HUDSON RIVER ECOLOGICAL STUDY IN THE AREA OF INDIAN POINT

1978 ANNUAL REPORT

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SECTION I

SUMMARY AND CONCLUSIONS

The 1978 Indian Point Annual Report presents the results of ecological and impingement monitoring studies conducted by Texas Instruments Incorporated (TI) in the area of Indian Point during 1978. The primary goals of the 1978 program were to analyze the numbers and species of fish impinged on intake screens at the Indian Point generating station and to assess abundance and composition of Hudson River fish populations in the Indian Point region. The 1978 results are compared with riverwide studies and with previous years' results. The report contains a synopsis of studies and conclusions by various contractors that have contributed to the Indian Point environmental monitoring program which reviews the history of fish impingement problems, protective measures, fish distribution and behavior, mitigation measures, and related factors as they apply to the operation of the Indian Point generating station.

Specific objectives of the 1978 Indian Point nearfield study program were:

- to monitor numbers and species of fish impinged at the Indian Point generating station Units No. 2 and No. 3,
- to assess whether species abundance and composition in the vicinity of Indian Point have been altered by plant operation,
- to analyze fish impingement in relation to environmental and plant operational variables and provide information useful in defining potential mitigative procedures.

A. SYNOPSIS OF INDIAN POINT STUDIES

The Indian Point generating station began commercial operation with the completion of Unit No. 1 in 1962. Units No. 2 and No. 3 were completed and began commercial operation in 1973 and 1976, respectively. Unit No. 1 has not operated for commercial production since October 1974. Each unit utilizes a once-through cooling system which results in the entrainment or impingement of eggs, larvae, and small fish. The two currently operating units (No. 2 and No. 3) each have six 140,000 gal/min circulator pumps and service water pumps with capacities of 30,000 gal/min at each unit. During winter of each year when water temperatures fall below about 4°C (39.2°F) (approximately December through April), the amount of water drawn through the intake screens associated with each pump is reduced to 60% of the normal pump capacity to help reduce fish impingement.

Ecological investigations to determine the effects of the Indian Point generating station on the aquatic biota in its vicinity have been continuous since 1969, with exception of 1971, and were expanded in 1973 to include a major portion of the Hudson River estuary. This 1978 Indian Point Annual Report emphasizes results of the seventh year of Nearfield Studies conducted by Texas Instruments Incorporated.

The Hudson River estuary extends 152 river miles (243 km) northward from New York City to the Troy Dam near Albany. Water movement in the estuary is dominated by tidal flow which usually masks the net freshwater flow of the Hudson River drainage basin. Periods of low freshwater flow occur in mid-summer and mid-winter allowing salt water to intrude into the estuary. The extent of intrusion is inversely related to freshwater flow; spring and fall surges of freshwater can move the salt front (defined as 0.3 mS/cm conductivity) downstream as far as river mile (RM) 28. The Indian Point generating station (RM 42, KM 67) is near the center of the range of salt front movement in the estuary. From 1975 through 1978, freshwater flow varied considerably from year to year except for biannual peaks, and mean monthly conductivities at Indian Point were inversely related to freshwater flow rates. Monthly temperatures, dissolved oxygen concentrations, turbidity, and pH at Indian Point were consistent across the four years.

B. SPECIES ABUNDANCE AND COMPOSITION

Data concerning collection efficiency of impinged fish was accumulated in sufficient quantities during 1978 to adjust impingement collections and to estimate the number of fish impinged as opposed to reports of previous years in which only the number of impinged fish collected was reported. The 1978 collection efficiency rates for Unit No. 2 and No. 3 were 29.6% and 73.4%, respectively, which are essentially the same as those of 1977. Adjustment factors resulting from the 1974 through 1978 rates (3.5 for Unit No. 2 and 1.4 for Unit No. 3) were applied to all impingement collections reported herein.

A relatively small number of fish species dominated impingement, nearfield, and riverwide samples from 1974 through 1978. The ranking of these species has varied from year to year, but no trends that could be related to operation of the Indian Point generating station have been detected. The predominant species in impingement samples changed seasonally during 1978 and were the same species that dominated concurrent nearfield surface and bottom trawl samples; species collected primarily in the shore zone were impinged less frequently. Species such as Atlantic tomcod and bay anchovy, species associated with saline water in the Indian Point region during summer, and blueback herring, a species that migrates downriver past Indian Point during the fall, dominated impingement samples from June through November. During the rest of the year, white perch, a resident species that overwinters in deep water near Indian Point, was the most numerous species in impingement collections.

Of the 114 fish species reported from the Hudson River estuary, 99 have been collected by riverwide beach seine and bottom trawl efforts; 65 by standard stations beach seine, bottom trawl, and surface trawl sampling; and 87 by impingement sampling at Indian Point generating station. From 1974 through 1978, no decline has occurred in the yearly number of species collected within the estuary, indicating that operation of the Indian Point generating station has had no discernable effect on fish species diversity.

Predominant species in impingement collections at Indian Point were generally the same as in collective field samples from the Indian Point region. However, aside from instances in which a single species dominated both impingement and nearfield collections, no particular similarity between impingement samples and samples from any single standard station was found. For example, surface trawl catches most closely reflected impingement collections when both were heavily dominated by a species such as blueback herring, bay anchovy, or alewife. Beach seine catches did not reflect the species composition of impingement collections indicating that fish species favoring shallow water ($\leq$3m deep) are not equally exposed to the Indian Point intakes which withdraw water from up to 9m deep adjacent to the channel. The overall species composition in bottom trawl catches were similar to impingement collections when collections were dominated by yearling white perch or juvenile Atlantic tomcod.

Most fish impinged at Indian Point were in the first year of life and, therefore, small and immature. Of the six species examined for size composition and representing approximately 90% of the fish impinged, the percentage of fish less than 12 months old ranged from 88.7% (white perch) to 99.6% (blueback herring). Mean weights of the six species examined ranged from 2.0g (blueback herring) to 9.8g (striped bass). Except for white perch, percentages of young fish ($\leq$12 months old) in impingement samples were similar to those in samples from field gear; older white perch were less vulnerable to impingement than to field gear. Striped bass, American shad, blueback herring, and alewife were impinged almost exclusively during their first year, primarily as they emigrated from the estuary. Few Atlantic tomcod live beyond one year and most of those impinged had not reached maturity. Impingement of tomcod adults occurred mostly after spawning and should not represent a serious loss to the population. The average biomass of each of the six fish species impinged each year from 1976 through 1978 ranged from 140 kg (308 lb) for American shad to 18,736 kg (40,219 lb) for white perch. For the two species with greatest commercial value, striped bass and American shad, impingement at Indian Point removed far less biomass than did the Hudson River commercial fishery based on commercial catch data from 1965 to 1974.

Recovery rates of marked fish released at various locations in the Hudson River estuary were used to qualitatively define regions of the estuary from which fishes came that eventually were impinged at Indian Point. A greater proportion of striped bass marked upriver (RM 47-76) than of those marked downriver (RM 12-38) from the Indian Point Generating Station in the fall of 1978 were subsequently impinged before the end of the year, as was expected for an anadromous species. No clear relationship existed between the recovery rate of striped bass and the distance of their release points from Indian Point. White perch impinged at Indian Point during 1978 included fish marked and released in 1976, 1977, and 1978. Fish from all marking regions (RM 12-152) were susceptible to impingement and, for fish released in 1976, 1977, and 1978, nearly equal proportions from all parts of the estuary moved into or past Indian Point. Marked Atlantic tomcod impinged at Indian Point during 1978 exhibited predominantly downstream movement. Atlantic tomcod were relatively invulnerable to impingement during late fall and early winter as they migrated upstream past Indian Point to spawn. Data obtained during the last three years suggest that more post-spawning adults are susceptible to impingement at Indian Point than pre-spawning adults.

A comparison of impingement rates between Units No. 2 and No. 3 revealed a significant difference for striped bass, white perch, Atlantic tomcod, blueback herring, bay anchovy, hogchoker, weakfish, and rainbow smelt; no difference was detected for American shad or alewife. There is evidence that collection efficiency varies among months; therefore, inferences regarding relative impingement rates of Units No. 2 and No. 3 may be altered when adequate data are available to determine seasonal adjustment factors.

Three general impingement patterns associated with nearfield fish abundance were observed in the Indian Point regions: 1) unimodal, with peak impingement during winter; 2) unimodal, with peak impingement during summer; 3) bimodal, with a smaller impingement peak during summer and a larger peak during fall. The first impingement pattern was exhibited by white perch, spottail shiner, white catfish, and hogchoker. These species were most heavily impinged when they moved into the deeper channel areas in the Indian Point region during late fall and winter. This occurred during a period of low temperatures which presumably reduced their activity level and ability to avoid being impinged. The timing of the late fall-early winter movement to deep water was affected by yearly variations in conductivity. Offshore movement and subsequent increased impingement were delayed when conductivity in the Indian Point region remained high into the winter months.

The second impingement pattern was exhibited by species (Atlantic tomcod, bay anchovy, bluefish, and weakfish) that utilize the lower regions of the estuary. These species were most heavily impinged during summer when they moved into the Indian Point region as conductivity increased in the middle estuary. Timing and amplitude of the summer impingement peak was affected by the timing and rate of change in conductivity. Highest impingement occurred in years with delayed but rather sharp increases in monthly mean conductivities near Indian Point. This appeared to aggregate these species so that their downriver movements were concentrated during a relatively brief time period.

The third impingement pattern was exhibited by anadromous species: alewife, American shad, blueback herring, striped bass, and rainbow smelt. These species were impinged during the summer as populations of young-of-the-year increased in the Indian Point region, either as individuals grew to impingeable size or when some young fish from the upper estuary moved downriver past the plant. A second and larger impingement peak occurred during the fall as the young-of-the-year of these species moved offshore and migrated downriver. Timing and amplitude of the impingement peaks were affected by changes in conductivity; summer impingement was relatively low during years when conductivity in the Indian Point region was high and relatively high in years when conductivity was low. Fall impingement was relatively low when the salt front moved downriver gradually, thus decreasing Indian Point region conductivities gradually over a period of months. However, fall impingement was relatively high when the salt front moved downriver more rapidly. Thus, at least three factors determine seasonal and yearly trends in impingement at Indian Point: the species, the size of the young-of-the-year population (i.e., nearfield abundance), and the dynamic behavior of the salt front.

Diel and tidal effects accounted for differences in impingement rates among some fish species. Blueback herring and alewife impingement rates increased at dawn and dusk and were elevated even more when dawn and ebb tide coincided. Striped bass were impinged at greater rates during ebb tide, but no diel influence was apparent. Neither tide nor time of day appeared to significantly affect impingement rates for white perch, Atlantic tomcod, or white catfish.

C. MITIGATION

Two mitigative measures for reducing the effects of fish loss due to entrainment and impingement at Indian Point were investigated during 1978. One measure was to offset losses through a hatchery and restocking program, while the other relied on mechanical improvements at the intakes to reduce entrainment and improve survival of impinged fish.

Results of the hatchery program demonstrated that hatchery-reared and wild striped bass attain sexual maturity at a comparable age. In early 1979, two mature hatchery-reared females were captured, providing evidence that hatchery-reared striped bass will return and contribute to the Hudson River spawning stock.

A continuously operating fine-mesh traveling screen modified with fish buckets was tested to investigate its effects on recovery rates and survival of impinged fish. The modified traveling screen system reduced entrainment effects slightly, but significantly improved survival of impinged fishes. Initial survival ranged from 0% for bay anchovy to 100% for white perch; similarly extended survival ranged from 0% for alewife to 100% for white perch. Tests included small sample sizes; therefore initial and extended survival estimates were calculated using all 118 fish collected. Combined initial survival was 59% and combined extended survival was 61%. Both estimates are probably conservative.

D. CONCLUSIONS

Although there have been annual changes in nearfield fish species composition and annual abundance, there is no evidence that these changes were caused by impingement at the Indian Point generating station. Furthermore, the total biomass of impinged species is a negligible fraction of what would have been taken annually by the commercial fishery had it been in operation. Virtually all impinged fish are young-of-the-year.

Fish impingement at the Indian Point generating station was influenced strongly by seasonal cycles in spatio-temporal distribution. Changes in water temperature and conductivity (related to salt front position) had the greatest influence on daily and seasonal variations in impingement. These physicochemical parameters not only influenced the behavioral patterns of the fishes, but affected impingement by altering fish abundance at Indian Point; i.e., temperature and conductivity had a significant influence on the abundance of five major fish species (striped bass, white perch, Atlantic tomcod, blueback herring, and bay anchovy) in the Indian Point region. There was a direct relationship between number of fish impinged and total volume of water circulated, supporting its use in the determination of impingement rate. Variations in impingement were also correlated with precipitation, tidal amplitude, effects of multiple screen washes, and unit interaction.

The capture of two mature, hatchery-reared female striped bass early in 1979 provides evidence that the effects of impingement of this species can be mitigated. Another mitigative measure, the continuously operating fine-mesh traveling screen modified with fish buckets and a low pressure spray wash system demonstrated a potential for reducing impingement effects. Survival rates ranged from 0% for the more fragile species to 100% for the more heavily impinged white perch.

SECTION II

INTRODUCTION

The Indian Point electric generating station began commercial operation with the completion of Unit No. 1 in 1962. Units No. 2 and No. 3 were completed and began commercial operation in 1973 and 1976 respectively. Each unit of the nuclear plant utilizes a once-through cooling system which results in the entrainment and impingement of eggs, larvae, and small fish.

During 1969, a series of ecological studies were initiated to study the effects of operation of the Indian Point electric generating station on the aquatic biota of the Hudson River estuary. This 1978 Indian Point Annual Report emphasizes results of the seventh year of Nearfield Studies conducted by Texas Instruments Incorporated (TI).

A. THE INDIAN POINT GENERATING STATION

The combined pumping capacity of the three units is 2,058,000 gal/min (7790m^3/min), although Unit No. 1, which has two 140,000 gal/min circulator pumps, was retired from commercial operation in October 1974. The two currently operating units (No. 2 and No. 3) each have six 140,000 gal/min circulator pumps. Several service pumps with much lower capacities (38,000 gal/min at Unit No. 1, 30,000 gal/min at both Unit No. 2 and No. 3) are also associated with each unit. During winter of each year when water temperatures fall below about 4^{o}C (39.2^{o}F) (approximately December to April), the amount of water drawn through the intake screen associated with each circulator pump is reduced to 60% of the normal pump capacity to reduce fish impingement. Units No. 1 and No. 2 each have fixed intake screens at the river's edge and traveling screens within each intake forebay.

Unit No. 3 has traveling screens at the river's edge but has no fixed screens. Details of the plant and associated intake structures have been presented previously (TI 1975c, Con Edison 1977a).

B. STUDY PROGRAM AND REPORT OBJECTIVES

Primary emphasis of this report is directed toward analyzing the numbers and species of fish impinged on intake screens and toward assessing abundance and species composition of fish populations in the vicinity of Indian Point during 1978. The 1978 results are put in perspective by comparison with riverwide studies and with previous years' results. In addition, this report contains a synopsis of studies and conclusions by various contractors that have done research as part of the Indian Point environmental studies program since its inception in 1969.

Major objectives of the Indian Point nearfield study conducted by Texas Instruments Incorporated (TI) during 1978 were:

- to assess whether or not plant operation has altered species compositon or abundance,
- to analyze fish impingement in relation to environmental variables (biological and physico-chemical) and thus provide information potentially useful in defining mitigative procedures,
- to monitor numbers and species of impinged fish.

Specifically, this report has been designed to summarize the findings of the previous years of the Indian Point study as well as to detail the results obtained during 1978. Topics discussed include: A synopsis of past studies (Section III); a discussion of the species composition of field and impingement collections; a species by species analysis of abundance trends both within 1978 and over the previous three to five years; analysis of impingement rates in relation to time of day, tide stage, and the influence of physicochemcal factors; and the range of movement of marked fish prior to impingement (Section IV). The results of two mitigative studies (Section V) are also discussed along with a glossary (Section VI) of frequently used and report-specific terms.

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SECTION III

A SYNOPSIS OF INDIAN POINT STUDIES

Early ecological studies in the Con Edison Study Program evaluated the effectiveness of individual structural modifications for reducing impingement and evolved into the current program that examines the effects of electrical generating stations on the Hudson River estuary. Studies related to impingement magnitude, causes, and effects on vulnerable fish species are still in progress. This synopsis is designed to trace the evolution of the study program and to place the 1978 studies in perspective by describing the objectives and major findings of previous studies. Specific information regarding changes in study design of the Indian Point Study Program are tabulated chronologically for each nearfield effort in Appendix D.

A. STUDY AREA CHARACTERISTICS

1. Geography and Morphology

The Hudson River estuary, or tidal region of the Hudson River, extends 152 river miles (243 km) northward from the Battery on Manhattan Island to the Troy Dam near Albany, New York (Figure III-1). Although the estuary has several areas of about 30 m in depth and a depth at one point of about 53 m, it is typically shallower, with depths of 10 to 20 m being common. In general the width and cross-sectional area decrease as the depth increases, a phenomenon directly attributable to the presence or absence of mountainous terrain. The deepest section of the estuary is the highlands region near West Point, New York, where the river cuts through the Hudson Highlands and is confined to a narrow gorge. The Hudson River has a slightly inclined bed from the continental shelf to Albany where the channel bottom is approximately at sea level.

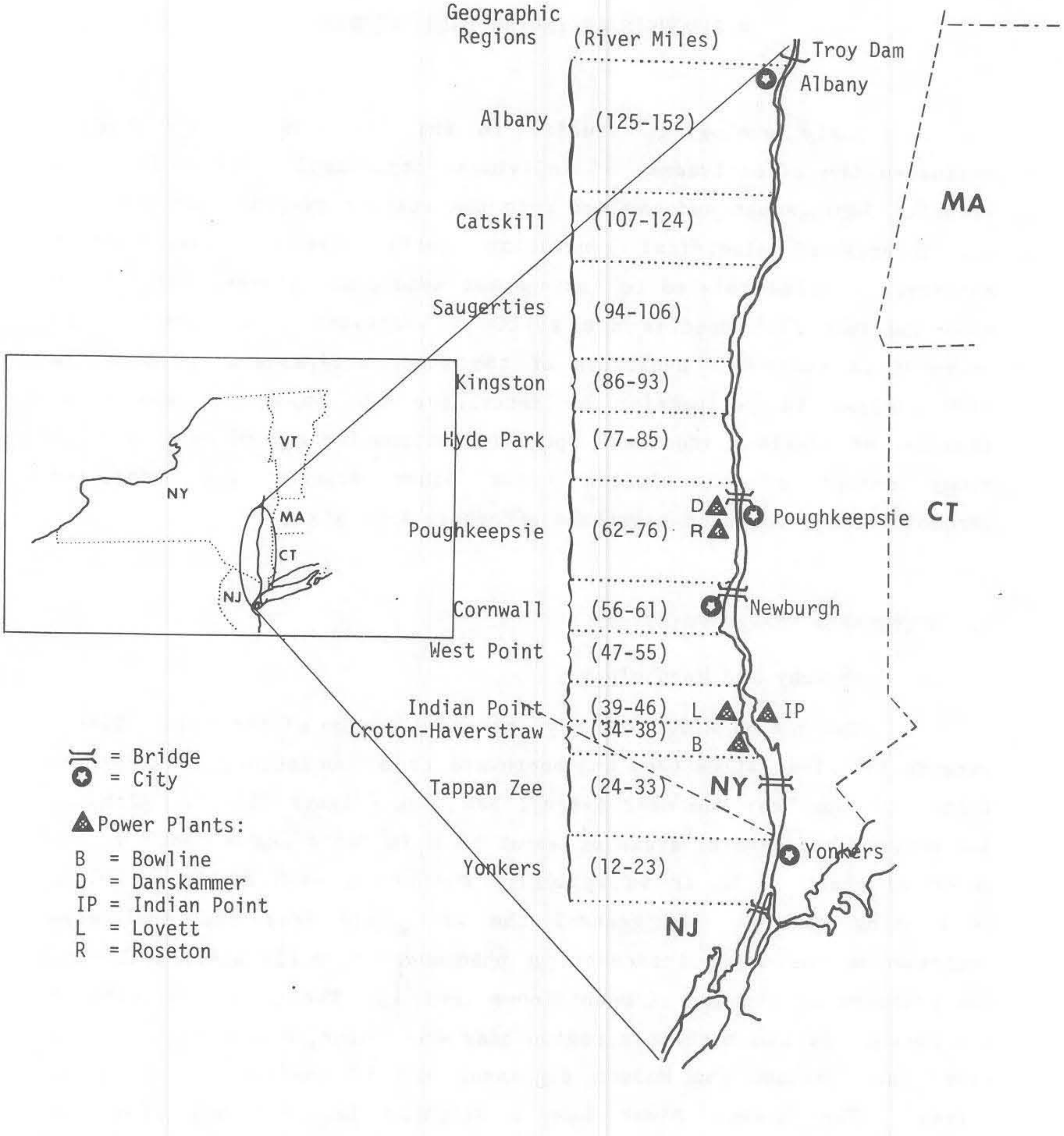

Figure III-1. Location of Twelve Geographic Regions (With River Mile Boundaries) Used during 1977 through 1978 Field Sampling Programs in Hudson River Estuary

2. Tidal Influence

The overall water movement in the Hudson River estuary is clearly dominated by tidal flow which is typically from 10 to 100 times the volume of freshwater flow. Tidal flow ranges from about 200,000 to 300,000 cfs (5,670 to 8,500 m^3/sec), but exceptional tidal flows may be greater than 490,000 cfs [14,000 m^3/sec (Busby 1966)]. As a consequence, the net freshwater flow of the Hudson River drainage is usually masked by the tidal flows superimposed on it. However, even the estuary's largest tidal flow can be suppressed by unusual weather conditions; strong winds from the north or south can push water into or out of the estuary, obscuring the true tidal regimes (Busby 1966).

The volume of freshwater flow into the estuary tends to exhibit a yearly bimodal pattern similar to that generally found in streams within the New York area. Periods of high discharges occur in November and December and again during March, April, and May. Both periods result from increased precipitation, and the springtime flows are augmented by the melting of snow and ice.

Freshwater flow into the estuary is partially controlled by the Troy Dam and other flood control and water supply reservoirs in the Hudson River drainage basin. Approximately 60% of the net flow of the Hudson estuary passes the Green Island gauge below the Troy Dam. The drainage basin below Troy contributes the remainder, principally from the tributaries in the southeastern Catskill Mountains. The average flow at Green Island is 12,500 cfs (354 m^3/sec); the mean freshwater flow at New York City amounts to about 20,480 cfs (580 m^3/sec). Periods of low fresh water flow, as occur in mid-summer and to a lesser extent in mid-winter, allow salt water to intrude into the estuary with the extent of intrusion inversely related to the volume of freshwater flow.

Mixing of freshwater and saltwater in the lower estuary is influenced by both tidal action and river morphometry. Salt water intrusion occurs first in the deeper channel areas because of the greater density of salt water. Intrusion into shallower shoal and bay areas occurs only after tidal action mixes surface and bottom water, and saline water is introduced into shallow areas by upper level circulation patterns. Flushing of saline water from backwater bay areas during ebb tide and/or periods of increased freshwater flow is less abrupt than channel flushing because of reduced circulation of tidal and freshwater flows through these areas (TI 1976e).

The degree of salt water intrusion into the estuary is measured by the river mile location of the salt front. The salt front is defined as the water mass having 0.1 $^{o}/oo$ salinity or about 0.3 mS/cm conductivity. The salt front seldom moves north of Newburgh (RM 62, KM 99) or south of the Tappan Zee Bridge (RM 28, KM 45) which generally defines the "middle" estuary. The estuary can be divided into three general regions based on annual salinity ranges (Figure III-2). The area north of Newburgh (approximately RM 62-152) normally contains freshwater (i.e., the upper estuary); the area from Croton-Haverstraw to Cornwall (approximately RM 34-61) usually exhibits low but variable salinity (i.e., the middle estuary); and the Yonkers and Tappan Zee regions (approximately RM 12-33) generally maintain relatively high and variable salinity (i.e., the lower estuary). Thus, the Indian Point generating station (RM 42, KM 67) is near the center of the range of salt front movement in the Hudson River estuary. Consequently, measurements of conductivity at Indian Point during the year normally range from zero to about 9 mS/cm.

3. Water Chemistry

Several studies have examined concentrations of biogenic nutrients and heavy metals in water of the Indian Point region. The New

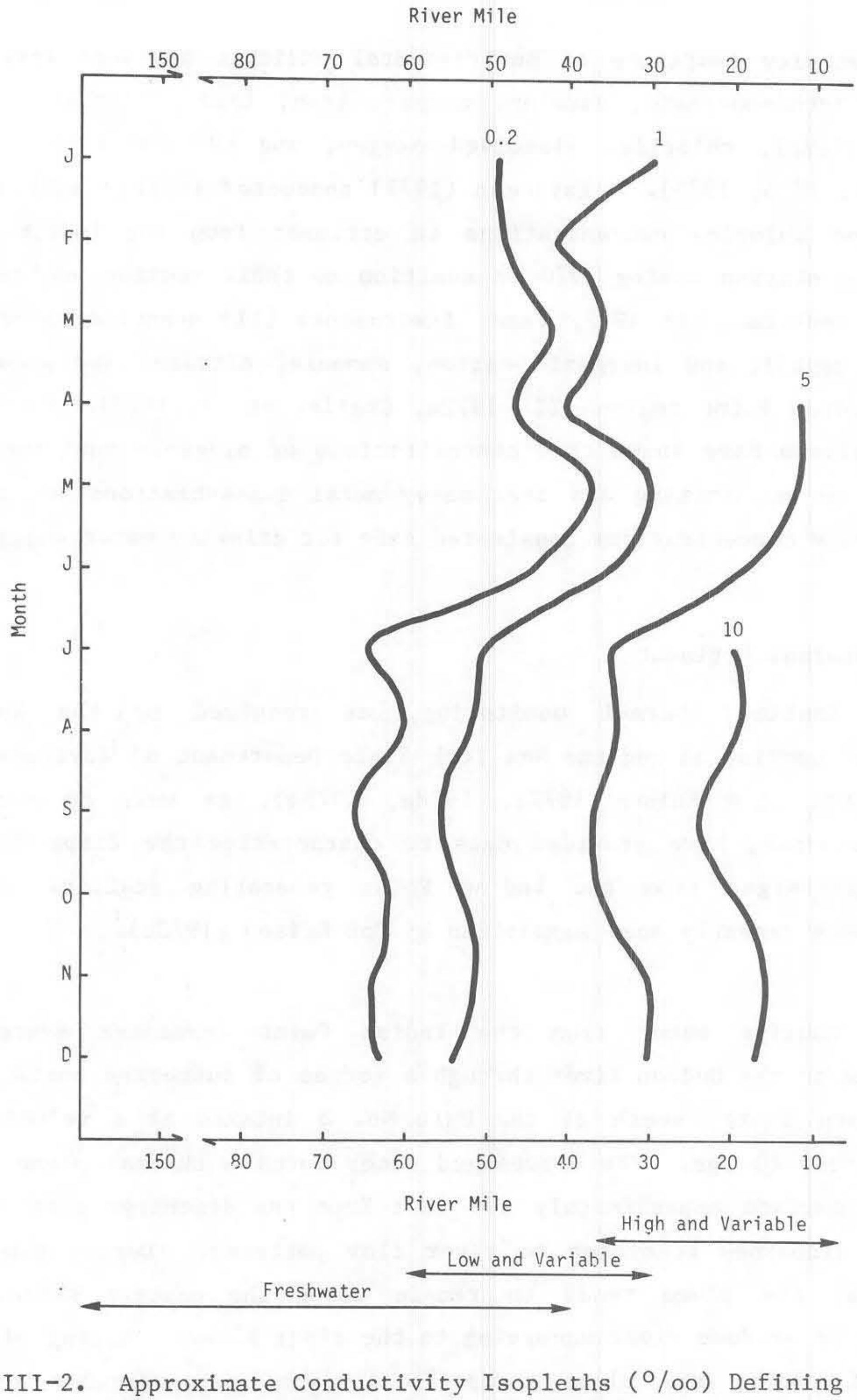

Figure III-2. Approximate Conductivity Isopleths ($^{0}/oo$) Defining Three General Regions of Hudson River Estuary, One Typically Freshwater, One Typically Low and Variable, and One High and Variable in Conductivity, 1978

York University Institute of Environmental Medicine analyzed levels of nitrate, orthophosphate, cadmium, copper, iron, lead, manganese, zinc, cobalt, nickel, chloride, dissolved oxygen, and pH from 1969 to 1973 (NYU 1971, 1973, 1974). Raytheon (1971) conducted limited analyses of copper and chlorine concentrations in effluent from the Indian Point generating station during 1970 in addition to their routine analyses of other parameters. In 1972, Texas Instruments (TI) measured concentrations of organic and inorganic carbon, ammonia, nitrate, and phosphate in the Indian Point region (TI 1972a, Chailer et al. 1973). Generally these analyses have shown that concentrations of biogenic nutrients are unlikely to be limiting and that heavy metal concentrations are almost always below concentrations considered safe for drinking water supplies.

4. Thermal Effluent

Routine thermal monitoring, as required by the Nuclear Regulatory Commission and the New York State Department of Environmental Conservation (Con Edison 1977a, 1978a, 1978b), as well as numerous special studies, have provided data to characterize the dispersion of heated discharges from the Indian Point generating station. These studies have recently been summarized by Con Edison (1978c).

Cooling water from the Indian Point condenser system is discharged to the Hudson River through a series of submerged ports along the eastern shore, south of the Unit No. 3 intakes at a velocity of approximately 10 fps. The discharged water forms a thermal plume which tends to surface approximately 100 feet from the discharge ports after which it disperses according to river flow patterns. During flood or ebb tides, the plume tends to remain along the eastern shore, but disperses up or down river according to the river flow. During high or low slack tides, the plume tends to disperse perpendicular to the eastern shore but has not been found to extend much beyond midriver (Con Edison 1978c). Because of the buoyancy of heated water, the plume tends to remain in the upper strata and has no significant benthic component. Thus, the magnitude of the Indian Point thermal plume has been maintained within thermal criteria for both surface width and cross-sectional areas established by the New York State Department of Environmental Conservation. Because of the importance to the biological community, consideration has been given to the potential linking of the Indian Point thermal plume with that of the Lovett generating station located one mile downstream and across the river. Infrared photogrpahy (Raytheon 1971, TI 1972c, 1973c), plume modeling (Alden Associates 1972), plume mapping (Dames and Moore 1974a, 1974b, 1974c), and routine monitoring studies (Con Edison 1978c) have all indicated insignificant linkage of the two plumes.

5. Summary of 1975 to 1978 Water Quality Trends

Variables such as temperature, conductivity, turbidity, dissolved oxygen, pH, and freshwater flow directly and indirectly affect distribution and movements of fish species within the Indian Point region, and their subsequent vulnerability to power plant impingement.

The temporal distribution of freshwater flow (ft^3/sec) at Green Island varied considerably from year to year [Figure III-3(a)]; however, highest flows generally occurred during early spring (March and April) and October. Flow in 1975 was intermediate in comparison to other years, while 1976 flow rates were consistently higher than 1975 and 1978 from February through August. Noteworthy also were the 1978 July through December flow rates which were considerably less than any previous year.

Monthly mean conductivities (mS/cm) showed an inverse relationship to freshwater flow, with highest conductivities occurring during May through October when flow rates were lowest (Figure III-3).

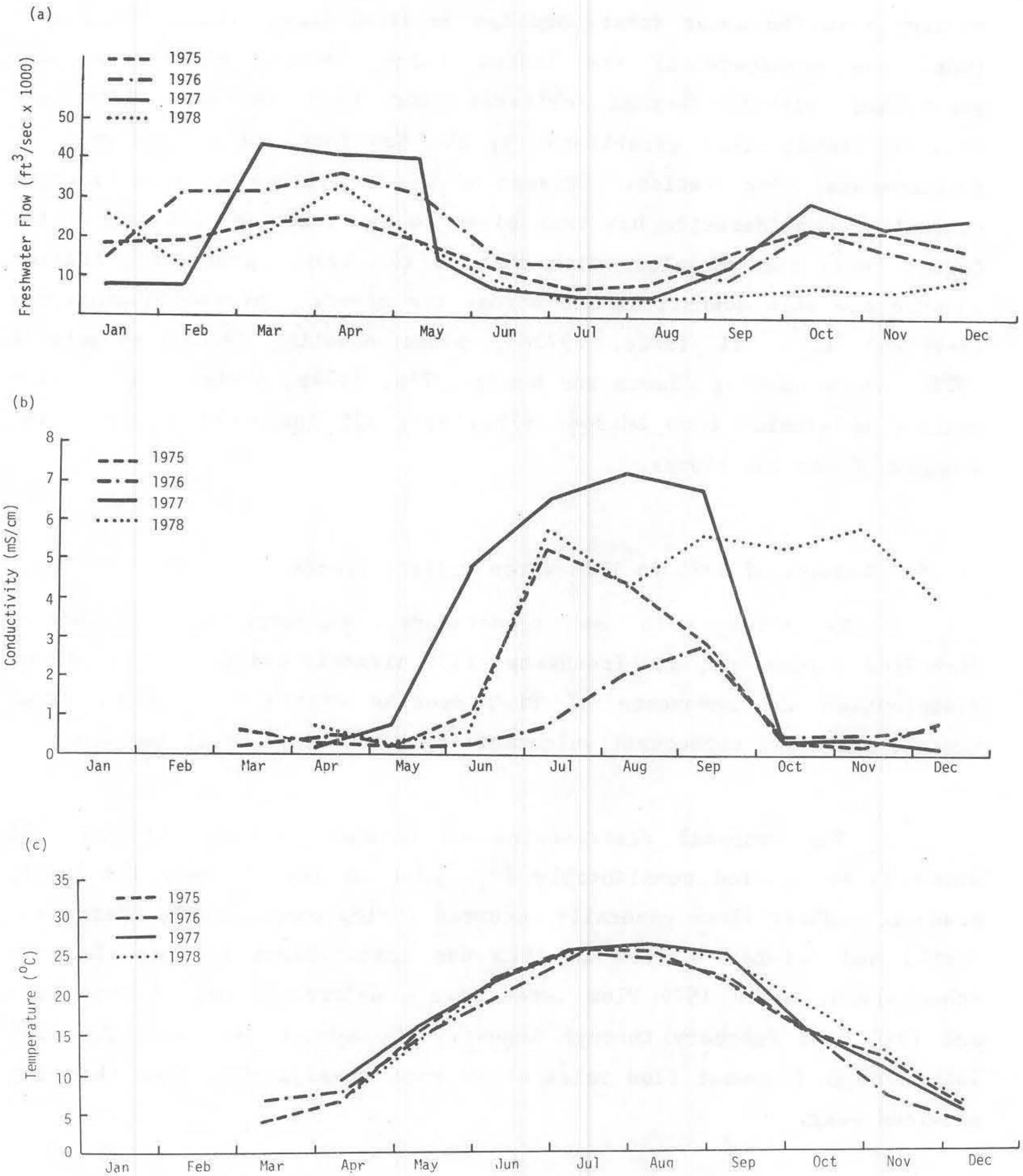

Figure III-3. Monthly Mean Freshwater Flow at Green Island (a), and Conductivity (b), and Water Temperature (c) in Indian Point Region 1975 through 1978

Intrusion of the salt front into the Indian Point region during summer and early fall increases the movement of many marine and euryhaline species into this area and their vulnerability to impingement. In 1975, 1976, and 1977, conductivities decreased sharply in October; however, conductivities remained high in 1978 through December, and may account for the relatively high nearfield abundance and impingement rates of certain species during the fall months of 1978 (see Section IV-D).

Seasonal trends in water temperatures (°C) during March through December were similar in the Indian Point region from 1975 through 1978, with highest temperatures (26°C) occurring during July and August (Figure III-3). Higher water temperatures during the summer months were reflective of increasing solar radiation and decreasing freshwater flow, and influenced spatial distribution of fish as they sought higher or lower water temperatures within the water column. Late April was consistently the month when spring warming began, and coincided with the annual spring spawning migration of many species. Late September marked the time of fall temperature decreases and the emigration of several anadromous species (TI 1979b). Winter temperatures were undoubtedly low (0° to 5°C), although they could not be measured since standard stations sampling efforts are not conducted during winter months.

The pattern of dissolved oxygen concentrations (ppm) was reversed from that of water temperature due to the inverse relationship between water temperature and gas solubility (Figure III-4). Seasonal trends in dissolved oxygen concentration were consistent across years, with lowest values occurring during the summer months (June through August) and higher values occurring during spring and fall.

Turbidity level (FTU) trends in the Indian Point region were basically consistent across all years, with highest turbidity occurring during early spring and late fall (Figure III-4). Turbidity levels in

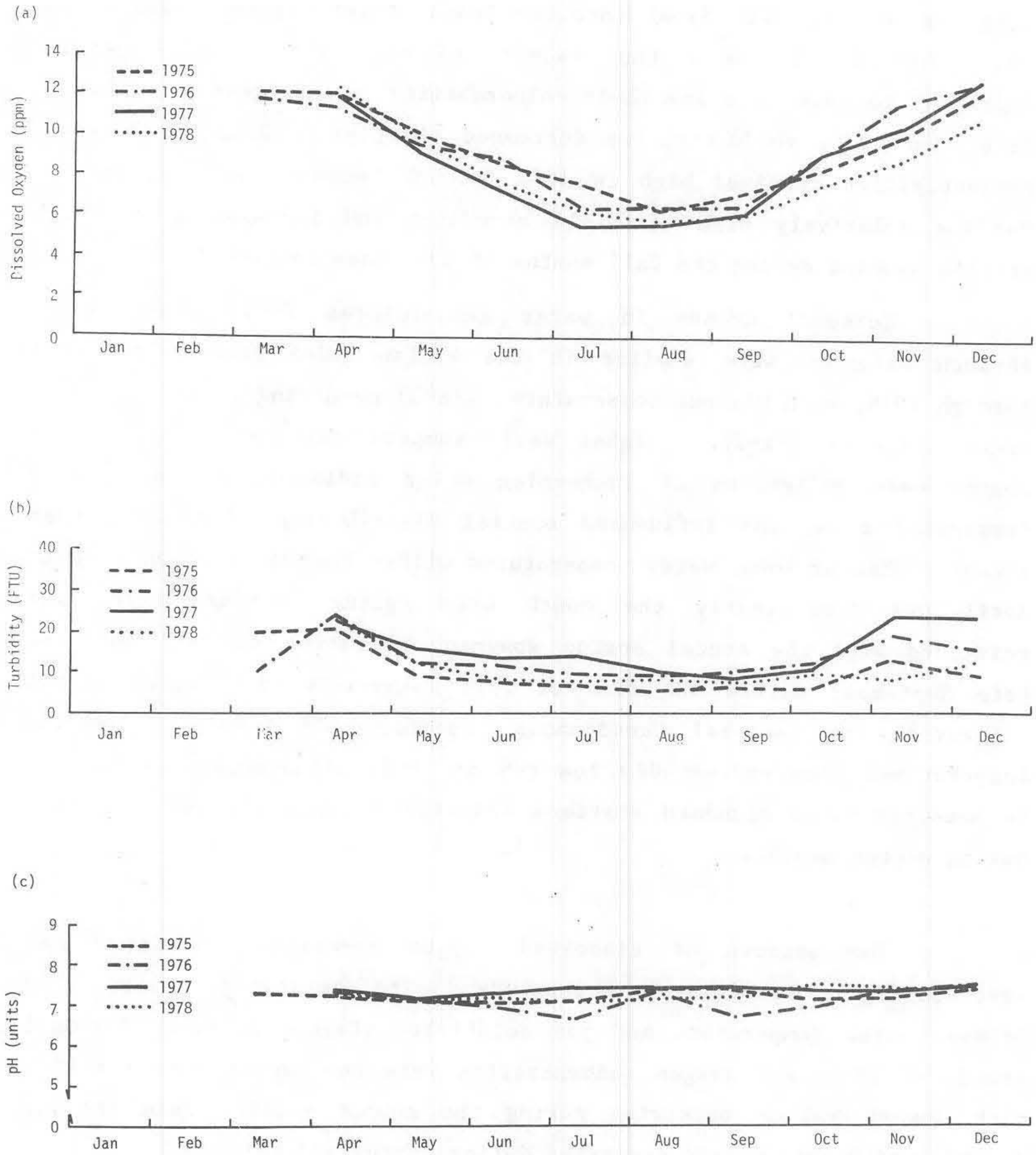

Figure III-4. Monthly Mean Dissolved Oxygen (a), Turbidity (b), and pH (c) in Indian Point Region 1975 through 1978 the Hudson River are primarily influenced by freshwater flow rates and summer phytoplankton densities (TI 1976e). High freshwater flow washes sediment into the river, induces turbulence, and maintains particles in suspension. Turbidity levels in the Indian Point region were highest during 1976 and 1977, when freshwater flows were also quite high (Figure III-3).

The mean monthly pH values of water in the Indian Point region showed little variation either within or between years from 1975 through 1978 (Figure III-4). Mean monthly pH was usually neutral (pH = 7.0) to slightly alkaline (pH >7.0) throughout the sampling period. The relative stability of pH values reflects the strong buffering capacity of the Hudson River estuary.

B. IMPINGEMENT STUDIES

Fish impingement at the Indian Point generating station began when Indian Point Unit No. 1 began operation in October 1962, and has continued to the present. Con Edison has tested and evaluated various methods of fish guidance and screening in an effort to deter fish from the intake system. The history of fish impingement, studies of fish distribution and behavior, mitigation measures tested, and studies of related environmental factors as they apply to the operation of the Indian Point generating station are well documented (Con Edison 1970, 1973, Raytheon 1971, TI 1973a, 1974c, 1975e, 1976d, 1977e, 1978d).

In April 1970, the Indian Point Fish Advisory Board, composed of members of the scientific community, was created to assist in planning and implementing studies to achieve fish protection at Indian Point (Con Edison 1973). Subsequent research has sought to characterize impingement and to evaluate plant operations and environmental factors that could affect impingement. Studies related to impingement causes and effects on vulnerable fish species are still in progress.

1. Early Attempts to Reduce Impingement

Difficulties with fish impingement intensified in March 1963, when fish congregated in the open intake forebays of Unit No. 1 and were subsequently impinged. Air curtains installed in front of the forebays and foxwire netting placed across openings in the sheet piling to keep fish away from the forebays met with limited success in 1963 (Con Edison 1970). Trash racks were modified in 1965 with the addition of smaller mesh, but fish were gilled in the screens rendering the modification unacceptable (Con Edison 1970). A correlation noted in June 1965 between impingement of large fish and the addition of sodium hypochlorite (used to reduce biofouling of the cooling system) resulted in moving the point of addition from the forebay to behind the traveling screen, resulting in decreased impingement of large fish (Con Edison 1970). The sluice designed to carry live fish washed from the screens back to the river was extended in summer 1965 to reduce reimpingement (Con Edison 1973); in August 1965, sheet pilings were removed from the pier surrounding the intakes in an attempt to reduce a sanctuary effect, but small fish continued to be impinged (Con Edison 1970).

The discharge canal was extended downstream in spring 1966 to reduce impingement that may have been caused by the attraction of fishes to heated waters. The effluent flow was directed south along the river bank resulting in reduced recirculation, but fish continued to enter the forebays (Con Edison 1970). In April 1966, the forebay entrances were enlarged, reducing the average intake velocity from approximately 1.3 to 0.8 ft/sec (Con Edison 1970), and in the summer of 1967 fixed screens (0.375 in. sq mesh) were installed at the mouth of the intake forebays and substantially reduced impingement collections (Con Edison 1970, 1973).

Other modifications in plant/operational procedures were implemented at Unit No. 1 in an effort to reduce impingement, but these efforts met with varied success. These modifications included: backup fixed screens (January 1970), changes in procedures for disposing of dead fish in order to minimize recirculation (April 1970), flow reduction to 60% on days with high fish collection (January 1971) or when water temperatures were below 4.4°C (March 1972), and completion of submerged discharge ports (June 1972) (Con Edison 1973).

The effectiveness of air bubble curtains as fish deterrents were evaluated beginning with their installation in front of Unit No. 1 in summer 1972 and Unit No. 2 in winter 1973. Air curtains were ineffective as a visual or behavioral avoidance stimulus for reducing fish impingement, and their use was discontinued in March 1976.

2. Monitoring of Impingement

a. Wash Procedures and Schedules

Observations and counts of fish collected at the intakes were performed irregularly before 1970, making it difficult to determine the temporal impingement magnitude or to assess the effectiveness of plant design modifications (Con Edison 1973). Sporadic sampling was conducted from April through December 1970; since January 1971, samples have been collected and recorded daily (Con Edison 1973). The collection techniques have been standardized since 1970 to provide quantitative data on species composition, length and weight, and condition of impinged fish relative to river fish.

The fixed intake screens at Units No. 1 and No. 2 have been raised and washed daily between 0800 and 1200 hrs during periods of normal operation since June 1972. The traveling screens at Unit No. 3 (where there are no fixed screens) have also generally been washed once daily between 0800 and 1200 hrs. Traveling screens at Units No. 1 and No. 2 have been washed immediately after the fixed screens. Modes and schedules of screen washing have occasionally varied as a result of mechanical failure, variation in impingement and debris loads, and specific testing designs. For example, prior to May 1973, Unit No. 1 fixed and traveling screens were cleaned at 4-hr intervals (June through November 1972) and 8-hr intervals (December 1972 through May 1973). Four-hour screen washing intervals were also employed at Unit No. 3 during initial testing of the circulators in 1974.

b. Collection Efficiency

The efficiency of collecting impinged fish has routinely been less than 100% as a result of fish loss due to scavenging, tidal or river currents, disintegration, entanglement in submerged structures, air curtain operation, and screen wash procedures. Various tests have been conducted at Indian Point since 1974 to estimate the percentage of impinged fish actually collected.

Tests conducted at Unit No. 2 prior to March 1976, during air curtain operation, provided an estimated collection efficiency of 15% (McFadden et al. 1978). As of 1977, the best estimate of collection efficiency at Unit No. 2 without an air curtain was 29%, based on nine tests in 1977 and three earlier tests. Collection efficiency for Unit No. 3, which has never had an air curtain, was estimated to be 71%, based on 18 tests conducted during 1976 and 1977. Differences in the retrieval rates for fish impinged at the two units is apparently related to differences in intake design and the associated screen wash procedures. The spray washing of fish and debris from Unit No. 2 fixed screens apparently results in loss of impinged fish which does not occur at Unit No. 3 due to the absence of fixed screens (TI 1979c).

3. Factors Affecting Impingement

The relationship of impingement to environmental parameters is confounded by interactions among physicochemical factors and plant operational factors as well as by the behavior and general biology of the fishes. At Indian Point, factors that explained most of the variation observed in impingement collections included nearfield fish abundance, changes in temperature, and position of the salt front (TI 1975e, 1976d, 1979c). Other factors such as precipitation, tidal amplitude, and unit interactions have also been correlated with variations in impingement rates (TI 1979c).

a. Fish Behavior

1) Depth Distribution

Restricting water withdrawal to selected zones of the water column has been suggested as a means of reducing impingement rates at power plants where fish particularly subject to impingement are concentrated at a specific depth. Investigations into the depth distribution of fish in front of the Indian Point generating station, conducted from October 1964 to January 1965, indicated that the discharge water was causing fish to concentrate on or near the bottom in front of the wharf (Unit No. 1) where they could easily move into the cooling water intakes (Con Edison 1970). Additionally, certain demersal fish, particularly Atlantic tomcod, composed a large portion of the numbers impinged (Con Edison 1973, TI 1974c, 1975e, 1976d).

To examine the connection between these observations, the vertical distributions of impinged fish and of fish in the river directly in front of the plant were studied (TI 1975e). Gill nets, baskets attached to the fixed screens, and sonar were used in an effort to estimate fish density and vertical distribution in front of intakes (TI 1975e). Gill nets did not sample the same portions of the river populations as the fixed screens (TI 1975e); sonar readings and impingement collections showed no correlation (TI 1975e). When the air curtain was operating, the fixed screen baskets collected most fish in the upper half of the screen; however, when the air curtain was off, the screen basket collections were more evenly distributed across the upper three fourths of the screen (TI 1975e). Operation of the air curtain may have forced fish toward the surface, thereby resulting in higher impingement in the upper portion of the screen and partially explaining this apparent contradiction with observed bottom distribution of numerous species.

Submerged weirs, which were positioned directly in front of the intakes and limited cooling water withdrawal to the upper strata of the water column, were installed at Unit No. 1 and their effects on impingement were monitored during a two-month period in 1977 (TI 1978a). Unit No. 1 was suitable for this study since it was not in commercial operation and intake structures and circulator flows could be manipulated without influencing power generation at the Indian Point station. The results of this study (TI 1978a) suggested that the weirs did not significantly influence impingement at Indian Point Unit No. 1; however, because these tests were conducted during a restricted portion of a single year, the extent to which these results may be applicable to other seasons, years, and environmental conditions is uncertain.

2) Swim Speed Capability

A study conducted at Indian Point in April 1966 first demonstrated the value of reduced flow through the plant intakes as a mitigative procedure. After reviewing this and other special studies on temperature and fish swimming speeds (King 1970, Tatham 1970), the Fish Advisory Board recommended even lower intake velocities in an effort to reduce impingement (Con Edison 1973). Additional studies conducted in

1970 and 1973 further demonstrated the effectiveness of intake flow manipulation and fixed screens in reducing impingement (TI 1974c).

Studies of the swimming ability of fishes have demonstrated that although differences exist among species, swimming speed and endurance typically decline with temperature (TI 1974c, Rulifson and Huish 1975). Because of these findings and normally high winter impingement rates, Con Edison established a policy, in accordance with requirements of the New York State Department of Environmental Conservation, to reduce flow at all Indian Point units to 60% of capacity when river temperatures decline to 4.4°C (40°F) or below (TI 1974c, 1975e).

While a reduction in intake flows may generally reduce impingement during the winter, a recent analysis (Wallace, unpublished) suggests that reducing plant pumping rates at Indian Point may not always lead to fewer fish becoming impinged, depending upon environmental conditions. Wallace concluded that "Impingement mitigation measures which rely on reduction in plant pumping rate may be less effective than previously expected under conditions of high estuarine salinity and moderate temperatures."

3) Behavior Influencing Devices

Sound, water jets, shockwaves, light, electricity, chemical repellents, and air bubble curtains have been tested at either Indian Point or at other power plants in attempts to guide or repel fish from water intake areas. None of these methods appears to be capable of significantly reducing fish impingement rates at Indian Point (Con Edison 1970, Kerr 1953, VanDerWalker 1966, Moore and Newman 1956, Burner and Moore 1962, Pugh et al. 1970, Bates and VanDerWalker 1969, Bibko et al. 1972, TI 1974e, 1975e, 1976d). Results of TI studies at Indian Point since June 1972 suggested that the use of protective devices as behavioral avoidance stimuli will be of limited value. Interspecific and life history variations in behavioral response, habituation, physiological condition, and seasonal changes in species composition would require broad spectrum applicability of a behavioral device; few devices have such application. High turbidity and diel impingement patterns further reduce the value of visual stimulus devices to deter fish impingement.

4) Diel Impingement Patterns

Examination of diel variations in impingement was conducted in 1974 when fish were collected at Unit No. 3 at 4-hr intervals. Distinct daily impingement peaks occurred between 2200 and 0600 hrs; diel peaks in impingement may be related to circadian activity patterns or nocturnal vertical or channel/shoal fish movement (TI 1975e).

b. Fish Condition

The condition of impinged fish was studied in response to the suggestion that impingement may cull the weaker fish from the population, thereby functioning as a selective predator. In 1970, impinged fish were sent to biologists and pathologists for determination of the cause of death, but it proved difficult to definitely establish the cause of death with any certainty, and results were inconclusive (Con Edison 1970). From June through December 1972, white perch and Atlantic tomcod collected from the river and from impingement were sent to histological laboratories for comparison of tissue structure. No significant difference ($\alpha = 0.05$) in the incidence of tissue pathology between river fish and impinged fish was observed (TI 1974e). Histopathology studies continued in April and May 1974 and larger fish were collected than in 1972; impinged fish showed a higher percentage of pathology than fish collected in the river (TI 1975e). Further evidence that impinged fish may represent a weaker segment of the population was obtained in a study of the incidence of gill parasites in white perch and striped bass collected from mid-June through mid-October 1974 in which significantly greater ($\alpha = 0.05$) parasitic infestations were observed in impinged than in river fish (TI 1975e).

A study conducted in 1974 investigated the occurrence of gas bubble disease, which is the accumulation of gas bubbles in body tissues and blood vessels. This disease results when fish are exposed to supersaturations of gases in the water, a condition which can occur through any rapid heating or high mixing in an aquatic environment (TI 1975e). In the 1974 study at Indian Point, nitrogen and oxygen saturation levels were consistently higher in the cooling water effluent than in the intake, and significantly ($\alpha = 0.05$) greater incidence of gas bubbles were observed in impinged as opposed to river fish (TI 1975e).

The relationship between length and weight has been used with white perch, striped bass, and Atlantic tomcod to assess differences in condition or plumpness of impinged versus river fish. Results of these analyses have in general suggested that impinged fish weigh less at a given length than those collected in the river (TI 1974c, 1976d, 1979c). However, these studies have been inconclusive, and several factors, such as weight change during sampling, may have confounded the results (TI 1979c).

4. Range of Influence

The distance over which tagged or fin-clipped striped bass, white perch, and Atlantic tomcod traveled prior to being impinged has been examined to ascertain the range of influence of the Indian Point generating station with respect to fish impingement. Marked striped bass have been collected on the screens at Indian Point (RM 42) from release points as far away as the Yonkers and Poughkeepsie regions [RM 12 to RM 76 (TI 1979c)]. White perch have been recaptured from throughout the estuary (RM 12 to RM 152), whereas Atlantic tomcod recaptures have consisted primarily of fish marked upriver from Indian Point (TI 1977d, 1979c).

5. Mitigation

Methods to mitigate, or alleviate, losses due to impingement have been examined since 1963. Early mitigative efforts (1963 through 1973) were previously discussed in Section III.B.1. More recent studies, conducted by Texas Instruments, include the hatchery program (1973 through 1975) and fish-pump tests (1973 through 1974), summarized in the following paragraphs, and the fine-mesh traveling screen studies (1977 through 1978) reported in Section V. Additionally, an experimental program to evaluate the effectiveness and applicability of fish diversion devices (flumes) was conducted by Stone and Webster Engineering Corporation (Stone & Webster 1976).

a. Hatchery

In response to a license application by Con Edison to operate a pumped storage hydroelectric plant at Cornwall, New York, the Federal Power Commission stipulated that a hatchery study be conducted to investigate the feasibility of mitigating impingement and entrainment losses of striped bass by artificially hatching, rearing, and stocking young-of-the-year fish in the Hudson River. Consequently, between 1973 and 1975, more than 318,000 fish were raised, marked, and stocked from RM 24 through 62. The first substantial return of adult hatchery reared fish was observed during 1977 (TI 1979c) and continued into 1979 (Section V) indicating that the stocking program is a viable method of mitigation.

b. Fish-pump Tests

The use of fish pumps to collect impinged fish and return them unharmed to the river was examined in an effort to reduce impingement. Results of tests conducted during 1973 and 1974 indicated that a properly instituted pumping regime could provide approximately 80% survival of pumped fish. Survival would be maximized in such a system if the impinged fish remained in water during transport and were returned to an area providing temporary protection from predators until they became reoriented and resumed normal activity (TI 1975e).

C. FIELD PROGRAM

A baseline study conducted by Raytheon Company from June 1969 through October 1970 (Appendix Tables D-1 through D-5) was designed to collect the biological, chemical, and physical data for distinguishing between natural variations in the estuary and variations induced by the operation of the Indian Point generating station (Raytheon 1971). The study provided the first detailed characterization of the Indian Point nearfield area, RM 35-47 (KM 56-75), and identified this area as a physically, chemically, and biologically diverse transition between fresh and salt water. Community overlap indices, which are a measure of the extent to which two stations have the same species composition, indicated that depth was dominant in controlling the distribution of non-pelagic species in bottom trawl collections. Community overlap among surface trawl stations revealed a uniform community of pelagic species regardless of river depth. Seine catches showed the least community overlap. There were no major overlaps among the three gear types. The study also described the effluent thermal plume and reported results of laboratory experiments on the effects of the effluent on fish.

After a period of evaluation during 1971 in which no environmental studies were conducted, Con Edison developed a comprehensive ecological research program. Preliminary field efforts designed to evaluate the biological significance of fish impingement and the effectiveness of various sampling gear (TI 1973e) were begun in 1972 by Texas Instruments. Sampling was restricted in 1972 to RM 39-43, the section of the estuary now sampled in the Standard Stations Program (Appendix C).

Hearings on the proposed Cornwall pumped storage hydroelectric station indicated a need for more comprehensive data on the basic life history, distribution, and movements of fishes throughout the Hudson River estuary. Consequently, a longitudinal river survey was initiated in 1973 and sampled the estuary from the George Washington Bridge to the Troy Dam, RM 12-152 (KM 19-243). Both the Standard Stations Program and the Long River Survey have continued to the present. The Standard Stations Program uses beach seines, surface trawls, and bottom trawls; the long river program uses beach seines, bottom trawls, box traps, and gill nets.

Until 1977, the Standard Stations Program and the Longitudinal River Survey were discrete sampling programs in terms of data analysis, as well as data collection. In an effort to relate the results of the two survey programs, nearfield abundance indices for striped bass, white perch, Atlantic tomcod, American shad (1965 through 1977), and four other species (1975 through 1977) were compared to their riverwide abundance indices (TI 1979c). The nearfield abundance indices of seven of the eight species examined reflected yearly trends in river abundance. Comparisons of length-frequency data for juvenile striped bass, white perch, and Atlantic tomcod (1975 through 1977) indicated that nearfield data for striped bass and white perch were representative of adjacent river regions during August. The length-frequency distribution of Atlantic tomcod was not, however, characteristic of the riverwide distribution.

1. Fish Community

Texas Instruments collected samples at standard stations in the Indian Point nearfield (RM 39-43) from 1972 through 1977 to assess the effects of the generating station on the fish community. Since 1972 five shore zone and seven deep water stations have been sampled using beach seines, bottom trawls, or surface trawls; in 1974 two additional shore zone stations were sampled (see Appendix C). These seven standard stations provide a long term data base to examine effects of plant operation on the fish community in the Indian Point region.

From 1972 to 1977 more than 60 species of fish have been collected in the Indian Point nearfield (TI 1976a, 1979c). The most abundant species were blueback herring, bay anchovy, white perch, banded killifish, American shad, Atlantic tomcod, hogchoker, spottail shiner, and alewife. A ranking by numbers caught in 1975, 1976, and 1977 revealed that only seventeen species comprised the top fifteen ranks each year (TI 1979c). Although these rankings changed slightly from 1972 to 1977, the dominant species have remained essentially the same.

The shore zone has consistently provided the greatest variety of fish species; the offshore bottom area has been dominated by hogchoker, white perch, and Atlantic tomcod, and the offshore surface area by blueback herring, alewife, American shad, and bluefish (TI 1979c). In the shore zone, striped bass, bluefish, bay anchovy, American shad, and blueback herring were most often collected near open beaches adjacent to deep water. White perch, banded killifish, spottail shiner, American eel, alewife, and tessellated darter were more often collected in areas with dense vegetation (TI 1976a, 1979c).

Temperature and conductivity have been found to correlate strongly with variations in distribution and abundance of fish in the Indian Point area. White perch move into the shore zone during the summer and then return to the deeper water in the fall as water temperature declines (TI 1975c, 1976a). Spring spawning runs of clupeid species and the subsequent fall emigration of juveniles from the estuary both appear to be timed by changes in water temperature (TI 1975d, 1976a). Intrusion of brackish water into the middle estuary during summer as a result of low freshwater flow allows marine and brackish-water species, such as bluefish and bay anchovy, to move into the Indian Point area. Thus the lower and middle estuary serves as a nursery and feeding area for many fish species during the summer (TI 1976a). Several species, notably white perch and Atlantic tomcod, seem to follow the movement of the salt front as it moves up and down the river (TI 1975c) and probably exploit the biological diversity and productivity characteristic of the interface between two salinity regimes (Odum 1971).

Another important aspect of the Indian Point program is the biocharacteristics study, which has been conducted since 1972 for striped bass and white perch, and since 1973 for Atlantic tomcod. Studies of age composition, growth patterns, and reproductive capabilities of these three key species have found no strong trends that would indicate overexploitation of the populations (TI 1976a, 1977e).

2. Effects of Thermal Discharges on the Fish Community

In 1972, surface and bottom trawls were employed to compare fish distribution and abundance in the thermal plume and in a control area near the plume (TI 1973e). A fish sampling program was also conducted in the discharge canal using a fyke net, a gill net, and two box traps to determine species composition and relative abundance of the fish community there (TI 1973e). Blueback herring and bay anchovy were found to be more common near the surface in the plume than in the control area, while species composition and relative abundance near the bottom were similar in both the plume and control areas (TI 1973e).

These findings were consistent with data indicating that the plume is confined to the upper 3 meters of the water column (TI 1976c, Con Edison 1978c). The fish community of the discharge canal was dominated by bottom dwelling species, with white catfish composing 86.5% of the catch (TI 1973e).

Laboratory studies were conducted from 1972 through 1977 to determine the behavioral response (i.e., thermal preference and avoidance) of young-of-the-year striped bass, white perch, and Atlantic tomcod to above ambient temperatures and the physiological effects (temperature tolerance and active respiration) of increases and decreases of environmental temperature. Both striped bass and white perch preferred temperatures above ambient (TI 1976c), which could result in an attraction of these species to the thermal plume, particularly in the spring and fall (TI 1976c). These preferences by striped bass and white perch for above ambient temperatures were confirmed by later studies performed by Ecological Analysts (EAI 1978) in which white catfish, Atlantic sturgeon, and spottail shiner were also shown to prefer warmer than ambient temperatures while Atlantic tomcod, alewife, and bay anchovy preferred temperatures below ambient. Blueback herring and American shad showed a preference for temperatures equal to or slightly above ambient. The EAI report also provided information on the effects of thermal shock on representative important species, their upper and lower thermal tolerances, and the effects of prolonged exposure to elevated temperatures on hatching successs of fish eggs and on growth of young fish. Catch data from standard stations beach seines indicated that young-of-the-year striped bass and white perch remained for a month longer at the station closest to the plume than at other sites (TI 1973e). However, maximum anticipated plume temperatures will not exceed the upper thermal-tolerance limits of either species (TI 1976c). Moderate changes in temperature (approximately 8°C) would probably not cause death regardless of the rate of change under normal temperature regimes of the plume area. Laboratory studies revealed that a larger, more rapid decrease from 13° to 18°C to a very low water temperature (2°C) in 3 hours could cause stress or death in both species (TI 1976c). Atlantic tomcod avoided temperatures that were 8° to 10°C greater than their acclimation temperature indicating that they would also be likely to avoid the thermal plume given a similar temperature differential. Thus, although there may be limited local attraction of some species to the plume, and local shifts in vertical distribution (Section III.B), the size and extent of the thermal plume is small enough that there has been little detectable impact on the fish community due to thermal effluents from the Indian Point generating station (TI 1976c). There have been no detectable alterations in species composition or relative abundance (Section IV-C) that can be attributed to plant operations (Con Edison 1978c).

3. Effects of Thermal Discharges on the Benthic Community

In 1972, sampling was conducted with a variety of gear to characterize the species composition, relative abundance, biomass, and seasonal distribution of benthic organisms in the Indian Point area (RM 39-43) (TI 1976c). In 1973 and 1974, test and control areas were sampled to compare community structure and response within and beyond the thermal plume. Studies emphasized the population dynamics of Cyathura polita (Stimpson), a benthic isopod abundant in the estuary and exploited as food by fish (TI 1976c).

The macrobenthic community comprised 86 taxa representing nine phyla, with crustaceans, insects, and annelid worms dominant in numbers (TI 1976c). Comparisons of test and control area revealed no significant differences ($\alpha = 0.05$) in standing crop biomass, diversity, sediment composition, oxidation-reduction potential or sediment temperature (TI 1976c). Comparisons with earlier benthic studies showed a shift in community dominance from more halophilic forms in 1969 and 1970 toward less salt-tolerant forms in 1972 and 1973 then back to more halophilic forms in 1974, all in response to changes in the duration of salt water intrusion into the Indian Point region (TI 1975c).

The Cyathura polita population consisted of three year classes and exhibited a consistent annual abundance pattern, with peaks in August and September each year (TI 1976c). In 1973, heavy rains in early May resulted in a deposition of detritus in the southern extreme of the control area, disrupted the C. polita population there, and caused a significant difference ($\alpha = 0.05$) in population density between test and control areas (TI 1976c). However, for the study period as a whole (1972 through 1974), no significant difference ($\alpha = 0.05$) was detected in numbers of C. polita between test and control areas.

Based on these findings and the fact that the effects of the thermal effluent are limited to the upper strata of the river (Con Edison 1978c) it can be concluded that the operation of the Indian Point generating station has had no discernable effect on the benthic community of the Hudson River estuary beyond a limited scour area in the immediate vicinity of the effluent ports (TI 1976c). The addition of the operation of Unit 3 has not caused any change in the restriction of the thermal plume to surface waters (Con Edison 1977 and 1978c).

The major conclusions on the effects of generating station operation on the local biota derived from the studies performed by Texas Instruments from 1972 through 1977 are:

- Thermal discharges from Indian Point have had no detectable effect on the benthic communities in the region. Species composition and abundance are governed by seasonal and annual variations in the temperature and salinity regimes and by differences in the microhabitats in the river (TI 1976c).

- No detectable alteration has occurred in the fish community near Indian Point that could be attributed to plant operation, either in terms of species composition or relative abundance.

- No changes in biological characteristics of striped bass, white perch, and Atlantic tomcod for the period 1972 through 1977 have been discerned that could be attributed to Indian Point plant operations.

- Thermal discharges may attract striped bass, white perch, clupeids, and bay anchovy; however, no mortality due to above ambient temperature or cold shock caused by plant shutdown is likely to occur with current plant operating procedures.

- Based on the physical, chemical, and biological data relating to thermal effluents from the Indian Point facilities, there has been little detectable impact from power plants on the ecology of the Hudson River in the vicinity of Indian Point (TI 1976c).

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SECTION IV

FISH IMPINGEMENT AND ABUNDANCE

A. INTRODUCTION

The impingement monitoring program at Indian Point is designed primarily to determine the numbers of each species of fish impinged; and secondarily, to provide data which, when used in conjunction with data from other sampling programs, can relate variations in numbers of fish impinged to biological, environmental, and plant operational variables. Data relative to the numbers of fish impinged are necessary for the assessment of the impact of power plants on Hudson River fish populations, whereas information on factors influencing impingement is needed to develop mitigative procedures. This section contains a qualitative evaluation of the impact of Indian Point impingement on Hudson River fishes [complete data on number and biomass of fishes impinged at Indian Point are presented in Appendix A; quantitative impact of power plants on the fishes of the Hudson River estuary is presented in other reports (TI 1975b, 1979b, McFadden et al. 1978)]. The evaluation of impingement impact, whether it be qualitative or quantitative, requires an estimation of the species composition and numbers of fish killed by impingement in relation to the species composition and numbers present in the river. Changes in composition of the fish community might imply environmental change, one possible medium of which is the operation of Hudson River power plants. Insight into whether impingement is likely to affect populations of Hudson River fishes is provided by comparing the magnitude of fish loss due to impingement with losses imposed by other sources such as a commercial fishery and from identification of the portion of certain fish populations subject to impingement.

Estimates of the number of fish impinged requires adjustment of actual numbers collected to account for less than 100% collection efficiency. Therefore, the rationale and derivation of such adjustment factors are provided in this section. In addition, monthly trends in abundance and distribution of fishes near Indian Point have been examined relative to changes in levels of impingement, and factors potentially influencing impingement rates on a daily basis were analyzed through regression analysis. The influence of factors such as temperature and conductivity on both distribution and impingement were evaluated while other factors such as tide stage and time of day were examined relative to fluctuations in impingement only. An attempt was also made to identify sampling areas near Indian Point in which the composition of catches with field gear most closely resembled the composition of impingement collections.

B. IMPINGEMENT COLLECTION EFFICIENCY

Simple counts of fish collected daily from intake screens at Indian Point provided a rough estimate of impingement trends. However, the efficiency of collecting impinged fish is less than 100% because impinged fish may be lost prior to collection as a result of scavenging by fish and birds, loss to tidal or river currents, disintegration of fragile species, or entanglement in submerged structures associated with the intakes. Collection efficiency adjustment factors may be applied to counts of impinged fish collected to estimate total actual impingement. The adjustment should be applied to each screen wash collection to provide collection specific estimates of actual impingement that can be summed over any time period.

Tests have been conducted at Indian Point since 1974 to determine the percentages of impinged fish which are actually collected. Summaries of test results through 1977 have been reported by McFadden et al. (1978) and Texas Instruments (1979c). During 1978, further tests were conducted at Units No. 2 and No. 3. Dyed dead fish (primarily white perch) were released in front of intake screens and collected during subsequent routine daily collections. A detailed description of test procedures is presented in Appendix C.

Tests at Unit No. 2 during 1978 involved the release of 2,340 fish (from which 692 were recovered) in a total of 13 tests. The overall collection efficiency was 29.6% (Table IV-1) which is similar to the 28.6% efficiency calculated previously (Table IV-2, McFadden et al. 1978). Individual test results were quite variable in 1978, ranging from 5.6% to 64.4%. However, the effects of season and temperature were confounded and could not be separated statistically. As a result, the 1978 data were pooled with those already available to provide an estimate of collection efficiency at Unit No. 2 of 29.1% (a return of 1,408 fish recovered divided by 4,840 fish released during tests conducted from 1974 through 1978). The adjustment factor of 3.4 (100 divided by 29.1) derived from this estimate is sufficiently similar to the adjustment factor of 3.5 used previously (McFadden et al. 1978, TI 1979c) that 3.5 has been applied to Unit No. 2 collections throughout this report.

Tests at Unit No. 3 during 1978 involved the release of 2,520 fish (from which 1,851 were recovered) in fourteen tests. The overall collection efficiency was 73.4% (Table IV-3) which is similar to the 71.2% efficiency calculated previously (Table IV-4, McFadden et al. 1978). The individual test results were variable in 1978, ranging from 38.3% to 93.3%. The effects of season and temperature, as at Unit No. 2, as well as the effects of flow rate were confounded and could not be separated statistically. Consequently, the 1978 data were pooled with those collected earlier to provide an estimated collection efficiency at Unit No. 3 of 72.3% (a return of 3,609 divided by 4,989 fish released during tests conducted from 1976 through 1978). The adjustment factor of 1.4 (100 divided by 72.3) derived from this estimate is the same as the one used previously (McFadden et al. 1978, TI 1979c) and has been

Table IV-1

Number and Percentage of Fish Recovered in Collection Efficiency Tests at Indian Point Unit No. 2, 1978

Test Date*	Number Released	Number Recovered	Percent Recovered
07 Jun 1978	180	53	29.4
13 Jun 1978	180	21	11.7
20 Jun 1978	180	44	24.4
27 Jun 1978	180	19	10.6
06 Jul 1978	180	10	5.6
11 Jul 1978	180	25	13.9
28 Jul 1978	180	60	33.3
11 Aug 1978	180	96	53.3
22 Aug 1978	180	63	35.0
11 Oct 1978	180	36	20.0
25 Oct 1978	180	50	27.8
10 Nov 1978	180	99	55.0
07 Dec 1978	180	116	64.4
Total	2340	692	29.6

*All tests were conducted at a circulator flow rate of 100%

Table IV-2

Summary of Impingement Collection Efficiency Tests at Indian Point Unit No. 2, 1974 through 1977

Test Date	Number Released	Number Recovered	Percent Recovered
18 Nov 1974*	400	298	74.5
09 Dec 1974*	400	148	37.0
03 Oct 1975	200	46	23.0
23 May 1977	180	36	20.0
29 May 1977	180	18	10.0
03 Jun 1977	120	22	18.3
11 Jun 1977	120	17	14.2
15 Jun 1977	180	9	5.0
18 Jun 1977	180	53	29.4
22 Jun 1977	180	23	12.8
25 Jun 1977	180	30	16.7
29 Jun 1977	180	16	8.9
Total	2500	716	28.6

*Circulators operating at 60% flow capacity, other tests conducted at 100% flow capacity

Table IV-3

Number and Percentage of Fish Recovered in Collection Efficiency Tests at Indian Point Unit No. 3, 1978

Test Date	Number Released	Number Recovered	Percent Recovered
03 Mar 1978*	180	168	93.3
13 Mar 1978*	180	163	90.6
21 Mar 1978*	180	150	83.3
28 Mar 1978*	180	155	86.1
03 Apr 1978*	180	133	73.9
11 Apr 1978*	180	142	78.9
18 Apr 1978*	180	143	79.4
18 May 1978	180	69	38.3
24 May 1978	180	86	47.8
12 Sep 1978	180	126	70.0
21 Sep 1978	180	93	51.7
30 Oct 1978	180	146	81.1
28 Nov 1978	180	121	67.2
28 Dec 1978*	180	156	86.7
Total	2520	1851	73.4

*Circulators operating at 60% flow capacity, other tests conducted at 100% flow capacity

Table IV-4

Summary of Impingement Collection Efficiency Tests at Indian Point Unit No. 3, 1976 through 1977

Test Date	Number Released	Number Recovered	Percent Recovered
11 Jun 1976	50	41	82.0
16 Jun 1976	50	40	80.0
22 Jun 1976	50	43	86.0
24 Jun 1976	100	81	81.0
07 Jul 1976	100	75	75.0
21 Jul 1976	100	76	76.0
11 Aug 1976	100	79	79.0
31 Mar 1977*	180	130	72.2
13 Apr 1977	179	112	62.6
15 Jun 1977	180	127	70.6
22 Jun 1977	180	143	79.4
06 Jul 1977	180	128	71.1
16 Jul 1977	180	111	61.7
20 Jul 1977	180	105	58.3
03 Aug 1977	180	117	65.0
06 Aug 1977	180	153	85.0
14 Sep 1977	180	120	66.7
21 Sep 1977	120	77	64.2
Total	2469	1758	71.2

*Circulators operating at 60% flow capacity, other tests conducted at 100% flow capacity

applied to Unit No. 3 impingement collection data discussed throughout this report.

Seasonal differences in collection efficiency appeared to exist at both Units No. 2 and No. 3; efficiency tended to be higher during periods of lower water temperature. Unfortunately, many variables which may influence collection efficiency, including temperature, scavenger abundance, intake flow rate (60 versus 100%), and number of fish impinged are confounded with season. Nevertheless, an attempt was made to identify factors contributing to the heterogeneity among results of individual tests.

The multiple correlation (Steel and Torrie 1960) among collection efficiency, temperature, and collection size (the number of fish taken from the intake screens following the release of test fish) was examined at both units (Table IV-5 and IV-6). The measure of collection size used in the correlation differed between units. For Unit No. 2, all non-test fish taken from the intake screens on both the first and second screen washes following release of test fish were used. However, at Unit No. 3, only those non-test fish collected on the first screen wash were used. The units were treated differently because 84% of the test fish eventually recovered at Unit No. 3 in 1978 were recovered on the first screen wash. At Unit No. 2, only 50% of the test fish eventually recovered were taken on the first wash, but 88% were recovered on the first two washes combined. Efficiency data were transformed prior to analysis using the $\arcsin\sqrt{x}$ transformation, where x was collection efficiency divided by 100 (Sokal and Rohlf 1969). The partial correlation coefficient (Steel and Torrie 1960) for temperature (t) and efficiency (e) while holding collection size (c) constant was significant at Unit No. 2 [$r_{et \cdot c}$ = -0.56 (p=0.004)] and nearly significant at Unit No. 3 [$r_{et \cdot c}$ = -0.35 (p=0.055)]. Collection efficiency generally increased as the temperature decreased and may reflect the effect of temperature on decomposition rates.

Table IV-5

Multiple Correlation of Water Temperature and Mean Collection Size on Collection Efficiency at Indian Point Unit No. 2, 1974 through 1978

Test Date	Temperature (^{o}C)	Collection Size*	Collection Efficiency
18 Nov 1974	10	832	74.5
09 Dec 1974	6	470	37.0
03 Oct 1975	18	4836	23.0
23 May 1977	18	7272	20.0
29 May 1977	19	3023	10.0
03 Jun 1977	22	6489	18.3
11 Jun 1977	20	2576	14.2
15 Jun 1977	20	512	5.0
18 Jun 1977	22	9561	29.4
22 Jun 1977	21	7369	12.8
25 Jun 1977	23	1384	16.7
29 Jun 1977	24	4473	8.9
07 Jun 1978	21	561	29.4
13 Jun 1978	20	74	11.7
20 Jun 1978	21	3382	24.4
27 Jun 1978	23	1553	10.6
06 Jul 1978	22	78	5.6
11 Jul 1978	23	584	13.9
28 Jul 1978	26	6886	33.3
11 Aug 1978	26	7220	53.3
22 Aug 1978	27	3008	35.0
11 Oct 1978	19	2349	20.0
25 Oct 1978	17	3223	27.8
10 Nov 1978	14	11914	55.0
07 Dec 1978	8	2746	64.4

$r_{et \cdot c}$** = -0.56, p = 0.004

$r_{ec \cdot t}$** = +0.40, p = 0.054

*Count based on mean of number of fish collected during first and second washes following test releases

**Factor held constant while others were tested: where c = collection size, t = temperature, and e = efficiency

Table IV-6

Multiple Correlation of Water Temperature and Collection Size on Collection Efficiency at Indian Point Unit No. 3, 1976 through 1978

Test Date	Temperature (°C)	Collection Size*	Collection Efficiency
11 Jun 1976	19	91	82.0
16 Jun 1976	21	154	80.0
22 Jun 1976	22	161	86.0
24 Jun 1976	25	349	81.0
07 Jul 1976	26	228	75.0
21 Jul 1976	26	91	76.0
11 Aug 1976	26	704	79.0
31 Mar 1977	5	278	72.2
13 Apr 1977	8	788	62.6
15 Jun 1977	20	4133	70.6
22 Jun 1977	22	10009	79.4
06 Jul 1977	26	11707	71.1
16 Jul 1977	27	4418	61.7
20 Jul 1977	28	9632	58.3
03 Aug 1977	26	4931	65.0
06 Aug 1977	27	4645	85.0
14 Sep 1977	25	1278	66.7
21 Sep 1977	23	1498	64.2
03 Mar 1978	3	4235	93.3
13 Mar 1978	3	10346	90.6
21 Mar 1978	4	5183	83.3
28 Mar 1978	2	365	86.1
03 Apr 1978	4	528	73.9
11 Apr 1978	7	679	78.9
18 Apr 1978	7	1504	79.4
18 May 1978	13	290	38.3
24 May 1978	16	299	47.8
12 Sep 1978	25	451	70.0
21 Sep 1978	23	684	51.7
30 Oct 1978	16	15106	81.1
28 Nov 1978	11	1430	67.2
28 Dec 1978	6	2344	86.7

$r_{et\cdot c}$** = -0.35, p = 0.055

$r_{ec\cdot t}$** = +0.21, p = 0.249

*Count based on number of fish collected during first wash following release of test fish

**Factor held constant while others were tested: where c = collection size, t = temperature, and e = efficiency

The partial correlation coefficient between collection size and collection efficiency while holding temperature constant was not significant at Unit No. 3 [$r_{ec \cdot t}$ = +0.21; (p=0.249)]. At Unit No. 2, the corresponding partial correlation coefficient was positive and nearly significant [$r_{ec \cdot t}$ = +0.40 (p=0.054)], suggesting that the size of the collection may affect efficiency at this unit.

These results indicate that temperature and collection size may influence impingement collection efficiency. Thus, a more accurate estimate of actual numbers impinged might result from applying one of several adjustment factors to daily impingement counts depending on such variables as season, temperature, or collection size. The use of a single adjustment factor is believed to overestimate total annual impingement of species typically impinged in greatest numbers during winter. The data suggest that efficiency is greatest during the winter months (i.e., at lower temperatures) when impingement collections are largest, especially for striped bass and white perch. However, winter impingement counts are adjusted upward by the single adjustment factor that is inflated by lower summer efficiencies. On the other hand, impingement of young tomcod, which are impinged in greatest numbers during the summer months, may be underestimated using the single adjustment factor. Greater precision than that provided by the single factors presently used at each unit would require a matrix of adjustment factors or the use of regression analysis to adjust daily impingement counts. With the present data, it is premature to attempt to achieve such precision because it is not yet possible to factor out the influence of confounding variables. The number of tests available is limited, and discontinuous unit operation has left occasional gaps in each year's data.

C. SPECIES COMPOSITION OF IMPINGEMENT AND FIELD COLLECTIONS

The number of species collected in impingement monitoring, nearfield standard stations sampling, and riverwide fisheries sampling (Appendix C) and the predominant species in each task are presented in this section. The number of species inhabiting the estuary is of interest to this study of the Indian Point generating station because a change in the number of species within any biological community could indicate that a significant change has occurred in the environment. For example, if a change in the number of species collected in the area of Indian Point was observed, it could indicate that the station's operation had altered the diversity of the fish community. Similarly, shifts in the predominant species could indicate that changes in environmental conditions, perhaps resulting from generating station operation, were causing changes in community structure. On the other hand, shifts in predominant species could just as likely be influenced by conditions outside the Indian Point area or by local changes not related to station operation (e.g., commercial exploitation of adult fish in coastal fisheries, favorable or unfavorable conditions in spawning areas, shifts in local weather patterns, etc.). The objective of this section is to summarize species composition data gathered since 1975 (with emphasis on 1978) and to examine these data for any trends that could be related to the operation of the Indian Point generating station. Data from six sampling programs: 1) impingement, 2) nearfield (standard stations) beach seines, 3) nearfield bottom trawls, 4) nearfield surface trawls, 5) riverwide beach seines, and 6) riverwide bottom trawls (Appendix C) are presented in this section.

This section is organized to first compare the total number and the seasonal pattern in the number of species impinged from 1975 through 1978 with the number of species collected in nearfield and riverwide sampling. Then nearfield and riverwide species numbers are treated more fully, including a discussion of deep water versus shore zone species composition. Conclusions are drawn concerning the possible effects of the Indian Point generating station on species diversity in the Hudson River estuary. Next the predominant species collected in each of the sampling programs are discussed, especially relative to seasonal changes and comparisons to past years. Finally, conclusions relative to the effects of operation of the Indian Point generating station are also discussed.

1. Number of Species

a. Impingement Sampling

During 1978, a total of 72 fish species were impinged at the Indian Point generating station, though the monthly total varied from 21 species in February to 51 species in December (Figure IV-1, Appendix Table B-1). The monthly pattern (Figure IV-1) was probably the combined result of at least three factors: 1) seasonal changes in the number of fish species occupying the Indian Point nearfield area; 2) seasonal changes in the fishes' ability to avoid impingement; and 3) variation in the volume of power plant cooling water withdrawn from the river.

Complete comparison of the number of species collected in nearfield sampling programs with the number of species impinged is not possible because impingement sampling was conducted daily, year-round, while nearfield sampling is conducted only from April through December. Thus the importance of the first factor listed above relative to the other two factors is difficult to assess. The second factor is related to water temperature, since some fish species lose stamina at low temperatures (Powers 1976), increasing their susceptibility to impingement. This may be the principal cause of the relatively high number of species impinged during January and December. Conversely, swimming ability is enhanced by spring and summer temperatures and this may account for the relatively low number of species impinged during May through August. The third factor, volume of cooling water withdrawn from the river, has been shown to be positively correlated with the

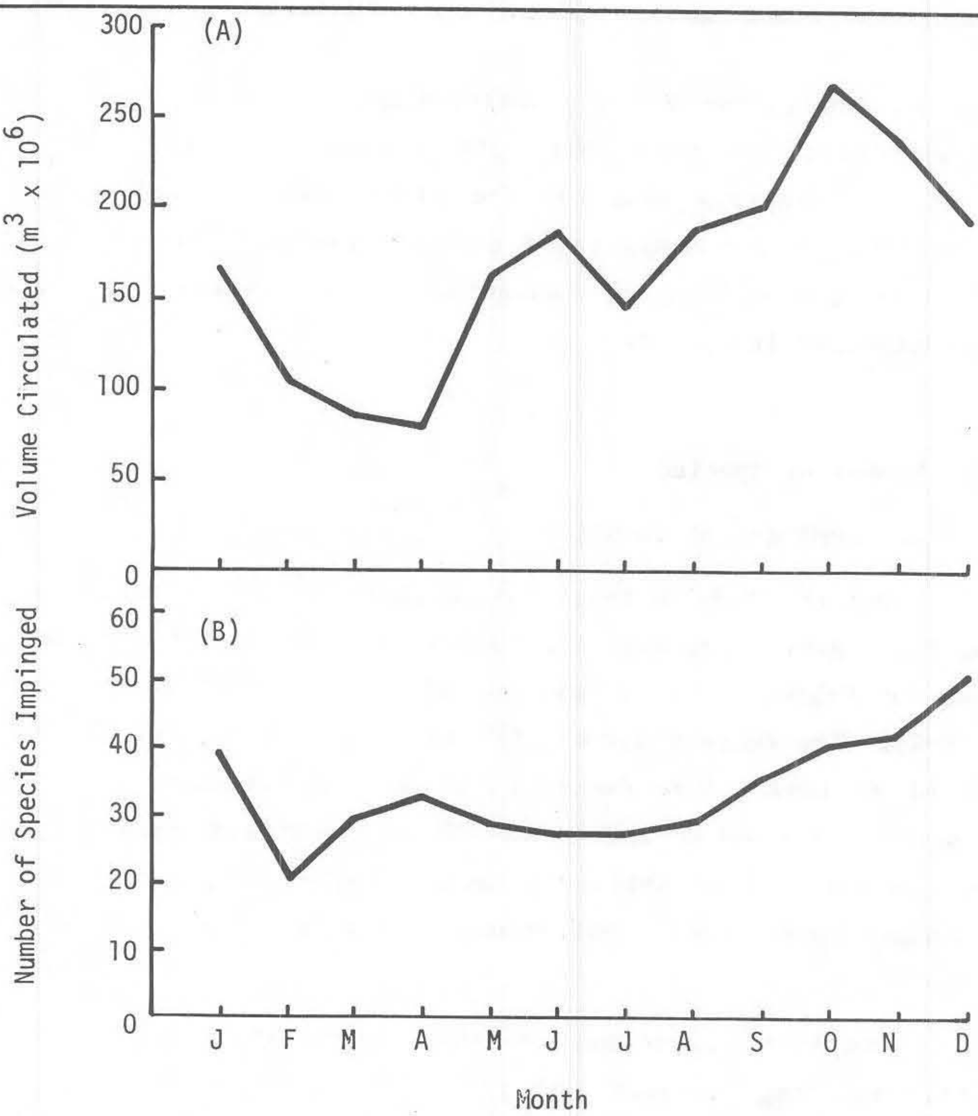


Figure IV-1. Volume of Water Circulated and Number of Species Impinged, Each Month during 1978 at Indian Point Units No. 2 and No. 3

number of fish impinged (Section IV.E.5). Thus, there may be a causal relationship between the low volume withdrawn (Appendix Table A-21) and the relatively low number of species impinged during February and March. This relationship of volume circulated to number of species impinged is subject to exception due to the interaction of other variables such as temporal variation in the number of species present and susceptibility to impingement. However, given a constant population of fishes, increased sampling effort (i.e., increased volume circulated) will yield an increasing likelihood of collecting additional species until an asymptote is eventually reached. This tendency has been demonstrated at Indian Point in across year comparisons both in impingement (see discussion below) and in field sampling efforts (TI 1978e).

The number of fish species impinged at Indian Point during 1975 through 1978 has increased in conjunction with increases in the volume of cooling water circulated through the generating station (Table IV-7). Increased sampling was previously shown to increase the likelihood of collecting a greater number of species (TI 1979c). Nine of the 72 species impinged during 1978 were not impinged from 1975 through 1977 (Table IV-8), while 16 species that had been impinged during at least one year from 1975 through 1977 were not impinged during 1978. None of these 25 species was common in the study area and thus their collection or non-collection does not represent an important shift in the composition of the fish community in the estuary.

Table IV-7

Volume of Water Circulated and Number of Species Impinged, 1975 through 1978, Indian Point Units No. 2 and No. 3

Year	Impingement: Number of Species	Impingement: Volume Circulated ($\times 10^6 m^3$)
1975	50	1119*
1976	58	1329
1977	72	2159
1978	72	2030

*For a summary of volume circulated by month and by unit, see Appendix Table A-17

Table IV-8

Species Impinged during 1978 but Not in 1975, 1976, or 1977, and Species Impinged during 1975, 1976, or 1977, but Not in 1978, Indian Point Units No. 2 and No. 3

Species Impinged during 1978 but not 1975, 1976, 1977	Species Impinged during 1975 1976 or 1977 but not 1978
Hickory shad	Rainbow trout (1)*
Black sea bass	Brown trout (2)
Silver perch	Brook Trout (1)
Moonfish	Central mudminnow (1)
Smallmouth flounder	Redfin pickerel (1)
Windowpane	Northern pike (1)
Seahorse	Chain pickerel (1)
Conger eel	Cutlips minnow (1)
Silver lamprey	Satinfin shiner (1)
	Blacknose dace (1)
	Northern hogsucker (1)
	White hake (1)
	Brook stickleback (1)
	Atlantic croaker (2)
	Tautog (1)
	Striped mullet (1)

*Number in parentheses is the number of years during which the species was impinged, 1975 through 1977

b. River Sampling

At least 114 species of fish have reportedly been collected from the Hudson River estuary (McFadden 1977). During 1978, 72 of these species were collected by TI in riverwide beach seine and bottom trawl sampling, whereas only 47 were collected in nearfield sampling, primarily because of the nature of the two programs. Riverwide sampling included a greater geographic range, a greater range of physicochemical conditions, and was more intensive than nearfield sampling (e.g., riverwide sampling includes 100 beach seine samples per week, while only 7 samples per week are collected in the nearfield seine sampling program). Yellow bullhead was the only species collected during nearfield sampling that was not collected in riverwide sampling; the additional 26 species (Table IV-9) that occurred only in riverwide samples were mainly marine and freshwater species that were relatively uncommon within the estuary.

Table IV-9

Species Collected in Riverwide but Not Nearfield Sampling during 1978

Three-spined stickleback	Northern pike
Striped searobin	Cutlips minnow
Butterfish	Satinfin shiner
White crappie	Longnose dace
Common shiner	Northern hogsucker
Smallmouth bass	Silvery minnow
Northern searobin	Kingfish
Summer flounder	Fathead minnow
Rock bass	Log perch
Spotfin shiner	Trout perch
Brown trout	Bluntnose minnow
Brook trout	Atlantic herring
Redfin pickerel	Creek chub

The 72 species collected in riverwide sampling and the 47 in nearfield sampling were unevenly divided between deepwater (surface and bottom trawls) and shore zone (beach seine) samples (Table IV-10). The higher number of species in shore zone collections was probably the result of more intensive sampling in the shore zone than in deeper water (e.g., every two weeks during July there were 214 beach seine samples collected between RM 12 and 152 compared to 59 trawl samples between RM 27 and 77), as well as the greater productivity of shallow areas of the estuary (Boyce-Thompson 1977, Odum 1971), which provide more abundant food supplies. Shortnose sturgeon, Atlantic sturgeon, butterfish, and log perch were the only species collected in bottom trawls but not in

Table IV-10

Number of Species Collected in Nearfield and Riverwide Sampling Using Beach Seines and Bottom Trawls, Hudson River Estuary, 1978

	Number of Species	
	Beach Seine	Bottom Trawl
Nearfield	43	22
Riverwide	69	30

Beach seines. The sturgeons are bottom-dwelling species (Scott and Crossman 1973), and butterfish and log perch are relatively uncommon within the study area.

In contrast with impingement, where the greatest number of species was collected during December, the 1978 river sampling programs generally collected the greatest number of species during summer (June, July, or August; Appendix Table B-1). A summer peak in the number of species is typical of estuaries (Dahlberg and Odum 1970). The lack of a summer peak in the number of species impinged was possibly related to the fact that swimming ability is greater at summer temperatures thus reducing the likelihood of impingement. It is also possible that the microdistribution of fish during summer (when the actual number of species in the estuary was at its highest) reduced their susceptibility to impingement.

During 1978, 20 species were collected in nearfield sampling, riverwide sampling, or both, but were not impinged (Table IV-11). Most of these were freshwater species collected in riverwide samples. In contrast, 16 of the 18 species impinged but not collected in riverwide or nearfield sampling were marine species.

Table IV-11

Species Impinged but Not Collected in River Sampling and Species Collected in River Sampling but Not Impinged, Hudson River Estuary, 1978

Impinged but not Collected in Nearfield or Riverwide Sampling	Collected in Nearfield or Riverwide Sampling but not Impinged
Silver hake	Brown trout
Squirrel hake	Brook trout
White bass	Redfin pickerel
Lookdown	Northern pike
Sea lamprey	Chain pickerel
Black sea bass	Cutlips minnow
Four-beard rockling	Satinfin shiner
Silver perch	Blacknose dace
Spot	Longnose dace
Grubby	Northern hogsucker
Moonfish	Silvery minnow
Scup	Fallfish
Smallmouth flounder	Kingfish
Northern puffer	Fathead minnow
Windowpane	Log perch
Sea horse	Trout perch
Conger eel	Bluntnose minnow
Silver lamprey	Atlantic herring
	Creek chub
	Yellow bullhead

From 1974 through 1978, the number of species collected in riverwide and nearfield programs was generally stable, ranging from 43 to 50 for nearfield sampling and from 72 to 78 for riverwide sampling (Table IV-12); although the particular species composing the total number varied slightly. During 1972 and 1973, the effort expended in field programs was less than the effort expended in subsequent years and the number of species collected was therefore lower. The only species collected during 1972 and 1973 but not collected later were fat sleeper (riverwide), bridle shiner, striped mullet, and butterfish (nearfield). Most (56) of the species caught in riverwide sampling during 1974 through 1978 were caught every year, while 44 species were absent from collections in at least one of these years (Appendix Table B-2). No discernible trends in the number of species collected in either program have appeared since 1974.

Table IV-12

Number of Species Collected in Nearfield and Riverwide Sampling, Hudson River Estuary, 1972 through 1978

Year	Riverwide Number of Species	Nearfield Number of Species
1972	47	38
1973	66	41
1974	75	50
1975	74	47
1976	78	43
1977	76	48
1978	72	47

c. Summary and Conclusions

At least 114 fish species have been collected in the Hudson River estuary. Since 1974, ninety-nine of these species occurred in riverwide beach seine and bottom trawl samples, 65 species occurred in Indian Point nearfield beach seine, bottom trawl, and surface trawl samples, and 87 species were impinged at the Indian Point generating station. Riverwide sampling captured the most species because it included the largest range of environmental conditions (from freshwater at the upriver end of the study area to a saline environment at the downriver end) especially during summer. In contrast, nearfield sampling occurred over a relatively restricted area; the result was 34 fewer species collected. Although impingement sampling is geographically restricted, it is conducted 24 hours a day throughout the year, increasing the probability that species uncommon in the Indian Point area will be collected by impingement. Thus impingement collections contained 22 more species than nearfield collections but 12 fewer species than riverwide collections. No decline has occurred in the number of species collected within the estuary, indicating that the operation of the Indian Point generating station has had no discernible effect on fish species diversity.

2. Predominant Species Collected

a. Impingement Sampling

Ninety-nine percent of the fish impinged at the Indian Point generating station during 1978 were of 15 species (Table IV-13). During winter and early spring, white perch composed the largest proportion of the fish impinged; Atlantic tomcod, blueback herring and bay anchovy predominated in summer and fall (Table IV-14). These seasonal patterns were the result of several factors. Some white perch are believed to overwinter in relatively deep areas near Indian Point [TI 1980 (in preparation)]. Their proximity to the Indian Point generating station intakes and a reduction in swimming ability and stamina brought on by cold temperatures (Powers 1976) may contribute to increased white perch impingement rates during winter. Later, as water temperatures increase and white perch move into the shore zone (TI 1979b) they become less susceptible to impingement. Atlantic tomcod [TI 1980 (in preparation)] and bay anchovy (TI 1979c), on the other hand, tend to be associated with the salt front. Thus, as the position of the salt front progresses upriver toward Indian Point these species replace white perch as the predominant species in impingement samples. Decreasing water temperature in the fall probably triggers the emigration of blueback herring (McFadden 1977), which becomes the most numerous species in impingement samples in October and November as they migrate downriver past the Indian Point generating station.

The total number of fish impinged (all species combined) was high during January and December, relative to the rest of the year, (Figure IV-2), and when white perch predominated; impingement was also high during October and November when blueback herring were predominant. Sixty-nine percent of the total number of fish impinged during 1978 were impinged during these four months.

Table IV-13

Number of Individuals, Percent, and Rank of Seventeen Fish Species Impinged at Indian Point Generating Station during, 1975 through 1978

Species**	1975*			1976*			1977			1978		
	Number	Percent	Rank	Number	Percent	Rank	Number	Percent	Rank	Number	Percent	Rank
White perch	299,325	43.0	1	440,641	54.0	1	1,094,592	37.8	1	807,235	44.9	1
Blueback herring	155,707	22.3	2	258,303	31.6	2	637,519	22.0	3	510,741	28.4	2
Atlantic tomcod	78,627	11.3	4	34,236	4.2	3	747,702	25.8	2	120,275	6.7	3
Bay anchovy	96,058	13.8	3	12,142	1.5	6	146,879	5.1	4	106,737	5.9	4
Hogchoker	18,839	2.7	5	14,795	1.8	5	25,472	.9	8	46,524	2.6	5
Striped bass	5,977	.9	9	6,130	.8	7	27,677	1.0	6	42,282	2.4	6
Rainbow smelt	7,790	1.1	8	3,049	.4	12	26,988	.9	7	38,945	2.2	7
American shad	1,148	.2	13	4,223	.5	9	12,704	.4	13	31,993	1.8	8
Alewife	4,243	.6	10	3,549	.4	10	58,592	2.0	5	30,908	1.7	9
Clupeid unid.†	108	.1	21	179	.1	25	19,743	.7	11	25,444	1.4	10
Weakfish	8,969	1.3	7	556	.1	19	7,587	.3	14	12,927	.7	11
White catfish	10,171	1.5	6	18,767	2.3	4	24,755	.9	9	7,498	.4	12
Spottail shiner	3,949	.6	11	5,154	.6	8	5,308	.2	16	3,886	.2	13
American eel	773	.1	15	877	.1	17	2,827	.1	19	1,999	.1	14
Pumpkinseed	573	.1	17	1,718	.2	14	2,949	.1	18	1,738	.1	15
Gizzard shad	921	.1	14	2,777	.3	13	6,636	.2	15	1,684	.1	16
Spot	0	0.0	N/A	1,471	.2	16	16,267	.6	12	3	<.1	56
Bluefish	1,616	.2	12	1,525	.2	15	21,403	.7	10	889	<.1	18
Centrarchid unid.	277	.1	18	3,135	.4	11	3,283	.1	17	537	<.1	22
Total	696,714			816,130			2,896,232			1,798,026		

*Units No. 1, No. 2, and No. 3 combined for 1975 and 1976, Units No. 2 and No. 3 for 1977 and 1978
†Unidentifiable clupeids were primarily blueback herring and alewives
**Unidentified Clupeidae and Centrarchidae are not counted as separate species

White perch have dominated impingement collections every year since 1975, ranging from 38 to 54 percent of the yearly catch (Table IV-13). Most white perch were impinged during winter and spring; during summer the number impinged declined. Atlantic tomcod, bay anchovy, and blueback herring combined have made up 37 to 53 percent of the number of fish impinged each year since 1975; most were impinged during summer and fall. No other species has made up more than 3 percent of the number of fish impinged during any year since 1975.

Table IV-14

Predominant Species and Percent of Total Impinged or Percent Catch/Effort of Fish Collected in Nearfield Bottom Trawl, Surface Trawl, and Beach Seine Collections, 1978

	Predominant Species							
Month	Impingement	Percent	Nearfield Bottom Trawl (unlined)	Percent	Nearfield Surface Trawl	Percent	Nearfield Beach Seine	Percent
Jan	White perch	94	*					
Feb	White perch	94						
Mar	White perch	92						
Apr	White perch	87	White perch	93			Spottail shiner Tesselated darter Banded killifish	18 14 14
May	White perch	70	White perch	35			Blueback herring	28
Jun	Atlantic tomcod	83	Atlantic tomcod	52			Bay anchovy	35
Jul	Blueback herring	28	Atlantic tomcod	63	Blueback herring	57	Blueback herring	81
Aug	Atlantic tomcod	38	Atlantic tomcod	53	Blueback herring Bay anchovy	49 46	Banded killifish	40
Sep	Bay anchovy	32	Hogchoker	47	Bay anchovy	84	Banded killifish	51
Oct	Blueback herring	71	Hogchoker	45	Blueback herring	80	White perch	31
Nov	Blueback herring	58	Blueback herring	56	Blueback herring	95	Blueback herring	52
Dec	White perch	77	Hogchoker	57	Blueback herring	74	Banded killifish	30

*No entry indicated no sampling

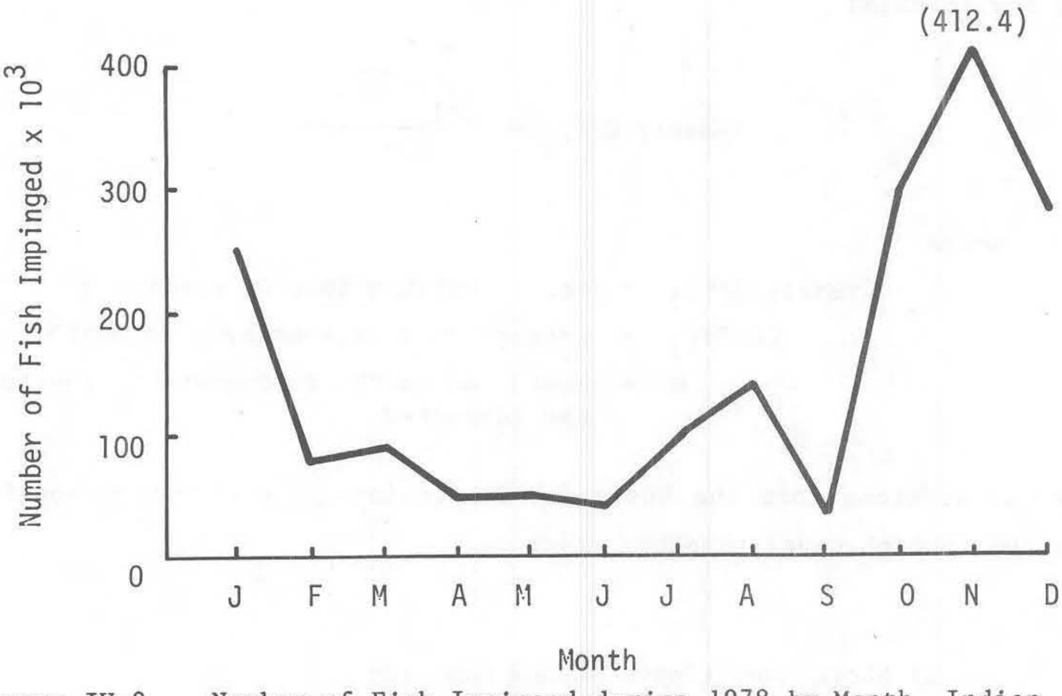


Figure IV-2. Number of Fish Impinged during 1978 by Month, Indian Point Generating Station Units Combined

b. River Sampling

Relative predominance of the various species in collections of fish taken from the river was determined by condensing the nearfield and riverwide data into monthly and yearly catch/efforts using the following formula:

$$(C/f)_{ij} = \frac{n_{ij}}{T_i}$$

where

$(C/f)_{ij}$ = catch/effort of species j in month i

n_{ij} = number of individuals of species j collected during month i

T_i = number of tows in month i

These monthly C/f estimates were combined to yield yearly catch/effort using the formula:

$$(\text{yearly } C/f)_j = \frac{\sum_{i=1}^{m} (C/f)_{ij}}{m}$$

where

$(\text{yearly } C/f)_j$ = yearly catch/effort of species j

$(C/f)_{ij}$ = catch/effort of species j in month i

m = number of months during which program was conducted

These calculations form the basis for discussions of predominant species collected in each river sampling program.

1) Shore Zone (Beach Seine) Sampling

Ten of the 69 species collected in riverwide shore zone sampling during 1978 composed 97 percent of the yearly catch/effort

(Table IV-15). The same was true for nearfield shore zone sampling, though the ranks of each species within the ten predominant species differed from that of riverwide sampling (Table IV-16).

Table IV-15

Catch/Effort and Percent of Ten Fish Species in Riverwide Beach Seine Sampling, Hudson River Estuary, 1974 through 1978

Species	1974 C/f	1974 Percent	1975 C/f	1975 Percent	1976 C/f	1976 Percent	1977 C/f	1977 Percent	1978 C/f	1978 Percent
Blueback herring	19.44	20	38.09	34	44.33	37	71.78	49	62.05	43
American shad	6.48	7	5.80	5	6.05	5	9.53	6	18.31	13
Clupeid unident.*	2.58	3	2.58	2	4.35	4	15.17	10	14.60	10
White perch	11.77	12	10.29	9	12.39	10	7.61	5	10.06	7
Bay anchovy	17.90	18	13.08	12	15.20	13	16.33	11	10.51	7
Spottail shiner	13.83	14	10.57	9	12.65	11	9.44	6	7.41	5
Striped bass	3.53	4	4.08	4	2.89	2	4.45	3	4.48	3
Alewife	4.58	5	3.08	3	2.45	2	2.74	2	4.16	3
Banded killifish	5.85	6	10.71	9	5.43	5	2.97	2	3.70	3
Tesselated darter	1.99	2	2.94	3	2.17	2	1.77	1	2.20	2
Pumpkinseed	1.92	2	1.93	2	1.75	1	0.80	1	1.55	1
Others	8.44	9	9.74	9	8.61	7	5.33	4	6.44	4
All species combined	98.31		112.89		118.27		147.92		145.47	

*Post-larval juvenile alewife and blueback herring which were too small to identify to species

The predominant species in riverwide and nearfield sampling varied seasonally between April and December (Table IV-17) since many of the species collected in the Hudson River estuary are anadromous or highly migratory. For example, resident species (spottail shiner, tesselated darter, banded killifish) dominated April collections before the arrival of migratory species and the recruitment of young-of-the-year. After May, migratory species such as blueback herring and bay anchovy became abundant.

Table IV-16

Catch/Effort and Percent of Ten Fish Species Collected during Nearfield Beach Seine Sampling, Hudson River Estuary, 1974 through 1978

Species	1974		1975		1976		1977		1978	
	C/f	Percent	C/f	Percent	C/f	Percent	C/f	Percent	C/f	Percent
Blueback herring	8.24	8	31.62	22	50.74	36	80.45	50	108.49	52
Banded killifish	18.82	18	48.34	34	14.50	10	10.51	7	27.00	13
American shad	8.50	8	4.36	3	12.83	9	5.54	3	20.75	10
White perch	12.85	12	6.01	4	14.93	11	12.87	8	18.42	9
Striped bass	6.60	6	6.05	4	5.28	4	9.74	6	7.58	4
Bay anchovy	23.34	22	16.48	12	6.11	4	15.24	9	6.07	3
Spottail shiner	11.61	11	9.37	7	12.65	9	9.63	6	5.41	3
Tesselated darter	3.52	3	5.26	4	7.26	5	3.88	2	4.30	2
Alewife	1.23	1	1.41	1	5.76	4	2.34	1	2.35	1
Pumpkinseed	3.15	3	3.25	2	2.39	2	1.58	1	1.00	<1
Others	8.37	8	9.94	7	9.62	7	8.86	6	6.34	3
All species combined	106.23		142.09		142.07		160.64		207.71	

Table IV-17

Nearfield and Riverwide Predominant Species in Beach Seine Samples, April through December, 1978

Month	Species: Nearfield	Species: Riverwide
Apr	Spottail shiner Tesselated darter Banded killifish	Spottail shiner
May	Blueback herring	Spottail shiner
Jun	Bay anchovy	Bay anchovy
Jul	Blueback herring	Blueback herring
Aug	Banded killifish	Blueback herring
Sep	Banded killifish	Blueback herring
Oct	White perch	Blueback herring
Nov	Blueback herring	Blueback herring
Dec	Banded killifish	Blueback herring

The ten species most abundant in nearfield and riverwide beach seine samples during 1978 have also been predominant since 1974 (Table IV-15 and IV-16). The only detectable trend has been a steady increase in the proportion of blueback herring which has not been accompanied by a decline in the other nine top-ranking species.

2) Bottom and Surface Trawl Sampling

Seven species composed over 95 percent of both nearfield and riverwide bottom trawl catches during 1978 (Table IV-18, IV-19). This list included three bottom dwelling species (Atlantic tomcod, hogchoker, and rainbow smelt) that are infrequently found in shallow water. However, the list also included the more pelagic blueback herring, alewife and bay anchovy.

Table IV-18

Mean Annual Catch/Effort and Percent Composition of Fish Collected during Standard Station Unlined Bottom Trawl Sampling, Hudson River Estuary, 1974 through 1978

	1974		1975		1976		1977		1978	
Species	C/f	Percent	C/f	Percent	C/f	Percent	C/f	Percent	C/f	Percent
Atlantic tomcod	8.72	14	10.48	12	13.17	14	42.99	43	22.54	28
White perch	14.18	22	10.73	12	15.70	17	4.63	5	18.39	23
Hogchoker	25.58	40	20.25	22	7.59	8	5.52	5	18.27	23
Bay anchovy	4.36	7	20.92	23	29.44	31	20.89	21	10.76	13
Blueback herring	4.00	6	12.03	12	19.02	20	19.10	19	3.71	5
Rainbow smelt	0.09	<1	1.10	1	0.88	1	1.14	1	2.18	3
Alewife	3.06	5	8.75	10	2.45	3	2.90	3	0.81	1
Others	4.35	7	6.16	7	5.49	6	3.45	3	4.19	5
All species combined	64.34		90.42		93.74		100.62		80.85	

Ranking of the seven predominant species in bottom trawls varied from year to year. Other species which composed one percent or more of nearfield bottom trawl catch/effort during at least one year were weakfish, American eel, white catfish, American shad, and striped bass. Riverwide bottom trawl catch/effort from 1974 through 1978 indicated an increasing trend in the proportion of blueback herring and rainbow smelt (Table IV-19).

Table IV-19

Catch/Effort and Percent of Seven Fish Species in Riverwide Bottom Trawl Sampling, Hudson River Estuary, 1974 through 1978

	1974*		1975*		1976*		1977*		1978**	
Species	C/f	Percent	C/f	Percent	C/f	Percent	C/f	Percent	C/f	Percent
Bay anchovy	259.85	71	135.59	58	91.47	42	170.85	49	115.24	57
Blueback herring	8.98	2	15.26	6	14.90	7	19.66	6	21.48	11
Atlantic tomcod	61.04	17	30.70	13	54.33	25	91.19	26	17.45	9
Hogchoker	11.20	3	20.09	9	16.42	8	16.71	5	15.99	8
Rainbow smelt	2.51	1	3.33	1	5.67	3	7.67	2	11.36	6
White perch	11.31	3	10.89	5	17.92	8	23.45	7	10.12	5
Alewife	7.31	2	9.88	4	2.84	1	6.19	2	3.53	2
Others	6.37	2	9.76	4	12.54	6	11.52	3	6.20	3
All species combined	368.57		235.50		216.09		347.24		201.37	

*RM 24-61 during 1974, 1975, 1976, 1977
**RM 24-76 during 1978

The arrival and departure of migratory and anadromous species caused seasonal shifts in species composition of bottom trawl collections (Table IV-20), especially outside the Indian Point area. Species that spend most of their life cycle within the estuary (white perch, Atlantic tomcod, and hogchoker) predominated in nearfield bottom trawl samples except during November when blueback herring migrated downriver and became predominant. During July through October, the more migratory bay anchovy and blueback herring were predominant in riverwide bottom trawls.

Table IV-20

Predominant Species Collected in Nearfield and Riverwide Bottom Trawl Samples, Hudson River Estuary, April through December, 1978

Month	Species: Nearfield	Species: Riverwide
Apr	White perch	White perch
May	White perch	Atlantic tomcod
Jun	Atlantic tomcod	Atlantic tomcod
Jul	Atlantic tomcod	Bay anchovy
Aug	Atlantic tomcod	Bay anchovy
Sep	Hogchoker	Bay anchovy
Oct	Hogchoker	Blueback herring
Nov	Blueback herring	Hogchoker
Dec	Hogchoker	No Sampling

In contrast to the catch of nearfield bottom trawls, nearfield surface trawl catches (Table IV-21) were dominated by blueback herring, American shad, alewife, and bay anchovy (all anadromous species that migrate in and out of the estuary). In addition, catch/effort of these species was higher in the nearfield surface trawls than in bottom trawls of either nearfield or riverwide surveys (no surface trawl sampling was conducted riverwide). Abundance of these species in the surface zone is a result of their pelagic, schooling behavior.

No consistent change in the species that predominated in offshore habitats has occurred since 1974. Thus, there is no evidence that the operation of the Indian Point generating station has affected fish species composition in the estuary.

Table IV-21

Catch/Effort and Percent of Five Fish Species Collected in Nearfield Surface Trawl Samples, Hudson River Estuary, 1974 through 1978

Species	1974		1975		1976		1977		1978	
	C/f	Percent	C/f	Percent	C/f	Percent	C/f	Percent	C/f	Percent
Blueback herring	114.64	45	604.59	57	639.99	77	855.93	69	371.24	66
Bay anchovy	114.90	45	440.81	41	167.58	20	360.23	29	135.89	24
American shad	21.46	8	11.88	1	11.88	1	9.02	1	30.12	5
Alewife	0.69	< 1	6.29	1	0.52	< 1	6.74	1	18.15	3
Bluefish	5.12	2	1.27	< 1	0.57	< 1	1.62	< 1	0.61	< 1
Others	0.23	< 1	0.31	< 1	7.66	1	0.48	< 1	2.43	< 1
All species combined	257.04		1065.15		828.20		1234.02		558.44	

c. Summary and Conclusions

As is common in estuarine fish communities (Dahlberg and Odum 1970, Marcy 1976, Massman 1953), a relatively small number of species predominated in riverwide, nearfield, and impingement sampling programs in the Hudson River estuary from 1974 through 1978. The ranking of any particular species within the predominant group has varied from year to year, but no trends that could be related to the operation of Indian Point generating station have been detected.

Predominant species in impingement samples during 1978 changed seasonally as a result of fish movement, but these same species also predominated in surface and bottom trawl samples. Species such as Atlantic tomcod and bay anchovy (which spend the summer months associated with salinity ranges that usually occur in the Indian Point area) and blueback herring (which migrate downriver past Indian Point during the fall as water temperature declines) predominated in impingement samples from June through November. During the rest of the year white perch, a resident species that overwinters in deep water near Indian Point, was the most numerous species in impingement collections. Except during December, the species that predominated in impingement collections were the same ones that predominated in nearfield bottom or surface trawl collections. The Indian Point generating station impinged primarily those species that occupied deep water in the Indian Point area (Appendix Table B-2). Those species collected primarily in the shore zone were impinged less frequently.

3. Cluster Analysis of Fish Species Composition in Samples from Indian Point Nearfield Standard Stations and Impingement

In the preceding sections (IV.C.1 and IV.C.2) data were presented which demonstrated that predominant species in impingement collections at Indian Point were generally the same as those in nearfield collections, when those river samples were examined collectively. Cluster analysis was undertaken in this section to determine which combinations of nearfield river sampling gear and/or standard station sites in the Indian Point area were most representative of impingement collection. It was anticipated that the identification of a specific gear/station combination which consistently reflected impingement catches could provide direction for development and implementation of mitigative procedures. Such direction might be gained from a thorough characterizaton of the habitat type from which a majority of fish are apparently impinged.

A limited set of 1978 standard stations and impingement data were selected to ensure that samples used for this analysis were collected on approximately the same days during the same week. Bottom trawl (unlined), surface trawl, and beach seine samples were used. Thus, only two samples were available per month at each station because surface trawls were collected biweekly (Appendix C). Impingement samples (Unit No. 2 or No. 3) were included from those days during both weeks of a month when any of the nearfield samples were collected; impingement samples were usually pooled across 2 or 3 days in the selected weeks because nearfield sampling (especially trawls) usually extended over several days. Fish collections from each gear and station were pooled for the two weeks in each month and the percent of this total contributed by each species was computed. A maximum of 23 gear-station combinations were possible in a month if all three nearfield sampling efforts were conducted (7 stations each) and collections from both Units No. 2 and No. 3 were available.

The monthly percent species composition data were analyzed by cluster analysis on samples (Dixon 1975) utilizing a sum of squares procedure. A measure of the similarity between samples (amalgamation distance) was computed for all possible pairs; samples which were most similar were grouped together. The amalgamation distance is zero for samples with identical species composition and increases for samples which are progressively less similar. Samples or groups of samples were then clustered together from most similar to least similar and the results presented graphically as a dendrogram (Figure IV-3).

Gear/station combinations which were most similar to impingement collections in each month were identified from the dendrograms and presented as primary and secondary clusterings in Table IV-22. Primary clusters include the gear/station(s) combination which had collections most similar to the impingement unit, i.e., were connected by the lowest horizontal line in Figure IV-3. Secondary clusters included those gear stations which were most similar to the primary clusters.

