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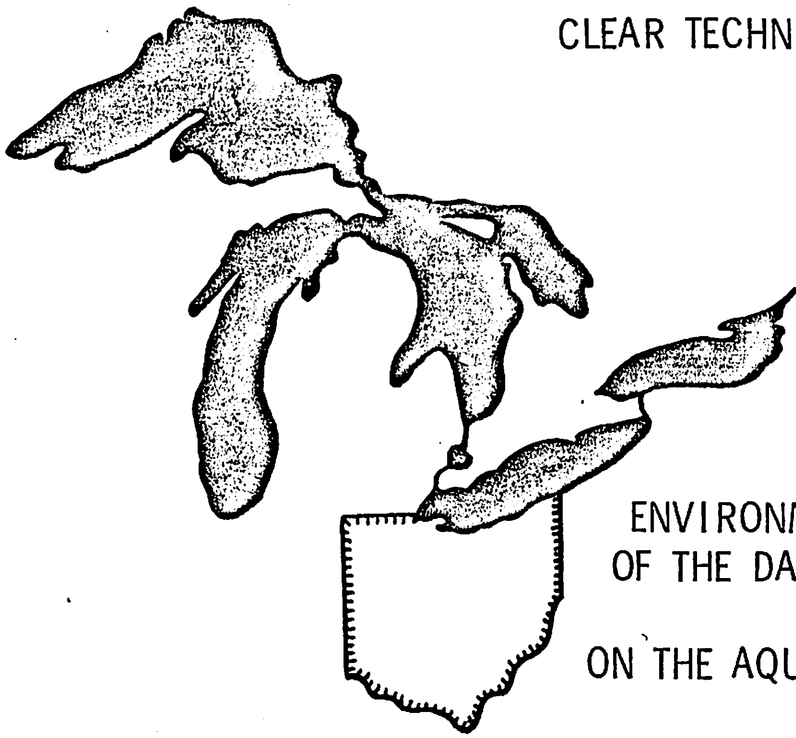

ENVIRONMENTAL IMPACT APPRAISAL OF THE DAVIS-BESSE NUCLEAR POWER STATION, UNIT 1 ON THE AQUATIC ECOLOGY OF LAKE ERIE 1973 - 1979

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PREFACE

The Ohio State University's Center for Lake Erie Area Research has conducted an aquatic ecology monitoring program in Lake Erie in the vicinity of the Davis-Besse Nuclear Power Station for the Toledo Edison Company since April 1973. This effort has been supervised by Drs. Charles E. Herdendorf and Jeffrey M. Reutter. Dr. Herdendorf took responsibility for water quality analyses, and Dr. Reutter was responsible for biological analyses.

The following report provides an appraisal of the impacts of the operation of the Davis-Besse Nuclear Power Station, Unit 1, on the aquatic environment of Lake Erie in the vicinity of the Station. The primary responsibility for the preparation of the various components of the report are designated below:

<u>Charles E. Herdendorf</u>

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2. Station Description
3. Aquatic Environment
4. Impact Appraisal
   -- Water Quality

<u>Jeffrey M. Reutter</u>

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EXECUTIVE SUMMARY

The Davis-Besse Nuclear Power Station is located in Ottawa County, Ohio, at Locust Point on the southwest shore of Lake Erie, about 21 miles east of Toledo. Unit 1 has a net electrical capacity of 906 MWe and a closed condenser cooling system which dissipates heat to the atmosphere by means of a natural-draft cooling tower, 493 feet high and 415 feet in diameter at its base. Make-up water for cooling purposes is drawn from Lake Erie from a submerged intake crib 3000 feet offshore through a buried eight-foot diameter conduit to a closed, but uncovered, intake canal. The canal is approximately 2950 feet long and terminates at the trash racks of the intake structure. Water is drawn through the intake crib and conduit by gravity. Design capacity for Unit 1 is 42,000 gpm with a resultant approach velocity through the crib ports of 0.25 ft/sec. Cooling tower blowdown is discharged at a point approximately 1200 feet offshore through a six-foot diameter buried conduit which terminates in a high velocity nozzle to promote rapid mixing. The maximum allowable ΔT is $20^{o}F$.

Studies of the aquatic environment in Lake Erie in the vicinity of the intake and discharge of this station were initiated in 1973. From 1973 to 1979, with few exceptions, the following parameters were sampled, during ice-free times, at approximately monthly intervals: water quality, phytoplankton, zooplankton, benthic macroinvertebrates (60-day intervals in 1977, 1978, and 1979), fish, and ichthyoplankton (approximately 10-day intervals during the spring spawning season). Ichthyoplankton entrainment studies and fish impingement studies were initiated after the plant began operating in August 1977. As is to be expected when a new unit first goes "on line", Unit 1 was operated sporadically from August 1977 through December 1979. It is the purpose of this report to appraise the impact of unit operation on the aquatic environment by comparing results obtained prior to unit operation with those obtained from September 1977 through December 1979.

Water Quality. Eighteen water quality parameters were monitored at approximately monthly intervals beginning in April 1974. In general the quality of Lake Erie water in the vicinity of the Station's discharge structure has remained relatively constant over the past seven years. The concentrations of dissolved and suspended substances were slightly higher during the operational period, particularly: chloride, magnesium, silica, sulfate, nitrate, turbidity, and suspended solids. Dissolved oxygen and phosphorus were slightly lower after operation. The magnitude of these differences was not great and appeared to be caused by the general condition of the nearshore waters of western Lake Erie rather than Unit operation.

Phytoplankton. Quantitative estimates of phytoplankton densities at Locust Point were obtained at approximately monthly intervals from 1974 through 1979. Operational phytoplankton densities were larger during the spring and fall than pre-operational densities. This was a natural phenomenon occurring throughout the nearshore waters of western Lake Erie and not caused by unit operation.

Zooplankton. Quantitative estimates of zooplankton densities in Lake Erie at Locust Point were obtained at approximately monthly intervals from 1973 through 1979. With the exception of cladoceran densities, which were very similar during the pre-operational and operational studies, zooplankton operational densities, though generally similar to pre-operational densities, were somewhat lower than the corresponding pre-operational monthly density. However, these differences appeared to be due to natural phenomena occurring along the south shore of the Western Basin and not related to unit operation.

Benthic Macroinvertebrates. Benthic macroinvertebrate densities in Lake Erie at Locust Point were observed at approximately 30-day intervals from 1973-1976 and 60-day intervals from 1977-1979. Operational densities were within the ranges established during the pre-operational study for every month except September. Differences were attributable to natural variation.

Fish. Monthly gill net catches from Lake Erie near Locust Point from 1973-1979 were used to evaluate the impact of unit operation. Fish populations for each of the eight major species at Locust Point, alewife, channel catfish, freshwater drum, gizzard shad, spottail shiner, walleye, white bass, and yellow perch, and the density of all species combined showed little or no variation between pre-operational and operational results.

Ichthyoplankton. Ichthyoplankton densities from Lake Erie in the vicinity of the intake and discharge were monitored at approximately 10-day intervals from 1974 through 1979. Tremendous variability was observed from year to year. However, due to the similarity in densities observed at the intake and discharge and control stations, there is indication that the activities of the Power Station have not significantly altered these populations.

Entrainment. Ichthyoplankton entrainment estimates were not developed until the spring of 1978 as entrainment is an operational phenomenon, and there were few, if any, ichthyoplankters in Lake Erie to be entrained during the first fall and winter of the operational period (September 1977 - March 1978). During 1978 and 1979, the number of ichthyoplankters entrained was insignificant compared to lake populations. Furthermore, the off-shore intake, where larvae densities are lower, and the low intake water volume due to the cooling tower and closed condender cooling system, necessitate a very low-level impact on western Lake Erie fish populations.

Impingement. Fish impingement at the Davis-Besse Nuclear Power Station was estimated from measurements of approximately 24 hours taken approximately 3 times per week from January 1, 1978 to December 31, 1979. Goldfish was the species most commonly impinged, representing 49.9 percent (1978) and 78.6 percent (1979) of the total number of fish impinged. By number, the 6,607 fish impinged during 1978 were 0.04 percent of the Ohio 1978 sport fishing harvest, while the 4,385 fish impinged during 1979 were

0.03 percent of the Ohio 1978 sport fishing harvest. By weight, impingement was less than 0.001 percent (both years) of the Ohio 1978 sport fishing harvest. These figures become even less significant when one realizes that the Ohio sport catch was only 83.4 percent of the Ohio 1978 commercial catch and only 15.9 percent of the 1978 commercial catch from all of Lake Erie.

Conclusion. Based upon the results obtained to date, there are indications that operation of the Davis-Besse Nuclear Power Station, Unit 1, has had no short-term deleterious effects on the Lake Erie ecosystem. Therefore, it is the conclusion of this appraisal that the Station has not significantly altered the aquatic environment at Locust Point and that long-term deleterious impacts are unlikely.

INTRODUCTION

The Davis-Besse Nuclear Power Station, Unit 1, initiated commercial operation on August 29, 1977 (Table 1). The purpose of this report is to provide a preliminary appraisal of the impacts of station operation on the aquatic environment of Lake Erie. A pre-operational aquatic ecology monitoring program at the Station was begun in 1973-1974 and continued through the construction period. The program consisted of monitoring 18 water quality parameters and biological populations, including plankton, benthos and fish. Normally samples were taken monthly during the ice-free seasons on Lake Erie. Once commercial operation was started, the monitoring program continued essentially unchanged, except for the addition of fish impingement/entrainment studies. This report will attempt to compare natural water quality/biological variability, as measured during the pre-operational period, with values obtained during the operational period. The details of the monitoring program are found in Appendix B to License NPR-3 "Environmental Technical Specifications".

For the purposes of this report, the pre-operational period is considered to be from 1973 or 1974 (depending on when monitoring for a particular component began) to August 31, 1977. The operational period considered is from September 1, 1977 to December 31, 1979. The Station's operating history, including: 1) reactor power record, 2) electrical power record, 3) intake and discharge temperature records, 4) water pumping record, and 5) water discharge record are presented in Figures 1 to 10. It can be seen from these figures that during the period of operation being considered, average generation was approximately 33% of its potential capacity. This circumstance was largely due to several months of maintenance "outage" during the summer of 1978 and the "Three-Mile Island Incident" in 1979. Of the 28 operational months being considered in 1977, 1978, and 1979 water quality/biological sampling and mean unit output of greater than 453 MWe (50% capacity) coincided during six months.

STATION DESCRIPTION

Station Location

The Davis-Besse Nuclear Power Station, Unit 1 is located in Ottawa County, Ohio, on the southwest shore of Lake Erie, about 21 miles east of Toledo. The 954-acre site is located in Carroll Township adjacent to the mouth of the Toussaint River (coordinates: 41°35'57" N and 83°05'28" W).The site has 7,250 feet of Lake Erie frontage (Figure 11). This section of shoreline is flat and marshy with a maximum elevation only a few feet above the lake level (U.S. Atomic Energy Commission, 1973).

General Station Description

Unit 1 is a nuclear-powered electric generating facility with a net electrical capacity of 906 MWe. The facility utilizes a pressurized water reactor (PWR) manufactured by Babcock and Wilcox Company. Most of the heat from the turbine steam condenser is dissipated to the atmosphere by means of natural-draft cooling tower, 493 feet high and 415 feet in diameter at its base.

Cooling Water Intake Design

The cooling water intake shown in Figure 12 is made up of three principle elements; the intake crib and conduit, intake canal, and intake structure. The Unit obtains its cooling water from Lake Erie through the intake crib. Water entering the intake crib flows by gravity through the eight-foot diameter intake conduit buried beneath the lake bottom to the intake canal. The water then flows through the intake canal to the intake structure located at the west end of the intake canal forebay. From the intake structure cooling water will be pumped to the various systems within the unit. These three principle components are described in detail in the following sections.

Intake Crib. The intake crib for the Davis-Besse Nuclear Power Station is located in the Western Basin of Lake Erie approximately 3000 feet offshore from the land area commonly known as Locust Point in approximately 11 feet of water at low water datum (568.6 ft. I.G.L.D.). The lake area off of Locust Point has been identified as an area of constant sand movement. The intake crib is a wooden cross shaped structure rising 3'-10" above the lake bottom with intake screens (ports) located in the ends of each of the four arms so that water enters the crib downward through the ports. At the design maximum flow of 42,000 gpm, the intake velocity has been calculated at 0.25 ft/sec (U.S. Nuclear Regulatory Commission, 1975). Table 2 shows calculated intake velocities for various pumping rates. At the 42,000 gpm design flow rate, the velocity through the eight-foot diameter conduit would be approximately 1.8 ft/sec. This design is similar to the one used at the Oregon, Ohio, and Port Clinton, Ohio, municipal water intakes. Figure 13 shows the similarities of these intakes.

