips (for example, the mean catch rate for a particular place of fishing in a particular season) or means associated with fishermen (for example, mean family income of non-Rhode Island anglers fishing on party boats). Since the primary sampling unit is the trip, it is necessary to count trips in order to estimate totals such as total catch for a species.

Recreational fishing participation rates for households in Rhode Island were estimated from a telephone survey which contacted 9,108 households. Of these, 647 households had members who had made at least one saltwater fishing trip in the last 60 days. Table A3 shows the number of calls, households contacted, and fishing households by two-month periods. Results of the two surveys were combined* to produce estimates of total catch and total effort.

*Methods of combination are discussed in a technical paper to be published at a later date.

Table A3. Telephone Survey: Calls, Households Contacted, and Fishing Households

Season	Calls	Households Contacted	2-Month Fishing Households	Households Contacted as % Total
Feb.-Mar.	1,959	935	10	10
Apr.-May	3,055	1,605	77	18
June-July	4,551	2,123	215	23
Aug.-Sept.	4,710	2,413	249	26
Oct.-Nov.	3,037	1,526	89	17
Dec.-Jan.	1,020	506	7	6
Totals	18,322	9,108	647	-

Seasons and Place of Fishing

Table A4 shows the distribution of the sample by residency, season, and place of fishing.

Table A4. Fishermen Interviewed in Field Survey, R.I. Residents and Non-Residents, by Season and Place of Fishing

Rhode Island Residents					
Season	Fixed Structure	Shore	Private Boat	Party/Charter Boat	Seasonal Totals
Feb.-Mar.	45	27	1	13	86
Apr.-May	155	195	48	2	400
June-July	347	389	103	43	882
Aug.-Sept.	263	301	159	35	758
Oct.-Nov.	291	411	97	14	813
Dec.-Jan.	9	3	5	5	22
Totals	1,110	1,326	413	112	2,961

Non-Residents					
Season	Fixed Structure	Shore	Private Boat	Party/Charter Boat	Seasonal Totals
Feb.-Mar.	18	6	1	27	52
Apr.-May	105	71	25	55	256
June-July	342	272	63	139	816
Aug.-Sept.	222	221	94	117	654
Oct.-Nov.	191	312	79	101	683
Dec.-Jan.	1	1	3	19	24
Totals	879	883	265	458	2,485