

THE RECREATIONAL FISHERY AT PILGRIM SHOREFRONT

Robert P. Lawton, Phillips Brady, Christine Sheehan

Wendell Sides, Elizabeth Kouloheras, Mando Borgatti

and Vincent Malkoski

ABSTRACT

A creel census conducted during 1973-1975 determined fishing effort, catch, and value of the recreational fishery at Pilgrim Nuclear Power Station's Shorefront. An estimated 21,120 angler visits were made and 9,332 fishes caught for a mean catch rate of 0.22 fish per angling hour. Cunner (*Tautogolabrus adspersus*) 37%, bluefish (*Pomatomus saltatrix*) 32%, and pollock (*Pollachius virens*) 13% accounted for 82% of the total catch. Economic value of this fishery was estimated at \$39,000 annually during the study period.

Sportfishing activity increased through the spring, peaked in July or August, and declined in autumn. Highest monthly catch rate occurred in September during two of the three years. Fishing success (catch rate) appeared to be influenced by species availability, anglers' skill, and plant operation. Large numbers of small fishes in the outfall area provided abundant forage for sportfishes. Nevertheless, catch rates were lower than reported from other coastal areas of Massachusetts.

INTRODUCTION

The Shorefront, a specially constructed recreational area near the Pilgrim Nuclear Power Station, provides shore-based marine sportfishing opportunities for the public. Accessibility, seasonal abundance of sportfishes, and ample parking popularized this site in a locale where previously there had been limited opportunity for shore fishing. Pilgrim Shorefront was officially opened to the public in April 1973. From April-November, anglers fish from two effluent canal

jetties and an intake breakwater. A footbridge spans the discharge channel allowing pedestrian passage to the intake breakwater.

A creel census to measure the magnitude of the newly established sport fishery and its economic value involved data collection for three years (1973-1975). Although the study was originally planned for at least one season prior to plant operation, delays in site construction and administrative problems precluded commencement until July of 1973, approximately six months after the station began commercial operation.

METHODS

Data were collected July-November 1973 and April-November 1974 and 1975. We surveyed only shore-based anglers who fished primarily from the two discharge canal jetties and the intake breakwater. No data were collected from boats fishing near the power plant.

Survey days, excluding holidays, were divided into morning and afternoon segments. The mornings commenced at 0600 hours, when the Shorefront opened to the public, and concluded at 1300 hours. The afternoon segment began at 1300 hours and terminated at 1930 hours when the area was closed for the night. The census consisted of four randomly selected half-day segments Monday-Friday, randomly chosen morning and afternoon segments each weekend, and all day on holidays. Results were grouped into three categories: anglers beginning and ending their trip in the morning; those fishing only in the afternoon; and those fishing during both morning and afternoon. The last group was asked to estimate starting time because their fishing usually commenced prior to arrival of the census taker.

Information collected from fishermen included number of anglers per party, hours fished, species sought, and number of each species caught. Fish length measurements were not obtained. Estimates of the number of fishing trips, effort expended, and total catch for each species were calculated separately for weekdays and weekends by extrapolating from respective sample data. Results were combined with holiday totals to provide monthly and yearly totals. The census concluded each year at the end of November, when the Shorefront was closed for the winter.

RESULTS AND DISCUSSION

During the three years of the study, there were an estimated 21,120 angler visits made to Pilgrim Shorefront, 41,405 hours of fishing effort expended, and 9,332 fishes caught for a mean catch rate of 0.22 fish per angler hour (Table 1). At least 15 species were caught (Table 2), with three species: cunner

Table 1. Estimated total angler trips, effort, catch, and mean catch rate at the Pilgrim Shorefront, by month, fishing seasons, 1973-1975.

