

MARINE RECREATIONAL FISHING IN RHODE ISLAND
APRIL AND MAY, 1978

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NOAA/Sea Grant
University of Rhode Island
Marine Memorandum 56



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I. INTRODUCTION

This paper is the second progress report on a study of marine recreational fishing in Rhode Island. The study is supported by the Sea Grant program at the University of Rhode Island and the National Marine Fisheries Service. The purpose of the study is to measure the economic and biological significance of marine recreational fishing in Rhode Island and to test methods of gathering sportfishing data.

The study, which runs from February 1, 1978, to January 31, 1979, is composed of two independent surveys. The first, the field survey, intercepts fishermen in Rhode Island waters. For the field survey, interviewers weigh and measure fish caught by fishermen, and ask the fishermen a variety of social and economic questions. The field survey is being managed at the University of Rhode Island. The other part of the survey, the telephone survey, makes calls to a random sample of Rhode Island households. This telephone survey determines participation in saltwater fishing by Rhode Island households, and number and place of fishing trips by households that fish. The telephone survey is being managed under contract to Human Sciences Research, Inc., of McLean, Virginia. A complete description of the methodology of both surveys will be forthcoming in a separate report. By combining the results of the two surveys, we can estimate the total impact of marine recreational fishing in Rhode Island.

The purpose of this report is to provide descriptive statistics of marine recreational fishing from data gathered in April and May. Two types of statistics are presented. First are aggregate measures of sportfishing catch and effort for Rhode Island. Second are descriptive measures of representative marine sportfishermen in Rhode Island in April and May.

Appendix A gives formulas for parameter estimation and expansion and Appendix B gives revised estimates for the February-March period.

II CATCH AND EFFORT ESTIMATES

The results for April and May are based on field interviews of 639 fishermen; 392 from Rhode Island and 247 from other states. The telephone survey, conducted from May 25 to June 3, contacted 1,605 households. Seventy-seven of these households had participated in marine finfishing in Rhode Island in April and May. The 77 households made 259 saltwater finfishing trips in Rhode Island during the two-month period.

Provisional estimates of catch and effort for Rhode Island fishermen in Rhode Island marine waters are presented in Table 1. Appendix A provides a description of the estimation procedures and Appendix B presents similar estimates for February and March. The participation rate indicates that 4.8% of the sampled households had at least one finfishing trip in Rhode Island during April and May. This is over four times the rate of participation in the February-March period. The mean trips per participating household is estimated at 3.36, an increase of 30% over the mean trips per participating household in February-March (see Table B1, Appendix B). Total participating households are estimated at 14,728, 4.8% of the 307,000 households in Rhode Island (U.S. Bureau of Census, 1975). The total trips estimate is the product of trips per household (3.36) and the total participating households (14,728) or 49,531, a nearly five-fold increase over total trips in February-March. This increase can be attributed to more hospitable weather, longer days, and an increased availability of winter flounder. The mean catch rate per trip is estimated at 2.98, about an 80% increase over the catch per trip of February-March. The product of the

catch per trip and total trips yields an estimate of the total number of fish caught in April-May; 147,653. This is more than ten times the estimate for February-March.

TABLE 1
CATCH AND EFFORT STATISTICS FOR FINFISHING IN RHODE ISLAND
BY RHODE ISLAND HOUSEHOLDS
APRIL AND MAY, 1978^a

Variable	Estimated Value	Standard Error	95% Confidence Interval	
Participation Rate (p)	.0480	.0053	.038	.058
Trips per Participating Households (t)	3.36	.4482	2.48	4.24
Total Participating Households ^b (P)	14,728	1,638	11,519	17,938
Total Trips (T)	49,531	8,656	32,566	66,497
Catch per Trip Numbers of Fish (x)	2.9810	.3125	2.3685	3.5935
Total Catch Numbers of Fish (X)	147,653	29,968	88,916 ^c	206,391 ^c

^aBased on telephone sample of 1,605 households and a field sample of 392 Rhode Island fishermen.

^bBased on an estimate of 307,000 households in Rhode Island in 1975 (U.S. Bureau of Census).

^c95% confidence assuming that the product of two normally distributed variables is approximately normally distributed for large sample sizes.

The sampling reliability of the estimates can be judged by the 95% confidence intervals, the last two columns of Table 1. The relative variation implied by the confidence intervals has been reduced when compared with February-March data. The April-May confidence intervals appear relatively tight. For example, 97.5% of such sampling schemes would give estimates of total catch of more than 88,000 fish and total trips of more than 32,000. There appear to be no order of magnitude sampling errors.

