HUDSON RIVER ECOLOGICAL STUDY

IN THE AREA OF INDIAN POINT

1983 ANNUAL REPORT

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1.0 SUMMARY

Impingement monitoring was conducted at the Indian Point Station during 1983. This program represented a continuation of sampling efforts which began in 1972.

Impingement collections during 1983 were made on a less than daily basis according to a stratified sampling design first introduced during the last six months of 1981. Before this time, samples were collected daily. The stratified (seasonally) design consisted of 110 sampling days per year, or approximately 30% of the annual effort expended on impingement collection at the Indian Point Station under the sampling regime used prior to July 1981.

Approximately 92,000 fish were collected from the intake screens at Units 2 and 3 during 1983. Using best estimates of collection efficiency to account for impingement losses prior to collection, it is estimated that approximately 850,000 fish were impinged. This is fewer fish than in any year since 1977 when both Units 2 and 3 began to operate simultaneously. The total weight of the impinged fish during 1983 is estimated to be approximately 4,600 kg (10,000 lb).

Although all the seasonal sampling quotas were met for Unit 2, the precision of the estimate of total fish impinged by that unit in 1983 was not nearly as good as anticipated from simulated sampling of historical impingement data. The coefficient of variation for 1983 was 29% at Unit 2, compared with 9.5% in the simulation (TI, 1980a). The poor precision of the 1983 estimate was due to high and variable numbers of weakfish and bay anchovy in the sparcely sampled summer stratum. The precision at Unit 3 (17% coefficient of variation) is also less than in the simulation. This was mainly due to restricted sampling because of extensive outages at Unit 3.

Seasonal patterns of impingement were similar in 1983 to previous years. In addition to the usual winter peak, however, there

was a strong summer peak due to the high numbers of weakfish and bay anchovies. The patterns of species composition and dominance were similar to previous years with the exception of the increased numbers of weakfish. White perch was the most dominant species, followed by weakfish, bay anchovy, and Atlantic tomcod. Total number of species was comparable to 1982, the first full year of reduced sampling.

Blue crab impingement, monitored for the first time in 1983, amounted to 821 crabs (152 kg), present during May through December. The number of crabs peaked strongly in August. Most of them were adults.

2.0 INTRODUCTION

This report is the twelfth in a series of annual reports entitled "Hudson River Ecological Study in the Area of Indian Point". Previous annual reports have presented the results of various studies conducted at or in the vicinity of the Station, including impingement sampling, fisheries surveys, mitigation studies and ichthyoplankton entrainment sampling (TI, 1973, 1974, 1975, 1976, 1977, 1979, 1980a, 1980b; Con Edison, 1982a, 1982b, 1983). This report discusses the 1983 impingement data and interprets these latest study results, wherever possible, in conjunction with the findings of previous years.

Impingement sampling during 1983 was conducted on certain selected days in accordance with a seasonally stratified sampling design approved by the New York State Department of Environmental Conservation. This sampling design was first implemented during the latter half of 1981 to replace daily impingement collections (Con Edison, 1982b). As such, the analytical procedures used in this report to estimate the numbers of fish impinged are similar to those used in the 1981 annual report (for the last six months of 1981) and in the 1982 annual report but somewhat different from those used in earlier reports.

Estimates of the total number of fish impinged at each Unit as well as estimates for all individual species are provided. Seasonal impingement trends at Units 2 and 3 are also discussed.

2.1 THE INDIAN POINT GENERATING STATION

The Indian Point Generating Station is located on the east bank of the Hudson River, approximately 69 km (43 miles) above the Battery in New York City (Figure 2-1). The Station began operation with the completion of Unit 1 in 1962. Unit 2, which is operated by Con Edison, and Unit 3, which is operated by New York Power Authority (NYPA), began commercial operation in 1973 and 1976, respectively. Each

HUDSON RIVER ESTUARY

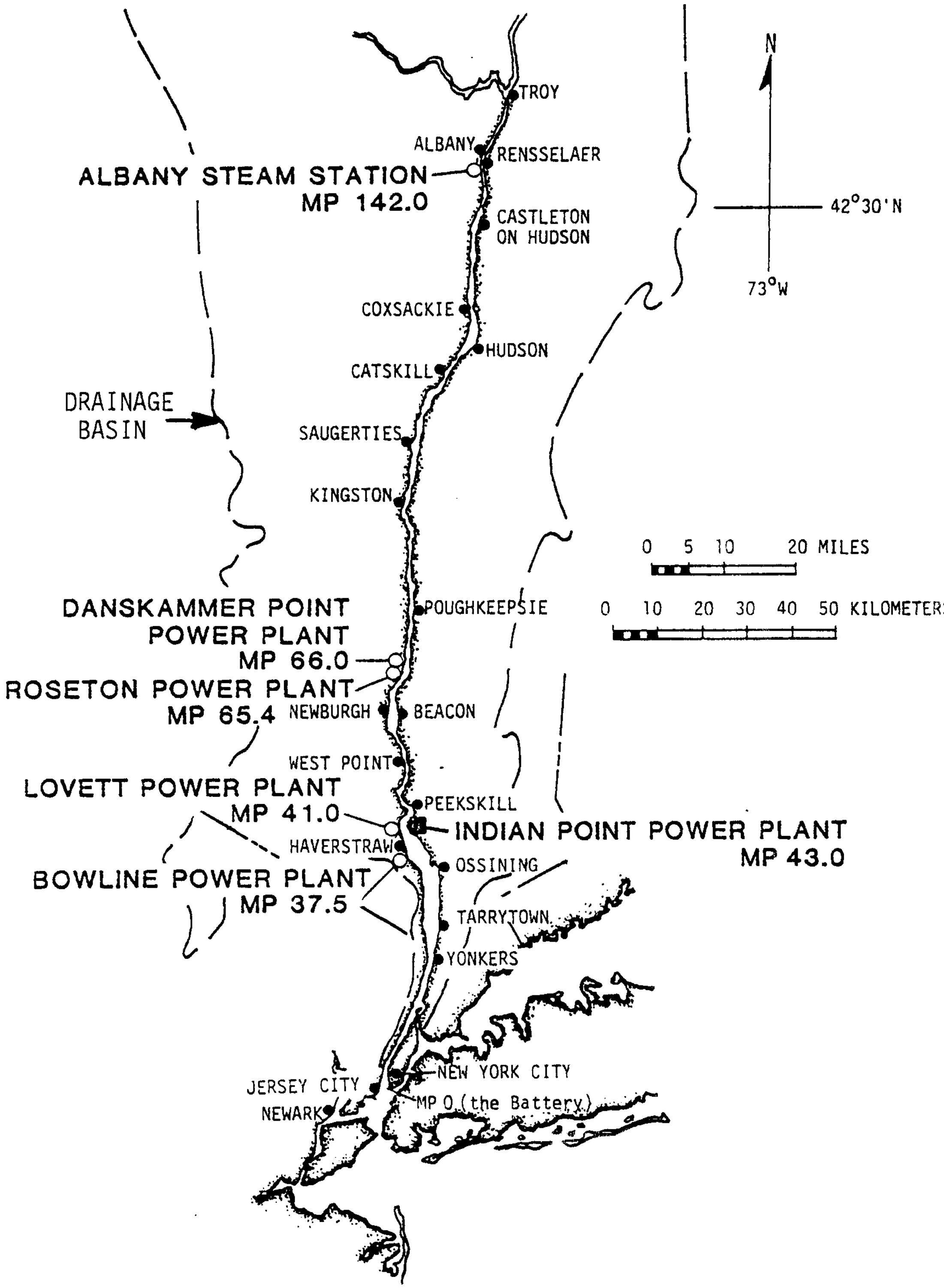

Figure 2-1. Location of Indian Point Station Relative to other Hudson River Stations.

unit of this nuclear plant utilizes a once-through cooling system which results in the entrainment of the early life stages of various fish species and the impingement of juvenile and older fish.

The combined pumping capacity of the three units for cooling purposes is 7790 m^3/min (2,058,000 gal/min). Unit No. 1, which has two (530 m^3/min or 140,000 gal/min) circulator pumps, was retired from commercial operation in October 1974. The two units currently operating each have six (530 m^3/min) circulator pumps. Service water pumps, with much lower total capacities, are located at each unit (two totaling 144 m^3/min or 38,000 gal/min at Unit 1; six totaling 114 m^3/min or 30,000 gal/min at Unit 2 and at Unit 3).

Units 1 and 2 each have fixed intake screens at the river's edge and traveling screens within each intake forebay (Figure 2-2). Unit 3 has traveling screens at the river's edge but no fixed screens (Figure 2-3). Details of the plant and associated intake structures have been presented previously (Con Edison 1977).

In December 1980, Con Edison, NYPA, and other Hudson River utilities consented to certain operating conditions as part of an agreement reached with government agencies. A schedule for pumping circulator water at the Indian Point Station (Table 2-1) was part of this Settlement Agreement, which became effective on May 14, 1981.

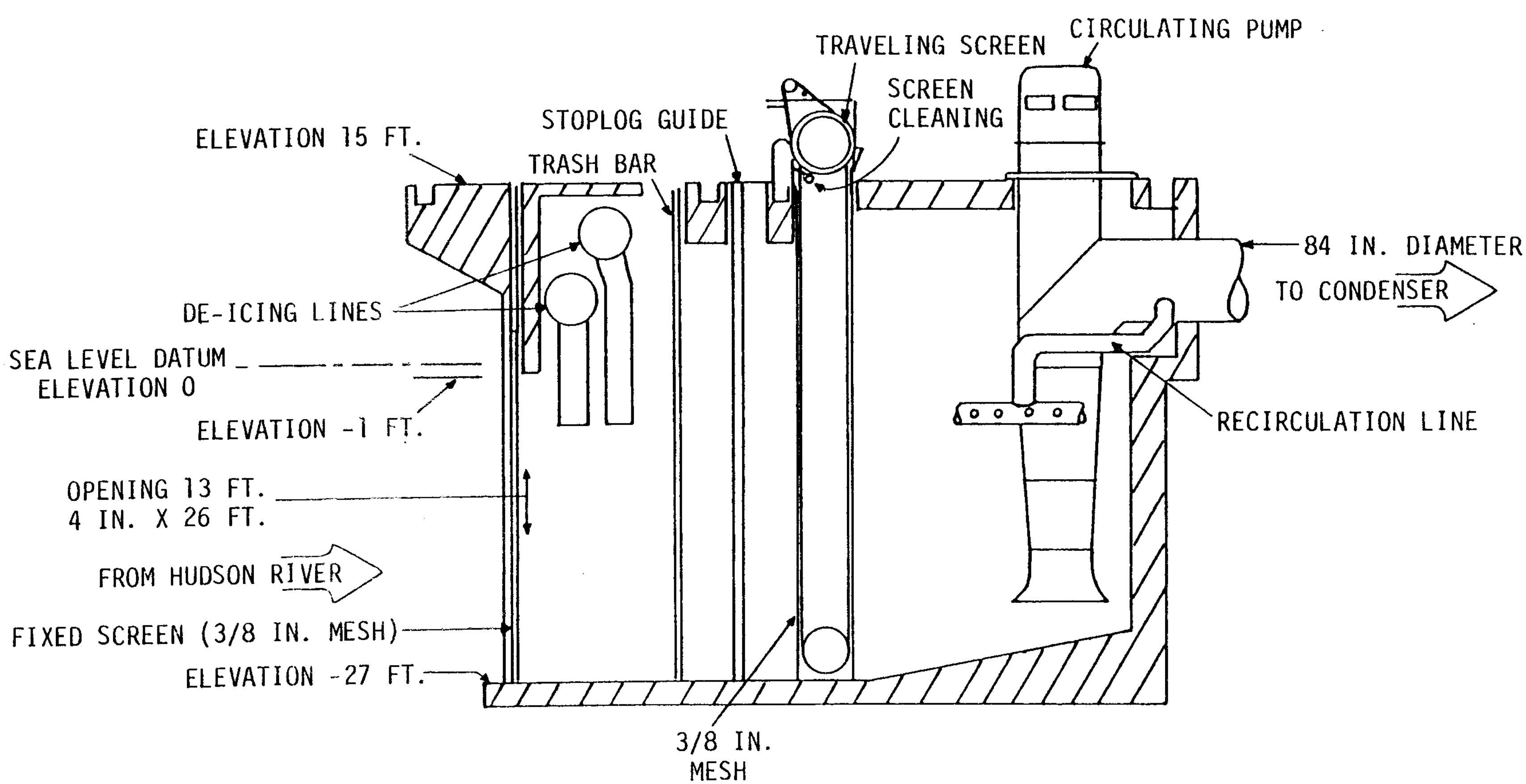

Figure 2-2. Schematic intake bay cross-section of Indian Point Unit No. 2.

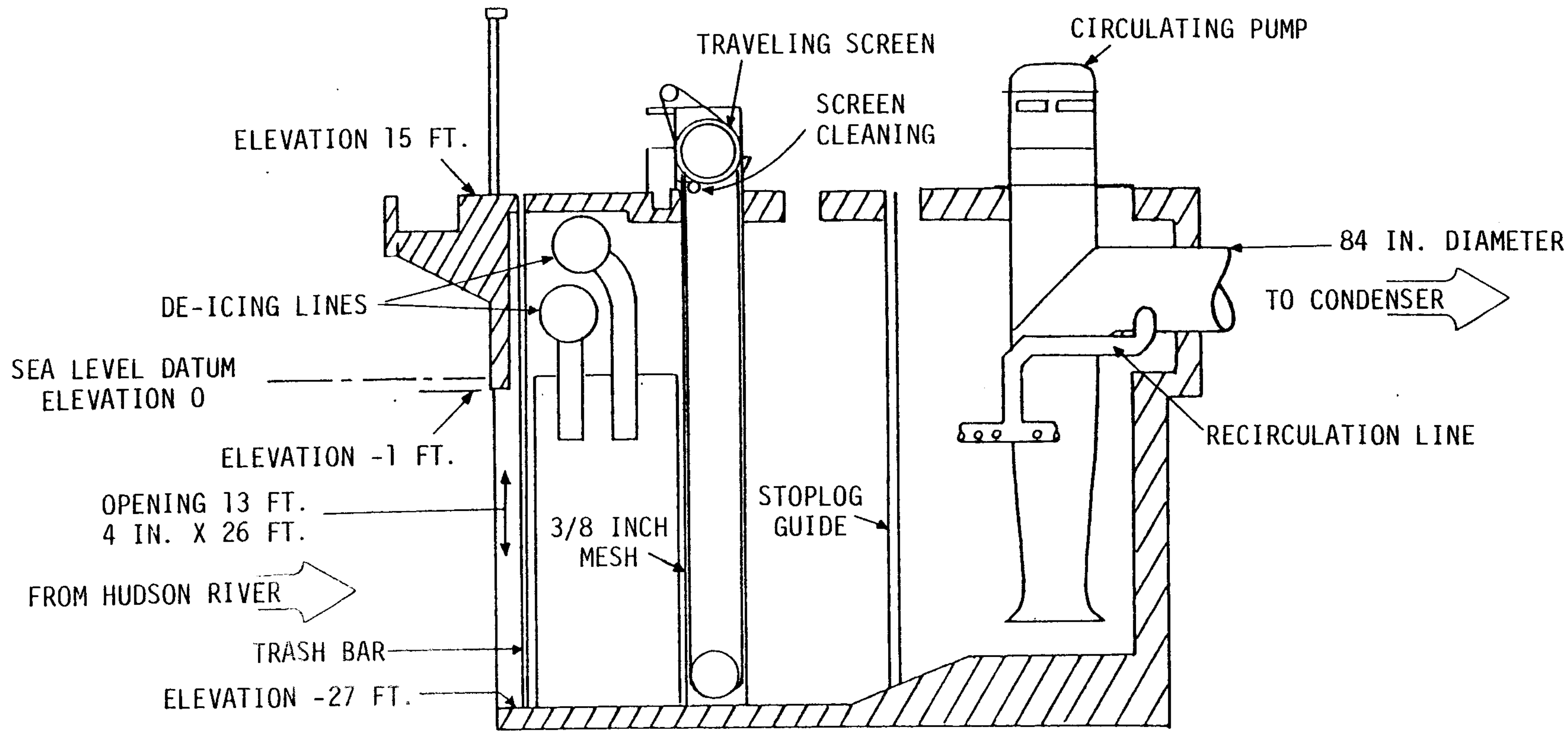

Figure 2-3. Schematic intake bay cross-section of Indian Point Unit No. 3.

TABLE 2-1. FLOW RATE SCHEDULE PROVIDED FOR INDIAN POINT UNITS 2 AND 3 IN THE SETTLEMENT AGREEMENT.

	CIRCULATOR WATER FLOW PER UNIT		
	PERCENT FLOW	GALLONS PER MINUTE	MILLIONS OF CUBIC METERS PER DAY
1 Nov-30 Apr	60	504,000	2.75
1 May-31 May	Change from 60 to 100	504,000 to 840,000	2.75 to 4.58
1 Jun-30 Sep	100	840,000	4.58
1 Oct-31 Oct	Change from 100 to 60	840,000 to 504,000	4.58 to 2.75

3.0 IMPINGEMENT AT THE INDIAN POINT STATION

Collections of fishes impinged by Indian Point Units 2 and 3 during 1983 were made on randomly selected days in accordance with the sampling design discussed below. On all days when the plant operated, whether or not sampling was scheduled for impinged fishes, the traveling screens were washed to remove fish and debris. On all days when the plant operated after April 1, samples of impinged blue crabs were collected. The field and laboratory procedures used in collecting and processing samples and the formulas used in the data calculations are presented in Appendix A.

3.1 SAMPLING DESIGN

The impingement collection sampling design followed in 1983 was similar to that followed during July 1981 through December 1982, (Con Edison, 1982b, 1983). Prior to July 1, 1981, impingement collections at the Indian Point Station were made daily.

With the implementation of the Settlement Agreement, the Utilities re-examined each of the programs they had been conducting to determine whether the allocated efforts were sufficient and justifiable. For the Indian Point impingement program, it became evident after extensive data analysis and literature review that daily collections were unnecessary to maintain acceptable levels of accuracy and precision. The details of the development of an appropriate design to replace daily sampling are summarized in the 1979 Indian Point annual report (TI, 1980b). Three potential sampling strategies were evaluated in terms of the accuracy and precision afforded by each in estimating total fish impingement at the Indian Point Station. One design randomly allocated the sampling effort throughout the year. The other two designs were both stratified, one on a seasonal basis and the other based on distinct periods of high and low impingement variation at each unit (TI, 1980b). Estimated Maximum Daily (EMD) impingement counts (actual daily counts for all species combined scaled up to the count which would be obtained under the maximum volume that could be pumped) for the four year period from 1976 through 1979 were used as the data base for all the analyses.

The precision of each design was evaluated by calculating the standard error of the scaled up EMD counts for various levels of sampling intensity ranging from 10 to 90 percent of the year. The design that was ultimately selected utilized seasonal stratification and involved sampling on 110 days annually. Simulated sampling at that yearly level of intensity (30%) was found to be very accurate; i.e., the 95% confidence intervals about the simulated mean EMD counts enclosed the true mean (the mean of all EMD counts for each unit in the 1976 through 1979 period) at Units 2 and 3 more than 92% and 93% of the time, respectively (TI, 1980b). Increasing the sampling intensity beyond 30% resulted in only marginal improvements in accuracy (TI, 1980b).

The impingement sampling design used in 1983 allocated the 110 sampling days to each unit in a manner which reflected the expected variation in seasonal impingement based upon the analyses of the 1976 through 1979 data base (Table 3-1). Seasonal quotas of sampling days were not met during the winter (January through March), summer (July through September), or fall (October through December) at Unit 3 because of extended outages. The standard procedure followed to minimize the effect of missed collection days is to randomly replace each lost day with one from the unallocated (i.e. not initially selected for collection) days remaining within that stratum (Appendix A). Due to extended outages at Unit 2 in the fall and at Unit 3 in the spring, a large number of "make-up" days were utilized in order to meet those seasons' sampling quotas. Tables 3-2 and 3-3 provide a more thorough description of the days "operated" and list the actual days on which collections occurred.

TABLE 3-1. NUMBERS OF IMPINGEMENT COLLECTION DAYS AND DAYS OF PLANT OPERATION AT INDIAN POINT UNITS 2 AND 3 DURING 1983.

			NUMBER OF DAYS	
		OF PLANT OPERATION[a]	OF IMPINGEMENT COLLECTIONS	ALLOCATED IN STRATIFIED DESIGN
Unit 2	Winter (Jan-Mar)	84	30	30
	Spring (Apr-Jun)	91	10	10
	Summer (Jul-Sep)	92	11	11
	Fall (Oct-Dec)	73	60	59
	TOTAL	340	111	110
Unit 3	Winter (Jan-Mar)	0	0	27
	Spring (Apr-Jun)	33	18	18
	Summer (Jul-Sept)	15	4	31
	Fall (Oct-Dec)	0	0	34
	TOTAL	48	22	110

[a]A unit was considered operating on a day if any circulator pump operated for any time on that day.

TABLE 3-2. COMPARISON OF SAMPLING DATES AND AVERAGE DAILY SAMPLING VOLUMES WITH OPERATING DATES AND AVERAGE DAILY OPERATING VOLUMES AT INDIAN POINT UNIT 2 BY MONTH DURING 1983.

	SAMPLING DATES	AVERAGE DAILY SAMPLING VOLUME ($10^6 m^3$)	STANDARD DEVIATION	OPERATING DATES	AVERAGE DAILY OPERATING VOLUME ($10^6 m^3$)[a]	STANDARD DEVIATION
January	3,4,5,7, 13,14,18, 21,22,24, 26	1.71	0.71	1-31	2.44	0.37
February	1,23,24, 25,26,27	2.09	0.41	1-2,9-28	2.13	0.62
March	10,11,12, 13,14,15, 16,17,22, 24,25,26, 29	2.40	0.24	1-31	2.47	0.28
April	3,5,30	2.66	0.07	1-30	2.78	0.09
May	9,27	4.56	0.04	1-31	4.47	0.53
June	5,11,20, 27,28	4.53	0.16	1-30	4.64	0.09
July	4,16	5.00	0.81	1-31	4.70	0.06
August	2,13,19	4.49	0.02	1-31	4.61	0.22
September	9,12,15, 19,21,27	4.68	0.19	1-30	4.66	0.13
October	3,29,31	3.37	1.01	1-5,25-31	3.21	1.04
November	1-30	2.72	0.20	1-30	2.87	0.09
December	1-7,9, 13-31	2.73	0.12	1-31	2.89	0.02

[a]Includes service water, excludes days when no circulating pump operated

TABLE 3-3. COMPARISON OF SAMPLING DATES AND AVERAGE DAILY SAMPLING VOLUMES WITH OPERATING DATES AND DAILY OPERATING VOLUMES AT INDIAN POINT UNIT 3 BY MONTH DURING 1983.

