Ecological Studies at Oyster Creek Nuclear Generating Station

Progress Report
September 1982 – August 1983

Prepared for

GPU Nuclear Corporation

ECOLOGICAL ANALYSTS, INC

EA Report GPU41A

ECOLOGICAL STUDIES AT OYSTER CREEK NUCLEAR GENERATING STATION, PROGRESS REPORT SEPTEMBER 1982 - AUGUST 1983

Prepared for

GPU Nuclear Corporation
Post Office Box 388
Route 9 South
Forked River, New Jersey

Prepared by

Ecological Analysts, Inc.
15 Loveton Circle
Sparks, Maryland 21152

January 1984

CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

Aquatic monitoring was conducted at Oyster Creek Nuclear Generating Station (OCNGS) on Barnegat Bay, New Jersey, from September 1982 through March 1983. No samples were collected during the remainder of the reporting period, April through August 1983, because the OCNGS was shut down for service. The program consisted of sampling fish and macroinvertebrates impinged on the OCNGS traveling screens. The monitoring program was carried out pursuant to Appendix B Oyster Creek Nuclear Generating Station Technical Specifications, issued to Jersey Central Power & Light Company by the U.S. Nuclear Regulatory Commission, effective 6 June 1979 and amended September 1981. This is the fourth annual progress report prepared by Ecological Analysts, Inc. to fulfill the aquatic monitoring requirements of the OCNGS Technical Specifications.

Impingement collections were made for a 24-hour period once each week by securing all or known portions of the screenwash from all operating screens. The extrapolated sampling catch for 29, 24-hour sampling periods totaled 811,403 organisms weighing 2,457.3 kg. This catch included 74 species of fish, 18 taxa of macroinvertebrates, and one reptile. Macroinvertebrates were most abundant with sand shrimp, grass shrimp, and blue crab composing 94 percent of the catch by number. The most abundant single organism was the sand shrimp with 707,969 individuals (87 percent of total). The Atlantic silverside was the most abundant fish collected from the traveling screens; the nearly 17,000 individuals constituted 36 percent of the fish catch by number, but only 2 percent of the combined fish and macroinvertebrate catch. Winter flounder, northern pipefish, and blueback herring followed in order of abundance.

For key and abundant species, weekly and annual estimates were made of the number impinged during the 1982-1983 study year. The "annual" estimate was not a true annual estimate, but rather an estimate of the total catches during the 7-month period during which the OCNGS operated. About half of the organisms analyzed increased in abundance compared to the previous year--sand shrimp, winter flounder, Atlantic silverside, blueback herring, and bluefish. Estimated "annual" impingement of blue crabs, bay anchovy, weakfish, northern puffer, Atlantic menhaden, and northern pipefish decreased compared to the previous (1981-1982) study year. Nearly all of the latter are typically more abundant during the warm season, a large portion of which (April-August) was not sampled during the study year. Conversely, of those species more abundant than in the previous year, all except the bluefish are more abundant during the winter. Therefore, "annual" estimates for these organisms were affected little by the spring-summer shutdown. In terms of the combined "annual" catch of fish and macroinvertebrates, there was more than a two-fold increase in 1982-1983 compared to the previous study year. This was largely a result of a large increase in numbers of sand shrimp and, to a lesser extent, winter flounder and Atlantic silverside.

With the inclusion of the 1982-1983 impingement data set, a continuous, 8-year set of impingement data was available for examination. Based on these data, the bay anchovy and northern puffer remain in decline in Barnegat Bay while the other species fluctuate in abundance from year to year, apparently as a result of natural climatic factors that affect spawning success (Ecological Analysts 1982).

1. INTRODUCTION

This is the fourth in a series of annual reports prepared by Ecological Analysts, Inc. (EA) detailing results of aquatic biological monitoring conducted at the Oyster Creek Nuclear Generating Station (OCNGS) from 1 September 1982 through 31 August 1983. Impingement data are presented in this report only through late March 1983, at which time OCNGS was shut down for an extended period. The studies described herein are based on Appendix B, Oyster Creek Nuclear Generating Station Technical Specifications, issued to Jersey Central Power and Light Company (JCP&L) by the U.S. Nuclear Regulatory Commission (NRC 1978), effective 6 June 1979 and amended September 1981.

The generating station and surrounding area were described by Danila et al. (1979), based on literature reviews and their own studies. OCNGS is a 620-MWe boiling-water reactor, located 3.2 kilometers west of Barnegat Bay in Lacey Township, New Jersey (Figure 1-1). Barnegat Bay is a large, shallow estuary created by offshore barrier beaches. A limited exchange of bay and ocean water occurs through narrow Barnegat Inlet and the Manasquan Canal. During station operation, cooling water is withdrawn from Barnegat Bay through the lower part of the south branch of Forked River, then into the dredged intake canal and into the plant. Heated water is discharged into a dredged canal and flows into lower Oyster Creek and into Barnegat Bay.

The interaction of OCNGS and Barnegat Bay has been under study since 1963 (Vouglitois 1983, personal communication). Early preoperational studies were conducted by Rutgers University and concentrated on benthic invertebrates, algae, and fish. These studies continued, with the inclusion of plankton, after commercial operation of OCNGS began in December 1969; most were carried out under the auspices of either Rutgers University or the New Jersey Division of Fish, Game, and Shellfish. Results of these studies were evaluated in the Final Environmental Statement published by the U.S. Atomic Energy Commission (AEC) in 1974. In 1978, Jersey Central Power and Light Company produced 316(a) and (b) demonstrations (JCP&L 1978) which evaluated the previous studies, including the first two years of aquatic monitoring studies done by Ichthyological Associates (IA 1977, 1978). The IA studies continued until June 1979 when EA assumed monitoring, both as a continuation of previous programs and as the first Environmental Technical Specifications aquatic monitoring. EA has continued to conduct the monitoring programs and produced three previous annual reports (Ecological Analysts 1981, 1982, 1983). In September 1981 the NRC dropped requirements for entrainment and Barnegat Bay fisheries sampling, thus these areas are not covered in the present report.

Following this introductory chapter, Chapters 2 and 3 treat, in turn, field and laboratory methodologies and impingement results. Tabular and graphical presentations are in consecutive order at the end of each chapter. A combined reference section is presented at the end of the report.

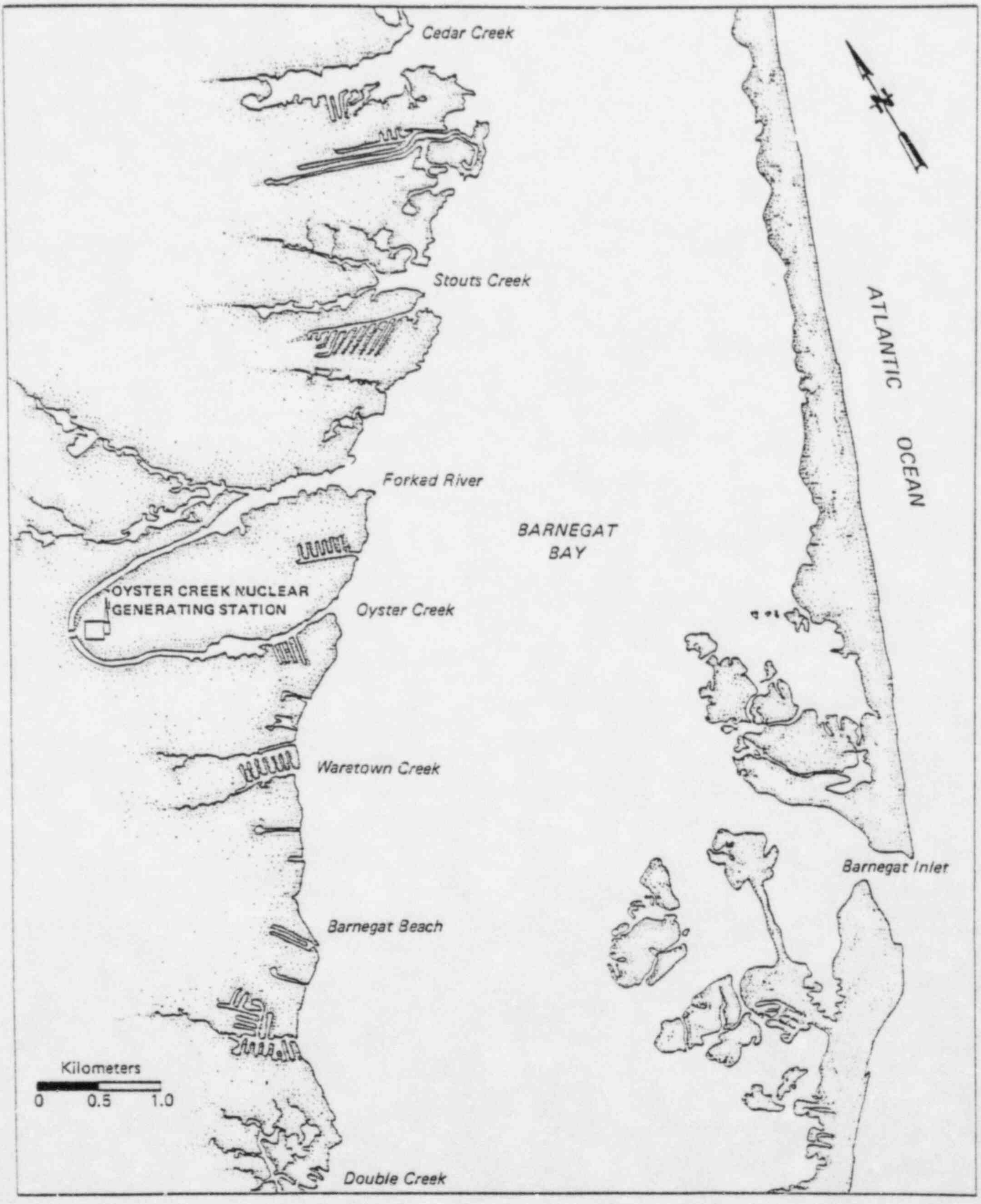

Figure 1-1. Map of the middle portion of Barnegat Bay (adapted from Tatham et al. 1978.)

2. METHODS

2.1 IMPINGEMENT

Impingement sampling was performed in the sluiceway pit, an open cuboid area downstream of all intake screens, at the point in the sluiceway where the screenwash conduit leads under the adjacent roadway to the adjacent discharge area (Figure 2-1). Samples were collected in a 101.6-cm x 101.6-cm x 121.9-cm wire basket with 10.7-mm mesh. When the larger basket was removed for emptying, a smaller basket with identical mesh was placed in the sluiceway pit.

Impingement collections were made over a 24-hour period once per week. Each collection consisted of a 2-hour time period in which either

1. all organisms were collected (2-hour collection and screenwash cycle), or

2. sample duration was reduced to one hour and the number of organisms caught was doubled to represent the 2-hour period, or

3. some fraction of organisms less than one-half were collected (continuous screenwash mode).

In the latter two cases, the total catch for the 2-hour time period was an estimate based on the ratio of the time period sampled to the entire 2-hour period.

This sampling approach was necessitated by the variation in the amount of organisms and debris encountered. Case 1 usually held for daylight hours when organism and debris loads were relatively light, and screens were routinely washed every two hours. Because of greater debris and organism loads at night, the screens normally were washed once per hour. Only one of the two screenwashes was collected in any nighttime 2-hour block (Case 2), because of physical limitations of the sampling system. The Case 3 approach was necessary at times when the debris load was so great that the screens were operated continuously. At these times, attempts were made to obtain at least 1/2-hour subsamples for each 2-hour sample block.

After each sample, the catch was sorted and all organisms identified and enumerated. Also, the total weight of each species was recorded. Subsampling of shrimp was carried out when large amounts of debris were present. Any organisms of questionable identity were preserved for subsequent laboratory examination. Records were kept of any organisms that had external parasites, disease, or morphological abnormalities.

2.2 WATER QUALITY MEASUREMENTS

Water quality measurements made in conjunction with routine biological sampling, included water temperature, pH, salinity, and dissolved oxygen (DO). Measurements were made at the surface and bottom in the OCNGS intake during each impingement collection. A Yellow Springs Instrument Company (YSI) Model 57 DO meter was used to measure dissolved oxygen; the instrument was calibrated weekly before each use. Water temperature and salinity were measured with a YSI Model 33 Salinity-Conductivity-Temperature (S-C-T) meter that was calibrated semimonthly. Measurements of pH were made with a Corning 610A meter, calibrated at least once per week.

2.3 DATA PROCESSING

All field and laboratory data were recorded on standard data sheets and checked for accuracy. The data were entered to computer-disk memory via a Hewlett-Packard 9830A terminal and verified against the original data sheets. Various summary programs then were run to reduce the data for analysis and presentation. Annual impingement estimates were also computed on the 9830A.

The impingement sampling program at OCNGS employed a multistage sampling design. In the first stage, sampling days were selected once a week; these sampling days were grouped sequentially into strata so that no stratum had fewer than two sample days. In the second stage, the sample day was partitioned into two 12-hour periods roughly representing day and night. In a third stage, the 12-hour periods were subdivided further into six 2-hour periods. In some cases, all fish impinged in the 2-hour period were collected and counted giving an exact count for impingement. During periods of heavy impingement, a fourth stage was employed whereby a subinterval of the 2-hour period was sampled.

