United States Marine Recreational Fisheries, 1986

Introduction

The National Marine Fisheries Service initiated a series of surveys in 1979 to obtain estimates of participation, catch, and effort by recreational fishermen in the marine waters of the United States. This effort implements the first priority of the NMFS Marine Recreational Fisheries Policy which was established in 1981, namely, the development on a regular and continuing basis of a comprehensive marine recreational fisheries data acquisition and analysis system. The Marine Recreational Fishery Statistics Surveys (MRFSS) have included the use of commercial contractors to perform data collection and processing tasks.

This article[1] covers the MRFSS activities on the Pacific, Atlantic, and Gulf coasts from January through December 1986. The results of the 1979-85 surveys were previously published in the Current Fisheries Statistics publications 8322, 8323, 8324, 8325, 8326, 8327, and 8328.

Data on commercial fisheries have long been collected by the NMFS and its predecessor agencies. However, data on marine recreational fisheries have been collected on a systematic or continuing basis. The purpose of the MRFSS is to establish a reliable data base for estimating the impact of marine recreational fishing on marine resources. The information required for fishery management and development purposes includes size of catch by species, by subregion, by area, and by mode of fishing. For example, the MRFSS helps meet the goals of the Magnuson Fishery Conservation and Management Act of 1976 (MFCMA—Public Law 94-265). The MFCMA mandated a national program for management of fishery resources in the Exclusive Economic Zone (3-200 miles), and requires that the fishery management plans developed consider recreational as well as commercial fisheries and their harvests.

The surveys reported here reflect trip and catch data acquired during 1986, and present a brief summary of the survey findings and results.

These limited data are only a summary of those available from the MRFSS data base. Depending on sample size, catch estimates for individual species at the state, mode, area, and wave levels may be available. Estimates of number of trips and participants are also available at similar levels of detail. Other data available in a variety of formats include catch rates, lengths, weights and site descriptions. Inquiries for additional information should be directed to the NMFS National Fishery Statistics Program, F/RE1, Washington, DC 20235.

Overall Atlantic and Gulf Results

The total number of fish caught in 1986 along the Atlantic and Gulf coasts was estimated at 411.2 million fish (Table 1). This was slightly higher than the 1979-85 average catch of 387.5 million fish. About 37 percent of the total catch was released alive in 1986. However, the percentage of live releases varied considerably among the subregions with 43 percent being released alive in the Gulf of Mexico subregion, 36 percent in the Middle Atlantic, 35 percent in the South Atlantic, and 25 percent in the North Atlantic subregion. Overall, the total Atlantic and Gulf estimates are very consistent with previous survey years.

The 1986 catch did show some significant changes from 1979 to 1985 in the total number of fish caught in some important species groups. Black sea bass and scup catches in 1986 were more than double the 1979-85 average catches, while winter flounder catches in 1986 were less than half of the 1979-85 levels. Bluefish, spot, Atlantic croaker, summer flounder, winter flounder, spotted seatrout and black sea bass remained the most frequently caught species. Bluefish, which ranked either first or second in number caught in 1979-85, was ranked third after black sea bass and Atlantic croaker in 1986.

Over 80 percent of the catch in number of fish was taken in inland waters (e.g., rivers, sounds, bays) or in the ocean within 3 miles of shore in 1986. About 16 percent of the catch was taken in waters >3 miles from shore. The remaining portion of the catch could not be identified by area. The proportion of the 1986 catch in number taken in waters >3 miles from shore varied from 7 percent in the South Atlantic to 21 percent in the North Atlantic.

The private/rental boat mode accounted for the highest percentage of the catch in number for all subregions combined in 1986 with 62 percent. All subregions except for the South Atlantic (31 percent) had private/rental boat catches representing over 60 percent of the total catch.

The average weight of a fish, estimated from the Type A catch (those available for identification) for all subregions combined, was 0.67 kg (1.48 pounds) in 1986. The average weight of fish sampled ranged from 0.57 kg in the Mid-Atlantic subregion to 0.96 kg in the North Atlantic subregion.

Thirty-six percent of the 1986 catch by

[1]This article is taken from Current Fishery Statistics 8392 and 8393, prepared under the supervision of Mark C. Holliday. Past and present MRFSS personnel involved in the survey design, survey implementation, and analysis of data include David G. Deuel, Ronald J. Essig, Mark C. Holliday, W. Malon Scogin, and John F. Witzig.

Table 1.—Estimated total number of fish caught by Atlantic and Gulf coast marine recreational fishermen by species group and subregion, Jan.-Dec. 1986.