Month	Number of Fishing trips	Effort (hours)	Catch	Catch rate (fish/hr)
<u>1973</u>				
July	1927	3925	706	0.18
August	1266	2811	126	0.04
September	1032	2353	593	0.25
October	1495	3159	754	0.24
November	181	203	2	0.01
Total	5901	12451	2181	0.17*
<u>1974</u>				
April	596	1297	291	0.22
May	882	1714	197	0.11
June	1265	2671	366	0.14
July	2137	4146	323	0.08
August	2913	5655	1283	0.23
September	1562	3195	1233	0.39
October	703	1146	432	0.38
November	77	82	4	0.05
Total	10135	19906	4129	0.21*
<u>1975</u>				
April	185	325	7	0.02
May	673	1261	193	0.15
June	1096	1958	742	0.38
July	1467	2622	1155	0.44
August	963	1697	545	0.32
September	541	957	337	0.35
October	100	127	43	0.34
November	59	101	0	0.00
Total	5084	9048	3022	0.33*
Grand total (1973-1975)	21120	41405	9332	0.22*

* Averages figured from totals.

(*Tautoglabrus adspersus*) 37%, bluefish (*Pomatomus saltatrix*) 32%, and pollock (*Pollachius virens*) 13% accounting for 82% of the 3-year catch (Table 3). Cunner were angled May-October; adult bluefish, July-October; young-of-the-year (snapper) bluefish, August-September; and pollock, April-October. Fishing effort was similar each year; angler activity increased in the spring and early summer, peaked in July or August, and declined to closing at the end of November. In a statewide survey of marine recreational fishing in 1975, the Massachusetts

Table 2. Catch by species at the Pilgrim Shorefront, fishing seasons, 1973-1975.

Month	Atlantic tomcod	Atlantic cod	Atlantic mackerel	Winter flounder	Pollack	Tautog	Cunner	Striped bass	Bluefish adult	Bluefish snapper	Others*	Total
1973												
July	11	39	46	35	461	23	82	5	4	-	-	706
Aug.	-	5	5	2	41	8	-	3	62	-	-	126
Sept.	-	-	-	-	11	14	-	127	441	-	-	593
Oct.	2	15	-	-	75	24	-	511	127	-	-	754
Nov.	-	-	-	-	-	-	-	2	-	-	-	2
Total	13	59	51	37	588	69	82	648	634	-	-	2181
1974												
April	-	17	-	60	208	-	-	-	-	-	6	291
May	-	24	2	70	90	2	9	-	-	-	4	197
June	2	15	-	70	95	2	178	-	-	-	-	366
July	-	6	-	26	25	12	240	4	8	-	-	323
Aug.	-	1	-	6	8	4	157	3	68	1036	-	1283
Sept.	4	-	-	-	4	4	466	-	615	140	-	1233
Oct.	1	72	-	-	10	4	244	32	69	-	-	432
Nov.	-	4	-	-	-	-	-	-	-	-	-	4
Total	7	139	2	232	440	28	1294	39	760	1176	12	4129
1975												
April	-	7	-	-	-	-	-	-	-	-	-	7
May	3	34	-	23	25	5	78	21	-	-	4	193
June	-	35	-	30	122	6	542	5	2	-	-	742
July	-	10	42	45	24	12	989	3	15	-	15	1155
Aug.	-	-	18	17	11	-	310	-	92	97	-	545
Sept.	-	-	-	-	4	5	128	6	14	180	-	337
Oct.	-	-	-	-	-	3	40	-	-	-	-	43
Nov.	-	-	-	-	-	-	-	-	-	-	-	-
Total	3	86	60	115	186	31	2087	35	123	277	19	3022

* Includes ocean pout, American eel, scup, longhorn sculpin, skate (several species), and northern sea robin.

Division of Marine Fisheries (1977) recorded 15 species caught by anglers in the area from south of Nantasket Beach, Hull, to the east end of the Cape Cod Canal. This survey included our study waters. Species composition was similar in both surveys.

Table 3. Summary of creel survey data by species with estimated catch and percentage of total catch (in parentheses) at the Pilgrim Shorefront, fishing seasons, 1973-1975.