	SAMPLING DATES	AVERAGE DAILY SAMPLING VOLUME ($10^6 m^3$)	STANDARD DEVIATION	OPERATING DATES	AVERAGE DAILY OPERATING VOLUME ($10^6 m^3$)[a]	STANDARD DEVIATION
January	--[b]	--	--	--	--	--
February	--	--	--	--	--	--
March	--	--	--	--	--	--
April	--	--	--	--	--	--
May	--	--	--	29,30,31	1.75	1.03
June	5,9,11, 12,13,14, 15,16,17, 20,21,22, 23,24,25, 26,27,28	2.14	1.49	1-30	2.21	1.21
July	3,4,8,9	0.76	0.01	1-15	0.79	0.11
August	--	--	--	--	--	--
September	--	--	--	--	--	--
October	--	--	--	--	--	--
November	--	--	--	--	--	--
December	--	--	--	--	--	--

[a]Includes service water, excludes days when no circulating pump operated.

[b]Unit outage; no operating days or sampling days during the month.

The method used to calculate an estimate of the total number of fish impinged during the year (described in Appendix A) assumes that sample days are representative of all operating days in a stratum, because each day is weighted equally in computing the estimate. With respect to the volume of water circulated this assumption was justified for 1983, as shown by the close correspondence between sample and operating days in the average daily circulating volumes (Tables 3-2 and 3-3).

3.2 COLLECTION EFFICIENCY

While collections from the intake screens at Indian Point do provide an indication of seasonal and yearly impingement patterns, they usually do not account for 100% of the fish impinged. Some impinged fish may be lost prior to collection because of scavenging fish and birds, current action or the screenwash collection procedures. Deterioration and disintegration of impinged fish on the screens can also contribute to these losses.

Over a period of several years extensive collection efficiency studies were performed at Indian Point. The observed values of collection efficiency in those studies, summarized by Con Edison (1983: Figures 3-2 and 3-3), were characterized by (1) being consistently and often substantially less than 1.0, (2) generally tending to be lower at higher water temperatures, and (3) having a high degree of variability throughout the range of observed temperatures. The low values confirm the necessity of applying a collection efficiency correction to impingement counts. The apparent relationship to water temperature suggested that the accuracy of a correction factor would be improved by making it a function of temperature. The high variability (low precision) indicates that any collection efficiency estimate, and thus the impingement estimate derived from it, would contain an inherent degree of uncertainty. A large number of observations of collection efficiency were made in order to minimize this source of error as much as possible.

Collection efficiency studies at Indian Point Units 2 and 3 have led to the development of several correction factors that were used to adjust impingement collections (McFadden *et al.*, 1978; TI 1979, 1980a, 1980b). By the end of 1980, sufficient data had been collected to examine the relationship between collection efficiency and water temperature. Data were available from 1977 through 1980 for Unit 2 and from 1976 through 1980 for Unit 3. Analyses concluded that the relationship between the two variables could be properly modeled as a linear regression (Con Edison, 1982a). In 1982, additional collection efficiency data were gathered at temperatures in the 5 to 15°C range to supplement the earlier data, and the following regression models were developed by Con Edison (1983), utilizing data from all available years:

$$E_2 = -0.00871\ T_2 + 0.51858 \qquad \text{(Equation 1)}$$

$$E_3 = -0.00792\ T_3 + 0.71640 \qquad \text{(Equation 2)}$$

where E_2 and E_3 = collection efficiency at Units 2 and 3 and T_2 and T_3 = intake water temperature (°C) at Units 2 and 3.

Although individual observations of collection efficiency were highly variable at all temperatures, the above relationships were found by Con Edison (1983) to be statistically significant (efficiency decreased significantly with increasing temperature), and therefore useful for estimating actual impingement rates from impingement collections.

No additional collection efficiency tests were conducted in 1983. The estimates of numbers of fish impinged in 1983 were calculated using the above regression equations based on previous years' data. An illustration of the effect of the collection efficiency adjustment on the original count data is provided in Figures 3-1, 3-2, and 3-3, for a cold weather dominant (white perch), for a warm weather dominant (bay anchovy) and for the total of all taxa.

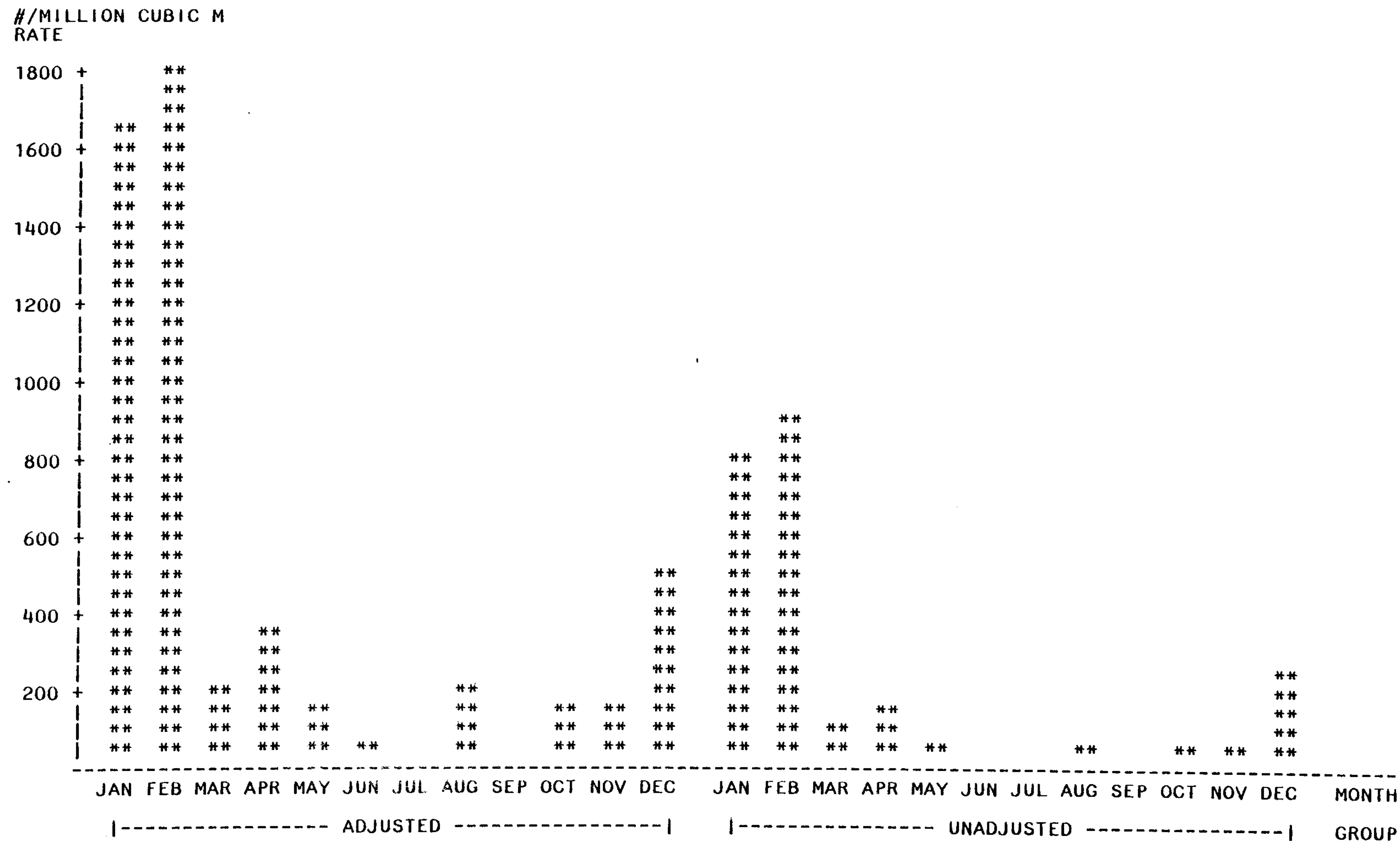

FIGURE 3-1 COMPARISON OF IMPINGEMENT RATES FOR WHITE PERCH
AT INDIAN POINT UNIT 2 IN 1983
UNADJUSTED AND ADJUSTED FOR COLLECTION EFFICIENCY

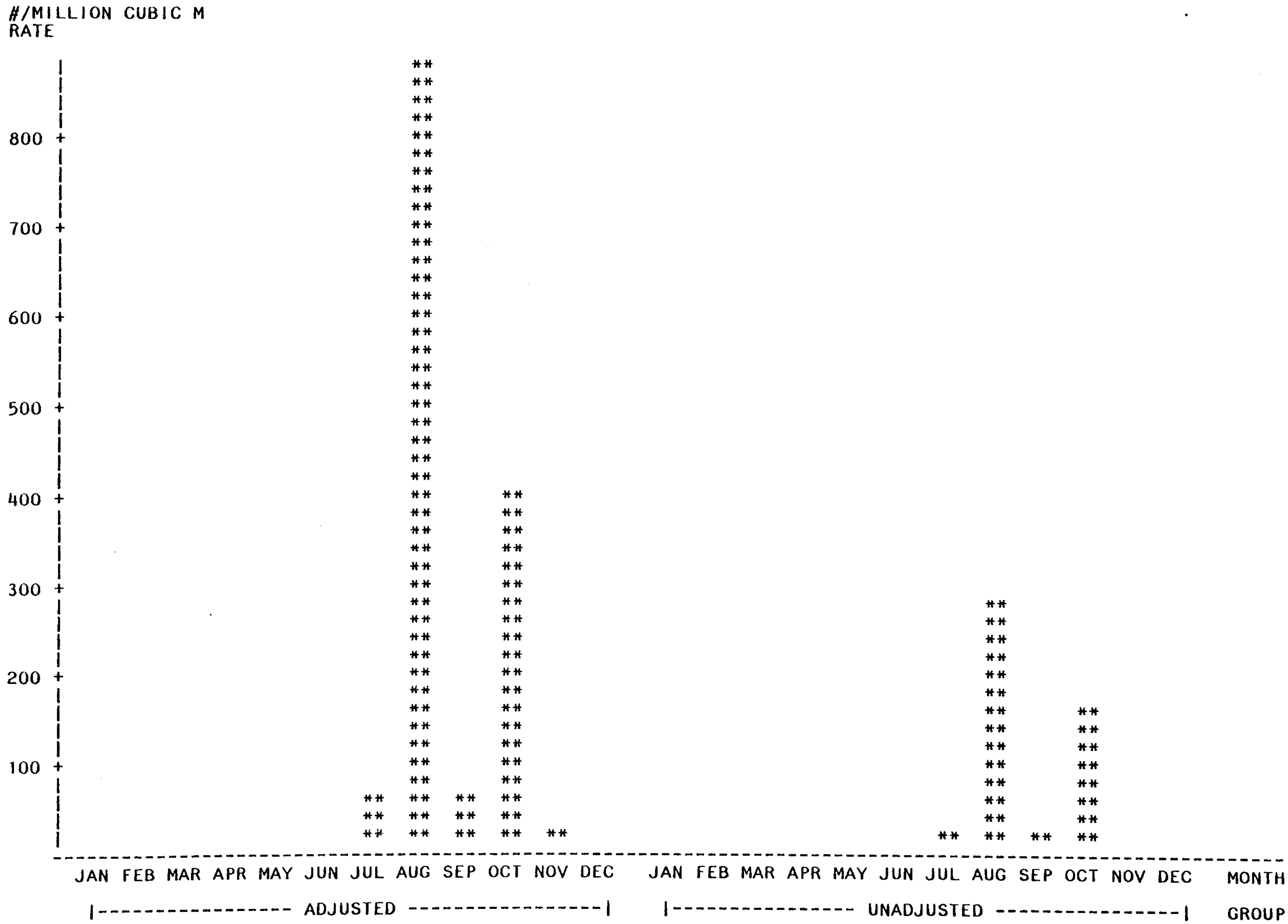

FIGURE 3-2 COMPARISON OF IMPINGEMENT RATES FOR BAY ANCHOVY
AT INDIAN POINT UNIT 2 IN 1983
UNADJUSTED AND ADJUSTED FOR COLLECTION EFFICIENCY

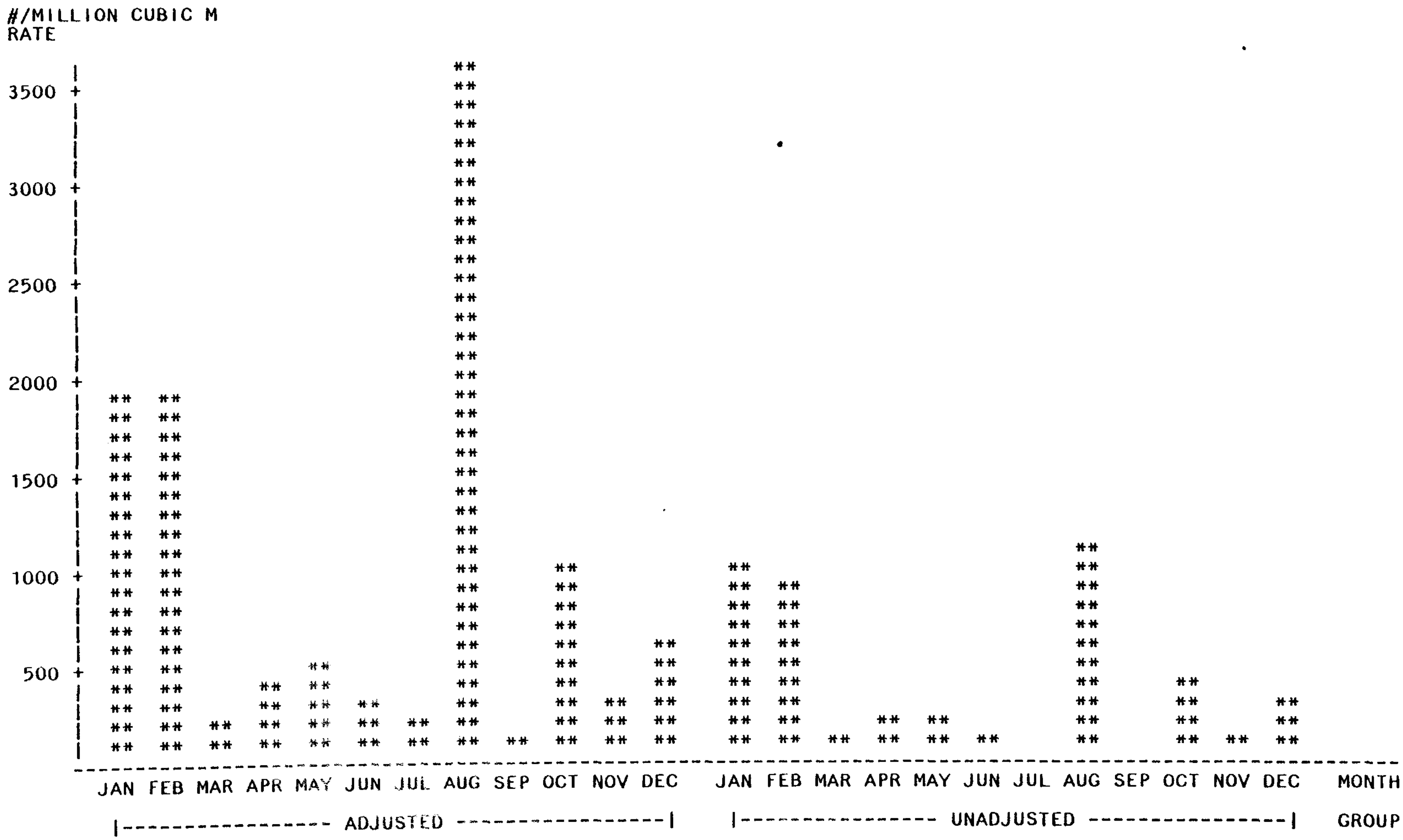

FIGURE 3-3 COMPARISON OF IMPINGEMENT RATES FOR ALL TAXA AT INDIAN POINT UNIT 2 IN 1983 UNADJUSTED AND ADJUSTED FOR COLLECTION EFFICIENCY

3.3 ESTIMATED NUMBERS OF FISH IMPINGED DURING 1983

A total of 91,541 fish were collected at Indian Point Units 2 and 3 combined in 1983 (Table A-3). When adjusted for collection efficiency and scaled up to the number of operating days, the estimated total number impinged was 0.82 million fish by Unit 2 and 0.029 million by Unit 3 (Tables 3-4 and 3-5) for a total of 0.85 million weighing an estimated 4600 kg (Table A-11). The levels of precision (standard errors) were 29.2 and 17.2 percent of the total estimates for Unit 2 and Unit 3, respectively. Compared to the precision levels projected by TI (1980b) for the stratified sampling design of 9.5% for Unit 2 and 8.2% for Unit 3, the 1983 estimates were substantially less precise than expected. For Unit 2, the summer stratum accounted for by far the greatest part (about 98%) of the high standard error. This was due to the combination of small sample size (11 of 92 dates) and the high variance of that stratum (Table 3-6). The high variance was in turn due to large and variable numbers of weakfish and bay anchovy, which together accounted for 66% of the fish in the summer impingement estimate (Table 3-4).

The total number of fish impinged by Units 2 and 3 combined in 1983, estimated at 0.85 million (Tables 3-4 and 3-5), was substantially lower than any year in the 1976-1982 historical data base (range 1.6-6.5 million, Table 3-7). The volume of water circulated through the plant in 1983 was lower than most previous years, but the difference was not enough to account for the lower number of fish impinged: the average impingement rate (per volume) was only 23-56% of that in previous years. The extended outage at Unit 3 was not the only reason for low numbers impinged in 1983, shown by the fact that impingement at Unit 2 alone, which operated most of the year, was lower than in any year during 1976-1982 (TI, 1977, 1979, 1980a, 1980b; Con Edison 1982a, 1982b, 1983).

The precision of estimated totals of individual species varied greatly. In general, those species with the least precise estimates occurred primarily in the summer (e.g., weakfish, blueback herring, American shad) or spring (hogchoker), when the low number of sampling

TABLE 3-4
ESTIMATED NUMBER OF FISH IMPINGED AT INDIAN POINT UNIT 2 DURING 1983
BY TAXON AND SEASONAL STRATUM
(ADJUSTED FOR COLLECTION EFFICIENCY)

COMMON NAME	WINTER	SPRING	SUMMER	FALL	1983 TOTAL	STANDARD ERROR	COEFFICIENT OF VARIATION
ALEWIFE	0	204	4229	116	4549	2243	49.3
AMERICAN EEL	140	572	343	124	1180	163	13.8
AMERICAN SHAD	0	24	8292	188	8504	3629	42.7
ATLANTIC CROAKER	0	0	0	13	13	5	42.2
ATLANTIC MENHADEN	0	91	30	15	136	67	49.4
ATLANTIC MOONFISH	0	0	0	3	3	1	42.2
ATLANTIC STURGEON	0	0	0	7	7	2	23.9
ATLANTIC TOMCOD	3347	48945	64218	724	117234	43413	37.0
BANDED KILLIFISH	46	96	29	88	259	59	22.7
BAY ANCHOVY	135	1271	120494	6727	128626	54742	42.6
BLACK CRAPPIE	0	0	0	10	10	2	20.6
BLACK SEA BASS	0	0	0	19	19	5	26.1
BLUEBACK HERRING	24	719	36286	9825	46854	26865	57.3
BLUEFISH	0	4628	2615	26	7269	3054	42.0
BLUEGILL	41	26	29	189	285	43	15.2
BROWN BULLHEAD	29	0	463	36	528	378	71.5
BUTTERFISH	0	0	1638	115	1753	982	56.0
CENTRARCHID UNIDENTIFIED	90	46	0	30	166	54	32.7
CLUPEID UNIDENTIFIED	0	30	977	0	1008	582	57.7
COMMON CARP	0	23	0	2	25	22	85.5
CREVALLE JACK	0	0	0	35	35	5	14.0
FOURSPINE STICKLEBACK	0	24	0	12	36	23	63.9
GIZZARD SHAD	524	0	0	1292	1817	202	11.1
GOLDEN SHINER	0	0	0	17	17	3	18.9
GOLDFISH	0	0	0	3	3	1	42.2
HOGCHOKER	58	16932	2932	2254	22176	13061	58.9
INLAND SILVERSIDE	0	0	0	85	85	8	9.1
LARGEMOUTH BASS	0	0	0	34	34	6	17.2
MUMMICHOG	0	0	25	2	28	24	85.5
NORTHERN PIPEFISH	0	0	1647	1165	2812	431	15.3
PUMPKINSEED	86	143	82	279	591	94	15.9
RAINBOW SMELT	714	1209	217	55	2196	693	31.6
RED HAKE	90	0	0	0	90	58	64.5
REDBREAST SUNFISH	0	0	29	0	29	27	93.8
SEA LAMPREY	12	0	0	5	17	7	40.3
SILVER HAKE	35	0	0	0	35	17	48.8
SPOTTAIL SHINER	249	96	29	722	1096	98	8.9
STRIPED BASS	10983	100	4669	3271	19023	3477	18.3
STRIPED SEAROBIN	0	0	0	15	15	3	21.6
TAUTOG	6	0	0	0	6	5	80.2
TESSELLATED DARTER	41	219	54	32	347	116	33.5
THREESPINE STICKLEBACK	17	0	0	0	17	10	59.1
WEAKFISH	0	0	174016	975	174991	109654	62.7
WHITE CATFISH	70	274	200	1149	1692	187	11.0
WHITE MULLET	0	0	0	3	3	1	42.2
WHITE PERCH	152368	41945	22469	58116	274899	27303	9.9
WINTER FLOUNDER	0	0	0	6	6	2	29.6
YELLOW PERCH	23	20	0	61	104	25	23.7
TOTAL ALL TAXA	169128	117638	446012	87845	820624	239651	29.2

STANDARD ERROR-----------STANDARD ERROR OF 1983 TOTAL
COEFFICIENT OF VARIATION-(STANDARD ERROR/1983 TOTAL)*100

TABLE 3-5
ESTIMATED NUMBER OF FISH IMPINGED AT INDIAN POINT UNIT 3 DURING 1983
BY TAXON AND SEASONAL STRATUM
(ADJUSTED FOR COLLECTION EFFICIENCY)

COMMON NAME	WINTER	SPRING	SUMMER	FALL	1983 TOTAL	STANDARD ERROR	COEFFICIENT OF VARIATION
ALEWIFE	0	204	7	0	212	32	15.0
AMERICAN EEL	0	157	65	0	222	38	17.2
AMERICAN SHAD	0	10	0	0	10	5	49.2
ATLANTIC MENHADEN	0	4	0	0	4	2	67.4
ATLANTIC TOMCOD	0	11688	673	0	12361	3262	26.4
BANDED KILLIFISH	0	7	0	0	7	3	46.3
BAY ANCHOVY	0	186	218	0	404	85	21.0
BLUEBACK HERRING	0	2878	0	0	2878	422	14.7
BLUEFISH	0	143	407	0	550	66	12.1
BLUEGILL	0	3	0	0	3	2	67.4
BROWN BULLHEAD	0	3	0	0	3	2	67.4
CENTRARCHID UNIDENTIFIED	0	10	0	0	10	4	36.6
FOURSPINE STICKLEBACK	0	7	0	0	7	3	46.3
HOGCHOKER	0	795	22	0	817	140	17.1
PUMPKINSEED	0	50	0	0	50	9	17.6
RAINBOW SMELT	0	125	7	0	132	30	22.7
ROUGH SILVERSIDE	0	3	0	0	3	2	67.4
SPOTTAIL SHINER	0	16	14	0	31	14	43.7
STRIPED BASS	0	60	7	0	67	14	21.4
TESSELLATED DARTER	0	7	0	0	7	3	46.3
WARMOUTH	0	3	0	0	3	2	67.4
WHITE CATFISH	0	40	0	0	40	9	21.6
WHITE PERCH	0	11444	189	0	11633	1593	13.7
TOTAL ALL TAXA	0	27844	1609	0	29453	5057	17.2

STANDARD ERROR-----------STANDARD ERROR OF 1983 TOTAL
COEFFICIENT OF VARIATION-(STANDARD ERROR/1983 TOTAL)*100

TABLE 3-6. ESTIMATED MEAN DAILY NUMBER OF FISH IMPINGED IN EACH SEASONAL STRATUM BY INDIAN POINT UNITS 2 AND 3 DURING 1983.