The strongest similarity in species composition between impingement and nearfield collections occurred in April, June, October,

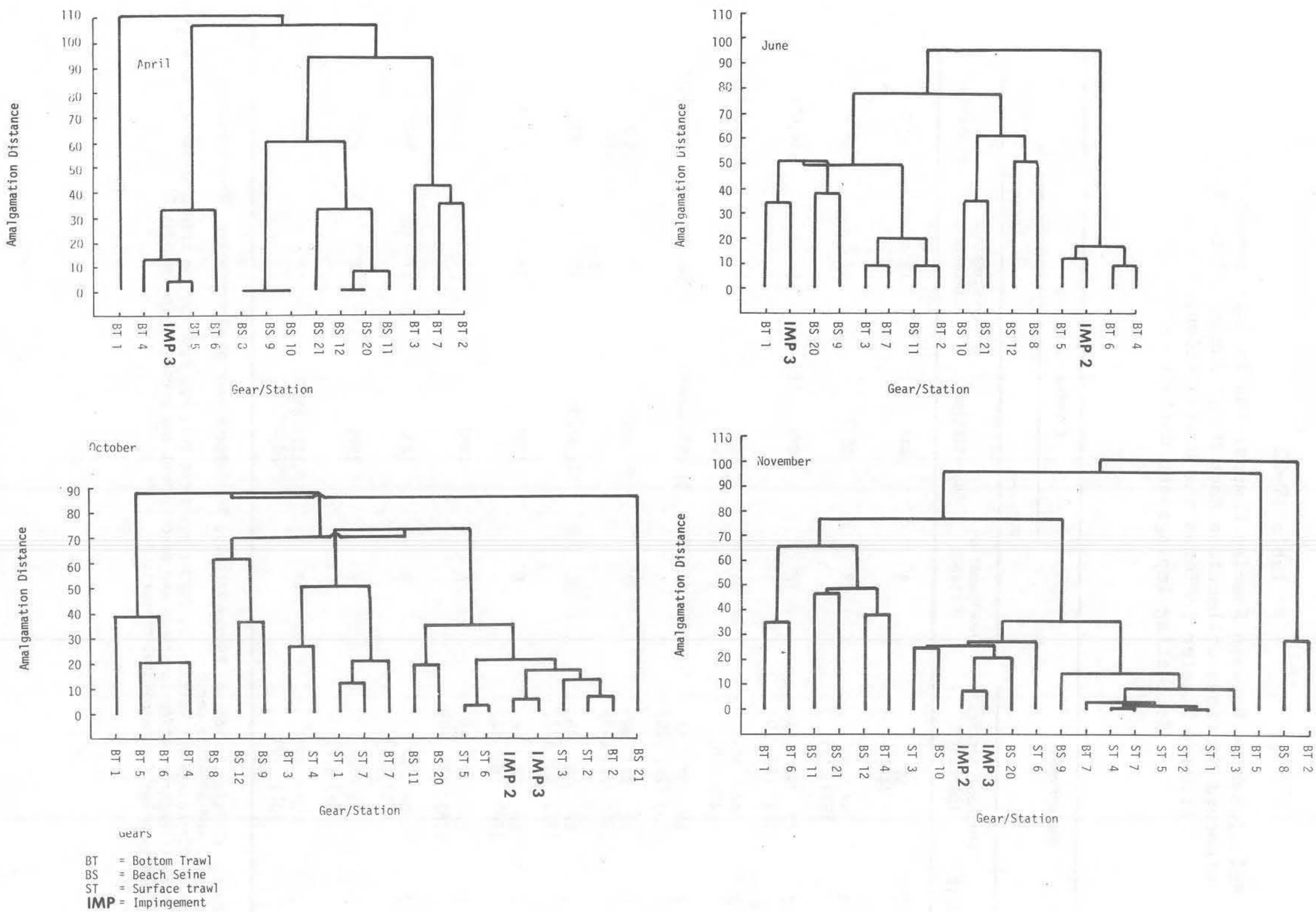


Figure IV-3. Representative Dendrograms from Cluster Analysis of Monthly Species Composition in Impingement and Standard Stations, 1978

Table IV-22

Relationships Between Species Composition in Impingement and Standard Stations Collections Each Month during 1978. The Primary Cluster Includes the Gear-Station(s) Best Reflecting Impingement Collections

	Impingement		Cluster Grouping			
			Primary		Secondary	
Month	Unit	Dominant Species* (percent)	Amalgamation Distance	Gear-Station†	Amalgamation Distance	Gear-Station†
Apr	3	WP (95)	4	BT5	13	BT4
May	3	WP RS (81) (7)	29	BS12	33	BT6
Jun	2	AT RS BA (77) (7) (6)	12	BT5	17	BT4,BT6
	3	BA RS (28) (18)	34	BT1	51	BS20,BS9
Jul	2	BH AT BA (23) (22) (20)	37	ST1,ST3,BS20	38	ST4,ST5,ST6,ST7
Aug	2	BA AT WP (36) (28) (13)	37	BT2,BS20	41	ST1,ST2,ST3, ST6,ST7,BT3,BT7
Sep	2	BA H BH (37) (21) (17)	36	ST2,BS20	51	ST3
Oct	2	BH BA H (80) (6) (6)	5	IMP3	17	ST2,ST3,BT2
	3	BH H BA (76) (7) (6)	5	IMP2	17	ST2,ST3,BT2
Nov	2	BH WP (69) (21)	8	IMP3	21	BS20
	3	BH WP (64) (17)	8	IMP2	21	BS20
Dec	2	WP SB (80) (9)	94	BS9,BS11,BS12, BS20,BS21	**	

*Species Codes: AT=Atlantic tomcod, BA=bay anchovy, BH=blueback herring, H=hogchoker, RS=rainbow smelt, SB=striped bass, and WP=white perch

†Gear Codes: IMP2=impingement Unit No. 2, IMP3=impingement Unit No. 3, BT=bottom trawl, ST=surface trawl, BS=beach seine (standard station locations and descriptions are presented in Appendix C)

**Clusters too dissimilar for meaningful comparison and November when white perch, Atlantic tomcod, and blueback herring dominated impingement collections (Table IV-22). Impingement and nearfield station similarities were generally strongest (small amalgamation distance) when a single species clearly dominated collections. No single gear or station was consistently most similar to impingement collections. During months when impingement and nearfield collections were most similar (April at Unit No. 3; June at Unit No. 2), bottom trawl catches at station 5 had a species composition most similar to impingement, followed by bottom trawls at stations 4 and 6 (Table IV-22); these three stations are deep water stations [14 and 15 m in depth (Appendix Table C-3)]. White perch and Atlantic tomcod dominated at station 4 and 6. Impingement collections in October and November were dominated by blueback herring and were most similar to catches at surface trawl stations 2 and 3, bottom trawl station 2, and beach seine station 20 (Table IV-22).

To assess the overall relationships between impingement and standard station catches throughout the year, stations which had amalgamation distances of less than 30 were identified and the frequency of such relatively strong similarities in species composition were tabulated (Table IV-23). Thus, each entry in Table IV-23 represents the total number of months during 1978 that each pair of stations were associated with an amalgamation distance less than or equal to 30. An amalgamation distance of 30 was selected because approximately half (47 percent) of the computed amalgamation distances between stations and station clusters were below this level throughout the year.

Overall, surface trawls had the highest frequency of relatively strong similarities with impingement collections, even though surface trawls were sampled for only six months; surface trawl stations 3 (shallow) and 6 (deep) were relatively similar to impingement most frequently (Table IV-23). However, in contrast to the general trend for surface trawls, station 4 was notably ineffective in reflecting the

Table IV-23

Frequency of Association Among Impingement and Individual Standard Station Site Collections throughout 1978

	Station Number	Impingement			Beach Seine								Bottom Trawl								Surface Trawl							
		2	3	Σ	8	9	10	11	12	20	21	Σ	1	2	3	4	5	6	7	Σ	1	2	3	4	5	6	7	Σ
Impingement	2		2	2			1			1		2		1		1	1	1		4		1	2		1	2		6
	3	2		2			1		1	1		3		1		1	1			3		1	2		1	2		6
	Σ			4								5								7								12
Beach Seine	8			0		2	1	1	2			6		1						1								0
	9			0	2		1		3		1	7			1				1	2	1	1		1	1		1	5
	10	1	1	2	1	1				1	1	4		1						1	1		2	1		1		5
	11			0	1				1	2		4		1	1				1	3								0
	12		1	1	2	3		1		1	1	8								0								0
	20	1	1	2			1	2	1			4		1						1	1	1	2			1		5
	21			0		1	1		1			3								0								0
	Σ			5								36								8								15
Bottom Trawl	1			0								0				1	3	3		7								0
	2	1	1	2	1		1	1		1		4			2				3	5	2	1	2	2	2	2	1	12
	3			0		1		1				2		2					3	5	2	1		3	2	1	2	11
	4	1	1	2								0	1				5	4		10								0
	5	1	1	2								0	3			5		6		14								0
	6	1		1								0	3			4	6			13								0
	7			0		1		1				2		3	3					6	4	2	1	2	2	2	4	17
	Σ			7								8								60								40
Surface Trawl	1			0		1	1			1		3		2	2				4	8		2	3	3	2	2	4	16
	2	1	1	2		1				1		2		1	1				2	4	2		2	1	2	2	2	11
	3	2	2	4			2			2		4		2					1	3	3	2		1	1	3	1	11
	4			0		1	1					2		2	3				2	7	3	1	1		3	2	3	13
	5	1	1	2		1						1		2	2				2	6	2	2	1	3		3	4	15
	6	2	2	4			1			1		2		2	1				2	5	2	2	3	2	3		3	15
	7			0		1						1		1	2				4	7	4	2	1	3	4	3		17
	Σ			12								15								40								98

species composition of impingement collections, perhaps due to localized effects of the Indian Point thermal plume which is restricted primarily to the upper 3 m of the river surface near this point (TI 1976c). Bottom trawl collections reflected impingement species composition somewhat more frequently than beach seine collections, although neither were particularly effective. Beach seine stations 10 and 20 and bottom trawl stations 2, 4, and 5 reflected impingement collections better than most other stations sampled with those gear (Table IV-23). Among these five stations, only beach seine station 10 is likely to be influenced by the thermal plume (TI 1976c) but any thermal effects on the fish community at station 10 appears to be transient.

The similarities in species composition among collections from a single nearfield gear type at nearfield stations were usually stronger than those between nearfield and impingement collections. Overall, catches among surface trawl stations were most similar; in particular catches at station 7 were usually similar to catches at stations 1 and 5 (Table IV-23). Surface trawl stations 2, 3, and 4 had the most unique species composition relative to other surface trawl stations. Bottom trawl catches in deeper water (stations 1, 4, 5, 6) were frequently similar to one another, but distinct from bottom trawl catches at more shallow stations (2, 3, 7). Beach seine stations generally had unique species assemblages reflected in the general dissimilarity among catches at the nine stations. The species composition of the beach seine sites is probably influenced not only by the presence or absence of vegetation, but also by bottom type which is quite heterogenous among the stations (Appendix C.2).

This cluster analysis suggests that from a multispecies perspective, nearfield surface trawls provide the best overall description of the fish species composition in impingement collections at the Indian Point generating station. Surface trawl catches most closely reflected impingement collections when both were dominated by abundant species such as blueback herring, alewife, and bay anchovy. Adults of the anadromous blueback herring and alewife spawn in the estuary north of Indian Point (McFadden et al. 1978); large numbers of pelagic juveniles are caught in surface trawls and impingement collections as they leave the estuary in summer and fall. Bay anchovy spawn in the lower estuary, but large numbers of both adults and juveniles move upriver into the middle and upper estuary during the summer (TI 1976b, McFadden et al. 1978). In contrast, species such as white perch and Atlantic tomcod are caught in bottom trawl and impingement collections when juveniles occupy deep water areas near Indian Point during periods of reduced activity. Failure of beach seine catches to reflect the species composition of impingement collections supports the conclusion reached elsewhere (Section IV.D, TI 1979c) that fish favoring shallow water (i.e., shore zone) are not exposed to the Indian Point intakes which withdraw water from at least 8 m (26 ft) deep (Con Edison 1977a). Aside from those instances in which a single species dominated both impingement and nearfield collections, no particular similarity in species composition between impingement samples and any single standard station was found.

4. Size and Age of Impinged Fish Relative to River Fish from Nearfield Collections

Intake screens at power generating stations are selective for fish of a particular size or age as are most other methods of capturing fish. Selectivity may be due to the size of the screen mesh, the size and swimming ability of the fish, the velocity of the water passing through the screens, differential distribution and behavior for different species, or a combination of such factors. Selectivity can be accurately quantified only when the true size or age composition of the population is known; for large systems such as the Hudson River estuary, the true distribution can only be estimated.

This section compares the age distribution of six species of fish commonly impinged at the Indian Point generating station and collected in the Indian Point Standard Stations nearfield sampling program. Comparisons were based upon the percentage of the fish less than 12 months old from both types of collections. Striped bass, white perch, Atlantic tomcod, American shad, alewife, and blueback herring from impingement samples were sorted into age (based on length) categories prior to counting. These six species composed from 85% to 91% of the total number of fish impinged each year from 1976 through 1978. Mean weights of impinged fish were calculated as an indication of their size. Collection efficiencies were incorporated to estimate the total biomass (weight) impinged each year. The biomass impinged was calculated by adjusting the total weight of each species collected by a correction factor for collection efficiency (Section IV-B). Adjusted biomass impinged was compared to commercial fisheries landings where such data were available to provide, at least on a relative basis, an assessment of the biomass removed from the population by these two types of exploitation.

a. Striped Bass

The majority (97.3%) of all striped bass impinged from 1976 through 1978 were less than 12 months of age (Table IV-24) and less than 175 mm total length. The average weight of striped bass impinged was 9.8 g. During the same time, 93% of the striped bass taken by field sampling near Indian Point were less than 12 months old. Age composition differed little between nearfield and impingement collections during any month throughout this period (Figure IV-4).

Table IV-24

Percentage of Fish ≤12 Months Old Collected in Impingement and Indian Point Standard Station Collections, 1976 through 1978

	Impingement		Standard Stations	
Species	Total Number Impinged	Percent of Number	Total Number Collected	Percent of Number
Striped Bass	7.60×10^4	97.3	6.18×10^3	93.0
White Perch	2.37×10^6	88.7	2.04×10^4	66.4
Atlantic Tomcod	9.04×10^5	99.0	2.07×10^4	98.7
Alewife	9.69×10^4	96.9	6.98×10^3	93.4
American Shad	4.90×10^4	99.3	1.51×10^4	99.8
Blueback Herring	1.40×10^6	99.6	2.53×10^4	99.2

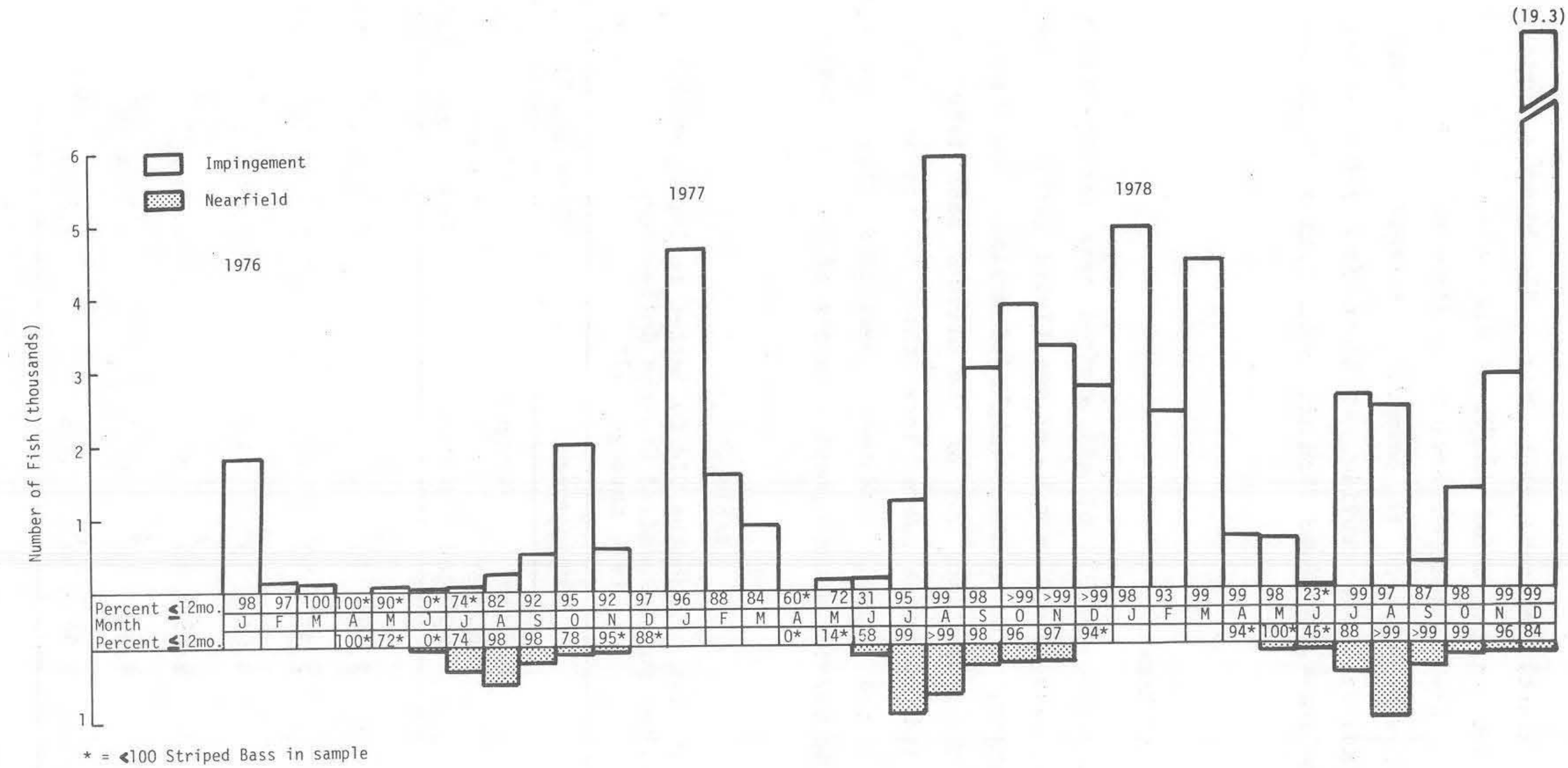


Figure IV-4. Number of Striped Bass Collected in Impingement and Indian Point Standard Station Sampling by Month, 1976 through 1978; and Percentage of the Total Which Were of Youngest Year Class (Lack of a Percentage Indicates No Sample)

The biomass (weight) of the estimated number of striped bass impinged at Indian Point Units No. 2 and No. 3 from 1976 through 1978 was 1,965 kg (approximately 4,320 lb). The greatest weight removed in a single year was 1,277 kg (approximately 2,810 lb) in 1978 (Table IV-25). This can be contrasted with the average annual commercial catch of striped bass from within the Hudson River, 1965 through 1975, of approximately 46,000 lb (McFadden et al. 1978). A still greater catch of Hudson River striped bass occurs in Atlantic coastal waters (McFadden et al. 1978).

Table IV-25

Estimated Total Biomass Impinged (kg) at Indian Point Generating Station (Units No. 2 and No. 3 Combined) for Striped Bass, White Perch, Atlantic Tomcod, Alewife, American Shad, and Blueback Herring, 1976 through 1978

Species	1976	1977	1978	Total
Striped Bass	183	505	1277	1965
White Perch	6936	25715	23556	56207
Atlantic Tomcod	968	4428	2396	7792
Alewife	132	531	396	1059
American Shad	49	92	279	420
Blueback Herring	1268	3288	2433	6989

b. White Perch

Impingement collections of white perch from 1976 through 1978 were composed primarily (88.7%) of fish less than 12 months of age and less than 110 mm total length (Table IV-24). The mean weight of all white perch impinged 1976 through 1978 was 8.6 g. It is not surprising that compared to striped bass a greater proportion of older white perch are impinged since white perch are not anadromous but rather remain in the Hudson river throughout their lives. White perch less than 12 months old composed only 66.4% of nearfield samples during the same time. The proportion of older fish in nearfield samples increased relative to impingement samples from August through December (Figure IV-5) and may reflect the earlier movement of younger perch from beaches to deeper water which increased their exposure to plant intakes. Older perch tended to remain in the shore zone.

The estimated total biomass of white perch impinged at Indian Point from 1976 through 1978 was 56,207 kg (approximately 124,000 lb). The highest single year's impingement was 25,715 kg (approximately 57,000 lb) in 1977 (Table IV-25). In comparison, the landings from the Hudson River reported to the NMFS by commercial fishermen from 1965 through 1975 averaged 1,440 lbs (McFadden et al. 1978). Since the white perch is of little commercial value locally, most of these landings were incidental catches taken while fishing for striped bass and American shad.

c. Atlantic Tomcod

Atlantic tomcod impinged and collected in nearfield gear were almost entirely (99.0% and 98.7%, respectively) less than 12 months of age (Table IV-24) and less than 225 mm total length. Proportions of young fish in field and impingement samples were similar during all months for which both types of collections were made (Figure IV-6). The average weight of impinged Atlantic tomcod, 1976 through 1978, was only 3.8 g reflecting the fact that most are impinged during mid-summer while immature and less than 140 mm long.

Total biomass of Atlantic tomcod impinged over the three years was 7,792 kg (17,000 lb); the largest single year's impingement was 4,428 kg in 1977 (Table IV-25). No commercial catch records are regularly kept for Atlantic tomcod from the Hudson River although some

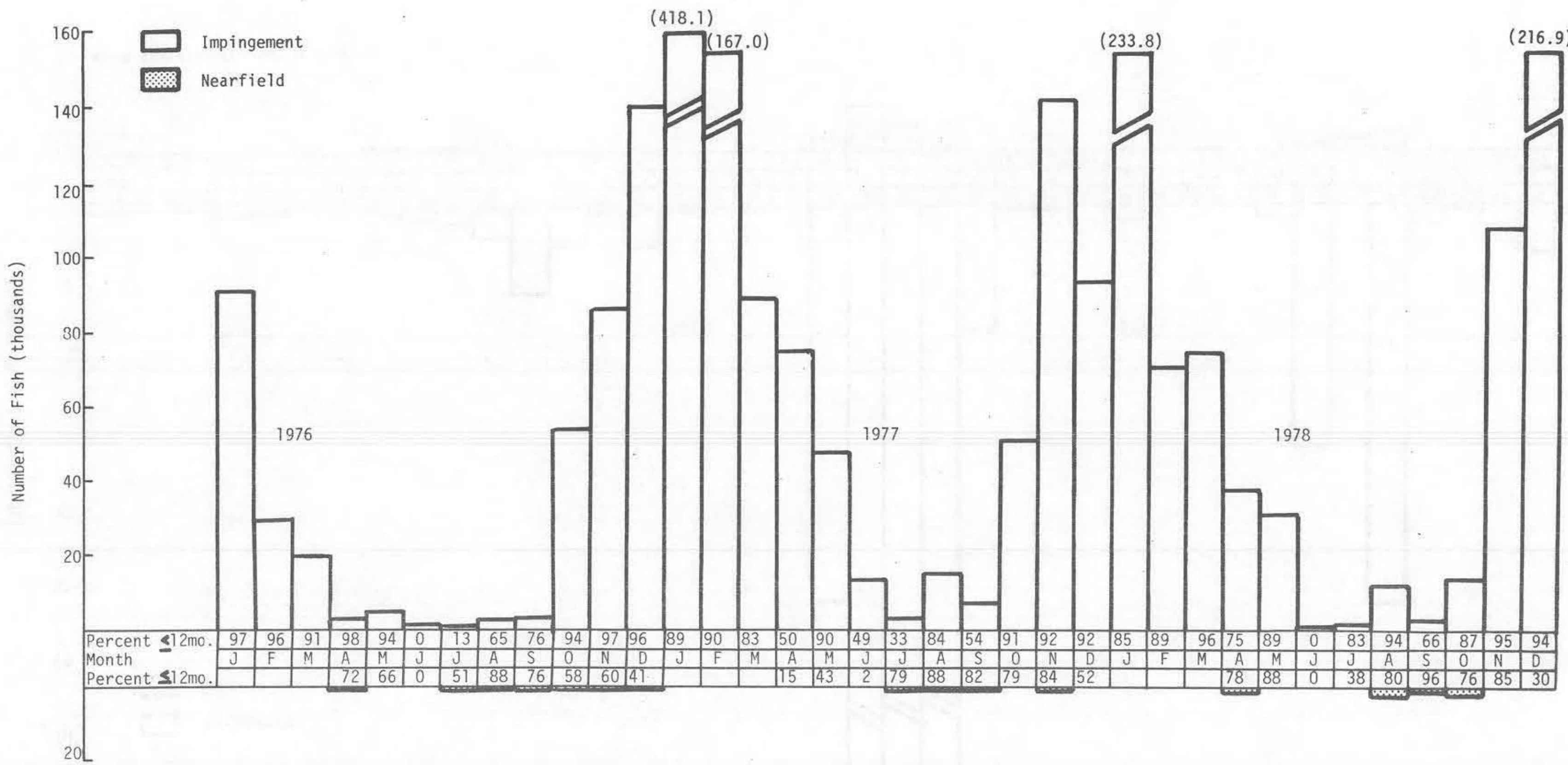


Figure IV-5. Number of White Perch Collected in Impingement and Indian Point Standard Station Sampling by Month, 1976 through 1978, and Percentage of Total Which Were of Youngest Year Class (Lack of a Percentage Indicates No Sample)

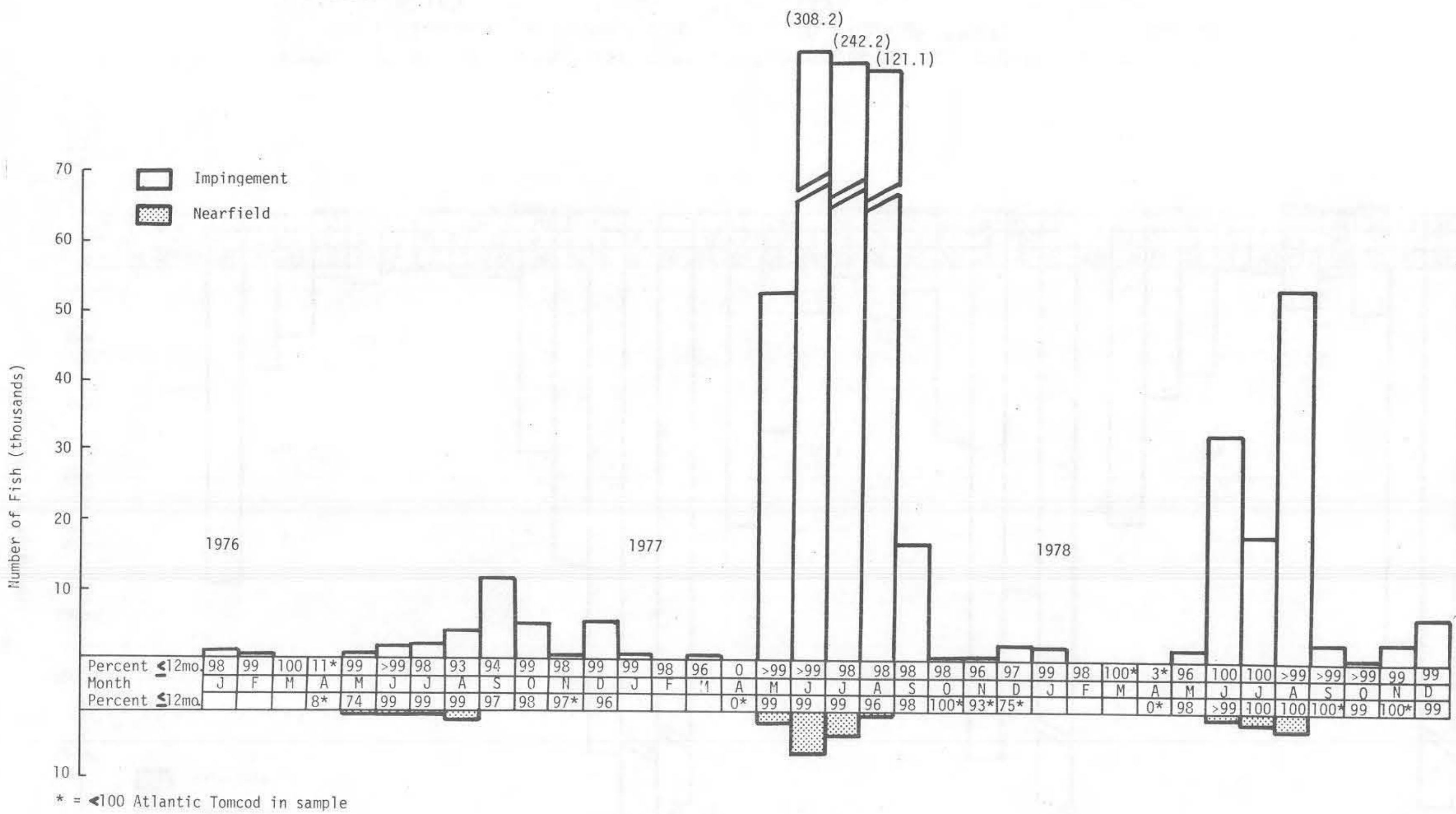


Figure IV-6. Number of Atlantic Tomcod Collected in Impingement and Indian Point Standard Station Sampling by Month, 1976 through 1978; and Percentage of Total Which Were of Youngest Year Class (Lack of a Percentage Indicates No Sample) scattered records indicate annual catch to be less than 2,000 lbs (McFadden et al. 1978).

d. American Shad

Young American shad are impinged and captured in nearfield collections during the summer and fall months as they emigrate from the Hudson River (Figure IV-7). From 1976 through 1978, 99.3% of the American shad impinged were less than 12 months of age and less than 150 mm long; the mean weight of these fish was approximately 4.1 g. Fish less than 12 months old composed 99.8% of the nearfield samples examined during the same time.

The commercial fishery removed an average of 218,000 lbs of American shad from the Hudson River each year between 1965 and 1977 (McFadden et al. 1978); the highest annual catch was 289,000 lbs. In comparison, impingement at Indian Point has taken only 420 kg (approximately 924 lb) over the last three years (Table IV-25) with a maximum of 279 kg (approximately 614 lbs) in 1978.

e. Alewife and Blueback Herring

Impingement of alewife was highly seasonal (Figure IV-8) with the majority of fish being impinged from July through November. Between 1976 and 1978, 96.9% of the alewife impinged at Indian Point were less than 12 months old and less than 150 mm total length (Table IV-24). Nearfield collections had a slightly lower percentage of young fish (93.4%) during the same time because of the appearance of some adult fish during the spring spawning migration (Figure IV-8). Mean weight of all impinged alewife was 6.3g over the three years.

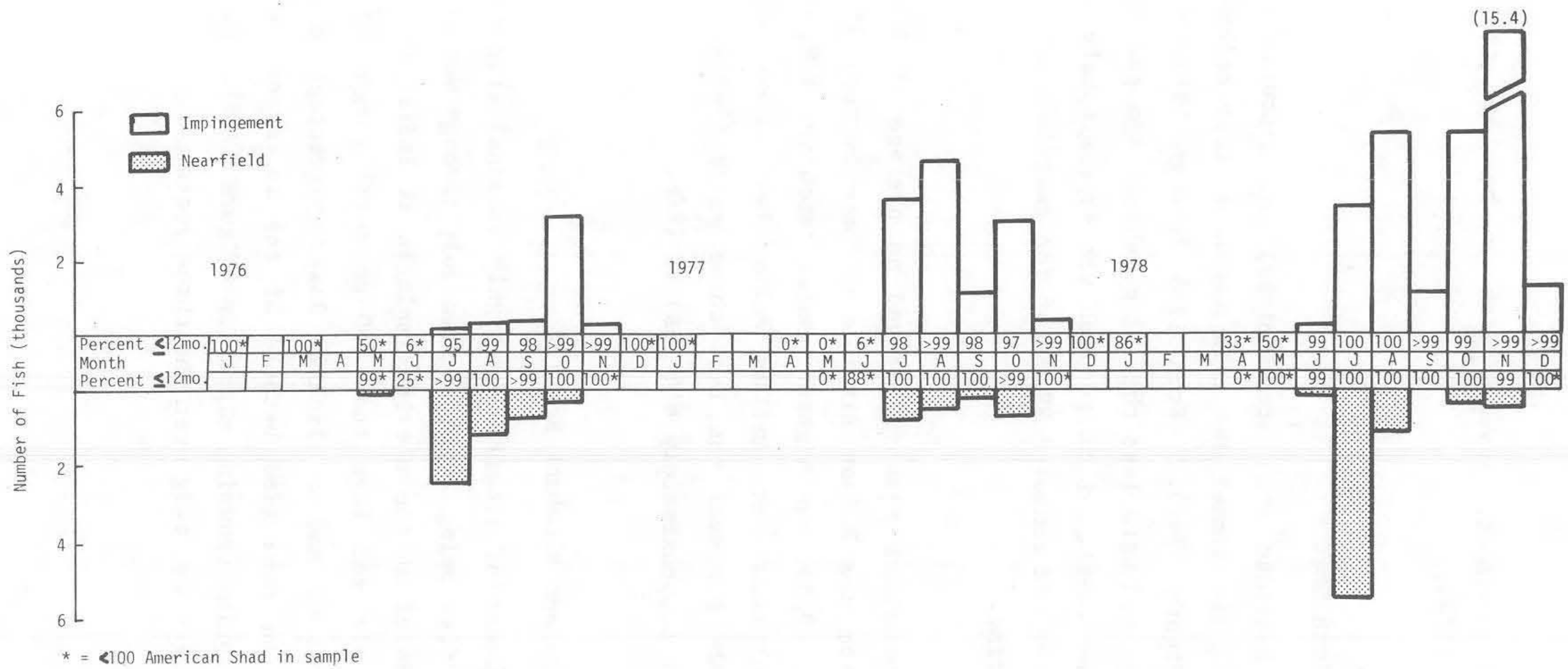


Figure IV-7. Number of American Shad in Impingement and Indian Point Standard Station Sampling by Month, 1976 through 1978, and Percentage of Total Which Were of Youngest Year Class (Lack of Percentage Indicates No Sample)

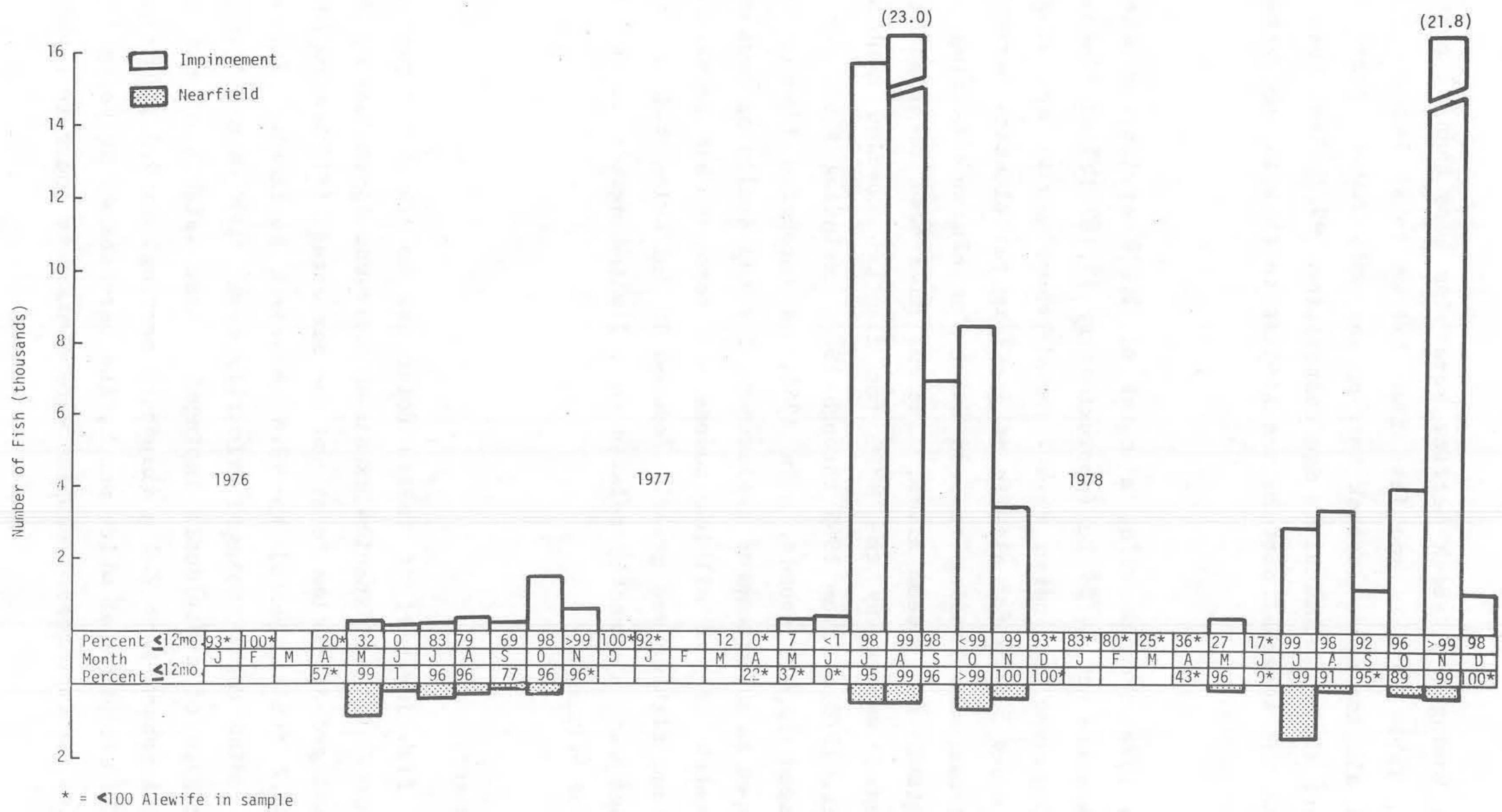


Figure IV-8. Number of Alewife Collected in Impingement and Indian Point Standard Station Sampling by Month, 1976 through 1978; and Percentage of Total Which Were of Youngest Year Class (Lack of a Percentage Indicates No Sample)

Most impinged blueback herring were also less than 12 months of age (99.6%, Table IV-24), and less than 130 mm total length. The mean weight of all impinged blueback herring was only 2.0 g. Nearfield collections were almost identical in age composition (99.2% less than 12 months old) and the seasonal pattern was similar to that in impingement samples (Figure IV-9).

From 1976 through 1978, a total of 1,059 kg (approximately 2,330 lb) of alewife and 6,989 kg (approximately 15,380 lb) of blueback herring were impinged at Indian Point. Impingement during any single year did not exceed 531 kg for alewife or 3,288 kg for blueback herring. Although no commercial landing records exist for blueback herring and alewife from within the Hudson River, landings have been recorded from New York coastal waters by the NMFS for the two species combined (McFadden et al. 1978). From 1965 through 1975, excluding 1966, annual landings averaged 10,400 pounds. In 1966, an intensive fishery for herring developed as an attempted replacement for the declining menhaden fishery. A catch of 4.2 million pounds was reported, but processing plants closed and fishing was greatly reduced in following years. Low average landings were apparently related to a limited market and not to the abundance of herrings.

f. Summary

Most fish impinged at Indian Point are in the first year of life and immature. The six species examined represent approximately 90% of the fish impinged at Indian Point and the percentage ($\leq$12 months old) ranged from 88.7 (white perch) to 99.6 (blueback herring). Further evidence that Indian Point impinged primarily young fish is provided by the average weights of individuals impinged. Mean weights of the six species examined ranged from 2.0 g (blueback herring) to 9.8 g (striped bass). With the exception of white perch, the percentages of young ($\leq$12 months old) fish in impingement samples were similar to those in samples

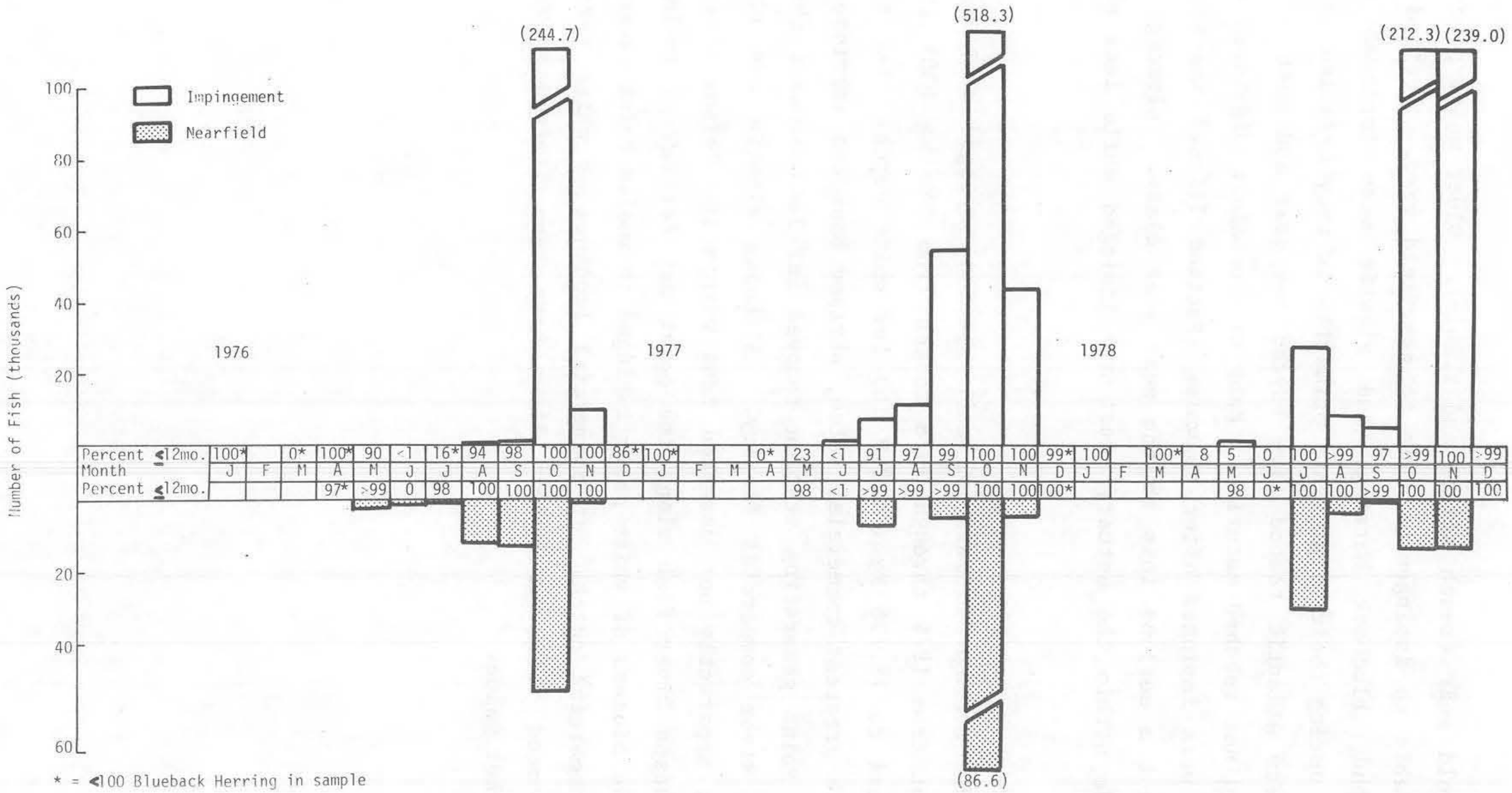


Figure IV-9. Number of Blueback Herring Collected in Impingement and Indian Point Standard Station Sampling by Month, 1976 through 1978; and Percentage of Total Which Were of Youngest Year Class (Lack of a Percentage Indicates No Sample) from nearfield gear (beach seines and trawls). Older white perch were less vulnerable to impingement than to nearfield gear. Striped bass, American shad, blueback herring, and alewife were impinged almost exclusively during their first year, primarily as they emigrate from the estuary. Few Atlantic tomcod live beyond one year and most of those impinged had not reached maturity. Many of the adults impinged during the winter were impinged after spawning (Section III.E.) and thus did not represent a serious loss to the next year class. Although white perch reside within the estuary, most are impinged while less than 12 months old.

The average biomass of each species impinged each year at Indian Point from 1976 through 1978 ranged from 140 kg (308 lb) for American shad to 18,736 kg (40,219 lb) for white perch. For the two species with greatest commercial value, striped bass and American shad, the Indian Point generating station removed far less biomass than did the Hudson River commercial fishery. Although alewife and blueback herring are apparently not marketed from within the Hudson River, the catch of Hudson River fish along the coast may far exceed impingement losses. The biomass of white perch impinged at Indian Point exceeds the reported commercial catch, but commercial landings of white perch and Atlantic tomcod from the Hudson River have been limited because of minimal market value.

D. MONTHLY ABUNDANCE TRENDS OF SELECTED REPRESENTATIVE IMPORTANT SPECIES

Relationships between fish impingement rates at Indian Point and abundance in the Hudson River, particularly in the Indian Point region (RM 39-46) are discussed in this section with emphasis on year to year variations and seasonal patterns within each year. The primary question was whether fish were impinged in proportion to their abundance in the river. Results for 15 species are presented; ten of these (striped bass, white perch, Atlantic tomcod, shortnose sturgeon, Atlantic sturgeon, spottail shiner, white catfish, bay anchovy, weakfish, and alewife) have been included because of their designation by the United States Environmental Protection Agency (EPA) as representative important species (Con Edison 1978c) and an additional five (blueback herring, American shad, hogchoker, bluefish, and rainbow smelt) are included because of their abundance in impingement collections at Indian Point or their importance as sport or commercial fish.

Impingement trends were analyzed through the use of adjusted and selected impingement rates (TI 1979c). That is, the number of fish collected from intake screens on selected days (selected for the ability to accurately match numbers collected to the volume pumped) was multiplied by an adjustment to correct for less than 100% collection efficiency (Section IV.B), then divided by the volume of water pumped through the intake screens to yield the number of fish impinged per million cubic meters pumped. Rates were computed on a combined unit basis to represent impingement at Indian Point as a whole. That is, the adjusted counts for Unit No. 2 were added to the adjusted counts for Unit No. 3 and then divided by the sum of the volumes for both units. Thus, during months when rates were available from only one unit (Appendix Table A-20), the rate utilized in this section represents Indian Point impingement as a whole for that month although it includes the operation of one unit only.

A relative catch index (RCI) was developed for comparing impingement rates with fish abundance in the river (TI 1979c). The RCI adjusts impingement rates and river C/f data allowing direct comparison on the same scale over any selected time period. Relative catch indices were calculated for the three-year period from 1976 to 1978 for comparison of impingement rates at Indian Point (Units No. 2 and No. 3 combined) with abundance estimates from standard station beach seine, and standard station bottom trawl (with and without fine mesh liner) and the Indian Point Region (RM 39-46) portion of the long river beach seine survey efforts.

One limitation to the RCI method of comparing abundance estimates is that the same time interval must be sampled by every gear included in RCI comparisons. Therefore, since there was no winter sampling conducted with seines or trawls, RCI values were calculated only for the period from April through December. Impingement data for January through March were thus excluded to maintain comparability. In the interest of examining as much of the year as possible, surface trawl data (no samples were taken before July) and interregional trawl data for the Indian Point Region (no December sampling) were excluded completely. The impingement, seine, and trawl data used for calculation of RCI's included all life stages (i.e., young-of-the-year, yearling, and older fish combined).

RCI values in this section were calculated for monthly time periods across three years (27 time periods) for each gear (including impingement) as follows:

$$RCI_i = \frac{X_i}{\bar{X}}$$

where

RCI_i = RCI for the i^{th} time period

X_i = C/f for the i^{th} time period

$\bar{X}$ = $\frac{1}{n} \Sigma X_i$ = mean C/f over n time periods

The value of relative catch indices for interpreting abundance patterns lies in the relationship to the average abundance for the period being considered. For example, an RCI of 1.0 for a given month would indicate that abundance for that month was equal to the average abundance for the time period considered (three years in this case). A monthly RCI of <1.0 would represent a below average abundance, and a monthly RCI of 5.0 would indicate an abundance level five times as large as the average for the three year period. This approach provides a qualitative assessment of trends and relationships that are analyzed quantitatively in Section IV.E.6.

To aid in the interpretation of impingement patterns indicated by the RCI's, seasonal and yearly differences in abundance of fishes in the vicinity of the Indian Point generating station (nearfield) were examined using the standard stations catches. Riverwide survey data were also examined to provide a broader perspective on changes in the abundance of fish within the nearfield region.

The abundance of many species in the Hudson River estuary changes considerably, both spatially and temporally, within each year. Therefore, abundance indices based on riverwide data were calculated differently from indices based on nearfield sampling. In the riverwide data set, where the focus was on regional differences in abundance and distribution, it was possible to define a period of peak abundance for each year that provided equal numbers of non-zero biweekly catches (C/f), and an analysis of variance was used to analyze the differences among regions and years. This analytical approach is similar to that used for the abundance indices for the key species in Year Class reports [TI 1980 (in preparation)]. The yearly patterns of abundance and a more detailed description of the analytical methods used are discussed in Appendix B.

Analysis of the nearfield data focused on distribution and abundance patterns in the vicinity of Indian Point. An abundance index for each of the standard stations was generated by summing the biweekly catch efforts within each year, and differences among stations (totals of biweekly catch efforts) were identified using contingency analysis (Everitt 1977). In this analysis, standard stations were grouped according to physical characteristics, and emphasis was placed on differences in spatial distribution and yearly changes in abundance. Beach seine stations 10, 11, 20, and 21 (Appendix Figure C-1) were characterized as open (lacking vegetation) while stations 8, 9, and 12 were characterized as sheltered (having dense vegetation). Bottom and surface trawl stations 1, 4, 5, and 6 were categorized as deep (>20 ft) while 2, 3, and 7 were considered shallow (≤20 ft).

Since two different analytical techniques were used, the yearly abundance indices from riverwide and nearfield data are not comparable. Additionally, from a statistical standpoint, the nearfield and riverwide abundances should not be compared directly because subsampling within the nearfield region was not randomly allocated as was riverwide subsampling. Specific locations (stations) were repeatedly sampled in the nearfield and the within-region variation includes the affects of this fixed design.

For these analyses of riverwide distribution, the twelve geographic regions of the river that have been conventionally used [TI 1980 (in preparation)] were consolidated into five super regions as described in Appendix B.2. The consolidation was performed to simplify analyses of shifts in riverwide distribution and abundance and also to minimize potential statistical bias that would have resulted from unequal sampling efforts among the 12 original regions. Two additional factors influencing the delineation of super regions were 1) the need to keep the original Indian Point region (RM 39-46) distinct for comparison with impingement and 2) predominantly higher salinities of the Yonkers region

(RM 12-23) which often separates the distribution of fish in this region from the remainder of the study area.

Data from super regions 1 and 5 were excluded from the analysis of interregional trawl data because sampling was not always conducted in these two regions in each year.

1. Resident Species

Species that are permanent residents of the Hudson River estuary, such as white perch, spottail shiner, and white catfish vary in their ability to tolerate changes in salinity. Generally, abundance is equal to or greater in the middle and upper estuary than in the lower estuary for these species, indicating that their distribution is throughout the entire system. The adults are usually not a major component of the Indian Point impingement samples because of their ability to avoid the intake screens. During the summer and fall the young-of-the-year populations of these three species are not heavily impinged because their habitat preferences include areas away from the intakes of the Indian Point generating station. Juvenile white catfish are demersal while juvenile white perch and spottail shiner prefer shallow water with vegetation, at least during the summer and early fall. Since these three species are residents, the juveniles remain in the estuary through the winter. Consequently, the juveniles of all three species are impinged at Indian Point when they move into the deeper water in the channel to overwinter.

a. White Perch

White perch in the Hudson River overwinter in the deeper waters of the lower and middle estuary (McFadden et al. 1978). In the spring they move shoreward and generally upriver to spawn in the shallower brackish and freshwater areas of the estuary during May through July (TI 1979b, Con Edison 1978c). After hatching, young-of-the-year (YOY) are first concentrated in deeper water, but move into the shore zone of the middle and upper estuary during July (McFadden et al. 1978). A gradual downriver movement of white perch (all age groups) occurs in the shore zone during August and September (McFadden et al. 1978, Con Edison 1978c), and then as water temperatures decrease in the fall they move offshore to deeper water.

Comparisons of 1976 through 1978 impingement rates with nearfield seine and trawl catches indicated that small yearly changes had occurred in impingement magnitude and nearfield abundance, but the seasonal pattern of impingement was the same each year (Figure IV-10). With respect to the yearly changes, the abundance of yearling and older white perch (in standard station beach seines) fluctuated during the three-year period with no discernible trend (Figure IV-11). Abundance of young-of-the-year white perch at Indian Point also varied through this time period, but catches in 1978 were higher than in 1976 and 1977 (Figure IV-11). Thus, the small yearly changes in nearfield abundance agreed with yearly impingement trends, except in 1978. Conductivity levels in 1978 remained high through the fall when white perch impingement typically increases (Figure III-3); this probably delayed the downriver movement of white perch and reduced fall impingement.

With respect to the seasonal impingement pattern, relative catch indices (RCI) revealed that impingement was up slightly in the spring, very low through the summer, and high in the fall (Figure IV-10). Although RCI values were not calculated for the winter months, because there was no winter nearfield sampling for comparative purposes, impingement of white perch was highest during the winter months (Appendix A). Impingement levels in the spring reflected the gradual decline from the peak winter impingement period. As white perch began to move out of the deeper channel areas and into the shore zone as water temperature increased in April and May, they became less vulnerable to impingement.

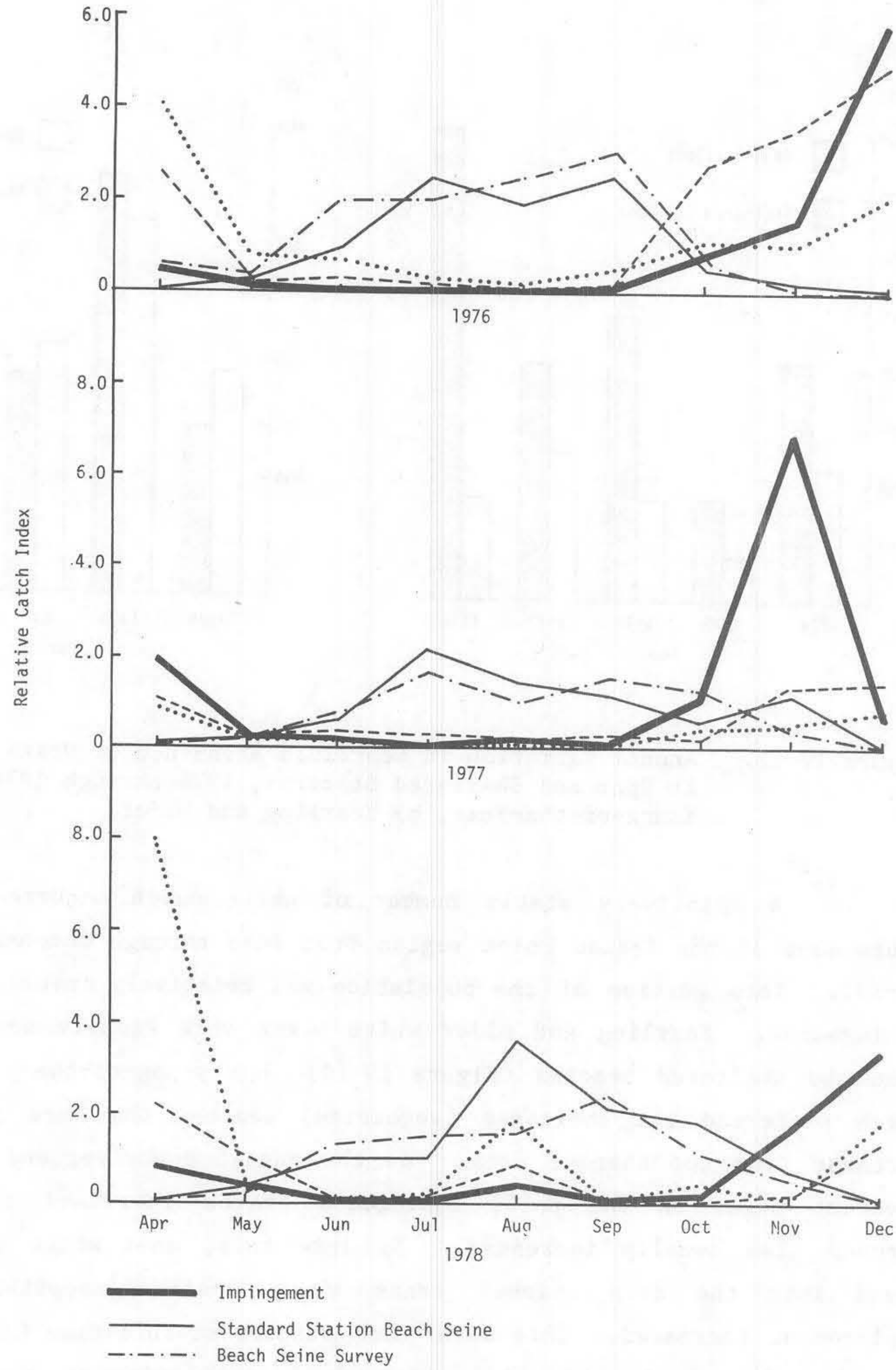


Figure IV-10. Monthly Variations in Indian Point Impingement and Field Collections of White Perch in Indian Point Region (RM 39-46), Hudson River Estuary as Portrayed by Relative Catch Index, 1976 through 1978

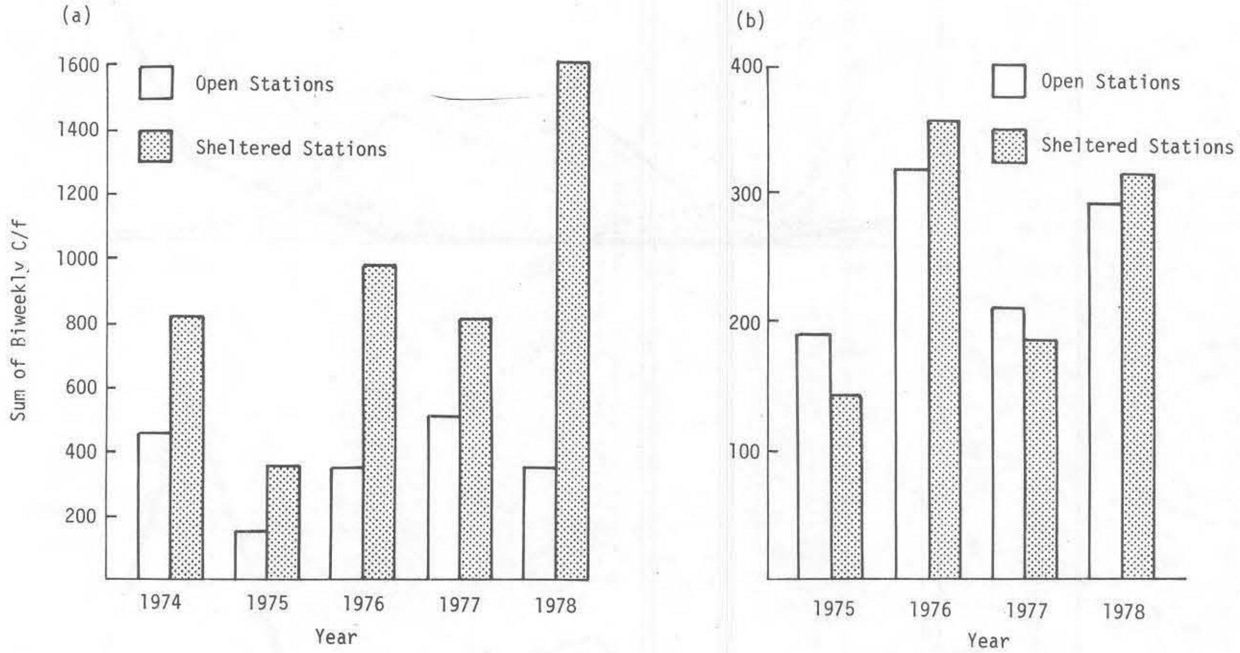


Figure IV-11. Annual Variation in Nearfield Abundance of White Perch at Open and Sheltered Stations, 1974 through 1978: a) Young-of-the-Year, b) Yearling and Older

A relatively stable number of white perch occurred in the shore zone of the Indian Point region from June through October (Figure IV-10). This portion of the population was relatively invulnerable to impingement. Yearling and older white perch were equally abundant at open and sheltered beaches (Figure IV-11), but young-of-the-year white perch preferred the sheltered (vegetated) beaches that are generally farthest from the channel area. As the annual downriver and offshore movement began in the fall, impingement rates increased and trawl catches also usually increased. By late fall, most white perch had moved into the deep channel areas where their susceptibility to impingement increased. Cold water temperatures at this time (and during the winter) probably reduced the swimming capabilities of these fish, also increasing their vulnerability to impingement.

The only major change in the seasonal impingement pattern during the three years was a marked peak in November 1977. This period of high impingement was probably a response to the period of high conductivity during the summer of 1977 which was followed by a sharp decrease in conductivity in October. Since white perch exhibit a preference for low salinity or fresh water, the high conductivities associated with movement of the salt front through the Indian Point region probably caused many white perch to remain upriver of Indian Point during the summer. Increased freshwater flows and the concomittant sharp decrease in conductivity during October probably stimulated these fish to move downriver. Because the conductivity change was abrupt, the population may have quickly moved downstream and greatly increased their exposure to impingement at Indian Point.

In summary, yearly changes in nearfield abundance of white perch are not necessarily reflected in the impingement trends because during several months of the year impingement is apparently reduced when the population is concentrated in the shore zone and shoal areas. Seasonally, white perch impingement is highest during the fall and winter, reflecting the downriver and offshore movement of white perch into deeper areas of the river which take them past the intake screens of the generating station. Conductivity levels (dependent on salt front location) in the Indian Point vicinity may also affect impingement by delaying and/or concentrating the fall migration.

b. Spottail Shiner

The spottail shiner is one of the more abundant resident species in the Hudson River estuary. Adults spawn during the spring in fresh or slightly brackish waters along the shore zone in the middle and upper estuary (TI 1976b). Both adults and young-of-the-year remain in the upper and middle estuary through the summer. Young-of-the-year use the shore zone areas as a nursery and by late fall move offshore to overwinter in deeper water with the older fish (TI 1976b).

Impingement of spottail shiner was similar during 1976, 1977, and 1978 even though nearfield abundance fluctuated among years (Figure IV-12). Spottail shiners are apparently not very susceptible to impingement during much of the year. This hypothesis is supported by beach seine data which reveals that both young-of-the-year and yearling and older spottails were located primarily at sheltered beach areas (shore zone) away from the Indian Point generating station's intake screens (Figure IV-13).

Long river beach seine surveys from 1974 through 1978 clearly showed that spottail shiners prefer the freshwater regions of the upper estuary; there was a significant increase in spottail abundance between each region and the next region upriver (Figure IV-14). There is, however, a relatively constant population of shiners residing in the shore zone of the Indian Point nearfield, as shown by beach seine relative catch indices from 1976 through 1978 (Figure IV-12). The trawl data indicated an increased abundance in the nearfield in 1976. These relatively high trawl catches of spottail shiners was probably related to the low conductivity levels present in the Indian Point region in 1976. As conductivity increased in August, spottail shiner abundance in trawls sharply decreased (Figure IV-12 and III-3).

The spottail shiner population in the Indian Point nearfield are most susceptible to impingement during the winter when they move into the deep areas of the river. Although RCI's were not calculated during the winter, impingement rates were highest during the winter months (Appendix A). The increase in RCI values in December of each year and the decrease in RCI's during April through May reflected the beginning and end of the high winter impingement periods. The high

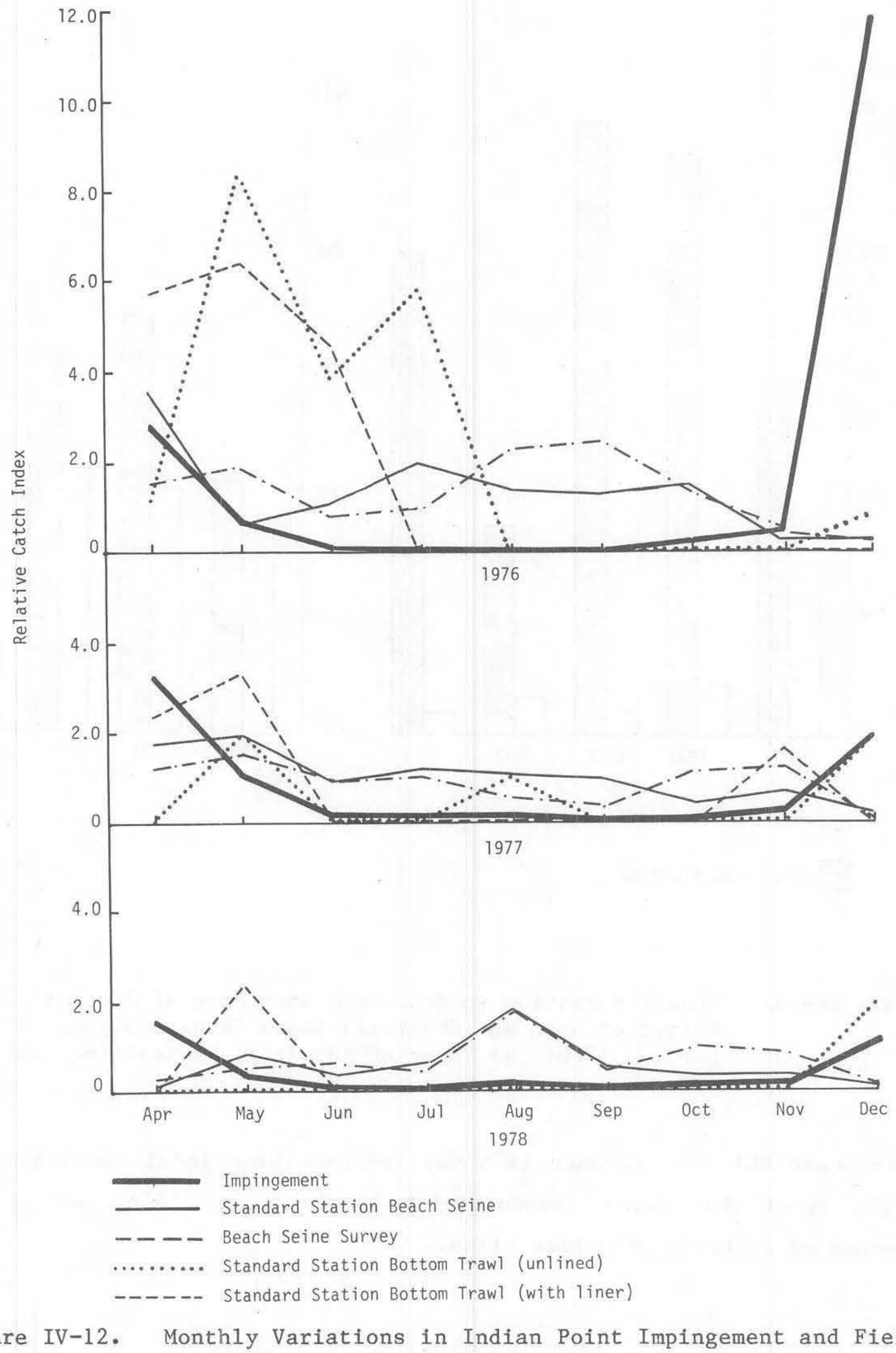


Figure IV-12. Monthly Variations in Indian Point Impingement and Field Collections of Spottail Shiner in Indian Point Region (RM 39-46), Hudson River Estuary as Portrayed by Relative Catch Index, 1976 through 1978

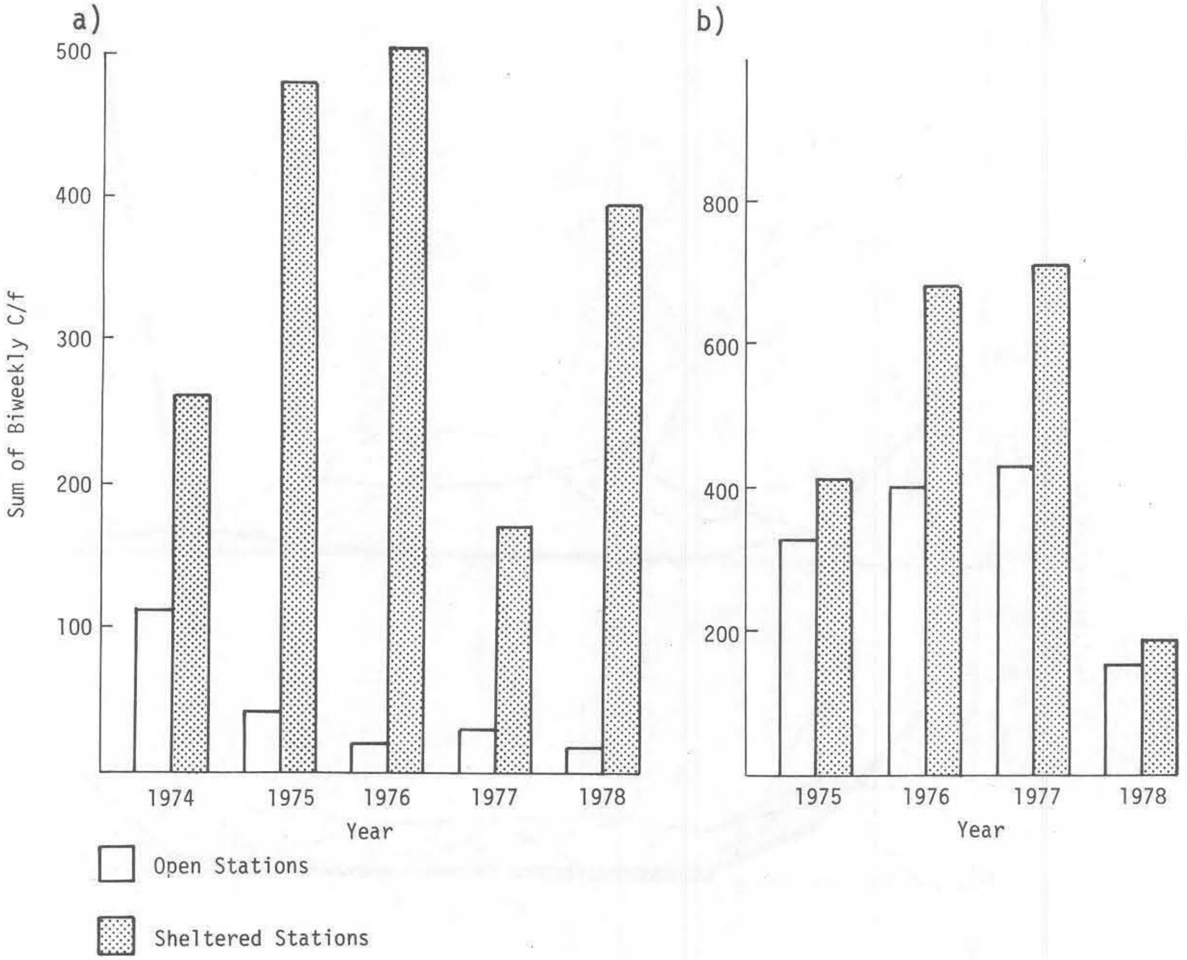
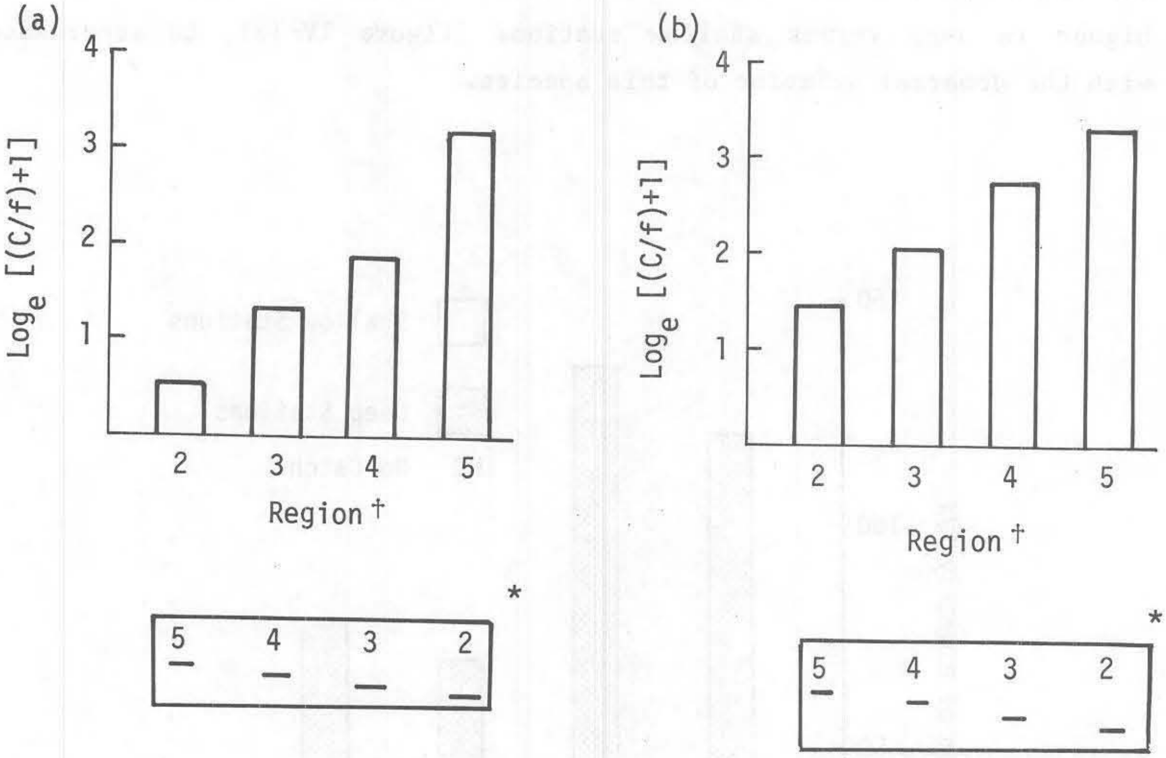


Figure IV-13. Annual Variation in Nearfield Abundance of Spottail Shiner at Open and Sheltered Beach Seine Stations, 1974 through 1978: a) Young-of-the-Year, b) Yearling and Older

impingement RCI for December 1976 may indicate high local abundance due to the lower than usual conductivity levels during 1976, and/or the presence of a strong 1976 year class.



*Regions are shown in order of descending C/f (left to right), a common underline indicates no significant difference ($p<0.05$). The Indian Point generating station is located in Region 3

†Region 1 excluded from analysis because there were large numbers of empty catches

Figure IV-14. Mean Regional C/f Values (Transformed) and Results of Multiple Comparison Test* for Young-of-the-Year Spottail Shiner Collected during Beach Seine Surveys. 1974 through 1978: a) Young-of-the-Year, b) Yearling and Older

c. White Catfish

White catfish construct nests on sand bars or gravel bottoms (Raney 1967). Young-of-the-year appear in July and move to deeper water during August (TI 1977e, Con Edison 1978c). The abundance of white catfish in bottom trawl catches from the Indian Point nearfield was much higher in deep versus shallow stations (Figure IV-15), in accordance with the demersal behavior of this species.

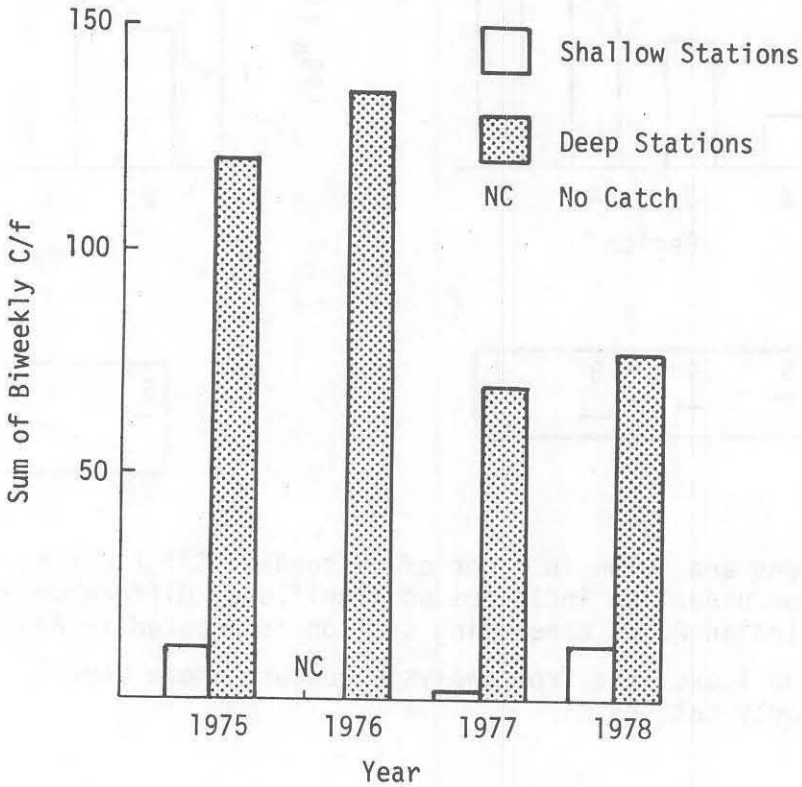


Figure IV-15. Annual Variation in Nearfield Abundance of White Catfish (All Life Stages Combined) at Shallow and Deep Bottom Trawl Stations, 1975 through 1978

Impingement RCI's for white catfish from 1976 through 1978 exhibited strong year-to-year differences but a fairly consistent seasonal pattern (Figure IV-16). The seasonal impingement trends were generally inversely related to changes in conductivity. Impingement was low during the summer months when conductivity was highest but increased in the fall as conductivity decreased. Although relative catch indices were not calculated for the winter (there was no winter nearfield sampling), impingement of white catfish was relatively high during the winter months, especially during January (Appendix A). White catfish were probably subject to impingement during the winter because they apparently aggregate in the channel areas of the middle estuary. RCI's for field sampling did not closely parallel impingement trends partly because of small catches. This was particularly true for standard station beach seine catches in 1977.

During 1978, conductivity levels remained high into December and the typical fall increase in impingement did not occur (Figure IV-16). The seasonal movement of white catfish into the Indian Point region during the fall of 1978 either did not occur or was apparently delayed until winter by the sustained high conductivity levels. Such behavior is consistent with their preference for fresh water (Jones et al. 1978). The earlier occurrence of the fall impingement peak in 1976 as compared to 1977 was also probably related to conductivity. In 1976, conductivity levels in the Indian Point region decreased sharply during September, but in 1977 the summer conductivity levels were higher and did not decrease until early October.

In summary, the seasonal impingement pattern for white catfish was quite consistent, but seasonal fluctuations in nearfield trawl and seine samples were variable from year to year, and none of the relative catch indices from field gear were truly reflective of white catfish impingement.

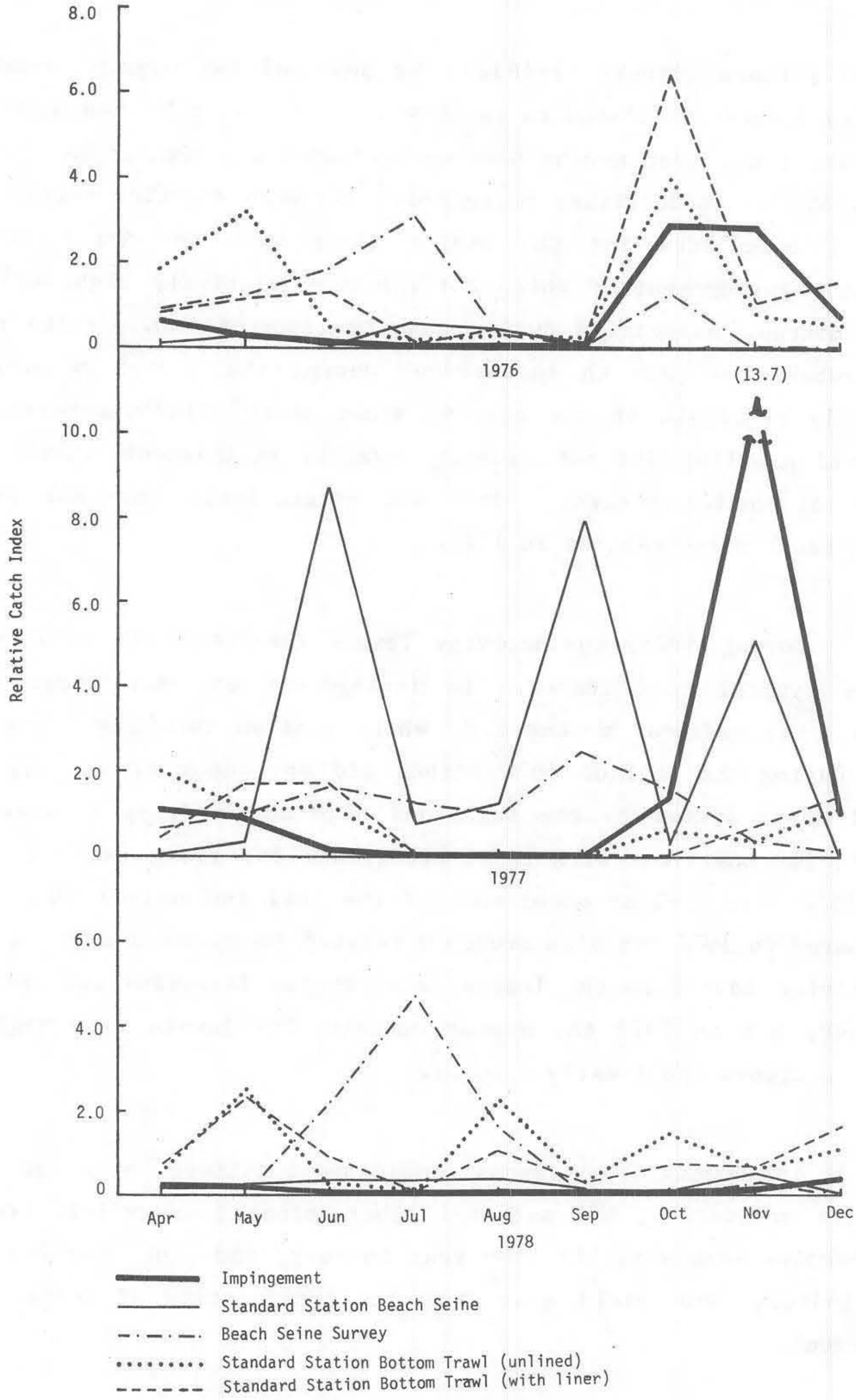


Figure IV-16. Monthly Variations in Indian Point Impingement and Field Collections of White Catfish in Indian Point Region (RM 39-46), Hudson River Estuary as Portrayed by Relative Catch Index, 1976 through 1978

d. Shortnose Sturgeon

Very little is known about the early life stages of this bottom dwelling species, which is apparently a resident of large tidal rivers (Scott and Crossman 1973, McFadden et al. 1978). In the Hudson River estuary, juvenile sturgeons (not identified to species) are collected in the middle and upper estuary, while yearling and older shortnose sturgeons are collected mainly from the lower estuary (McFadden et al. 1978). Con Edison (1978c) reported that migratory patterns in the Hudson River have not yet been clearly defined; Dovel (1978) speculates that some mature fish, after spawning in the upper estuary during April and May, migrate downstream to the lower estuary or even the Atlantic Ocean during the summer and fall where they remain for an indefinite period before returning to the Hudson River to spawn again. Dadswell (1975) reported on shortnose sturgeon in the St. John River estuary in Canada and determined that migration definitely occurs.

Low and sporadic collections of shortnose sturgeon during 1976 through 1978 precluded evaluation of impingement and nearfield abundance trends. Twelve shortnose sturgeon (1 in 1976, 7 in 1977, 5 in 1978) were impinged at Indian Point during each of these three years and in nearfield bottom trawls only one was collected in 1976, 0 in 1977, and 0 in 1978.

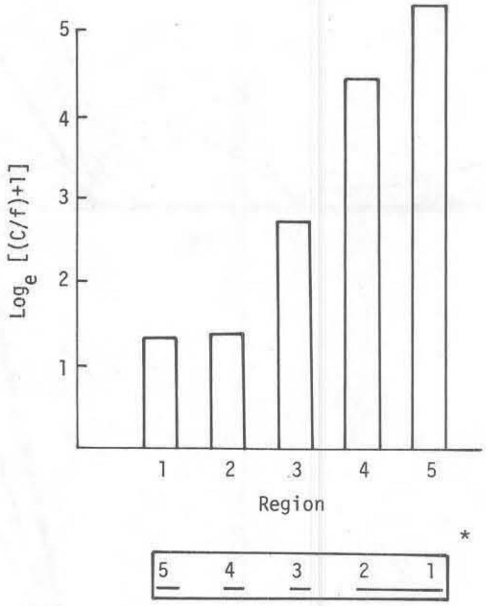
2. Anadromous Species

The Hudson River estuary serves as a spawning and nursery area for several anadromous species. The adults are present only for a short time during the spring or early summer spawning season and experience low levels of impingement, primarily because of their size and ability to avoid the power plant intakes. The young-of-the-year, on the other hand, are exposed to impingement for a longer period of time, especially when they move downriver during late summer and fall, and begin to emigrate from the estuary. Additionally, young-of-the-year are not as physically capable as the adults at evading the intake screens. Consequently, the young-of-the-year populations experience greater levels of impingement. The riverwide distributions of the juvenile populations during the summer and fall determine the exposure of each anadromous species to the power plants and are the focus of the following discussion on the patterns of impingement and nearfield abundance exhibited by six anadromous species (blueback herring, alewife, American shad, striped bass, rainbow smelt, and Atlantic sturgeon).

a. Blueback Herring

Riverwide surveys during 1974 through 1978 indicated that, during the summer, young-of-the-year blueback herring were located primarily upriver of the Indian Point generating station (Figure IV-17). During the fall, young-of-the-year bluebacks moved downriver toward the sea. This seasonal distribution explains why blueback herring were impinged most heavily during the fall (Figure IV-18).

Fall impingement rates were much higher in 1977 than in 1976 or 1978 (Figure IV-18), and these yearly variations in impingement were reflected in similar variations in nearfield abundance (Figure IV-19). However, the relationship between nearfield abundance and impingement was not as strong in 1976 and 1978 as it was in 1977 (Figure IV-18), indicating that factors other than abundance such as water temperature or conductivity also affect impingement (Section IV.E.6). The fall emigration of young-of-the-year blueback herring is probably triggered by water temperature (or photoperiod), but conductivity could influence how fast the majority of the population moves downriver. For example, the high conductivity at Indian Point during early fall 1977 (Figure III-3) might have delayed the fall migration, and then the sharp decline in conductivity (in October) could have stimulated the young-of-the-year population to move downriver in a concentrated mass. This relationship



*Regions are shown in order of descending C/f (left to right), a common underline indicates no significant difference ($p < 0.05$). The Indian Point generating station is located in Region 3

Figure IV-17. Mean Regional C/f Values (Transformed) and Results of Multiple Comparison Test* for Blueback Herring Young-of-the-Year Collected during Beach Seine Surveys, 1974 through 1978

between conductivity and downriver movements could explain the high 1977 impingement peak in October through November and the close association between nearfield abundance and impingement magnitude.

In summary, the seasonal pattern of young-of-the-year blueback herring impingement reflects the summer upriver distribution and the fall emigration to the sea. Differences in the level of impingement

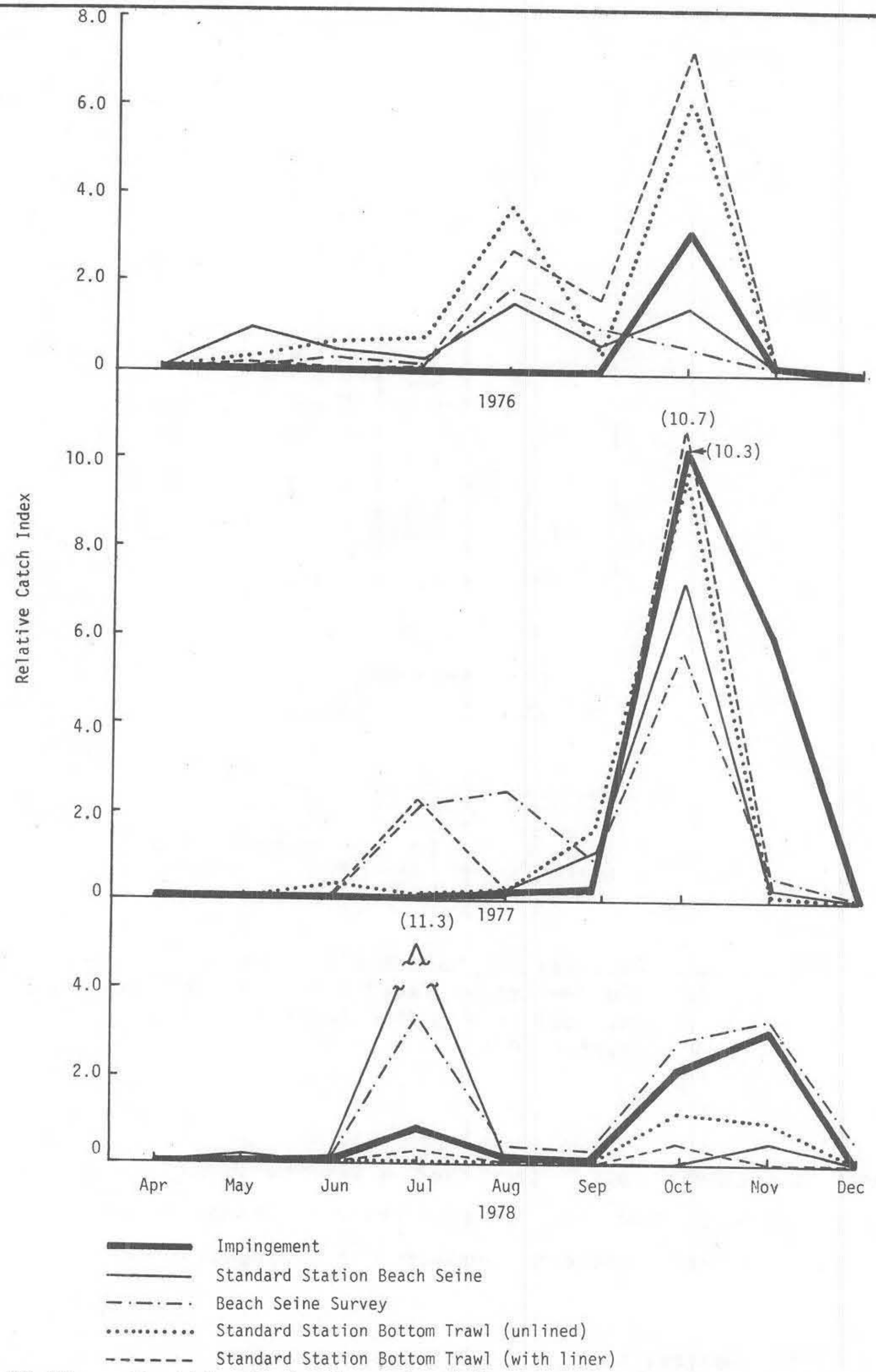


Figure IV-18. Monthly Variations in Indian Point Impingement and Field Collections of Blueback Herring in Indian Point Region (RM 39-46), Hudson River Estuary as Portrayed by Relative Catch Index, 1976 through 1978

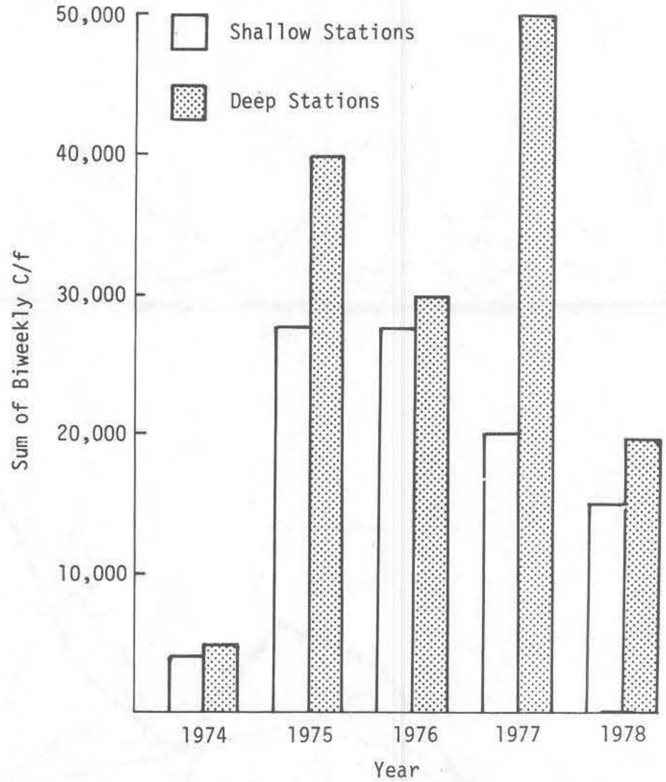


Figure IV-19. Annual Variation in Nearfield Abundance of Young-of-the-Year Blueback Herring at Shallow and Deep Surface Trawl Stations, 1974 through 1978

among years appears to be the result of nearfield abundance and environmental factors such as conductivity and water temperature.

b. Alewife

In contrast to the single fall peak observed for blueback herring impingement (Figure IV-18), both a summer and fall peak were observed for alewife (Figure IV-20). The center of the riverwide distribution for young-of-the-year alewives was located slightly

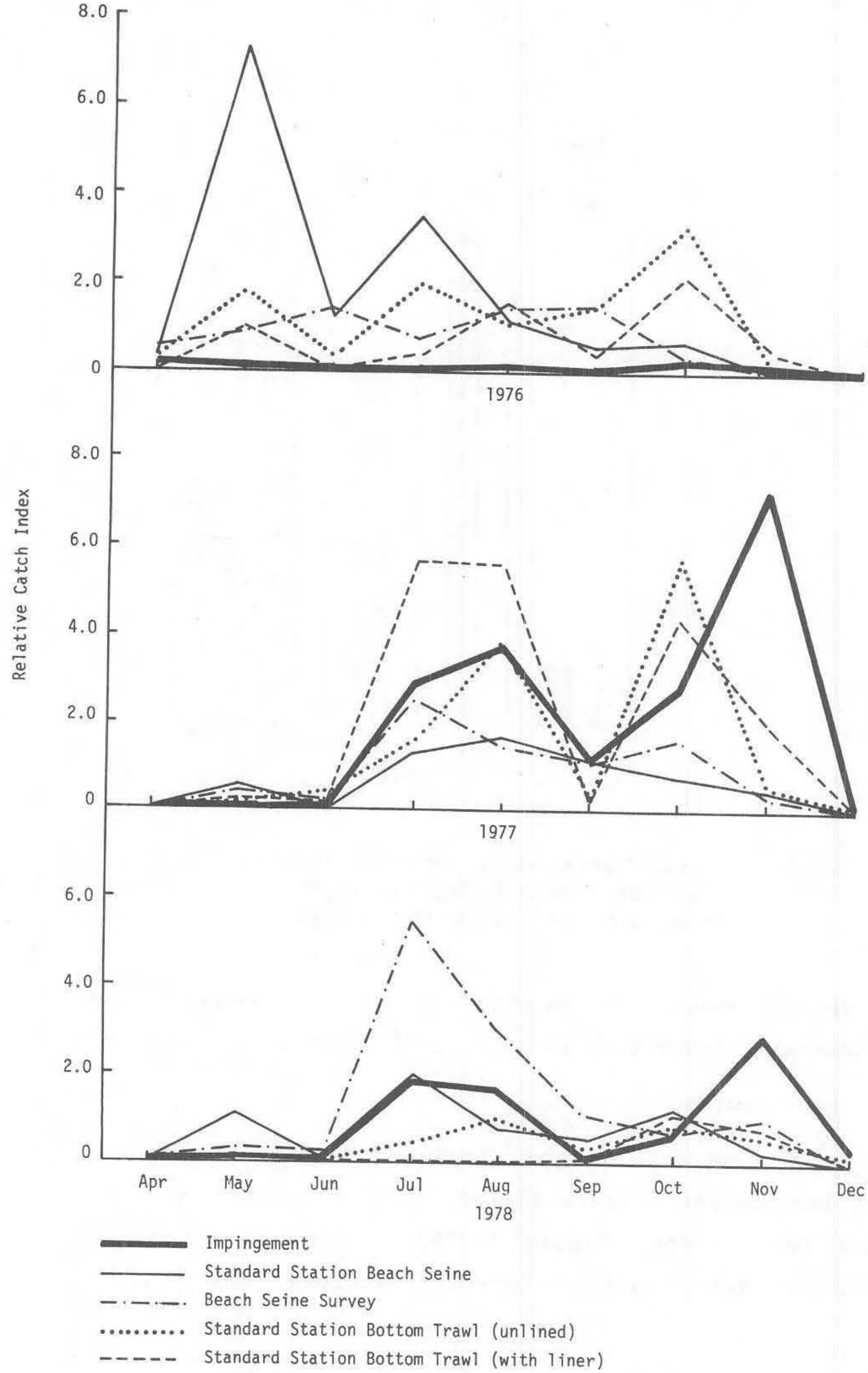


Figure IV-20. Monthly Variations in Indian Point Impingement and Field Collections of Alewife in Indian Point Region (RM 39-46), Hudson River Estuary as Portrayed by Relative Catch Index, 1976 through 1978 downriver from that for blueback herring (Figure IV-21). Consequently, a greater proportion of the young-of-the-year alewife population was exposed to the Indian Point generating station, and impingement increased during June and July as the young-of-the-year alewives attained an impingeable size.

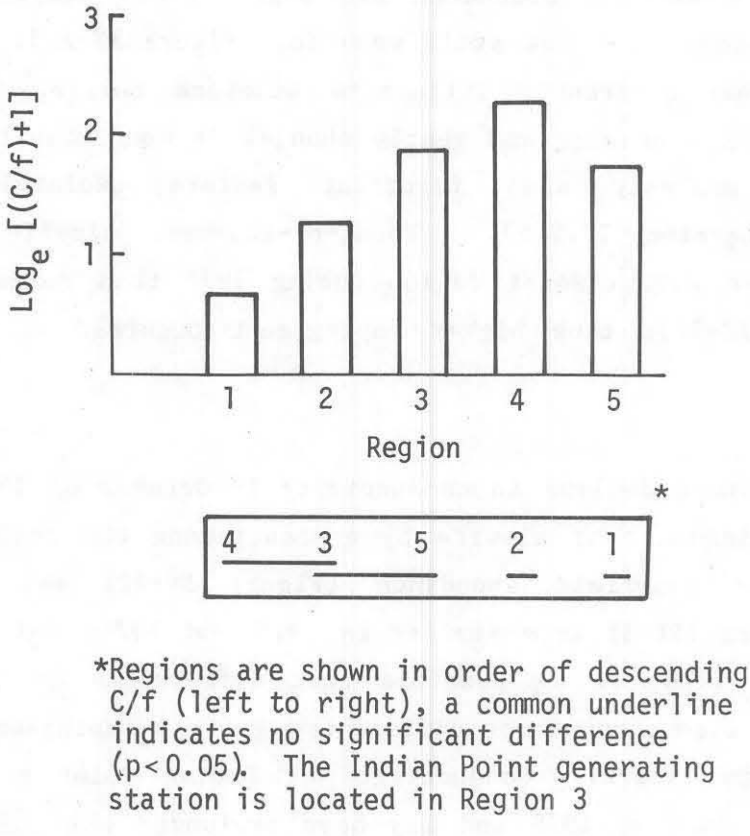


Figure IV-21. Mean Regional C/f Values (Transformed) and Results of Multiple Comparison Test* for Young-of-the-Year Alewife Collected during Beach Seine Surveys, 1974 through 1978

Impingement of alewife during 1976 through 1978 exhibited the same yearly changes as for blueback herring; impingement was highest in 1977 and lowest in 1976 (Figure IV-20). The low impingement in the summer of 1976 may have been the result of reduced operations at Unit No. 2 (Appendix Table A-21), which often accounts for more than 50% of the impingement of alewife at Indian Point (Section IV.E.2). Unit No. 2, however, was in operation during October of 1976 when alewife were migrating downstream and abundance was high in the nearfield (Figure IV-20); yet, impingement was still very low (Figure IV-20). Hence, the two factors that apparently influenced blueback herring impingement, namely nearfield abundance and yearly changes in conductivity at Indian Point, were probably also important factors explaining alewife impingement (Section IV.E.6). Young-of-the-year alewife were more abundant in the Indian Point region during 1977 than during 1976 and 1978 (Figure IV-22); thus higher impingement occurred as expected in 1977.

The sharp decline in conductivity in October of 1977 may have influenced impingement of alewife by concentrating the fall emigration pulse. Since nearfield abundance (Figure IV-22) and temperature patterns (Figure III-3) were similar in 1976 and 1978, yet impingement was higher in 1978, it is possible that differences in conductivity patterns could also account for differences in fall impingement observed during these two years. Conductivity at Indian Point remained high throughout the fall of 1978 and may have prolonged the fall downriver movement of young-of-the-year; thus, the population may have been exposed to impingement over a longer time interval during 1978 than in 1976.

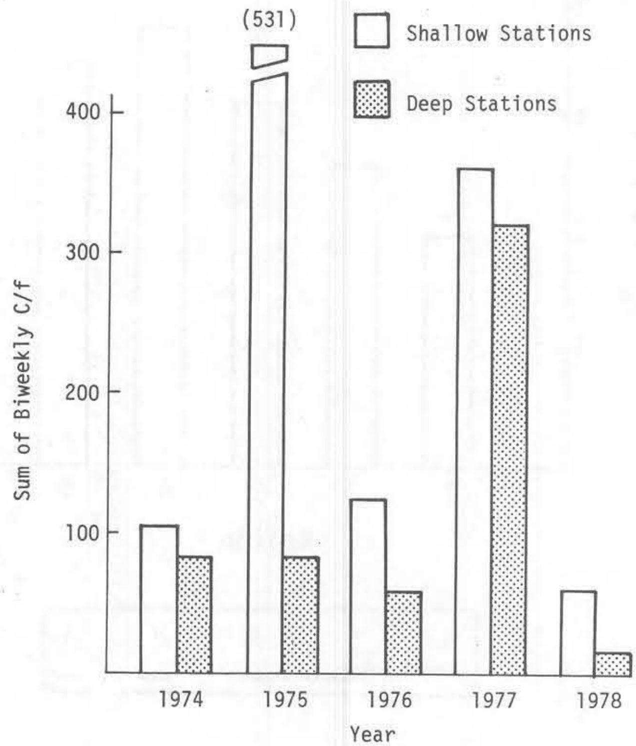
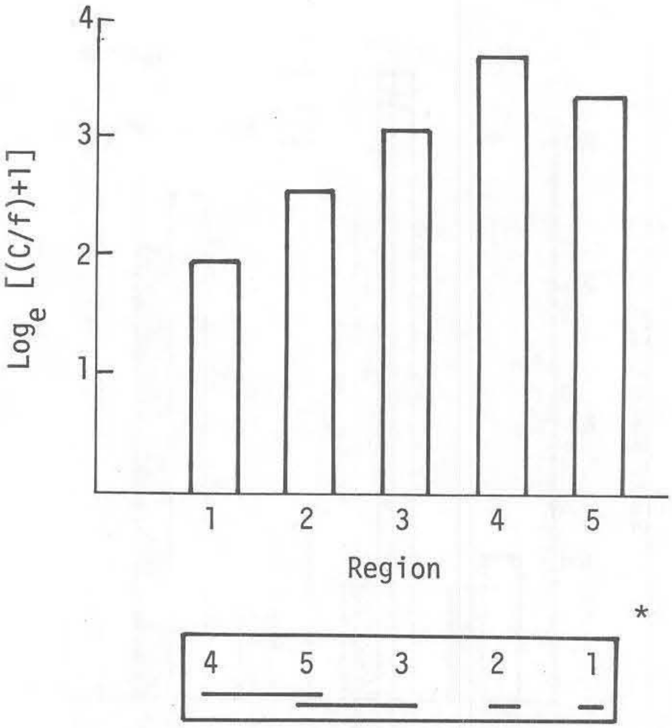


Figure IV-22. Annual Variation in Nearfield Abundance of Young-of-the-Year Alewife at Shallow and Deep Bottom Trawl Stations, 1974 through 1978

c. American Shad

The riverwide distribution of young-of-the-year American shad was similar to that of young-of-the-year alewife (Figures IV-23 and IV-21). Therefore, a greater proportion (relative to blueback herring) of the young-of-the-year American shad population was exposed to the Indian Point intakes and a summer impingement peak was usually observed (Figure IV-24). The fall impingement peak was related to the fall emigration of young-of-the-year American shad population to the sea.



*Regions are shown in order of descending C/f (left to right), a common underline indicates no significant difference ($p < 0.05$). The Indian Point generating station is located in Region 3

Figure IV-23. Mean Regional C/f Values (Transformed) and Results of Multiple Comparison Test* for Young-of-the-Year American Shad Collected during Beach Seine Surveys, 1974 through 1978

Impingement of American shad during 1976 through 1978 was very similar to that observed for alewife. Relative catch indices for impingement were below average (RCI <1.0) throughout 1976, with the exception of a small fall peak, but were relatively high in 1977 and 1978 when both summer and fall impingement peaks were observed (Figure IV-24). The highest impingement of American shad was observed in 1978, rather than in 1977 like alewife. The 1978 summer impingement peak

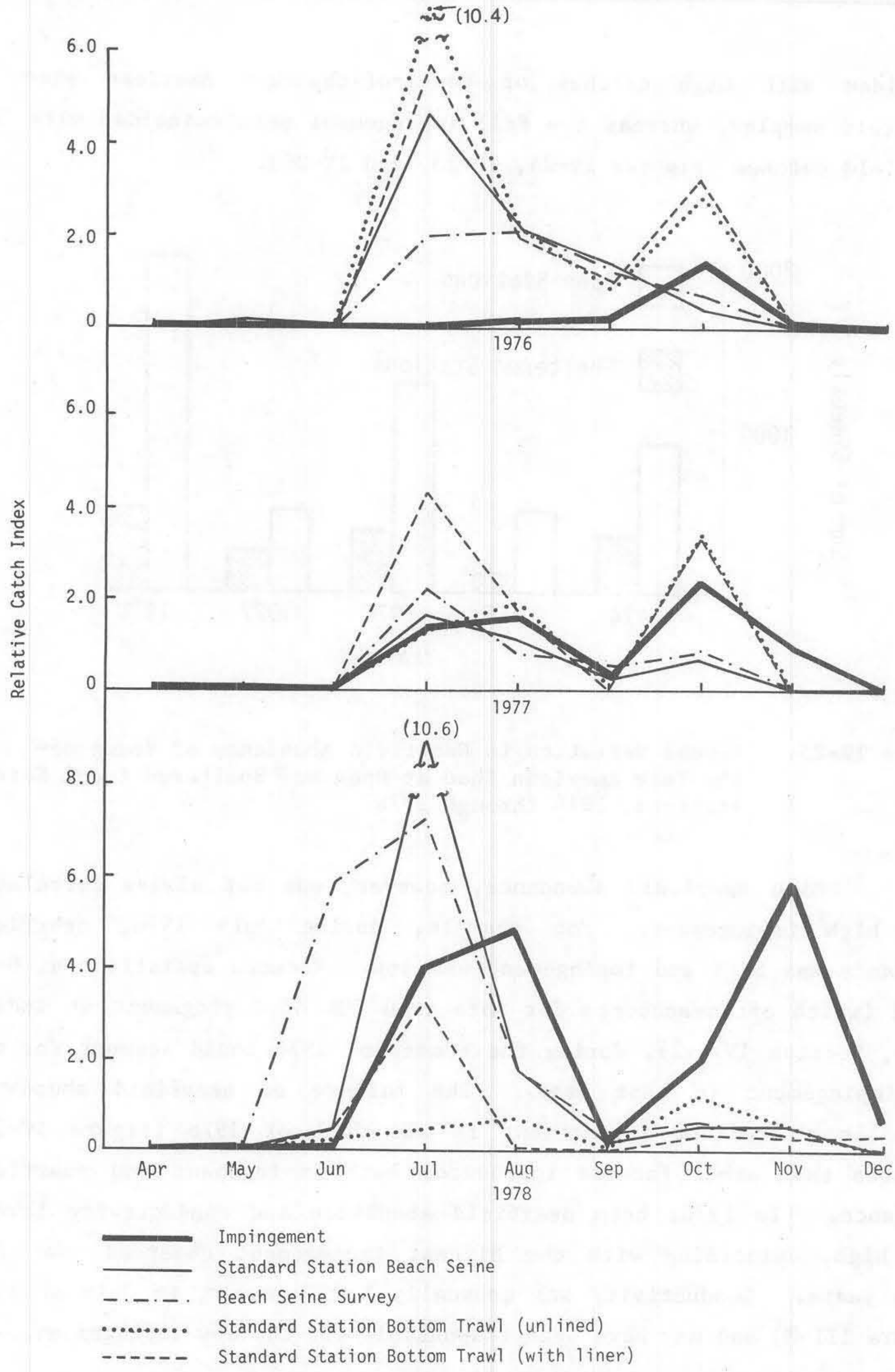


Figure IV-24. Monthly Variations in Indian Point Impingement and Field Collections of American Shad in Indian Point Region (RM 39-46), Hudson River Estuary as Portrayed by Relative Catch Index, 1976 through 1978 coincided with high catches of young-of-the-year American shad in nearfield samples, whereas the fall impingement peak coincided with low nearfield catches (Figures IV-24, IV-25, and IV-26).

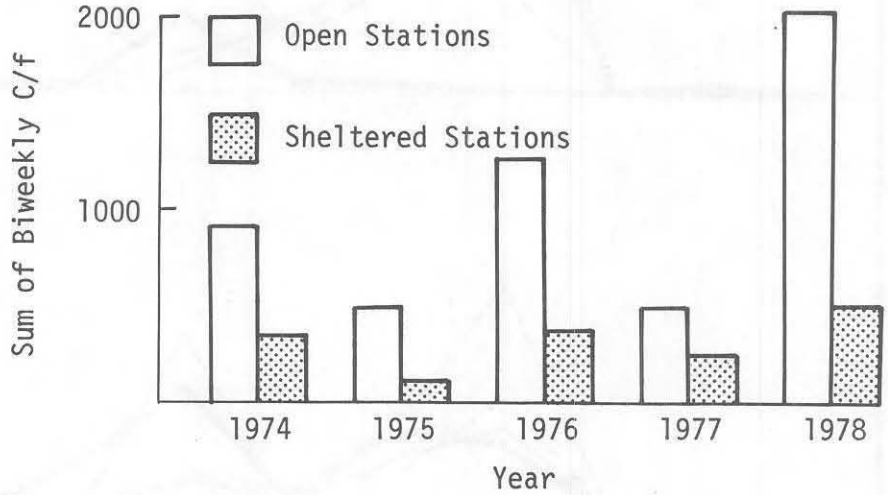


Figure IV-25. Annual Variation in Nearfield Abundance of Young-of-the-Year American Shad at Open and Sheltered Beach Seine Stations, 1974 through 1978

High nearfield abundance, however, was not always correlated with high impingement. For example, during July 1976, nearfield abundance was high and impingement was low. Reduced operations at Unit No. 2 (which often accounts for more than 50% of impingement at Indian Point, Section IV.E.2), during the summer of 1976 could account for the low impingement in that year. The failure of nearfield abundance estimates to reflect impingement in the fall of 1978 (Figure IV-24) suggests that other factors influenced both impingement and nearfield abundance. In 1978, both nearfield abundance and conductivity levels were high, coinciding with the highest impingement observed over the three years. Conductivity was unusually low, however, in July of 1976 (Figure III-3) and may have been responsible for the low impingement.

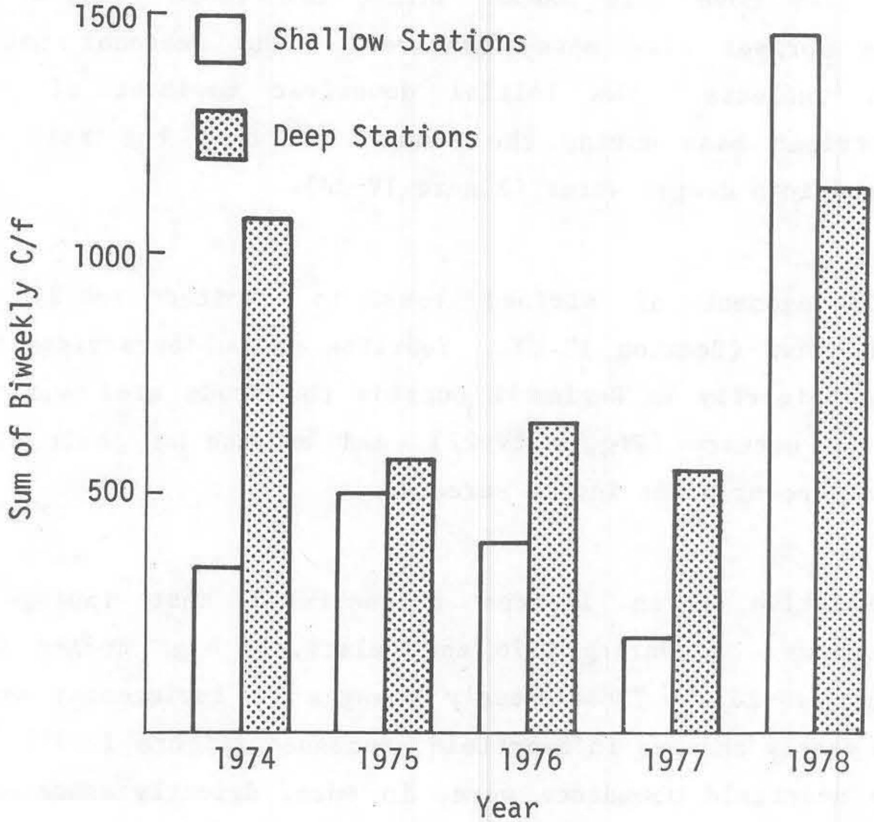


Figure IV-26. Annual Variation in Nearfield Abundance of Young-of-the-Year American Shad at Shallow and Deep Surface Trawl Stations, 1974 through 1978

d. Striped Bass

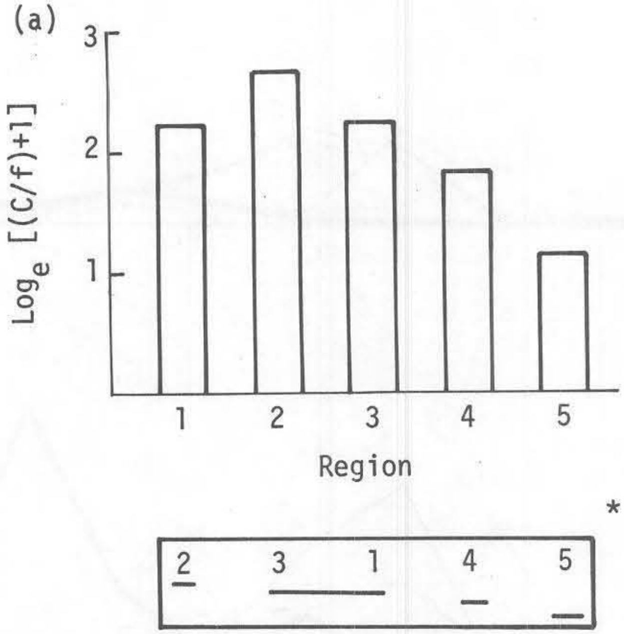
The striped bass, like the three clupeid species discussed above is an anadromous species that spawns in the middle estuary from April through June (TI 1979b). Young-of-the-year striped bass move downriver and by late summer (July through September) the center of the riverwide distribution is in the lower estuary (Figure IV-27). During the summer and fall, young-of-the-year striped bass are primarily in the shore zone and shoals, but as water temperatures decrease with the onset of winter they move into deeper water, and those young-of-the-year distributed upriver also move downriver. The seasonal pattern of impingement reflects the initial downriver movement of young-of-the-year striped bass during the summer and then the fall movement downriver and into deeper water (Figure IV-28).

Impingement of striped bass is limited mostly to the young-of-the-year (Section IV.C). Yearling and older striped bass are distributed primarily in Region 1 outside the study area and near the mouth of the estuary (Figure IV-27), and because of their size, can usually evade power plant intake screens.

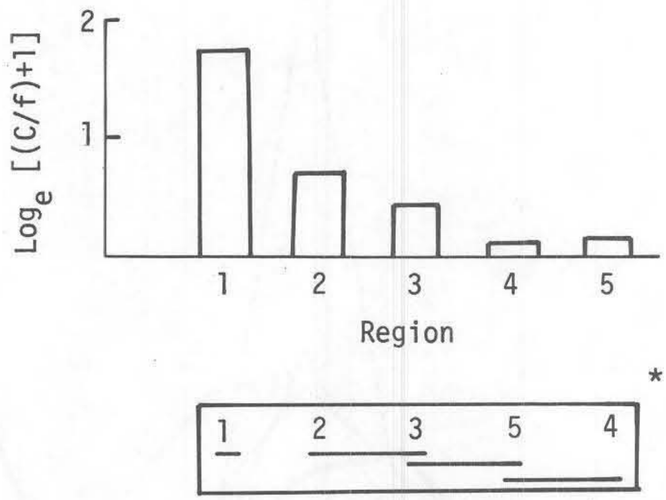
Relative catch indices demonstrated that impingement of striped bass was low during 1976 and relatively high during 1977 and 1978 (Figure IV-28). These yearly changes in impingement were very similar to yearly changes in nearfield abundance (Figure IV-29). Yearly changes in nearfield abundance were, in turn, directly associated with changes in conductivity levels in the Indian Point region; conductivity during 1976 was much lower than in 1977 and 1978 (Figure III-3). Since young-of-the-year striped bass exhibit some preference for the more brackish areas in the estuary, as shown by their longriver distribution (Figure IV-27), then the relatively low conductivity levels at Indian Point in 1976 may have resulted in the low nearfield abundance due to shift in the spatial distribution of the young-of-the-year population.

Levels of impingement in the three years paralleled levels of nearfield abundance (Figure IV-28), but annual differences in timing of the seasonal impingement peaks (such as between 1977 and 1978) suggest

(a)



(b)



*Regions are shown in order of descending C/f (left to right), a common underline indicates no significant difference ($p<0.05$). The Indian Point generating station is located in Region 3

Figure IV-27. Mean Regional C/f Values (Transformed) and Results of Multiple Comparison Test* for Striped Bass Collected during Beach Seine Surveys, 1974 through 1978: a) Young-of-the-Year, b) Yearling and Older

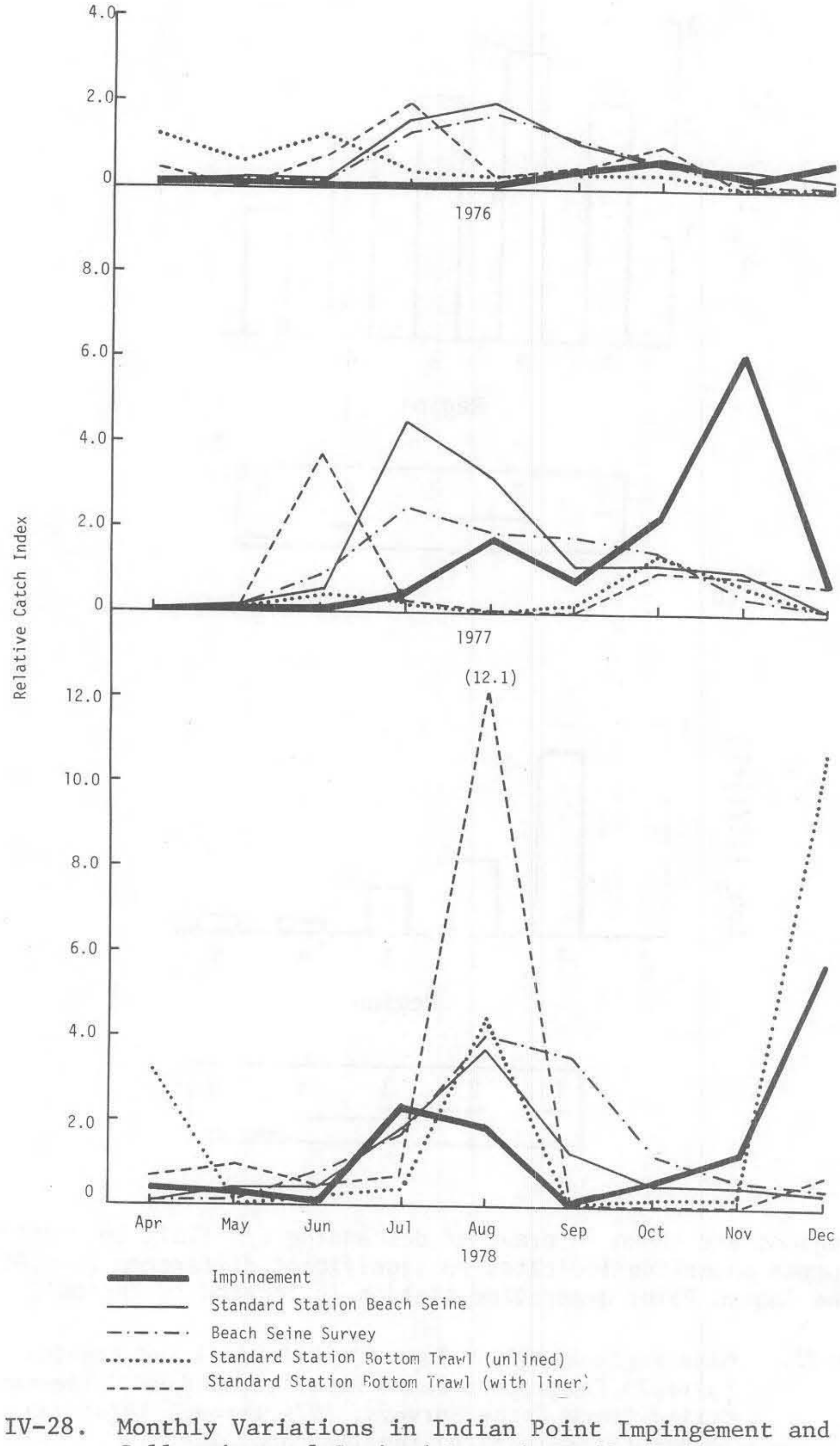


Figure IV-28. Monthly Variations in Indian Point Impingement and Field Collections of Striped Bass in Indian Point Region (RM 39-46) Hudson River Estuary as Portrayed by Relative Catch Index, 1976 through 1978

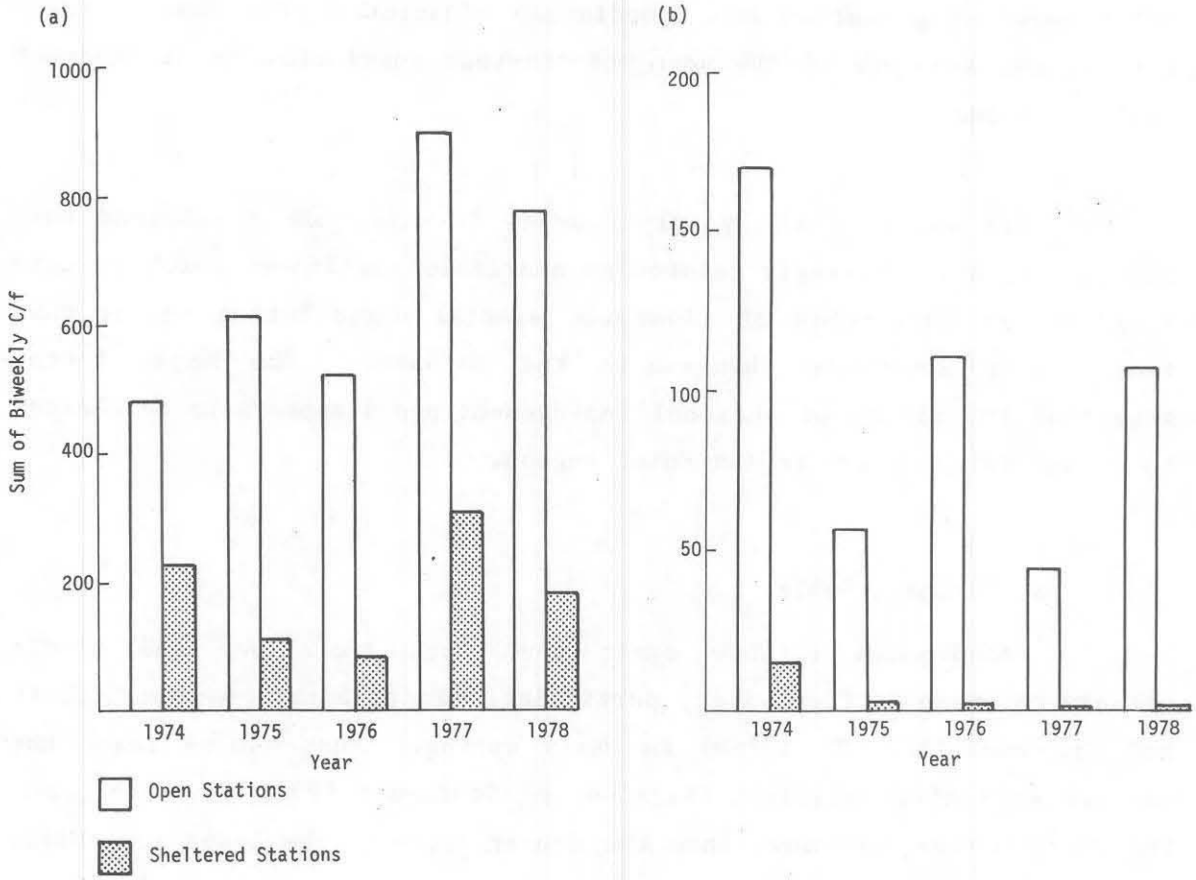


Figure IV-29. Annual Variation in Nearfield Abundance of Striped Bass at Open and Sheltered Beach Seine Stations, 1974 through 1978: a) Young-of-the-Year, b) Yearling and Older

that conductivity levels also affected impingement (Section IV.E.6). The noticeable fall (November) impingement peak during 1977 followed a sharp decline in conductivity in the Indian Point region. The winter increase in impingement during 1978 might have been in response to the persistently high conductivity levels during the fall of 1978 (Figure III-3), but decreasing water temperatures also may be involved.