Normal practice in intake design has been to locate intake cribs in 20 to 50 feet of water to avoid ice formation and the possibility of blockage from ice jams. Inlet ports should be located four to eight feet off the bottom to minimize the uptake of sand, silt, and other sediment. However, adherance to these practices has not always been possible in the Western Basin of Lake Erie because of its shallowness. This is the case with the design chosen for the Davis-Besse intake crib. The Davis-Besse intake crib is located in relatively shallow water, 11 feet below low water datum, and five feet below the lowest water level experienced at the site, 562.9 IGLD computed from the Toledo gauging station records corrected to the site. Therefore, the intake design must be such that the crib will not be exposed by low water and the intake ports have to be high enough off the bottom that sand and sediment are not drawn into the crib. Locating the crib in deeper water was investigated but found not to be a viable alternative. Water depths of 20 feet are not reached in the vicinity of the site until approximately four to five miles from shore. The design finally chosen utilized a downward flow of water into the crib so that the intake ports could be located as far off the lake bottom as possible and still be under water during low lake level conditions.

During the design of the intake crib, consideration was given to using velocity caps to change the direction of the intake flow from vertical to horizontal. However, this did not turn out to be feasible, since under low lake level conditions the upper portion of the velocity caps would have been above water. Also, since the velocity caps would protrude above the top of the intake crib, they would be subjected to winter ice conditions. These ice conditions, floating ice, and wind blown ice masses, would most likely damage the velocity caps annually and in doing so could cause structural damage to the intake crib itself.

Intake Canal. The intake canal is an open channel with earthen embankments to convey water from the intake conduit (bringing water from the intake crib) to the intake structure located immediately east of Unit No. 1. The intake canal is approximately 2950 feet long including the forebay and is separated from the lake by a sand beach and beachfront dike constructed of large limestone rip-rap. The canal is approximately 40 to 45 feet wide at the bottom, with 3:1 side slopes and a water depth of 13 to 14 feet at normal lake levels except in the vicinity of the intake structure where it widens to form the forebay. At a flow rate of 42,000 gpm, the calculated velocity in the intake canal is approximately 0.11 ft/sec. The intake canal forebay is approximtely 800 feet long, 200 feet wide, at the bottom, with 3:1 side slopes and a water depth of 16 to 17 feet at normal lake levels.

Intake Structure. The intake structure is shown in Figure 14 and is located at the western end of the intake canal forebay. All of the water which is used by the unit is pumped via the pumps located in the intake structure. The following pumps are located in the intake structure.

Service Water Pumps - 2 operating, 1 standby
Cooling Tower Makeup Pump - 2 used as required
Dilution Pump - 1 used as required
Water Treatment Feedpumps - 1 operating, 1 standby
Screen Backwash Pumps - 2 used as required

These pumps are preceded by the trash racks and traveling screens. The trash racks are fixed screens, have 4-inch by 26-inch openings, and will be manually cleaned. The traveling screens have ¼-inch square openings and will be automatically cleaned either on a pre-set time interval or differential pressure across the screens. The impinged material washed from these screens is sluiced through a trough to a holding basin with an overflow weir discharge to allow monitoring of this material. Collections of impinged fish were made by placing a basket within the trough itself.

Water Use

The quantity of water used for cooling at the Davis-Besse Nuclear Power Station, Unit No. 1, has been minimized by using a closed condenser cooling water system and a natural draft cooling tower. The unit's water usage is also minimized by recycling the heated discharge from the service water system and using it as makeup to the closed condenser cooling water system. This exceeds the requirement of 40 CFR 423.13, "Effluent limitation guidelines representing the degree of effluent reduction attainable by the application of the best available technology economically achievable" as well as 40 CFR 423.15, "New Source Performance Standards" which would permit the heated discharge from the service water system to be discharged, provided it meets chlorine limitations. Table 3 shows the unit's maximum, minimum, and average water usage for each month during 1978 at the intake crib.

Discharge System

All station effluents (except storm water drainage and certain building drains which go to the Toussaint River) are mixed in the collection box prior to discharge into Lake Erie. Most of this mixture is cooling tower blowdown water and its associated dilution water which is added so that the concentration of dissolved solids in the discharge will be less than twice the concentration in the lake. The collection box has a small volume compared with the flow rates into it, and, therefore, the box merely serves to mix the various effluents. From the collection box, the station discharge flows through a six-foot diameter buried pipe to the slot-type jet discharge structure (4.5 feet wide x 1.5 feet high) 1200 feet offshore in Lake Erie (Figure 12). The elevation of the collection box provides the necessary head for discharge through the pipe to the lake under all predicted water level conditions. The slot-type discharge has an exit water velocity of about 6.5 ft/sec at the design maximum discharge flow of 20,000 gpm. The nominal calculated water velocity of 3.6 ft/sec, at the typical discharge rate of 11,000 gpm, promotes rapid entrainment and mixing with lake water. The lake bottom has been rip-rapped with rock for about 200 feet in front of the slot discharge to minimize scouring of the lake bottom and associated turbidity.

Chemical Discharge. All of the makeup water to the recirculating system (cooling tower) is partially neutralized with sulfuric acid, releasing carbon dioxide, and thereby reducing the amount of scale formed in the condenser. The only other chemical added to the circuits is elemental chlorine for defouling. The recirculating cooling water blowdown contains the major fraction of all chemicals discharged to Lake Erie. Due to the evaporation of water in the cooling tower, the concentration of dissolved solids in the recirculating water is approximately double that in the lake. Because of the addition of sulfuric acid and the loss of carbon dioxide, the sulfate ratio is slightly higher and the carbonate ratio is slightly lower in discharge water while ratios for various other chemicals are the same as in lake water.

Thermal Discharge. The discharge of cooling tower blowdown from the station's submerged discharge structure generates a thermal plume in Lake

Erie. The plume is calculated to have a maximum surface area of 0.7 acres (U.S. Atomic Energy Commission, 1973). The temperature difference between cooling tower blowdown water and ambient lake water ranges as high as $30^{o}F$. Lake water is used to dilute the blowdown so that the effluent to the lake never exceeds $20^{o}F$ above ambient lake water temperature.

AQUATIC ENVIRONMENT

Habitat Description

Locust Point and Western Lake Erie. Locust Point is a gently curving headland on the south shore of western Lake Erie, approximately ten miles west of Port Clinton, Ohio (Figure 15). The Davis-Besse Nuclear Power Station is located on a 954-acre tract of land on this point. The terrain of the point is relatively flat and contains about 600 acres of marshland. The Station has a 7,250-foot frontage on Lake Erie along the point. The point has a relatively stable barrier beach which separates Navarre marsh from the lake. The shore is not tending to straighten itself or advance over the wetland which is usual for barrier beaches with such a configuration. This may be in part due to the extensive rip-rap dike placed on the berm of the beach during the record-high water levels of the 1972 and 1973. The dike now protects the Station site, as well as the wetland, from the lake encroachment.

Hydrographic surveys show a very gentle slope of the lake bottom from the shore out for a distance of at least 4000 feet (Figure 15). Two sand bars typically lie in the nearshore zone, one at 120 feet offshore and the other at 280 feet from the beach. The deeper area between the beach and the first sand bar has a thin bottom layer of fluffy silt and shell fragments over the sand. The inshore slope of the first bar contains an abundant population of naiad clams. The sand bottom, generally medium- to fine-grained, extends to 800 feet offshore (5.0 feet water depth, IGLD, 1955). At this point the bottom deepens by 0.5 feet and is composed of hard, glaciolacustrine clay which forms a 500 to 700-foot wide strip around the point. Lakeward the bottom again becomes sandy and the sand increases in thickness in a lakeward direction. The lake reaches a depth of ten feet at a distance of 200 feet offshore and 12 feet at 4000 feet offshore. The sand and gravel bottom, underlain by hard clay persists lakeward to the rocky reefs about three miles offshore (Figure 16).

The offshore reefs consist of bedrock and associated rock rubble and gravel. The topography of the reef tops ranges from rugged surfaces caused by bedrock pinnacles and large angular boulders, to smooth slabs of horizontally bedded rock. In places the exposed bedrock has the appearance of low stairs with steps dipping slightly to the east from the crest to the fringe of the submerged reef. All of the bedrock formations that form the reefs and shoals are carbonate rocks which contain abundant solution cavities, in many cases up to one or two cm in diameter. The bedrock itself is commonly masked by rubble composed of both autochthonous and glacial origin and ranging from small pebbles to boulders up to five feet in diameter. On the reefs, isolated patches of sand and gravel fill vertical joint cracks and small depressions in the bedrock; at the fringes of reefs, sand and gravel beds or glacial till lap over the rock. During quiet periods the rocks are often covered by a thin layer of fluff, organic-rich silt, which can be several millimeters thick (Herdendorf, 1970).

Lakeward of the reefs the depths increase rapidly to 24 feet. Here the bottom is composed of mud (semi-fluid silt and clay-sized particles) and less than ten percent sand (Figure 16).

The lack of permanent siltation on the bedrock and gravel reefs make them the only suitable sites for "clean water" benthic organisms such as certain mayflies, caddisflies, isopods, and amphipods. These organisms are important in the food web of many of the commercial and game fish species of western Lake Erie. The absence of these invertebrate animals on or in the adjacent mud bottoms limits fish feeding to the reefs and inshore areas.

The reefs project above the bottom and they are generally areas of higher energy due to the force of waves and currents. These factors allow simulation of the environment found in the riffles of streams. Several species of fish, particularly walleye and white bass, appear to have enjoyed success in Lake Erie because of the availability of this type of habitat.

Because of the lack of shelter in the nearshore zone at Locust Point, except the intake and discharge structures, the area does not appear to support a large resident fish population. Monthly fish collections in this area (gill net, shore seine, and trawl) show great variability in species composition and relative abundance which strongly suggest a transient fish population. Results from 17 years of sampling at Locust Point indicate that 51 different species of fish have been captured (Table 4), but only ten species are of any real numerical or commercial significance. Alewife, carp, gizzard shad, white bass, emerald shiner, spottail shiner, yellow perch, channel catfish, freshwater drum, and walleye constitute over 97% of the total number that were captured (Reutter and Herdendorf, 1976).

The general flat or gently sloping lake bottom in the nearshore zone (within one mile of the shore) of Locust Point is broken only by the intake and discharge structures and uneven clay fill along the route of the buried pipelines. An ice barrier of rip-rap rock has been constructed on the lake side of the intake crib, and a scour prevention apron of similar material has been placed on the bottom lakeward of the discharge slot. In 1976, icthyoplankton sampling stations were established in the vicinity of the water intake discharge structure as well as control stations at similar distances offshore in an attempt to determine if these structures were inducing higher than normal fish spawning rates for their position offshore. The populations at these structures were within the normal range observed at the control station, indicating that the populations at the intake and discharge structures were not unusual for their position in the nearshore zone (Reutter and Herdendorf, 1976).

Intake Canal. In September 1974, the intake canal was poisoned to eliminate resident fish prior to the operation of the Station. During periods of 1972 and 1973 the intake canal was open to Lake Erie, and fish were free to enter the canal through an opening at the beachfront. In 1974 the canal was closed at the beach and the only water communication with the lake was via the 3000-foot-long, buried, intake pipe. Immediately prior to the poisoning, 22 trawls yielded 411 fish of 18 species. Trawls taken in the canal in October 1974, one month after poisoning, yielded only one fish, an adult carp, indicating that the kill was essentially complete. The benthic population was also destroyed in the process (Reutter and Herdendorf, 1975). Later trawls, in summer 1975, yielded 420 individuals of 13 species indicating some fish were entering the crib and traveling via the pipeline to the intake canal. The most common species found in the canal were white crappie, bullhead, black crappie, carp, yellow perch, and sunfish.

Trawls in the intake canal were not continued after 1975. However, there is evidence that white crappie, goldfish, and other species have developed resident populations in the intake canal, and these populations represent a sizeable percentage of the fish impinged on the traveling screens. The size, age classes and relative abundance of species impinged at the Station are markedly different than individuals captured with trawls and gill nets in the vicinity of the intake crib.

The intake canal is constructed of earthen walls and has a mud bottom over hard clay. The steep-sided walls of the canal preclude the development of extensive aquatic vegetation. The entire surface of the canal is unshaded. Velocities in the canal during 1978, are calculated to have had a maximum, minimum, and mean velocity of 0.16, 0.02, and 0.06 feet/sec, respectively.

Hydrology

Circulation Patterns. Western Lake Erie is dominated by the large in-flow of the Detroit River with a mean flow of approximately 210,000 cfs. The mid-channel flow of this river penetrates deep into the Western Basin, at times reaching the vicinity of Locust Point. The Maumee River, with an average flow of 4,700 cfs, is the second largest stream flowing into the lake and carries 37 percent of the sediment loading to the basin, but accounts for less than three percent of the total water drainage to Lake Erie. Maumee River water enters the lake through Maumee Bay where it divides into a northern flow along the Michigan shore and an eastern flow along the Ohio shore toward Locust Point. The Toussaint River, with an average flow of only 76 cfs, is a minor contributor to circulation patterns in the vicinity of Locust Point.