		NUMBER OF SAMPLING DAYS	MEAN DAILY ESTIMATE[a]	STANDARD DEVIATION
Unit 2	Winter (Jan-Mar)	30	2,013.4	1,782.9
	Spring (Apr-Jun)	10	1,292.7	874.8
	Summer (Jul-Sep)	11	4,848.0	9,121.9
	Fall (Oct-Dec)	60	1,203.4	1,058.7
	1983 Total	111	2,413.6	
Unit 3	Winter (Jan-Mar)[b]	0	--	--
	Spring (Apr-Jun)	18	843.8	955.3
	Summer (Jul-Sep)[c]	4	107.3	108.3
	Fall (Oct-Dec)[b]	0	--	--
	1983 Total	22	613.6	

[a]Adjusted for collection efficiency

[b]No operating days in winter or fall strata at Unit 3

[c]Sampling quota not met due to extended outage in summer stratum at Unit 3

TABLE 3-7. TOTAL VOLUME CIRCULATED AT INDIAN POINT UNITS 2 AND 3 COMBINED, ESTIMATED NUMBER OF FISH IMPINGED, IMPINGEMENT RATE, AND NUMBER OF SPECIES COLLECTED DURING 1976 THROUGH 1983.

	VOLUME (10^6 m^3)[a]	ESTIMATED NO. IMPINGED (10^6)[b]	IMPINGEMENT RATE (No./10^6 m^3)	NO. SPECIES COLLECTED
1976	1329	1.63	1190	58
1977	2159	6.47	2910	72
1978	2030	3.91	1870	72
1979	1935	4.48	2230	74
1980	1822	3.21	1710	76
1981	1617	4.57	2830	72
1982	1273	1.60	1260	43
1983	1286	0.85	661	49

[a]Including service water

[b]Adjusted for collection efficiency

days and high variance resulted in imprecise species estimates. Several species had high coefficients of variation because they did not occur frequently enough to form an adequate sample (tautog, threespine stickleback, common carp, etc.).

3.4 SPECIES COMPOSITION AND RELATIVE ABUNDANCE

The 91,541 fish collected in 1983 impingement sampling represented 49 species (Table 3-8). Sixteen of these species are primarily freshwater fishes, 13 are marine, and the remaining 20 are tolerant of a wide range of salinities and are typically common in estuaries. The number of species caught in 1983 was smaller than in any of the previous seven years except for 1982 (Table 3-7). This is a natural result of changing to the stratified sampling design, which reduced the sampling effort by 70%: when fewer total organisms are collected, the probability of collecting species which are impinged in very small numbers decreases. Another factor which may have contributed to the reduced number of species was the shutdown during most of October. In previous years, species rarely collected were impinged in the fall as strays from marine waters, particularly from regions farther south, due to the high salinities and high water temperatures at that time of year. Examples include Atlantic needlefish, lookdown, silver perch (TI, 1980b).

The three species which in previous years were the principal dominants, white perch, Atlantic tomcod, and bay anchovy, were again dominant in 1983. In addition, a fourth species, weakfish, was prominent in 1983 samples. It had the second highest estimated total, after white perch. These four species accounted for 85% of impinged fishes in 1983 (Table 3-9).

Unit 2 operated throughout most of the year except for a 6-day shutdown in February and a 19-day shutdown in October, so the relative abundance among species was not greatly affected by plant operating schedule. Unit 3, however, was shut down for most of 1983, operating

TABLE 3-8. SPECIES COLLECTED IN IMPINGEMENT SAMPLING AT INDIAN POINT UNITS 2 AND 3 IN 1983.

COMMON NAME[a]	SCIENTIFIC NAME[a]	SALINITY PREFERENCE[b]
Alewife	*Alosa pseudoharengus*	e
American eel	*Anguilla rostrata*	e
American shad	*Alosa sapidissima*	e
Atlantic croaker	*Micropogonias undulatus*	e
Atlantic menhaden	*Brevoortia tyrannus*	m
Atlantic moonfish	*Selene setapinnis*	m
Atlantic sturgeon	*Acipenser oxyrhynchus*	e
Atlantic tomcod	*Microgadus tomcod*	e
Banded killifish	*Fundulus diaphanus*	f
Bay anchovy	*Anchoa mitchilli*	e
Black crappie	*Pomoxis nigromaculatus*	f
Black sea bass	*Centropristis striata*	m
Blueback herring	*Alosa aestivalis*	e
Bluefish	*Pomatomus saltatrix*	m
Bluegill	*Lepomis macrochirus*	f
Brown bullhead	*Ictalurus nebulosus*	f
Butterfish	*Peprilus triacanthus*	m
Common carp	*Cyprinus carpio*	f
Crevalle jack	*Caranx hippos*	e
Fourspine stickleback	*Apeltes quadracus*	e
Gizzard shad	*Dorosoma cepedianum*	f
Golden shiner	*Notemigonus crysoleucas*	f
Goldfish	*Carassius auratus*	f
Hogchoker	*Trinectes maculatus*	e
Inland silverside	*Menidia beryllina*	e
Largemouth bass	*Micropterus salmoides*	f
Mummichog	*Fundulus heteroclitus*	e
Northern pipefish	*Syngnathus fuscus*	m
Pumpkinseed	*Lepomis gibbosus*	f
Rainbow smelt	*Osmerus mordax*	e
Redbreast sunfish	*Lepomis auritus*	f
Red hake	*Urophycis chuss*	m
Rough silverside	*Membras martinica*	e
Sea lamprey	*Petromyzon marinus*	m
Silver hake	*Merluccius bilinearis*	m
Spottail shiner	*Notropis hudsonius*	f
Striped bass	*Morone saxatilis*	e
Striped searobin	*Prionotus evolans*	m
Tautog	*Tautoga onitis*	m
Tessellated darter	*Etheostoma olmstedi*	f

continued

TABLE 3-8. (Continued)

COMMON NAME[a]	SCIENTIFIC NAME[a]	SALINITY PREFERENCE[b]
Threespine stickleback	*Gasterosteus aculeatus*	e
Warmouth	*Lepomis gulosus*	f
Weakfish	*Cynoscion regalis*	m
White catfish	*Ictalurus catus*	f
White mullet	*Mugil curema*	e
White perch	*Morone americana*	e
Winter flounder	*Pseudopleuronectes americanus*	m
Yellow perch	*Perca flavescens*	f

[a]Names recognized by the American Fisheries Society (Robins *et al.*, 1980)

[b]m = marine, e = euryhaline, f = freshwater

TABLE 3-9. ESTIMATED NUMBER IMPINGED AT INDIAN POINT IN 1983 AND TOTAL PERCENT COMPOSITION OF THE TEN MOST ABUNDANT SPECIES[a] AND ALL SPECIES COMBINED.

	UNIT 2		UNIT 3		BOTH UNITS		
	NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT	CUM. PERCENT
White perch	274898	33.5	11633	39.5	286531	33.7	33.7
Weakfish	174991	21.3	0	0.0	174991	20.6	54.3
Bay anchovy	128627	15.6	404	1.4	129031	15.2	69.5
Atlantic tomcod	117234	14.3	12361	41.9	129595	15.2	84.7
Blueback herring	46854	5.7	2878	9.8	49732	5.9	90.6
Hogchoker	22176	2.7	817	2.8	22993	2.7	93.3
Striped bass	19023	2.3	67	0.2	19090	2.2	95.5
Bluefish	7269	0.9	550	1.9	7819	0.9	96.4
American shad	6382	0.8	10	0.03	6392	0.8	97.2
Alewife	4549	0.6	211	0.7	4760	0.6	97.7
All species combined	820623		29453		850076		

[a]Includes all species comprising over 0.5% of the total at the two units combined, and includes 10 of the 14 selected species.

only for 3 days in May, 30 days in June, and 15 days in July (Tables 3-2, 3-3, 3-10). This caused weakfish and bay anchovy to be under-represented in impingement collections because their peak occurrences were later than the Unit 3 sampling, while tomcod were strongly represented since their peak abundance occurs earlier in the year.

3.5 SEASONAL AND YEARLY IMPINGEMENT PATTERNS

Seasonal trends were examined using mean monthly impingement rates (number of fish collected in a day adjusted for collection efficiency, divided by that day's circulating water volume, averaged over each month).

Unit 3 data are only available for June and July due to the extended outages during the rest of the year. The impingement rate was somewhat higher at Unit 3 than at Unit 2 in June (Figure 3-4). This was due to larger numbers of white perch and blueback herring at Unit 3. The July impingement rate was fairly similar at the two units.

Unit 2 in 1983 provided a fairly complete and consistent measure of the seasonal patterns of impingement rate, because outages were limited. The overall pattern was bimodal, with high impingement rates in the winter due mostly to white perch; low impingement in the spring; a second peak in August, due to weakfish, bay anchovy, and tomcod; and fairly low impingement in the fall.

Fifteen species had been previously selected for more detailed examination of impingement patterns, based on abundance in impingement collections, designation by the U.S. Environmental Protection Agency as representative important species, and current or potential importance to commercial or sport fisheries (TI, 1980b):

TABLE 3-10. CIRCULATING WATER VOLUME PUMPED (10^6 m^3) IN ASSOCIATION WITH IMPINGEMENT SAMPLING AT INDIAN POINT IN 1983.

	UNIT 2	UNIT 3	UNITS 2 AND 3
Jan	18.8	--[a]	18.8
Feb	12.5	--	12.5
Mar	31.2	--	31.2
Apr	8.0	--	8.0
May	9.1	--	9.1
Jun	22.6	38.5	61.2
Jul	10.0	3.0	13.0
Aug	13.5	--	13.5
Sep	28.1	--	28.1
Oct	10.1	--	10.1
Nov	81.6	--	81.6
Dec	73.7	--	73.7
Total	319.3	41.5	360.8

[a]No sampling due to unit shutdown

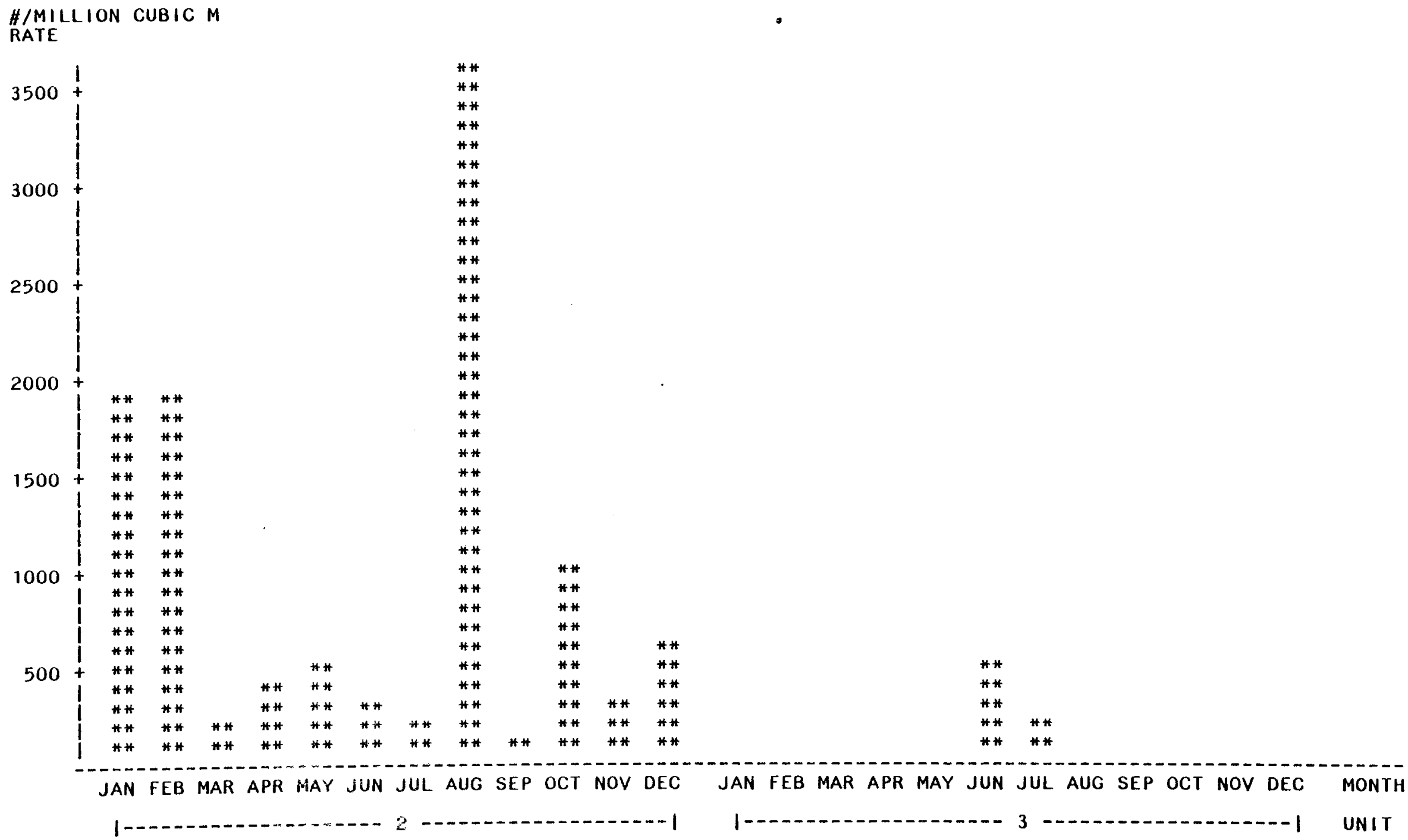

FIGURE 3-4 MONTHLY ADJUSTED IMPINGEMENT RATES FOR ALL TAXA COMBINED AT INDIAN POINT UNITS 2 AND 3 IN 1983 ADJUSTED FOR COLLECTION EFFICIENCY

White perch	Striped bass	American shad
Atlantic tomcod	Hogchoker	Alewife
Bay anchovy	White catfish	Rainbow smelt
Weakfish	Bluefish	Atlantic sturgeon
Blueback herring	Spottail shiner	Shortnose sturgeon

The monthly impingement rates for 13 of those species are presented in Figures 3-5 through 3-17 (only three Atlantic sturgeon were collected in 1983, and no shortnose sturgeon).

White perch, the most abundant species overall, occurred in high numbers in the winter when it was an overwhelmingly dominant species. Its numbers decreased during the spring, were low in summer, and started increasing again in the fall (Figure 3-5). This pattern is consistent with previous years, and is a result of the white perch juveniles overwintering in the deeper waters in the middle and lower Hudson River estuary, and then moving upriver and into shallower water in the spring as their spawning season approaches (TI, 1980a). These movements within and to and from the deeper waters take them past the Indian Point intakes where they are vulnerable to impingement.

Atlantic tomcod were caught mostly during May through August (Figure 3-6), as they were in previous years, reflecting the downstream movement of young-of-the-year fish during the summer into deeper cooler waters (TI, 1980a).

Bay anchovy were restricted to summer and early fall in 1983 impingement collections (Figure 3-7). Previous years have also shown a summer peak for this species, which utilizes the estuary to spawn during that period (TI, 1980a). Bay anchovy abundance has been variable among years, with 1983 being lower than average.

Weakfish impingement in 1983 was characterized by a single strong and brief peak during the month of August (Figure 3-8). This species utilizes the estuary as a nursery area as young-of-the-year fish (TI, 1980a). Past years usually had a longer period of occurrence

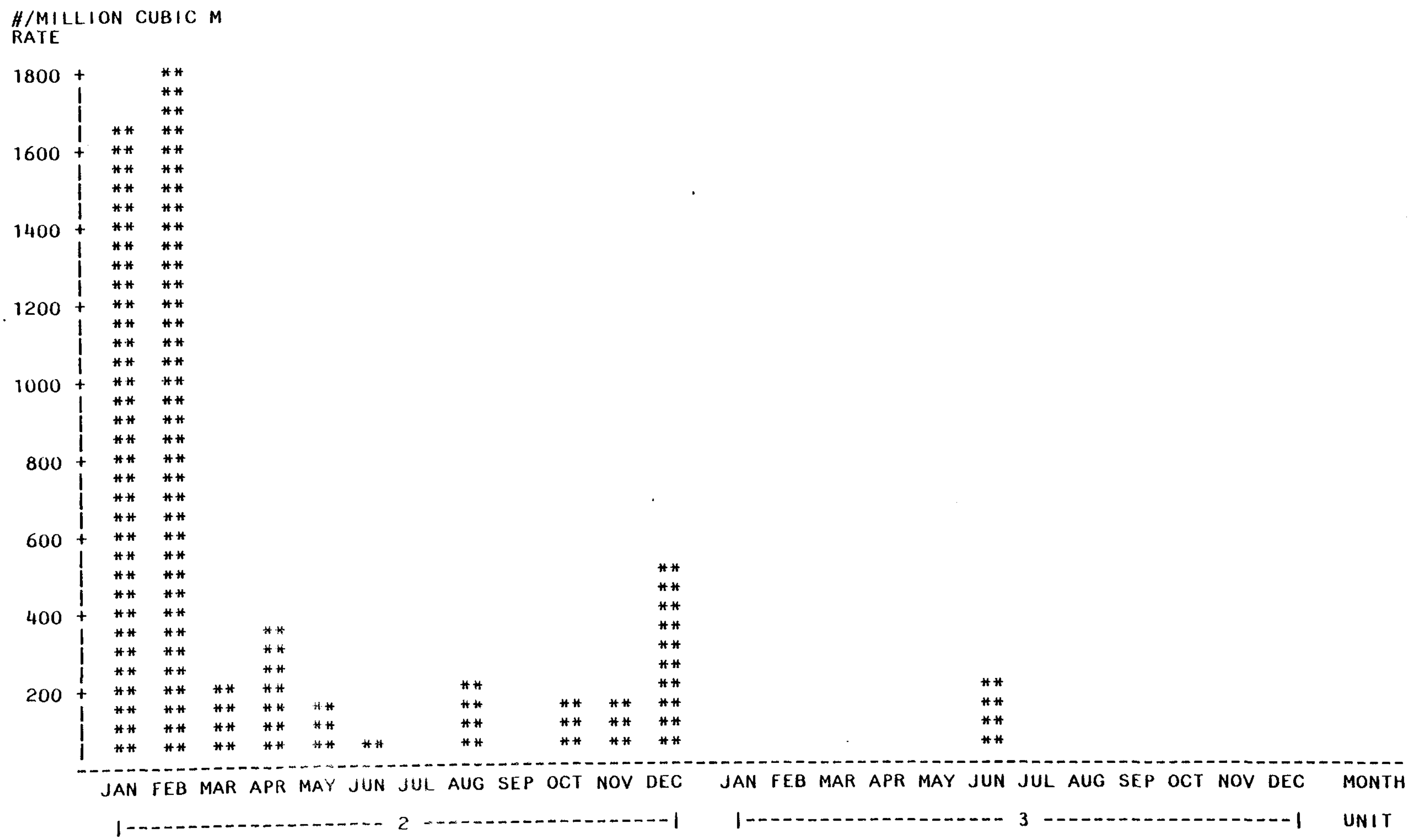

FIGURE 3-5 MONTHLY ADJUSTED IMPINGEMENT RATES FOR WHITE PERCH AT INDIAN POINT UNITS 2 AND 3 IN 1983 ADJUSTED FOR COLLECTION EFFICIENCY