Young-of-the-year striped bass move into deeper water during late fall as temperatures decrease (TI 1979b); since the intakes at the Indian Point generating station are immediately adjacent to the channel (deep water), the exposure of the young-of-the-year population to impingement would increase.

In summary, the yearly changes in magnitude of striped bass impingement are apparently related to nearfield abundance, which in turn could be an expression of riverwide spatial distribution rather than true yearly abundance changes in the estuary. The major factor affecting the timing of seasonal impingement peaks appears to be changes in conductivity in the Indian Point region.

e. Rainbow Smelt

Anadromous rainbow smelt move into the lower and middle estuary to spawn in freshwater, particularly in tributary streams (Scott and Crossman 1973, TI 1976b) in early spring. Most adults leave the estuary soon after spawning (Bigelow and Schroeder 1953, TI 1976b), and the young-of-the-year move into the deeper areas of the lower and middle estuary in early summer.

Impingement collections revealed a strong contrast between 1976 and 1978 both in magnitude and seasonal peaks (Figure IV-30). Impingement was low throughout 1976 but there were two pronounced seasonal peaks in 1978. Differences between these two years were apparently related to nearfield abundance, as young-of-the-year smelt were about twice as numerous in 1978 (Figure IV-31). Annual nearfield abundance fluctuations could be explained by differences in conductivity within the Indian Point region between 1976 and 1978 (Figure III-3). In 1976, conductivity remained relatively low and may have caused a shift in riverwide distribution so abundance at Indian Point was low. The 1976 year class may also have been relatively weak.

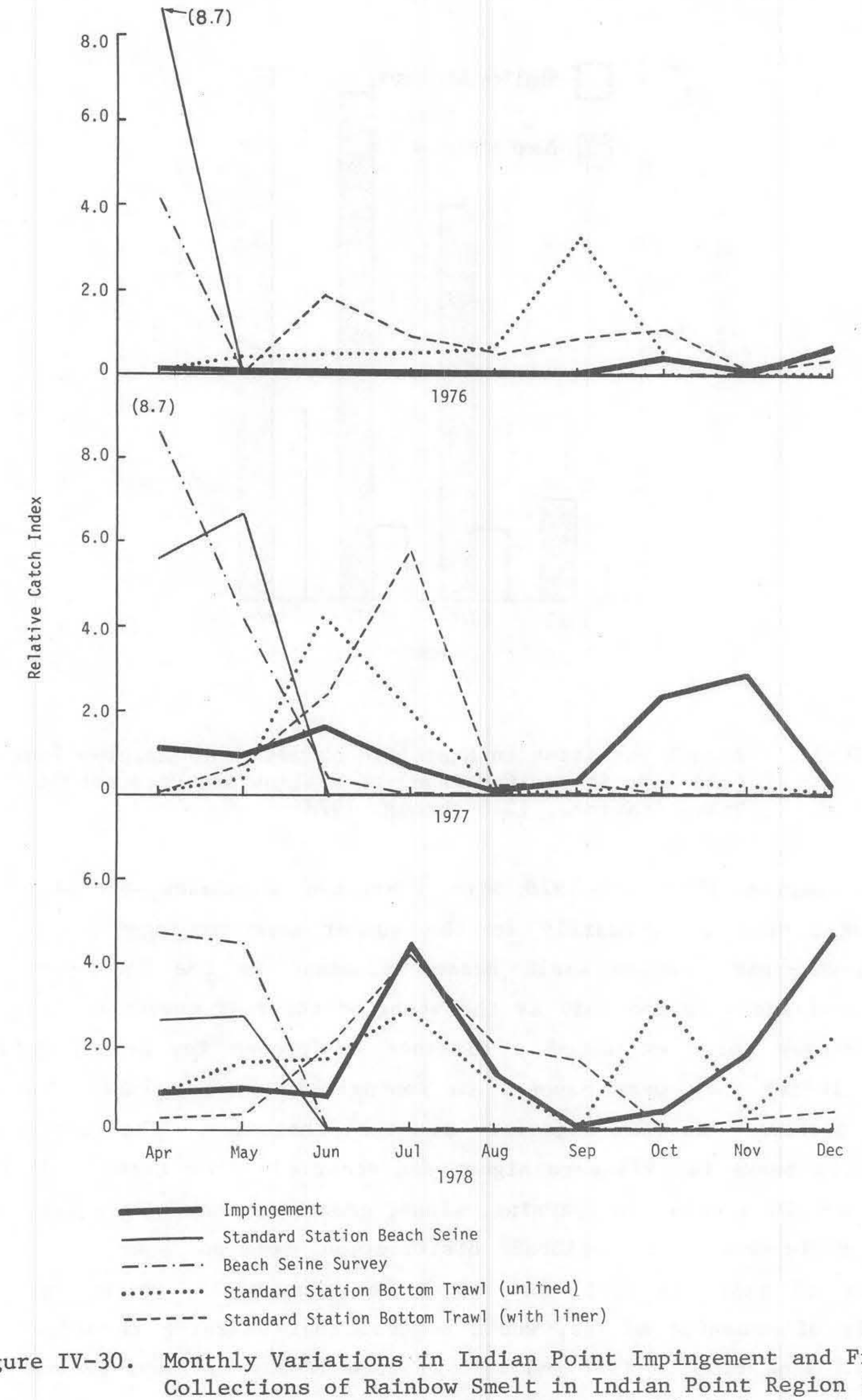


Figure IV-30. Monthly Variations in Indian Point Impingement and Field Collections of Rainbow Smelt in Indian Point Region (RM 39-46), Hudson River Estuary as Portrayed by Relative Catch Index, 1976 through 1978

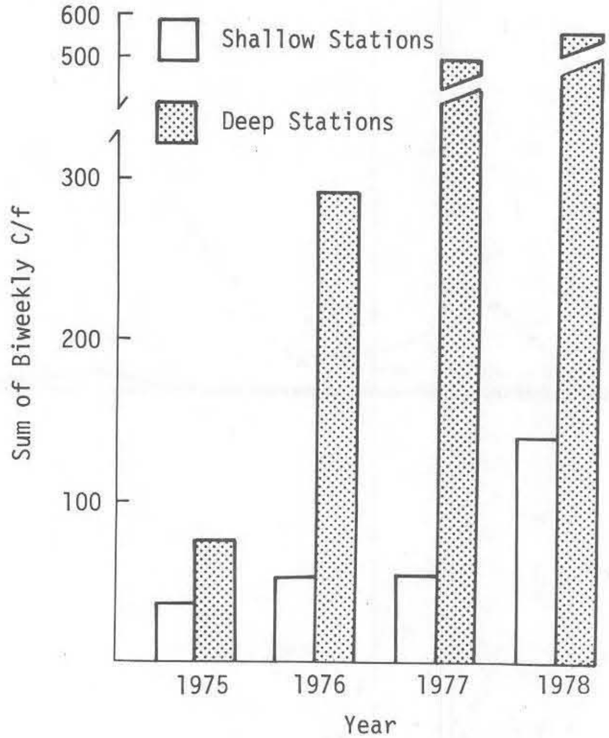


Figure IV-31. Annual Variation in Nearfield Abundance of Rainbow Smelt (All Life Stages Combined) at Shallow and Deep Bottom Trawl Stations, 1975 through 1978

During 1977 and 1978 when nearfield abundance was higher, impingement occurred primarily in the summer when impingeable sized young-of-the-year rainbow smelt became abundant in the Indian Point region, and again in the fall as the young-of-the-year moved downriver. Since rainbow smelt exhibited a distinct preference for deeper water (Figure IV-31) they were exposed to impingement on the Indian Point intake screens located adjacent to the channel. The seasonal impingement peaks in 1978 were higher and occurred later than in 1977, perhaps due to a delay in spawning, slower growth of the young smelt, or slight differences in regional distribution between years. The abundance of smelt in April and May beach seine hauls, which consist primarily of spawning adults, would suggest that spawning occurred at about the same time in 1977 and 1978 (Figure IV-30). Slower growth in

1978 could account for the delayed summer impingement peak, since smelt would reach an impingeable size at a later date, but growth could not explain the delayed fall peak.

The major difference in the Indian Point region between 1977 and 1978 was the seasonal pattern of conductivity changes which subsequently affected the riverwide distribution of smelt. During 1978, the riverwide distribution of rainbow smelt was shifted upriver (Figure IV-32). This change in distribution of smelt was associated with the following changes in conductivity. In 1978, conductivity increased in the Indian Point region almost one month later than in 1977 (Figure III-3). Furthermore, conductivity did not begin to decline in 1978 until December, compared to October in 1977. These differences in the conductivity patterns correlate well with the one-month delay in the summer impingement peak and the two-month delay in the fall impingement peak in 1978; the fall impingement peak is apparently related to the downriver movement of young-of-the-year rainbow smelt associated with changes in conductivity in the Indian Point Region resulting from movement of the salt front. Thus, it appears that conductivity is the major environmental factor controlling the riverwide distribution of rainbow smelt and hence nearfield abundance and impingement (Section IV.E.6).

f. Atlantic Sturgeon

Mature adults of this bottom-dwelling species migrate into the estuary in the spring, move upriver to areas above the salt front, and spawn during May and June (Dovel 1978, Con Edison 1978c). The adults remain in the estuary until autumn and then return to the sea. Young-of-the-year Atlantic sturgeon are first collected in the middle and upper estuary during June, move downstream during the summer, and overwinter in the warmer waters of the lower and middle estuary (Dovel 1978). The next spring the yearlings move upriver again. Immature

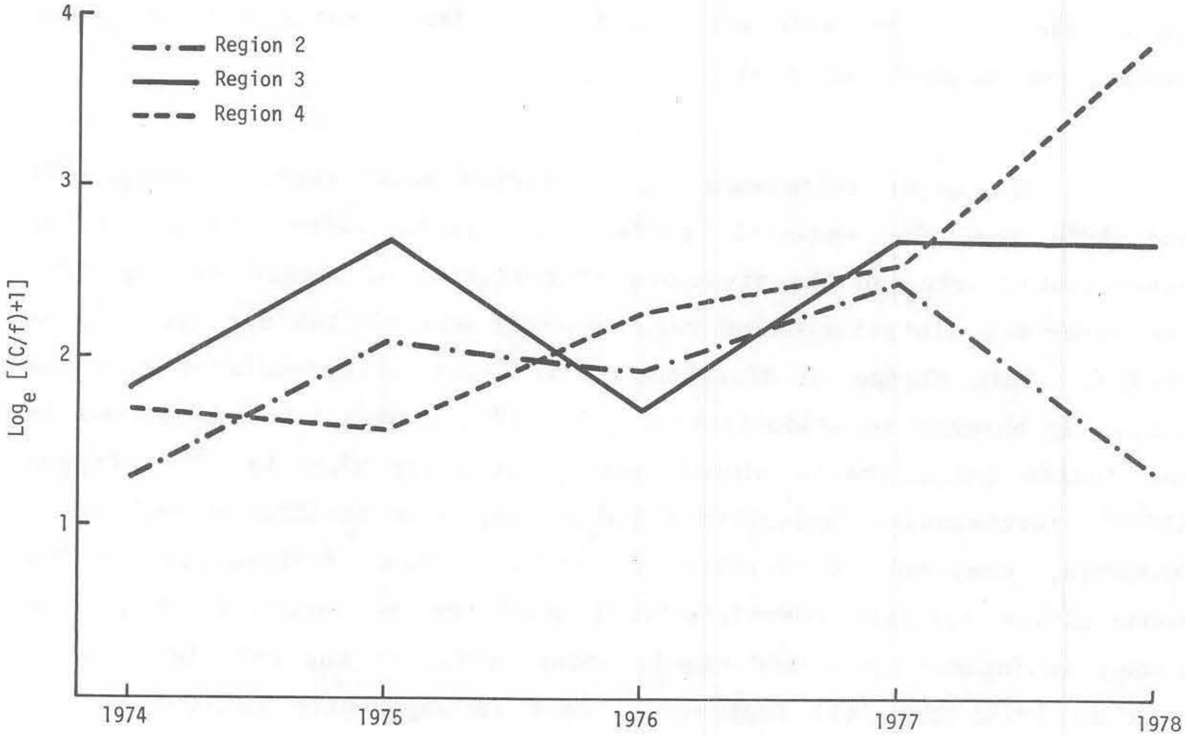


Figure IV-32. Mean Regional C/f Values (Transformed) for Rainbow Smelt (All Life Stages Combined) Collected during Interregional Trawl Surveys, 1974 through 1978

sturgeon follow this pattern for several years, moving upriver in the spring and downriver during summer, and then migrate to the ocean where they mature (Dovel 1978).

Although immature Atlantic sturgeon may move past the Indian Point generating station several times each year for several years, they are less vulnerable to impingement than many species because they usually swim near the bottom and rapidly reach a size which enables them to evade the intake screens. Since impingement and nearfield trawl catches of Atlantic sturgeon from 1976 through 1978 were usually low and/or sporadic (250 and 24 fish respectively), it was not practical to compute relative catch indices or perform statistical analyses of abundance trends.

3. Lower or Middle Estuarine Species

There are several species present in the Hudson River estuary whose distribution is limited primarily to the lower or middle estuary from approximately RM 12 through RM 61. Some of these, such as the Atlantic tomcod, bay anchovy, and hogchoker, utilize the estuary for spawning and as a nursery area while others, such as bluefish and weakfish, are marine species that use the estuary only for a nursery area. During the summer, young-of-the-year of all four of the above species, as well as adult bay anchovy, are collected in the Indian Point nearfield and are present in impingement collections. During the fall, impingement of these species declines as they move out of the Indian Point region. Most of these species overwinter in or near the ocean, but Atlantic tomcod move upriver during the late fall and winter towards the spawning grounds in the middle estuary.

a. Atlantic Tomcod

The Atlantic tomcod spawns mostly within the middle estuary during late December and January (TI 1979b). Young-of-the-year are abundant in the estuary during early summer and their distribution within the lower and middle estuary is governed by their preference for brackish waters (TI 1979b). A general downstream movement occurs through the summer as the young-of-the-year move to the deeper cooler waters (TI 1979b, Con Edison 1978c). Very few yearling and older Atlantic tomcod are caught in the estuary; they mature during the first year of life, migrate downstream after spawning and only a few return to spawn again (TI 1979b).

Atlantic tomcod impingement and nearfield seine and trawl collections during 1976 through 1978 revealed a definite relationship between nearfield abundance and the magnitude of impingement, and between yearly differences in abundance and conductivity levels in the Indian Point region (Figure IV-33). In 1976, conductivity levels at Indian Point remained low throughout the year (Figure III-3) and nearfield abundance of young-of-the-year tomcod was also low (Figures IV-34 and IV-33). Impingement of Atlantic tomcod during 1976 was, as expected, the lowest of the three years. In 1977, conductivity increased steadily through May and June and reached levels above 7 mS/cm by mid-summer. Nearfield abundance and impingement were high in 1977. In 1978, conductivity levels, nearfield abundance, and impingement rates were intermediate between 1976 and 1977.

Although the spring increases in impingement reflected the spring increase in conductivity levels at Indian Point, the decrease in impingement during late summer reflected decreasing nearfield abundance, which was probably a response to increasing water temperatures (TI 1979b) rather than changes in conductivity. The absence of a decrease in conductivity levels during 1978 (Figure III-3) did not delay the late summer decrease in impingement.

Ninety-eight percent of the Atlantic tomcod collected by standard station bottom trawls at Indian Point were caught at the deep water stations (Figure IV-34). This preference for deep water indicates that most young-of-the-year Atlantic tomcod were in the channel area adjacent to the the Indian Point intakes. Potential impingement impact on this species is also considerable since they were more abundant at Indian Point (Region 3) and in the region immediately upriver (Region 4) than they were at Region 2, downriver from Indian Point (Figure IV-35).

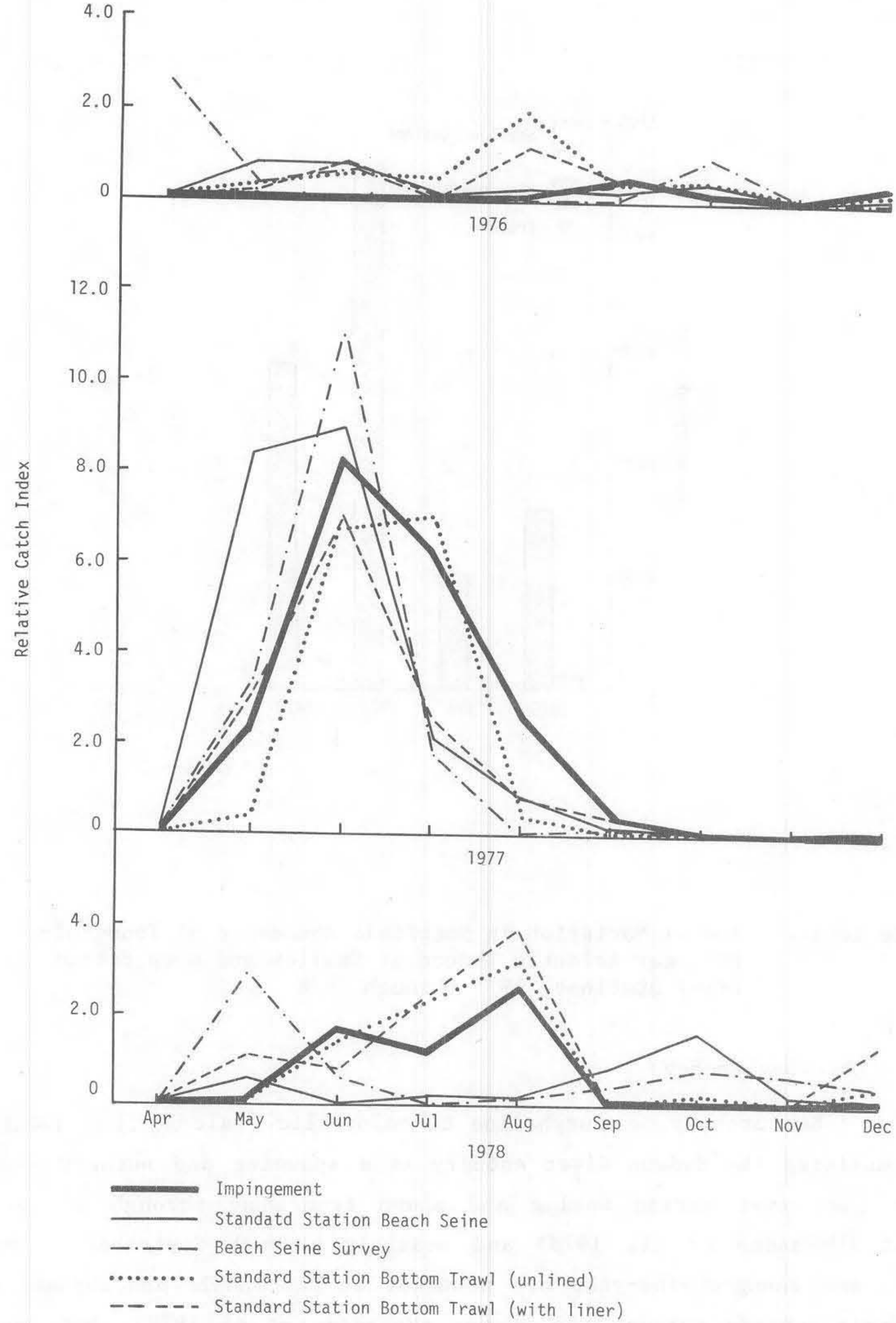


Figure IV-33. Monthly Variations in Indian Point Impingement and Field Collections of Atlantic Tomcod in Indian Point Region (RM 39-46), Hudson River Estuary as Portrayed by Relative Catch Index, 1976 through 1978

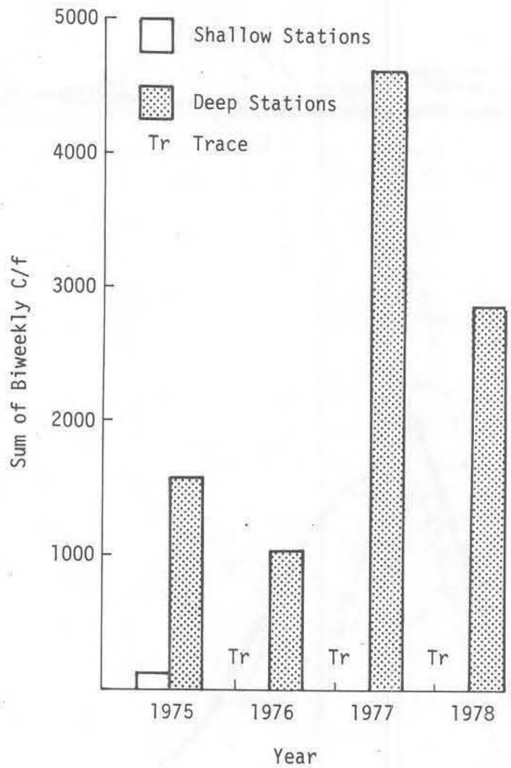
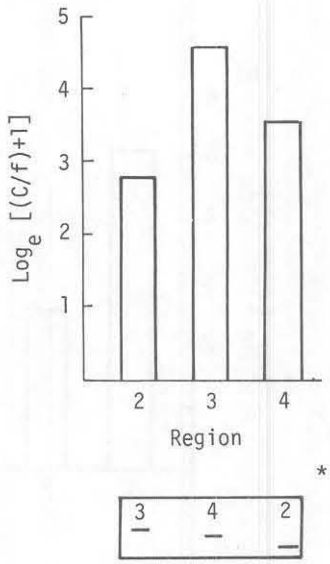


Figure IV-34. Annual Variation in Nearfield Abundance of Young-of-the-Year Atlantic Tomcod at Shallow and Deep Bottom Trawl Stations, 1975 through 1978

b. Bay Anchovy

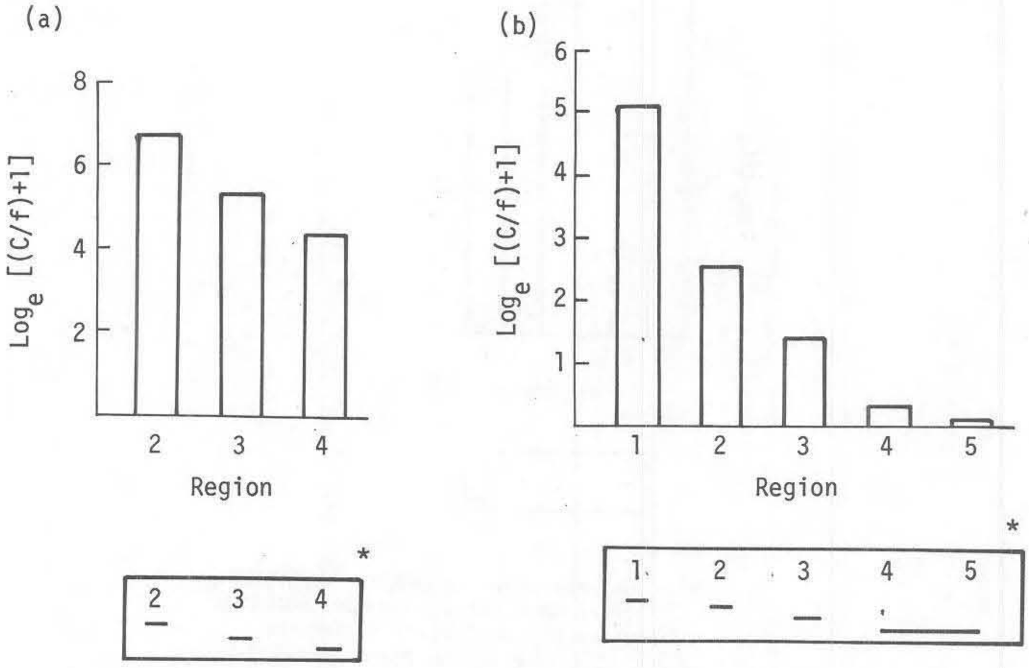
Bay anchovy, a euryhaline to halophilic (salt-loving) species that utilizes the Hudson River estuary as a spawning and nursery area, enter the river during spring and spawn from June through at least August (McFadden et al. 1978) and possibly through September. Both adults and young-of-the-year are abundant in the shoals and channel of the lower estuary through the summer (McFadden et al. 1978), but their abundance decreases progressively upriver (Figure IV-36).



*Regions are shown in order of descending C/f (left to right), a common underline indicates no significant difference ($p < 0.05$). The Indian Point generating station is located in Region 3

Figure IV-35. Mean Regional C/f Values (Transformed) and Results of Multiple Comparison Test* for Young-of-the-Year Atlantic Tomcod Collected during Interregional Trawl Surveys, 1974 through 1978

Relative catch indices, based on nearfield and impingement sampling, indicated that levels of impingement and abundance were variable from year to year and that impingement did not generally coincide with nearfield abundance (Figure IV-37). Impingement during 1976 was very low while nearfield seine and trawl samples indicated that bay anchovy were relatively abundant at Indian Point. In 1976, Unit No. 2, which appears to impinge more bay anchovy than Unit No. 3 (Section IV.E.2.), was not operational for much of the summer and this may have been the cause for the low impingement that year. Conversely, in 1978,



*Regions are shown in order of descending C/f (left to right), a common underline indicates no significant difference ($p<0.05$). The Indian Point generating station is located in Region 3

Figure IV-36. Mean Regional C/f Values (Transformed) and Results of Multiple Comparison Test* of Bay Anchovy (All Life Stages Combined) Collected during: a) Interregional Trawl Surveys and, b) Beach Seine Surveys, 1974 through 1978

nearfield abundance was relatively low, but impingement was high. Only in 1977, was there some correlation between nearfield abundance and impingement. During 1977 nearfield bottom trawl catches closely tracked the summer peak in impingement (Figure IV-37).

Nearfield sampling with bottom trawls suggested that bay anchovy preferred shallow to deepwater areas, but a comparison of surface and bottom trawl C/f data also showed that they were numerous in

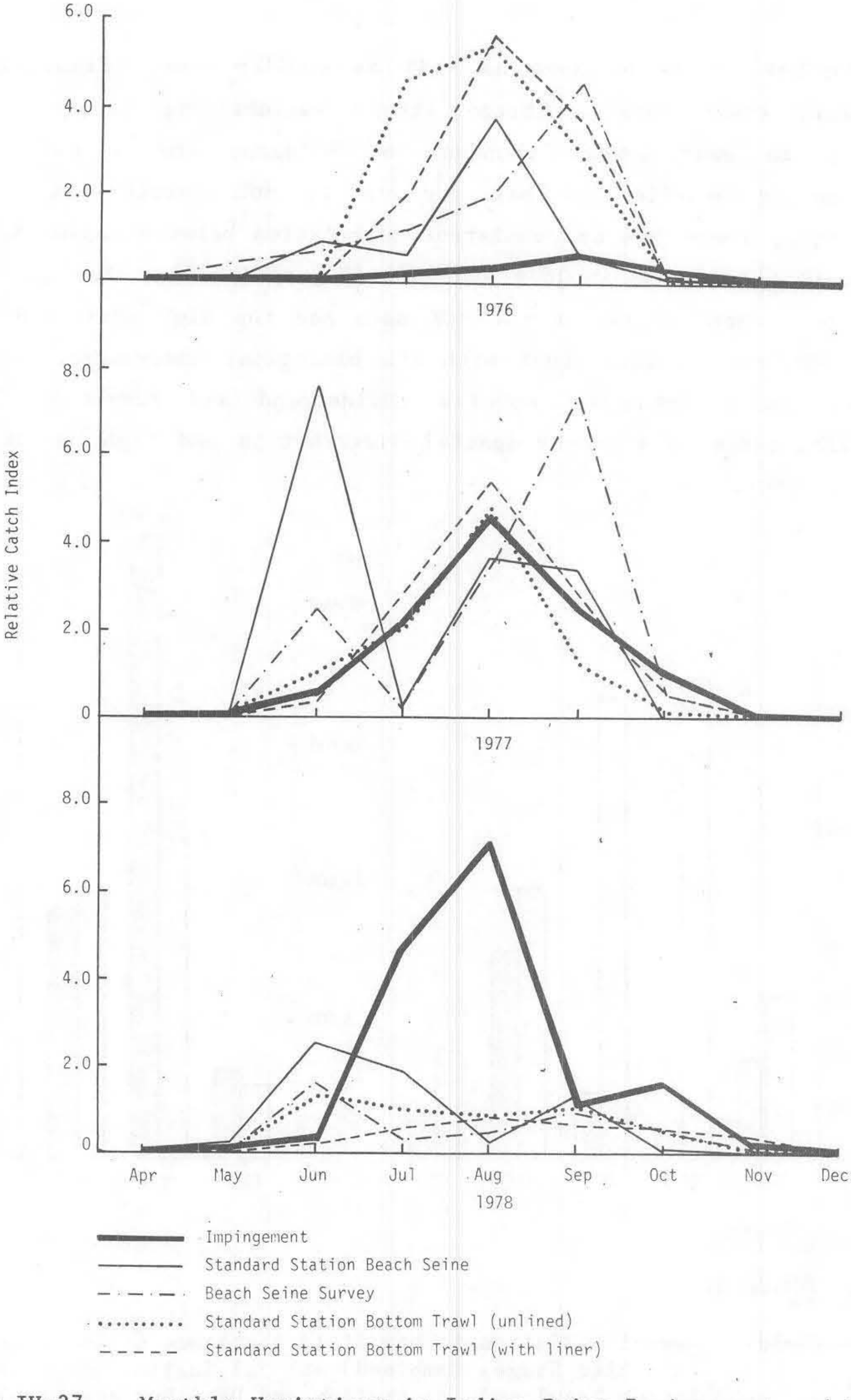


Figure IV-37. **Monthly Variations in Indian Point Impingement and Field Collections of Bay Anchovy in Indian Point Region (RM 39-46), Hudson River Estuary as Portrayed by Relative Catch Index, 1976 through 1978** the surface layers of deep as well as shallow areas (Figure IV-38). Nearfield trawl data exhibited strong variability, especially with respect to year-to-year changes in abundance and a clear depth distribution profile for bay anchovy is not readily discernible. Futhermore, there was no consistent correlation between impingement and nearfield collections in 1976 and 1978 (Figure IV-37). The absence of consistent correlations in the RCI data and the high variation in the trawl catches are consistent with the biological observation that bay anchovy is a schooling species (Hildebrand and Schroeder, 1928). Schooling leads to a patchy spatial distribution and high variation in trawl catches.

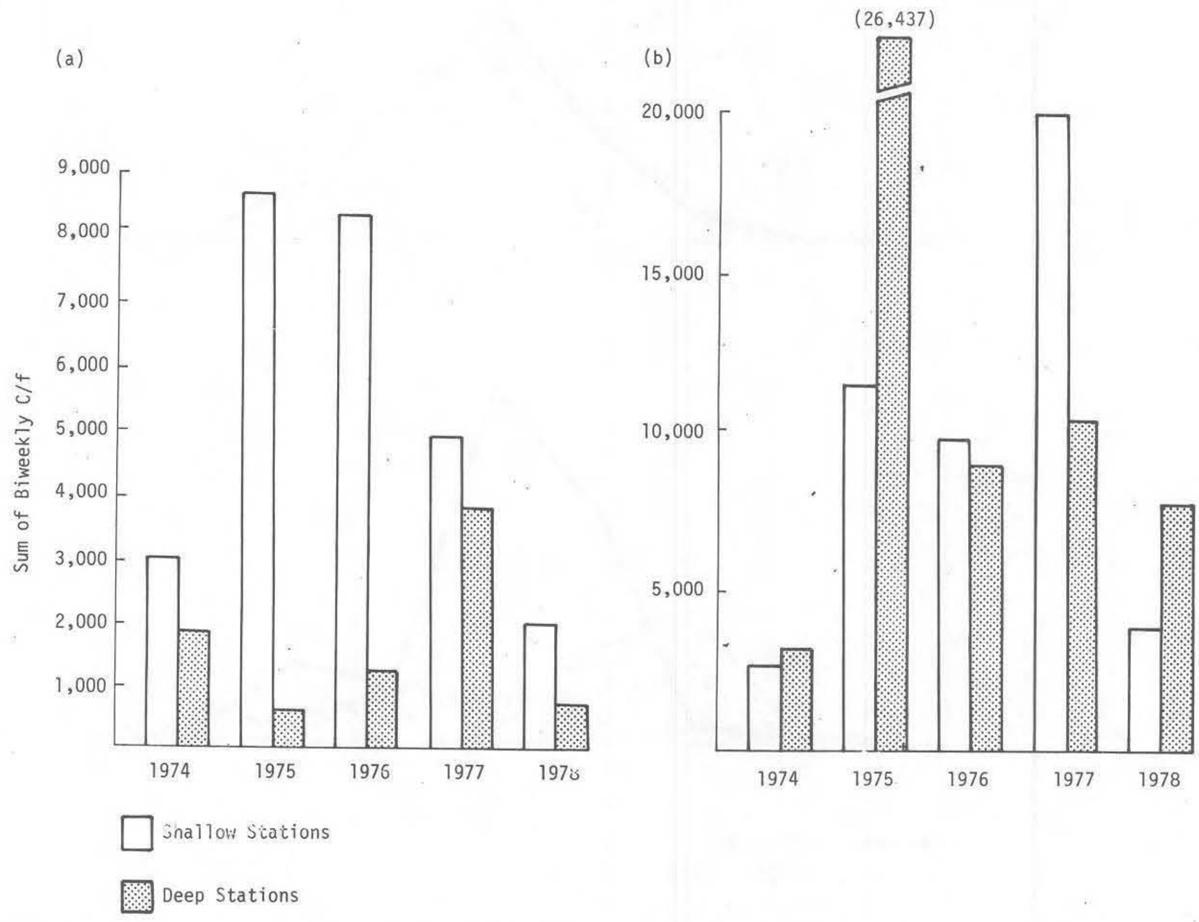
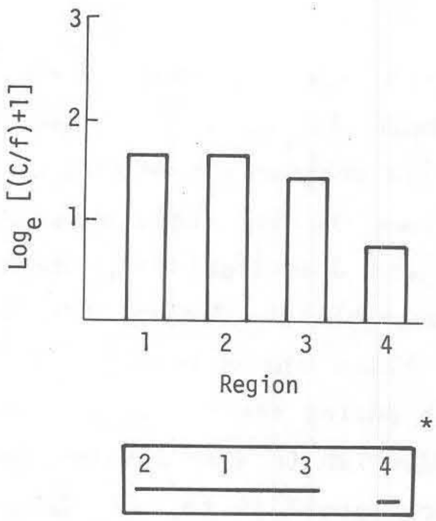


Figure IV-38. Annual Variation in Nearfield Abundance of Bay Anchovy (All Life Stages Combined) at: a) Shallow and Deep Bottom Trawl and, b) Shallow and Deep Surface Trawl Stations, 1974 through 1978

c. Bluefish

Bluefish is a marine species which spawns offshore near the edge of the continental shelf during July and August. Schools of immature fish, commonly called snappers, move into harbors and estuaries from Delaware Bay to Cape Cod and use these areas as nursery grounds during the summer (Bigelow and Schroeder 1953, Clark and Smith 1971). The range of young bluefish within the Hudson River estuary is limited to brackish water regions below the salt front (TI 1976f), and the center of their distribution during the summer was located in the lower estuary (Figure IV-39). Bluefish is also a warm-water species that is abundant only at temperatures above 14 to 16°C (Bigelow and Schroeder 1953), so its presence in the vicinity of Indian Point is limited to the summer months when conductivity in the Indian Point Region is elevated. This accounted for the low numbers in the nearfield and impingement collection in April and May, the rapid increases in all RCI's from May through July, and the decline in nearfield abundance and impingement by late September (Figure IV-40).

Water temperature was not an important factor related to differences in the magnitude or timing of impingement peaks observed in 1976 through 1978, because seasonal water temperature trends were similar during all three years (Figure III-3). Conductivity however, does appear to be related to the magnitude or timing of impingement peaks (Section IV.E.6.), but does not seem to be a major controlling factor. During 1978, the summer impingement peak occurred a month later than in 1977 and the sharp rise in conductivity was also one month later in 1978 (Figures IV-40, III-3). However, if conductivity was a major factor then the impingement peak in 1976 should have also been delayed because conductivity did not increase until July of that year, but the peak was not delayed.



*Regions are shown in order of descending C/f (left to right), a common underline indicates no significant difference ($p < 0.05$). The Indian Point generating station is located in Region 3

Figure IV-39. Mean Regional C/f Values (Transformed) and Results of Multiple Comparison Test* for Young-of-the-Year Bluefish Collected During Beach Seine Surveys, 1974 through 1978

Relative catch indices indicated that both nearfield catches and impingement rates for bluefish were highest in 1977, as compared to 1976 and 1978 (Figure IV-40). These differences in impingement among the three years were likely related to the size of the bluefish population in the nearfield. Yearly differences in conductivity levels in the nearfield during 1976 through 1978 were apparently not important. During both 1977 and 1978 summer conductivity levels at Indian Point were favorable for bluefish but high impingement rates were observed only in 1977 when bluefish were most abundant in the area, compared to 1976 and 1978 (Figures IV-40, IV-41).

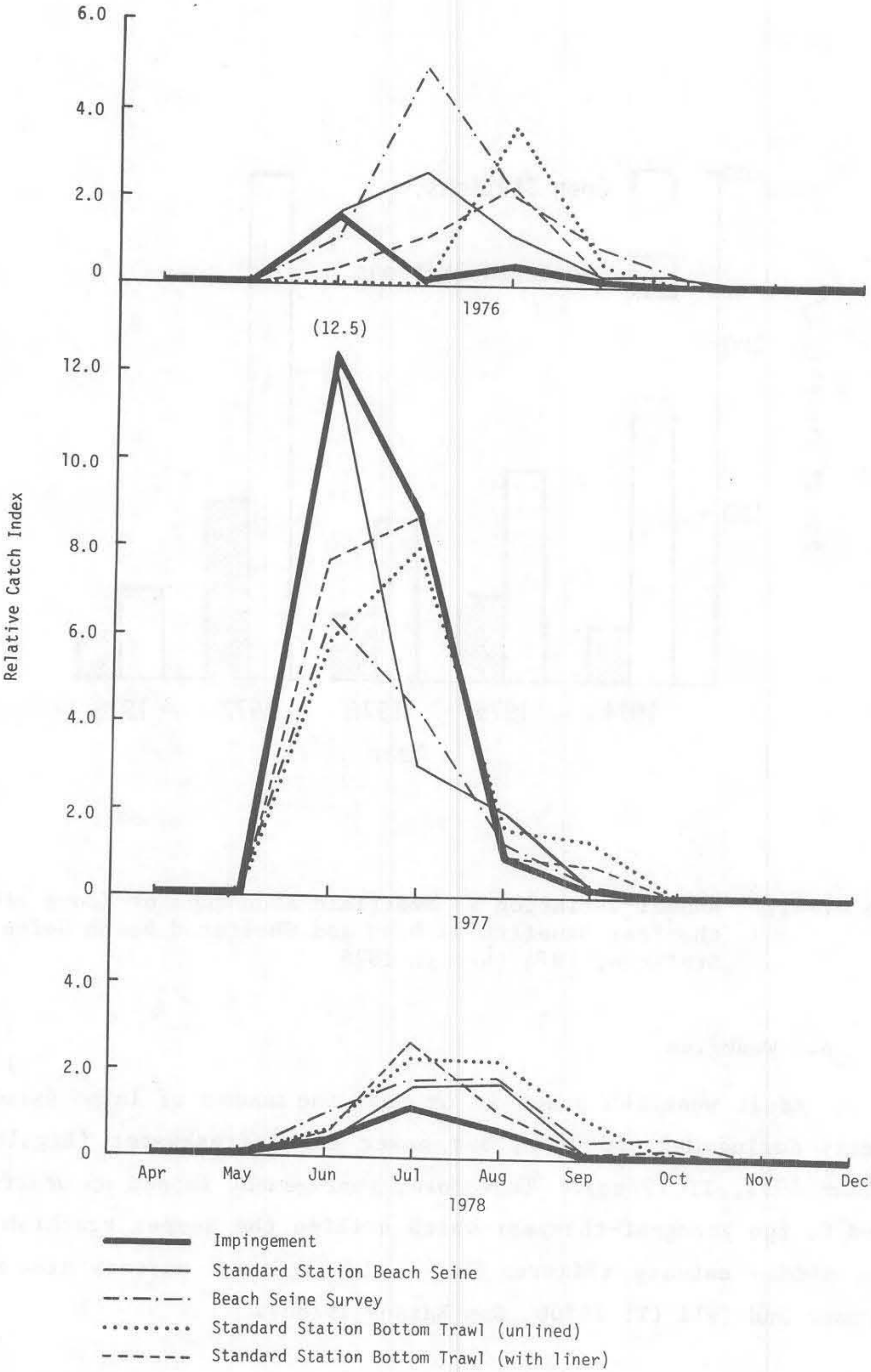


Figure IV-40. Monthly Variations in Indian Point Impingement and Field Collections of Bluefish in Indian Point Region (RM 39-46), Hudson River Estuary as Portrayed by Relative Catch Index, 1976 through 1978

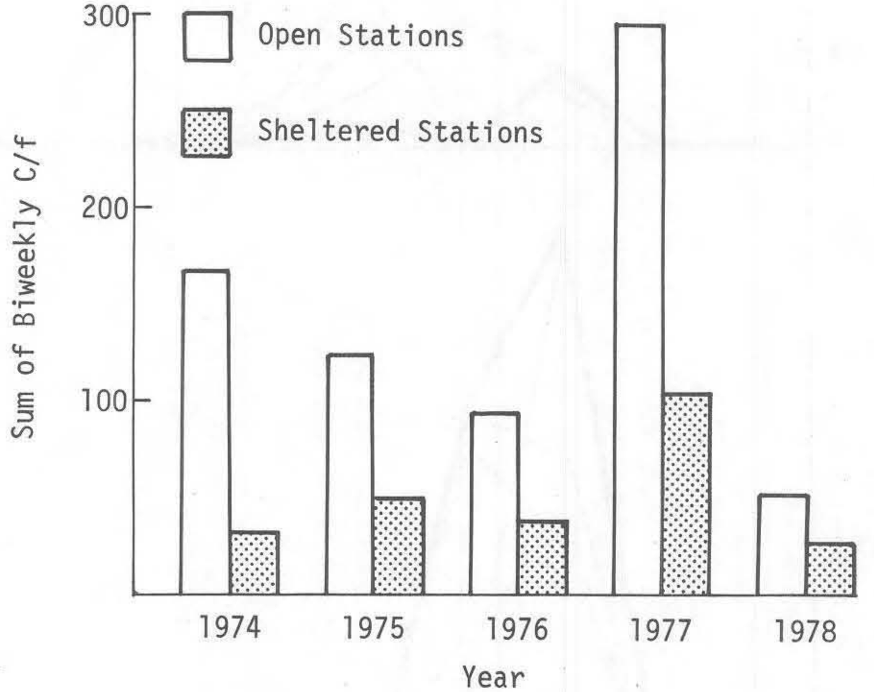


Figure IV-41. Annual Variation in Nearfield Abundance of Young-of-the-Year Bluefish at Open and Sheltered Beach Seine Stations, 1974 through 1978

d. Weakfish

Adult weakfish spawn in or near the mouths of large estuaries, primarily during May and June, but never enter freshwater (Bigelow and Schroeder 1953, TI 1976b). Therefore, impingement impact on weakfish is limited to the young-of-the-year which utilize the deeper brackish areas of the middle estuary (Figures IV-42, IV-43) as a nursery area during the summer and fall (TI 1976b, Con Edison 1978c).

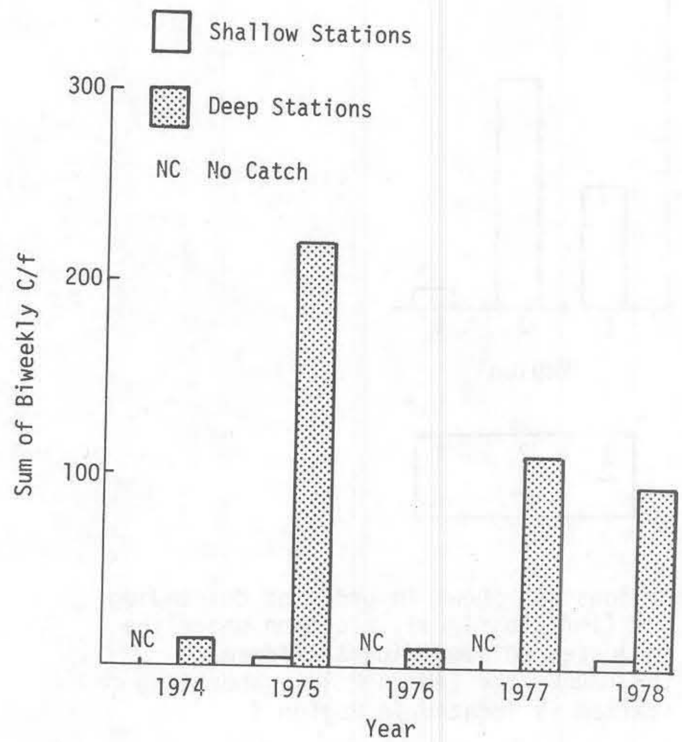
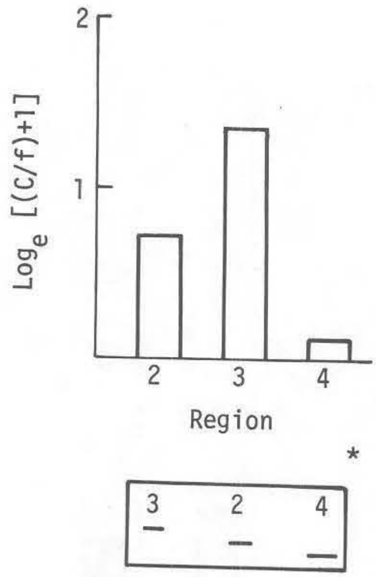


Figure IV-42. Annual Variation in Nearfield Abundance of Young-of-the-Year Weakfish at Shallow and Deep Bottom Trawl Stations, 1974 through 1978

The seasonal pattern of impingement tended to reflect the movement of young weakfish into the estuary (Figure IV-44), but the patterns observed in 1977 and 1978 were quite different suggesting that factors other than nearfield abundance also affect the impingement of weakfish (Section IV.E.6). The low level of impingement during 1976 was probably a direct reflection of the low weakfish abundance in that year (Figures IV-42, IV-44). However, nearfield abundance was similar in 1977 and 1978 with respect to magnitude and seasonal peaks, but the impingement peak in 1978 was much higher and occurred earlier than in 1977.



*Regions are shown in order of descending C/f (left to right), a common underline indicates no significant difference ($p < 0.05$). The Indian Point generating station is located in Region 3

Figure IV-43. Mean Regional C/f Values (Transformed) and Results of Multiple Comparison Test* for Young-of-the-Year Weakfish Collected during Interregional Trawl Surveys, 1974 through 1978

Weakfish movement into the Indian Point area, and thus impingement, is probably affected by conductivity levels as was the case of bluefish, another marine species that use the estuary as nursery areas. Conductivity levels in the Indian Point region increased sharply during late May in 1977; while in 1978, increased conductivity was not observed until late June. Conductivity levels generally increase in the Indian Point region in the spring or summer when freshwater flows diminish. The sharp increase in conductivity in 1978 (Figure III-3) coincided with the large impingement RCI values (Figure IV-44),

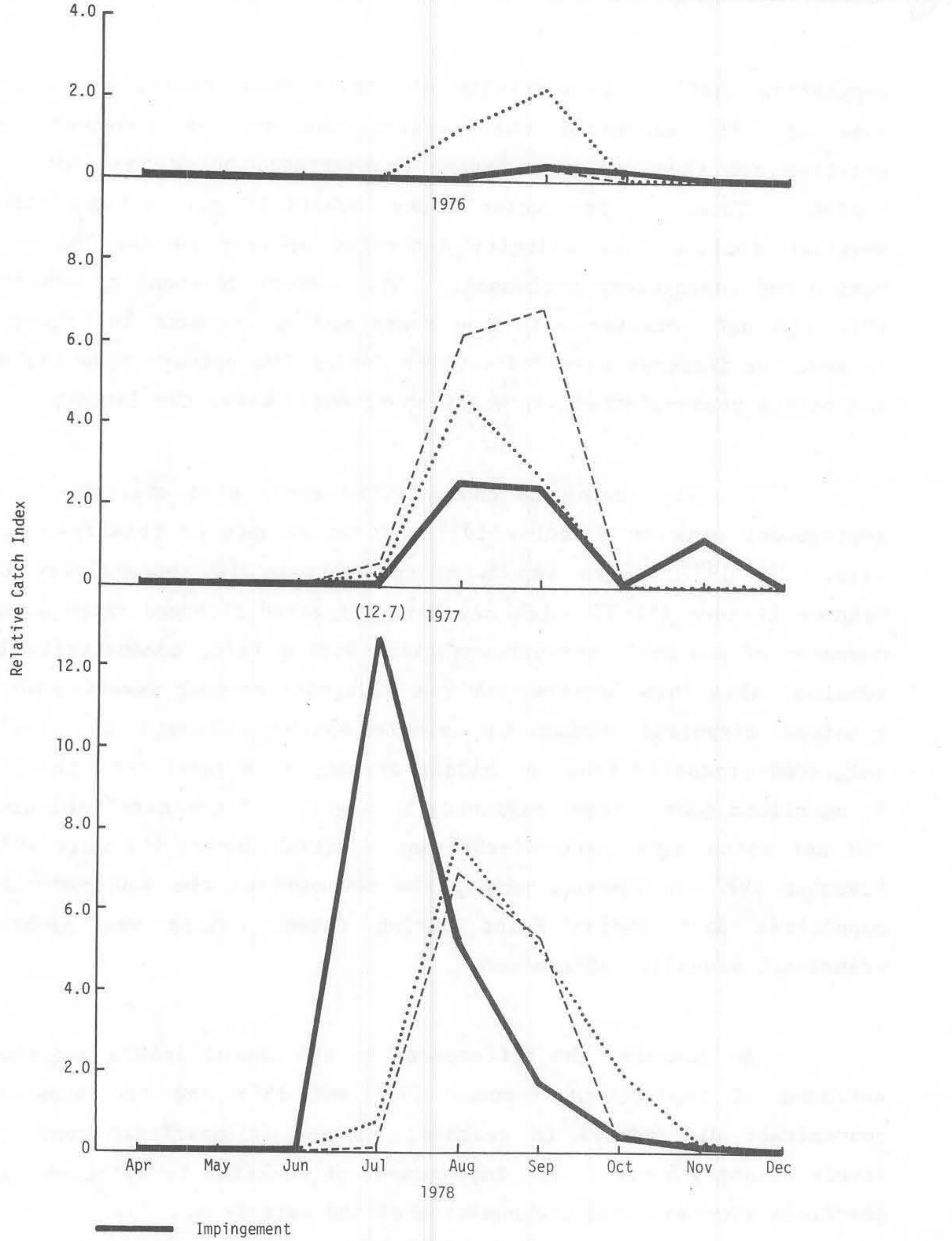


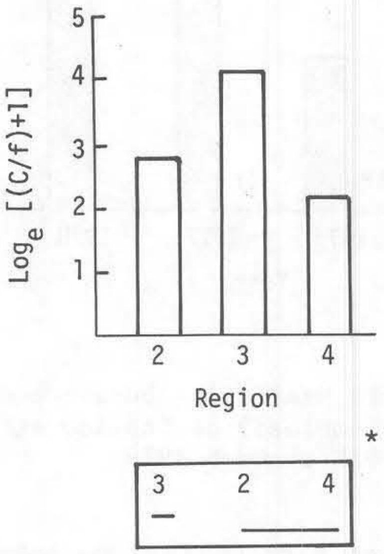
Figure IV-44. Monthly Variations in Indian Point Impingement and Field Collections of Weakfish in Indian Point Region (RM 39-46), Hudson River Estuary as Portrayed by Relative Catch Index, 1976 through 1978 suggesting that low conductivity at Indian Point during late May-early June of 1978 prevented the upriver movement of young-of-the-year weakfish and they may have become concentrated below the Indian Point region. Then, as freshwater flows subsided, the young-of-the-year weakfish followed the salinity intrusion upriver to the Indian Point region and impingement increased. The upriver movement of weakfish in 1977 did not coincide with the sharp spring increase in conductivity because the increase occurred earlier during the primary spawning period and before young-of-the-year weakfish normally enter the estuary.

A sharp change in conductivity might also explain the small impingement peak in November 1977 and the absence of this fall peak in 1978. In 1977, there was a sharp decrease in conductivity during October (Figure III-3) which may have triggered a concentrated downriver movement of young-of-the-year weakfish. During 1978, conductivity levels remained high into December so the young-of-the-year weakfish may have remained dispersed within the middle estuary through the fall, or emigrated gradually from the middle estuary as suggested by the decline in nearfield gear catches beginning in August. Since nearfield sampling did not catch many young-of-the-year weakfish during the July 1978 and November 1977 impingement peaks, the movement of the young-of-the-year population past Indian Point during these periods was probably a transient, wave-like phenomenon.

In summary, the differences in the annual levels and seasonal patterns of impingement between 1977 and 1978 and the presence of concomitant differences in seasonal changes in nearfield conductivity levels strongly suggest that impingement of weakfish is affected both by nearfield abundance and the position of the salt front.

e. Hogchoker

This small flatfish is most common in brackish waters of bays and estuaries (Bigelow and Schroeder 1953, TI 1976b), and is generally considered to be a resident of the lower and middle Hudson River estuary. Spawning occurs during late spring and summer (Hildebrand and Schroeder 1928). Hogchoker, after their first appearance in samples during August, spend the cold months of the year at the bottom of shoal and channel areas. By early fall, the center of riverwide distribution for hogchoker in the Hudson River estuary was the Indian Point region (Figure IV-45). Within the Indian Point region, hogchoker were most abundant in deep water (Figure IV-46).



*Regions are shown in order of descending C/f (left to right), a common underline indicates no significant difference ($p < 0.05$). The Indian Point generating station is located in Region 3

Figure IV-45. Mean Regional C/f Values (Transformed) and Results of Multiple Comparison Test* for Hogchoker (All Life Stages Combined) Collected during Interregional Trawl Surveys, 1974 through 1978

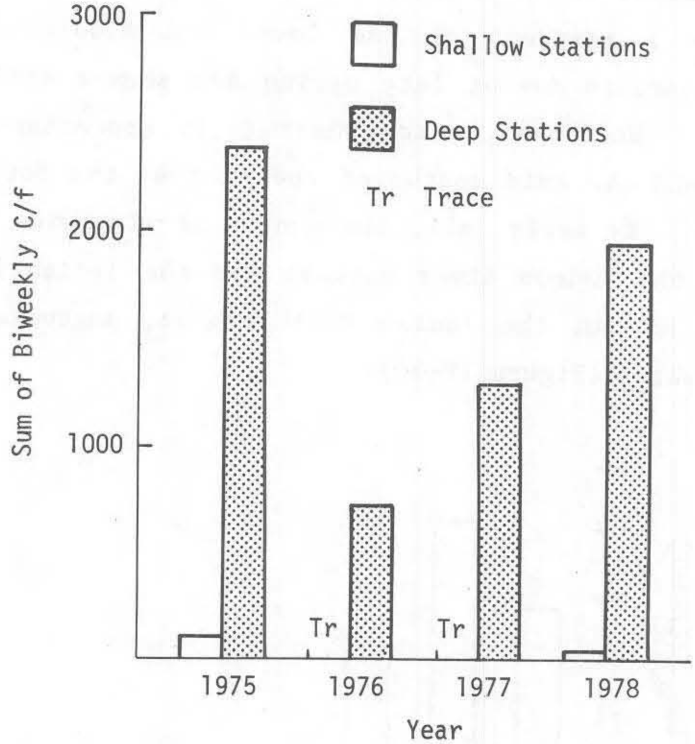


Figure IV-46. Annual Variation in Nearfield Abundance of Hogchoker (All Life Stages Combined) at Shallow and Deep Bottom Trawl Stations, 1975 through 1978

The seasonal impingement pattern for hogchoker exhibited two peaks, a small one in May reflecting increased activity as water temperatures increased and a prominent peak during the fall when seasonal abundance at Indian Point was highest (Figure IV-47). The level of impingement was low during 1976 and reflected the low nearfield abundance (Figures IV-46, IV-47). Nearfield abundance increased in 1977 and 1978 and impingement increased correspondingly. Seasonal peaks in impingement, however, did not correlate well with seasonal peaks in nearfield abundance (Figure IV-47). For example, the September peak in nearfield abundance in 1977 was probably associated with rapidly

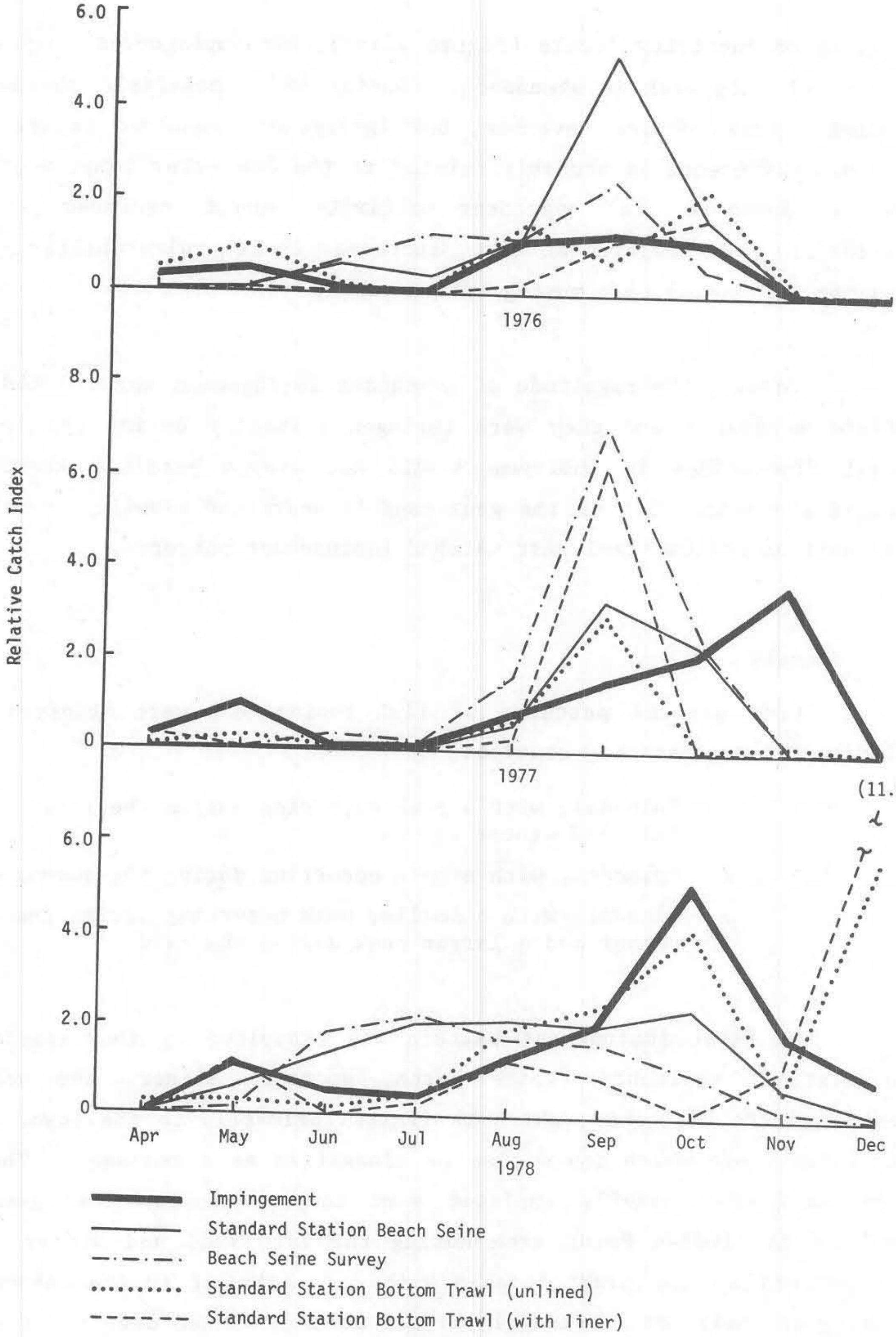


Figure IV-47. Monthly Variations in Indian Point Impingement and Field Collections of Hogchoker in Indian Point Region (RM 39-46), Hudson River Estuary as Portrayed by Relative Catch Index, 1976 through 1978 decreasing conductivity levels (Figure III-3), but impingement rates did not parallel this peak in abundance. During 1978, nearfield abundance increased sharply during November, but impingement remained relatively low. This difference is probably related to the low water temperatures, since a decrease in hogchoker activity would decrease their vulnerability to impingement but increase their vulnerability (by decreasing avoidance) to a moving bottom trawl.

Overall, the magnitude of hogchoker impingement was related to nearfield abundance and they were impinged primarily during the fall. Seasonal flucuations in impingement did not always parallel seasonal nearfield abundance, but of the gear used in nearfield sampling, catches in the unlined bottom trawl best matched impingement patterns.

4. Summary

Three general patterns of fish impingement were observed at the Indian Point generating station:

1. Unimodal, with a peak occurring during the late fall and winter
2. Unimodal, with a peak occurring during the summer
3. Bimodal, with a smaller peak occurring during the summer and a larger peak during the fall

The first impingement pattern was exhibited by four species, three distinct residents (white perch, spottail shiner, and white catfish) and the hogchoker, which is limited primarily to the lower and middle estuary but which could also be classified as a resident. These species were most heavily impinged when they moved into the deeper channel in the Indian Point area during the late fall and winter and became exposed to the plant intakes which are adjacent to the channel. The timing of their late fall-early winter movements into deep water was affected by year-to-year variations in the position and movement of the salt front during the fall. The offshore movements of these species and subsequent increases in impingment were delayed when conductivity levels in the Indian Point region remained high through December.

The second impingement pattern was exhibited by the four halophilic or euryhaline species (Atlantic tomcod, bay anchovy, bluefish, and weakfish) utilizing primarily the lower regions of the Hudson River estuary. These species were most heavily impinged during the summer when they moved upriver into the Indian Point region as the salt front moved into the middle estuary and conductivity near Indian Point increased. The timing and magnitude of the summer impingement peaks for these four species were affected by the timing and rate of salt front movement. A delay in the movement of the salt front appeared to aggregate these species so that when the salt front finally moved upriver their movements into or through the Indian Point region were sudden and concentrated. As a result, the highest impingement rates were associated with delayed but rapidly increasing conductivities in the Indian Point region.

The third impingement pattern was exhibited by five anadromous species (alewife, American shad, blueback herring, striped bass, and rainbow smelt). These species were impinged during the summer as individuals of the young-of-the-year population grew to impingeable size or as the larvae, spawned in the upper estuary, transformed to juveniles and moved downriver into the middle and lower estuary. A second and larger impingement peak occurred during the fall as the young-of-the-year populations of these five species moved offshore and migrated downriver past the Indian Point station. Summer impingement of these five species was relatively low when the salt front was located upriver from the Indian Point region, and high when the salt front was down-river from Indian Point. Fall impingement peaks were relatively low when the salt front moved gradually downriver during the fall, but relatively high if the salt front descended rapidly.

These results indicate that at least three factors are involved in determining seasonal and yearly trends in fish impingement at the Indian Point generating station: species, size of the young-of-the-year population (i.e., nearfield abundance), and the dynamic behavior of the salt front which causes variation in conductivity levels near Indian Point. The latter factor determines the intensity of the exposure of each species to the power plant during a given season by influencing the riverwide distribution of the populations.

E. EFFECTS OF BEHAVIOR AND/OR ENVIRONMENTAL FACTORS IN IMPINGEMENT RATES

1. Introduction

Variations in impingement rates are inextricably associated with the daily and seasonal behavioral and abundance patterns of fishes, fluctuations in key environmental factors such as temperature or salinity, and power plant related factors. Impingement collections monitored throughout 1978 were analyzed with emphasis on explaining periodic variations in impingement by examining variations in environmental factors, fish abundance in the river, and plant related factors. Of particular interest were 1) differences in impingement rates between Units No. 2 and No. 3, 2) diel variations in impingement, 3) extent of the river over which fish may travel prior to being impinged (range of influence), 4) physicochemical and plant operational factors affecting impingement, and 5) physicochemical factors affecting nearfield abundance.

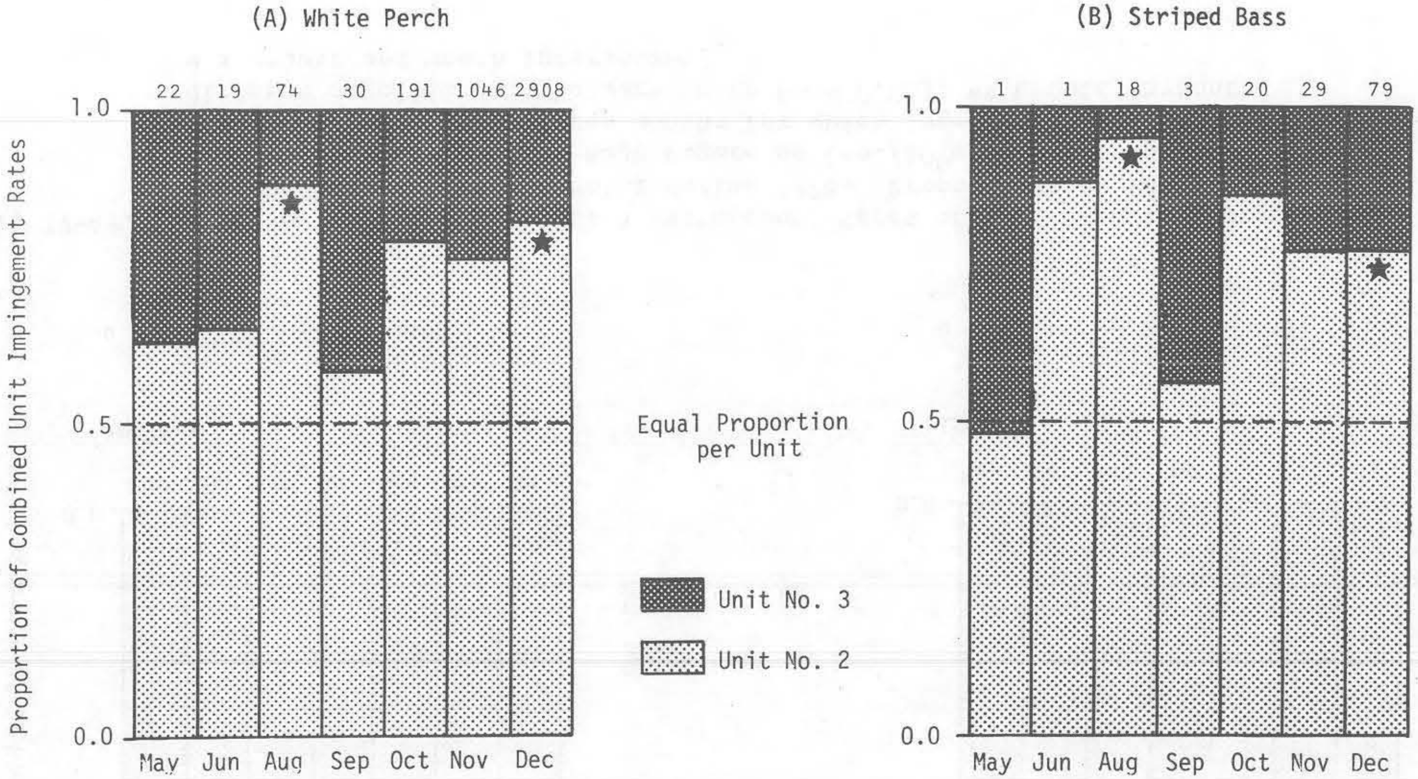
2. Comparison of Impingement Rates between Unit No. 2 and Unit No. 3

Indian Point Units No. 2 and No. 3 were compared with regard to 1978 impingement rates for each of ten species of fish. Selection of these species was based on their abundance in impingement collections and comparisons based on selected adjusted impingement rates (Sections IV.A and B) using only those days when both units operated simultaneously (Appendix Table A-20). Seven months (May, June, August, September, October, November, December) could be tested. No comparison was possible for January through April because Unit No. 2 did not begin operating with its normal complement of fixed traveling screens until 24 May 1978. July was also omitted because Unit No. 3 did not operate.

A two-way analysis of variance for unequal numbers of replicates (Winer 1971) was performed on each month's daily impingement rates ($\alpha = 0.05$) after transformation [$\log_{10}$ (x +1)] to ensure homogeneity of variance. Tukey's HSD (Honestly Significant Difference) test (Kirk 1968) was used subsequent to ANOVA to determine the source of the significant unit effect in the presence of a significant unit x month interaction. For purposes of visual comparison, a combined impingement rate (numbers/10^6m^3) was calculated for each month at both units utilizing the same (though not transformed) selected data used in the ANOVA. The proportion of the combined rate contributed by each unit was then determined and presented in the form of histograms.

For eight of the ten species examined (striped bass, white perch, Atlantic tomcod, blueback herring, bay anchovy, hogchoker, weakfish, and rainbow smelt), there was a significant ($\alpha = 0.05$) difference in impingement rates between Unit No. 2 and Unit No. 3 for all seven months combined (Figures IV-48 to IV-51). American shad and alewife (Figure IV-52) were the only species examined for which no unit difference was detected. In every case where an overall statistical difference was found, Unit No. 2 contributed more than 50% of the combined impingement rate during most months. The significant interactions between month and unit for each species indicated that the impingement rate at Unit No. 2 was not significantly greater than that at Unit No. 3 in every month. Tukey's HSD test revealed few months within which a significant ($\alpha = 0.05$) difference could actually be detected between units for any species. This was because substantial variation among daily impingement rates for some months resulted in lack of statistical significance between units in spite of the fact that mean rates for those months were sometimes greater than the mean rates in months where significant differences were found (Figure IV-48, IV-50, and IV-51). In every case in which a significant difference was found the rate of Unit No. 2 was greater than the rate at Unit No. 3.

High variability among daily impingement rates at the two units was sufficiently large, both in this analysis and in a similar analysis of 1977 data (TI 1979c), that any general inference regarding differences in impingement rates between the two units is tenuous. The 1977 analyses suggested a seasonal difference in impingement rates between the two units with Unit No. 3 apparently impinging fish at a greater rate during summer months and Unit No. 2 impinging fish at



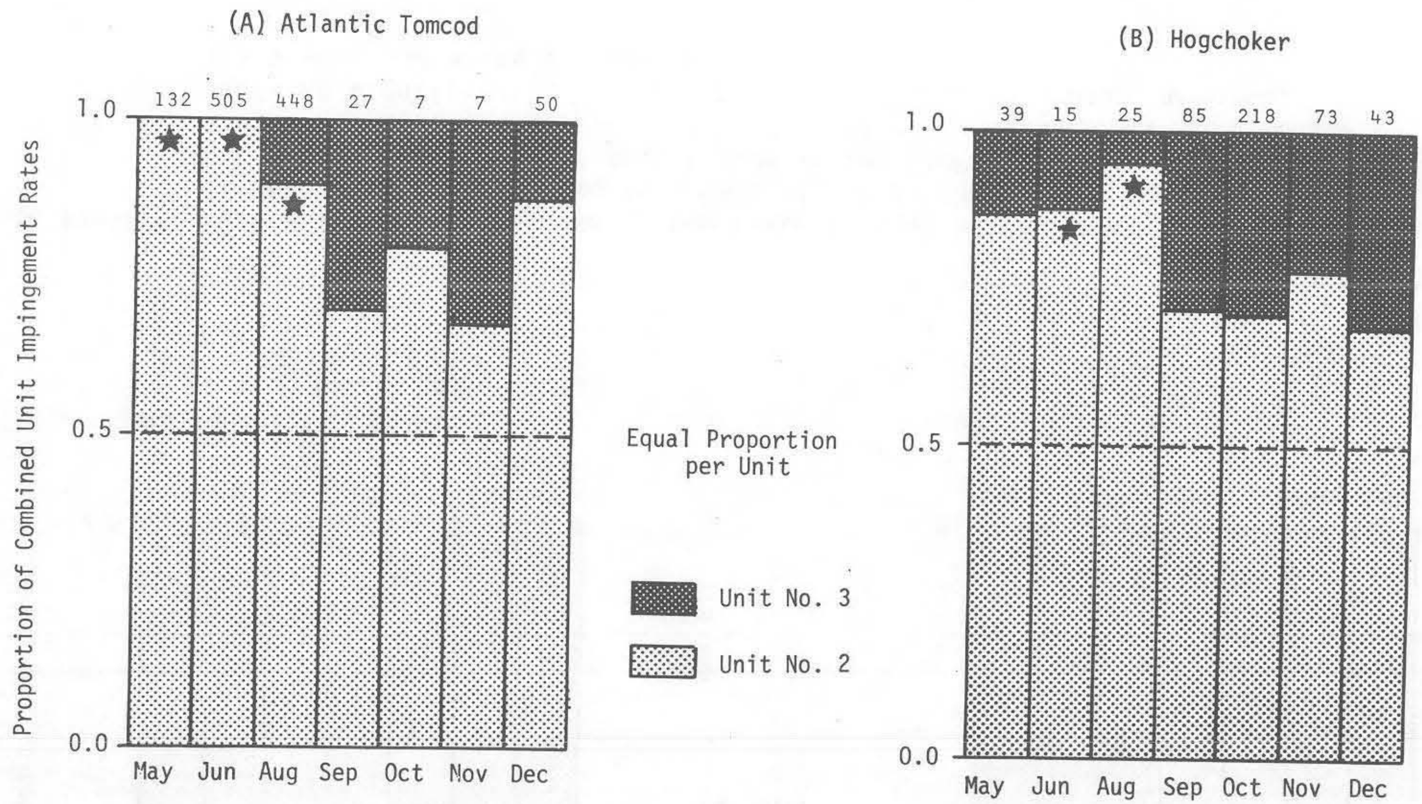
(A) White Perch

ANOVA**	F	p
u	32.81	0.0001
m	46.21	0.0001
u x m	2.27	0.0396

(B) Striped Bass

ANOVA**	F	p
u	34.31	0.0001
m	37.23	0.0001
u x m	3.93	0.0011

Figure IV-48. Unit No. 2 versus Unit No. 3 Impingement Rates of (A) White Perch and (B) Striped Bass at Indian Point during 1978. Proportions of Combined Unit Rate Presented at Top of Each Figure as (no./10^6/m^3) Attributable to Each Individual Unit [★Indicates months for which log-transformed daily rates differed significantly between units ($\alpha = 0.05$); ** u=unit, m=month, u x m=unit and month interaction]



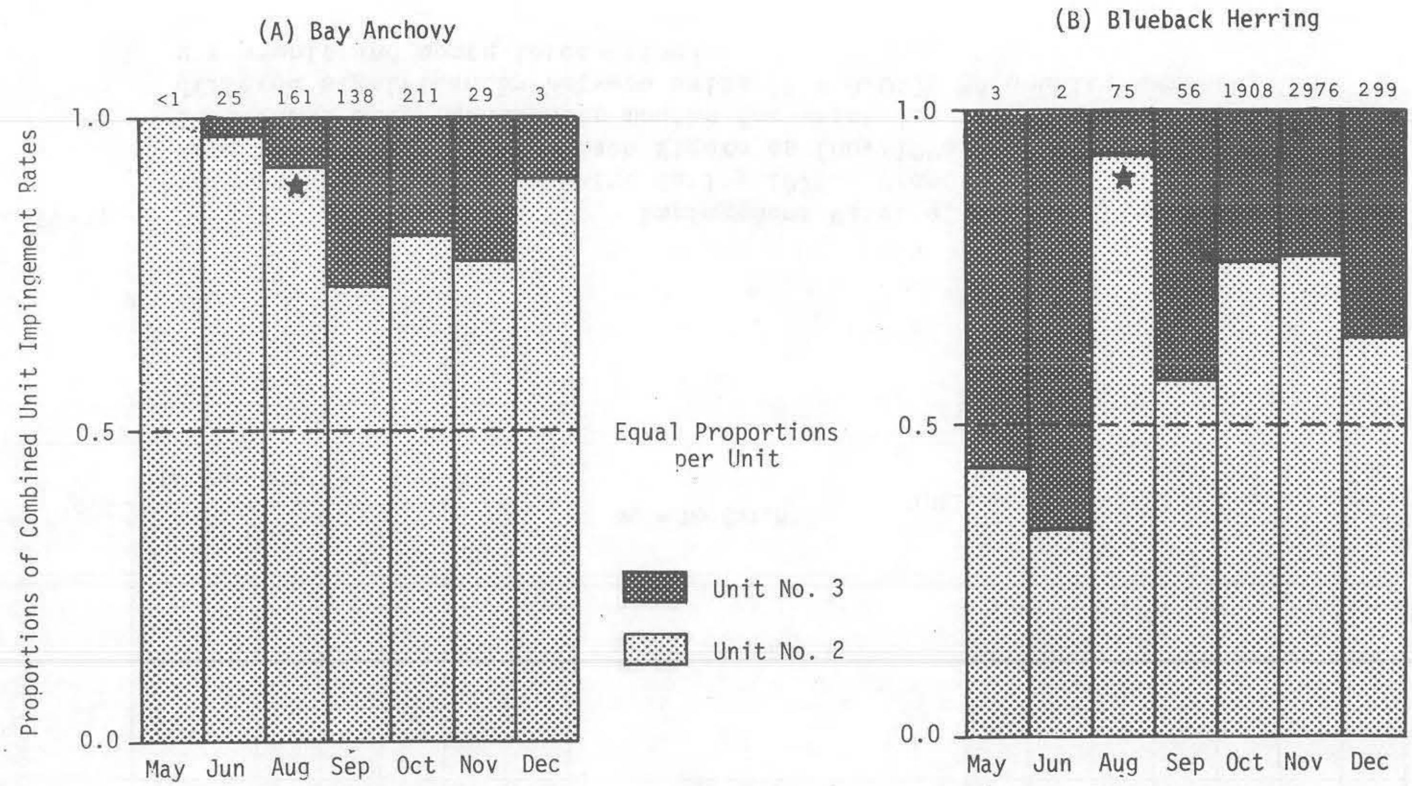
(A) Atlantic Tomcod

ANOVA**	F	p
u	91.16	0.0001
m	18.66	0.0001
u x m	14.48	0.0001

(B) Hogchoker

ANOVA**	F	p
u	62.08	0.0001
m	27.58	0.0001
u x m	2.54	0.0227

Figure IV-49. Unit No. 2 versus Unit No. 3 Impingement Rates of (A) Atlantic Tomcod and (B) Hogchoker at Indian Point during 1978. Proportions of Combined Unit Rate Presented at Top of Each Figure as (no./$10^6 m^3$) Attributable to Each Individual Unit [★Indicates months for which log-transformed daily rates differed significantly between units ($\alpha = 0.05$); ** u=unit, m=month, u x m=unit and month interaction]



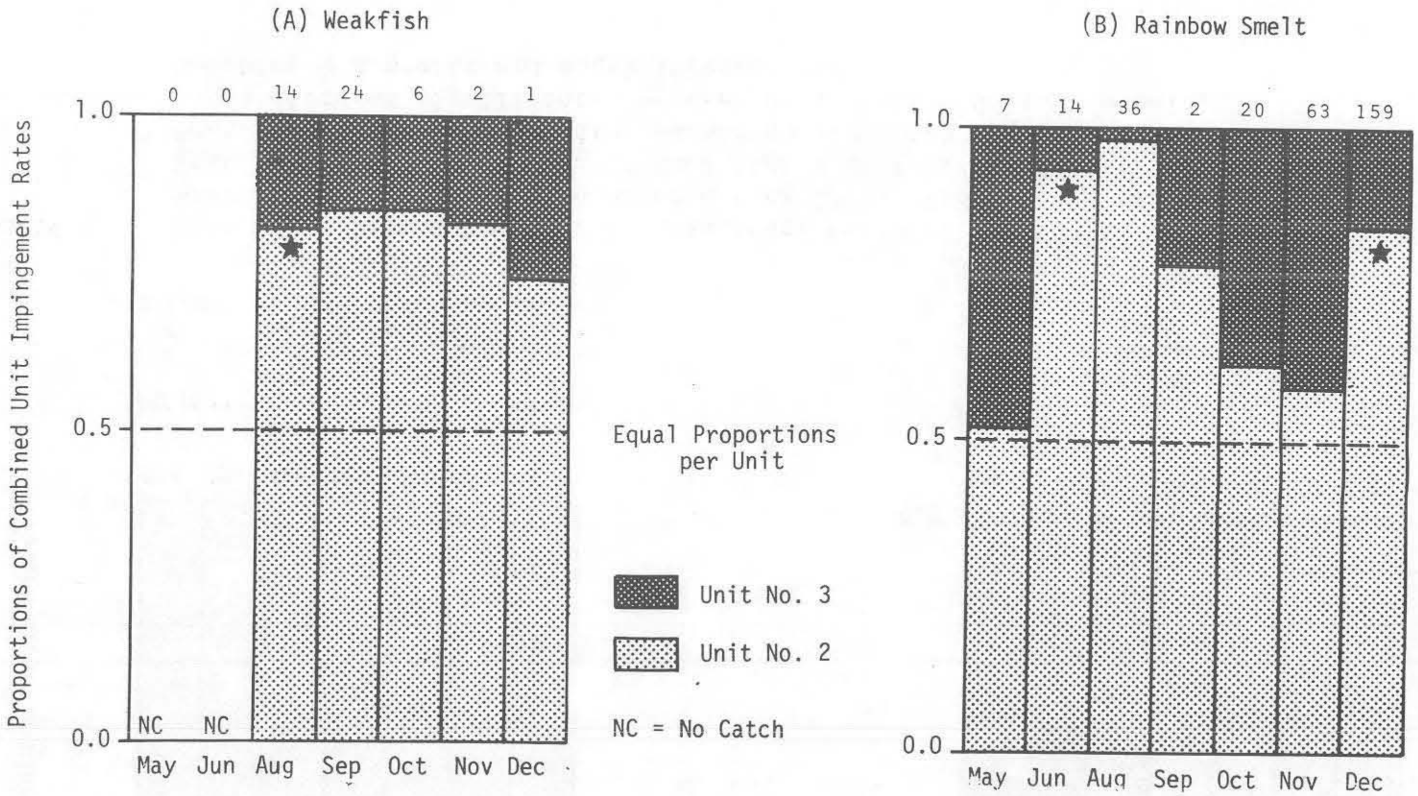
(A) Bay Anchovy

ANOVA **	F	p
u	29.55	0.0001
m	36.24	0.0001
u x m	3.12	0.0065

(B) Blueback Herring

ANOVA **	F	p
u	10.98	0.0012
m	70.32	0.0001
u x m	2.83	0.0123

Figure IV-50. Unit No. 2 versus Unit No. 3 Impingement Rates of (A) Bay Anchovy and (B) Blueback Herring at Indian Point during 1978. Proportions of Combined Unit Rate Presented at Top of Each Figure as (no./$10^6 m^3$) Attributable to Each Individual Unit [★Indicates months for which log-transformed daily rates differed significantly between units (α = 0.05); ** u=unit, m=month, u x m=unit and month interaction]



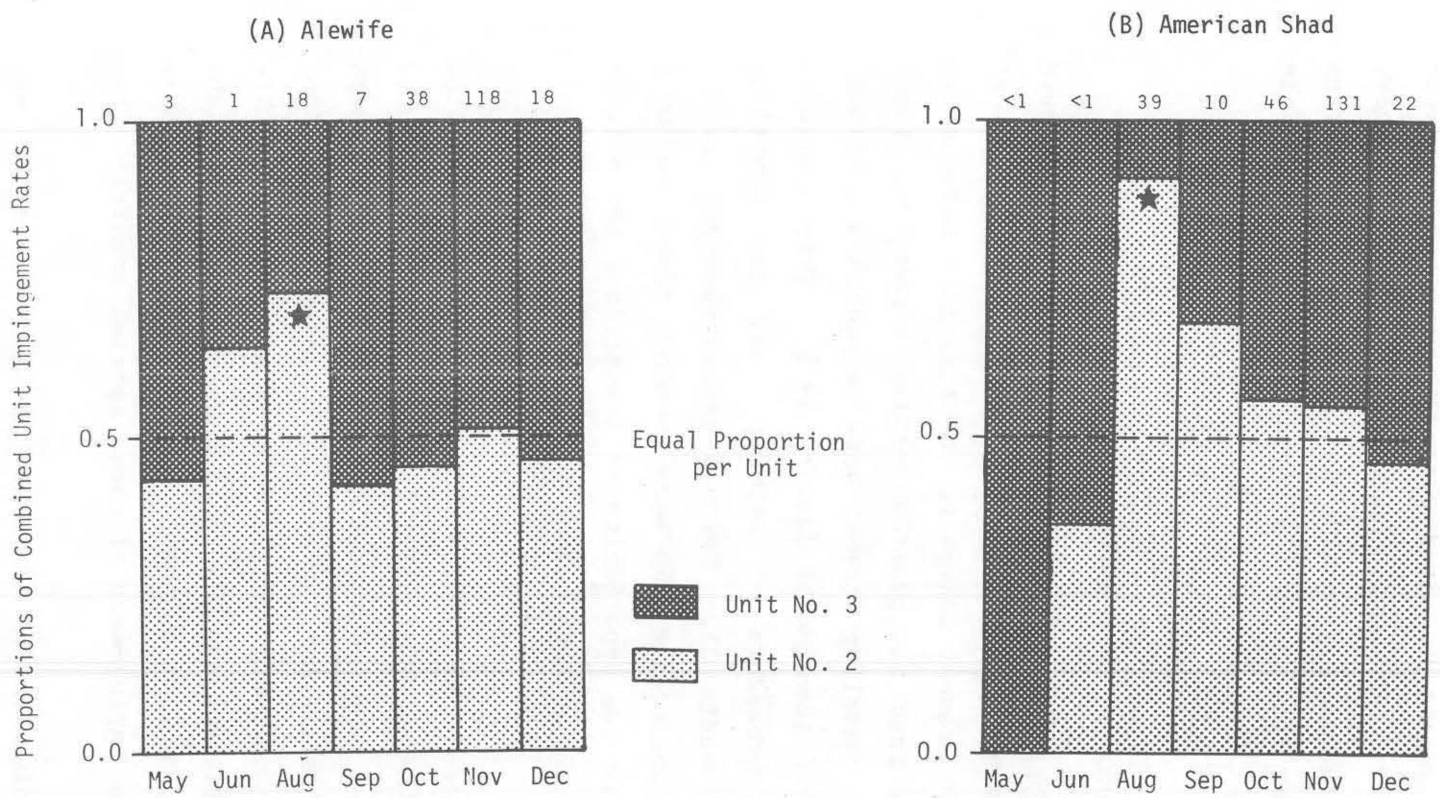
(A) Weakfish

ANOVA **	F	p
u	18.19	0.0001
m	18.07	0.0001
u x m	2.52	0.0235

(B) Rainbow Smelt

ANOVA **	F	p
u	27.09	0.0001
m	16.62	0.0001
u x m	3.31	0.0044

Figure IV-51. Unit No. 2 versus Unit No. 3 Impingement Rates of (A) Weakfish and (B) Rainbow Smelt at Indian Point during 1978. Proportions of Combined Unit Rate Presented at Top of Each Figure as (no./$10^6 m^3$) Attributable to Each Individual Unit [★Indicates months for which log-transformed daily rates differed significantly between units (α = 0.05); ** u=unit, m=month, u x m=unit and month interaction]



(A) Alewife

ANOVA**	F	p
u	0.68	0.4105
m	37.72	0.0001
u x m	3.29	0.0045

(B) American Shad

ANOVA**	F	p
u	2.64	0.1061
m	33.66	0.0001
u x m	2.86	0.0114

Figure IV-52. Unit No. 2 versus Unit No. 3 Impingement Rates of (A) Alewife and (B) American Shad at Indian Point during 1978. Proportions of Combined Unit Rate Presented at Top of Each Figure as (no./$10^6 m^3$) Attributable to Each Individual Unit [★Indicates months for which log-transformed daily rates differed signficantly between units ($\alpha = 0.05$); ** u-=unit, m=month, u x m=unit and month interaction] a greater rate during winter months. No such difference was apparent in the 1978 comparisons. It should be noted that these comparisons were based on counts of impinged fish corrected for collection efficiency, using a single factor applied in all months to each unit. The larger correction factor applied at Unit No. 2 (Section IV.B.) is reflected in these analyses.

3. Diel and Tidal Effects on Impingement Rate

In early November 1977, heavy debris loading badly damaged fixed screens at the entrance to intake bays No. 21, 24, and 25 at Indian Point Unit No. 2. To prevent damage to the traveling screens and subsequent entry of debris into the plant's cooling system, the fixed screens were lifted and the traveling screens were washed on a continual basis from 10 November 1977 through 11 January 1978. This operation differed from the normal procedure of washing fixed and traveling screens once daily (see Appendix C). The new screen washing schedule required that impingement collections be made several times during a 24-hour period, and afforded the opportunity to investigate the effects of time of day (diel) and tide on impingement at Indian Point.

Fish were collected from the continuously washed traveling screens every four hours (0400, 0800, 1200, 1600, 2000, and 2400 hours) and processed as described in Appendix C. Impingement rates were calculated at four-hour intervals for six species impinged in sufficient quantity to make analysis practical; these included: striped bass, white perch, Atlantic tomcod, blueback herring, alewife, and white catfish. Only November collections were considered for alewife and blueback herring since essentially no impingement of those species occurred after November.

Tidal stage during each four-hour collection period was determined using the following criteria:

Ebb tide	=	all of the four-hour collection period occurred between the time of high and low water
Flood tide	=	all of the four-hour collection period occurred between the time of low and high water
High tide	=	time of high tide occurred within the four-hour collection period
Low Tide	=	time of low tide occurred within the four-hour collection period

Times of high and low water for Peekskill, New York (approximately two miles upriver from Indian Point), were derived by Texas Instruments Incorporated by adjusting National Oceanic and Atmospheric Administration tide tables of predicted times of high and low water at the battery in New York City according to formulas provided for the Peekskill area (NOAA 1976, 1977). The effects of tide and time of day on impingement rates were evaluated by two-way analysis of variance (Sokal and Rohlf 1969). Duncan's New Multiple Range Test (Kirk 1968) was used as an *a posteriori* analysis to provide further insight into the interpretation of significant effects from the ANOVA.

Time of day seemed to significantly influence only clupeid impingement. Blueback herring and alewife were impinged in greater numbers near dawn (0400 to 0800 hrs) and dusk (1600 to 2000 hrs) than at other times of the day (Figures IV-53 and IV-54). A significant time x tide interaction ($\alpha = 0.05$) was generated primarily by an increase in impingement rates for these two species near dawn during ebb tide (Tables IV-26 and IV-27).

Impingement of the other four species examined was not significantly influenced by time of day, but there was evidence of a tidal effect on each species (Figures IV-55 to IV-58). Impingement rates of striped bass were significantly greater ($\alpha = 0.05$) during ebb tide than during all other tidal phases (Table IV-28). Impingement of white perch

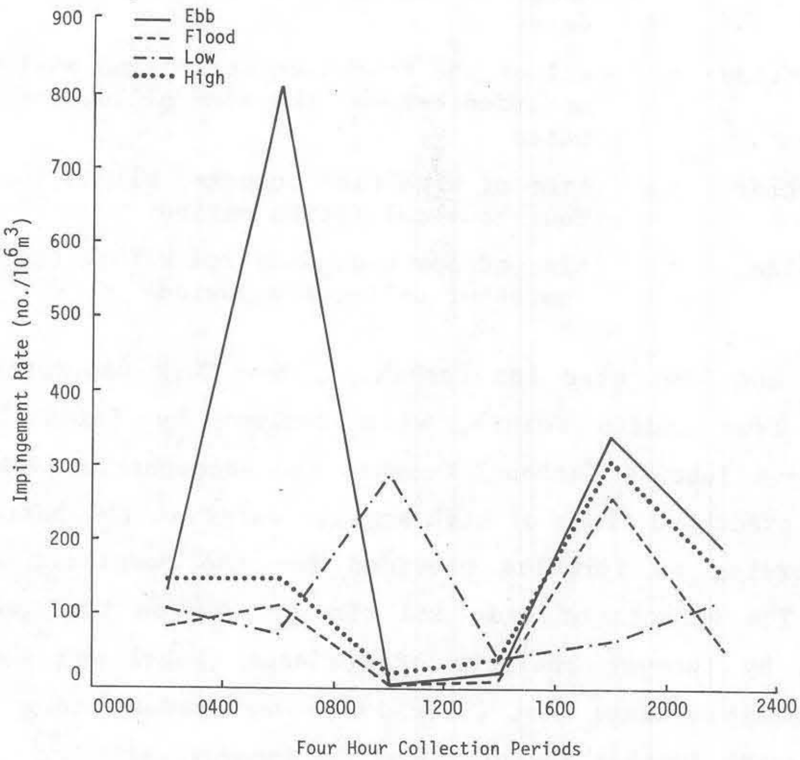


Figure IV-53. Impingement Rates of Blueback Herring versus Time of Day and Tidal Stage

(Figure IV-56), Atlantic tomcod (Figure IV-57), and white catfish (Figure IV-58) tended to be higher during ebb tide than at any other time, but the tendency was not statistically significant (Table IV-29).

Many field and laboratory studies have shown evidence of cyclic patterns in daily activity of freshwater and marine fishes (Schwassman 1971), with increased activity frequently occurring near dawn and dusk (Spoor and Schloemmer 1939, Scott 1955). Increased activity of fish is generally thought to result in increased probability of encountering a net (Scott 1955); the same is probably also true for the probability of encountering an intake screen. Studies investigating diel and tidal variation in impingement rates have frequently found impingement to be

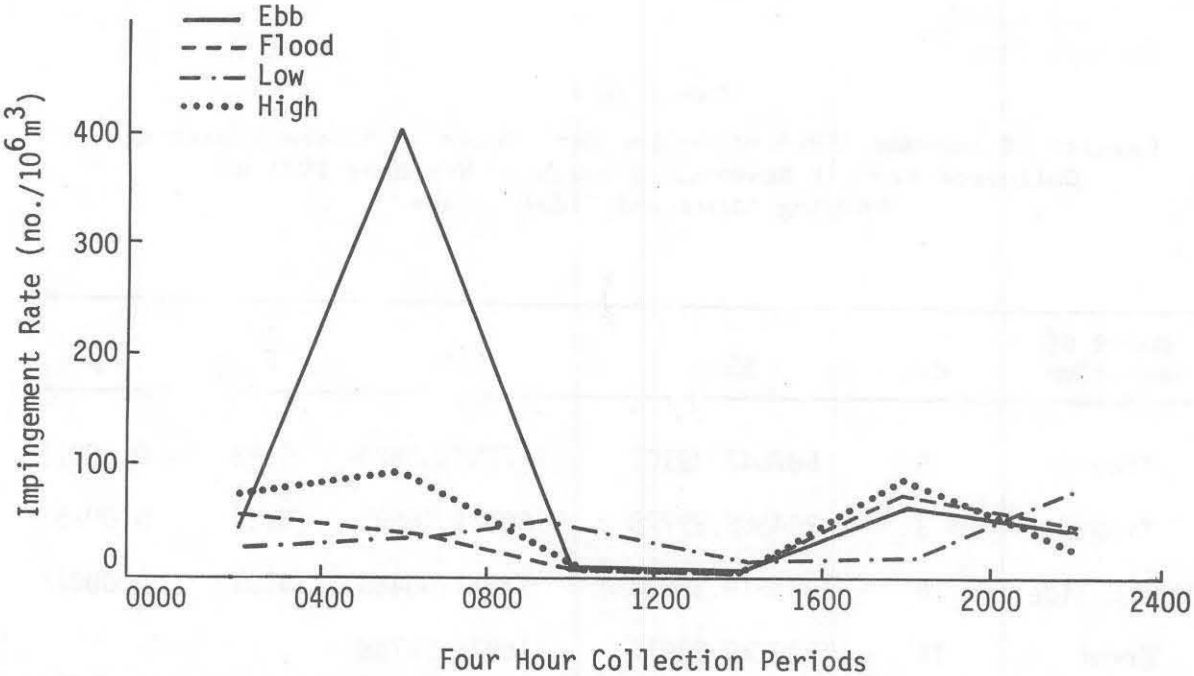


Figure IV-54. Impingement Rates of Alewife versus Time of Day and Tidal Stage

Table IV-26

Results of Two-Way ANOVA of Impingement Rates of Alewife Collected from 10 November through 30 November 1977 at Varying Times and Tidal Stages

Source of Variation	df	SS	MS	F	p
Time	5	154995.01276	30999.00255	9.81	0.0001*
Tide	3	41698.37108	13899.45703	4.40	0.0066*
Time x Tide	15	234287.68366	15619.17891	4.94	0.0001*
Error	79	249566.96764	3159.07554		

df = degrees of freedom
SS = sum of squares
MS = mean square
F = test statistic
p = probability of a larger F
* = significant (α=0.05)

Table IV-27

Results of Two-Way ANOVA of Impingement Rates of Blueback Herring Collected from 10 November through 30 November 1977 at Varying Times and Tidal Stages

Source of Variation	df	SS	MS	F	p
Time	5	587647.79102	117529.55820	6.98	0.0001*
Tide	3	264365.29778	88121.76593	5.24	0.0025*
Time x Tide	15	1087679.32274	72511.95485	4.31	0.0001*
Error	79	1329279.87916	16826.32758		

df = degrees of freedom
SS = sum of squares
MS = mean square
F = test statistic
p = probability of a larger F
* = significant (α=0.05)

higher at certain times of the day than at others (Landry 1971, Grimes 1975; TI 1974c, 1975e, and TI 1977f). At least two studies have shown impingement rates to increase near dawn and dusk. Impingement of several species (including alewife and white perch) collected at the Ginna Nuclear Station on Lake Ontario increased for a short time following sunset (Storr and Goehle 1978), and impingement rates for fish collected at the Anclote Generating Station on the Anclote River, Florida, were higher during the hours following sunset and preceding sunrise (TI 1977f). Although the cause of peak collections at these times is not known, many hypotheses have been presented including: movements between shallow and deep water, vertical migration (Storr and Goehle 1978), and changes in feeding activity (LMS 1974).

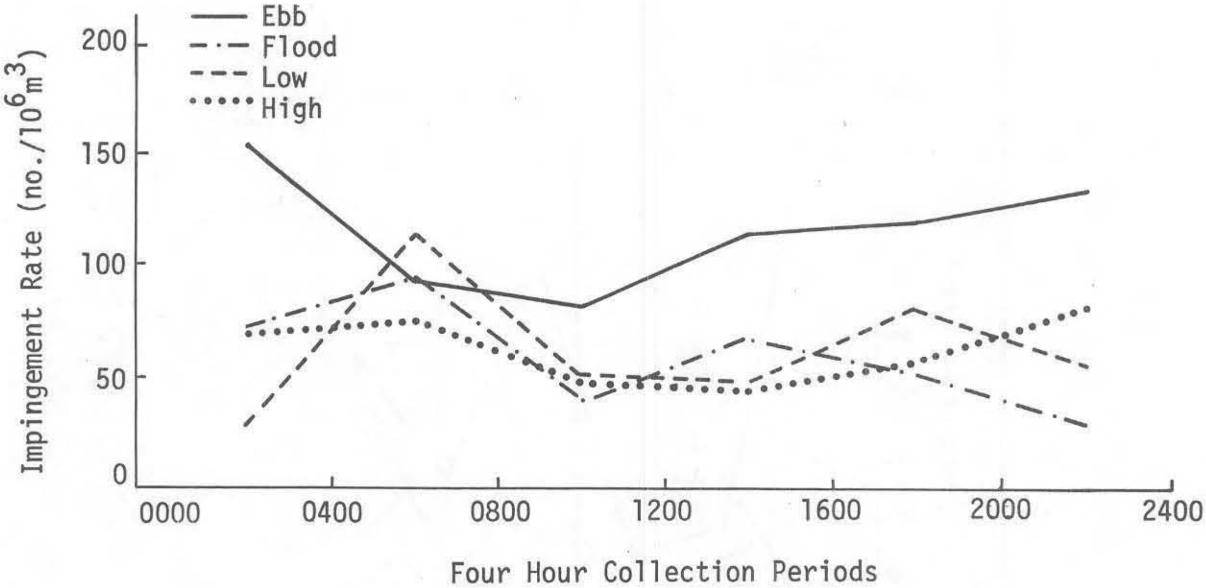


Figure IV-55. Impingement Rates of Striped Bass versus Time of Day and Tidal Stage

Tide was shown to have an influence on impingement rates in studies done at the Lovett generating station in 1974, (LMS 1975) where it was found that significantly more white perch were impinged during ebb tide when the tidal flow past the plant intake came from a shallow cove north of the plant. It was speculated that water currents may have washed white perch out of the shallow cove where they were feeding and into the area of the intake. A similar phenomenon may occur at Indian Point since it is also downstream from a large shallow area, Peekskill Bay. Fish may use tidal currents as a passive transport system, and thus migrate downstream; however, it is unlikely that white perch of the size being impinged during the present study would be passively washed out of the bay since they are able to maintain swim speeds greater than river or tidal currents. It is also possible that white perch actively follow drifting food organisms into the intake area.

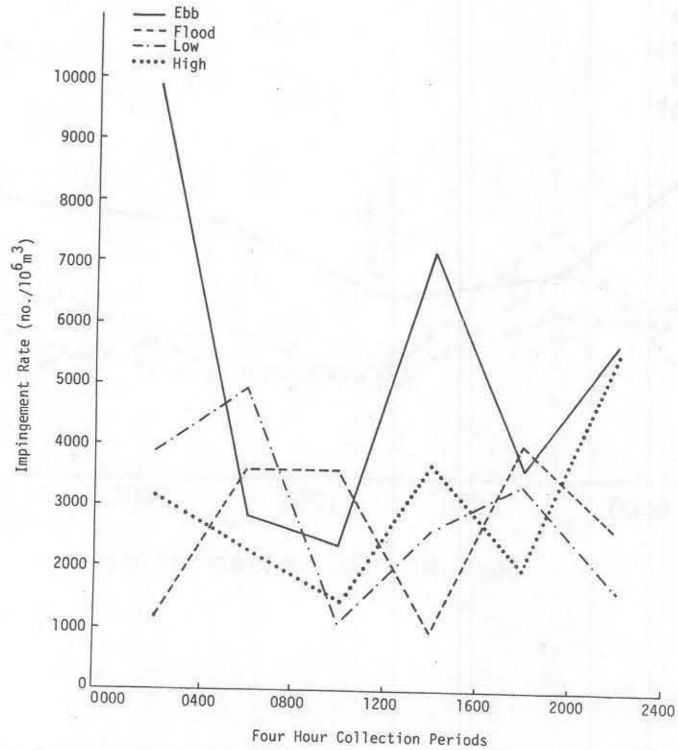


Figure IV-56. Impingement Rates of White Perch versus Time of Day and Tidal Stage

At the Anclote generating station an apparently synergistic effect between debris and tide was seen when ebb tide (which precipitated higher rates of seagrass/algae impingement that entrapped fish) occurred near dusk or dawn (TI 1977f). Though increased impingement rates (particularly of alewife and blueback herring) were associated with a time and tide interaction in the present study, there was no evidence of synergistic effects with debris such as observed at Anclote. The reason for an increase in impingement rates when ebb tide was coupled with a particular time of day is not known.

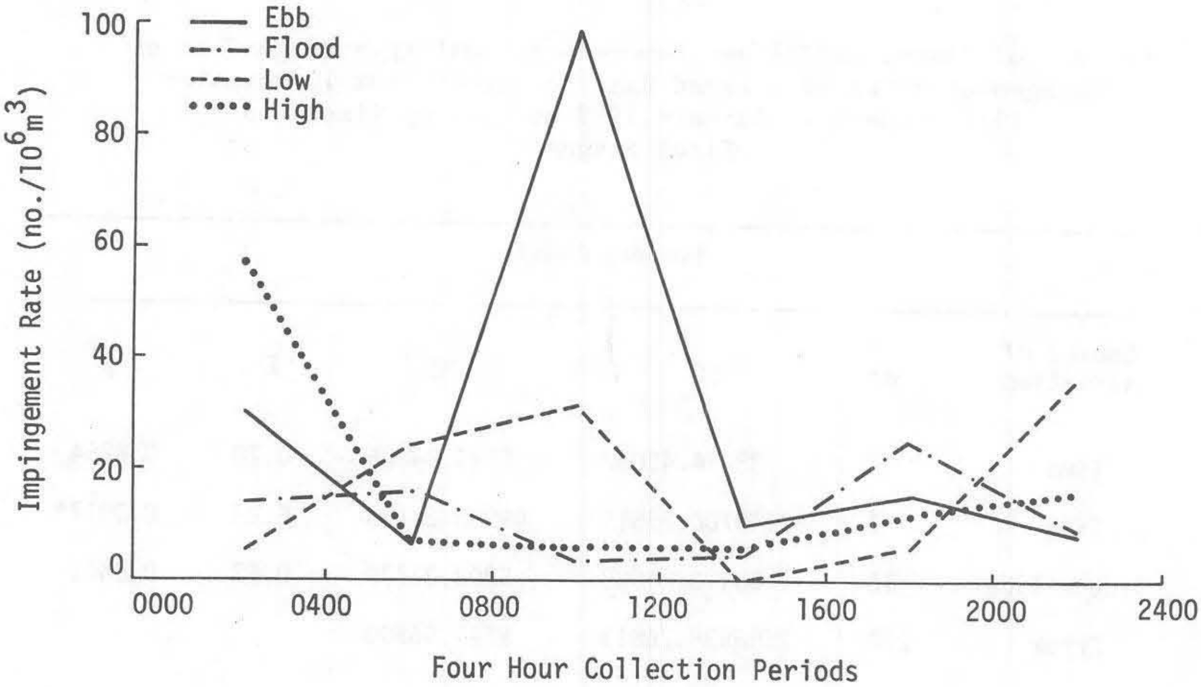


Figure IV-57. Impingement Rates of Atlantic Tomcod versus Time of Day and Tidal Stage

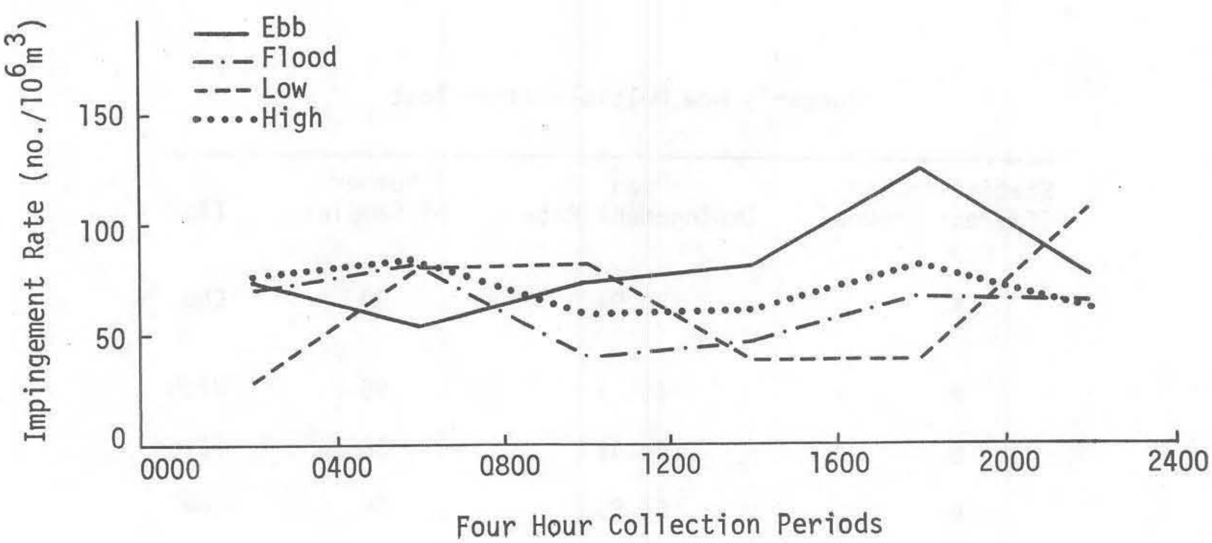


Figure IV-58. Impingement Rates of White Catfish versus Time of Day and Tidal Stage

Table IV-28

Results of Two-Way ANOVA and Duncan's New Multiple Range Test of Impingement Rates of Striped Bass Collected from 10 November 1977 through 11 January 1978 at Varying Times and Tidal Stages

Two-Way ANOVA

Source of Variation	df	SS	MS	F	p
Time	5	33474.42032	6694.84406	0.70	0.6254
Tide	3	149700.63511	49900.21170	5.23	0.0017*
Time x Tide	15	88473.26689	5898.21779	0.62	0.8602
Error	272	2596938.76813	9547.56900		

df = degrees of freedom
SS = sum of squares
MS = mean square
F = test statistic
p = probability of a larger F
* = significant (α=0.05)

Duncan's New Multiple Range Test

Statistically* Different Groups	Mean Impingement Rate	Number of Samples	Tide
A	120.94	70	Ebb
B	65.38	95	High
B	64.42	36	Flood
B	63.83	95	Low

Mean Square = 9547.57
df = 272

*Means grouped within the same letter are not significantly different (α=0.05)

Table IV-29

Results of Two-Way ANOVA of Impingement Rates of White Perch, Atlantic Tomcod, and White Catfish Collected from November 1977 through 11 January 1978 at Varying Times and Tidal Stages

Source of Variation	df	SS	MS	F	p
		White Perch			
Time	5	128178817.95560	25635763.59112	0.63	0.6818
Tide	3	265969719.87577	88656573.29192	2.17	0.0905
Time x Tide	15	690302985.11322	46020199.00755	1.13	0.3326
Error	272	11119322016.34078	40879860.35419		
		Atlantic Tomcod			
Time	5	18671.49296	3734.29859	0.61	0.6965
Tide	3	9074.85389	3024.95130	0.49	0.6920
Time x Tide	15	85795.17123	5719.67808	0.93	0.5305
Error	272	1671164.47671	6143.98705		
		White Catfish			
Time	5	14287.96042	2857.59208	0.48	0.7906
Tide	3	13387.41527	4462.47176	0.75	0.5236
Time x Tide	15	66871.35930	4458.09062	0.75	0.7286
Error	272	1608099.12917	5912.12915		

df = degrees of freedom
SS = sum of squares
MS = mean square
F = Test statistic
p = probability of a larger F

Conclusions regarding behavioral response to diel or tidal influences apply only to the species discussed and only to the November to January time period. Changes in several environmental factors (e.g., salt front position) could override diel or tidal influences at other times of the year. However, late fall and winter is the primary period of impingement for several of the above species. Of the total number of fish impinged at Unit No. 2 during 1977, November and December accounted for 7.3% of the blueback herring, 22.0% of the alewives, 25.9% of the white perch, 32.1% of the striped bass, 0.9% of the Atlantic tomcod, and 67.2% of the white catfish. Thus, for four of the six species the behavior patterns observed are of some consequence in describing variations in impingement rates of the species.

In summary, blueback herring and alewife exhibited increased impingement rates at dawn and dusk which may be indicative of crepuscular activity. The rate was particularly elevated when dawn and ebb tide coincided. Striped bass were also impinged at greater rates during ebb tide, but no effect of time of day was apparent. Increased impingement at ebb tide may result from the fish moving with the current downstream since all three species tend to actively move downriver during November and December. No significant effect of either tide or time of day was apparent for white perch, Atlantic tomcod, or white catfish.

4. Range of Influence of the Indian Point Generating Station

The mark/recapture program provides data used to estimate population sizes and also can provide information on the movements of marked fish. Finclips and tags have been used to mark striped bass and white perch since 1972, and Atlantic tomcod since 1974. The objective of this section is to report the occurrence of marked fish among those impinged at Indian Point in 1978, to assess the exposure of striped bass, white perch, and Atlantic tomcod from various parts of the Hudson River estuary to impingement at Indian Point, and to estimate a range of influence of this generating station.

Impingement recovery rates [number of impingement recaptures (R) divided by number of marks released (M)] can be useful to qualitatively describe exposure to the plant, because the region of the estuary from which fish may move to eventually become impinged at Indian Point can be determined and an approximate range of influence described. Since the numbers of marked fish released are relatively small (<100 fish) in some regions, particularly those farthest from Indian Point, absence of marked fish in impingement collections released in a particular region does not conclusively demonstrate their invulnerability to impingement.

a. Striped Bass

During 1978 finclipped striped bass from both the 1977 and 1978 year classes were impinged at Indian Point (Table IV-30). Striped bass from the 1977 year class recaptured by impingement were finclipped during September through November 1977, and those from the 1978 year class were finclipped during September through November 1978. Only one tagged striped bass released in October 1977 at RM 53 was recovered at Indian Point in 1978 (Appendix A.5). Impingement recaptures of the 1977 and 1978 year classes indicated that young-of-the-year and yearling striped bass from at least the Yonkers (RM 12-23) through Poughkeepsie (RM 76) regions were susceptible to impingement at Indian Point. A similar range of influence was observed at Indian Point in 1977, and is indicative of movement of striped bass into the Indian Point region from areas both up and downstream.

A comparison of 1978 recapture rates for striped bass marked and released in all marking regions (RM 12-152) during 1977 and 1978 (Table IV-30) showed no clear relationship between recovery rate and distance of the release region from the Indian Point plant. Although no fish marked above RM 77 were recovered from impingement collections in 1978, striped bass marked from this region in 1977 were recaptured below Indian Point in other sampling gear, indicating that striped bass marked above RM 77 do move downstream past the power plant. The absence of any impingement recaptures of fish released above RM 77 is probably due to the small number of striped bass marked between RM 77 and 152. Most young-of-the-year move downstream from this region before fall and are thus not available for marking. However, as might be expected of an anadromous species, a greater proportion of those marked directly upriver (RM 47-76) than of those marked downriver (RM 12-38) from the Indian Point plant in the fall of 1978 were subsequently impinged before the end of the year.

Table IV-30

Number Marked, Number Recaptured, and Recovery Rate for Striped Bass Finclips Recaptured at Indian Point Generating Station in 1978; Summarized by Month and Region of Release

1977 Year Class

Release Location	September 1977			October 1977			November 1977			Total Fall 1977 Releases			Spring 1978 Releases		
	R	M	R/M	R	M	R/M	R	M	R/M	R	M	R/M	R	M	R/M
RM 12-23	0	1272	0.0000	1	1421	0.0007	0	868	0.0000	1	3561	0.0003	0	457	0.0000
RM 24-38	1	3190	0.0003	2	3274	0.0006	6	1884	0.0032	9	8348	0.0011	0	307	0.0000
RM 39-46	2	1042	0.0019	1	1709	0.0006	0	925	0.0000	3	3676	0.0008	0	66	0.0000
RM 47-76	1	583	0.0017	0	364	0.0000	0	100	0.0000	1	1047	0.0010	0	16	0.0000
RM 77-152	0	99	0.0000	0	20	0.0000	0	2	0.0000	0	121	0.0000	0	3	0.0000
Total	4	6186	0.0006	4	6788	0.0006	6	3779	0.0016	14	16753	0.0008	0	849	0.0000

1978 Year Class

Release Location	September 1978			October 1978			November 1978			Total Fall 1978 Releases		
	R	M	R/M	R	M	R/M	R	M	R/M	R	M	R/M
RM 12-23	0	320	0.0000	1	68	0.0147	1	214	0.0047	2	602	0.0033
RM 24-38	8	7073	0.0011	2	1218	0.0016	4	489	0.0082	14	8780	0.0016
RM 39-46	8	1862	0.0043	9	511	0.0176	3	301	0.0100	20	2674	0.0075
RM 47-76	3	701	0.0043	1	418	0.0024	2	160	0.0125	6	1279	0.0047
RM 77-152	0	101	0.0000	0	26	0.0000	0	8	0.0000	0	135	0.0000
Total	19	10057	0.0019	13	2241	0.0058	10	1172	0.0085	42	13470	0.0031

R = Number of marked fish recovered from impingement at Indian Point
M = Number of fish marked

b. White Perch

Impingement of marked white perch at the Indian Point generating station during 1978 consisted of fish which had been released in 1976, 1977, and 1978. Impingement recaptures indicated that white perch of all age groups and released in all five marking regions (RM 12-152) were susceptible to impingement, either as young-of-the-year (Table IV-31), yearlings (Table IV-31), or older than yearlings (Figures IV-59 through IV-66). Impingement recapture rates of white perch marked with finclips and released in the fall of 1977 and 1978 did not decline directly with distance from the Indian Point generating station (Table IV-31), suggesting that nearly equal proportions of those marked from throughout the estuary move into or past the Indian Point plant.

c. Atlantic Tomcod

Atlantic tomcod impinged at Indian Point in 1978 included 28 recaptures (25 tags and 3 finclips) of fish marked and released during the spawning run from November 1977 through February 1978 (Table IV-32, Figure IV-67) and only one recapture from the spawning run of fish released during November through December 1978 (Figure IV-68). Atlantic tomcod from the 1977 to 1978 spawning run recaptured by impingement exhibited predominantly downstream movement as all but four of the 28 fish recaptured had been released upstream from the Indian Point generating station (Table IV-32, Figure IV-67). The single impingement recapture of Atlantic tomcod marked during the 1978 to 1979 spawning run had traveled upstream from RM 25 (Figure IV-68).