Using data collected by this sampling design, impingement estimates were computed with the following formulas:

$$\hat{I} = \sum_{i=1}^{L} N_i \bar{Y}_i \qquad \text{(Equation 2-1)}$$

where

I = estimated total number (or weight) of organisms impinged

L = total number of strata

i = ordinal number for strata

N_i = number of days in the i^{th} stratum

$$\bar{Y}_i = \frac{1}{n} \sum_{j=1}^{n_i} \hat{Y}_{ij} \qquad \text{(Equation 2-2)}$$

= average daily impingement for i^{th} stratum

where

n_i = number of sample days in i^{th} stratum
j = ordinal number for sample day

$$\hat{Y}_{ij} = \sum_{k=1}^{2} \hat{Y}_{ijk} \qquad \text{(Equation 2-3)}$$

= estimated impingement for j^{th} sample day of i^{th} stratum

where

2 = number of diel periods
k = ordinal number for diel period

$$\hat{Y}_{ijk} = \sum_{l=1}^{6} \frac{T_{Bijkl}}{T_{sijkl}} Y_{ijkl} \qquad \text{(Equation 2-4)}$$

= estimated impingement of the k^{th} diel period of the j^{th} sample day of the i^{th} stratum

where

6 = number of blocks within diel periods
l = ordinal number for block
T_{Bijkl} = length (in minutes) of block
T_{sijkl} = time sampled (in minutes) in block
Y_{ijkl} = count of organisms for the sample collected in the $ijkl^{th}$ block

The estimated variance of I that was used for computing confidence intervals was computed by the formula

$$\hat{Var}(\hat{I}) = \sum_{i=1}^{L} \frac{N_i}{n_i} \left[(N_i - n_i)\, S_{1i}^2 + \sum_{j=1}^{n_i} \sum_{n=1}^{2} \sum_{l=1}^{6} \hat{Var}(\hat{Y}_{ijkl}) \right] \qquad \text{(Equation 2-5)}$$

where

$$S_{1i}^2 = \frac{1}{n_i - 1} \sum_{j=1}^{n_i} (\hat{Y}_{ij} - \bar{Y}_i)^2$$

$$\hat{Var}(\hat{Y}_{ijkl}) = \frac{T^2_{Bijkl} - T_{Bijkl}\, T_{sijkl}}{T^2_{sijkl}} Y_{ijkl}$$

The 80 percent confidence intervals then were computed using the normal approximation

$$\hat{I} \pm 1.645 \sqrt{\hat{Var}(\hat{I})}$$

The weekly impingement estimates were computed by multiplying the estimated impingement for the j^{th} sample day of the i^{th} stratum by seven.

$$\hat{I}_{ij} = \hat{Y}_{ij} \cdot 7 \qquad \text{(Equation 2-6)}$$

where

$\hat{I}_{ij}$ = estimated impingement for j^{th} week of i^{th} stratum

$\hat{Y}_{ij}$ = as defined above

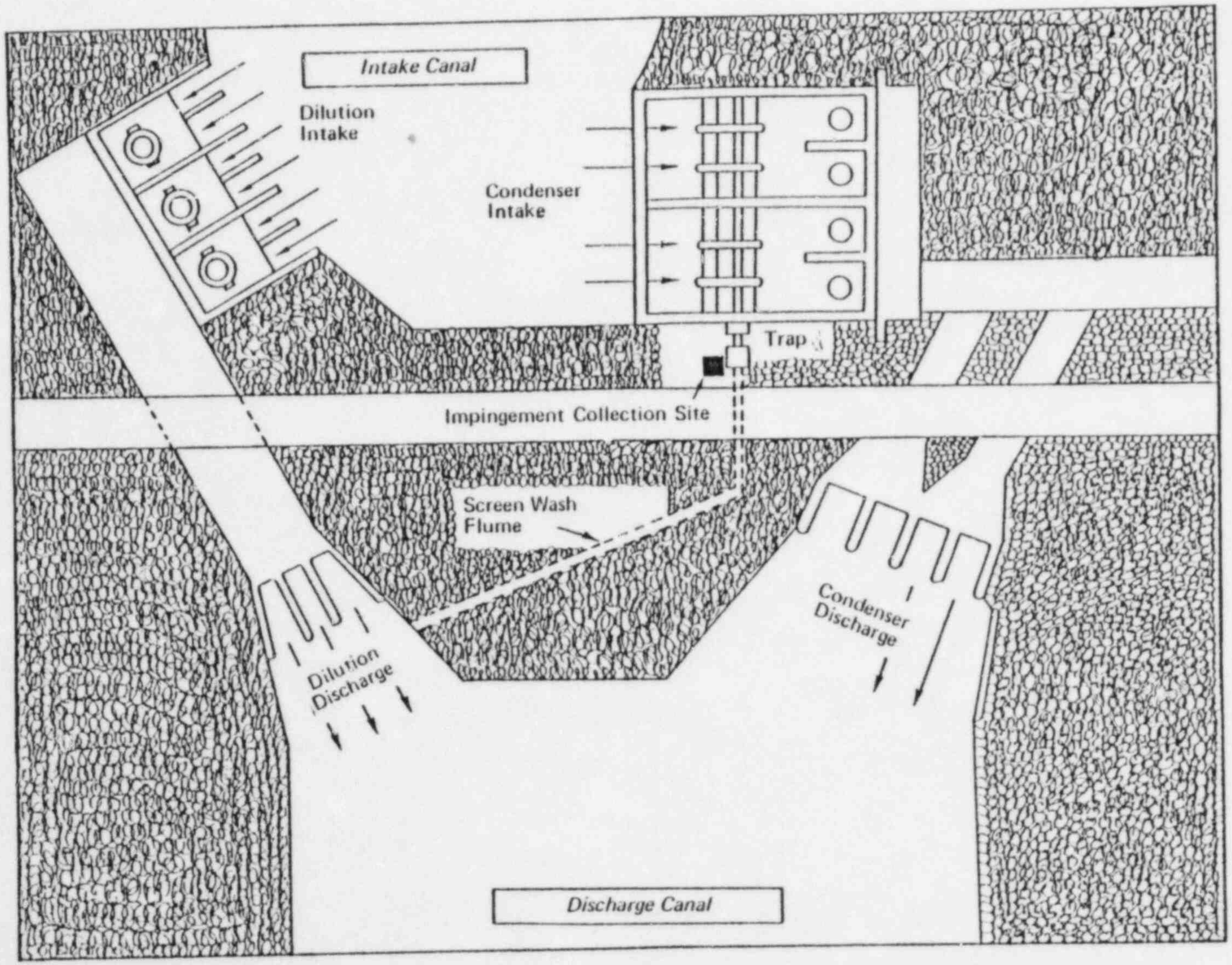

Figure 2-1. Diagram of the intake and discharge of the circulating water system and the dilution pumps at the Oyster Creek Nuclear Generating Station (adapted from Tatham et al. 1978).

3. IMPINGEMENT OF FISH AND MACROINVERTEBRATES ON THE INTAKE SCREENS

3.1 GENERAL SPECIES COMPOSITION AND ABUNDANCE

Impingement collections from September 1982 through March 1983 yielded 93 taxa of fish, macroinvertebrates, and reptiles (Table 3-1). Of these, 74 were finfish, 18 were invertebrates, and one was a reptile. The total number of all organisms collected during the study period was 811,403. Of these, 763,968 (94 percent) were macroinvertebrates, 47,430 (6 percent) were finfish, and 5 were reptiles. The catch was heavily dominated by the sand shrimp which, together with the grass shrimp, constituted over 90 percent of all organisms caught. Ninty-nine percent of the catch was reflected in the 12 most abundant species.

The total weight of all organisms collected was 2,457.3 kilograms (Table 3-2). In contrast to the numbers, the weight of invertebrates (1,559.4 kg) constituted only 64 percent of the combined weight of all organisms. By virtue of their relatively small size, the sand shrimp and grass shrimp composed only 30 percent of the total catch weight, whereas these organisms represented over 90 percent of the numerical catch.

Seasonal distribution of estimated weekly numbers and weight of all organisms combined is illustrated in Figures 3-1 and 3-2. These data are tabulated in Table 3-3 and 3-4 along with a breakdown by species. The estimated weekly number of organisms impinged was relatively low from early September to mid-November. Impingement rates increased dramatically after that, with two large peaks during 13 December and 24 January. Catches remained relatively high until late March when OCNGS was shut down. The data in Table 3-3 reveal that the increased total catches beginning in mid-November were due primarily to increased catches of sand shrimp.

The distribution of estimated weekly weight of all organisms impinged (Figure 3-2) is markedly different than the weekly distribution of the numerical catch. Whereas numerical catches were consistently low from early September to mid-November, the total weekly weights during this period, although variable, were generally as high or higher than later in the study period. The high weights during this period were mostly the result of blue crabs, which, although relatively few in number, are relatively larger and heavier organisms. After blue crab numbers diminished in November, the weekly estimated weight of impinged organisms was maintained primarily by sand shrimp (by virtue of their large numbers) and winter flounder (by virtue of their relatively high weight per fish).

The numbers and weight of organisms impinged was consistently greater at night (Table 3-5); nearly 90 percent by number and 77 percent by weight. The only notable exception was the Atlantic menhaden (Brevoortia tyrannus) which was 2.5 times more abundant in day catches. However, 80 percent of menhaden weight was collected at night. This seeming discrepancy is a result of smaller fish ($\bar{x}$ = 6 gm) being impinged during the day and larger fish ($\bar{x}$ = 63 gm) at night. The reverse was true for the American eel (Anguilla rostrata); by number, three-fourths were impinged

at night but only one-half of the weight was recorded at night. Although there were more than three times the number of eels impinged at night compared to day, the average size of eels at night (31 gm) was only one-third the average weight per eel during day (91 gm). In other cases, e.g., bay anchovy (Anchoa mitchilli) and summer flounder (Paralichthys dentatus), the average weight per organism was the same during day and night.

3.2 OCCURRENCE AND ABUNDANCE OF KEY SPECIES

The U.S. Nuclear Regulatory Commission has defined 11 fish species and 2 invertebrates species as "Key Species" of finfish and shellfish in Barnegat Bay (NRC 1978). The designated species are: summer flounder, winter flounder, Atlantic menhaden, Atlantic silverside, bay anchovy, bluefish, weakfish, striped bass, northern pipefish, northern puffer, northern kingfish, blue crab, and sand shrimp. All of the 11 defined key fish species, except striped bass, were collected from the OCNGS screens; both key invertebrates species were collected. The key fish species composed 69 percent of the fish collected from the traveling screens. The two key invertebrate species accounted for 93.5 percent of the invertebrate catch by number and 86.9 percent of the catch by weight.

In addition to the abundance of each of the key species, blueback herring (Alosa aestivalis) abundance is discussed because of this species' abundance on the screens (8 percent of the total fish catch). In discussing the key species, reference is made to weekly estimates of abundance for both numbers and weights (Tables 3-3 and 3-4, respectively). The "annual estimates" presented in Table 3-6 are not true annual estimates but are estimates for the 7-month period during which OCNGS operated.

In the presentations to follow, the use of the terms "collected" and "sampled" refer to the 24-hour extrapolated totals based on (usually) 18 hours of actual sampling. The terms "estimate" or "estimated" imply the weekly or annual projected impingement catches.

3.2.1 Bay Anchovy (Anchoa mitchilli)

The bay anchovy ranked ninth in overall abundance and was the fifth most abundant fish species impinged (Table 3-1). The 3,642 specimens collected from the screens represented 7.7 percent of the total number of fish collected. The small average size of individual bay anchovy relegated the species to the 19th position in terms of total weight collected. Night catches accounted for 85 percent of the catch (Table 3-5). When the sampling catch of bay anchovy was extrapolated over the 7-month study period ("annual estimate"), the result was 26,187 specimens weighing 86.4 kilograms (Table 3-6).

Bay anchovy were most abundant in impingement catches during the first half of the study period (September - early December). Over 90 percent of the total estimated catch for the 7-month period was impinged during the first half (Table 3-4). The highest weekly estimate of 3,921 fish (13.08 kg) occurred during the week of 11 October.

The annual impingement catch of this species during 1982-1983 was the lowest in eight years of record (Figure 3-3). Part of the reason involves the shutdown of OCNGS from early spring through August; the spring and summer months are typically periods of relatively high impingement of bay anchovy. The shutdown is not the sole reason for the lower abundance in 1982-1983, however. During the first 14 weeks of 1982, approximately 3,400 individuals were estimated to have been impinged. During the same period in the previous study year (1981-1982), nearly 55,000 bay anchovy were estimated to have been impinged (Ecological Analysts 1983). By inference, the number of bay anchovy available in Barnegat Bay was considerably lower in 1982. Whether or not this signals a continued decline in the Bay population is not evident from the impingement data. Previous annual reports (Ecological Analysts 1981, 1982, 1983) discussed possible reasons for the apparent decline in the bay anchovy population. Possible contributing factors considered were predation on early life stages by ctenophores or Atlantic silverside, and the effects of entrainment of eggs and larvae into the OCNGS cooling system, but nothing was substantiated. The situation remains unresolvable because of the lack of information on bay anchovy populations outside of Barnegat Bay. That is, because there are no comparable data for other nearby estuaries during the period in question, it is not clear whether the apparent decline in the population is limited to Barnegat Bay or whether it is symptomatic of a more widespread population decline.

3.2.2 Atlantic Silverside (*Menidia menidia*)

Atlantic silverside was the most abundant fish in the impingement collections during 1982-1983 (Table 3-1). The 16,841 individuals represented 36 percent of the fish catch by number, but only 8 percent by weight (Table 3-2) because of their relatively small size. Catches were slightly greater at night (60 percent). The estimated number impinged during the period early September - late March was 117,009 (528.5 kg) (Table 3-6).