Species Caught

During April and May, Rhode Island fishermen caught 15 different species. They were cod, tomcod, winter flounder, tautog, white perch, cunner, mackerel, spiny dogfish, American eel, silver hake, pollock, ocean pout, summer flounder, and bluefish. The principal species were winter flounder, cod, and tautog. Estimates of catch per trip, weight per fish, and total numbers and weight for these three species are given in Table 2. The catch rate per species is estimated by dividing the total number of fish caught by the total number of fishermen intercepted. This procedure explains why the catch rate for cod decreased from .233 fish per trip in February-March to .133 per trip in April-May. In February-March, cod tended to be the primary species sought, especially on headboats. In April-May, fishing trips were more diversified, and more species were sought. Despite the drop in the catch rate for cod, the total catch (in kilograms) increased from 6,166 to 19,896 because of the substantial increase in fishing trips. The catch rate for winter flounder increased from 1.38 to 2.59, as fishermen increased their shorefishing. The total weight of winter flounder landed increased about 16-fold to 84,633 kilograms. Almost 14 metric tons (13,997 kilograms) of tautog were landed in April-May. Tautog was not caught in February-March.

The sampling variability for individual species is naturally greater than for all species aggregated. In particular, for cod the 95% confidence intervals for the catch rate, total weight, and total numbers include zero. The variability in the catch rate causes the wide confidence intervals. This variability will be greatly reduced when we expand annual estimates on the basis of mode of fishing.

TABLE 2
 CATCH BY SPECIES FOR RHODE ISLAND FISHERMEN IN
 RHODE ISLAND MARINE WATERS
 APRIL AND MAY, 1978

Variable	Estimated Value	Standard Error	95% Confidence Interval	
-----WINTER FLOUNDER-----				
Fish per Trip	2.585	.302	1.993	3.177
Mean Weight per Fish, kg. (n=381)	.661	.020	.622	.700
Total Catch:				
Weight, kg.	84,633	17,887	49,576	119,691 ^a
Numbers	128,039	26,793	75,524	180,553 ^a
-----COD-----				
Fish per Trip	.133	.074	-.011	.277
Mean Weight per Fish, kg. (n=227)	3.027	.087	2.857	3.198
Total Catch:				
Weight, kg.	19,896	11,404	-2,455	42,247 ^a
Numbers	6,573	3,764	-805	13,950 ^a
-----TAUTOG-----				
Fish per Trip	.174	.039	.098	.250
Mean Weight per Fish, kg. (n=73)	1.625	.080	1.468	1.782
Total Catch:				
Weight, kg.	13,997	3,990	6,176	21,818 ^a
Numbers	8,613	2,422	3,867	13,360 ^a

^a95% confidence interval assuming that the product of two normally distributed variables is approximately normally distributed for large samples.

Variations in Catch Rates by Mode of Fishing

The sampling effort for April and May was intensive enough to permit estimates of catch rates by mode. Table 3 presents mean numbers of fish caught per hour by mode, along with standard errors of the means and number of fishermen sampled. The variation in mean catch rates among fishing modes is substantial. Fishermen in private boats have the most success, while fishing from fixed structures is least successful. Perhaps more revealing than the mean catch per hour figures is the distribution of catch rates by mode among fishermen. The histograms in Figure 1 reveal how much the distribution of the catch per hour varies among modes. For shore and fixed structure fishing, over 60% of the fishermen catch fewer than one-half fish per hour. In fact, most of those 60% caught none. In contrast, the percentage of non-successful fishermen for party and private boats is much lower. Thus, the probability of catching at least one fish is greater on a boat, and highest of all on party boats. On the other hand, chances for very high catch rates (greater than one fish per hour) occur on private boats. These figures are in part a reflection of target species—private boats tend to pursue game fish such as striped bass, which are highly mobile and dispersed and hence have a greater range of possible catch outcomes, while party boats tend to go after groundfish, a somewhat more evenly distributed group. These figures also show the value of going on party boats. It is the best mode to choose if one wants to be as certain as possible of catching a fish.