Data collected since 1976 suggest that post spawning individuals moving downstream are the segment of the adult population most vulnerable to impingement at Indian Point (TI 1977e, 1979c). During the 1977 to 1978 spawning run, 2,615 (24%) of the total number of 10,873 tomcod marked during that run were released in November and December 1977 between RM's 12 through 38, below Indian Point; only one

Table IV-31

Number Marked, Number Recaptured, and Recovery Rate for White Perch Finclips Recaptured at Indian Point Generating Station in 1978 Summarized, by Month and Region of Release

1976 Year Class

Release Location	September 1976			October 1976			November 1976			Total Fall 1976 Releases			Spring 1977 Releases		
	R	M	R/M	R	M	R/M	R	M	R/M	R	M	R/M	R	M	R/M
RM 12-23	0	42	0.0000	0	40	0.0000	0	59	0.0000	0	141	0.0000	0	69	0.0000
RM 24-38	1	8617	0.0001	0	3239	0.0000	0	269	0.0000	1	12125	0.0001	3	4167	0.0007
RM 39-46	0	4668	0.0000	0	3065	0.0000	0	1795	0.0000	0	9528	0.0000	2	1117	0.0018
RM 47-76	0	2161	0.0000	1	537	0.0019	0	38	0.0000	1	2736	0.0004	0	354	0.0000
RM 77-152	0	471	0.0000	0	214	0.0000	0	14	0.0000	0	699	0.0000	0	323	0.0000
Total	1	15959	0.0001	1	7095	0.0001	0	2175	0.0000	2	25229	0.0001	5	6030	0.0008

1977 Year Class

Release Location	September 1977			October 1977			November 1977			Total Fall 1977 Releases			Spring 1978 Releases		
	R	M	R/M	R	M	R/M	R	M	R/M	R	M	R/M	R	M	R/M
RM 12-23	0	24	0.0000	2	266	0.0075	11	323	0.0341	13	613	0.0212	0	78	0.0000
RM 24-38	10	1200	0.0083	23	2696	0.0085	63	2708	0.0233	96	6604	0.0145	1	2659	0.0004
RM 39-46	27	1824	0.0148	44	2953	0.0149	23	1284	0.0179	94	6061	0.0155	1	504	0.0020
RM 47-76	6	1959	0.0031	4	1044	0.0038	8	563	0.0142	18	3566	0.0050	2	351	0.0057
RM 77-152	4	280	0.0143	0	125	0.0000	1	43	0.0233	5	448	0.0112	0	176	0.0000
Total	47	5287	0.0089	73	7084	0.0103	106	4921	0.0215	226	17292	0.0131	4	3768	0.0011

1978 Year Class

Release Location	September 1978			October 1978			November 1978			Total Fall 1978 Releases		
	R	M	R/M	R	M	R/M	R	M	R/M	R	M	R/M
RM 12-23	0	3	0.0000	0	6	0.0000	2	27	0.0741	2	36	0.0556
RM 24-38	9	6483	0.0014	13	1386	0.0094	6	419	0.0143	28	8288	0.0034
RM 39-46	16	1670	0.0096	87	1800	0.0483	65	1635	0.0398	168	5105	0.0329
RM 47-76	16	2483	0.0064	37	1822	0.0203	10	368	0.0272	63	4673	0.0135
RM 77-152	2	479	0.0042	0	83	0.0000	0	33	0.0000	2	595	0.0034
Total	43	11118	0.0039	137	5097	0.0269	83	2482	0.0334	263	18697	0.0141

R = Number of marked fish recovered from impingement at Indian Point
M = Number of fish marked

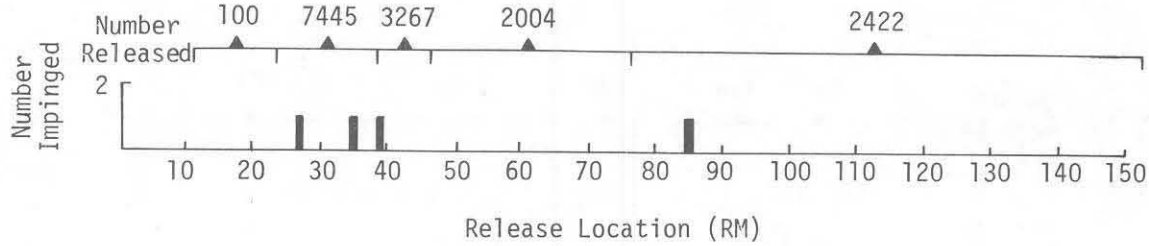


Figure IV-59. Number Released and Location of Tagged White Perch ≤150 mm (total length) Released in 1976 and Impinged at Indian Point Generating Station (RM 42) in 1978

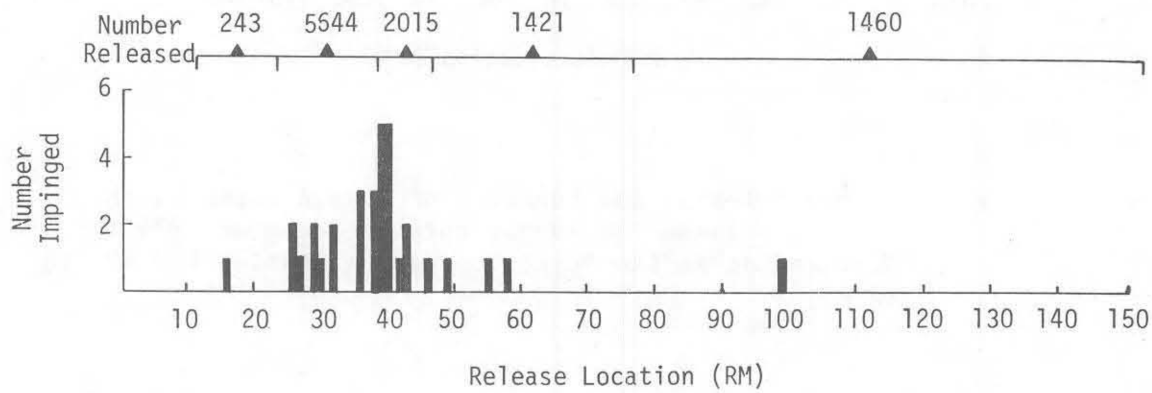


Figure IV-60. Number Released and Location of Tagged White Perch ≤150 mm (total length) Released in 1977 and Impinged at Indian Point Generating Station (RM 42) in 1978

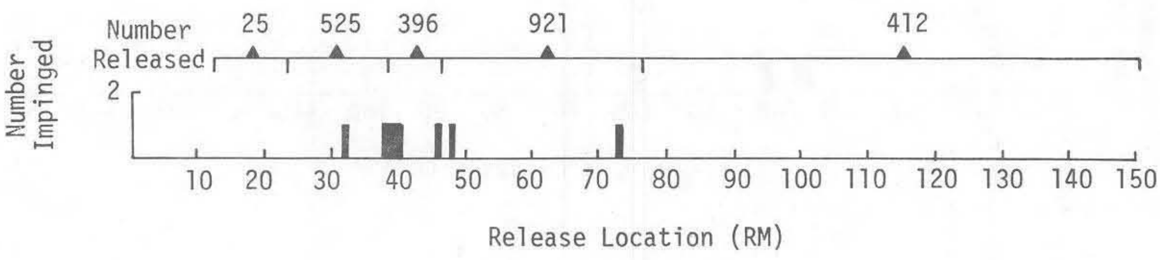


Figure IV-61. Number Released and Location of Tagged White Perch ≤150 mm (total length) Released April through June 1978 and Impinged at Indian Point Generating Station (RM 42) in 1978

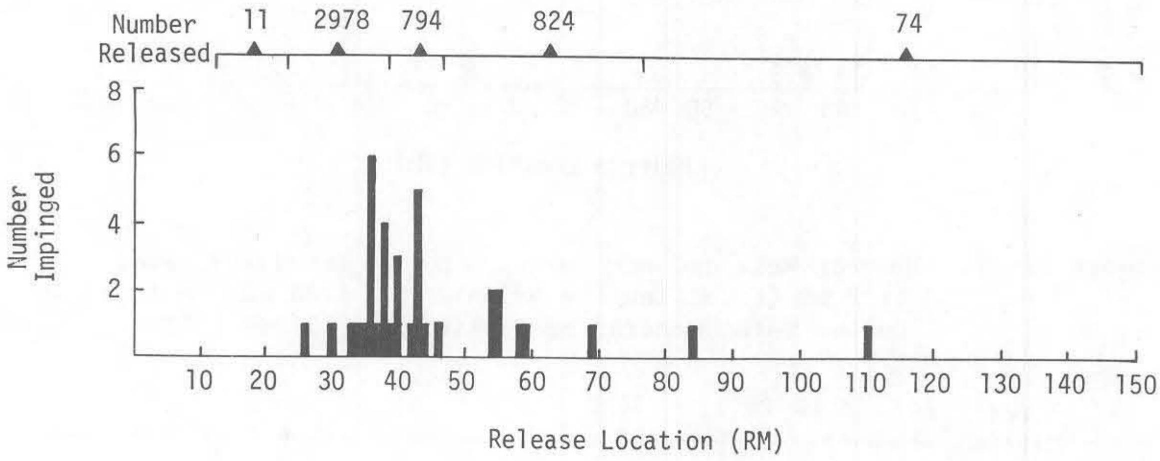


Figure IV-62. Number Released and Location of Tagged White Perch ≤150 mm Released in August through December 1978 Impinged at Indian Point Generating Station (RM 42) in 1978

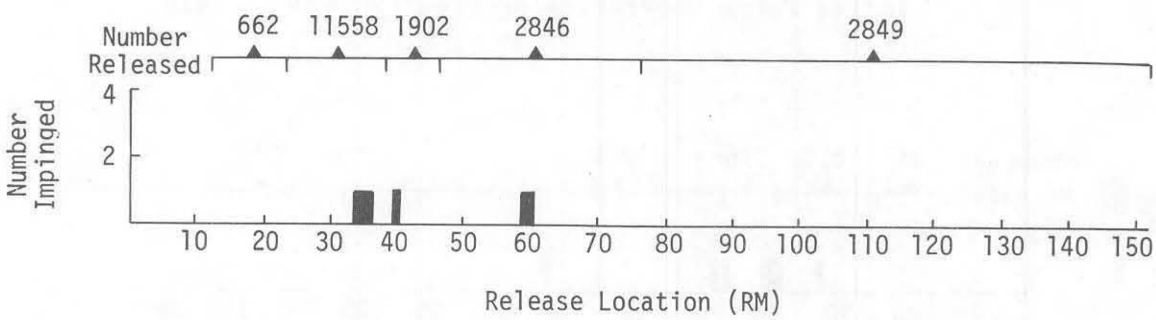


Figure IV-63. Number Released and Location of Tagged White Perch >150 mm (total length) Released in 1976 and Impinged at Indian Point Generating Station (RM 42) in 1978

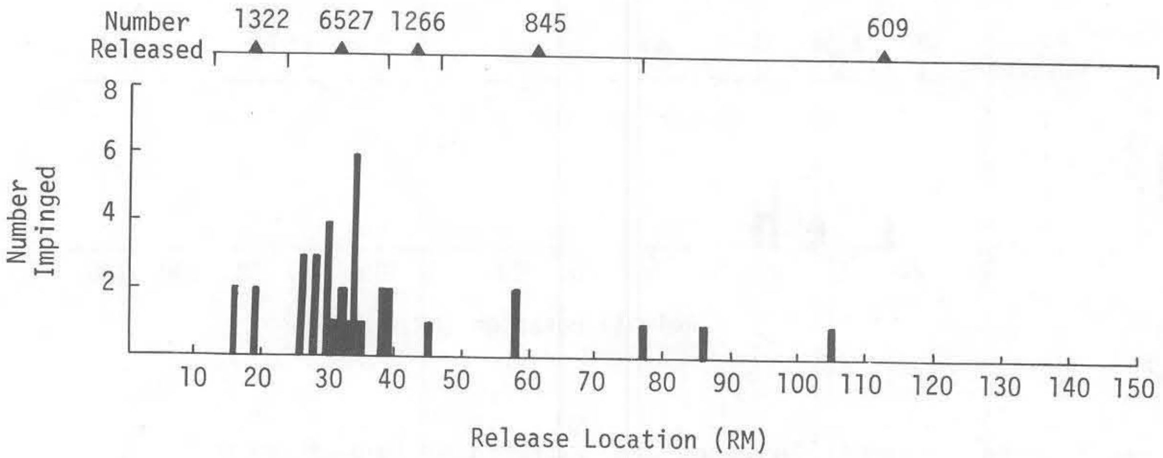


Figure IV-64. Number Released and Location of Tagged White Perch >150 mm (total length) Released in 1977 and Impinged at Indian Point Generating Station (RM 42) in 1978

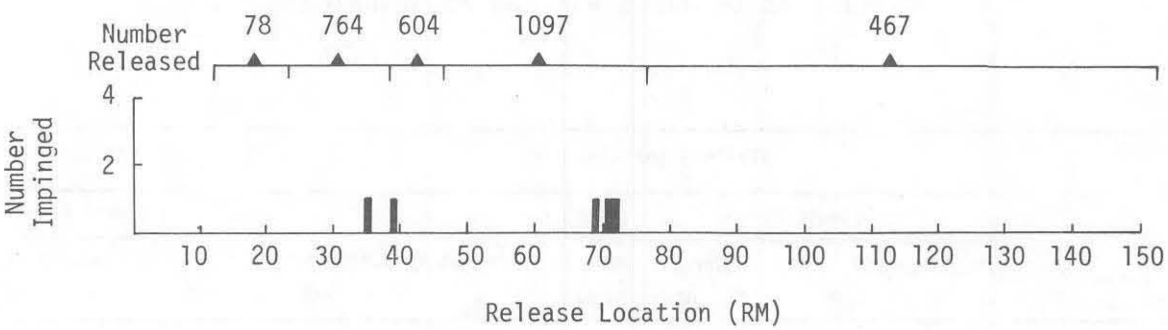


Figure IV-65. Number Released and Location of Tagged White Perch > 150 mm (total length) Released April through June 1978 and Impinged at Indian Point Generating Station (RM 42) in 1978

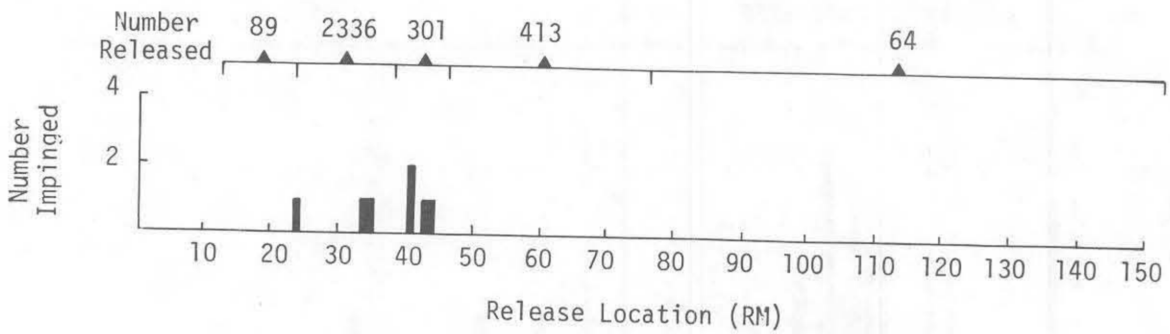


Figure IV-66. Number Released and Location of Tagged White Perch >150 mm (total length) Released August through December 1978 and Impinged at Indian Point Generating Station (RM 42) in 1978

Table IV-32

Number Marked, Number Recaptured, and Recovery Rate for Atlantic Tomcod Finclips Recaptured at Indian Point Generating Station in 1978; Summarized by Month and Region of Release

	1977-1978 Spawning Run									1978-1979 Spawning Run		
	Release Period									Release Period		
	December 1977			January 1978			Total 1977-1978 Run			December 1978		
Release Location	R	M	R/M	R	M	R/M	R	M	R/M	R	M	R/M
RM 12-38	0	632	0.0000	0	268	0.0000	0	900	0.0000	0	858	0.0000
RM 39-46	0	0	0.0000	0	0	0.0000	0	0	0.0000	0	0	0.0000
RM 47-61	2	506	0.0040	0	0	0.0000	2	506	0.0040	0	849	0.0000
RM 62-153	1	59	0.0169	0	136	0.0000	1	195	0.0051	0	0	0.0000
Total	3	1197	0.0025	0	404	0.0000	3	1601	0.0019	0	1707	0.0000

R = Number of marked fish recovered from impingement at Indian Point
M = Number of fish marked

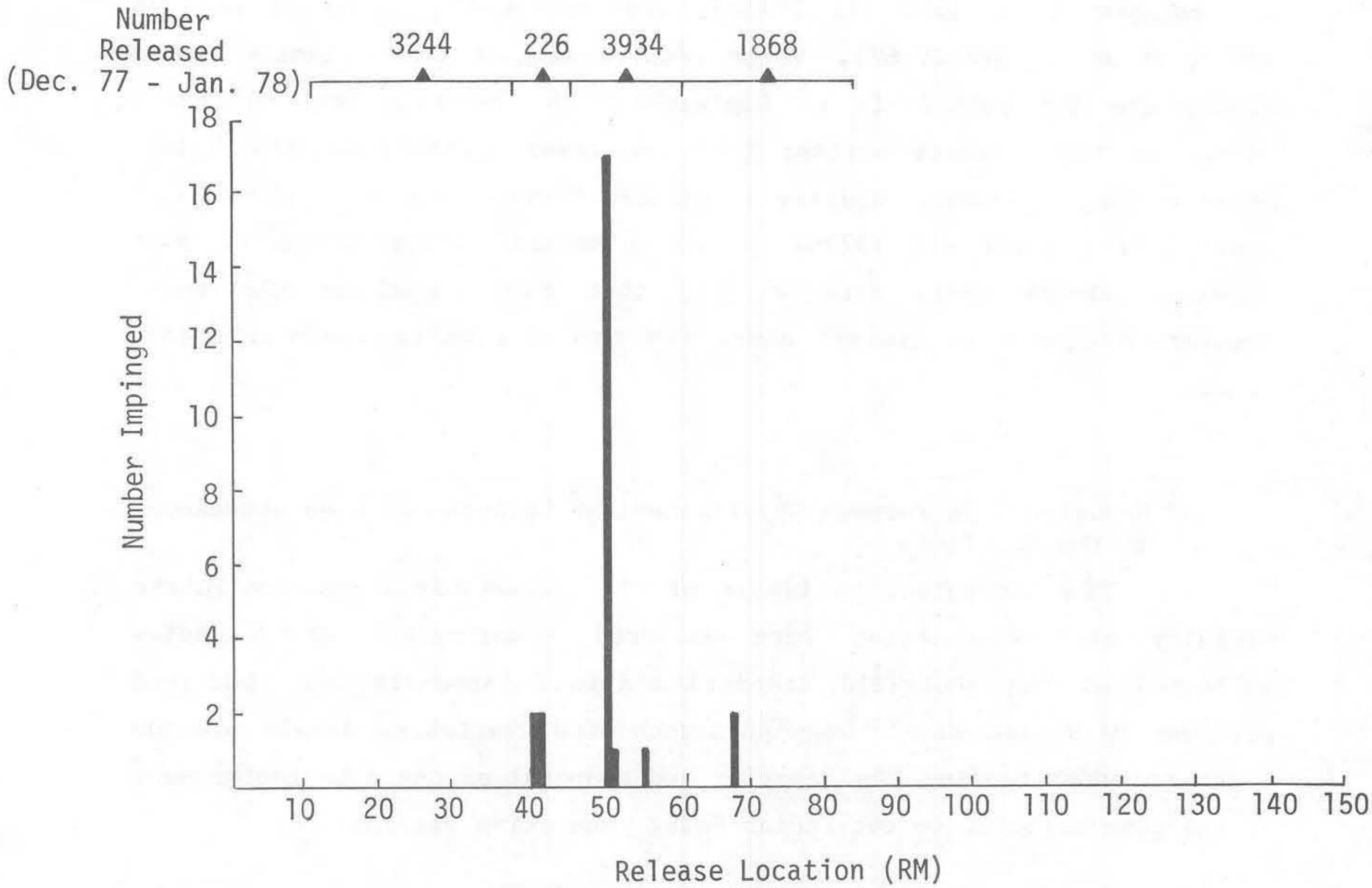


Figure IV-67. Number Released and Location of Tagged Atlantic Tomcod Released during 1977 through 1978 Spawning Run and Impinged at Indian Point Generating Station (RM 42) in 1978

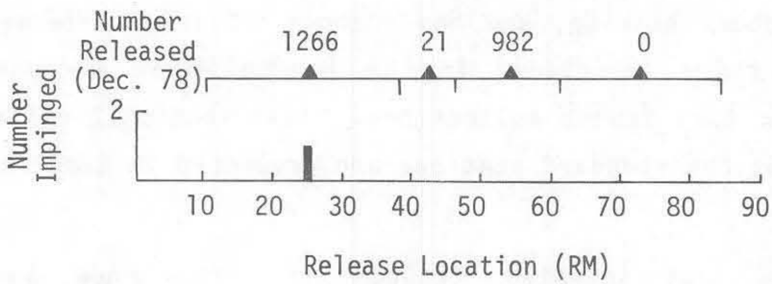


Figure IV-68. Number Released and Location of Tagged Atlantic Tomcod Released during the 1978 through 1979 Spawning Run and Impinged at Indian Point Generating Station (RM 42) in 1978 was recaptured in 1977 (TI 1979c), and none were recaptured in 1978 (Table IV-32, Figure IV-67). These results suggest that Atlantic tomcod simply are not vulnerable to impingement in the late fall and early winter as they migrate upriver from the lower portions of the Hudson River estuary to spawn, usually in an area upriver from the Indian Point generating station (TI 1979b). If impingement kills primarily post spawning adults during the winter, then this impact on the adult population should be minimal since few tomcod live to spawn a second time.

5. Relationships Between Physicochemical Factors and Fish Abundance in the Nearfield

Physicochemical variables of the Hudson River estuary in the vicinity of Indian Point were measured concurrently with samples collected at the nearfield standard stations (Appendix C). Observed patterns in variation of these physicochemical variables should provide a key to understanding the behavior and temporal exposure to impingement of the common fishes to the Indian Point generating station.

As a first step toward this understanding, two of the principal physicochemical variables, water temperature and conductivity (as a measure of salinity), are related in this section to the distribution of five fish species: striped bass, white perch, Atlantic tomcod, blueback herring, and bay anchovy. Species were selected either because of their importance in the Hudson River ecosystem or their abundance in impingement collections. Distributional patterns of these species among the standard stations are presented in Section IV-D.

The relationships between fish abundance and these two physicochemical variables were tested using analysis of covariance (ANCOVA). This technique combines the features of analysis of variance and regression to investigate the linear relationships between variables

(Snedecor and Cochran 1967). Due to the strictly observational nature of the sampling program (i.e., none of the variables are regulated by the experimenter), significant results with the ANCOVA do not necessarily imply cause and effect relationships among the tested variables.

ANCOVA was performed separately by species, season (spring: April through June; summer: July through September; fall: October through December), age group (young-of-the-year, yearling and older, all ages combined) and gear type (beach seine, surface trawl, bottom trawl). Stations sampled by each gear type were assigned to one of two distinct habitats: open and sheltered stations for beach seines; shallow and deep stations for surface and bottom trawls (Section VI.D.). Catch per unit effort data were transformed as $[\log_e (x+1)]$ prior to analysis.

Relationships between species abundance and physicochemical variables in the nearfield were investigated using temperatures (water temperature), temperature squared, conductivity, and conductivity squared as covariates in the analysis. The inclusion of squared terms permitted the investigation of non-linear relationships between species abundance and temperature or conductivity. For example, a model in which both linear and squared terms are significant ($P<0.05$) (e.g., temperature and temperature squared) indicates a parabolic relationship between abundance and water temperature if their coefficients have opposite signs (Figure IV-69). In this case, a fish species whose abundance is positively related to temperature and negatively related to temperature squared was most abundant near the middle of the observed temperature range. The inclusion of a significant squared term with or without a linear term of the same sign indicates that abundance changed little through the lower range of observed temperature or conductivity values, but increased or decreased sharply as the physicochemical variable increased (Figure IV-69). Such results might indicate a threshold effect with the species present only above or below a certain

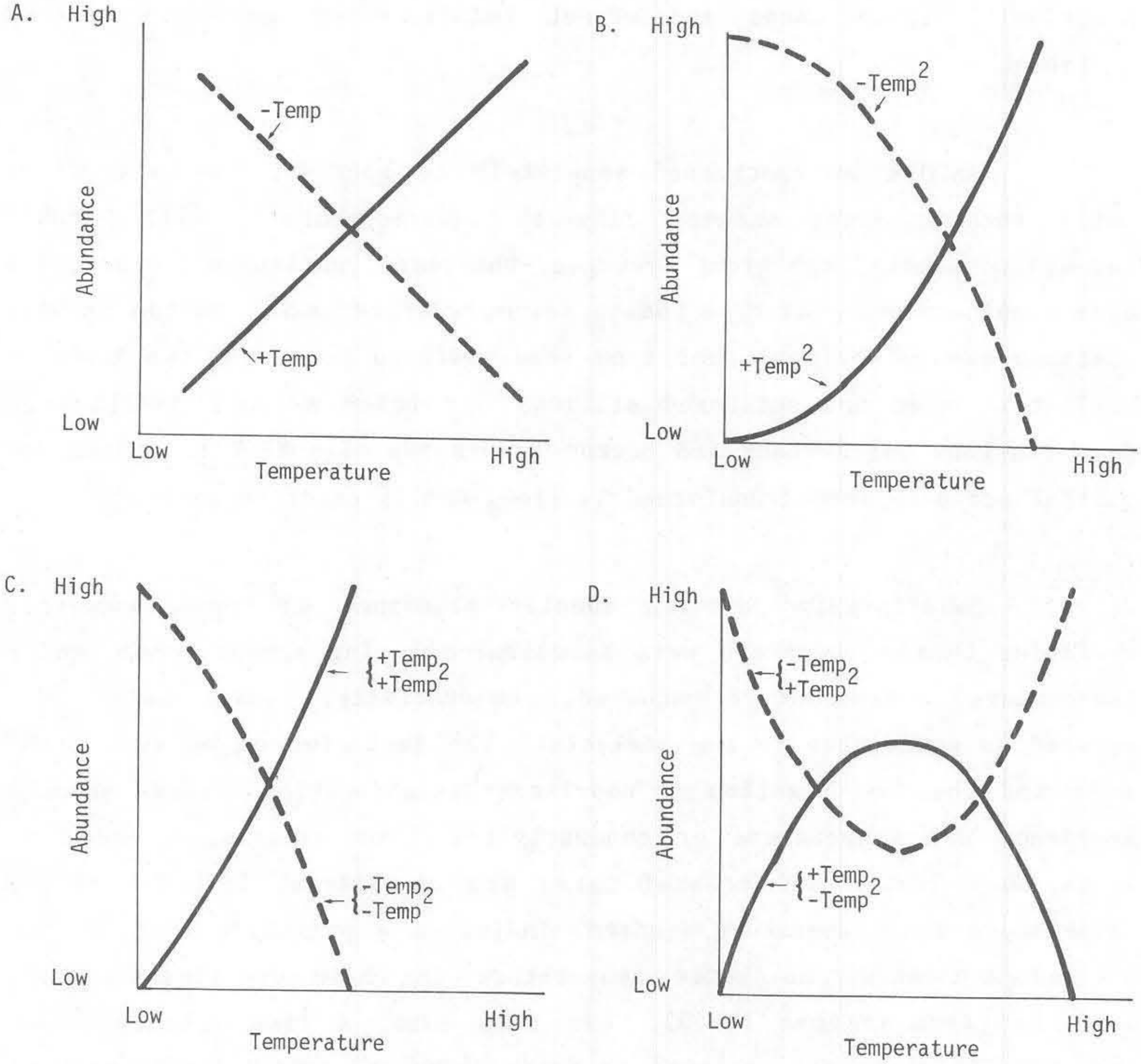


Figure IV-69. Hypothetical Plots Using Temperature (TEMP) as an Example to Illustrate General Form of Relationships between Fish Abundance and Linear or Quadratic Expressions of Environmental Variables Used in Analysis of Covariance critical value of temperature or conductivity. The significance of only a linear term (Figure IV-69) indicates a constant relationship between changes in the dependent and independent variables. It should be noted that despite separating the analysis by season, the two physicochemical variables, water temperature and conductivity, may not be completely independent because both are directly influenced by freshwater flow (TI 1976e). A correlation among independent variables (covariates) would tend to inflate the estimated error about their regression coefficients and thereby make it less likely that the variables will be judged significant (Neter and Wasserman 1974).

Differences in species abundance among years and between habitats were accounted for by treating these effects as blocking factors in the ANCOVA. The ANCOVA was limited to those species-gear-season combinations which had abundant catches (Table IV-33) because these data subsets would provide the most statistically interpretable results. The significant ($\alpha = 0.05$) results (Table IV-33) are described separately for each of the five species in the following paragraphs.

a. Striped Bass

Beach seine catches of young-of-the-year striped bass during the summer were positively related to temperature and negatively related to temperature squared. The positive relationship reflects shoreward movement of the early juveniles following transformation from the post yolk-sac stage in July, when temperatures are increasing; the negative relationship with temperature squared may be related to an offshore movement of the juveniles in late summer, perhaps to avoid high water temperatures. The negative relationship between abundance and conductivity squared indicates that striped bass young-of-the-year occurred predominantly in areas, or at times, when conductivity was relatively low. Overall, the analysis indicates that striped bass

Table IV-33

Summary of Results of Analysis of Covariance Relating Temperature and Conductivity to Fish Abundance in Vicinity of Indian Point, 1975 through 1978

Species	Age†	Season	Gear	Significance‡ and Direction‡ of Results			
				Temperature	Temperature²	Conductivity	Conductivity²
Striped Bass	YOY	Summer	Beach Seine	** (+)	** (-)		* (-)
	YR+	Spring	Beach Seine	** (+)		** (-)	
White Perch	YOY	Summer	Beach Seine				* (-)
	YR+	Spring	Bottom Trawl	** (-)		** (+)	
Atlantic Tomcod	YOY	Spring	Bottom Trawl	** (+)			
	All	Fall	Bottom Trawl			** (+)	** (-)
Blueback Herring	YOY	Summer	Surface Trawl				* (-)
	YOY	Fall	Surface Trawl	* (-)	** (-)		
	YR+	Spring	Beach Seine		** (-)		
Bay Anchovy	YOY	Summer	Surface Trawl				** (-)
	YR+	Spring	Beach Seine	* (-)		** (+)	** (-)

†YOY = young-of-the-year
YR+ = yearling and older
All = all life stages combined

‡ * = $p<0.05$
** = $p\leq0.01$

‡(-)negative relationship
(+)positive relationship

young-of-the-year are most abundant at intermediate summer water temperatures.

Beach seine catches of yearling and older striped bass during spring were positively related to temperature and negatively related to conductvity. This pattern reflects the movement of fish from deep over-wintering areas into shallow waters to feed as increased spring insolation warms water temperatures and increased runoff reduces conductivity.

b. White Perch

Beach seine catches of young-of-the-year white perch showed only a negative relationship with conductivity squared. A clear explanation for this pattern is lacking, but the statistical relationship indicates that young white perch occurred predominantly in low conductivity areas in the Indian Point region. Young white perch are apparently less temperature sensitive than young striped bass because no temperature covariates were significant.

Catches of yearling and older white perch in bottom trawls during the spring were negatively related to temperature and positively related to conductivity. This pattern reflects movement of fish from deep overwintering areas into shallow waters to feed and spawn (for age II plus) as spring runoff warms water temperatures and reduces conductivity.

c. Atlantic Tomcod

Atlantic tomcod spawn during winter and the larvae rapidly move to areas downstream from the Indian Point region during early spring. The tomcod juveniles again enter the Indian Point region with the approach of summer. This pattern of movement explains the positive relationship observed between water temperature and catches of young-of-the-year tomcod in bottom trawls during spring. In the fall, the maturing tomcod move upriver towards the middle estuary spawning grounds. The relationship between bottom trawl catches of tomcod and conductivity (positive conductivity, negative conductivity squared; Table IV-33) indicates that tomcod were most abundant at intermediate conductvity levels (Figure IV-69) as they move upstream to spawn in the late fall and winter.

d. Blueback Herring

Young-of-the-year blueback herring catches in surface trawls were negatively related to conductivity squared during summer. At this time the young herring are principally in freshwater areas north of Indian Point and their extreme downriver range is probably determined by the salt front position. During the fall, catches of young blueback herring in surface trawls were negatively related to both temperature and temperature squared, indicating a sharp increase in abundance as water temperature decreased. This pattern can be explained by the migration of the young-of-the-year into the Indian Point region as temperatures decline in fall.

In the spring, catches of yearling and older blueback herring in beach seines were negatively related to temperature squared. This relationship probably reflects the pattern of catches in 1976, since few yearling and older blueback herring were collected in the Indian Point region during the spring of 1977 or 1978 (Figure IV-18). During the spring of 1976, catches apparently decreased as temperature increased, thus yielding a negative relationship between abundance and temperature squared such as that illustrated in Figure IV-69B.

e. Bay Anchovy

In summer, young-of-the-year bay anchovy catches in surface trawls were negatively related to conductivity squared. This is difficult to explain as anchovies are halophilic and would be expected to be most abundant in more saline areas. If young bay anchovy require a period of physiological adjustment to rapid salinity increases, the observed negative relationship between nearfield abundance and conductivity squared may be real.

In the spring, beach seine catches of yearling and older anchovy were negatively related to temperature and conductivity squared and positively related to conductivity. While no explanation for the temperature relationship is apparent, the opposite signs for conductivity (positive) and conductivity squared (negative) suggest that, as with tomcod, bay anchovies are seeking intermediate salinity levels.

f. Summary

Temperature and conductivity both appear to have an important influence on the abundance of five major fish species in the vicinity of Indian Point; one or both physicochemical factors were significant in all eleven data subsets. Neither factor dominated the results, although the interrelationships between temperature and conductivity at certain times of the year may mask the relative importance of either variable in this analysis. The principal difference in the effects of these two variables is that the significant relationships involving temperature include four with temperature alone (linear) and three with temperature squared (curvilinear). Thus, the temperature effects were both linear and nonlinear. On the other hand, conductivity squared showed more significant relationships (six) than conductivity alone (two). In other words, the effects of conductivity were principally nonlinear over the ranges tested. It is highly likely that over the relatively limited ranges of water temperature during each season (Figure III-3), relationships between catch and temperature may appear linear, whereas over a much wider range the effects of temperature could be truly nonlinear. In contrast, conductivity varies considerably in each season. Species which have clearcut salinity preferences or life-cycle related movement patterns which are concurrent with conductivity changes would be more likely to exhibit non-linear, threshhold type relationships with this parameter.

In many cases the general relationships between variations in fish abundance and fluctuating physicochemical conditions may be explained in terms of life-cycle related seasonal movement patterns. Thus, some of the observed statistical relationships could be coincidental since many physicochemical variables also exhibit very predictable seasonal trends. For example, water temperatures have highly predictable patterns of change through the year and show little variation among years (Figure III-3); therefore life-cycle related movements of fishes, which are also highly predictable, could produce strong correlations between abundance and temperature, even if the species were not actively seeking a certain temperature range.

Annual patterns of conductivity levels are much less consistent among years, (Figure III-3) than water temperatures, and fish abundance relationships with conductivity are less likely to be coincidental when analyzed over several years. The high proportion of nonlinear relationships between nearfield abundance and conductivity suggests that fish abundance patterns in the Indian Point region reflect relatively sharp differences between favorable and unfavorable salinity regimes. Thus, nearfield abundance and temporal exposure to impingement for several frequently impinged fish species is closely related to nearfield salinity.

6. Assessment of Power Plant and Environmental Factors Affecting Daily Impingement Rates at Indian Point

a. Analytical Procedures

Power plant and environmental parameters, selected on the basis of previous studies (TI 1974c, 1975e, 1976d, 1977e, and 1979c), were examined, using stepwise regression analysis, to investigate causes of temporal variation in impingement collections at Units No. 2 and No. 3. Physicochemical variables used in the analyses are defined in Table IV-34 along with a list of the fish species considered. The analyses

Table IV-34

Definition of Variables Used in Impingement Stepwise Regression Models, Indian Point Units No. 2 and No. 3, 1978

Independent Variables	Definitions
VOL	Volume of water circulated
CATCH-BS	Weekly beach seine catch-per-effort (C/f), Nearfield
CATCH-BT	Biweekly bottom trawl catch-per-effort (C/f), Nearfield
WT	Water temperature, Indian Point Nearfield
WT2	Water temperature squared
DWT	Water temperature change from previous day
MXAT	Average maximum daily air temperature
MNAT	Average minimum daily air temperature
SF	Salt front position relative to Indian Point
SF2	Salt front position squared in the Indian Point Region
COND	Conductivity in Indian Point Region
COND2	Conductivity squared in Indian Point Region
DCOND	Conductivity change from previous day
AMP	Tidal amplitude at Indian Point
PPT	Mean daily precipitation
WASH	Single versus multiple screen washes
U	Unit operation interaction

Dependent Variables*

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

*Impingement counts expressed as $\log_e$ (count + 1) were directed at the examination of daily effects as opposed to monthly trends examined in Section IV.D. Intake screens were generally washed daily between 8:00 a.m. and 12:00 noon; therefore daily impingement collections were computed on the basis of fish accumulated during the period from noon to noon each day (Appendix A.3). Weather and water quality values (daily means from all measurements taken in the Indian Point Region, RM 39-46) were matched as closely as possible to the daily impingement collection period and used as independent variables in the regression. Precipitation and air temperature data for four local cities, Carmel, Yorktown Heights, West Point, and Glenham (obtained from the National Climatic Center, Ashville, North Carolina), were used to generate daily mean values for these independent variables. In addition, standard station beach seine and bottom trawl C/f data were also incorporated into each stepwise model. Weekly beach seine collections were matched to each selected impingement day within a week (i.e., Sunday to Saturday) and bottom trawl collections taken biweekly were applied to each selected impingement day within a two week period. Lined and unlined bottom trawl efforts were combined biweekly C/f values. The analysis period was restricted to the nine months (April through December) of standard stations sampling.

A stepwise regression procedure (Draper and Smith 1966) was used to identify variables related to fish impingement counts. This type of analysis is exploratory in nature and is not intended to establish functional relationships. Snedecor and Cochran (1967) state, "In the many areas of research in which controlled experiments are not practicable, multiple regression analyses are extensively used in attempts to disentangle and measure the effects of different X-variables on some response Y." However, these authors also point out that "difficulty arises because one can never be sure there are not other X-variables related to Y in the population sampled." Also, outliers may bias the regression equation and correlation among independent variables can make the bias worse; therefore, any inferences must be drawn with caution. This problem can never be completely overcome, but there exist several factors in this study that mitigate its effect:

- Large R-square (R^2) values for many of the regressions indicate that much of the impingement variability has been accounted for by the models.
- The ranges of values for water temperature, conductivity, water volume circulated, air temperature, tidal amplitude and precipitation, are large and as a result the regressions are based on values likely to be encountered in the future.
- Specific changes in impingement resulting from specific changes in other variables are not reported, but instead only the direction of the change.

Fish impingement counts were transformed [$\log_e(X+1)$] for the regression analysis to stabilize the variance of the Y-variable (Snedecor and Cochran 1967).

The stepwise procedure started with a simple correlation matrix and entered into regression the variable most highly correlated with daily impingement collections of the species in question; i.e., selected the single-variable model (regression) which produced the largest R^2 statistic. At each subsequent step an additional variable, one whose partial correlation with impingement counts was highest, was added to the previous step's model. After each variable was added, the procedure reexamined all variables included in the model. Any variable not producing a partial F statistic at the specified significance level for retention in the analysis was deleted from the model. The significance level for entry of a variable was 0.50, while the significance level for removal of a variable was 0.10. The final regression model resulting from the stepwise procedure for each species included those variables which best explained the observed variations in daily impingement collections; i.e., those variables which when included in the model were each still sufficiently significant to generate F values with probabilities less than 0.10.

Some of the factors thought to influence impingement were represented by "dummy" variables; i.e., variables which indicated only the presence or absence of a condition such as single versus multiple screen washes and concurrent operation of the other unit. Additionally, the square of water temperature, salt front position, and conductivity were included in the analyses to identify nonlinear as well as linear relationships (Bradley and Srivastava 1979). These variables were transformed by subtracting the mean value of each parameter from each daily value of the parameter over the time period considered.

b. Results and Discussion

The variables found to be significant by the regression procedures were generally season, temperature, nearfield abundance, salt front position, conductivity, multiple screen washes, and volume of water circulated. Other variables, such as precipitation, tidal amplitude, and unit interaction were found to be important, but their failure to appear consistently in the regression models suggests a lesser role in affecting impingement collections at the Indian Point generating station. The results of the analyses are presented by individual species in Appendix A.6. and are summarized in Table IV-35. The occurrence of several low R^2 values may indicate that nonlinear relationships or interactions of independent variables not included in the models govern impingement.

Volume of water circulated during the collection period was selected in the regression model for each species except bluefish at Unit No. 2 (Table IV-35) and the coefficient for volume was always

Table IV-35

Summary of Results from Stepwise Regression Analysis of Impingement Rates at Indian Point Units No. 2 and No. 3, 1978

Species	Unit	R^2	VOL	BS CATCH	BT CATCH	WT	WT2	DWT	MXAT	MNAT	SF	SF2	COND	COND2	DCOND	AMP	PPT	WASH	U
All Species	2	0.7516	+			-				+	+	-	+	-		+	-	+	
	3	0.8010	+	+						-	-	-	+	-	-			+	-
Alewife	2	0.6858	+		+	-				+	+		+	-		+	-	+	
	3	0.7565	+	-	+								+	-		+		+	+
Bay Anchovy	2	0.7495	+			+	-				+	-	+	-	-	+			
	3	0.8053	+			+				-	-	+	+	-			-		
American Shad	2	0.7250	+		-		-						+	-		+	-	+	-
	3	0.7464	+	+	+				-				+	-			-	+	+
Bluefish	2	0.6484		+			+			+				-		+			-
	3	0.2966	+			+	+		-		-								
Hogchoker	2	0.6287	+	+			-			+		-	+	-	-	+			+
	3	0.8047	+	+		+	-					-	+		-	+			-
Blueback Herring	2	0.7005	+	-			-						+	-	-	+	-	+	
	3	0.8454	+		+		-					-	+	-	-			+	+
Rainbow Smelt	2	0.7279	+		-	-	+							-		+			-
	3	0.7043	+	+		-	+					-		-		+		+	
Spottail Shiner	2	0.4288	+	+		-	+				-								
	3	0.7166	+		+	-	+				-		-	+			-		-
Striped Bass	2	0.7209	+	+	+	-							+	-				+	-
	3	0.7243	+		+					-		-	+	-		+		+	-
Atlantic Tomcod	2	0.7993	+	-	+		+			+			-		+	+			+
	3	0.5031	+		-	+	+					-		-	-	+		+	
White Catfish	2	0.5896	+		+	-								-		+		+	+
	3.	0.6779	+	-		-					-							+	-
White Perch	2	0.7429	+		+	-				+		-	+	-				+	+
	3	0.8099	+		+	-	+			-		-		-				+	-
Weakfish	2	0.6731	+		+				+				+	-	-	+	-		
	3	0.6571	+		+	+				-	-	-	+		-				

positive (+), indicating that impingement collections increased as the water volume circulated increased. This result was anticipated and supports expressing impingement C/f as a rate determined by dividing the number of fish impinged by the total volume of water pumped during a given time period (i.e., number of fish impinged/$10^6 m^3$ water circulated).

Comparisons of river abundances to impingement collections (Secton IV.D) illustrated that fish densities in the Indian Point region are key variables in impingement. This observation was made in previous studies (TI 1979c), and by Haven and Ginn (1978) in their development of a regression model for predicting impingement. Bay anchovy was the only species examined for which neither standard station beach seine nor bottom trawl collections were selected by the regression models. Increased bottom trawl collections reflected increased impingement for striped bass, white perch, alewife, and weakfish at both Units No. 2 and No. 3 (Table IV-35). Increased beach seine collections coincided with increased impingement for hogchoker at both units. For striped bass, at Unit No. 2 and American shad at Unit No. 3 increased impingement coincided with both increased bottom trawl and beach seine collections of these species. Results for other species were not consistent for nearfield gear or unit, indicating that other relationships or interactions among independent variables inextricably override the importance of nearfield abundance. The effects of physicochemcial factors on impingement collections are associated with daily and seasonal behavioral and distributional patterns of the fishes (Haven and Ginn 1978; Lifton and Storr 1978).

The results in the bluefish models are of particular interest. In the stepwise regression procedure, a new model (one which produces the largest R^2 statistic) is generated for each variable added until the final model is attained (see Draper and Smith 1966). At Unit No. 2, bottom trawl and beach seine C/f data accounted for 54% of the impingement variation for bluefish in the first two steps of the regression procedure. At Unit No. 3, however, neither beach seine nor bottom trawl collections of bluefish were selected in the model. These results lend support to the hypothesis that predators such as bluefish gather at Unit No. 2 fixed screens to take advantage of available prey (Section IV.B), while at Unit No. 3 this attractant for bluefish apparently does not exist.

Season is the main factor affecting presence and location of fishes in the Hudson River and therefore availability of fish vulnerable to impingement. While seasonal trends in impingement were well defined, the amplitude of impingement peaks was strongly influenced by the combined effects of temperature and conductivity changes (Section IV.D). For example, striped bass and white perch impingement displayed an inverse relationship with seasonal temperature trends (Table IV-35) indicative of movements between shoal and channel habitats in response to seasonal rise and fall of river temperatures. Futhermore, maximum impingement of striped bass and white perch, which occurred in late fall during 1978 (Figures IV-10 and IV-28), coincided with the presence of the salt front in the vicinity of Indian Point (Appendix Tables A-35 and A-38). Throughout much of the summer, young striped bass and white perch were concentrated in the shore zone (Section IV.D) presumably beyond the influence of the intakes. Bay anchovy and weakfish, however, were abundant in the Indian Point region during summer and increased impingement collections of these species were associated with local salt front movements and increased conductivities (Appendix Tables A-28 and A-39).

Temperature and conductivity changes explained much of the variation in impingement collections for other species examined as well. Increases in daily water temperatures coincided with decreases in daily impingement for white catfish (Appendix Table A-37) and alewife (Appendix Table A-27). The stepwise regression procedure used mean daily values for various factors whereas RCI's were calculated on a monthly basis; hence the two analyses are not comparable. A nonlinear relationship between impingement and water temperature existed for several species (Table IV-35) and resulted in one of two types of responses which are best described as parabolic shaped curves; one arched upwards (convex) and the other arched downwards (Figure IV-69). For example, impingement of American shad, hogchoker, and blueback herring at Unit No. 2 tended to increase as water temperatures approached approximately 14°C (Appendix Tables A-29, A-31, and A-32). The converse was true for Atlantic tomcod, rainbow smelt, and spottail shiner, since impingement collections appeared to decrease at Unit No. 2 as water temperatures approached approximately 14°C, 22°C, and 23°C, respectively (Appendix Tables A-36, A-33, and A-34).

The effects of air temperature on impingement, as selected in the models differed for the two units. At Unit No. 2, impingement of alewife, weakfish, hogchoker, Atlantic tomcod, white perch and all species combined tended to increase with increasing air temperatures (Table IV-35). Increasing air temperatures, on the other hand, coincided with decreased impingement at Unit No. 3 for striped bass, bluefish, weakfish, bay anchovy, American shad, white perch and all species combined. For some species (e.g., alewife and all species combined at Unit No. 2) these results are inconsistent with the results for water temperature. Most likely, the different response produced by air temperature at the two units resulted from interactions with other independent variables.

Daily conductivity levels in the Indian Point region and salt front position were identified as important variables in the regression models (see also Section IV.D). Salt front position as used in the analyses was predicted from a model based primarily on tidal amplitude and freshwater flow (TI 1979c). Large impingement collections were frequently associated with salt front intrusions in the Indian Point region. As in past studies (TI 1975c, 1976a, 1977e, and 1979c), increased abundance of fishes moving with the salt front in the vicinity of the plant during 1978 contributed to increased impingement collections. Analyses indicated that a nonlinear relationship between impingement and salt front position existed for most species; for all species but one (bay anchovy), salt front squared (SF^2) had a negative coefficient (Figure IV-69). For example, impingement of Atlantic tomcod, hogchoker, blueback herring, and rainbow smelt at Unit No. 3 increased as the salt front approached Indian Point and decreased thereafter (Appendix Tables A-36, A-31, A-32, and A-33), whereas peak impingement of weakfish (Appendix Table A-39) at Unit No. 3 occurred as the salt front passed through the Tappan Zee region. As expected for freshwater species such as white catfish and spottail shiner, impingement decreased as the salt front moved farther upriver (Table IV-35 and Section IV.D.1).

A nonlinear relationship between impingement and conductivity was portrayed in the models for most species examined (Table IV-35). For the majority of species, including striped bass, white perch, and the three clupeids (American shad, alewife, and blueback herring), impingement increased as conductivity approached a certain specific value (Appendix A.6) and then decreased. For example, impingement of white perch, Atlantic tomcod, and rainbow smelt at Unit No. 3 increased as conductivity approached approximately 2,820 mS/cm, and decreased at higher values (Appendix Tables A-38, A-36, and A-33).

Daily changes in conductivity were included in the analyses (as opposed to longer term conductivity trends discussed in Section IV.D), but only a few species appeared to be affected by day-to-day changes (Table IV-35). Decreased impingement of blueback herring and weakfish, for example, coincided with increased delta conductivity (i.e., amount of conductivity change from the previous day).

Tidal amplitude appeared important in explaining some of the variation in impingement for most species at one or both units (Table IV-35). In each of the 16 models that selected tidal amplitude, it had a positive coefficient indicating that as tidal amplitude increased, impingement increased. These results are consistent with those discussed above for conductivity because variations in daily conductivities are associated with tidal mixing (TI 1976e), so conductivity values and tidal amplitudes were expected to have similar effects on impingement.

Increased precipitation corresponded with decreased impingement for the three clupeids, (alewife, American shad, blueback herring), bay anchovy, weakfish, spottail shiner, and all species combined at one or both units (Table IV-35). The apparent change in impingement vulnerability due to precipitation (and perhaps barometric pressure changes) may have been related to changes in behavioral patterns including movement from shoals to channel, vertical migration, and/or changes in activity levels.

Multiple screen washings (i.e., more than one per day) at Units No. 2 and No. 3 were associated with increased collections for the majority of species including striped bass, white perch, and the three clupeids (Table IV-35). This may be explained by the fact that high fish (and debris) loading often resulted in multiple screen washings (i.e., impingement would have been high regardless of multiple washings) and/or that multiple washings increase the fish collection potential of the screens.

The effect of operation of one unit on the impingement collections at the other unit explains some of the variation in impingement for several species. Consistent with previous findings (TI 1979d), a decrease in impingement of striped bass and all species combined at one unit was associated with concurrent operations of the other (Table IV-35). These and similar results for bluefish, rainbow smelt, and spottail shiner in 1978 (Table IV-35) support the suggestion that, for certain species, the two units compete for some portion of the total number of fish subject to impingement. On the other hand, for alewife, blueback herring, and Atlantic tomcod, the opposite effect (an increase in impingement at one unit coinciding with concurrent operation at the other) was evident (Table IV-35). Furthermore, mixed effects occurred for American shad, hogchoker, white catfish, and white perch (Table IV-35). These results suggest that combined unit operations affect the distribution or behavior of fish in front of the intakes, or that the effects of unit interaction are confounded by other variables.

In summary, fish impingement at the Indian Point generating station exhibited seasonal cycles that were partly related to migratory activities and partly to the nursery function of the estuary. Seasonal and probably diurnal variations in impingement were most affected by changes in water temperature and by salt front position and resulting conductivity changes. These physicochemical parameters not only influenced the behavioral patterns of the fishes but affected impingement by altering the abundance of fishes in the Indian Point region. Results of the regression analyses were not always consistent for the variables examined, but varied by species and unit, making it difficult to characterize consistent trends. Frequently a variable selected at one unit was not selected at the other for the same species. There were, however, several variables which consistently affected impingement of most species.

The variable conductivity squared, selected in nearly all models, had negative coefficients in all but one model. When tidal amplitude or multiple washes were selected, they had positive coefficients; when precipitation was selected, it had a negative coefficient. The volume of water circulated also proved to be a key variable, being selected for 27 of 28 models, and supports the practice of expressing impingement catch per effort as the number of fish impinged divided by the total water volume circulated as opposed to other possible measures such as catch per time period.

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SECTION V

MITIGATION STUDIES

The entrainment and impingement of fishes at cooling water intakes has been a major concern in power plant operation. In recent years extensive research has been directed toward finding methods to mitigate entrainment and impingement effects, and several methods have been proposed. One method of offsetting losses to a population due to plant operations is through the use of artificial propagation and stocking programs. Another method is to increase the survival of impinged individuals. This section describes a striped bass hatchery program, including the recapture of mature hatchery-reared fish returning to spawn, and a continuously operating fine mesh traveling screen system designed to reduce entrainment and improve survival of impinged fish at the Indian Point generating station Unit No. 1.

A. STRIPED BASS HATCHERY PROGRAM

1. History

Since 1973, TI has been investigating the feasibility of stocking hatchery-reared striped bass as a method for mitigating the impact of power plant operation on the striped bass population of the Hudson River. Undertaking such a study was a stipulation of the license issued in 1970 by the Federal Power Commission (presently the Federal Energy Regulatory Commission) to Con Edison for constructing and operating a pumped storage hydroelectric plant at Cornwall, New York. During 1973 through 1975, approximately 319,000 hatchery-reared fingerlings (young-of-the-year or juveniles) were marked and stocked in the Hudson River (Figure V-1) between RM 24 and 62 (KM 39-100) with the intent of monitoring their survival through a recapture effort.

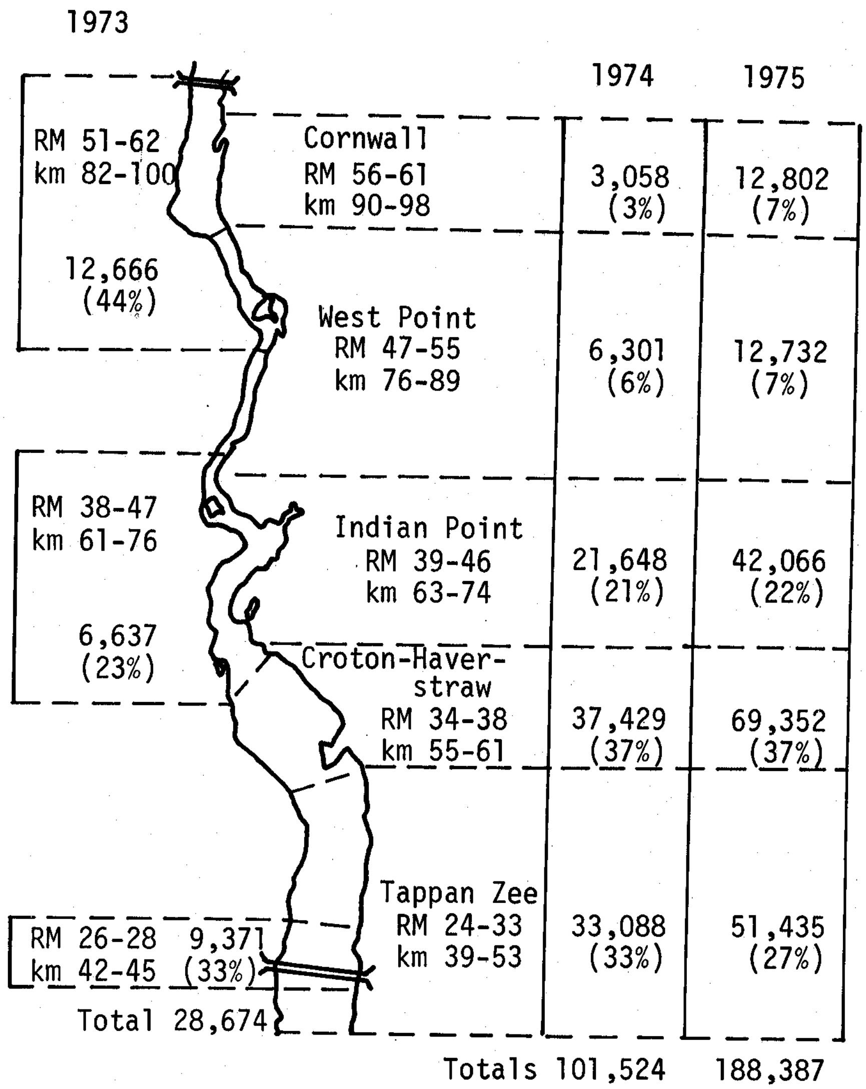

Figure V-1. Number of Hatchery-Reared Striped Bass Fingerlings Stocked in Hudson River by Geographical Area during 1973, 1974, and 1975

These fish were hatched at a pilot facility operated by TI at Verplanck, New York, using induced spawning techniques on wild brood fish captured each spring from the Hudson River. Shortly after hatching, larvae were shipped to pond facilities in the south and southwest United States where they were reared to stockable fingerlings (50-150 mm TL) during the summer. A portion (319,000) of the fingerlings produced were transported back to the Hudson in the fall for marking and stocking. Additionally, approximately 25 percent of the larvae hatched at Verplanck were supplied to several agencies (including TI) for use in experiments designed to advance intensive culture technology and to evaluate power plant entrainment.

Intensive culture in tanks or aquaria has been viewed as a desirable alternative to pond (or extensive) culture for a facility located near the Hudson. In addition to fish distributed as mentioned above, over two million Hudson River fingerlings were reared in pond type facilities in southern United States and were stocked in various rivers and lakes as remuneration for the rearing of those fish shipped to and stocked in the Hudson River. Details of the spawning, rearing, stocking, and experimental programs were presented in several TI reports (TI 1974b, 1975f, 1977a) and a summary of the entire program was presented in the 1977 Hatchery Overview Report (TI 1977b).

Positive identification of hatchery-reared fish has been assured by marking each individual with a finclip and magnetic nose tag prior to stocking. As of 30 June 1979, 1,917 hatchery-reared striped bass have been recaptured from the Hudson River and adjacent waters (Table V-1 and Appendix Table B-5). By examining the change in rate of recapture of marked wild fingerlings versus marked hatchery-reared fingerlings through time, short-term survival (3 to 9 months) of hatchery-reared fingerlings has been shown to be equal to or greater than that of wild fingerlings (TI 1977b). Analysis of stomach contents, growth, and movements have provided evidence that hatchery-reared and wild striped bass behave and grow similarly (TI 1977e, 1979c). Accordingly, a model was generated to estimate the number of hatchery-reared striped bass needed to offset power plant related losses of the juvenile population in the Hudson River, assuming equivalence of hatchery-reared and wild striped bass (TI 1977b).

Table V-1

Summary of Recapture of Hatchery-Reared Striped Bass during Year of Release and Subsequent Year

Year Stocked	Number Stocked	Year Recaptured	Number Recaptured
1973*	28,674	1973	46
		1974	3
1974	101,524	1974	164
		1975	442
		1976	6
		1977	6
		1978	21
		1979†	11
1975	188,387	1975	925
		1976	259
		1977	10
		1978	11
		1979†	13
Total	318,585		1917

*All fish stocked in 1973 were marked by clipping the second dorsal fin, which is now known to be capable of rapid regeneration. Fin regeneration, combined with a nose-tag insertion/retention rate of only 17% in 1973 (TI 1974b), may explain why more recaptures from the first year of stocking have not been identified.

†Through 30 June 1979

2. Present Status

As part of the current hatchery program, efforts are being made to identify hatchery-reared striped bass from among the adults and sub-adults captured preceding and during the annual spawning run in the Hudson River. The sexual maturity of hatchery-reared fish recaptured in 1977, 1978, and through 30 June 1979, has been determined (For methodology see McFadden 1977) and, like wild striped bass [TI 1980 (in preparation)], most four and five year-old males were mature (Table V-2). Female striped bass are known to mature slower (McFadden et al. 1978) than males, so it was not until 1979 (as five-year old fish) that

Table V-2

Sexual Maturity of Hatchery-Reared Striped Bass Recaptured from Hudson River during 1977 through 30 June 1979

Year Stocked	Year Recaptured	Age (years)	Number Recaptures: Immature Female	Mature Female*	Immature Male	Mature Male*	Undetermined†
1974	1977	3	0	0	1	5	0
	1978	4	2	0	1	14	4
	1979	5	3	2	0	4	2
1975	1977	2	3	0	4	0	3
	1978	3	7	0	3	1	0
	1979	4	6	0	4	2	1
Total			21	2	13	26	10

*Includes ripe and developing fish with body weight to gonad weight ratios less than 70:1 for females and 235:1 for males

†Visible sexual condition undetermined or fish collected outside of spawning season

two mature hatchery-reared females were recaptured. These findings show that hatchery-reared striped bass survive, grow, mature, and contribute to the Hudson River spawning stock.

Although the stocking program ended in 1975, TI has continued to operate the Verplanck hatchery to provide eggs, larvae, and juveniles for experimental purposes. In 1976, most larvae were supplied to Southern Illinois University for intensive culture experiments, but in 1977 and 1978 most eggs and larvae were supplied or reared to the juvenile stage for power plant entrainment studies (TI 1977c, 1977h, and TI 1979a).

B. FINE MESH TRAVELING SCREEN STUDIES

1. Brief History and Objectives of 1978 Study

The fine mesh traveling screen system design was based on techniques developed in studies conducted by the Virginia Electric and Power Company (VEPCO) (White and Brehmer 1976) and the Tennessee Valley Authority (Tomljanovich et al. 1977). Techniques for reducing impingement effects involved modifications to the design and operation of the existing conventional traveling screen system. These modifications included: a) the fitting of fine mesh screening (2.5 mm) to each screen panel to reduce entrainment by retaining larval fish on the screen, b) continuous operation of the traveling screen to minimize impingement duration, c) addition of troughs (fish buckets) to each screen panel to collect fish, thereby reducing the mechanical abrasion of fish impinged against the screen, d) addition of a low pressure wash system to remove impinged fish while minimizing physical damage in the process, and e) addition of a sluiceway system to transport collected fish back to the river. TI conducted preliminary studies in 1977 to monitor the initial and extended survival of juvenile (>50 mm), and yearling and older fish diverted to the sluiceway to test the effectiveness of the system in reducing impingement effects at the Indian Point generating station. The effectiveness of this screen for reducing entrainment at Indian Point was investigated by Ecological Analysts, Inc. (EAI 1977, 1979).

In the 1977 preliminary tests conducted by TI, 12 of the species tested (including striped bass, Atlantic tomcod, and white catfish) exhibited relatively high (80-100%) survival. The remaining species, composed predominantly of clupeid fishes (*Alosa* spp., menhaden) and bay anchovy exhibited lower, more variable survival (TI 1978d). Initial and extended survival for all species combined were 41% and 24% respectively. These estimates indicated that a greater percentage of fish survived impingement on the fine mesh screen than on a conventionally operated traveling screen (survival has been assumed to be zero at Indian Point for purposes of impact estimates), but less than that reported from other studies conducted with modified continuously operating traveling screens (King et al. 1978, White and Brehmer 1976). Observations made during the 1977 Indian Point study and techniques used in the VEPCO study indicated that survival of impinged fish could be improved by optimizing the spray pressure of the low pressure wash systems. Observations at Indian Point during 1977 also indicated a need to determine the efficiency of the sluiceway in recovering fish washed from the traveling screen.

Thus, the overall goal for the 1978 study was to increase survival through improvements to the fine mesh screen system. The specific objectives were:

1) to determine the effect of wash pressure on recovery rates of impinged fishes (collection efficiency),
2) to minimize mechanical effects of the recovery system on survival of impinged fishes by optimizing spray wash pressures,
3) to determine initial, extended, and overall survival of fish impinged on the continuously operating screen (i.e., survival tests).

2. Description of the Traveling Screen and Collection System

Modifications were made to the conventional traveling screen at one intake bay (no. 11) of Indian Point Unit No. 1 for testing purposes. Each conventional screen panel was removed and replaced with 2.5 mm fine mesh nylon screening and a horizontal trough or fish bucket 10.2 cm (4 in) wide by 3 m (10 ft) long that retained about two inches of water as the screen was rotated (Figure V-2). The collection sluice was constructed of plywood lined with fiberglass and extended the entire width of the traveling screen (Figure V-3). The screen panels were washed by two low pressure spray cleaning systems: one inside the

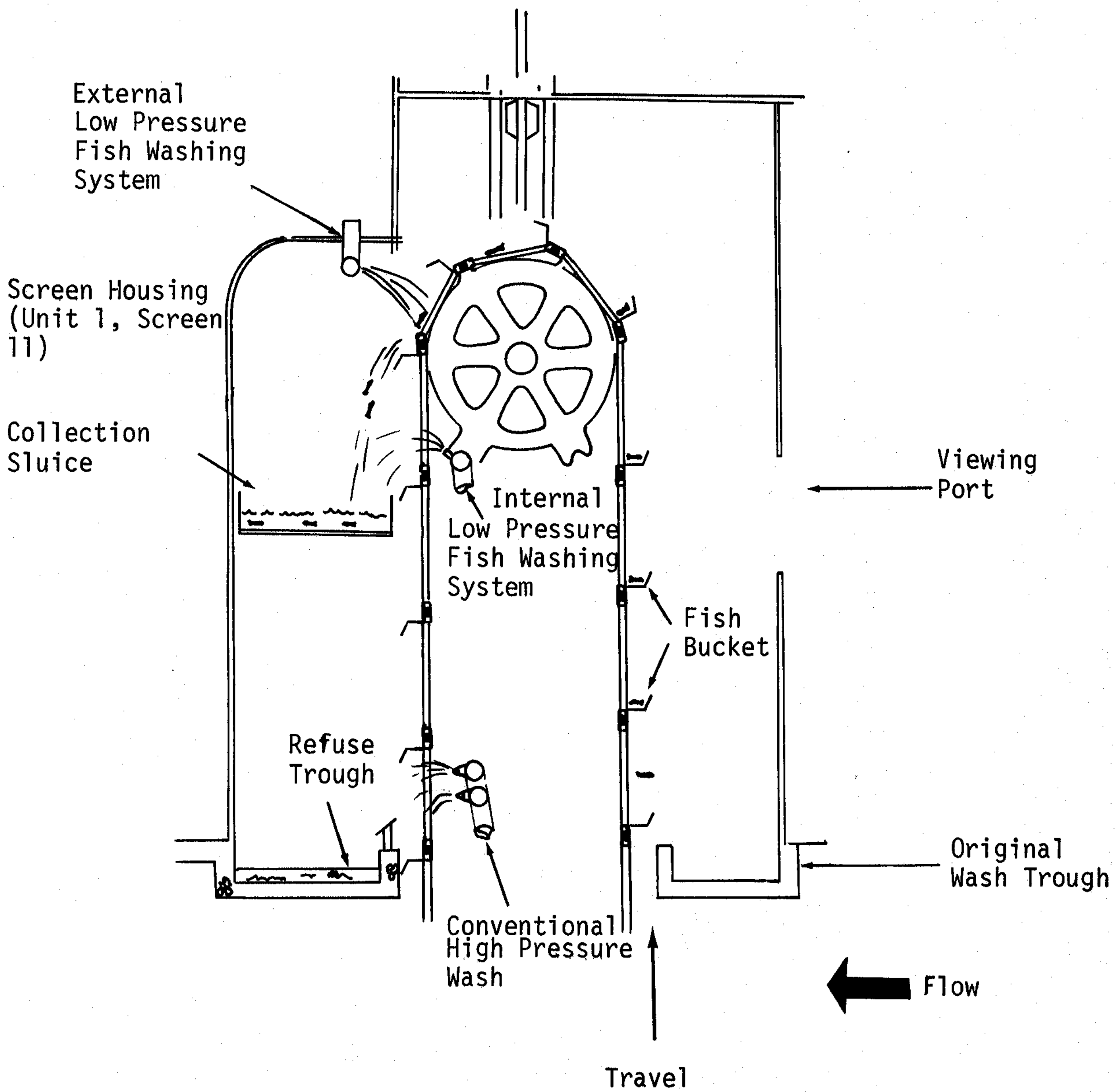

Figure V-2. Schematic Diagram of a Fine Mesh Continuously Operating Traveling Screen. (Modified from Figure 2, White and Brehmer, 1976)

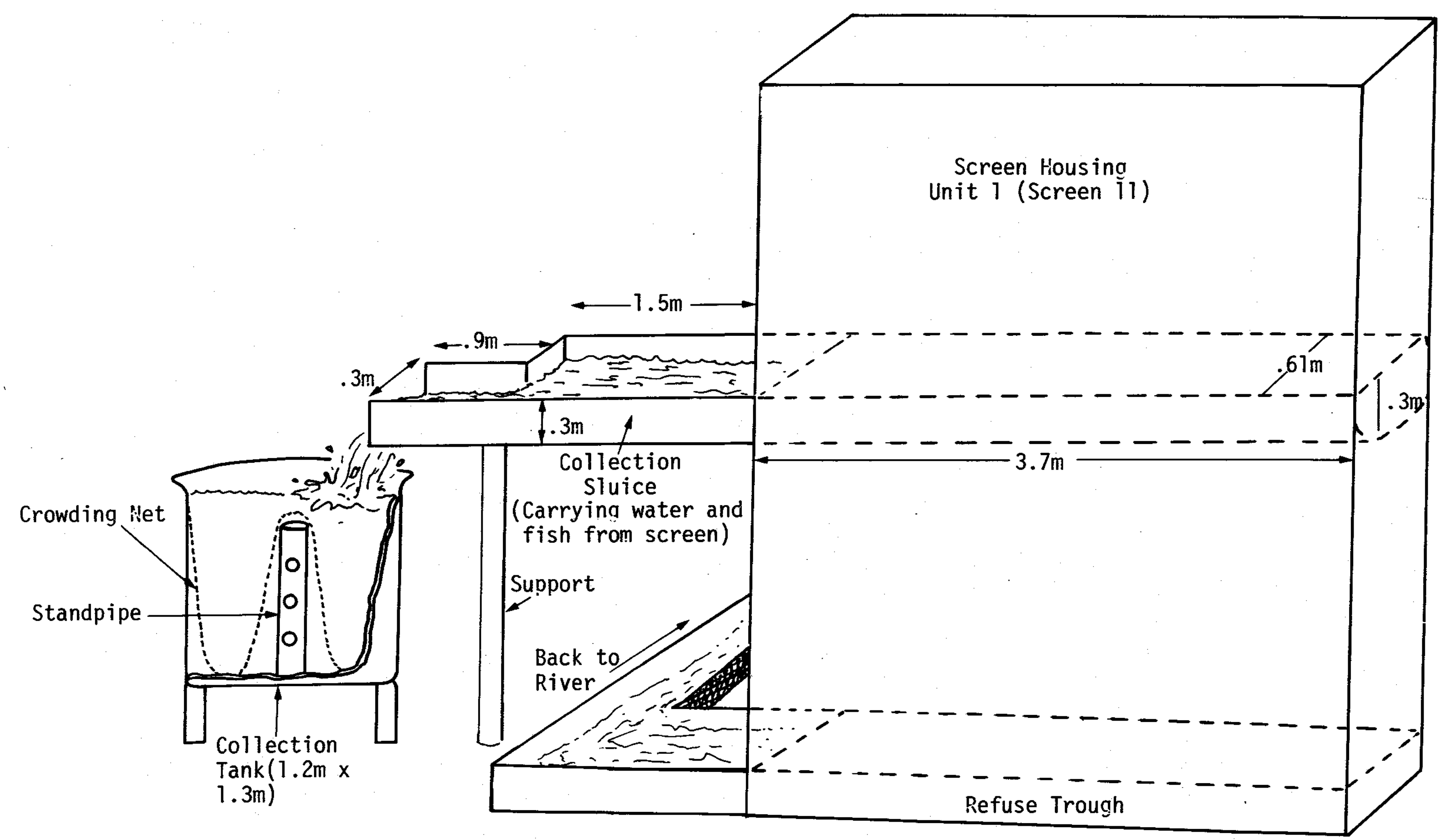

Figure V-3. Collection Device and Collection Tank Used to Collect Fish from Fine Mesh Traveling Screen at Indian Point Unit No. 1

rotating screen pointing out toward the collection sluice and another located outside and above the screen pointing down toward the collection sluice (Figure V-2). These spray nozzles extended the full width of the traveling screen. A third nozzle was located at the end of the sluiceway to supplement the amount of water in the sluice. An additional high pressure wash, located below the collection sluice, removed debris from the screen.

3. Collection Efficiency Tests

To determine the percent of impinged fish that were recovered in the collection sluice (i.e., collection efficiency), spray wash pressure combinations (low pressure system) low enough to minimize physical damage to the fish, but high enough to determine any differences in screen washing effectiveness were tested. Twelve treatment combinations consisting of three internal wash pressures (0, 10, 20 lb/in^2 gauge) and four external pressures (0, 10, 20, 30 lb/in^2 gauge) were tested. A larger range of wash pressures was tested for the external wash because it was assumed this wash system could have a more direct influence than the internal wash system on washing fish from the screen.

Three replicate lots of 50 dead fish per lot were tested at each of the 12 treatment combinations. Because of the large number of fish needed for testing, dead juvenile Atlantic tomcod (predominant in impingement collections at the time of testing) acquired from impingement collections at Units No. 2 and No. 3 were tested. The circulator for intake bay no. 11 was turned off prior to testing, and the traveling screen and sluiceway systems were examined to ensure that they were free of debris and fish. Traveling screen speed was set at 1.5 m/min (5 ft/min). The external and internal wash systems were set at the appropriate pressures for each test. The viewing port cover was removed from the screen housing (Figure V-2) and ten fish were placed along the entire screen width in each of a series of five fish buckets (screen troughs). When the last fish bucket containing fish had passed the sluiceway, the test was ended and the number of fish recovered in the sluiceway were counted.

To test the assumption that live fish respond the same as dead fish to the low pressure spray wash combinations, single lots of 50 live fish each were tested at four internal/external spray wash combinations (10/10, 10/20, 20/10, and 20/20 lb/in^2). The techniques employed were the same as those described for tests with dead fish. Juvenile striped bass collected by 100-ft beach seines were used for testing as it was not feasible to collect the number of live specimens of juvenile Atlantic tomcod needed for testing. It was assumed that any differences in collection frequency due to species differences would be minimal, as the size and body shape of both species was similar. The rationale for choosing the four combinations of spray wash pressures is discussed in the section describing the results of live fish tests.

The percentage of fish recovered for each test was calculated by:

$$R = \frac{N_r}{N_t} \times 100$$

where

R = percent recovered in the sluiceway
N_r = number recovered in the sluiceway
N_t = number tested

a. Dead Fish

The mean percent collection efficiency for the 12 treatment combinations ranged from a low of 3.3 percent at 0 lb/in^2 (for both internal and external systems) to a high of 41.3 percent at internal and external wash pressures of 20 lb/in^2 and 30 lb/in^2, respectively (Table V-3). The results supported two prior hypotheses: 1) that collection efficiency was less than 100 percent, and 2) that spray wash pressure had a direct effect on collection efficiency.

Table V-3

Mean Percent Recovery of Dead Fish in Sluiceway of Fine Mesh Traveling Screen at Twelve Low Pressure Spray Wash Combinations

Internal Pressure	External Pressure 0	10	20	30	Mean
0	3.3	4.0	14.0	15.6	9.2
10	15.3	8.0	24.7	17.3	16.3
20	21.3	28.7	36.0	41.3	31.8
Mean	13.3	13.6	24.9	24.7	19.1

Observations made at the time of testing indicated that many of the fish not recovered in the collection sluiceway were recovered in the lower refuse trough (Figure V-2). The combined recovery of fish from the sluiceway and the refuse trough ranged from 60.0 percent to 95.3 percent. In each test the percent recovery was higher in the lower refuse trough than in the upper sluiceway and indicated that the conventional high wash pressures (40 and 50 lb/in^2) were more effective than the lower spray wash pressures in washing fish from the screen. Fish not recovered in either the sluiceway or refuse trough presumably fell behind the traveling screen.

To determine the relative effects of the internal and external wash systems on collection efficiency, the percent recovery data were analyzed by two-way analysis of variance (ANOVA). Because the percentages were not normally distributed they were transformed using an arc sine transformation (Sokal and Rohlf 1969) before performing the ANOVA. Both internal and external pressure had a significant effect ($\alpha = 0.05$) on collection efficiency (Table V-4).

An _a posteriori_ Student-Newman-Keuls (SNK) test (Sokal and Rohlf 1969) was performed to make comparisons among wash pressures within each factor (internal and external wash pressures). Collection efficiencies at each of the three internal wash pressures were significantly different ($\alpha = 0.05$) from one another (Table V-5). The collection efficiencies for each of the four external wash pressures could be divided into two distinct groups: 0 and 10 lb/in^2 versus 20 and 30 lb/in^2 (Table V-5), which were significantly different ($\alpha = 0.05$).

b. Live Fish

Selection of the four treatment combinations used to test live fish (internal and external wash pressures of 10 and 20 lb/in^2) was based on the results of the SNK test described above. Pressures of 0 lb/in^2 were not used because of the poor collection efficiency. An external pressure of 30 lb/in^2 was not tested because it did not produce significantly greater collection efficiency than 20 lb/in^2 (Table V-5).

The percentage of live fish recovered in the collection sluiceway ranged from 52 to 78 percent (Table V-6) and was greater than the percentage of dead fish recovered. Contingency analysis (Sokal and Rohlf 1969) (G-Test) on numbers recovered revealed that only the

Table V-4

Results of ANOVA on Transformed Collection Efficiency Estimates of Dead Fish Recovered from a Continuously Operating Fine Mesh Traveling Screen in 1978

Source of Variation	df	SS	MS	F	p
Internal Pressure	2	1817.698	908.849	23.396*	<0.001
External Pressure	3	789.583	263.194	6.775*	0.001<p<0.005
Internal x External Interaction	6	195.837	32.640	0.840	0.5<p<0.75
Error Term	24	932.314	38.846		
Total	35	3735.431			

df = degrees of freedom
SS = sum of squares
MS = mean squares
F = test statistic
p = probability of larger F
* = significant ($\alpha=0.05$)
† = arc sine transformation

Table V-5

Results of Student-Newman-Keuls Test on Transformed Mean Collection Efficiency Estimates of Dead Fish at Three Internal and Four External Spray Wash Pressures

	Spray Wash Pressure (lb/in^2)†			
	0	10	20	30
External Spray*	19.71	19.89	29.14	29.19
Internal Spray**	16.49	23.20	33.76	

†Values with common underlines are not significantly different ($p<0.05$)
*External Spray - Two distinct groups 0 and 10 lb/in^2 and 20 and 30 lb/in^2 were significantly different ($\alpha=0.05$) from one another
**Internal Spray - Each of the three internal wash pressures were significantly different ($\alpha=0.05$) from one another

Table V-6

Percent Recovery of Live Fish in Sluiceway System of Fine Mesh Traveling Screen at Four Spray Wash Pressure Combinations

Internal Pressure	External Pressure 10	20
10	52	56
20	65	78

internal wash had a significant effect (α = 0.05) on collection efficiency of live fish (Table V-7).

Higher recovery rates of live fish probably resulted from the observed flipping response of live fish. Lacking this flipping response, dead fish simply slid down along the face of the screen and came to rest on the bottom of the inverted fish bucket of the preceding panel as the bucket containing them inverted. In this position the dead fish were partially sheltered from the internal spray wash and consequently collection efficiency was reduced. Live fish, however, were stimulated by the external spray wash and began flipping as soon as the fish bucket inverted. As the fish flipped and fell away from the screen, they were exposed to the internal spray wash which pushed them away from the screen toward the sluiceway. Increased internal pressures exerted more lateral force, pushed the fish farther toward the sluiceway, and accounted for higher efficiencies at increased internal wash pressures. The external wash system apparently acted mainly as a stimulant, and low pressures of 10 lb/in^2 were adequate to induce the flipping response. It should be noted that collection efficiency of

Table V-7

Results of G-Test on Transformed† Collection Efficiency Counts of Live Fish Recovered from Continuously Operating Fine Mesh Traveling Screen in 1978

Hypothesis Tested	df	G	p
P_E x R Independence	1	1.722	$0.1<p<0.5$
P_I x R Independence	1	6.798*	$0.005<p<0.01$
P_I x P_E Independence	1	0.586	$0.1<p<0.5$
P_I x P_E x R Interaction	1	0.308	$0.5<p<0.9$
P_I x P_E x R Independence	4	9.414	$0.05<p<0.1$

df = degrees of freedom
G = G-statistic
p = probability of larger G
P_E = external pressure
P_I = internal pressure
R = recovery (collection efficiency)
* = significant (α=0.05)
† = flnf transformation

both live and dead fish would be greatly increased by the installation of a neoprene-nylon deflector on the inner edge (side facing the screen) of the collection sluice. This deflector (flap) would close the gap between the collection sluice and the leading edge of the traveling screen, and divert fish into the collection sluice that might otherwise fall through.

4. Survival Tests

Survival tests were performed on fish that were washed into the collection sluiceway by the dual spray wash system. During testing periods, the fixed screens at forebay no. 11 were lifted and held up with blocks; the fine mesh traveling screen (Figure V-2) was rotated and washed continuously. At the time of testing, intake flow was 100 percent of circulator capacity and approach velocities were calculated to be 0.17 m/sec (0.56 ft/sec) (Con Edison 1978d). Since the speed of the traveling screen was 1.5 m/min, the elapsed transit time for impinged fish was approximately 5 minutes from the air-water interface to the point where the fish were washed into the sluiceway. During collection periods (maximum of 2 hrs/test), fish were carefully removed from the collection tank with small buckets and placed in barrels for transport to the laboratory. Transit time was approximately 10 minutes. Dead fish were counted and numbers of live fish were estimated and recorded at the time of removal from the collection tank. Fish were considered to be dead if there was no spontaneous body or opercular movement and if the fish failed to respond to probing.

Once in the laboratory, fish were placed in a series of interconnected 185 liter (49 gallon) aquaria supplied with a continuous flow of unfiltered river water. The fish were divided evenly among the holding facilities with no more than 50 fish per aquarium. The aquaria were checked at 0, 24, 48, and 96 hour time intervals; all dead fish were removed and counted at the end of each time interval. After 96 hours, tests were terminated and the remaining live fish were counted and returned to the river.

Initial survival and survival after each time interval (extended survival), were calculated for each species in each test. Pooled estimates were calculated for each species by summing numbers of fish held and numbers surviving to the end of each interval respectively from all tests. Initial survival (S_I) was calculated as:

$$S_I = \frac{N_A}{N_C} \times 100$$

where

N_A = number of alive individuals per species recovered after screen washing

N_C = total number of that species collected

Extended survival (S_E) at each time interval was calculated as:

$$S_E = \frac{N_X}{N_A} \times 100$$

where

N_X = number of alive individuals per species at the end of each interval (X = 0, 24, 48, and 96 hours)

Control survival tests were also conducted to evaluate the mortality related to handling and holding in the absence of impingement. Juvenile white perch and blueback herring were collected from the river by 100-ft beach seines, transferred to TI's hatchery facility at Verplanck, and placed in 1,669 liter (441 gallon) tanks containing filtered river water. The water in the transfer buckets and holding tanks was treated with salt (5.5 grams/liter) to help the fish maintain osmotic balance (Gordon 1972).

Controls were held in the large tanks until the effects of collection diminished and initial mortality subsided (2 to 6 days). After the initial holding period, control fish were transferred from the large tanks to 185 liter aquaria in the hatchery building in the same manner as impinged fish. Fish were checked at 0, 24, 48, and 96 hour intervals, and all dead fish were removed and counted at the end of each interval.

Low collections for many attemped tests and mechanical failure of the traveling screen and sluiceway limited successful collections of test fish to only two dates, 31 October and 10 November. Water temperature and conductivity measurements were 16.0°C and 2,980 μS/cm, and 14.9°C and 1,000 μS/cm, respectively, on each date. Juvenile white perch and blueback herring accounted for the majority of the 118 fish (9 species) collected in the two tests combined (Table V-8). Of the 118 fish collected, 70 survived the impingement screen washing process and 43 of the 70 survived to 96 hours, the limit of extended survival tests (Table V-8). Both initial and extended survival ranged from 0 to 100 percent, depending on species and life stage. These rates, however, were based for the most part, on very small sample sizes in that 11 of 15 tests involved less than 7 fish (Table V-8). Therefore, calculations of initial and extended survival were based on all 118 fish originally collected. The combined initial survival estimate was 59 percent and the combined extended survival estimate was 61 percent (Table V-8). The estimate of initial survival is possibly conservative since a portion of the fish collected could have been dead before being impinged. Extended survival was probably an underestimate also, since no adjustment was made for mortality due to handling and confinement in the test aquaria. Since both tests were conducted at internal and external pressures of 20 lb/in^2, no evaluation of the effect of varying spray wash pressures on survival was made.

Although caution must be exercised in drawing inferences from this limited data set, survival following impingement on the modified traveling screen appeared to be mostly species specific and to follow the three general patterns shown in the 1977 studies (TI 1978d). White perch exemplified one pattern and exhibited an ability to withstand the effects of impingement, as extended survival was 100 percent. The soft-bodied clupeids, apparently more susceptible to scale loss and physical damage, demonstrated the second pattern of relatively high initial survival, but poor extended survival. Bay anchovy, also a fragile species, demonstrated a third pattern of low initial survival.

Table V-8

Initial, Extended, and Overall Survival of Juvenile, Yearling, and Older Fishes Impinged on Continuously Operating Fine Mesh Traveling Screen in 1978

Species		Test† Date	Number Impinged	Initial Survival (Percent)	Number Held for Extended Survival Tests	Number Surviving through: 0Hrs	24Hrs	48Hrs	96Hrs	Extended Survival (Percent) 96Hrs
Striped Bass	(1)*	10/31	1	100	1	1	1	NC	0	0
White Perch	(1)	10/31	22	100	22	22	22	22	22	100
		11/10	11	100	11	11	11	11	11	100
		Pooled Estimate	33	100	33	33	33	33	33	100
White Perch	(2)*	10/31	4	100	4	4	4	4	4	100
Blueback Herring	(1)	10/31	44	41	18	18	3	NC	2	11
		11/10	6	67	4	4	3	3	1	25
		Pooled Estimate	50	44	22	22	6	--**	3	14
Alewife	(1)	10/31	6	67	4	4	2	NC	0	0
		11/10	1	100	1	1	1	1	0	0
		Pooled Estimate	7	71	5	5	3	--	0	0
Bay Anchovy	(1)	10/31	12	0						
		11/10	4	0						
		Pooled Estimate	16	0						
Bay Anchovy	(2)	10/31	1	0						
Hogchoker	(2)	10/31	1	100	1	1	1	1	1	100
White Catfish	(2)	10/31	2	100	2	2	2	2	2	100
Rainbow Smelt	(2)	10/31	2	50	1	1	1	NC	0	0
Weakfish	(1)	10/31	1	100	1	1	0			0
Totals (Pooled Estimates)			118	59	70	70	51	--	43	61

*(1) = juvenile, (2) = yearling and older

**Indicates that no pooled estimate of survival could be made since it was not known how many fish had survived to 48 hrs because checks were not always made at this time interval

†10/31 - based on 4 hrs of screen washing - 2 tests run for 2 hrs each
11/10 - based on 2 hrs of screen washing

NC = Not Checked

Control survival tests were conducted on juvenile white perch and blueback herring so that the effects of handling and confinement stress could be determined separately from impingement stress (Table V-9). Survival of juvenile white perch through 96 hours was 95 percent. Chi-square analyses showed no significant difference ($\alpha = 0.05$) between survival of impinged and control fish (Table V-10) indicating that the effect of handling and impingement stress on survival of juvenile white perch was minimal.

Table V-9

Extended Survival of Selected Species of Juvenile Fish Collected by 100 Foot Beach Seine for Use in Control Tests

Species	Test Date	Number Tested	Percent of Extended Survival			
			0 Hrs.	24 Hrs.	48 Hrs.	96 Hrs.
White Perch	8 Nov 78	111	100	99	99	95
Blueback Herring	6 Nov 78	383	100	83	51	8

Control tests conducted on juvenile blueback herring presented several problems. Juvenile blueback herring collected as controls continued to die throughout the holding period, even though several precautions were taken to minimize stress. Under these conditions, mortality resulting from collection stress could not be separated from mortality resulting from handling and holding stress after collection.

5. Summary and Conclusions

The study of the fine mesh traveling screen in 1978 was designed to : 1) investigate the effect of spray wash pressure on

Table V-10

Chi-Square Analysis of Impingement and Control Survival Estimates of Juvenile White Perch

Treatment	Observation	Observed Frequencies f	Expected Frequencies $\hat{f}$	Deviations from Expected $(f-\hat{f})$	Deviations from Expected Adjusted* $(\lvert f-\hat{f}\rvert-0.5)$	Deviations Squared $(\lvert f-\hat{f}\rvert-0.5)^2$	$\frac{(\lvert f-\hat{f}\rvert-0.5)^2}{\hat{f}}$
Impingement	Alive	33	31.6	1.4	0.9	0.81	0.026
	Dead	0	1.4	-1.4	0.9	0.81	0.579
Control	Alive	105	106.4	-1.4	0.9	0.81	0.008
	Dead	6	4.6	1.4	0.9	0.81	0.176
Totals		144	144.0	0			0.789†

*Adjustment = Yates' correction for continuity which should be applied when n is less than 200 (Sokal and Rohlf 1969).

†$\chi^2 = 0.789$ is not significant $(0.1 < p < 0.5)$

recovery rates and survival of impinged fish, and 2) determine the initial and extended survival of impinged fish. Collection efficiency estimates for dead fish were low (range of 3 to 41 percent) and collection efficiency varied directly with wash pressures. Collection efficiency estimates for live fish were much higher (range of 52 to 78 percent) and the low pressure internal spray wash systems had a greater influence than the external wash system on collection efficiency. Two successful survival tests were completed with impinged fish, but no evaluation of the effect of wash pressure on survival could be made because of the limited number of tests. Survival after impingement was mainly a function of species. Extended survival estimates for white perch were 100 percent, only 14 percent for blueback herring, and 0 percent for alewife. Survival on a species basis should be viewed with caution however, since sample sizes for most species were very small (i.e., less than 7).

The fine mesh continuously operating traveling screen was shown to be of limited value in reducing entrainment effects (EAI 1979), but it does have the potential for reducing impingement effects (i.e., improving survival of impinged fishes). A comparison of survival estimates of fishes collected from the modified fine mesh screen to limited survival data from tests conducted on fishes collected from conventional screens at Indian Point Unit No. 3 in 1973 indicated improved survival for 3 of 4 species tested (TI 1978d). Other studies conducted by White and Brehmer (1976), King et al. (1978), and Chase [in Tatham et al. (1978)] have demonstrated that with continuous operation of the traveling screen, low pressure wash systems, and the addition of fish buckets to the traveling screen, survival of impinged fishes was improved. The modified traveling screen system, therefore, has demonstrated effectiveness in improving impingement survival and a potentially useful method to mitigate power plant related fish mortality.

SECTION VI

GLOSSARY

Age Composition: (Age Structure) The quantitative make-up of a group or population of fish based on age classes (e.g., age 1, 2, 3, etc.); usually expressed as the proportion or percentage of individuals of a given age in the population.

Anadromous: Fish which spend a portion of their life cycle at sea but enter rivers or streams to spawn.

Biological Characteristics (Biocharacteristics): Attributes of a population, which are set by the interaction of their genetic-based characteristics with a particular environment; examples include sex ratios, age composition, fecundity, age at maturity and growth.

Catch-Per-Area (Catch-Per-Area Swept): The number or weight of fish, collected by sampling a defined area, e.g., catch per m^2.

Catch-Per-Effort (C/f): The catch of fish, in numbers or weight, collected using a specified gear for a defined amount of time or effort, e.g., catch per tow, catch per volume.

Channel: see Stratum.

Condition: The relationship between the length and weight of a fish which describes its plumpness or well-being. The weight (W) of a fish varies with the cube of its length (L) thus, any change in the relative plumpness of a fish will cause a change in the value of C (representing its condition) in the formula $W = CL^3$.

Conductivity (Specific Conductance): A measure of the total concentration of the solutes in water (i.e, a measure of salinity) determined by a solution's capacity to conduct an electric current. Since conductivity increases 2 to 3 percent for each degree centigrade, it is reported at a standard temperature of 25°C in micro-siemens per centimeter (mS/cm).

Demersal: Organisms which live on or near the bottom.

Diversity: The number of taxonomic groups (usually species) found in a a given area.

Dissolved Oxygen: Oxygen dissolved in water. Derived from photosynthesis and diffusion of atmospheric oxygen and expressed in milligrams per liter (mg/l).

Entrainment: The passage of small organisms along with water through a power plant cooling system. Entrained organisms are organisms too small to be impinged (see Impingement).

NRC: Nuclear Regulatory Commission.

NYSDEC: New York State Department of Environmental Conservation.

NYU: New York University.

pH: The pH of a solution is a measure of its hydrogen ion activity - its acidity or alkalinity. Neutral pH is 7, with increasing acidity from pH 7 to pH 1 and increasing alkalinity from pH 7 to pH 14.

Population: The organisms of a given species, collectively inhabiting an area or region.

Population Characteristics: See Biological Characteristics.

Population Dynamics: Changes in the size, mortality rates, or biological characteristics of a population due to environmental (biological and physical) factors.

Post Yolk-Sac Larvae: The life stage of fishes from initial development of a complete and functional digestive system (regardless of the amount of yolk-sac retention) until transformation to the juvenile lifestage (having a full complement of fin rays).

Relative Abundance: A measure of the number of organisms in a given time period or area relative to another time period or area.

Riverwide: As used in this report, refers to the "long river" study area encompassed by river miles 12 through 152.

Salinity: See Conductivity, Salt Front.

Salt Front: The leading gradient area of a mass of seawater intruding into the estuary. Salt front is defined as the area associated with a conductivity of 0.3 mS/cm or equivalent to a salinity of about 0.1 part per thousand ($^{o}/oo$).

Shoals: See Stratum.

Shore Zone: See Stratum.

Species Composition: The assemblage of species found in an area. Also, the proportion of individuals of a given species making up the total number of individuals represented by all species (i.e., relative species composition).

Standard Stations: Standard sampling areas in the nearfield (RM 39-42) of the Indian Point generating station.

Stratum (Strata pl.): A cross sectional area of the river. As used in this report, strata include the shoals (depth $\leq$20 feet), bottom (depth within 10 feet of river bottom, but not in shoal), and channel (area other than shoal or bottom).

Turbidity: The opacity of water caused by the presence of suspended particulate matter (such as clay, silt, microorganisms, and organic and inorganic detritus).

Estuary: A semi-enclosed coastal body of water which has free access to the sea and which has salinity that is measurably diluted below the salinity of open ocean water by freshwater tributaries and surface drainage. For the Hudson system, the estuary is the portion downstream from the Troy Dam at RM 153.

Euryhaline: An organism tolerant of wide changes in salinity; characteristic of many estuarine species and certain stages in the life history of other species.

Exposure: The presence of a population within the vicinity of a generating station. Measured as the proportion of a population located within the region or vicinity from which cooling water is withdrawn. Organisms may be exposed with or without being vulnerable (see Vulnerability).

FERC: Federal Energy Regulatory Commission.

Finclip: A method for marking fish by excising one or more of the fins; this method is used on fish that are too small to tag effectively.

Gear Avoidance: The behavior of a fish which enables it to escape being captured by fishing gear.

Ichthyoplankton: The early life stages of fish (eggs, larvae, early juveniles) which have little or no swimming ability and drift passively with currents.

Impingement: The process whereby the force of water being withdrawn through an intake screen forces organisms to come in contact with and be held against that screen.

Indian Point Region: An area of the Hudson River near the Indian Point station (RM 39-43).

Juvenile: The lifestage beginning when a fish acquires the full complement of adult fin characteristics and extending to Age I (i.e., through 31 December of the year spawned). This lifestage is also referred to as young-of-the-year.

Lower Estuary: As used in this report, includes the Yonkers and Tappan-Zee River regions (characterized by variable but usually salt or brackish water).

Microdistribution: The distribution of organisms over small, localized areas, often compartmentalized vertically or laterally.

Middle Estuary: As used in this report, includes the general area from approximately Croton-Haverstraw to Newburgh, (characterized by low but variable salinity).

Nearfield: Area of the Hudson River estuary in the vicinity of a power plant. In this report, it refers to the area near the Indian Point generating station, RM 39-43 (See Indian Point Region).

Upper Estuary: As used in this report, includes the Poughkeepsie through Albany River regions (approximately RM 62-152) of the Hudson River estuary (characterized by freshwater).

Vulnerability: See Exposure. The susceptibility of an organism or population of organisms to either entrainment or impingement by a power plant. Dependent on such things as microdistribution, physiological condition, behavior patterns etc.

Year Class: A cohort of fish spawned or hatched during a given calendar year.

Year-Class Abundance: The number or relative number of fish of a given species spawned or hatched during a given calendar year.

Year-Class Strength: The abundance of each year-class relative to other year classes.

Yearling: The age of fish during the calendar year following the year in which they were spawned.

Yolk-Sac Larvae: The transitional life stage of a fish from hatching through development of a complete and functional digestive system.

Young-of-the-Year: See Juvenile.

SECTION VII

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APPENDIX A
IMPINGEMENT STUDIES

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APPENDIX A.1

Total Counts of Each Species Impinged

Table A-1

Total Estimated Count of Each Species Impinged Monthly at Indian Point Unit No. 2 during 1978, Adjusted to Account for Collection Efficiency

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR TOT
SEA LAMPREY	0	0	0	0	0	0	0	0	0	0	0	66	66
SHORTNOSE STURGEON	4	0	0	0	0	0	0	0	0	0	4	0	8
ATLANTIC STURGEON	31	0	0	0	0	4	8	0	4	0	8	8	63
AMERICAN EEL	224	56	0	0	30	226	380	375	151	240	468	1276	3426
CLUPEID UNIDENTIFIED	8	0	0	0	0	2015	17215	3233	321	17885	18732	376	59785
BLUEBACK HERRING	194	0	0	0	72	213	97670	28743	5907	335511	411483	24372	904165
HICKORY SHAD	0	0	0	0	0	0	0	4	0	4	0	0	8
ALEWIFE	55	0	0	0	111	152	10092	11259	556	3278	13492	1117	40142
AMERICAN SHAD	32	0	0	0	0	870	11898	18039	1065	5196	13726	1165	51991
ATLANTIC MENHADEN	0	0	0	0	0	19	143	39	49	224	54	4	552
GIZZARD SHAD	1042	0	0	0	0	0	0	0	0	0	20	1615	2677
BAY ANCHOVY	0	0	0	0	12	6099	84023	155595	15921	44375	3815	480	310322
RAINBOW SMELT	5716	369	0	0	213	4276	16834	7197	170	2309	6960	29091	73335
MUDMINNOW UNIDENTIFIED	0	0	0	0	0	0	0	0	0	0	0	4	4
GOLDFISH	184	38	0	0	43	23	4	23	4	4	12	371	706
CARP	15	0	0	0	0	0	0	0	0	0	4	27	46
GOLDEN SHINER	162	16	0	0	7	16	8	4	4	8	4	69	298
COMMON SHINER	7	0	0	0	0	0	0	0	0	0	0	0	7
SPOTTAIL SHINER	1693	221	0	0	16	45	16	103	8	86	81	4846	7115
SPOTFIN SHINER	0	0	0	0	0	0	0	0	0	0	0	4	4
WHITE SUCKER	4	0	0	0	4	4	0	0	0	0	0	0	12
WHITE CATFISH	4696	339	0	0	87	129	35	105	39	185	1297	1481	8393
BROWN BULLHEAD	81	38	0	0	0	0	4	27	0	0	12	98	260
4-BEARDED ROCKLING	0	0	0	0	0	0	0	0	0	0	0	8	8
SILVER HAKE	0	0	0	0	0	0	0	0	0	0	0	158	158
ATLANTIC TOMCOD	3173	355	0	0	5630	114741	64744	176724	2716	1219	1042	20107	390451
SQUIRREL OR RED HAKE	4	0	0	0	0	0	0	0	0	0	0	121	125
ATLANTIC NEEDLEFISH	0	0	0	0	0	0	4	11	0	0	0	0	15
BANDED KILLIFISH	70	16	0	0	0	32	4	20	15	246	79	527	1009
MUMMICHOG	4	0	0	0	0	4	0	4	4	0	4	16	36
ROUGH SILVERSIDE	0	0	0	0	0	0	0	0	4	0	0	0	4
TIDEWATER SILVERSIDE	4	0	0	0	0	0	0	0	0	0	0	0	4
ATLANTIC SILVERSIDE	26	0	0	0	0	0	0	0	7	0	0	0	33
4-SPINE STICKLEBACK	0	0	0	0	0	0	0	0	0	0	8	4	12
3-SPINE STICKLEBACK	142	48	0	0	0	0	0	0	0	0	0	7	197
NORTHERN PIPEFISH	0	0	0	0	0	4	12	434	300	1134	243	149	2276
MORONE LARVAE	0	0	0	0	0	11	4	0	0	0	0	0	15
WHITE PERCH	546749	49145	0	0	913	2963	7266	42488	2786	27543	165672	589297	1454822
WHITE BASS	48	0	0	0	0	0	0	4	0	0	0	106	158
STRIPED BASS	10598	1112	0	0	27	168	9193	8185	378	3129	5139	49664	87593
CENTRARCHID UNID	95	4	0	0	35	40	0	0	0	145	174	1107	1600
REDBREAST SUNFSH	4	0	0	0	0	0	0	0	4	4	0	4	16
PUMPKINSEED	693	82	0	0	29	90	46	53	0	390	147	1086	2606
BLUEGILL	49	4	0	0	11	8	0	0	4	84	43	423	626
SMALLMOUTH BASS	4	0	0	0	0	0	0	0	0	0	0	0	4
LARGEMOUTH BASS	19	0	0	0	0	0	0	0	0	0	8	28	55
WHITE CRAPPIE	7	4	0	0	0	0	0	0	0	0	0	0	11
BLACK CRAPPIE	24	8	0	0	0	0	0	0	0	0	0	0	32
TESSELATED DARTER	15	0	0	0	0	4	27	81	12	145	570	2349	3203
YELLOW PERCH	230	31	0	0	4	12	0	0	0	0	12	314	603
BLUEFISH	0	0	0	0	0	569	1113	1008	19	12	4	0	2725
CREVALLE JACK	0	0	0	0	0	0	4	8	12	102	39	4	169
LOOKDOWN	0	0	0	0	0	0	0	0	12	27	0	0	39
MOONFISH	0	0	0	0	0	0	0	0	0	4	0	0	4
NORTHERN PORGY OR SCUP	0	0	0	0	0	0	4	0	0	4	0	0	8
SILVER PERCH	0	0	0	0	0	0	0	0	0	0	0	4	4
WEAKFISH	0	0	0	0	0	0	22462	11761	2981	1276	312	117	38909
SPOT	0	0	0	0	0	0	0	0	0	0	0	4	4
WHITE MULLET	0	0	0	0	0	0	0	0	0	0	0	4	4
BUTTERFISH	0	0	0	0	0	0	0	0	0	4	20	12	36
SEAROBIN	0	0	0	0	0	0	0	0	0	4	0	0	4
STRIPED SEAROBIN	0	0	0	0	0	0	0	0	0	73	27	11	111
GRUBBY	0	0	0	0	0	0	0	0	0	0	0	8	8
SMALLMOUTH FLOUNDER	0	0	0	0	0	0	0	0	0	0	0	8	8
SUMMER FLOUNDER	0	0	0	0	0	0	0	4	0	0	0	0	4
WINDOWPANE	0	0	0	0	0	0	0	0	0	0	0	4	4
WINTER FLOUNDER	0	0	0	0	0	0	8	0	8	4	4	12	36
HOGCHOKER	4	0	0	0	1594	3129	2084	7435	9197	40611	11453	3912	79419
NORTHERN PUFFER	0	0	0	0	0	0	0	0	0	4	4	0	8
COLUMN TOTALS	576100	51886	0	0	8838	135866	345307	472986	42688	485669	675176	736045	3530561

Table A-2

Total Estimated Count of Each Species Impinged Monthly at Indian Point Unit No. 3 during 1978, Adjusted to Account for Collection Efficiency

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR TOT
SILVER LAMPREY	0	0	0	1	0	0	0	0	0	0	0	0	1
SEA LAMPREY	1	0	0	0	0	0	0	0	0	0	0	1	2
STURGEON UNIDENTIFIED	0	0	0	0	0	0	0	1	0	0	0	0	1
SHORTNOSE STURGEON	1	0	1	0	1	0	0	0	0	0	0	0	3
ATLANTIC STURGEON	14	0	1	3	2	1	0	0	1	0	0	2	24
AMERICAN EEL	59	9	20	79	262	25	0	18	61	145	307	433	1438
CONGER EEL	0	0	0	0	0	0	0	0	0	0	0	1	1
CLUPEID UNIDENTIFIED	0	0	0	0	0	0	0	19	258	5791	5513	142	11723
BLUEBACK HERRING	102	0	1	144	1417	119	0	290	4696	163052	173042	10530	353393
HICKORY SHAD	0	0	0	0	0	0	0	0	2	6	3	0	11
ALEWIFE	15	7	4	108	481	39	0	247	1441	4254	19552	1084	27232
AMERICAN SHAD	7	0	0	3	2	2	0	220	1130	5393	15939	1306	24002
ATLANTIC MENHADEN	0	0	0	0	1	8	0	13	151	529	61	13	776
GIZZARD SHAD	448	2	2	0	0	0	0	0	0	1	113	727	1293
BAY ANCHOVY	0	0	0	0	2	51	0	780	8922	13929	1565	74	25323
RAINBOW SMELT	868	1009	1448	4287	5019	96	0	133	138	1548	6640	4032	25218
EAST MUDMINNOW	0	0	0	1	0	0	0	0	0	0	0	0	1
GOLDFISH	59	48	116	84	90	3	0	1	1	4	27	96	529
CARP	13	0	7	0	0	0	0	0	0	0	7	7	34
GOLDEN SHINER	79	13	112	24	13	1	0	0	1	3	2	14	262
EMERALD SHINER	0	0	1	1	0	0	0	0	0	0	0	0	2
COMMON SHINER	0	0	0	0	0	0	0	0	0	1	0	0	1
SPOTTAIL SHINER	516	230	475	498	274	7	0	3	4	16	66	518	2607
WHITE SUCKER	0	0	0	1	0	1	0	0	0	0	0	0	2
WHITE CATFISH	2975	403	736	663	965	10	0	6	44	85	416	859	7162
BROWN BULLHEAD	9	8	8	23	6	1	0	1	0	0	9	14	79
4-BEARDED ROCKLING	0	0	0	1	0	0	0	0	0	0	0	1	2
SILVER HAKE	5	0	0	0	0	0	0	0	0	0	4	50	59
ATLANTIC TOMCOD	1689	49	21	89	208	105	0	5015	2946	401	580	1127	12230
SQUIRREL OR RED HAKE	0	0	0	0	0	0	0	0	0	0	1	19	20
ATLANTIC NEEDLEFISH	0	0	0	0	0	0	0	0	2	0	0	0	2
BANDED KILLIFISH	32	7	13	17	1	0	0	0	1	22	28	39	160
MUMMICHOG	0	0	4	3	1	1	0	0	1	0	0	2	12
ROUGH SILVERSIDE	0	0	0	0	0	0	0	0	3	4	0	0	7
ATLANTIC SILVERSIDE	9	0	0	0	0	0	0	0	1	0	0	0	10
4-SPINE STICKLEBACK	0	0	0	0	1	0	0	0	0	1	1	0	3
3-SPINE STICKLEBACK	11	37	62	7	4	0	0	0	0	0	0	0	121
SEA HORSE	0	0	0	1	0	0	0	0	0	0	0	0	1
NORTHERN PIPEFISH	0	0	0	19	0	0	0	8	59	111	14	11	222
WHITE PERCH	108808	79822	105204	52366	43936	580	0	561	3318	8837	76871	67934	548237
WHITE BASS	5	0	1	0	0	0	0	0	0	0	6	11	23
STRIPED BASS	2714	2954	6280	1031	984	8	0	43	376	668	2035	7102	24195
BLACK SEA BASS	0	0	0	0	0	0	0	0	0	1	2	1	4
CENTRARCHID UNID	15	0	0	8	9	1	0	0	3	10	33	33	112
ROCK BASS	0	0	1	0	0	0	0	0	0	0	0	0	1
REDBREAST SUNFSH	0	0	1	2	3	0	0	0	0	0	0	0	6
PUMPKINSEED	214	63	283	138	252	54	0	5	48	111	73	152	1393
BLUEGILL	29	2	5	5	29	1	0	1	1	21	33	98	225
SMALLMOUTH BASS	1	0	0	0	0	0	0	0	0	0	0	0	1
LARGEMOUTH BASS	12	0	3	1	0	1	0	0	0	0	1	3	21
WHITE CRAPPIE	1	0	0	0	0	0	0	0	0	1	0	0	2
BLACK CRAPPIE	6	3	2	1	8	0	0	0	0	0	0	1	21
TESSELATED DARTER	0	0	2	112	43	0	0	1	4	11	38	86	297
YELLOW PERCH	36	15	42	90	38	3	0	0	0	1	10	42	277
BLUEFISH	0	0	0	0	0	3	0	17	95	31	8	0	154
CREVALLE JACK	0	0	0	0	0	0	0	0	20	59	82	1	162
LOOKDOWN	0	0	0	0	0	0	0	0	8	16	0	0	24
MOONFISH	0	0	0	0	0	0	0	0	0	1	0	0	1
SILVER PERCH	0	0	0	0	0	0	0	0	0	0	0	2	2
WEAKFISH	0	0	0	0	0	0	0	177	1956	259	92	62	2546
SPOT	0	0	0	0	0	0	0	0	0	1	0	1	2
WHITE MULLET	0	0	0	0	0	0	0	0	0	0	4	4	8
BUTTERFISH	0	0	0	0	0	0	0	0	6	16	17	9	48
SEAROBIN	0	1	0	0	0	0	0	0	1	0	0	0	2
NORTHERN SEAROBIN	0	0	0	0	0	0	0	0	0	0	0	1	1
STRIPED SEAROBIN	0	0	0	0	0	0	0	0	1	24	20	17	62
GRUBBY	0	0	0	0	0	0	0	0	0	0	0	1	1
WINTER FLOUNDER	4	0	5	2	0	0	0	0	7	1	0	4	23
HOGCHOKER	0	1	0	416	5272	141	0	74	5566	16501	4079	1336	33386
COLUMN TOTALS	118757	84683	114861	60231	59324	1262	0	7634	31293	221866	307294	98003	1105208

Table A-3

Total Estimated Count of Each Species Impinged Monthly at Indian Point Units No. 2 and No. 3 during 1978, Adjusted to Account for Collection Efficiency

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR TOT
SILVER LAMPREY	0	0	0	1	0	0	0	0	0	0	0	0	1
SEA LAMPREY	1	0	0	0	0	0	0	0	0	0	0	67	68
STURGEON UNIDENTIFIED	0	0	0	0	0	0	0	1	0	0	0	0	1
SHORTNOSE STURGEON	5	0	1	0	1	0	0	0	0	0	4	0	11
ATLANTIC STURGEON	45	0	1	3	2	5	8	0	5	0	8	10	87
AMERICAN EEL	283	65	20	79	292	251	380	393	232	365	775	1709	4864
CONGER EEL	0	0	0	0	0	0	0	0	0	0	0	1	1
CLUPEID UNIDENTIFIED	8	0	0	0	0	2015	17215	3252	579	23676	24245	518	71508
BLUEBACK HERRING	296	0	1	144	1489	332	97670	29033	10603	498563	584525	34902	1257558
HICKORY SHAD	0	0	0	0	0	0	0	4	2	10	3	0	19
ALEWIFE	70	7	4	108	592	191	10092	11506	2027	7532	33044	2201	67374
AMERICAN SHAD	39	0	0	3	2	872	11898	18259	2195	10589	29665	2471	75993
ATLANTIC MENHADEN	0	0	0	0	1	27	143	72	200	753	115	17	1328
GIZZARD SHAD	1490	2	2	0	0	0	0	0	0	1	133	2342	3970
BAY ANCHOVY	0	0	0	0	14	6150	84025	156375	24843	58304	5380	554	335645
RAINBOW SMELT	6584	1378	1448	4287	5232	4372	16834	7330	308	4057	13600	33123	98553
MUDMINNOW UNIDENTIFIED	0	0	0	0	0	0	0	0	0	0	0	4	4
EAST MUDMINNOW	0	0	0	1	0	0	0	0	0	0	0	0	1
GOLDFISH	243	86	116	84	133	26	4	24	5	8	39	467	1235
CARP	28	0	7	0	0	0	0	0	0	0	11	34	80
GOLDEN SHINER	241	29	112	24	20	17	8	4	5	11	6	83	560
EMERALD SHINER	0	0	1	1	0	0	0	0	0	0	0	0	2
COMMON SHINER	7	0	0	0	0	0	0	0	0	1	0	0	8
SPOTTAIL SHINER	2209	451	475	498	290	52	16	106	12	102	147	5364	9722
SPOTFIN SHINER	0	0	0	0	0	0	0	0	0	0	0	4	4
WHITE SUCKER	4	0	0	1	4	5	0	0	0	0	0	0	14
WHITE CATFISH	7671	742	736	663	1052	139	35	111	83	270	1713	2340	15555
BROWN BULLHEAD	90	46	8	23	6	1	4	28	0	0	21	112	339
4-BEARDED ROCK ING	0	0	0	1	0	0	0	0	0	0	0	9	10
SILVER HAKE	5	0	0	0	0	0	0	0	0	0	4	208	217
ATLANTIC TOMCOD	4862	404	21	89	5838	114846	64744	181739	5662	1620	1622	21234	402681
SQUIRREL OR RED HAKE	4	0	0	0	0	0	0	0	0	0	1	140	145
ATLANTIC NEEDLEFISH	0	0	0	0	0	0	4	11	2	0	0	0	17
BANDED KILLIFISH	102	23	13	17	1	32	4	20	16	268	107	566	1169
MUMMICHOG	4	0	4	3	1	5	0	4	5	0	4	18	48
ROUGH SILVERSIDE	0	0	0	0	0	0	0	0	7	4	0	0	11
TIDEWATER SILVERSIDE	4	0	0	0	0	0	0	0	0	0	0	0	4
ATLANTIC SILVERSIDE	35	0	0	0	0	0	0	0	8	0	0	0	43
4-SPINE STICKLEBACK	0	0	0	0	1	0	0	0	0	1	9	4	15
3-SPINE STICKLEBACK	153	85	62	7	4	0	0	0	0	0	0	7	318
SEA HORSE	0	0	0	1	0	0	0	0	0	0	0	0	1
NORTHERN PIPEFISH	0	0	0	19	0	4	12	442	359	1245	257	160	2498
MORONE LARVAE	0	0	0	0	0	11	4	0	0	0	0	0	15
WHITE PERCH	655557	128967	105204	52366	44849	3543	7266	43049	6104	36380	262543	657231	2003059
WHITE BASS	53	0	1	0	0	0	0	4	0	0	6	117	181
STRIPED BASS	13312	4066	6280	1031	1011	176	9193	8228	754	3797	7174	56766	111788
BLACK SEA BASS	0	0	0	0	0	0	0	0	0	1	2	1	4
CENTRARCHID UNID	110	4	0	8	44	41	0	0	3	155	207	1140	1712
ROCK BASS	0	0	1	0	0	0	0	0	0	0	0	0	1
REDBREAST SUNFSH	4	0	1	2	3	0	0	0	4	4	0	4	22
PUMPKINSEED	897	145	283	138	281	144	46	58	48	501	220	1238	3999
BLUEGILL	78	6	5	5	40	9	0	1	5	105	76	521	851
SMALLMOUTH BASS	5	0	0	0	0	0	0	0	0	0	0	0	5
LARGEMOUTH BASS	31	0	3	1	0	1	0	0	0	0	9	31	76
WHITE CRAPPIE	8	4	0	0	0	0	0	0	0	1	0	0	13
BLACK CRAPPIE	30	11	2	1	8	0	0	0	0	0	0	1	53
TESSELATED DARTER	15	0	2	112	43	4	27	82	16	156	608	2435	3500
YELLOW PERCH	266	46	42	90	42	15	0	0	0	1	22	356	880
BLUEFISH	0	0	0	0	0	572	1113	1025	114	43	12	0	2879
CREVALLE JACK	0	0	0	0	0	0	4	8	32	161	121	5	331
LOOKDOWN	0	0	0	0	0	0	0	0	20	43	0	0	63
MOONFISH	0	0	0	0	0	0	0	0	0	5	0	0	5
NORTHERN PORGY OR SCUP	0	0	0	0	0	0	4	0	0	4	0	0	8
SILVER PERCH	0	0	0	0	0	0	0	0	0	0	0	6	6
WEAKFISH	0	0	0	0	0	0	22462	11938	4937	1535	404	179	41455
SPOT	0	0	0	0	0	0	0	0	0	1	0	5	6
WHITE MULLET	0	0	0	0	0	0	0	0	0	0	4	8	12
BUTTERFISH	0	0	0	0	0	0	0	0	6	20	37	21	84
SEAROBIN	0	1	0	0	0	0	0	0	1	4	0	0	6
NORTHERN SEAROBIN	0	0	0	0	0	0	0	0	0	0	0	1	1
STRIPED SEAROBIN	0	0	0	0	0	0	0	0	1	97	47	28	173
GRUBBY	0	0	0	0	0	0	0	0	0	0	0	9	9
SMALLMOUTH FLOUNDER	0	0	0	0	0	0	0	0	0	0	0	8	8
SUMMER FLOUNDER	0	0	0	0	0	0	0	4	0	0	0	0	4
WINDOWPANE	0	0	0	0	0	0	0	0	0	0	0	4	4
WINTER FLOUNDER	4	0	5	2	0	0	8	0	15	5	4	16	59
HOGCHOKER	4	1	0	418	6866	3270	2084	7509	14763	57112	15532	5248	112807
NORTHERN PUFFER	0	0	0	0	0	0	0	0	0	4	4	0	8
COLUMN TOTALS	694857	136569	114861	60231	68162	137128	345307	480620	73961	707535	982470	834048	4635769

Table A-4

Total Estimated Count of Each Species Impinged Monthly at Indian Point Unit No. 2 during 1977, Adjusted to Account for Collection Efficiency

TAXON	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YR_TOTAL
ALEWIFE	62	0	0	0	115	368	8	9118	7737	25970	12223	40	55641
BAY ANCHOVY	4	0	0	0	176	8124	442	99649	82208	13952	77	8	204640
AMERICAN SHAD	15	0	0	0	0	15	0	2458	1224	8831	1113	16	13672
BLUEFISH	0	0	0	0	14	13380	851	137	103	8	0	0	14493
BLUEGILL	11	4	48	15	12	4	4	0	8	280	2152	620	3358
BROWN BULLHEAD	7	8	32	11	4	0	4	0	12	181	35	171	465
PUMPKINSEED	970	278	1344	223	47	75	4	16	27	1108	392	1155	5639
BLACK CRAPPIE	11	0	11	15	0	8	0	0	0	4	45	135	229
CARP	0	0	0	0	0	0	0	0	0	0	0	20	20
AMERICAN EEL	225	52	119	225	157	645	85	447	381	638	422	583	4179
GOLDFISH	58	45	89	69	0	0	0	0	4	8	81	142	496
GOLDEN SHINER	28	27	54	39	4	4	4	0	0	4	16	176	356
HOGCHOKER	0	0	4	27	3382	623	22	3549	9776	16423	8812	43	42661
TESSELLATED DARTER	4	0	20	192	87	23	4	0	0	19	89	84	522
BANDED KILLIFISH	233	40	280	51	4	54	4	0	35	68	68	115	952
EMERALD SHINER	0	0	11	15	0	0	0	0	0	0	0	8	34
LARGEMOUTH BASS	8	0	16	8	0	0	0	0	8	73	94	145	352
MUMMICHOG	60	4	71	4	4	4	0	0	4	12	0	4	167
ATLANTIC MENHADEN	0	0	0	0	0	202	4	16	79	4	11	0	316
BLUEBACK HERRING	51	0	0	0	105	773	78	15930	132387	1729783	147331	215	2026653
WHITE SUCKER	0	0	4	0	12	0	0	0	0	0	4	4	24
ATLANTIC SILVERSIDE	0	0	0	0	4	0	0	0	7	14	19	0	44
RAINBOW SMELT	9835	1720	1849	1719	3639	6042	378	457	3087	16420	3849	2321	51316
SHORTNOSE STURGEON	4	4	0	7	4	0	0	0	0	0	0	0	19
SPOTTAIL SHINER	2424	903	1890	2563	435	147	4	45	20	53	1040	2811	12335
ATLANTIC STURGEON	23	4	19	63	0	11	0	12	12	4	12	8	168
STRIPED BASS	12247	4422	2073	12	43	213	12	6481	5012	11097	11696	8043	61351
4-SPINE STICKLEBACK	0	0	0	0	0	4	0	0	0	0	0	0	4
ATLANTIC TOMCOD	2056	771	1441	687	160809	578770	40373	121418	28912	1561	1801	7137	945736
UNIDENTIFIED AT CAPTURE	0	0	0	0	0	12	0	0	0	8	0	0	20
WHITE CATFISH	2221	485	1564	715	2149	1002	14	105	196	9726	27117	10052	55346