The distribution of weekly estimated impingement catches (Tables 3-3 and 3-4) show greater abundance during fall and winter. This is a typical pattern for the Atlantic silverside based on previous study years. Substantial numbers were impinged beginning in mid-October, with a peak of 29,064 individuals (132.81 kg). Later catches were variable, but remained relatively high through the remainder of the study period.

Insofar as the rate of impingement of a species reflects its population level in Barnegat Bay, the Atlantic silverside has increased in number substantially compared to the previous study year (Figure 3-3). Because they are relatively few in impingement collections during the warm seasons, the estimated annual catch would not have been much higher had the plant operated from April through August of 1983. The total estimated catch for 1982-1983 was the fourth highest in the eight years of record. The pattern of annual abundance depicted in Figure 3-3 suggests that impingement catches reflect natural annual fluctuations in abundance of the species in Barnegat Bay.

3.2.3 Northern Pipefish (Syngnathus fuscus)

The northern pipefish was the third most abundant fish; 4,069 individuals weighing 8.3 kilograms were collected from the OCNGS screens (Tables 3-1, and 3-2). Eighty percent of the pipefish were impinged at night (Table 3-5). Extrapolation of the weekly collection numbers over the entire 7-month study period yielded an "annual" estimate of 28,021 individuals (57.17 kg) (Table 3-6).

Northern pipefish were present during the entire study period (Table 3-3). Pipefish were consistently abundant from late October through November, with episodic periods of relative abundance after that. The greatest estimated catch of 3,901 individuals occurred during the week of 13 December. Generally greater abundance during the late October through November period is consistent with data from previous study years (Ecological Analysts 1981, 1982, 1983).

The representation of the annual catch of northern pipefish in 1982-1983 in Figure 3-3 is misleading because the April - August period is not included. Had that period been sampled, the annual catch would likely have been greater than the previous year; this would have made it one of the higher annual catches of the 8-year record. The variability in annual impingement catches among the eight years may reflect normal population level fluctuation in Barnegat Bay.

3.2.4 Winter Flounder (Pseudopleuronectes americanus)

In terms of numbers impinged, the winter flounder was second only to the Atlantic silverside (Table 3-1), and was first among fish species in total weight (Table 3-2). The winter flounder catch composed 11 percent of the number and 39 percent of the weight of all impinged fish. Over 80 percent were collected in night samples. A total of 37,170 winter flounder weighing 2,398.8 kilograms were estimated to have been impinged during the 7-month study period (Table 3-6).

The species was absent during the early part of the study period but began to appear in impingement collections in October (Table 3-3). Low to moderate numbers were estimated to have been impinged on a weekly basis through the week of 6 December. Weekly impingement estimates increased dramatically after that and stayed relatively high except for several weeks in February and March. This pattern of few or no fish in September then increasing numbers to a winter peak has been documented in previous study years. It represents the migration of adults into the Bay for the purpose of spawning.

The estimated "annual" impingement catch of winter flounder is the third largest in the 8-year record (Figure 3-3). Since the period in 1983 during which OCNGS was shut down (late March - August) is typically a period of relatively low abundance, the 1982-1983 annual estimate would not have been much greater had the plant operated through the period in question. The factors affecting abundance of winter flounder in impingement samples from year to year have been discussed in previous reports (Ecological Analysts 1981, 1982, 1983). To a large extent, the annual impingement of this species is influenced by plant operating schedules. Because it

is only abundant in winter, winter outages of OCNGS can have a great influence on the annual estimate. Significantly, the 1982-1983 estimate, third largest in eight years, is for a year in which OCNGS operated throughout the normal period of winter flounder abundance.

3.2.5 Weakfish (Cynoscion regalis)

Weakfish ranked ninth in abundance and tenth in weight among fish impinged on the OCNGS screens (Tables 3-1 and 3-2). The 913 individuals impinged constituted 2 percent of all fish collected. Most of those collected were taken during nighttime sampling (Table 3-5). Extrapolation of weekly estimates over the 7-month study period yielded 6,372 individuals weighing 102 kilograms (Table 3-6).

Based on weekly estimates of numbers and weight impinged (Table 3-3 and 3-4), weakfish displayed a typical pattern of abundance. The population is primarily juveniles that migrate into the Bay as larvae and quickly grow to a size vulnerable to impingement. Their movement out of the Bay in autumn reduces impingement numbers to zero. The peak weekly estimate of 1,823 individuals and 36 kilograms occurred during the week of 11 October.

The "annual" estimate of the number of weakfish impinged was the second lowest in the 8-year record (Figure 3-3). It can only be conjectured what annual total would have resulted had OCNGS operated from late March through August 1983. Given a catch distribution in 1983 similar to 1981-1982, a 12-month annual estimate would have been little different than that for the 7-month period, September 1982 - March 1983. This is because only 5 percent of the annual total impingement for 1981-1982 occurred after March (Ecological Analysts 1983, Table 3-4). Conversely, during the 1980-1981 study year, fully 75 percent of the impingement catch occurred after March (Ecological Analysts 1982, Table 4-5). Were the latter scenario to have been realized in the present study year, the annual estimate for 1982-1983 would have been four times as large. This illustrates the effect of year-class strength on the annual estimates. For example, the highest annual impingement estimate in the 8-year record (1979-1980) was a result of large catches, both in the fall (1979 year-class) and the following summer (1980 year-class).

3.2.6 Blueback Herring (Alosa aestivalis)

The 4,069 specimens of blueback herring collected composed 8.5 percent of the fish catch. The corresponding total weight of the sampling catch was 20.5 kilograms (2 percent of total). Seventy-seven percent of the numbers and 62 percent of the weight was impinged at night (Table 3-5). The "annual" 7-month estimate of numbers and weight impinged were 26,044 individuals and 143.2 kilograms (Table 3-6).

Blueback herring were present in impingement collections during all but a few weeks of the study period (Table 3-3). Their greatest abundance occurred from mid-December through mid-January. Nearly 9,000 were estimated to have been impinged during the week of 3 January.

Based on impingement collections, there were more blueback herring in Barnegat Bay in 1982-1983 than the previous year (Figure 3-3). With the exception of 1978-1979, annual estimates have been relatively consistent. The impingement catch is mainly composed of young of the year that use Barnegat Bay as a nursery ground during their first summer.

3.2.7 Atlantic Menhaden (*Brevoortia tyrannus*)

The impingement catch of Atlantic menhaden was essentially identical to that of weakfish; 909 individuals were collected that together weighed 20.2 kilograms (Tables 3-1 and 3-2), or 2 percent of both total number and weight of fish impinged. The day-night distribution of the catch is curious because, whereas 72 percent of the individuals were impinged during the day, these only composed 20 percent of the weight impinged (Table 3-5). When the average weight per individual is calculated from the data in Table 3-5, the results are 6 and 63 grams for day and night respectively. This is a result of a large influx of young of the year during daylight sampling periods in the week of 17 January. This one spate accounted for 60 percent of all menhaden collected during the study period. The estimated total impinged during the 7-month study period was 6,324 individuals (140.2 kg) (Table 3-6).

Atlantic menhaden were moderately abundant from November through mid-January, after which only a few were impinged (Table 3-3). As mentioned above, the peak catch in the week of 17 January was attributable to an influx of young-of-the-year individuals. Typically there is a peak occurrence in the fall-winter and again, sometimes smaller, in summer.

Comparison of Atlantic menhaden annual impingement estimates over the eight years of record (Figure 3-3) reveals little change in the last five years. Had the summer of 1983 been sampled, the estimate may have been higher, but probably not much higher. As inferred from impingement sampling, the populations that enter the Bay have been stable in size over the last five years.

3.2.8 Bluefish (*Pomatomus saltatrix*)

The sampling catch of bluefish totaled 520 individuals weighing 4.8 kilograms (Tables 3-1 and 3-2). Seventy percent of these were impinged at night. The total estimated number impinged during the 7-month study period was 3,960 (Table 3-6).

The entire catch occurred in the first 11 weeks of the study period. The bluefish in Barnegat Bay are juveniles that enter the Bay in spring, and leave again in fall. The catch distribution in Table 3-3 reflects the availability of the 1982 year-class. When the plant operates year-round, there is a second period of abundance from spring through August (end of August being the arbitrary cutoff point for each study year). The preceding three study years (1979-1980, 1980-1981, and 1981-1982) produced 61, 83, and 60 percent, respectively, of the total bluefish catch during the second half of the study year. Had the OCNGS operated through this period in 1983, the catch could have been considerably higher than illustrated in Figure 3-3, perhaps the highest on record.

As pointed out (Ecological Analysts 1983), the final annual estimate would have been determined by the size of the 1983 year-class that entered Barnegat Bay.

3.2.9 Northern Puffer (*Sphoeroides maculatus*)

Northern puffer were uncommon in impingement samples during the study period--only 94 individuals weighing 10.9 kilogram were collected (Tables 3-1 and 3-2). There was little differences between day and night catches. The "annual" (7-month) estimated impingement total was 658 individuals and 72.5 kilograms (Table 3-6).

All of the northern puffer were impinged during the first three months of the study period (Table 3-3); the peak estimated number impinged per week (182) occurred during the week of 11 October. The impingement of northern puffer is typically a warm season phenomenon. In previous study years, when OCNGS operated through spring and summer, the species would begin to show up on the screens again in the spring.

The "annual" estimate of number impinged was similar to the low estimates in all study years except 1977-1978 and 1980-1981. The estimate would undoubtedly have been higher had OCNGS operated from April through August 1983. However, the estimate would still have been low, compared to 1977-1978 and 1980-1981, had OCNGS operated all year. By comparing trawl and seine catches and impingement rates for six study years beginning in 1975-1976, Ecological Analysts (1982) concluded that impingement catches directly reflect abundance of northern pufrer in Barnegat Bay. The relatively large catches in 1977-1978 and 1980-1981 were attributed to large young-of-the-year classes. These year-classes had no apparent effect on the subsequent years' abundances, and the species continues in decline.

3.2.10 Summer Flounder (*Paralichthys dentatus*)

A total of 372 summer flounder, or < 1 percent of total, were collected from the OCNGS screens during the study period. Although 16th in numerical abundance among fish, they were 4th in abundance in terms of weight (Tables 3-1 and 3-2). They were slightly more abundant in night samples (58 percent). The estimated total number impinged for the 7-month study period was 2,566 (44.0 kg).

Summer flounder were present in impingement samples through mid-January but were abundant only in October (Table 3-3). The peak of abundance occurred during the week of 19 October when 1,145 flounder were estimated to have been impinged. Based on sampling data from previous study years, summer flounder are typically most abundant in impingement catches in the fall.

The "annual" estimate of the number impinged at OCNGS was nearly three times higher than the previous study year (1981-1982), but was yet one of the lower estimates of record (Figure 3-3). Discussions by Metzger (1978) seem to suggest that the year-to-year fluctuations in abundance of summer flounder in Barnegat Bay may be a result of variable spawning success in the ocean.

3.2.11 Northern Kingfish (*Menticirrhus saxatilis*)

Four northern kingfish were collected during the period, September 1982 through March 1983. This species has been rare since impingement collections began in 1975. Boyle (1978) outlined the historical catch of this species in Barnegat Bay and examined the reduction of numbers collected in the Bay after 1967.

3.2.12 Striped Bass (*Morone saxatilis*)

No striped bass were collected from the OCNGS screens during the study period, nor have any been collected since EA began impingement monitoring in 1979. Metzger (1979) reported that the species is rarely encountered in Barnegat Bay in recent years.

3.2.13 Sand Shrimp (*Crangon septemspinosa*)

The sand shrimp was the most abundant organism impinged at OCNGS in terms of both number and weight (Tables 3-1 and 3-2). Sand shrimp made up nearly 90 percent of the total number of individuals of fish and macroinvertebrates collected. Due to the relatively small size, the sand shrimp accounted for only 28.5 percent of the total weight of impinged organisms. Ninety-one percent of the sand shrimp were collected in night samples. The "annual" estimate of numbers and weight impinged was 4,912,601 individuals and 4,869.7 kilograms (Table 3-6).

The sand shrimp was virtually absent during the first month of the study period, with numbers beginning to increase in October (Table 3-3). Numbers remained high throughout the remainder of the study period with peaks in mid-December and late January. Based on previous years' results, the organisms probably remained relatively abundant in the vicinity of OCNGS until July or August, when there was probably a sharp reduction in abundance. This has been a typical pattern in previous study years.

The "annual" estimate of nearly 5 million sand shrimp impinged is one of the highest in the eight years of record (Figure 3-3). Had the April - August period been sampled in 1983, the estimate might have approached that of the 1980-1981 study period. Annual abundance of sand shrimp in the vicinity of OCNGS has been variable over the last eight years. Although some of this variability can be attributed to shutdowns of OCNGS during periods of abundance, not all of it can be thus explained. Moore (1978) cited the severe winter of 1976-1977 and/or the presence of anoxic bottom waters off the coast of New Jersey in late summer - early fall 1976, as possible reasons for the low impingement catch in 1976-1977. Ecological Analysts (1983) cited severe winter conditions in 1982 as one possible reason for the relatively low catch. The fact that the 1982-1983 winter was relatively mild and impingement of sand shrimp was much greater than the previous year gives some credence to severe cold weather as at least one factor contributing to low rates of impingement of sand shrimp.