Species group	Catch in thousands[1] N. Atl.	Mid Atl.	S Atl.	Gulf	All reg.	Species group	Catch in thousands[1] N. Atl.	Mid Atl.	S Atl.	Gulf	All reg.
01 Sharks	33	1,141	452	695	2,322	41 Spotted seatrout	*	179	1,958	21,455	23,592
02. Sharks, dogfish	410	1,563	179	–	2,172	42. Weakfish	–	11,106	1,204	*	12,322
03. Skates/rays	521	409	306	404	1,639	43. Sand seatrout	*	*	*	6,404	6,404
04. Eels	42	285	–	54	410	44. Silver perch	*	–	154	298	465
05. Herrings	701	1,085	5,068	4,148	11,002	45. Spot	*	15,738	5,761	142	21,640
06. Freshwater catfishes	*	695	94	938	1,727	46. Kingfishes	*	656	3,271	4,102	8,029
07. Saltwater catfishes	*	–	3,033	15,331	18,368	47. Atlantic croaker	*	12,988	6,088	14,912	33,989
08. Toadfishes	–	2,705	559	200	3,464	48. Black drum	*	34	403	1,430	1,867
09. Atlantic cod	1,493	56	*	*	1,549	49. Red drum	*	57	553	3,513	4,123
10. Atlantic tomcod	349	–	*	*	355	50. Drums	*	36	237	1,281	1,554
11 Pollock	436	–	*	*	446	51 Mullets	*	46	1,713	4,582	6,341
12. Silver hake		160	*	*	168	52. Barracudas	*	–	253	221	477
13. Searobins	834	10,908	75	41	11,858	53. Tautog	4,179	4,996	–	*	9,186
14. Sculpins	318	–	*	*	323	54. Cunner	1,321	1,383	*	*	2,703
15. White perch	–	3,978	144	*	4,125	55. Little tunny/Atl. bonito	563	54	655	523	1,795
16. Striped bass	683	706	–	–	1,429	56. Atlantic mackerel	1,238	4,642	*	*	5,879
17. Black sea bass	981	30,257	1,677	1,824	34,739	57. King mackerel	*	–	592	147	753
18. Groupers	*	*	156	2,227	2,383	58. Spanish mackerel	*	–	1,066	7,914	8,987
19. Sea basses	*	–	138	1,152	1,300	59. Tunas/mackerels	33	534	150	209	927
20. Bluefish	10,646	18,379	3,101	541	32,667	60. Summer flounder	4,305	18,394	1,484	*	24,183
21 Jack crevalle	*	*	2,566	761	3,328	61. Gulf flounder	*	*	*	502	502
22. Blue runner	*	*	2,671	687	3,358	62. Southern flounder	*	–	441	2,568	3,021
23. Greater amberjack	*	37	123	282	442	63. Winter flounder	5,411	5,016	*	*	10,428
24. Florida pompano	*	–	1,830	253	2,099	64. Flounders	55	828	*	1,539	2,422
25. Jacks	*	148	747	1,815	2,710	65. Triggerfishes/filefishes	–	60	158	231	452
26. Dolphins	*	37	603	614	1,254	66. Puffers	–	391	378	227	1,000
27. Gray snapper	*	*	529	1,561	2,090	67 Other fishes	505	2,930	2,100	10,663	16,199
28. Red snapper	*	*	210	645	855						
29. Lane snapper	*	*	45	174	218	Totals	56,654	163,670	59,047	131,865	411,235
30. Vermilion snapper	*	*	56	303	359						
31 Yellowtail snapper	*	*	278	302	580						
32. Snappers	*	*	134	199	334						
33. Pigfish	*	104	338	1,011	1,453						
34. White Grunt	*	*	698	992	1,690						
35. Grunts	*	–	1,036	2,279	3,320						
36. Scup	21,567	10,794	*	*	32,361						
37. Pinfish	*	–	2,547	7,325	9,882						
38. Sheepshead	*	31	839	1,852	2,722						
39. Red porgy	*	*	–	255	269						
40. Porgies	*	–	134	88	225						

[1]An asterisk (*) denotes none reported; a dash denotes less than thirty thousand reported, though the figure is included in row and column totals.

weight, estimated from the Type A catch, for all subregions combined was from the EEZ. The percentage catch by weight in the EEZ was highest in the South Atlantic (45 percent), followed by the Middle Atlantic (41 percent), the North Atlantic (31 percent), and the Gulf (26 percent).

About 7.7 million anglers made 45.9 million fishing trips within their home state during 1986. Out-of-state anglers contributed an additional 15.7 million trips. The majority of all fishing trips within a state were made by coastal county residents of the same state. However, out-of-state anglers made more fishing trips than resident fishermen in Delaware. Residents of all 50 states were intercepted on either the Atlantic or Gulf coast in 1986.

The Middle Atlantic subregion accounted for the greatest number of fishing trips and participation by residents in 1986 with one-third of the Atlantic and Gulf coast total. This differs from 1985 when the Gulf subregion had the highest average number of trips and participants. However, the exclusion of Texas and South Atlantic and Gulf party-boat trips in 1986 may account for the differences between 1986 and previous years. The North Atlantic subregion had the fewest trips and participants for all 8 years of the survey. The private/rental boat mode accounted for the highest percentage of the fishing effort in 1986 in the North Atlantic and Middle Atlantic subregions. Most of the 1986 fishing effort in the South Atlantic and Gulf was in the shore mode.

Angler success, as measured by the average number of fish caught, was highest for the private/rental boat mode in the North Atlantic and Gulf subregions in 1986. Catch per trip was highest from the party/charter boat mode in the Middle Atlantic and from the shore mode in the South Atlantic. Overall, more than 70 percent of the anglers fishing in party/charter and private/rental boat modes were successful in catching one or more fish; about 50 percent of those fishing

the shore mode were successful in catching fish. The success rates for the private/rental boat mode in the Gulf subregion was the highest of all reported in 1986.

The coefficient of variation for the total number of fish caught in 1986 was 3 percent. At the 95 percent confidence level the actual total catch was between 389.9 and 432.6 million fish. Ninety percent of the species groups had coefficients of variation less than 30 percent. The lowest species group coefficients of variation were 7 percent for bluefish and spotted seatrout, and 8 percent for spot, red drum, and summer flounder.

Length-frequency histograms for selected species in 1986 were similar to 1983-85. A bimodal distribution was observed for bluefish, with a major peak at 450 mm and a secondary peak at 750 mm. This bimodal distribution is most likely the result of differences in the size of fish caught among fishing modes and areas. The length-frequency data for each species are highly aggregated in these plots so differences among subregions, modes, areas, and waves are masked. The regional nature of the recreational fishery is characterized by the varying composition of the catches. Therefore, the following discussion will focus on the significant changes in the catches of specific groups in the individual subregions.

North Atlantic

Scup and bluefish dominated the marine recreational fishery in the North Atlantic during 1986, as they did in 1979-85. These two species accounted for over 57 percent of the total catch in numbers in the subregion. Other frequently caught species in 1986 were summer flounder, tautog, Atlantic cod, cunner, and Atlantic mackerel. Catches of winter flounder, the top-ranked species in 1979-82 and 1985, were the lowest in the 8 years of the survey.

The private/rental boat catch from inland waters accounted for the largest proportion of the total number of fish caught in 1986 (36 percent). The private/rental boat mode alone accounted for 73 percent of the total number of fish caught. This was higher than the 1979-85 average private/rental boat mode contribution of 61 percent. In 1986 the inland area accounted for the greatest proportion of the catch in number with 44 percent. This was similar to 1979-82 and 1985, when the inland area accounted for the greatest proportion of the catch.