East of the dominating effect of the Detroit River, the prevailing southwest winds produce a clockwise surface flow around the Bass Islands to the northeast of Locust Point. However, this surface flow is often altered by changes in the direction, intensity, and duration of the wind. Strong winds from any direction can drive the surface currents over most of the basin toward the windward shore (Herdendorf, 1975). Current maps of western Lake Erie in the vicinity of Locust Point for various wind conditions are presented by Herdendorf (1970). Bottom currents have essentially the same pattern as surface flows in that part of the basin influenced by the Detroit River. However, in other parts of the basin bottom currents are commonly the reverse of and compensate for strong, wind-driven, surface currents.

Herdendorf and Braidech (1972) measured currents at 68 stations in the vicinity of Locust Point and the offshore reefs during a three-year study. The average recorded velocity for surface currents was 0.28 knots

(0.48 feet/sec) and 0.15 knots (0.26 feet/sec) for bottom currents. These velocities are not capable of eroding bottom material, but are able to transport fine sand, silt, clay, and fish eggs or larvae once they have been placed in suspension. Velocities in excess of 0.5 knots (0.84 feet/sec) were recorded on the reefs but not in the nearshore zone at Locust Point. The mean intake velocity for the Station is approximately half of the average bottom current velocity measured by Herdendorf and Braidech (1972).

Littoral Drift. Locust Point is at a position of diverging littoral (alongshore) drifts of sand which ordinarily would result in the beach being starved of sand because of movement east and west away from the headlands which form the point. However, the shore is apparently maintained at near equilibrium by replenishment from an extensive sand and gravel deposit which lies north of a narrow strip of compact glaciolacustrine clay that fronts the point beyond the sandy nearshore zone. Transportation of this material from offshore to the beach can be accomplished by at least three forces: 1) currents induced by wind action of Detroit River flow; 2) wave action; and 3) ice shove. Most of the sand probably migrates shoreward by wave action and currents generated by northeast and northwest storms. Evidence for the shoreward movement of sand can be found in the position of bars before and after major storms. For example, fathometer profiles of the lake bottom at Locust Point before (13 June 1972) and after (28 June 1972) tropical storm Agnes revealed that two offshore bars migrated 20 to 25 feet shoreward as a result of wave attack from the northwest storm (Herdendorf and Hair, 1972).

Thermal Conditions. Water temperatures in western Lake Erie range from 32° F in the winter to about 75° in late summer. The Western Basin frequently freezes from shore to shore in December and the ice cover breaks up in March and April. A shallow epilimnion develops early during the spring, but because the basin is so shallow, wind action causes efficient vertical mixing and by June the water becomes vertically isothermal. Diurnal microthermoclines are common in the summer, but prolonged periods of hot, calm weather can cause temporary thermal stratification, due to the heating of the surface water without the benefit of mixing. In 1953, such a situation resulted in severe oxygen depletion in the bottom water (Britt, 1955).

Water Quality. Nutrient overenrichment is the most significant water quality problem in western Lake Erie. Locust Point, being within the nearshore zone, is also characterized by low transparency, high concentrations of dissolved solids and warmer water temperature when compared with offshore water quality studies at Locust Point in July 1972 (Figure 17). Over the past 8 years most parameters have shown typical seasonal trends with only small variations from year to year. Trends for 8 water quality parameters from July 1972 through November 1979 are shown on Figures 18, 19, and 20. Temperature and dissolved oxygen show normal seasonal trends for each year with only minor variations from one year to the next or over the entire period. DO appears to have undergone more depletion in 1976 and 1977 than in previous years or in 1978. Hydrogen-ion concentration (pH) and alkalinity remained fairly stable over the period. Transparency, turbidity, phosphorus, and conductivity have shown radical variations which are probably due to storms and dredging activities that have disturbed the bottom sediments. Phosphorus levels were low in 1977, 1978, and 1979 compared to earlier years. In general however, no significant deviations from the normal quality of the water in this part of western Lake Erie have been observed during the past seven years.

IMPACT APPRAISAL

Water Quality

Procedures and Results

Water quality measurements during the period April 1974 to November 1979 were used for the purposes of this appraisal. The results of the water quality monitoring program are contained in semi-annual reports (1974-1976) and annual reports (1977 - 1979) of the Toledo Edison Company to the U.S. Nuclear Regulatory Commission. The data used included Station No. 13 (500 feet east of the discharge structure) and Station No. 8 (adjacent to the water intake crib). Station No. 13 serves as the station most likely to be impacted, while Station No. 8 serves as a control station (Figure 17). Each station was visited once a month during the ice-free period of the year (normally April-November). Surface and bottom water samples were taken at each station and were analyzed in accordance with the procedures listed in Table 5. Because the intake and discharge structures are located at or near the bottom, bottom samples were used for comparing pre-operational and operational conditions. Tables 6 to 23 summarize pre-operational and operational data for the 18 water quality parameters at the intake and discharge stations. These data are displayed graphically for the discharge station on Figures 21 to 38. The following discussion summarizes the comparison for each of the parameters.

Dissolved Oxygen. During both the pre-operational and operational period DO showed a typical trend of high values in the spring and fall with low concentrations in the summer. Operational concentrations were considerably lower than the pre-operational range in April and November, but not during the critical summer months (Figure 21).

Hydrogen-ions (pH). Throughout the pre-operational and operational period pH values remained relatively stable, never exceeding 9.0 or falling below 7.5. The operational values showed more variability than the nearly straight-line mean concentration for the pre-operational period (Figure 22). However, both periods had a mean pH of 8.3.

Transparency. Both the pre-operational and operational measurements showed the lowest water clarity in the spring, the best transparency in the summer, and intermediate clarity in the fall. In general, operational values were within the range of pre-operational values throughout the year (Figure 23).

Turbidity. Being somewhat the reciprocal of transparency, the lowest readings occurred in the summer, the highest in spring and intermediate values in the fall for the pre-operational period. Operational values showed a general decreasing trend throughout the year, with only a slight rise in the fall. However, values for May, June, and

September well exceeded the pre-operational ranges for those months (Figure 24).

Suspended Solids. This parameter, like turbidity showed a "U" shaped trend during the pre-operational period with summer concentrations being the lowest. Like transparency and turbidity, high particulate material in the water during the spring and fall months of the operational period yield readings in excess of the pre-operational ranges for these months (Figure 25).

Conductivity. This parameter is a measure of the ionized material in the water and it also shows high concentrations in the spring for both the pre-operational and operational periods. Only conductivity values in April for the operational period exceed the range for this month during the pre-operational period (Figure 26).

Dissolved Solids. The concentration of dissolved substances in the water during pre-operational and operational periods were relatively similar, with the operational data falling within or nearly within the pre-operational range for each month. Operational concentrations were somewhat lower than pre-operational conditions for April and October, while September was slightly higher (Figure 27).

Calcium. This element, one of the most common found in Lake Erie water, showed relatively consistent values during both the pre-operational and operational period. High concentrations typified the spring with considerably lower values in the summer and fall. Only in November did operational concentrations exceed the range of pre-operational data (Figure 28).

Chloride. Operational chloride concentrations were within the range of pre-operational concentrations during six of the eight months for which comparative data is available. The greatest discrepancy occurred in April and November. Pre-operational data show a progressive decrease in concentration throughout the year, while operational data indicate a more "U" shaped trend (Figure 29).

Sulfate. Both pre-operational and operational sulfate data show relatively consistent concentrations throughout the year with somewhat higher values in the spring. Operational data were more erratic, with four months above the pre-operational range and one month below the range (Figure 30).

Sodium. A trend similar to that of sulfate was noted for sodium. Operational data again showed greater variability with two months above and one month below the range for pre-operational data. April and November yielded the highest concentrations for the operational period, both beyond the pre-operational range (Figure 31).

Magnesium. This parameter showed the least agreement between pre-operational and operational data of any of those tested. Operational concentrations exceeded the range of pre-operational data for all months except May. In April, the operational mean value was nearly double the pre-operational mean concentration (Figure 32).

Total Alkalinity. This parameter showed considerable variability in both the pre-operational and operational data, with the highest values occurring in the spring and fall during the pre-operational period and in the spring and summer during operation. April, July, August, and November were periods when operational values exceeded pre-operational ranges, while May and June were months of relatively low operational alkalinity (Figure 33).

Nitrate. Serving as a biological nutrient, this parameter fluctuates widely in response to plankton productivity. Concentrations during both the pre-operational and operational periods were highest in the spring but decreased in the summer as this material was utilized by algae. Fall concentrations increased as algal productivity declined. Concentrations during both periods were relatively consistent with operational values being somewhat higher, particularly in June, August, and November (Figure 34).

Phosphorus. This parameter is also an important biological nutrient and, like nitrate, shows seasonal variations such as high spring and low summer concentrations. Pre-operational and operational data were relatively consistent throughout the year, except for May which showed a considerably higher mean concentration during the pre-operational period (Figure 35).

Silica. As a necessary material for diatom cells, silica also undergoes seasonal changes in concentration. As the growing season progresses this material greatly declines in the water. Both pre-operational and operational data show the same seasonal trend. Operational concentrations exceeded the pre-operational ranges for May and November (Figure 36).

Biochemical Oxygen Demand. BOD levels were relatively consistent throughout the year for both the pre-operational and operational periods. Values were highest in the spring and lowest in the fall. All of the operational concentrations fall within the range of pre-operational data, except for June (Figure 37).

Temperature. Both pre-operational and operational data show typical seasonal temperature trends for Lake Erie; and both data sets are relatively consistent. Most of the operational values fall within the range of pre-operational data (Figure 38).

Appraisal

In general the quality of Lake Erie water in the vicinity of the Station's discharge structure has remained relatively constant over the past seven years (Figures 18, 19, and 20). In comparing the 18 water quality parameters during the ice-free months for the pre-operational versus the operational period (Figures 21 to 38), it can be seen that there is a 67% agreement (operational data within pre-operational range) between the two data sets. This is a relatively good agreement considering the short data base, particularly for the operational period (Figure 39).

Table 24 summarizes this comparison and provides an indication of the degree of difference between the two periods. In general the concentrations of dissolved and suspended substances were higher during the operational period, particularly: magnesium, silica, nitrate, turbidity, and suspended solids. Dissolved oxygen was lower after operation. The magnitude of these differences was not great and seemed to be caused by the general condition of the nearshore waters of western Lake Erie rather than Station operation. For example, Table 17 shows that magnesium was not only high at the discharge (Sta. No. 13) but also high at the water intake (Sta. No. 8) which serves as a control station.

Table 25 indicates the percent change in water quality at the lake intake (Station 8) and discharge (Station 13) from the pre-operational period through the operational period. Dissolved oxygen and phosphorus showed the largest decreases in concentration (7 and 35 percent, respectively), while sulfate, magnesium, BOD, silica, chloride, turbidity, and suspended solids all had increases greater than 5%. In all cases where an increase in excess of 5% occurred at the discharge station, a similar increase was also observed at the control station. These observations further substantiate the conclusion that most of the changes are due to general lake conditions, and not localized changes resulting from Station operation. The decrease in phosphorus concentration is consistent with other nearshore measurements in western Lake Erie which indicate a decline in this substance as a result of pollution abatement programs.

With the inherent limitations of the data base acknowledged, short-term degradation of Lake Erie water quality can not be demonstrated as a result of Station operation. The stability of water quality in the vicinity of Locust Point is well-documented; long-term deleterious impacts resulting from station operation are unlikely.

Plankton Studies

Procedures

Plankton monitoring at the Davis-Besse Nuclear Power Station has been completed approximately monthly during ice-free periods since 1973 (Table 26). The stations at which samples were collected each year are listed in Table 27 and shown on Figure 17. In 1973 only quantitative zooplankton samples were collected, while both quantitative zooplankton and phytoplankton samples were collected in all other years. The preservation techniques have been modified occasionally as new techniques to make specimen identification easier appeared in the literature. However, no modifications which would have quantitatively affected the results were made, and formalin was always the final preservative. Two vertical tows, bottom to surface, were collected at each station for phytoplankton and zooplankton with a Wisconsin plankton net (12 cm mouth; 0.064 mm mesh in 1973 and 1974 and 0.080 mm mesh from 1975-1979). Each sample was concentrated to 50 ml and preserved. The volume of water sampled was computed by multiplying the depth of the tow by the area of the net mouth. Three 1-ml aliquots were withdrawn from each 50-ml sample and placed in counting cells.

Whole organism counts of the phytoplankton were made from 25 random Whipple Disk fields in each of the three 1-ml aliquots from each of the 2 samples. When filamentous forms number 100 or more in 10 Whipple fields, they were not counted in the remaining 15 fields. Identification was carried as far as practicable, usually to the genus or species level.