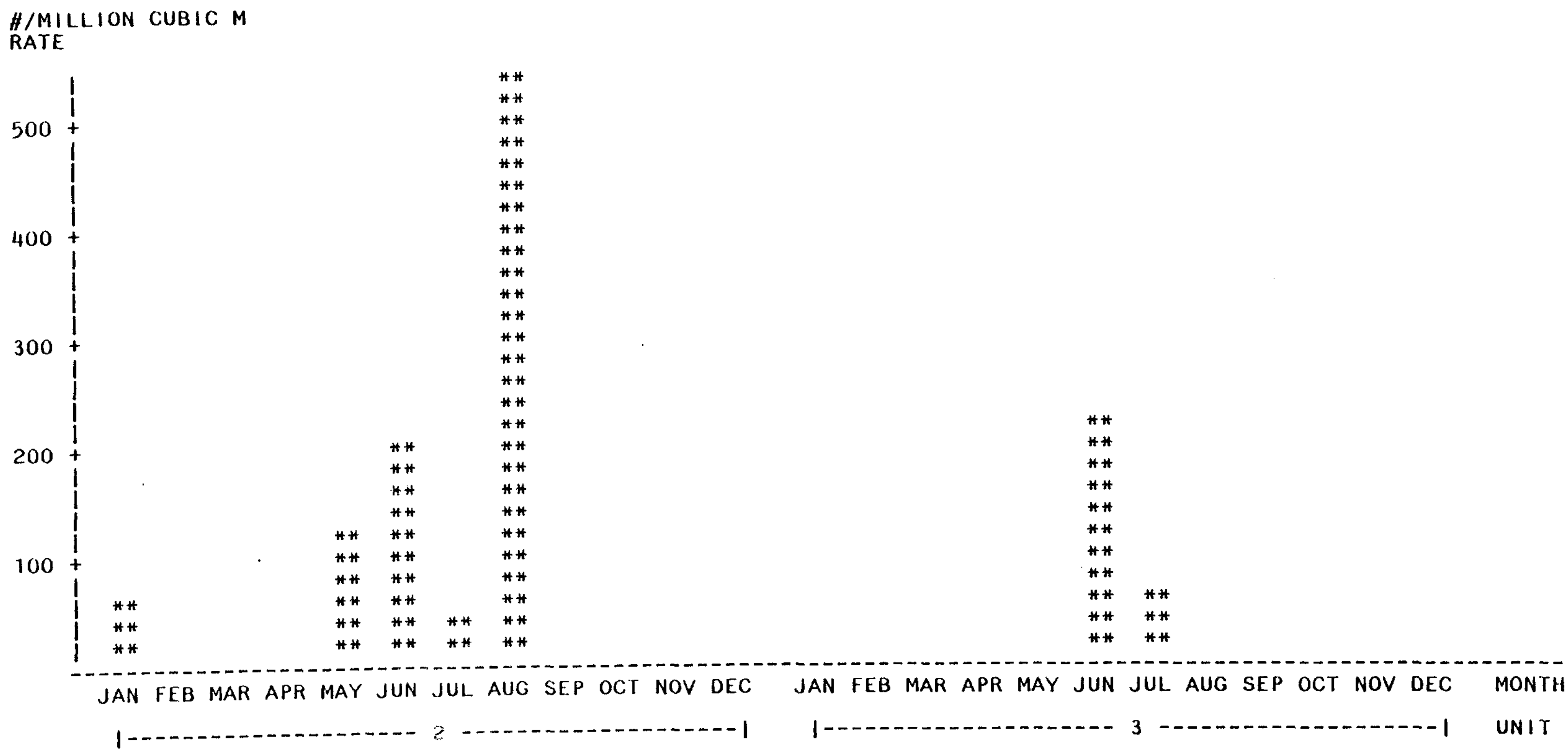

FIGURE 3-6 MONTHLY ADJUSTED IMPINGEMENT RATES FOR ATLANTIC TOMCOD AT INDIAN POINT UNITS 2 AND 3 IN 1983 ADJUSTED FOR COLLECTION EFFICIENCY

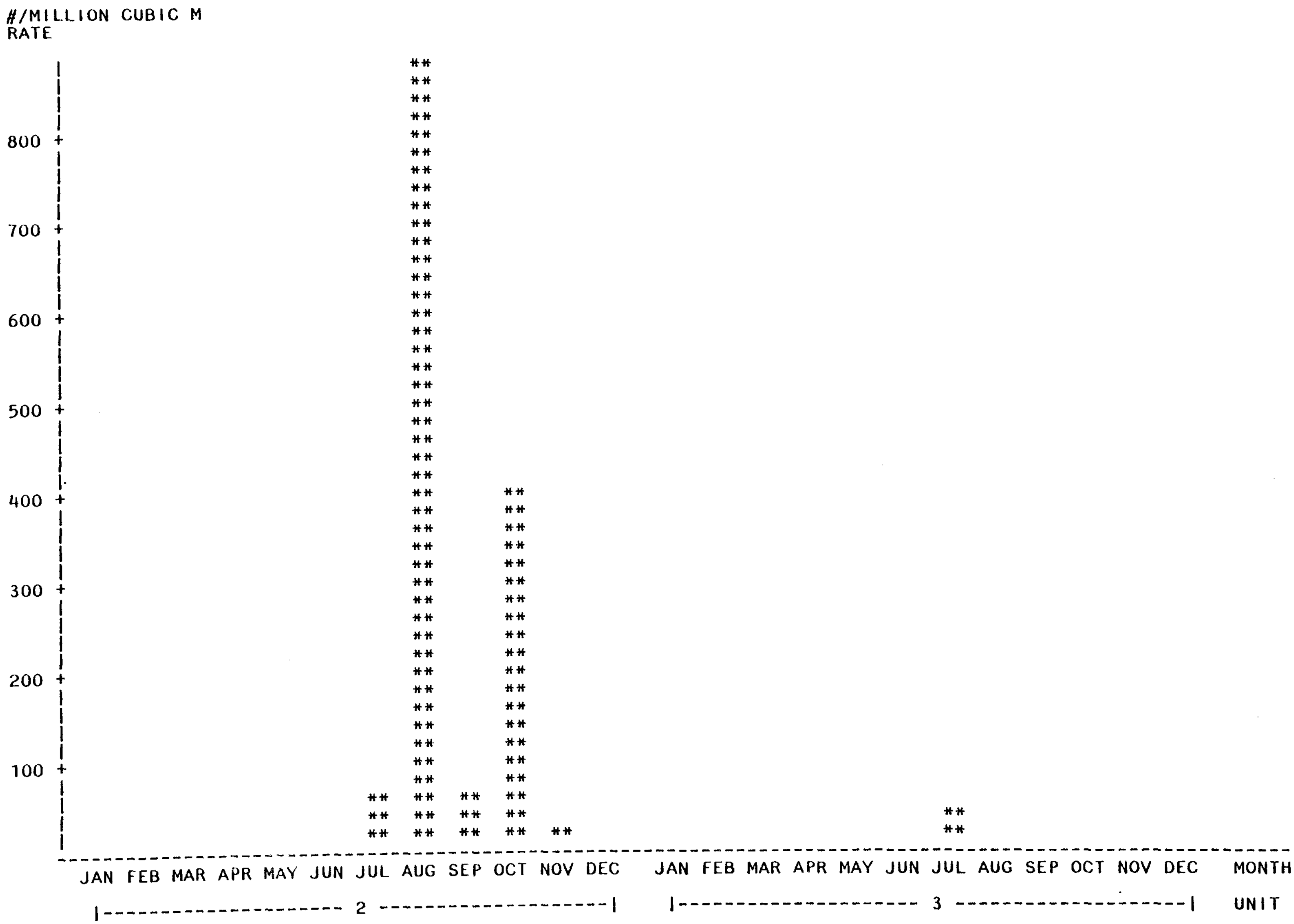

FIGURE 3-7 MONTHLY ADJUSTED IMPINGEMENT RATES FOR BAY ANCHOVY AT INDIAN POINT UNITS 2 AND 3 IN 1983 ADJUSTED FOR COLLECTION EFFICIENCY

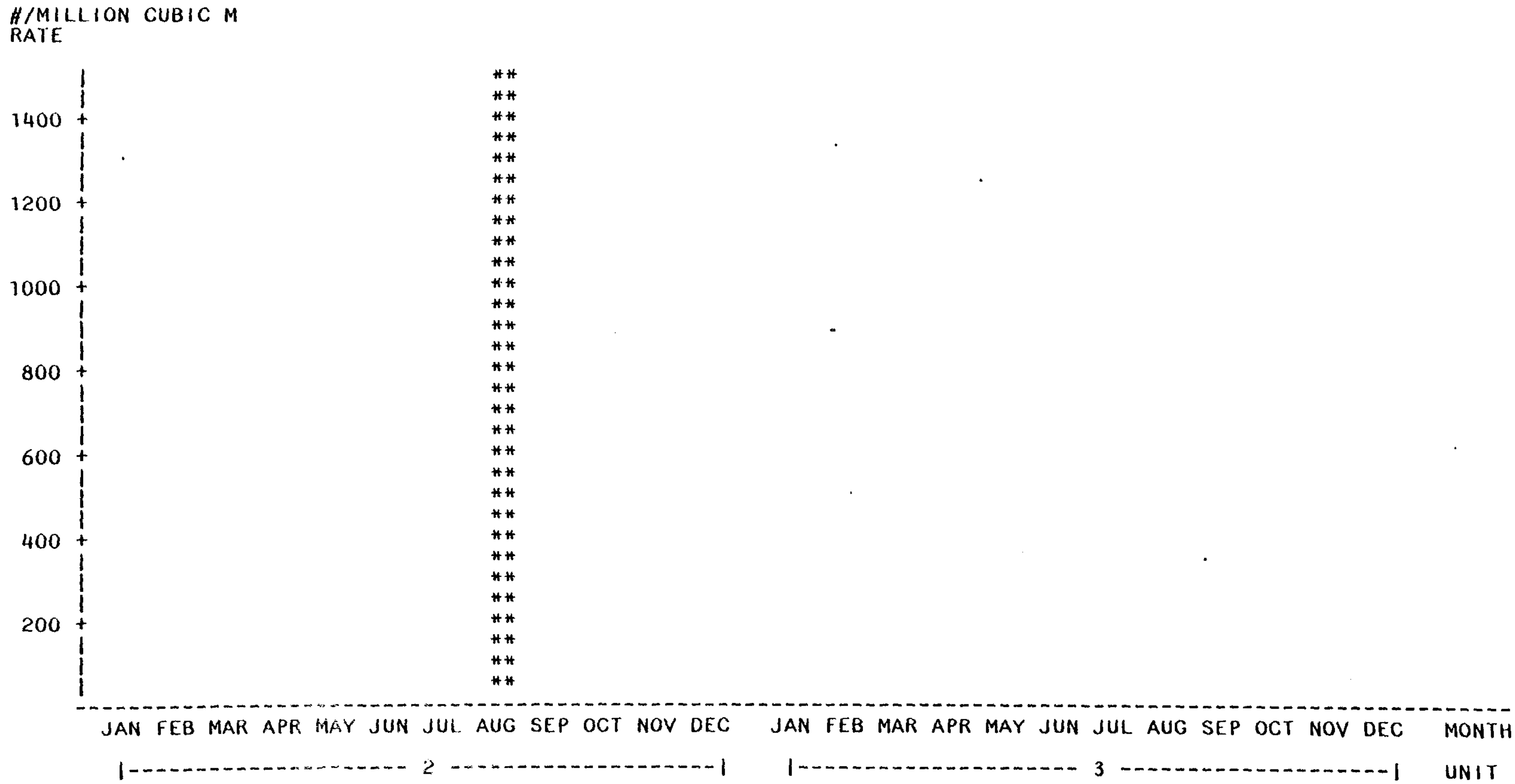

FIGURE 3-8 MONTHLY ADJUSTED IMPINGEMENT RATES FOR WEAKFISH AT INDIAN POINT UNITS 2 AND 3 IN 1983 ADJUSTED FOR COLLECTION EFFICIENCY

extending into the fall, and a much lower impingement rate, about $200/10^6\ m^3$ or less during 1979-1982 (TI, 1980b; Con Edison, 1982a, 1982b, 1983). The reason for the apparent increase in weakfish impingement in 1983 is not known. Because of the small number of samples during 1983's peak month of August (three sampling days) and the large variation among weakfish catches during that month, the uncertainty in the estimate for the August impingement rate is relatively large compared to estimates for other months and other species. The 95% confidence limits for the August estimate of 1516 weakfish impinged per $10^6\ m^3$ are zero and 4988. Since the peak rates observed in prior years fall within these confidence limits it is not certain that the 1983 peak actually was higher. A factor which may have contributed to the high variation in weakfish impingement collections is that this species exhibits schooling behavior (Bigelow and Schroeder, 1953).

Blueback herring were impinged in moderately high numbers in late summer and fall in 1983 (Figure 3-9). During the fall, young-of-the-year bluebacks move downriver past Indian Point as they migrate to the sea (TI, 1980a), and earlier years of impingement data show this same seasonal pattern. Variation in impingement rates among years has been high and the highest monthly rate in 1983 ($>300/10^6\ m^3$) was much lower than in some other years, for example $3000/10^6\ m^3$ in 1979 (TI, 1980b) and $>1000/10^6\ m^3$ in 1981 (Con Edison, 1982b).

Striped bass impingement in 1983 was highest in January, dropping to negligible values in the spring, and was variable (generally low) during late summer and fall (Figure 3-10). This anadromous species spawns in the spring and the young-of-the-year fish move downriver in the summer and seek deeper water in the fall for overwintering (TI, 1980b). The highest impingement rates in previous years have also occurred in the winter. The 1983 rate did not reach as high a level as in most previous years.

Hogchoker (Figure 3-11) were impinged at low levels during most of 1983 except for May when the impingement rate exhibited a sharp peak. Previous years have usually been characterized by a bimodal

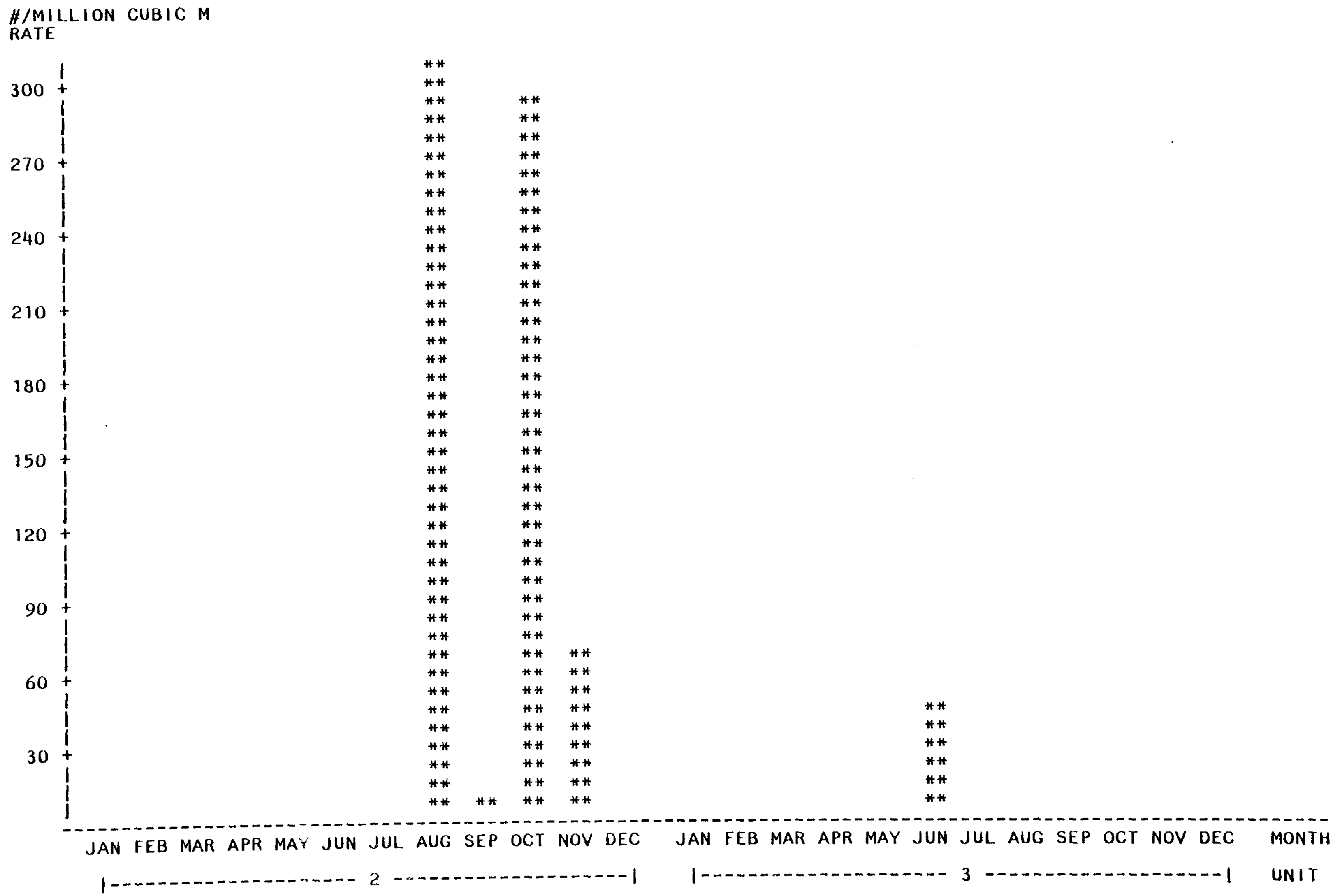

FIGURE 3-9 MONTHLY ADJUSTED IMPINGEMENT RATES FOR BLUEBACK HERRING AT INDIAN POINT UNITS 2 AND 3 IN 1983 ADJUSTED FOR COLLECTION EFFICIENCY

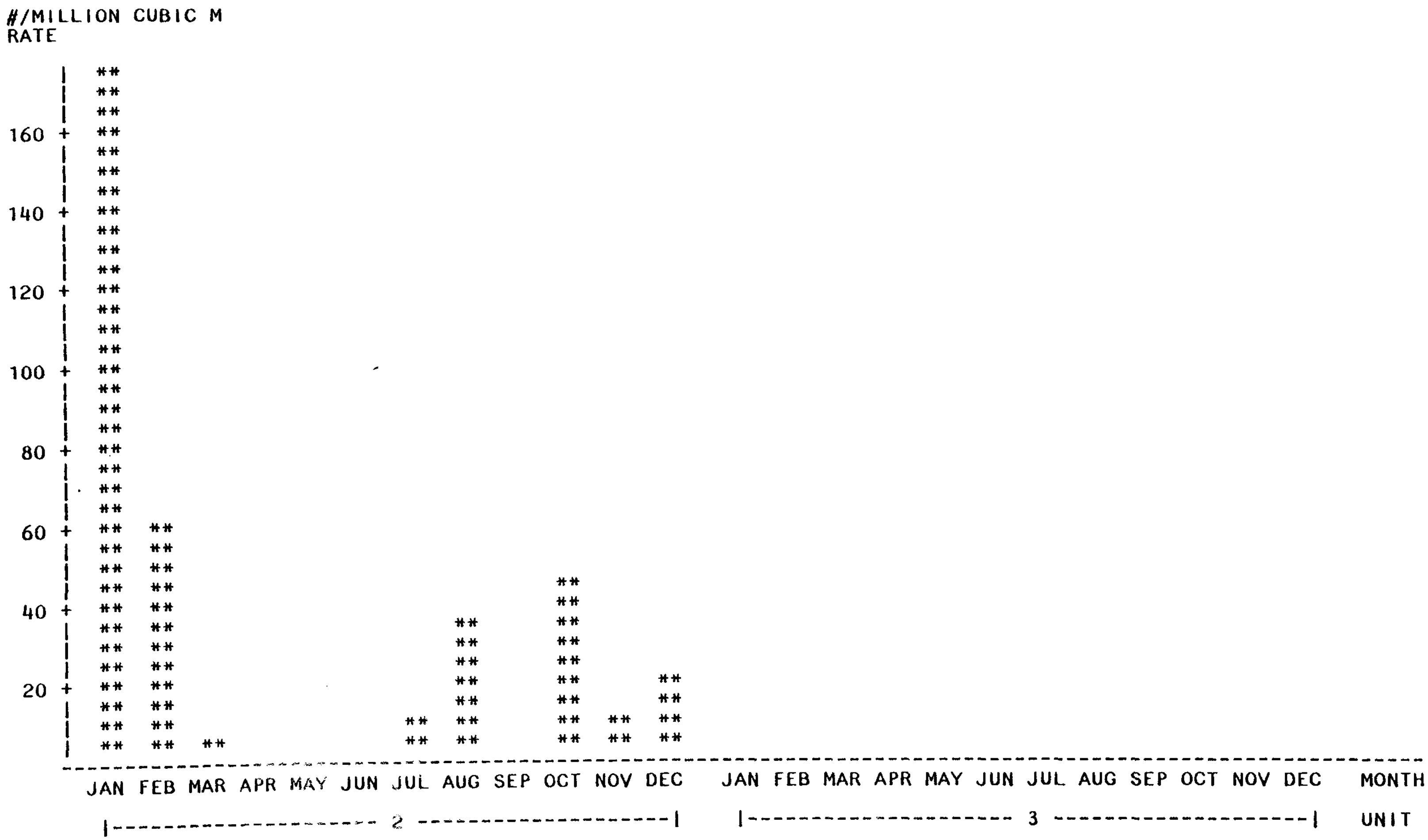

FIGURE 3-10 MONTHLY ADJUSTED IMPINGEMENT RATES FOR STRIPED BASS AT INDIAN POINT UNITS 2 AND 3 IN 1983 ADJUSTED FOR COLLECTION EFFICIENCY

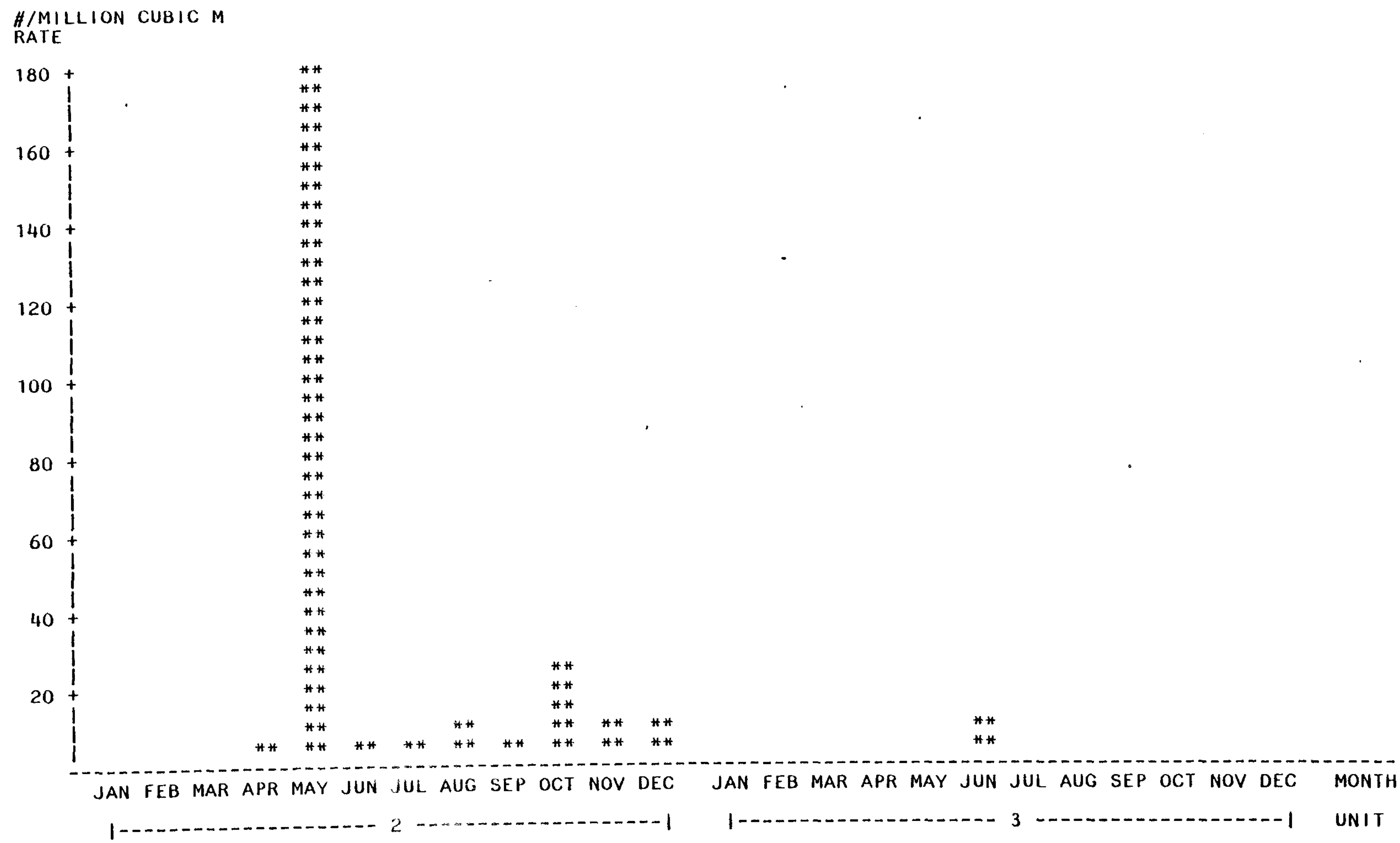

FIGURE 3-11 MONTHLY ADJUSTED IMPINGEMENT RATES FOR HOGCHOKER AT INDIAN POINT UNITS 2 AND 3 IN 1983 ADJUSTED FOR COLLECTION EFFICIENCY

pattern, with a fall peak in addition to (and sometimes larger than) the one in the spring. In 1983 there was only a slight increase in the fall, although the 19-day outage in October (the month when that increase occurred) may explain the low numbers. The spring peak is associated with increasing activity as the water temperature rises (TI, 1980b).