About 1.3 million New England residents participated in marine recreational fishing in the North Atlantic and made an estimated 5.8 million fishing trips in 1986. These effort statistics were similar to the 1979-85 means of 1.3 million participants and 5.7 million trips. Fishing activity was greatest during the July/August wave in 1986; about 8 percent of the coastal county residents of the North Atlantic States participated in marine recreational fishing during these months. Out-of-state residents made an additional 2.5 million fishing trips in this subregion.

Average catch rates for the boat fishing modes in 1986 were higher than 1979-85 mean values, while the shore mode in 1986 was lower than 1979-85 mean values for the combined man-made and beach/bank modes. The private/rental boat mode had the highest average catch rate with 8.1 fish/trip and the shore mode had the lowest catch rate with 2.3 fish/trip.

As in all previous survey years except 1980, bluefish was the most sought species in 1986. In 1986, winter flounder was ranked second, and Atlantic cod was ranked third. Since intercept interviews are conducted at the completion of a fishing trip, there may be some response bias introduced that correlates the species sought with what was actually caught.

The coefficient of variation for the total catch in number of fish was 7 percent in 1986. Based on the standard error of the estimate, the actual total catch in number of fish was between 49.0 and 64.3 million fish in 1986 at the 95 percent confidence level. Although the precision of the catch estimates for individual species groups varied greatly, 65 percent of the species groups had coefficients of variation less than 30 percent. The lowest coefficients of variation were 13 percent for scup and 16 percent for bluefish.

Middle Atlantic

Black sea bass, summer flounder, bluefish, and spot composed 50 percent of the total catch in number in the Middle Atlantic in 1986. These same species were major components of the 1979-85 catches. The catch of black sea bass was considerably higher in 1986 than in 1979-85, while the estimated catch of winter flounder was significantly lower in 1986.

The private/rental boat catch from inland waters accounted for the greatest percentage of the total number of fish caught in the subregion in 1986 with 38 percent. The private/rental boat mode alone accounted for about 63 percent of the total number of fish caught. The 1979-85 average percentage of catch from the private/rental boat mode was 57 percent. Seventy-four percent of the marine recreational catch in number in 1986 was from inland waters or within 3 miles of shore.

About 2.5 million residents of the Middle Atlantic States participated in marine recreational fishing during 1986. Coastal residents made about 72 percent of the marine fishing trips. Residents of the subregion made an estimated 15.3 million marine fishing trips in 1986; an additional 5.2 million trips were made by out-of-state residents. Fishing activity was greatest in the July/August wave with about 8 percent of the sampled residents of the coastal counties participating in the fishery. Catch rates in all fishing modes in 1986 were higher than the 1979-85 average catch rates. The average catch rate was highest for party/charter boat mode with 13.6 fish/trip.

As in previous years summer flounder and bluefish were the most sought individual species in 1986 with about 31 percent of the respondents indicating a preference for one of the species. No other species accounted for more than 10 percent of the responses during 1986.

The coefficient of variation for total number of fish caught in 1986 was 5 percent. At the 95 percent confidence level the actual total catch was between 147.0 and 180.4 million fish. Species groups with coefficients of variation less than 10 percent were bluefish (7 percent), summer flounder (8 percent), and spot (9 percent).

South Atlantic

No species group clearly dominated the recreational fishery in the South Atlantic during 1986. Atlantic croaker, spot, and herrings were the most abun-

dant species caught in 1986 and accounted for about 29 percent of the total catch.

Anglers fishing in the shore mode took about 67 percent of the recreational catch in 1986. Seven percent of the total number of fish was taken in the ocean greater than 3 miles from shore area. Part of the percent change in catches among the modes is attributable to the exclusion of the party boat catch from the 1986 survey. Average catch rates in 1986 were similar to those in 1979-85. Catch rates were highest in the shore mode with an average of 4.3 fish/trip and lowest in the charter boat mode with an average of 3.2 fish/trip.

An estimated 1.7 million residents of the South Atlantic States participated in the marine recreational fishery in 1986. The estimated participation was lower than the 1979-85 average of 2.1 million South Atlantic resident fisherman and may be attributed to exclusion of party boats from the sample frame. Coastal residents made about 77 percent of the estimated 14.8 million trips in 1986. Fishing activity was greatest in the September/October wave with about 11 percent of the coastal population of the subregion participating in the fishery. Over 7 percent of all households surveyed reported marine recreational fishing activity during each wave.

As in 1983-85, four of the five most highly sought species were spotted seatrout, bluefish, red drum, and king mackerel. Dolphins were added to the most-sought list in 1986. The coefficient of variation for the total number of fish caught during 1986 was 5 percent. The actual total catch was 53.0 to 65.1 million fish at the 95 percent confidence level.

Gulf of Mexico

Forty-one percent of the total marine recreational catch in the Gulf of Mexico in 1986 consisted of various members of the Sciaenid family (i.e., drums, seatrouts, croakers) an increase from 34 percent of the total catch in 1985. Spotted seatrout was the most commonly caught species with 16 percent of the total catch. Other commonly caught species groups were saltwater catfishes, Atlantic croaker, Spanish mackerel, sand seatrout, and pinfish. The exclusion of Texas and party boat sampling in the Gulf subregion in 1986 may account for several apparent changes in Gulf of Mexico results. In the 1985 MRFSS, Texas accounted for 24.8 million fish caught on 7.3 million trips by 1.8 million participants. The exclusion of party boats, many of which target reef fish, may contribute to the changes in species sought for the subregion.

The private/rental boat-ocean 3 mile or less mode-area combination accounted for the largest proportion (40 percent) of the catch in 1986. About 71 percent of the total number of fish was taken by anglers in the private/rental boat mode. Fourteen percent of the total number of fish was taken in the ocean greater than 3 miles from shore. Average catch rates increased in 1986 from the 1985 rates for all modes. The private/rental boat mode had the highest catch rate (14.5 fish/trip). The shore mode had the lowest catch rate (4.0 fish/trip).

An estimated 2.2 million residents of the Gulf states participated in marine recreational fishing during 1986. Over 8 percent of the households contacted in the telephone survey reported marine fishing activity in all waves of 1986. Spotted seatrout and red drum were the most highly sought species in 1986 as in 1983-85.