TABLE 3
FISH CAUGHT PER HOUR, BY MODE

Mode	Mean	Standard Error	Number of Fishermen Interviewed
Fixed Structure ^a	.60	.09	255
Shore	.69	.10	255
Private Boats	1.92	.42	72
Party Boats	.94	.10	56

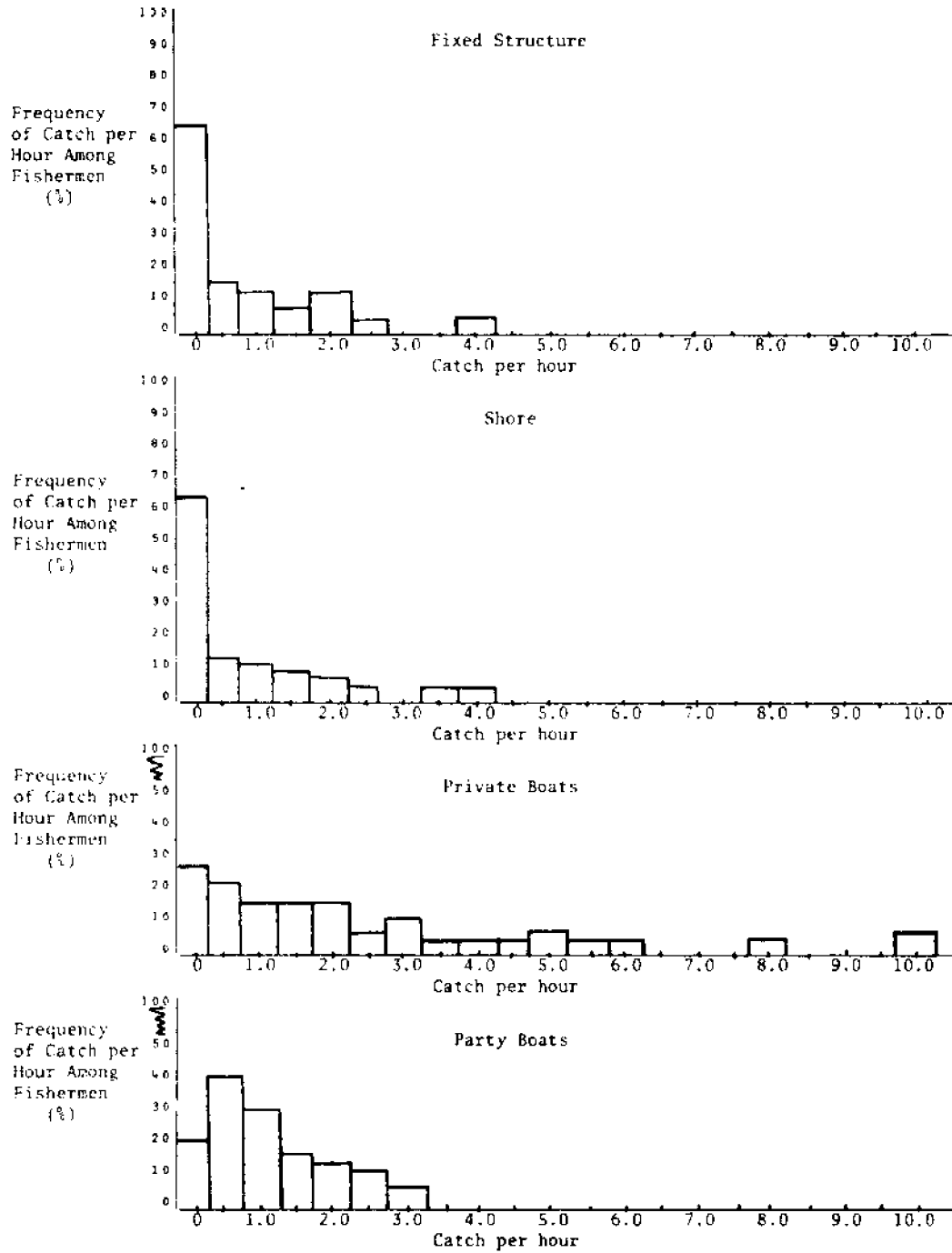
^aFixed structures are bridges, piers, jetties, breachways, and other immovable, man-made structures.

III. DESCRIPTIVE STATISTICS FOR FISHERMEN

The estimated means of characteristics of fishermen intercepted in the field survey give a picture of the representative fishermen in Rhode Island. These means are presented for residents of Rhode Island and out-of-state persons in Tables 5 and 6. Naturally, out-of-state fishermen travel further. They also tend to spend more, and they appear to have slightly higher incomes. The measures of catch per unit effort (fish caught per hour) are quite similar for both groups. The typical fisherman catches less than one fish per hour. The catch per hour for out-of-state fishermen is .849 and for Rhode Island fishermen .787, but the difference is not statistically significant.