A-4 (Contd)

TAXON	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YR_TOTAL
WHITE PERCH	1129258	469908	240710	124610	13817	19536	498	22650	12397	171568	497719	279177	3002050
YELLOW PERCH	63	26	170	277	96	0	0	0	0	20	123	632	1427
SATINFIN SHINER	0	0	0	0	0	0	0	0	0	7	0	0	7
NORTHERN PIPEFISH	0	0	0	0	0	27	0	379	621	8	0	0	1035
REDBREAST SUNFSH	0	0	0	12	0	0	0	4	12	4	0	15	47
CREVALLE JACK	0	0	0	0	0	0	0	7	12	4	0	0	23
WEAKFISH	0	0	0	0	0	18	0	6474	7840	318	731	0	15381
COMMON SHINER	0	0	0	0	4	0	0	0	0	0	0	8	12
LOOKDOWN	0	0	0	0	0	0	0	8	39	0	0	0	47
CLUPEID UNIDENTIFIED	0	0	0	0	0	7	231	2528	3413	43180	1106	0	50465
CLUPEID LARVAE	0	0	0	0	0	25	0	0	0	0	0	0	25
MORONE LARVAE	0	0	0	0	0	0	49	0	0	0	0	0	49
MORONE UNIDENTIFIED	0	0	0	0	0	0	0	0	0	92	0	4	96
REDFIN PICKEREL	0	0	8	4	0	0	0	0	0	0	0	0	12
4-BEARDED ROCKLING	0	0	0	0	0	0	0	0	0	0	8	0	8
SPOT	0	0	0	0	0	0	0	4977	5357	4215	1884	11	16444
BROOK STICKLEBACK	0	0	4	0	0	0	0	0	0	0	0	42	46
NORTHERN PORGY OR SCUP	0	0	0	0	0	0	0	0	12	0	0	0	12
WINTER FLOUNDER	8	4	0	0	0	0	0	33	62	4	11	0	122
TIDEWATER SILVERSIDE	0	0	0	0	0	4	0	0	0	0	0	0	4
SEA LAMPREY	0	4	0	0	0	4	0	0	0	0	0	12	20
GIZZARD SHAD	940	45	4	0	0	0	0	0	4	1506	8649	7952	19100
SILVER HAKE	0	0	0	0	0	0	0	0	0	4	29	23	56
3-SPINE STICKLEBACK	105	73	42	8	0	8	0	0	0	0	4	0	240
BROWN TROUT	0	0	0	0	0	0	0	0	0	0	4	0	4
BUTTERFISH	0	0	0	0	0	0	0	0	0	0	8	0	8
WHITE CRAPPIE	4	0	0	0	0	0	0	0	0	23	46	38	111
NORTHERN PIKE	0	0	0	0	0	4	0	0	0	0	0	0	4
BLACKNOSE DACE	0	0	0	0	0	0	0	0	0	0	0	4	4
CUTLIPS MINNOW	0	0	0	0	0	0	0	0	0	0	25	0	25
CENTRARCHID UNID	43	19	220	108	23	8	0	4	47	4186	4649	1410	10722
OTHERS	12	0	22	30	8	8	0	12	100	749	915	350	2206
COLUMN TOTAL	1161015	498846	252119	131709	185154	630354	43073	297114	301155	2062137	734410	323934	6621020

Table A-5

Total Estimated Count of Each Species Impinged Monthly at Indian Point Unit No. 3 during 1977, Adjusted to Account for Collection Efficiency

TAXON	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YR_TOTAL
ALEWIFE	14	0	10	100	438	475	22094	28562	6624	1475	0	2	59794
BAY ANCHOVY	0	0	0	0	47	5639	46519	51453	17002	3123	0	4	123787
AMERICAN SHAD	7	0	0	1	2	15	5053	5462	1066	721	0	5	12332
BLUEFISH	0	0	0	0	0	12820	9591	1468	291	0	0	0	24170
BLUEGILL	15	3	33	27	65	3	1	6	9	25	0	65	252
BROWN BULLHEAD	1	0	12	11	8	1	3	1	1	0	0	9	47
PUMPKINSEED	170	40	515	207	385	68	112	110	53	61	0	178	1899
BLACK CRAPPIE	0	0	16	27	12	0	0	0	0	0	0	18	73
CARP	0	0	1	0	0	0	0	0	0	0	0	2	3
AMERICAN EEL	115	21	30	477	453	377	252	417	131	34	0	10	2317
GOLDFISH	8	1	59	24	12	1	1	1	0	0	0	33	140
GOLDEN SHINER	1	2	23	15	13	3	4	3	5	1	0	87	157
HOGCHOKER	2	0	3	1228	6158	209	560	4105	5633	726	0	2	18626
TESSELLATED DARTER	0	0	1	335	165	2	7	2	1	0	0	1	514
BANDED KILLIFISH	6	5	53	10	4	9	1	0	0	0	0	8	96
EMERALD SHINER	0	0	3	2	1	0	0	0	0	0	0	0	6
LARGEMOUTH BASS	3	1	2	0	0	0	0	0	3	7	0	18	34
MUMMICHOG	4	2	6	1	1	1	0	0	0	1	0	0	16
ATLANTIC MENHADEN	0	0	0	0	0	364	76	170	111	3	0	0	724
BLUEBACK HERRING	23	0	0	60	756	1209	8308	10299	26066	35165	0	6	81892
WHITE SUCKER	0	0	3	1	4	1	0	0	0	0	0	0	9
ATLANTIC SILVERSIDE	0	0	0	0	0	0	0	3	1	0	0	0	4
RAINBOW SMELT	537	89	225	2381	3174	6550	2820	254	530	520	0	221	17301
SMALLMOUTH BASS	0	0	0	0	0	0	0	0	1	0	0	0	1
SHORTNOSE STURGEON	0	0	0	0	0	0	0	0	1	0	0	0	1
SPOTTAIL SHINER	135	24	287	653	821	37	146	108	4	0	0	309	2526
ATLANTIC STURGEON	0	0	24	117	15	15	21	1	5	0	0	0	198
STRIPED BASS	1579	598	411	52	168	134	1719	5632	2242	1083	0	631	14249
4-SPINE STICKLEBACK	1	0	0	1	0	0	0	0	0	0	0	0	2
ATLANTIC TOMCOD	95	31	232	130	10830	199848	322897	121748	12245	49	0	430	668535
UNIDENTIFIED AT CAPTURE	0	0	0	0	0	2	0	0	0	0	0	0	2
WHITE CATFISH	330	118	475	3742	5962	267	31	58	135	167	0	1288	12573

A-5 (Contd)

TAXON	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YR_TOTAL
WHITE PERCH	91119	39285	28816	54876	61556	10969	4658	12903	5805	3930	0	17762	331681
YELLOW PERCH	3	1	24	85	173	10	1	1	0	0	0	36	334
SATINFIN SHINER	0	0	0	1	0	0	0	0	0	0	0	0	1
ROCK BASS	0	0	1	1	0	0	0	0	0	0	0	0	2
NORTHERN PIPEFISH	0	0	0	0	2	11	0	24	41	2	0	0	80
REDBREAST SUNFSH	0	0	0	1	6	1	4	2	2	0	0	3	19
ATLANTIC NEEDLEFISH	0	0	0	0	0	0	0	0	1	0	0	0	1
CREVALLE JACK	0	0	0	0	0	3	1	11	9	0	0	0	24
WEAKFISH	0	0	0	0	0	4	239	2560	1672	0	0	0	4475
COMMON SHINER	0	0	0	0	1	1	0	0	0	0	0	1	3
LOOKDOWN	0	0	0	0	0	0	0	1	17	0	0	0	18
CLUPEID UNIDENTIFIED	0	0	0	0	0	0	4024	1852	534	1055	0	0	7465
MORONE LARVAE	0	0	0	0	0	0	460	0	0	0	0	0	460
NORTHERN HOGSUCKER	0	0	0	0	1	0	0	0	0	0	0	0	1
MORONE UNIDENTIFIED	0	0	0	0	0	0	22	0	0	0	0	0	22
TAUTOG	0	0	0	0	0	1	0	0	0	0	0	0	1
4-BEARDED ROCKLING	0	0	0	0	0	4	0	0	0	0	0	0	4
SPOT	0	0	0	0	0	0	232	10848	4216	917	0	0	16213
NORTHERN PORGY OR SCUP	0	0	0	0	0	0	2	2	11	0	0	0	15
WINTER FLOUNDER	1	0	1	3	0	3	2	22	4	0	0	1	37
TIDEWATER SILVERSIDE	0	0	0	0	1	0	0	1	0	0	0	0	2
SEA LAMPREY	0	0	1	0	0	0	0	0	0	0	0	0	1
GIZZARD SHAD	332	21	8	0	0	0	3	3	6	0	0	1312	1685
SILVER HAKE	2	0	0	0	0	0	0	0	0	0	0	5	7
3-SPINE STICKLEBACK	3	5	15	0	0	0	0	0	0	0	0	1	24
BUTTERFISH	0	0	0	0	0	1	2	1	0	0	0	0	4
WHITE CRAPPIE	0	0	1	3	1	0	0	0	0	0	0	1	6
NORTHERN PIKE	0	0	0	0	0	1	0	0	0	0	0	0	1
NORTHERN PUFFER	0	0	0	0	0	0	0	0	1	0	0	0	1
BLACKNOSE DACE	0	0	1	0	0	0	0	0	0	0	0	0	1
CENTRARCHID UNID	4	0	54	37	109	1	0	0	8	69	0	47	329
SPOTFIN SHINER	0	0	0	0	0	0	1614	0	0	0	0	0	1614
OTHERS	3	0	3	4	6	2	3	24	4	0	0	32	81
COLUMN TOTAL	94513	40247	31349	64613	91352	239062	431485	258118	84491	49134	0	22528	1406892

Table A-6

Total Estimated Count of Each Species Impinged Monthly at Indian Point Unit No. 2 during 1976, Adjusted* to Account for Collection Efficiency

TAXON	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YR_TOTAL
ALEWIFE	193	7	0	0	0	12	0	0	55	2150	142	8	2567
BAY ANCHOVY	0	0	0	0	0	12	0	0	5722	6116	8	0	11858
AMERICAN SHAD	7	0	7	0	0	0	0	0	68	3941	18	12	4053
BLUEFISH	0	0	0	0	0	0	0	0	12	27	0	7	46
BLUEGILL	21	7	0	0	0	0	0	0	18	209	33	187	475
BROWN BULLHEAD	14	28	21	0	0	0	0	0	8	4	0	16	91
PUMPKINSEED	595	293	122	0	0	19	0	0	14	425	15	2502	3985
BLACK CRAPPIE	21	0	7	0	0	0	0	0	0	0	0	0	28
CARP	0	0	0	0	0	0	0	0	0	0	4	0	4
AMERICAN EEL	240	167	115	4	0	15	0	0	4	218	16	238	1017
GOLDFISH	35	14	28	0	0	0	0	0	0	16	0	110	203
GOLDEN SHINER	61	14	14	0	0	0	0	0	0	4	0	61	154
HOGCHOKER	7	0	28	0	0	19	0	0	952	9395	86	4	10491
TESSELLATED DARTER	234	63	990	19	0	0	0	0	8	16	4	26	1360
BANDED KILLIFISH	1018	258	148	0	0	0	0	0	7	84	4	584	2103
EMERALD SHINER	0	7	7	0	0	0	0	0	0	0	0	0	14
LARGEMOUTH BASS	14	7	7	0	0	0	0	0	0	19	11	123	181
MUMMICHOG	109	35	73	0	0	0	0	0	0	0	0	24	241
ATLANTIC MENHADEN	0	0	0	0	0	0	0	0	30	41	4	0	75
BLUEBACK HERRING	140	0	7	0	0	22	0	0	1329	456801	4844	15	463158
WHITE SUCKER	53	0	7	0	0	0	0	0	0	0	0	0	60
ATLANTIC SILVERSIDE	0	0	0	0	0	0	0	0	0	777	7	4	788
RAINBOW SMELT	2397	747	1141	0	0	25	0	0	89	3064	68	2038	9569
SMALLMOUTH BASS	0	0	0	0	0	0	0	0	0	4	0	4	8

*Due to operation of an air curtain, impingement counts of January through March 1976 were adjusted by a factor of 6.6 (McFadden et al. 1978)

A-6 (Contd)

TAXON	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YR_TOTAL
SHORTNOSE STURGEON	0	7	0	0	0	0	0	0	0	0	0	0	7
SPOTTAIL SHINER	6889	3201	3215	4	0	0	0	0	4	327	37	7588	21265
ATLANTIC STURGEON	27	7	7	0	0	0	0	0	0	4	0	4	49
STRIPED BASS	12001	688	748	4	0	4	0	0	608	3954	128	1435	19570
4-SPINE STICKLEBACK	0	13	0	0	0	0	0	0	0	4	0	12	29
ATLANTIC TOMCOD	8626	4274	1711	0	0	1328	0	0	5502	9889	19	18113	49462
WHITE CATFISH	3297	660	511	4	0	40	0	0	0	18468	1235	2010	26225
WHITE PERCH	604138	178286	121799	151	0	262	0	0	4320	134608	10975	362530	1417069
YELLOW PERCH	416	88	222	0	0	4	0	0	0	0	0	172	902
NORTHERN PIPEFISH	0	0	0	0	0	0	0	0	8	0	0	0	8
REDBREAST SUNFSH	7	0	0	0	0	0	0	0	0	4	0	0	11
ATLANTIC NEEDLEFISH	0	0	0	0	0	0	0	0	0	4	0	0	4
CREVALLE JACK	0	0	0	0	0	0	0	0	0	8	0	0	8
WEAKFISH	0	0	0	0	0	0	0	0	195	394	0	0	589
COMMON SHINER	0	0	0	0	0	0	0	0	0	95	0	0	95
MORONE UNIDENTIFIED	13	0	0	0	0	0	0	0	0	0	0	0	13
SPOT	0	0	0	0	0	0	0	0	123	749	0	0	872
WINTER FLOUNDER	145	0	0	0	0	0	0	0	4	4	0	0	153
SEA LAMPREY	21	7	0	0	0	0	0	0	0	0	0	4	32
GIZZARD SHAD	9313	236	14	0	0	0	0	0	0	36	90	486	10175
3-SPINE STICKLEBACK	34	14	21	0	0	0	0	0	0	0	0	4	73
WHITE CRAPPIE	0	0	0	0	0	0	0	0	0	0	0	4	4
NORTHERN PUFFER	7	0	0	0	0	0	0	0	0	0	0	0	7
CENTRARCHID UNID	60	102	21	0	0	0	0	0	34	6146	317	954	7634
OTHERS	68	14	0	0	0	0	0	0	0	4	0	0	86
COLUMN TOTAL	650221	189244	130991	186	0	1762	0	0	19114	658009	18065	399279	2066871

Table A-7

Total Estimated Count of Each Species Impinged Monthly at Indian Point Unit No. 3 during 1976, Adjusted to Account for Collection Efficiency

TAXON	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YR_TOTAL
0	0	0	0	0	0	0	1	0	0	0	0	0	1
ALEWIFE	0	0	0	93	389	233	299	526	370	1248	819	0	3977
BAY ANCHOVY	0	0	0	114	96	116	3793	3347	3405	1238	2	0	12111
AMERICAN SHAD	0	0	0	0	4	21	238	417	453	2860	282	0	4275
BLUEFISH	0	0	0	0	0	960	545	452	121	33	0	0	2111
BLUEGILL	0	0	0	5	13	5	1	1	7	79	31	16	158
BROWN BULLHEAD	0	0	0	1	7	7	9	2	6	1	2	1	36
PUMPKINSEED	0	17	0	61	140	105	88	60	38	162	65	253	989
BLACK CRAPPIE	0	0	0	1	3	0	0	0	0	1	0	1	6
CARP	0	0	0	1	0	0	0	0	0	0	1	0	2
AMERICAN EEL	0	2	0	8	122	146	50	38	26	90	308	113	903
GOLDFISH	0	1	0	0	1	1	0	0	0	2	14	12	31
GOLDEN SHINER	0	3	0	5	4	8	5	0	0	2	8	13	48
HOGCHOKER	0	0	0	203	1323	228	934	4975	5829	2622	383	3	16500
TESSELLATED DARTER	0	0	0	527	340	7	3	5	0	0	2	3	887
BANDED KILLIFISH	0	4	0	2	19	13	2	8	5	22	3	40	118
LARGEMOUTH BASS	0	1	0	0	0	0	0	6	1	11	2	9	30
MUMMICHOG	0	1	0	2	13	2	1	0	0	0	0	2	21
ATLANTIC MENHADEN	0	0	0	0	0	6	108	65	93	55	0	0	327
CHAIN PICKEREL	0	0	0	1	0	0	0	0	0	0	0	0	1
BLUEBACK HERRING	0	0	0	100	993	843	123	1015	1303	159627	12345	3	176352
WHITE SUCKER	0	0	0	1	7	4	0	0	0	0	1	0	13
ATLANTIC SILVERSIDE	0	0	0	0	0	0	0	0	1	0	0	0	1
RAINBOW SMELT	0	1	0	57	114	122	88	115	89	448	119	80	1233
SMALLMOUTH BASS	0	0	0	0	0	0	0	0	0	0	0	2	2
SPOTTAIL SHINER	0	22	0	208	250	35	31	23	12	33	229	353	1196
ATLANTIC STURGEON	0	0	0	1	0	1	1	1	1	2	1	0	8

A-7 (Contd)

TAXON	JAN	FEB	MAP	APP	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YP_TOTAL
STRIPED BASS	0	17	0	36	127	55	96	324	514	1206	721	175	3271
4-SPINE STICKLEBACK	0	0	0	0	1	0	0	0	0	0	0	0	1
ATLANTIC TOMCOD	0	8	0	12	1276	1927	2965	5756	14156	3118	960	605	30783
UNIDENTIFIED AT CAPTURE	0	0	0	0	1	0	0	0	0	0	0	0	1
WHITE CATFISH	0	12	0	340	738	298	34	60	25	4979	9271	830	16587
WHITE PERCH	0	3895	0	4464	7223	2209	1480	4086	3135	21431	116120	55301	219344
YELLOW PEPCH	0	2	0	7	24	0	2	2	0	3	18	38	96
REDBPEAST SUNFSH	0	0	0	1	4	1	1	2	0	1	0	0	10
CREVALLE JACK	0	0	0	0	0	0	0	0	1	14	0	0	15
WEAKFISH	0	0	0	0	0	0	4	68	252	215	0	0	539
CLUPEID UNIDENTIFIED	0	0	0	0	0	0	122	116	10	0	0	0	248
CLUPEID LARVAE	0	0	0	0	0	0	0	1	0	0	0	0	1
GRASS PICKEPEL	0	0	0	0	0	0	0	0	0	0	1	0	1
MOPONE UNIDENTIFIED	0	0	0	0	0	0	0	0	0	22	0	0	22
SPOT	0	0	0	0	0	0	11	246	973	442	8	4	1684
STURGEON UNIDENTIFIED	0	0	0	0	0	0	0	0	0	0	1	0	1
WINTER FLOUNDEP	0	0	0	0	0	0	0	1	0	0	0	0	1
SEA LAMPREY	0	0	0	0	0	0	0	0	0	0	0	1	1
GIZZARD SHAD	0	6	0	1	2	0	0	0	0	68	917	620	1614
SILVER HAKE	0	0	0	0	0	0	0	0	0	0	37	0	37
STRIPED MULLET	0	0	0	0	0	0	0	0	0	0	1	0	1
BROWN TROUT	0	0	0	0	0	0	1	0	0	0	0	0	1
BUTTERFISH	0	0	0	0	0	0	5	0	0	0	0	0	5
WHITE CRAPPIE	0	0	0	0	4	0	0	0	0	0	0	2	6
BROOK TROUT	0	0	0	0	0	1	0	0	0	0	0	0	1
CENTRARCHID UNID	0	0	0	9	26	2	1	4	393	712	184	35	1366
OTHERS	0	0	0	0	0	0	1	0	0	2	26	2	31
COLUMN TOTAL	0	3992	0	6261	13264	7356	11043	21722	31219	200749	142882	58517	497005

Table A-8

Total Monthly Actual Count of Each Species Collected from Intake Screens of Indian Point Unit No. 2 during 1978

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR TOT
SEA LAMPPEY	0	0	0	0	0	0	0	0	0	0	0	18	18
SHORTNOSE STUPGEON	1	0	0	0	0	0	0	0	0	0	1	0	2
ATLANTIC STURGEON	8	0	0	0	0	1	2	0	1	0	2	2	16
AMEPICAN EEL	60	15	0	0	8	63	107	105	41	66	131	359	955
CLUPEID UNIDENTIFIED	2	0	0	0	0	575	4916	921	91	5108	5351	106	17070
BLUEBACK HEPPING	54	0	0	0	20	59	27903	8208	1635	95856	117562	6960	258307
HICKORY SHAD	0	0	0	0	0	0	0	1	0	1	0	0	2
ALEWIFE	14	0	0	0	31	42	2879	3213	165	932	3851	316	11443
AMEPICAN SHAD	8	0	0	0	0	248	3397	5151	303	1481	3919	331	14838
ATLANTIC MENHADEN	0	0	0	0	0	5	38	16	13	62	14	1	149
GIZZAPD SHAD	291	0	0	0	0	0	0	0	0	0	5	457	753
BAY ANCHOVY	0	0	0	0	3	1740	24005	44453	4547	12676	1038	134	88646
PAINBOW SMELT	1626	104	0	0	60	1219	4807	2054	47	715	1985	8306	20923
MUDMINNOW UNIDENTIFIED	0	0	0	0	0	0	0	0	0	0	0	1	1
GOLDFISH	49	10	0	0	12	6	1	6	1	1	3	103	192
CAPP	4	0	0	0	0	0	0	0	0	0	1	7	12
GOLDEN SHINER	43	4	0	0	2	4	2	1	1	2	1	19	79
COMMON SHINEP	2	0	0	0	0	0	0	0	0	0	0	0	2
SPOTTAIL SHINEP	477	62	0	0	4	12	4	27	2	24	21	1381	2014
SPOTFIN SHINEP	0	0	0	0	0	0	0	0	0	0	0	1	1
WHITE SUCKEP	1	0	0	0	1	1	0	0	0	0	0	0	3
WHITE CATFISH	1335	95	0	0	24	35	9	29	10	51	368	419	2375
BPOWN BULLHEAD	21	10	0	0	0	0	1	7	0	0	3	26	68
4-BEAPDED ROCKLING	0	0	0	0	0	0	0	0	0	0	0	2	2
SILVEP HAKE	0	0	0	0	0	0	0	0	0	0	0	44	44
ATLANTIC TOMCOD	900	100	0	0	1607	32780	18494	50488	774	345	295	5740	111523
SQUIPPEL OR RED HAKE	1	0	0	0	0	0	0	0	0	0	0	33	34
ATLANTIC NEEDLEFISH	0	0	0	0	0	0	1	3	0	0	0	0	4
BANDED KILLIFISH	18	4	0	0	0	8	1	5	4	69	21	147	277
MUMMICHOG	1	0	0	0	0	1	0	1	1	0	1	4	9
POUGH SILVEPSIDE	0	0	0	0	0	0	0	0	1	0	0	0	1
TIDEWATEP SILVERSIDE	1	0	0	0	0	0	0	0	0	0	0	0	1
ATLANTIC SILVERSIDE	7	0	0	0	0	0	0	0	2	0	0	0	9
4-SPINE STICKLEBACK	0	0	0	0	0	0	0	0	0	0	2	1	3
3-SPINE STICKLEBACK	38	13	0	0	0	0	0	0	0	0	0	2	53
NOPTHERN PIPEFISH	0	0	0	0	0	1	3	122	84	322	67	41	640
MORONE LARVAE	0	0	0	0	0	3	1	0	0	0	0	0	4
WHITE PERCH	156206	14040	0	0	260	844	2074	12137	794	7866	53046	168365	415632
WHITE BASS	12	0	0	0	0	0	0	1	0	0	0	29	42
STPIPED BASS	3020	316	0	0	7	47	2624	2336	106	392	1466	14185	24999
CENTRARCHID UNID	26	1	0	0	9	11	0	0	0	41	48	314	450
REDBREAST SUNFSH	1	0	0	0	0	0	0	0	1	1	0	1	4
PUMPKINSEED	190	22	0	0	8	24	12	14	0	110	40	306	726
BLUEGILL	13	1	0	0	3	2	0	0	1	23	11	118	172
SMALLMOUTH BASS	1	0	0	0	0	0	0	0	0	0	0	0	1
LARGEMOUTH BASS	5	0	0	0	0	0	0	0	0	0	2	7	14
WHITE CRAPPIE	2	1	0	0	0	0	0	0	0	0	0	0	3
BLACK CRAPPIE	6	2	0	0	0	0	0	0	0	0	0	0	8
TESSELATED DARTER	4	0	0	0	0	1	7	22	3	40	161	667	905
YELLOW PERCH	62	8	0	0	1	3	0	0	0	0	3	87	164
BLUEFISH	0	0	0	0	0	162	316	286	5	3	1	0	773
CREVALLE JACK	0	0	0	0	0	0	1	2	3	28	10	1	45
LOOKDOWN	0	0	0	0	0	0	0	0	3	7	0	0	10
MOONFISH	0	0	0	0	0	0	0	0	0	1	0	0	1
NORTHERN PORGY OR SCUP	0	0	0	0	0	0	1	0	0	1	0	0	2
SILVER PERCH	0	0	0	0	0	0	0	0	0	0	0	1	1
WEAKFISH	0	0	0	0	0	0	6416	3358	850	362	86	32	11104
SPOT	0	0	0	0	0	0	0	0	0	0	0	1	1
WHITE MULLET	0	0	0	0	0	0	0	0	0	0	0	1	1
BUTTERFISH	0	0	0	0	0	0	0	0	0	1	5	3	9
SEAROBIN	0	0	0	0	0	0	0	0	0	1	0	0	1
STRIPED SEAROBIN	0	0	0	0	0	0	0	0	0	20	7	3	30
GRUBBY	0	0	0	0	0	0	0	0	0	0	0	2	2
SMALLMOUTH FLOUNDER	0	0	0	0	0	0	0	0	0	0	0	2	2
SUMMER FLOUNDER	0	0	0	0	0	0	0	1	0	0	0	0	1
WINDOWPANE	0	0	0	0	0	0	0	0	0	0	0	1	1
WINTER FLOUNDER	0	0	0	0	0	0	2	0	2	1	1	3	9
HOGCHOKER	1	0	0	0	455	892	593	2122	2626	11601	3270	1113	22673
NORTHERN PUFFER	0	0	0	0	0	0	0	0	0	1	1	0	2
COLUMN TOTALS	164511	14808	0	0	2515	38789	98617	135090	12167	138711	192850	210203	1008261

Table A-9

Total Monthly Actual Count of Each Species Collected from Intake Screens of Indian Point Unit No. 3 during 1978

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR TOT
SILVER LAMPREY	0	0	0	1	0	0	0	0	0	0	0	0	1
SEA LAMPREY	1	0	0	0	0	0	0	0	0	0	0	1	2
STURGEON UNIDENTIFIED	0	0	0	0	0	0	0	1	0	0	0	0	1
SHORTNOSE STURGEON	1	0	1	0	1	0	0	0	0	0	0	0	3
ATLANTIC STURGEON	12	0	1	2	2	1	0	0	1	0	0	2	21
AMERICAN EEL	45	8	17	57	187	20	0	13	60	104	222	311	1044
CONGER EEL	0	0	0	0	0	0	0	0	0	0	0	1	1
CLUPEID UNIDENTIFIED	3	0	0	0	0	0	0	14	184	4135	3938	100	8374
BLUEBACK HERRING	94	0	1	103	1011	85	0	209	3337	116465	123603	7526	252434
HICKORY SHAD	0	0	0	0	0	0	0	0	2	6	3	0	11
ALEWIFE	11	6	4	78	343	28	0	178	1032	3042	13966	777	19465
AMERICAN SHAD	6	0	0	3	2	2	0	157	809	3855	11387	934	17155
ATLANTIC MENHADEN	0	0	0	0	1	6	0	11	110	377	46	10	561
GIZZARD SHAD	322	2	2	0	0	0	0	0	0	1	85	519	931
BAY ANCHOVY	0	0	0	0	2	37	0	557	6372	9950	1118	55	18091
RAINBOW SMELT	622	721	1033	3062	3585	71	0	96	100	1106	4743	2883	18022
EAST MUDMINNOW	0	0	0	1	0	0	0	0	0	0	0	0	1
GOLDFISH	44	36	85	65	66	3	0	1	1	4	22	71	398
CARP	10	0	5	0	0	0	0	0	0	0	6	6	27
GOLDEN SHINER	60	12	82	19	11	1	0	0	1	3	2	13	204
EMERALD SHINER	0	0	1	1	0	0	0	0	0	0	0	0	2
COMMON SHINER	0	0	0	0	0	0	0	0	0	1	0	0	1
SPOTTAIL SHINER	370	165	339	355	199	5	0	2	4	12	50	371	1872
WHITE SUCKER	0	0	0	1	0	1	0	0	0	0	0	0	2
WHITE CATFISH	2123	290	525	476	686	8	0	4	34	62	299	616	5123
BROWN BULLHEAD	8	6	8	19	6	1	0	1	0	0	8	12	69
4-BEARDED ROCKLING	0	0	0	1	0	0	0	0	0	0	0	1	2
SILVER HAKE	4	0	0	0	0	0	0	0	0	0	3	35	42
ATLANTIC TOMCOD	1207	38	18	64	151	74	0	3583	2105	289	417	806	8752
SQUIRREL OR RED HAKE	0	0	0	0	0	0	0	0	0	0	1	15	16
ATLANTIC NEEDLEFISH	0	0	0	0	0	0	0	0	2	0	0	0	2
BANDED KILLIFISH	25	6	11	15	1	0	0	0	1	16	23	30	128
MUMMICHOG	0	0	4	3	1	1	0	0	1	0	0	2	12
ROUGH SILVERSIDE	0	0	0	0	0	0	0	0	3	4	0	0	7
ATLANTIC SILVERSIDE	7	0	0	0	0	0	0	0	1	0	0	0	8
4-SPINE STICKLEBACK	0	0	0	0	1	0	0	0	0	1	1	0	3
3-SPINE STICKLEBACK	9	27	47	6	4	0	0	0	0	0	0	0	93
SEA HORSE	0	0	0	1	0	0	0	0	0	0	0	0	1
NORTHERN PIPEFISH	0	0	0	14	0	0	0	26	42	60	11	10	163
WHITE PERCH	77719	57016	75146	37405	31381	416	0	401	2371	6312	54910	48526	391603
WHITE BASS	5	0	1	0	0	0	0	0	0	0	5	10	21
STRIPED BASS	1936	2111	4485	737	703	6	0	32	269	478	1454	5072	17283
BLACK SEA BASS	0	0	0	0	0	0	0	0	0	1	2	1	4
CENTRARCHID UNID	12	0	0	6	9	1	0	0	2	7	25	25	87
ROCK BASS	0	0	1	0	0	0	0	0	0	0	0	0	1
REDBREAST SUNFSH	0	0	1	2	3	0	0	0	0	0	0	0	6
PUMPKINSEED	155	47	204	100	181	40	0	5	37	79	53	111	1012
BLUEGILL	22	2	5	4	22	1	0	1	1	16	26	72	172
SMALLMOUTH BASS	1	0	0	0	0	0	0	0	0	0	0	0	1
LARGEMOUTH BASS	10	0	3	1	0	1	0	0	0	0	1	3	19
WHITE CRAPPIE	1	0	0	0	0	0	0	0	0	1	0	0	2
BLACK CRAPPIE	6	3	2	1	7	0	0	0	0	0	0	1	20
TESSELATED DARTER	0	0	2	82	34	0	0	1	3	9	28	62	221
YELLOW PERCH	26	13	32	67	30	2	0	0	0	1	8	34	213
BLUEFISH	0	0	0	0	0	3	0	13	69	24	7	0	116
CREVALLE JACK	0	0	0	0	0	0	0	0	16	44	61	1	122
LOOKDOWN	0	0	0	0	0	0	0	0	8	13	0	0	21
MOONFISH	0	0	0	0	0	0	0	0	0	1	0	0	1
SILVER PERCH	0	0	0	0	0	0	0	0	0	0	0	2	2
WEAKFISH	0	0	0	0	0	0	0	127	1398	186	67	45	1823
SPOT	0	0	0	0	0	0	0	0	0	1	0	1	2
WHITE MULLET	0	0	0	0	0	0	0	0	0	0	4	3	7
BUTTERFISH	0	0	0	0	0	0	0	0	5	12	13	7	37
SEAROBIN	0	1	0	0	0	0	0	0	1	0	0	0	2
NORTHERN SEAROBIN	0	0	0	0	0	0	0	0	0	0	0	1	1
STRIPED SEAROBIN	0	0	0	0	0	0	0	0	1	18	16	14	49
GRUBBY	0	0	0	0	0	0	0	0	0	0	0	1	1
WINTER FLOUNDER	3	0	4	2	0	0	0	0	6	1	0	4	20
HOGCHOKER	0	1	0	300	3767	101	0	53	3974	11786	2913	956	23851
COLUMN TOTALS	84857	60511	82070	43054	42397	915	0	5466	22363	158506	219547	70059	789765

Table A-10

Total Monthly Actual Count of Each Species Collected from Intake Screens of Indian Point Units No. 2 and No. 3 during 1978

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR TOT
SILVER LAMPREY	0	0	0	1	0	0	0	0	0	0	0	0	1
SEA LAMPREY	1	0	0	0	0	0	0	0	0	0	0	19	20
STURGEON UNIDENTIFIED	0	0	0	0	0	0	0	1	0	0	0	0	1
SHORTNOSE STURGEON	2	0	1	0	1	0	0	0	0	0	1	0	5
ATLANTIC STURGEON	20	0	1	2	2	2	2	0	2	0	2	4	37
AMERICAN EEL	105	23	17	57	195	83	107	118	101	170	353	670	1999
CONGER EEL	0	0	0	0	0	0	0	0	0	0	0	1	1
CLUPEID UNIDENTIFIED	2	0	0	0	0	575	4916	935	275	9246	9289	206	25444
BLUEBACK HERRING	128	0	1	103	1031	144	27903	8417	5042	212321	241165	14486	510741
HICKORY SHAD	0	0	0	0	0	0	0	1	2	7	3	0	13
ALEWIFE	25	6	4	78	374	70	2879	3391	1197	3974	17817	1093	30908
AMERICAN SHAD	14	0	0	3	2	250	3397	5308	1112	5336	15306	1265	31993
ATLANTIC MENHADEN	0	0	0	0	1	11	38	27	123	439	60	11	710
GIZZARD SHAD	613	2	2	0	0	0	0	0	0	1	90	976	1684
BAY ANCHOVY	0	0	0	0	5	1777	24005	45010	10919	22626	2206	189	106737
RAINBOW SMELT	2248	825	1033	3062	3645	1290	4807	2150	147	1821	6728	11189	38945
MUDMINNOW UNIDENTIFIED	0	0	0	0	0	0	0	0	0	0	0	1	1
EAST MUDMINNOW	0	0	0	1	0	0	0	0	0	0	0	0	1
GOLDFISH	93	46	85	65	78	9	1	7	2	5	25	174	590
CARP	14	0	5	0	0	0	0	0	0	0	7	13	39
GOLDEN SHINER	103	16	82	19	13	5	2	1	2	5	3	32	283
EMERALD SHINER	0	0	1	1	0	0	0	0	0	0	0	0	2
COMMON SHINER	2	0	0	0	0	0	0	0	0	1	0	0	3
SPOTTAIL SHINER	847	227	339	355	203	17	4	29	6	36	71	1752	3886
SPOTFIN SHINER	0	0	0	0	0	0	0	0	0	0	0	1	1
WHITE SUCKER	1	0	0	1	1	2	0	0	0	0	0	0	5
WHITE CATFISH	3458	385	525	476	710	43	9	33	44	113	667	1035	7498
BROWN BULLHEAD	29	16	8	19	6	1	1	8	0	0	11	38	137
4-BEARDED ROCKLING	0	0	0	1	0	0	0	0	0	0	0	3	4
SILVER HAKE	4	0	0	0	0	0	0	0	0	0	3	79	86
ATLANTIC TOMCOD	2107	138	18	64	1758	32854	18494	54071	2879	634	712	6546	120275
SQUIRREL OR RED HAKE	1	0	0	0	0	0	0	0	0	0	1	48	50
ATLANTIC NEEDLEFISH	0	0	0	0	0	0	1	3	2	0	0	0	6
BANDED KILLIFISH	43	10	11	15	1	8	1	5	5	85	44	177	405
MUMMICHOG	1	0	4	3	1	2	0	1	2	0	1	6	21
ROUGH SILVERSIDE	0	0	0	0	0	0	0	0	4	4	0	0	8
TIDEWATER SILVERSIDE	1	0	0	0	0	0	0	0	0	0	0	0	1
ATLANTIC SILVERSIDE	14	0	0	0	0	0	0	0	3	0	0	0	17
4-SPINE STICKLEBACK	0	0	0	0	1	0	0	0	0	1	3	1	6
3-SPINE STICKLEBACK	47	40	47	6	4	0	0	0	0	0	0	2	146
SEA HORSE	0	0	0	1	0	0	0	0	0	0	0	0	1
NORTHERN PIPEFISH	0	0	0	14	0	1	3	128	126	402	78	51	803
MORONE LARVAE	0	0	0	0	0	3	1	0	0	0	0	0	4
WHITE PERCH	233925	71056	75146	37405	31641	1260	2074	12538	3165	14178	107956	216891	807235
WHITE BASS	17	0	1	0	0	0	0	1	0	0	5	39	63
STRIPED BASS	4956	2427	4485	737	710	53	2624	2368	375	1370	2920	19257	42282
BLACK SEA BASS	0	0	0	0	0	0	0	0	0	1	2	1	4
CENTRARCHID UNID	38	1	0	6	18	12	0	0	2	48	73	339	537
ROCK BASS	0	0	1	0	0	0	0	0	0	0	0	0	1
REDBREAST SUNFSH	1	0	1	2	3	0	0	0	1	1	0	1	10
PUMPKINSEED	345	69	204	100	189	64	12	19	37	189	93	417	1738
BLUEGILL	35	3	5	4	25	3	0	1	2	39	37	190	344
SMALLMOUTH BASS	2	0	0	0	0	0	0	0	0	0	0	0	2
LARGEMOUTH BASS	15	0	3	1	0	1	0	0	0	0	3	10	33
WHITE CRAPPIE	3	1	0	0	0	0	0	0	0	1	0	0	5
BLACK CRAPPIE	12	5	2	1	7	0	0	0	0	0	0	1	28
TESSELATED DARTER	4	0	2	82	34	1	7	23	6	49	189	729	1126
YELLOW PERCH	88	21	32	67	31	5	0	0	0	1	11	121	377
BLUEFISH	0	0	0	0	0	165	316	299	74	27	8	0	889
CREVALLE JACK	0	0	0	0	0	0	1	2	19	72	71	2	167
LOOKDOWN	0	0	0	0	0	0	0	0	11	20	0	0	31
MOONFISH	0	0	0	0	0	0	0	0	0	2	0	0	2
NORTHERN PORGY OR SCUP	0	0	0	0	0	0	1	0	0	1	0	0	2
SILVER PERCH	0	0	0	0	0	0	0	0	0	0	0	3	3
WEAKFISH	0	0	0	0	0	0	6416	3485	2248	548	153	77	12927
SPOT	0	0	0	0	0	0	0	0	0	1	0	2	3
WHITE MULLET	0	0	0	0	0	0	0	0	0	0	4	4	8
BUTTERFISH	0	0	0	0	0	0	0	0	5	13	18	10	46
SEAROBIN	0	1	0	0	0	0	0	0	1	1	0	0	3
NORTHERN SEAROBIN	0	0	0	0	0	0	0	0	0	0	0	1	1
STRIPED SEAROBIN	0	0	0	0	0	0	0	0	1	38	23	17	79
GRUBBY	0	0	0	0	0	0	0	0	0	0	0	3	3
SMALLMOUTH FLOUNDER	0	0	0	0	0	0	0	0	0	0	0	2	2
SUMMER FLOUNDER	0	0	0	0	0	0	0	1	0	0	0	0	1
WINDOWPANE	0	0	0	0	0	0	0	0	0	0	0	1	1
WINTER FLOUNDER	3	0	4	2	0	0	2	0	8	2	1	7	29
HOGCHOKER	1	1	0	300	4222	993	593	2175	6600	23387	6183	2069	46524
NORTHERN PUFFER	0	0	0	0	0	0	0	0	0	1	1	0	2
COLUMN TOTALS	249368	75519	82070	43054	44912	39704	98617	140556	34550	297217	412397	280262	1798026

Appendix A.2

Numbers and Weights of Major Impinged Species

Total counts and total weights of sixteen species predominant in impingement collections (adjusted for collection efficiency) are summarized in the following tables by week, month, season, and year. The following codes denote the sixteen species presented.

SB	Striped Bass
WP	White Perch
TC	Atlantic Tomcod
BH	Blueback Herring
AL	Alewife
AS	American Shad
SNS	Shortnose Sturgeon
ATS	Atlantic Sturgeon
HC	Hogchoker
BF	Bluefish
RS	Rainbow Smelt
BA	Bay Anchovy
WC	White Catfish
SS	Spottail Shiner
WKF	Weakfish
PS	Pumpkinseed

Table A-11

Total Estimated Count of Sixteen Major Species and All Species Combined Impinged at Indian Point Unit No. 2 Intake Screens during 1978 (Summarized by Week, Month, Season, and Year, and Adjusted for Collection Efficiency)

PERIOD	ALL SPEC	SB	WP	TC	BH	AL	AS	SNS	ATS
WEEK									
1	201821	4253	190875	258	4	8	8	0	8
2	135017	1853	125899	2229	20	23	16	4	4
3	29307	449	27524	342	0	0	0	0	4
4	205165	3807	198428	185	170	20	8	0	15
5	7045	433	5778	187	0	4	0	0	0
6	36941	738	35271	188	0	0	0	0	0
7	12690	177	12119	79	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0
21	1400	19	436	315	19	64	0	0	0
22	9753	8	800	6548	74	58	0	0	0
23	8749	39	2057	5432	65	68	0	0	0
24	18581	8	218	17341	23	0	0	0	0
25	81379	61	287	73173	71	58	4	0	0
26	25505	60	78	17790	33	15	866	0	4
27	2913	22	62	328	4	109	163	0	0
28	11737	465	152	3699	530	1120	341	0	0
29	156796	2799	617	25354	51735	5431	4146	0	4
30	137015	4699	3351	28053	37152	2706	6099	0	4
31	85877	2550	7786	13014	14730	3647	3271	0	0
32	141586	3277	20082	38675	6290	4267	6093	0	0
33	167698	1549	10341	71744	7175	2659	5609	0	0
34	100088	1752	5535	56693	6482	937	3594	0	0
35	15525	290	1773	3737	2449	496	713	0	0
36	22529	195	1487	781	3200	314	548	0	0
37	16563	153	1016	1706	2365	183	390	0	4
38	1870	8	107	172	155	4	35	0	0
39	121	0	11	0	33	4	0	0	0
40	9912	50	170	75	1773	36	26	0	0
41	42051	111	1045	149	14535	217	102	0	0
42	242030	1048	6581	698	187171	853	1910	0	0
43	95389	1475	14006	191	58799	997	1386	0	0
44	326646	2083	40218	451	237551	6067	6265	0	0
45	155901	1094	50382	363	86493	3654	2607	0	8
46	212629	1472	56861	258	134415	4033	5571	4	0
47	74595	897	42737	98	26169	902	1055	0	0
48	7953	134	8074	26	676	57	50	0	0
49	71240	1570	50766	134	13522	724	447	0	0
50	170685	3546	142767	1780	9627	294	611	0	4
51	289255	16933	233311	16772	582	41	57	0	4
52	145555	18619	117239	523	42	4	0	0	0
53	52999	8898	40335	880	11	8	0	0	0
MONTH									
JAN	576100	10598	546749	3173	194	55	32	4	31
FEB	51386	1112	49145	355	0	0	0	0	0
MAR	0	0	0	0	0	0	0	0	0
APR	0	0	0	0	0	0	0	0	0
MAY	8838	27	913	5630	72	111	0	0	0
JUN	135866	168	2963	114741	213	152	870	0	4
JUL	345307	9193	7266	64744	97670	10092	11898	0	8
AUG	472986	8185	42488	176724	28743	11259	18039	0	0
SEP	42688	378	2786	2716	5907	586	1065	0	4
OCT	485669	3129	27543	1219	335511	3278	5196	0	0
NOV	675176	5139	185672	1042	411483	13492	13726	4	8
DEC	736045	49664	569297	20107	24372	1117	1165	0	8
SEASON									
WIN	627986	11710	595894	3528	194	55	32	4	31
SPR	144704	195	3876	120371	285	263	870	0	4
SUM	860981	17756	52540	244184	132320	21937	31002	0	12
FAL	1896890	57932	802512	22368	771366	17887	20087	4	16
YEAR	3530561	87593	1454822	390451	904165	40142	51991	8	63

A-11 (Contd)

PERIOD	HC	BF	RS	BA	WC	SS	WKF	PS
WEEK								
1	0	0	2820	0	2119	469	0	149
2	0	0	1213	0	1908	541	0	331
3	0	0	342	0	157	203	0	62
4	4	0	1193	0	444	391	0	105
5	0	0	205	0	125	118	0	53
6	0	0	209	0	210	149	0	38
7	0	0	103	0	72	43	0	19
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
21	302	0	104	4	51	4	0	22
22	1874	0	166	26	40	19	0	7
23	344	0	379	121	61	20	0	47
24	275	0	349	247	12	4	0	19
25	1458	294	1724	4094	37	4	0	12
26	505	296	1851	1731	15	4	0	12
27	211	82	525	1070	19	0	0	23
28	454	49	1659	2551	8	0	0	8
29	533	621	1788	39035	0	8	8252	11
30	615	237	4578	28869	4	4	13030	4
31	410	558	475	33673	26	20	4284	8
32	1793	341	1051	53318	35	23	4845	4
33	2583	135	1153	61510	22	8	2189	8
34	2161	82	4618	15724	18	34	1513	15
35	858	15	80	4461	8	26	149	18
36	4306	8	72	8821	20	0	1857	0
37	3750	11	50	5522	19	4	1017	0
38	464	0	40	792	0	0	57	0
39	12	0	0	33	0	0	4	0
40	5181	0	8	2323	4	4	19	4
41	14223	4	40	10702	47	0	153	37
42	11293	8	939	22648	55	4	747	152
43	5066	0	800	5819	61	67	193	169
44	9809	0	2450	5464	236	27	274	88
45	2977	4	1756	714	310	15	65	37
46	2665	0	2650	410	550	23	109	30
47	768	0	787	82	204	15	12	18
48	389	0	123	19	64	16	18	33
49	1084	0	1588	111	166	145	80	18
50	1350	0	8755	159	398	163	26	11
51	911	0	10495	72	576	3470	4	801
52	233	0	5902	63	235	959	0	226
53	47	0	2252	64	57	105	0	19
MONTH								
JAN	4	0	5716	0	4696	1693	0	683
FEB	0	0	369	0	339	221	0	82
MAR	0	0	0	0	0	0	0	0
APR	0	0	0	0	0	0	0	0
MAY	1594	0	213	12	87	16	0	29
JUN	3129	569	4276	6099	129	45	0	90
JUL	2084	1113	16834	84025	55	16	22462	46
AUG	7435	1008	7197	155595	105	103	11761	53
SEP	9197	19	170	15921	39	8	2981	0
OCT	40611	12	2509	44375	185	86	1276	390
NOV	11453	4	6960	3815	1297	81	312	147
DEC	3912	0	29091	480	1481	4846	117	1086
SEASON								
WIN	4	0	6085	0	5035	1914	0	765
SPR	4723	569	4489	6111	216	61	0	119
SUM	18716	2140	24201	255541	179	127	37204	99
FAL	55976	16	38560	48670	2963	5013	1705	1623
YEAR	79419	2725	73335	310322	8393	7115	38909	2606

Table A-12

Total Estimated Count of Sixteen Major Species and All Species Combined Impinged at Indian Point Unit No. 3 Intake Screens during 1978 (Summarized by Week, Month, Season, and Year, and Adjusted for Collection Efficiency)

PERIOD	ALL SPEC	SB	WP	TC	BH	AL	AS	SNS	ATS
WEEK									
1	27694	688	25438	393	1	4	3	0	3
2	40990	711	36053	1052	26	3	3	0	5
3	1171	37	907	72	0	0	0	0	0
4	42164	1057	40175	117	64	8	0	1	4
5	7183	254	6557	68	11	0	1	0	2
6	6790	142	6507	10	0	0	0	0	0
7	48685	340	48106	13	0	1	0	0	0
8	17625	1064	15921	3	0	5	0	0	0
9	31707	3185	27784	15	1	1	0	1	0
10	31052	2461	27527	4	0	2	0	0	0
11	41670	1413	39464	9	0	2	0	0	1
12	16845	522	15647	2	0	0	0	0	0
13	4681	82	3697	4	0	0	0	0	0
14	4593	30	3571	30	0	14	0	0	0
15	7113	15	7109	24	0	11	2	0	3
16	17938	253	16833	9	28	26	0	0	0
17	25266	654	20870	23	97	47	1	0	0
18	29689	468	24012	33	212	96	0	0	1
19	22694	441	17986	41	606	99	0	0	0
20	6799	86	3729	40	450	83	0	0	0
21	4095	59	1822	89	115	185	1	1	1
22	732	0	233	26	92	44	2	0	0
23	775	8	438	57	70	23	0	0	1
24	60	0	18	14	5	0	1	0	0
25	72	0	9	12	4	0	0	0	0
26	15	0	0	4	1	0	0	0	0
27	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0
33	2182	4	89	1856	12	14	24	0	0
34	4246	17	228	2974	178	58	104	0	0
35	1394	31	290	193	106	195	102	0	0
36	5157	58	634	335	648	413	285	0	0
37	10284	133	1162	1722	689	530	499	0	1
38	13150	151	1262	865	2600	391	271	0	0
39	2514	25	214	16	753	87	65	0	0
40	11469	49	308	112	2009	127	144	0	0
41	16117	40	799	55	8866	227	109	0	0
42	119194	259	1654	143	100868	576	2191	0	0
43	40115	183	3432	21	30258	1062	1122	0	0
44	133194	881	17628	308	89116	6492	6400	0	0
45	72133	465	24025	119	32170	6715	4211	0	0
46	106899	553	23664	192	65056	6582	5852	0	0
47	20134	177	10727	19	6056	1232	811	0	0
48	22448	473	10515	123	6365	1063	1027	0	0
49	31350	823	18137	201	7672	794	729	0	0
50	5836	173	4779	247	122	11	30	0	1
51	25131	1764	21058	405	47	7	10	0	1
52	19197	3326	13967	126	17	2	2	0	0
53	3896	639	2949	37	2	0	0	0	0
MONTH									
JAN	118757	2714	108608	1689	102	15	7	1	14
FEB	84683	2954	79822	49	0	7	0	0	0
MAR	114661	6280	105204	21	1	4	0	1	1
APR	60231	1031	52366	89	144	108	3	0	3
MAY	59324	984	43936	208	1417	481	2	1	2
JUN	1262	8	580	105	119	39	2	0	1
JUL	0	0	0	0	0	0	0	0	0
AUG	7634	43	561	5015	290	247	220	0	0
SEP	31293	376	3318	2946	4696	1441	1130	0	1
OCT	221866	668	8837	401	163052	4254	5393	0	0
NOV	307294	2035	76871	580	173042	19552	15939	0	0
DEC	98003	7102	67934	1127	10530	1084	1306	0	2
SEASON									
WIN	318301	11948	293834	1759	103	26	7	2	15
SPR	120817	2023	96882	402	1680	628	7	1	6
SUM	38927	419	3879	7961	4986	1688	1350	0	1
FAL	627163	9805	153642	2108	346624	24890	22638	0	2
YEAR	1105208	24195	548237	12230	353393	27232	24002	3	24

A-12 (Contd)

PEPIOD	HC	BF	PS	BA	WC	SS	WKF	PS
WEEK								
1	0	0	203	0	478	161	0	37
2	0	0	297	0	2205	186	0	94
3	0	0	26	0	72	26	0	10
4	0	0	289	0	157	107	0	92
5	0	0	87	0	99	43	0	19
6	0	0	26	0	73	12	0	13
7	0	0	217	0	105	40	0	20
8	1	0	561	0	103	101	0	13
9	0	0	348	0	174	126	0	17
10	0	0	369	0	187	80	0	40
11	0	0	387	0	149	100	0	46
12	0	0	238	0	173	85	0	79
13	0	0	353	0	153	171	0	98
14	1	0	375	0	141	227	0	67
15	3	0	116	0	144	168	0	26
16	23	0	209	0	44	32	0	10
17	341	0	2767	0	273	47	0	20
18	790	0	3155	0	435	124	0	96
19	1509	0	1402	0	345	98	0	60
20	1333	0	309	1	129	23	0	37
21	1057	0	309	1	100	35	0	51
22	224	0	28	0	9	4	0	43
23	42	0	49	18	7	4	0	20
24	4	0	9	5	0	0	0	1
25	4	2	3	20	0	0	0	5
26	0	1	1	8	0	0	0	0
27	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0
33	16	4	15	112	0	0	29	1
34	24	7	111	378	3	0	139	2
35	59	10	9	334	6	3	10	5
36	856	10	10	1320	5	1	472	7
37	1540	23	22	2570	2	2	1155	16
38	2706	50	93	4156	13	0	320	16
39	377	8	11	832	21	1	9	9
40	7243	13	2	1014	24	3	25	11
41	4578	4	12	2944	22	0	54	21
42	2823	8	375	7245	16	0	108	57
43	654	4	185	1761	19	5	19	17
44	3335	8	2314	1840	104	17	79	27
45	858	1	1882	434	124	7	21	13
46	409	0	2374	209	82	8	13	7
47	148	0	535	28	49	8	1	12
48	679	1	1119	38	351	42	59	27
49	640	0	1385	32	340	78	28	9
50	102	0	244	9	36	16	3	1
51	170	0	785	3	82	247	3	100
52	51	0	882	8	82	148	0	33
53	20	0	123	3	29	21	0	1
MONTH								
JAN	0	0	868	0	2975	516	0	214
FEB	1	0	1009	0	403	230	0	63
MAR	0	0	1448	0	736	475	0	283
APR	418	0	4287	0	663	498	0	138
MAY	5272	0	5019	2	965	274	0	252
JUN	141	3	96	51	10	7	0	54
JUL	0	0	0	0	0	0	0	0
AUG	74	17	133	780	6	3	177	5
SEP	5566	95	138	8922	44	4	1956	48
OCT	16501	31	1548	13929	85	16	259	111
NOV	4079	8	6640	1565	416	66	92	73
DEC	1336	0	4032	74	859	518	62	152
SEASON								
WIN	1	0	3325	0	4114	1221	0	560
SPR	5831	3	9402	53	1638	779	0	444
SUM	5640	112	271	9702	50	7	2133	53
FAL	21916	39	12220	15568	1360	600	413	336
YEAR	33388	154	25218	25323	7162	2607	2546	1393

Table A-13

Total Estimated Count of Sixteen Major Species and All Species Combined Impinged at Indian Point Units No. 2 and No. 3 Intake Screens during 1978 (Summarized by Week, Month, Season, and Year, and Adjusted for Collection Efficiency)

PERIOD	ALL SPEC	SB	WP	TC	BH	AL	AS	SNS	ATS
WEEK									
1	229515	4941	216313	651	5	12	11	0	11
2	176007	2564	161952	3231	46	26	19	4	9
3	30478	486	22431	464	0	0	0	0	4
4	247329	4864	233600	302	234	28	8	1	19
5	14225	687	12335	265	11	4	1	0	2
6	43731	880	41778	198	0	0	0	0	0
7	41575	517	60225	92	0	1	0	0	0
8	17825	1064	15921	3	0	5	0	0	0
9	31707	3185	27734	15	1	1	0	1	0
10	31052	2461	27827	4	0	2	0	0	0
11	41670	1413	39464	9	0	2	0	0	1
12	16845	522	15447	2	0	0	0	0	0
13	4681	82	3897	4	0	0	0	0	0
14	4593	30	3571	30	0	14	0	0	0
15	7713	19	7104	24	0	11	2	0	3
16	17938	253	16833	9	28	26	0	0	0
17	25286	654	20670	23	97	47	1	0	0
18	29689	468	24012	33	212	96	0	0	1
19	22694	441	17986	41	606	99	0	0	0
20	5799	26	3728	40	450	83	0	0	0
21	5495	8	2258	404	134	249	1	1	1
22	10485	8	1033	6574	166	102	2	0	0
23	9524	47	2495	5489	135	91	0	0	1
24	18841	8	234	17355	28	0	1	0	0
25	81451	61	296	73185	5	53	4	0	0
26	25520	60	75	17794	34	15	866	0	4
27	2913	22	62	328	4	109	163	0	0
28	11737	465	152	3699	530	1120	341	0	0
29	156726	2719	617	25354	51755	5431	4146	0	4
30	137015	4696	3561	28053	37152	2766	6099	0	0
31	85877	2550	7786	13014	14730	3647	3271	0	0
32	141586	3277	20082	38675	6290	4267	6093	0	0
33	169880	1553	10430	73600	7187	2673	5633	0	0
34	104334	1769	5763	59667	6650	995	3698	0	0
35	16919	321	2065	3930	2555	691	815	0	0
36	27086	253	2131	1116	3848	727	833	0	0
37	26847	286	2178	3428	3054	713	889	0	5
38	15020	159	1369	1037	2755	395	306	0	0
39	2635	25	225	16	786	91	65	0	0
40	21381	99	478	187	3782	163	170	0	0
41	58168	151	1844	204	21401	444	211	0	0
42	361244	1307	8235	841	285039	1429	4101	0	0
43	135504	1658	17438	212	89057	2059	2508	0	0
44	459840	2966	57846	759	326667	12559	12665	0	0
45	228034	1559	74407	482	118863	10369	6818	0	8
46	319529	2025	80545	450	199471	10615	11423	4	0
47	94729	1074	53464	87	32225	2134	1866	0	0
48	30431	607	16589	149	7041	1120	1077	0	0
49	102590	2393	68903	335	21194	1518	1176	0	0
50	176571	3719	147546	2027	8749	305	641	0	5
51	314386	18697	254369	17177	629	48	67	0	5
52	164752	21945	131206	649	59	6	2	0	0
53	56895	9537	43284	917	13	8	0	0	0
MONTH									
JAN	694857	13312	655557	4862	296	70	39	5	45
FEB	136569	4066	128967	404	0	7	0	0	0
MAR	114661	6280	105204	21	1	4	0	1	1
APR	60231	1031	52366	89	144	108	3	0	3
MAY	68162	1011	44849	5638	1489	592	2	1	2
JUN	137128	176	3543	114846	332	191	872	0	5
JUL	345307	9193	7266	64744	97670	10092	11898	0	8
AUG	460620	8228	43049	181739	29033	11506	18259	0	0
SEP	73961	754	6104	5662	10603	2027	2195	0	5
OCT	707535	3797	36380	1620	496563	7532	10589	0	0
NOV	982470	7174	262543	1622	584525	33044	29665	4	8
DEC	834048	56766	657231	21234	34902	2201	2471	0	10
SEASON									
WIN	946287	23658	889728	5287	297	81	39	6	46
SPR	263521	2218	100758	120773	1965	891	877	1	10
SUM	899908	18175	56419	252145	137306	23625	32352	0	13
FAL	2524053	67737	956154	24476	1117990	42777	42725	4	18
YEAR	4635769	111788	2003059	402661	1257558	67374	75993	11	87

A-13 (Contd)

PERIOD	HC	BF	RS	BA	WC	SS	WKF	PS
WEEK								
1	0	0	3023	0	2597	630	0	186
2	0	0	1510	0	4113	727	0	425
3	0	0	368	0	229	229	0	72
4	4	0	1479	0	601	498	0	170
5	0	0	272	0	224	161	0	77
6	0	0	235	0	283	161	0	51
7	0	0	320	0	177	83	0	39
8	1	0	561	0	103	101	0	13
9	0	0	348	0	174	126	0	17
10	0	0	369	0	187	50	0	60
11	0	0	387	0	149	100	0	46
12	0	0	238	0	173	85	0	79
13	0	0	353	0	153	171	0	98
14	1	0	375	0	141	227	0	97
15	3	0	114	0	144	168	0	26
16	23	0	609	0	44	32	0	10
17	341	0	2707	0	273	47	0	20
18	790	0	3155	0	435	124	0	66
19	1509	0	1402	0	345	98	0	60
20	1533	0	309	1	129	23	0	37
21	1359	0	613	5	151	39	0	73
22	2098	0	104	26	46	23	0	50
23	389	0	445	139	68	30	0	67
24	279	0	358	252	12	4	0	20
25	1462	296	1727	4114	37	4	0	17
26	505	297	1652	1739	15	4	0	12
27	211	62	525	1070	19	0	0	23
28	454	49	1688	2551	8	0	7	6
29	583	621	7788	34085	0	8	8252	11
30	615	237	6579	28889	4	4	13030	4
31	416	558	475	33573	26	20	4284	8
32	1763	341	1051	53318	55	23	4845	4
33	2606	139	1128	61622	22	8	2218	4
34	2155	89	4728	16102	21	34	1651	17
35	917	25	89	4725	14	29	159	23
36	5662	18	82	10141	25	1	2329	7
37	5290	34	72	6092	21	6	2172	16
38	3230	50	133	4948	13	0	377	16
39	389	5	11	865	21	1	13	6
40	12424	13	10	3337	28	7	44	15
41	18801	5	52	13646	29	0	212	58
42	14116	16	1314	29913	71	4	255	209
43	5720	4	985	7580	80	72	212	186
44	13144	5	4794	7304	340	44	353	65
45	3835	5	3638	1148	434	22	86	50
46	3274	0	5024	219	632	31	122	37
47	910	0	1332	110	253	23	13	30
48	1048	1	1247	57	415	58	77	60
49	1724	0	2976	143	506	223	106	27
50	1452	0	8999	168	434	179	29	12
51	1057	0	11280	75	653	3717	7	901
52	284	0	6784	71	317	1107	0	259
53	67	0	2375	67	56	126	0	20
MONTH								
JAN	4	0	6584	0	7671	2209	0	897
FEB	1	0	1378	0	742	451	0	145
MAR	0	0	1448	0	736	475	0	283
APR	418	0	4287	0	663	498	0	138
MAY	6866	0	5232	14	1052	290	0	281
JUN	3270	572	4372	6150	139	32	0	144
JUL	2084	1113	16834	84025	33	16	22462	46
AUG	7509	1025	7330	156375	111	106	11938	58
SEP	14763	114	308	24843	83	12	4937	48
OCT	57112	43	4057	58304	270	102	1535	501
NOV	15532	12	13600	5380	1713	147	404	220
DEC	5248	0	33123	554	2340	5364	179	1238
SEASON								
WIN	5	0	9410	0	9149	3135	0	1325
SPR	10554	572	13891	6164	1854	840	0	563
SUM	24356	2252	24472	265243	229	134	39337	152
FAL	77892	55	50780	64238	4323	5613	2118	1959
YEAR	112807	2879	98553	335645	15555	9722	41455	3999

Table A-14

Total Estimated Weight (g) of Sixteen Major Species and All Species Combined Impinged at Indian Point Unit No. 2 Intake Screens during 1978 (Summarized by Week, Month, Season, and Year, and Adjusted for Collection Efficiency)

PERIOD	ALL SPEC	SB	WP	TC	BH	AL	AS	SNS	ATS
WEEK									
1	1856106	25649	1723652	8218	11	217	91	0	532
2	2010891	18532	1768618	68354	67	264	148	95	277
3	651449	8474	596806	10263	0	0	0	0	189
4	6882941	86091	6732566	3912	502	449	89	0	844
5	594852	159032	402246	5914	0	32	0	0	0
6	803429	94565	774131	3863	0	0	0	0	0
7	602777	26235	559201	2010	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0
21	40655	4012	5252	2026	2657	11505	0	0	0
22	81243	49	9466	7072	11702	10457	0	0	0
23	67483	3417	18720	9326	7771	2322	0	0	0
24	66191	71	8758	42996	2734	0	0	0	0
25	245991	529	5493	200978	4582	3963	53	0	0
26	77867	11	2869	54528	1769	1309	421	0	280
27	19248	15	2551	1171	32	2885	141	0	0
28	55395	253	4929	14982	695	3535	498	0	0
29	357567	3091	5380	121318	44451	13093	6540	0	11
30	355851	6324	14177	137686	36082	7227	9174	0	767
31	285509	4320	26515	74693	17194	10765	5721	0	0
32	585569	6188	62063	243755	9268	13001	11499	0	0
33	687958	4317	37706	363708	10083	8146	10718	0	0
34	421456	4345	30032	248938	4653	4360	7132	0	0
35	82574	1723	15553	20964	3520	1606	1388	0	0
36	134164	552	15209	3609	5511	1222	1198	0	0
37	105900	2245	12076	11629	3521	672	842	0	1152
38	15875	32	2595	1310	1291	11	81	0	0
39	1322	0	154	0	124	[illegible]	0	0	0
40	99349	205	4317	445	2431	88	67	0	0
41	346022	472	12189	1191	30541	2223	609	0	0
42	812509	4672	65767	7310	283964	5835	8669	0	0
43	353123	5815	80498	2084	108464	5498	5228	0	0
44	925807	7740	259986	6768	364953	24204	28755	0	0
45	590342	4969	300200	5102	140045	13489	12503	0	585
46	776809	7167	363037	4396	239048	15779	28575	3290	0
47	352891	3949	254153	1062	46629	3531	5388	0	0
48	55914	664	36251	933	1381	221	218	0	0
49	357161	8639	246243	3711	27196	2900	2259	0	0
50	1121866	24029	921610	48715	18674	1379	3068	0	347
51	2809391	169284	1850390	450956	1601	432	291	0	53
52	1329412	196457	985177	13892	151	14	0	0	0
53	536442	108115	364799	27630	165	193	0	0	0
MONTH									
JAN	11807581	227434	11119328	93734	580	962	327	95	1842
FEB	1694864	191164	1437892	8800	0	0	0	0	0
MAR	0	0	0	0	0	0	0	0	0
APR	0	0	0	0	0	0	0	0	0
MAY	99870	4061	11224	7539	11093	20243	0	0	0
JUN	477063	4828	39134	308601	20122	9313	474	0	280
JUL	896018	11318	32641	316081	91238	28258	18380	0	778
AUG	1949955	20992	164227	911901	39752	36166	34231	0	0
SEP	268299	3095	33072	16769	10665	2126	2321	0	1152
OCT	1783986	12974	200029	12388	550564	19073	22852	0	0
NOV	2376195	23974	1147546	16433	666163	51620	66942	3290	585
DEC	6197127	507029	4397042	545374	49016	5093	5836	0	400
SEASON									
WIN	13502445	418598	12557220	102534	580	962	327	95	1842
SPR	576933	8889	50358	316140	31215	29556	474	0	280
SUM	3114272	35405	229940	1244751	141655	66350	54932	0	1930
FAL	10357308	543977	5744617	574195	1265743	75786	95630	3290	983
YEAR	27550958	1006869	18582135	2237620	1439193	172854	151363	3385	5037

A-14 (Cont'd)

PERIOD	HC	BF	RS	BA	WC	SS	WKF	PS
WEEK								
1	0	0	8355	0	38443	3215	0	7552
2	0	0	3452	0	63103	3328	0	11469
3	0	0	1669	0	6183	1406	0	3447
4	63	0	5380	0	18822	2374	0	3591
5	0	0	1119	0	9156	751	0	2700
6	0	0	2620	0	13851	848	0	2258
7	0	0	935	0	2497	288	0	1373
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
21	2948	0	463	14	2133	21	0	907
22	12098	0	730	71	3750	57	0	333
23	4047	0	1860	442	4456	137	0	2321
24	1034	0	1630	705	173	32	0	755
25	2267	471	5913	12133	546	11	0	596
26	1326	547	1741	5196	351	11	0	481
27	453	149	261	2904	466	0	0	809
28	1384	204	751	8077	453	0	21	288
29	2784	2511	3445	113205	0	50	18170	449
30	4894	1172	4377	77180	553	4	37068	119
31	5608	3980	1793	90714	2490	65	22735	413
32	42264	2244	3607	144020	2276	145	29496	130
33	62471	1503	2296	156067	1909	25	13322	281
34	48452	954	5209	42656	1183	115	3879	865
35	18394	169	178	11727	627	126	600	1173
36	68112	74	33	24973	2843	0	3738	0
37	46825	371	137	16136	1160	7	2056	0
38	6977	0	33	1902	0	0	292	0
39	123	0	0	40	0	0	60	0
40	77250	0	8	5650	396	14	449	11
41	241250	168	128	26617	5539	0	1222	569
42	211871	343	2345	59779	6197	42	11117	982
43	102691	0	2714	16381	4765	193	2494	1223
44	159071	0	11846	13881	8035	71	4044	442
45	52783	343	8348	2092	14096	64	1639	690
46	46126	0	11982	1181	23301	92	4475	1033
47	10123	0	3435	213	5202	32	319	340
48	4694	0	492	42	2850	54	613	632
49	14251	0	8443	176	9248	610	919	526
50	14744	0	25443	152	20911	561	372	763
51	10027	0	40334	75	40116	22226	88	17688
52	2730	0	20761	50	15914	4600	0	8868
53	452	0	6721	71	4530	599	0	1048
MONTH								
JAN	63	0	19589	0	130807	10898	0	27323
FEB	0	0	3942	0	21248	1312	0	5067
MAR	0	0	0	0	0	0	0	0
APR	0	0	0	0	0	0	0	0
MAY	11829	0	923	39	3237	53	0	1240
JUN	11796	976	11372	18175	8172	216	0	4183
JUL	11938	4821	9251	233493	2081	86	60604	1665
AUG	171074	8107	12679	411377	8376	437	64456	2862
SEP	125824	445	232	45078	4003	14	6427	0
OCT	708593	511	8576	116356	17958	284	17596	2869
NOV	193570	343	32413	9452	50526	267	8195	2835
DEC	45900	0	102011	552	92616	28607	1960	29111
SEASON								
WIN	63	0	23531	0	152055	12210	0	32390
SPR	23625	976	12295	18214	11409	269	0	5423
SUM	308836	13373	22162	689948	14460	537	131487	4527
FAL	948063	854	143000	126360	161100	29158	27751	34815
YEAR	1280587	15203	200988	834522	339024	42174	159238	77155

Table A-15

Total Estimated Weight (g) of Sixteen Major Species and All Species Combined Impinged at Indian Point Unit No. 3 Intake Screens during 1978 (Summarized by Week, Month, Season, and Year and Adjusted for Collection Efficiency

PERIOD	ALL SPEC	SB	WP	TC	BH	AL	AS	SNS	ATS
WEEK									
1	188239	3582	147149	11784	4	15	49	0	255
2	393401	6695	243440	33300	90	17	84	0	1504
3	17880	218	9886	1921	0	0	0	0	0
4	497828	9455	467212	2763	202	147	0	91	*373
5	129964	20295	92049	1725	50	0	15	0	259
6	86248	6985	68460	292	0	0	0	0	0
7	393709	7435	372373	320	0	45	0	0	0
8	203532	10850	171799	98	0	62	0	0	0
9	261938	31568	209371	426	3	4	0	76	0
10	219983	13751	170471	110	0	63	0	0	0
11	276486	15698	229138	230	0	404	0	0	435
12	121338	8765	77212	91	0	0	0	0	0
13	83265	3845	42345	53	0	0	0	0	0
14	178494	196	140833	657	0	3558	0	0	0
15	213241	906	190517	593	0	2454	706	0	318
16	210350	2012	187138	126	6230	5173	0	0	0
17	246428	4542	175865	723	19549	6450	1396	0	0
18	346665	4029	202597	1292	43188	9731	0	0	259
19	384697	3922	167345	1647	131637	11947	0	0	0
20	197379	765	46378	187	65513	17241	0	0	0
21	118870	650	22932	275	18341	29712	20	87	221
22	45807	0	8385	24	14316	7718	2616	0	0
23	33564	79	10213	148	12257	3574	0	0	38
24	2751	0	1075	36	592	0	50	0	0
25	3387	0	607	35	361	0	0	0	0
26	244	0	0	7	203	0	0	0	0
27	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0
33	11388	12	430	9559	30	110	57	0	0
34	23377	112	3260	14174	284	597	238	0	0
35	21694	147	10303	998	688	1156	212	0	0
36	37263	359	9365	1723	1603	1842	726	0	0
37	81157	1582	15814	13617	2936	2999	1389	0	493
38	142722	1445	39065	7547	6964	3928	983	0	0
39	36155	575	10947	151	1251	1943	191	0	0
40	201967	351	11230	1285	4808	1531	629	0	0
41	176731	1993	26428	577	18511	4995	1047	0	0
42	363895	1472	33761	2042	194741	5931	9348	0	0
43	143229	1706	28728	273	65978	5397	5606	0	0
44	519028	5932	169204	5470	159905	28139	31751	0	0
45	353748	3358	192373	2397	56258	22117	19075	0	0
46	456315	3974	204684	4356	123875	26484	35794	0	0
47	142564	1203	80098	390	11801	7643	4829	0	0
48	296709	8147	168041	3955	14295	5366	6036	0	0
49	323373	10269	199394	6661	16443	4750	4077	0	0
50	65933	3752	38911	8366	293	89	158	0	42
51	227439	17426	148895	11528	191	79	59	0	22
52	193758	35784	107480	3223	173	-1	14	0	0
53	40590	7287	21587	1050	5	0	0	0	0
MONTH									
JAN	1210643	35321	953512	50972	326	179	148	91	2391
FEB	814694	49850	704482	1466	0	111	0	0	0
MAR	837262	58974	637739	619	3	467	0	76	435
APR	905729	10434	732019	2223	30150	17690	2102	0	318
MAY	1029699	8690	411092	3320	263538	74086	1421	87	480
JUN	57861	79	15946	243	18499	5782	1465	0	38
JUL	0	0	0	0	0	0	0	0	0
AUG	52520	243	12416	24695	653	1802	486	0	0
SEP	301836	3989	76766	23074	12903	10773	3310	0	493
OCT	1014479	6334	125466	5020	328538	28112	25265	0	0
NOV	1445061	14202	660883	12054	315729	78263	85922	0	0
DEC	1045739	82118	643465	34499	23020	6187	7216	0	64
SEASON									
WIN	2862599	144145	2295733	53077	329	757	148	167	2826
SPR	1993289	19203	1159057	5786	312167	97558	4968	87	836
SUM	354356	4232	89134	47769	13756	12575	3796	0	493
FAL	3505279	102654	1429614	51573	667287	112562	118423	0	64
YEAR	8715523	270234	4973788	158205	993559	223452	127355	254	4219

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A-15 (Cont'd)

PERIOD	HC	BF	RS	BA	WC	SS	WKF	PS
WEEK								
1	0	0	701	0	6894	1327	0	2300
2	0	0	834	0	75258	1456	0	3979
3	0	0	187	0	2516	216	0	634
4	0	0	1430	0	4938	636	0	2777
5	0	0	308	0	4601	276	0	988
6	0	0	195	0	5846	361	0	686
7	0	0	3263	0	5469	255	0	1196
8	39	0	5426	0	4546	576	0	536
9	0	0	4717	0	7022	858	0	967
10	0	0	7829	0	10759	484	0	2521
11	0	0	8146	0	7311	568	0	2649
12	0	0	4547	0	12375	548	0	4496
13	0	0	6902	0	10581	494	0	5398
14	14	0	8235	0	5325	1340	0	3706
15	142	0	1841	0	4922	729	0	874
16	548	0	2817	0	1201	143	0	406
17	6750	0	12490	0	4530	293	0	836
18	17200	0	15263	0	6646	948	0	5953
19	36072	0	6807	0	3576	774	0	3519
20	45096	0	1766	6	2457	154	0	1939
21	23512	0	2745	7	3835	239	0	2781
22	3430	0	151	0	562	40	0	2244
23	685	0	504	73	349	34	0	1212
24	27	0	55	19	0	0	0	80
25	23	9	19	59	0	0	0	243
26	0	3	10	21	0	0	0	0
27	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0
33	353	62	143	348	0	0	176	102
34	416	88	211	1212	878	0	351	119
35	1401	347	85	989	1081	15	135	351
36	10348	491	44	4249	916	13	1536	563
37	19549	1030	106	8349	1526	21	3329	1085
38	51696	2555	79	11841	2599	0	3081	971
39	7706	419	23	1821	3830	14	199	427
40	129090	952	9	3143	3819	41	506	909
41	80150	287	64	8886	2922	0	1134	903
42	64932	609	1549	20154	3599	0	1328	565
43	12819	308	1091	6093	3821	23	288	292
44	66016	1162	17598	6657	3765	98	1180	708
45	15432	301	15495	1590	4089	50	382	431
46	13114	0	20159	851	3409	52	120	214
47	3801	0	4458	104	5331	57	10	463
48	12776	337	9683	90	28193	249	603	1374
49	11960	0	12645	71	21304	432	299	335
50	1081	0	1109	5	2390	117	80	8
51	2033	0	5008	6	5681	1676	98	2339
52	601	0	6385	9	5113	905	0	1659
53	220	0	812	8	1974	115	0	119
MONTH								
JAN	0	0	3399	0	91989	3856	0	10200
FEB	39	0	11049	0	21909	1734	0	3410
MAR	0	0	28914	0	43792	2871	0	14950
APR	8598	0	28335	0	17041	2646	0	6943
MAY	122833	0	24871	13	15927	2079	0	14380
JUN	2078	9	670	172	891	63	0	3087
JUL	0	0	0	0	0	0	0	0
AUG	1543	284	420	2412	1714	15	664	403
SEP	89926	4708	271	26397	9116	48	8145	3245
OCT	306010	2346	10262	41797	14685	109	4145	2686
NOV	86697	1610	34864	5734	26763	408	1147	2743
DEC	22318	0	30949	136	54162	3298	736	4888
SEASON								
WIN	39	0	43362	0	157690	8461	0	28560
SPR	133509	9	53576	185	33359	4766	0	24410
SUM	91469	4992	691	28809	10830	63	8809	3648
FAL	417025	3956	96075	47667	95610	3815	6028	10319
YEAR	642042	8957	194004	76661	297989	17127	14837	66937

Table A-16

Total Estimated Weight (g) of Sixteen Major Species and All Species Combined Impinged at Indian Point Units No. 2 and No. 3 Intake Screens during 1978 (Summarized by Week, Month, Season, and Year and Adjusted for Collection Efficiency)

PERIOD	ALL SPEC	SB	WP	TC	BH	AL	AS	SNS	ATS
WEEK									
1	2044345	29231	1870801	20002	15	232	140	0	787
2	2404292	25227	2012058	101654	157	281	232	95	1781
3	669329	8692	906692	12184	0	0	0	0	189
4	7380769	95547	7199778	6675	704	596	88	91	1217
5	724816	179327	494295	7639	30	32	15	0	259
6	989677	103550	842591	4155	0	0	0	0	0
7	996486	33691	931574	2330	0	45	0	0	0
8	203532	10850	171799	98	0	62	0	0	0
9	261938	31568	209371	426	3	4	0	76	0
10	219983	18751	170471	110	0	63	0	0	0
11	276486	15698	229138	230	0	404	0	0	435
12	121338	8765	77212	91	0	0	0	0	0
13	83265	3848	42345	53	0	0	0	0	0
14	178694	196	140833	657	0	3553	0	0	0
15	213241	906	190517	593	0	2454	706	0	318
16	210350	2012	187138	126	6230	5173	0	0	0
17	246428	4642	175865	723	19549	6450	1396	0	0
18	346665	4029	202597	1292	43188	9731	0	0	259
19	384697	3922	167345	1647	131637	11947	0	0	0
20	197379	765	46378	187	65513	17241	0	0	0
21	159526	4662	28184	2303	20998	41217	20	87	221
22	127050	49	17851	7096	26018	18175	2816	0	0
23	101047	3496	28933	9474	20028	5896	0	0	38
24	68942	71	9833	43032	3326	0	50	0	0
25	249348	569	6100	201013	4943	3963	53	0	0
26	78131	771	2669	54535	1972	1309	421	0	280
27	19248	15	2551	1171	32	2885	141	0	0
28	55895	283	4929	14982	895	3555	498	0	0
29	357567	3061	5380	121318	44481	13093	6540	0	11
30	355651	6324	14177	137886	36082	7227	9174	0	767
31	285509	4320	26515	74693	17194	10765	5721	0	0
32	588569	8188	62063	243755	9268	13001	11499	0	0
33	699376	4329	38136	373267	10113	8256	10775	0	0
34	444833	4457	33292	263112	9937	4957	7370	0	0
35	104268	1870	26856	21962	4208	2762	1600	0	0
36	172027	911	24574	5332	7114	3064	1924	0	0
37	187123	3827	27890	25246	6457	3671	2231	0	1645
38	158597	1477	41660	8857	8255	3939	1064	0	0
39	37477	575	11101	151	1375	1950	191	0	0
40	301316	556	15547	1730	7739	1619	696	0	0
41	522753	2465	38617	1768	49052	7218	1656	0	0
42	1056704	6144	99528	9352	478705	11766	18017	0	0
43	506352	7321	109226	2357	174442	10895	10834	0	0
44	1444835	15672	429190	12238	524858	52343	60506	0	0
45	944090	8327	492573	7499	196313	35606	31578	0	585
46	1233124	11141	567721	8752	362923	42263	64369	3290	0
47	495425	5152	334251	1452	58430	11174	10217	0	0
48	352623	8811	204292	4888	15676	5587	6254	0	0
49	680334	18908	444637	10372	43639	7650	6336	0	0
50	1187799	27781	960521	57081	18967	1468	3226	0	389
51	3036830	186710	1999285	462484	1792	511	350	0	75
52	1523170	232241	1092657	17115	324	55	14	0	0
53	577032	115402	386386	28680	170	193	0	0	0
MONTH									
JAN	13018224	262755	12072840	144706	906	1141	475	186	4233
FEB	2509558	241014	2142374	10286	0	111	0	0	0
MAR	837262	58974	637739	619	3	467	0	76	435
APR	905729	10434	732019	2223	30150	17690	2102	0	318
MAY	1129569	12751	422316	10859	274631	94329	1421	87	480
JUN	534924	4907	55080	308844	38621	15095	1939	0	318
JUL	896018	11318	32641	316081	91238	28258	18380	0	778
AUG	2002475	21235	176643	936596	40605	37968	34717	0	0
SEP	570135	7084	109840	39843	23568	12899	5631	0	1645
OCT	2798465	19308	325495	17408	879102	47185	48137	0	0
NOV	3821256	38176	1808429	28487	981892	129883	152864	3290	585
DEC	7242866	589147	5040507	579873	72036	11280	13052	0	464
SEASON									
WIN	16365044	562743	14852953	155611	909	1719	475	262	4668
SPR	2570222	28092	1209415	321926	343402	127114	5462	87	1116
SUM	3468628	39637	319124	1292520	155411	79125	58728	0	2423
FAL	13862587	646631	7174431	625768	1933030	188348	214053	3290	1049
YEAR	36266481	1277103	23555923	2395825	2432752	396306	278718	3639	9256

A-16 (Cont'd)

PERIOD	HC	BF	RS	BA	WC	SS	WKF	PS
WEEK								
1	0	0	9056	0	45337	4542	0	9852
2	0	0	4286	0	138391	4784	0	15448
3	0	0	1856	0	8699	1622	0	4081
4	63	0	6810	0	23760	3010	0	6368
5	0	0	1427	0	13757	1027	0	3686
6	0	0	2815	0	19697	1209	0	2944
7	0	0	4199	0	7966	543	0	2569
8	39	0	5426	0	4546	576	0	586
9	0	0	4717	0	7022	858	0	967
10	0	0	7829	0	10759	484	0	2521
11	0	0	8146	0	7311	568	0	2649
12	0	0	4547	0	12375	548	0	4496
13	0	0	6902	0	10581	994	0	5398
14	14	0	8285	0	5325	1340	0	3706
15	142	0	1841	0	4922	729	0	874
16	548	0	2817	0	1201	143	0	406
17	6760	0	12490	0	4530	293	0	836
18	17200	0	15263	0	6646	948	0	5953
19	36072	0	6807	0	3576	774	0	3519
20	45096	0	1766	6	2457	154	0	1939
21	26460	0	3208	21	5968	260	0	3688
22	15528	0	881	71	4312	97	0	2577
23	4732	0	2364	515	4805	171	0	3533
24	1061	0	1685	724	173	32	0	865
25	2290	477	5932	12192	546	11	0	839
26	1326	550	1751	5217	351	11	0	481
27	453	149	261	2904	466	0	0	809
28	1384	204	751	8077	953	0	21	288
29	2784	2511	3445	113205	0	50	18170	449
30	4894	1172	4377	77180	553	4	37068	119
31	5608	3980	1793	90714	2490	65	22735	413
32	42264	2244	3607	144020	2276	145	29496	130
33	62824	1565	2439	156415	1909	25	13500	383
34	48868	1042	5420	43868	2061	115	4230	984
35	19795	516	263	12716	1708	141	735	1554
36	78460	565	77	29222	3759	13	5324	563
37	66374	1401	243	24485	2086	28	5385	1085
38	58673	2555	112	13743	2599	0	3373	971
39	7829	419	23	1861	3830	14	259	427
40	206340	952	17	8793	4215	55	955	920
41	321400	455	192	35503	8461	0	2356	1472
42	276803	952	3894	79933	9796	42	12445	1547
43	115510	308	3805	22474	8586	216	2782	1515
44	225087	1162	29444	20538	11600	169	5224	1150
45	71215	644	23843	3682	16185	114	2021	1121
46	59240	0	32141	2032	26710	144	4595	1247
47	13924	0	7923	317	10533	89	329	803
48	17470	337	10175	132	31043	303	1216	2006
49	26211	0	21038	247	30552	1042	1218	861
50	15825	0	26552	157	23301	678	452	771
51	12060	0	45342	81	45997	23902	186	20027
52	3331	0	27126	59	21027	5505	0	10527
53	672	0	7533	79	6504	714	0	1167
MONTH								
JAN	63	0	22988	0	222796	14754	0	37523
FEB	39	0	14991	0	43157	3046	0	8477
MAR	0	0	28914	0	43792	2871	0	14950
APR	8598	0	28335	0	17041	2646	0	6943
MAY	134662	0	25794	52	19164	2132	0	15620
JUN	13874	985	12042	18347	9063	279	0	7270
JUL	11938	4821	9251	233493	2081	86	60604	1665
AUG	172617	8391	13099	413789	10090	452	65120	3265
SEP	215750	5153	503	71475	13119	62	14572	3245
OCT	1014603	2857	18838	158153	32643	393	21741	5555
NOV	282267	1953	87277	15186	77289	675	9342	5580
DEC	68218	0	132960	688	146778	31905	2696	33999
SEASON								
WIN	102	0	66893	0	309745	20671	0	60950
SPR	157134	985	66171	18399	45268	5057	0	29833
SUM	400305	18365	22853	718757	25290	600	140296	8175
FAL	1365088	4810	239075	174027	256710	32973	33779	45134
YEAR	1922629	24160	394992	911183	637013	59301	174075	144092

APPENDIX A.3

Selected Adjusted Impingement Rates

The need for accurate daily impingement rates prompted a selection process in which impingement data were sorted so that any days thought to include imcomplete data, or data otherwise capable of introducing spurious variation, were eliminated. Data collected on the "selected" days remaining were adjusted for collection efficiency (Section IV.B.) and used to compute impingement rates. The criteria used for selection of appropriate days are described below and the impingement rates are presented in the following tables.

Selection Criteria

Continuous Circulator Operation

Each circulator at a unit was required to have operated continuously throughout each collection day (which extended from 1201 noon to 1200 noon). This was to eliminate the possibility of fish loss as a result of the backwash which occurs when a circulator is shut off.

Duration of Collection Period

Each screen at a unit was required to have been washed at least once on the previous collection day. The two purposes of this requirement were 1) to ensure that each daily impingement rate represented only that day so that comparison could be made to daily variation in physicochemical parameters, and 2) to prevent erroneously low rates that would result if collection efficiency decreased with long periods (greater than one day) of impingement.

Unscheduled Washes

It was occasionally necessary for plant operators to conduct unschedueld screen washes (i.e., in addition to the routine morning screen wash) primarily to relieve pressure caused by heavy debris build-up on the intake screens. Routine collection procedures were followed whenever possible during such washes. However, the emergency nature of unscheduled washes often led to collections by nonroutine personnel and occasionally to missed collections. Therefore, in the interest of computing rates with the least number of inconsistencies, it was deemed advisable to eliminate analysis of any collection day on which an unscheduled wash had occurred for a particular unit.

Abnormal Collection

All days for which collections were coded as abnormal were excluded from the computation of selected impingement rates. A collection of impinged fish was coded as abnormal by the operating TI technician on any day for which equipment malfunction or actual loss or miscount of fish might cause that day to be unrepresentative of the normal operating regime of the unit in question. For example, a collection was coded as abnormal when the retaining screen in the collection pit broke, allowing fish in the pit to escape back into the river. On another occasion, during November and December 1977 and January and February 1978, collections at Unit No. 2 were coded as abnormal because three fixed screens had collapsed, making the collection nonrepresentative of normal Unit No. 2 operation.

Table A-17

Selected, Adjusted Impingement Rates (No./$10^6 m^3$) (Summarized by Week, Month, Season, and Year) for Sixteen Major Species Impinged at Indian Point Unit No. 2 during 1978

PERIOD	ALL SPEC	SB	WP	TC	BH	AL	AS	SNS	ATS
WEEK									
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	118.62	1.50	40.23	30.45	0.75	2.63	0.0	0.0	0.0
22	388.13	0.17	27.30	265.21	2.75	2.05	0.0	0.0	0.0
23	265.96	1.16	66.47	163.96	1.66	2.22	0.0	0.0	0.0
24	579.22	0.25	6.80	541.09	0.72	0.0	0.0	0.0	0.0
25	2538.41	1.90	8.96	2283.18	2.22	1.81	0.0	0.0	0.0
26	795.14	1.87	2.43	555.10	1.03	0.47	0.12	0.0	0.0
27	105.25	0.61	2.12	13.83	0.18	1.81	27.02	0.0	0.12
28	387.34	19.83	3.41	142.85	16.98	40.28	5.74	0.0	0.0
29	4993.77	89.20	19.66	807.89	1648.75	172.94	9.00	0.0	0.0
30	3923.90	133.42	96.14	808.11	1000.74	90.36	131.80	0.0	0.13
31	1954.04	55.70	201.66	212.03	194.99	128.10	181.41	0.0	0.17
32	4857.78	114.70	705.07	1321.53	215.13	144.51	79.72	0.0	0.0
33	6749.56	57.77	507.28	3002.56	328.18	126.79	212.75	0.0	0.0
34	2860.71	53.83	178.67	1558.27	190.43	30.06	182.00	0.0	0.0
35	572.79	9.72	66.29	155.55	82.02	18.44	105.97	0.0	0.0
36	769.64	6.95	48.49	25.15	111.54	8.59	25.98	0.0	0.0
37	576.17	2.15	33.01	75.70	66.56	3.91	16.75	0.0	0.0
38	382.67	0.87	21.64	35.17	30.80	0.87	13.11	0.0	0.0
39	18.12	0.0	2.93	0.0	5.86	0.0	7.64	0.0	0.0
40	747.18	5.08	13.81	6.90	85.63	3.26	0.0	0.0	0.0
41	1123.17	2.57	30.75	5.54	336.50	5.90	2.87	0.0	0.0
42	11725.73	57.88	316.34	40.33	9421.40	39.83	2.57	0.0	0.0
43	2974.29	46.02	437.03	5.96	1834.42	31.05	96.10	0.0	0.0
44	10235.53	59.80	998.43	13.70	7710.84	170.67	43.12	0.0	0.0
45	8059.15	56.08	2456.47	19.66	4617.79	183.96	198.56	0.0	0.0
46	7052.90	46.03	1939.92	8.61	4394.58	136.78	149.95	0.0	0.55
47	3317.86	47.20	1996.14	3.81	1060.80	43.09	190.09	0.0	0.0
48	466.55	12.67	349.04	1.75	21.41	1.75	47.71	0.0	0.0
49	2681.98	60.68	1768.28	11.01	605.07	37.22	0.0	0.0	0.0
50	5323.83	110.65	4454.74	55.54	300.27	9.14	19.25	0.0	0.0
51	8536.94	191.99	7134.91	340.95	66.62	3.93	19.06	0.0	0.12
52	0.0	0.0	0.0	0.0	0.0	0.0	8.52	0.0	0.0
53	17568.97	2819.80	13431.74	313.43	4.00	4.00	0.0	0.0	0.0
MONTH									
JAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FEB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
APR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAY	378.49	0.63	27.08	262.40	2.41	2.62	0.0	0.0	0.0
JUN	1047.99	1.26	21.31	887.81	1.53	1.13	6.79	0.0	0.03
JUL	2602.75	63.19	30.10	476.24	760.91	83.66	87.11	0.0	0.08
AUG	3490.95	62.94	351.74	1286.55	204.53	89.62	128.13	0.0	0.0
SEP	587.69	4.43	37.34	33.13	80.07	6.12	13.40	0.0	0.0
OCT	4373.06	32.23	285.03	11.65	3087.86	32.78	52.15	0.0	0.0
NOV	7206.88	54.58	1949.34	11.23	4438.37	139.09	153.81	0.0	0.11
DEC	5923.55	268.78	4804.31	91.18	309.67	12.89	16.96	0.0	0.09
SEASON									
WIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SPR	961.36	1.17	22.06	806.88	1.66	1.32	5.91	0.0	0.03
SUM	2591.11	51.74	168.16	734.99	393.06	71.22	90.31	0.0	0.03
FAL	3743.22	93.31	1898.52	29.32	2952.58	66.69	80.95	0.0	0.06
YEAR	3275.68	53.81	723.15	511.60	1172.03	52.94	66.91	0.0	0.04

A-17 (Cont'd)

PERIOD	HC	BF	RS	BA	WC	SS	WKF	PS
WEEK								
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	21.81	0.0	8.65	0.0	5.45	0.75	0.0	3.38
22	76.93	0.0	6.33	0.96	1.27	0.66	0.0	0.31
23	8.55	0.0	10.99	4.40	1.82	0.69	0.0	1.57
24	8.58	0.0	10.89	7.71	0.37	0.12	0.0	0.59
25	45.49	9.17	53.79	127.62	1.15	0.12	0.0	0.37
26	15.76	9.24	57.76	54.01	0.47	0.12	0.0	0.37
27	8.27	2.44	18.12	39.27	0.68	0.0	0.0	0.86
28	12.25	1.20	51.91	68.66	0.23	0.0	0.40	0.23
29	18.58	19.79	247.96	1245.29	0.0	0.25	262.52	0.35
30	19.71	8.44	233.74	791.84	0.0	0.0	438.90	0.17
31	9.99	14.96	14.42	886.08	0.98	0.66	135.20	0.22
32	63.49	10.67	37.11	1820.70	1.02	0.69	159.45	0.15
33	103.64	6.17	40.95	2237.53	0.98	0.22	96.76	0.22
34	51.15	2.34	145.94	460.21	0.66	1.24	46.83	0.40
35	29.74	0.50	3.25	161.69	0.18	0.68	4.20	0.81
36	167.20	0.29	2.62	306.59	0.58	0.0	62.47	0.0
37	118.15	0.68	3.42	203.73	1.17	0.0	40.39	0.0
38	90.64	0.0	7.86	172.33	0.0	0.0	10.05	0.0
39	2.13	0.0	0.0	5.86	0.0	0.0	0.0	0.0
40	451.41	0.0	0.0	163.45	0.52	0.0	1.43	0.0
41	373.70	0.20	0.71	345.47	1.26	0.0	4.79	1.46
42	379.47	0.58	49.44	965.27	2.62	0.29	31.67	6.12
43	157.86	0.0	24.96	181.13	1.90	2.09	6.02	5.27
44	319.99	0.0	79.19	189.16	5.80	0.86	9.66	2.40
45	160.92	0.28	73.46	31.25	16.21	0.28	3.45	1.52
46	89.27	0.0	87.40	13.49	17.11	0.88	3.28	0.57
47	32.98	0.0	36.74	3.81	10.72	0.76	0.81	1.12
48	18.78	0.0	4.81	1.75	1.75	3.49	4.81	9.61
49	66.18	0.0	57.40	2.36	11.53	4.19	3.28	0.0
50	42.03	0.0	272.87	4.96	12.42	5.09	0.81	0.34
51	77.32	0.0	623.15	9.17	16.16	6.12	0.0	0.0
52	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
53	15.29	0.0	793.96	22.93	19.29	35.68	0.0	7.64
MONTH								
JAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FEB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
APR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAY	68.17	0.0	7.03	0.21	2.83	0.63	0.0	1.31
JUN	23.53	4.44	32.78	47.55	0.92	0.30	0.0	0.67
JUL	14.69	9.24	147.50	602.95	0.19	0.08	185.90	0.39
AUG	55.50	6.87	55.53	1125.43	0.78	0.77	91.02	0.37
SEP	126.14	0.30	2.95	229.79	0.56	0.0	43.72	0.0
OCT	298.65	0.14	25.40	345.05	1.65	0.94	10.26	3.56
NOV	119.86	0.05	72.54	40.67	13.69	0.82	3.46	1.55
DEC	47.83	0.0	302.46	6.00	13.04	6.83	1.09	0.68
SEASON								
WIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SPR	29.30	3.66	29.45	41.42	1.17	0.34	0.0	0.75
SUM	53.63	6.51	80.52	752.92	0.52	0.36	118.13	0.31
FAL	177.91	0.08	104.51	159.22	8.55	2.22	5.75	2.19
YEAR	90.18	3.68	76.47	380.18	3.41	0.99	51.54	1.06

Table A-18

Selected Adjusted Impingement Rates (No./$10^6 m^3$) (Summarized by Week, Month, Season, and Year) for Sixteen Major Species Impinged at Indian Point Unit No. 3 during 1978

PERIOD	ALL SPEC	SB	WP	TC	BH	AL	AS	SNS	ATS
WEEK									
1	1440.53	35.78	1322.90	20.44	0.05	0.21	0.16	0.0	0.16
2	2316.25	41.81	2120.80	40.31	1.56	0.19	0.19	0.0	0.25
3	66.66	2.53	51.90	2.53	0.0	0.0	0.0	0.0	0.0
4	570.56	14.25	536.35	2.02	0.92	0.09	0.0	0.0	0.0
5	429.58	15.01	392.50	3.91	0.55	0.0	0.07	0.0	0.0
6	965.53	14.42	932.76	2.29	0.0	0.0	0.0	0.0	0.0
7	2542.72	17.65	2501.74	0.68	0.0	0.05	0.0	0.0	0.0
8	927.71	55.33	827.97	0.16	0.0	0.26	0.0	0.0	0.0
9	1649.17	165.64	1444.90	0.78	0.05	0.05	0.0	0.05	0.0
10	1615.42	127.98	1447.14	0.21	0.0	0.10	0.0	0.0	0.0
11	2167.25	73.48	2052.32	0.47	0.0	0.10	0.0	0.0	0.05
12	1002.44	31.00	931.16	0.12	0.0	0.0	0.0	0.0	0.0
13	286.71	5.17	220.82	0.29	0.0	0.0	0.0	0.0	0.0
14	287.25	1.87	222.85	1.87	0.0	0.87	0.0	0.0	0.0
15	482.15	1.00	443.64	1.50	0.0	0.69	0.12	0.0	0.19
16	1120.12	15.79	1050.48	0.37	1.75	1.62	0.0	0.0	0.0
17	953.95	33.96	826.17	0.11	6.01	2.29	0.0	0.0	0.0
18	1101.63	17.09	910.08	1.15	4.67	3.04	0.0	0.0	0.05
19	838.78	17.04	671.42	1.35	19.61	3.49	0.0	0.0	0.0
20	225.75	2.77	114.00	2.13	12.90	3.03	0.0	0.0	0.0
21	153.33	2.21	68.22	3.33	4.31	6.96	0.04	0.04	0.04
22	27.52	0.0	8.72	0.97	3.44	1.65	0.07	0.0	0.0
23	37.80	0.48	23.18	1.59	3.66	1.10	0.0	0.0	0.07
24	12.36	0.0	3.37	2.62	0.94	0.0	0.19	0.0	0.0
25	14.42	0.0	1.68	2.23	0.75	0.0	0.0	0.0	0.0
26	22.28	0.0	0.0	5.24	1.31	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	403.20	1.75	18.78	329.81	0.87	4.37	6.12	0.0	0.0
34	400.20	2.13	25.72	265.54	18.51	5.90	10.16	0.0	0.0
35	58.32	1.20	11.96	4.91	4.91	8.90	4.42	0.0	0.0
36	155.56	1.28	13.64	9.70	20.25	6.61	5.54	0.0	0.0
37	162.70	3.28	23.65	10.35	15.86	10.62	10.55	0.0	0.0
38	439.26	4.60	41.83	33.48	85.89	12.57	8.73	0.0	0.0
39	111.39	0.96	9.28	0.72	33.67	4.01	2.63	0.0	0.0
40	366.19	1.69	10.03	3.95	63.24	3.98	4.77	0.0	0.0
41	424.55	1.34	27.06	1.85	129.95	7.36	2.39	0.0	0.0
42	4246.51	10.64	68.17	6.36	3574.15	20.71	76.10	0.0	0.0
43	1119.44	5.59	111.65	0.50	843.42	27.73	30.39	0.0	0.0
44	4123.77	25.25	406.30	10.75	2821.99	203.87	210.99	0.0	0.0
45	2449.18	13.43	806.07	4.43	1092.72	230.18	132.29	0.0	0.0
46	2946.16	13.49	724.88	3.77	1810.16	149.40	146.45	0.0	0.0
47	363.83	1.87	201.27	0.07	83.82	31.60	13.00	0.0	0.0
48	692.73	14.42	323.39	3.84	197.61	32.83	31.73	0.0	0.0
49	1222.35	32.23	707.51	7.81	297.77	30.91	28.47	0.0	0.0
50	94.03	2.95	33.38	0.33	20.31	0.98	4.91	0.0	0.0
51	1485.28	90.26	1275.13	17.77	3.37	0.66	0.82	0.0	0.0
52	1045.34	181.22	759.18	5.27	1.13	0.13	0.13	0.0	0.0
53	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MONTH									
JAN	1240.58	27.63	1139.08	18.13	0.70	0.13	0.11	0.0	0.11
FEB	1362.25	48.11	1282.93	0.77	0.0	0.12	0.0	0.0	0.0
MAR	1471.52	80.94	1347.75	0.27	0.01	0.05	0.0	0.01	0.01
APR	661.49	10.38	593.60	1.08	1.39	1.21	0.03	0.0	0.05
MAY	484.83	8.23	366.45	1.84	9.11	4.01	0.02	0.01	0.02
JUN	28.03	0.19	12.78	1.90	2.73	0.86	0.05	0.0	0.03
JUL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AUG	182.46	1.52	16.66	104.08	8.41	8.41	6.34	0.0	0.0
SEP	202.85	2.45	21.15	12.22	37.51	8.09	6.58	0.0	0.0
OCT	1488.57	5.01	68.09	3.29	1057.46	32.77	37.98	0.0	0.0
NOV	2113.71	12.88	500.98	4.15	1213.30	129.78	107.28	0.0	0.0
DEC	1190.88	78.42	798.34	9.25	137.84	16.24	19.44	0.0	0.0
SEASON									
WIN	1366.43	54.41	1262.90	6.03	0.23	0.10	0.04	0.01	0.04
SPR	451.39	7.35	367.96	1.62	5.56	2.56	0.03	0.01	0.03
SUM	196.90	2.18	19.84	39.01	29.02	8.19	6.51	0.0	0.0
FAL	1612.26	26.37	394.09	5.09	876.44	59.58	55.41	0.0	0.0
YEAR	1079.19	26.22	581.32	8.16	312.66	22.54	20.20	0.0	0.02

A-18 (Cont'd)

PERIOD	HC	BF	RS	BA	WC	SS	WKF	PS
WEEK								
1	0.0	0.0	10.56	0.0	24.81	8.37	0.0	1.92
2	0.0	0.0	17.91	0.0	62.34	8.30	0.0	4.06
3	0.0	0.0	1.31	0.0	4.37	2.10	0.0	0.44
4	0.0	0.0	10.12	0.0	2.39	0.64	0.0	1.84
5	0.0	0.0	3.97	0.0	5.82	2.40	0.0	1.10
6	0.0	0.0	3.28	0.0	8.19	3.28	0.0	0.98
7	0.0	0.0	11.29	0.0	5.46	2.08	0.0	1.04
8	0.05	0.0	29.17	0.0	5.36	5.25	0.0	0.68
9	0.0	0.0	18.10	0.0	9.05	6.55	0.0	0.88
10	0.0	0.0	19.03	0.0	9.72	4.16	0.0	3.12
11	0.0	0.0	20.13	0.0	7.75	5.20	0.0	2.39
12	0.0	0.0	14.10	0.0	10.13	5.13	0.0	4.76
13	0.0	0.0	23.66	0.0	9.17	12.23	0.0	6.12
14	0.06	0.0	23.40	0.0	8.80	14.17	0.0	4.18
15	0.19	0.0	7.24	0.0	8.99	10.48	0.0	1.62
16	1.44	0.0	37.88	0.0	2.75	2.00	0.0	0.62
17	13.76	0.0	59.08	0.0	2.51	1.97	0.0	1.20
18	25.11	0.0	105.66	0.0	14.78	5.71	0.0	3.77
19	59.67	0.0	43.55	0.0	12.10	4.24	0.0	2.10
20	70.45	0.0	11.61	0.06	3.48	0.90	0.0	1.48
21	39.43	0.0	19.06	0.04	3.74	1.31	0.0	1.91
22	8.39	0.0	1.05	0.0	0.22	0.15	0.0	1.61
23	1.66	0.0	2.48	0.97	0.34	0.28	0.0	0.69
24	0.75	0.0	1.68	0.94	0.0	0.0	0.0	0.19
25	0.75	0.37	0.56	3.74	0.0	0.0	0.0	0.94
26	0.0	1.31	1.31	10.48	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	5.24	0.44	4.81	23.15	0.0	0.0	6.12	0.44
34	2.62	1.15	6.72	44.89	0.49	0.0	12.45	0.33
35	1.91	0.49	0.27	15.94	0.33	0.0	0.55	0.27
36	45.39	0.11	0.32	59.00	0.11	0.0	10.66	0.21
37	17.63	0.39	0.72	48.69	0.07	0.0	15.40	0.52
38	99.30	1.15	1.53	132.78	0.38	0.0	9.58	0.54
39	19.51	0.42	0.66	31.60	0.48	0.06	0.54	0.30
40	230.88	0.34	0.08	33.52	0.64	0.0	0.83	0.38
41	149.97	0.13	0.40	90.87	0.65	0.0	1.71	0.76
42	111.42	0.21	13.56	281.57	0.42	0.0	4.38	1.67
43	16.55	0.14	3.65	47.71	0.72	0.18	0.45	0.77
44	111.53	0.31	81.65	69.50	2.01	0.70	3.15	0.79
45	29.55	0.05	76.29	13.59	4.74	0.11	0.95	0.47
46	15.73	0.0	43.74	4.04	2.84	0.38	0.33	0.27
47	3.14	0.0	16.44	1.05	0.97	0.07	0.0	0.60
48	20.78	0.03	34.26	1.19	10.76	1.31	1.84	0.84
49	25.11	0.0	54.24	1.24	13.42	3.02	1.08	0.35
50	7.54	0.0	5.24	0.0	0.33	0.0	0.0	0.33
51	13.17	0.0	42.54	0.16	4.11	9.71	0.25	4.03
52	2.19	0.0	48.33	0.25	4.07	8.46	0.0	1.63
53	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MONTH								
JAN	0.0	0.0	10.58	0.0	25.59	5.64	0.0	2.16
FEB	0.02	0.0	16.73	0.0	3.98	3.84	0.0	0.89
MAR	0.0	0.0	18.28	0.0	9.08	6.09	0.0	3.47
APR	2.57	0.0	28.38	0.0	6.15	7.76	0.0	2.05
MAY	41.46	0.0	37.37	0.02	7.20	2.57	0.0	2.10
JUN	3.29	0.08	1.68	1.26	0.21	0.19	0.0	1.18
JUL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AUG	2.24	0.55	2.37	24.65	0.25	0.0	4.23	0.21
SEP	40.50	0.57	0.80	59.28	0.31	0.02	8.16	0.44
OCT	127.96	0.20	12.14	98.97	0.58	0.11	1.98	0.78
NOV	31.16	0.08	46.88	12.05	3.13	0.63	0.90	0.65
DEC	18.14	0.0	49.74	0.86	11.26	5.12	0.89	1.40
WIN	0.01	0.0	15.40	0.0	13.34	5.28	0.0	2.29
SPR	22.40	0.02	27.85	0.25	5.55	3.69	0.0	1.91
SUM	29.34	0.57	1.26	49.18	0.30	0.01	7.02	0.37
FAL	68.79	0.11	32.91	45.97	4.14	1.56	1.35	0.90
YEAR	33.39	0.11	23.32	21.64	6.59	2.97	1.25	1.49

Table A-19

Selected, Adjusted Impingement Rates (No./$10^6 m^3$) (Summarized by Week, Month, Season, and Year) for Sixteen Major Species Impinged at Indian Point Units No. 2 and No. 3 during 1978

PERIOD	ALL SPEC	SB	WP	TC	BH	AL	AS	SNS	ATS
WEEK									
1	1440.53	35.78	1322.90	20.44	0.05	0.21	0.16	0.0	0.16
2	2316.25	41.81	2120.80	40.31	1.56	0.19	0.19	0.0	0.25
3	66.66	2.53	51.90	2.53	0.0	0.0	0.0	0.0	0.0
4	570.56	14.25	536.35	2.02	0.92	0.09	0.0	0.0	0.0
5	429.58	15.01	392.50	3.91	0.55	0.0	0.07	0.0	0.0
6	963.53	14.42	932.76	2.29	0.0	0.0	0.0	0.0	0.0
7	2542.72	17.68	2501.74	0.68	0.0	0.05	0.0	0.0	0.0
8	927.71	35.33	827.97	0.16	0.0	0.26	0.0	0.0	0.0
9	1649.17	165.64	1444.90	0.78	0.05	0.05	0.0	0.05	0.0
10	1615.42	127.98	1447.14	0.21	0.0	0.10	0.0	0.0	0.0
11	2167.25	73.48	2052.32	0.47	0.0	0.10	0.0	0.0	0.05
12	1002.44	31.00	931.16	0.12	0.0	0.0	0.0	0.0	0.0
13	266.71	5.17	220.62	0.29	0.0	0.0	0.0	0.0	0.0
14	287.25	1.87	222.85	1.87	0.0	0.87	0.0	0.0	0.0
15	482.15	1.00	443.64	1.50	0.0	0.69	0.12	0.0	0.19
16	1120.12	15.79	1030.48	0.37	1.75	1.62	0.0	0.0	0.0
17	953.95	33.96	826.17	0.11	6.01	2.29	0.0	0.0	0.0
18	1101.83	17.09	910.08	1.15	4.67	3.04	0.0	0.0	0.05
19	638.78	17.04	671.42	1.35	19.61	3.49	0.0	0.0	0.0
20	225.75	2.77	114.00	2.13	12.90	3.03	0.0	0.0	0.0
21	147.56	2.09	63.57	7.64	3.72	6.24	0.03	0.03	0.03
22	193.96	0.08	17.30	122.93	3.13	1.83	0.04	0.0	0.0
23	187.14	0.93	51.52	107.87	2.48	1.83	0.0	0.0	0.02
24	498.24	0.21	6.31	464.16	0.75	0.0	0.03	0.0	0.0
25	2177.84	1.63	7.92	1957.33	2.01	1.55	0.11	0.0	0.0
26	777.17	1.83	2.38	542.31	1.04	0.46	26.39	0.0	0.12
27	105.23	0.81	2.12	13.83	0.18	1.81	5.74	0.0	0.0
28	387.34	19.83	5.41	142.85	16.98	40.28	9.00	0.0	0.0
29	4993.77	89.20	19.66	807.89	1646.75	172.94	131.80	0.0	0.13
30	3923.90	133.42	96.14	808.11	1000.74	90.36	181.41	0.0	0.17
31	1954.04	55.70	201.66	212.03	194.99	128.10	79.72	0.0	0.0
32	4857.78	114.70	705.07	1321.55	215.13	144.51	212.75	0.0	0.0
33	6044.41	51.55	453.00	2705.59	291.81	113.19	162.46	0.0	0.0
34	2412.07	44.45	150.78	1322.56	159.08	25.66	88.50	0.0	0.0
35	339.82	5.86	41.69	87.34	47.10	14.12	16.22	0.0	0.0
36	613.28	5.51	39.62	21.22	89.29	8.09	13.89	0.0	0.0
37	328.58	2.83	28.21	36.57	37.00	7.93	11.58	0.0	0.0
38	424.57	3.63	36.64	33.92	71.58	9.53	8.45	0.0	0.0
39	94.28	0.78	8.11	0.59	30.20	3.27	2.15	0.0	0.0
40	451.50	2.45	10.88	4.61	68.30	3.82	4.35	0.0	0.0
41	716.93	1.86	28.60	3.40	216.39	6.75	2.47	0.0	0.0
42	7368.32	30.36	171.76	20.54	6014.78	28.69	84.45	0.0	0.0
43	2215.71	29.49	303.96	3.73	1429.13	29.69	37.92	0.0	0.0
44	7414.72	43.85	725.14	12.34	5454.44	165.99	204.30	0.0	0.0
45	4878.57	31.90	1520.77	11.02	2619.25	211.03	139.94	0.0	0.24
46	5365.08	32.63	1440.55	6.62	3332.41	141.97	172.15	0.0	0.0
47	2122.04	28.65	1269.56	2.30	665.31	38.44	33.66	0.0	0.0
48	677.66	14.30	325.10	3.70	165.86	30.75	29.62	0.0	0.0
49	1555.03	38.71	949.28	8.54	367.81	32.33	26.37	0.0	0.0
50	4869.07	101.28	4070.45	50.74	275.92	8.43	17.83	0.0	0.11
51	3414.86	118.10	2878.57	106.21	20.68	1.55	2.93	0.0	0.0
52	1045.34	181.22	759.18	3.27	1.13	0.13	0.13	0.0	0.0
53	17568.97	2819.80	13431.74	313.43	4.00	4.00	0.0	0.0	0.0
MONTH									
JAN	1240.58	27.63	1139.08	18.13	0.70	0.13	0.11	0.0	0.11
FEB	1362.25	48.11	1282.93	0.77	0.0	0.12	0.0	0.0	0.0
MAR	1471.52	80.94	1347.75	0.27	0.01	0.05	0.0	0.01	0.01
APR	661.49	10.38	593.60	1.08	1.39	1.21	0.03	0.0	0.05
MAY	467.73	7.00	311.87	43.74	8.03	3.79	0.02	0.01	0.02
JUN	617.68	1.01	19.39	667.77	1.82	1.07	5.27	0.0	0.03
JUL	2602.75	63.19	30.10	476.24	760.91	83.66	87.11	0.0	0.08
AUG	2904.04	52.05	292.30	1076.79	169.74	75.21	106.52	0.0	0.0
SEP	381.01	3.37	28.67	21.93	57.28	7.18	9.75	0.0	0.0
OCT	2767.53	17.08	164.28	6.99	1957.73	32.77	44.26	0.0	0.0
NOV	4548.55	32.81	1193.38	7.54	2755.08	134.23	129.52	0.0	0.05
DEC	3154.94	157.42	2460.82	43.25	220.85	14.85	18.41	0.0	0.04
SEASON									
WIN	1366.43	54.41	1262.90	6.03	0.23	0.10	0.04	0.01	0.04
SPR	669.94	4.70	219.72	346.72	3.89	2.03	2.55	0.0	0.03
SUM	2018.70	39.89	132.70	568.59	306.03	56.15	70.27	0.0	0.02
FAL	3463.97	56.38	1068.45	15.96	1807.07	62.76	66.86	0.0	0.03
YEAR	2080.08	38.79	645.95	237.57	704.25	36.40	41.49	0.0	0.03

A-19 (Cont'd)

PERIOD	HC	BF	RS	BA	WC	SS	WKF	PS
WEEK								
1	0.0	0.0	10.56	0.0	24.81	8.37	0.0	1.92
2	0.0	0.0	17.91	0.0	62.34	8.30	0.0	4.06
3	0.0	0.0	1.31	0.0	4.37	2.10	0.0	0.44
4	0.0	0.0	10.12	0.0	2.39	0.64	0.0	1.84
5	0.0	0.0	3.97	0.0	5.82	2.40	0.0	1.10
6	0.0	0.0	3.28	0.0	8.19	3.28	0.0	0.98
7	0.0	0.0	11.29	0.0	5.46	2.08	0.0	1.04
8	0.05	0.0	29.17	0.0	5.36	5.25	0.0	0.68
9	0.0	0.0	18.10	0.0	9.05	6.55	0.0	0.88
10	0.0	0.0	19.03	0.0	9.72	4.16	0.0	3.12
11	0.0	0.0	20.13	0.0	7.75	5.20	0.0	2.39
12	0.0	0.0	14.10	0.0	10.13	5.13	0.0	4.76
13	0.0	0.0	23.66	0.0	9.17	12.23	0.0	6.12
14	0.06	0.0	23.40	0.0	8.80	14.17	0.0	4.18
15	0.19	0.0	7.24	0.0	8.99	10.48	0.0	1.62
16	1.44	0.0	37.88	0.0	2.75	2.00	0.0	0.62
17	13.76	0.0	59.08	0.0	2.51	1.97	0.0	1.20
18	25.11	0.0	105.68	0.0	14.78	5.71	0.0	3.77
19	59.67	0.0	43.55	0.0	12.10	4.24	0.0	2.10
20	70.45	0.0	11.61	0.06	3.48	0.90	0.0	1.48
21	36.50	0.0	17.33	0.03	4.03	1.22	0.0	2.15
22	40.02	0.0	3.49	0.44	0.71	0.38	0.0	1.01
23	6.17	0.0	8.05	3.22	1.31	0.35	0.0	1.26
24	7.46	0.0	9.57	6.74	0.32	0.11	0.0	0.53
25	39.10	7.92	46.19	109.92	0.99	0.11	0.0	0.45
26	15.39	9.05	56.44	53.00	0.46	0.12	0.0	0.37
27	8.27	2.44	18.12	39.27	0.68	0.0	0.0	0.86
28	12.25	1.20	51.91	68.66	0.23	0.0	0.40	0.23
29	18.58	19.79	247.96	1245.29	0.0	0.25	262.52	0.35
30	19.71	8.44	233.74	791.84	0.0	0.0	438.90	0.17
31	9.99	14.96	14.42	886.08	0.98	0.66	135.20	0.22
32	63.49	10.67	37.11	1820.70	1.02	0.69	159.45	0.15
33	92.71	5.53	36.94	2009.27	0.87	0.19	86.69	0.24
34	50.48	2.12	120.55	384.48	0.63	1.02	40.56	0.39
35	17.14	0.49	1.90	95.69	0.25	0.37	2.55	0.57
36	136.18	0.24	2.04	238.45	0.46	0.0	49.27	0.05
37	57.95	0.51	1.80	110.89	0.51	0.0	25.43	0.31
38	97.05	0.85	3.18	143.05	0.28	0.0	9.70	0.40
39	16.32	0.34	0.54	26.88	0.39	0.05	0.44	0.24
40	280.26	0.26	0.06	62.61	0.61	0.0	0.96	0.29
41	243.60	0.17	0.53	197.43	0.91	0.0	3.00	1.05
42	223.30	0.36	28.54	566.94	1.34	0.12	15.77	3.53
43	100.07	0.06	16.25	126.57	1.42	1.31	3.74	3.43
44	223.78	0.14	80.32	133.94	4.05	0.79	6.65	1.65
45	86.44	0.15	75.06	21.24	9.71	0.18	2.03	0.93
46	59.04	0.0	69.46	9.61	11.24	0.67	2.06	0.45
47	20.90	0.0	28.52	2.69	6.77	0.48	0.48	0.91
48	20.65	0.03	32.30	1.22	10.16	1.46	2.04	1.43
49	34.47	0.0	54.96	1.49	12.99	3.29	1.58	0.27
50	39.03	0.0	249.60	4.53	11.37	4.64	0.74	0.34
51	30.72	0.0	201.42	2.63	7.41	8.73	0.18	2.93
52	2.19	0.0	48.33	0.25	4.07	8.46	0.0	1.63
53	15.29	0.0	793.96	22.93	19.29	35.68	0.0	7.64
MONTH								
JAN	0.0	0.0	10.58	0.0	25.59	5.64	0.0	2.16
FEB	0.02	0.0	16.73	0.0	5.98	3.84	0.0	0.89
MAR	0.0	0.0	18.28	0.0	9.08	6.09	0.0	3.47
APR	2.57	0.0	28.38	0.0	6.15	7.76	0.0	2.05
MAY	45.76	0.0	32.49	0.05	6.50	2.26	0.0	1.97
JUN	18.96	3.45	25.76	37.09	0.76	0.27	0.0	0.79
JUL	14.89	9.24	147.50	602.95	0.19	0.08	185.90	0.39
AUG	46.05	5.75	46.11	930.17	0.69	0.63	75.62	0.34
SEP	80.28	0.45	1.80	138.46	0.43	0.01	24.68	0.23
OCT	203.64	0.17	18.02	208.08	1.05	0.48	5.65	2.01
NOV	73.57	0.07	59.15	25.73	8.18	0.72	2.12	1.08
DEC	30.46	0.0	154.62	2.99	12.00	5.83	0.97	1.10
SEASON								
WIN	0.01	0.0	15.40	0.0	13.34	5.28	0.0	2.29
SPR	25.36	1.66	28.53	17.89	3.67	2.26	0.0	1.41
SUM	47.82	5.09	61.57	584.67	0.46	0.27	91.57	0.32
FAL	117.70	0.10	65.00	96.73	6.11	1.86	3.32	1.48
YEAR	59.27	1.74	47.54	185.02	5.14	2.07	24.16	1.29

APPENDIX A.4

Volumes Circulated and Days of Operation at Indian Point

Table A-20

Number of Days of 1978 Operation at Indian Point Units No. 2 and No. 3 with Number of Days Selected for Computation of Impingement Rates and Number of Selected Days with Simultaneous Operation at Both Units

		Number of Days				
		Unit No. 2		Unit No. 3		Simultaneous
Year	Month	Operation*	Selected	Operation*	Selected	Selected
1976	Jan	31	22	0	0	0
	Feb	29	16	24	3	3
	Mar	31	20	31	0	0
	Apr	4	2	30	4	0
	May	0	0	30	20	0
	Jun	14	3	30	20	2
	Jul	0	0	31	14	0
	Aug	0	0	31	20	0
	Sep	16	6	30	21	4
	Oct	31	17	31	19	8
	Nov	13	10	21	23	7
	Dec	24	10	31	21	8
Total		193	106	320	165	32
1977	Jan	31	24	31	7	6
	Feb	27	5	28	1	1
	Mar	31	23	31	16	14
	Apr	14	6	30	13	4
	May	18	16	31	22	15
	Jun	30	24	30	21	20
	Jul	3	2	31	25	2
	Aug	28	17	31	30	16
	Sep	30	22	30	26	18
	Oct	31	18	12	9	7
	Nov	30	6	0	0	0
	Dec	31	0	18	10	0
Total		303	163	303	180	103
1978	Jan	31	0	31	24	0
	Feb	17	0	28	23	0
	Mar	0	0	31	29	0
	Apr	0	0	30	26	0
	May	12	5	31	26	5
	Jun	30	28	25	23	21
	Jul	31	22	0	0	0
	Aug	31	24	19	12	7
	Sep	30	21	30	15	9
	Oct	31	22	31	25	18
	Nov	30	22	30	19	15
	Dec	31	11	31	23	6
Total		274	155	317	245	81

*Data obtained from Con Edison plant performance records

Table A-21

Total Unit Discharge* ($10^6 m^3$) at Indian Point Units No. 2 and No. 3, 1975 through 1978

		Total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1975	Unit 2	1118.9	50.4	51.6	30.5	84.1	118.9	138.8	131.7	97.3	121.6	78.8	105.5	109.7
	Unit 3	--**	--	--	--	--	--	--	--	--	--	--	--	--
	Combined	1118.9	50.4	51.6	30.5	84.1	118.9	138.8	131.7	97.3	121.6	78.8	105.5	109.7
1976	Unit 2	462.4	79.9	75.1	81.9	4.3	0	12.9	0	0	32.3	107.1	17.6	51.3
	Unit 3	866.7	0	30.6	25.5	53.7	85.9	93.7	107.0	113.1	80.1	104.9	98.1	74.1
	Combined	1329.1	79.9	105.7	107.4	58.0	85.9	106.6	107.0	113.1	112.4	212.0	115.7	125.4
1977	Unit 2	1016.5	58.8	56.5	71.8	39.9	88.1	133.3	13.0	106.8	140.9	123.3	95.4	88.7
	Unit 3	1142.1	73.0	63.9	82.3	100.5	139.5	135.7	139.8	146.0	141.0	53.7	0	66.7
	Combined	2158.6	131.8	120.4	154.1	140.0	227.6	269.0	152.8	252.8	281.9	177.0	95.4	155.4
1978	Unit 2	1015.2	79.0	34.0	0	1.6	40.2	141.5	144.1	145.6	82.6	129.5	107.4	109.7
	Unit 3	1015.2	88.1	71.4	86.1	76.0	122.0	47.2	2.1	38.7	121.7	140.8	133.6	87.5
	Combined	2030.4	167.1	105.4	86.1	77.6	162.2	188.7	146.2	184.3	204.3	270.3	241.0	197.2

* Including service water
** Dashes = Not in operation

APPENDIX A.5

Recaptures of Marked Fish Impinged at Indian Point Generating Station during 1978

Definitions of codes appearing in this section of the Appendix are as follows:

SPECIES 30	:	Striped Bass
SPECIES 32	:	Atlantic Tomcod
SPECIES 35	:	White Perch
RC MONTH	:	Recovery Month
TT	:	Tag Type
TAG TYPE 5	:	Floy Fingerling Tag
TAG TYPE 6	:	Carlin Tag
TAG TYPE 9	:	Dennison Internal Anchor Tag
TAG TYPE 26	:	Floy Fingerling Tag and 1st Dorsal Finclip
TAG TYPE 29	:	Dennison Internal Anchor Tag and 1st Dorsal Finclip
TAG TYPE 30	:	Dennison Internal Anchor Tag and 1st Dorsal Finclip
TAG NO	:	Tag Number
RL DATE	:	Release Date (month, day, year)
RL RM	:	Release River Mile
RL SITE	:	Release Site
RL LENG	:	Release Total Length (mm)
RL GR	:	Release Gear (Sampling Device) 5 = 3' x 6' Boxtrap with wings and leads 12 = 100' Beach Seine 14 = 200' Beach Seine 36 = 3' x 6' Boxtrap without wings and leads 53 = 500' Beach Seine 64 = 1 Metre Epibenthic Sled
RC DATE	:	Recovery Date (month, day, year)
RC RM	:	Recovery River Mile
RC SITE	:	Recovery Site
RC LENG	:	Recovery Total Length (mm)
DAYS	:	Days at Large
DSTNC	:	Distance in Miles (Rel.-Rec.)