White catfish occurred in nearly every month in 1983, and showed a strong peak in impingement rate in December (Figure 3-12). A winter peak also occurred in other years. This is a result of the white catfish moving into deeper water for the winter (TI, 1980b).

Bluefish impingement occurred mostly in summer (June-August), with a small amount continuing into the fall, and none in winter or spring in 1983 (Figure 3-13). This is consistent with patterns observed in previous years. Bluefish utilize the estuary as a nursery area in the summer months (TI, 1980b).

Spottail shiners were impinged during most months of 1983 but were distinctly more numerous in the winter (Figure 3-14), as they have been in past years. The young-of-the-year spottail shiners congregate in shallow inshore nursery areas during the summer and fall, then move into deeper water during the winter (TI, 1980b). This movement to and from and within the deeper waters increases their vulnerability to inpingement. Impingement rates in 1982 were somewhat lower than during 1979-1981 (Con Edison, 1983); the 1983 rates were similar to those in 1982.

American shad were impinged mainly during July through November in 1983, with July and August being the peak months (Figure 3-15). Previous years have shown either a summer peak, a fall peak, or a bimodal pattern (summer and fall). The young-of-the-year shad are abundant in the Indian Point region of the Hudson, and early summer is when they have grown to a large enough size to be impinged in substantial numbers. In the fall they migrate downriver on their way to

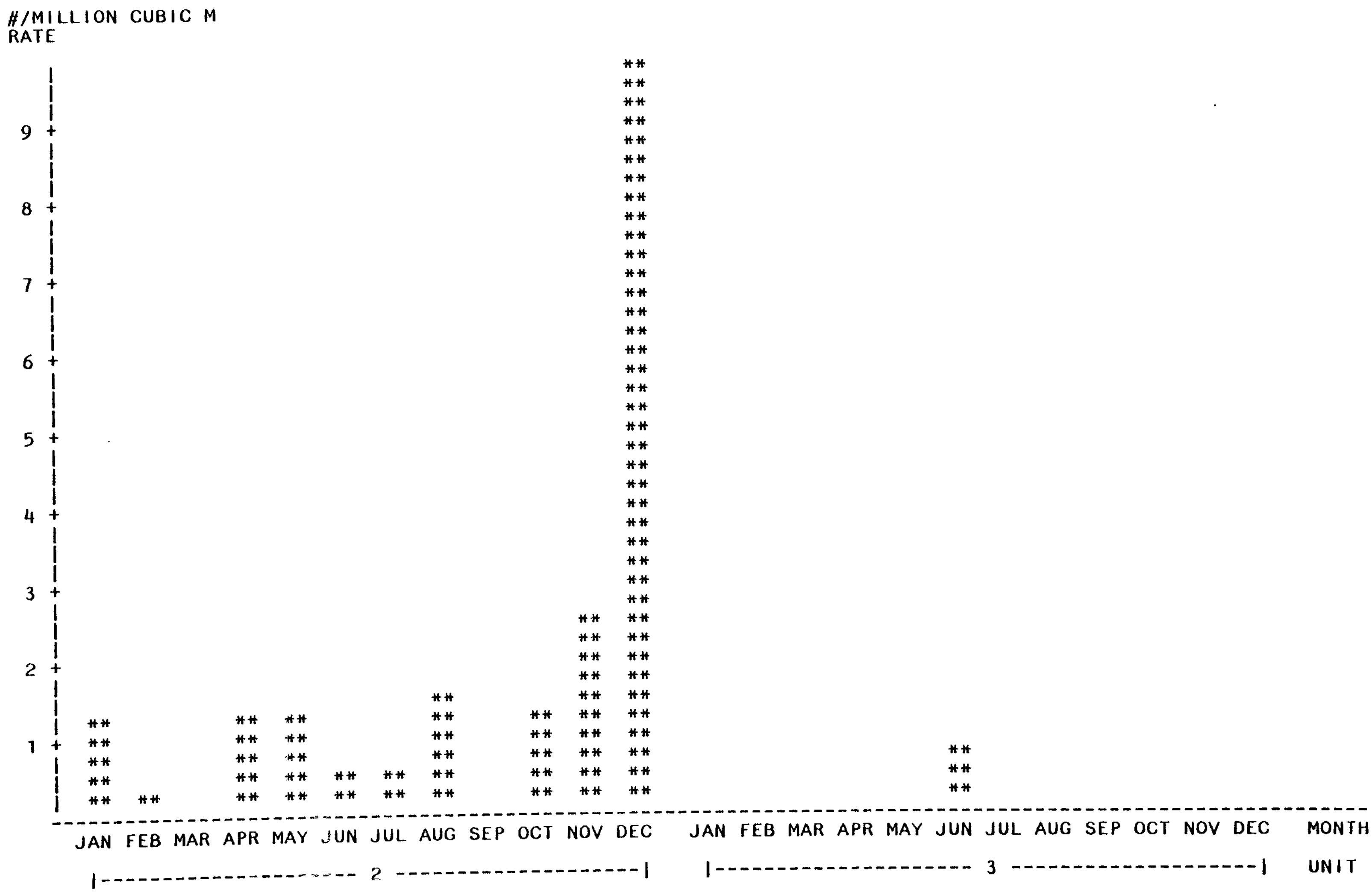

FIGURE 3-12 MONTHLY ADJUSTED IMPINGEMENT RATES FOR WHITE CATFISH AT INDIAN POINT UNITS 2 AND 3 IN 1983 ADJUSTED FOR COLLECTION EFFICIENCY

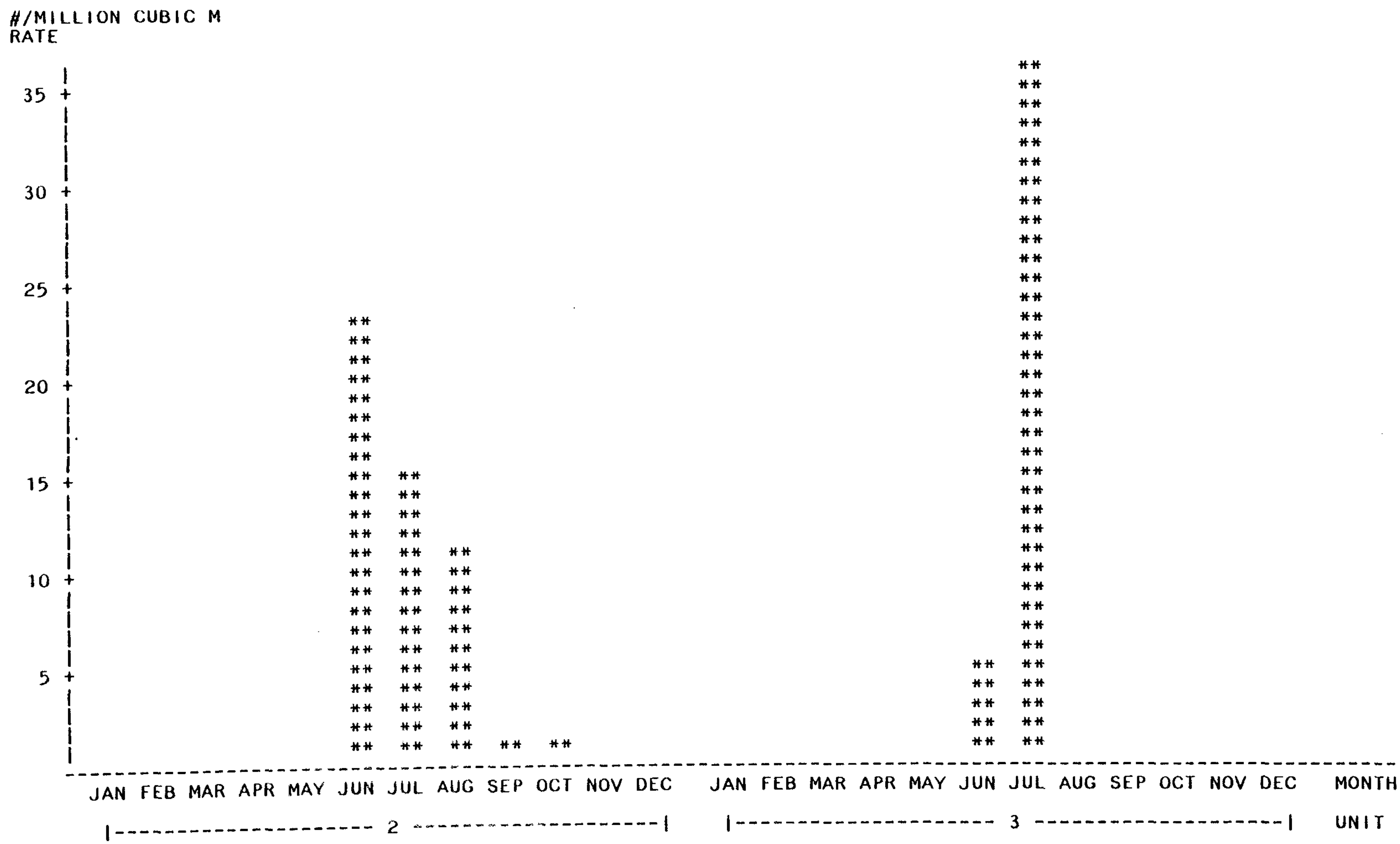

FIGURE 3-13 MONTHLY ADJUSTED IMPINGEMENT RATES FOR BLUEFISH AT INDIAN POINT UNITS 2 AND 3 IN 1983 ADJUSTED FOR COLLECTION EFFICIENCY

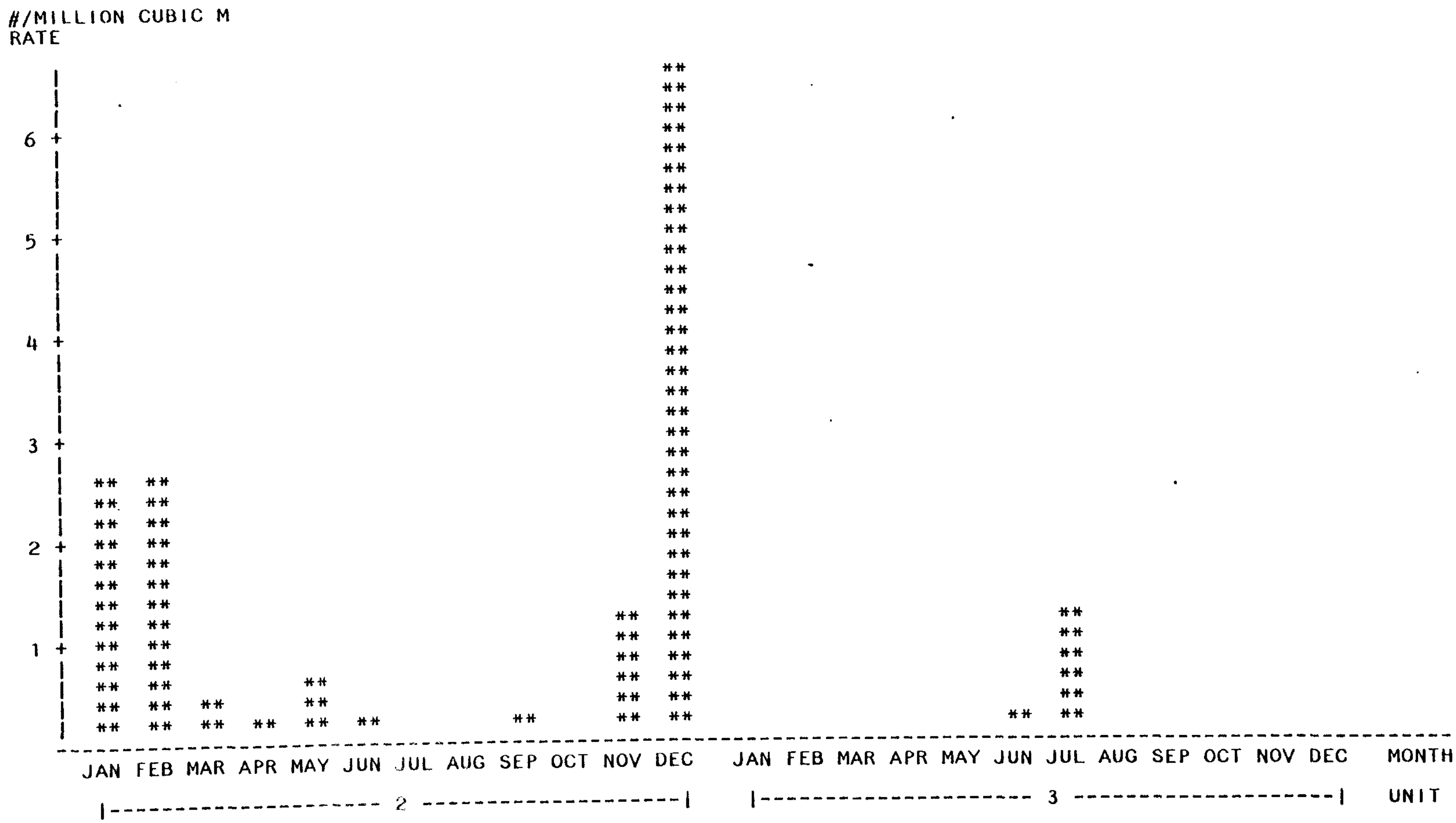

FIGURE 3-14 MONTHLY ADJUSTED IMPINGEMENT RATES FOR SPOTTAIL SHINER AT INDIAN POINT UNITS 2 AND 3 IN 1983 ADJUSTED FOR COLLECTION EFFICIENCY

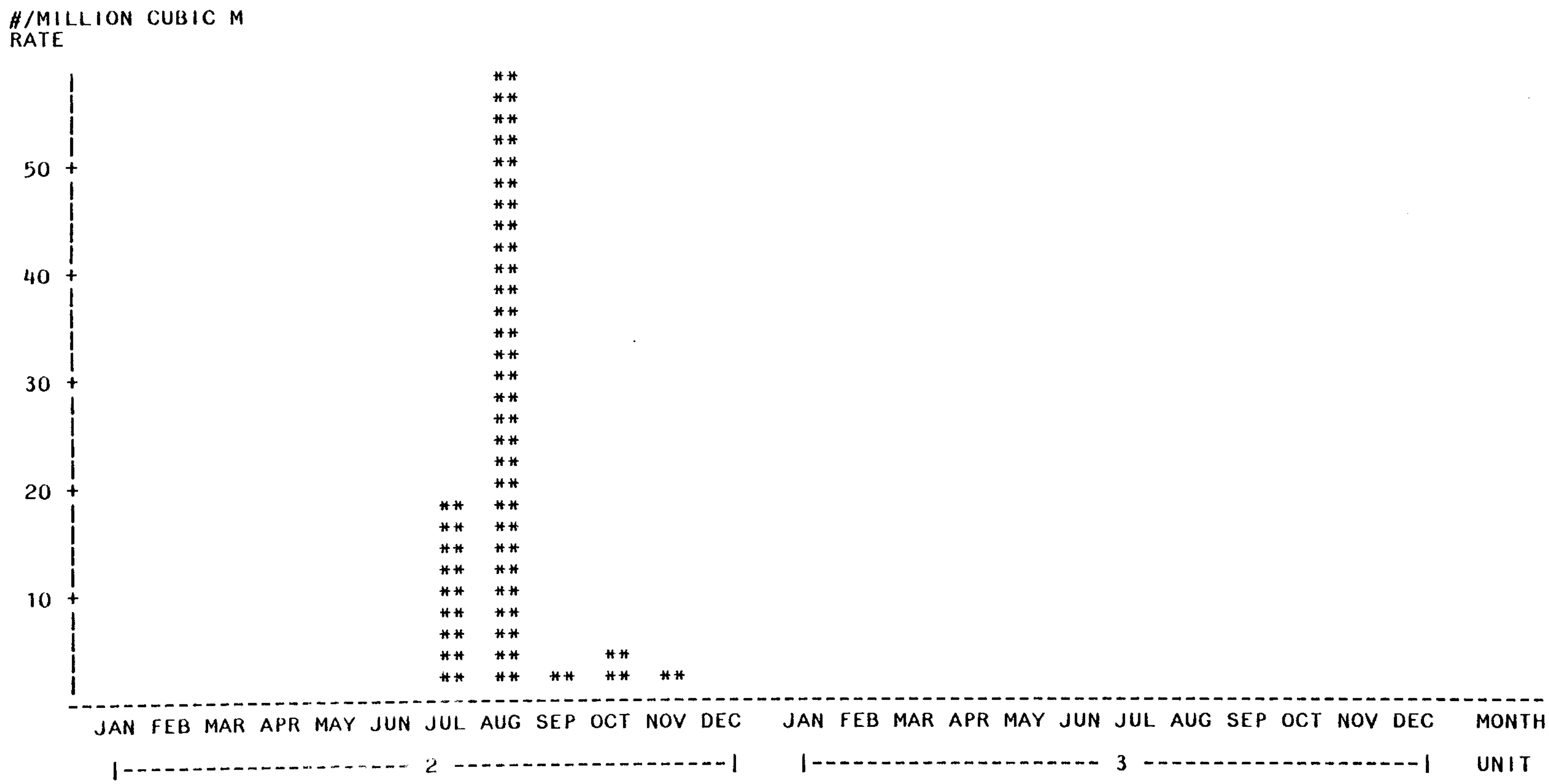

FIGURE 3-15 MONTHLY ADJUSTED IMPINGEMENT RATES FOR AMERICAN SHAD AT INDIAN POINT UNITS 2 AND 3 IN 1983 ADJUSTED FOR COLLECTION EFFICIENCY

the sea (TI, 1980b). In 1983, for the second consecutive year, the shad impingement rate was lower than in past years.

Alewife impingement rates in 1983 were similar to shad in both seasonal pattern and magnitude, except that the summer peak began a little later (Figure 3-16). Historical impingement patterns and life history for the alewife are similar to the shad's. The numbers of impinged alewife have generally been lower than for shad in the past, but in 1983 (as in 1982) they were about equal due to the decreased shad impingement.

Rainbow smelt were impinged sporadically throughout most of 1983, without a distinct seasonal pattern; the highest numbers occurred in January and May (Figure 3-17). Other years have been inconsistent as to the season of highest impingement, with high counts occurring in different months in different years. Smelt migrate into freshwater to spawn in the spring, and the young-of-the-year move into deeper water in the early summer and then migrate downriver in the fall (TI, 1980b).

Atlantic sturgeon were only rarely impinged in 1983. A total of three were collected, all in December. Previous years have shown low and variable impingement rates. This is a large demersal species which is less vulnerable to impingement than many other fishes. The adults move upriver in the spring to spawn, and the young move downriver in the fall (TI, 1980b).

No shortnose sturgeon were impinged in 1983. Low numbers have been impinged in previous years, but the reduced sampling frequency has decreased the likelihood of collecting shortnose sturgeon in impingement samples. None were collected in 1982, the first full year of reduced sampling (Con Edison, 1983). Their life history and habits are not well known (Dovel, 1979).