3.2.14 Blue Crab (Callinectes sapidus)

The blue crab ranked fourth in number and second in weight among all organisms collected from September 1982 to March 1983 (Tables 3-1 and 3-2). A total of 6,321 specimens weighing 654.6 kilograms were collected. Although the total number represents <1 percent of all organisms collected, the total weight of blue crab composed nearly 27 percent of the total weight. Three-fourths of the crabs appeared in night samples. Extrapolation of weekly sample totals over the entire 7-month period yielded an annual estimate of 46,259 individuals and 4,745.6 kilograms.

The blue crab exhibited a typical pattern of abundance during the warmer season and variable, but lesser, numbers during the winter (Table 3-3). The greatest weekly estimate of abundance (9,246 individuals) occurred during the first week of the study period. Numbers remained relatively high into November, at which time they began to decline and became scarce or absent by mid-December.

The "annual" abundance estimate for the blue crab of 46,259 individuals was the lowest in eight years of record (Figure 3-3). This is largely misleading because the period during which OCNGS was shut down (April - August 1983) is typically a period of high abundance of blue crab. For example, in the 1981-1982 study year, 83 percent of blue crabs were impinged during this period. The total number impinged during 1982-1983 would undoubtedly have been larger had OCNGS operated through spring and summer 1983; how much larger is impossible to estimate lacking sampling data for the spring-summer period.

In previous annual reports, Ecological Analysts (1981, 1982) identified an inverse relationship between the average size of crabs impinged and the total estimated number impinged in a given year. It was theorized that when the blue crabs in the vicinity of OCNGS were larger, and thus less vulnerable to impingement, fewer were impinged. This relationship was consistent for the first seven years of record and is further substantiated when data from the present study year are included:

Year	Mean Weight (g) Per Crab
1975-1976	9.1
1976-1977	47.0
1977-1978	18.0
1978-1979	52.8
1979-1980	64.7
1980-1981	21.2
1981-1982	58.8
1982-1983	103.6

When these data are compared with Figure 3-3, it is clear that the three highest annual estimates were for study years in which the average weight per crab was lowest. The average weight for 1982-1983 was the highest in eight years. This is consistent with the relatively low annual estimate. However, as pointed out above, a significant portion of the annual estimate would have come from the April - August 1983 period when OCNGS was

not operating. No estimate can be made for impingement during this period, but the pattern shown thus far with regard to impingement numbers and size of crabs suggests that a 12-month estimate of impingement for 1982-1983 would not have been much larger than the 7-month estimate shown in Figure 3-3, at least not comparable to the 1975-1976, 1977-1978, and 1980-1981 study years.

3.3 WATER QUALITY ASSOCIATED WITH IMPINGEMENT SAMPLING

Water temperature at the OCNGS intake ranged from -0.8°C on 17 January 1983 to 23.8°C on 13 September 1982 (Table 3-7). The winter was relatively mild in that water temperature fell below 2°C during only one week (17 January) of the study period. In contrast, there was a 4-week period in the 1981-1982 study period during which intake water temperatures remained below 2°C (Ecological Analysts 1983).

Dissolved oxygen values followed a typical pattern of lower readings in the warm season and high readings in the winter (Table 3-8). The range was from 6.1 mg/liter on 19 September 1982 to 13.6 mg/liter on 21 February 1983.

Salinity values (Table 3-9) ranged from 12.2 ppt on 14 February 1983 to 27.1 ppt on 20 December 1982. The salinity values were rather consistent through the study period except in the last few weeks when there was a noticeable lowering of values due to freshwater runoff. The surface water salinities on 14 February are dramatically lower than the values recorded during the previous or following week. The fact that this sharp drop was not also seen in bottom waters suggests it was a result of dilution of surface water with rain runoff.

Daily ranges of pH measurements are shown in Table 3-10.

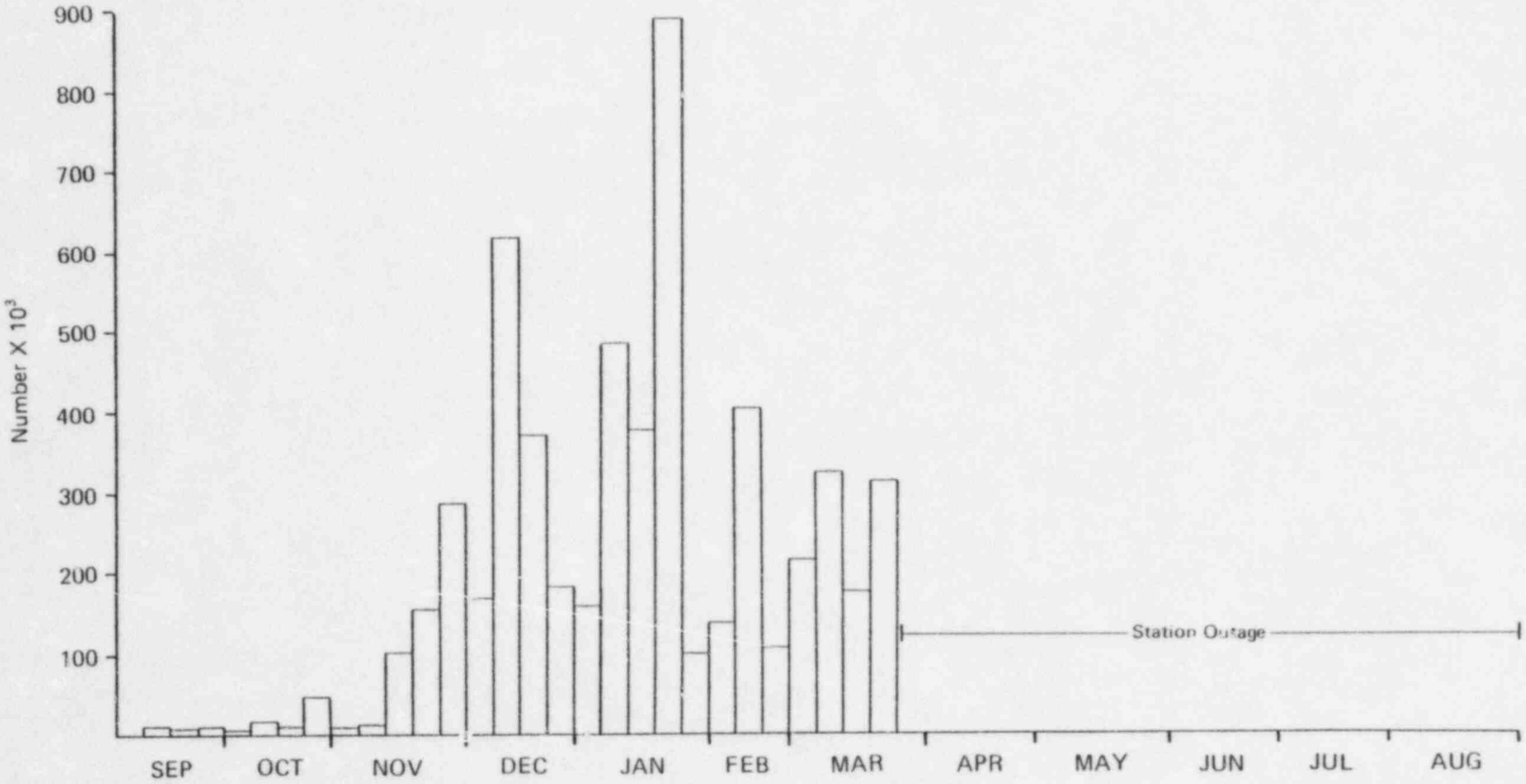

Figure 3-1. Estimated weekly number of fish and macroinvertebrates impinged on the Oyster Creek Nuclear Generating Station traveling screens, September 1982 – August 1983.

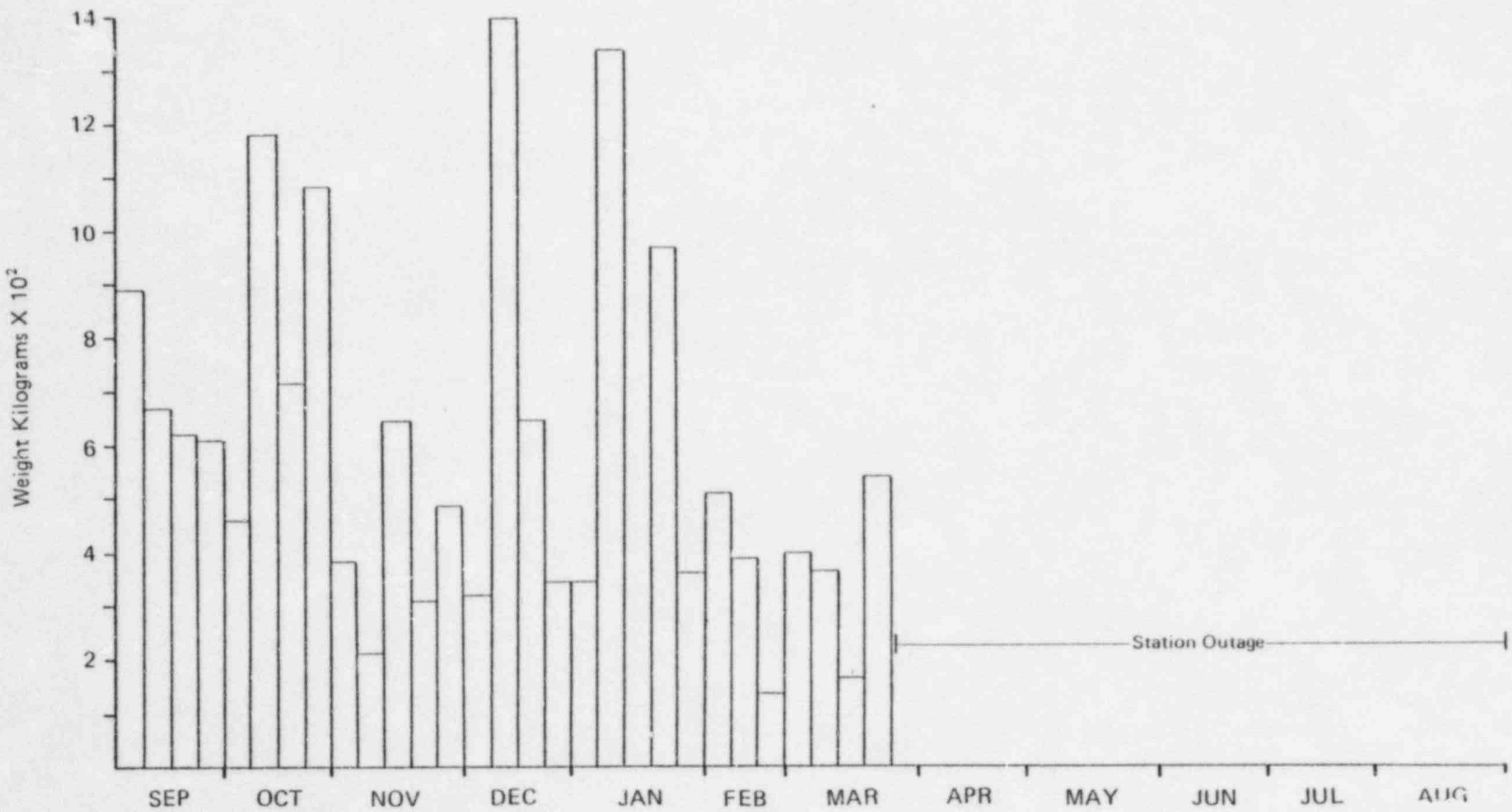

Figure 3-2. Estimated weekly weight (kg) of fish and macroinvertebrates impinged on the Oyster Creek Nuclear Generating Station traveling screens, September 1982 – August 1983.

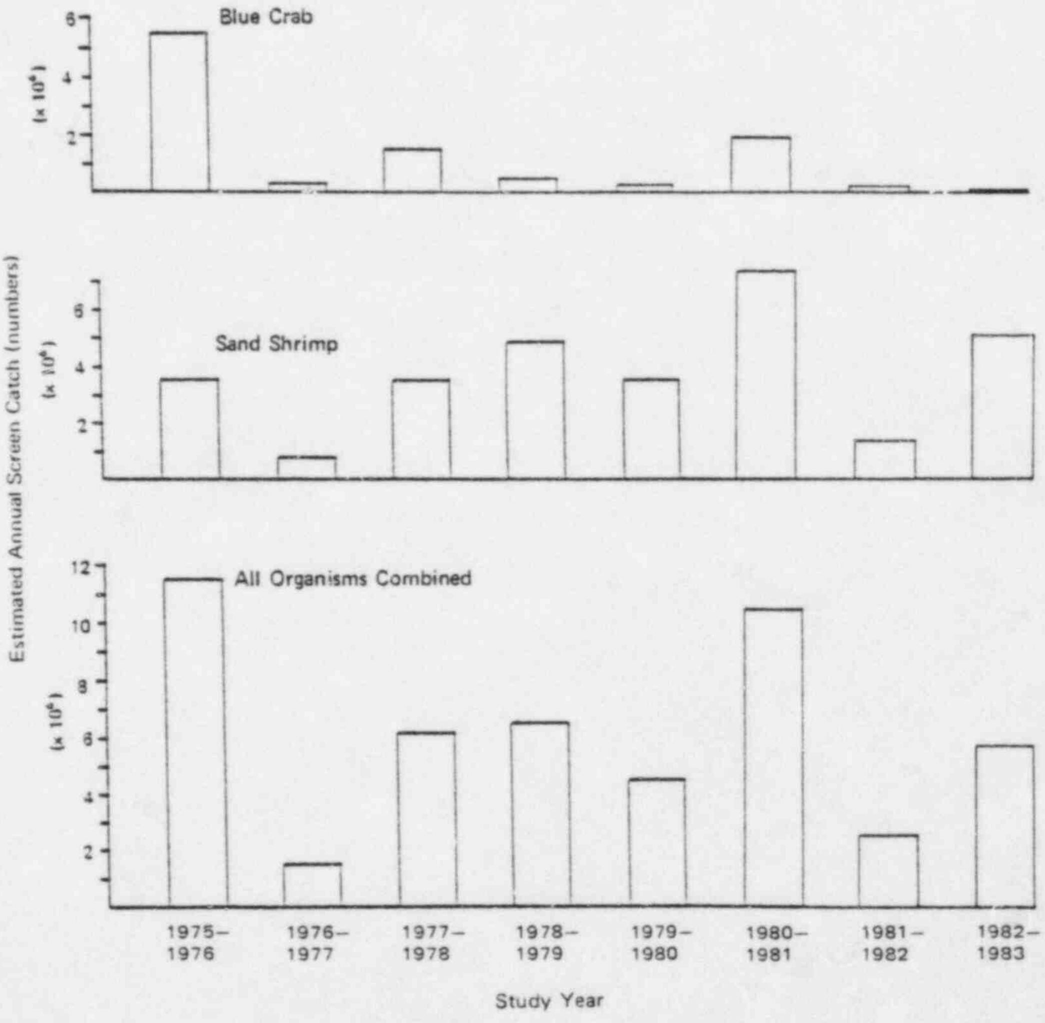

Figure 3-3. Estimated annual impingement catches for total organisms and key and abundant organisms at Oyster Creek Nuclear Generating Station.