Using Tables 1 and 3, we can gain some appreciation of the economic impact of recreational fishing. Average expenditures by Rhode Island fishermen only, excluding travel, were \$2.81 per trip. Rhode Islanders took an estimated 49,531 trips. A crude estimate of the economic impact of Rhode Island sport fishermen on the Rhode Island economy during April and May is their total expenditures, \$139,000. This measure is a crude, conservative measure of the economic impact of recreational fishing. It

Figure 1
DISTRIBUTION OF FISH CAUGHT PER HOUR BY MODE



excludes the impact of out-of-state fishermen and it is not related to the economic value of recreational fishing.

TABLE 5
RHODE ISLAND SALTWATER FISHERMEN IN RHODE ISLAND WATERS
APRIL AND MAY, 1978

Variable	Mean	Standard Error
One-way Distance Traveled per Trip (miles)	17.7	.72
Age	39.5	.88
Cost per Trip	\$2.81	.14
Years Fished	19.5	.81
Household Income	\$14,400	50
Fish Caught per Hour	.787	.094

TABLE 6
OUT-OF-STATE SALTWATER FISHERMEN IN RHODE ISLAND WATERS
APRIL AND MAY, 1978

Variable	Mean	Standard Error
One-way Distance Traveled per Trip (miles)	66.4	5.8
Age	38.1	1.0
Cost per Trip	\$11.11	1.1
Years Fished	16.4	.93
Household Income	\$16,800	700
Fish Caught per Hour	.849	.119

Figure 2 gives the distribution of fishermen by state of residence. Rhode Island is known for its fine saltwater fishing, so it is not surprising, even in the early months of April and May, that almost 40% of the fishermen are from out-of-state. This proportion may become larger for the period June through August.

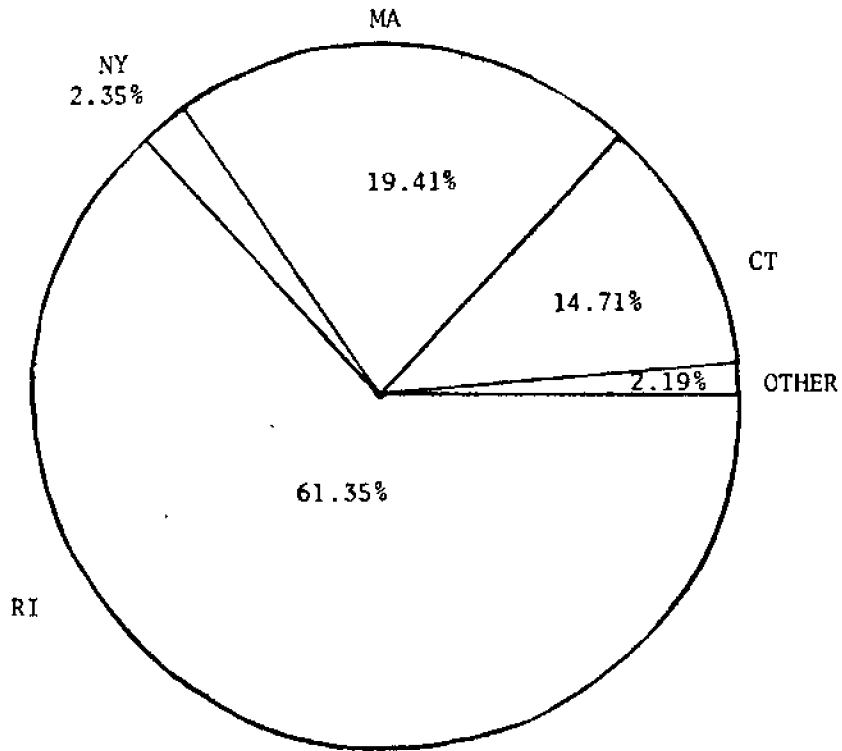


Figure 2. Distribution of Fishermen by State of Residence

IV. CONCLUSION

This report has presented catch and effort estimates for recreational fishing in Rhode Island during April and May, 1978. The estimates show a substantial increase in fishing activity over the two months of February and March. This report will be followed by estimates for other periods and by annual estimates, as well as analyses of the sampling methodology and economics of marine recreational fishing.

References

- Goodman, Leo. "On the Exact Variance of Products." Journal of the American Statistical Association (December, 1960), 708-713.
- Human Sciences Research. 1978. "A Telephone Survey in Rhode Island to Collect Marine Recreational Fishing Statistics in 1978-1979." Progress Report No. 2, June 1978.
- U.S. Department of Commerce, Bureau of the Census. 1977. Population Estimates and Projections. Series P-25, No. 687.