Table A-22

White Perch Marked and Released during 1976 and Recaptured at Indian Point Generating Station in 1978 Summarized by Month of Recapture, Tag Type, and Date of Recapture*

RELEASE						RECOVERY					
SPECIES=35	RC_MONTH=1	TT=5									
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
34178	06/09/76	85	WEST	146	14	01/05/78	42	EAST	149	574	43
45134	10/05/76	35	EAST	143	53	01/23/78	42	EAST	159	474	-7
40598	09/28/76	27	WEST	134	14	01/26/78	42	EAST	141	484	-15
SPECIES=35	RC_MONTH=1	TT=9									
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
57803	05/05/76	40	WEST	168	12	01/24/78	42	EAST	175	628	-2
72464	10/04/76	60	EAST	171	5	01/24/78	42	EAST	175	476	18
73544	10/08/76	34	EAST	177	14	01/27/78	42	EAST	185	475	-8
SPECIES=35	RC_MONTH=2	TT=9									
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
65607	09/22/76	59	EAST	156	12	02/20/78	42	EAST	160	515	17
70867	10/04/76	36	EAST	166	14	02/21/78	42	EAST	164	504	-6
66353	09/23/76	35	EAST	168	14	02/24/78	42	EAST	173	518	-7
SPECIES=35	RC_MONTH=3	TT=5									
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
40502	09/22/76	39	EAST	147	14	03/14/78	42	EAST	163	537	-3

*Striped bass and Atlantic tomcod marked and released during 1976 were not recaptured at the Indian Point Generating Station in 1978.

Table A-23

Striped Bass, Atlantic Tomcod, and White Perch Marked and Released during 1977 and Recaptured at Indian Point Generating Station in 1978 Summarized by Species, Month of Recapture, Tag Type, and Date of Recapture

RELEASE						RECOVERY					
SPECIES=30 RC_MONTH=1 TT=5											
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
60390	10/20/77	53	EAST	189	14	01/27/78	42	EAST	188	99	11
SPECIES=32 RC_MONTH=1 TT=6											
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
44563	12/28/77	51	WEST	201	36	01/03/78	42	EAST	198	6	9
44503	12/28/77	51	WEST	137	36	01/07/78	42	EAST	135	10	9
45272	12/30/77	51	EAST	127	36	01/07/78	42	EAST	121	8	9
45824	12/21/77	51	EAST	167	36	01/09/78	42	EAST	163	19	9
46959	12/28/77	68	WEST	177	36	01/10/78	42	EAST	170	13	26
47513	12/27/77	51	EAST	237	36	01/10/78	42	EAST	223	14	9
51044	12/27/77	51	EAST	180	36	01/10/78	42	EAST	177	14	9
51248	12/27/77	51	EAST	198	36	01/10/78	42	EAST	189	14	9
45725	12/30/77	51	WEST	158	36	01/11/78	42	EAST	144	12	9
45810	12/21/77	51	EAST	225	36	01/11/78	42	EAST	219	21	9
51367	12/22/77	52	WEST	137	36	01/12/78	42	EAST	133	21	10
51083	12/27/77	51	EAST	137	36	01/13/78	42	EAST	133	17	9
51382	12/22/77	56	WEST	148	36	01/17/78	42	EAST	145	26	14
44120	12/30/77	51	EAST	184	36	01/20/78	42	EAST	183	21	9
45327	12/30/77	51	EAST	155	36	01/21/78	42	EAST	151	22	9

A-23 (Contd)

RELEASE						RECOVERY					
SPECIES=35						RC_MONTH=1		TT=5			
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
57767	10/12/77	99	EAST	108	12	01/07/78	42	EAST	110	87	57
50227	05/11/77	38	EAST	144	5	01/08/78	42	EAST	150	242	-4
51250	05/05/77	49	WEST	118	12	01/22/78	42	EAST	127	262	7
55521	06/23/77	36	WEST	149	14	01/22/78	42	EAST	163	213	-6
52036	06/14/77	36	EAST	126	14	01/23/78	42	EAST	148	223	-6
51993	06/14/77	40	WEST	136	14	01/24/78	42	EAST	139	224	-2
50863	05/31/77	32	EAST	122	12	01/26/78	42	EAST	144	240	-10
59949	11/02/77	39	EAST	133	12	01/26/78	42	EAST	134	85	-3

SPECIES=35						RC_MONTH=1		TT=9			
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
92176	06/13/77	38	EAST	154	5	01/09/78	42	EAST	155	210	-4
88039	05/11/77	58	WEST	152	12	01/10/78	42	EAST	150	244	16
95350	11/01/77	34	EAST	181	14	01/22/78	42	EAST	176	82	-8
97641	10/06/77	34	EAST	178	12	01/22/78	42	EAST	166	108	-8
97745	10/04/77	58	EAST	167	12	01/22/78	42	EAST	164	110	16
101602	11/29/77	30	WEST	190	64	01/22/78	42	EAST	181	54	-12
88892	06/02/77	39	EAST	172	12	01/24/78	42	EAST	173	236	-3
99008	10/18/77	33	EAST	154	53	01/24/78	42	EAST	152	98	-9
100058	10/20/77	26	WEST	173	64	01/24/78	42	EAST	169	96	-16
100234	10/19/77	28	WEST	180	64	01/24/78	42	EAST	160	97	-14
101772	11/30/77	28	WEST	176	64	01/24/78	42	EAST	170	55	-14
88110	05/12/77	35	EAST	151	14	01/25/78	42	EAST	157	258	-7
100010	11/09/77	16	WEST	192	12	01/25/78	42	EAST	192	77	-26
101589	11/29/77	30	WEST	153	64	01/26/78	42	EAST	152	58	-12
100206	10/19/77	23	WEST	171	64	01/27/78	42	EAST	168	100	-14
54881	06/27/77	38	EAST	134	5	01/28/78	42	EAST	166	215	-4
87321	04/21/77	16	WEST	190	14	01/28/78	42	EAST	191	282	-26

SPECIES=35						RC_MONTH=1		TT=26			
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
55032	09/14/77	39	EAST	124	12	01/07/78	42	EAST	125	115	-3
49836	09/20/77	39	EAST	112	14	01/21/78	42	EAST	113	123	-3
53490	09/08/77	29	WEST	124	12	01/21/78	42	EAST	128	135	-13
55075	09/14/77	42	WEST	112	12	01/22/78	42	EAST	120	130	0
56896	09/15/77	29	WEST	121	12	01/25/78	42	EAST	126	132	-13
56923	09/15/77	39	WEST	111	12	01/27/78	42	EAST	115	134	-3

A-23 (Contd)

RELEASE						RECOVERY					
SPECIES=35 RC_MONTH=1 TT=26											
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
56413	09/07/77	38	WEST	110	12	01/28/78	42	EAST	111	143	-4
SPECIES=35 RC_MONTH=1 TT=30											
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
96032	09/06/77	26	WEST	186	12	01/05/78	42	EAST	160	121	-16
94358	09/20/77	39	EAST	240	14	01/22/78	42	EAST	229	124	-3
88161	09/29/77	19	WEST	207	12	01/23/78	42	EAST	202	116	-23
93392	09/08/77	30	WEST	153	12	01/24/78	42	EAST	155	138	-12
93424	09/28/77	34	EAST	191	12	01/24/78	42	EAST	189	118	-8
94933	09/08/77	34	EAST	172	14	01/27/78	42	EAST	187	141	-8
97530	09/29/77	86	EAST	168	12	01/27/78	42	EAST	168	120	44
SPECIES=35 RC_MONTH=2 TT=5											
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
50216	05/11/77	38	EAST	138	5	02/09/78	42	EAST	155	274	-4
58941	10/05/77	46	EAST	119	12	02/18/78	42	EAST	113	136	4
61235	10/24/77	40	EAST	134	14	02/22/78	42	EAST	134	121	-2
54505	06/22/77	40	WEST	115	14	02/23/78	42	EAST	122	246	-2
50297	06/01/77	53	WEST	125	12	02/27/78	42	EAST	135	271	16
54325	11/09/77	16	WEST	112	12	02/27/78	42	EAST	114	110	-26
59155	11/04/77	39	EAST	127	53	02/28/78	42	EAST		116	-3
SPECIES=35 RC_MONTH=2 TT=9											
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
86925	04/19/77	45	WEST	173	12	02/11/78	42	EAST	170	298	3
88352	06/27/77	34	EAST	166	5	02/11/78	42	EAST	162	229	-8
98480	10/05/77	26	WEST	156	14	02/12/78	42	EAST	152	130	-16
93023	06/07/77	77	EAST	159	14	02/23/78	42	EAST	160	261	35
98182	11/09/77	105	WEST	169	12	02/26/78	42	EAST	166	109	63

A-23 (Contd)

RELEASE						RECOVERY					
SPECIES=35 RC_MONTH=2 TT=26											
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
57824	09/20/77	36	WEST	118	14	02/27/78	42	EAST		160	-6
SPECIES=35 RC_MONTH=3 TT=5											
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
55555	06/22/77	27	WEST	134	14	03/01/78	42	EAST	140	252	-15
61607	10/26/77	40	EAST	127	14	03/03/78	42	EAST	121	128	-2
61655	11/17/77	26	WEST	132	14	03/04/78	42	EAST	127	107	-16
54355	11/22/77	32	EAST	128	12	03/06/78	42	EAST	128	104	-10
SPECIES=35 RC_MONTH=3 TT=9											
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
100991	11/28/77	30	WEST	166	64	03/01/78	42	EAST	162	93	-12
88590	06/20/77	34	EAST	155	14	03/02/78	42	EAST	157	255	-8
SPECIES=35 RC_MONTH=3 TT=26											
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
57028	09/06/77	26	EAST	142	14	03/01/78	42	EAST	146	176	-16
58848	09/27/77	40	EAST	134	14	03/01/78	42	EAST		155	-2
SPECIES=35 RC_MONTH=4 TT=5											
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
53438	09/07/77	43	EAST	126	12	04/24/78	42	EAST		229	1
60217	10/17/77	55	EAST	119	14	04/24/78	42	EAST	121	189	13
SPECIES=35 RC_MONTH=4 TT=26											
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
57631	09/21/77	43	EAST	132	12	04/21/78	42	EAST	125	212	1

A-23 (Contd)

			RELEASE						RECOVERY		
SPECIES=35 RC_MONTH=5 TT=9											
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
100895	11/14/77	32	EAST	169	64	05/17/78	42	EAST	168	184	-10
SPECIES=35 RC_MONTH=6 TT=5											
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
59458	11/14/77	30	WEST	124	14	06/05/78	42	EAST	118	203	-12
SPECIES=35 RC_MONTH=8 TT=9											
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
98268	10/17/77	19	WEST	180	64	08/14/78	42	EAST	175	301	-23
SPECIES=35 RC_MONTH=9 TT=9											
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
100853	11/14/77	32	EAST	160	64	09/22/78	42	EAST	155	312	-10
SPECIES=35 RC_MONTH=10 TT=9											
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
100681	11/03/77	31	WEST	196	64	10/09/78	42	EAST	191	340	-11

Table A-24

Atlantic Tomcod and White Perch Marked and Released during January through June 1978 and Recaptured at Indian Point Generating Station in 1978
Summarized by Species, Month of Recapture, Tag Type, and Date of Recapture*

RELEASE						RECOVERY					
SPECIES=32						RC_MONTH=1	TT=6				
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
47898	01/03/78	51	EAST	190	36	01/06/78	42	EAST	192	3	9
49481	01/06/78	42	EAST	162	36	01/06/78	42	EAST	162	0	0
45671	01/03/78	41	EAST	163	36	01/08/78	42	EAST	155	5	-1
49478	01/06/78	42	EAST	140	36	01/08/78	42	EAST	138	2	0
48846	01/10/78	51	EAST	165	36	01/11/78	42	EAST	160	1	9
54112	01/06/78	41	EAST	153	36	01/11/78	42	EAST	148	5	-1
50807	01/03/78	51	EAST	187	36	01/16/78	42	EAST	178	13	9
53640	01/10/78	68	WEST	141	36	01/29/78	42	EAST	140	19	26
54848	01/12/78	51	EAST	125	36	01/31/78	42	EAST	126	19	9
SPECIES=32						RC_MONTH=2	TT=6				
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
48641	01/06/78	51	EAST	127	36	02/03/78	42	EAST	127	28	9
SPECIES=35						RC_MONTH=5	TT=5				
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
63151	05/26/78	40	EAST	123	14	05/27/78	42	EAST	124	1	-2
SPECIES=35						RC_MONTH=6	TT=5				
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
62309	05/25/78	73	EAST	145	12	06/01/78	42	EAST	141	7	31
63180	05/31/78	48	WEST	113	12	06/02/78	42	EAST	115	2	6
63744	06/13/78	38	EAST	142	5	06/20/78	42	EAST		7	-4

*Striped bass marked and released during January through June 1978 were not recaptured at the Indian Point Generating Station in 1978.

A-24 (Contd)

RELEASE						RECOVERY					
---------- SPECIES=35						RC_MONTH=6	TT=9 ----------				
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
99348	06/01/78	69	WEST	152	12	06/05/78	42	EAST		4	27
99335	06/01/78	71	WEST	166	12	06/06/78	42	EAST	159	5	29
103547	06/08/78	72	WEST	201	12	06/13/78	42	EAST	191	5	30
---------- SPECIES=35						RC_MONTH=7	TT=9 ----------				
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
102290	06/07/78	35	EAST	177	14	07/18/78	42	EAST	164	41	-7
---------- SPECIES=35						RC_MONTH=10	TT=5 ----------				
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
63128	05/25/78	39	EAST	121	5	10/18/78	42	EAST	134	146	-3
61813	05/22/78	46	EAST	146	12	10/21/78	42	EAST	153	152	4
64060	06/16/78	32	EAST	135	12	10/24/78	42	EAST		130	-10
---------- SPECIES=35						RC_MONTH=10	TT=9 ----------				
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
98725	05/22/78	39	EAST	151	5	10/02/78	42	EAST	156	133	-3

Table A-25

Atlantic Tomcod and White Perch Marked and Released during August through December 1978 and Recaptured at Indian Point Generating Station in 1978 Summarized by Species, Month of Recapture, Tag Type, and Date of Recapture*

RELEASE						RECOVERY					
SPECIES=32						RC_MONTH=12		TT=6			
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
46474	12/18/78	25	EAST	139	36	12/21/78	42	EAST	136	3	-17
SPECIES=35						RC_MONTH=9		TT=5			
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
59674	09/06/78	36	EAST	139	12	09/12/78	42	EAST		6	-6
60504	09/06/78	59	EAST	124	12	09/17/78	42	EAST		11	17
SPECIES=35						RC_MONTH=10		TT=5			
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
148826	09/20/78	36	EAST	134	14	10/03/78	42	EAST	132	13	-6
148667	10/04/78	40	EAST	118	14	10/08/78	42	EAST		4	-2
149841	09/21/78	38	WEST	135	12	10/17/78	42	EAST	137	26	-4
149415	09/08/78	38	EAST	117	5	10/20/78	42	EAST	119	42	-4
63027	10/20/78	42	EAST	125	14	10/21/78	42	EAST	124	1	0
151725	10/13/78	58	WEST	141	12	10/23/78	42	EAST		10	16
149595	10/24/78	43	EAST	121	14	10/25/78	42	EAST	124	1	1
152123	10/06/78	36	WEST	128	12	10/25/78	42	EAST		19	-6
62800	10/16/78	46	WEST	128	12	10/30/78	42	EAST	126	14	4
64089	10/26/78	69	EAST	130	12	10/30/78	42	EAST		4	27

*Striped bass marked and released during August through December 1978 were not recaptured at the Indian Point Generating Station in 1978.

A-25 (Contd)

TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
RELEASE						RECOVERY					
SPECIES=35	RC_MONTH=10	TT=9									
99961	09/08/78	34	EAST	208	5	10/10/78	42	EAST	206	32	-8
102527	09/06/78	35	EAST	184	53	10/24/78	42	EAST	172	48	-7
SPECIES=35	RC_MONTH=11	TT=5									
150035	09/14/78	36	EAST	135	14	11/04/78	42	EAST	128	51	-6
152192	10/23/78	55	EAST	123	14	11/04/78	42	EAST	122	12	13
152193	10/23/78	55	EAST	123	14	11/04/78	42	EAST	114	12	13
150800	10/03/78	40	WEST	128	14	11/05/78	42	EAST	128	33	-2
151855	11/01/78	54	EAST	141	14	11/05/78	42	EAST	139	4	12
151804	10/31/78	38	WEST	120	14	11/29/78	42	EAST		29	-4
149337	09/29/78	36	EAST	128	14	11/30/78	42	EAST		62	-6
151775	10/17/78	26	EAST	135	12	11/30/78	42	EAST	137	44	-16
SPECIES=35	RC_MONTH=11	TT=9									
104671	09/26/78	43	EAST	192	12	11/02/78	42	EAST	188	37	1
104723	11/14/78	41	EAST	164	0	11/23/78	42	EAST	161	9	-1

A-25 (Contd)

	RELEASE						RECOVERY				
SPECIES=35	RC_MONTH=12	TT=5									
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
62774	10/23/78	44	EAST	129	12	12/01/78	42	EAST	126	39	2
62871	10/19/78	40	EAST	132	14	12/01/78	42	EAST	124	43	-2
152406	11/14/78	37	EAST	122	14	12/06/78	42	EAST		22	-5
64081	10/25/78	110	EAST	122	12	12/14/78	42	EAST	120	50	68
149219	09/13/78	84	WEST	116	12	12/14/78	42	EAST	118	92	42
150606	10/09/78	43	EAST	124	12	12/14/78	42	EAST	123	66	1
152833	12/04/78	38	EAST	124	5	12/15/78	42	EAST	124	11	-4
149709	09/25/78	43	EAST	135	14	12/17/78	42	EAST	130	83	1
61777	09/06/78	33	EAST	129	14	12/18/78	42	EAST	135	103	-9
149713	09/25/78	43	EAST	132	14	12/18/78	42	EAST		84	1
152556	11/03/78	54	EAST	128	14	12/18/78	42	EAST	124	45	12
63548	09/06/78	35	EAST	134	14	12/21/78	42	EAST	132	106	-7
60585	09/08/78	39	EAST	130	12	12/24/78	42	EAST	132	107	-3
64332	10/24/78	43	EAST	136	14	12/26/78	42	EAST	136	63	1
59576	09/05/78	30	WEST	140	12	12/28/78	42	EAST	142	114	-12
151423	10/04/78	36	EAST	125	12	12/31/78	42	EAST	111	88	-6
151811	10/31/78	34	EAST	101	14	12/31/78	42	EAST	99	61	-8
SPECIES=35	RC_MONTH=12	TT=9									
TAG_NO	RL_DATE	RL_RM	RL_SITE	RL_LENG	RL_GR	RC_DATE	RC_RM	RC_SITE	RC_LENG	DAYS	DSTNC
104729	11/14/78	41	EAST	200	0	12/05/78	42	EAST	190	21	-1
106127	10/09/78	44	EAST	176	12	12/30/78	42	EAST	177	82	2
106422	11/08/78	24	EAST	157	12	12/31/78	42	EAST	156	53	-18

APPENDIX A.6

Stepwise Regression Models for Assessment of Power Plant and Environmental Factors Affecting Impingement at Indian Point Generating Station, 1978

Interpretations provided at the bottom of each model must be considered with all other variables held constant. All inferences drawn from the data are restricted to the ranges of the data which are:

(1) Conductivity at Unit No. 2 - 142 to 9769 mS/cm
    Conductivity at Unit No. 3 - 124 to 9769 mS/cm

(2) Water temperature at Unit No. 2 - 5.4 to 27.5°C
    Water temperature at Unit No. 3 - 3.6 to 27.3°C

(3) Salt front positions at Unit No. 2 - RM 27 to 71
    Salt front positions at Unit No. 3 - RM 15 to 69

Table A-26

Stepwise Regression Models for All Species Impingement Collections as Functions of Plant/Environmental Parameters, April through December 1978

Indian Point Unit No. 2

R SQUARE = 0.75163375

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	10	430.78857637	43.07885764	40.55	0.0001
ERROR	134	142.34770967	1.06229634		
TOTAL	144	573.13628604			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	2.53832783				
VOLUME	1.16434968	0.08551956	196.91628800	185.37	0.0001
WT	-0.20445704	0.03696233	32.50358491	30.60	0.0001
COND	0.00040230	0.00006111	46.03476246	43.34	0.0001
COND2	-0.00000008	0.00000001	36.33926522	34.21	0.0001
MNAT	0.07805263	0.02571882	9.78405333	9.21	0.0029
SF	0.06291690	0.02391222	7.35428923	6.92	0.0095
SF2	-0.00358417	0.00095932	14.82843269	13.96	0.0003
AMP	0.61841184	0.10883012	34.30070375	32.29	0.0001
PPT	-0.76308034	0.40968944	3.68533242	3.47	0.0647
WASH	0.91669002	0.36456260	6.71655328	6.32	0.0131

Interpretation*:

1. Impingement increased as volume increased.
2. As water temperature increased, impingement decreased.
3. and 4. Impingement increased as conductivity approached 5.333 mS/cm, i.e., maximum impingement occurred when conductivity was about 5.333 mS/cm.
5. As average minimum air temperature increased, impingement increased.
6. and 7. Impingement increased as the salt front approached RM 52; i.e., maximum impingement occurred when the salt front was in the vicinity of RM 52.
8. As tidal amplitude increased, impingement increased.
9. As average daily precipitation increased, impingement decreased.
10. Multiple washes, necessitated by high debris loading, increased impingement.

*with all other variables held constant

A-26 (Cont'd)

Indian Point Unit No. 3

R SQUARE = 0.80100913

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	10	541.98032009	54.19803201	57.97	0.0001
ERROR	144	134.64158364	0.93501100		
TOTAL	154	676.62190374			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	5.73113738				
VOLUME	1.04180792	0.06929793	211.32531708	226.01	0.0001
COND	0.00033628	0.00006650	23.91156016	25.57	0.0001
COND2	-0.00000009	0.00000001	36.02125450	38.52	0.0001
DCOND	-0.00018899	0.00009275	3.88240091	4.15	0.0434
MNAT	-0.10975233	0.01784578	35.36497048	37.82	0.0001
SF	-0.03662757	0.01234384	8.23250616	8.80	0.0035
SF2	-0.00134263	0.00050669	6.56508751	7.02	0.0090
WASH	0.76349122	0.27220689	7.35574386	7.87	0.0057
U	-1.55812649	0.28205970	28.53251602	30.52	0.0001
CATCH_BS	0.00467379	0.00143641	9.89918505	10.59	0.0014

Interpretation*:

1. Impingement increased as volume increased.
2. and 3. Impingement increased as conductivity approached 4.687 mS/cm; i.e., maximum impingement occurred when conductivity was about 4.687 mS/cm.
4. Impingement decreased when change in conductivity from previous day increased.
5. Impingement decreased as average minimum air temperature increased.
6. and 7. Impingement increased as the salt front approached RM 29; i.e., maximum impingement occurred when the salt front was in the vicinity of RM 29.
8. Multiple washes, necessitated by high debris loading, increased impingement.
9. Decreased impingement at Unit No. 3 was associated with concurrent operation at Unit No. 2.
10. Impingement increased as average weekly beach seine C/f increased.

*with all other variables held constant

Table A-27

Stepwise Regression Models for Alewife Impingement Collections as Functions of Plant/Environmental Parameters, April through December 1978

Indian Point Unit No. 2

R SQUARE = 0.68578356

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	10	549.63228835	54.96322884	29.25	0.0001
ERROR	134	251.83383466	1.87935698		
TOTAL	144	801.46612301			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-1.58236430				
VOLUME	0.86010628	0.11749887	100.70386690	53.58	0.0001
WT	-0.23632620	0.04835764	44.88516679	23.88	0.0001
COND	0.00068635	0.00008585	120.11224712	63.91	0.0001
COND2	-0.00000014	0.00000002	95.50174618	50.82	0.0001
MNAT	0.16332154	0.03394384	43.50850758	23.15	0.0001
SF	0.03566158	0.01988530	6.04430193	3.22	0.0752
AMP	0.38414188	0.14666680	12.89225715	6.86	0.0098
PPT	-1.13427377	0.54386594	8.17450254	4.35	0.0389
WASH	1.66574996	0.48558413	22.11566178	11.77	0.0008
CATCH_BT	0.41473691	0.11887337	22.87628378	12.17	0.0007

Interpretation*:

1. Impingement increased as volume increased.
2. As water temperature increased, impingement decreased.
3. and 4. Impingement increased as conductivity approached 5.270 mS/cm; i.e., maximum impingement occurred when conductivity was about 5.270 mS/cm.
5. As average minimum air temperature increased, impingement increased.
6. As the salt front moved up the Hudson, impingement increased.
7. As tidal amplitude increased, impingement increased.
8. As the average daily precipitation increased, impingement decreased.
9. Multiple washes, necessitated by high debris loading, increased impingement.
10. Impingement increased as average biweekly bottom trawl C/f increased.

*with all other variables held constant

A-27 (Cont'd)

Indian Point Unit No. 3

R SQUARE = 0.75645105

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	8	472.52816389	59.06602049	56.68	0.0001
ERROR	146	152.13639829	1.04203013		
TOTAL	154	624.66456217			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-1.87951618				
VOLUME	1.08105483	0.08619210	163.92335043	157.31	0.0001
COND	0.00008888	0.00005295	2.93657114	2.82	0.0953
COND2	-0.00000005	0.00000001	12.28320916	11.79	0.0008
AMP	0.23674914	0.09412903	6.59188951	6.33	0.0130
WASH	0.74051111	0.28953040	6.81640058	6.54	0.0116
U	0.72783395	0.24821369	8.95969890	8.60	0.0039
CATCH_BS	-0.09121154	0.03292276	7.99810917	7.68	0.0063
CATCH_BT	0.38295989	0.09331366	17.55077752	16.84	0.0001

Interpretation*:

1. Impingement increased as volume increased.
2. and 3. Impingement increased as conductivity approached 3.708 mS/cm; i.e., maximum impingement occurred when conductivity was about 3.708 mS/cm.
4. As tidal amplitude increased, impingement increased.
5. Multiple washes, necessitated by high debris loading, increased impingement.
6. Impingement increased as average weekly beach seine C/f decreased.
7. Impingement increased as average biweekly bottom trawl C/f increased.

*with all other variables held constant

Table A-28

Stepwise Regression Models for Bay Anchovy Impingement Collections as Functions of Plant/Environmental Parameters, April through December 1978

Indian Point Unit No. 2

R SQUARE = 0.74952158

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	9	697.58779498	77.50975500	44.89	0.0001
ERROR	135	233.12296012	1.72683674		
TOTAL	144	930.71075510			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-1.81357722				
VOLUME	1.10118408	0.11506350	158.15974074	91.59	0.0001
WT	0.22558976	0.03803437	60.74878273	35.18	0.0001
WT2	-0.00716003	0.00387074	5.90871782	3.42	0.0665
COND	0.00076500	0.00008282	147.32200887	85.31	0.0001
COND2	-0.00000010	0.00000002	54.81565171	31.74	0.0001
DCOND	-0.00026654	0.00011937	8.60934067	4.99	0.0272
SF	0.06880494	0.03017746	8.97687315	5.20	0.0242
SF2	-0.00370326	0.00121206	16.12015666	9.34	0.0027
AMP	0.53457179	0.13683180	26.35659464	15.26	0.0001

Interpretation*:

1. Impingement increased as volume increased.
2. and 3. Impingement increased as water temperature increased; impingement was more sensitive to water temperature increases at lower temperatures than higher ones.
4. and 5. Impingement increased as conductivity approached 6.644 mS/cm; i.e., maximum impingement occurred when conductivity was about 6.644 mS/cm.
6. Impingement decreased when change in conductivity from previous day increased.
7. and 8. Impingement increased as the salt front approached RM 52; i.e, maximum impingement occurred when the salt front was in the vicinity of RM 52.
9. As tidal amplitude increased, impingement increased.

*with all other variables held constant

A-28 (Cont'd)

Indian Point Unit No. 3

R SQUARE = 0.80525356

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	8	665.83337700	83.22917213	75.46	0.0001
ERROR	146	161.02838094	1.10293412		
TOTAL	154	826.86175795			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	1.02118460				
VOLUME	0.66427810	0.07204939	93.75379365	85.00	0.0001
WT	0.27580703	0.03220384	80.89934986	73.35	0.0001
COND	0.00054734	0.00006413	80.35469197	72.86	0.0001
COND2	-0.00000011	0.00000001	69.96909467	63.44	0.0001
MNAT	-0.12497871	0.02565579	26.17284673	23.73	0.0001
SF	-0.03666633	0.01410417	7.45399474	6.76	0.0103
SF2	0.00117289	0.00050864	5.86464667	5.32	0.0225
PPT	-0.57583529	0.30994767	3.80688158	3.45	0.0652

Interpretation*:

1. Impingement increased as volume increased.
2. Impingement increased as water temperature increased.
3. and 4. Impingement increased as conductivity approached 5.307 mS/cm; i.e., maximum impingement occurred when conductivity was about 5.307 mS/cm.
5. Impingement increased as average minimum air temperature decreased.
6. and 7. Impingement decreased as the salt front approached RM 59; i.e., minimum impingement occurred when the salt front was in the vicinity of RM 59.
8. Impingement increased as average daily precipitation decreased.

*with all other variables held constant

Table A-29

Stepwise Regression Models for American Shad Impingement Collections as Functions of Plant/Environmental Parameters, April through December 1978

Indian Point Unit No. 2

R SQUARE = 0.72504235

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	9	745.78129354	82.86458817	39.55	0.0001
ERROR	135	282.82247581	2.09498130		
TOTAL	144	1028.60376935			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	2.79899950				
VOLUME	1.12888609	0.12724744	164.88542670	78.70	0.0001
WT2	-0.01177780	0.00298745	32.56161281	15.54	0.0001
COND	0.00104907	0.00007493	410.61565397	196.00	0.0001
COND2	-0.00000022	0.00000002	252.09323269	120.33	0.0001
AMP	0.29182734	0.14734449	8.21796586	3.92	0.0497
PPT	-1.44994330	0.57449471	13.34474032	6.37	0.0128
WASH	1.08864030	0.51395720	9.39929010	4.49	0.0360
U	-2.88780550	0.48109087	75.48519817	36.03	0.0001
CATCH_BT	-1.51216633	0.23376451	87.66416998	41.84	0.0001

Interpretation*:

1. Impingement increased as volume increased.
2. As water temperature approached 13.7°C, impingement increased; i.e., maximum impingement occurred when water temperature was about 13.7°C.
3. and 4. As conductivity approached 5.203 mS/cm, impingement increased; i.e., maximum impingement occurred when conductivity was about 5.203 mS/cm.
5. As tidal amplitude increased, impingement increased.
6. Impingement decreased as average daily precipitation increased.
7. Multiple washes, necessitated by high debris loading, increased impingement.
8. Impingement decreased at Unit No. 2 when Unit No. 3 was operational.
9. Impingement decreased as average biweekly bottom trawl C/f increased.

*with all other variables held constant

A-29 (Cont'd)

Indian Point Unit No. 3

R SQUARE = 0.74640016

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	9	602.48700337	66.94300037	47.42	0.0001
ERROR	145	204.70334089	1.41174718		
TOTAL	154	807.19034427			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	0.21324847				
VOLUME	0.69862132	0.08214802	102.10484955	72.33	0.0001
COND	0.00029535	0.00006155	32.50882189	23.03	0.0001
COND2	-0.00000005	0.00000002	14.13506686	10.01	0.0019
MXAT	-0.07140757	0.01415894	35.90739954	25.43	0.0001
PPT	-1.01897476	0.35076470	11.91384695	8.44	0.0042
WASH	0.85831189	0.33403932	9.32077437	6.60	0.0112
U	1.14009088	0.29301745	21.37218454	15.14	0.0002
CATCH_BS	0.06093907	0.01562821	21.46496567	15.20	0.0001
CATCH_BT	0.75893113	0.31561896	8.16273110	5.78	0.0175

Interpretation*:

1. Impingement increased as volume increased.
2. and 3. As conductivity approached 5.772 mS/cm impingement increased; i.e., maximum impingement occurred when conductivity was about 5.772 mS/cm.
4. As average maximum air temperature increased, impingement decreased.
5. As average daily precipitation increased, impingement decreased.
6. Multiple washes, necessitated by high debris loading, increased impingement.
7. Impingement increased at Unit No. 3 when Unit No. 2 was operational.
8. Impingement increased as average weekly beach seine C/f increased.
9. Impingement increased as average biweekly bottom trawl C/f increased.

*with all other variables held constant

Table A-30

Stepwise Regression Models for Bluefish Impingement Collections as Functions of Plant/Environmental Parameters, April through December 1978

Indian Point Unit No. 2

R SQUARE = 0.64841866

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	6	266.04059089	44.34009848	42.42	0.0001
ERROR	138	144.25079415	1.04529561		
TOTAL	144	410.29138504			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-0.02707486				
WT2	0.00810236	0.00252566	10.75756340	10.29	0.0017
COND2	-0.00000003	0.00000001	9.35711587	8.95	0.0033
MNAT	0.02834103	0.01652916	3.07304339	2.94	0.0887
AMP	0.44839302	0.10435260	19.29968644	18.46	0.0001
U	-1.24462668	0.32062411	15.75161087	15.07	0.0002
CATCH_BS	0.26511984	0.13004448	4.34449948	4.16	0.0434

Interpretation*:

1. As water temperature approached 13.7°C, impingement decreased; i.e. minimum impingement occurred when water temperature was about 13.7°C.
2. As conductivity approached 2.819 mS/cm, impingement increased, i.e., maximum impingement occurred when conductivity was about 2.819 mS/cm.
3. As average minimum air temperature increased, impingement increased.
4. As tidal amplitude increased, impingement increased.
5. Impingement at Unit No. 2 decreased when Unit No. 3 was operational.
6. As average weekly beach seine C/f increased, impingement increased.

*with all other variables held constant

A-30 (Cont'd)

Indian Point Unit No. 3

R SQUARE = 0.29657503

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	5	10.61924941	2.12384988	12.56	0.0001
ERROR	149	25.18703286	0.16904049		
TOTAL	154	35.80628227			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	0.12911032				
VOLUME	0.13770812	0.03270539	2.99689321	17.73	0.0001
WT	0.06009071	0.01442615	2.93294896	17.35	0.0001
WT2	0.00269456	0.00098565	1.26333020	7.47	0.0070
MXAT	-0.03010934	0.00898163	1.89969108	11.24	0.0010
SF	-0.01078169	0.00513411	0.74547605	4.41	0.0374

R square value too low for meaningful interpretation

Table A-31

Stepwise Regression Models for Hogchoker Impingement Collections as Functions of Plant/Environmental Parameters, April through December 1978

Indian Point Unit No. 2

R SQUARE = 0.62871704

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	10	233.15419719	23.31541972	22.69	0.0001
ERROR	134	137.68702743	1.02751513		
TOTAL	144	370.84122462			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-1.22136156				
VOLUME	1.07046347	0.09209603	138.81938933	135.10	0.0001
WT2	-0.01450796	0.00272083	29.21439386	28.43	0.0001
COND	0.00054476	0.00006271	77.52832749	75.45	0.0001
COND2	-0.00000005	0.00000002	10.81469832	10.53	0.0015
DCOND	-0.00016205	0.00009296	3.12232669	3.04	0.0836
MNAT	0.06358592	0.01965142	10.75777479	10.47	0.0015
SF2	-0.00166760	0.00059174	8.16045806	7.94	0.0056
AMP	0.30198052	0.10620514	8.30720664	8.08	0.0052
U	1.51830465	0.25135098	37.49254339	36.49	0.0001
CATCH_BS	0.29512499	0.12760183	5.49650159	5.35	0.0223

Interpretation*:

1. Impingement increased as volume increased.
2. As water temperature approached 13.7°C, impingement increased; i.e., maximum impingement occurred when water temperature was about 13.7°C.
3. and 4. As conductivity approached 8.267 mS/cm, impingement increased; i.e., maximum inpingement occurred when conductivity was about 8.267 mS/cm.
5. Impingement decreased when change in conductivity from previous day increased.
6. As average minimum air temperature increased , impingement increased.
7. As the salt front approached Indian Point, impingement increased; i.e., maximum impingement occurred when the salt front was in the vicinity of Indian Point.
8. As tidal amplitude increased, impingement increased.
9. Impingement increased at Unit No. 2 when Unit No. 3 was operational.
10. Impingement increased as average weekly beach seine C/f increased.

*with all other variables held constant

A-31 (Cont'd)

Indian Point Unit No. 3

R SQUARE = 0.80465635

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	9	617.06483845	68.56275983	66.36	0.0001
ERROR	145	149.80270811	1.03312212		
TOTAL	154	766.86754656			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	0.66445939				
VOLUME	0.97157689	0.09505914	107.92406345	104.46	0.0001
WT	0.08414599	0.02028867	17.77098419	17.20	0.0001
WT2	-0.01611349	0.00305804	28.68437582	27.76	0.0001
COND	0.00024711	0.00004213	35.54747478	34.41	0.0001
DCOND	-0.00025594	0.00009769	7.09138980	6.86	0.0097
SF2	-0.00245503	0.00057942	18.54744337	17.95	0.0001
AMP	0.35275103	0.09792064	13.40725309	12.98	0.0004
U	-1.17631620	0.29182298	16.78652644	16.25	0.0001
CATCH_BS	0.39267915	0.16627589	5.76194048	5.58	0.0195

Interpretation*:

1. Impingement increased as volume increased.
2. and 3. As water temperature approached 16.3°C, impingement increased; i.e., maximum impingement occurred when water temperture was about 16.3°C.
4. As conductivity increased, impingement increased.
5. As change in conductivity from previous day increased, impingement decreased.
6. As the salt front approached Indian Point, impingement increased; i.e., maximum impingement occurred when the salt front was in the vicinity of Indian Point.
7. As tidal amplitude inceased impingement increased.
8. Impingement decreased at Unit No. 3 when Unit No. 2 was operational.
9. Impingement increased as average weekly beach seine C/f increased.

*with all other variables held constant

Table A-32

Stepwise Regression Models for Blueback Herring Impingement Collections as Functions of Plant/Environmental Parameters, April through December 1978

Indian Point Unit No. 2

R SQUARE = 0.70052118

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	9	1056.59279372	117.39919930	35.09	0.0001
ERROR	135	451.70250099	3.34594445		
TOTAL	144	1508.29529471			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	0.34480294				
VOLUME	1.48016825	0.15839267	292.19363308	87.33	0.0001
WT2	-0.02681031	0.00321612	232.51882239	69.49	0.0001
COND	0.00137197	0.00009282	731.05846504	218.49	0.0001
COND2	-0.00000020	0.00000002	227.61703613	68.03	0.0001
DCOND	-0.00037791	0.00016464	17.62868762	5.27	0.0233
AMP	0.42378298	0.18916002	16.79372626	5.02	0.0267
PPT	-1.68647212	0.72189785	18.26104237	5.46	0.0210
WASH	2.03850312	0.64105929	33.83335718	10.11	0.0018
CATCH_BS	-0.00089946	0.00025821	40.60147950	12.13	0.0007

Interpretation*:

1. Impingement increased as volume increased.
2. As water temperature approached 13.7°C, impingement increased; i.e., maximum impingement occurred when water temperature was about 13.7°C.
3. and 4. As conductivity approached 6.249 mS/cm impingement increased; i.e., maximum impingement occurred when conductivity was about 6.249 mS/cm.
5. As change in conductivity from previous day increased, impingement decreased.
6. As tidal amplitude increased, impingement increased.
7. As average daily precipitation increased, impingement decreased.
8. Multiple washes, necessitated by high debris loading, increased impingement.
9. Impingement decreased as average weekly beach seine C/f increased.

*with all other variables held constant

A-32 (Cont'd)

Indian Point Unit No. 3

R SQUARE = 0.84544573

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	9	1191.58567586	132.39840843	88.13	0.0001
ERROR	145	217.83142776	1.50228571		
TOTAL	154	1409.41710362			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	1.49682799				
VOLUME	0.95231709	0.11169328	109.20979796	72.70	0.0001
WT2	-0.01815588	0.00333196	44.60540224	29.69	0.0001
COND	0.00052209	0.00006460	98.13212479	65.32	0.0001
COND2	-0.00000010	0.00000002	55.09827695	36.68	0.0001
DCOND	-0.00023786	0.00011636	6.27724619	4.18	0.0428
SF2	-0.00153604	0.00070829	7.06532282	4.70	0.0317
WASH	1.11604380	0.34576382	15.65149777	10.42	0.0015
U	0.86475926	0.30015019	12.46997888	8.30	0.0046
CATCH_BT	0.04751503	0.01054896	30.47862284	20.29	0.0001

Interpretation*:

1. Impingement increased as volume increased.
2. As water temperature approached 13.7°C, impingement increased; i.e., maximum impingement occurred when water temperature was about 13.7°C.
3. and 4. As conductivity approached 5.645 mS/cm, impingement increased; i.e., maximum impingement occurred when conductivity was about 5.645 mS/cm.
5. As change in conductivity from previous day increased, impingement decreased.
6. As the salt front approached Indian Point, impingement increased; i.e., maximum impingement occurred when the salt front was in the vicinity of Indian Point.
7. Multiple washes, necessitated by high debris loading, increased impingement.
8. Impingement increased at Unit No. 3 when Unit No. 2 was operational.
9. Impingement increased as average biweekly bottom trawl C/f increased.

*with all other variables held constant

Table A-33

Stepwise Regression Models for Rainbow Smelt Impingement Collections as Functions of Plant/Environmental Parameters, April through December 1978

Indian Point Unit No. 2

R SQUARE = 0.72788696

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	7	477.18618273	68.16945468	52.35	0.0001
ERROR	137	178.39113613	1.30212508		
TOTAL	144	655.57731887			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	3.02015154				
VOLUME	0.61433392	0.09779415	51.38495273	39.46	0.0001
WT	-0.21258226	0.03033930	63.92865854	49.10	0.0001
WT2	0.01337577	0.00324244	22.15882289	17.02	0.0001
COND2	-0.00000011	0.00000001	94.76676448	72.78	0.0001
AMP	0.57913582	0.11847301	31.11535351	23.90	0.0001
U	-1.90073372	0.32493204	44.55640849	34.22	0.0001
CATCH_BT	-0.05489563	0.03215120	3.79606696	2.92	0.0900

Interpretation*:

1. Impingement increased as volume increased.
2. and 3. As water temperature approached 21.6°C, impingement decreased; i.e., minimum impingement occurred when water temperature was about 21.6°C.
4. As conductivity approached 2.819 mS/cm, impingement increased; i.e., maximum impingement occurred when conductivity was about 2.819 mS/cm.
5. As tidal amplitude increased, impingement increased.
6. Impingement decreased at Unit No. 2 when Unit No. 3 was operational.
7. Impingement decreased as average biweekly bottom trawl C/f increased.

*with all other variables held constant

A-33 (Cont'd)

Indian Point Unit No. 3

R SQUARE = 0.70430621

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	8	423.41910405	52.92738801	43.47	0.0001
ERROR	146	177.76699637	1.21758217		
TOTAL	154	601.18610042			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	0.27331120				
VOLUME	0.68103648	0.09279528	65.58239692	53.86	0.0001
WT	-0.18658422	0.01718485	143.53464293	117.88	0.0001
WT2	0.00573309	0.00309762	4.17079156	3.43	0.0662
COND2	-0.00000005	0.00000001	27.92113768	22.93	0.0001
SF2	-0.00199459	0.00060018	13.44754086	11.04	0.0011
AMP	0.37726358	0.10188766	16.69340135	13.71	0.0003
WASH	0.95595879	0.31048843	11.54212492	9.48	0.0025
CATCH_BS	0.34200420	0.09005875	17.55938654	14.42	0.0002

Interpretation*:

1. Impingement increased as volume increased.
2. and 3. Impingement decreased as water temperature increased; impingement was less sensitive to increases at higher temperatures.
4. As conductivity approached 2.819 mS/cm, impingement increased; i.e., maximum impingement occurred when the salt front was in the vicinity of Indian Point.
5. As the salt front approached Indian Point impingement increased; i.e., maximum impingement occurred when the salt front was in the vicinity of Indian Point.
6. As tidal amplitude increased, impingement increased.
7. Multiple washes, necessitated by high debris loading, increased impingement.
8. As average weekly beach seine C/f increased, impingement increased.

*with all other variables held constant

Table A-34

Stepwise Regression Models for Spottail Shiner Impingement Collections as Functions of Plant/Environmental Parameters, April through December 1978

Indian Point Unit No. 2

R SQUARE = 0.42879578

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	5	69.48792742	13.89758548	20.87	0.0001
ERROR	139	92.56573658	0.66594055		
TOTAL	144	162.05366400			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	0.67403177				
VOLUME	0.12881422	0.05916837	3.15634066	4.74	0.0312
WT	-0.18265777	0.02151450	48.00086397	72.08	0.0001
WT2	0.00997070	0.00230149	12.49881349	18.77	0.0001
SF	-0.01643200	0.00935401	2.05504288	3.09	0.0812
CATCH_BS	0.03132626	0.01595227	2.56807427	3.86	0.0516

Interpretation*:

1. Impingement increased as volume increased.
2. and 3. As water temperature approached 22.9°C, impingement decreased; i.e., minimum impingement occurred when water temperature was about 22.9°C.
4. As the salt front moved up the Hudson, impingement decreased.
5. As average weekly beach seine C/f increased, impingement increased.

*with all other variables held constant

A-34 (Cont'd)

Indian Point Unit No. 3

R SQUARE = 0.71660842

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	9	173.34385397	19.26042822	40.74	0.0001
ERROR	145	68.55094974	0.47276517		
TOTAL	154	241.89480372			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-0.09564730				
VOLUME	0.35368143	0.06355232	14.64222564	30.97	0.0001
WT	-0.09533842	0.01435613	20.85003752	44.10	0.0001
WT2	0.01024480	0.00189122	13.87293497	29.34	0.0001
COND	-0.00016102	0.00004355	6.46387068	13.67	0.0003
COND2	0.00000002	0.00000001	2.66191656	5.63	0.0190
SF	-0.02052200	0.00955952	2.17877666	4.61	0.0335
PPT	-0.42395177	0.20041380	2.11554922	4.47	0.0361
U	-0.58207368	0.19943058	4.02733643	8.52	0.0041
CATCH_BT	3.22661036	1.76245300	1.58454084	3.35	0.0692

Interpretation*:

1. Impingement increased as volume increased.
2. and 3. As water temperature approached 18.4°C, impingement decreased; i.e., minimum impingement occurred when water temperature was about 18.4°C.
4. and 5. As conductivity approached 6.844 mS/cm, impingement decreased; i.e., minimum impingement occurred when conductivity was about 6.844 mS/cm.
6. As the salt front moved up the Hudson, impingement decreased.
7. As average daily precipitation increased, impingement decreased.
8. Impingement decreased at Unit No. 3 when Unit No. 2 was operational.
9. As average biweekly bottom trawl C/f increased, impingement increased.

*with all other variables held constant

Table A-35

Stepwise Regression Models for Striped Bass Impingement Collections as Functions of Plant/Environmental Parameters, April through December 1978

Indian Point Unit No. 2

R SQUARE = 0.72089235

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	8	531.80963262	66.47620408	43.91	0.0001
ERROR	136	205.90055876	1.51397470		
TOTAL	144	737.71019139			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	1.06505658				
VOLUME	0.90200888	0.10595390	109.72518778	72.47	0.0001
WT	-0.21581757	0.02549161	108.51697375	71.68	0.0001
COND	0.00058761	0.00006336	130.23311164	86.02	0.0001
COND2	-0.00000010	0.00000002	51.52661331	34.03	0.0001
WASH	0.99518679	0.42939344	8.13236770	5.37	0.0220
U	-0.61093578	0.30529246	6.06286072	4.00	0.0474
CATCH_BS	0.07265812	0.01298669	47.39034529	31.30	0.0001
CATCH_BT	0.17267980	0.10223466	4.31922006	2.85	0.0935

Interpretation*:

1. Impingement increased as volume increased.
2. As water temperature increased, impingement decreased.
3. and 4. As conductivity approached 5.757 mS/cm, impingement increased; i.e., maximum impingement occurred when conductivity was about 5.757 mS/cm.
5. Multiple washes, necessitated by high debris loading, increased impingement.
6. Impingement decreased at Unit No. 2 when Unit No. 3 was operational.
7. Impingement increased as average weekly beach seine C/f increased.
8. Impingement increased as average biweekly bottom trawl C/f increased.

*with all other variables held constant

A-35 (Cont'd)

Indian Point Unit No. 3

R SQUARE = 0.72429428

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	9	327.50654488	36.38961610	42.32	0.0001
ERROR	145	124.66676899	0.85977082		
TOTAL	154	452.17331387			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	1.79671604				
VOLUME	0.55524135	0.06650745	59.92467343	69.70	0.0001
COND	0.00025268	0.00004460	27.59327238	32.09	0.0001
COND2	-0.00000006	0.00000001	20.56039284	23.91	0.0001
MNAT	-0.07047595	0.01375351	22.57551897	26.26	0.0001
SF2	-0.00227529	0.00048035	19.29069897	22.44	0.0001
AMP	0.26250941	0.08584958	8.03889011	9.35	0.0027
WASH	1.17984757	0.26192042	17.44599732	20.29	0.0001
U	-1.42556770	0.24474879	29.16871355	33.93	0.0001
CATCH_BT	0.44044953	0.08308483	24.16192429	28.10	0.0001

Interpretation*;

1. Impingement increased as volume increased.
2. and 3. As conductivity approached 4.925 mS/cm, impingement increased; i.e., maximum impingement occurred when conductivity was about 4.925 mS/cm.
4. As average minimum air temperature increased, impingement decreased.
5. As the salt front approached Indian Point impingement increased; i.e., maximum impingement occurred when the salt front was in the vicinity of Indian Point.
6. As tidal amplitude increased, impingement increased.
7. Multiple washes, necessitated by high debris loading, increased impingement.
8. Impingement decreased at Unit No. 3 and Unit No. 2 was operational.
9. Impingement increased as average biweekly bottom trawl C/f increased.

*with all other variables held constant

Table A-36

Stepwise Regression Models for Atlantic Tomcod Impingement Collections as Functions of Plant/Environmental Parameters, April through December 1978

Indian Point Unit No. 2

R SQUARE = 0.79927228

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	9	843.33978114	93.70442013	59.73	0.0001
ERROR	135	211.79474969	1.56885000		
TOTAL	144	1055.13453083			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-2.30197882				
VOLUME	0.75237668	0.10884043	74.96724376	47.78	0.0001
WT2	0.02158737	0.00364231	55.10970295	35.13	0.0001
COND	-0.00039258	0.00006167	63.58115394	40.53	0.0001
DCOND	0.00018820	0.00011326	4.33184361	2.76	0.0989
MNAT	0.04823114	0.02299781	6.90022675	4.40	0.0378
AMP	0.66257177	0.13694503	36.72440198	23.41	0.0001
U	0.98649461	0.40418346	9.34574206	5.96	0.0160
CATCH_BS	-0.62840817	0.31211959	6.35950052	4.05	0.0461
CATCH_BT	0.01521254	0.00423357	20.25678983	12.91	0.0005

Interpretation*:

1. Impingement increased as volume increased.
2. As water temperature approached 13.7°C, impingement decreased; i.e., minimum impingement occurred when water temperature was about 13.7°C.
3. As conductivity increased, impingement decreased.
4. As change in conductivity from previous day increased, impingement increased.
5. As average minimum air temperature increased, impingement increased.
6. As tidal amplitude increased, impingement increased.
7. Impingement increased at Unit No. 2 when Unit No. 3 was operational.
8. Impingement decreased as average weekly beach seine C/f increased.
9. Impingement increased as average biweekly bottom trawl C/f increased.

*with all other variables held constant

A-36 (Cont'd)

Indian Point Unit No. 3

R SQUARE = 0.50311782

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	9	186.99405610	20.77711734	16.31	0.0001
ERROR	145	184.67645589	1.27363073		
TOTAL	154	371.67051199			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-1.79679635				
VOLUME	0.53600102	0.10112037	35.78470806	28.10	0.0001
WT	0.04748996	0.01774891	9.11809193	7.16	0.0083
WT2	0.01890961	0.00311765	46.85471982	36.79	0.0001
COND2	-0.00000003	0.00000001	6.64506366	5.22	0.0238
DCOND	-0.00029066	0.00010846	9.14706095	7.18	0.0082
SF2	-0.00168491	0.00064056	8.81207479	6.92	0.0095
AMP	0.49833887	0.10560364	28.36189818	22.27	0.0001
WASH	0.74211064	0.31584729	7.03115279	5.52	0.0201
CATCH_BT	-0.01605874	0.00779486	5.40566783	4.24	0.0412

Interpretation*:

1. Impingement increased as volume increased.
2. and 3. As water temperature approached 12.4°C, impingement decreased; i.e., minimum impingement occurred when water temperature was about 12.4°C.
4. As conductivity approached 2.819 mS/cm, impingement increased; i.e., maximum impingement occurred when conductivity was about 2.819 mS/cm.
5. As change in conductivity from previous day increased, impingement decreased.
6. As the salt front approached Indian Point, impingement increased,; i.e., minimum impingement occurred when the salt front was in the vicinity of Indian Point.
7. As tidal amplitude increased, impingement increased.
8. Multiple washes, necessitated by high debris loading, increased impingement.
9. Impingement increased as average biweekly bottom trawl C/f decreased.

*with all other variables held constant

Table A-37

Stepwise Regression Models for White Catfish Impingement Collections as Functions of Plant/Environmental Parameters, April through December 1978

Indian Point Unit No. 2

R SQUARE = 0.58955216

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	7	178.51056007	25.50150858	28.11	0.0001
ERROR	137	124.27954642	0.90714997		
TOTAL	144	302.79010649			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	0.04791831				
VOLUME	0.26928825	0.07856549	10.65737476	11.75	0.0008
WT	-0.14364783	0.01719306	63.32433546	69.81	0.0001
COND2	-0.00000003	0.00000001	5.53716297	6.10	0.0147
AMP	0.31025213	0.09723122	9.23628203	10.18	0.0018
WASH	1.08442357	0.33081112	9.74802844	10.75	0.0013
U	0.45248085	0.21506016	4.01568434	4.43	0.0372
CATCH_BT	0.22357320	0.10359097	4.22546736	4.66	0.0327

Interpretation*:

1. Impingement increased as volume increased.
2. As water temperature increased, impingement decreased.
3. As conductivity approached 2.819 mS/cm, impingement increased; i.e., maximum impingement occurred when conductivity was about 2.819 mS/cm.
4. As tidal amplitude increased, impingement increased.
5. Multiple washes, necessitated by high debris loading, increased impingement.
6. Impingement increased at Unit No. 2 when Unit No. 3 was operational.
7. Impingement increased as average biweekly bottom trawl C/f increased.

*with all other variables held constant

A-37 (Cont'd)

Indian Point Unit No. 3

R SQUARE = 0.67789544

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	6	200.68784010	33.44797335	51.91	0.0001
ERROR	148	95.35757756	0.64430796		
TOTAL	154	296.04541766			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	0.83839629				
VOLUME	0.42150621	0.05523572	37.51988349	58.23	0.0001
WT	-0.05518835	0.01390967	10.14273094	15.74	0.0001
SF	-0.03342830	0.00877449	9.35143402	14.51	0.0002
WASH	1.25047743	0.22345204	20.17792769	31.32	0.0001
U	-0.58889539	0.22502459	4.41275529	6.85	0.0098
CATCH_BS	-5.01518930	1.25237548	10.33234850	16.04	0.0001

Interpretation*:

1. Impingement increased as volume increased.
2. As water temperature increased, impingement decreased.
3. As the salt front moved up the Hudson, impingement decreased.
4. Multiple washes, necessitated by high debris loading, increased impingement.
5. Impingement decreased at Unit No. 3 when Unit No. 2 was operational.
6. Impingement decreased as average weekly beach seine C/f increased.

*with all other variables held constant

Table A-38

Stepwise Regression Models for White Perch Impingement Collections as Functions of Plant/Environmental Parameters, April through December 1978

Indian Point Unit No. 2

R SQUARE = 0.74286271

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	9	692.61850448	76.95761161	43.33	0.0001
ERROR	135	239.74557530	1.77589315		
TOTAL	144	932.36407978			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	0.85702474				
VOLUME	1.06814689	0.11487634	153.53860093	86.46	0.0001
WT	-0.30242589	0.04643015	75.34502844	42.43	0.0001
COND	0.00061114	0.00007964	104.57166946	58.88	0.0001
COND2	-0.00000011	0.00000002	65.72753346	37.01	0.0001
MNAT	0.09377565	0.03395185	13.54783877	7.63	0.0065
SF2	-0.00160697	0.00080993	6.99091653	3.94	0.0493
WASH	1.20835022	0.47019777	11.72846969	6.60	0.0113
U	1.90678713	0.35097687	52.41604783	29.52	0.0001
CATCH_BT	0.07755982	0.01723142	35.97892978	20.26	0.0001

Interpretation*:

1. Impingement increased as volume increased.
2. As water temperature increased impingement decreased.
3. and 4. As conductivity approached 5.597 mS/cm, impingement increased; i.e., maximum impingement occurred when conductivity was about 5.597 mS/cm.
5. As average minimum air temperature increased, impingement increased.
6. As the salt front approached Indian Point, impingement increased; i.e., minimum impingement occurred when the salt front was in the vicinity of Indian Point.
7. Multiple washes, necessitated by high debris loading, increased impingement.
8. Impingement increased at Unit No. 2 when Unit No. 3 was operational.
9. Impingement increased as average biweekly bottom trawl C/f increased.

*with all other variables held constant

A-38 (Cont'd)

Indian Point Unit No. 3

R SQUARE = 0.80985839

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	9	697.93551565	77.54839063	68.62	0.0001
ERROR	145	163.86393464	1.13009610		
TOTAL	154	861.79945029			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	3.29720464				
VOLUME	1.11315600	0.09275068	162.77705653	144.04	0.0001
WT	-0.13887120	0.03016300	23.95469276	21.20	0.0001
WT2	0.00912712	0.00296105	10.73717400	9.50	0.0025
COND2	-0.00000004	0.00000001	16.58854943	14.68	0.0002
MNAT	-0.05940291	0.02238489	7.95830816	7.04	0.0088
SF2	-0.00173551	0.00061762	8.92332945	7.90	0.0056
WASH	1.35891854	0.30103329	23.02889846	20.38	0.0001
U	-1.29743001	0.30035492	21.08694910	18.66	0.0001
CATCH_BT	0.00912728	0.00335267	8.37560253	7.41	0.0073

Interpretation*:

1. Impingement increased as volume increased.
2. and 3. As water temperature approached 21.3°C, impingement decreased; i.e., minimum impingement occurred when water temperature was about 21.3°C.
4. As conductivity approached 2.819 mS/cm, impingement increased; i.e., maximum impingement occurred when conductivity was about 2.819 mS/cm.
5. As average maximum air temperature increased, impingement decreased.
6. As the salt front approached Indian Point, impingement increased; i.e. maximum impingement occurred when the salt front was in the vicinity of Indian Point.
7. Multiple washes, necessitated by high debris loading, increased impingement.
8. Impingement decreased at Unit No. 3 when Unit No. 2 was operational.
9. Impingement increased as average biweekly bottom trawl C/f increased.

*with all other variables held constant

Table A-39

Stepwise Regression Models for Weakfish Impingement Collections as Functions of Plant/Environmental Parameters, April through December 1978

Indian Point Unit No. 2

R SQUARE = 0.67305505

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	8	642.39151213	80.29893902	35.00	0.0001
ERROR	136	312.04975185	2.29448347		
TOTAL	144	954.44126398			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-3.65860419				
VOLUME	0.86306330	0.12444729	110.35685956	48.10	0.0001
COND	0.00071977	0.00008117	180.42674199	78.64	0.0001
COND2	-0.00000007	0.00000002	28.85172946	12.57	0.0005
DCOND	-0.00029893	0.00013820	10.73529015	4.68	0.0323
MXAT	0.03246630	0.01672375	8.64735609	3.77	0.0543
AMP	0.43700034	0.15572663	18.06852518	7.87	0.0057
PPT	-1.08408334	0.60288149	7.41901715	3.23	0.0744
CATCH_BT	0.60696752	0.11743445	61.29496689	26.71	0.0001

Interpretation*:

1. Impingement increased as volume increased.
2. and 3. As conductivity approached 7.960 mS/cm, impingement increasd; i.e., maximum impingement occurred when conductivity was about 7.960 mS/cm.
4. As change in conductivity from previous day increased, impingement decreased.
5. As average maximum air temperature increased, impingement increased.
6. As tidal amplitude increased, impingement increased.
7. As average daily precipitation increased, impingement decreased.
8. Impingement increased as average biweekly bottom trawl C/f increased.

*with all other variables held constant

A-39 (Cont'd)

Indian Point Unit No. 3

R SQUARE = 0.65714673

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	8	157.09874101	19.63734263	34.98	0.0001
ERROR	146	81.96315050	0.56139144		
TOTAL	154	239.06189151			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	0.14340517				
VOLUME	0.26299899	0.05079191	15.05167600	26.81	0.0001
WT	0.07337874	0.02415929	5.17890508	9.23	0.0028
COND	0.00018306	0.00003748	13.38831382	23.85	0.0001
DCOND	-0.00016262	0.00007126	2.92370659	5.21	0.0239
MNAT	-0.06049230	0.01757959	6.64734551	11.84	0.0008
SF	-0.02750500	0.00972305	4.49245695	8.00	0.0053
SF2	-0.00106835	0.00037995	4.43854019	7.91	0.0056
CATCH_BT	0.63694567	0.10249513	21.68024010	38.62	0.0001

Interpretation*:

1. Impingement increased as volume increased.
2. As water temperature increased, impingement increased.
3. As conductivity increased, impingement increased.
4. As change in conductivity from previous day increased, impingement decreased.
5. As average minimum air temperature increased, impingement decreased.
6. and 7. As the salt front approached RM 30, impingement increased; i.e., maximum impingement occurred when the salt front was in the vicinity of RM 30.
8. Impingement increased as average biweekly bottom trawl C/f increased.

*with all other variables held constant

APPENDIX B

RIVER STUDIES

TABLE OF CONTENTS

APPENDIX B.1

Species Collected in Impingement, Nearfield, and Riverwide Sampling during 1978

Table B-1

Number of Species Collected Each Month in Impingement, Nearfield, and Riverwide Sampling in Hudson River Estuary, 1978

Month	Impingement	Nearfield				Riverwide	
		Beach Seine	Unlined Bottom Trawl	Lined Bottom Trawl	Surface Trawl	Beach Seine	Bottom Trawl
Jan	39	NS*	NS	NS	NS	NS	NS
Feb	21	NS	NS	NS	NS	NS	NS
Mar	30	NS	NS	NS	NS	NS	NS
Apr	33	20	8	8	NS	36	17
May	29	25	8	10	NS	41	18
Jun	27	27	13	12	NS	54	17
Jul	27	31	15	13	11	53	17
Aug	29	31	15	16	5	52	22
Sep	35	28	13	12	7	45	18
Oct	41	31	13	13	4	41	17
Nov	42	24	13	14	7	39	18
Dec	51	14	15	13	6	26	NS

*NS = No Sampling

Table B-2

Species Collected in Impingement (Indian Point Units No. 2 and No. 3) Riverwide and Nearfield Sampling in Hudson River Estuary, 1975 through 1978

Species	Salinity Preference*	Impingement				Riverwide					Nearfield				
		1975	1976	1977	1978	1974	1975	1976	1977	1978	1974	1975	1976	1977	1978
White Perch	e	X**	X	X	X	X	X	X	X	X	X	X	X	X	X
Blueback Herring	e	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Atlantic Tomcod	e	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Bay Anchovy	e	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hogchoker	e	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Striped Bass	e	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Rainbow Smelt	e	X	X	X	X	X	X	X	X	X	X	X	X	X	X
American Shad	e	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Alewife	e	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Weakfish	m	X	X	X	X	X	X	X	X	X	X	X	X	X	X
White Catfish	f	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Spottail Shiner	f	X	X	X	X	X	X	X	X	X	X	X	X	X	X
American Eel	e	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Pumpkinseed	f	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Gizzard Shad	f	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tesselated Darter	f	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Bluefish	m	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Northern Pipefish	m	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Atlantic Menhaden	m	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Goldfish	f	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Banded Killifish	f	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Yellow Perch	f	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Bluegill	f	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Golden Shiner	f	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Crevalle Jack	m	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Three-Spined Stickleback	e	X	X	X	X	X	X	X	X	X	X				
Brown Bullhead	f	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Silver Hake	m	X	X	X	X	X	X		X						
Striped Searobin	m			X	X		X			X					
White Bass	f	X	X	X	X				X					X	
Squirrel or Red Hake	m	X			X										
Butterfish	m	X	X	X	X	X		X		X					
Carp	f	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Atlantic Sturgeon	e	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Largemouth Bass	f	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Lookdown	m			X	X	X	X	X	X						

*m = marine, e = euryhaline, f = freshwater
**X - indicate species was collected

B-2 (Cont'd)

Species	Salinity Preference*	Impingement 1975	Impingement 1976	Impingement 1977	Impingement 1978	Riverwide 1974	Riverwide 1975	Riverwide 1976	Riverwide 1977	Riverwide 1978	Nearfield 1974	Nearfield 1975	Nearfield 1976	Nearfield 1977	Nearfield 1978
Brown Trout	f		X**	X				X	X	X				X	
Brook Trout	f		X						X	X					
Central Mudminnow	f			X				X							
Redfin Pickerel	f			X		X	X	X	X	X		X			
Northern Pike	f			X			X	X	X	X	X				
Chain Pickerel	f		X			X	X	X	X	X	X				X
Cutlips Minnow	f			X		X	X	X		X					
Satinfin Shiner	f			X		X	X	X	X	X					
Blacknose Dace	f			X		X	X	X	X	X	X				X
Longnose Dace	f						X	X	X	X				X	
Northern Hog Sucker	f			X		X		X	X	X					
Black Bullhead	f								X				X		
White Hake	m	X													
Brook Stickleback	f			X		X		X	X		X	X		X	
Green Sunfish	f						X		X			X			
Atlantic Croaker	m		X	X				X	X		X		X		
Tautog	m			X											
Striped Mullet	m		X			X		X	X						
Silvery Minnow	f					X	X	X	X	X	X				
Comely Shiner	f					X									
Fallfish	f					X	X	X	X	X					X
Kingfish	m					X	X	X		X					
Bridle Shiner	f					X		X							
Fathead Minnow	f					X	X	X	X	X					
Log Perch	f					X		X	X	X					
Trout Perch	f					X	X	X	X	X					
Mimic Shiner	f					X									
Bluntnose Minnow	f					X	X	X	X	X					
Rosyface Shiner	f					X									
Round Herring	m					X									
Seaboard Goby	m					X									
Atlantic Herring	m						X			X					
Creek Chub	f						X	X	X	X					
Striped Killifish	m							X							
Naked Goby	e														
Striped Anchovy	m						X								
Yellow Bullhead	f						X								

*m = marine, e = euryhaline, f = freshwater
**X - indicate species was collected

B-2 (Cont'd)

Species	Salinity Preference*	Impingement				Riverwide					Nearfield				
		1975	1976	1977	1978	1974	1975	1976	1977	1978	1974	1975	1976	1977	1978
Winter Flounder	m	X**	X	X	X	X	X	X	X	X				X	X
Black Crappie	f	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mummichog	e	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sea Lamprey	m	X	X	X	X	X			X			X			
Atlantic Silverside	m	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hickory Shad	e				X		X			X					X
Redbreast Sunfish	f	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Rough Silverside	m	X		X	X		X	X	X	X		X	X	X	X
White Mullet	m		X		X	X	X	X	X	X		X			X
Atlantic Needlefish	m		X	X	X	X	X	X	X	X	X	X	X	X	X
Four-Spine Stickleback	e	X	X	X	X	X	X	X	X	X	X	X	X	X	X
White Sucker	f	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Shortnose Sturgeon	e	X	X	X	X		X	X	X	X	X	X	X		X
White Crappie	f	X	X	X	X	X	X	X	X	X				X	
Black Sea Bass	m				X										
Four-Beard Rockling	m			X	X										
Silver Perch	m				X	X					X				
Spot	m		X	X	X	X	X	X	X				X	X	
Grubby	m		X	X	X										
Common Shiner	f		X	X	X	X	X	X	X	X	X			X	
Emerald Shiner	f	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Smallmouth Bass	f	X	X	X	X	X	X	X	X	X					
Moonfish	m				X			X				X			
Scup	m			X	X	X		X							
Smallmouth Flounder	m				X										
Northern Puffer	m		X	X	X				X						
Northern Searobin	m			X	X					X					
Summer Flounder	m		X	X	X	X	X	X	X	X	X				
Windowpane	m				X		X								
Tidewater Silverside	e			X	X	X	X	X	X	X	X	X	X	X	X
Sea Horse	m				X										
Rock Bass	f	X		X	X	X	X	X	X	X				X	
Spotfin Shiner	f			X	X	X	X	X	X	X	X	X			
Eastern Mudminnow	f	X		X	X		X								
Conger Eel	m				X										
Rainbow Trout	f		X												
Silver Lamprey	f				X										
Totals	m- 40	50	58	72	72	75	74	78	76	72	50	47	43	48	47
	e- 18														
	f- 52														
Totals for All Years	110	88				99					67				

*m = marine, e = euryhaline, f = freshwater
**X - indicate species was collected

APPENDIX B.2

Annual Abundance Trends for Selected Fish Species
1974 through 1978

This appendix of annual abundance trends is provided as background for the discussion of yearly nearfield abundance trends presented in Section IV.D. Variations in nearfield abundance trends may indicate actual changes in population abundance within the estuary, or may simply reflect regional shifts in distribution. Thus, to put the discussion of nearfield abundance in perspective, beach seine survey and interregional bottom trawl survey data (description of each survey in Appendix C) collected over a five-year period from 1974 through 1978 were analyzed by two-way analysis of variance (ANOVA) (Sokal and Rohlf 1969) to determine: 1) significant changes in abundance (C/f) among years (year effect), 2) differences in abundance (C/f) among regions (region effect), and 3) the consistency of the riverwide spatial distribution (distribution pattern) among years (year x region interraction). Any main effects (year or region) which were found to be significant ($\alpha = 0.05$) were further analyzed by Multiple Comparison Test (Duncan's New Multiple Range Test, Kirk 1968).

Of the thirteen representative and important species considered, data for four species was analyzed separately by age group (young-of-the-year and yearling and older). For species in which catches of young-of-the-year were low (e.g., hogchoker), or in which peak concentrations of young-of-the-year and yearling and older occurred concurrently (e.g., bay anchovy), C/f values for all age groups were combined and analyzed. For alewife, blueback herring, weakfish, and bluefish, only young-of-the-year were considered because other age groups were not commonly caught.

Generally, data from the survey which had the highest C/f values for each species and age group combination were used in the analysis. However, for species in which C/f values from both beach seine and bottom trawls were high (e.g., white perch), data from both surveys were used. A listing of the species, age group, and gear combinations used in the analysis appears in Appendix Table B-3.

Regional biweekly C/f values over an eight-week period (four biweekly intervals) were used as replicates in the ANOVA and were computed as the sum of the biweekly collections for each species divided by the total number of samples taken within the biweekly period for each region. The biweekly C/f values were transformed, $\log_e$ (biweekly C/f + 1), so that all assumptions of the ANOVA were satisfied.

Table B-3

Species*, Age Group, and Gear Used in Analysis of Riverwide Abundance and Distribution Trends from 1974 through 1978

Species	Age Group	Gear
White Perch	Young-of-the-Year	Beach Seine
	Yearling and Older	Beach Seine
	Yearling and Older	Bottom Trawl
Striped Bass	Young-of-the-Year	Beach Seine
	Yearling and Older	Beach Seine
Atlantic Tomcod	Young-of-the-Year	Bottom Trawl
	Yearling and Older	Bottom Trawl
Spottail Shiner	Young-of-the-Year	Beach Seine
	Yearling and Older	Beach Seine
White Catfish	All Age Groups Combined	Bottom Trawl
Bay Anchovy	All Age Groups Combined	Beach Seine
	All Age Groups Combined	Bottom Trawl
Weakfish	Young-of-the-Year	Bottom Trawl
Alewife	Young-of-the-Year	Bottom Trawl
	Young-of-the-Year	Beach Seine
Blueback Herring	Young-of-the-Year	Beach Seine
American Shad	Young-of-the-Year	Beach Seine
Hogchoker	All Age Groups Combined	Bottom Trawl
Bluefish	Young-of-the-Year	Beach Seine
Rainbow Smelt	All Age Groups Combined	Bottom Trawl

*Data for Atlantic and Shortnose Sturgeon was not analyzed because of the high percentage of low or zero catches

The period of peak abundance in each year was used in the analysis because it assured that maximum recruitment to the sampling gear had occurred. Because the timing of peak abundance varied from year to year, biweekly C/f values for each year were examined and the eight-week period which had the highest C/f values in each year was chosen for use in the analysis. Use of an eight-week period (four biweekly periods) minimized bias in the analysis resulting from small sample size, and generally corresponded to a normal time span of peak catches. In the case of young-of-the-year some species known to undergo fall (October-November) emigration (e.g., blueback herring), selection of the period of peak abundance was limited to the time prior to emigration. Generally young-of-the-year were most abundant from mid-summer through early fall, while yearling and older age individuals were most abundant in spring. A listing of the time period chosen for each species, age group, and gear combination appears in Appendix Table B-4.

For this analysis, the twelve regional divisions of the river that are conventionally used in TI studies (Figure III-1) were consolidated into river super regions as follows:

Super Region 1	=	RM 12-23 (Yonkers Region)
Super Region 2	=	RM 24-38 (Tappan Zee and Croton-Haverstraw Regions)
Super Region 3	=	RM 39-46 (Indian Point Region)
Super Region 4	=	RM 47-61 (West Point and Cornwall Regions)
Super Region 5	=	RM 62-152 (Poughkeepsie through Albany Regions)

The use of these five super regions assured that sampling effort among regions was fairly equal, thus minimizing bias which might result from unequal sample sizes. The Indian Point region was treated separately because it includes the nearfield standard stations. The Yonkers region

Table B-4

Time Periods of Peak Abundance Used in Analysis of Riverwide Abundance and Distribution Trends for Each Year, 1974 through 1978

Species	Age* Group	Gear	1974	1975	1976	1977	1978
White Perch	YOY	Seine	25 Aug - 19 Oct	27 Jul - 20 Sep	25 Jul - 18 Sep	10 Jul - 03 Sep	30 Jul - 23 Sep
	Older	Seine	19 May - 13 Jul	18 May - 12 Jul	16 May - 10 Jul	15 May - 09 Jul	21 May - 15 Jul
	Older	Trawl	24 Mar - 18 May	06 Apr - 31 May	04 Apr - 29 May	03 Apr - 28 May	09 Apr - 03 Jun
Striped Bass	YOY	Seine	11 Aug - 05 Oct	13 Jul - 06 Sep	11 Jul - 04 Sep	10 Jul - 03 Sep	16 Jul - 09 Sep
	Older	Seine	21 Apr - 15 Jun	20 Apr - 14 Jun	21 Mar - 14 May	03 Apr - 28 May	23 Apr - 17 Jun
Atlantic Tomcod	YOY	Trawl	14 Jul - 07 Sep	04 May - 28 Jun	25 Jul - 18 Sep	15 May - 09 Jul	18 Jun - 12 Aug
	Older	Trawl	07 Apr - 01 Jun	06 Apr - 31 May	25 Jul - 18 Sep	03 Apr - 28 May	23 Apr - 17 Jun
Spottail Shiner	YOY	Seine	14 Jul - 07 Sep	13 Jul - 06 Sep	25 Jul - 18 Sep	26 Jun - 20 Aug	16 Jul - 09 Sep
	Older	Seine	21 Apr - 15 Jun	06 Apr - 31 May	02 May - 26 Jun	17 Apr - 11 Jun	07 May - 11 Jul
White Catfish	All	Trawl	Apr through Dec	Apr through Dec	Apr through Dec	Apr through Dec	Apr through Dec
Bay Anchovy	All	Trawl	28 Jul - 21 Sep	10 Aug - 04 Oct	22 Aug - 16 Oct	24 Jul - 17 Sep	13 Aug - 07 Oct
	All	Seine	05 May - 29 Jun	18 May - 12 Jul	02 May - 26 Jun	15 May - 09 Jul	07 May - 01 Jul
Weakfish†	YOY	Trawl	28 Jul - 05 Oct	27 Jul - 04 Oct	08 Aug - 16 Oct	07 Aug - 15 Oct	16 Jul - 23 Sep
Alewife	YOY	Trawl	06 Oct - 30 Nov	05 Oct - 29 Nov	03 Oct - 27 Nov	18 Sep - 12 Nov	10 Sep - 04 Nov
	YOY	Seine	30 Jun - 24 Aug	29 Jun - 23 Aug	25 Jul - 18 Sep	26 Jun - 20 Aug	02 Jul - 26 Aug
Blueback Herring	YOY	Seine	30 Jun - 24 Aug	27 Jul - 20 Sep	25 Jul - 18 Sep	10 Jul - 03 Sep	16 Jul - 09 Sep
American Shad	YOY	Seine	28 Jul - 21 Sep	15 Jun - 09 Aug	11 Jul - 04 Sep	26 Jun - 20 Aug	18 Jun - 12 Aug
Hogchoker	All	Trawl	06 Oct - 30 Nov	10 Aug - 04 Oct	08 Aug - 02 Oct	18 Sep - 12 Nov	24 Sep - 18 Nov
Bluefish	YOY	Seine	30 Jun - 24 Aug	01 Jun - 26 Jun	13 Jun - 07 Aug	12 Jun - 06 Aug	02 Jul - 26 Aug
Rainbow Smelt	All	Trawl	16 Jun - 10 Aug	15 Jun - 09 Aug	13 Jun - 07 Aug	29 May - 23 Jul	02 Jul - 26 Aug

* YOY = Young-of-the-Year
Older = Yearling and Older
All = All Age Groups Combined

† The time period for weakfish spans a ten week period

was treated separately because its proximity to the mouth of the river (and highest salinities) often separates the distribution of fish in this region from the remainder of the study area.

Beach seine data were available from all five regions but bottom trawling was limited almost entirely to super regions 2, 3, and 4; therefore, only the three center super regions were used in the analysis of interregional bottom trawl survey data. To assure comparability between riverwide data and standard stations bottom trawl data, the interregional trawl C/f data was adjusted as described in TI 1980 (in preparation).

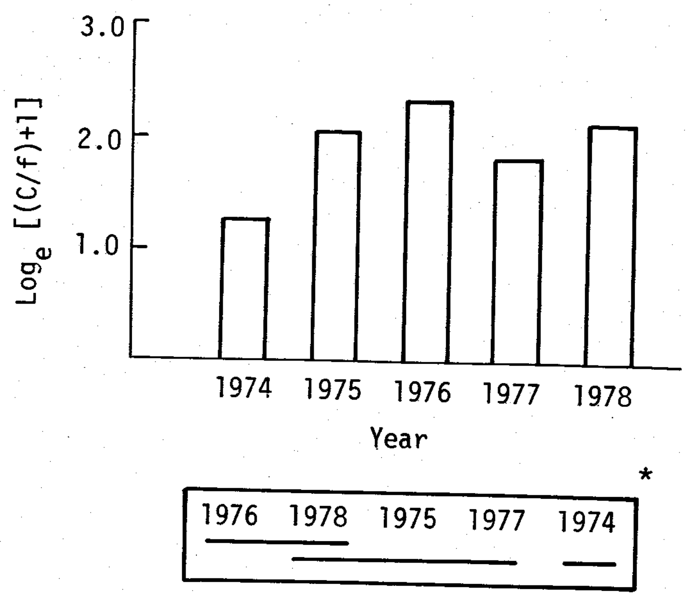
The results of this analysis pertaining to regional differences in abundance and the consistency of the geographic distribution patterns have been treated in Section IV.D., while the results of the analysis pertaining to changes in annual abundance are presented in this appendix.

a. White Perch

The abundance (C/f) of young-of-the-year white perch changed significantly over the five-year period from 1974 through 1978, with highest abundances in 1976 and 1978 and lowest in 1974 (Figure B-1). Abundances of yearling and older white perch in beach seines also fluctuated during the five-year period. Catch-per-effort values in 1974 and 1976 were significantly greater than those in 1977 (Figure B-2). Interregional bottom trawl surveys indicated a similar pattern of fluctuating abundance of yearling and older white perch, and bottom trawl C/fs were highest in 1978 and lowest in 1975 (Figure B-3).

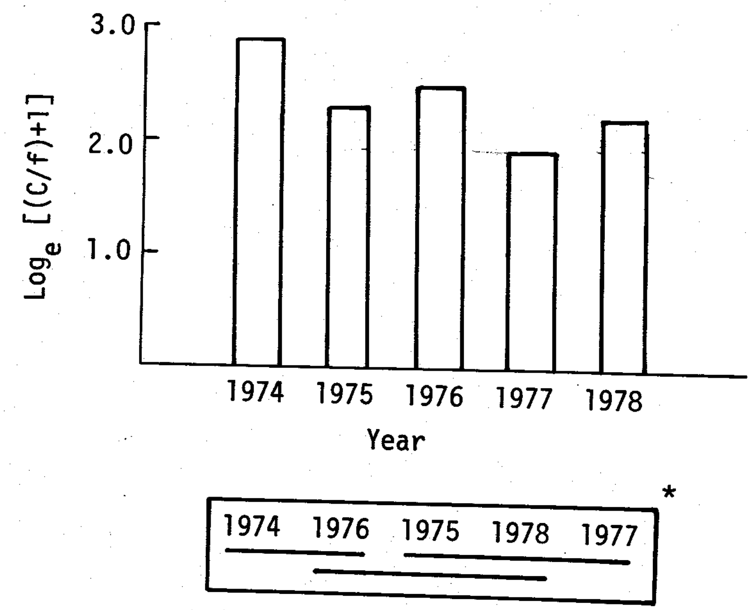
b. Striped Bass

Young-of-the-year striped bass abundance differed significantly over the five-year period, being highest in 1977 and lowest in 1974 and



*Years are shown in order of descending C/f (left to right), a common underline indicates no significant difference ($p<0.05$)

Figure B-1. Mean Yearly C/f Values (Transformed) and Results of Multiple Comparison Test* for Young-of-the-Year White Perch Collected during Beach Seine Surveys, 1974 through 1978



*Years are shown in order of descending C/f (left to right), a common underline indicates no significant difference ($p<0.05$)

Figure B-2. Mean Yearly C/f Values (Transformed) and Results of Multiple Comparison Test* for Yearling and Older White Perch Collected during Beach Seine Surveys, 1974 through 1978

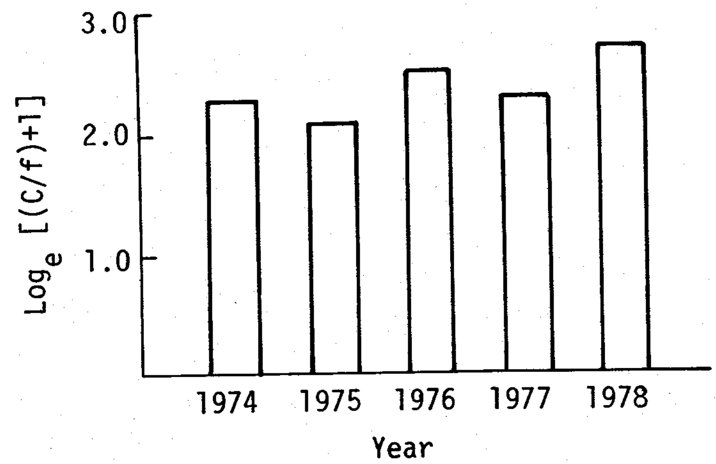
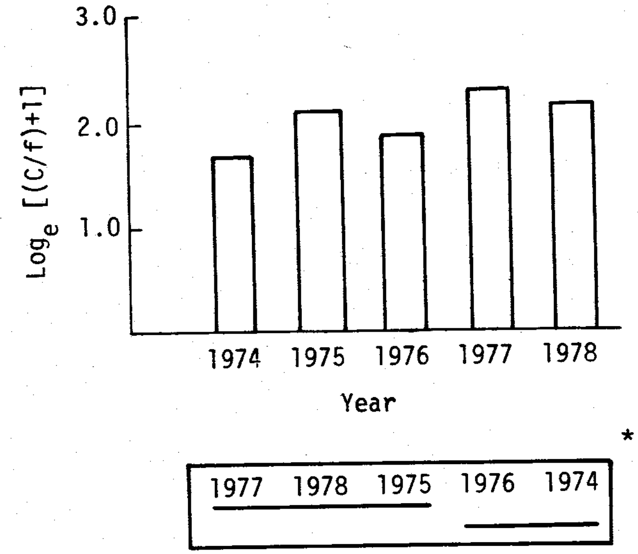


Figure B-3. Mean Yearly C/f Values (Transformed) for Yearling and Older White Perch Collected during Interregional Bottom Trawl Surveys, 1974 through 1978 (There Was No Significant Difference Among Years)



*Years are shown in order of descending C/f (left to right), a common underline indicates no significant difference ($p<0.05$)

Figure B-4. Mean Yearly C/f Values (Transformed) and Results of Multiple Comparison Test* for Young-of-the-Year Striped Bass Collected during Beach Seine Surveys, 1974 through 1978 showing no discernible trend (Figure B-4). The abundance of yearling and older striped bass revealed a downward trend from 1974 through 1977 and then an increase in 1978. The analysis indicated a significant difference in abundance over the five-year period; C/f in 1974 was significantly greater ($\alpha = 0.05$) than in any other year from 1975 through 1978 (Figure B-5).

c. Atlantic Tomcod

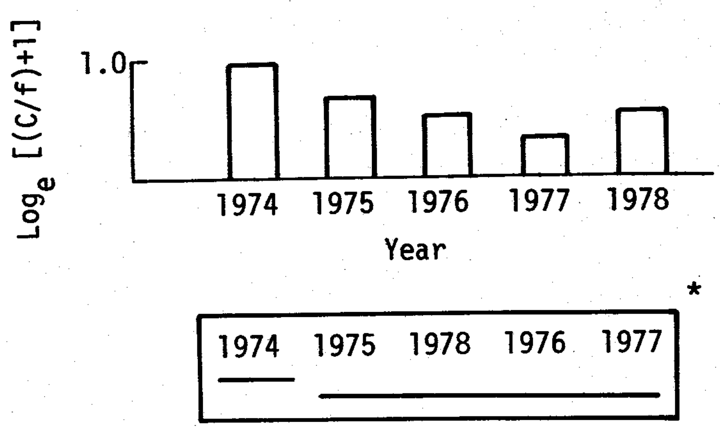
There was a significant difference in the abundance of young-of-the-year Atlantic tomcod during 1974 through 1978, as C/f values in 1977 and 1976 were significantly greater ($\alpha = 0.05$) than in the other three years (Figure B-6). Abundance of yearling and older Atlantic tomcod also differed signficantly over the five-year period and showed patterns of abundance similar to young-of-the-year Atlantic tomcod. Catches (C/f) were highest in 1976 and 1977, and lower in the three years remaining (Figure B-7). Neither age group showed overall upward or downward trends in abundance during the five-year period.

d. Spottail Shiner

Abundance of young-of-the-year spottail shiner fluctuated during the five-year period. Catch-per-efforts in 1975, 1976, and 1978 were significantly greater ($\alpha = 0.05$) than in 1974 and 1977 (Figure B-8). Yearling and older spottail shiner also showed a fluctuating abundance pattern, although it differed from the young-of-the-year pattern. Catches (C/f) for yearling and older spottail shiner were highest in 1974 and 1976, and lowest in 1978 (Figure B-9).

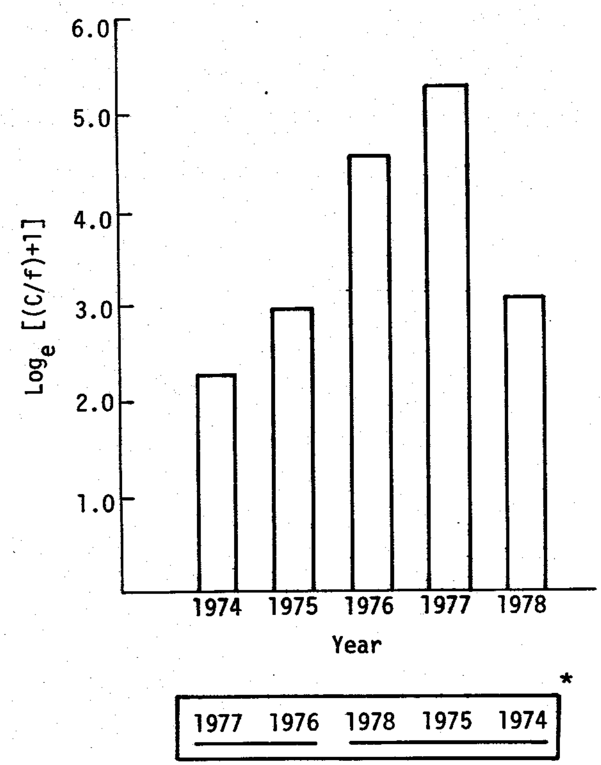
e. White Catfish

Abundance of white catfish increased from 1974 through 1976, remained high in 1977, and declined in 1978 (Figure B-10).



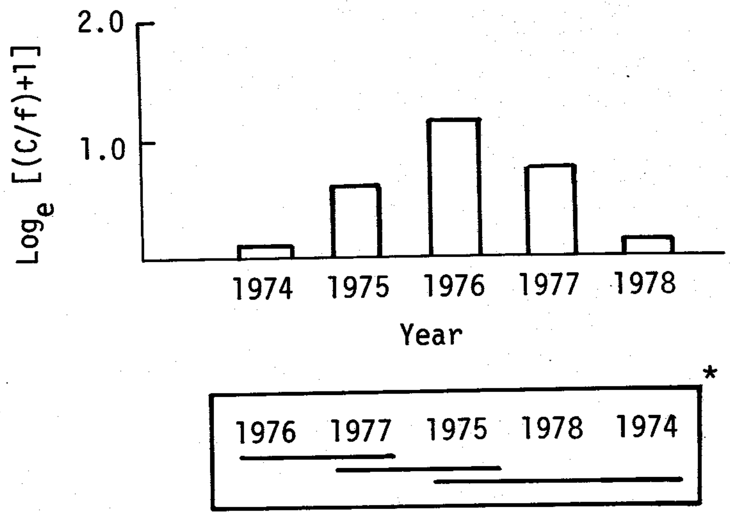
*Years are shown in order of descending C/f (left to right), a common underline indicates no significant difference ($p<0.05$)

Figure B-5. Mean Yearly C/f Values (Transformed) and Results of Multiple Comparison Test* for Yearling and Older Striped Bass Collected during Beach Seine Surveys, 1974 through 1978



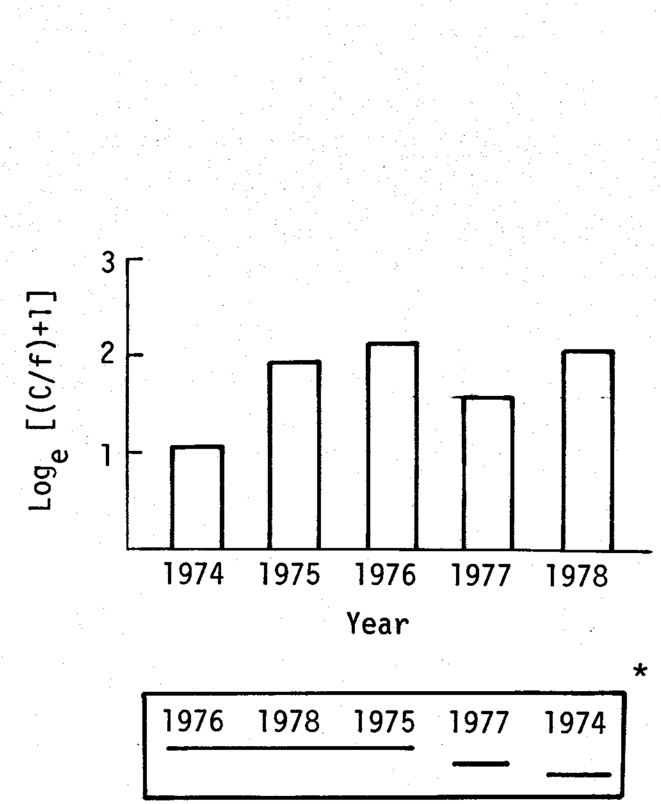
*Years are shown in order of descending C/f (left to right), a common underline indicates no significant difference ($p<0.05$)

Figure B-6. Mean Yearly C/f Values (Transformed) and Results of Multiple Comparision Test* for Young-of-the-Year Atlantic Tomcod Collected during Interregional Bottom Trawl Surveys, 1974 through 1978



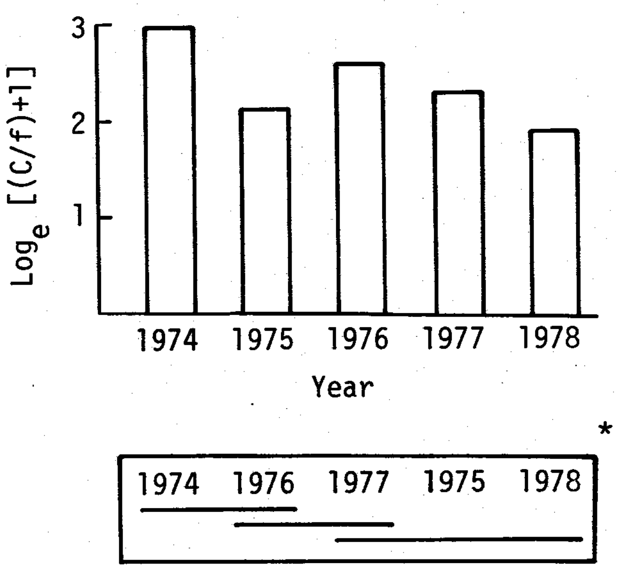
*Years are shown in order of descending C/f (left to right), a common underline indicates no significant difference ($p<0.05$)

Figure B-7. Mean Yearly C/f Values (Transformed) and Results of Multiple Comparison Test* for Yearling and Older Atlantic Tomcod Collected during Interregional Bottom Trawl Surveys, 1974 through 1978

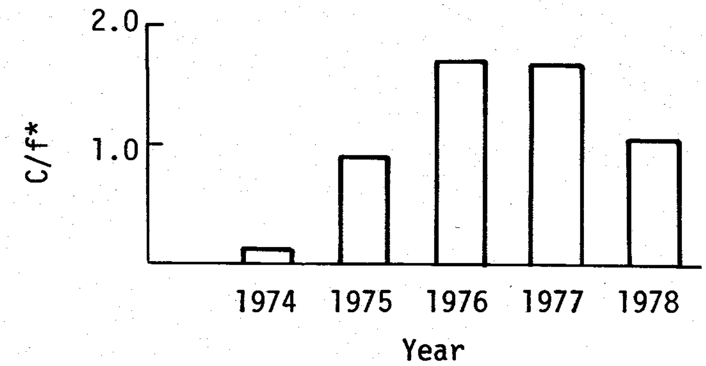


*Years are shown in order of descending C/f (left to right), a common underline indicates no significant difference ($p<0.05$)

Figure B-8. Mean Yearly C/f Values (Transformed) and Results of Multiple Comparison Test* for Young-of-the-Year Spottail Shiner Collected during Beach Seine Surveys, 1974 through 1978



*Years are shown in order of descending C/f (left to right), a common underline indicates no significant difference ($p<0.05$)



*C/f values as presented have not been transformed

Figure B-9. Mean Yearly C/f Values (Transformed) and Results of Multiple Comparison Test* for Yearling and Older Spottail Shiner Collected during Beach Seine Surveys, 1974 through 1978

Figure B-10. Mean Yearly C/f Values for White Catfish (All Age Groups Combined) Collected during Interregional Bottom Trawl Surveys, 1974 through 1978

f. Bay Anchovy

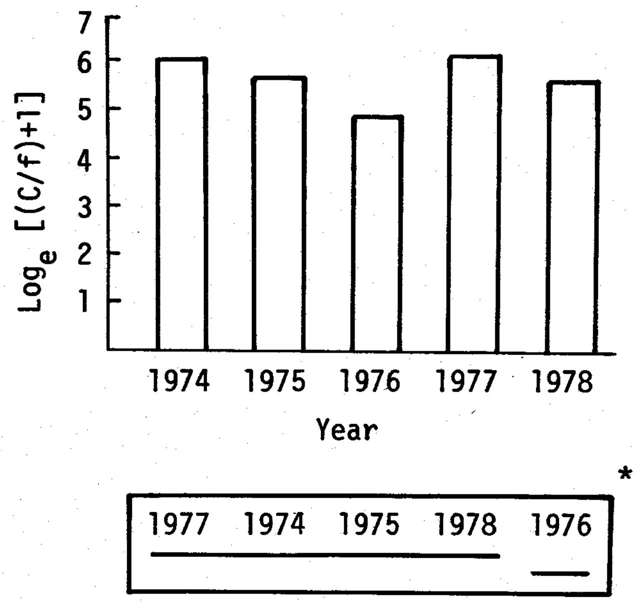
The abundance of bay anchovy indicated minor fluctuations during the five-year period (Figures B-11 and B-12). Beach seine survey data indicated no significant difference among years (highest C/f in 1977 and 1976, and lowest in 1975). Interregional bottom trawl data showed a significant difference ($\alpha = 0.05$) between the highest (1977) and lowest year (1976) only. Since peak abundance of bay anchovy in beach seine catches occurred in the spring and later in the summer for bottom trawl catches (Table B-4), beach seine catches probably represent yearling and older fish, and bottom trawl catches represent young-of-the-year fish. It is therefore, not surprising that the two surveys reveal different abundance patterns (Figures B-11 and B-12).

g. Weakfish

Abundance of weakfish was lowest in 1974, reached a peak in 1975, and declined steadily during 1976, 1977, and 1978 (Figure B-13). The high abundance in 1975 was significantly greater ($\alpha = 0.05$) than the abundance in 1974 and 1978 (Figure B-13).

h. Alewife

Abundance of young-of-the-year alewife was relatively high in both the beach seine and interregional bottom trawl surveys; therefore yearly abundance patterns based on both surveys were analyzed. Peak beach seine catches of young-of-the-year alewife normally occurred in July and August as early juveniles began to move into the shore zone (Appendix Table B-4). Bottom trawl catches were normally highest in late September and October as alewife began to migrate downstream (Appendix Table B-4). Both surveys indicated that the abundance of young-of-the-year alewife fluctuated over the five-year period; however, the patterns in yearly abundance indicated by each survey were different. Although both surveys showed abundance to be relatively low in 1974 and 1976, and high in 1977,



*Years are shown in order of descending C/f (left to right), a common underline indicates no significant difference (p<0.05)

Figure B-11. Mean Yearly C/f Values (Transformed) and Results of Multiple Comparison Test* for Bay Anchovy (All Age Groups Combined) Collected during Interregional Bottom Trawl Surveys, 1974 through 1978

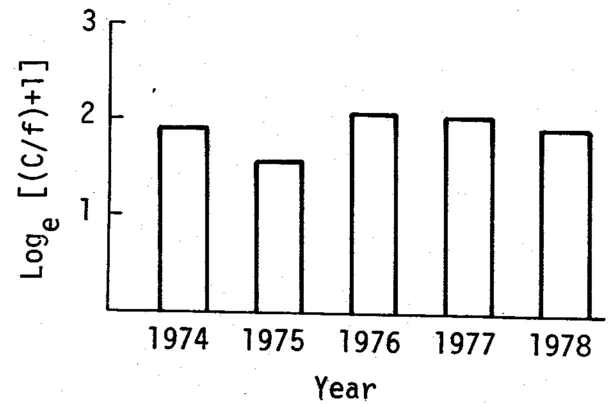
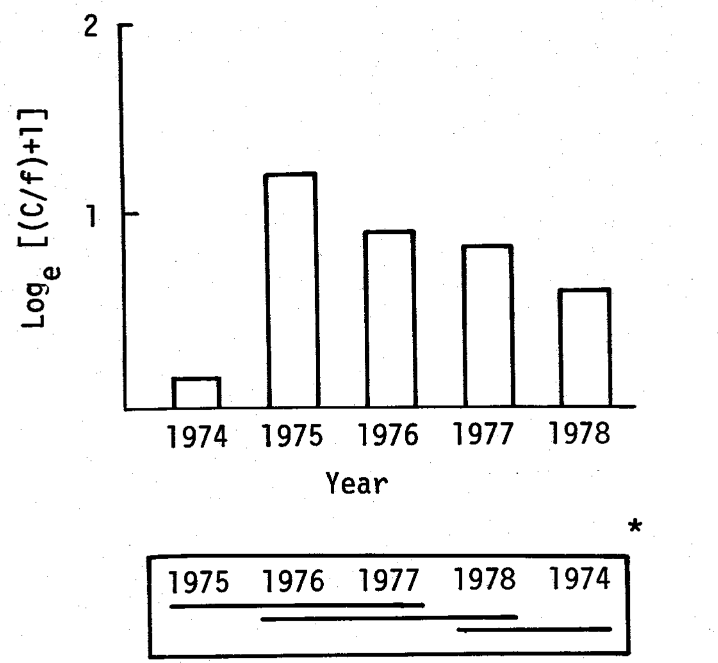
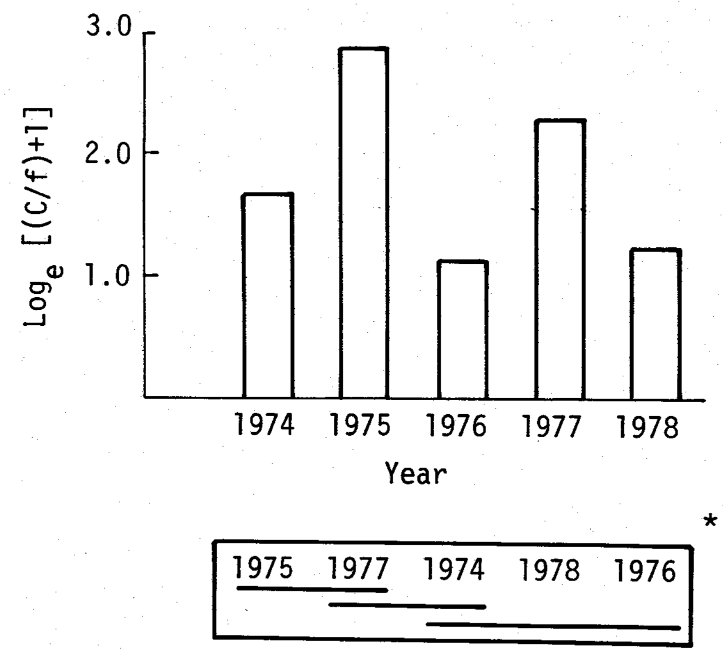


Figure B-12. Mean Yearly C/f Values (Transformed) for Bay Anchovy (All Age Groups Combined) Collected during Beach Seine Surveys, 1974 through 1978



*Years are shown in order of descending C/f (1fet to right), a common underline indicates no significant difference ($p<0.05$)

Figure B-13. Mean Yearly C/f Values (Transformed) and Results of Multiple Comparison Test* for Young-of-the-Year Weakfish Collected during Interregional Bottom Trawl Surveys, 1974 through 1978



*Years are shown in order of descending C/f (left to right), a common underline indicates no significant difference ($p<0.05$)

Figure B-14. Mean Yearly C/f Values (Transformed) and Results of Multiple Comparison Tests* for Young-of-the-Year Alewife Collected during Interregional Bottom Trawl Surveys, 1974 through 1978 abundance was highest in 1975 based on interregional trawl surveys (and relatively low in 1978), but was highest in 1978 based on beach seine survey data (and intermediate in 1975) (Figure B-14 and 15).

i. Blueback Herring

Abundance of young-of-the-year blueback herring rose steadily from 1974 through 1977 and then declined slightly in 1978 (Figure B-16). During the years of steadily increasing abundance (1974 through 1977), C/f was significantly higher ($\alpha = 0.05$) in each successive year (Figure B-16). Abundance in 1978 was statistically similar to the abundance in 1976 and 1977.

j. American Shad

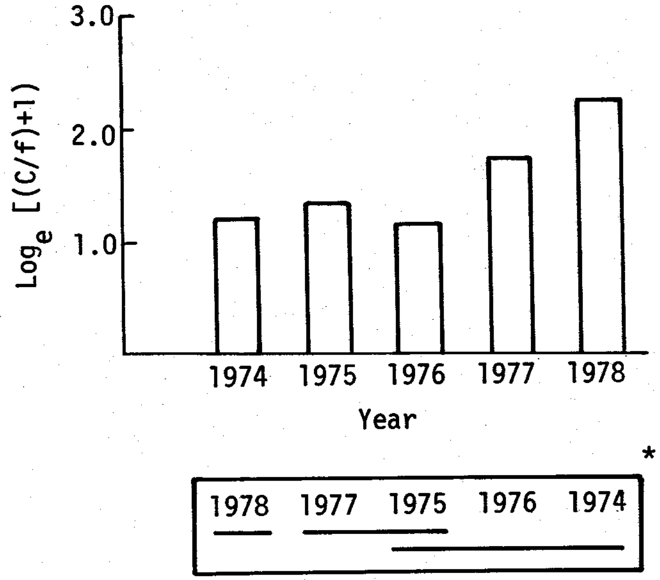
The abundance of American shad declined from 1974 to 1975, but began an upward trend during the next three years (Figure B-17). Catches (C/f) were significantly greater ($\alpha = 0.05$) in 1978 and significantly lower ($\alpha = 0.05$) in 1975 than in any other year.

k. Hogchoker

Abundance of hogchoker (all age groups combined) fluctuated very little during the five-year period and there were no significant differences in C/f across years (Figure B-18).

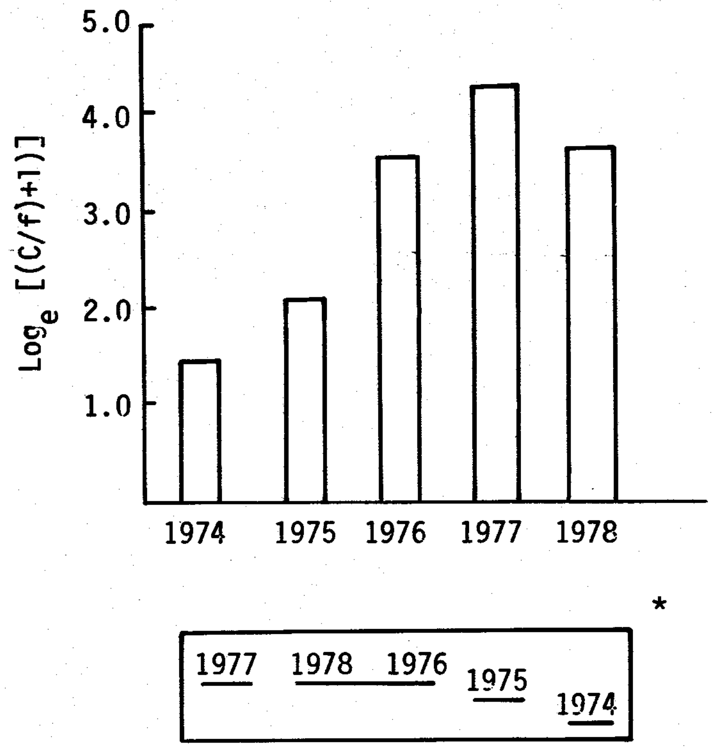
l. Bluefish

The abundance of young-of-the-year bluefish fluctuated slightly over the five-year period (Figure B-19). Catches (C/f) during 1974 through 1977 were not statistically different, but abundance in 1978 was significatly lower ($\alpha = 0.05$) than in all other years except 1976.



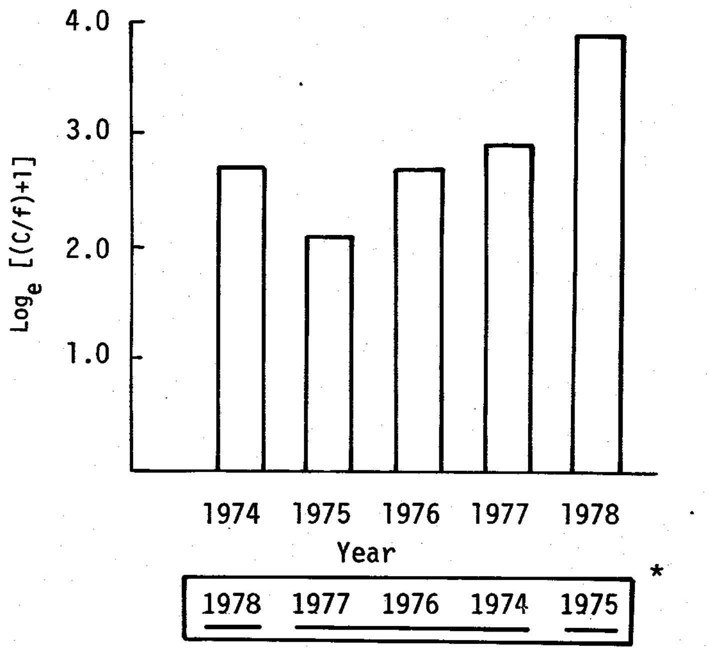
*Years are shown in order of descending C/f (left to right), a common underline indicates no significant difference ($p<0.05$)

Figure B-15. Mean Yearly C/f Values (Transformed) and Results of Multiple Comparison Test* for Young-of-the-Year Alewife Collected during Beach Seine Surveys, 1974 through 1978



*Years are shown in order of descending C/f (left to right), a common underline indicates no significant difference ($p < 0.05$)

Figure B-16. Mean Yearly C/f Values (Transformed) and Results of Multiple Comparison Test* for Young-of-the-Year Blueback Herring Collected during Beach Seine Surveys, 1974 through 1978



*Years are shown in order of descending C/f (left to right), a common underline indicates no significant difference ($p<0.05$)

Figure B-17. Mean Yearly C/f Values (Transformed) and Results of Multiple Comparison Test* for Young-of-the-Year American Shad Collected during Beach Seine Surveys, 1974 through 1978

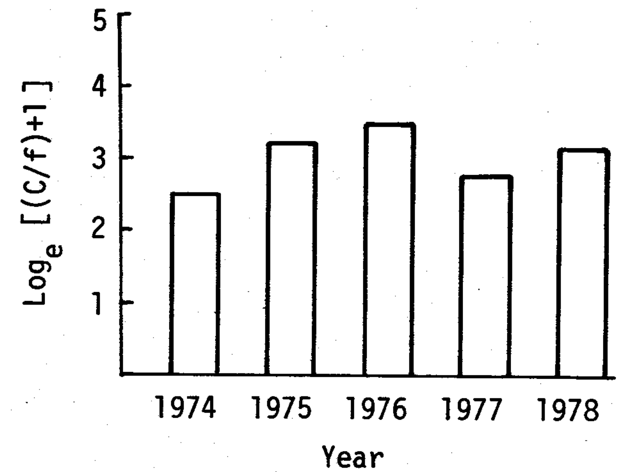
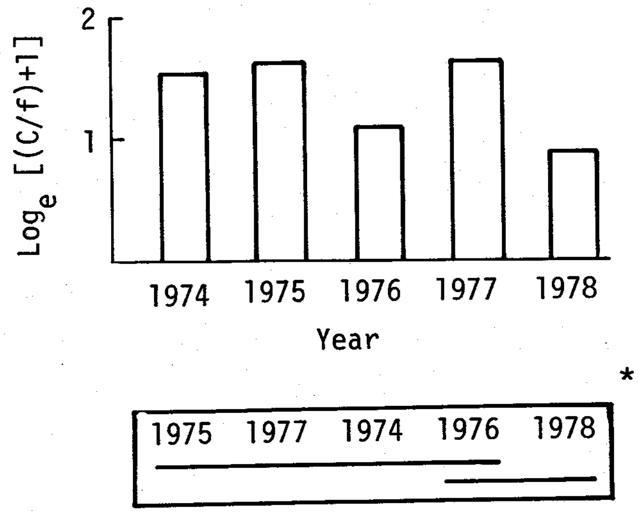


Figure B-18. Mean Yearly C/f Values (Transformed) for Hogchoker (All Age Groups Combined) Collected during Inter-regional Bottom Trawl Surveys, 1974 through 1978

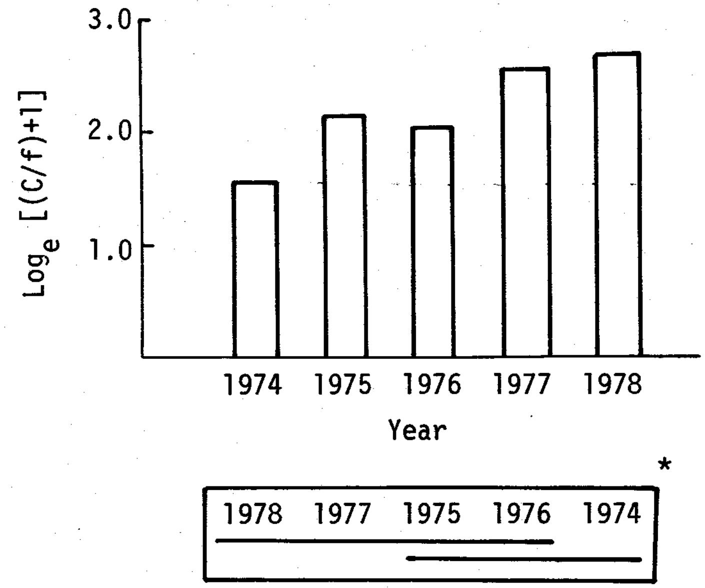
m. Rainbow Smelt

Rainbow smelt (all age groups combined) showed a slight increasing trend in abundance over the five-year period (Figure B-20). Catches (C/f) were significantly lower ($\alpha = 0.05$) in 1974 than in 1977 and in 1978 but catches (C/f) in all other years were similar.