All zooplankters within each of the three 1-ml aliquots from each of the 2 samples were counted by scanning the entire counting cell with a microscope. Identification was carried as far as practicable, usually to the genus or species level.

Phytoplankton Results

The results of the phytoplankton monitoring program were presented in the semi-annual reports (1974-1976) and annual reports (1977 - 1979) of the Toledo Edison Company to the U.S. Nuclear Regulatory Commission. This report summarizes the findings presented in these earlier reports through graphic presentations of monthly densities of the major phytoplankton components, Bacillariophyceae, Chlorophyceae, and Myxophyceae, encountered yearly from 1974-1979 (Figures 40 -45). Figure 46 presents the monthly estimates of the total phytoplankton density from 1974 through 1979.

Table 28 and Figures 47 - 50 summarize the above data in a different manner by combining all monthly density estimates from all years and all stations and comparing pre-operational means, minima, maxima, and standard deviations with operational results. Table 29 and Figures 51 - 53 use this same technique to compare the total phytoplankton densities observed at Station 8 (intake structure), Station 13 (plume area), and Station 3 (control station). A discussion of these comparisons follows.

Diatoms. Both pre-operational and operational densities were high during the spring and fall, and low during the summer (Figure 47). Spring densities were highest. This is typical for western Lake Erie and as one would expect since diatoms are cold-water forms. Operational densities observed during the spring and fall were larger than the corresponding pre-operational values. However, operational standard deviations (when able to be calculated) overlapped the pre-operational standard deviations.

Green Algae. Chlorophycean densities, in general, were much lower than diatom densities or blue-green algae densities during the pre-operational and the operational studies. Furthermore, these green algae population densities are much less predictable seasonally than diatoms. Reutter (1976) has demonstrated that green algae densities parallel transparency closely and are opposite to turbidity and, therefore, are often controlled by factors such as the wind, which affects transparency by suspending bottom sediments through wave action. However, most of the monthly samples collected during the operational period fell within the range established during the pre-operational period, and for those which were outside the range (July, September, and November), the standard deviation of the operational period overlapped the standard deviation of the pre-operational period (Figure 48).

Blue-Green Algae. Myxophycean populations during both the pre-operational and operational periods showed tendencies toward sudden, large, mid-summer pulses (Figure 49). Operational densities were generally larger than pre-operational densities. However, with the exception of October and November, the operational standard deviations always overlapped the pre-operational standard deviations.

Total Phytoplankton. The total phytoplankton density, i.e., the sum total of the 3 major component groups previously discussed and several other minor classes, was higher during most of the operational study than during the pre-operational study (Figure 50). However, with the exception of April and October, the standard deviations of the means observed during the operational study overlapped the standard deviations from the pre-operational study.

Zooplankton Results

The results of the zooplankton monitoring program were presented in the semi-annual reports (1974-1976) and annual reports (1973, 1977, 1978 and 1979) of the Toledo Edison Company to the U.S. Nuclear Regulatory Commission. This report summarizes the findings presented in these earlier reports through graphic presentations of the monthly densities of the total zooplankton population and its major components, rotifers, copepods, and cladocerans encountered yearly from 1972 -1979 (Figures 54 - 57).

Table 30 and Figures 58 - 61 summarize the data in a different manner by combining all monthly density estimates from all years and all stations and comparing pre-operational means, minima, maxima, and standard deviations with operational results. Table 31 and Figures 62 - 64 use this same technique to compare total zooplankton densities observed at Station 8 (intake structure), Station 13 (plume area), and Station 3 (control station). A discussion of these comparisons follows.

Total Zooplankton. The total zooplankton population density, i.e., a sum total of the major zooplankton groups (rotifers, copepods, and cladocerans) and any minor classes or orders, has usually exhibited two pulses, one in the late spring or early summer and a smaller pulse in the fall. This is true of both pre-operational and operational results, although operational densities were generally lower than pre-operational densities (Figure 58).

Rotifers. Rotifer densities at Locust Point during the operational period were lower for every month than the mean value from the pre-operational period for the same month (Figure 59). However, the operational monthly mean was below the pre-operational monthly range only during June and November, and the operational monthly mean was always less than two standard deviations from the pre-operational mean.

Copepods. Copepod densities at Locust Point during the pre-operational study generally exhibited spring pulses (Figure 60). This was also the case during the operational study, except the pulse was somewhat smaller than those observed during the pre-operational study. As observed with the rotifers, operational monthly densities were never more than two standard deviations from the pre-operational mean (Figure 60).

Cladocerans. Cladoceran densities at Locust Point during both the pre-operational and operational studies have exhibited spring (or early summer) and fall pulses (Figure 61). However, during the operational period the two pulses were less distinct. With the exception of August, none of the monthly operational densities were more than two standard deviations from the pre-operational mean.

Appraisal

Prior to the appraisal of the effects of unit operation on the zooplankton and phytoplankton communities, some assistance in interpreting these results is warranted. First, one should bear in mind that when sampling the same population eight months each year for seven years, and plotting data with monthly minima and maxima, as in this report, eight minima and eight maxima will be generated. That is, there will be seven values for each of the eight months, or one value for each month from each of the seven years. Each of the eight months will have a minimum value and a maximum value, and, since there are eight months, there will be a total of eight minimum values and eight maximum values (one of each for each month). If there is nothing unusual about the environmental conditions which existed during any of the seven years, then each year would have an equal chance (probability) of producing several monthly minimum or maximum values. Assuming each year does have an equal probability of producing these minima and maxima, and since there are eight monthly minimum values and eight monthly maximum values, each year of the seven years would produce 1.14 of the monthly minimum values and 1.14 of the monthly maximum values. This is pointed out to demonstrate that it is natural for any year to produce a population extreme (monthly minimum or maximum value). Consequently, it should not be automatically viewed as a unit produced effect if any operational variable is above or below the pre-operational range.

Another point useful in the interpretation of these results involves the distance of the operational monthly mean from the pre-operational mean. A general "rule-of-thumb" is that when dealing with a normal distribution, the area within one standard deviation on either side of the mean will contain approximately 66 percent of the values, two standard deviations would contain approximately 95 percent of the values, and three standard deviations would contain approximately 99 percent of the values.

As a final aid in interpreting these results, population densities are presented from a control station (unaffected) to allow comparison with the discharge where the impact should be greatest. This allows a distinction to be made between unusual values caused by unit operation and unusual results which are typical of the entire lake due to an unusual set of climatic or biological conditions -- natural variation.

Between September 1977 and the end of 1979, the operational period, plankton samples were collected on 18 occasions. On these dates, the station was operating at 90 percent capacity, 8 percent capacity, 100 percent capacity, 99 percent capacity, 48 percent capacity, and 0.0 percent capacity on the remaining 13 sampling dates.

Phytoplankton. Reutter and Fletcher (1980) summarized the results of phytoplankton sampling at Locust Point and concluded that "populations observed at Locust Point during 1979 are similar to those of previous years and appear typical for those occurring in the nearshore waters of the Western Basin of Lake Erie." This report has taken the results compiled by Reutter and Fletcher a step farther by computing means, ranges, and standard deviations for the pre-operational period and by adding the results from the last portion of 1977 to those of 1978 and 1979 to summarize the operational period.

Operational phytoplankton densities were somewhat larger than pre-operational densities (Figure 50). This appears to be a general trend, as the operational values of the three major phytoplankton groups were never below the pre-operational range and often above it. Due to the unusually harsh winters of 1978 and 1979, it is likely that these differences were caused by natural weather conditions.

Figures 51 - 53 present phytoplankton densities at the station intake (Station 8), discharge (Station 13), and a control station (Station 3). It would probably be safe to use the station intake as a control station, however, as an extra measure of caution Station 3, 3000 feet northwest of the discharge, was selected as a control. Using this comparative technique, any difference between pre-operational and operational data observed at the discharge which was also observed at the intake or Station 3 would obviously have been due simply to natural variation in population densities. The only large differences between operational and pre-operational data at the discharge were unusually high spring and fall population densities, and, since these were also observed at the intake and Station 3, they were obviously a natural phenomenon and not caused by unit operation.

In conclusion, to date, operation of the Davis-Besse Nuclear Power Station, Unit 1, has not had a significant effect on Lake Erie phytoplankton densities.

Zooplankton. Reutter and Fletcher (1980) summarized the results of zooplankton sampling at Locust Point through 1979 and concluded that "populations observed in 1979 should be considered typical for the south shore of the Western Basin of Lake Erie." This report has taken the results compiled by Reutter and Fletcher a step farther by computing means, ranges, and standard deviations for the pre-operational period and by adding the results from the last portion of 1977 to those of 1978 and 1979 to summarize the operational period.

Zooplankton operational densities, though generally similar to pre-operational densities, were often somewhat lower than the corresponding pre-operational monthly density (Figures 58 - 61). However, as with the phytoplankton, these differences should not be interpreted as due to unit operation, for it appears that zooplankton densities even in unaffected areas were lower during the operational period (Figures 62 - 64).

Consequently, these differences were obviously attributable to natural variation and not unit operation.

The obvious conclusion is that to date, operation of the Davis-Besse Nuclear Power Station, Unit 1, has not had a significant effect on Lake Erie zooplankton densities.

Benthic Studies

Procedures

Benthic macroinvertebrate densities in the vicinity of the Davis-Besse Nuclear Power Station were monitored at approximately monthly intervals during ice-free periods (normally April through November) from 1973 through 1976, and at invervals of approximately 60 days during the ice-free periods of 1977, 1978, and 1979 (Table 32). The stations at which samples were collected each year are listed in Table 33 and shown on Figure 17. Population densities were sampled with a Ponar dredge (Area=0.052 m^2). Three replicate grabs were collected at each station on each date from 1974 through 1979, whereas one sample was collected at each station on each date during 1973. Samples were sieved on the boat through a U.S. #40 soil sieve, preserved in 10% formalin, and returned to the laboratory for identification and enumeration. Individuals were identified as far as practicable (usually to genus; to species when possible). Results were reported as the number of organisms per m^2.

Results

The results of the benthos monitoring program were presented in the semi-annual reports (1974 - 1976) and annual reports (1973, 1977, 1978, and 1979) of the Toledo Edison Company to the U.S. Nuclear Regulatory Commission. This report summarizes the findings presented in these earlier reports through a graphic presentation of the monthly benthic macroinvertebrate densities encountered yearly from 1972 - 1979 (Figure 65).

Table 34 and Figures 66 - 70 summarize the data in a different manner by combining all monthly density estimates for the major benthic groups from all years and all stations during the pre-operational study, and comparing these pre-operational monthly means, minima, maxima, and standard deviations to operational results. Table 35 and Figures 71 - 73 use this same technique to compare total benthic macroinvertebrate densities observed at Station 8 (intake structure), Station 13 (discharge area), and Station 3 (control station). A discussion of these comparisons follows.

Total Benthic Macroinvertebrates. The population densities of all benthic macroinvertebrates, i.e., the sum total of the major benthic groups (Coelenterata, Annelida, Arthropoda, and Mollusca), were generally the highest in the late summer and fall during the pre-operational study. During the operational study the highest densities occurred slightly earlier in the summer and fall (Figure 66). Operational densities were very close to the pre-operational mean during every month except September, when they were slightly lower than the pre-operational minimum.

Coelenterata. Pre-operational coelenterate population densities generally produced peaks in the spring and fall (Figure 67). During the operational study only a fall peak was observed. However, operational density estimates were always within one standard deviation of the pre-operational mean.

Annelida. Benthic annelid densities during both the pre-operational and operational studies showed peaks in late summer or early fall (Figure 68). However, all monthly operational results were within the pre-operational range or within one standard deviation of the pre-operational mean, except May and September, when the operational densities were slightly lower.

Arthropoda. Both pre-operational and operational benthic arthropod densities peaked during the summer and fall (Figure 69). Operational densities were above the pre-operational maxima during May, June, and July, and below the minimum during October.

Mollusca. Benthic mollusc densities were extremely low (five was maximum during the seven-year study period) and variable, and, consequently, pre-operational/operational differences are difficult to detect (Figure 70). However, nothing unusual was observed during the operational period.

Appraisal

Initially it should be pointed out, as discussed in the plankton appraisal (see page 18), that operational densities which fall outside the pre-operational range may be due to natural variation and not related to unit operation. To allow comparisons of ambient densities with densities at the unit discharge, population densities have been presented from Station 3, a control station located 3000 ft northwest of the unit discharge structure, the same distance from shore as the discharge and at approximately the same water depth. These comparisons allow one to more accurately assess the causes of observed differences - natural variation or unit operation.