APPENDIX A

DEFINITIONS AND COMPUTING PROCEDURES

1. Participation Rate:

p = participation rate = proportion of Rhode Island households having at least one finfishing trip in previous two months; estimated directly from telephone survey.

$p = n_2/n_1$ where n_2 is the number of participating households and n_1 is the number of households contacted.

Variance of Participation Rate:

$$V(p) = \frac{P(1-P)}{n_1}$$

where $n_1 = 1605$ = number of households contacted on phone survey.

[$V(\cdot)$ notation denotes variance of (\cdot)]

2. Trips per Participating Households:

T_s = total trips from phone survey.

$t = T_s/n_2$ mean trips per participating household.

Variance of Trips per Participating Households:

$$V(t) = s^2/(n_2-1)$$

where $n_2 = 77$ = number of participating households, and

s = standard deviation of trips per participating household, computed from phone survey.

3. Total Number of Participating Households:

P = total number of participating households in Rhode Island = Hp

where H is number of households in Rhode Island, as given by census data.

Variance of Total Participating Households:

$$V(P) = V(Hp) = H^2V(p).$$

4. Total Trips by Rhode Island Households:

T = total trips = Ht_a , where $t_a = T_s/n_1$ = mean trips per household, including non-participating households.

Variance of Total Trips by Rhode Island Households:

$$V(T) = V(H \cdot t_a) = H^2V(t_a).$$

5. Total Catch in Numbers of Fish, by Rhode Island Households:

Total Catch, in numbers = $X = (\text{catch per trip}) (\text{total trips}) = xT$

where x = mean catch per trip by Rhode Island fishermen;
estimated from field survey.

Sample Variance of Total Catch (see Goodman, 1960):

$$V(X) = V(xT) = T^2V(x) + x^2V(T) - V(x)V(T)$$

assuming T and x to be distributed independently.

6. Total Catch in Weight of Fish, by Rhode Island Households:

Total Catch, in weight = $W = (\text{weight of catch per trip}) (\text{total trips}) = wT$

where w = mean weight of catch per trip by Rhode Island households; estimated from field survey.

Variance of Total Weight (see Goodman, 1960):

$$V(W) = V(wT) = T^2V(w) + w^2V(T) - V(w)V(T)$$

assuming x and T to be distributed independently.

For calculating number and weight of catch by species, the mean number of catch for species i (x_i) and the mean weight of catch for species i (w_i) are substituted for x and w , respectively.

APPENDIX B

This appendix gives catch and effort measures for marine recreational fishing in Rhode Island for February and March, 1978. These measures are revised from our original progress report for two reasons. First, our estimate of the mean trips per household has been reduced from 3.2 to 2.6. The new estimate results from reading trip data directly from the files provided by Human Sciences Research. Second, we have used slightly different estimating procedures for computing the variance of a product.

TABLE B1

CATCH AND EFFORT STATISTICS FOR FINFISHING IN RHODE ISLAND
BY RHODE ISLAND HOUSEHOLDS, FEBRUARY AND MARCH, 1978

Variable	Estimated Value	Standard Error	95% Confidence Interval	
Participation Rate (p)	.011	.003	.004	.017
Trips per Participating Households (t)	2.60	.498	1.624	3.576
Total Participating Households (P)	2383	1033	1259	5,308
Total Trips (T)	8537	3115	2431	14,643
Catch per Trip Numbers of Fish(x)	1.62	.286	1.059	2.181
Total Catch Numbers of Fish (X)	13,829	5,535	2,981 ^a	24,678 ^a

^a95% confidence interval assuming that the product of two normally distributed variables is approximately normally distributed for large samples.

TABLE B2

CATCH BY SPECIES FOR RHODE ISLAND FISHERMEN IN
RHODE ISLAND MARINE WATERS
FEBRUARY AND MARCH, 1978

Variable	Estimated Value	Standard Error	95% Confidence Interval	
-----WINTER FLOUNDER-----				
Fish per Trip	1.38	.283	.825	1.93
Mean Weight, kg. (n=61)	.454	.036	.382	.526
Total Catch:				
Weight, kg.	5,349	2,236	9,732 ^a	965 ^a
Numbers	11,781	4,852	21,291 ^a	2,271 ^a
-----COD-----				
Fish per Trip	.233	.088	.061	.405
Mean Weight, kg. (n=16)	3.10	.279	2.553	3.647
Total Catch:				
Weight, kg.	6,166	3,155	-16 ^a	12,349 ^a
Numbers	1,989	1,006	17 ^a	3,961 ^a

^a95% confidence interval based on the assumption that the product of two normally distributed variables is approximately normally distributed for large sample sizes.