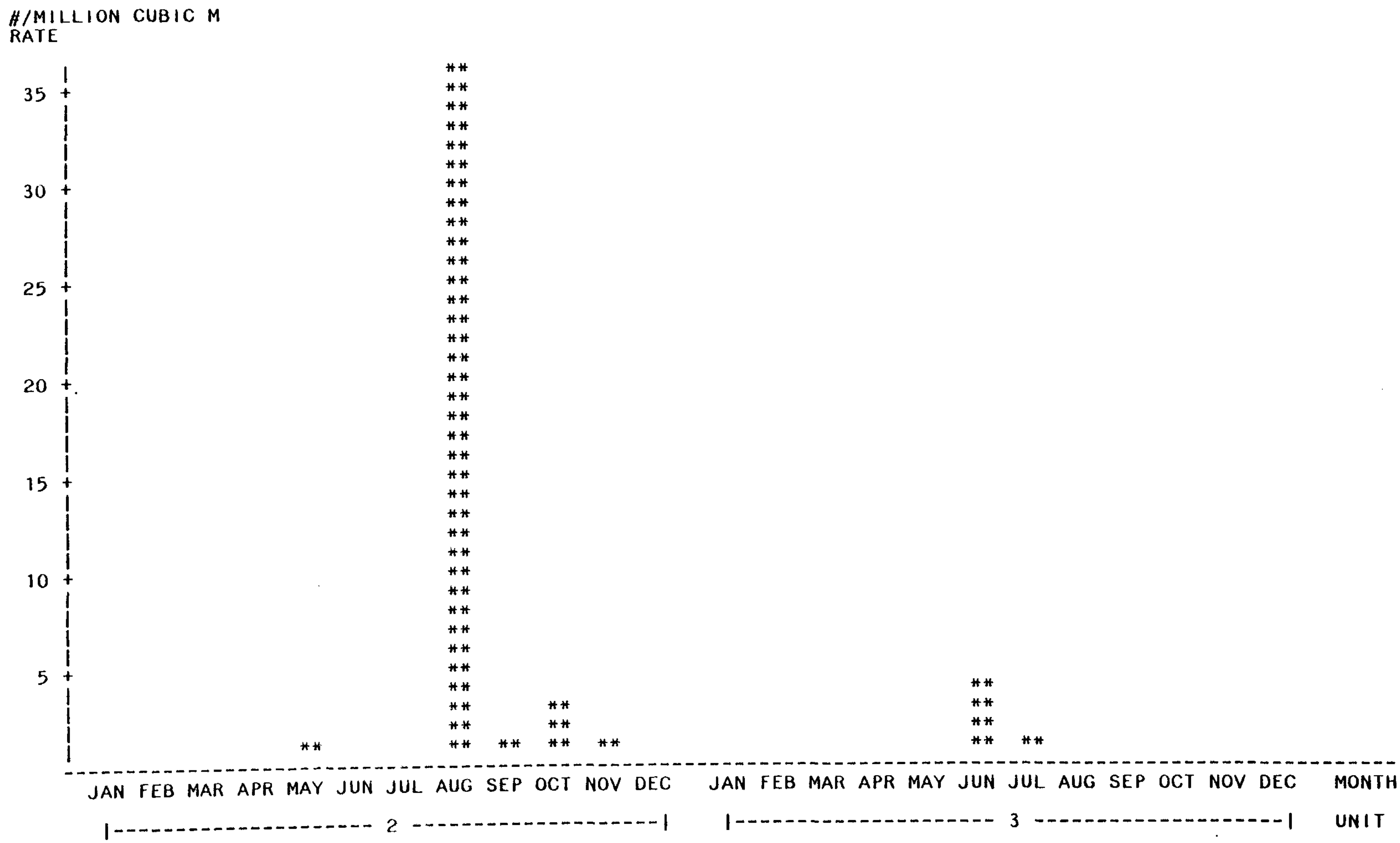

FIGURE 3-16 MONTHLY ADJUSTED IMPINGEMENT RATES FOR ALEWIFE AT INDIAN POINT UNITS 2 AND 3 IN 1983 ADJUSTED FOR COLLECTION EFFICIENCY

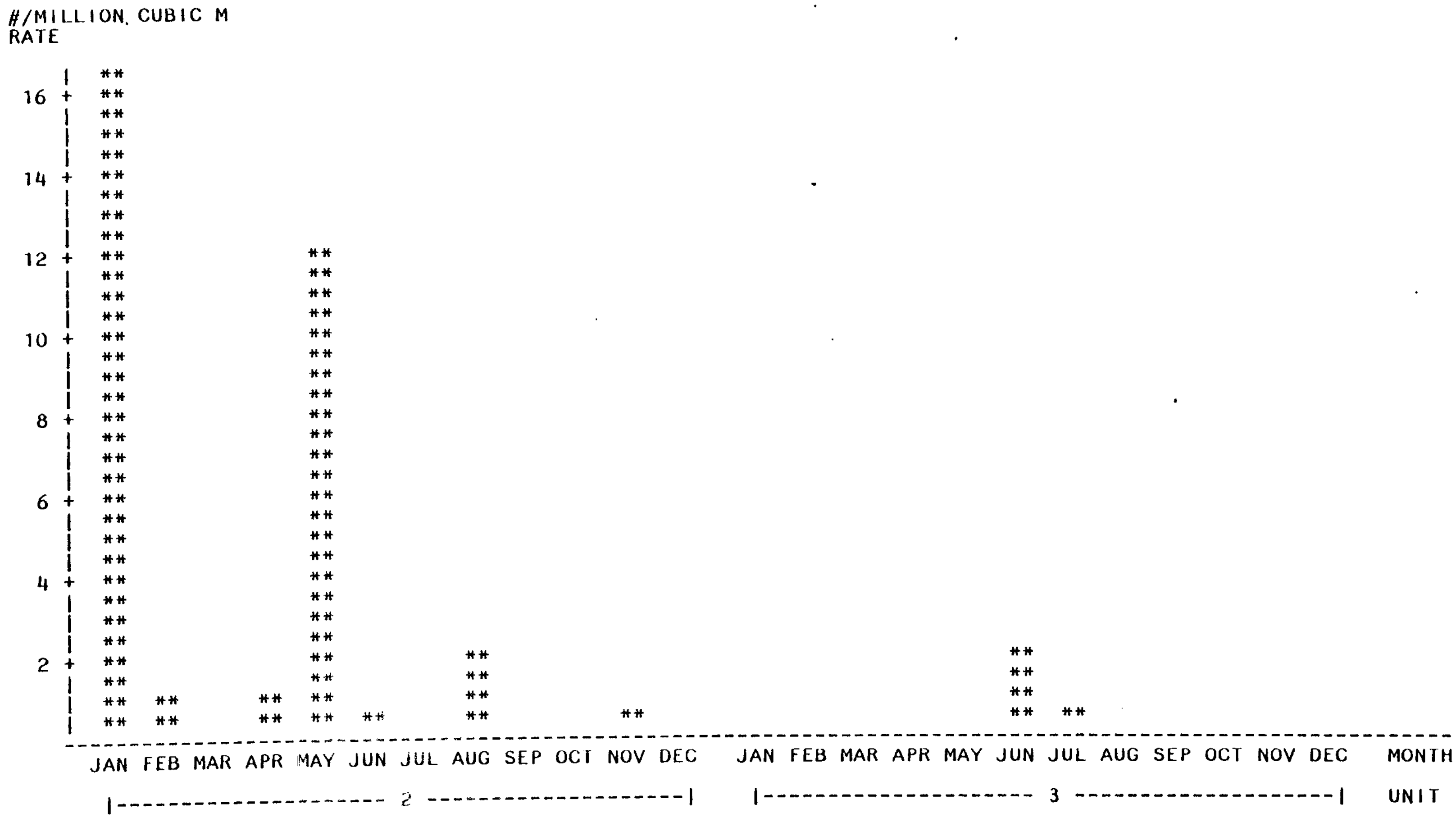

FIGURE 3-17 MONTHLY ADJUSTED IMPINGEMENT RATES FOR RAINBOW SMELT AT INDIAN POINT UNITS 2 AND 3 IN 1983 ADJUSTED FOR COLLECTION EFFICIENCY

3.6 BLUE CRAB IMPINGEMENT

Impinged blue crabs were sampled beginning in April 1983. They were not sampled in previous years. A total of 821 blue crabs were collected, with a total weight of 152 kg. Both numbers and total weight were low in the spring (none impinged until May), high in the summer (peaking sharply in August), and low again in the fall (Table 3-11).

Monthly counts are presented in Table A-12 broken down by the following variables: unit (2 or 3), sex, survival, and condition. Unit 2 accounted for most of the blue crab impingement, 96%, probably due to the extended outages at Unit 3. In June when both units were operating, the number of crabs impinged did not differ greatly between Unit 2 and Unit 3.

Males accounted for 72% of the crabs impinged, a sex ratio of 2.63:1 (Table 3-12). The ratio of males to females was highest in June and October, although total numbers of crabs were low in those months. The sex ratio did not change greatly among the other months. During the three-month period when most of the crabs were impinged (~~June~~ July-September, 87% of the 1983 total) the sex ratio gradually decreased from 3.52 (~~June~~ July) to 1.87 (September).

Survival of the crabs was 73% overall. Damaged specimens (missing body parts, such as legs) accounted for 48% of all crabs (38% of the live crabs were damaged and 77% of the dead ones). The proportions of dead or damaged crabs did not differ appreciably among months.

Sizes of blue crabs are presented in Table A-13 by month and 10-mm size classes (carapace width). Most of the crabs impinged were adults: 92% were 100 mm or larger. Only four or five crabs appear to have been young-of-the-year based on the size-frequency distribution. Four specimens were under 40 mm when collected in November, and another was under 80 mm in October.

TABLE 3-11
TOTAL NUMBERS AND WEIGHTS OF BLUE CRABS IMPINGED EACH MONTH
AT INDIAN POINT DURING APRIL- DECEMBER 1983

		APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
NUMBER	UNIT 2	0	23	18	118	375	215	24	10	7	790
	UNIT 3	0	0	27	4	0	0	0	0	0	31
	TOTAL	0	23	45	122	375	215	24	10	7	821
WEIGHT (grams)	UNIT 2	0	767	1343	17819	69851	51199	5879	1756	1945	150559
	UNIT 3	0	0	1312	87	0	0	0	0	0	1399
	TOTAL	0	767	2655	17906	69851	51199	5879	1756	1945	151958

TABLE 3-12. MONTHLY COUNTS BY SEX, SURVIVAL, AND CONDITION OF BLUE CRABS IMPINGED AT INDIAN POINT DURING APRIL THROUGH DECEMBER 1983.

		APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Sex	Male	0	14	42	95	270	140	21	8	5	595
	Female	0	9	3	27	105	75	3	2	2	226
Survival	Alive	0	17	41	84	249	176	18	10	6	601
	Dead	0	6	4	38	126	39	6	0	1	220
Condition	Intact	0	13	32	42	185	126	11	8	6	423
	Missing parts	0	10	13	80	190	89	13	2	1	398
Total		0	23	45	122	375	215	24	10	7	821

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APPENDIX A

IMPINGEMENT FIELD, LABORATORY, AND DATA CALCULATION PROCEDURES

The reduced sampling design for impingement and water quality data collection, which was initiated in July 1981, was continued throughout 1983. Sample days were assigned to randomly selected dates within four seasonal strata, in contrast to the daily sampling which was conducted before July 1981. On days not selected for sample collection (non-sample days), fish and debris were discarded when the traveling screens were washed. Impingement counts and biocharacteristics data were collected for blue crabs in 1983 for the first time beginning in April. Collection efficiency tests were not conducted in 1983.

Schedule

On the randomly selected sample days, fish and blue crab impingement samples were collected. On non-sample days, only blue crab samples were collected. Blue crabs were not sampled before April. On occasions when sampling could not be carried out due to unit outages, abnormal screenwash procedures, or unexpected operating conditions, an additional sampling day was randomly selected from the remaining non-sample days in the stratum (if there were any) to replace the one lost.

Sampling was conducted during the routinely scheduled daily screen washing, generally around 0900 hours. If unscheduled screen washes or continuous washing was necessary during a sampling day because of heavy trash loading, screen malfunction, etc., then sampling was also conducted during those unscheduled washes, whenever possible, to make the date representative of the full 24-hour period.

Sample Collection

On sample days all fish and blue crabs washed in a 24-hour period from the intake screens of the unit(s) being sampled were taken to the laboratory for processing. On non-sample days, only blue crabs were kept for processing. Temperature (^{o}C) and conductivity (micro siemans) were measured at the intake of each unit (2 and 3) at 0.3 m (1 foot) below the water surface on days when fish or blue crabs were collected, as close as was practical to the time of flood or high tide (Tables A-1 and A-2). Plant operating data were recorded for each day that fish or blue crabs were collected: time of screenwash, screenwash order, head loss at each screen, and operating condition of each screen.

Sample Processing

Fish were identified and enumerated by four general size classes for each species, based on total length in millimeters:

Length Class 1 = up to Division 1
Length Class 2 = Division 1 + 1 mm up to Division 2
Length Class 3 = Division 2 + 1 mm up to 250 mm
Length Class 4 = 251 mm and larger

The division cutoffs (Division 1 and Division 2) used to define the length groups represent the upper length limits of young-of-the-year and yearling age classes, respectively. The values for the division cutoffs were determined from length-frequency data obtained from the impingement collections, supplemented when necessary by aging selected specimens by scale analysis. These values were periodically updated throughout the year to allow for growth, usually every two weeks.

For any species, except Atlantic tomcod during January through March and during December, if the total number of fish in length class 1 or 2 exceeded 100 then a subsample was taken. In those cases 100 fish were randomly selected within the length class and weighed. The total count for that species in the subsampled length class was estimated as 100 multiplied by the ratio of the total weight of the length class to the subsample weight. Total counts (sum of four length classes) for each species are summarized by month in Tables A-3 through A-5 and by seasonal stratum in Tables A-6 through A-8. For each species, weights were recorded to the nearest gram for Length Class 1, Length Class 2, and total of all four length classes (Tables A-9 through A-11).

Blue crabs were examined for total count (Table A-12) and total weight, and the following data were recorded for each specimen: carapace width to the nearest millimeter (Table A-13), weight (nearest 0.1 g), survival (alive or dead), condition (intact or missing body parts), and sex. After processing the sample, all live crabs were returned to the river away from the intake structure.

Any shortnose or Atlantic sturgeon were measured (total length), weighed, and the data entered in a Sturgeon Log. Live sturgeon were returned to the river. All yearling and older striped bass, white perch, and Atlantic tomcod, and young-of-the-year tomcod after the first day of marking in December, were examined for fin clips, tags, or tag wounds. Any suspected recaptures were preserved in 10% formalin for later verification.

Quality control (QC) checks were performed on fish identifications, counts, weights, crab measurements, and examination for suspected recaptures. The selection of samples for QC checks followed Military Standard 1235 (Single and Multiple Level Continuous Sampling Procedures), which assured that 90% or more of the data were within specified tolerance limits. Data were recorded on standard data coding forms developed for this study.

Calculations

To estimate the number of fish actually impinged on a sampling day the count from that day's impingement collection was divided by the corresponding collection efficiency (Equation 1).

$$Y_{im} = \frac{\sum_{L=1}^{4} C_{Lim}}{E_{im}} \qquad \text{(Equation 1)}$$

where Y_{im} = estimated number of fish impinged on day i at unit m

C_{Lim} = count for length class L on day i at Unit m

E_{im} = collection efficiency estimate for day i at Unit m (calculated as shown in Section 3.2)

Within each seasonal stratum, h, a mean ($\bar{Y}_{hm}$) and a variance (S^2_{hm}) were calculated for the n_{hm} values of the daily estimate Y_{im} (where n_{hm} = the number of sampling days in stratum h at Unit m). The total number of fish impinged over the whole year was estimated by Equation 2.

$$T_m = \sum_{h=1}^{4} N_{hm} \bar{Y}_{hm} \qquad \text{(Equation 2)}$$

where T_m = total estimated number of fish impinged at Unit m

N_{hm} = number of days in stratum h that Unit m operated (a unit was considered to be operating if any circulating water was being pumped)

$\bar{Y}_{hm}$ = mean daily estimate for stratum h at Unit m

This estimate $\left(T_m\right)$ of the total number of fish impinged is equivalent to the number which would result from generating an annual estimate from each of the daily estimates and then averaging them using the appropriate stratified sampling formula. Therefore, its standard error can be calculated from the within-stratum variances as a measure of the estimate's precision (Equation 3).

$$S.E. = \sqrt{\sum_{h=1}^{4} \frac{N_{hm} (N_{hm} - n_{hm}) \ S^2_{hm}}{n_{hm}}} \qquad \text{(Equation 3)}$$

where $S.E.$ = standard error of the total estimated number of fish impinged at Unit m

N_{hm}, n_{hm}, S^2_{hm} = as defined on the previous page

The coefficient of variation was calculated to relate the precision to the total estimate (Equation 4).

$$C.V. = \frac{S.E.}{T_{hm}} \times 100\% \qquad \text{(Equation 4)}$$

where $C.V.$ = coefficient of variation

$S.E.$ = as defined above

T_{hm} = estimated number of fish impinged in stratum h at Unit m

The total weight of fish impinged for each stratum was estimated using Equation 5.

$$W_{hm} = \left(\frac{w_{hm}}{\sum_{L=1}^{4} C_{Lhm}} \right) N_{hm} \bar{Y}_{hm} \qquad \text{(Equation 5)}$$

where W_{hm} = total estimated weight of fish impinged in stratum h at Unit m

w_{hm} = total weight of fish actually collected in stratum h at Unit m

C_{Lhm} = total count of fish actually collected in length class L in stratum h at Unit m

N_{hm}, $\bar{Y}_{hm}$ = as defined above

Monthly mean impingement rates were calculated by standardizing the daily impingement estimate (adjusted for collection efficiency) by dividing by that day's circulating water volume.

$$A_{km} = \frac{1}{n_{km}} \sum_{i=1}^{n_{km}} \frac{\sum_{L=1}^{4} C_{Likm}}{V_{ikm} \quad E_{ikm}}$$

where A_{km} = adjusted impingement rate for month k at Unit m

n_{km} = number of samplng days in month k at Unit m

C_{Likm} = count for length class L on day i of month k at Unit m

V_{ikm}, E_{ikm} = circulating volume, and collection efficiency on day i of month k at Unit m

TABLE A-1
DAILY INTAKE TEMPERATURE (DEGREES CENTIGRADE)
AT THE INDIAN POINT GENERATING STATION DURING 1983

DATE	UNIT 2	UNIT 3	MEAN	DATE	UNIT 2	UNIT 3	MEAN
03JAN83	5.3		5.3	29MAY83	16.5	17.0	16.8
04JAN83	4.6		4.6	30MAY83	16.5	16.5	16.5
05JAN83	4.9		4.9	01JUN83	16.5	17.0	16.8
07JAN83	4.8		4.8	02JUN83	17.0	17.0	17.0
13JAN83	4.2		4.2	03JUN83	17.0	16.0	16.5
14JAN83	4.0		4.0	05JUN83	19.0	18.0	18.5
18JAN83	5.5		5.5	09JUN83	18.5	18.0	18.3
21JAN83	1.4		1.4	10JUN83	19.0	18.5	18.8
22JAN83	1.8		1.8	11JUN83	19.5	20.0	19.8
24JAN83	1.7		1.7	12JUN83	20.0	20.5	20.3
26JAN83	1.8		1.8	13JUN83	20.0	20.0	20.0
01FEB83	2.0		2.0	14JUN83	20.0	20.0	20.0
23FEB83	0.8		0.8	15JUN83	21.5	20.0	20.8
24FEB83	0.9		0.9	16JUN83	21.5	21.0	21.3
25FEB83	2.2		2.2	17JUN83	20.0	20.5	20.3
26FEB83	1.5		1.5	18JUN83	24.5	24.0	24.3
27FEB83	1.4		1.4	19JUN83	24.0	23.5	23.8
10MAR83	3.0		3.0	20JUN83	24.0	22.5	23.3
11MAR83	3.5		3.5	21JUN83	24.0	23.0	23.5
12MAR83	5.3		5.3	22JUN83	25.0	24.0	24.5
13MAR83	5.9		5.9	23JUN83	24.0	24.0	24.0
14MAR83	5.9		5.9	24JUN83	24.0	24.0	24.0
15MAR83	5.6		5.6	25JUN83	24.0	24.5	24.3
16MAR83	5.5		5.5	26JUN83	24.0	23.5	23.8
17MAR83	7.7		7.7	27JUN83	25.0	25.0	25.0
22MAR83	6.0		6.0	28JUN83	25.0	24.0	24.5
24MAR83	5.0		5.0	29JUN83	23.0	22.5	22.8
25MAR83	5.2		5.2	01JUL83	23.5	23.5	23.5
26MAR83	5.6		5.6	03JUL83	25.5	25.5	25.5
29MAR83	10.0		10.0	04JUL83	25.0	25.0	25.0
03APR83	6.2	6.5	6.3	05JUL83	25.5	26.0	25.8
05APR83	7.0	6.0	6.5	06JUL83	25.0	24.5	24.8
30APR83	8.0	10.0	9.0	08JUL83	26.0	25.5	25.8
09MAY83	14.0	13.8	13.9	09JUL83	25.0	25.0	25.0
14MAY83	13.0	14.8	13.9	10JUL83	24.0	23.5	23.8
15MAY83	15.5	15.0	15.3	11JUL83	24.0	24.0	24.0
17MAY83	13.5	13.5	13.5	12JUL83	25.0	25.5	25.3
19MAY83	14.5	14.5	14.5	13JUL83	25.0	25.5	25.3
21MAY83	16.0	15.0	15.5	15JUL83	26.0	25.5	25.8
22MAY83	15.0	15.0	15.0	16JUL83	26.5	26.5	26.5
23MAY83	15.2	15.2	15.2	18JUL83	26.5	26.5	26.5
24MAY83	17.0	16.5	16.8	19JUL83	27.5	27.0	27.3
26MAY83	16.0	16.5	16.3	20JUL83	26.5	26.5	26.5
27MAY83	16.5	16.5	16.5	21JUL83	28.0	27.5	27.8
28MAY83	15.5	14.0	14.8	22JUL83	26.5	26.5	26.5

Continued

TABLE A-1. (Continued)
DAILY INTAKE TEMPERATURE (DEGREES CENTIGRADE)
AT THE INDIAN POINT GENERATING STATION DURING 1983

DATE	UNIT 2	UNIT 3	MEAN	DATE	UNIT 2	UNIT 3	MEAN
23JUL83	26.0	26.0	26.0	08SEP83	27.0	26.0	26.5
24JUL83	26.5	27.0	26.8	09SEP83	26.5	26.0	26.3
25JUL83	26.5	26.0	26.3	10SEP83	27.0	27.0	27.0
26JUL83	26.5	26.5	26.5	11SEP83	27.0	27.0	27.0
27JUL83	26.5	26.5	26.5	12SEP83	26.0	25.5	25.8
28JUL83	26.0	26.0	26.0	13SEP83	25.5	25.0	25.3
29JUL83	26.0	26.0	26.0	14SEP83	24.0	24.0	24.0
30JUL83	26.5	26.0	26.3	15SEP83	23.5	23.5	23.5
01AUG83	27.0	27.0	27.0	16SEP83	24.0	24.0	24.0
02AUG83	26.5	26.5	26.5	18SEP83	25.0	24.0	24.5
03AUG83	26.5	26.5	26.5	19SEP83	24.0	24.5	24.3
04AUG83	27.0	27.0	27.0	20SEP83	23.5	24.0	23.8
05AUG83	27.0	27.0	27.0	21SEP83	24.5	25.2	24.8
06AUG83	27.0	25.5	26.3	22SEP83	21.2	22.1	21.6
07AUG83	26.0	25.0	25.5	23SEP83	21.2	20.6	20.9
08AUG83	26.5	26.5	26.5	24SEP83	20.2	20.5	20.3
09AUG83	25.5	25.0	25.3	25SEP83	19.7	19.8	19.7
10AUG83	25.0	24.5	24.8	26SEP83	20.0	20.0	20.0
11AUG83	25.0	25.0	25.0	27SEP83	20.0	20.0	20.0
12AUG83	24.0	24.0	24.0	28SEP83	20.0	20.0	20.0
13AUG83	21.5	21.0	21.3	29SEP83	21.0	20.5	20.8
14AUG83	25.0	25.0	25.0	30SEP83	20.5	20.0	20.3
15AUG83	25.0	24.5	24.8	01OCT83	20.0	20.5	20.3
16AUG83	25.5	25.5	25.5	02OCT83	21.0	21.5	21.3
17AUG83	25.5	25.5	25.5	03OCT83	28.5	22.0	25.3
18AUG83	27.0	26.0	26.5	04OCT83	20.5	20.0	20.3
19AUG83	27.0	26.5	26.8	05OCT83	20.0	20.0	20.0
20AUG83	28.0	27.0	27.5	29OCT83	16.0	16.0	16.0
21AUG83	26.0	26.0	26.0	31OCT83	15.0	15.0	15.0
22AUG83	26.5	27.0	26.8	01NOV83	15.5	17.0	16.3
23AUG83	26.5	26.5	26.5	02NOV83	15.5	15.5	15.5
24AUG83	26.0	26.0	26.0	03NOV83	16.5	17.5	17.0
25AUG83	25.5	27.0	26.3	04NOV83	15.5	15.5	15.5
26AUG83	25.5	25.5	25.5	05NOV83	14.5	14.5	14.5
27AUG83	26.5	27.0	26.8	06NOV83	14.0	14.0	14.0
28AUG83	26.5	26.5	26.5	07NOV83	17.0	16.0	16.5
29AUG83	26.0	26.0	26.0	08NOV83	16.0	16.0	16.0
30AUG83	24.5	24.5	24.5	09NOV83	15.0	17.0	16.0
31AUG83	25.5	25.5	25.5	10NOV83	15.0	17.5	16.3
01SEP83	26.0	26.0	26.0	11NOV83	15.5	15.0	15.3
02SEP83	25.0	25.0	25.0	12NOV83	15.0	14.5	14.8
03SEP83	26.0	26.0	26.0	13NOV83	12.0	13.0	12.5
05SEP83	27.0	27.0	27.0	14NOV83	12.5	14.0	13.3
06SEP83	28.0	27.5	27.8	15NOV83	13.0	14.0	13.5
07SEP83	28.5	28.0	28.3	16NOV83	14.0	14.0	14.0