During what is defined as the operational period, samples were collected on ten occasions. On these ten occasions, the unit was operating at 98 percent on one occasion, 100 percent on another, 99 percent on another, and not operating on the remaining seven dates. While this is very critical to water quality and plankton results, it is somewhat less important when observing benthic communities. Benthic communities are much less mobile than plankton or fish, and, therefore, are generally considered to be good pollution indicators, even of intermittent pollutants or environmental changes. The rationale is that even if the unit were not operating on the sampling date, a large portion of the community sampled would have been present when the unit was operating.

This is not true of plankters, and fish are capable of leaving when unfavorable conditions exist and then returning quickly when the conditions are improved.

Reutter (1980a) summarized the results of benthic macroinvertebrate sampling at Locust Point through 1979 and concluded that "populations found at Locust Point during 1979 must be considered typical for those of the nearshore waters of the Western Basin of Lake Erie . . . no significant environmental changes due to unit operation were observed." This report has taken the results compiled by Reutter a step farther by computing means, ranges, and standard deviations for the pre-operational period and by adding the results from the last portion of 1977 to those from 1978 and 1979 to summarize the operational period.

Benthic macroinvertebrate densities observed during the operational study were within the limits established during the pre-operational study on all but one occasion. A review of Figures 71 - 73 shows that variability in population densities was widespread and not related to unit operation. Operational densities observed at the discharge (Figure 72) more closely resembled pre-operational densities than did those observed at the intake (Figure 71) or Station 3 (Figure 73), which were designed to be the control stations. Results at Station 3, where no construction has ever occurred and well away from the intake and discharge, are graphic examples of the discussion at the beginning of this appraisal section, showing that natural variability can produce values far from the pre-operational densities. Furthermore, this type of variability is to be expected in the Locust Point vicinity, a shallow wave-swept zone with shifting substrate.

In conclusion, to date, operation of the Davis-Besse Nuclear Power Station, Unit 1, has not had a significant effect on Lake Erie benthic macroinvertebrate densities.

Fisheries Population Studies

Procedures

Fish populations in Lake Erie at Locust Point in the vicinity of the Davis-Besse Nuclear Power Station were monitored at approximately monthly intervals during ice-free periods (normally April - November) from 1973 through 1979. Fish were collected by three sampling techniques, experimental gill nets, shore seines, and trawls.

Experimental gill nets (125 feet long, consisting of five 25-ft contiguous panels of ½, 3/4, 1, 1½, and 2-inch bar mesh) were set parallel to the intake pipeline at Station 8 (intake) and parallel to the discharge pipeline at Station 13 (discharge or plume area) from 1973 through 1979 (Table 36). During 1977, 1978, and 1979, nets were also placed at Stations 3 and 26 to serve as controls (Figure 17). Each net was fished at the lake bottom for approximately 24 hours. Results were reported as catch per unit effort (CPE), where one unit of effort was equal to one 24-hour set with one net.

Shore seining was conducted at Stations 23, 24, and 25 with a 100-ft bag seine (¼-inch bar mesh). The seine was stretched perpendicular to the shoreline until the shore brail was at the water's edge. The far brail was then dragged through a 90^0 arc back to shore. Two hauls were made at each station in opposite directions.

Four 5-minute bottom tows with a 16-ft trawl (1/8-inch mesh bag) were conducted on a transect between Stations 8 (intake) and 13 (plume area) at a speed of 3 - 4 knots. Starting in 1977, tows were also made on a transect between Stations 3 and 26 for comparative purposes.

All fish captured by each technique were identified, enumerated, weighed, and measured (Trautman, 1957; Bailey, et al., 1970). All results were keypunched and stored on magnetic tape at The Ohio State University Computer Center.

Results

The results of the fishery population monitoring program are contained in the semi-annual reports (1974 - 1976) and the annual reports (1973, 1977, 1978, and 1979) of the Toledo Edison Company to the U.S. Nuclear Regulatory Commission. These reports have shown gill netting to be the superior sampling technique for measuring the impact of unit operation for several reasons:

1. gill nets can be set right at the point of impact, are relatively unbiased sampling devices, and collect adequate sample sizes (quantities of fish);

2. shore seines sample mainly young-of-the-year fish and, consequently, are subject to sudden pulses following spawning;

3. shore seines sample at locations over 1000 feet from the point of discharge;

4. trawls have been shown to collect too few fish.

Consequently, although the results of shore seining and trawling have greatly increased our ability to interpret yearly results, gill nets have proven to be the most effective assessment tool, and, therefore, these results and discussions will pertain mainly to this gear type.

Fifty-one fish species have been collected at Locust Point since 1963 (Table 4). However, the fish community at Locust Point has consistently been dominated by seven species: alewife, emerald shiner, freshwater drum, gizzard shad, spottail shiner, white bass, and yellow perch. These seven species generally constitute well over 90 percent of the annual catch by the sampling program. The monthly mean, minimum, maximum, and standard deviation of the number of each of these species, except emerald shiner, collected in the gill net set at the discharge have been presented in Table 37 and Figures 74 - 81. Emerald shiners are seldom collected in gill nets of these mesh sizes, so they were not included in the tabulations. However, due to their economic importance, channel catfish and walleye were added to the list. Table 38 and Figures 82 - 85 summarize the gill net results by presenting pre-operational means, minima, maxima, and standard deviations and comparing them to operational results at Stations 8 (intake), 13 (discharge or plume area), 3 and 26 (controls).

Alewife. Alewife densities in the vicinity of the unit discharge during both the operational and pre-operational periods were generally highest during the late summer and early fall (Figure 74). The maximum pre-operational catch was 322, while 136 was the maximum catch during the operational period (Table 37). Although operational catches were generally lower than pre-operational catches, they were always within the pre-operational range.

Channel Catfish. Channel catfish catches during both the pre-operational and operational studies were greatest during the summer (Figure 75). They were seldom a significant component of the catch, as 18 was the maximum pre-operational catch and 6 was the maximum operational catch (Table 37). The pre-operational and operational catches were quite similar, and all operational means were within the pre-operational range.

Freshwater Drum. During both the pre-operational and operational studies, freshwater drum were most abundant during the summer (Figure 76). The maximum catch during the pre-operational study was 50, while 75 was the maximum operational catch (Table 37). With the exception of June, which was higher, all operational catches were within the range established during the pre-operational study.

Gizzard Shad. Gizzard shad densities during both the pre-operational and operational studies were always greatest during the late summer and fall (Figure 77). The maximum pre-operational catch was 184, while 291 was the maximum operational catch (Table 37). The monthly pre-operational and operational mean catches were generally quite similar, and all but one of the operational means were within the pre-operational range (Figure 77).

Spottail Shiner. Spottail shiners were always most abundant during the month of May (Figure 78). In fact, with the exception of April and June, the minimum catch in May was greater than the maximum catch of any of the other months during the pre-operational period. The operational catch was within the range established during the pre-operational period during all months but September.

Walleye. Walleye catches during both the pre-operational and operational studies were greatest during the summer (Figure 79). This species was never a significant portion of the catch, as 15 was the maximum prior to plant operation and 8 was the maximum afterwards (Table 37). With the exception of August, when the operational catch was above the range of pre-operational catches, all catches after the unit began operation were within the range of catches prior to unit operation.

White Bass. White bass were generally most abundant during the summer (Figure 80 and Table 37). The magnitude of the pre-operational and operational catches were very similar, but the pre-operational peak occurred in August whereas the operational peak occurred in June. With the exception of June and July, when the operational catch was above the pre-operational mean, all operational values were within the range established during the pre-operational study.

Yellow Perch. Yellow perch generally occurred in similar numbers from month to month during the pre-operational period with a slight increase in the early fall, followed by a decrease to low densities in November (Figure 81). Operational densities were of similar magnitude during all months but August when they were higher than the pre-operational mean but very close to the pre-operational maximum for September.

Appraisal

In the appraisals of the phytoplankton, zooplankton, and benthos sections, it was shown that extreme values, i.e., either maxima or minima, in addition to being potentially due to unit operation, will occur by chance alone, due to natural variation. Furthermore, the magnitude of the standard deviation gives one a good indication of the magnitude of natural variation to be expected.

The above statements are hardly necessary when evaluating the impact of unit operation on the fishery populations in the vicinity of the Davis-Besse Nuclear Power Station, for there was little or no variation out of the pre-operational range during the operational period for the eight major species (Figures 74 - 81). On the 17 sampling dates during the operational period, the unit was operating at above 90 percent capacity on four dates, 15.0 percent capacity on another, and not operating on the remaining twelve dates.

Another way to measure impact and an approach which allows us to include all species (not just the major eight) is to compare catches at the discharge (Station 13) and those at the intake (Station 8) with two control stations (Figures 82 - 85 and Table 38). This method shows that the only operational catches at the intake and discharge which were outside the pre-operational range occurred during November (Figures 82 and 83). Both of these catches were above pre-operational data which is an indication that it was either a lake-wide occurrance, or a case of fish being attracted to the rip-rap material which was placed around these structures to prevent bottom scouring and ice damage. However, since an identical November increase occurred at the control stations (Figures 84 and 85), natural variation, not unit operation, should be considered the cause.

In conclusion, to date, operation of the Davis-Besse Nuclear Power Station, Unit 1, has not had a significant effect on Lake Erie fish populations at Locust Point.

Ichthyoplankton

Procedures

Ichthyoplankton was sampled at Locust Point in the vicinity of the Davis-Besse Nuclear Power Station from 1974 through 1979 with a 0.75-meter diameter oceanographic plankton net (No.00, 0.75 mm mesh). Each sample consisted of a 5-minute circular tow at 3 to 4 knots. Samples were collected at the surface and bottom of each station.

Sampling was conducted at the following stations during the following years: 1974, Stations 8 and 12; 1975, Stations 8, 12, and Toussaint Reef (Figure 15); 1976, Stations 3, 8, 13, 26, 28, 29, and Toussaint Reef; 1977, 1978 and 1979, Stations 3, 8, 13, 29, and Toussaint Reef. Toussaint Reef was used for comparisons since the Ohio Division of Wildlife considers it a spawning location. Each sample was preserved in 5 percent formalin and returned to the laboratory for sorting and analysis. Samples were generally collected at approximately 10-day intervals from April through August. Sampling was terminated at the end of August to add a margin of safety to the USEPA (Grosse Ile Office) sampling program for the Western Basin of Lake Erie which terminated each year in July (Table 39).

From 1974 to 1976, a single sample was collected at each depth of each station, and results were reported as the number of individuals per 5-minute tow. In 1977, 1978 and 1979, duplicate samples were collected at the surface and bottom of each station, and the net was equipped with a calibrated General Oceanics flowmeter to allow presentation of the results as the number of individuals per 100 m^3 of water. All specimens were identified and enumerated using the works of Fish (1932), Norden (1961a and b), and Nelson and Cole (1975).

Results

The results of the ichthyoplankton analyses have been thoroughly described in the semi-annual reports (1974 - 1976) and annual reports (1977, 1978, and 1979) of the Toledo Edison Company to the U.S. Nuclear Regulatory Commission. Since the reporting of results changed (catch per unit effort vs. no./100 m^3) during the course of the study, direct comparisons of results from 1977, 1978, and 1979 with those of the early pre-operational years, 1974 - 1976, are not possible. However, comparisons of the relative portions of the total density constituted by each species are possible.

Ichthyoplankton populations varied greatly from 1974 - 1979. Emerald shiners constituted 81 percent of the 1974 larvae, 1 percent of the 1975 larvae, 60 percent of the 1976 larvae, 3 percent of the 1977 larvae, 14 percent of the 1978 larvae, and 3 percent of the 1979 larvae. Yellow perch constituted 5 percent of the 1974 larvae, 70 percent of the 1975 larvae, 4 percent of the 1976 larvae, 26 percent of the 1977 larvae, 2 percent of the 1978 larvae, and 11 percent of the 1979 larvae. Gizzard shad appear to have increased significantly, reaching 34 percent of the 1976 larvae, 56 percent of the 1977 larvae, 69 percent of the 1978 larvae, and 82 percent of the 1979 larvae. It is felt that the above described variability is largely due to the fact that schooling populations are being sampled. Consequently, when the net is drawn through a school the density appears quite high. This is also quite dependent on the seasonal frequency of sampling. For example, if the weather allows more frequent spring sampling but prohibits summer sampling, then spring species such as perch and walleye appear relatively more abundant.

Nineteen seventy-eight was the second year that walleye constituted a significant portion of the catch. However, as noted in 1977, adult populations throughout the Western Basin are increasing greatly (Scholl, 1978). These walleye larvae contributed to the 53 percent increase observed in larval densities from 1977 (mean density = 37.0/100 m^3) to 1978 (mean density = 56.6/100 m^3). However, gizzard shad were the major source of this increase as their mean densities increased from 20.7/100 m^3 in 1977 to 38.9/100 m^3 in 1978. Yellow perch densities decreased significantly from 9.5/100 m^3 in 1977 to 1.2/100 m^3 in 1978. This decrease is similar to that observed by the Ohio Division of Wildlife for the adult population (Scholl, 1979).