These two species represented 34 percent of the responses to species sought. As in the South Atlantic, the diversity of species sought was much higher than the North Atlantic and Middle Atlantic subregions. The coefficient of variation for the total number of fish caught was 3 percent in 1986. The actual total catch in number of fish was between 122.8 and 140.9 million fish at 95 percent confidence level.

Overall Pacific Coast Results

Combined MRFSS and state survey estimates of total Pacific landings were approximately 32 million fish in 1986. This estimate includes the salmon catch for the Pacific coast. These combined estimates were about 5 percent greater than the MRFSS estimates in 1986. The total Pacific coast catch of salmon was about 1.2 million fish in 1986, a 23 percent increase from 1985 and a 50 percent increase from 1984. The salmon catch in 1986 was about 27 percent lower than the 1983 catch.

The effect of adding state survey data to MRFSS estimates varied by state. In California where salmon catches were the lowest of the three Pacific coast states, there was little impact on the total number of fish caught. Estimated numbers of fish caught in Oregon increased significantly (32 percent) with the addition of state data. Most of the increase in Oregon was attributable to the salmon catch and the by-catch of black rockfish in the salmon fishery. Salmon catches increased the estimate in Washington by 15 percent in 1986.

For 1986, the MRFSS estimated that 55 million fish were caught by marine anglers on the Pacific coast (Table 2), compared with 43 million fish in 1985 and 47 million in 1984. As in the previous 5 years the most commonly caught species in 1986 was Pacific mackerel. The contribution of the rockfishes to the total catch in numbers dropped from 26 percent in 1985 to 18 percent in 1986. The rockfishes, however, remained the most frequently caught family by number in 1986.

About 44 percent of the total Pacific catch by number was released alive in 1986, an increase of 5 percent from 1985. Fifty-six percent of the fish caught in Southern California were released alive compared with 29 percent in Northern California, 34 percent in Oregon, and 14 percent in Washington. As in previous years, the ocean within 3 miles of shore accounted for the majority of the Pacific catch by number (56 percent). Historically, catch in number by fishing mode has fluctuated considerably among years. However, 1986 was very similar to 1985.

The party/charter and private/rental boat modes accounted for 73 percent of the total catch in 1986, compared with 75 percent in 1985. The share of the total catch attributable to the private/rental boat mode (43 percent) and the party/charter boat mode (30 percent) did not change significantly from 1985. Catch from the shore mode made up the remainder of the catch.

During 1986, the smelt, sea bass, surfperch, and the sculpin families each accounted for 10 percent or more of the

Table 2.—Estimated total number of fish caught by west coast marine recreational fishermen by species group and subregion, Jan.-Dec. 1986.

Species group	Catch in thousands[1] S. California	N. California	Oreg.	Wash.	All regions
01 Spiny dogfish	104	–	*	461	577
02. Sharks, other	145	758	*	*	903
03. Sturgeons	*	74	–	–	92
04. Pacific herring	–	277	–	171	482
05. Northern anchovy	*	37	–	–	40
06. Surf smelt	*	1,556	120	3,669	5,345
07. Smelts, other	*	–	–	567	578
08. Pacific cod	*	*	*	136	136
09. Pacific tomcod	*	–	–	55	68
10. Walleye pollock	*	*	*	158	158
11 Pacific hake	–	61	*	–	104
12. Silversides	236	–	–	*	239
13. Jacksmelt	207	146	–	*	356
14. Striped bass	*	75	*	*	75
15. Kelp bass	4,500	–	*	*	4,502
16. Spotted sand bass	604	*	*	*	604
17. Barred sand bass	2,270	*	*	*	2,270
18. Sea basses, other	1,141	*	*	*	1,141
19. Yellowtail	–	*	*	*	–
20. White croaker	2,117	738	*	*	2,855
21 California corbina	60	*	*	*	60
22. Queenfish	551	*	*	*	551
23. Croakers, other	312	–	*	*	312
24. Opaleye	113	*	*	*	113
25. Halfmoon	291	*	*	*	291
26. Shiner perch	74	206	46	62	388
27. Striped seaperch	–	117	44	30	200
28. Black perch	–	41	*	*	67
29. Walleye surfperch	171	55	32	–	261
30. Silver surfperch	101	34	–	–	150
31 White seaperch	–	86	–	*	94
32. Pile perch	–	286	80	48	432
33. Redtail surfperch	*	61	110	53	224
34. Barred surfperch	538	178	*	*	716
35. Surfperches, other	207	383	72	110	771
36. Pacific barracuda	1,160	*	*	*	1,160
37. California sheephead	204	*	*	*	204
38. Pacific bonito	3,970	–	*	*	3,970
39. Chub mackerel	7,086	79	*	*	7,165
40. Tunas	57	–	*	*	67

Species group	Catch in thousands[1] S. California	N. California	Oreg.	Wash.	All regions
41 Brown rockfish	158	216	*	–	392
42. Copper rockfish	165	76	–	95	337
43. Widow rockfish	122	42	–	–	165
44. Yellowtail rockfish	218	296	–	–	534
45. Chilipepper rockfish	189	363	*	*	552
46. Quillback rockfish	*	–	–	83	95
47 Black rockfish	36	465	319	81	902
48. Blue rockfish	559	327	50	–	945
49. Bocaccio	677	191	–	–	868
50. Canary rockfish	125	276	–	–	426
51 Greenspotted rockfish	225	102	*	*	327
52. Olive rockfish	197	66	*	*	263
53. Gopher rockfish	439	71	*	*	511
54. California scorpionfish	307	*	*	*	307
55. Rockfishes, other	2,387	933	35	210	3,566
56. Sablefish	–	37	–	–	52
57. Kelp greenling	–	137	89	45	281
58. Lingcod	169	264	46	58	536
59. Greenlings, other	*	78	–	–	117
60. Cabezon	113	93	–	–	231
61 Sculpins, other	81	1,127	387	370	1,964
62. Sanddabs	269	236	*	100	605
63. California halibut	1,339	–	*	*	1,349
64. Rock sole	–	–	*	52	62
65. Starry flounder	–	32	–	–	59
66. Flatfishes, other	53	57	–	140	251
67 Other fish	1,180	433	155	112	1,880
Totals	35,334	11,227	1,754	6,998	55,312

[1]An asterisk (*) denotes none reported. A dash denotes less than 30,000 reported. However, the figure is included in row and column totals.

total number of fish caught in the inland area. The rockfish family accounted for less than 4 percent of the total catch in numbers during 1986 in the inland area.