Species	Number of fish by species (percentage of total catch)			
	July - November	April - November		Years
	1973	1974	1975	Combined
Cunner	82 (3.8)	1294 (31.3)	2087 (69.1)	3463 (37.1)
Bluefish (adult)	634 (29.1)	760 (18.4)	123 (4.1)	1517 (16.2)
Bluefish (snapper)	0 (0.0)	1176 (28.5)	277 (9.2)	1453 (15.6)
Pollock	588 (27.0)	440 (10.7)	186 (6.2)	1214 (13.0)
Striped bass	648 (29.7)	39 (0.9)	35 (1.2)	722 (7.7)
Winter flounder	37 (1.7)	232 (5.6)	115 (3.8)	384 (4.1)
Atlantic cod	59 (2.7)	139 (3.4)	86 (2.8)	284 (3.0)
Tautog	69 (3.2)	28 (0.7)	31 (1.0)	128 (1.4)
Atlantic mackerel	51 (2.3)	2 (trace)	60 (2.0)	113 (1.2)
Other*	13 (0.6)	19 (0.5)	22 (0.7)	54 (0.6)
Total number	2181	4129	3022	9332

* Includes Atlantic tomcod, skate (several species), ocean pout, American eel, scup, longhorn sculpin, and northern sea robin.

Bluefish (snapper) = young of the year.

1973 Season

During the abbreviated July-November census period, an estimated 5,901 angler visits occurred at Pilgrim Shorefront and 12,451 hours of effort were expended to catch 2,181 fishes. The average annual catch rate was 0.17 fish per hour (Table 1). Fishing pressure was heaviest in July and lightest in November. Largest monthly catch for all species (754 fish) occurred in October and included 511 striped bass (*Morone saxatilis*) (Table 2). Highest monthly catch rate, 0.25 fish per angling hour, occurred in September and was largely attributable to the number of adult bluefish landed.

Striped bass, bluefish and pollock comprised 86% of the total catch (Table 3). Striped bass were taken every month of the census with a peak in October. Bluefish and pollock were caught during four of the five months with largest catches recorded in September and July, respectively (Table 2).

From mid-September, about 85% of the anglers interviewed indicated a preference for striped bass and/or bluefish. Many anticipated fishing in the vicinity into late autumn; but the plant did not operate in November, and no sustained effort materialized (Table 2).

Species composition of the angler catch was compared with gill net sampling nearby (Lawton et al., page 204), revealing similar seasonal occurrence for several species. Atlantic mackerel (*Scomber scombrus*) were abundant in both programs in July, and Atlantic cod (*Gadus morhua*) and pollock abundance levels both declined in late summer. Bluefish and striped bass appeared most abundantly in September and October, respectively, in both sampling programs. However, certain differences were also noted. Pollock and cunner were seasonally abundant in gill net catches but were lacking in the sportfish catch in November and August-November, respectively. Most anglers were fishing for striped bass and bluefish in the fall and were not likely to catch pollock because of using different fishing techniques. Cunner were generally not considered a desirable species and were often discarded. Tautog (*Tautoga onitis*) were caught by anglers July-October but were not gill netted after early September. The small number of bluefish gill netted in September probably reflected gear selectivity and did not necessarily indicate a lack of abundance in the area.

Mean catch rate of 0.17 fish per angler hour was low in relation to other Massachusetts coastal areas. More than a decade earlier, Fitzpatrick and Russell (1961) reported a mean rate of 0.7 fish per hour as the statewide average for shore-based anglers in Massachusetts. A three-year catch rate for shore-based fishermen in the Cape Cod Canal averaged 0.99 fish per hour (Fairbanks et al. 1971). Mean catch per unit of effort in Salem Harbor in 1973 was 0.83 fish per hour for shore-based fishermen (Anderson et al. 1975).

1974 Season

During this expanded census-year (April-November) there were an estimated 10,135 angler visits to the Shorefront, 19,906 hours of fishing effort, and 4,129 fishes caught. Catch rate averaged 0.21 fish per angling hour (Table 1). Fishing pressure was greatest in August and least in November. Highest monthly catch (1,283 fishes) occurred in August and reflected a large catch of young of the year snapper bluefish (1,036). Highest monthly mean catch-per-hour (0.39) was recorded in September, as in 1973.