The 1979 ichthyoplankton density (66.79/100 m^3) was 18 percent greater than the 1978 density (56.6/100 m^3) (Reutter, 1979). Although walleye densities decreased from 6.1/100 m^3 to 0.15/100 m^3, the loss was more than offset by yellow perch densities which increased from 1.2/100 m^3 in 1978 to 7.46/100 m^3 in 1979 and gizzard shad densities which increased from 38.9/100 m^3 in 1978 to 54.64/100 m^3 in 1979. It appears that walleye and yellow perch densities will fluctuate yearly, however, a definite increasing trend is emerging for gizzard shad densities.

In 1976, control stations (3 and 29) were established on either side of the intake (Station 3)/discharge complex (Station 13) to determine if unusually large fish larvae populations were occurring due to possible spawning in the rip-rap material around these structures. This does not appear to be occurring to any significant degree as Station 13 (plume area) exhibited densities similar to Station 3 (control), and Station 8 (intake) exhibited the lowest densities. These lower densities observed at Station 8 are probably due to the fact that this station is the farthest from shore and in the deepest water.

Appraisal

Ichthyoplankton at Locust Point in the vicinity of the Davis-Besse Nuclear Power Station, Unit 1, was sampled for two major reasons: 1) to determine if unit operation had a significant effect on densities in the area; and 2)to provide the ichthyoplankton densities to be used for the entrainment estimates. The first goal of the program is reasonable, and Reutter (1980b) stated, "due to the similarity between test and control stations, there is no indication that the activities of the plant have significantly altered these populations." To date, this assessment is true, although it should be tempered somewhat since on the 20 sampling dates during the operational study, the unit was operating at over 90 percent capacity on 3 dates, 40 percent capacity on another, 39 percent capacity on another one, 29 percent capacity on another, and not operating on the remaining 14.

The second reason for sampling ichthyoplankton is no longer valid as these results will not be used for entrainment estimates. Reutter and Cooper (1978) demonstrated that night samples at Locust Point produced density estimates 13.1 times greater than day estimates. Consequently, a night ichthyoplankton sampling program was initiated, the results of which were to be used to estimate entrainment losses at the unit.

Fish Egg and Larvae Entrainment

Procedures

Fish egg and larvae (ichthyoplankton) entrainment at the Davis-Besse Nuclear Power Station was computed by multiplying the ichthyoplankton concentration observed at Station 8 (intake) by the intake volume. Ichthyoplankton densities were determined at approximately 10-day intervals from April - August of 1978 and 1979 from four 3-minute, oblique (bottom to surface) tows at 3 - 4 knots made at night on each date (Tables 40 and 41) with a 0.75 meter diameter heavy-duty oceanographic plankton net (No. 00, 0.75 mm mesh) equipped with a calibrated General Oceanics flowmeter. Oblique tows were selected as this is the technique required at intakes on Lake Erie by U.S. Environmental Protection Agency and U.S. Fish and Wildlife Service. Night sampling is also required by these agencies to minimize net avoidance by larvae and to more accurately assess populations of species which may cling to the bottom during daylight. Samples were preserved in 5% formalin and returned to the laboratory for sorting and analysis. All specimens were identified and enumerated using the works of Fish (1932), Norden (1961a and b), and Nelson and Cole (1975). Densities were presented as number of ichthyoplankters per 100 m^3 of water.

From the above estimates it was possible to determine an approximate period of occurrence for each species and a mean density during that period. For example, during 1978 walleye were not found on April 30 or on June 7 or later (Table 40). They were present in samples from May 11 and May 21. Therefore, the period of occurrence was estimated to have been from May 6 (the midpoint between April 30 and May 11) to May 30 (the midpoint between May 21 and June 7) (Table 42). The mean density of walleye during this period was estimated to have been 41.6/100 m^3, computed from the concentration of 79.2/100 m^3 observed on May 11 and the concentration of 4.0/100 m^3 observed on May 21. It was this concentration, 41.6/100 m^3, which was multiplied by the volume of water drawn through the plant from May 6 to May 30. The same procedure was used in 1979 (Table 43). The daily intake volume was computed by multiplying the daily discharge volume by 1.3. The daily intake volumes were then added for all days within the period of occurrence of the species in question to determine the total intake volume during the period. All specimens were vouchered and all data were keypunched and stored at The Ohio State University's Center for Lake Erie Area Research, Columbus, Ohio.

Results

No pre-operational comparisons can be made since entrainment is associated with unit operation. Furthermore, since the operational period began in September 1977 (after the spawning season), no entrainment of fish and eggs occurred until 1978.

Ichthyoplankton densities observed at Station 8 (intake) during 1978 indicated that ichthyoplankters were entrained at the Davis-Besse Nuclear Power Station from May 6 to August 17 (Table 40). May 6 was selected as the first day since it is midway between April 30 and May 11. August 17 was selected as the last day because larvae were present in night samples on August 11 (Table 40) but were absent from day samples at Station 8 on August 23 and later.

During 1978 the mean larvae density from all night samples at Station 8 (47.5/100 m^3) was 49 percent greater than the mean density from all day samples collected at Station 8 (31.9/100 m^3). Gizzard shad constituted 69 percent of the night ichthyoplankton population, followed by walleye at 22 percent, and emerald shiners at 5 percent (Table 40).

Based on the above results (Table 40), it is estimated that 6,311,371 larvae and 44,278 eggs were entrained at the Davis-Besse Nuclear Power Station during 1978 (Table 42). Of this total, gizzard shad constituted 76 percent, walleye 15 percent, and emerald shiners 5 percent.

Ichthyoplankton densities observed at Station 8 (intake) during 1979 indicated that ichthyoplankters were entrained at the Davis-Besse Nuclear Power Station from 26 April to 9 August (Table 41). April 26 was selected as the first day because several walleye were collected on the first sampling date (1 May) and 26 April is half of one sampling interval (10 days) ahead of this first collection. It should also be noted that in 1978 no ichthyoplankters were collected prior to 11 May. August 9 was selected as the last day since it is midway between 3 August, the last sampling date on which larvae were present, and 15 August, a sampling date on which no ichthyoplankters were collected.

During 1979 the mean larvae density from all night samples at Station 8 (142.97/100 m^3) was 2.9 times greater than the mean density from all day samples collected at Station 8 (36.7/100 m^3). Gizzard shad constituted 50 percent of the night ichthyoplankton population, followed by emerald shiners at 32 percent, yellow perch at 8 percent, freshwater drum at 5 percent, and smelt at 4 percent (Table 41).

Based on the results in Table 41, it is estimated that 20,620,799 larvae and 101,405 eggs were entrained at the Davis-Besse Nuclear Power Station during 1979 (Table 43). Of this total, gizzard shad constituted 49 percent, emerald shiners 33 percent, yellow perch 8 percent, freshwater drum 5 percent, and rainbow smelt 4 percent.

Appraisal

Ichthyoplankton entrainment at the Davis-Besse Nuclear Power Station during 1978 and 1979 was typical for an intake on the south shore of the Western Basin of Lake Erie -- it was strongly dominated by gizzard shad. As explained in the ichthyoplankton section of this report, gizzard shad are on the increase and, consequently, it would not be surprising if they represented an even greater portion of the entrainment in future years. Walleye and perch populations appear to be fluctuating. They will obviously be entrained at this station. However, the number could vary greatly from year to year.

One way to put entrainment losses into perspective is to look at fecundity. Based on an average of 300,000 eggs/female gizzard shad (Hartley and Herdendorf, 1977), the 4,796,964 larvae entrained during 1978 could have been produced by 16 females; based on an average of 331,000 eggs/female walleye (Hartley and Herdendorf, 1977), the 916,738 larvae entrained during 1978 could have been produced by 3 females; and based on 44,000 eggs/female yellow perch (Hartley and Herdendorf, 1977) the 35,259 larvae entrained during 1978 could have been produced by 1 female. In actuality, the above estimates of the number of females required to produce the entrained larvae are quite low since they do not take mortality from eggs to larvae into account. If we assume 99 percent mortality from eggs to larvae to be safe (90 percent is probably more reasonable) then the entrained larvae could have been produced by 1,600 gizzard shad, 300 walleyes, and 100 perch. These values are less than 0.1 percent of the number of perch and walleye captured by Ohio sport fishermen in 1978 (Scholl, 1979). Furthermore, if one looks at the worst case, the value for the upper 95 percent confidence limit and assumes 99 percent mortality from eggs to larvae, the losses of perch and walleye larvae are still less than 0.25 percent of the number lost due to harvesting by Ohio sport fishermen.

Another way to determine the impact of entrainment losses is to estimate the number of adults the entrained larvae might have produced had they lived. This technique requires some knowledge of the mortality between larval stages and between year classes. Patterson (1976) has developed such estimates for yellow perch, and, since it is in the same family, the estimates will also be used here for walleye. Several assumptions are involved.

I. All entrained larvae are killed.

II. All larvae lost by entrainment are in their late larval stage. This provides a conservative or high estimate because it does not account for early larval mortality which may range from 83-96 percent (Patterson, 1976).

III. Yellow perch become vulnerable to commercial capture, and reach sexual maturity at age class III.

IV. A one percent survival rate from late larvae to age III adults is assumed. Again, this is conservative since survival rates from:

late larvae to YOY = 4 to 17 percent;
YOY to age class I = 12 to 33 percent;
age class I to age class II = 38 percent;
age class II to age class III = 38 percent (Patterson, 1976, and Brazo, _et al_., 1975).

This trend translates to a survivorship ranging from 0.1 percent to one percent over the period from the late larval stage to age class III.

Based on the above assumptions, in 1978 the 916, 738 entrained walleye larvae might have produced 917-9,167 age class III adults and the

35,259 entrained yellow perch larvae might have produced 35-353 age class III adults. In 1979, the 41,648 entrained walleye larvae might have produced 42 - 416 age class III adults and the 1,595,066 entrained yellow perch larvae might have produced 1,595 -15,951 age class III adults.

The author feels little weight should be placed on the above impact assessments since they are based on the number of entrained larvae which can vary greatly from year to year depending on the success of the hatch which in turn is dependent upon the size of the brood stock and weather conditions during spawning and incubation. In the case of Davis-Besse, the off-shore intake where larvae densities are lower and the low volume intake (1978 mean = 21,389 gpm) due to the cooling tower and closed condenser cooling system necessitate a very low-level impact on Western Basin fish populations.

Fish Impingement

Procedures

As was the case with entrainment, impingement is an operational phenomenon and, consequently, pre-operational comparisons are impossible. Furthermore, since estimates are available for only a small portion of 1977 (Reutter, 1978), and since impingement should be viewed for an entire year to allow for seasonal interpretations, only the 1978 and 1979 results will be discussed.

Between January 1 and December 31, 1978 the traveling screens at the Davis-Besse Nuclear Power Station were operated 221 times, while between January 1 and December 31, 1979 the screens were operated 272 times. The date, time, and duration of each screen operation were recorded and keypunched, even when the impinged fish were not collected (Tables 44 and 45). Collections of impinged fish were made by Toledo Edison personnel during 144 of the 221 screen operations during 1978 and on 134 of the 272 screen operations in 1979 by placing a screen having the same mesh size as the traveling screens (¼-inch bar mesh) in the sluiceway through which the backwashed material passed. Fish collected in this manner were placed in plastic bags, labeled with the date and time of screen operation, and frozen. The samples were picked up by personnel of The Ohio State University's Center for Lake Erie Area Research (CLEAR) weekly. All specimens, or a representative number thereof, were also weighed and measured.

In addition to the information pertinent to traveling screen operation, the total number and total weight of each species and the length and weight of each individual fish were also keypunched. All these data were stored on magnetic tape at The Ohio State University for use with the Statistical Analysis System: SAS (Barr et al., 1976) on an AMDAHL 370 computer.

Since the time and duration of every screen operation was known, it was possible to determine the number of hours represented by each collection. From this a rate, fish impinged/hour, was developed and used to estimate impingement on days when samples were not collected.

Results

A total of 6,607 fish representing 20 species was impinged on the traveling screens at the Davis-Besse Nuclear Power Station from January 1 through December 31, 1978 (Table 46). Goldfish was the dominant species impinged representing 49.9 percent of the total. Only 6 other species represented more than 1 percent of the total: yellow perch, 23.9 percent; emerald shiner, 15.0 percent; gizzard shad, 5.9 percent; black crappie, 1.2 percent; freshwater drum, 1.2 percent; and rainbow smelt, 1.0 percent.

A total of 4,385 fish representing 19 species was impinged on the traveling screens at the Davis-Besse Nuclear Power Station from January 1 through December 31, 1979 (Table 47). Goldfish was the dominant species impinged representing 78.6 percent of the total. Only 4 other species represented more than 1 percent of the total: yellow perch, 6.5 percent; emerald shiner, 4.9 percent; gizzard shad, 3.7 percent; and freshwater drum, 2.6 percent.