The rockfishes made up about 19 percent of the total number of fish caught in the ocean within 3 miles of shore during 1986 compared with 25 percent in 1985. As in 1985, Pacific mackerel was the most abundant species caught during the year in this area. The sea basses, tunas, and mackerels group, and the sciaenids each constituted more than 10 percent of the total catch in the inshore ocean area during 1986.

During 1986, about 35 percent of the total number of fish caught in the ocean >3 miles from shore consisted of various species of the rockfish family, a decrease from 48 percent in 1985. The tunas and mackerels accounted for about 32 percent of the total recreational catch in the offshore area during 1986 with Pacific mackerel accounting for 22 percent of the total catch.

Surf smelt dominated the shore catch with 36 percent of the total catch within the mode in 1986. No other species accounted for more than 5 percent of the catch within the mode. Pacific mackerel was the most abundant species caught in the party/charter and private/rental boat modes. Pacific bonito, white croaker, barred sand bass, and kelp bass each accounted for more than 5 percent of the total catch in the boat modes.

It was not possible to estimate the total number of distinct participants in the Pacific coast marine recreational fishery in 1986 with the MRFSS method because an individual can fish in more than one state. A Californian fishing in Oregon would be double-counted if included as a California resident participant and an out-of-state participant in Oregon. Estimates were made on a subregion basis only. In 1986 southern California had the most fishermen, followed by northern California, Washington, and Oregon.

About 11.0 million trips were taken by Pacific coast fishermen in 1986, an increase from 9.9 million trips in 1985 and 10.1 million trips in 1984. Over 88 percent of these trips were taken by coastal

residents, while noncoastal residents took about 4 percent and out-of-state residents took 7 percent of the trips. Forty-five percent of all fishing trips on the Pacific coast in 1986 were in the private/rental boat mode, 15 percent in the party/charter boat mode, and 40 percent in the shore mode.

The coefficient of variation for the catch estimate of all species combined on the Pacific coast was 3 percent in 1986. This coefficient was similar to the coefficients of variation of 2-4 percent reported for 1980 through 1985. Based on the standard error the total catch in 1986 in numbers of fish was between 52.2 million and 58.5 million fish at the 95 percent confidence limit. Length frequency histograms for selected species in 1986 were virtually identical to those for previous years. Since the length frequency data for each species are highly aggregate in these plots, differences among subregions, modes, areas, and waves are masked.

Southern California

Pacific mackerel accounted for 20 percent of the total catch in numbers in this subregion during 1986. Other species accounting for more than 10 percent of the total catch were kelp bass (13 percent) and Pacific bonito (11 percent). As in the previous 6 years, Pacific mackerel was the most commonly caught species. Barred sand bass and white croaker each accounted for more than 5 percent of the total catch in numbers in 1986.

The rockfish complex accounted for 27 percent of the weight of the catch available for identification in 1986 compared to 34 percent in 1985. Pacific mackerel, barred sand bass, kelp bass and Pacific bonito accounted for 36 percent of the total weight of the identified catch. Overall, about 56 percent of the total catch in number was released alive. The proportion of the fish released alive varied considerably among species groups with over 90 percent of all California halibut caught being released alive to less than 10 percent of the catch of some species of rockfish being released.

About 88 percent of the total catch in number in 1986 was taken from boat modes, about the same proportion as in 1983-85. In 1986 the private/rental and party/charter modes accounted for 48 percent and 40 percent, respectively, of total catch in number for the subregion. In 1986, the May/June wave provided the highest percentage of the catch by number. July/August had the highest proportion of the total catch in the previous 3 years. About 21 percent of the total catch in number were caught during this period.

An estimated 1.4 million southern California residents participated in marine recreational fishing in the subregion in 1986 compared to 994,000 in 1985 and 1.2 million in 1983-1984. Northern California residents fishing in southern California were considered out-of-state residents for the purpose of estimating participation. Therefore, it is not possible to estimate total participants for California because of potential double-counting.

As in the previous 6 years of the survey, almost 90 percent of the trips in this subregion in 1986 were taken by southern California coastal county residents. About 6.1 million trips were made in the subregion in 1986, an increase from the 1985 estimate of 5.3 million trips. Fishing trips in southern California accounted for the largest proportion of the total number of trips taken on the Pacific coast (55 percent).

Anglers targeted a wide variety of species in 1986 with only California halibut being targeted by more than 5 percent of the anglers interviewed. Since the intercept interviews were conducted at the completion of a fishing trip, there is probably some response bias introduced that correlates the species sought response with what was actually caught. In addition, a prestige bias may also be present if respondents gain satisfaction by responding they were seeking highly desirable species.

As in 1983-85, the party/charter mode had the highest catch rates in 1986, with an average of 9.7 fish per trip. The private/rental mode averaged 6.5 fish per trip in 1986, compared with the 1983-85 average of 5.3 fish per trip. Catch rates for the shore mode averaged 1.9 fish per trip. Over 95 percent of fishermen intercepted in 1986 in the southern California subregion were residents of California. Residents of 43 of the 50 United States were intercepted in southern California.

The coefficient of variation for the total number of fish caught was 3 percent in 1986. This value was similar to the coefficients of variation of 2 to 3 percent reported in 1980 through 1985. The actual total catch in number of fish in 1985 was between 33.4 and 37.2 million fish at the 95 percent confidence level. This estimate is significantly higher than the 1985 estimate of 27.6 million fish. The precision of the catch estimate varied among species groups. Coefficients of variation ranged from 7 percent for barred sand bass to 34 percent for widow rockfish.

Northern California

As in the previous 3 years, surf smelt was the leading species in number of fish caught in northern California in 1986 accounting for 14 percent of the total catch in number. The only other individual species to account for more than 5 percent of the total catch was white croaker. The rockfishes composed 30 percent of the total number of fish caught in the subregion in 1986 compared to 36 percent in 1985. Lingcod was the top ranked single species by weight of catch (available for identification) in 1986 (15 percent). The rockfish family accounted for approximately 44 percent by weight of the catch during 1986.