Total anglers, effort, and catch increased substantially in 1974 (Table 1). Presumably, increased fishing pressure resulted, in part, from publicity about the 1973 season. In addition to a large catch of snapper bluefish there was a 16-fold increase in landings of cunner, which were more actively sought than in 1973. Catch rate, a convenient statistic for comparing angler success among census years, increased slightly from 0.17 to 0.21 (Table 1).

Bluefish (adults and snappers), cunner, and pollock constituted 89% of total catch (Table 3). Temporal fluctuations in catch of all major species was evident (Table 2) and paralleled, in most instances, that of gill-net collections. As before, disparity between the two "collecting" methods probably reflected, among other things, angler preference and gear selectivity. Pollock and cunner were generally sought only in the absence of bluefish, striped bass, and mackerel.

Adult bluefish were first caught in July with the catch peaking in September (Table 2). None were caught in November despite operation of the power plant and release of heated water. Contrary to expectations, the thermal discharge did not prolong bluefishing.

The major dissimilarity between 1973 and 1974 was that snapper bluefish appeared in the sportfish catch in 1974. They were abundant in the seaward end of the discharge canal in August and September and were readily caught, comprising 47% of the two-month total. However, none were impinged on the intake screens at Pilgrim Station. Young-of-the-year bluefish were notably abundant coastwide that year.

Striped bass fishing peaked in October of both years but was far less productive in 1974 (Table 3). The substantial increase in cunner landings, comprising 31% of the catch, probably represented the efforts of a small group of fishermen specifically seeking this species in 1974.

1975 Season

During 1975, from April-November an estimated 5,084 anglers expended 9,048 hours catching 3,022 fish. Mean catch rate increased to 0.33 fish per hour (Table 1). Greatest angler activity (1,467 fishing trips), highest monthly catch (1,155 fishes), and highest catch rate (0.44 fish per hour) all occurred in July, coincident with the largest monthly catch of cunner (989) for the entire survey.

Improvement in overall catch rate was attributable to the larger landing of cunner, comprising 69.1% of the sportfish catch that year (Table 3). Gill net data through 1975 suggested that the cunner population remained relatively stable throughout the study period (Lawton et al., page 207). Increased sportfish catch of this species apparently resulted from increased angler interest.

Although there was an improvement in catch rate, the number of anglers and effort declined by approximately 50% from the 1974 totals. Angler visits dropped sharply in late summer and early fall when the spectacular bluefishing of 1973 and 1974 did not materialize. Excluding snappers, only 14 bluefish were caught in September and October, during a plant outage, as compared to 568 in 1973 and 684

in 1974 (Table 2). The total catch of striped bass was again relatively poor. Far fewer pollock were landed than in 1973 and 1974; gill net data suggested there was a decline in pollock abundance in 1975 (Lawton et al., page 208). With the striped bass and bluefish holding the interest of the more avid anglers, it is natural that when fishing success for these species declined, angler visits also declined.

Economic Value

According to the Massachusetts Division of Marine Fisheries (1977), the average out-of-pocket expenditure incurred by a Massachusetts marine recreational fisherman in 1975 was \$5.60 per fishing trip. Federal statistics collected in 1970 estimated total expenditure per salt water fishing trip on the Atlantic Coast at \$10.43 (U. S. Fish and Wildlife Service 1972). This latter figure was not used to compute economic value of the sport fishery at Pilgrim Shorefront because it included expenditures for food and lodging. Most fishermen visiting Pilgrim Shorefront made only day trips, and \$5.60 represented a reasonable estimate of cost per day. Based on this, the estimated annual economic value of the sport fishery at Pilgrim Shorefront was \$33,000 for 1973 (based on a partial season); \$57,000 in 1974; and \$28,000 for 1975. Average for the three years was \$39,000.

Dominant Species

It is not altogether surprising that cunner ranked first in overall catch, for Bigelow and Schroeder (1953) reported Massachusetts Bay as an area with high cunner abundance. Despite its small size, this species is potentially an important recreational fish because of its abundance, vulnerability to anglers, and its appeal to youngsters and novice fishermen. Most cunner were caught from the intake breakwater, some distance from the warm-water discharge. Their availability appeared attributable to a preference for the shelter of the rocky habitat afforded by the Shorefront jetties and breakwater. Cunner was the fifth most abundant species impinged at the power station (Lawton et al., page 206).