*Years are shown in order of descending C/f (left to right), a common underline indicated no significant difference ($p<0.05$)

Figure B-19. Mean Yearly C/f Values (Transformed) and Results of Multiple Comparison Test* for Bluefish Collected during Beach Seine Surveys, 1974 through 1978



*Years are shown in order of descending C/f (left to right), a common underline indicates no significant difference ($p<0.05$)

Figure B-20. Mean Yearly C/f Values (Transformed) and Results of Multiple Comparison Test* for Rainbow Smelt (All Age Groups Combined) Collected during Interregional Bottom Trawl Surveys, 1974 through 1978

APPENDIX B.3

Recaptures of Hatchery-Reared Striped Bass

Definitions of codes appearing in this section of the Appendix are as follows:

Site:	1 =	West of Channel
	3 =	East of Channel
Stocking Region:	CW =	Cornwall (RM 56-61)
	WP =	West Point (RM 47-55)
	IP =	Indian Point (RM 39-46)
	CH =	Croton-Haverstraw (RM 34-38)
	TZ =	Tappan Zee (RM 24-33)
Sex:	M =	Male
	F =	Female
Visible Sexual Condition:	D =	Developing
	I =	Immature
	R =	Ripe
	U =	Undetermined
Symbols:	ND =	No Data
	• =	Unknown

Table B-5

Hatchery Reared Striped Bass Recaptured from Hudson River Estuary and Adjacent Waters, 1973 through 1978

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON		REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
1	10/18/73	55	88	3	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	124	24.7	YES	CW	.	.	.
2	10/18/73	55	88	3	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	124	26.5	NO	ND	.	.	.
3	10/18/73	55	88	3	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	102	13.2	NO	ND	.	.	.
4	10/19/73	43	69	1	EPIBENTHIC SLED	2ND DORSAL	OCT	1973	ND	114	15.4	NO	ND	.	.	.
5	10/19/73	38	61	3	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	124	20.9	NO	ND	.	.	.
6	10/19/73	38	61	3	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	102	14.0	NO	ND	.	.	.
7	10/23/73	55	88	2	BOTTOM TRAWL	2ND DORSAL	OCT	1973	ND	130	25.9	NO	ND	.	.	.
8	10/24/73	42	67	3	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	124	20.2	NO	ND	.	.	.
9	10/24/73	42	67	3	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	110	18.5	NO	ND	.	.	.
10	10/29/73	39	62	3	ND	2ND DORSAL	OCT	1973	ND	126	24.8	NO	ND	.	.	.
11	10/30/73	35	56	3	200' BEACH SEINE	2ND DORSAL	OCT	1973	ND	86	5.3	NO	ND	.	.	.
12	10/30/73	38	61	1	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	100	8.7	YES	CW	.	.	.
13	10/31/73	66	106	1	DANSKAMMER SCREENS	2ND DORSAL	OCT	1973	ND	105	12.6	YES	CW	.	.	.
14	10/31/73	66	106	1	DANSKAMMER SCREENS	2ND DORSAL	OCT	1973	ND	113	16.0	YES	CW	.	.	.
15	10/31/73	66	106	1	DANSKAMMER SCREENS	2ND DORSAL	OCT	1973	ND	119	18.2	YES	CW	.	.	.
16	10/31/73	66	106	1	DANSKAMMER SCREENS	2ND DORSAL	OCT	1973	ND	134	21.9	NO	ND	.	.	.
17	10/31/73	66	106	1	DANSKAMMER SCREENS	2ND DORSAL	OCT	1973	ND	144	35.1	NO	ND	.	.	.
18	10/31/73	66	106	1	DANSKAMMER SCREENS	2ND DORSAL	OCT	1973	ND	127	23.6	NO	ND	.	.	.
19	10/31/73	55	88	3	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	127	22.5	NO	ND	.	.	.
20	10/31/73	55	88	3	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	141	36.1	NO	ND	.	.	.
21	11/01/73	43	69	3	ND	2ND DORSAL	OCT	1973	ND	121	17.2	NO	ND	.	.	.
22	11/01/73	43	69	3	ND	2ND DORSAL	OCT	1973	ND	132	25.5	YES	CW	.	.	.
23	11/02/73	42	67	3	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	93	7.2	NO	ND	.	.	.
24	11/02/73	42	67	3	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	127	21.6	NO	ND	.	.	.
25	11/02/73	53	85	1	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	128	24.6	NO	ND	.	.	.
26	11/02/73	40	64	3	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	138	26.0	NO	ND	.	.	.
27	11/07/73	35	56	3	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	87	6.8	NO	ND	.	.	.
28	11/07/73	35	56	3	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	78	4.4	NO	ND	.	.	.
29	11/07/73	42	67	1	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	110	13.7	YES	CW	.	.	.
30	11/08/73	42	67	3	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	139	31.0	NO	ND	.	.	.
31	11/09/73	19	30	3	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	106	10.4	NO	ND	.	.	.
32	11/10/73	42	67	3	I.P. SCREENS	2ND DORSAL	OCT	1973	ND	112	13.6	NO	ND	.	.	.
33	11/15/73	66	106	1	DANSKAMMER SCREENS	2ND DORSAL	OCT	1973	ND	134	25.6	NO	ND	.	.	.
34	11/15/73	66	106	1	DANSKAMMER SCREENS	2ND DORSAL	OCT	1973	ND	147	36.7	NO	ND	.	.	.
35	11/15/73	66	106	1	DANSKAMMER SCREENS	2ND DORSAL	OCT	1973	ND	120	17.8	NO	ND	.	.	.
36	11/15/73	43	69	3	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	143	34.5	NO	ND	.	.	.
37	11/15/73	43	69	3	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	118	16.4	NO	ND	.	.	.
38	11/15/73	42	67		BOX TRAP	2ND DORSAL	OCT	1973	ND	117	15.1	YES	CW	.	.	.
39	11/16/73	53	85	3	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	124	15.7	NO	ND	.	.	.
40	11/16/73	66	106	1	DANSKAMMER SCREENS	2ND DORSAL	OCT	1973	ND	111	12.9	NO	ND	.	.	.
41	11/27/73	42	67	3	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	95	8.6	NO	ND	.	.	.
42	11/27/73	42	67	3	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	141	29.1	NO	ND	.	.	.
43	11/30/73	39	62	3	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	96	5.9	NO	ND	.	.	.
44	12/06/73	40	64	1	100' BEACH SEINE	2ND DORSAL	OCT	1973	ND	138	28.2	NO	ND	.	.	.
45	12/07/73	34	54	2	TRAWL	2ND DORSAL	OCT	1973	ND	139	26.8	NO	ND	.	.	.
46	12/12/73	26	42	.	TRAWL	2ND DORSAL	OCT	1973	ND	115	15.2	NO	ND	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON	REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
47	04/02/74	42	67	3	I.P. SCREENS	2ND DORSAL	FALL 1973	R992	146	33.1	NO	ND	.	.	.
48	04/06/74	42	67	3	I.P. SCREENS	2ND DORSAL	FALL 1973	R989	138	26.6	NO	ND	.	.	.
49	04/08/74	42	67	3	I.P. SCREENS	2ND DORSAL	FALL 1973	R696	148	.	YES	ND	.	.	.
50	08/20/74	38	61	3	BEACH SEINE	2ND DORSAL	SUMMER 1974	R643	68	4.1	ND	ND	.	.	.
51	08/21/74	36	58	2	EPIBENTHIC SLED	2ND DORSAL	SUMMER 1974	R1293	71	3.0	ND	ND	.	.	.
52	08/21/74	42	67	3	I.P. SCREENS	2ND DORSAL	SUMMER 1974	R642	48	1.2	ND	ND	.	.	.
53	08/26/74	41	66	3	BOX TRAP	2ND DORSAL	SUMMER 1974	ND	60	.	ND	ND	.	.	.
54	08/27/74	40	64	3	BEACH SEINE	2ND DORSAL	SUMMER 1974	R628	62	2.7	ND	ND	.	.	.
55	08/27/74	40	64	3	BEACH SEINE	2ND DORSAL	SUMMER 1974	R629	67	3.8	ND	ND	.	.	.
56	08/27/74	40	64	3	BEACH SEINE	2ND DORSAL	SUMMER 1974	R632	61	2.4	ND	ND	.	.	.
57	08/28/74	42	67	1	BOX TRAP	2ND DORSAL	SUMMER 1974	R625	80	5.9	ND	ND	.	.	.
58	08/30/74	42	67	3	BEACH SEINE	2ND DORSAL	SUMMER 1974	R646	64	3.0	ND	ND	.	.	.
59	09/30/74	39	62	1	BEACH SEINE	1ST DORSAL	FALL 1974	R679	100	11.1	YES	ND	.	.	.
60	10/02/74	39	62	1	BEACH SEINE	1ST DORSAL	FALL 1974	R761	100	11.2	YES	ND	.	.	.
61	10/03/74	37	59	3	EPIBENTHIC SLED	1ST DORSAL	FALL 1974	R1147	122	21.8	YES	ND	.	.	.
62	10/06/74	42	67	3	BEACH SEINE	1ST DORSAL	FALL 1974	R926	125	22.6	YES	ND	.	.	.
63	10/07/74	35	56	1	BEACH SEINE	1ST DORSAL	FALL 1974	R740	117	19.3	YES	ND	.	.	.
64	10/09/74	35	56	3	BEACH SEINE	1ST DORSAL	FALL 1974	R919	85	6.7	YES	ND	.	.	.
65	10/09/74	40	64	3	BEACH SEINE	1ST DORSAL	FALL 1974	R939	109	14.4	YES	ND	.	.	.
66	10/09/74	40	64	3	BEACH SEINE	1ST DORSAL	FALL 1974	R940	108	14.4	NO	ND	.	.	.
67	10/10/74	38	61	1	BEACH SEINE	1ST DORSAL	FALL 1974	R988	131	21.6	NO	ND	.	.	.
68	10/10/74	40	64	3	BEACH SEINE	1ST DORSAL	FALL 1974	R902	121	20.2	YES	ND	.	.	.
69	10/14/74	38	61	1	BEACH SEINE	1ST DORSAL	FALL 1974	R827	77	4.6	YES	ND	.	.	.
70	10/14/74	38	61	1	BEACH SEINE	1ST DORSAL	FALL 1974	R828	100	10.5	YES	ND	.	.	.
71	10/14/74	38	61	1	BEACH SEINE	1ST DORSAL	FALL 1974	R829	84	6.0	YES	ND	.	.	.
72	10/14/74	38	61	1	BEACH SEINE	1ST DORSAL	FALL 1974	R809	115	17.2	YES	ND	.	.	.
73	10/15/74	40	64	3	BEACH SEINE	2ND DORSAL	SUMMER 1974	R953	83	5.8	NO	ND	.	.	.
74	10/15/74	42	67	3	EPIBENTHIC SLED	1ST DORSAL	FALL 1974	R1269	125	23.5	YES	ND	.	.	.
75	10/15/74	42	67	3	BEACH SEINE	1ST DORSAL	FALL 1974	R895	125	18.5	YES	ND	.	.	.
76	10/15/74	42	67	3	BEACH SEINE	1ST DORSAL	FALL 1974	R896	112	14.1	YES	ND	.	.	.
77	10/15/74	43	69	2	EPIBENTHIS SLED	1ST DORSAL	FALL 1974	R1021	136	25.7	NO	ND	.	.	.
78	10/16/74	40	64	3	BEACH SEINE	1ST DORSAL	FALL 1974	R957	114	16.5	YES	ND	.	.	.
79	10/16/74	39	62	2	EPIBENTHIC SLED	1ST DORSAL	FALL 1974	R1023	126	21.4	NO	ND	.	.	.
80	10/16/74	37	59	1	BEACH SEINE	1ST DORSAL	FALL 1974	R866	134	27.5	YES	ND	.	.	.
81	10/16/74	38	61	1	EPIBENTHIC SLED	1ST DORSAL	FALL 1974	R1070	91	7.1	YES	ND	.	.	.
82	10/17/74	43	69	3	BEACH SEINE	1ST DORSAL	FALL 1974	R974	134	23.1	YES	ND	.	.	.
83	10/17/74	29	46	2	EPIBENTHIC SLED	1ST DORSAL	FALL 1974	R1008	100	10.3	YES	ND	.	.	.
84	10/17/74	29	46	2	EPIBENTHIC SLED	1ST DORSAL	FALL 1974	R1009	107	15.7	YES	ND	.	.	.
85	10/18/74	31	50	1	EPIBENTHIC SLED	1ST DORSAL	FALL 1974	R1012	87	6.1	YES	ND	.	.	.
86	10/21/74	40	64	1	BEACH SEINE	1ST DORSAL	FALL 1974	R837	123	19.8	YES	ND	.	.	.
87	10/21/74	40	64	1	BEACH SEINE	1ST DORSAL	FALL 1974	R838	111	16.9	YES	ND	.	.	.
88	10/21/74	40	64	1	BEACH SEINE	1ST DORSAL	FALL 1974	R839	118	18.0	YES	ND	.	.	.
89	10/23/74	39	62	1	BEACH SEINE	1ST DORSAL	FALL 1974	R943	89	6.3	NO	ND	.	.	.
90	10/23/74	39	62	1	BEACH SEINE	1ST DORSAL	FALL 1974	R944	85	6.0	YES	ND	.	.	.
91	10/23/74	39	62	1	BEACH SEINE	1ST DORSAL	FALL 1974	R945	93	7.1	YES	ND	.	.	.
92	10/23/74	39	62	1	BEACH SEINE	1ST DORSAL	FALL 1974	R952	92	7.1	NO	ND	.	.	.
93	10/23/74	41	66	1	BEACH SEINE	1ST DORSAL	FALL 1974	R962	95	9.2	YES	ND	.	.	.
94	10/23/74	40	64	3	BEACH SEINE	1ST DORSAL	FALL 1974	R846	109	.	NO	ND	.	.	.
95	10/23/74	41	66	3	BEACH SEINE	1ST DORSAL	FALL 1974	R848	117	17.0	YES	ND	.	.	.
96	10/23/74	41	66	3	BEACH SEINE	1ST DORSAL	FALL 1974	R849	115	17.5	YES	ND	.	.	.
97	10/23/74	39	62	1	BEACH SEINE	1ST DORSAL	FALL 1974	R958	109	12.1	YES	ND	.	.	.
98	10/23/74	41	66	3	BEACH SEINE	1ST DORSAL	FALL 1974	R850	113	15.0	YES	ND	.	.	.
99	10/23/74	41	66	3	BEACH SEINE	1ST DORSAL	FALL 1974	R851	114	14.9	YES	ND	.	.	.
100	10/23/74	41	66	3	BEACH SEINE	1ST DORSAL	FALL 1974	R852	131	22.7	NO	ND	.	.	.
101	10/23/74	41	66	3	BEACH SEINE	1ST DORSAL	FALL 1974	R853	97	9.3	YES	ND	.	.	.
102	10/24/74	40	64	1	BEACH SEINE	1ST DORSAL	FALL 1974	R884	108	16.5	NO	ND	.	.	.
103	10/24/74	40	64	3	BOX TRAP	1ST DORSAL	FALL 1974	R948	121	20.1	YES	ND	.	.	.
104	10/24/74	36	58	1	BEACH SEINE	1ST DORSAL	FALL 1974	R833	124	19.6	YES	ND	.	.	.
105	10/24/74	39	62	1	BEACH SEINE	1ST DORSAL	FALL 1974	R830	105	12.6	NO	ND	.	.	.
106	10/21/74	38	61	1	BEACH SEINE	1ST DORSAL	FALL 1974	2425	80	4.7	YES	ND	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON	REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
107	10/24/74	41	66	3	BEACH SEINE	1ST DORSAL	FALL 1974	R813	120	20.0	YES	ND	.	.	.
108	10/25/74	34	54	3	BEACH SEINE	1ST DORSAL	FALL 1974	R814	120	19.7	YES	ND	.	.	.
109	10/25/74	34	54	3	BEACH SEINE	1ST DORSAL	FALL 1974	R813	103	11.2	YES	ND	.	.	.
110	10/25/74	34	54	3	BEACH SEINE	1ST DORSAL	FALL 1974	R842	95	9.2	YES	ND	.	.	.
111	10/29/74	40	64	3	BEACH SEINE	1ST DORSAL	FALL 1974	R831	79	5.4	YES	ND	.	.	.
112	10/29/74	43	69	3	EPIBENTHIC SLED	1ST DORSAL	FALL 1974	R1295	133	21.6	YES	ND	.	.	.
113	10/29/74	37	59	1	BEACH SEINE	1ST DORSAL	FALL 1974	R915	82	5.6	NO	ND	.	.	.
114	10/30/74	42	67	3	BEACH SEINE	1ST DORSAL	FALL 1974	R955	119	16.7	YES	ND	.	.	.
115	10/31/74	34	54	1	EPIBENTHIC SLED	1ST DORSAL	FALL 1974	R1276	108	13.8	YES	ND	.	.	.
116	10/31/74	35	56	1	EPIBENTHIC SLED	1ST DORSAL	FALL 1974	R1277	109	12.8	YES	ND	.	.	.
117	10/31/74	15	24	1	BEACH SEINE	BOTH PELVIC	FALL 1974	R868	85	6.2	YES	ND	.	.	.
118	10/31/74	44	70	2	SURFACE TRAWL	1ST DORSAL	FALL 1974	R1466	111	15.6	YES	ND	.	.	.
119	10/31/74	40	64	1	BEACH SEINE	1ST DORSAL	FALL 1974	R969	124	18.0	YES	ND	.	.	.
120	10/31/74	40	64	1	BEACH SEINE	1ST DORSAL	FALL 1974	R970	120	16.5	YES	ND	.	.	.
121	10/31/74	40	64	1	BEACH SEINE	1ST DORSAL	FALL 1974	R971	99	8.7	YES	ND	.	.	.
122	10/31/74	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R1243	79	3.3	YES	ND	.	.	.
123	10/--/74	.	.	.	ND	1ST DORSAL	FALL 1974	R816	78	3.9	NO	ND	.	.	.
124	10/--/74	.	.	.	ND	1ST DORSAL	FALL 1974	R984	62	4.8	YES	ND	.	.	.
125	11/01/74	36	58	1	EPIBENTHIC SLED	BOTH PELVIC	FALL 1974	R1273	105	15.1	YES	ND	.	.	.
126	11/04/74	40	64	3	BOX TRAP	1ST DORSAL	FALL 1974	R1129	21	.	YES	ND	.	.	.
127	11/04/74	40	64	3	BOX TRAP	1ST DORSAL	FALL 1974	R1130	127	22.2	YES	ND	.	.	.
128	11/05/74	41	66	3	BEACH SEINE	BOTH PELVIC	FALL 1974	R1037	100	10.5	YES	ND	.	.	.
129	11/05/74	41	66	3	BEACH SEINE	1ST DORSAL	FALL 1974	R1038	132	25.9	YES	ND	.	.	.
130	11/06/74	40	64	3	BEACH SEINE	BOTH PELVIC	FALL 1974	R1112	102	11.2	NO	ND	.	.	.
131	11/06/74	42	67	2	BOTTOM TRAWL	1ST DORSAL	FALL 1974	R1022	132	24.3	YES	ND	.	.	.
132	11/06/74	41	66	1	BEACH SEINE	BOTH PELVIC	FALL 1974	R1114	110	16.6	YES	ND	.	.	.
133	11/06/74	41	66	1	BEACH SEINE	1ST DORSAL	FALL 1974	R1115	110	15.1	NO	ND	.	.	.
134	11/06/74	41	66	3	BEACH SEINE	1ST DORSAL	FALL 1974	R1118	121	19.3	YES	ND	.	.	.
135	11/06/74	41	66	3	BEACH SEINE	1ST DORSAL	FALL 1974	R1119	132	33.4	YES	ND	.	.	.
136	11/06/74	41	66	3	BEACH SEINE	1ST DORSAL	FALL 1974	R1120	130	21.2	YES	ND	.	.	.
137	11/07/74	40	64	1	BEACH SEINE	1ST DORSAL	FALL 1974	R1072	87	7.9	NO	ND	.	.	.
138	11/07/74	29	45	3	EPIBENTHIC SLED	1ST DORSAL	FALL 1974	R1280	89	6.6	YES	ND	.	.	.
139	11/07/74	42	67	3	BEACH SEINE	1ST DORSAL	FALL 1974	R1140	110	13.5	YES	ND	.	.	.
140	11/07/74	42	67	3	BEACH SEINE	1ST DORSAL	FALL 1974	R1141	116	17.6	YES	ND	.	.	.
141	11/07/74	32	51	1	EPIBENTHIC SLED	1ST DORSAL	FALL 1974	R1282	103	12.0	YES	ND	.	.	.
142	11/08/74	40	64	3	BEACH SEINE	1ST DORSAL	FALL 1974	R1005	131	23.2	YES	ND	.	.	.
143	11/08/74	35	56	1	BEACH SEINE	1ST DORSAL	FALL 1974	R1292	86	6.3	YES	ND	.	.	.
144	11/08/74	47	75	1	BEACH SEINE	1ST DORSAL	FALL 1974	R1139	112	14.4	NO	ND	.	.	.
145	11/08/74	37	59	2	EPIBENTHIC SLED	1ST DORSAL	FALL 1974	R1369	130	23.0	YES	ND	.	.	.
146	11/08/74	40	64	3	EPIBENTHIC SLED	1ST DORSAL	FALL 1974	R1371	124	17.8	YES	ND	.	.	.
147	11/08/74	36	58	2	EPIBENTHIC SLED	1ST DORSAL	FALL 1974	R1370	112	13.9	YES	ND	.	.	.
148	11/11/74	39	62	3	BEACH SEINE	1ST DORSAL	FALL 1974	R1155	110	14.0	YES	ND	.	.	.
149	11/12/74	42	67	3	BEACH SEINE	1ST DORSAL	FALL 1974	R1076	128	25.6	YES	ND	.	.	.
150	11/12/74	42	67	3	BEACH SEINE	1ST DORSAL	FALL 1974	R1077	122	18.7	YES	ND	.	.	.
151	11/12/74	42	67	3	BEACH SEINE	1ST DORSAL	FALL 1974	R1078	135	28.5	YES	ND	.	.	.
152	11/12/74	42	67	3	BEACH SEINE	1ST DORSAL	FALL 1974	R1079	138	32.1	YES	ND	.	.	.
153	11/13/74	40	64	3	BOX TRAP	1ST DORSAL	FALL 1974	R1071	122	23.5	YES	ND	.	.	.
154	11/13/74	40	64	3	BEACH SEINE	1ST DORSAL	FALL 1974	R1080	119	18.1	YES	ND	.	.	.
155	11/13/74	40	64	3	BEACH SEINE	1ST DORSAL	FALL 1974	R1056	126	22.1	YES	ND	.	.	.
155	11/13/74	41	66	3	BEACH SEINE	BOTH PELVIC	FALL 1974	R1014	105	13.0	YES	ND	.	.	.
157	11/13/74	42	67	3	BEACH SEINE	1ST DORSAL	FALL 1974	R1094	105	12.4	YES	ND	.	.	.
158	11/13/74	42	67	3	BEACH SEINE	1ST DORSAL	FALL 1974	R1095	125	18.5	YES	ND	.	.	.
159	11/13/74	42	67	3	BEACH SEINE	1ST DORSAL	FALL 1974	R1121	135	29.2	YES	ND	.	.	.
160	11/13/74	.	.	.	BEACH SEINE	1ST DORSAL	FALL 1974	R1131	82	5.8	NO	ND	.	.	.
161	11/14/74	22	35	1	EPIBENTHIC SLED	1ST DORSAL	FALL 1974	R1885	82	5.7	NO	ND	.	.	.
162	11/14/74	35	56	3	BEACH SEINE	BOTH PELVIC	FALL 1974	R1081	102	11.5	NO	ND	.	.	.
163	11/14/74	35	56	3	BEACH SEINE	1ST DORSAL	FALL 1974	R1090	101	10.5	YES	ND	.	.	.
164	11/14/74	35	56	3	BEACH SEINE	1ST DORSAL	FALL 1974	R1091	121	22.1	YES	ND	.	.	.
165	11/14/74	41	66	3	BEACH SEINE	1ST DORSAL	FALL 1974	R1025	85	6.7	YES	ND	.	.	.
166	11/15/74	40	64	3	BEACH SEINE	1ST DORSAL	FALL 1974	R1096	128	23.2	YES	ND	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON		REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL CCND
167	11/17/74	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R1266	85	5.6	YES	ND	.	.	.
168	11/18/74	42	67	3	BEACH SEINE	1ST DORSAL	FALL	1974	R1082	90	6.6	YES	ND	.	.	.
169	11/18/74	42	67	3	BEACH SEINE	1ST DORSAL	FALL	1974	R1083	135	28.0	YES	ND	.	.	.
170	11/19/74	42	67	3	BEACH SEINE	1ST DORSAL	FALL	1974	R1067	125	23.4	YES	ND	.	.	.
171	11/19/74	40	64	3	BEACH SEINE	BOTH PELVIC	FALL	1974	R1164	105	13.7	YES	ND	.	.	.
172	11/20/74	28	45	2	EPIBENTHIC SLED	1ST DORSAL	FALL	1974	R1886	111	14.0	YES	ND	.	.	.
173	11/20/74	30	48	1	EPIBENTHIC SLED	1ST DORSAL	FALL	1974	R1887	133	25.5	NO	ND	.	.	.
174	11/20/74	31	50	1	EPIBENTHIC SLED	1ST DORSAL	FALL	1974	R1888	113	15.4	YES	ND	.	.	.
175	11/20/74	42	67	3	BEACH SEINE	BOTH PELVIC	FALL	1974	R1001	110	13.4	YES	ND	.	.	.
176	11/20/74	42	67	3	BEACH SEINE	1ST DORSAL	FALL	1974	R1002	114	14.7	YES	ND	.	.	.
177	11/20/74	41	66	3	BEACH SEINE	1ST DORSAL	FALL	1974	R1065	81	5.7	YES	ND	.	.	.
178	11/20/74	41	66	3	BEACH SEINE	1ST DORSAL	FALL	1974	R1103	95	8.7	NO	ND	.	.	.
179	11/20/74	41	66	3	BEACH SEINE	1ST DORSAL	FALL	1974	R1104	88	6.6	YES	ND	.	.	.
180	11/20/74	41	66	3	BEACH SEINE	1ST DORSAL	FALL	1974	R1105	105	12.0	YES	ND	.	.	.
181	11/20/74	41	66	3	BEACH SEINE	1ST DORSAL	FALL	1974	R1106	110	16.5	YES	ND	.	.	.
182	11/20/74	41	66	3	BEACH SEINE	1ST DORSAL	FALL	1974	R1107	89	7.9	NO	ND	.	.	.
183	11/21/74	35	56	3	EPIBENTHIC SLED	1ST DORSAL	FALL	1974	R2006	121	20.9	YES	ND	.	.	.
184	11/22/74	36	58	3	BEACH SEINE	BOTH PELVIC	FALL	1974	R1019	109	15.1	YES	ND	.	.	.
185	11/22/74	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R1195	80	4.3	YES	ND	.	.	.
186	11/24/74	26	42	1	EPIBENTHIC SLED	1ST DORSAL	FALL	1974	R2002	108	13.5	YES	ND	.	.	.
187	11/25/74	40	64	1	BEACH SEINE	1ST DORSAL	FALL	1974	R1007	119	18.1	YES	ND	.	.	.
188	11/25/74	42	67	3	BEACH SEINE	1ST DORSAL	FALL	1974	R1153	135	25.8	YES	ND	.	.	.
189	11/25/74	42	67	3	BEACH SEINE	1ST DORSAL	FALL	1974	R1154	150	40.5	YES	ND	.	.	.
190	11/25/74	41	66	3	BEACH SEINE	1ST DORSAL	FALL	1974	R1168	107	14.4	YES	ND	.	.	.
191	11/25/74	41	66	3	BEACH SEINE	1ST DORSAL	FALL	1974	R1169	134	24.4	YES	ND	.	.	.
192	11/25/74	37	59	2	BEACH SEINE	1ST DORSAL	FALL	1974	R2003	116	16.0	NO	ND	.	.	.
193	11/27/74	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R1255	87	6.7	YES	ND	.	.	.
194	12/02/74	42	67	3	BEACH SEINE	BOTH PELVIC	FALL	1974	R1058	122	20.1	YES	ND	.	.	.
195	12/02/74	42	67	3	BEACH SEINE	1ST DORSAL	FALL	1974	R1059	133	24.8	YES	ND	.	.	.
196	12/03/74	14	22	1	EPIBENTHIC SLED	1ST DORSAL	FALL	1974	R2005	114	16.2	YES	ND	.	.	.
197	12/03/74	24	38	2	EPIBENTHIC SLED	1ST DORSAL	FALL	1974	R2007	98	9.3	YES	ND	.	.	.
198	12/06/74	39	62	1	BOTTOM TRAWL	1ST DORSAL	FALL	1974	R1274	87	7.0	YES	ND	.	.	.
199	12/10/74	31	50	3	EPIBENTHIC SLED	BOTH PELVIC	FALL	1974	R2082	122	21.1	NO	ND	.	.	.
200	12/11/74	44	70	1	BOTTOM TRAWL	BOTH PELVIC	FALL	1974	R1283	110	17.2	YES	ND	.	.	.
201	12/12/74	14	22	1	EPIBENTHIC SLED	1ST DORSAL	FALL	1974	R2297	104	12.5	YES	ND	.	.	.
202	12/14/74	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R1410	114	15.5	YES	ND	.	.	.
203	12/19/74	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R1668	75	.	YES	ND	.	.	.
204	12/27/74	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R1391	96	9.8	NO	ND	.	.	.
205	12/27/74	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R1392	115	17.3	YES	ND	.	.	.
206	12/27/74	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R1393	80	5.9	YES	ND	.	.	.
207	12/28/74	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R1572	104	11.6	NO	ND	.	.	.
208	12/29/74	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R1720	86	5.9	YES	ND	.	.	.
209	12/29/74	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R1642	108	12.5	NO	ND	.	.	.
210	12/29/74	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R1641	111	14.5	YES	ND	.	.	.
211	12/30/74	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL	1974	R1318	90	8.8	YES	ND	.	.	.
212	12/31/74	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL	1974	R1414	104	11.6	YES	ND	.	.	.
213	12/31/74	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL	1974	R1415	110	13.6	YES	ND	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON	REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
214	01/01/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R1707	125	21.1	YES	ND	.	.	.
215	01/01/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R1708	96	10.1	YES	ND	.	.	.
216	01/08/75	37	59	1	QLM GEAR	1ST DORSAL	FALL 1974	R2715	137	30.3	YES	ND	.	.	.
217	01/09/75	41	66	1	LOVETT SCREENS	1ST DORSAL	FALL 1974	R2426	126	19.6	YES	ND	.	.	.
218	01/09/75	41	66	1	LOVETT SCREENS	1ST DORSAL	FALL 1974	R2427	90	7.5	YES	ND	.	.	.
219	01/09/75	41	66	1	LOVETT SCREENS	1ST DORSAL	FALL 1974	R2428	80	5.2	YES	ND	.	.	.
220	01/09/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R1859	89	7.4	YES	ND	.	.	.
221	01/29/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R1881	124	20.4	NO	ND	.	.	.
222	01/29/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R1895	91	7.5	NO	ND	.	.	.
223	01/30/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R1904	99	9.9	YES	ND	.	.	.
224	01/31/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R1903	90	7.2	YES	ND	.	.	.
225	02/03/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R1998	105	10.6	YES	ND	.	.	.
226	02/04/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R1989	103	10.7	YES	ND	.	.	.
227	02/07/75	41	66	1	LOVETT SCREENS	1ST DORSAL	FALL 1974	R2717	108	11.6	YES	ND	.	.	.
228	02/07/75	41	66	1	LOVETT SCREENS	1ST DORSAL	FALL 1974	R2718	112	11.8	YES	ND	.	.	.
229	02/07/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R2695	130	24.6	YES	ND	.	.	.
230	02/07/75	43	69	2	BOTTOM TRAWL	BOTH PELVIC	FALL 1974	R1987	109	15.1	YES	ND	.	.	.
231	02/10/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R1969	87	5.5	YES	ND	.	.	.
232	02/10/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R1978	97	9.0	YES	ND	.	.	.
233	02/12/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R1961	108	12.2	YES	ND	.	.	.
234	02/13/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R1937	107	12.2	YES	ND	.	.	.
235	02/13/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R1939	90	6.0	YES	ND	.	.	.
236	02/13/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R1940	90	7.2	YES	ND	.	.	.
237	02/13/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R1941	89	6.7	YES	ND	.	.	.
238	02/13/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R1923	109	12.4	YES	ND	.	.	.
239	02/13/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R1924	118	15.2	YES	ND	.	.	.
240	02/13/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R1938	85	5.7	YES	ND	.	.	.
241	02/13/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R1936	132	23.0	YES	ND	.	.	.
242	02/13/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R1935	97	7.6	NO	ND	.	.	.
243	02/13/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R1934	133	19.6	YES	ND	.	.	.
244	02/13/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R1933	130	19.9	YES	ND	.	.	.
245	02/13/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R1932	107	11.0	YES	ND	.	.	.
246	02/13/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R1950	109	13.3	YES	ND	.	.	.
247	02/14/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2055	82	5.3	YES	ND	.	.	.
248	02/14/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2133	125	18.1	YES	ND	.	.	.
249	02/14/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2132	94	7.9	YES	ND	.	.	.
250	02/14/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2131	118	14.4	YES	ND	.	.	.
251	02/14/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R2130	90	6.1	YES	ND	.	.	.
252	02/15/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R2248	95	7.4	NO	ND	.	.	.
253	02/15/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2247	99	9.5	YES	ND	.	.	.
254	02/15/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2246	136	24.0	YES	ND	.	.	.
255	02/15/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2284	119	18.6	YES	ND	.	.	.
256	02/15/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2283	114	11.6	YES	ND	.	.	.
257	02/16/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2024	115	16.0	NO	ND	.	.	.
258	02/16/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2025	110	13.1	YES	ND	.	.	.
259	02/16/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2026	111	11.9	YES	ND	.	.	.
260	02/16/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2023	122	19.1	YES	ND	.	.	.
261	02/16/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2022	112	14.5	YES	ND	.	.	.
262	02/17/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2162	114	12.6	YES	ND	.	.	.
263	02/17/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2164	95	8.3	YES	ND	.	.	.
264	02/17/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2163	102	9.4	YES	ND	.	.	.
265	02/17/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2161	84	5.3	YES	ND	.	.	.
266	02/17/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2160	110	10.5	YES	ND	.	.	.
267	02/18/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2136	88	6.6	NO	ND	.	.	.
268	02/18/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2135	97	8.7	YES	ND	.	.	.
269	02/18/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2094	92	7.7	YES	ND	.	.	.
270	02/18/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2093	132	25.4	YES	ND	.	.	.
271	02/18/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R2092	101	10.0	YES	ND	.	.	.
272	02/18/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2091	114	14.0	YES	ND	.	.	.
273	02/18/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2090	118	17.2	NO	ND	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON		REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
274	02/18/75	37	59	2	BOTTOM TRAWL	1ST DORSAL	FALL	1974	R2288	119	16.9	YES	ND	.	.	.
275	02/20/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R2267	90	7.2	YES	ND	.	.	.
276	02/20/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R2265	87	6.0	YES	ND	.	.	.
277	02/20/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R2266	91	6.3	YES	ND	.	.	.
278	02/20/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R2201	121	19.5	YES	ND	.	.	.
279	02/20/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R2200	110	14.1	YES	ND	.	.	.
280	02/20/75	44	70	2	BOTTOM TRAWL	1ST DORSAL	FALL	1974	R2292	125	17.1	YES	ND	.	.	.
281	02/20/75	42	67	3	BOTTOM TRAWL	BOTH PELVIC	FALL	1974	R2310	115	.	YES	ND	.	.	.
282	02/21/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL	1974	R2256	121	18.7	YES	ND	.	.	.
283	02/24/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R2239	81	5.2	YES	ND	.	.	.
284	02/24/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R2124	88	6.2	YES	ND	.	.	.
285	02/26/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R2044	136	29.5	NO	ND	.	.	.
286	02/26/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R2045	93	7.2	NO	ND	.	.	.
287	02/26/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R2009	118	15.7	YES	ND	.	.	.
288	03/05/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R2287	90	6.3	YES	ND	.	.	.
289	03/06/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL	1974	R2289	88	6.3	YES	ND	.	.	.
290	03/10/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R2278	78	3.1	NO	ND	.	.	.
291	03/12/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2716	120	18.7	NO	ND	.	.	.
292	03/12/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R2392	95	7.3	NO	ND	.	.	.
293	03/14/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R2377	95	7.7	YES	ND	.	.	.
294	03/16/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R2418	105	10.4	YES	ND	.	.	.
295	03/16/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R2419	80	5.0	YES	ND	.	.	.
296	03/16/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL	1974	R2415	115	14.9	YES	ND	.	.	.
297	03/19/75	66	106	1	DANSKAMMER SCREENS	1ST DORSAL	FALL	1974	R3358	121	.	YES	ND	.	.	.
298	03/20/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2696	134	22.7	YES	ND	.	.	.
299	03/20/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2697	122	13.8	YES	ND	.	.	.
300	03/20/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2698	107	10.8	YES	ND	.	.	.
301	03/20/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2699	87	5.3	YES	ND	.	.	.
302	03/20/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2700	93	6.8	NO	ND	.	.	.
303	03/20/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2701	92	6.6	NO	ND	.	.	.
304	03/20/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2702	87	6.7	YES	ND	.	.	.
305	03/20/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2703	90	5.7	YES	ND	.	.	.
306	03/20/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2704	85	5.1	YES	ND	.	.	.
307	03/20/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2705	95	7.7	YES	ND	.	.	.
308	03/20/75	41	66	1	LOVETT SCREENS	1ST DORSAL	FALL	1974	R2678	120	16.5	YES	ND	.	.	.
309	03/20/75	41	66	1	LOVETT SCREENS	1ST DORSAL	FALL	1974	R2706	89	5.2	YES	ND	.	.	.
310	03/20/75	41	66	1	LOVETT SCREENS	1ST DORSAL	FALL	1974	R2707	93	6.1	YES	ND	.	.	.
311	03/20/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2708	115	10.4	YES	ND	.	.	.
312	03/20/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2709	85	5.0	YES	ND	.	.	.
313	03/20/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2710	87	5.3	YES	ND	.	.	.
314	03/27/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2682	129	20.2	YES	ND	.	.	.
315	03/27/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2683	105	10.8	YES	ND	.	.	.
316	03/27/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2684	122	16.8	YES	ND	.	.	.
317	03/27/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2685	103	10.4	YES	ND	.	.	.
318	03/27/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2686	105	10.7	YES	ND	.	.	.
319	03/27/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2687	92	7.2	YES	ND	.	.	.
320	03/27/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2688	117	15.1	YES	ND	.	.	.
321	03/27/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2689	105	11.1	YES	ND	.	.	.
322	03/27/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2690	113	13.7	YES	ND	.	.	.
323	03/27/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2691	97	8.2	YES	ND	.	.	.
324	03/27/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2692	87	6.2	YES	ND	.	.	.
325	03/27/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2693	92	7.3	NO	ND	.	.	.
326	03/27/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2694	111	13.6	YES	ND	.	.	.
327	03/27/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2711	90	6.7	NO	ND	.	.	.
328	03/27/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2712	114	12.2	YES	ND	.	.	.
329	03/27/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2713	98	9.0	YES	ND	.	.	.
330	04/03/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2681	89	7.0	YES	ND	.	.	.
331	04/03/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2680	81	4.5	YES	ND	.	.	.
332	04/03/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2679	108	10.4	NO	ND	.	.	.
333	04/03/75	14	22	3	BEACH SEINE	1ST DORSAL	FALL	1974	R2442	94	8.3	ND	ND	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON	REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
334	04/03/75	15	24	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2432	76	4.2	ND	ND	.	.	.
335	04/03/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R2714	94	5.0	YES	ND	.	.	.
336	04/09/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3093	89	7.2	YES	ND	.	.	.
337	04/10/75	41	66	1	LOVETT SCREENS	1ST DORSAL	FALL 1974	R3096	105	10.5	NO	ND	.	.	.
338	04/10/75	41	66	2	BOTTOM TRAWL	1ST DORSAL	FALL 1974	P2437	118	.	ND	ND	.	.	.
339	04/11/75	28	45	3	BOX TRAP	1ST DORSAL	FALL 1974	R2433	114	.	ND	ND	.	.	.
340	04/11/75	42	67	3	BOTTOM TRAWL	BOTH PELVIC	FALL 1974	R2431	119	.	ND	ND	.	.	.
341	04/11/75	42	67	3	BOTTOM TRAWL	1ST DORSAL	FALL 1974	R2430	103	.	ND	ND	.	.	.
342	04/15/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R2547	112	13.1	YES	ND	.	.	.
343	04/15/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2546	104	9.1	YES	ND	.	.	.
344	04/16/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2517	87	5.4	YES	ND	.	.	.
345	04/17/75	41	66	1	LOVETT SCREENS	1ST DORSAL	FALL 1974	R3087	131	22.7	YES	ND	.	.	.
346	04/17/75	41	66	1	LOVETT SCREENS	1ST DORSAL	FALL 1974	R3088	107	11.5	YES	ND	.	.	.
347	04/18/75	41	66	3	BEACH SEINE	BOTH PELVIC	FALL 1974	R2553	107	13.4	YES	ND	.	.	.
348	04/18/75	41	66	3	BEACH SEINE	BOTH PELVIC	FALL 1974	R2554	108	14.3	NO	ND	.	.	.
349	04/18/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2555	99	8.3	NO	ND	.	.	.
350	04/18/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2560	80	4.5	YES	ND	.	.	.
351	04/18/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2559	82	4.6	YES	ND	.	.	.
352	04/19/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R2641	113	13.1	NO	ND	.	.	.
353	04/19/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2642	108	9.2	YES	ND	.	.	.
354	04/19/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R2643	98	7.7	YES	ND	.	.	.
355	04/19/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2644	113	3.7	NO	ND	.	.	.
356	04/19/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2652	118	15.0	YES	ND	.	.	.
357	04/19/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R2651	108	11.1	YES	ND	.	.	.
358	04/20/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2541	108	11.2	YES	ND	.	.	.
359	04/20/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2538	101	7.7	YES	ND	.	.	.
360	04/20/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R2535	97	7.8	YES	ND	.	.	.
361	04/20/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2512	124	13.2	YES	ND	.	.	.
362	04/21/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R2496	108	10.0	YES	ND	.	.	.
363	04/21/75	23	37	3	BOX TRAP	1ST DORSAL	FALL 1974	R2676	83	5.7	YES	ND	.	.	.
364	04/21/75	23	37	3	BOX TRAP	1ST DORSAL	FALL 1974	R2675	122	19.2	NO	ND	.	.	.
365	04/22/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2602	120	15.3	YES	ND	.	.	.
366	04/22/75	29	46	2	EPIBENTHIC SLED	1ST DORSAL	FALL 1974	R2732	135	29.2	YES	ND	.	.	.
367	04/23/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2594	105	10.6	YES	ND	.	.	.
368	04/23/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2575	117	15.0	YES	ND	.	.	.
369	04/23/75	13	21	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2610	106	12.9	YES	ND	.	.	.
370	04/23/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2574	125	18.1	YES	ND	.	.	.
371	04/23/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R2480	115	16.6	YES	ND	.	.	.
372	04/23/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R2479	100	10.2	YES	ND	.	.	.
373	04/23/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R2478	122	18.7	YES	ND	.	.	.
374	04/23/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2477	123	17.0	YES	ND	.	.	.
375	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3001	96	9.1	NO	ND	.	.	.
376	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R2965	111	11.1	YES	ND	.	.	.
377	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R2964	89	5.6	YES	ND	.	.	.
378	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R2961	96	8.2	NO	ND	.	.	.
379	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R2956	112	13.3	YES	ND	.	.	.
380	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R2963	85	5.4	YES	ND	.	.	.
381	04/24/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2771	108	12.2	NO	ND	.	.	.
382	04/24/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2772	93	7.6	YES	ND	.	.	.
383	04/24/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R2773	103	10.2	YES	ND	.	.	.
384	04/24/75	42	67	3	I.P. SCREENS	1ST DORSALS	FALL 1974	R2774	84	6.0	YES	ND	.	.	.
385	04/24/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R2775	110	13.0	YES	ND	.	.	.
386	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R2979	114	12.5	NO	ND	.	.	.
387	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R2962	116	13.5	YES	ND	.	.	.
388	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R2938	112	11.4	YES	ND	.	.	.
389	04/24/75	41	66	1	LOVETT SCREENS	1ST DORSAL	FALL 1974	R3004	113	14.2	YES	ND	.	.	.
390	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3016	92	7.7	YES	ND	.	.	.
391	04/24/75	16	26	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2677	.	.	YES	ND	.	.	.
392	04/24/75	41	66	1	LOVETT SCREENS	1ST DORSAL	FALL 1974	R3005	134	27.1	YES	ND	.	.	.
393	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3003	85	5.7	YES	ND	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON		REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
394	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R3009	92	7.3	YES	ND	.	.	.
395	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R3011	105	11.5	YES	ND	.	.	.
396	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R3008	92	7.7	YES	ND	.	.	.
397	04/24/75	41	66	1	LOVETT SCREENS	1ST DORSAL	FALL	1974	R3006	124	17.4	NO	ND	.	.	.
398	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R3010	85	5.3	YES	ND	.	.	.
399	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R3015	105	10.3	YES	ND	.	.	.
400	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R3014	88	7.1	NO	ND	.	.	.
401	04/24/75	41	66	1	LOVETT SCREENS	1ST DORSAL	FALL	1974	R3007	140	30.0	YES	ND	.	.	.
402	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R3013	82	5.4	YES	ND	.	.	.
403	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2942	119	15.1	YES	ND	.	.	.
404	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2943	129	19.2	NO	ND	.	.	.
405	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2940	108	13.1	NO	ND	.	.	.
406	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2945	114	12.6	NO	ND	.	.	.
407	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R3012	83	6.0	YES	ND	.	.	.
408	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R3002	112	12.3	YES	ND	.	.	.
409	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R3000	107	11.5	YES	ND	.	.	.
410	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2993	105	9.5	YES	ND	.	.	.
411	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2994	129	18.0	YES	ND	.	.	.
412	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2990	107	12.1	YES	ND	.	.	.
413	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2995	110	11.4	YES	ND	.	.	.
414	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2991	94	6.5	NO	ND	.	.	.
415	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2996	114	12.6	YES	ND	.	.	.
416	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2998	96	7.8	YES	ND	.	.	.
417	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2999	107	11.4	YES	ND	.	.	.
418	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2997	112	13.8	YES	ND	.	.	.
419	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2992	108	11.0	YES	ND	.	.	.
420	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2985	116	16.1	NO	ND	.	.	.
421	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2986	107	10.7	NO	ND	.	.	.
422	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2982	125	17.7	YES	ND	.	.	.
423	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2980	105	9.6	NO	ND	.	.	.
424	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2987	116	14.2	YES	ND	.	.	.
425	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2984	119	13.8	YES	ND	.	.	.
426	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2988	107	11.8	YES	ND	.	.	.
427	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2981	117	15.0	NO	ND	.	.	.
428	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2983	119	14.2	YES	ND	.	.	.
429	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2989	123	17.9	NO	ND	.	.	.
430	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2975	94	7.2	NO	ND	.	.	.
431	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2978	137	25.2	YES	ND	.	.	.
432	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2971	89	7.8	NO	ND	.	.	.
433	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2974	105	11.7	NO	ND	.	.	.
434	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2977	108	11.7	YES	ND	.	.	.
435	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2976	127	20.1	YES	ND	.	.	.
436	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2973	124	19.1	YES	ND	.	.	.
437	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2972	93	7.3	YES	ND	.	.	.
438	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2948	114	12.1	YES	ND	.	.	.
439	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2958	126	16.8	YES	ND	.	.	.
440	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2957	122	16.5	YES	ND	.	.	.
441	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2954	111	12.0	YES	ND	.	.	.
442	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2953	124	16.1	YES	ND	.	.	.
443	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2951	134	20.7	NO	ND	.	.	.
444	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2955	122	17.5	YES	ND	.	.	.
445	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2947	105	10.7	YES	ND	.	.	.
446	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2939	111	11.5	YES	ND	.	.	.
447	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2968	99	8.3	YES	ND	.	.	.
448	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2946	92	7.0	YES	ND	.	.	.
449	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2941	112	13.2	YES	ND	.	.	.
450	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2949	123	16.1	YES	ND	.	.	.
451	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2950	115	14.2	YES	ND	.	.	.
452	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2944	110	14.5	YES	ND	.	.	.
453	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL	1974	R2952	89	6.1	YES	ND	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON	REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
454	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R2966	94	7.4	YES	ND	.	.	.
455	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R2960	123	17.6	YES	ND	.	.	.
456	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R2970	112	15.8	YES	ND	.	.	.
457	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R2967	88	5.8	NO	ND	.	.	.
458	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R2959	103	9.6	YES	ND	.	.	.
459	04/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R2969	82	4.6	YES	ND	.	.	.
460	04/24/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2650	120	17.0	NO	ND	.	.	.
461	04/24/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R2767	95	8.4	YES	ND	.	.	.
462	04/24/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R2822	115	13.8	YES	ND	.	.	.
463	04/24/75	13	21	1	BEACH SEINE	BOTH PELVIC	FALL 1974	R2596	112	16.1	YES	ND	.	.	.
464	04/24/75	13	21	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2595	85	5.3	YES	ND	.	.	.
465	04/24/75	15	24	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2665	139	26.8	YES	ND	.	.	.
466	04/25/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R2817	115	15.4	YES	ND	.	.	.
467	04/26/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R2795	110	12.9	YES	ND	.	.	.
468	04/26/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R2796	115	15.8	YES	ND	.	.	.
469	04/26/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2812	88	5.5	NO	ND	.	.	.
470	04/29/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R2753	103	11.7	YES	ND	.	.	.
471	04/29/75	34	54	3	BEACH SEINE	1ST DORSAL	FALL 1974	R2475	87	6.2	YES	ND	.	.	.
472	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3072	122	17.1	NO	ND	.	.	.
473	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3017	130	21.3	YES	ND	.	.	.
474	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3075	127	17.1	YES	ND	.	.	.
475	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3071	115	13.5	YES	ND	.	.	.
476	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3077	95	6.4	YES	ND	.	.	.
477	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3062	116	14.0	YES	ND	.	.	.
478	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3081	115	13.3	YES	ND	.	.	.
479	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3069	124	16.4	YES	ND	.	.	.
480	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3070	102	8.4	NO	ND	.	.	.
481	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3085	82	5.6	YES	ND	.	.	.
482	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3074	127	17.6	NO	ND	.	.	.
483	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3086	95	8.0	YES	ND	.	.	.
484	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3080	118	14.6	YES	ND	.	.	.
485	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3064	104	10.3	YES	ND	.	.	.
486	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3065	126	18.1	YES	ND	.	.	.
487	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3073	121	15.1	YES	ND	.	.	.
488	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3078	112	12.6	YES	ND	.	.	.
489	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3079	79	4.1	YES	ND	.	.	.
490	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3082	84	4.7	NO	ND	.	.	.
491	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3048	118	14.6	YES	ND	.	.	.
492	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3076	119	14.5	YES	ND	.	.	.
493	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3027	102	9.3	YES	ND	.	.	.
494	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3067	99	9.0	YES	ND	.	.	.
495	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3068	105	10.4	YES	ND	.	.	.
496	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3066	105	9.8	YES	ND	.	.	.
497	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3058	89	6.1	YES	ND	.	.	.
498	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3019	135	24.6	NO	ND	.	.	.
499	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3063	132	19.6	YES	ND	.	.	.
500	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3061	96	6.8	NO	ND	.	.	.
501	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3059	100	8.8	YES	ND	.	.	.
502	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3052	126	17.3	YES	ND	.	.	.
503	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3055	100	10.4	YES	ND	.	.	.
504	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3043	122	16.6	YES	ND	.	.	.
505	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3047	116	14.2	YES	ND	.	.	.
506	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3050	122	17.1	YES	ND	.	.	.
507	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3042	121	15.4	YES	ND	.	.	.
508	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3040	122	17.2	YES	ND	.	.	.
509	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3060	83	5.6	YES	ND	.	.	.
510	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3051	132	21.1	YES	ND	.	.	.
511	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3053	117	15.1	YES	ND	.	.	.
512	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3045	105	9.7	YES	ND	.	.	.
513	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3044	97	8.2	YES	ND	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON	REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
514	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3049	99	8.7	YES	ND	.	.	.
515	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3056	97	7.7	YES	ND	.	.	.
516	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3054	127	20.5	YES	ND	.	.	.
517	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3046	106	12.2	YES	ND	.	.	.
518	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3041	101	9.4	YES	ND	.	.	.
519	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3029	109	14.1	YES	ND	.	.	.
520	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3036	91	6.6	YES	ND	.	.	.
521	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3032	120	17.5	YES	ND	.	.	.
522	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3023	114	14.1	YES	ND	.	.	.
523	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3037	117	13.3	NO	ND	.	.	.
524	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3034	102	8.3	YES	ND	.	.	.
525	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3025	108	12.7	YES	ND	.	.	.
526	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3024	119	16.4	YES	ND	.	.	.
527	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3039	89	5.8	YES	ND	.	.	.
528	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3035	104	11.0	YES	ND	.	.	.
529	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3028	87	7.0	YES	ND	.	.	.
530	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3026	118	15.4	YES	ND	.	.	.
531	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3033	99	9.3	YES	ND	.	.	.
532	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3022	100	9.4	YES	ND	.	.	.
533	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3021	124	18.1	YES	ND	.	.	.
534	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3018	126	19.1	YES	ND	.	.	.
535	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3020	127	17.5	YES	ND	.	.	.
536	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3031	134	24.2	NO	ND	.	.	.
537	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3038	97	8.1	YES	ND	.	.	.
538	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3030	107	12.3	YES	ND	.	.	.
539	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3083	109	11.2	YES	ND	.	.	.
540	04/30/75	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R2806	93	6.8	NO	ND	.	.	.
541	04/30/75	42	67	3	BOTTOM TRAWL	1ST DORSAL	FALL 1974	R2472	135	22.3	YES	ND	.	.	.
542	04/30/75	14	22	1	BEACH SEINE	BOTH PELVIC	FALL 1974	R2654	115	17.3	YES	ND	.	.	.
543	04/30/75	14	22	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2653	110	13.2	YES	ND	.	.	.
544	04/30/75	15	24	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2474	98	10.1	YES	ND	.	.	.
545	04/30/75	41	66	1	LOVETT SCREENS	1ST DORSAL	FALL 1974	R3090	107	16.2	YES	ND	.	.	.
546	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3091	91	7.1	YES	ND	.	.	.
547	04/30/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3089	112	13.2	NO	ND	.	.	.
548	05/01/75	15	24	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2658	121	19.7	YES	ND	.	.	.
549	05/01/75	15	24	1	BEACH SEINE	BOTH PELVIC	FALL 1974	R2657	128	20.9	YES	ND	.	.	.
550	05/06/75	12	19	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2821	87	7.6	YES	ND	.	.	.
551	05/06/75	13	21	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2736	107	10.4	ND	ND	.	.	.
552	05/06/75	14	22	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2750	88	7.5	NO	ND	.	.	.
553	05/06/75	16	26	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2730	101	12.2	YES	ND	.	.	.
554	05/06/75	16	26	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2729	94	9.7	YES	ND	.	.	.
555	05/06/75	19	30	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2751	112	19.1	YES	ND	.	.	.
556	05/07/75	14	22	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2734	127	23.4	YES	ND	.	.	.
557	05/07/75	15	24	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2744	117	17.4	YES	ND	.	.	.
558	05/08/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3097	135	24.4	NO	ND	.	.	.
559	05/08/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3094	132	24.4	YES	ND	.	.	.
560	05/08/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	FALL 1974	R3095	135	26.8	YES	ND	.	.	.
561	05/09/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R2866	101	8.4	NO	ND	.	.	.
562	05/12/75	14	22	1	EPIBENTHIC SLED	BOTH PELVIC	FALL 1974	R2917	112	16.8	YES	ND	.	.	.
563	05/12/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R3132	141	25.5	YES	ND	.	.	.
564	05/12/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R3131	100	9.2	YES	ND	.	.	.
565	05/12/75	14	22	1	BEACH SEINE	BOTH PELVIC	FALL 1974	R2749	95	9.2	YES	ND	.	.	.
566	05/12/75	14	22	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2748	105	14.7	YES	ND	.	.	.
567	05/12/75	15	24	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2723	118	18.3	YES	ND	.	.	.
568	05/12/75	16	26	1	BEACH SEINE	BOTH PELVIC	FALL 1974	R2737	113	14.0	YES	ND	.	.	.
569	05/15/75	13	21	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2728	109	13.5	YES	ND	.	.	.
570	05/15/75	12	19	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2722	80	5.1	YES	ND	.	.	.
571	05/15/75	14	22	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2720	128	22.7	YES	ND	.	.	.
572	05/15/75	14	22	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2721	100	10.2	YES	ND	.	.	.
573	05/16/75	MAN	.	1	BEACH SEINE	1ST DORSAL	FALL 1974	R2747	105	13.4	NO	ND	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON		REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
574	05/19/75	41	66	3	BEACH SEINE	BOTH PELVIC	FALL	1974	R2752	110	15.1	YES	ND	.	.	.
575	05/21/75	37	59	1	BOWLINE SCREENS	IST DORSAL	FALL	1974	R3092	113	14.5	YES	ND	.	.	.
576	05/21/75	19	30	1	BEACH SEINE	BOTH PELVIC	FALL	1974	R2933	88	7.2	YES	ND	.	.	.
577	05/21/75	STI	.	1	BEACH SEINE	BOTH PELVIC	FALL	1974	R2921	89	8.2	YES	ND	.	.	.
578	05/27/75	MAN	.	1	BEACH SEINE	IST DORSAL	FALL	1974	R2901	101	10.2	NO	ND	.	.	.
579	05/27/75	MAN	.	1	BEACH SEINE	IST DORSAL	FALL	1974	R2902	121	18.8	YES	ND	.	.	.
580	05/27/75	35	56	1	BEACH SEINE	IST DORSAL	FALL	1974	R2925	135	22.9	NO	ND	.	.	.
581	05/27/75	40	64	3	BOX TRAP	BOTH PELVIC	FALL	1974	R2835	121	21.1	YES	ND	.	.	.
582	05/27/75	LNB	.	.	BEACH SEINE	IST DORSAL	FALL	1974	R2887	138	26.6	YES	ND	.	.	.
583	05/28/75	1	2	1	BEACH SEINE	IST DORSAL	FALL	1974	R2914	85	6.4	YES	ND	.	.	.
584	05/28/75	35	56	3	HAUL SEINE	BOTH PELVIC	FALL	1974	R2907	120	17.4	YES	ND	.	.	.
585	05/29/75	35	56	1	BEACH SEINE	IST DORSAL	FALL	1974	R2916	118	18.3	YES	ND	.	.	.
586	05/29/75	35	56	1	BEACH SEINE	IST DORSAL	FALL	1974	R2913	133	24.9	YES	ND	.	.	.
587	05/29/75	35	56	1	BEACH SEINE	BOTH PELVIC	FALL	1974	R2906	113	14.4	YES	ND	.	.	.
588	05/29/75	34	54	3	HAUL SEINE	IST DORSAL	FALL	1974	R2915	158	41.6	YES	ND	.	.	.
589	05/30/75	40	64	1	BEACH SEINE	BOTH PELVIC	FALL	1974	R2860	99	10.7	YES	ND	.	.	.
590	05/30/75	40	64	1	BEACH SEINE	BOTH PELVIC	FALL	1974	R2859	115	15.7	YES	ND	.	.	.
591	05/30/75	69	110	3	BEACH SEINE	IST DORSAL	FALL	1974	R2881	136	24.1	YES	ND	.	.	.
592	05/30/75	MAN	.	.	BEACH SEINE	IST DORSAL	FALL	1974	R2908	144	31.5	YES	ND	.	.	.
593	05/30/75	MAN	.	.	BEACH SEINE	IST DORSAL	FALL	1974	R2892	135	26.4	YES	ND	.	.	.
594	05/30/75	MAN	.	.	BEACH SEINE	IST DORSAL	FALL	1974	R2893	120	18.8	YES	ND	.	.	.
595	05/31/75	37	59	1	BEACH SEINE	BOTH PELVIC	FALL	1974	R2886	119	18.4	YES	ND	.	.	.
596	06/04/75	JAM	.	.	BEACH SEINE	IST DORSAL	FALL	1974	R2856	147	35.0	YES	ND	.	.	.
597	06/03/75	126	202	1	BEACH SEINE	IST DORSAL	FALL	1974	R2850	140	31.4	NO	ND	.	.	.
598	06/03/75	126	202	1	BEACH SEINE	BOTH PELVIC	FALL	1974	R2851	121	18.5	YES	ND	.	.	.
599	06/06/75	36	58	1	BEACH SEINE	BOTH PELVIC	FALL	1974	R2857	125	25.2	YES	ND	.	.	.
600	06/06/75	36	58	1	BEACH SEINE	IST DORSAL	FALL	1974	R2858	130	22.2	YES	ND	.	.	.
601	06/10/75	41	66	3	BEACH SEINE	IST DORSAL	FALL	1974	R2872	110	13.2	YES	ND	.	.	.
602	06/10/75	57	91	1	BEACH SEINE	IST DORSAL	FALL	1974	R2880	120	16.2	YES	ND	.	.	.
603	06/11/75	66	106	1	DANSKAMMER SCREENS	IST DORSAL	FALL	1974	R3363	139	.	YES	ND	.	.	.
604	06/11/75	42	67	1	BOTTOM TRAWL	IST DORSAL	FALL	1974	R3127	155	35.7	NO	ND	.	.	.
605	06/11/75	49	64	3	BEACH SEINE	IST DORSAL	FALL	1974	R3140	161	45.3	YES	ND	.	.	.
606	06/12/75	37	59	1	BOWLINE SCREENS	IST DORSAL	FALL	1974	R3181	115	16.8	YES	ND	.	.	.
607	06/12/75	39	62	3	BOTTOM TRAWL	IST DORSAL	FALL	1974	R3124	142	26.7	YES	ND	.	.	.
608	06/13/75	30	48	1	BEACH SEINE	IST DORSAL	FALL	1974	R3150	148	37.2	YES	ND	.	.	.
609	06/16/75	HAR	.	.	BEACH SEINE	BOTH PELVIC	FALL	1974	R3165	120	15.6	YES	ND	.	.	.
610	06/16/75	40	64	1	BOX TRAP	BOTH PELVIC	FALL	1974	R3164	111	12.6	NO	ND	.	.	.
611	06/17/75	38	61	1	BEACH SEINE	IST DORSAL	FALL	1974	R3129	93	7.2	YES	ND	.	.	.
612	06/19/75	42	67	3	I.P. SCREENS	IST DORSAL	FALL	1974	R3118	84	6.4	NO	ND	.	.	.
613	06/19/75	78	125	3	BEACH SEINE	IST DORSAL	FALL	1974	R3145	148	32.2	YES	ND	.	.	.
614	06/20/75	47	75	1	BEACH SEINE	BOTH PELVIC	FALL	1974	R3147	122	17.2	YES	ND	.	.	.
615	06/23/75	LNB	.	.	HAUL SEINE	IST DORSAL	FALL	1974	R3105	139	27.0	YES	ND	.	.	.
616	06/23/75	LNB	.	.	HAUL SEINE	BOTH PELVIC	FALL	1974	R3102	156	33.7	YES	ND	.	.	.
617	06/23/75	LNB	.	.	HAUL SEINE	IST DORSAL	FALL	1974	R3101	156	35.5	YES	ND	.	.	.
618	06/23/75	LNB	.	.	HAUL SEINE	IST DORSAL	FALL	1974	R3100	179	36.3	YES	ND	.	.	.
619	06/23/75	LNB	.	.	HAUL SEINE	IST DORSAL	FALL	1974	R3098	157	39.3	YES	ND	.	.	.
620	06/23/75	LNB	.	.	HAUL SEINE	IST DORSAL	FALL	1974	R3106	147	31.6	YES	ND	.	.	.
621	06/23/75	LNB	.	.	HAUL SEINE	IST DORSAL	FALL	1974	R3107	137	24.9	NO	ND	.	.	.
622	06/23/75	LNB	.	.	HAUL SEINE	IST DORSAL	FALL	1974	R3108	155	40.2	YES	ND	.	.	.
623	06/23/75	LNB	.	.	HAUL SEINE	IST DORSAL	FALL	1974	R3109	154	37.5	NO	ND	.	.	.
624	06/23/75	43	69	3	TUCKER TRAWL	IST DORSAL	FALL	1974	R3173	144	28.6	YES	ND	.	.	.
625	06/25/75	66	106	1	DANSKAMMER SCREENS	IST DORSAL	FALL	1974	R3362	125	.	YES	ND	.	.	.
626	06/25/75	141	226	1	ALBANY SCREENS	IST DORSAL	FALL	1974	R6266	129	18.1	YES	ND	.	.	.
627	07/03/75	38	61	1	BEACH SEINE	IST DORSAL	FALL	1974	R3120	147	26.1	YES	ND	.	.	.
628	07/08/75	LNB	.	.	BEACH SEINE	IST DORSAL	FALL	1974	R3174	126	22.0	YES	ND	.	.	.
629	07/08/75	141	226	1	ALBANY SCREENS	IST DORSAL	FALL	1974	R6261	157	36.5	YES	ND	.	.	.
630	07/11/75	54	86	1	BEACH SEINE	IST DORSAL	FALL	1974	R3180	100	9.2	YES	ND	.	.	.
631	07/16/75	66	106	1	DANSKAMMER SCREENS	IST DORSAL	FALL	1974	R3352	130	.	NO	ND	.	.	.
632	07/17/75	66	106	1	DANSKAMMER SCREENS	IST DORSAL	FALL	1974	R3353	132	22.6	YES	ND	.	.	.
633	07/23/75	42	67	3	I.P. SCREENS	IST DORSAL	FALL	1974	R3176	122	18.5	YES	ND	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON	REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
634	07/25/75	66	106	1	DANSKAMMER SCREENS	1ST DORSAL	FALL 1974	R6175	135	26.9	YES	ND	.	.	.
635	07/29/75	LNB	.	.	EXPERIMENTAL GEAR	1ST DORSAL	FALL 1974	R3257	130	23.6	YES	ND	.	.	.
636	07/29/75	LNB	.	.	EXPERIMENTAL GEAR	1ST DORSAL	FALL 1974	R3258	152	37.1	YES	ND	.	.	.
637	08/13/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R3182	143	34.0	YES	ND	.	.	.
638	08/13/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R3183	187	82.8	YES	ND	.	.	.
639	08/13/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R3184	152	37.5	NO	ND	.	.	.
640	08/13/75	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R3185	139	31.4	YES	ND	.	.	.
641	08/13/75	63	101	3	QLM GEAR	1ST DORSAL	FALL 1974	R6257	169	51.6	NO	ND	.	.	.
642	08/14/75	65	104	1	QLM GEAR	1ST DORSAL	FALL 1974	R6258	144	29.1	YES	ND	.	.	.
643	08/27/75	35	56	1	EPIBENTHIC SLED	1ST DORSAL	FALL 1974	R3218	208	97.6	NO	ND	.	.	.
644	08/29/75	59	94	1	BOTTOM TRAWL	1ST DORSAL	FALL 1974	R3232	177	61.8	NO	ND	.	.	.
645	09/08/75	66	106	1	QLM GEAR	1ST DORSAL	FALL 1974	R6255	177	52.1	NO	ND	.	.	.
646	09/10/75	37	59	1	QLM GEAR	1ST DORSAL	SEPT 1975	R5765	140	28.3	YES	CW	.	.	.
647	09/10/75	54	86	2	BOTTOM TRAWL	1ST DORSAL	SEPT 1975	R4061	99	.	YES	CW	.	.	.
648	09/12/75	53	85	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R3826	74	8.0	NO	CW	.	.	.
649	09/15/75	42	67	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R4033	103	.	NO	ND	.	.	.
650	09/15/75	42	67	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R4034	85	.	YES	IP	.	.	.
651	09/15/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R3865	63	1.9	NO	ND	.	.	.
652	09/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3810	86	6.5	NO	ND	.	.	.
653	09/22/75	47	75	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3723	95	9.6	YES	WP	.	.	.
654	09/22/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4036	120	.	YES	IP	.	.	.
655	09/22/75	42	67	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R4049	110	.	YES	ND	.	.	.
656	09/22/75	43	69	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4046	128	.	NO	ND	.	.	.
657	09/23/75	115	184	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3504	186	87.5	YES	IP	.	.	.
658	09/23/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3762	113	16.8	YES	IP	.	.	.
659	09/23/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3555	110	16.6	YES	IP	.	.	.
660	09/23/75	42	67	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R3728	118	18.6	YES	ND	.	.	.
661	09/23/75	42	67	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R3729	118	15.2	YES	IP	.	.	.
662	09/23/75	42	67	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R3730	120	19.6	YES	IP	.	.	.
663	09/23/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3859	128	23.6	YES	IP	.	.	.
664	09/23/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3556	78	4.9	YES	IP	.	.	.
665	09/24/75	54	86	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3382	124	.	NO	ND	.	.	.
666	09/24/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3387	92	.	YES	IP	.	.	.
667	09/24/75	48	77	3	BOTTOM TRAWL	1ST DORSAL	SEPT 1975	R3520	110	14.3	NO	ND	.	.	.
668	09/25/75	43	69	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3381	112	.	NO	ND	.	.	.
669	09/25/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3431	105	13.8	YES	IP	.	.	.
670	09/25/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3432	124	22.6	YES	IP	.	.	.
671	09/25/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3433	129	23.7	YES	IP	.	.	.
672	09/25/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3434	121	20.1	YES	IP	.	.	.
673	09/25/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3435	113	15.8	YES	IP	.	.	.
674	09/25/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3436	126	23.0	YES	IP	.	.	.
675	09/25/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3437	116	18.4	YES	IP	.	.	.
676	09/25/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3438	120	19.3	YES	IP	.	.	.
677	09/25/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3439	111	16.9	YES	IP	.	.	.
678	09/25/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3440	109	15.2	YES	IP	.	.	.
679	09/25/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3441	116	17.1	YES	IP	.	.	.
680	09/25/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3442	84	6.7	YES	IP	.	.	.
681	09/25/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3443	109	14.0	NO	ND	.	.	.
682	09/25/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3965	127	24.4	YES	ND	.	.	.
683	09/25/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R3971	119	21.3	YES	IP	.	.	.
684	09/25/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R3972	95	10.2	YES	IP	.	.	.
685	09/25/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R3974	127	27.2	YES	IP	.	.	.
686	09/25/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R3975	116	19.5	YES	IP	.	.	.
687	09/26/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3426	114	16.8	YES	IP	.	.	.
688	09/26/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3427	115	18.5	YES	IP	.	.	.
689	09/26/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3428	115	17.9	YES	IP	.	.	.
690	09/26/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3429	130	25.0	YES	IP	.	.	.
691	09/26/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3374	90	7.4	YES	IP	.	.	.
692	09/26/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3375	119	22.5	YES	ND	.	.	.
693	09/26/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3376	110	14.2	YES	CW	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON	REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
694	09/26/75	40	64	3	BEACH SEINE	1ST DOPSAL	SEPT 1975	R3378	83	5.8	YES	IP	.	.	.
695	09/26/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3380	111	.	NO	ND	.	.	.
696	09/29/75	43	69	3	BEACH SEINE	1ST DOPSAL	SEPT 1975	R3466	91	7.8	YES	ND	.	.	.
697	09/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4056	102	.	YES	IP	.	.	.
698	09/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4057	113	.	YES	IP	.	.	.
699	09/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4058	98	.	YES	IP	.	.	.
700	09/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4059	113	.	YES	IP	.	.	.
701	09/29/75	43	69	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3994	108	14.2	YES	IP	.	.	.
702	09/29/75	40	64	1	BEACH SEINE	1ST DOPSAL	SEPT 1975	R4025	114	.	NO	ND	.	.	.
703	09/29/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R4026	113	.	YES	IP	.	.	.
704	09/29/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R4027	111	.	YES	IP	.	.	.
705	09/29/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R5197	125	21.4	YES	IP	.	.	.
706	09/29/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3456	108	14.5	YES	IP	.	.	.
707	09/29/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3457	111	15.7	YES	IP	.	.	.
708	09/29/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3458	91	8.0	NO	ND	.	.	.
709	09/29/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3459	88	7.2	YES	IP	.	.	.
710	09/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3444	114	16.8	NO	ND	.	.	.
711	09/29/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R3724	113	17.8	YES	IP	.	.	.
712	09/29/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R3725	115	17.5	NO	ND	.	.	.
713	09/30/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3990	100	11.6	YES	IP	.	.	.
714	09/30/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3991	103	12.5	YES	IP	.	.	.
715	09/30/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3992	102	12.3	YES	ND	.	.	.
716	09/30/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3993	112	15.7	NO	ND	.	.	.
717	09/30/75	43	69	3	BOTTOM TRAWL	1ST DORSAL	SEPT 1975	R4029	107	.	YES	WP	.	.	.
718	09/30/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3448	98	9.9	YES	IP	.	.	.
719	09/30/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3449	119	20.2	NO	ND	.	.	.
720	09/30/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R3452	125	21.8	YES	IP	.	.	.
721	10/01/75	37	59	1	EPIBENTHIC SLED	1ST DORSAL	SEPT 1975	R4499	90	7.2	YES	WP	.	.	.
722	10/01/75	37	59	3	EPIBENTHIC SLED	1ST DORSAL	SEPT 1975	R3845	114	17.0	YES	IP	.	.	.
723	10/01/75	35	56	3	EPIBENTHIC SLED	1ST DORSAL	SEPT 1975	R3805	123	20.7	YES	IP	.	.	.
724	10/01/75	84	134	3	EPIBENTHIC SLED	1ST DORSAL	SEPT 1975	R4064	82	.	YES	IP	.	.	.
725	10/01/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R3405	108	12.3	YES	IP	.	.	.
726	10/01/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R3409	132	24.9	NO	ND	.	.	.
727	10/01/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R3410	122	20.2	YES	IP	.	.	.
728	10/01/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R3414	126	23.2	YES	IP	.	.	.
729	10/01/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R3415	116	18.3	YES	ND	.	.	.
730	10/01/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R3420	108	12.8	YES	IP	.	.	.
731	10/01/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R3481	126	22.9	YES	IP	.	.	.
732	10/01/75	37	59	1	QLM GEAR	1ST DORSAL	SEPT 1975	R5758	114	15.8	YES	IP	.	.	.
733	10/01/75	37	59	1	QLM GEAR	1ST DORSAL	SEPT 1975	R5759	107	13.2	YES	IP	.	.	.
734	10/01/75	37	59	1	QLM GEAR	1ST DORSAL	SEPT 1975	R5760	123	17.2	YES	IP	.	.	.
735	10/01/75	37	59	1	QLM GEAR	1ST DORSAL	SEPT 1975	R5761	123	17.3	NO	ND	.	.	.
736	10/01/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3388	125	.	YES	IP	.	.	.
737	10/01/75	42	67	1	BOTTOM TRAWL	1ST DORSAL	SEPT 1975	R4030	110	.	YES	CW	.	.	.
738	10/01/75	41	66	2	BOTTOM TRAWL	1ST DORSAL	SEPT 1975	R4028	124	.	YES	IP	.	.	.
739	10/01/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3390	139	.	YES	IP	.	.	.
740	10/01/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3365	129	24.0	YES	IP	.	.	.
741	10/01/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3366	117	16.2	YES	IP	.	.	.
742	10/01/75	35	56	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3367	117	16.3	YES	IP	.	.	.
743	10/01/75	35	56	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3368	105	13.5	YES	IP	.	.	.
744	10/01/75	35	56	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3369	129	22.8	YES	IP	.	.	.
745	10/01/75	35	56	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3370	110	14.0	YES	IP	.	.	.
746	10/01/75	35	56	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3371	113	13.3	YES	IP	.	.	.
747	10/01/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3372	103	10.4	NO	ND	.	.	.
748	10/01/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3373	100	11.1	YES	IP	.	.	.
749	10/01/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3392	127	19.5	YES	CW	.	.	.
750	10/01/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3393	127	11.5	YES	CW	.	.	.
751	10/01/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3394	124	20.3	YES	IP	.	.	.
752	10/01/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3395	133	26.5	YES	IP	.	.	.
753	10/01/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R3396	129	22.2	NO	ND	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON		REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
754	10/01/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3397	111	13.4	NO	ND	.	.	.
755	10/01/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3398	113	15.5	YES	IP	.	.	.
756	10/01/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3399	100	11.3	YES	IP	.	.	.
757	10/01/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3400	125	22.0	YES	IP	.	.	.
758	10/01/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3401	118	15.8	NO	ND	.	.	.
759	10/02/75	30	48	1	EPIBENTHIC SLED	1ST DORSAL	SEPT	1975	R4496	106	12.9	YES	ND	.	.	.
760	10/02/75	36	58	1	EPIBENTHIC SLED	1ST DORSAL	SEPT	1975	R4062	115	.	YES	IP	.	.	.
761	10/02/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R3526	114	16.4	YES	IP	.	.	.
762	10/02/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R3527	105	12.8	YES	IP	.	.	.
763	10/02/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R3529	114	15.8	YES	IP	.	.	.
764	10/02/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3746	113	17.8	YES	IP	.	.	.
765	10/02/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3747	108	14.6	YES	IP	.	.	.
766	10/02/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R3735	113	15.8	YES	IP	.	.	.
767	10/02/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R3736	113	14.8	NO	ND	.	.	.
768	10/02/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R3737	116	18.2	YES	IP	.	.	.
769	10/02/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R3738	108	14.4	YES	IP	.	.	.
770	10/02/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R3739	92	10.0	YES	IP	.	.	.
771	10/02/75	41	66	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3488	117	15.6	YES	IP	.	.	.
772	10/02/75	41	66	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3489	105	9.2	NO	ND	.	.	.
773	10/02/75	41	66	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3490	96	8.9	YES	IP	.	.	.
774	10/02/75	41	66	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3491	88	6.1	NO	ND	.	.	.
775	10/02/75	41	66	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3492	77	3.8	YES	IP	.	.	.
776	10/02/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3580	124	19.0	YES	IP	.	.	.
777	10/02/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3581	116	17.7	YES	IP	.	.	.
778	10/02/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3582	140	30.9	YES	IP	.	.	.
779	10/02/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3583	128	23.1	YES	IP	.	.	.
780	10/02/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3584	105	12.2	YES	ND	.	.	.
781	10/02/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3585	106	13.0	YES	CH	.	.	.
782	10/02/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3586	116	15.6	YES	IP	.	.	.
783	10/02/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3587	118	17.9	YES	IP	.	.	.
784	10/02/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3588	136	27.1	YES	CH	.	.	.
785	10/02/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3589	148	35.9	YES	CH	.	.	.
786	10/02/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3590	111	14.4	NO	ND	.	.	.
787	10/02/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3591	122	19.7	NO	ND	.	.	.
788	10/02/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3592	111	14.2	YES	IP	.	.	.
789	10/03/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT	1975	R3997	87	6.0	YES	WP	.	.	.
790	10/03/75	39	62	3	BOTTOM TRAWL	1ST DORSAL	SEPT	1975	R4052	111	.	YES	IP	.	.	.
791	10/05/75	42	67	3	I.P. SCREENS	2ND DORSAL	OCT	1975	R4002	112	16.3	YES	CH	.	.	.
792	10/06/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT	1975	R4019	110	13.0	NO	ND	.	.	.
793	10/06/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3830	139	26.9	YES	IP	.	.	.
794	10/06/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3831	136	28.6	YES	IP	.	.	.
795	10/06/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3832	133	24.9	YES	IP	.	.	.
796	10/06/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3833	121	20.0	YES	IP	.	.	.
797	10/06/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3834	118	17.4	YES	IP	.	.	.
798	10/06/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3835	116	16.6	NO	ND	.	.	.
799	10/06/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3836	110	13.8	YES	IP	.	.	.
800	10/06/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3837	121	18.8	YES	IP	.	.	.
801	10/06/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3838	112	17.9	YES	CH	.	.	.
802	10/06/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3839	122	20.8	NO	ND	.	.	.
803	10/06/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3840	123	22.1	YES	IP	.	.	.
804	10/06/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3841	114	15.9	YES	IP	.	.	.
805	10/06/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3842	124	21.5	YES	IP	.	.	.
806	10/06/75	42	67	3	BEACH SEINE	2ND DORSAL	OCT	1975	R3843	124	22.2	YES	IP	.	.	.
807	10/06/75	30	48	1	BEACH SEINE	2ND DORSAL	OCT	1975	R3984	113	16.4	YES	CH	.	.	.
808	10/06/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3850	107	12.5	YES	IP	.	.	.
809	10/06/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R3851	109	14.7	YES	IP	.	.	.
810	10/06/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R3846	129	22.7	YES	IP	.	.	.
811	10/06/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R3847	133	24.5	YES	IP	.	.	.
812	10/06/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R3848	123	19.1	YES	IP	.	.	.
813	10/06/75	34	54	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4000	136	35.6	YES	CH	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON	REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
814	10/06/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4023	112	.	YES	IP	.	.	.
815	10/06/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R3854	81	6.2	NO	ND	.	.	.
816	10/06/75	34	54	3	EPIBENTHIC SLED	2ND DORSAL	OCT 1975	R3855	147	37.5	NO	ND	.	.	.
817	10/07/75	34	54	3	BEACH SEINE	2ND DORSAL	OCT 1975	R4072	105	13.9	YES	CH	.	.	.
818	10/08/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4173	95	12.4	ND	ND	.	.	.
819	10/08/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4172	105	12.6	NO	ND	.	.	.
820	10/08/75	41	66	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4260	117	18.6	YES	IP	.	.	.
821	10/08/75	41	66	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4261	102	11.5	YES	IP	.	.	.
822	10/08/75	41	66	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4262	115	17.1	YES	CH	.	.	.
823	10/08/75	35	56	3	BEACH SEINE	2ND DORSAL	OCT 1975	R4333	116	19.4	YES	CH	.	.	.
824	10/08/75	35	56	3	BEACH SEINE	2ND DORSAL	OCT 1975	R4334	129	26.0	YES	CH	.	.	.
825	10/08/75	51	82	3	BEACH SEINE	1ST DORSAL	FALL 1974	R4487	233	141.0	NO	ND	.	.	.
826	10/08/75	39	62	1	BOTTOM TRAWL	2ND DORSAL	OCT 1975	R4902	116	18.1	YES	CH	.	.	.
827	10/09/75	65	104	1	QLM GEAR	1ST DORSAL	FALL 1974	R6279	226	146.0	NO	ND	.	.	.
828	10/09/75	42	67	3	BOTTOM TRAWL	1ST DORSAL	SEPT 1975	R4749	116	17.7	NO	ND	.	.	.
829	10/09/75	42	67	3	BOTTOM TRAWL	1ST DORSAL	SEPT 1975	R4750	105	13.0	YES	CH	.	.	.
830	10/09/75	42	67	3	BOTTOM TRAWL	1ST DORSAL	SEPT 1975	R4751	105	11.8	YES	IP	.	.	.
831	10/09/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R4137	91	8.4	YES	CW	.	.	.
832	10/09/75	36	58	3	BEACH SEINE	2ND DORSAL	OCT 1975	R4183	127	24.9	YES	CH	.	.	.
833	10/09/75	29	46	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4113	116	17.9	YES	IP	.	.	.
834	10/09/75	56	90	3	EPIBENTHIC SLED	1ST DORSAL	SEPT 1975	R4304	120	20.2	YES	IP	.	.	.
835	10/10/75	42	67	1	EPIBENTHIC SLED	1ST DORSAL	SEPT 1975	R4181	122	20.6	YES	IP	.	.	.
836	10/10/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4497	105	11.7	YES	IP	.	.	.
837	10/10/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4250	112	14.8	YES	IP	.	.	.
838	10/10/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4251	133	23.7	YES	IP	.	.	.
839	10/10/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4252	125	20.0	YES	IP	.	.	.
840	10/10/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4253	135	28.3	YES	ND	.	.	.
841	10/10/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4254	104	11.9	YES	IP	.	.	.
842	10/10/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4255	100	10.3	YES	IP	.	.	.
843	10/10/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4256	118	16.2	YES	IP	.	.	.
844	10/10/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4257	135	24.2	YES	IP	.	.	.
845	10/10/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4258	125	21.4	YES	IP	.	.	.
846	10/10/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4259	111	19.6	YES	IP	.	.	.
847	10/10/75	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R4117	127	23.8	YES	ND	.	.	.
848	10/10/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R4118	87	6.2	YES	IP	.	.	.
849	10/10/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R4452	114	14.9	YES	IP	.	.	.
850	10/10/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R4453	100	10.0	YES	IP	.	.	.
851	10/10/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R4454	123	21.1	YES	IP	.	.	.
852	10/10/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R4455	102	11.6	YES	IP	.	.	.
853	10/10/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R4456	105	13.1	YES	IP	.	.	.
854	10/10/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R4451	128	25.0	YES	IP	.	.	.
855	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4399	123	20.8	YES	IP	.	.	.
856	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4400	139	30.3	NO	ND	.	.	.
857	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4401	118	17.3	YES	IP	.	.	.
858	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4402	105	12.7	YES	IP	.	.	.
859	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4403	126	24.3	YES	CH	.	.	.
860	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4404	126	22.7	YES	CH	.	.	.
861	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4405	130	21.8	YES	IP	.	.	.
862	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4406	116	15.7	YES	IP	.	.	.
863	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4407	123	20.8	YES	CH	.	.	.
864	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4408	120	19.5	YES	CH	.	.	.
865	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4409	104	10.9	YES	CH	.	.	.
866	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4410	119	17.8	YES	IP	.	.	.
867	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4411	125	21.1	YES	CH	.	.	.
868	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4412	133	23.9	YES	IP	.	.	.
869	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4413	106	12.3	YES	IP	.	.	.
870	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4414	114	15.5	YES	IP	.	.	.
871	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4415	106	12.0	YES	IP	.	.	.
872	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4416	107	12.5	NO	ND	.	.	.
873	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4417	124	21.4	YES	IP	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON	REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
874	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4418	131	27.9	YES	IP	.	.	.
875	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4419	85	7.5	YES	IP	.	.	.
876	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4420	93	8.7	NO	ND	.	.	.
877	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4421	93	8.7	YES	IP	.	.	.
878	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4422	116	17.1	YES	IP	.	.	.
879	10/10/75	36	58	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R4457	101	11.9	YES	CH	.	.	.
880	10/10/75	34	54	1	BEACH SEINE	2ND DORSAL	OCT 1975	R4476	134	32.9	YES	CH	.	.	.
881	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4088	128	25.3	YES	IP	.	.	.
882	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4089	122	20.8	NO	ND	.	.	.
883	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4090	126	22.7	YES	IP	.	.	.
884	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4091	122	22.5	NO	ND	.	.	.
885	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4092	114	16.3	YES	IP	.	.	.
886	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4093	95	10.0	YES	IP	.	.	.
887	10/10/75	42	67	3	BEACH SEINE	2ND DORSAL	OCT 1975	R4094	128	25.1	YES	CH	.	.	.
888	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4095	130	24.7	YES	IP	.	.	.
889	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4096	110	15.9	YES	ND	.	.	.
890	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4097	111	16.6	YES	IP	.	.	.
891	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4098	116	16.4	YES	IP	.	.	.
892	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4099	131	26.0	YES	IP	.	.	.
893	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4100	110	14.9	YES	IP	.	.	.
894	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4101	128	22.6	YES	IP	.	.	.
895	10/10/75	42	67	3	BEACH SEINE	2ND DORSAL	OCT 1975	R4102	109	17.0	YES	CH	.	.	.
896	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4103	113	15.6	NO	ND	.	.	.
897	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4104	115	15.8	YES	IP	.	.	.
898	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4105	124	20.7	YES	IP	.	.	.
899	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4106	120	19.4	YES	IP	.	.	.
900	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4107	126	20.6	YES	IP	.	.	.
901	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4108	113	42.3	YES	IP	.	.	.
902	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4109	110	14.8	NO	ND	.	.	.
903	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4110	148	34.0	YES	IP	.	.	.
904	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4111	119	18.5	YES	IP	.	.	.
905	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4112	103	11.6	YES	IP	.	.	.
906	10/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4244	116	18.5	YES	IP	.	.	.
907	10/10/75	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R4243	116	18.1	YES	CH	.	.	.
908	10/13/75	30	48	1	I.P. SCREENS	1ST DORSAL	SEPT 1975	R4482	107	13.6	YES	IP	.	.	.
909	10/13/75	40	64	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R4494	114	14.2	YES	IP	.	.	.
910	10/13/75	40	64	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R4491	105	12.2	YES	CH	.	.	.
911	10/13/75	59	94	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R4450	85	5.8	YES	ND	.	.	.
912	10/13/75	40	64	1	I.P. SCREENS	1ST DORSAL	SEPT 1975	R4501	121	19.8	YES	IP	.	.	.
913	10/13/75	40	64	1	I.P. SCREENS	1ST DORSAL	SEPT 1975	R4503	98	11.4	YES	CH	.	.	.
914	10/13/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R4338	115	14.0	YES	IP	.	.	.
915	10/13/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R4340	132	24.2	YES	CH	.	.	.
916	10/13/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R4341	131	25.5	NO	ND	.	.	.
917	10/13/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R4342	128	23.1	YES	IP	.	.	.
918	10/13/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R4343	145	31.4	NO	ND	.	.	.
919	10/13/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R4344	134	25.5	YES	CH	.	.	.
920	10/13/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4345	146	34.1	YES	IP	.	.	.
921	10/13/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4346	115	15.4	YES	IP	.	.	.
922	10/13/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4347	134	25.5	YES	IP	.	.	.
923	10/13/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4348	133	24.5	NO	ND	.	.	.
924	10/13/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4349	131	22.3	NO	ND	.	.	.
925	10/13/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4350	143	29.9	YES	CH	.	.	.
926	10/13/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4351	127	21.8	NO	ND	.	.	.
927	10/13/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4252	133	22.5	YES	IP	.	.	.
928	10/13/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4353	126	19.3	YES	IP	.	.	.
929	10/13/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4354	135	24.5	YES	IP	.	.	.
930	10/13/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4355	116	14.0	YES	IP	.	.	.
931	10/13/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4335	130	25.0	NO	ND	.	.	.
932	10/13/75	42	67	3	BEACH SEINE	2ND DORSAL	OCT 1975	R4336	131	28.8	YES	CH	.	.	.
933	10/13/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4337	132	24.9	YES	CH	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON		REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
934	10/13/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4339	135	26.1	YES	CH	.	.	.
935	10/13/75	32	51	3	EPIBENTHIC SLED	2ND DORSAL	OCT	1975	R4087	118	19.2	YES	CH	.	.	.
936	10/14/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4128	84	6.3	YES	IP	.	.	.
937	10/14/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT	1975	R4144	87	7.5	NO	ND	.	.	.
938	10/14/75	32	51	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4321	73	5.2	YES	CH	.	.	.
939	10/14/75	54	86	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4288	131	25.1	YES	IP	.	.	.
940	10/14/75	34	54	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4462	113	17.5	NO	ND	.	.	.
941	10/14/75	48	77	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R5080	133	26.3	YES	IP	.	.	.
942	10/14/75	48	77	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R5081	118	19.0	YES	CH	.	.	.
943	10/14/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4272	125	20.6	YES	IP	.	.	.
944	10/14/75	47	75	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4075	116	18.5	YES	IP	.	.	.
945	10/14/75	47	75	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4068	131	29.8	NO	ND	.	.	.
946	10/14/75	47	75	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4069	137	30.6	YES	IP	.	.	.
947	10/14/75	47	75	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4070	112	16.0	YES	WP	.	.	.
948	10/15/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT	1975	R4242	129	20.1	YES	IP	.	.	.
949	10/15/75	36	58	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4433	95	9.1	YES	IP	.	.	.
950	10/15/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4438	122	18.3	YES	IP	.	.	.
951	10/15/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4439	120	19.4	NO	ND	.	.	.
952	10/15/75	42	67	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4440	118	20.1	NO	ND	.	.	.
953	10/15/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4441	130	24.2	NO	ND	.	.	.
954	10/15/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4442	131	23.5	YES	ND	.	.	.
955	10/15/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4443	138	32.2	YES	IP	.	.	.
956	10/15/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4444	124	20.2	YES	IP	.	.	.
957	10/15/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4445	129	23.4	YES	IP	.	.	.
958	10/15/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4446	122	18.8	YES	IP	.	.	.
959	10/15/75	42	67	3	BOTTOM TRAWL	1ST DORSAL	SEPT	1975	R4480	147	36.1	NO	ND	.	.	.
960	10/15/75	43	69	3	BOTTOM TRAWL	1ST DORSAL	SEPT	1975	R4481	119	16.8	NO	ND	.	.	.
961	10/15/75	35	56	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4273	80	7.1	YES	CH	.	.	.
962	10/15/75	35	56	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4275	100	10.8	YES	CH	.	.	.
963	10/15/75	35	56	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4276	114	17.4	NO	ND	.	.	.
964	10/15/75	35	56	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4277	115	14.5	YES	WP	.	.	.
965	10/15/75	35	56	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4279	93	7.7	NO	ND	.	.	.
966	10/15/75	35	56	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4280	98	10.2	YES	ND	.	.	.
967	10/15/75	35	56	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4281	116	16.5	YES	CH	.	.	.
968	10/15/75	41	66	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4077	130	23.9	YES	ND	.	.	.
969	10/15/75	41	66	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4078	131	23.4	NO	ND	.	.	.
970	10/15/75	41	66	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4079	129	24.5	YES	IP	.	.	.
971	10/15/75	41	66	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4080	129	23.0	YES	CH	.	.	.
972	10/16/75	36	58	2	EPIBENTHIC SLED	2ND DORSAL	FALL	1975	R4479	121	20.6	YES	TZ	.	.	.
973	10/16/75	38	61	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4081	120	18.5	YES	CH	.	.	.
974	10/16/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4082	82	7.6	YES	ND	.	.	.
975	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4195	130	23.6	YES	IP	.	.	.
976	10/16/75	42	67	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4196	117	17.6	NO	ND	.	.	.
977	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4197	157	43.3	NO	ND	.	.	.
978	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4198	124	20.1	NO	ND	.	.	.
979	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4199	118	16.5	YES	IP	.	.	.
980	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4200	125	20.8	YES	IP	.	.	.
981	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4201	96	11.1	NO	ND	.	.	.
982	10/16/75	42	67	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4202	115	16.1	YES	CH	.	.	.
983	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4203	119	16.1	YES	CW	.	.	.
984	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4205	124	22.1	YES	IP	.	.	.
985	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4206	147	35.2	YES	IP	.	.	.
986	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4207	139	29.1	YES	IP	.	.	.
987	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4208	139	28.8	YES	IP	.	.	.
988	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4209	127	23.5	NO	ND	.	.	.
989	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4210	120	15.2	NO	ND	.	.	.
990	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4211	140	33.5	YES	IP	.	.	.
991	10/16/75	42	67	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4213	122	19.5	NO	ND	.	.	.
992	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4214	120	18.6	YES	IP	.	.	.
993	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4215	131	21.9	NO	ND	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON		REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
994	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4216	110	14.4	YES	CH	.	.	.
995	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4217	152	39.0	YES	IP	.	.	.
996	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4218	118	15.9	YES	WP	.	.	.
997	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4219	120	19.7	YES	IP	.	.	.
998	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4220	122	23.2	YES	ND	.	.	.
999	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4221	116	17.0	NO	ND	.	.	.
1000	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4222	134	24.0	NO	ND	.	.	.
1001	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4223	134	23.3	YES	IP	.	.	.
1002	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4224	111	13.8	YES	IP	.	.	.
1003	10/16/75	42	67	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4225	105	12.8	YES	CH	.	.	.
1004	10/16/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4226	121	20.3	NO	ND	.	.	.
1005	10/16/75	42	67	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4227	129	26.5	YES	CH	.	.	.
1006	10/17/75	30	48	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4149	128	24.9	NO	ND	.	.	.
1007	10/17/75	30	48	1	BEACH SEINE	2ND DORSAL	SEPT	1975	R4150	110	.	YES	CH	.	.	.
1008	10/17/75	42	67	3	BEACH SEINE	1ST DORSAL	FALL	1974	R4160	203	119.0	YES	ND	.	.	.
1009	10/17/75	42	67	3	BEACH SEINE	1ST DORSAL	FALL	1974	R4161	209	107.0	NO	ND	.	.	.
1010	10/17/75	42	67	3	BEACH SEINE	1ST DORSAL	FALL	1974	R4162	219	121.0	YES	ND	.	.	.
1011	10/17/75	42	67	3	BEACH SEINE	1ST DORSAL	FALL	1974	R4163	205	113.0	NO	ND	.	.	.
1012	10/17/75	42	67	3	BEACH SEINE	1ST DORSAL	FALL	1974	R4164	207	94.7	YES	ND	.	.	.
1013	10/17/75	42	67	3	BEACH SEINE	1ST DORSAL	FALL	1974	R4165	213	95.0	YES	ND	.	.	.
1014	10/17/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4167	142	32.4	YES	IP	.	.	.
1015	10/17/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4169	132	24.0	YES	CH	.	.	.
1016	10/17/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4170	136	27.1	NO	ND	.	.	.
1017	10/17/75	35	56	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4114	105	15.6	YES	CH	.	.	.
1018	10/20/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4120	130	21.6	NO	ND	.	.	.
1019	10/20/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4121	122	18.5	NO	ND	.	.	.
1020	10/20/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4122	125	20.9	YES	IP	.	.	.
1021	10/20/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4123	107	11.6	YES	IP	.	.	.
1022	10/20/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4152	120	19.7	YES	ND	.	.	.
1023	10/20/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4153	124	18.9	YES	IP	.	.	.
1024	10/20/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4154	113	14.5	YES	IP	.	.	.
1025	10/20/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4492	123	21.0	YES	IP	.	.	.
1026	10/20/75	43	69	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4085	121	17.0	NO	ND	.	.	.
1027	10/20/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4130	123	19.1	YES	ND	.	.	.
1028	10/20/75	39	62	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4159	119	20.2	YES	CH	.	.	.
1029	10/20/75	31	50	1	EPIBENTHIC SLED	2ND DORSAL	OCT	1975	R4386	108	14.9	YES	CH	.	.	.
1030	10/20/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4151	118	16.3	YES	IP	.	.	.
1031	10/20/75	30	48	1	EPIBENTHIC SLED	2ND DORSAL	OCT	1975	R4460	126	21.2	YES	CH	.	.	.
1032	10/20/75	38	61	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4139	101	11.3	YES	CH	.	.	.
1033	10/20/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4141	101	10.2	YES	CW	.	.	.
1034	10/20/75	38	61	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4142	111	15.4	YES	CH	.	.	.
1035	10/21/75	34	54	3	EPIBENTHIC SLED	1ST DORSAL	SEPT	1975	R4475	100	15.6	YES	IP	.	.	.
1036	10/21/75	36	58	1	EPIBENTHIC SLED	1ST DORSAL	SEPT	1975	R4477	108	13.6	YES	IP	.	.	.
1037	10/21/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4447	120	20.2	YES	IP	.	.	.
1038	10/21/75	38	61	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4388	112	16.8	YES	CH	.	.	.
1039	10/21/75	43	69	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4467	124	20.9	YES	IP	.	.	.
1040	10/21/75	37	59	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4372	113	16.0	NO	ND	.	.	.
1041	10/21/75	42	67	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4358	83	6.3	NO	ND	.	.	.
1042	10/21/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4359	148	35.2	YES	IP	.	.	.
1043	10/21/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4360	121	19.0	YES	IP	.	.	.
1044	10/21/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4361	115	14.9	NO	ND	.	.	.
1045	10/21/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4362	123	19.0	YES	IP	.	.	.
1046	10/21/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4363	129	22.5	NO	ND	.	.	.
1047	10/21/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4364	129	22.3	YES	IP	.	.	.
1048	10/21/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4365	111	14.9	YES	IP	.	.	.
1049	10/21/75	42	67	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4366	120	19.9	YES	TZ	.	.	.
1050	10/21/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4368	114	16.1	NO	ND	.	.	.
1051	10/21/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4369	87	7.4	YES	IP	.	.	.
1052	10/21/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4370	96	8.9	NO	ND	.	.	.
1053	10/21/75	25	40	1	EPIBENTHIC SLED	2ND DORSAL	FALL	1975	R4390	123	18.3	NO	ND	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON	REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
1054	10/21/75	25	40	1	EPIBENTHIC SLED	2ND DORSAL	FALL 1975	R4391	84	6.6	YES	CH	.	.	.
1055	10/21/75	25	40	1	EPIBENTHIC SLED	2ND DORSAL	FALL 1975	R4380	141	30.2	YES	CH	.	.	.
1056	10/21/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R4383	131	22.5	NO	ND	.	.	.
1057	10/21/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R4384	115	12.0	YES	IP	.	.	.
1058	10/21/75	26	42	1	EPIBENTHIC SLED	2ND DORSAL	FALL 1975	R4397	136	27.8	NO	ND	.	.	.
1059	10/21/75	26	42	1	EPIBENTHIC SLED	2ND DORSAL	OCT 1975	R4398	119	15.7	YES	CH	.	.	.
1060	10/21/75	26	42	1	EPIBENTHIC SLED	2ND DORSAL	OCT 1975	R4389	112	15.2	YES	CH	.	.	.
1061	10/22/75	27	43	1	EPIBENTHIC SLED	1ST DORSAL	SEPT 1975	R4396	102	9.9	NO	ND	.	.	.
1062	10/22/75	20	32	1	EPIBENTHIC SLED	2ND DORSAL	FALL 1975	R4356	133	23.4	YES	TZ	.	.	.
1063	10/22/75	22	35	1	EPIBENTHIC SLED	2ND DORSAL	OCT 1975	R4423	118	16.6	YES	CH	.	.	.
1064	10/22/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R5129	142	32.5	YES	IP	.	.	.
1065	10/22/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R5130	143	35.5	YES	CH	.	.	.
1066	10/22/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R5131	124	20.8	YES	IP	.	.	.
1067	10/22/75	37	59	1	QLM GEAR	2ND DORSAL	FALL 1975	R5755	128	22.0	NO	ND	.	.	.
1068	10/22/75	19	30	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R5069	128	22.4	YES	IP	.	.	.
1069	10/22/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R5114	93	11.6	YES	CH	.	.	.
1070	10/22/75	33	53	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4905	111	14.2	YES	IP	.	.	.
1071	10/22/75	33	53	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4906	141	32.8	NO	ND	.	.	.
1072	10/22/75	34	54	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R5073	115	15.5	YES	IP	.	.	.
1073	10/22/75	34	54	3	BEACH SEINE	2ND DORSAL	OCT 1975	R5074	135	29.5	YES	CH	.	.	.
1074	10/22/75	34	54	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R5075	132	27.1	NO	ND	.	.	.
1075	10/22/75	34	54	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R5076	117	18.3	YES	IP	.	.	.
1076	10/22/75	34	54	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R5077	118	20.1	YES	CH	.	.	.
1077	10/22/75	34	54	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4949	128	22.3	NO	ND	.	.	.
1078	10/22/75	34	54	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4950	116	15.1	YES	IP	.	.	.
1079	10/22/75	34	54	3	BEACH SEINE	2ND DORSAL	OCT 1975	R4951	126	20.9	YES	CH	.	.	.
1080	10/22/75	34	54	3	BEACH SEINE	2ND DORSAL	OCT 1975	R4952	123	20.2	YES	CH	.	.	.
1081	10/22/75	34	54	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4953	128	21.6	YES	CH	.	.	.
1082	10/22/75	34	54	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4954	105	11.3	YES	CW	.	.	.
1083	10/23/75	16	26	1	EPIBENTHIC SLED	2ND DORSAL	FALL 1975	R4903	114	18.4	YES	TZ	.	.	.
1084	10/23/75	34	54	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4653	95	8.7	YES	IP	.	.	.
1085	10/23/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R5117	132	24.9	YES	IP	.	.	.
1086	10/23/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R5118	120	17.4	YES	IP	.	.	.
1087	10/23/75	38	61	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4742	152	35.2	YES	IP	.	.	.
1088	10/23/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4927	132	24.0	NO	ND	.	.	.
1089	10/23/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4928	141	34.1	YES	CH	.	.	.
1090	10/23/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4929	137	25.5	NO	ND	.	.	.
1091	10/23/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4930	138	27.8	YES	IP	.	.	.
1092	10/23/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4931	129	22.9	NO	ND	.	.	.
1093	10/23/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4932	125	18.7	NO	ND	.	.	.
1094	10/23/75	39	62	1	EPIBENTHIC SLED	1ST DORSAL	SEPT 1975	R4736	118	16.7	NO	ND	.	.	.
1095	10/23/75	38	61	1	BEACH SEINE	2ND DORSAL	FALL 1975	R4602	117	16.0	YES	TZ	.	.	.
1096	10/23/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R4603	129	24.7	YES	CH	.	.	.
1097	10/23/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R4604	125	19.4	NO	ND	.	.	.
1098	10/23/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R4605	109	12.8	YES	IP	.	.	.
1099	10/23/75	38	61	1	BEACH SEINE	2ND DORSAL	FALL 1975	R4606	88	7.0	NO	ND	.	.	.
1100	10/23/75	38	61	1	BEACH SEINE	1SR DORSAL	SEPT 1975	R4607	112	14.7	YES	IP	.	.	.
1101	10/23/75	38	61	1	BEACH SEINE	1SR DORSAL	SEPT 1975	R4608	83	5.4	YES	IP	.	.	.
1102	10/23/75	38	61	2	BEACH SEINE	1ST DORSAL	SEPT 1975	R4600	109	13.3	YES	ND	.	.	.
1103	10/23/75	38	61	2	BEACH SEINE	1ST DORSAL	SEPT 1975	R4601	99	11.6	YES	ND	.	.	.
1104	10/24/75	47	75	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4648	155	43.1	NO	ND	.	.	.
1105	10/24/75	47	75	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4649	123	18.7	YES	CH	.	.	.
1106	10/24/75	47	75	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4650	126	23.8	NO	ND	.	.	.
1107	10/24/75	47	75	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4651	113	14.4	YES	IP	.	.	.
1108	10/24/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R4759	112	14.7	YES	IP	.	.	.
1109	10/24/75	30	48	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R4675	116	13.6	YES	CW	.	.	.
1110	10/24/75	32	51	1	BEACH SEINE	2ND DORSAL	OCT 1975	R4917	128	23.2	YES	CH	.	.	.
1111	10/24/75	32	51	1	BEACH SEINE	2ND DORSAL	OCT 1975	R4918	112	14.4	NO	ND	.	.	.
1112	10/24/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4647	141	33.2	YES	ND	.	.	.
1113	10/24/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4631	127	23.1	YES	IP	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON	REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
1114	10/24/75	41	66	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4612	138	27.7	YES	IP	.	.	.
1115	10/24/75	41	66	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4613	136	29.8	YES	IP	.	.	.
1116	10/24/75	41	66	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4614	124	19.1	YES	IP	.	.	.
1117	10/24/75	39	62	3	BEACH SEINE	2ND DORSAL	OCT 1975	R5066	129	22.8	YES	CH	.	.	.
1118	10/24/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R5067	143	35.5	YES	IP	.	.	.
1119	10/27/75	48	77	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R4536	138	29.3	NO	ND	.	.	.
1120	10/27/75	40	64	1	BEACH SEINE	2ND DORSAL	FALL 1975	R4632	125	21.2	YES	TZ	.	.	.
1121	10/27/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R4633	139	29.3	NO	ND	.	.	.
1122	10/27/75	40	64	1	BEACH SEINE	2ND DORSAL	FALL 1975	R4634	123	19.1	YES	TZ	.	.	.
1123	10/27/75	40	64	1	BEACH SEINE	2ND DORSAL	FALL 1975	R4635	112	16.2	YES	TZ	.	.	.
1124	10/27/75	51	82	3	BEACH SEINE	2ND DORSAL	FALL 1975	R4665	126	20.1	NO	ND	.	.	.
1125	10/27/75	29	46	1	BEACH SEINE	2ND DORSAL	OCT 1975	R4935	128	20.1	YES	CH	.	.	.
1126	10/27/75	48	77	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4576	195	92.9	NO	ND	.	.	.
1127	10/27/75	36	58	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R5072	122	20.5	NO	ND	.	.	.
1128	10/28/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4587	80	5.9	YES	ND	.	.	.
1129	10/28/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4588	133	21.5	YES	IP	.	.	.
1130	10/28/75	54	86	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4891	126	24.6	NO	ND	.	.	.
1131	10/28/75	40	64	3	BEACH SEINE	2ND DORSAL	FALL 1975	R5212	122	19.7	YES	TZ	.	.	.
1132	10/28/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R5201	126	22.3	YES	IP	.	.	.
1133	10/28/75	31	50	1	EPIBENTHIC SLED	1ST DORSAL	SEPT 1975	R4657	114	14.2	YES	IP	.	.	.
1134	10/28/75	36	58	3	BEACH SEINE	2ND DORSAL	OCT 1975	R4663	120	17.7	YES	CH	.	.	.
1135	10/28/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4516	117	16.5	YES	IP	.	.	.
1136	10/28/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4517	105	13.3	NO	ND	.	.	.
1137	10/28/75	36	58	1	BEACH SEINE	2ND DORSAL	FALL 1975	R4589	131	22.9	ND	ND	.	.	.
1138	10/28/75	34	54	3	BEACH SEINE	2ND DORSAL	FALL 1975	R4943	121	19.4	NO	ND	.	.	.
1139	10/28/75	34	54	3	BEACH SEINE	2ND DORSAL	FALL 1975	R4944	95	8.9	NO	ND	.	.	.
1140	10/28/75	34	54	3	BEACH SEINE	2ND DORSAL	OCT 1975	R4945	120	18.4	YES	CH	.	.	.
1141	10/28/75	34	54	3	BEACH SEINE	2ND DORSAL	OCT 1975	R4946	120	18.1	YES	CH	.	.	.
1142	10/28/75	55	88	3	BEACH SEINE	2ND DORSAL	OCT 1975	R5029	119	17.9	YES	CH	.	.	.
1143	10/28/75	55	88	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R5030	112	14.8	YES	IP	.	.	.
1144	10/28/75	55	88	3	BEACH SEINE	2ND DORSAL	OCT 1975	R5031	129	22.3	YES	CH	.	.	.
1145	10/28/75	55	88	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R5032	119	15.3	YES	IP	.	.	.
1146	10/28/75	55	88	3	BEACH SEINE	2ND DORSAL	OCT 1975	R5033	120	18.8	YES	CH	.	.	.
1147	10/28/75	55	88	3	BEACH SEINE	2ND DORSAL	OCT 1975	R5034	114	15.2	YES	CH	.	.	.
1148	10/28/75	35	56	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R5082	159	47.2	NO	ND	.	.	.
1149	10/28/75	35	56	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R5083	127	20.8	YES	IP	.	.	.
1150	10/28/75	35	56	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R5084	117	17.9	YES	IP	.	.	.
1151	10/28/75	35	56	3	BEACH SEINE	2ND DORSAL	OCT 1975	R5085	130	21.9	YES	CH	.	.	.
1152	10/28/75	35	56	3	BEACH SEINE	2ND DORSAL	FALL 1975	R5086	127	20.2	YES	TZ	.	.	.
1153	10/28/75	35	56	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R5087	124	19.0	YES	IP	.	.	.
1154	10/28/75	35	56	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R5088	118	16.9	YES	IP	.	.	.
1155	10/28/75	35	56	3	BEACH SEINE	2ND DORSAL	OCT 1975	R5089	103	11.9	YES	CH	.	.	.
1156	10/28/75	35	56	3	BEACH SEINE	2ND DORSAL	FALL 1975	R5090	94	8.6	YES	TZ	.	.	.
1157	10/28/75	35	56	3	BEACH SEINE	2ND DORSAL	OCT 1975	R5091	122	18.6	YES	CH	.	.	.
1158	10/28/75	35	56	3	BEACH SEINE	2ND DORSAL	OCT 1975	R5092	105	11.7	YES	CH	.	.	.
1159	10/28/75	38	61	1	BEACH SEINE	2ND DORSAL	OCT 1975	R5055	131	23.4	YES	CH	.	.	.
1160	10/28/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R5056	132	26.5	YES	CH	.	.	.
1161	10/28/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R5057	121	19.9	YES	WP	.	.	.
1162	10/28/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R5058	150	37.1	YES	CH	.	.	.
1163	10/28/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT 1975	R5062	115	15.3	YES	CH	.	.	.
1164	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4957	123	16.8	YES	IP	.	.	.
1165	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4958	134	24.9	NO	ND	.	.	.
1166	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4959	132	23.1	YES	ND	.	.	.
1167	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4960	127	19.9	NO	ND	.	.	.
1168	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4961	132	23.9	YES	IP	.	.	.
1169	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4962	115	16.5	YES	IP	.	.	.
1170	10/29/75	40	64	3	BEACH SEINE	2ND DORSAL	OCT 1975	R4963	126	21.4	YES	CH	.	.	.
1171	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4964	141	30.1	YES	CH	.	.	.
1172	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4965	125	19.4	YES	IP	.	.	.
1173	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT 1975	R4966	124	18.4	YES	IP	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON		REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
1174	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4967	120	16.7	YES	IP	.	.	.
1175	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4968	150	36.9	YES	CH	.	.	.
1176	10/29/75	40	64	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4969	140	29.6	YES	TZ	.	.	.
1177	10/29/75	40	64	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4970	127	20.2	YES	CH	.	.	.
1178	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4971	124	17.3	NO	ND	.	.	.
1179	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4972	123	17.6	NO	ND	.	.	.
1180	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4973	123	17.8	YES	CH	.	.	.
1181	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4974	119	16.9	YES	IP	.	.	.
1182	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4975	109	11.9	NO	ND	.	.	.
1183	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4976	126	17.5	NO	ND	.	.	.
1184	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4977	92	8.3	YES	IP	.	.	.
1185	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4978	90	.	YES	CW	.	.	.
1186	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4979	125	18.3	YES	IP	.	.	.
1187	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4980	125	24.1	YES	IP	.	.	.
1188	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4981	118	15.0	YES	IP	.	.	.
1189	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4982	125	20.3	NO	ND	.	.	.
1190	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4983	98	8.9	NO	ND	.	.	.
1191	10/29/75	40	64	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4985	75	4.7	YES	CH	.	.	.
1192	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4987	139	28.1	NO	ND	.	.	.
1193	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4988	133	27.5	YES	IP	.	.	.
1194	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4989	133	22.2	NO	ND	.	.	.
1195	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4990	122	18.8	YES	IP	.	.	.
1196	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4991	130	22.1	YES	IP	.	.	.
1197	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4992	135	24.8	YES	IP	.	.	.
1198	10/29/75	40	64	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4993	126	18.7	YES	CH	.	.	.
1199	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4994	126	23.3	YES	IP	.	.	.
1200	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4995	122	18.8	NO	ND	.	.	.
1201	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4996	126	19.2	NO	ND	.	.	.
1202	10/29/75	40	64	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4997	124	18.9	YES	CH	.	.	.
1203	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4998	125	21.0	NO	ND	.	.	.
1204	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4999	132	26.0	YES	IP	.	.	.
1205	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5000	138	27.4	YES	CH	.	.	.
1206	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5001	125	19.2	YES	IP	.	.	.
1207	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5002	100	9.6	NO	ND	.	.	.
1208	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5004	122	16.3	YES	IP	.	.	.
1209	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5005	122	18.9	YES	IP	.	.	.
1210	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5007	97	9.4	YES	IP	.	.	.
1211	10/29/75	66	106	1	DANSKAMMER SCREENS	1ST DORSAL	SEPT	1975	R6161	108	7.6	YES	IP	.	.	.
1212	10/29/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4618	140	26.2	YES	IP	.	.	.
1213	10/29/75	34	54	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4538	88	10.7	YES	TZ	.	.	.
1214	10/29/75	34	54	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4551	126	22.4	YES	CH	.	.	.
1215	10/29/75	39	62	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4562	132	24.8	YES	CH	.	.	.
1216	10/29/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4564	85	6.6	NO	ND	.	.	.
1217	10/29/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4563	114	14.3	YES	IP	.	.	.
1218	10/29/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4584	132	22.8	YES	CH	.	.	.
1219	10/29/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4585	109	12.4	NO	ND	.	.	.
1220	10/29/75	39	62	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4533	96	9.0	YES	CH	.	.	.
1221	10/29/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4535	119	16.7	YES	IP	.	.	.
1222	10/29/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4636	150	36.2	YES	CH	.	.	.
1223	10/29/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5020	103	10.9	ND	ND	.	.	.
1224	10/29/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5009	115	15.3	YES	IP	.	.	.
1225	10/29/75	39	62	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5010	136	25.3	YES	CH	.	.	.
1226	10/29/75	39	62	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5011	130	24.6	NO	ND	.	.	.
1227	10/29/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5012	108	12.9	YES	CH	.	.	.
1228	10/29/75	39	62	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5013	128	22.2	YES	TZ	.	.	.
1229	10/29/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5014	116	15.6	NO	ND	.	.	.
1230	10/29/75	39	62	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5015	120	18.1	YES	CH	.	.	.
1231	10/29/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5016	127	20.1	YES	IP	.	.	.
1232	10/29/75	39	62	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5017	106	11.7	YES	TZ	.	.	.
1233	10/29/75	39	62	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5018	109	14.1	NO	ND	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON		REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
1234	10/29/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5019	112	14.4	YES	IP	.	.	.
1235	10/29/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5008	115	15.3	NO	ND	.	.	.
1236	10/29/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4737	130	23.7	NO	ND	.	.	.
1237	10/29/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4738	126	24.8	NO	ND	.	.	.
1238	10/29/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4739	115	14.8	YES	CH	.	.	.
1239	10/30/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5133	141	31.9	NO	ND	.	.	.
1240	10/30/75	40	64	1	BEACH SEINE	2ND DORSAL	OCT	1975	R5111	117	16.8	NO	CH	.	.	.
1241	10/30/75	40	64	1	BEACH SEINE	2ND DORSAL	FALL	1975	R5112	128	22.2	YES	TZ	.	.	.
1242	10/30/75	48	77	1	BEACH SEINE	1ST DORSAL	FALL	1974	R4569	178	58.1	YES	ND	.	.	.
1243	10/30/75	48	77	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4570	121	17.4	YES	IP	.	.	.
1244	10/30/75	48	77	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4571	120	16.8	YES	IP	.	.	.
1245	10/30/75	48	77	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4572	125	18.8	YES	IP	.	.	.
1246	10/31/75	41	66	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4883	119	19.5	NO	ND	.	.	.
1247	10/31/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4537	137	30.3	NO	ND	.	.	.
1248	11/01/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT	1975	R4658	127	20.9	NO	ND	.	.	.
1249	11/01/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT	1975	R4659	119	17.2	YES	IP	.	.	.
1250	11/01/75	42	67	3	I.P. SCREENS	2ND DORSAL	OCT	1975	R4660	103	10.6	YES	CH	.	.	.
1251	11/03/75	42	67	3	BEACH SEINE	1ST DORSAL	OCT	1975	R4881	121	16.8	NO	ND	.	.	.
1252	11/03/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT	1975	R5051	118	15.3	YES	ND	.	.	.
1253	11/03/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5199	141	29.7	YES	IP	.	.	.
1254	11/03/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R5193	113	14.4	YES	IP	.	.	.
1255	11/03/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R5194	115	16.1	NO	ND	.	.	.
1256	11/03/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R5195	99	8.9	YES	IP	.	.	.
1257	11/03/75	40	64	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R5196	117	15.9	YES	IP	.	.	.
1258	11/04/75	13	21	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4762	91	7.8	YES	CH	.	.	.
1259	11/04/75	36	58	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4793	120	16.6	YES	CH	.	.	.
1260	11/04/75	36	58	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4794	104	12.0	YES	CH	.	.	.
1261	11/04/75	36	58	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4640	136	27.3	YES	CH	.	.	.
1262	11/04/75	38	61	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4884	130	24.4	YES	CH	.	.	.
1263	11/04/75	46	74	3	BOTTOM TRAWL	1ST DORSAL	SEPT	1975	R5281	118	16.4	NO	ND	.	.	.
1264	11/05/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5035	117	18.5	YES	ND	.	.	.
1265	11/05/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5036	123	21.5	YES	CW	.	.	.
1266	11/05/75	30	48	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4561	123	18.2	NO	ND	.	.	.
1267	11/05/75	37	59	1	QLM GEAR	1ST DORSAL	SEPT	1975	R5726	126	18.0	YES	IP	.	.	.
1268	11/05/75	37	59	1	QLM GEAR	1ST DORSAL	SEPT	1975	R5727	142	29.4	YES	CW	.	.	.
1269	11/05/75	37	59	1	QLM GEAR	1ST DORSAL	SEPT	1975	R5728	123	16.3	YES	CW	.	.	.
1270	11/05/75	37	59	1	QLM GEAR	2ND DORSAL	FALL	1975	R5729	132	25.1	NO	ND	.	.	.
1271	11/05/75	37	59	1	QLM GEAR	1ST DORSAL	SEPT	1975	R5730	105	11.7	YES	CH	.	.	.
1272	11/05/75	40	64	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4878	150	35.4	YES	CH	.	.	.
1273	11/05/75	40	64	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4921	128	22.0	YES	TZ	.	.	.
1274	11/05/75	40	64	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4922	141	31.5	NO	ND	.	.	.
1275	11/05/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4743	126	21.7	YES	IP	.	.	.
1276	11/05/75	40	64	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4744	112	14.4	YES	CH	.	.	.
1277	11/05/75	51	82	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5121	141	29.2	YES	IP	.	.	.
1278	11/05/75	39	62	3	BOTTOM TRAWL	2ND DORSAL	OCT	1975	R5240	131	23.4	YES	CH	.	.	.
1279	11/05/75	39	62	1	BOTTOM TRAWL	1ST DORSAL	SEPT	1975	R5434	132	22.3	YES	IP	.	.	.
1280	11/05/75	29	46	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4670	124	19.3	YES	CH	.	.	.
1281	11/05/75	37	59	1	QLM GEAR	1ST DORSAL	SEPT	1975	R5743	124	19.2	YES	IP	.	.	.
1282	11/05/75	37	59	1	QLM GEAR	1ST DORSAL	SEPT	1975	R5744	140	25.5	YES	IP	.	.	.
1283	11/05/75	37	59	1	QLM GEAR	2ND DORSAL	FALL	1975	R5745	118	17.8	YES	TZ	.	.	.
1284	11/06/75	41	66	1	LOVETT SCREENS	1ST DORSAL	SEPT	1975	R5751	118	16.3	YES	CH	.	.	.
1285	11/06/75	41	66	1	LOVETT SCREENS	2ND DORSAL	OCT	1975	R5752	164	47.2	YES	CH	.	.	.
1286	11/06/75	41	66	1	LOVETT SCREENS	1ST DORSAL	SEPT	1975	R5753	129	18.3	NO	ND	.	.	.
1287	11/06/75	40	64	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4609	135	25.0	YES	TZ	.	.	.
1288	11/06/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4610	145	33.3	NO	ND	.	.	.
1289	11/06/75	27	43	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4791	123	20.5	YES	CH	.	.	.
1290	11/06/75	41	66	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4664	118	17.2	NO	ND	.	.	.
1291	11/06/75	41	66	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4625	82	6.2	YES	ND	.	.	.
1292	11/06/75	41	66	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4626	120	16.1	YES	CH	.	.	.
1293	11/06/75	41	66	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4627	120	15.3	YES	IP	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON		REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
1294	11/06/75	41	66	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4628	140	31.3	YES	IP	.	.	.
1295	11/06/75	41	66	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4629	130	20.4	YES	IP	.	.	.
1296	11/06/75	41	66	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4630	129	24.8	YES	TZ	.	.	.
1297	11/06/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4936	120	17.1	YES	IP	.	.	.
1298	11/06/75	35	56	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4888	123	20.2	YES	IP	.	.	.
1299	11/06/75	35	56	1	BEACH SEINE	2ND DORSAL	FALL	1975	R4889	141	30.3	NO	ND	.	.	.
1300	11/07/75	36	58	1	BEACH SEINE	2ND DORSAL	OCT	1975	R5021	111	15.4	YES	CH	.	.	.
1301	11/07/75	36	58	1	BEACH SEINE	2ND DORSAL	OCT	1975	R5023	114	15.5	YES	CH	.	.	.
1302	11/07/75	39	62	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4784	146	34.0	NO	ND	.	.	.
1303	11/07/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4785	133	25.4	YES	IP	.	.	.
1304	11/08/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT	1975	R4724	131	20.1	YES	IP	.	.	.
1305	11/10/75	29	46	1	BEACH SEINE	2ND DORSAL	FALL	1975	R4712	128	25.8	YES	TZ	.	.	.
1306	11/10/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4741	147	33.6	YES	CH	.	.	.
1307	11/10/75	30	48	1	BEACH SEINE	2ND DORSAL	FALL	1975	R4524	121	19.5	YES	TZ	.	.	.
1308	11/10/75	30	48	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4525	123	19.1	YES	CH	.	.	.
1309	11/10/75	35	56	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4530	129	22.6	YES	IP	.	.	.
1310	11/10/75	35	56	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4531	129	22.3	NO	ND	.	.	.
1311	11/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4701	145	31.9	NO	ND	.	.	.
1312	11/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4702	140	31.8	YES	IP	.	.	.
1313	11/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4703	138	30.1	YES	IP	.	.	.
1314	11/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4704	133	25.9	YES	IP	.	.	.
1315	11/10/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4705	104	11.1	YES	CH	.	.	.
1316	11/10/75	38	61	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4717	90	7.2	YES	CH	.	.	.
1317	11/10/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4720	105	12.9	YES	IP	.	.	.
1318	11/10/75	38	61	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4645	118	17.4	YES	CH	.	.	.
1319	11/10/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4646	87	8.9	YES	IP	.	.	.
1320	11/10/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4643	118	14.7	NO	IP	.	.	.
1321	11/11/75	39	62	2	EPIBENTHIC SLED	ND DORSAL	FALL	1975	R4567	126	20.1	NO	ND	.	.	.
1322	11/11/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT	1975	R5403	119	16.0	NO	ND	.	.	.
1323	11/11/75	27	43	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4848	105	12.4	YES	CH	.	.	.
1324	11/11/75	40	64	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5148	151	38.2	YES	CH	.	.	.
1325	11/11/75	40	64	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5152	118	17.9	YES	CH	.	.	.
1326	11/11/75	40	64	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5153	128	20.9	YES	CH	.	.	.
1327	11/11/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5154	119	15.6	NO	ND	.	.	.
1328	11/11/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5155	132	24.7	YES	IP	.	.	.
1329	11/11/75	40	64	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4666	117	11.9	YES	CH	.	.	.
1330	11/11/75	40	64	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4667	120	12.8	NO	ND	.	.	.
1331	11/11/75	40	64	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4668	135	19.7	YES	CH	.	.	.
1332	11/11/75	42	67	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4616	119	13.5	NO	ND	.	.	.
1333	11/11/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4617	131	18.0	YES	IP	.	.	.
1334	11/11/75	13	21	1	BEACH SEINE	2ND DORSAL	FALL	1975	R4522	100	11.1	YES	TZ	.	.	.
1335	11/11/75	15	24	1	BEACH SEINE	2ND DORSAL	FALL	1975	R4792	116	17.2	YES	TZ	.	.	.
1336	11/11/75	36	58	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4799	126	19.4	YES	IP	.	.	.
1337	11/11/75	36	58	1	BEACH SEINE	2ND DORSAL	FALL	1975	R4800	137	25.9	NO	ND	.	.	.
1338	11/11/75	36	58	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4801	137	23.6	YES	IP	.	.	.
1339	11/11/75	36	58	1	BEACH SEINE	2ND DORSAL	FALL	1975	R4802	130	22.0	YES	TZ	.	.	.
1340	11/11/75	36	58	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4803	125	20.7	YES	CH	.	.	.
1341	11/11/75	36	58	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4804	127	18.1	YES	IP	.	.	.
1342	11/11/75	36	58	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4805	115	15.6	YES	IP	.	.	.
1343	11/11/75	36	58	1	BEACH SEINE	2ND DORSAL	FALL	1975	R4806	123	17.6	YES	TZ	.	.	.
1344	11/11/75	36	58	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4807	134	23.3	YES	CH	.	.	.
1345	11/11/75	33	53	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4638	113	13.9	YES	CH	.	.	.
1346	11/11/75	34	54	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4682	123	19.1	YES	TZ	.	.	.
1347	11/11/75	34	54	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4683	127	20.4	NO	ND	.	.	.
1348	11/11/75	34	54	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4684	120	16.4	YES	TZ	.	.	.
1349	11/11/75	26	42	3	EPIBENTHIC SLED	2ND DORSAL	FALL	1975	R5187	124	22.1	NO	ND	.	.	.
1350	11/12/75	29	46	2	EPIBENTHIC SLED	1ST DORSAL	SEPT	1975	R5189	121	17.5	NO	ND	.	.	.
1351	11/12/75	30	48	2	EPIBENTHIC SLED	2ND DORSAL	OCT	1975	R5207	135	27.4	YES	CH	.	.	.
1352	11/12/75	39	62	1	BOTTOM TRAWL	2ND DORSAL	OCT	1975	R5204	121	19.4	YES	CH	.	.	.
1353	11/12/75	40	64	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4934	126	16.0	NO	ND	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON		REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
1354	11/12/75	38	61	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4818	136	23.9	YES	CH			
1355	11/12/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4721	147	33.3	NO	ND	.	.	.
1356	11/12/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4722	126	20.1	NO	ND	.	.	.
1357	11/12/75	36	58	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4688	139	28.0	YES	CH	.	.	.
1358	11/12/75	36	58	1	BEACH SEINE	2ND DORSAL	FALL	1975	R4689	128	20.7	NO	ND	.	.	.
1359	11/12/75	36	58	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4690	120	17.8	YES	CH	.	.	.
1360	11/12/75	36	58	1	BEACH SEINE	2ND DORSAL	FALL	1975	R4691	120	18.0	NO	ND	.	.	.
1361	11/12/75	36	58	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4692	114	13.9	YES	CH	.	.	.
1362	11/12/75	36	58	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4693	123	17.9	YES	CH	.	.	.
1363	11/12/75	36	58	1	BEACH SEINE	2ND DORSAL	FALL	1975	R4695	108	12.5	NO	ND	.	.	.
1364	11/12/75	39	62	3	EPIBENTHIC SLED	1ST DORSAL	SEPT	1975	R5213	95	8.3	NO	ND	.	.	.
1365	11/12/75	37	59	3	EPIBENTHIC SLED	1ST DORSAL	SEPT	1975	R5200	121	15.8	NO	ND	.	.	.
1366	11/12/75	33	53	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4880	112	15.5	YES	CH	.	.	.
1367	11/12/75	35	58	1	EPIBENTHIC SLED	2ND DORSAL	FALL	1975	R5190	75	3.9	NO	ND	.	.	.
1368	11/13/75	66	106	1	DANSKAMMER SCREENS	2ND DORSAL	FALL	1975	R6126	113	22.5	YES	TZ	.	.	.
1369	11/13/75	65	106	1	DANSKAMMER SCREENS	2ND DORSAL	OCT	1975	R6125	137	23.6	YES	CH	.	.	.
1370	11/13/75	141	226	1	ALBANY SCREENS	2ND DORSAL	OCT	1975	R6274	115	15.4	YES	CH	.	.	.
1371	11/13/75	66	106	1	DANSKAMMER SCREENS	2ND DORSAL	FALL	1975	R6140	134	26.1	YES	TZ	.	.	.
1372	11/13/75	36	58	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5141	132	25.7	YES	CH	.	.	.
1373	11/13/75	36	58	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5142	125	19.9	YES	IP	.	.	.
1374	11/13/75	41	66	2	SURFACE TRAWL	1ST DORSAL	SEPT	1975	R5211	127	23.3	YES	IP	.	.	.
1375	11/13/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5101	135	19.7	YES	IP	.	.	.
1376	11/13/75	42	67	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5102	147	27.5	YES	TZ	.	.	.
1377	11/13/75	32	.	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4788	101	9.8	YES	CH	.	.	.
1378	11/13/75	30	48	1	BEACH SEINE	2ND DORSAL	FALL	1975	R4894	120	19.9	YES	TZ		.	
1379	11/13/75	41	66	1	LOVETT SCREENS	2ND DORSAL	FALL	1975	R5747	114	14.5	NO	ND	.	.	.
1380	11/13/75	41	66	1	LOVETT SCREENS	2ND DORSAL	FALL	1975	R5748	88	6.2	NO	ND	.	.	.
1381	11/14/75	42	67	3	I.P. SCREENS	2ND DORSAL	FALL	1975	R5277	140	28.5	NO	ND	.	.	.
1382	11/14/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4714	130	23.5	YES	CH	.	.	.
1383	11/14/75	39	62	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4512	132	22.6	YES	CH	.	.	.
1384	11/14/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4838	138	21.7	YES	IP	.	.	.
1385	11/17/75	40	64	1	BEACH SEINE	2ND DORSAL	OCT	1975	R5206	101	10.4	NO	ND	.	.	.
1386	11/17/75	34	54	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4849	138	26.2	YES	TZ	.	.	.
1387	11/17/75	34	54	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4850	126	19.6	YES	IP	.	.	.
1388	11/17/75	34	54	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4852	92	8.0	YES	CH	.	.	.
1389	11/17/75	34	54	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4827	116	15.8	YES	CH	.	.	.
1390	11/17/75	34	54	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4828	102	9.7	YES	CH	.	.	.
1391	11/17/75	34	54	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4829	126	19.8	YES	CH	.	.	.
1392	11/17/75	34	54	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4830	105	11.2	YES	CH	.	.	.
1393	11/17/75	34	54	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4831	89	8.4	YES	IP	.	.	.
1394	11/17/75	34	54	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4836	90	6.9	YES	TZ	.	.	.
1395	11/17/75	35	56	3	BEACH SEINE	2ND DORSAL	FALL	1975	R4862	97	8.6	YES	TZ	.	.	.
1396	11/17/75	35	56	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4858	136	23.7	YES	IP	.	.	.
1397	11/17/75	35	56	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4859	113	16.3	YES	IP	.	.	.
1398	11/17/75	35	56	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4860	98	10.8	NO	ND	.	.	.
1399	11/17/75	35	56	3	BEACH SEINE	2ND DORSAL	OCT	1975	R4861	84	6.0	YES	CH	.	.	.
1400	11/17/75	38	61	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4820	128	21.1	YES	CH	.	.	.
1401	11/17/75	38	61	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4821	123	16.7	YES	CH	.	.	.
1402	11/17/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4822	123	16.9	NO	ND	.	.	.
1403	11/17/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4823	118	15.9	NO	ND	.	.	.
1404	11/17/75	38	61	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4824	122	17.1	NO	ND	.	.	.
1405	11/17/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4825	96	10.4	NO	ND	.	.	.
1406	11/17/75	38	61	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R4826	97	8.2	NO	ND	.	.	.
1407	11/18/75	43	69	3	EPIBENTHIC SLED	1ST DORSAL	SEPT	1975	R4566	155	33.7	YES	IP	.	.	.
1408	11/18/75	15	24	1	BEACH SEINE	2ND DORSAL	OCT	1975	R4948	78	4.8	YES	CH	.	.	.
1409	11/18/75	14	22	1	BEACH SEINE	2ND DORSAL	FALL	1975	R5098	87	5.9	NO	ND	.	.	.
1410	11/18/75	14	22	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R5110	100	10.3	YES	CH	.	.	.
1411	11/18/75	30	48	1	BEACH SEINE	2ND DORSAL	FALL	1975	R4941	120	16.1	YES	TZ	.	.	.
1412	11/18/75	30	48	1	BEACH SEINE	2ND DORSAL	FALL	1975	R4942	110	19.9	YES	TZ	.	.	.
1413	11/18/75	33	53	1	BEACH SEINE	2ND DORSAL	FALL	1975	R5143	126	20.0	YES	TZ	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON		REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
1414	11/18/75	34	54	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5218	117	15.7	NO	ND	.	.	.
1415	11/18/75	34	54	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5220	123	16.7	YES	IP	.	.	.
1416	11/18/75	36	58	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R4939	124	17.2	NO	ND	.	.	.
1417	11/18/75	38	61	1	BEACH SEINE	2ND DORSAL	FALL	1975	R5135	123	18.3	YES	TZ	.	.	.
1418	11/18/75	38	61	1	BEACH SEINE	2ND DORSAL	FALL	1975	R5136	121	18.7	YES	TZ	.	.	.
1419	11/18/75	38	61	1	BEACH SEINE	2ND DORSAL	OCT	1975	R5137	115	15.8	NO	ND	.	.	.
1420	11/19/75	39	62	1	EPIBENTHIC SLED	1ST DORSAL	SEPT	1975	R5185	126	19.1	YES	IP	.	.	.
1421	11/19/75	37	59	1	QLM GEAR	2ND DORSAL	FALL	1975	R5725	129	23.2	YES	TZ	.	.	.
1422	11/19/75	41	66	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5047	126	16.6	YES	IP	.	.	.
1423	11/19/75	37	59	1	QLM GEAR	2ND DORSAL	FALL	1975	R5721	155	43.3	NO	ND	.	.	.
1424	11/19/75	37	59	1	QLM GEAR	2ND DORSAL	FALL	1975	R5722	135	25.5	YES	CH	.	.	.
1425	11/19/75	37	59	1	QLM GEAR	2ND DORSAL	FALL	1975	R5723	136	24.6	YES	TZ	.	.	.
1426	11/19/75	37	59	1	QLM GEAR	2ND DORSAL	FALL	1975	R5724	156	43.1	YES	TZ	.	.	.
1427	11/19/75	65	106	1	DANSKAMMER SCREENS	1ST DORSAL	SEPT	1975	R6151	112	14.4	YES	CW	.	.	.
1428	11/19/75	41	66	1	QLM GEAR	2ND DORSAL	OCT	1975	R5749	129	21.3	YES	CH	.	.	.
1429	11/19/75	41	66	1	QLM GEAR	2ND DORSAL	FALL	1975	R5750	143	31.4	YES	TZ	.	.	.
1430	11/19/75	42	67	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5723	125	20.6	YES	IP	.	.	.
1431	11/19/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5224	135	30.5	NO	ND	.	.	.
1432	11/19/75	42	67	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5225	129	26.2	YES	TZ	.	.	.
1433	11/19/75	42	67	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5226	128	21.1	YES	IP	.	.	.
1434	11/19/75	42	67	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5227	116	16.3	YES	TZ	.	.	.
1435	11/19/75	42	67	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5228	125	22.0	YES	IP	.	.	.
1436	11/19/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5229	118	14.8	YES	IP	.	.	.
1437	11/19/75	42	67	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5230	121	20.3	NO	ND	.	.	.
1438	11/19/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5231	110	14.6	YES	IP	.	.	.
1439	11/19/75	37	59	1	BEACH SEINE	2ND DORSAL	OCT	1975	R5151	127	18.7	YES	CH	.	.	.
1440	11/19/75	65	104	1	ROSETON SCREENS	2ND DORSAL	OCT	1975	R6158	82	5.2	YES	CH	.	.	.
1441	11/19/75	66	106	1	DANSKAMMER SCREENS	1ST DORSAL	SEPT	1975	R6154	134	26.2	YES	IP	.	.	.
1442	11/19/75	66	106	1	BEACH SEINE	2ND DORSAL	OCT	1975	R5167	108	13.0	YES	CH	.	.	.
1443	11/19/75	66	106	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R5168	110	12.4	YES	CW	.	.	.
1444	11/19/75	66	106	1	BEACH SEINE	2ND DORSAL	OCT	1975	R5169	142	29.6	YES	CH	.	.	.
1445	11/19/75	66	106	1	BEACH SEINE	2ND DORSAL	OCT	1975	R5170	123	16.8	YES	CH	.	.	.
1446	11/19/75	66	106	1	BEACH SEINE	2ND DORSAL	OCT	1975	R5171	128	19.5	YES	CH	.	.	.
1447	11/19/75	66	106	1	BEACH SEINE	2ND DORSAL	FALL	1975	R5172	115	13.1	NO	ND	.	.	.
1448	11/19/75	66	106	1	BEACH SEINE	1ST DORSAL	SEPT	1975	R5173	131	21.0	YES	ND	.	.	.
1449	11/19/75	66	106	1	BEACH SEINE	2ND DORSAL	FALL	1975	R5174	105	14.5	YES	ND	.	.	.
1450	11/19/75	34	54	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5156	108	12.9	YES	TZ	.	.	.
1451	11/19/75	34	54	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5158	88	6.4	NO	ND	.	.	.
1452	11/19/75	34	54	3	BEACH SEINE	2ND DORSAL	OCT	1975	P5163	117	15.5	YES	CH	.	.	.
1453	11/19/75	34	54	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5164	126	19.6	YES	CH	.	.	.
1454	11/19/75	34	54	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5165	110	13.2	YES	CH	.	.	.
1455	11/20/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT	1975	R5410	118	16.1	YES	IP	.	.	.
1456	11/20/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5418	104	11.5	YES	CH	.	.	.
1457	11/20/75	39	62	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5455	118	15.6	NO	ND	.	.	.
1458	11/20/75	39	62	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5233	131	21.0	YES	IP	.	.	.
1459	11/20/75	39	62	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5234	122	17.7	NO	NC	.	.	.
1460	11/20/75	39	62	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5235	111	12.5	NO	NC	.	.	.
1461	11/20/75	39	62	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5236	120	17.0	YES	TZ	.	.	.
1462	11/20/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5376	122	11.2	YES	ND	.	.	.
1463	11/20/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5377	127	19.8	NO	ND	.	.	.
1464	11/20/75	40	64	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5378	130	21.3	YES	CH	.	.	.
1465	11/20/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5379	135	26.4	NO	ND	.	.	.
1466	11/20/75	40	64	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5380	108	12.5	YES	CH	.	.	.
1467	11/20/75	40	64	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5381	109	12.1	NO	ND	.	.	.
1468	11/20/75	40	64	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5382	137	24.1	YES	TZ	.	.	.
1469	11/20/75	40	64	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5383	126	1790.0	YES	CH	.	.	.
1470	11/20/75	40	64	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5384	118	16.6	YES	CH	.	.	.
1471	11/20/75	40	64	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5385	123	19.3	NO	ND	.	.	.
1472	11/20/75	40	64	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5386	105	17.5	NO	ND	.	.	.
1473	11/20/75	40	64	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5387	128	18.7	YES	CH	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON		REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
1474	11/20/75	40	64	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5388	119	14.8	YES	CH	.	.	.
1475	11/20/75	40	64	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5389	118	15.5	NO	ND	.	.	.
1476	11/20/75	40	64	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5390	128	21.0	YES	CH	.	.	.
1477	11/20/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5391	130	19.7	YES	IP	.	.	.
1478	11/20/75	40	64	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5392	106	14.0	NO	ND	.	.	.
1479	11/20/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5393	133	22.7	NO	ND	.	.	.
1480	11/20/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5394	121	16.5	NO	ND	.	.	.
1481	11/20/75	40	64	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5395	99	8.8	YES	IP	.	.	.
1482	11/20/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5295	157	39.6	NO	ND	.	.	.
1483	11/20/75	42	67	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5297	132	23.1	NO	ND	.	.	.
1484	11/20/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5298	153	36.0	NO	ND	.	.	.
1485	11/20/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5300	131	23.1	NO	ND	.	.	.
1486	11/20/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5302	130	20.3	YES	IP	.	.	.
1487	11/20/75	42	67	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5303	111	12.2	YES	TZ	.	.	.
1488	11/20/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5304	110	11.3	YES	CH	.	.	.
1489	11/20/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5305	133	23.0	YES	IP	.	.	.
1490	11/20/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5306	133	21.1	YES	IP	.	.	.
1491	11/20/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5307	138	27.0	NO	ND	.	.	.
1492	11/20/75	42	67	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5308	135	24.7	YES	CH	.	.	.
1493	11/20/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5309	126	19.1	YES	WP	.	.	.
1494	11/20/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5310	139	26.0	YES	CH	.	.	.
1495	11/20/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5311	130	18.5	YES	IP	.	.	.
1496	11/20/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5312	120	16.5	YES	IP	.	.	.
1497	11/20/75	42	67	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5313	117	15.2	NO	ND	.	.	.
1498	11/20/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5314	130	23.1	YES	CH	.	.	.
1499	11/20/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5315	115	13.2	YES	IP	.	.	.
1500	11/20/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5317	146	34.1	YES	IP	.	.	.
1501	11/20/75	42	67	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5318	122	16.3	NO	ND	.	.	.
1502	11/20/75	42	67	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5319	116	15.7	NO	ND	.	.	.
1503	11/20/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5320	117	14.2	YES	IP	.	.	.
1504	11/20/75	42	67	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5321	129	23.8	YES	CH	.	.	.
1505	11/20/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5322	110	12.5	YES	IP	.	.	.
1506	11/20/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5323	133	23.6	YES	IP	.	.	.
1507	11/20/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5324	129	21.2	YES	IP	.	.	.
1508	11/20/75	42	67	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5325	137	25.1	NO	ND	.	.	.
1509	11/20/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5326	130	22.1	YES	IP	.	.	.
1510	11/20/75	42	67	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5328	128	20.4	YES	CW	.	.	.
1511	11/20/75	42	67	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5329	127	20.5	YES	TZ	.	.	.
1512	11/20/75	42	67	3	BEACH SEINE	2ND DORSAL	OCT	1975	R5330	125	19.9	YES	CH	.	.	.
1513	11/21/75	40	64	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5409	127	21.2	YES	TZ	.	.	.
1514	11/23/75	42	67	3	I.P. SCREENS	2ND DORSAL	FALL	1975	R5440	124	20.2	NO	ND	.	.	.
1515	11/23/75	24	38	3	EPIBENTHIC SLED	2ND DORSAL	OCT	1975	R5358	110	14.3	YES	CH	.	.	.
1516	11/24/75	41	66	3	BEACH SEINE	1ST DORSAL	SEPT	1975	R5400	142	28.0	NO	ND	.	.	.
1517	11/25/75	66	106	1	DANSKAMMER SCREENS	1ST DORSAL	SEPT	1975	R6217	113	17.4	NO	ND	.	.	.
1518	11/25/75	66	106	1	DANSKAMMER SCREENS	2ND DORSAL	OCT	1975	R6218	86	6.8	YES	CH	.	.	.
1519	11/25/75	47	75	3	BEACH SEINE	2ND DORSAL	FALL	1975	R5363	171	53.6	YES	TZ	.	.	.
1520	11/25/75	41	66	2	BOTTOM TRAWL	1ST DORSAL	SEPT	1975	R5444	135	27.1	NO	ND	.	.	.
1521	11/26/75	40	64	1	BEACH SEINE	2ND DORSAL	FALL	1975	R5369	114	15.5	YES	TZ	.	.	.
1522	12/02/75	42	67	3	I.P. SCREENS	2ND DORSAL	FALL	1975	R5448	137	25.5	YES	TZ	.	.	.
1523	12/02/75	30	48	1	EPIBENTHIC SLED	1ST DORSAL	SEPT	1975	R5349	108	13.6	YES	CW	.	.	.
1524	12/03/75	66	106	1	DANSKAMMER SCREENS	2ND DORSAL	FALL	1975	R6207	149	37.7	YES	TZ	.	.	.
1525	12/03/75	66	106	1	DANSKAMMER SCREENS	2ND DORSAL	OCT	1975	R6208	132	23.8	YES	CH	.	.	.
1526	12/03/75	66	106	1	DANSKAMMER SCREENS	2ND DORSAL	FALL	1975	R6209	122	19.0	NO	ND	.	.	.
1527	12/03/75	42	67	3	I.P. SCREENS	2ND DORSAL	FALL	1975	R5283	119	20.3	NO	TZ	.	.	.
1528	12/03/75	42	67	3	I.P. SCREENS	2ND DORSAL	FALL	1975	R5284	118	15.5	NO	ND	.	.	.
1529	12/03/75	37	59	1	QLM GEAR	1ST DORSAL	SEPT	1975	R6004	119	22.3	YES	CH	.	.	.
1530	12/03/75	37	59	1	QLM GEAR	2ND DORSAL	FALL	1975	R6005	157	43.1	NO	ND	.	.	.
1531	12/03/75	37	59	1	QLM GEAR	2ND DORSAL	OCT	1975	R6006	129	21.3	YES	CH	.	.	.
1532	12/03/75	41	66	1	QLM GEAR	1ST DORSAL	SEPT	1975	R6009	121	18.4	YES	IP	.	.	.
1533	12/03/75	41	66	1	QLM GEAR	2ND DORSAL	OCT	1975	R6011	119	15.2	YES	CH	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON	REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
1534	12/03/75	41	66	1	QLM GEAR	2ND DORSAL	OCT 1975	R6012	111	16.4	YES	CH	.	.	.
1535	12/04/75	42	67	3	I.P. SCREENS	2ND DORSAL	FALL 1975	R5429	118	19.4	YES	TZ	.	.	.
1536	12/04/75	43	69	1	BOTTOM TRAWL	2ND DORSAL	FALL 1975	F5350	129	22.7	YES	TZ	.	.	.
1537	12/04/75	43	69	1	BOTTOM TRAWL	1ST DORSAL	SEPT 1975	R5351	133	24.4	YES	IP	.	.	.
1538	12/06/75	42	67	3	I.P. SCREENS	2ND DORSAL	FALL 1975	R5332	112	15.8	YES	TZ	.	.	.
1539	12/08/75	42	67	3	I.P. SCREENS	2ND DORSAL	FALL 1975	R5262	122	17.2	NO	ND	.	.	.
1540	12/08/75	65	104	1	QLM GEAR	1ST DORSAL	SEPT 1975	R6273	110	15.1	YES	CW	.	.	.
1541	12/10/75	42	67	3	I.P. SCREENS	2ND DORSAL	FALL 1975	R5238	95	8.2	NO	ND	.	.	.
1542	12/10/75	41	66	2	BOTTOM TRAWL	2ND DORSAL	FALL 1975	R5348	149	33.7	YES	TZ	.	.	.
1543	12/10/75	16	26	1	EPIBENTHIC SLED	1ST DORSAL	SEPT 1975	R5367	115	16.6	YES	IP	.	.	.
1544	12/13/75	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5256	112	13.8	NO	ND	.	.	.
1545	12/17/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R5243	110	12.1	YES	CH	.	.	.
1546	12/17/75	37	59	1	QLM GEAR	1ST DORSAL	FALL 1974	R6014	222	157.0	NO	ND	.	.	.
1547	12/17/75	39	62	2	BOTTOM TRAWL	2ND DORSAL	FALL 1975	R5241	157	41.0	YES	TZ	.	.	.
1548	12/19/75	42	67	3	I.P. SCREENS	2ND DORSAL	FALL 1975	R5343	119	16.5	YES	TZ	.	.	.
1549	12/19/75	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5344	109	11.7	YES	CH	.	.	.
1550	12/19/75	42	67	3	I.P. SCREENS	2ND DORSAL	FALL 1975	R5345	126	19.7	YES	TZ	.	.	.
1551	12/19/75	42	67	3	I.P. SCREENS	2ND DORSAL	FALL 1975	R5347	104	12.2	NO	ND	.	.	.
1552	12/20/75	42	67	3	I.P. SCREENS	2ND DORSAL	FALL 1975	R5519	120	17.5	NO	ND	.	.	.
1553	12/20/75	42	67	3	I.P. SCREENS	2ND DORSAL	FALL 1975	R5520	89	7.4	NO	ND	.	.	.
1554	12/21/75	42	67	3	I.P. SCREENS	2ND DORSAL	FALL 1975	R5429	107	12.4	NO	ND	.	.	.
1555	12/22/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R5333	121	17.3	YES	CH	.	.	.
1556	12/22/75	42	67	3	I.P. SCREENS	2ND DORSAL	CCT 1975	R5334	121	17.3	YES	CH	.	.	.
1557	12/23/75	42	67	3	BOTTOM TRAWL	2ND DORSAL	FALL 1975	R5714	148	35.0	YES	TZ	.	.	.
1558	12/23/75	39	62	1	BOTTOM TRAWL	2ND DORSAL	FALL 1975	R5445	153	37.0	YES	TZ	.	.	.
1559	12/23/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	SEPT 1975	R6016	145	50.9	NO	ND	.	.	.
1560	12/23/75	37	59	1	BOWLINE SCREENS	2ND DORSAL	FALL 1975	R6017	92	8.8	NO	ND	.	.	.
1561	12/23/75	37	59	1	BOWLINE SCREENS	2ND DORSAL	FALL 1975	R6018	95	8.9	NO	ND	.	.	.
1562	12/23/75	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6019	95	9.1	YES	CH	.	.	.
1563	12/24/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R5488	130	.	YES	IP	.	.	.
1564	12/24/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R5489	101	10.4	NO	ND	.	.	.
1565	12/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	SEPT 1975	R5990	107	13.0	NO	ND	.	.	.
1566	12/24/75	37	59	1	BOWLINE SCREENS	1ST DORSAL	SEPT 1975	R5991	96	8.7	NO	ND	.	.	.
1567	12/24/75	37	59	1	BOWLINE SCREENS	2ND DORSAL	FALL 1975	R5993	89	7.6	NO	ND	.	.	.
1568	12/24/75	37	59	1	BOWLINE SCREENS	2ND DORSAL	SEPT 1975	R5994	92	8.1	NO	ND	.	.	.
1569	12/25/75	42	67	3	I.P. SCREENS	2ND DORSAL	FALL 1975	R5501	18	.	YES	TZ	.	.	.
1570	12/25/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R5508	107	11.3	NO	ND	.	.	.
1571	12/25/75	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R5509	113	14.3	YES	IP	.	.	.
1572	12/26/75	42	67	3	I.P. SCREENS	2ND DORSAL	FALL 1975	R5473	104	10.5	NO	ND	.	.	.
1573	12/30/75	41	66	1	LOVETT SCREENS	2ND DORSAL	FALL 1975	R6025	113	15.8	NO	ND	.	.	.
1574	12/31/75	37	59	1	BOWLINE SCREENS	2ND DORSAL	FALL 1975	R5979	95	8.9	YES	TZ	.	.	.
1575	12/31/75	37	59	1	BOWLINE SCREENS	2ND DORSAL	FALL 1975	R5980	124	19.4	YES	TZ	.	.	.
1576	12/31/75	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R5981	114	14.7	YES	CH	.	.	.
1577	12/31/75	37	59	1	BOWLINE SCREENS	2ND DORSAL	FALL 1975	R5982	104	11.3	YES	TZ	.	.	.
1578	12/31/75	37	59	1	BOWLINE SCREENS	2ND DORSAL	FALL 1975	R5983	91	7.6	YES	TZ	.	.	.
1579	12/31/75	37	59	1	BOWLINE SCREENS	2ND DORSAL	FALL 1975	R5984	83	6.1	NO	ND	.	.	.
1580	12/31/75	37	59	1	BOWLINE SCREENS	2ND DORSAL	FALL 1975	R5985	82	5.7	YES	TZ	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON	REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
1581	01/13/76	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R5530	130	21.5	YES	ND	.	.	.
1582	01/17/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5785	109	11.7	NO	ND	.	.	.
1583	01/18/76	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R5773	133	22.6	YES	IP	.	.	.
1584	01/19/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5546	152	38.0	YES	TZ	.	.	.
1585	01/19/76	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R5547	118	15.4	YES	IP	.	.	.
1586	01/19/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5548	122	17.7	YES	CH	.	.	.
1587	01/20/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5690	87	6.0	NO	ND	.	.	.
1588	01/21/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5699	144	30.2	YES	TZ	.	.	.
1589	01/21/76	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R5701	98	8.5	YES	CW	.	.	.
1590	01/22/76	41	66	1	LOVETT SCREENS	2ND DORSAL	OCT 1975	R6364	134	25.4	YES	TZ	.	.	.
1591	01/22/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5572	93	7.2	NO	ND	.	.	.
1592	01/22/76	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R5573	110	11.3	YES	IP	.	.	.
1593	01/22/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5574	94	7.5	YES	CH	.	.	.
1594	01/22/76	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R5575	127	18.3	NO	ND	.	.	.
1595	01/22/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5576	134	22.4	YES	CH	.	.	.
1596	01/22/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5577	98	9.0	YES	CH	.	.	.
1597	01/22/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5584	78	4.1	YES	CH	.	.	.
1598	01/24/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5833	113	14.3	NO	ND	.	.	.
1599	01/24/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5834	121	17.5	YES	TZ	.	.	.
1600	01/24/76	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R5835	81	6.5	NO	ND	.	.	.
1601	01/25/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5922	128	20.8	YES	CH	.	.	.
1602	01/26/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5939	127	23.8	YES	CH	.	.	.
1603	01/26/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5940	122	17.3	YES	CH	.	.	.
1604	01/26/76	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R5941	102	9.4	YES	CW	.	.	.
1605	01/26/76	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R5942	112	12.4	NO	ND	.	.	.
1606	01/26/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5943	80	5.5	YES	CH	.	.	.
1607	01/27/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5859	108	14.8	YES	CH	.	.	.
1608	01/27/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5860	112	12.4	NO	ND	.	.	.
1609	01/27/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5861	95	7.7	NO	ND	.	.	.
1610	01/27/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5862	102	.	YES	ND	.	.	.
1611	01/27/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R5863	86	6.3	NO	ND	.	.	.
1612	01/28/76	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R5798	122	16.6	YES	CH	.	.	.
1613	01/28/76	41	66	1	LOVETT SCREENS	2ND DORSAL	OCT 1975	R6370	152	36.8	YES	TZ	.	.	.
1614	01/28/76	41	66	1	LOVETT SCREENS	2ND DORSAL	OCT 1975	R6368	134	28.0	YES	TZ	.	.	.
1615	01/29/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6372	88	7.0	NO	ND	.	.	.
1616	02/05/76	41	66	1	LOVETT SCREENS	1ST DORSAL	FALL 1974	R6374	201	90.7	YES	ND	.	.	.
1617	02/11/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R6076	131	26.0	YES	CH	.	.	.
1618	02/11/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R6077	143	34.1	YES	TZ	.	.	.
1619	02/12/76	66	106	1	DANSKAMMER SCREEN	1ST DORSAL	FALL 1974	R6200	226	153.0	YES	ND	.	.	.
1620	02/13/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R6051	119	17.7	YES	TZ	.	.	.
1621	02/19/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6376	122	14.8	YES	TZ	.	.	.
1622	02/19/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6377	89	7.4	YES	CH	.	.	.
1623	02/25/76	37	59	1	BOWLINE SCREENS	1ST DORSAL	SEPT 1975	R6381	99	9.1	NO	ND	.	.	.
1624	02/25/76	3	5	2	BOTTOM TRAWL	2ND DORSAL	OCT 1975	R6026	130	24.1	YES	TZ	.	.	.
1625	02/25/76	3	5	2	BOTTOM TRAWL	2ND DORSAL	OCT 1975	R6027	143	32.3	NO	ND	.	.	.
1626	03/03/76	41	66	1	LOVETT SCREENS	2ND DORSAL	OCT 1975	R6417	134	23.4	YES	TZ	.	.	.
1627	03/10/76	25	40	2	EPIBENTHIC SLED	1ST DORSAL	SEPT 1975	R6289	162	47.7	YES	CH	.	.	.
1628	03/15/76	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R6298	86	5.5	NO	ND	.	.	.
1629	03/17/76	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R6294	100	9.1	NO	ND	.	.	.
1630	03/17/76	37	59	1	LMS GEAR	2ND DORSAL	OCT 1975	R6909	122	18.3	YES	TZ	.	.	.
1631	03/17/76	37	59	1	LMS GEAR	2ND DORSAL	OCT 1975	R6910	130	22.4	YES	CH	.	.	.
1632	03/17/76	37	59	1	LMS GEAR	2ND DORSAL	OCT 1975	R6916	116	15.6	YES	CH	.	.	.
1633	03/17/76	37	59	1	LMS GEAR	1ST DORSAL	SEPT 1975	R6917	104	10.8	YES	IP	.	.	.
1634	03/17/76	37	59	1	LMS GEAR	2ND DORSAL	OCT 1975	R6924	123	18.6	YES	CH	.	.	.
1635	03/17/76	37	59	1	LMS GEAR	2ND DORSAL	OCT 1975	R6925	91	7.4	NO	ND	.	.	.
1636	03/18/76	37	59	1	BOWLINE SCREENS	1ST DORSAL	SEPT 1975	R6938	126	16.9	NO	ND	.	.	.
1637	03/19/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R6308	96	8.5	NO	ND	.	.	.
1638	03/22/76	15	24	1	50' BEACH SEINE	2ND DORSAL	OCT 1975	R6362	86	6.5	YES	CH	.	.	.
1639	03/23/76	40	64	2	EPIBENTHIC SLED	1ST DORSAL	SEPT 1975	R6290	122	18.5	YES	IP	.	.	.
1640	03/25/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6929	127	18.3	YES	CH	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON	REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
1641	03/31/76	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R6357	104	9.3	NO	ND	.	.	.
1642	03/31/76	30	48	1	LMS GEAR	1ST DORSAL	SEPT 1975	R6907	125	18.6	YES	IP	.	.	.
1643	03/31/76	13	21	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6293	87	6.5	YES	TZ	.	.	.
1644	03/31/76	15	24	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6291	119	17.1	NO	ND	.	.	.
1645	03/31/76	15	24	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6292	81	5.3	YES	CH	.	.	.
1646	03/31/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6928	118	15.4	YES	CH	.	.	.
1647	04/08/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6939	96	6.9	YES	TZ	.	.	.
1648	04/08/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6940	89	5.5	YES	TZ	.	.	.
1649	04/08/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7058	92	6.8	YES	TZ	.	.	.
1650	04/14/76	13	21	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6405	87	6.8	NO	ND	.	.	.
1651	04/15/76	37	59	1	BOWLINE SCREENS	1ST DORSAL	SEPT 1975	R6903	110	12.7	NO	ND	.	.	.
1652	04/15/76	21	34	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6403	87	7.3	YES	WP	.	.	.
1653	04/16/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6960	114	19.6	NO	ND	.	.	.
1654	04/16/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6962	101	9.8	NO	ND	.	.	.
1655	04/16/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6964	106	10.8	YES	CH	.	.	.
1656	04/16/76	37	59	1	BOWLINE SCREENS	1ST DORSAL	SEPT 1975	R6966	90	6.2	NO	ND	.	.	.
1657	04/16/76	37	59	1	BOWLINE SCREENS	1ST DORSAL	SEPT 1975	R6967	89	6.7	NO	ND	.	.	.
1658	04/16/76	37	59	1	BOWLINE SCREENS	1ST DORSAL	SEPT 1975	R6971	88	5.8	NO	ND	.	.	.
1659	04/16/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6889	102	11.0	YES	TZ	.	.	.
1660	04/17/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6997	98	8.9	YES	TZ	.	.	.
1661	04/17/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6998	97	8.4	NO	ND	.	.	.
1662	04/17/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6999	99	9.5	YES	TZ	.	.	.
1663	04/17/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7000	102	9.0	NO	ND	.	.	.
1664	04/17/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7001	103	13.7	YES	ND	.	.	.
1665	04/17/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7002	106	9.7	NO	ND	.	.	.
1666	04/17/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7003	98	9.0	YES	CH	.	.	.
1667	04/17/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7005	101	9.1	YES	CH	.	.	.
1668	04/17/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7006	103	9.2	YES	TZ	.	.	.
1669	04/18/76	37	59	1	BOWLINE SCREENS	1ST DORSAL	SEPT 1975	R7021	104	10.3	YES	IP	.	.	.
1670	04/18/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7022	114	12.2	NO	ND	.	.	.
1671	04/18/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7023	96	8.9	YES	TZ	.	.	.
1672	04/18/76	37	59	1	BOWLINE SCREENS	1ST DORSAL	SEPT 1975	R7024	105	9.6	NO	ND	.	.	.
1673	04/18/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7025	119	17.4	NO	ND	.	.	.
1674	04/18/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7026	91	6.9	YES	CH	.	.	.
1675	04/18/76	37	59	1	BOWLINE SCREENS	1ST DORSAL	SEPT 1975	R6993	138	30.6	YES	CH	.	.	.
1676	04/19/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6945	122	19.1	YES	TZ	.	.	.
1677	04/19/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6946	136	24.4	YES	CH	.	.	.
1678	04/19/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6947	127	20.5	YES	CH	.	.	.
1679	04/19/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6948	114	14.3	YES	TZ	.	.	.
1680	04/19/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6949	88	6.2	NO	ND	.	.	.
1681	04/19/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6950	92	6.6	YES	TZ	.	.	.
1682	04/19/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6954	78	6.0	NO	ND	.	.	.
1683	04/19/76	12	19	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6415	141	32.9	YES	CH	.	.	.
1684	04/19/76	12	19	1	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6416	149	38.9	NO	ND	.	.	.
1685	04/19/76	16	26	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6408	88	7.4	YES	TZ	.	.	.
1686	04/19/76	37	59	1	BOWLINE SCREENS	1ST DORSAL	SEPT 1975	R6941	122	15.4	YES	IP	.	.	.
1687	04/20/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6972	118	17.4	NO	ND	.	.	.
1688	04/20/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6973	123	16.5	YES	CH	.	.	.
1689	04/20/76	37	59	1	BOWLINE SCREENS	1ST DORSAL	SEPT 1975	R6974	133	21.5	YES	IP	.	.	.
1690	04/20/76	34	54	3	200' BEACH SEINE	2ND DORSAL	OCT 1975	R6392	117	17.7	YES	TZ	.	.	.
1691	04/20/76	34	54	3	200' BEACH SEINE	2ND DORSAL	OCT 1975	R6393	117	16.9	YES	CH	.	.	.
1692	04/20/76	14	22	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6390	145	36.6	NO	ND	.	.	.
1693	04/20/76	12	19	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6410	93	14.3	YES	TZ	.	.	.
1694	04/20/76	14	22	1	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6394	144	34.1	YES	IP	.	.	.
1695	04/20/76	14	22	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6395	101	11.2	NO	ND	.	.	.
1696	04/20/76	14	22	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6396	105	14.1	NO	ND	.	.	.
1697	04/20/76	15	26	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6401	134	26.3	NO	ND	.	.	.
1698	04/21/76	37	59	1	BOWLINE SCREENS	1ST DORSAL	SEPT 1975	R7144	116	14.0	YES	IP	.	.	.
1699	04/21/76	37	59	1	BOWLINE SCREENS	1ST DORSAL	SEPT 1975	R7145	125	15.9	YES	IP	.	.	.
1700	04/21/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7146	130	21.3	YES	CH	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON	REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
1701	04/21/76	37	59	1	BOWLINE SCREENS	1ST DORSAL	SEPT 1975	R7147	117	19.8	NO	ND	.	.	.
1702	04/21/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7148	112	11.5	YES	CH	.	.	.
1703	04/21/76	37	59	1	BOWLINE SCREENS	1ST DORSAL	SEPT 1975	R7149	90	6.7	NO	ND	.	.	.
1704	04/21/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7150	99	8.3	NO	ND	.	.	.
1705	04/21/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7151	95	7.7	NO	ND	.	.	.
1706	04/21/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7152	91	6.6	YES	TZ	.	.	.
1707	04/21/76	40	64	1	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6406	115	15.5	YES	IP	.	.	.
1708	04/22/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6890	114	14.9	NO	ND	.	.	.
1709	04/22/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R6891	133	20.7	YES	CH	.	.	.
1710	04/23/76	LII	.	.	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6492	116	15.4	NO	ND	.	.	.
1711	04/23/76	37	59	1	BOWLINE SCREENS	1ST DORSAL	SEPT 1975	R7181	138	27.7	YES	CH	.	.	.
1712	04/24/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7175	114	14.2	YES	CH	.	.	.
1713	04/24/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R6431	115	12.3	NO	ND	.	.	.
1714	04/24/76	42	67	3	I.P. SCREENS	2ND DORSAL	OCT 1975	R6432	93	6.9	NO	ND	.	.	.
1715	04/24/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7177	121	15.5	YES	CH	.	.	.
1716	04/24/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7178	115	13.9	YES	CH	.	.	.
1717	04/25/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7172	103	9.2	YES	CH	.	.	.
1718	04/25/76	37	59	1	BOWLINE SCREENS	1ST DORSAL	SEPT 1975	R7173	93	6.2	YES	IP	.	.	.
1719	04/25/76	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R6436	115	15.5	NO	ND	.	.	.
1720	04/28/76	25	40	3	100' BEACH SEINE	BOTH PELVIC	FALL 1974	R6433	194	77.8	YES	ND	.	.	.
1721	04/28/76	25	40	3	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6434	93	8.4	NO	ND	.	.	.
1722	04/28/76	16	26	1	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6451	130	24.2	YES	IP	.	.	.
1723	04/28/76	21	34	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6430	101	16.9	NO	ND	.	.	.
1724	04/28/76	37	59	1	LMS GEAR	2ND DORSAL	OCT 1975	R7122	157	42.6	YES	CH	.	.	.
1725	04/28/76	37	59	1	LMS GEAR	2ND DORSAL	OCT 1975	R7123	138	28.4	YES	TZ	.	.	.
1726	04/28/76	37	59	1	LMS GEAR	1ST DORSAL	SEPT 1975	R7124	138	30.1	YES	IP	.	.	.
1727	04/28/76	37	59	1	LMS GEAR	1ST DORSAL	SEPT 1975	R7125	141	28.7	NO	ND	.	.	.
1728	04/28/76	37	59	1	LMS GEAR	1ST DORSAL	SEPT 1975	R7126	131	23.5	YES	IP	.	.	.
1729	04/28/76	37	59	1	LMS GEAR	2ND DORSAL	OCT 1975	R7127	124	20.9	NO	ND	.	.	.
1730	04/28/76	37	59	1	LMS GEAR	2ND DORSAL	OCT 1975	R7128	123	20.4	NO	ND	.	.	.
1731	04/28/76	37	59	1	LMS GEAR	2ND DORSAL	OCT 1975	R7129	115	15.9	YES	CH	.	.	.
1732	04/28/76	37	59	1	LMS GEAR	2ND DORSAL	OCT 1975	R7130	123	21.3	YES	TZ	.	.	.
1733	04/28/76	37	59	1	LMS GEAR	1ST DORSAL	SEPT 1975	R7131	119	16.2	YES	IP	.	.	.
1734	04/28/76	37	59	1	LMS GEAR	2ND DORSAL	OCT 1975	R7132	108	12.7	YES	CH	.	.	.
1735	04/29/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7053	119	15.9	NO	ND	.	.	.
1736	04/29/76	12	19	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6452	124	20.4	YES	TZ	.	.	.
1737	04/29/76	14	22	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6437	141	28.9	YES	TZ	.	.	.
1738	04/29/76	14	22	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6453	132	24.7	YES	TZ	.	.	.
1739	04/29/76	14	22	1	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6454	115	14.8	NO	ND	.	.	.
1740	04/29/76	14	22	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6455	122	18.1	YES	TZ	.	.	.
1741	04/29/76	15	24	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6445	142	31.5	NO	ND	.	.	.
1742	04/29/76	15	24	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6446	139	26.6	YES	TZ	.	.	.
1743	04/29/76	15	24	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6448	115	15.4	YES	TZ	.	.	.
1744	04/29/76	15	24	1	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6449	120	20.0	NO	ND	.	.	.
1745	04/29/76	16	26	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6440	131	22.8	NO	ND	.	.	.
1746	04/29/76	16	26	1	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6442	114	15.2	YES	CW	.	.	.
1747	04/29/76	16	26	1	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6443	142	27.0	YES	IP	.	.	.
1748	05/05/76	43	69	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6500	128	20.7	NO	ND	.	.	.
1749	05/06/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7138	98	8.5	YES	CH	.	.	.
1750	05/06/76	43	69	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6497	138	29.4	YES	IP	.	.	.
1751	05/06/76	43	69	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6498	122	18.9	NO	ND	.	.	.
1752	05/06/76	37	59	1	BOWLINE SCREENS	1ST DORSAL	SEPT 1975	R7136	123	14.3	NO	ND	.	.	.
1753	05/11/76	42	67	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6491	136	28.1	YES	CH	.	.	.
1754	05/11/76	40	69	3	200' BEACH SEINE	1ST DORSAL	SEPT 1975	R6466	128	21.9	NO	ND	.	.	.
1755	05/12/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7135	134	24.0	YES	TZ	.	.	.
1756	05/13/76	43	69	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6494	139	25.6	YES	IP	.	.	.
1757	05/13/76	14	22	3	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6485	132	27.6	NO	ND	.	.	.
1758	05/13/76	24	38	3	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6493	123	20.2	NO	ND	.	.	.
1759	05/13/76	42	67	1	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6488	152	.	YES	IP	.	.	.
1760	05/14/76	40	64	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6486	144	32.1	YES	ND	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON	REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
1761	05/15/76	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R6504	140	28.2	YES	IP	.	.	.
1762	05/16/76	45	72	1	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6469	140	28.6	YES	CH	.	.	.
1763	05/17/76	LII	.	.	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6484	135	24.9	NO	ND	.	.	.
1764	05/18/76	149	238	3	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6501	139	29.7	YES	CH	.	.	.
1765	05/21/76	43	69	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6489	122	18.4	YES	IP	.	.	.
1766	05/24/76	12	19	1	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6470	115	13.7	NO	ND	.	.	.
1767	05/25/76	43	69	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6472	147	31.7	YES	IP	.	.	.
1768	05/26/76	39	62	3	BOTTOM TRAWL	2ND DORSAL	OCT 1975	R6473	142	28.0	YES	CH	.	.	.
1769	05/26/76	39	62	3	BOTTOM TRAWL	2ND DORSAL	OCT 1975	R6474	149	32.2	YES	CH	.	.	.
1770	05/26/76	39	62	3	BOTTOM TRAWL	1ST DORSAL	SEPT 1975	R6475	137	24.1	YES	IP	.	.	.
1771	05/26/76	37	59	1	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R5503	142	27.2	YES	CH	.	.	.
1772	05/26/76	37	59	1	LMS GEAR	2ND DORSAL	OCT 1975	R7137	130	22.8	YES	CH	.	.	.
1773	05/27/76	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R6512	130	20.3	NO	ND	.	.	.
1774	05/27/76	57	91	1	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6516	166	48.6	YES	ND	.	.	.
1775	05/27/76	42	67	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6522	138	.	YES	IP	.	.	.
1776	05/27/76	42	67	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6523	158	.	YES	IP	.	.	.
1777	05/27/76	42	67	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6524	154	.	YES	IP	.	.	.
1778	05/27/76	42	67	3	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6525	148	.	YES	TZ	.	.	.
1779	05/27/76	42	67	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6526	151	.	NO	ND	.	.	.
1780	05/27/76	42	67	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6527	147	.	YES	IP	.	.	.
1781	05/27/76	42	67	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6528	130	.	NO	ND	.	.	.
1782	06/01/76	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R6608	136	23.9	YES	IP	.	.	.
1783	06/01/76	41	66	3	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6610	137	26.0	NO	ND	.	.	.
1784	06/02/76	69	110	3	200' BEACH SEINE	2ND DORSAL	OCT 1975	R6714	160	43.1	YES	TZ	.	.	.
1785	06/02/76	133	213	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6668	138	28.3	NO	ND	.	.	.
1786	06/03/76	43	69	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6578	171	46.8	NO	ND	.	.	.
1787	06/04/76	42	67	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6656	147	5.5	NO	ND	.	.	.
1788	06/08/76	29	46	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6564	171	45.2	NO	ND	.	.	.
1789	06/09/76	37	59	1	BOWLINE SCREENS	2ND DORSAL	OCT 1975	R7141	148	39.1	YES	CH	.	.	.
1790	06/09/76	33	53	3	200' BEACH SEINE	2ND DORSAL	OCT 1975	R6666	116	13.6	YES	TZ	.	.	.
1791	06/09/76	33	53	3	200' BEACH SEINE	1ST DORSAL	SEPT 1975	R6667	97	8.9	YES	CW	.	.	.
1792	06/09/76	41	66	1	LMS GEAR	1ST DORSAL	SEPT 1975	R7121	150	32.2	YES	IP	.	.	.
1793	06/09/76	76	122	1	200' BEACH SEINE	1ST DORSAL	FALL 1974	R6734	241	136.0	YES	ND	.	.	.
1794	06/09/76	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R6696	130	19.5	YES	CW	.	.	.
1795	06/10/76	82	131	1	200' BEACH SEINE	1ST DORSAL	SEPT 1975	R6730	149	32.2	YES	IP	.	.	.
1796	06/10/76	39	62	3	BOTTOM TRAWL	2ND DORSAL	OCT 1975	R6692	114	5.5	YES	TZ	.	.	.
1797	06/11/76	35	56	1	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6704	128	19.0	NO	ND	.	.	.
1798	06/11/76	12	19	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6539	98	11.7	NO	ND	.	.	.
1799	06/11/76	41	66	3	200' BEACH SEINE	1ST DORSAL	SEPT 1975	R6660	164	48.5	YES	IP	.	.	.
1800	06/11/76	40	64	1	200' BEACH SEINE	1ST DORSAL	SEPT 1975	R6727	138	23.0	NO	ND	.	.	.
1801	06/11/76	35	56	1	200' BEACH SEINE	1ST DORSAL	SEPT 1975	R6579	152	35.1	YES	ND	.	.	.
1802	06/11/76	35	56	1	200' BEACH SEINE	2ND DORSAL	OCT 1975	R6580	146	36.4	YES	CH	.	.	.
1803	06/11/76	35	56	1	200' BEACH SEINE	2ND DORSAL	OCT 1975	R6581	146	33.4	YES	CH	.	.	.
1804	06/13/76	42	67	3	I.P. SCREENS	1ST DORSAL	SEPT 1975	R6693	158	35.4	NO	ND	.	.	.
1805	06/14/76	42	67	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6617	137	.	YES	IP	.	.	.
1806	06/14/76	42	67	3	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6618	135	.	YES	TZ	.	.	.
1807	06/14/76	42	67	3	200' BEACH SEINE	1ST DORSAL	OCT 1975	R6629	130	19.3	NO	ND	.	.	.
1808	06/14/76	43	69	3	100' BEACH SEINE	1ST DORSAL	OCT 1975	R6625	138	25.2	NO	ND	.	.	.
1809	06/14/76	36	58	3	200' BEACH SEINE	1ST DORSAL	OCT 1975	R6699	135	22.1	YES	CH	.	.	.
1810	06/15/76	31	50	2	EPIBENTHIC SLED	1ST DORSAL	OCT 1975	R6827	130	26.5	YES	ND	.	.	.
1811	06/15/76	15	24	3	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6649	129	16.9	YES	TZ	.	.	.
1812	06/15/76	119	190	1	100' BEACH SEINE	BOTH PELVIC	FALL 1974	R6716	234	127.0	NO	ND	.	.	.
1813	06/16/76	36	58	1	200' BEACH SEINE	2ND DORSAL	OCT 1975	R6733	151	32.4	NO	ND	.	.	.
1814	06/16/76	26	42	1	100' BEACH SEINE	2ND DORSAL	OCT 1975	R6731	138	28.9	YES	TZ	.	.	.
1815	06/17/76	42	67	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6701	146	28.6	NO	ND	.	.	.
1816	06/21/76	43	69	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R6773	153	36.0	NO	ND	.	.	.
1817	06/24/76	43	69	3	200' BEACH SEINE	1ST DORSAL	SEPT 1975	R6842	145	24.5	NO	ND	.	.	.
1818	06/28/76	43	69	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R7068	143	31.9	YES	IP	.	.	.
1819	06/28/76	43	69	3	100' BEACH SEINE	2ND DORSAL	OCT 1975	R7069	137	22.6	YES	CH	.	.	.
1820	06/29/76	38	61	1	200' BEACH SEINE	1ST DORSAL	SEPT 1975	R7076	162	34.3	YES	CH	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON	REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
1821	06/29/76	38	61	1	200' BEACH SEINE	2ND DORSAL	OCT 1975	R7077	142	23.8	NO	ND	.	.	.
1822	07/02/76	39	62	2	BOTTOM TRAWL	1ST DORSAL	SEPT 1975	R7118	158	35.2	NO	ND	.	.	.
1823	07/08/76	40	64	2	EPIBENTHIC SLED	1ST DORSAL	SEPT 1975	R7096	156	37.8	NO	ND	.	.	.
1824	07/08/76	94	64	1	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R7099	153	32.3	YES	IP	.	.	.
1825	07/09/76	42	67	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R7110	126	18.0	NO	ND	.	.	.
1826	07/09/76	42	67	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R7109	169	47.8	NO	ND	.	.	.
1827	07/12/76	42	67	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R7100	173	.	YES	IP	.	.	.
1828	07/14/76	38	61	1	200' BEACH SEINE	1ST DORSAL	SEPT 1975	R7097	141	24.8	NO	ND	.	.	.
1829	07/14/76	41	66	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R7093	152	25.7	YES	IP	.	.	.
1830	07/21/76	55	88	3	200' BEACH SEINE	1ST DORSAL	SEPT 1975	R7095	139	21.6	YES	IP	.	.	.
1831	07/27/76	39	62	3	BOTTOM TRAWL	2ND DORSAL	OCT 1975	R7101	153	35.1	YES	TZ	.	.	.
1832	08/09/76	40	64	3	200' BEACH SEINE	1ST DORSAL	SEPT 1975	R7319	149	29.5	NO	ND	.	.	.
1833	08/16/76	46	66	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R7301	147	33.3	YES	IP	.	.	.
1834	08/18/76	41	66	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R7308	135	20.9	YES	IP	.	.	.
1835	08/30/76	39	62	3	BOX TRAP	1ST DORSAL	SEPT 1975	R7343	155	39.4	NO	ND	.	.	.
1836	09/20/76	57	91	1	200' BEACH SEINE	2ND DORSAL	SEPT 1975	R7826	197	77.3	YES	CH	.	.	.
1837	09/29/76	.	.	.	ND	1ST DORSAL	SEPT 1975	R7503	153	35.9	NO	ND	.	.	.
1838	10/04/76	60	96	3	BOX TRAP	2ND DORSAL	OCT 1975	R8599	205	86.3	YES	CH	.	.	.
1839	10/04/76	34	54	3	200' BEACH SEINE	1ST DORSAL	FALL 1974	R8600	241	17.4	YES	ND	.	.	.
1840	10/27/76	37	59	1	ND	1ST DORSAL	SEPT 1975	R9658	205	87.7	YES	CH	.	.	.
1841	10/06/76	58	93	1	100' BEACH SEINE	ND	SEPT 1975	R8822	174	51.5	YES	IP	.	.	.
1842	10/14/76	42	67	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R9036	182	57.7	YES	IP	.	.	.
1843	10/18/76	42	67	3	200' BEACH SEINE	2ND DORSAL	FALL 1975	R8474	190	76.2	YES	TZ	.	.	.
1844	10/25/76	42	67	3	100' BEACH SEINE	1ST DORSAL	SEPT 1975	R9037	233	14.2	YES	CH	.	.	.
1845	11/09/76	42	67	3	200' BEACH SEINE	1ST DORSAL	SEPT 1975	R9337	198	89.7	YES	ND	.	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON		REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
1846	03/06/77	42	67	3	I.P. SCREENS	2ND DORSAL	FALL	1975	R10160	215	104.2	NO	ND	M	.	.
1847	04/20/77	35	56	3	HAUL SEINE	1ST DORSAL	FALL	1974	R9853	334	480.0	YES	ND	M	47.5	D
1848	04/20/77	42	67	3	100' BEACH SEINE	1ST DORSAL	SEPT	1975	R10226	199	91.9	NO	ND	M	2297.5	I
1849	04/28/77	40	64	1	GILL NET	1ST DORSAL	FALL	1974	R9854	400	655.0	YES	ND	M	33.1	R
1850	05/04/77	35	56	3	HAUL SEINE	1ST DORSAL	FALL	1974	R9855	325	357.0	YES	ND	M	.	I
1851	05/05/77	34	54	3	GILL NET	1ST DORSAL	FALL	1974	R9856	433	652.0	NO	ND	M	32.3	D
1852	05/19/77	67	107	3	COMMERCIAL FISHERMAN	BOTH PELVIC	FALL	1974	R9860	260	171.0	YES	ND	M	90.0	D
1853	05/23/77	31	50	1	BOTTOM TRAWL	2ND DORSAL	OCT	1975	R9857	207	100.0	YES	CH	M	3333.3	I
1854	05/23/77	31	50	1	BOTTOM TRAWL	1ST DORSAL	SEPT	1975	R9858	220	187.0	YES	CH	F	1246.7	I
1855	05/26/77	40	64	1	HAUL SEINE	1ST DORSAL	FALL	1974	R9859	312	291.0	NO	ND	M	.	R
1856	06/01/77	37	59	1	LMS BOTTOM TRAWL	1ST DORSAL	SEPT	1975	R14033	242	173.0	YES	CH	M	1441.7	I
1857	06/29/77	67	107	3	COMMERCIAL FISHERMAN	1ST DORSAL	SEPT	1975	R9864	235	164.0	YES	IP	F	565.5	I
1858	06/29/77	67	107	3	COMMERCIAL FISHERMAN	1ST DORSAL	SEPT	1975	R9865	256	178.0	YES	IP	F	278.1	I
1859	06/30/77	67	107	3	COMMERCIAL FISHERMAN	1ST DORSAL	SEPT	1975	R9862	270	198.0	YES	IP	M	.	U
1860	06/30/77	67	107	3	COMMERCIAL FISHERMAN	1ST DORSAL	SEPT	1975	R9863	285	229.0	NO	ND	.	.	U
1861	09/28/77	60	96	3	BOX TRAP	1ST DORSAL	SEPT	1975	R11665	282	237.0	NO	ND	M	.	.