The proportion of the total catch in the subregion attributable to a particular mode and area has fluctuated considerably over the 8 years of the survey. The private/rental-ocean 3 miles or less from shore combination accounted for the most fish in 1986 (25 percent). Twenty percent of the total catch in number was taken in the shore-ocean <3 miles combination. The boat modes accounted for about 60 percent of the total catch in the subregion in 1986, about the same proportion as in 1985. The shore mode accounted for 40 percent of the total number of fish caught in 1986. As in previous years, catch by number was highest in the summer. Peak catch by number was in the July/August wave with about 32 percent of the total catch being taken in this 2-month period.

An estimated 632,000 northern California residents went saltwater fishing in the subregion in 1986 compared with

725,000 in 1985. The 1986 estimate is comparable to the estimated participation for the subregion for 1980 through 1984. About 90 percent of the total number of anglers in the subregion were northern California residents. Four percent of all households contacted in the telephone portion of the survey indicated some saltwater fishing activity during the year. About 2.8 million fishing trips were taken in the subregion in 1986, a slight increase from the 2.5 million trips taken in 1985. Overall, trips in northern California composed 25 percent of the Pacific coast total. No single species was targeted by more than 10 percent of the anglers intercepted in the survey. The rockfish and surfperch families were targeted by more than 10 percent of the anglers interviewed.

The party/charter boat mode had the highest catch rates per trip (with an average of 8.6 fish per trip). Catch rates in the other two modes were less than half the catch rate in party/charter boat mode. Eighty-seven percent of the intercepted fishermen in the northern California subregion were residents of northern California. Less than 3 percent of the fishermen intercepted in the subregion were not residents of California. Highly avid fishermen are over-represented in the totals because the probability of being interviewed in the intercept survey is directly proportional to the number of trips taken by an individual.

The estimated total catch for the northern California subregion was 10.1-12.4 million fish in 1986 at the 95 percent confidence level. The 1986 estimate is not significantly different from the 1985 estimate of 10.5 million fish. The coefficient of variation for the total number of fish caught in the northern California subregion was 5 percent. This error rate is comparable to the error rates reported for 1981 through 1985. Coefficients of variation ranged from 10 percent for "other rockfishes" to 64 percent for white seaperch.

Oregon

An estimated 1.8 million fish were caught in Oregon during 1986 compared with 1.9 million fish in 1985. This catch represented 3 percent of the total west coast catch. The estimated total recreational catch in numbers had decreased annually from 3.2 million fish in 1981 to 1.2 million fish in 1984. The 1986 and 1985 fishing years may mark the reversal of this downward trend in catch. As in previous years no single species dominated the catch during 1986. However, black rockfish accounted for 18 percent of the total catch during the year and surf smelt, redtail surfperch, kelp greenling, and other sculpins each accounted for more than 5 percent of the total 1986 catch. Black rockfish accounted for the largest proportion of the estimated total weight of the catch (available for identification) in Oregon during 1986 (26 percent). This species was also dominant by weight during the previous 5 years.

Shore-based anglers accounted for the largest proportion of the catch in the state in 1986 (57 percent). The inland area accounted for 61 percent of total catch in numbers during the year. The ocean area <3 miles from shore accounted for 37 percent of the total catch and the offshore area (>3 miles from shore) accounted for about 1 percent of the total catch in the subregion.

Catch in number has varied seasonally among years. In 1986 the summer waves accounted for the greatest proportion of the total catch with 27 percent of the catch being taken in May/June and 24 percent in July/August. Peak catches by weight occurred during September/October. About 277,000 Oregon residents fished in the State during 1986 compared with 210,000 Oregon participants in 1985. Estimated participation by Oregon residents in 1986 was comparable to participation in the previous 2 years, however participation by state residents was considerably less than estimates for 1980 through 1983. Oregon residents comprised 91 percent of the anglers in the State in 1986.

About 960,000 fishing trips were taken in Oregon in 1986 compared with an estimated 765,000 fishing trips made during 1985 and 595,000 trips in 1984. The 1986 estimate is comparable to the peak activity years of 1981-83 which averaged 970,000 trips. Over 86 percent of the respondents to the species sought questions in Oregon in 1986 indicated either "other fish", or "surfperches, other." No single species accounted for more than 5 percent of the responses.

As in 1983-85, the party/charter boat mode accounted for the highest catch rate per trip in 1986 with an average of 3.4 fish per trip. Shore anglers caught 2.6 fish per trip and anglers in the private/rental boat mode averaged 1.3 fish per trip. The estimated total catch for Oregon was 1.6 to 1.9 million fish in 1986 at the 95 percent confidence level. The 1986 estimate is comparable to the estimated catch for the state in 1985. The coefficient of variation for the total number of fish caught in Oregon was 4 percent in 1986. The coefficients of variation ranged from 10 percent for kelp greenling to 34 percent for blue rockfish.

Washington

Total Washington catch in number was estimated at 7.0 million fish in 1986, more than double the estimated 1985 catch of 3.1 million fish. Surf smelt accounted for 52 percent of the total catch in 1986. No single species accounted for more than 5 percent of the remaining catch. As in Oregon the estimated total catch in Washington had been declining since 1981 when an estimated 9.0 million fish were caught; 1986 may be a turning point in the recreational catch in the state.

Black rockfish, lingcod, and walleye pollock combined accounted for 31 percent of the catch by weight in 1986 compared with 40 percent in 1985, 35 percent in 1984, and 50 percent in 1983 for these same species. About 77 percent of the Washington catch by number was made in the inland area in 1986. Shore based anglers accounted for the greatest proportion of the total catch in 1986 (75 percent). The private/rental boat mode contributed 22 percent of the catch in 1986 compared with 59 percent in 1985 and 48 percent in 1984. The large surf smelt catch in 1986 was taken entirely in the shore mode, and thus these proportions are skewed towards the shore mode. As in the previous 3 years, the July/August wave accounted for the greatest catch by number in 1986 (38 percent). Catch by weight also peaked in July/August.