Bluefish (adult and snappers) ranked second in overall catch and along with striped bass appealed to most anglers. When striped bass catches declined after 1973, bluefish received most of the fishing pressure expended along the discharge jetties. However, none were impinged (Lawton et al., page 220). This species is a warm-water fish which migrates inshore when water temperatures reach 12-15 C (Lund and Maltezos 1970). Lyman (1975) indicated that bluefish are attracted to tidal and current rips. SCUBA observations revealed that Pilgrim Station's thermal effluent concentrated forage fishes during late summer and early autumn, thus

supplying an obvious food supply for bluefish. Poor fishing for bluefish in September and October 1975 was attributed to the power plant not operating during those months, for we observed bluefish being caught elsewhere in the area at the time.

Pollock, the third most frequently caught species, often augmented irregular catches of more desirable species. Concentration of forage fishes in the thermal plume (observed by SCUBA) and in the protective habitat afforded by the jetties apparently attracted pollock. However, many were caught by anglers fishing for other species. This species ranked only 12th in impingement at Pilgrim Station (Lawton et al., page 220).

The marked decline in sportfish landings of striped bass in 1974 and 1975 probably reflected the beginning of an overall decline in striped bass along the Atlantic coast. Historically, Cape Cod Bay has been the principal center of bass abundance in the Gulf of Maine during the summer months. Bass local abundance is thought to reflect a preference for surf-swept beaches, rock substrate, and the mouths of rivers and estuaries. Bigelow and Schroeder (1953) reported that few bass were caught along the rocky stretch from Cape Cod Canal to the entrance of Plymouth Harbor although the area appeared to be ideal habitat. However, bass have been traditionally caught in Plymouth Harbor and along Duxbury Beach. Pilgrim Shorefront now provides access to shore fishing at Rocky Point, and the plant's thermal discharge current concentrates forage fishes that, in turn, attract bass.

Fishing Variables

Seasonal fluctuations in angling pressure at Pilgrim Shorefront were attributed, in part, to fishermen's knowledge of sport fish migrations in Plymouth waters as well as periods of favorable weather conditions and traditional summer vacations. Angling pressure was highest during July and August and lowest in November, when most fish had departed from inshore waters.

The largest group of anglers were casual fishermen who fished irregularly for a variety of small demersal fishes from the intake breakwater. Fairbanks et al. (1971) reported a similar finding for the Cape Cod Canal. A small group of avid fishermen regularly sought bluefish, striped bass, and mackerel, when available. The latter group fished primarily from the terminus of discharge jetties. The Massachusetts Division of Marine Fisheries (1977), in a sportfishing survey along the Massachusetts coastline, found that over 80% of the recreational fishermen interviewed indicated a strong preference for striped bass, bluefish, winter flounder, and Atlantic cod.

A three-year mean catch rate of 0.22 fish per angler-hour at Pilgrim Shorefront is low when compared to other areas such as the Cape Cod Canal (Fairbanks et al. 1971). Possibly, different hydrographic conditions accounted for the difference in catch rates at these sites. Pilgrim Shorefront provides limited access to a shallow open coast, whereas the Cape Cod Canal offers extensive deep-water access to shore fishermen.

Fishing success (catch per hour) was apparently influenced by species availability, plant operation, and anglers' skill. With the plant operating, the outfall area was an attractive feeding ground for sportfishes. Although highest catch rates occurred in September of 1973 and 1974, in 1975 the plant was not operating in September, and catch rate peaked in July instead. Scarcity of mackerel from 1973-1975 and striped bass from 1974-1975 probably influenced overall catch rates.

Although catch rates were lower than reported in other coastal areas in Massachusetts, considerable angler interest has been created by the Shorefront development. Pilgrim Shorefront has provided angling opportunities in an area that was previously inaccessible.

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