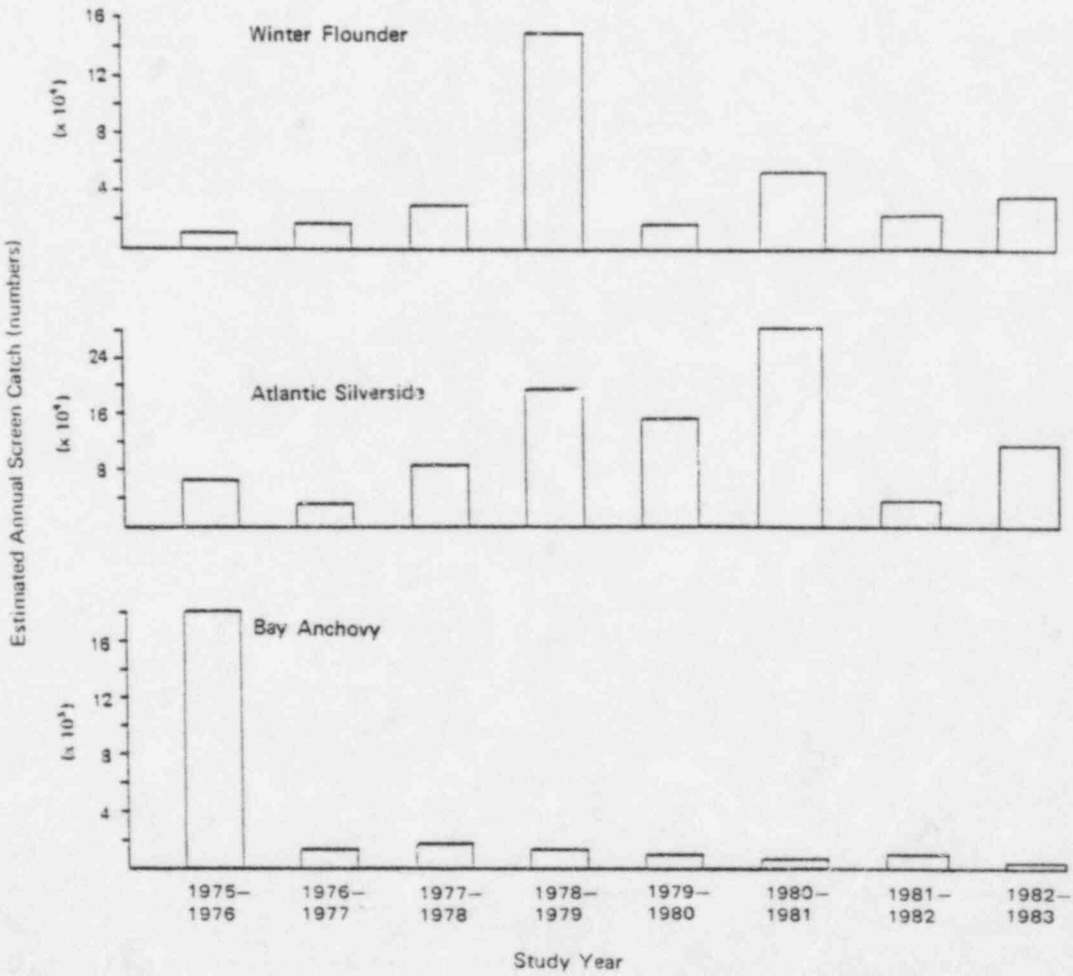

Figure 3-3. (Cont.)

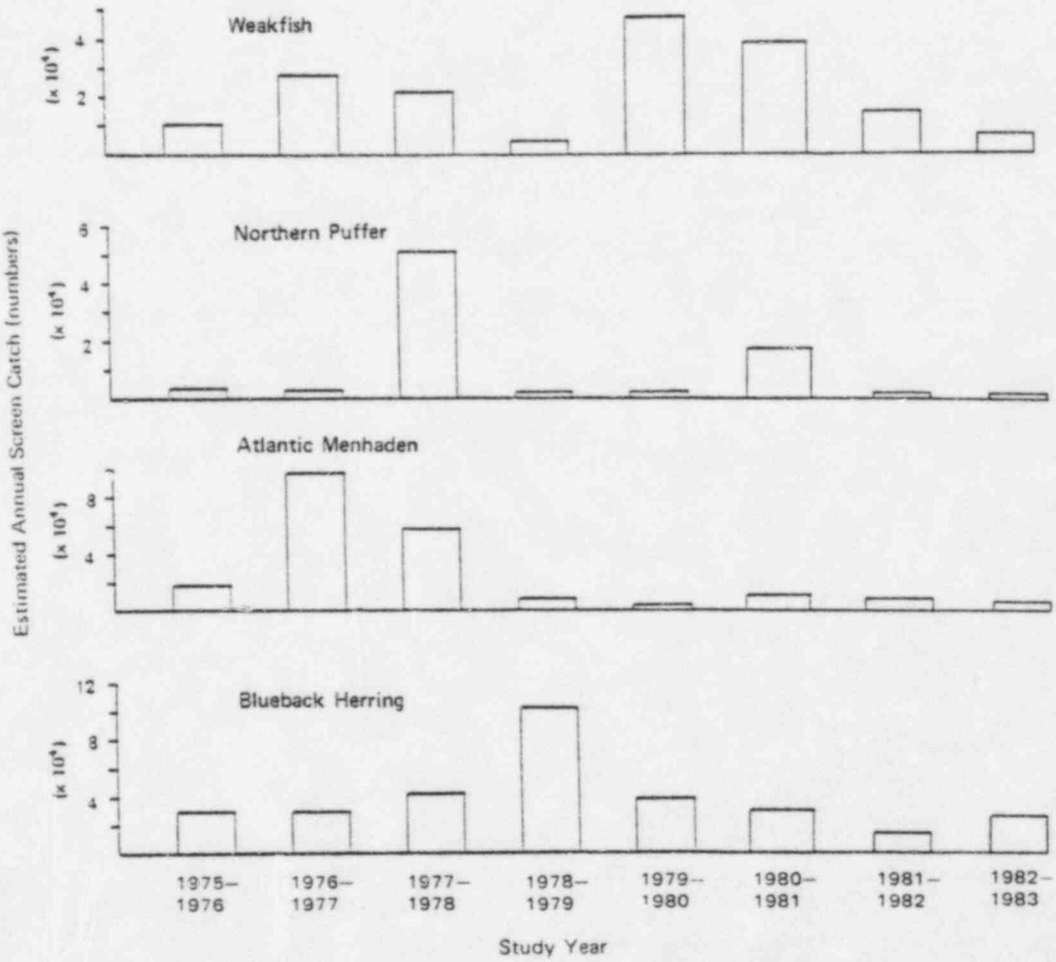

Figure 3-3. (Cont.)

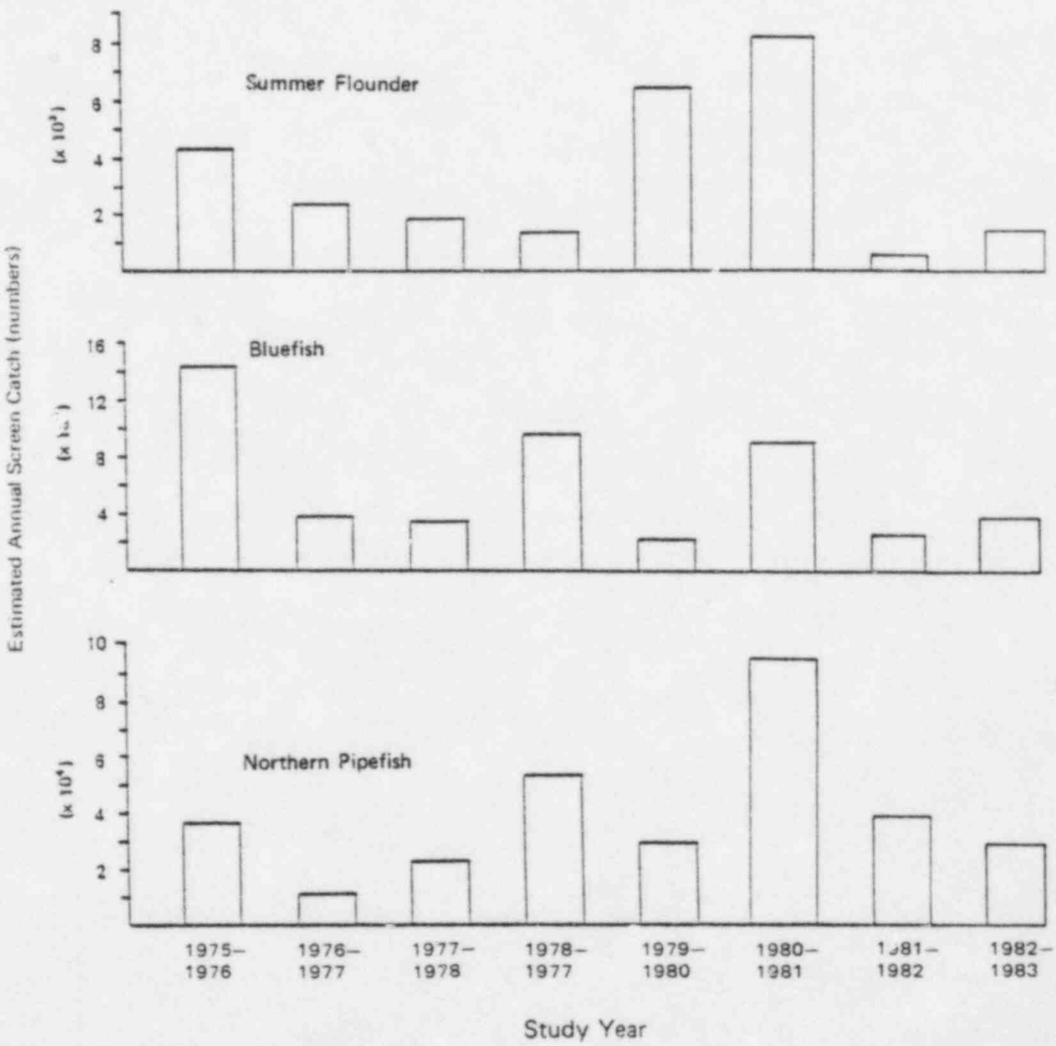

Figure 3-3. (Cont.)

TABLE 3-1 TOTAL EXTRAPOLATED NUMBER, PERCENT COMPOSITION, AND CUMULATIVE PERCENT OF FINFISH, OTHER VERTEBRATES, AND MACROINVERTEBRATES COLLECTED FROM THE TRAVELING SCREENS AT THE OYSTER CREEK NUCLEAR GENERATING STATION DURING 29 24-HOUR SAMPLING PERIODS, SEPTEMBER 1982 - MARCH 1983

Species Name	Number	Percent	Cumulative Percent
Crangon septemspinosa	707,969	87.25	87.25
Palaemonetes vulgaris	43,127	5.32	92.57
Menidia menidia	16,841	2.08	94.65
Callinectes sapidus	6,321	0.78	95.43
Pseudopleuronectes americanus	5,374	0.66	96.09
Phylum Nemertea	4,700	0.58	96.67
Syngnathus fuscus	4,069	0.50	97.17
Alosa aestivalis	3,732	0.46	97.63
Anchoa mitchilli	3,644	0.45	98.08
Leiostomus xanthurus	3,205	0.39	98.47
Etropus microstomus	1,771	0.21	98.68
Ovalipes ocellatus	1,071	0.13	98.81
Gobiosoma bosci	1,056	0.13	98.94
Cynoscion regalis	913	0.11	99.06
Brevoortia tyrannus	906	0.11	99.17
Apeltes quadracus	725	0.09	99.26
Hippocampus erectus	530	0.07	99.32
Pomatomus saltatrix	520	0.06	99.39
Prionotus evolans	485	0.06	99.45
Anguilla rostrata	462	0.06	99.51
Cancer irroratus	447	0.06	99.56
Paralichthys dentatus	372	0.05	99.61
Myoxocephalus aenaeus	355	0.04	99.65
Opsanus tau	347	0.04	99.69
Tautoga onitis	191	0.02	99.72
Penaeus aztecus	173	0.02	99.74
Gasterosteus aculeatus	146	0.02	99.76
Alosa pseudoharengus	142	0.02	99.78
Scophthalmus aquosus	138	0.02	99.79
Trinectes maculatus	128	0.02	99.81
Urophycis chuss	120	0.01	99.82
Caranx hippos	113	0.01	99.84
Cyprinodon variegatus	110	0.01	99.85
Anchoa hepsetus	109	0.01	99.86
Ammodytes americanus	103	0.01	99.88

Note: See Appendix for scientific and common name list.