Impingement was also computed on a monthly basis (Tables 48 and 49). Most of the impingement during 1978 occurred during April (43.5 percent) and December (35.3 percent). Of the 2,875 fish estimated to have been impinged during April, 834 (29.0 percent) were emerald shiners, 799 (27.8 percent) were goldfish, and 1,098 (38.2 percent) were yellow perch. Of the 2,330 fish estimated to have been impinged during December, 1,870 (80.3 percent) were goldfish and 360 (15.5 percent) were gizzard shad.

Most of the impingement during 1979 occurred during January (55.4 percent) and April (17.2 percent). Of the 2,429 fish estimated to have been impinged during January, 2,218 (91.3 percent) were goldfish, 103 (4.2 percent) were freshwater drum, and 80 (1.8 percent) were gizzard shad. Of the 753 fish estimated to have been impinged in April, 333 (44.2 percent) were goldfish, 200 (26.6 percent) were yellow perch, and 184 (24.4 percent) were emerald shiners.

Appraisal

With the exception of the blackside darter and the bluntnose minnow, all species impinged at the Davis-Besse Nuclear Power Station have been captured within the past 17 years at Locust Point (Table 4). However, both the blackside darter and bluntnose minnow have been reported from the island area of Lake Erie and most of the tributaries, including the Toussaint River and Turtle Creek near Locust Point (Trautman, 1957).

With the exception of goldfish, black and brown bullheads, and black and white crappies, the impinged fish occurred in relative numbers which were not unusual for populations in Lake Erie at Locust Point. These five species occurred in relative proportions well above that of the open lake. This indicates probable use of the intake canal as a permanent residence for these species. Furthermore, due to the small sizes of these fish (they were young-of-the-year) and results from previous trawling efforts

(Reutter and Herdendorf, 1975), it appears that these species are also spawning within the intake canal and, consequently, these losses should not be considered as a negative impact on the lake populations of these species.

Impingement losses at the Davis-Besse Nuclear Power Station during 1978 and 1979 were extremely low even when compared to other plants on the Western Basin with lower generating capacities (Reutter et al., 1978). Tables 50 - 52 present sport and commercial fish landings from the Ohio waters of Lake Erie and commercial landings from all of Lake Erie. Table 50 presents only 1978 results because 1979 sport fishing harvest estimates are not available for all species. However, they would probaly have been higher than 1978 because commercial fishing harvests increased by 13 percent from 1978 to 1979, and because the sport harvest of walleye increased from 1,652,000 in 1978 to 3,351,000 in 1979 (Ohio Department of Natural Resources, 1980). Although the fish impinged at Davis-Besse were primarily YOY (mean length, 74 mm and 71 mm in 1978 and 1979) and, consequently, much more abundant than the adults taken by commercial and sport fishermen, the total number impinged (including gizzard shad and goldfish which are not taken by sport fishermen) was only 0.04 percent (1978) and 0.03 percent (1979) of the number harvested by Ohio sport fishermen in 1978. This figure becomes even less significant when one realizes that the Ohio sport catch was only 83.4 percent of the Ohio 1978 commercial catch and only 15.9 percent of the 1978 commercial catch from all of Lake Erie (Tables 50 - 52).

The above comparisons make it obvious that impingement losses at the Davis-Besse Nuclear Power Station have an insignificant effect on Lake Erie fish stocks and further justification of this is unnecessary. However, it should be noted that although by number impingement losses were 0.04 percent (1978) and 0.03 percent (1979) of the Ohio 1978 sport fishing harvest, by weight impingement was less than 0.001 (1978 and 1979) percent of the Ohio sport harvest. Furthermore, based on the estimates of Patterson (1976) (see Entrainment Section) the impingement of 1,582 young-of-the-year yellow perch (1978), a species which is very important to sport and commercial fishermen, might result in the loss of only 28 - 75 adults which is from 0.0002 to 0.0007 percent of the number captured by Ohio sport fishermen in 1978, while the impingement of 285 young-of-the-year perch in 1979 might result in the loss of 5-16 adults, which is from 0.00004 to 0.0001 percent of the total number of perch captured by Ohio sport fishermen in 1978. It should also be noted that no walleye were impinged.

The obvious conclusion is that impingement losses at the Davis-Besse Nuclear Power Station, Unit 1, have an insignificant effect on Western Basin fish stocks. Furthermore, although the plant did not operate at full capacity during much of these years, the circulating pumps were operated, and consequently, impingement estimates are based on the entire 2-year period and not just dates of generator operation.

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TABLES

TABLE 1

MILESTONES FOR THE

DAVIS-BESSE NUCLEAR POWER STATION, UNIT 1

Date	Event
February 1968	Public announcement of project
August 1, 1969	File PSAR with AEC
May 1, 1970	Site preparation begun
March 24, 1971	Construction permit issued
December 7, 1972	Reactor vessel arrived on site by barge
December 8, 1972	Operating license application (FSAR) filed with AEC
March 9, 1973	FSAR docketed (No. 50-346)
June 15, 1973	Initiated aquatic ecology monitoring program
December 8, 1975	Begin fuel receipt at station
August 29, 1977	Commence operation

TABLE 2
CALCULATED INTAKE CRIB VELOCITIES FOR UNIT 1
FOR VARIOUS PUMPING RATES

Pumping Rate		Intake Velocity (ft/sec)
(gpm)	(mgd)	
0	0	0.00
5,000	7.2	0.03
10,000	14.4	0.06
15,000	21.6	0.09
20,000	28.8	0.12
25,000	36.0	0.15
30,000	43.2	0.18
35,000	50.4	0.21
40,000	57.6	0.24
45,000	64.8	0.27
50,000	72.0	0.30
55,000	79.2	0.33
60,000	86.4	0.36
65,000	93.6	0.39
70,000	100.8	0.42
75,000	108.0	0.45
80,000	115.2	0.48
85,000	122.4	0.51
90,000	129.6	0.54
95,000	136.8	0.57
100,000	144.0	0.60

TABLE 3

MONTHLY PUMPING RATES AND
CALCULATED VELOCITIES AT THE DAVIS-BESSE
NUCLEAR POWER STATION WATER INTAKE CRIB
FOR 1978

Month	Maximum		Minimum		Mean		Total
	Pumping Rate (mgd)	Velocity (ft/sec)	Pumping Rate (mgd)	Velocity (ft/sec)	Pumping Rate (mgd)	Velocity (ft/sec)	Millions of gallons
January	34.6	0.14	23.4	0.10	29.6	0.12	918.8
February	40.0	0.17	21.5	0.09	32.0	0.13	895.4
March	52.4	0.22	22.1	0.09	34.2	0.14	1059.9
April	56.2	0.23	23.0	0.10	38.1	0.16	1142.7
May	44.3	0.18	21.5	0.09	25.4	0.11	785.9
June	23.0	0.10	14.7	0.06	21.3	0.09	639.6
July	43.2	0.18	21.5	0.09	33.4	0.14	1035.7
August	53.8	0.22	10.4	0.05	38.9	0.16	1205.0
September	107.5	0.45	49.8	0.21	73.5	0.31	2203.5
October	64.6	0.27	36.1	0.15	55.6	0.23	1724.8
November	69.3	0.29	41.7	0.17	55.3	0.23	1657.5
December	83.5	0.35	25.7	0.11	43.3	0.18	1341.6
Annual	107.5	0.45	10.4	0.05	40.0	0.17	13268.8

TABLE 4

SPECIES FOUND IN THE LOCUST POINT AREA 1963 - 1979[1]

1972	1973	1974	1975	1976	1977	1978	1979	SCIENTIFIC NAME	COMMON NAME
								Amiidae	
*		*	*					*Amia calva*	bowfin
								Atherinidae	
		*	*	*	*	*		*Labidesthes sicculus*	brook silverside
								Catostomidae	
*				*	*	*	*	*Carpiodes cyprinus*	quillback
*	*	*	*	*	*	*	*	*Catostomus commersoni*	white sucker
		*						*Minytrema melanops*	spotted sucker
*								*Moxostoma erythrurum*	golden redhorse
					*		*	*Moxostoma macrolepidotum*	shorthead redhorse
*								*Ictiobus cyprinellus*	bigmouth buffalo
				*				*Hypentelium nigricans*	northern hogsucker
								Centrarchidae	
		*						*Ambloplites rupestris*	rockbass
	*	*	*					*Lepomis cyanellus*	green sunfish
		*	*					*L. gibbosus*	pumpkinseed
	*	*						*L. humilis*	orangespotted sunfish
		*	*					*L. macrochirus*	bluegill
	*							*L. microlophus*	redear sunfish
*	*	*				*		*Micropterus dolomieui*	smallmouth bass
	*	*						*M. salmoides*	largemouth bass
	*	*	*	*	*	*	*	*Pomoxis annularis*	white crappie
*	*	*	*	*	*	*	*	*P. nigromaculatus*	black crappie
								Clupeidae	
*	*	*	*	*	*	*	*	*Alosa pseudoharengus*	alewife
*	*	*	*	*	*	*	*	*Dorosoma cepedianum*	gizzard shad
								Cyprinidae	
*	*	*	*	*	*	*	*	*Carassius auratus*	goldfish
*	*						*	*C. auratus* x *Cyprinus carpio*	carp x goldfish hybrid
*	*	*	*	*	*	*	*	*Cyprinus carpio*	carp
	*	*	*	*	*	*	*	*Hybopsis storeriana*	silver chub
						*		*Notemigonus crysoleucas*	goldenshiner
*	*	*	*	*	*	*	*	*Notropis atherinoides*	emerald shiner
*	*	*	*	*	*	*	*	*N. hudsonius*	spottail shiner
	*		*	*	*		*	*N. spilopterus*	spotfin shiner
	*		*					*N. volucellus*	mimic shiner
							*	*Pimephales notatus*	bluntnose minnow
			*					*P. promelas*	fathead minnow

TABLE 4 (CON'T)

SPECIES FOUND IN THE LOCUST POINT AREA 1963 - 1979[1]

1972	1973	1974	1975	1976	1977	1978	1979	SCIENTIFIC NAME	COMMON NAME
								Esocidae	
							*	*Esox lucius*	northern pike
				*				*Esox masquinongy*	muskellunge
								Ictaluridae	
		*	*		*	*		*Ictalurus melas*	black bullhead
*	*	*				*	*	*I. natalis*	yellow bullhead
*	*	*	*	*	*	*	*	*I. nebulosus*	brown bullhead
*	*	*	*	*	*	*	*	*I. punctatus*	channel catfish
								Noturus flavus	stonecat
								Lepisosteidae	
		*		*	*			*Lepisosteus osseus*	longnose gar
								Osmeridae	
*	*	*	*	*	*	*	*	*Osmerus mordax*	rainbow smelt
								Percidae	
			*		*			*Etheostoma nigrum*	johnny darter
*	*	*	*	*	*	*	*	*Perca flavescens*	yellow perch
		*	*	*	*	*	*	*Percina caprodes*	logperch
			*	*	*	*		*Stizostedion canadense*	sauger
*	*	*	*	*	*	*	*	*S. v. vitreum*	walleye
								Percichthyidae	
							*	*Morone americana*	white perch
*	*	*	*	*	*	*	*	*M. chrysops*	white bass
								Percopsidae	
	*	*	*	*	*	*	*	*Percopsis omiscomaycus*	trout-perch
								Petromyzontidae	
		*						*Petromyzon marinus*	sea lamprey
								Salmonidae	
*		*						*Oncorhynchus kisutch*	coho salmon
								Sciaenidae	
*	*	*	*	*	*	*	*	*Aplodinotus grunniens*	freshwater drum
23	28	34	30	26	27	26	27		

[1] Includes species collected in Federal Aid Project F-41-R at Locust Point

TABLE 5

PROCEDURES FOR WATER QUALITY DETERMINATION

Parameter	Units	References for Analytical Methods
1. Dissolved Oxygen	^{o}C	APHA (1975): Sec. 422B
2. Hydrogen-ions (pH)	pH units	ASTM (1973): D1293-65
3. Transparency	meters	Welch (1948): Secchi disk
4. Turbidity	F.T.U.	APHA (1975): Sec. 214A
5. Suspended Solids	mg/l	APHA (1975): Sec. 208D
6. Conductivity	umhos/cm(25^{o}C)	ASTM (9175): D1125-64
7. Dissolved Solids	mg/l	USEPA (1974)
8. Calcium (Ca)	mg/l	APHA (1975): Sec. 306C
9. Chloride (Cl)	mg/l	APHA (1975): Sec. 408B
10. Sulfate (SO_4)	mg/l	ASTM (1973): D516-68C
11. Sodium (Na)	mg/l	ASTM (1973): D1428-64
12. Magnesium (Mg)	mg/l	APHA (1975): Sec. 313C
13. Alkalinity (Total as $CaCO_3$)	mg/l	APHA (1975): Sec. 403
14. Nitrate (NO_3)	mg/l	ASTM (1973): D992-71
15. Phosphorus (Total as P)	mg/l	APHA (1975): Sec. 425F
16. Silica (SiO_2)	mg/l	ASTM (1973): D859-68B
17. Biochemical Oxygen Demand	mg/l	APHA (1975): Sec. 507
18. Temperature	^{o}C	APHA (1975): Sec. 212