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON	REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
1862	02/04/78	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R15031	383	652.0	NO	ND	M	815.0	.
1863	02/05/78	42	67	3	I.P. SCREENS	BOTH PELVIC	FALL 1974	R15030	387	647.0	YES	ND	M	1617.5	.
1864	03/03/78	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	R15399	357	667.0	YES	ND	M	476.4	.
1865	04/03/78	34	54	1	GILL NET	1ST DORSAL	FALL 1974	R15400	496	1500.0	NO	ND	M	27.4	D
1866	04/05/78	34	54	3	GILL NET	1ST DORSAL	FALL 1974	R15402	457	1100.0	YES	ND	F	164.2	I
1867	04/05/78	34	54	3	GILL NET	1ST DORSAL	FALL 1974	R15403	376	586.0	YES	ND	M	34.3	D
1868	04/06/78	34	54	3	GILL NET	1ST DORSAL	FALL 1974	R15404	402	750.0	NO	ND	M	68.2	D
1869	04/06/78	34	54	3	GILL NET	1ST DORSAL	FALL 1974	R15405	435	900.0	NO	ND	M	20.5	D
1870	04/07/78	34	54	3	GILL NET	2ND DORSAL	FALL 1975	R15406	469	1300.0	YES	TZ	F	270.8	I
1871	04/08/78	34	54	3	GILL NET	1ST DORSAL	FALL 1974	R15407	390	673.0	NO	ND	M	43.7	D
1872	04/12/78	33	53	3	GILL NET	1ST DORSAL	SEPT 1975	R15408	380	596.0	YES	IP	M	149.0	D
1873	04/14/78	33	53	3	GILL NET	1ST DORSAL	FALL 1974	R15409	412	762.0	NO	ND	M	39.7	D
1874	04/14/78	33	53	3	GILL NET	1ST DORSAL	FALL 1974	R15410	410	700.0	NO	ND	M	83.3	D
1875	04/14/78	33	53	3	GILL NET	1ST DORSAL	FALL 1974	R15411	402	800.0	YES	ND	M	88.9	D
1876	04/14/78	33	53	3	GILL NET	1ST DORSAL	SEPT 1975	R15412	437	900.0	YES	IP	F	375.0	I
1877	04/14/78	33	53	3	GILL NET	2ND DORSAL	FALL 1975	R15413	379	702.0	YES	TZ	F	412.9	I
1878	04/20/78	12	19	2	COMMERCIAL FISHERMAN	1ST DORSAL	FALL 1974	R15414	396	632.0	NO	ND	M	632.0	I
1879	04/20/78	39	62	2	COMMERCIAL FISHERMAN	2ND DORSAL	FALL 1975	R15415	333	366.0	YES	ND	F	281.5	I
1880	04/21/78	34	54	3	GILL NET	1ST DORSAL	FALL 1974	R15416	482	1200.0	NO	ND	M	106.2	D
1881	04/21/78	33	53	3	GILL NET	1ST DORSAL	FALL 1974	R15417	338	420.0	YES	ND	M	72.4	D
1882	04/25/78	33	53	3	GILL NET	1ST DORSAL	FALL 1974	R15418	501	1400.0	YES	ND	M	84.8	D
1883	04/25/78	35	56	3	GILL NET	1ST DORSAL	FALL 1974	R15419	363	501.0	YES	ND	M	48.6	D
1884	04/27/78	35	56	3	GILL NET	1ST DORSAL	SEPT 1975	R15420	371	530.0	YES	CH	M	1325.0	I
1885	05/09/78	35	56	3	HAUL SEINE	1ST DORSAL	SEPT 1975	R15464	424	850.0	NO	ND	F	265.6	I
1886	05/11/78	46	74	1	GILL NET	1ST DORSAL	FALL 1974	R15465	569	2000.0	YES	ND	M	18.2	R
1887	05/19/78	35	56	3	HAUL SEINE	2ND DORSAL	OCT 1975	R15476	428	750.0	YES	CH	M	1250.0	I
1888	05/19/78	33	53	3	HAUL SEINE	1ST DORSAL	SEPT 1975	R15477	391	651.0	NO	ND	F	166.9	I
1889	05/19/78	33	53	3	HAUL SEINE	1ST DORSAL	SEPT 1975	R15478	315	350.0	YES	IP	F	388.9	I
1890	05/22/78	27	43	1	COMMERCIAL FISHERMAN	1ST DORSAL	FALL 1974	R15496	380	567.0	NO	ND	F	182.9	I
1891	05/23/78	33	53	3	HAUL SEINE	2ND DORSAL	OCT 1975	R15497	313	318.0	YES	CH	M	795.0	I
1892	05/30/78	27	59	1	COMMERCIAL FISHERMAN	BOTH PELVIC	FALL 1974	R15500	329	394.0	YES	ND	M	25.6	R
1893	10/11/78	35	56	3	200' BEACH SEINE	1ST DORSAL	FALL 1974	R18199	376	417.0	YES	ND	M	926.7	D

Table B-5 (Cont'd)

#	DATE	RM	KM	SITE	GEAR	FINCLIP	STOCKING SEASON	REF TAG #	LENGTH (MM)	WEIGHT (G)	NOSE TAG	STOCKING REGION	SEX	BODY WT/ GONAD WT	VISIBLE SEXUAL COND
1894	02/28/79	42	67	3	I.P. SCREENS	1ST DORSAL	FALL 1974	JT8433	430	850.0	YES	ND	M	.	D
1895	03/23/79	27	43	1	GILL NET	2ND DORSAL	OCT 1975	JT9129	421	700.0	YES	CH	F	250.0	I
1896	03/27/79	34	54	1	GILL NET	2ND DORSAL	OCT 1975	JT9329	409	700.0	YES	CH	M	1000.0	I
1897	03/28/79	34	54	3	GILL NET	BOTH PELVIC	FALL 1974	JT9388	436	900.0	NO	ND	M	56.6	D
1898	03/28/79	33	53	3	GILL NET	1ST DORSAL	FALL 1974	JT9110	530	1650.0	NO	ND	M	148.6	D
1899	04/02/79	33	53	3	GILL NET	1ST DORSAL	SEPT 1975	JT5472	388	660.0	YES	IP	F	347.4	I
1900	04/03/79	32	51	3	GILL NET	1ST DORSAL	SEPT 1975	JT8446	411	700.0	YES	IP	M	162.8	D
1901	04/05/79	33	53	3	GILL NET	1ST DORSAL	SEPT 1975	JT8908	416	650.0	YES	IP	F	224.1	I
1902	04/05/79	29	46	3	GILL NET	1ST DORSAL	FALL 1975	JT8911	398	710.0	NO	ND	M	1420.0	I
1903	04/23/79	35	56	3	BEACH SEINE	1ST DORSAL	FALL 1975	JT9730	410	650.0	NO	ND	M	1083.3	I
1904	04/23/79	32	51	3	GILL NET	1ST DORSAL	FALL 1974	JT3600	561	2150.0	NO	ND	F	188.6	I
1905	04/24/79	37	59	1	GILL NET	1ST DORSAL	FALL 1974	JT9912	710	3550.0	NO	ND	F	34.1	D
1906	04/27/79	32	51	3	GILL NET	1ST DORSAL	FALL 1975	JT10445	483	.	NO	ND	F	.	I
1907	04/27/79	32	51	3	GILL NET	1ST DORSAL	FALL 1975	JT10482	418	750.0	NO	ND	F	241.9	I
1908	04/27/79	32	51	3	GILL NET	1ST DORSAL	FALL 1975	JT10454	587	2400.0	NO	ND	M	727.3	D
1909	04/27/79	37	59	3	GILL NET	BOTH PELVIC	FALL 1975	JT10156	402	750.0	YES	ND	M	37.5	D
1910	05/01/79	35	56	3	GILL NET	1ST DORSAL	FALL 1974	JT10527	504	1500.0	YES	ND	M	37.6	D
1911	05/05/79	33	53	3	GILL NET	2ND DORSAL	FALL 1975	JT10000	476	800.0	YES	CH	F	216.2	I
1912	05/09/79	27	43	2	COMMERCIAL FISHERMAN	2ND DORSAL	OCT 1975	JT5241	374	568.0	YES	CH	F	334.1	I
1913	05/10/79	42	67	1	GILL NET	1ST DORSAL	FALL 1974	JT5255	627	2850.0	NO	ND	M	14.9	R
1914	05/18/79	40	64	1	GILL NET	1ST DORSAL	FALL 1974	JT10196	561	1900.0	NO	ND	F	191.9	I
1915	06/11/79	57	91	1	GILL NET	1ST DORSAL	FALL 1974	JT5477	511	1850.0	NO	ND	F	14.3	D
1916	06/12/79	27	43	1	COMMERCIAL FISHERMAN	1ST DORSAL	FALL 1974	JT2914	475	.	YES	ND	M	.	R
1917	06/12/79	27	43	1	COMMERCIAL FISHERMAN	1ST DORSAL	FALL 1974	JT5318	445	950.0	YES	IP	F	206.5	I

APPENDIX C

FIELD AND LABORATORY PROCEDURES

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Adult Atlantic tomcod from each sample were individually counted, as were young-of-the-year tomcod during the winter marking season. Numbers of young-of-the-year tomcod were estimated by subsampling from 1 April to 15 November when total daily counts were greater than 100 (using the subsampling technique described above).

Striped bass, white perch, Atlantic tomcod, blueback herring, alewife, and American shad were separated into four length classes and the total number determined for each length class either by estimate (as described above) or actual count. The four length classes were defined as:

Length Class 1 = 0 mm to X mm total length
Length Class 2 = X + 1 mm to 150 mm
Length Class 3 = 151 mm to 250 mm
Length Class 4 = 251 mm and over

where X, the division value, was a variable length which changed seasonally and was used to separate young-of-the-year from older fish. The value of X was empirically determined for each species by examining the size distribution of the population at regular intervals during the year. Length class (LC) 1 contained fish from the current year class, i.e. young-of-the-year between the current spawning season and 31 December, and then as yearlings from 1 January until the following spawning season. The date arbitrarily chosen for the spawning season was one month before the first appearance of young-of-the-year in field or impingement collections. The division value (X) was reduced to a smaller number at the beginning of each spawning season, thus causing any yearlings collected thereafter to be counted in LC 2. The X value was revised on 1 June for all but the winter-breeding Atlantic tomcod for which the revision occurred on 1 April.

Each of the six species mentioned above were separated into the four length classes and the total number of fish in each length class were tallied for each operating unit. Individual lengths and weights were determined from biweekly subsamples of 25 fish per length class (when available) for each of the three key species (striped bass, white perch, and Atlantic tomcod).

b. Power Plant and Environmental Variables

To provide a basis for computing impingement rates and for analyzing the factors affecting impingement rates at Units No. 2 and No. 3, cooling water circulator flow rates and the duration of circulator pump operation were monitored along with fish collections from the intake screens. Frequency of pump start-ups and shutdowns was also monitored along with water temperature, conductivity, and dissolved oxygen which were recorded daily at the intake of each unit and in the common discharge for all three units. Water quality measurements were taken two feet below the surface at each location as follows:

Unit 1 - off the pier

Unit 2 - at the south end of the intake near screen No. 21

Unit 3 - along the metal sea wall at the south end of the intake near screen No. 31

Discharge Canal - south of Unit No. 3 at the de-icing pump

Conductivity was measured with a YSI Model 33 salinity-conductivity-turbidity meter; temperature and dissolved oxygen were measured with a YSI Model 57 oxygen meter. Variables related to plant operation were obtained directly from plant engineers.

c. Determination of Impingement Rate

The magnitude of fish impingement under ideal conditions is best assessed by dividing the total number of impinged fish by the total volume of cooling water circulated. Factors such as ice floes, trash loading (which necessitates unscheduled screen washes), equipment failure, and plant maintenance sometimes interfere with computing an accurate volume of water pumped during a particular collection period. To calculate accurate impingement rates, daily impingement collection data were screened by TI to select days on which fish counts could be accurately matched to the water volume from which those fish were impinged. Rates computed from selected days are termed selected rates and are used throughout this report. Selected rates were originated by TI in 1977 and compared to more conventional unselected rates in a previous report (TI 1979c).

During 1978, sufficient data were available on the efficiency of collecting impinged fish (Section IV.B) to estimate the total number of fish impinged through the application of correction factors rather than using only counts of fish actually collected. Thus, impingement rates presented in this report are adjusted as well as selected. Details of 1978 collection efficiency test methods are presented in the following paragraphs.

d. Collection Efficiency Tests

Tests were continued during 1978 to estimate the percentage of fish that were impinged but not collected during the impingement monitoring process. Losses of impinged fish occurred as a result of scavenging by fish and birds, river and tidal currents, entrapment in the submerged structures associated with the intake screens, and possibly other as yet unidentified causes.

To measure collection efficiency, dead striped bass, white perch, or Atlantic tomcod were dyed various colors and released at three depths in front of intake screens number 22 and 26 (Unit No. 2) and number 32 and 36 (Unit No. 3). The units were not tested simultaneously. Each test was composed of three releases of 30 fish at each of the two screens, for a total of 180 fish per test. A different color of dye was used in each release to examine the effect of impingement duration on fish loss. The first fish were released at about 0900, immediately after the morning screen wash. Subsequent releases were made at 1600 and on the following day at 0600. When unscheduled washes interrupted a test, releases were halted but collections continued. Recovery of dyed fish began with the next screen wash and continued during all succeeding screen washes. Fish were released at three depths [9 ft (3 m), 15 ft (5 m), and 21 ft (6 m)] at both Unit No. 2 and Unit No. 3. Because previous studies had indicated greater impingement near the surface (TI 1975c), 18 of the 30 fish in each test release were placed at the 9 ft depth and six fish were placed at both the 15 ft and 21 ft depths.

At Unit No. 3 the three release locations (depths) were situated in a vertical line about 5 ft in front of the traveling screen. At Unit No. 2 the three positions were located on a diagonal about 2 ft in front of the fixed screen. The diagonal passed from an upper corner of the screen through the center, to the opposite lower corner. For each test release the slope of the diagonal was switched to the corners opposite those used on the previous test release.

e. Fine Mesh Experimental Study at Unit No. 1

A continuously operating fine mesh (2.5 mm) traveling screen, equipped with fish buckets and low pressure wash systems, was tested at Unit No. 1 to reduce fish entrainment and enhance the survival of impingement fishes. Studies were conducted in 1978 to examine means of reducing impingement effects. They were designed to 1) determine the recovery rates of impinged fish by testing various combinations of internal and external spray wash pressures and 2) to estimate the survival rates of fish that were collected. Descriptions of screen modifications and the study design appear in Section V.

2. Standard Stations Program at Indian Point

The Standard Stations Program sampled juvenile and older fishes in the vicinity of the Indian Point generating station. Sample collection and laboratory processing were similar in 1975 through 1978. Sampling in 1978 involved 14 fixed stations (Figure C-1) between RM 39 and 43 (KM 62-69). Beginning in April and continuing through December, seven shore zone stations (Table C-2) were sampled weekly during the day, approximately two hours before a low tide, with a 100-ft (30.5 m) beach seine. Seven offshore stations (Table C-3) were sampled twice weekly during the day; first using a bottom trawl [total length 44 ft (13 m), head rope 25 ft (8m), cod end stretch mesh 1.3 in (3.2 cm), with a fine mesh liner 0.6 in (1.6 cm) stretch mesh]; and then on another day that same week using the same trawl without a fine mesh liner. From July through December each offshore trawl station was also sampled biweekly during the day with a surface trawl [total length 49 ft (15 m), mouth opening 17 ft (5m) wide by 10 ft (3m) high, cod end stretch mesh 0.2 in (4 mm)] (TI 1979b). The entire catch from each sample was returned to the laboratory for processing.

Each sample was sorted by species into four length classes as defined above (Appendix Section C.1.a). The number of fish in each length class was recorded for each species, and a random subsample (maximum of 20 fish) from each length class for each species was measured and weighed.

Quality control procedures were maintained to ensure an average accuracy rate of 90% or better on the identification and total count of striped bass, white perch, Atlantic tomcod, and all other species

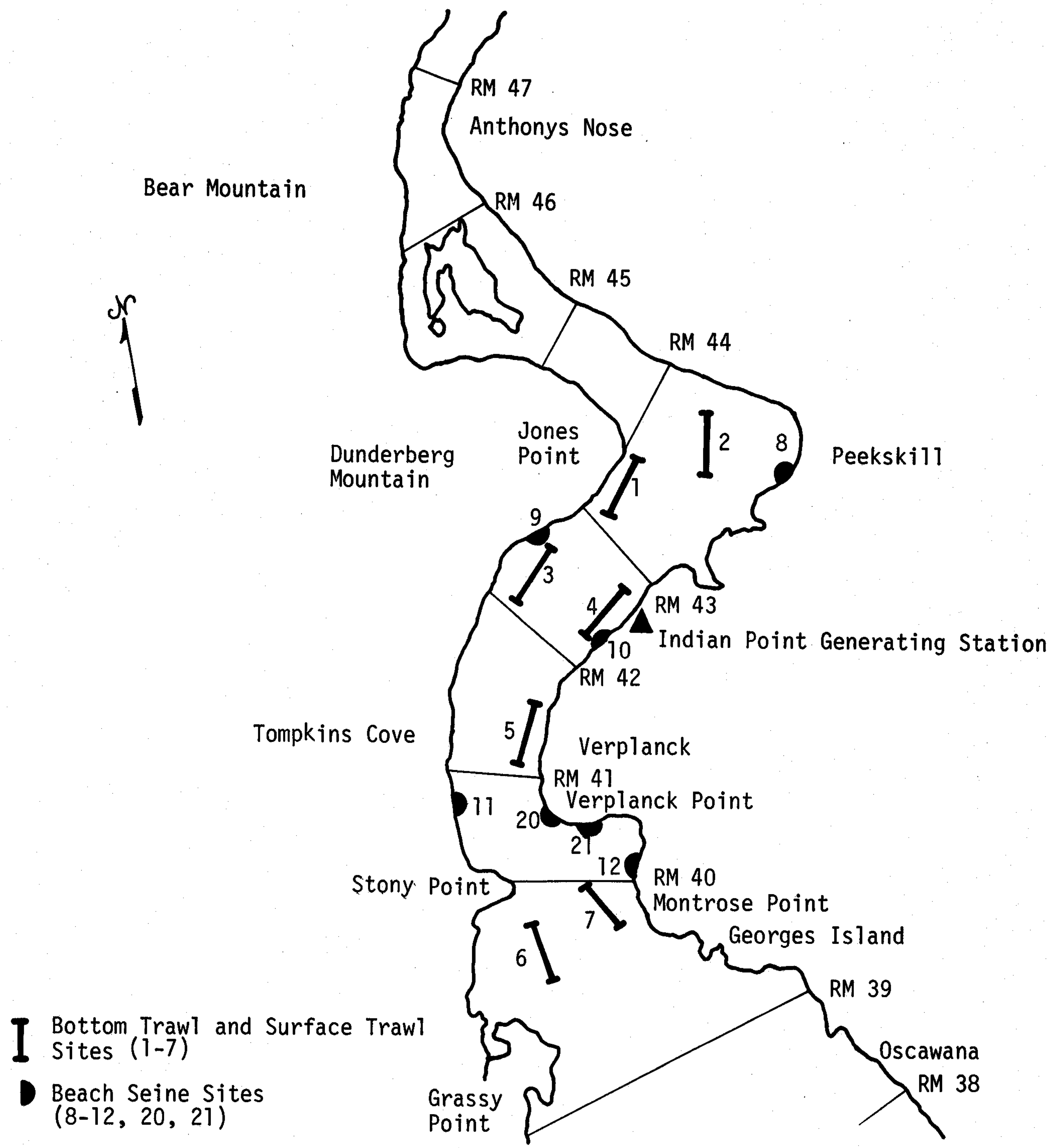

Figure C-1. Indian Point Standard Station Beach Seine, Bottom Trawl, and Surface Trawl Sites, Hudson River Estuary, RM 39-43, 1978

3. Long River Fisheries Sampling

a. Beach Seine Survey and Related Mark/Recapture Survey

The Beach Seine Survey yielded data on abundance and distribution of juvenile and older fishes in the shore zone of the estuary and provided a major portion of the mark/recapture effort. From April through June and September through December of each year, the estuary from RM 12 (KM 19) to RM 152 (KM 243) was sampled biweekly using 100-ft beach seines; on alternate weeks, sampling was confined to an area from Yonkers through Poughkeepsie (RM 12-77). During July and August of each year, all regions (RM 12-152) were sampled weekly.

Approximately 100 samples per week were collected during the daytime from nearly 300 available beach sites. Sample sites were selected by dividing each of the 12 river regions into three-mile segments and randomly selecting sites from each segment. Sites were chosen daily and sampled only once per day; some sites could have been sampled two or more times per week.

The 100-ft seine was set perpendicular to the shore, then towed to the beach to form a semicircular impoundment (TI 1979b). The wings (end panels) of the net were pulled onto the beach, concentrating the catch in the middle (bunt) of the net (TI 1978b).

The sample processing procedures varied slightly from year to year between 1975 and 1978. In 1975 all fish species were identified and separated into age classes. Striped bass, white perch, American shad, blueback herring, and alewife were separated into young-of-the-year, yearling, and older than yearling age classes; all other species were separated into only two age classes, either young-of-the-year or yearling and older. The fish were separated into their respective age groups according to predetermined maximum length values (divisions) for respective age groups. These values were updated as necessary throughout the year to allow for growth. All young-of-the-year fish collected in 1975 were preserved and returned to the laboratory except during fall marking periods when young-of-the-year striped bass and white perch were checked for clipped fins. All probable recaptures were returned to the laboratory for verification; unmarked fish were finclipped and released. Young-of-the-year fish returned to the lab were sorted by species and the number of individuals of each species counted. Total lengths were recorded for randomly selected subsamples of striped bass and white perch (during non-marking periods), and alewife, blueback herring, American shad, Atlantic tomcod, spottail shiner, tessellated darter, banded killifish, and bay anchovy. If a sample contained an extremely large number of a particular species, a subsampling technique was used to estimate the total number of that species. During the 1975 fall marking period, up to 25 young-of-the-year striped bass and white perch were randomly selected from each sample and the total length of each fish recorded before it was marked and released.

In 1976 all fish were identified and separated into one of four length groups as described above (Appendix Section C.1.a). A biweekly subsample of 20 lengths and weights were taken for each length group of striped bass, white perch, and Atlantic tomcod collected within each of the 12 geographic regions. An additional 40 young-of-the-year were measured for each of the three species. The biweekly length/weight subsamples were taken on weeks which coincided with the Interregional Bottom Trawl Survey. Collections of young-of-the-year fish in 1976, except for striped bass and white perch during marking periods, were preserved and returned to the lab where all species were sorted by species and the number of individuals of each species counted. Length and weight subsamples were taken for Atlantic tomcod as described above. Only the number of young-of-the-year striped bass and white perch needed to fill the length/weight quota were returned to the lab for processing.

As in 1975, all probable recaptures of striped bass, white perch, and adult tomcod were returned to the lab for verification.

In 1977 and 1978 sample processing procedures including length/weight subsampling were the same as in 1976 for the Croton-Haverstraw, West Point, and Cornwall regions. Length/weight subsampling was performed on fish collected in the Indian Point region as part of the Standard Stations Sampling Program. No length/weight subsampling was performed on striped bass, white perch, or Atlantic tomcod collected in the other eight geographic regions.

Marking procedures were identical from 1975 through 1978. Young-of-the-year striped bass and white perch were finclipped from September through mid-December (fall marking period). Yearling striped bass and white perch were finclipped from April through June (spring marking period) and tagged during the fall marking period. Yearling and older fish were tagged with either a Floy fingerling tag or a nylon internal anchor tag, depending on the total length of the fish. In the process of collecting striped bass and white perch, any yearling or older Atlantic tomcod collected were examined for finclips or tags and released; adults of other species were counted and released. Atlantic tomcod were marked (finclipped or tagged with Carlin tags) during their spawning season (approximately November through February).

b. Interregional Bottom Trawl Survey

The Interregional Bottom Trawl Survey yielded data on the abundance and distribution of juvenile and older fishes inhabiting the offshore bottom strata of the river. It also provided a deep-water recapture effort for marked fish. On alternate weeks from April through November, 38 fixed stations (Figure C-2) from RM 27 to RM 77 (KM 43 to KM 123) were sampled once during daytime with an otter-type bottom trawl (25-ft head rope) equipped with a fine mesh cod end cover (TI 1979b).

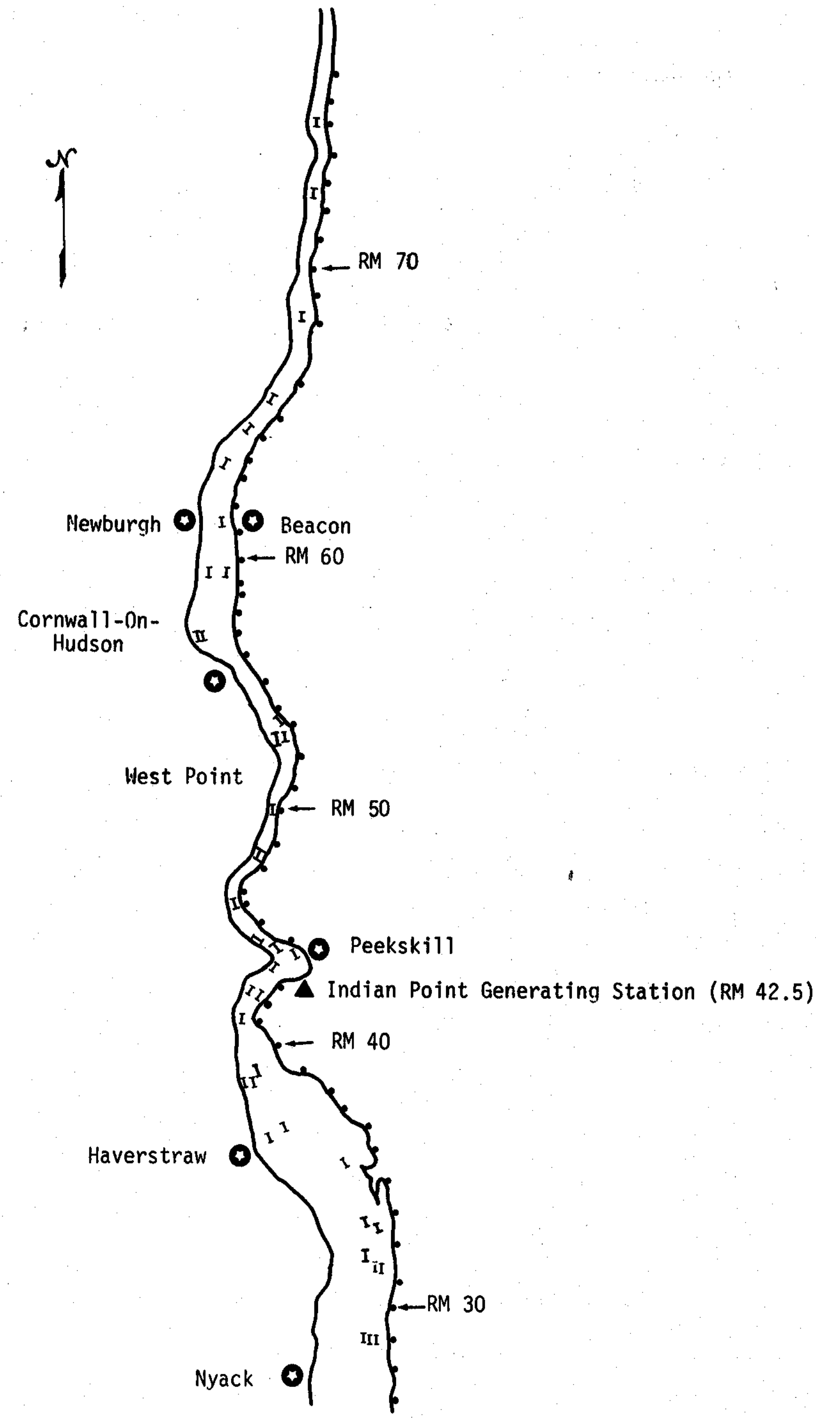

Figure C-2. Interregional Bottom Trawl Survey Sampling Sites, Hudson River Estuary, RM 27-77, 1978

Catches were sorted by species and length group as was done for the Standard Stations Program. Length/weight samples were taken in all regions sampled in 1978, and when available two samples of Atlantic tomcod per sampling period were collected and returned to the lab. Randomly selected subsamples from these two samples were processed for biological characteristics using methods identical to those described for Standard Stations bottom trawl samples. No fish were marked from the Interregional Bottom Trawl Survey.

4. Adult Striped Bass Program

a. Collection and Processing of Suspected Recaptures of Hatchery Reared Individuals

A comprehensive field and laboratory study of adult striped bass ($\geq$200 mm TL) has been conducted from mid-March through June since 1976 to determine the age and size structure, sex ratios, mortality rates, movement, and biological characteristics of the Hudson River spawning population. Texas Instruments (TI) personnel as well as commercial fishermen collected the samples. Since the commercial fishery for striped bass in the Hudson River was officially closed in early 1976, age and size composition of the commercial catch were estimated by contracting with four major commercial fishermen. In addition, tag returns (reward $5.00 per tag) from sport and commercial fishermen provided information on movements and exploitation rates. Striped bass collected in this program also provided brood fish for the ongoing hatchery program as well as an opportunity to recover any hatchery-reared individuals that were stocked in earlier years and participating in the spring spawning run.

Sampling effort was allocated on the basis of adult striped bass distribution in the previous year and concentrated in the vicinity of the Tappan Zee Bridge and Croton-Haverstraw Bay early in the spawning season (March-April), shifted upriver to the Indian Point area as the season progressed (May), and then back down river in June near the end of the spawning season. Two clusters of anchored gill nets were separated longitudinally in the river (and designated as north or south). Each cluster contained a minimum of four nets of different standard mesh sizes (4-, 5-, 6-, and 7-in. stretch multifilament) and usually from one to four additional nets (4-, 5-, 6-, or 7-in. stretch multifilament). A less size selective 900-ft (294-m) haul seine was used at night to collect striped bass in the shore zone, primarily in Haverstraw Bay (RM 33-39, KM 53-63).

Four commercial fishermen were contracted to fish for striped bass 2 days per week using their own fishing gear and standard techniques. Each fisherman was accompanied by TI personnel during net-tending.

Fish were measured and scale samples removed. Live fish in good condition and not needed for measurement of biological characteristics in the laboratory were tagged and released. Suspected hatchery-reared individuals were returned with the dead and dying fish to the laboratory for processing and examination for evidence of fin clips and/or magnetic nose tags which would verify their hatchery origin.

b. Verification of Hatchery Origin

In 1973 through 1975, Texas Instruments (TI) stocked young-of-the-year striped bass that were hatchery-reared. Fin clips and internal magnetic nose tags were applied to the young striped bass prior to stocking to evaluate post-stocking survival and movements.

All striped bass collected by TI field crews from the Hudson River have been exmained for marks since 1973. Those with evidence of one of the types of fin clips applied to hatchery reared fish were further checked for the presence of an internal magnetic nose tag. Since 1976, all striped bass returned to the laboratory and of a size compatible with those stocked in 1973, 1974, or 1975 have been examined for the presence of a nose tag regardless of evidence of a fin clip. Gonads have been taken and weighed and the ratio of body weight to gonad weight has been used to evaluate maturity. Male striped bass with a body weight to gonad weight ratio less than 235 and females with a ratio less than 70 during the prespawning period are mature and can be expected to spawn (McFadden 1977).

5. Water Quality Tasks

Water quality data (water temperature, dissolved oxygen, pH, conductivity, and turbidity) were collected concurrently with or subsequent to each impingement, standard stations, and fisheries sample in 1975 through 1978. The instruments used to measure water quality parameters, as well as other details, are described in Table C-4. All instruments and thermometers were calibrated prior to daily sampling and checked for accuracy periodically during the sampling day.

At the completion of each standard stations surface and bottom trawl sample and each Interregional Bottom Trawl Survey sample, all water quality variables except turbidity were measured in the field; a water sample was collected at the surface for subsequent laboratory measurement of turbidity. For beach seine samples from the Standard Stations Program and Long River Survey, surface water temperature and dissolved oxygen concentration were measured <u>in situ</u>. A water sample was collected at each shore zone site and delivered to the laboratory for determination of pH, conductivity, and turbidity.

Water quality data associated with impingement sampling (water temperature, dissolved oxygen concentration, and conductivity) were measured daily at the intakes of Units No. 1, 2, and 3, and in the discharge canal at the Indian Point generating station.

Table C-4

Physicochemical (Water Quality) Measurements Taken with Each Biological Sample and Sample Depth*, Field or Laboratory Determination, and Instrumentation** Used to Determine Sample Values, 1975 through 1978

		Physicochemical Measurements Taken With Each Biological Sample					
Year	Task	Sample Depth	Water Temperature	pH	D.O.	Conductivity	Turbidity
1975	Standard Stations and Long River Beach Seines	S	F(3)	L(4)	F(3)	L(5)	L(2)
	Standard Stations Trawls and Interregional Bottom Trawl	S,M,B,	F(1)	F(1)	F(1)	F(1)	L(2)
	Impingement Units No. 1, 2	S	F(3)	--‡	F(3)	F(12)	--
1976	Standard Stations and Long River Beach Seines	S	F(3)	L(7)	F(3)	L(5)	L(2)
	Standard Stations Trawls and Interregional Bottom Trawl	S,M,B,	F(1)	F(1)	F(1)	F(1)	L(2)
	Impingement Units No. 1, 2, 3	S	F(3)	--	F(3)	F(12)	--
1977 and 1978	Standard Stations and Long River Beach Seines	S	F(9)	L(10)	F(9)	L(11)	L(8)
	Standard Stations Surface and Bottom Trawls, and Interregional Bottom Trawl	S,M,B,	F(1)	F(1)	F(1)	L(11)	L(8)
	Impingement Units No. 1, 2, 3	S,B‡	F(9)	--	F(9)	F(12)	--

*S = Surface (Only surface samples were analyzed for turbidity.
M = Middle During surface trawling efforts, physicochemical
B = Bottom data were usually collected only at the surface.)

†F = Field Determination
L = Laboratory Determination

**(1) Hydrolab Surveyor Model 6D *in situ* Water Quality Analyzer

Reserve Equipment:

a) YSI Model 57 Dissolved Oxygen Meter (Temperature, D.O.)
b) YSI Model 33 Salinity-Conductivity-Temperature Meter
(No *in situ* pH measurement was taken when reserve equipment was used.)

(2) Hach Model 2100 A Turbidimeter
(3) YSI Model 57 or 54 Dissolved Oxygen Meter
(4) Sargent-Welch Model PBL pH Meter
(5) YSI Model 31 Conductivity Bridge
(6) Mercury Thermometer
(7) Sargent-Welch Model PBL or LSX pH Meter
(8) Hach Model 2100-A or Ecolab 104 Turbidimeter
(9) YSI Model 57 Dissolved Oxygen Meter
(10) Sargent-Welch Model LSX pH Meter
(11) YSI Model 31 or Model 33 Conductivity Bridge
(12) YSI Model 33 Salinity-Conductivity-Temperature Meter

‡Indicates no physicochemical measurements taken

Note: Temperature and conductivity measurements which were not taken *in situ* because of meter problems were determined from a sample collected at the surface. Water temperature was determined with a mercury, alcohol, or dial thermometer and the sample bottle was capped and returned to the Verplanck lab for analysis.

APPENDIX D

SYNOPSIS OF STUDY DESIGNS

Notes on the Interpretation of Tables D-1 through D-5

Arrow: indicates no change from previous year

References: call outs are provided for only that information which is a modification from the previous year and apply to information in the column above

Table D-1

Changes in Study Design and Methods of Indian Point Impingement Studies, 1969 through 1978

Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Contractor	Raytheon (RAY), New York University (NYU)		New York University	Texas Instruments (TI)						
Structural and Operational Modifications		*1. Back-up fixed screens installed (Jan) - Unit 1 *2. Discharge canal extended from original 320' to 540' (1966) Then to a. 960 ft downstream from Unit 1 (Feb) b. 1155 ft downstream from Unit 1 (Dec)	*3. Initiated policy (Jan) of winter flow reduction to 60% of capacity when water temperature <4°C (approximately Dec through Apr)	*c. Submerged discharge ports in use (Jun)						
Routine Collection Schedule Unit 1	*1. Irregular collections Con Ed, Raytheon, New York University (NYU)	*1. NYU began routine daily collections (Oct) *2. Fixed and traveling screens washed once daily between 0800 and 1200 hrs		†1. TI began routine collections at 4 hr intervals (Jun to Dec) †2. Collections at 8 hr intervals (Dec)	2. Collections at 8 hr intervals (1 Jan to 7 May); once per day (7 May through Dec)	*2. Unit 1 retired 1 Oct, monitored when circulators operated for experimental purposes or dilution of discharge water				
Unit 2			†1. Collections by NYU during sporatic testing of circulator pumps	†1. TI began routine collections during tests of circulators 2. 1 to 3 collections per day	*1. Unit 2 on Line 28 Sep, monitored by TI	2. Collections once per 24 hour (except special studies - as required)				
Unit 3						1. TI began collection during sporadic testing of circulator pumps 2. Collections at 4 hr intervals (continuous traveling screen operation)	Unit not in operation	*1. Unit 3 on line 30 Aug, TI began routine collection *2. Collections and traveling screen rotation once per 24 hr		
Types of Data Collected in Routine Monitoring	1. Total weight of collection (little documentation)	*1. Total weight and number by species (First documentation data filed)		†2. Length/weight subsampling (initiated 15 Jun) a. length and weight taken on subsample of 30 individuals per species per wash	2. Length/weight subsampling (modified 1 Dec) a. Length and weight taken on 25% of first 100 or fewer individuals plus 1% of remainder in excess of 100, per wash (all species except striped bass, white perch, Atlantic tomcod) b. Four length classes established for striped bass, white perch, Atlantic tomcod 1) length and weight subsample per length class filled as 2a above 3. Striped bass, white perch, Atlantic tomcod examined for marks †4. Water quality: temp, D.O., cond, pH, turb, (taken beginning 23 Feb)	4. Water quality: temp, D.O., cond, pH	1. Subsampling (total number calculated from total weight vs weight per 100) initiated for estimating total count (if >100) for all species except striped bass, white perch, Atlantic tomcod b. Four length classes for striped bass, white perch, Atlantic tomcod filled semi-monthly 1) 25 individuals per length and weight subsample 2) Total no. by length class extended to alewife, blueback herring, Am. shad (estimated count) 4. Water quality: temp, D.O., cond.	1. Subsampling (total number calculated from total weight vs weight per 100) for estimating total count (if >100) of all species except striped bass, white perch, Atlantic tomcod b. Length and weight subsample of first 25 striped bass, white perch, Atlantic tomcod per bi-weekly interval		
Fish Disposal Method	Disposal into river without tidal consideration	†Disposal into river at ebb tide only (initiated in Apr) to minimize recirculation of dead fish at Unit 1		Disposal off site, not into river						
Special Studies Air Curtain				Unit 1 2 tests (3 Aug, & 7 Sep) at Bays Nos. 11 & 12 1 fixed screen raised	†Unit 2 Test at all Bays (Nov & Dec)	†Unit 2 Test (Nov & Dec)	Unit 2 Sporadic tests at some bays overlapping collecting efficiency testing	†Air curtain discontinued (30 Mar)		
Collection Efficiency						**Unit 2	*Unit 2	**Unit 3	†Unit 2, 3	Unit 2,3
Miscellaneous Tests					Unit 1 - Fish Pump Tests 4 tests (May, Jun)	†Unit 2, screen 21 sonar test (8 Jul to 2 Aug) †Unit 2 gill net in front of intakes (Jun through Dec) †Unit 2 - verticle distribution			Unit 1 - submerged, weir at bays Nos. 13 & 14 (25 May to 29 Jul) Unit 1 - fine mesh at Bay No. 11 (15 Jun to 22 Dec)	*Unit 1 - fine mesh (8 Aug to 10 Nov)

Table D-2

Changes in Study Design and Methods of Indian Point Standard Station Bottom Trawl Efforts, 1969 through 1978

Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
	Raytheon (RAY)	→	No Contractor, no field data collected	Texas Instruments (TI)	→	→	→	→	→	→
...ption	Semi-Balloon Otter Trawl 1. Body: 1.5 in stretch mesh 2. Cod-end: 1.25 in stretch mesh 3. Liner: 0.25 in stretch mesh 4. Head Rope: 25 ft 5. Foot Rope: 30 ft 6. Doors: 1.5 ft x 3 ft	→	—	Semi-Balloon Otter Trawl 1. Body: 1.5 in stretch mesh 2. Cod-end: 1.25 in stretch 3. Liner: 0.25 in stretch mesh (Jul through Dec no liner) 4. Head Rope: 25 ft 5. Foot Rope: 30 ft 6. Doors: 1.5 ft x 3 ft	*45 ft (total length) Otter type trawl (knotted mesh) 6. Doors: 1.25 ft x 2.5 ft	*45 ft (total length) Otter type trawl knotless mesh After 21 Jun, knotted net used as necessary (whenever knotless under repair) 3. Liner: 0.6 in a. 1 set of trawls with liner b. 1 set without liner day preceding or following trawls with liner (beginning late Jun)† 4. Head Rope: 25 ft 5. Foot Rope: 30 ft 6. Doors: 1.25 x 2.5 ft	→	→	→	→
...ment	†1. Towed against current on slack tide, towed upstream 2. Speed: 1.5 m/sec (≈3 knots) 3. Duration: 10 min (7 min after 8 Aug) 4. Cable Length: River depth ratio = 3 or 3.5:1 5. Stern trawl using gallows frame 6. Tow speed determined by RPM of engine	→	—	†1. Towed against current 2. Speed: 1.0 m/sec 3. Duration: 10 min 4. Cable Length: River Depth ratio 3:1 5. Stern trawl using gallows frame 6. Tow speed determined by RPM of engine	*4. Cable Length: River depth ratios 4:1 6. Electronic flowmeter used to determine tow speed	5. Stern trawling using a mast, booms completely spread	→	→	5. Stern trawling using a mast, booms not completely spread	5. Stern trawling using a gallows frame with extentions
...or Strata Sampled	†1. Indian Point (major stations) RM 39-44 2. Croton-Haverstraw (minor stations) RM 27-38 & RM 47	1. Indian Point (Major stations) RM 39-44 2. Croton-Haverstraw (Minor stations) RM 35-38 & RM 47	—	†1. Indian Point (specifically RM 39-43)	*2. RM 56-57	→	→	→	→	→
...ations	†1. Major Stations (Nos. 8,9,10,11,12,15,16) No. 15 added Oct No. 16 added Nov 2. Minor Stations (Nos. 1,2,3,4,5,6,7,13,14) Nos. 1, 2 dropped Nov	1. Major Stations (7) 2. Minor Stations (7)	—	*6 Stations (TI Nos. 2-7 comparable to RAY Nos. 12, 11,10,16,8,9 RESP. and TI No. 1 and RAY No. 15 without comparable sites	*1. 7 Stations (RM 39-43) 2. 5 Stations (RM 56-57)	→	→	→	→	→
...iod, Frequency,	*1. Major Stations a. Day-weekly b. Night-monthly 2. Minor Stations a. Day-weekly b. Night-monthly	1. Major Stations a. Mar through May (Day-once per week minimum b. Jun through Oct 1) Day-once per week minimum 2) Night-once per month 2. Minor Stations (Day) a. Mar through May occasionally b. Jun through Oct 1) 3 times per month (to mid-Sep) 2) Once per month (Oct)	—	*Apr through Dec; a. Day-weekly b. Night- bi-weekly	*1. RM 39-43 Jan, Feb, Apr, through Dec; Day bi-weekly 2. RM 56-57 Apr through mid-Dec; Day bi-weekly	*1. RM 39-43 Apr through Dec; Day bi-weekly †2. RM 56-57 16 Apr only; Day	→	1 Apr through Dec; Day bi-weekly	→	→
... stations, etc.)	*Raytheon 1969a †Raytheon 1971	Raytheon 1971	—	*TI 1972a †TI 1973c **Raytheon 1971	*TI 1975b †CE 1973 **TI 1976a	*TI 1975b †TI 1975a	TI 1978c	TI Data Sheets	TI Documentation	TI Documentation

Table B-3

Changes in Study Design and Methods of Indian Point Standard Station Surface Trawl Efforts, 1979 through 1978

Year	1969	1970	1971*	1972	1973	1974	1975	1976	1977	1978
	Raytheon (RAY)	→	No Contractor, field data not collected	Texas Instruments (TI)	→	→	→	→	→	→
tion	Surface Trawl (Inverted Bottom Trawl) 1. Body: 1/2 in bar mesh 2. Cod end: 1/16 in bar mesh 3. Head rope: 30 ft 4. Foot rope: 25 ft 5. Bridle: 40 ft 6. Tow rope: 200 ft	→	—	Surface Trawl (*Inverted Marinovich Bottom Trawl) (Square mid-water trawl) 1. Body: 1/2 in bar mesh 2. Cod end: 1/16 in bar mesh 3. Head rope: 30 ft 4. Foot rope: 25 ft 5. Bridle: 40 ft 6. Tow rope: 200 ft 7. 2 depressors 8. Doors w/floats: 1/2 x 1 m †9. Liner removed: bunt mesh 3/8 in stretch	Surface Trawl (modified mid-water trawl 49 ft total length with spreader bar) 1. Body by section: 1.7, 1.4, 1.2, 1.0 in stretch mesh 2. Cod end: 0.2 in stretch mesh 3. Head rope: 17 ft 4. Foot rope: 17 ft	→	→	→	→	→
nt	†1. Towed against current 2. Speed: 1.5 m/s (≈3 knots) 3. Duration: 10 min 4. Towed by one boat	→	—	†1. Towed against current 2. Speed: 1.0 m/s 3. Duration: 10 min 4. Towed by one boat	→ 4. Towed by 2 boats - 150 ft apart	→	→	→	→	→
r Strata Sampled	†1. Indian Point 2. Croton-Haverstraw	→	—	1. Indian Point (RM 39-43) 2. Croton-Haverstraw (RM 24-38)	→	→	→	→	→	→
ations	**1. Major Stations (Nos. 8-12) through Sep, No. 15 added Oct, No. 16 added Nov **2. Minor Stations (Nos. 1-7, 13) through Oct, Nos. 1 and 2 dropped Nov	1. Major Stations (Nos. 8-12, 15, 16) 7 2. Minor Stations (Nos. 3-7, 13) 6		*1. Indian-Point Region (Standard Stations) **a. 6 stations (TI Nos. 2-7 comparable to RAY Nos. 12, 11, 10, 16, 8, 9 Resp; TI No. 1 and RAY No. 15 without comparable sites 2. Croton-Haverstraw Region 2 Stations	→	→	→	→	→	→
iod, Frequency,	**1. Sep through Dec a. Major stations 1) day - biweekly 2) night - alternate weeks b. Minor stations 1) day - monthly 2) night - monthly	†1. Jun through Oct a. Major stations 1) day - biweekly 2) night - alternate weeks b. Minor stations 1) day - monthly 2) night - monthly *2. Apr through Jun (selected stations once per month)	—	†1. Apr through Dec a. Indian Point Region stations 1) day - weekly 2) night - biweekly b. Croton-Haverstraw Region stations 1) day - weekly	†Jan, May through Dec Day bi-weekly	Mid-Jul through Dec Day bi-weekly	→	→	→	→
	*Raytheon 1969b	*Raytheon 1970a	—	*TI 1972a	*TI 1973c	TI 1975a				

Changes in Study Design and Methods of Indian Point Standard Station Beach Seine Efforts, 1969 through 1978

Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
	Raytheon (RAY)	→	No Contractor, Field data not collected	Texas Instruments (TI)	→	→	→	→	→	→
iption	*1. 75ft x 8ft Beach Seine (Jun to 10 Sep) a. Mesh 1/4 in square b. No bag *2. 100 ft x 10 ft (10 Sep to 31 Dec) a. Wings: 0.375 in square mesh b. Bag: 0.250 in square mesh	→	—	*2. 100 ft Beach Seine a. Wings: 40 ft x 8 ft 0.375 in b. Bag: 20 ft x 10 ft 0.250 in c. Tow line: 16 ft	→	→	→	→	→	→
ment	1. Set perpendicular to shore, pulled in semi-cicular path to shore by boat **2. Set against tidal and/or current flow 3. Hauled to shore by hand **4. Outboard jack weighted with lead (to hold net perpendicular to water surface)	→	—	1. Set perpendicular to shore, pulled in semi-circular path to shore by boat 2. Set clockwise without regard to tidal flow 3. Hauled to shore by hand	→	→	→	→	→	→
/or Strata Sampled	1. Indian Point (Major Stations) 2. Croton-Haverstraw (Minor Stations)	→	—	1. Indian Point (specifically RM 40-44)	→	→	→	→	→	→
tations	1. Major Stations (†Nos. 33, 34,35,36) through Sep No. 38 added Oct 2. Minor Stations (†Nos. 31, 32,37)	1. Major Stations (Nos. 33, 34,35,36,38) No. 39 added Nov →	—	**5 Stations (TI Nos. 9,10,11 comparable to RAY Nos. 35, 34,38, resp.) and TI Nos. 8,12 without comparable RAY stations	→	*Mar to Jun 5 Sites **2 Stations added TI Nos. 20,21, June 2 (comparable RAY No. 33)	7 Stations (TI Nos. 9,10,11, 12,20,21)	→	→	→
riod, Frequency,	1. Major Stations a. Day-Weekly b. Night-Monthly 2. Minor Stations a. Day-Monthly b. Night-Monthly	→ 3. 24 hr. sampling (Aug)	—	*1. Apr through Dec Day-Weekly (Begin 2 hr before mean low tide) *3. 24 hr sampling monthly †Sampled all sites every 6 hrs	Mar through Dec →	→	→	→	→	→
of stations, etc.)	*Raytheon 1971 †Raytheon 1969a **TI Documentation	Raytheon 1971	—	*TI 1972a †TI 1976a **Raytheon 1971 TI 1973e	TI 1976a	*Raytheon 1971 **TI 1973e	TI 1976a			

Table D-5

Changes in Study Design and Methods of Indian Point Impingement and Standard Station Water Quality Studies, 1969 through 1978

Year	1969	1970	1971	1972	1973	**1974	1975	1976	1977	1978
	Raytheon (RAY)		No Contractor, field data not collected	Texas Instruments Incorporated (TI)						
ion Beach	Temp D.O. Cond Turb †1. Depth: Surface **2. Time: After		—	Temp D.O. pH Cond Turb 1. Depth: Surface 2. Time: After 17 Jul-weekly (independent of biological samples)	1. Depth: Surface 2. Time: Weekly (independent of biological sampling	1. Depth: Surface 2. Time: After				
ion Bottom Trawls	Temp D.O. Cond 1. Depth: Surface, Middle, Bottom 2. Time : After		—	Temp D.O. pH Cond Turb 1. Depth: 5 ft increments to 20 ft 10 ft increments over 20 ft ‡2. Time: After 17 Jul-weekly (independent of biological samples)	1. Depth: 3m depth intervals 2. Time: weekly (independent of biological sampling)	Time: During	1. Depth: 3m depth intervals until Sep; Surface Middle, Bottom thereafter	1. Depth: Surface, Middle, Bottom		
on Surface Trawls	Temp D.O. Cond 1. Depth: Surface, Middle, Bottom 2. Time: After		—	Temp D.O. pH Cond Turb 1. Depth: 5 ft increments to 20 ft 10 ft increments over 20 ft 2. Time: After 17 Jul-weekly (independent of biological sampling)	Temp D.O. pH Cond 1. Depth: 3m depth intervals 2. Time: Weekly (independent of biological sampling)	1. Depth: 3m depth intervals 2. Time: During	1. Depth: Surface until Sep Surface, Middle, Bottom thereafter	1. Depth: Surface, Middle, Bottom		
t 1	Temp D.O. pH Cond 1. Depth: 12 ft 2. Time: Continuous			Temp D.O. pH Cond Turb 1. Depth: 12 ft 2. Time: Continuous	Temp D.O. pH Cond Turb 1. Depth: 2 ft below Surface 2. Time: While circulators operating	Temp D.O. pH Cond 1. Depth: 2 ft below Surface 2 ft above Bottom 2. Time: Slack tide	Temp D.O. Cond 1. Depth: 2 ft below surface 2. Time: Slack tide	1. Depth: Surface 2. Time: Slack or flood tide		
t 2	Not in operation				1. Depth: 2 ft below Surface 2. Time: While circulators operating	Temp D.O. pH Cond 1. Depth: 2 ft below Surface 2 ft above Bottom 2. Time: Slack tide	1. Depth: 2 ft below Surface 2. Time: Slack tide	1. Depth: Surface 2. Time: Slack or flood tide	1. Depth: Surface, Bottom (B = 28 Feb - 31 Dec) 2. Time: Slack or flood tide	1. Depth: Surface, Bottom (B = 1 Jan - 21 Feb) 2. Time: Slack or flood tide
t 3	Not in operation					Temp D.O. pH Cond 1. Depth: 2 ft below Surface 2. Time: Coincidental with 4 hr fish collections	Not in operation	1. Depth: Surface 2. Time: Slack or flood tide		
harge Canal	Temp D.O. pH Cond 1. Depth: middle of water column 2. Time: Continuous		—	Temp D.O. pH Cond Turb 1. Depth: 2 ft below Surface 2 ft above Bottom 2. Time: ?	2. Time: While circulators operating	2. Time: Slack tide	Temp D.O. Cond 1. Depth: 2 ft below Surface	2. Time: Slack or flood tide		
	Raytheon 1971			TI 1972a TI 1973e TI Data Sheets	TI 1974a TI 1976e TI 1973d	TI 1979d TI 1976e TI 1975e	TI 1979d TI 1976d	TI 1979d TI 1977e TI 1976g	TI 1979d TI 1977g	TI 1978f TI 1978e

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