TABLE 3-1 (CONT.)

Species Name	Number	Percent	Cumulative Percent
Fundulus heteroclitus	101	0.01	99.89
Sphoeroides maculatus	94	0.01	99.90
Alosa sapidissima	65	0.01	99.91
Ophidion marginatum	65	0.01	99.92
Chaetodon ocellatus	54	0.01	99.92
Class Scyphozoa	50	0.01	99.93
Morone americana	47	0.01	99.94
Astroscopus guttatus	30	0.00	99.94
Libinia dubia	30	0.00	99.94
Centropristis striata	30	0.00	99.95
Mugil curema	29	0.00	99.95
Neopanope sayi	25	0.00	99.95
Dorosoma cepedianum	24	0.00	99.96
Conger oceanicus	24	0.00	99.96
Merluccius bilinearis	23	0.00	99.96
Urophycis regius	22	0.00	99.97
Prionotus carolinus	21	0.00	99.97
Pagurus longicarpus	18	0.00	99.97
Carcinus maenas	16	0.00	99.97
Peprilus triacanthus	14	0.00	99.97
Limulus polyphemus	14	0.00	99.98
Family Xanthidae	13	0.00	99.98
Strongylura marina	12	0.00	99.98
Tautogolabrus adspersus	12	0.00	99.98
Chilomycterus schoepfi	11	0.00	99.98
Chasmodes bosquianus	10	0.00	99.98
Lutjanus griseus	10	0.00	99.98
Menidia beryllina	9	0.00	99.99
Class Holothuroidea	9	0.00	99.99
Gobiosoma ginsburgi	8	0.00	99.99
Sphyraena borealis	8	0.00	99.99
Membras martinica	6	0.00	99.99
Mugil cephalus	6	0.00	99.99
Dasyatis sayi	6	0.00	99.99
Enneacanthus obesus	6	0.00	99.99
Callinectes similis	5	0.00	99.99
Malaclemys terrapin	5	0.00	99.99
Fistularia tabacaria	4	0.00	99.99
Portunus gibbesi	4	0.00	99.99
Bairdiella chrysura	4	0.00	99.99
Caranx crysos	4	0.00	99.99

TABLE 3-1 (CONT.)

Species Name	Number	Percent	Cumulative Percent
Menticirrhus saxatilis	4	0.00	100.00
Hyporhamphus unifasciatus	4	0.00	100.00
Engraulis eurystole	4	0.00	100.00
Stenotomus chrysops	4	0.00	100.00
Sphyraena guachancho	3	0.00	100.00
Aluterus schoepfi	2	0.00	100.00
Alosa mediocris	2	0.00	100.00
Mustelus canis	2	0.00	100.00
Enneacanthus gloriosus	2	0.00	100.00
Penaeus setiferus	2	0.00	100.00
Phylum Invertebrata	2	0.00	100.00
Selar crumenophthalmus	2	0.00	100.00
Selene vomer	2	0.00	100.00
Fundulus diaphanus	2	0.00	100.00
Lolliguncula brevis	2	0.00	100.00
Monacanthus hispidus	2	0.00	100.00
Vomer setapinnis	1	0.00	100.00
Lucania parva	1	0.00	100.00

TABLE 3-2 TOTAL EXTRAPOLATED WEIGHT, PERCENT COMPOSITION, AND CUMULATIVE PERCENT OF FINFISH, OTHER VERTEBRATES, AND MACROINVERTEBRATES COLLECTED FROM THE TRAVELING SCREENS AT THE OYSTER CREEK NUCLEAR GENERATING STATION DURING 29 24-HOUR SAMPLING PERIODS, SEPTEMBER 1982 - MARCH 1983

Species Name	Weight (gm)	Percent	Cumulative Percent
Crangon septemspinosa	701,255	28.54	28.54
Callinectes sapidus	654,622	26.64	55.18
Pseudopleuronectes americanus	349,683	14.23	69.41
Leiostomus xanthurus	144,404	5.88	75.29
Menidia menidia	76,150	3.10	78.39
Phylum Nemertea	69,108	2.81	81.20
Paralichthys dentatus	63,489	2.58	83.78
Cancer irroratus	54,719	2.23	86.01
Tautoga onitis	43,173	1.76	87.77
Palaemonetes vulgaris	27,178	1.11	88.88
Limulus polyphemus	21,782	0.89	89.77
Anguilla rostrata	20,562	0.84	90.61
Alosa aestivalis	20,527	0.84	91.45
Brevoortia tyrannus	20,198	0.82	92.27
Opsanus tau	20,094	0.82	93.09
Ovalipes ocellatus	20,025	0.81	93.90
Cynoscion regalis	14,658	0.60	94.50
Etropus microstomus	14,310	0.58	95.08
Anchoa mitchilli	11,956	0.49	95.57
Sphoeroides maculatus	10,857	0.44	96.01
Prionotus evolans	9,338	0.38	96.39
Syngnathus fuscus	8,324	0.34	96.73
Trinectes maculatus	8,305	0.34	97.07
Scophthalmus aquosus	6,479	0.26	97.33
Mcrone americana	5,691	0.23	97.56
Libinia dubia	5,194	0.21	97.77
Pomatomus saltatrix	4,833	0.20	97.97
Alosa pseudoharengus	4,375	0.18	98.15
Caranx hippos	4,185	0.17	98.32
Centropristis striata	4,082	0.17	98.49
Myoxocephalus aenaeus	3,927	0.16	98.65
Hippocampus erectus	3,058	0.12	98.77
Class Scyphozoa	2,787	0.11	98.88
Ophidion marginatum	2,758	0.11	98.99
Penaeus aztecus	2,268	0.09	99.08

TABLE 3-2 (CONT.)

Species Name	Weight (gm)	Percent	Cumulative Percent
Dasyatis sayi	2,144	0.09	99.17
Urophycis chuss	2,069	0.09	99.26
Prionotus carolinus	1,804	0.08	99.34
Urophycis regius	1,343	0.06	99.40
Malaclemys terrapin	1,260	0.05	99.45
Mustelus canis	1,233	0.05	99.50
Astroscopus guttatus	1,014	0.04	99.54
Conger oceanicus	995	0.04	99.58
Chilomycterus schoepfi	900	0.04	99.62
Carcinus maenas	813	0.03	99.65
Apeltes quadracus	811	0.03	99.68
Alosa sapidissima	806	0.03	99.71
Gobiosoma bosci	762	0.03	99.74
Caranx crysos	666	0.03	99.77
Anchoa hepsetus	575	0.02	99.79
Merluccius bilinearis	508	0.02	99.81
Dorosoma cepedianum	500	0.02	99.83
Fundulus heteroclitus	484	0.02	99.85
Gasterosteus aculeatus	374	0.02	99.87
Mugil curema	337	0.01	99.88
Stenotomus chrysops	319	0.01	99.89
Cyprinodon variegatus	228	0.01	99.88
Aluterus schoepfi	225	0.01	99.89
Sphyraena borealis	221	0.01	99.90
Tautogolabrus adspersus	212	0.01	99.91
Alosa mediocris	211	0.01	99.92
Menticirrhus saxatilis	208	0.01	99.93
Ammodytes americanus	205	0.01	99.94
Chaetodon ocellatus	179	0.01	99.95
Strongylura marina	161	0.01	99.96
Peprilus triacanthus	148	0.01	99.97
Class Holothuroidea	136	0.01	99.98
Neopanope sayi	116	0.00	99.98
Bairdiella chrysura	112	0.00	99.98
Hyporhamphus unifasciatus	111	0.00	99.98
Mugil cephalus	94	0.00	99.98
Selar crumenophthalmus	85	0.00	99.98
Selene vomer	75	0.00	99.98
Fistularia tabacaria	63	0.00	99.98
Monacanthus hispidus	62	0.00	99.98

TABLE 3-2 (CONT.)

Species Name	Weight (gm)	Percent	Cumulative Percent
Pagurus longicarpus	48	0.00	99.99
Lutjanus griseus	44	0.00	99.99
Chasmodes bosquianus	41	0.00	99.99
Lolliguncula brevis	38	0.00	99.99
Sphyraena guachancho	31	0.00	99.99
Membras martinica	30	0.00	99.99
Family Xanthidae	26	0.00	99.99
Engraulis eurystole	26	0.00	100.00
Phylum Invertebrata	22	0.00	100.00
Enneacanthus obesus	19	0.00	100.00
Callinectes similis	16	0.00	100.00
Fundulus diaphanus	14	0.00	100.00
Portunus gibbesi	12	0.00	100.00
Menidia beryllina	9	0.00	100.00
Gobiosoma ginsburgi	8	0.00	100.00
Penaeus setiferus	4	0.00	100.00
Enneacanthus gloriosus	2	0.00	100.00
Vomer setapinnis	2	0.00	100.00
Lucania parva	1	0.00	100.00

TABLE 3-3 WEEKLY ESTIMATED NUMBER OF SELECTED SPECIES IMPINGED ON THE OYSTER CREEK NUCLEAR GENERATING STATION TRAVELING SCREENS, SEPTEMBER 1982 - MARCH 1983.

Date	Blueback Herring	Atlantic Menhaden	Bay Anchovy	Atlantic Silverside	Northern Pipefish	Bluefish	Weakfish	Northern Kingfish	Summer Flounder	Winter Flounder	Northern Puffer	Grass Shrimp	Sand Shrimp	Blue Crab	Total Organisms
7 SEP 82	70	40	3,671	0	315	1,108	371	0	59	0	95	12	0	9,246	16,433
13 SEP 82	20	17	2,145	0	134	923	354	0	26	0	0	56	82	6,937	11,934
19 SEP 82	14	14	2,145	0	28	437	227	0	98	0	79	0	0	5,120	8,931
27 SEP 82	14	31	1,846	0	915	188	925	0	161	0	45	0	95	4,718	10,237
4 OCT 82	14	0	1,015	14	14	198	182	0	42	0	14	0	0	2,954	4,966
11 OCT 82	28	28	3,921	0	324	141	1,823	14	168	14	182	42	254	8,024	17,379
19 OCT 82	41	15	2,578	1,596	490	427	619	0	1,145	14	28	238	323	1,577	12,539
26 OCT 82	369	407	1,869	1,757	3,846	92	656	14	471	192	86	18,426	5,576	1,993	48,121
1 NOV 82	0	42	266	315	504	14	698	0	119	56	42	1,202	1,836	1,545	10,296
8 NOV 82	14	127	402	350	1,234	41	269	0	92	90	28	4,827	4,713	300	15,502
15 NOV 82	69	459	1,298	29,064	3,360	70	181	0	68	579	28	19,181	34,840	42	100,345
22 NOV 82	0	225	493	673	1,892	0	71	0	14	42	0	15,620	132,380	463	155,185
29 NOV 82	55	266	914	7,783	1,459	0	0	0	0	280	28	12,592	254,616	84	281,513
6 DEC 82	85	28	876	495	70	0	0	0	0	267	0	7,669	154,436	797	165,918
13 DEC 82	1,409	239	877	15,558	3,901	0	0	0	84	6,330	0	5,574	570,641	0	616,029
20 DEC 82	188	126	174	12,560	2,374	0	0	0	14	1,538	0	9,991	332,585	0	368,811
27 DEC 82	464	99	70	1,394	127	0	0	0	14	1,061	0	10,033	163,584	42	179,905
3 JAN 83	8,931	195	84	2,877	152	0	14	0	0	2,592	0	3,343	133,524	0	153,794
10 JAN 83	6,861	126	549	3,051	255	0	0	0	14	7,540	0	10,149	441,452	350	483,902
17 JAN 83	6,119	3,738	0	5,559	1,747	0	0	0	13	8,111	0	5,120	339,618	0	373,532
24 JAN 83	28	28	0	14,468	258	0	0	0	0	218	0	9,884	860,944	0	886,061
31 JAN 83	580	0	14	5,097	213	0	0	0	0	1,462	0	25,042	65,541	14	99,355
7 FEB 83	541	0	0	2,599	504	0	0	0	0	2,464	0	8,120	118,071	0	134,082
14 FEB 83	0	0	0	265	256	0	0	0	0	673	0	2,459	394,569	0	398,684
21 FEB 83	19	28	0	4,001	14	0	0	0	0	241	0	43,166	54,617	0	105,570
1 MAR 83	14	0	59	1,764	157	0	0	0	0	441	0	15,193	184,457	28	214,471
7 MAR 83	0	0	176	2,666	1,095	0	0	0	0	1,195	0	21,489	292,805	0	322,332
14 MAR 83	57	0	7	859	548	0	0	0	0	141	0	12,389	158,933	0	174,073
22 MAR 83	118	56	48	3,124	2,293	0	0	0	0	2,078	0	40,067	255,259	14	309,914