Continued

TABLE A-1. (Continued)
DAILY INTAKE TEMPERATURE (DEGREES CENTIGRADE)
AT THE INDIAN POINT GENERATING STATION DURING 1983

DATE	UNIT 2	UNIT 3	MEAN
17NOV83	13.5	14.0	13.8
18NOV83	13.5	13.0	13.3
19NOV83	13.0	13.5	13.3
20NOV83	14.5	15.5	15.0
21NOV83	14.0	14.5	14.3
22NOV83	15.0	15.0	15.0
23NOV83	14.0	13.5	13.8
24NOV83	13.5	13.0	13.3
25NOV83	11.5	12.0	11.8
26NOV83	12.0	12.0	12.0
27NOV83	11.0	11.0	11.0
28NOV83	12.5	12.0	12.3
29NOV83	12.0	11.5	11.8
30NOV83	10.5	10.5	10.5
01DEC83	10.0	10.0	10.0
02DEC83	10.0	10.0	10.0
03DEC83	10.0	10.0	10.0
04DEC83	10.0	10.0	10.0
05DEC83	7.0	6.5	6.8
06DEC83	7.5	7.0	7.3
07DEC83	6.5	5.0	5.8
09DEC83	4.0	4.0	4.0
13DEC83	4.5	4.5	4.5
14DEC83	3.5	4.0	3.8
15DEC83	3.0	3.5	3.3
16DEC83	3.5	3.5	3.5
17DEC83	3.0	3.0	3.0
18DEC83	2.0	2.5	2.3
19DEC83	2.5	2.0	2.3
20DEC83	1.5	2.0	1.8
21DEC83	1.5	2.5	2.0
22DEC83	4.0	5.0	4.5
23DEC83	3.0	2.0	2.5
24DEC83	4.0	4.5	4.3
25DEC83	4.0	4.5	4.3
26DEC83	1.0	1.0	1.0
27DEC83	1.0	1.5	1.3
28DEC83	0.0	0.0	0.0
29DEC83	2.0	2.0	2.0
30DEC83	1.5	1.5	1.5
31DEC83	1.0	1.5	1.3

TABLE A-2
DAILY INTAKE CONDUCTIVITY (MICRO SIEMANS)
AT THE INDIAN POINT GENERATING STATION DURING 1983

DATE	UNIT 2	UNIT 3	MEAN	DATE	UNIT 2	UNIT 3	MEAN
03JAN83	1930		1930	29MAY83	120	123	122
04JAN83	1870		1870	30MAY83	119	120	120
05JAN83	1950		1950	01JUN83	119	125	122
07JAN83	2300		2300	02JUN83	124	124	124
13JAN83	2400		2400	03JUN83	126	127	127
14JAN83	2250		2250	05JUN83	133	133	133
18JAN83	1550		1550	09JUN83	144	144	144
21JAN83	1350		1350	10JUN83	146	146	146
22JAN83	1500		1500	11JUN83	150	151	151
24JAN83	2500		2500	12JUN83	146	148	147
26JAN83	2100		2100	13JUN83	150	152	151
01FEB83	820		820	14JUN83	153	158	156
23FEB83	1800		1800	15JUN83	154	151	153
24FEB83	1850		1850	16JUN83	161	159	160
25FEB83	1800		1800	17JUN83	151	159	155
26FEB83	1500		1500	18JUN83	169	166	168
27FEB83	1390		1390	19JUN83	183	172	178
10MAR83	1000		1000	20JUN83	173	170	172
11MAR83				21JUN83	171	169	170
12MAR83	1230		1230	22JUN83	174	172	173
13MAR83	2000		2000	23JUN83	161	161	161
14MAR83	1790		1790	24JUN83	166	166	166
15MAR83	1340		1340	25JUN83	171	176	174
16MAR83	550		550	26JUN83	163	163	163
17MAR83	350		350	27JUN83	209	238	223
22MAR83	140		140	28JUN83	178	186	182
24MAR83	132		132	29JUN83	265	305	285
25MAR83	133		133	01JUL83	1001	1031	1016
26MAR83	130		130	03JUL83	1321	1481	1401
29MAR83	76		76	04JUL83	1671	2791	2231
03APR83	117	120	118	05JUL83	3181	3191	3186
05APR83	111	112	112	06JUL83	2881	3281	3081
30APR83	109	111	110	08JUL83	4301	4231	4266
09MAY83	109	109	109	09JUL83	4281	4321	4301
14MAY83	109	106	108	10JUL83	3091	4161	3626
15MAY83	109	110	110	11JUL83	3021	3171	3096
17MAY83	104	106	105	12JUL83	3441	4161	3801
19MAY83	103	104	104	13JUL83	3701	4201	3951
21MAY83	110	111	111	15JUL83	4091	4021	4056
22MAY83	111	111	111	16JUL83	4151	4301	4226
23MAY83	110	111	111	18JUL83	4471	5901	5186
24MAY83	111	110	111	19JUL83	4131	4591	4361
26MAY83	118	121	120	20JUL83	5001	5801	5401
27MAY83	121	124	123	21JUL83	5201	5301	5251
28MAY83	116	121	119	22JUL83	5201	5401	5301

Continued

TABLE A-2. (Continued)
DAILY INTAKE CONDUCTIVITY (MICRO SIEMANS)
AT THE INDIAN POINT GENERATING STATION DURING 1983

DATE	UNIT 2	UNIT 3	MEAN	DATE	UNIT 2	UNIT 3	MEAN
23JUL83	6701	5301	6001	08SEP83	6801	6901	6851
24JUL83	6701	6801	6751	09SEP83	5801	5901	5851
25JUL83	7251	7001	7126	10SEP83	5701	6101	5901
26JUL83	6351	5401	5876	11SEP83	5601	5801	5701
27JUL83	7401	7501	7451	12SEP83	5601	5701	5651
28JUL83	5901	6401	6151	13SEP83	5801	5801	5801
29JUL83	6701	6801	6751	14SEP83	6001	6201	6101
30JUL83	6701	6601	6651	15SEP83	6401	6801	6601
01AUG83	6201	6501	6351	16SEP83	7101	7201	7151
02AUG83	5701	5801	5751	18SEP83	8201	8101	8151
03AUG83	5301	5401	5351	19SEP83	8201	8801	8501
04AUG83	6201	6801	6501	20SEP83	8301	9501	8901
05AUG83	6801	7201	7001	21SEP83	10101	10101	10101
06AUG83	7601	7401	7501	22SEP83	8201	9001	8601
07AUG83	7201	7201	7201	23SEP83	7501	7401	7451
08AUG83	7301	7401	7351	24SEP83	6901	7101	7001
09AUG83	7201	7001	7101	25SEP83	6801	6801	6801
10AUG83	6101	6001	6051	26SEP83	6301	6501	6401
11AUG83	5301	5501	5401	27SEP83	6201	6201	6201
12AUG83	5001	5201	5101	28SEP83	6001	5901	5951
13AUG83	6801	7001	6901	29SEP83	6001	6101	6051
14AUG83	5601	5801	5701	30SEP83	7001	7001	7001
15AUG83	5201	5901	5551	01OCT83	6501	7201	6851
16AUG83	5451	5551	5501	02OCT83	7901	8101	8001
17AUG83	6501	6751	6626	03OCT83	10101	8901	9501
18AUG83	6901	6901	6901	04OCT83	8501	8901	8701
19AUG83	6801	6701	6751	05OCT83	8201	8801	8501
20AUG83	7001	7001	7001	29OCT83	4101	4111	4106
21AUG83	6801	6701	6751	31OCT83	5001	5101	5051
22AUG83	7301	7301	7301	01NOV83	5001	6001	5501
23AUG83	6801	7601	7201	02NOV83	5301	5301	5301
24AUG83	6601	7201	6901	03NOV83	5301	5801	5551
25AUG83	6201	7401	6801	04NOV83	4676	5051	4864
26AUG83	6101	6201	6151	05NOV83	4421	4661	4541
27AUG83	6001	6201	6101	06NOV83	4251	4441	4346
28AUG83	5801	6001	5901	07NOV83	4051	4021	4036
29AUG83	6001	6101	6051	08NOV83	3651	3981	3816
30AUG83	5301	5301	5301	09NOV83	3231	3551	3391
31AUG83	5701	6001	5851	10NOV83	3351	3841	3596
01SEP83	5701	5901	5801	11NOV83	3551	3601	3576
02SEP83	5801	6201	6001	12NOV83	3211	3321	3266
03SEP83	6701	6901	6801	13NOV83	2421	3011	2716
05SEP83	7201	7101	7151	14NOV83	3371	3801	3586
06SEP83	7501	7001	7251	15NOV83	4801	5101	4951
07SEP83	7701	7501	7601	16NOV83	5401	5601	5501

Continued

TABLE A-2. (Continued)
DAILY INTAKE CONDUCTIVITY (MICRO SIEMANS)
AT THE INDIAN POINT GENERATING STATION DURING 1983

DATE	UNIT 2	UNIT 3	MEAN
17NOV83	5901	5901	5901
18NOV83	5001	5101	5051
19NOV83	5301	5801	5551
20NOV83	5901	6001	5951
21NOV83	5201	5501	5351
22NOV83	5001	5001	5001
23NOV83	4031	3981	4006
24NOV83	3801	3801	3801
25NOV83	2721	2701	2711
26NOV83	891	911	901
27NOV83	591	591	591
28NOV83	471	491	481
29NOV83	381	391	386
30NOV83	251	261	256
01DEC83	182	181	182
02DEC83	176	179	178
03DEC83	165	169	167
04DEC83	158	165	162
05DEC83	161	162	162
06DEC83	1601	1601	1601
07DEC83	152	147	149
09DEC83	137	137	137
13DEC83	132	152	142
14DEC83	242	247	244
15DEC83	122	122	122
16DEC83	117	120	118
17DEC83	119	117	118
18DEC83	105	102	103
19DEC83	92	94	93
20DEC83	85	88	86
21DEC83	112	97	104
22DEC83	94	98	96
23DEC83	97	94	95
24DEC83	104	102	103
25DEC83	100	102	101
26DEC83	85	85	85
27DEC83	93	55	74
28DEC83	95	94	94
29DEC83	102	103	102
30DEC83	100	100	100
31DEC83	92	94	93

TABLE A-3
TOTAL NUMBERS BY MONTH OF EACH TAXON ACTUALLY COLLECTED AT
INDIAN POINT UNIT 2 DURING 1983
(UNADJUSTED FOR COLLECTION EFFICIENCY)

COMMON NAME	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
ALEWIFE	0	0	0	0	5	3	1	142	6	9	28	0	194
AMERICAN EEL	17	1	6	8	4	11	6	5	1	4	17	22	102
AMERICAN SHAD	0	0	0	0	1	0	45	244	15	11	46	2	364
ATLANTIC CROAKER	0	0	0	0	0	0	0	0	0	0	4	0	4
ATLANTIC MENHADEN	0	0	0	0	0	3	0	1	0	1	4	0	9
ATLANTIC MOONFISH	0	0	0	0	0	0	0	0	0	0	1	0	1
ATLANTIC STURGEON	0	0	0	0	0	0	0	0	0	0	0	3	3
ATLANTIC TOMCOD	548	5	22	3	390	1408	102	2276	22	1	6	288	5071
BANDED KILLIFISH	2	0	6	0	3	1	1	0	0	4	8	21	46
BAY ANCHOVY	22	0	2	0	8	36	183	3677	577	1328	756	1	6590
BLACK CRAPPIE	0	0	0	0	0	0	0	0	0	0	0	4	4
BLACK SEA BASS	0	0	0	0	0	0	0	0	0	0	6	0	6
BLUEBACK HERRING	2	0	2	0	5	22	2	1198	64	950	2127	49	4421
BLUEFISH	0	0	0	0	0	153	41	42	9	5	1	0	251
BLUEGILL	2	0	5	0	0	1	1	0	0	1	13	59	82
BROWN BULLHEAD	2	1	2	0	0	0	0	18	0	2	5	5	35
BUTTERFISH	0	0	0	0	0	0	0	49	8	24	3	0	84
CENTRARCHID UNIDENTIFIED	15	0	1	1	0	1	0	0	0	1	7	2	28
CLUPEID UNIDENTIFIED	0	0	0	0	0	1	0	34	0	0	0	0	35
COMMON CARP	0	0	0	0	1	0	0	0	0	0	0	1	2
CREVALLE JACK	0	0	0	0	0	0	0	0	0	0	11	0	11
FOURSPINE STICKLEBACK	0	0	0	0	1	0	0	0	0	0	3	1	5
GIZZARD SHAD	73	17	2	0	0	0	0	0	0	0	0	531	623
GOLDEN SHINER	0	0	0	0	0	0	0	0	0	0	3	3	6
GOLDFISH	0	0	0	0	0	0	0	0	0	0	0	1	1
HOGCHOKER	10	0	0	14	657	55	15	49	42	92	321	339	1594
INLAND SILVERSIDE	0	0	0	0	0	0	0	0	0	0	2	32	34
LARGEMOUTH BASS	0	0	0	0	0	0	0	0	0	0	1	13	14
MUMMICHOG	0	0	0	0	0	0	0	1	0	0	0	1	2
NORTHERN PIPEFISH	0	0	0	0	0	0	1	31	27	104	264	3	430
PUMPKINSEED	7	3	5	0	5	1	1	2	0	16	48	33	121
RAINBOW SMELT	117	5	1	4	42	5	0	8	0	0	18	0	200
RED HAKE	16	0	0	0	0	0	0	0	0	0	0	0	16
REDBREAST SUNFISH	0	0	0	0	0	0	1	0	0	0	0	0	1
SEA LAMPREY	2	0	0	0	0	0	0	0	0	0	0	2	4
SILVER HAKE	6	0	0	0	0	0	0	0	0	0	0	0	6
SPOTTAIL SHINER	19	18	7	1	2	1	0	0	1	0	43	242	334
STRIPED BASS	1544	346	39	2	0	2	19	143	13	140	307	749	3304
STRIPED SEAROBIN	0	0	0	0	0	0	0	0	0	1	4	0	5
TAUTOG	1	0	0	0	0	0	0	0	0	0	0	0	1
TESSELLATED DARTER	1	0	6	0	7	2	0	2	0	0	3	9	30
THREESPINE STICKLEBACK	0	3	0	0	0	0	0	0	0	0	0	0	3
WEAKFISH	0	0	0	0	0	0	0	6184	121	76	233	2	6616
WHITE CATFISH	9	2	1	5	4	3	1	6	0	4	83	333	451
WHITE MULLET	0	0	0	0	0	0	0	0	0	0	0	1	1
WHITE PERCH	12199	11689	3008	1268	464	217	41	756	49	463	4196	17392	51742
WINTER FLOUNDER	0	0	0	0	0	0	0	0	0	0	2	0	2
YELLOW PERCH	3	0	1	1	0	0	0	0	0	0	2	22	29
TOTAL ALL TAXA	14617	12090	3116	1307	1599	1926	461	14868	955	3237	8576	20166	82918

TABLE A-4
TOTAL NUMBERS BY MONTH OF EACH TAXON ACTUALLY COLLECTED AT
INDIAN POINT UNIT 3 DURING 1983
(UNADJUSTED FOR COLLECTION EFFICIENCY)

COMMON NAME	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
ALEWIFE	0	0	0	0	0	62	1	0	0	0	0	0	63
AMERICAN EEL	0	0	0	0	0	47	9	0	0	0	0	0	56
AMERICAN SHAD	0	0	0	0	0	3	0	0	0	0	0	0	3
ATLANTIC MENHADEN	0	0	0	0	0	1	0	0	0	0	0	0	1
ATLANTIC TOMCOD	0	0	0	0	0	3541	93	0	0	0	0	0	3634
BANDED KILLIFISH	0	0	0	0	0	2	0	0	0	0	0	0	2
BAY ANCHOVY	0	0	0	0	0	55	30	0	0	0	0	0	85
BLUEBACK HERRING	0	0	0	0	0	869	0	0	0	0	0	0	869
BLUEFISH	0	0	0	0	0	41	56	0	0	0	0	0	97
BLUEGILL	0	0	0	0	0	1	0	0	0	0	0	0	1
BROWN BULLHEAD	0	0	0	0	0	1	0	0	0	0	0	0	1
CENTRARCHID UNIDENTIFIED	0	0	0	0	0	3	0	0	0	0	0	0	3
FOURSPINE STICKLEBACK	0	0	0	0	0	2	0	0	0	0	0	0	2
HOGCHOKER	0	0	0	0	0	240	3	0	0	0	0	0	243
PUMPKINSEED	0	0	0	0	0	15	0	0	0	0	0	0	15
RAINBOW SMELT	0	0	0	0	0	38	1	0	0	0	0	0	39
ROUGH SILVERSIDE	0	0	0	0	0	1	0	0	0	0	0	0	1
SPOTTAIL SHINER	0	0	0	0	0	5	2	0	0	0	0	0	7
STRIPED BASS	0	0	0	0	0	18	1	0	0	0	0	0	19
TESSELLATED DARTER	0	0	0	0	0	2	0	0	0	0	0	0	2
WARMOUTH	0	0	0	0	0	1	0	0	0	0	0	0	1
WHITE CATFISH	0	0	0	0	0	12	0	0	0	0	0	0	12
WHITE PERCH	0	0	0	0	0	3441	26	0	0	0	0	0	3467
TOTAL ALL TAXA	0	0	0	0	0	8401	222	0	0	0	0	0	8623

TABLE A-5
TOTAL NUMBERS BY MONTH OF EACH TAXON ACTUALLY COLLECTED AT
INDIAN POINT UNITS 2 AND 3 COMBINED DURING 1983
(UNADJUSTED FOR COLLECTION EFFICIENCY)

COMMON NAME	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
ALEWIFE	0	0	0	0	5	65	2	142	6	9	28	0	257
AMERICAN EEL	17	1	6	8	4	58	15	5	1	4	17	22	158
AMERICAN SHAD	0	0	0	0	1	3	45	244	15	11	46	2	367
ATLANTIC CROAKER	0	0	0	0	0	0	0	0	0	0	4	0	4
ATLANTIC MENHADEN	0	0	0	0	0	4	0	1	0	1	4	0	10
ATLANTIC MOONFISH	0	0	0	0	0	0	0	0	0	0	1	0	1
ATLANTIC STURGEON	0	0	0	0	0	0	0	0	0	0	0	3	3
ATLANTIC TOMCOD	548	5	22	3	390	4949	195	2276	22	1	6	288	8705
BANDED KILLIFISH	2	0	6	0	3	3	1	0	0	4	8	21	48
BAY ANCHOVY	22	0	2	0	8	91	213	3677	577	1328	756	1	6675
BLACK CRAPPIE	0	0	0	0	0	0	0	0	0	0	0	4	4
BLACK SEA BASS	0	0	0	0	0	0	0	0	0	0	6	0	6
BLUEBACK HERRING	2	0	2	0	5	891	2	1198	64	950	2127	49	5290
BLUEFISH	0	0	0	0	0	194	97	42	9	5	1	0	348
BLUEGILL	2	0	5	0	0	2	1	0	0	1	13	59	83
BROWN BULLHEAD	2	1	2	0	0	1	0	18	0	2	5	5	36
BUTTERFISH	0	0	0	0	0	0	0	49	8	24	3	0	84
CENTRARCHID UNIDENTIFIED	15	0	1	1	0	4	0	0	0	1	7	2	31
CLUPEID UNIDENTIFIED	0	0	0	0	0	1	0	34	0	0	0	0	35
COMMON CARP	0	0	0	0	1	0	0	0	0	0	0	1	2
CREVALLE JACK	0	0	0	0	0	0	0	0	0	0	11	0	11
FOURSPINE STICKLEBACK	0	0	0	0	1	2	0	0	0	0	3	1	7
GIZZARD SHAD	73	17	2	0	0	0	0	0	0	0	0	531	623
GOLDEN SHINER	0	0	0	0	0	0	0	0	0	0	3	3	6
GOLDFISH	0	0	0	0	0	0	0	0	0	0	0	1	1
HOGCHOKER	10	0	0	14	657	295	18	49	42	92	321	339	1837
INLAND SILVERSIDE	0	0	0	0	0	0	0	0	0	0	2	32	34
LARGEMOUTH BASS	0	0	0	0	0	0	0	0	0	0	1	13	14
MUMMICHOG	0	0	0	0	0	0	0	1	0	0	0	1	2
NORTHERN PIPEFISH	0	0	0	0	0	0	1	31	27	104	264	3	430
PUMPKINSEED	7	3	5	0	5	16	1	2	0	16	48	33	136
RAINBOW SMELT	117	5	1	4	42	43	1	8	0	0	18	0	239
RED HAKE	16	0	0	0	0	0	0	0	0	0	0	0	16
REDBREAST SUNFISH	0	0	0	0	0	0	1	0	0	0	0	0	1
ROUGH SILVERSIDE	0	0	0	0	0	1	0	0	0	0	0	0	1
SEA LAMPREY	2	0	0	0	0	0	0	0	0	0	0	2	4
SILVER HAKE	6	0	0	0	0	0	0	0	0	0	0	0	6
SPOTTAIL SHINER	19	18	7	1	2	6	2	0	1	0	43	242	341
STRIPED BASS	1544	346	39	2	0	20	20	143	13	140	307	749	3323
STRIPED SEAROBIN	0	0	0	0	0	0	0	0	0	1	4	0	5
TAUTOG	1	0	0	0	0	0	0	0	0	0	0	0	1
TESSELLATED DARTER	1	0	6	0	7	4	0	2	0	0	3	9	32
THREESPINE STICKLEBACK	0	3	0	0	0	0	0	0	0	0	0	0	3
WARMOUTH	0	0	0	0	0	1	0	0	0	0	0	0	1
WEAKFISH	0	0	0	0	0	0	0	6184	121	76	233	2	6616
WHITE CATFISH	9	2	1	5	4	15	1	6	0	4	83	333	463
WHITE MULLET	0	0	0	0	0	0	0	0	0	0	0	1	1
WHITE PERCH	12199	11689	3008	1268	464	3658	67	756	49	463	4196	17392	55209
WINTER FLOUNDER	0	0	0	0	0	0	0	0	0	0	2	0	2
YELLOW PERCH	3	0	1	1	0	0	0	0	0	0	2	22	29
TOTAL ALL TAXA	14617	12090	3116	1307	1599	10327	683	14868	955	3237	8576	20166	91541