An estimated 280,000 residents of Washington made 1.1 million fishing

trips in 1986. These figures are not significantly different from the 1985 estimates of 286,000 resident participants and 1.3 million fishing trips. Out-of-state residents made an additional 67,000 trips in 1986. The majority of all marine fishing trips taken in Washington were made in the private/rental boat mode (61 percent). Over 76 percent of the fishermen interviewed in Washington responded that they sought "other fish" or "none." No single species accounted for more than 5 percent of the responses in 1986. However, this excludes responses from salmon fishermen who were not sampled by the MRFSS.

The estimated total catch for the state was 4.8-9.2 million fish at the 95 percent confidence level. The 1986 estimated catch was significantly higher than the 1985 catch. The coefficient of variation for total number of fish caught was 16 percent in 1986, the highest for any of the Pacific coast subregions. Overall, the Washington coefficient of variation was heavily affected by the variability of the smelt fishery catch. The coefficients of variation ranged from 69 percent for "smelts, other" to 9 percent for spiny dogfish. (Sources: CFS 8392 and 8393.)

New Jersey-D.C. Striped Bass Plans Approved

The Interior and Commerce Departments jointly approved plans by New Jersey and the District of Columbia for managing striped bass, *Morone saxatilis*, in their jurisdictions earlier this year, averting a threatened 1 April 1987 Federal moratorium on striped bass fishing, report agencies for the two departments.

New Jersey and the District of Columbia were informed in February that pending regulations aimed at managing their striped bass populations were not in compliance with the Atlantic States Marine Fisheries Commission's Interstate Fisheries Management Plan. That plan called for the Atlantic states and the District of Columbia to take steps to protect the striped bass spawning stock in an effort to speed recovery of the highly prized fish.

On 24 March, New Jersey amended legislation on striped bass fishing to set a 31-inch minimum size limit until 31 July 1987, increasing to 33 inches until 30 September 1988. Only recreational fishing will be permitted in the state, and fishermen will be allowed to possess no more than five fish at a time.

The District's regulations, which went into effect 27 March, imposed a 24-inch minimum size limit and held fishermen to a two-fish bag limit. The striped bass season will be closed from 1 December to 31 May. Fishing in the District will be limited to recreational fishermen.

In separate letters sent to New Jersey's Governor Thomas H. Kean and to Washington's Mayor Marion Barry, William E. Evans, head of the National Oceanic and Atmospheric Administration's National Marine Fisheries Service, and Frank Dunkle, director of Interior's Fish and Wildlife Service, praised the jurisdictions' responsiveness in adopting striped bass regulations and commended their work "to contribute to cooperative management efforts on striped bass."

Collect Rewards for Albacore Tags Returned

Albacore, *Thunnus alalunga*, tagged with NMFS yellow and red tags are worth cash when properly returned. For each returned yellow tag the NMFS will pay $2.00 and give a baseball cap with a special albacore tagging logo. There is no need to return those fish; just forward the yellow tag to the NMFS address on it.

For red tags, however, the NMFS will purchase the fish at the cannery price and pay a reward of $50.00 for each fish returned with red tag intact. Notify the NMFS, P.O. Box 271, La Jolla, Calif., at telephone (619) 453-2820.

To collect the reward for yellow or red tags you must record where, when, and how the fish was caught, plug the length of the fish (tip of lower jaw to fork of tail). In addition, the American Fishermen's Research Foundation will award cash prizes for yellow and red tag numbers drawn in an annual lottery.

Fishery Agencies Tag 150,000 Atlantic Salmon

In early 1987, the Federal Government tagged about 150,000 small Atlantic salmon with external, "Carlin"-type tags and released them into New England's Connecticut and Penobscot Rivers. About 100,000 tagged, juvenile (or "smolt") salmon were released during early May into Maine's Penobscot River. About 50,000 tagged smolts were released during early April into Massachusetts, Connecticut, and Vermont tributaries to the mainstem.

The Carlin tag is a 5/8-inch long, green or blue-colored, oval-shaped disc that is attached behind the dorsal (top) fin of the 7-9 inch long smolt. Each of these tags has a number on one side and the phrase, "REWARD, NMFS, WOODS HOLE, MA, USA," on the other side.

Although the tags indicate a reward (which is $12), all states in the Connecticut River Basin have made it illegal to keep any Atlantic salmon that has been caught in the river or its tributaries. Maine has made it illegal to keep any Atlantic salmon (whether of sea-run or land-locked variety) less than 14 inches long that has been caught in the state's waters. Therefore, Atlantic salmon bearing these Federal tags are NOT exempt from any applicable state fishing regulations. Consequently, fishermen catching a tagged smolt Atlantic salmon were warmed that they should immediately return the fish to the water unharmed.

The various state regulations that prohibit the harvesting of Atlantic salmon

smolts protect the tagged smolts as they descend to the sea where they can grow, mature, and someday return as large, highly prized gamefish. These regulations also support the purpose of the tagging program to gather needed data on the at-sea habits of adult Atlantic salmon.

The tagging program, a joint effort among the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, and the New England states, attaches Carlin tags to about 150,000 of the million-plus, hatchery-produced smolts which are annually released into New England rivers as part of a long-term effort to restore the region's salmon populations and fisheries. Tag returns provide needed data on the Atlantic salmon's at-sea habits, including migration routes, migration timing, concentration areas, and fishing vulnerability. Such data permit the United States to: Enact better salmon management measures for its territorial waters, and negotiate better salmon management measures for other national and international waters through U.S. membership in the treaty-based North Atlantic Salmon Conservation Organization.

NASCO Further Protects Atlantic Salmon From Interception Fisheries

August 25, 1987 began a series of three dates which will be milestones in the Atlantic salmon conservation movement. On that date and on October 1 and 15, various controls take effect which will—for the first time—largely control salmon "interception" fisheries throughout the species' entire natural range.

Interception fisheries involve the harvesting by one country's fishermen of the salmon produced in another country's rivers, and principally occur in three locations: 1) Off the Faroe Islands (Danish Territory between Iceland and mainland Europe) where mostly European-origin but some North American-origin salmon are caught; 2) off Newfoundland and Labrador where mostly North American-origin salmon but some European-origin salmon are caught; and 3) off West Greenland where significant numbers of both North American- and European-origin salmon are caught.