TABLE 3-4 WEEKLY ESTIMATED WEIGHT (kg) OF SELECTED SPECIES IMPINGED ON THE OYSTER CREEK NUCLEAR GENERATING STATION TRAVELING SCREENS, SEPTEMBER 1982 - MARCH 1983

Date	Blueback Herring	Atlantic Menhaden	Bay Anchovy	Atlantic Silverside	Northern Pipefish	Bluefish	Weakfish	Northern Kingfish	Summer Flounder	Winter Flounder	Northern Puffer	Grass Shrimp	Sand Shrimp	Blue Crab	Total Weight
7 SEP 82	1.16	1.25	11.80	0.00	0.68	0.97	3.6[illegible]	0.00	10.15	0.00	11.16	0.01	0.00	792.04	889.57
13 SEP 82	0.08	2.81	6.15	0.00	0.40	8.19	3.05	0.00	3.26	0.00	0.00	0.06	0.07	590.10	662.75
19 SEP 82	0.22	2.69	6.95	0.00	0.06	11.75	2.67	0.00	13.93	0.00	20.95	0.00	0.00	506.28	621.23
27 SEP 82	0.41	0.38	4.88	0.00	2.37	0.88	16.01	0.00	22.10	0.00	13.10	0.00	0.10	510.51	616.25
4 OCT 82	0.27	0.00	3.52	0.08	0.07	1.14	3.69	0.00	15.20	0.00	0.64	0.00	0.00	417.23	464.69
11 OCT 82	0.61	0.95	13.08	0.00	0.87	0.90	35.98	0.52	28.62	4.17	23.45	0.04	0.21	988.32	1,179.54
19 OCT 82	0.68	0.31	8.33	3.91	1.37	4.98	9.64	0.00	209.87	3.12	0.46	0.17	0.28	203.38	716.49
26 OCT 82	14.21	12.72	5.66	6.64	8.10	2.33	12.04	0.94	82.87	31.79	2.03	13.20	4.76	239.17	1,082.97
1 NOV 82	0.00	4.16	0.74	1.13	1.24	0.18	8.26	0.00	23.47	8.46	3.89	0.90	1.71	182.10	379.58
8 NOV 82	1.82	6.63	1.28	1.38	2.99	0.49	4.52	0.00	17.21	30.32	0.11	3.89	4.27	33.09	210.52
15 NOV 82	0.62	8.84	3.55	132.81	7.07	2.01	2.42	0.00	12.25	148.36	0.18	14.61	32.67	6.58	645.30
22 NOV 82	0.00	5.40	1.41	3.03	3.94	0.00	0.45	0.00	2.32	6.78	0.00	11.68	121.41	34.44	305.47
29 NOV 82	0.39	29.81	3.92	36.82	3.40	0.00	0.00	0.00	0.00	44.29	0.03	9.75	267.80	1.96	481.92
6 DEC 82	0.50	3.43	3.69	1.92	0.15	0.00	0.00	0.00	0.00	60.33	0.00	5.09	133.10	71.12	316.21
13 DEC 82	7.85	27.42	4.13	77.11	0.67	0.00	0.00	0.00	3.11	169.49	0.00	4.47	683.29	0.00	1,392.35
20 DEC 82	0.72	3.54	0.65	57.37	3.71	0.00	0.00	0.00	0.02	125.60	0.00	6.02	336.51	0.00	648.29
27 DEC 82	1.74	3.46	0.29	8.00	0.30	0.00	0.00	0.00	0.01	103.32	0.00	6.70	152.27	2.38	343.64
3 JAN 83	28.64	11.78	0.28	12.72	0.37	0.00	0.20	0.00	0.00	119.71	0.00	2.13	126.67	0.00	341.01
10 JAN 83	32.64	5.16	2.06	15.53	0.35	0.00	0.00	0.00	0.01	577.59	0.00	6.36	470.85	0.35	1,333.82
17 JAN 83	43.45	0.93	0.00	22.04	2.35	0.00	0.00	0.00	0.01	242.25	0.00	2.75	341.54	0.00	770.69
24 JAN 83	0.10	0.27	0.00	56.31	0.34	0.00	0.00	0.00	0.00	12.46	0.00	7.28	888.76	0.00	970.54
31 JAN 83	4.10	0.00	0.06	23.23	0.34	0.00	0.00	0.00	0.00	221.78	0.00	14.77	58.47	0.01	353.73
7 FEB 83	1.77	0.00	0.00	11.63	0.53	0.00	0.00	0.00	0.00	332.00	0.00	4.53	101.99	0.00	505.30
14 FEB 83	0.00	0.00	0.00	0.95	0.30	0.00	0.00	0.00	0.00	22.14	0.00	1.56	353.97	0.00	387.45
21 FEB 83	0.09	0.36	0.00	17.94	0.01	0.00	0.00	0.00	0.00	16.48	0.00	22.67	42.90	0.00	129.77
1 MAR 83	0.06	0.00	0.24	8.00	0.40	0.00	0.00	0.00	0.00	35.24	0.00	9.24	150.03	3.25	398.54
7 MAR 83	0.00	0.00	0.85	13.03	2.63	0.00	0.00	0.00	0.00	34.80	0.00	13.06	254.40	0.00	362.92
14 MAR 83	0.20	0.00	0.02	4.39	1.28	0.00	0.00	0.00	0.00	2.61	0.00	6.78	129.36	0.00	158.90
22 MAR 83	1.37	9.07	0.19	17.06	5.98	0.00	0.00	0.00	0.00	94.69	0.00	22.53	251.39	0.04	531.78

TABLE 3-5 DAY-NIGHT COMPARISONS OF NUMBERS AND WEIGHTS (gm) OF SELECTED SPECIES COLLECTED FROM THE OYSTER CREEK NUCLEAR GENERATING STATION TRAVELING SCREENS, SEPTEMBER 1982 - MARCH 1983

Species	Number Collected		Percent Catch	Weight Collected		Percent Catch
	Day	Night	Night	Day	Night	Night
Callinectes sapidus	1,590	4,731	74.84	182,473	472,149	72.13
Pseudopleuronectes americanus	933	4,441	82.63	81,116	268,567	76.80
Crangon septemspinosa	61,059	646,909	91.38	59,266	641,989	91.55
Cynoscion regalis	112	801	87.72	2,077	12,582	85.83
Paralichthys dentatus	156	216	58.16	26,566	36,924	58.16
Menidia menidia	6,639	10,202	60.58	29,544	46,606	61.20
Anguilla rostrata	105	357	77.37	9,592	10,970	53.35
Tautoga onitis	93	98	51.43	19,924	23,249	53.85
Class Scyphozoa	26	25	49.28	2,104	683	24.51
Brevoortia tyrannus	648	257	28.39	3,943	16,251	80.47
Opsanus tau	83	264	75.99	2,163	17,932	89.24
Prionotus evolans	82	403	83.18	2,363	6,976	74.70
Anchoa mitchilli	531	3,112	85.43	1,730	10,227	85.53
Alosa aestivalis	851	2,881	77.20	7,796	12,730	62.02
Trinectes maculatus	29	100	77.71	1,632	6,674	80.35
Leiostomus xanthurus	1,176	2,028	63.30	53,910	90,494	62.67
Etropus microstomus	368	1,403	79.23	2,621	11,689	81.68
Pomatomus saltatrix	156	364	69.95	992	3,840	79.46
Palaemonetes vulgaris	5,494	37,633	87.26	3,371	23,806	87.60
Syngnathus fuscus	807	3,262	80.17	1,480	6,845	82.23
Gobiosoma bosci	269	787	74.57	192	570	74.78
Sphoeroides maculatus	40	54	57.37	5,738	5,119	47.15
Menticirrhus saxatilis	0	4	100.00	0	208	100.00
Ovalipes ocellatus	173	898	83.82	4,232	15,793	78.87
Other Organisms	1,298	7,455	85.17	65,653	143,968	68.68
Totals	82,718	728,685	89.81	570,478	1,886,841	76.78

TABLE 3-6 TOTAL ESTIMATED NUMBER AND WEIGHT (kg) WITH 80 PERCENT CONFIDENCE INTERVALS OF KEY AND ABUNDANT SPECIES IMPINGED AT THE OYSTER CREEK NUCLEAR GENERATING STATION, SEPTEMBER 1982 - MARCH 1983[(a)]

Species	Number	Weight
Blueback herring	26,044±10,003	143.22±70.33
Atlantic menhaden	6,324±5,691	140.22±56.44
Bay anchovy	26,187±5,831	86.04±20.04
Atlantic silverside	117,009±50,603	528.85±232.49
Northern pipefish	28,021±9,732	57.17±18.36
Bluefish	3,960±740	33.19±19.21
Weakfish	6,372±2,890	101.97±55.54
Northern kingfish	29±34	1.49±1.66
Summer flounder	2,566±1,071	439.80±195.76
Winter flounder	37,170±17,248	2,398.79±845.19
Northern puffer	658±349	72.53±44.10
Grass shrimp	295,355±83,758	186.44±47.93
Sand shrimp	4,912,601±1,308,227	4,869.68±1,455.44
Blue crab	46,259±9,683	4,745.63±1,037.22
Total[(b)]	5,629,917±1,316,351	17,231.91±2,798.71

(a) Because of station outage in 1983, the "annual" estimates represent only a 7-month period.

(b) Total includes all species collected from screens.

TABLE 3-7 MEAN WATER-TEMPERATURE VALUES (C) DURING DAY (INTD) AND NIGHT (INTN) IMPINGEMENT SAMPLING AT THE OYSTER CREEK NUCLEAR GENERATING STATION INTAKE, SEPTEMBER 1982 - MARCH 1983

	Surface			Bottom		
Date	INTD	INTN	Mean	INTD	INTN	Mean
7 SEP 82	21.5	20.4	20.9	21.5	20.4	20.9
13 SEP 82	23.8	23.8	23.8	23.8	23.7	23.7
19 SEP 82	21.7	19.8	20.7	21.7	19.7	20.7
27 SEP 82	20.3	19.7	20.0	20.3	19.7	20.0
4 OCT 82	20.1	19.2	19.7	20.2	19.2	19.7
11 OCT 82	15.9	15.8	15.8	15.9	15.8	15.9
19 OCT 82	12.8	15.1	14.0	12.7	15.1	13.9
26 OCT 82	10.7	11.0	10.8	10.7	11.1	10.9
1 NOV 82	18.1	16.2	17.2	17.8	15.9	16.8
8 NOV 82	10.8	12.1	11.4	10.7	11.8	11.2
15 NOV 82	8.4	9.0	8.7	8.3	8.9	8.6
22 NOV 82	12.1	11.1	11.6	12.0	11.1	11.5
29 NOV 82	7.9	9.0	8.4	7.8	8.9	8.4
6 DEC 82	11.1	13.8	12.4	11.0	13.7	12.4
13 DEC 82	2.2	2.4	2.3	2.1	2.4	2.3
20 DEC 82	2.4	3.3	2.8	2.2	3.2	2.7
27 DEC 82	9.3	6.6	7.9	9.2	6.3	7.7
3 JAN 83	4.2	4.4	4.3	4.0	4.5	4.2
10 JAN 83	6.9	6.9	6.9	6.8	6.9	6.8
17 JAN 83	-0.4	1.9	0.7	-0.8	1.9	0.5
24 JAN 83	2.0	2.2	2.1	1.9	1.9	1.9
31 JAN 83	3.3	3.2	3.2	3.1	3.2	3.1
7 FEB 83	1.5	2.2	1.9	1.4	2.2	1.8
14 FEB 83	2.1	0.3	1.2	0.9	-0.1	0.4
21 FEB 83	5.6	4.9	5.2	5.3	4.7	5.0
1 MAR 83	4.5	6.2	5.4	4.4	6.1	5.2
7 MAR 83	6.5	6.9	6.7	6.3	7.0	6.6
14 MAR 83	7.5	7.0	7.3	7.4	7.0	7.2
22 MAR 83	8.3	6.3	7.4	8.4	6.1	7.3
Mean	9.7	9.7	9.7	9.5	9.6	9.6

TABLE 3-8 MEAN DISSOLVED OXYGEN VALUES (mg/l) DURING DAY (INTD) AND NIGHT (INTN) IMPINGEMENT SAMPLING AT THE OYSTER CREEK NUCLEAR GENERATING STATION INTAKE, SEPTEMBER 1982 - MARCH 1983