TABLE A-6
TOTAL NUMBERS ACTUALLY COLLECTED BY TAXON AND SEASONAL SAMPLING STRATUM
AT INDIAN POINT UNIT 2 DURING 1983
(UNADJUSTED FOR COLLECTION EFFICIENCY)

COMMON NAME	WINTER	SPRING	SUMMER	FALL	TOTAL
ALEWIFE	0	8	149	37	194
AMERICAN EEL	24	23	12	43	102
AMERICAN SHAD	0	1	304	59	364
ATLANTIC CROAKER	0	0	0	4	4
ATLANTIC MENHADEN	0	3	1	5	9
ATLANTIC MOONFISH	0	0	0	1	1
ATLANTIC STURGEON	0	0	0	3	3
ATLANTIC TOMCOD	575	1801	2400	295	5071
BANDED KILLIFISH	8	4	1	33	46
BAY ANCHOVY	24	44	4437	2085	6590
BLACK CRAPPIE	0	0	0	4	4
BLACK SEA BASS	0	0	0	6	6
BLUEBACK HERRING	4	27	1264	3126	4421
BLUEFISH	0	153	92	6	251
BLUEGILL	7	1	1	73	82
BROWN BULLHEAD	5	0	18	12	35
BUTTERFISH	0	0	57	27	84
CENTRARCHID UNIDENTIFIED	16	2	0	10	28
CLUPEID UNIDENTIFIED	0	1	34	0	35
COMMON CARP	0	1	0	1	2
CREVALLE JACK	0	0	0	11	11
FOURSPINE STICKLEBACK	0	1	0	4	5
GIZZARD SHAD	92	0	0	531	623
GOLDEN SHINER	0	0	0	6	6
GOLDFISH	0	0	0	1	1
HOGCHOKER	10	726	106	752	1594
INLAND SILVERSIDE	0	0	0	34	34
LARGEMOUTH BASS	0	0	0	14	14
MUMMICHOG	0	0	1	1	2
NORTHERN PIPEFISH	0	0	59	371	430
PUMPKINSEED	15	6	3	97	121
RAINBOW SMELT	123	51	8	18	200
RED HAKE	16	0	0	0	16
REDBREAST SUNFISH	0	0	1	0	1
SEA LAMPREY	2	0	0	2	4
SILVER HAKE	6	0	0	0	6
SPOTTAIL SHINER	44	4	1	285	334
STRIPED BASS	1929	4	175	1196	3304
STRIPED SEAROBIN	0	0	0	5	5
TAUTOG	1	0	0	0	1
TESSELLATED DARTER	7	9	2	12	30
THREESPINE STICKLEBACK	3	0	0	0	3
WEAKFISH	0	0	6305	311	6616
WHITE CATFISH	12	12	7	420	451
WHITE MULLET	0	0	0	1	1
WHITE PERCH	26896	1949	846	22051	51742
WINTER FLOUNDER	0	0	0	2	2
YELLOW PERCH	4	1	0	24	29
TOTAL ALL TAXA	29823	4832	16284	31979	82918

TABLE A-7
TOTAL NUMBERS ACTUALLY COLLECTED BY TAXON AND SEASONAL SAMPLING STRATUM
AT INDIAN POINT UNIT 3 DURING 1983
(UNADJUSTED FOR COLLECTION EFFICIENCY)

COMMON NAME	WINTER	SPRING	SUMMER	FALL	TOTAL
ALEWIFE	0	62	1	0	63
AMERICAN EEL	0	47	9	0	56
AMERICAN SHAD	0	3	0	0	3
ATLANTIC MENHADEN	0	1	0	0	1
ATLANTIC TOMCOD	0	3541	93	0	3634
BANDED KILLIFISH	0	2	0	0	2
BAY ANCHOVY	0	55	30	0	85
BLUEBACK HERRING	0	869	0	0	869
BLUEFISH	0	41	56	0	97
BLUEGILL	0	1	0	0	1
BROWN BULLHEAD	0	1	0	0	1
CENTRARCHID UNIDENTIFIED	0	3	0	0	3
FOURSPINE STICKLEBACK	0	2	0	0	2
HOGCHOKER	0	240	3	0	243
PUMPKINSEED	0	15	0	0	15
RAINBOW SMELT	0	38	1	0	39
ROUGH SILVERSIDE	0	1	0	0	1
SPOTTAIL SHINER	0	5	2	0	7
STRIPED BASS	0	18	1	0	19
TESSELLATED DARTER	0	2	0	0	2
WARMOUTH	0	1	0	0	1
WHITE CATFISH	0	12	0	0	12
WHITE PERCH	0	3441	26	0	3467
TOTAL ALL TAXA	0	8401	222	0	8623

TABLE A-8
TOTAL NUMBERS ACTUALLY COLLECTED BY TAXON AND SEASONAL SAMPLING STRATUM
AT INDIAN POINT UNITS 2 AND 3 COMBINED DURING 1983
(UNADJUSTED FOR COLLECTION EFFICIENCY)

COMMON NAME	WINTER	SPRING	SUMMER	FALL	TOTAL
ALEWIFE	0	70	150	37	257
AMERICAN EEL	24	70	21	43	158
AMERICAN SHAD	0	4	304	59	367
ATLANTIC CROAKER	0	0	0	4	4
ATLANTIC MENHADEN	0	4	1	5	10
ATLANTIC MOONFISH	0	0	0	1	1
ATLANTIC STURGEON	0	0	0	3	3
ATLANTIC TOMCOD	575	5342	2493	295	8705
BANDED KILLIFISH	8	6	1	33	48
BAY ANCHOVY	24	99	4467	2085	6675
BLACK CRAPPIE	0	0	0	4	4
BLACK SEA BASS	0	0	0	6	6
BLUEBACK HERRING	4	896	1264	3126	5290
BLUEFISH	0	194	148	6	348
BLUEGILL	7	2	1	73	83
BROWN BULLHEAD	5	1	18	12	36
BUTTERFISH	0	0	57	27	84
CENTRARCHID UNIDENTIFIED	16	5	0	10	31
CLUPEID UNIDENTIFIED	0	1	34	0	35
COMMON CARP	0	1	0	1	2
CREVALLE JACK	0	0	0	11	11
FOURSPINE STICKLEBACK	0	3	0	4	7
GIZZARD SHAD	92	0	0	531	623
GOLDEN SHINER	0	0	0	6	6
GOLDFISH	0	0	0	1	1
HOGCHOKER	10	966	109	752	1837
INLAND SILVERSIDE	0	0	0	34	34
LARGEMOUTH BASS	0	0	0	14	14
MUMMICHOG	0	0	1	1	2
NORTHERN PIPEFISH	0	0	59	371	430
PUMPKINSEED	15	21	3	97	136
RAINBOW SMELT	123	89	9	18	239
RED HAKE	16	0	0	0	16
REDBREAST SUNFISH	0	0	1	0	1
ROUGH SILVERSIDE	0	1	0	0	1
SEA LAMPREY	2	0	0	2	4
SILVER HAKE	6	0	0	0	6
SPOTTAIL SHINER	44	9	3	285	341
STRIPED BASS	1929	22	176	1196	3323
STRIPED SEAROBIN	0	0	0	5	5
TAUTOG	1	0	0	0	1
TESSELLATED DARTER	7	11	2	12	32
THREESPINE STICKLEBACK	3	0	0	0	3
WARMOUTH	0	1	0	0	1
WEAKFISH	0	0	6305	311	6616
WHITE CATFISH	12	24	7	420	463
WHITE MULLET	0	0	0	1	1
WHITE PERCH	26896	5390	872	22051	55209
WINTER FLOUNDER	0	0	0	2	2
YELLOW PERCH	4	1	0	24	29
TOTAL ALL TAXA	29823	13233	16506	31979	91541

TABLE A-9
TOTAL ESTIMATED WEIGHT(GRAMS) OF FISH IMPINGED AT INDIAN POINT
UNIT 2 DURING 1983, BY TAXON AND SEASONAL STRATUM
(ADJUSTED FOR COLLECTION EFFICIENCY)

COMMON NAME	WINTER	SPRING	SUMMER	FALL	1983 TOTAL
ALEWIFE	0	24808	9507	1146	35461
AMERICAN EEL	18985	59831	23493	21940	124249
AMERICAN SHAD	0	243	13420	923	14586
ATLANTIC CROAKER	0	0	0	16	16
ATLANTIC MENHADEN	0	91	2508	3614	6213
ATLANTIC MOONFISH	0	0	0	21	21
ATLANTIC STURGEON	0	0	0	349	349
ATLANTIC TOMCOD	67089	99982	176144	18329	361544
BANDED KILLIFISH	323	241	58	521	1143
BAY ANCHOVY	129	3841	288376	6372	298718
BLACK CRAPPIE	0	0	0	42	42
BLACK SEA BASS	0	0	0	117	117
BLUEBACK HERRING	136	44121	55434	17661	117352
BLUEFISH	0	10436	31804	2131	44371
BLUEGILL	2258	2348	2761	1528	8895
BROWN BULLHEAD	4044	0	1414	1981	7439
BUTTERFISH	0	0	3994	2334	6328
CENTRARCHID UNIDENTIFIED	281	114	0	60	455
CLUPEID UNIDENTIFIED	0	30	1524	0	1554
COMMON CARP	0	76285	0	558	76843
CREVALLE JACK	0	0	0	1279	1279
FOURSPINE STICKLEBACK	0	24	0	12	36
GIZZARD SHAD	5547	0	0	11398	16945
GOLDEN SHINER	0	0	0	441	441
GOLDFISH	0	0	0	880	880
HOGCHOKER	956	300388	42486	23245	367075
INLAND SILVERSIDE	0	0	0	108	108
LARGEMOUTH BASS	0	0	0	616	616
MUMMICHOG	0	0	25	12	37
NORTHERN PIPEFISH	0	0	866	1777	2643
PUMPKINSEED	6081	6337	2491	4728	19637
RAINBOW SMELT	2101	6188	760	469	9518
RED HAKE	1204	0	0	0	1204
REDBREAST SUNFISH	0	0	3197	0	3197
SEA LAMPREY	41	0	0	19	60
SILVER HAKE	1006	0	0	0	1006
SPOTTAIL SHINER	822	550	86	4379	5837
STRIPED BASS	116985	847	12006	17928	147766
STRIPED SEAROBIN	0	0	0	288	288
TAUTOG	259	0	0	0	259
TESSELLATED DARTER	160	828	163	95	1246
THREESPINE STICKLEBACK	33	0	0	0	33
WEAKFISH	0	0	174596	7807	182403
WHITE CATFISH	11440	913	53449	20197	85999
WHITE MULLET	0	0	0	80	80
WHITE PERCH	972666	353814	261424	441111	2029015
WINTER FLOUNDER	0	0	0	62	62
YELLOW PERCH	432	431	0	1706	2569
TOTAL ALL TAXA	1212978	992691	1161986	618280	3985935

TABLE A-10
TOTAL ESTIMATED WEIGHT (GRAMS) OF FISH IMPINGED AT INDIAN POINT UNIT 3 DURING 1983, BY TAXON AND SEASONAL STRATUM
(ADJUSTED FOR COLLECTION EFFICIENCY)

COMMON NAME	WINTER	SPRING	SUMMER	FALL	1983 TOTAL
ALEWIFE	0	15218	1188	0	16406
AMERICAN EEL	0	20100	4613	0	24713
AMERICAN SHAD	0	212	0	0	212
ATLANTIC MENHADEN	0	4	0	0	4
ATLANTIC TOMCOD	0	24508	2438	0	26946
BANDED KILLIFISH	0	43	0	0	43
BAY ANCHOVY	0	768	877	0	1645
BLUEBACK HERRING	0	197335	0	0	197335
BLUEFISH	0	336	1053	0	1389
BLUEGILL	0	288	0	0	288
BROWN BULLHEAD	0	39	0	0	39
CENTRARCHID UNIDENTIFIED	0	16	0	0	16
FOURSPINE STICKLEBACK	0	7	0	0	7
HOGCHOKER	0	8642	36	0	8678
PUMPKINSEED	0	2548	0	0	2548
RAINBOW SMELT	0	865	58	0	923
ROUGH SILVERSIDE	0	20	0	0	20
SPOTTAIL SHINER	0	112	51	0	163
STRIPED BASS	0	1184	146	0	1330
TESSELLATED DARTER	0	30	0	0	30
WARMOUTH	0	66	0	0	66
WHITE CATFISH	0	9714	0	0	9714
WHITE PERCH	0	301277	7983	0	309260
TOTAL ALL TAXA	0	583332	18443	0	601775

TABLE A-11
TOTAL ESTIMATED WEIGHT (GRAMS) OF FISH IMPINGED AT INDIAN POINT
UNITS 2 AND 3 COMBINED DURING 1983, BY TAXON AND SEASONAL STRATUM
(ADJUSTED FOR COLLECTION EFFICIENCY)

COMMON NAME	WINTER	SPRING	SUMMER	FALL	1983 TOTAL
ALEWIFE	0	40026	10695	1146	51867
AMERICAN EEL	18985	79931	28106	21940	148962
AMERICAN SHAD	0	455	13420	923	14798
ATLANTIC CROAKER	0	0	0	16	16
ATLANTIC MENHADEN	0	95	2508	3614	6217
ATLANTIC MOONFISH	0	0	0	21	21
ATLANTIC STURGEON	0	0	0	349	349
ATLANTIC TOMCOD	67089	124490	178582	18329	388490
BANDED KILLIFISH	323	284	58	521	1186
BAY ANCHOVY	129	4609	289253	6372	300363
BLACK CRAPPIE	0	0	0	42	42
BLACK SEA BASS	0	0	0	117	117
BLUEBACK HERRING	136	241456	55434	17661	314687
BLUEFISH	0	10772	32857	2131	45760
BLUEGILL	2258	2636	2761	1528	9183
BROWN BULLHEAD	4044	39	1414	1981	7478
BUTTERFISH	0	0	3994	2334	6328
CENTRARCHID UNIDENTIFIED	281	130	0	60	471
CLUPEID UNIDENTIFIED	0	30	1524	0	1554
COMMON CARP	0	76285	0	558	76843
CREVALLE JACK	0	0	0	1279	1279
FOURSPINE STICKLEBACK	0	31	0	12	43
GIZZARD SHAD	5547	0	0	11398	16945
GOLDEN SHINER	0	0	0	441	441
GOLDFISH	0	0	0	880	880
HOGCHOKER	956	309030	42522	23245	375753
INLAND SILVERSIDE	0	0	0	108	108
LARGEMOUTH BASS	0	0	0	616	616
MUMMICHOG	0	0	25	12	37
NORTHERN PIPEFISH	0	0	866	1777	2643
PUMPKINSEED	6081	8885	2491	4728	22185
RAINBOW SMELT	2101	7053	818	469	10441
RED HAKE	1204	0	0	0	1204
REDBREAST SUNFISH	0	0	3197	0	3197
ROUGH SILVERSIDE	0	20	0	0	20
SEA LAMPREY	41	0	0	19	60
SILVER HAKE	1006	0	0	0	1006
SPOTTAIL SHINER	822	662	137	4379	6000
STRIPED BASS	116985	2031	12152	17928	149096
STRIPED SEAROBIN	0	0	0	288	288
TAUTOG	259	0	0	0	259
TESSELLATED DARTER	160	858	163	95	1276
THREESPINE STICKLEBACK	33	0	0	0	33
WARMOUTH	0	66	0	0	66
WEAKFISH	0	0	174596	7807	182403
WHITE CATFISH	11440	10627	53449	20197	95713
WHITE MULLET	0	0	0	80	80
WHITE PERCH	972666	655091	269407	441111	2338275
WINTER FLOUNDER	0	0	0	62	62
YELLOW PERCH	432	431	0	1706	2569
TOTAL ALL TAXA	1212978	1576023	1180429	618280	4587710

TABLE A-12
TOTAL NUMBER OF BLUE CRABS COLLECTED EACH MONTH
AT INDIAN POINT DURING 1983

UNIT	SEX	SURVIVAL	CONDITION	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
				MONTH								
2	MALE	ALIVE	INTACT	0	5	10	28	105	74	7	7	4
			MISSING-PARTS	0	4	6	32	70	38	8	1	0
		DEAD	INTACT	0	2	1	1	24	9	1	0	1
			MISSING-PARTS	0	3	0	30	71	19	5	0	0
	FEMALE	ALIVE	INTACT	0	6	1	7	49	42	3	1	1
			MISSING-PARTS	0	2	0	14	25	22	0	1	1
		DEAD	INTACT	0	0	0	3	7	1	0	0	0
			MISSING-PARTS	0	1	0	3	24	10	0	0	0
3	MALE	ALIVE	INTACT	0	0	19	3	0	0	0	0	0
			MISSING-PARTS	0	0	4	0	0	0	0	0	0
		DEAD	MISSING-PARTS	0	0	2	1	0	0	0	0	0
	FEMALE	ALIVE	MISSING-PARTS	0	0	1	0	0	0	0	0	0
		DEAD	INTACT	0	0	1	0	0	0	0	0	0
ALL	MALE	ALIVE	INTACT	0	5	29	31	105	74	7	7	4
			MISSING-PARTS	0	4	10	32	70	38	8	1	0
		DEAD	INTACT	0	2	1	1	24	9	1	0	1
			MISSING-PARTS	0	3	2	31	71	19	5	0	0
	FEMALE	ALIVE	INTACT	0	6	1	7	49	42	3	1	1
			MISSING-PARTS	0	2	1	14	25	22	0	1	1
		DEAD	INTACT	0	0	1	3	7	1	0	0	0
			MISSING-PARTS	0	1	0	3	24	10	0	0	0

TABLE A-13
SIZE DISTRIBUTION (CARAPACE WIDTH MILIMETERS) OF BLUE CRABS IN IMPINGEMENT COLLECTIONS AT INDIAN POINT DURING 1983, BY MONTH

UNIT	SIZECLASS	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	1983 TOTAL
2	20-29	0	0	0	0	0	0	0	3	0	3
	30-39	0	2	1	1	0	0	0	1	0	5
	40-49	0	6	0	0	0	0	0	0	0	6
	50-59	0	4	1	0	0	0	0	0	0	5
	60-69	0	1	2	1	0	0	0	0	0	4
	70-79	0	0	0	3	0	0	1	0	0	4
	80-89	0	2	1	3	2	0	0	0	0	8
	90-99	0	1	1	6	3	1	0	0	0	12
	100-109	0	3	0	7	6	0	0	0	0	16
	110-119	0	0	3	9	16	1	0	0	0	29
	120-129	0	2	3	13	34	2	0	0	0	54
	130-139	0	1	3	8	32	9	0	0	0	53
	140-149	0	1	2	13	40	13	0	0	0	69
	150-159	0	0	1	7	56	24	5	0	0	93
	160-169	0	0	0	16	64	45	3	2	2	132
	170-179	0	0	0	10	71	54	7	1	2	145
	180-189	0	0	0	11	29	44	3	2	2	91
	190-199	0	0	0	7	16	20	4	1	1	49
	200-209	0	0	0	3	6	2	1	0	0	12

continued

TABLE A-13
SIZE DISTRIBUTION (CARAPACE WIDTH MILIMETERS) OF BLUE CRABS IN IMPINGEMENT COLLECTIONS AT INDIAN POINT DURING 1983, BY MONTH

UNIT	SIZECLASS	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	1983 TOTAL
3	20-29	0	0	3	0	0	0	0	0	0	3
	30-39	0	0	3	0	0	0	0	0	0	3
	40-49	0	0	3	0	0	0	0	0	0	3
	50-59	0	0	2	2	0	0	0	0	0	4
	60-69	0	0	1	0	0	0	0	0	0	1
	70-79	0	0	3	1	0	0	0	0	0	4
	90-99	0	0	1	0	0	0	0	0	0	1
	110-119	0	0	3	1	0	0	0	0	0	4
	120-129	0	0	2	0	0	0	0	0	0	2
	130-139	0	0	3	0	0	0	0	0	0	3
	140-149	0	0	2	0	0	0	0	0	0	2
	150-159	0	0	1	0	0	0	0	0	0	1

continued

TABLE A-13
SIZE DISTRIBUTION (CARAPACE WIDTH MILIMETERS) OF BLUE CRABS IN IMPINGEMENT COLLECTIONS
AT INDIAN POINT DURING 1983, BY MONTH

	SIZECLASS	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	1983 TOTAL
TOTAL	20-29	0	0	3	0	0	0	0	3	0	6
	30-39	0	2	4	1	0	0	0	1	0	8
	40-49	0	6	3	0	0	0	0	0	0	9
	50-59	0	4	3	2	0	0	0	0	0	9
	60-69	0	1	3	1	0	0	0	0	0	5
	70-79	0	0	3	4	0	0	1	0	0	8
	80-89	0	2	1	3	2	0	0	0	0	8
	90-99	0	1	2	6	3	1	0	0	0	13
	100-109	0	3	0	7	6	0	0	0	0	16
	110-119	0	0	6	10	16	1	0	0	0	33
	120-129	0	2	5	13	34	2	0	0	0	56
	130-139	0	1	6	8	32	9	0	0	0	56
	140-149	0	1	4	13	40	13	0	0	0	71
	150-159	0	0	2	7	56	24	5	0	0	94
	160-169	0	0	0	16	64	45	3	2	2	132
	170-179	0	0	0	10	71	54	7	1	2	145
	180-189	0	0	0	11	29	44	3	2	2	91
	190-199	0	0	0	7	16	20	4	1	1	49
	200-209	0	0	0	3	6	2	1	0	0	12