These comprehensive controls on interception fisheries resulted from the fourth annual meeting of the treaty-based North Atlantic Salmon Conservation Organization (NASCO) held 7-11 June 1987 in Edinburgh, Scotland. At the June meeting, NASCO enacted its first conservation measures for the Faroese fishery and renewed its conservation measures for the Newfoundland-Labrador and West Greenland fisheries, which it first enacted at last year's annual meeting.

For the Faroese fishery, NASCO has agreed to cap the fishery, on a trial basis, at a combined harvest of 3,945,000 pounds for the 1987-88, 1988-89, and 1989-90 fishing seasons, with the harvest in any one season not to exceed 1,380,000 pounds. NASCO will also oversee effort restrictions in the Faroese fishery whose season opened 1 October and ends 31 May. These conservation measures are the first ones enacted by NASCO through its component North-East Atlantic Commission.

At last year's annual meeting, NASCO enacted conservation measures through its other two component Commissions, the North American and the West Greenland. The North American Commission, composed of the United States and Canada, agreed last year to close the commercial salmon fishery off Newfoundland and Labrador on 15 October, instead of the traditional 31 December, due to the high percentage of U.S.-origin salmon being harvested off those Canadian provinces in the fall. The 15 October closure was in effect again in 1987.

The West Greenland Commission, composed of the United States, Canada, Denmark (in respect to its Territory of Greenland), and the European Economic Community, agreed in 1986 to an annual total allowable catch in the West Greenland fishery of 1,875,000 pounds, based on a 1 August opening, which would be in effect for both the 1986 and 1987 fishing seasons. The agreement stipulates that if the opening is changed to a later date, the catch may be increased according to the projected increase in weight of the salmon between 1 August and the later opening. The Home Government of Greenland elected to open the 1987 West Greenland fishery on 25 August with an increased catch of 2,095,000 pounds.

Allen E. Peterson, Jr., one of the three U.S. Commissioners to NASCO and the Director of the National Marine Fisheries Service's Northeast Fisheries Center, lauded NASCO's actions. "The agreement reached by NASCO's North-East Atlantic Commission to regulate salmon harvests completes the cycle within NASCO. In just 4 short years, all three Commissions have taken definitive steps to reduce the harvests by one country's fishermen of the salmon produced in another country's rivers. This will now free the Commissions to address other important issues for which they have responsibility."

Atlantic Salmon Sampled in Canadian, Greenland Commercial Fisheries

U.S. scientists from Maine's Atlantic Sea-Run Salmon Commission and from the NMFS Northeast Fisheries Center were sent to Canada and Greenland during the summer of 1986 to collect data on the Atlantic salmon, *Salmo salar*, fisheries of Labrador and West Greenland. Since those fisheries intercept salmon of both North American and European origin, visiting scientists were granted permission not only to collect biological data, but also to recover tags from the commercial catch to determine the nation of origin of the individual fish in the catch.

For the study of stock composition and

the estimation of the harvest of U.S. salmon in those fisheries, smolts from U.S. hatcheries are now being marked with coded-wire tags prior to their seaward migration. The tags are subsequently detected in adult salmon with a magnetic sensor, then removed from the fish for interpretation. The tags, <1 mm long, contain information on the nation, river, and hatchery of origin. Tags are recaptured beginning 1 year after smolt release; thus the sampling efforts in summer 1986 were able to recover tags implanted in the 1985 smolt class. Sampling this year, summer 1987, will be to recover tags from the 1986 smolt class and the 1985 tags still at large.

Hawaii's Recreational Fishery Worth $200 Million

Money may not buy happiness, but happiness gained through recreational boat fishing is worth a hefty $199 million, according to a recently completed study on noncommercial fishing in Hawaii. That dollar figure excludes the $24 million the anglers spend annually on fishing gear, bait, ice, food, and transportation.

Discussions were held with boat clubs on Oahu, the Big Island, Maui, and Kauai to assess the economic value of Hawaii's recreational fishing, which the study defines as any fishing that is not full-time commercial. Included in the study's assessment are nonmarket goods, such as the joy of fishing. Although nonmarket goods have no monetary value, they can be degraded or enhanced by public and private decisions concerning Hawaii's marine fisheries. Estimating the economic dollar value of nonmarket goods is important in comparing the costs and benefits of fisheries management, development, and enhancement projects. The study was sponsored by the NMFS Southwest Fisheries Center's Honolulu Laboratory.

"This is the first time that the total economic value of recreational fishing has been estimated for Hawaii. The figures show how important the noncommercial fishery is to the people of Hawaii," said Richard S. Shomura, Director of the Honolulu Laboratory. Fishery landings by 6,700 noncommercial fishermen in Hawaii are an estimated 21 million pounds; $22 million is generated annually by the sale of half these fish. By comparison, commercial fish landings were 19.4 million pounds, worth $32 million in 1986, as estimated by the Honolulu Laboratory.

Annually, the average noncommercial fisherman takes 30 fishing trips and catches 1,500 pounds of fish, of which almost half is sold. The rest is kept for personal use, given to friends and family, or used as bait or other purposes. The study revealed that people fish for a variety of reasons, including excitement, relaxation, the chance to be with friends and family, getting fresh fish to eat, and earning extra money.

This study used an experimental technique that combines "contingent valuation" with information developed through "focus groups" of fishing clubs throughout Hawaii. Used increasingly by economists to reveal nonmarket values and estimate the direct expenditures of participants, this technique is still controversial, and the estimates are subject to reevaluation.

Results from a full recreational valuation survey in Hawaii could be useful to planners in making decisions about trade offs between commercial and recreational fishing interests, or between fishing interests and other users of our ocean environment. As an example, the Western Pacific Regional Fishery Management Council's (WPRFMC) interest in reducing foreign tuna fishing in Hawaii's 200-mile extended economic zone might be enhanced by this study's finding that as much as 40 percent of the noncommercial landings in Hawaii are tuna.

The Honolulu Laboratory is now involved in a project to design an ongoing survey of recreational fishing in Hawaii. Funded cooperatively with the WPRFMC, this new project attempts to develop consistent estimates of recreational fish landings as a basis for improving fisheries management in Hawaii. Results of the design study are expected by the year's end, and a State of Hawaii survey based on these results is expected to begin at that time.