Date	Surface			Bottom		
	INTD	INTN	Mean	INTD	INTN	Mean
7 SEP 82	6.6	7.4	7.0	6.5	7.4	7.0
13 SEP 82	6.9	7.3	7.1	6.9	7.3	7.1
19 SEP 82	6.7	6.1	6.4	6.7	6.1	6.4
27 SEP 82	7.6	6.9	7.2	7.6	6.9	7.2
4 OCT 82	7.9	8.1	8.0	7.9	8.1	8.0
11 OCT 82	8.3	8.5	8.4	8.2	8.5	8.4
19 OCT 82	8.6	8.1	8.4	8.6	8.1	8.4
26 OCT 82	8.9	8.9	8.9	8.9	9.0	8.9
1 NOV 82	8.4	9.5	8.9	8.4	9.5	9.0
8 NOV 82	8.9	8.8	8.9	8.9	8.9	8.9
15 NOV 82	8.5	7.7	8.1	8.5	7.7	8.1
22 NOV 82	8.0	9.4	8.7	8.0	9.5	8.8
29 NOV 82	9.0	9.1	9.0	9.1	9.1	9.1
6 DEC 82	9.7	8.5	9.1	9.7	8.5	9.1
13 DEC 82	11.2	10.9	11.1	11.5	11.0	11.2
20 DEC 82	10.7	10.4	10.5	10.9	10.6	10.8
27 DEC 82	9.0	10.0	9.5	9.1	10.1	9.6
3 JAN 83	11.1	11.0	11.0	11.3	11.2	11.2
10 JAN 83	9.6	9.6	9.6	9.7	9.5	9.6
17 JAN 83	12.1	11.7	11.9	12.4	11.8	12.1
24 JAN 83	12.1	12.4	12.3	12.2	12.5	12.3
31 JAN 83	11.4	11.2	11.3	11.4	11.2	11.3
7 FEB 83	11.9	11.8	11.9	12.1	11.8	12.0
14 FEB 83	11.6	12.3	11.9	12.1	12.5	12.3
21 FEB 83	12.3	13.3	12.8	12.6	13.6	13.1
1 MAR 83	11.3	9.9	10.6	11.4	9.9	10.7
7 MAR 83	10.7	10.8	10.7	10.8	10.9	10.8
14 MAR 83	12.0	11.5	11.7	12.1	11.6	11.8
22 MAR 83	11.1	11.6	11.3	10.7	11.4	11.0
Mean	9.7	9.7	9.7	9.8	9.8	9.8

TABLE 3-9 MEAN SALINITY VALUES (ppt) DURING DAY (INTD) AND NIGHT (INTN) IMPINGEMENT SAMPLING AT THE OYSTER CREEK NUCLEAR GENERATING STATION INTAKE, SEPTEMBER 1982 - MARCH 1983

	Surface			Bottom		
Date	INTD	INTN	Mean	INTD	INTN	Mean
7 SEP 82	24.2	23.0	23.6	24.2	23.0	23.6
13 SEP 82	24.1	23.9	24.0	24.1	24.0	24.0
19 SEP 82	26.3	26.0	26.1	26.3	26.0	26.1
27 SEP 82	24.3	25.7	25.0	24.2	25.7	24.9
4 OCT 82	23.0	25.3	24.1	23.0	25.2	24.1
11 OCT 82	25.6	25.9	25.8	25.6	25.9	25.8
19 OCT 82	25.2	25.1	25.1	25.2	25.0	25.1
26 OCT 82	23.5	24.2	23.9	23.5	24.2	23.9
1 NOV 82	24.9	24.8	24.8	24.8	24.6	24.7
8 NOV 82	25.3	25.1	25.2	25.2	24.9	25.1
15 NOV 82	25.2	25.1	25.1	25.2	25.3	25.2
22 NOV 82	24.4	21.9	23.1	24.4	21.9	23.2
29 NOV 82	23.9	24.9	24.4	23.9	24.9	24.4
6 DEC 82	23.8	23.9	23.9	23.8	23.8	23.8
13 DEC 82	24.1	26.0	25.1	24.1	26.1	25.1
20 DEC 82	25.2	27.3	26.2	25.2	27.1	26.2
27 DEC 82	24.0	23.2	23.6	24.0	23.2	23.6
3 JAN 83	24.6	25.6	25.1	24.5	25.4	24.9
10 JAN 83	25.5	23.9	24.7	25.5	23.9	24.7
17 JAN 83	24.2	25.4	24.8	24.2	25.4	24.8
24 JAN 83	23.2	22.0	22.6	24.4	27.0	25.7
31 JAN 83	24.2	27.3	25.7	24.2	27.3	25.7
7 FEB 83	24.9	24.3	24.6	25.0	24.3	24.7
14 FEB 83	12.2	14.8	13.5	23.8	23.3	23.5
21 FEB 83	21.0	21.6	21.3	22.0	22.4	22.2
1 MAR 83	23.8	21.9	22.8	23.8	22.4	23.1
7 MAR 83	19.1	22.1	20.6	19.6	22.1	20.8
14 MAR 83	20.8	20.6	20.7	20.9	20.7	20.8
22 MAR 83	18.1	20.6	19.2	19.5	20.5	20.0
Mean	23.4	23.9	23.6	23.9	24.3	24.1

TABLE 3-10 RANGE OF pH READINGS AMONG SURFACE/BOTTOM AND DAY/NIGHT MEASUREMENTS, OYSTER CREEK NUCLEAR GENERATING STATION INTAKE, SEPTEMBER 1982 - MARCH 1983

Week of	pH Measurement Range
7 SEP 82	7.7 - 8.0
13 SEP 82	7.6 - 7.9
19 SEP 82	7.1 - 8.1
27 SEP 82	7.4 - 8.1
4 OCT 82	7.7 - 8.2
11 OCT 82	7.8 - 8.1
19 OCT 82	7.7 - 8.3
26 OCT 82	7.9 - 8.1
1 NOV 82	7.7 - 8.2
8 NOV 82	8.1 - 8.2
15 NOV 82	8.1 - 8.2
22 NOV 82	7.8 - 8.1
29 NOV 82	8.0 - 8.2
6 DEC 82	7.8 - 8.2
13 DEC 83	8.0 - 8.2
20 DEC 82	8.1 - 8.3
27 DEC 82	7.8 - 8.3
3 JAN 83	8.0 - 8.1
10 JAN 83	7.9 - 8.3
17 JAN 83	8.0 - 8.2
24 JAN 83	8.0 - 8.2
31 JAN 83	8.0 - 8.2
7 FEB 83	7.9 - 8.1
14 FEB 83	7.0 - 7.9
21 FEB 83	8.1 - 8.3
1 MAR 83	7.8 - 8.3
7 MAR 83	7.8 - 8.1
14 MAR 83	8.0 - 8.2
22 MAR 83	7.8 - 8.2

REFERENCES

Boyle, M.F. 1979. Commercial fisheries, in Ecological Studies for the Oyster Creek Generating Station. Progress Report for the Period September 1977 - August 1978 (D.J. Danila and C.B. Milstein and Associates, eds.), pp. 88-89. Ichthyological Associates, Inc. Ithaca, N.Y.

Danila, D.J., C.B. Milstein, and Associates, eds. 1979. Ecological Studies for the Oyster Creek Generating Station. Progress Report for the Period September 1977 - August 1978. Ichthyological Associates, Inc., Ithaca, N.Y.

Ecological Analysts, Inc. 1981. Ecological Studies at Oyster Creek Nuclear Generating Station, Progress Report, September 1979 - August 1980. EA, Sparks, Md.

Ecological Analysts, Inc. 1982. Ecological Studies at Oyster Creek Nuclear Generating Station, Progress Report, September 1980 - August 1981. EA, Sparks, Md.

Ecological Analysts, Inc. 1983. Ecological Studies at Oyster Creek Nuclear Generating Station, Progress Report, September 1981 - August 1982. EA, Sparks, Md.

Ichthyological Associates. 1977. Ecological Studies for the Oyster Creek Generating Station, Vols. 1 and 2. Progress Report for the Period September 1975 - August 1976 (T.R. Tatham, D.J. Danila, and D.L. Thomas, eds.). IA, Ithaca, N.Y.

Ichthyological Associates. 1978. Ecological Studies for the Oyster Creek Generating Station, Vols. 1 and 2. Progress Report for the Period September 1976 - August 1977 (T.R. Tatham, D.J. Danila, and D.L. Thomas, eds.). IA, Ithaca, N.Y.

Jersey Central Power and Light Company. 1978. 316(a) and (b) Demonstration for the Oyster Creek and Forked River Nuclear Generating Stations. Jersey Central L, Morristown, N.J.

Metzger, F., Jr. 1979. Life history studies, in Ecological Studies for the Oyster Creek Generating Station. Progress Report for the Period September 1977 - August 1979 (D.J. Danila and C.B. Milstein, eds.), pp. 69-87. Ichthyological Associates, Inc. Ithaca, N.Y.

Moore, D.W. 1978. Sand shrimp, in Ecological Studies for the Oyster Creek Generating Station. Progress Report for the Period September 1976 - August 1977 (T.R. Tatham, D.J. Danila, and D.L. Thomas, eds.), pp. 242-250. Ichthyological Associates, Inc., Ithaca, N.Y.

Tatham, T.R., D.L. Thomas, and G.L. Miller. 1978. Survival of fishes and macroinvertebrates impinged at Oyster Creek Generating Station, in Fourth National Workshop on Entrainment and Impingement (L.D. Jensen, ed.), pp. 235-243. EA Communications, Melville, N.Y. 424 pp.

U.S. Atomic Energy Commission. 1974. Final Environmental Statement Related to Operation of Oyster Creek Nuclear Generating Station. Washington.

U.S. Nuclear Regulatory Commission. 1978. Oyster Creek Nuclear Generating Station Technical Specifications, Appendix "B" to License No. DPR-16. Washington.

Vouglitois, J.J. 1983. GPU Nuclear Corporation. Personal communication. January 1983.

APPENDIX:

SPECIES LIST

TABLE A-1 SCIENTIFIC AND COMMON NAMES OF FISHES, REPTILES, AND INVERTEBRATES ENCOUNTERED DURING IMPINGEMENT SAMPLING, SEPTEMBER 1982 - MARCH 1983

Scientific Name	Common Name
FISH:	
Mustelus canis	Smooth dogfish
Dasyatis sayi	Bluntnose stingray
Anguilla rostrata	American eel
Conger oceanicus	Conger eel
Alosa aestivalis	Blueback herring
Alosa mediocris	Hickory shad
Alosa pseudoharengus	Alewife
Alosa sapidissima	American shad
Brevoortia tyrannus	Atlantic menhaden
Dorosoma cepedianum	Gizzard shad
Anchoa hepsetus	Striped anchovy
Anchoa mitchilli	Bay anchovy
Engraulis eurystole	Silver anchovy
Opsanus tau	Oyster toadfish
Merluccius bilinearis	Silver hake
Urophycis chuss	Red hake
Urophycis regia	Spotted hake
Ophidion marginatum	Striped cusk-eel
Hyporhamphus unifasciatus	Halfbeak
Strongylura marina	Atlantic needlefish
Cyprinodon variegatus	Sheepshead minnow
Fundulus diaphanus	Banded killifish
Fundulus heteroclitus	Mummichog
Lucania parva	Rainwater killifish
Membras martinica	Rough silverside
Menidia beryllina	Tidewater silverside
Menidia menidia	Atlantic silverside
Apeltes quadracus	Fourspine stickleback
Gasterosteus aculeatus	Threespine stickleback
Fistularis tabacaria	Bluespotted cornetfish
Hippocampus erectus	Lined seahorse
Syngnathus fuscus	Northern pipefish
Morone americana	White perch
Centropristis striata	Black sea bass
Enneacanthus obesus	Banded sunfish
Enneacanthus gloriosus	Bluespotted sunfish
Pomatomus saltatrix	Bluefish

TABLE A-1 (CONT.)

Scientific Name	Common Name
Caranx hippos	Crevalle jack
Caranx crysos	Blue runner
Selene vomer	Lookdown
Selene setapinnis	Atlantic moonfish
Selar crumenophthalmus	Bigeye scad
Lutjanus griseus	Gray snapper
Stenotomus chrysops	Scup
Bairdiella chrysura	Silver perch
Cynoscion regalis	Weakfish
Leiostomus xanthurus	Spot
Menticirrhus saxatilis	Northern kingfish
Chaetodon ocellatus	Spotfin butterflyfish
Tautoga onitis	Tautog
Tautogolabrus adspersus	Cunner
Mugil cephalus	Striped mullet
Mugil curema	White mullet
Sphyraena borealis	Northern sennet
Sphyraena guachancho	Guaguanche
Astroscopus guttatus	Northern stargazer
Chasmodes bosquianus	Striped blenny
Ammodytes americanus	American sand lance
Gobiosoma bosci	Naked goby
Gobiosoma ginsburgi	Seaboard goby
Peprilus triacanthus	Butterfish
Prionotus carolinus	Northern searobin
Prionotus evolans	Striped searobin
Myoxocephalus aenaeus	Grubby
Etropus microstomus	Smallmouth flounder
Paralichthys dentatus	Summer flounder
Scophthalmus aquosus	Windowpane
Pseudopleuronectes americanus	Winter flounder
Trinectes maculatus	Hogchoker
Aluterus schoepfi	Orange filefish
Monacanthus hispidus	Planehead filefish
Sphoeroides maculatus	Northern puffer
Chilomycterus schoepfi	Striped burrfish
REPTILES:	
Malaclemys terrapin	Diamondback terrapin
INVERTEBRATES:	
Class Scyphozoa	True jellyfishes
Class Holothuroidea	Sea cucumbers
Phylum Nemertea	Ribbon worms

TABLE A-1 (CONT.)

Scientific Name	Common Name
Lolliguncula brevis	Squid
Limulus polyphemus	Horseshoe crab
Penaeus aztecus	Brown shrimp
Penaeus setiferus	White shrimp
Palaemonetes vulgaris	Grass shrimp
Crangon septemspinosa	Sand shrimp
Pagurus longicarpus	Long-armed hermit crab
Portunus gibbesi	Portunid crab
Callinectes sapidus	Blue crab
Callinectes similis	Lesser blue crab
Ovalipes ocellatus	Lady crab
Carcinus maenas	Green crab
Cancer irroratus	Rock crab
Family Xanthidae	Mud crabs
Neopanope texana sayi	Mud crab
Libinia dubia	Spider crab