TABLE 6

DISSOLVED OXYGEN DATA FOR BOTTOM WATER
IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (ppm)				Operational Data (ppm)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	11.8	11.8	11.8	0.0	-	-	-	-
April	11.0	13.2	11.9	0.9	9.5	9.5	9.5	0.0
May	7.2	10.4	9.1	1.4	9.2	12.4	10.8	2.3
June	7.0	10.2	8.1	1.5	7.2	8.8	8.0	1.1
July	4.8	8.9	6.6	1.7	6.1	7.6	6.9	1.1
August	6.0	9.1	7.4	1.3	8.3	8.4	8.4	0.1
September	8.6	9.3	8.9	0.4	8.2	9.2	9.1	0.1
October	10.0	11.2	10.5	0.6	9.5	11.4	10.7	1.0
November	11.0	12.1	11.5	0.6	10.2	12.2	11.5	1.1
December	11.4	14.1	12.8	1.9	-	-	-	-
Mean			9.9	2.1			9.4	1.6

Month	DISCHARGE (STA. NO. 13)							
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	11.8	11.8	11.8	0.0		-	-	-
April	11.8	12.8	12.3	0.5	9.5	9.5	9.5	0
May	8.6	10.0	9.4	0.6	9.0	12.0	10.5	2.1
June	6.8	10.1	8.5	1.4	5.7	8.5	7.1	2.0
July	4.5	8.4	6.6	1.6	8.3	8.8	8.6	0.4
August	6.6	9.3	7.7	1.2	8.1	8.2	8.2	0.1
September	8.2	9.3	8.6	0.6	8.7	9.2	8.6	0.4
October	10.4	11.3	11.3	0.8	10.4	11.5	11.0	0.6
November	11.3	12.2	11.7	0.5	4.8	12.1	9.6	4.2
December	14.1	10.2	12.2	2.76		-	-	-
Mean			10.0	2.1			9.1	1.3

TABLE 7

HYDROGEN-IONS (pH) DATA FOR BOTTOM WATER
IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

INTAKE (STA. NO. 8)

Month	Pre-Operational Data (pH units)				Operational Data (pH units)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	8.1	8.1	8.1	0.0	-	-	-	-
April	7.7	8.3	8.1	0.3	8.1	8.1	8.1	0.0
May	7.8	8.4	8.2	0.3	7.7	8.0	7.9	0.2
June	8.0	8.6	8.3	0.3	8.3	8.6	8.5	0.2
July	8.1	9.0	8.5	0.4	8.4	8.4	8.4	0.0
August	8.5	8.9	8.8	0.2	8.7	8.7	8.7	0.0
September	7.8	8.6	8.2	0.4	8.6	8.8	8.7	0.1
October	8.2	8.9	8.6	0.4	8.0	8.8	8.4	0.4
November	7.6	8.4	8.0	0.4	7.5	8.0	7.8	0.3
December	8.1	8.3	8.2	0.1	-	-	-	-
Mean			8.3	0.3			8.3	0.3

DISCHARGE (STA. NO. 13)

Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	7.8	7.8	7.8	0.0	-	-	-	-
April	7.7	8.5	8.1	0.4	8.1	8.1	8.1	0.0
May	7.8	8.6	8.3	0.3	7.5	8.3	7.9	0.6
June	7.8	8.6	8.3	0.4	8.5	8.6	8.6	0.1
July	8.0	8.7	8.4	0.4	8.1	8.5	8.3	0.3
August	8.0	8.7	8.4	0.3	8.7	8.7	8.7	0.0
September	8.3	8.5	8.4	0.1	8.5	8.9	8.7	0.2
October	8.4	8.8	8.6	0.2	8.0	8.6	8.2	0.3
November	7.7	8.4	8.0	0.7	6.9	8.1	7.6	0.6
December	7.9	8.4	8.2	0.4	-	-	-	-
Mean			8.3	0.2			8.3	0.4

TABLE 8

TRANSPARENCY DATA FOR WATER

IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (m)				Operational Data (m)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	0.15	0.15	0.15	0.00	-	-	-	-
April	0.10	0.50	0.34	0.20	0.40	0.40	0.40	0.00
May	0.35	1.00	0.70	0.30	0.20	0.40	0.30	0.10
June	0.50	0.60	0.60	0.05	0.35	0.45	0.40	0.10
July	0.40	1.10	0.70	0.30	0.75	0.85	0.80	0.10
August	0.45	1.30	0.90	0.40	0.50	0.95	0.70	0.30
September	0.60	0.80	0.70	0.10	0.40	1.15	0.72	0.40
October	0.50	0.80	0.60	0.17	0.45	0.60	0.53	0.10
November	0.30	0.50	0.43	0.12	0.35	0.80	0.62	0.20
December	0.40	0.40	0.40	0.00	-	-	-	-
Mean			0.55	0.22			0.56	0.18
	DISCHARGE (STA. NO. 13)							
March	0.10	0.10	0.10	0.00	-	-	-	-
April	0.10	0.40	0.25	0.13	0.35	0.35	0.35	0.00
May	0.30	0.70	0.60	0.20	0.20	0.40	0.30	0.10
June	0.30	0.50	0.50	0.10	0.30	0.40	0.35	0.10
July	0.30	0.95	0.61	0.33	0.55	0.85	0.70	0.20
August	0.50	1.00	0.77	0.25	0.45	0.70	0.58	0.20
September	0.50	0.65	0.58	0.08	0.40	1.15	0.68	0.40
October	0.40	0.65	0.53	0.13	0.50	0.50	0.50	0.00
November	0.30	0.60	0.45	0.15	0.35	0.80	0.55	0.20
December	0.40	0.45	0.43	0.04	-	-	-	-
Mean			0.48	0.19			0.49	0.14

TABLE 9

TURBIDITY DATA FOR BOTTOM WATER

IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (F.T.U.)				Operational Data (F.T.U.)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	145.0	145.0	145.0	0.0	-	-	-	-
April	12.0	105.0	46.3	42.8	67.0	67.0	67.0	0.0
May	5.5	21.0	14.9	6.7	46.0	55.0	50.5	6.4
June	10.0	53.0	26.3	18.6	40.0	57.0	48.5	12.0
July	3.0	53.0	16.9	24.2	14.0	58.0	33.0	26.9
August	2.0	23.0	10.5	9.0	13.0	18.0	15.5	3.5
September	5.0	10.0	9.3	4.0	10.0	27.0	18.3	8.5
October	7.0	18.0	11.7	5.7	13.0	32.0	20.7	10.0
November	13.0	36.0	21.7	12.5	8.0	58.0	26.0	27.8
December	16.0	47.0	31.5	21.9	-	-	-	-
Mean			33.4	40.8			34.9	18.5

DISCHARGE (STA. NO. 13)

Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	148.0	148.0	148.0	0.0	-	-	-	-
April	18.0	110.0	54.5	42.7	75.0	75.0	75.0	0.0
May	8.5	28.0	17.9	8.0	52.0	75.0	63.5	16.3
June	7.0	25.0	17.5	8.2	49.0	54.0	51.5	3.5
July	4.5	45.0	19.4	18.6	15.0	34.0	24.5	13.4
August	2.0	24.0	12.3	9.5	16.0	17.0	16.5	0.7
September	4.0	16.0	10.0	6.0	11.0	47.0	28.7	18.0
October	9.0	22.0	13.7	7.2	7.0	42.0	23.3	17.6
November	13.0	33.0	19.7	11.6	8.0	64.0	28.0	31.2
December	21.0	54.0	37.5	23.3	-	-	-	-
Mean			35.1	41.9			38.9	21.5

TABLE 10

SUSPENDED SOLIDS DATA FOR BOTTOM WATER

IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	148.0	148.0	148.0	0.0	-	-	-	-
April	13.0	80.0	46.8	36.7	50.0	50.0	50.0	0.0
May	10.0	26.0	16.3	7.1	50.0	86.0	68.0	25.5
June	9.0	60.0	30.3	25.1	43.0	63.0	53.0	14.1
July	1.0	33.0	21.3	14.0	10.0	14.0	12.0	2.8
August	8.0	19.0	12.5	5.5	11.0	18.0	14.5	5.0
September	6.0	15.0	10.0	4.6	11.0	37.0	26.0	13.5
October	9.0	14.0	12.0	2.7	18.0	27.0	23.3	4.7
November	11.0	28.0	20.7	8.7	32.0	87.0	68.7	31.8
December	17.0	21.0	19.0	2.8	-	-	-	-
Mean			33.7	41.6			39.4	23.3

Month	DISCHARGE (STA. NO. 13)							
	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	170.0	170.0	170.0	0.0	-	-	-	-
April	15.0	101.0	58.5	41.9	59.0	59.0	59.0	0.0
May	17.0	34.0	22.8	7.6	49.0	89.0	69.0	28.3
June	7.0	67.0	35.0	29.5	44.0	56.0	50.0	8.5
July	3.0	52.0	28.5	21.0	16.0	18.0	17.0	1.4
August	8.0	24.0	16.3	7.9	12.0	22.0	17.0	7.1
September	10.0	27.0	17.0	8.9	12.0	104.0	47.3	49.6
October	10.0	26.0	18.0	8.0	13.0	79.0	40.7	34.3
November	19.0	34.0	25.3	7.8	27.0	156.0	74.3	71.0
December	23.0	23.0	23.0	0.0	-	-	-	-
Mean			40.4	47.5			46.8	21.5

TABLE 11
CONDUCTIVITY DATA FOR BOTTOM WATER
IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (μmhos/cm)				Operational Data (μmhos/cm)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	410.0	410.0	410.0	0.0	-	-	-	-
April	287.0	340.0	314.5	27.9	410.0	410.0	410.0	0.0
May	280.0	365.0	310.8	39.0	290.0	320.0	305.0	21.2
June	285.0	310.0	292.8	11.7	295.0	300.0	297.5	3.5
July	260.0	305.0	280.0	22.9	275.0	300.0	287.5	17.7
August	233.0	285.0	253.8	22.1	250.0	295.0	272.5	31.8
September	217.0	267.0	246.3	26.1	222.0	284.0	262.0	34.7
October	233.0	298.0	272.0	34.4	265.0	350.0	316.7	45.4
November	230.0	300.0	262.7	35.2	245.0	320.0	278.3	38.2
December	283.0	297.0	290.0	9.9	-	-	-	-
Mean			293.3	46.8			303.7	46.5

Month	DISCHARGE (STA. NO. 13)							
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	392.0	392.0	392.0	0.0	-	-	-	-
April	272.0	360.0	312.8	43.9	435.0	435.0	435.0	0.0
May	270.0	365.0	312.5	42.3	285.0	320.0	302.5	24.8
June	286.0	340.0	309.8	24.9	300.0	303.0	301.5	2.1
July	220.0	300.0	268.5	34.2	275.0	300.0	287.5	17.7
August	245.0	280.0	262.8	17.3	260.0	295.0	277.5	24.8
September	215.0	264.0	244.7	26.1	230.0	315.0	276.3	43.0
October	238.0	324.0	280.7	43.0	265.0	335.0	310.7	39.6
November	230.0	306.0	268.0	38.0	250.0	330.0	283.3	41.6
December	285.0	300.0	292.5	10.6	-	-	-	-
Mean			296.2	39.4			309.3	52.3

TABLE 12

DISSOLVED SOLIDS DATA FOR BOTTOM WATER

IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	318.0	318.0	318.0	0.0	-	-	-	-
April	158.0	284.0	206.0	55.3	140.0	140.0	140.0	0.0
May	124.0	230.0	178.0	47.2	186.0	236.0	211.0	35.4
June	89.0	178.0	131.3	45.3	164.0	180.0	172.0	11.3
July	136.0	180.0	164.5	20.8	174.0	174.0	174.0	0.0
August	152.0	226.0	171.5	36.4	174.0	184.0	179.0	7.1
September	128.0	214.0	166.0	43.9	146.0	180.0	168.0	19.1
October	158.0	186.0	170.7	14.2	146.0	190.0	164.0	23.1
November	140.0	174.0	156.0	17.1	158.0	184.0	172.7	13.3
December	140.0	160.0	150.0	14.1	-	-	-	-
Mean			181.2	51.8			172.6	19.5

Month	DISCHARGE (STA. NO. 13)							
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	310.0	310.0	310.0	0.0	-	-	-	-
April	182.0	396.0	244.0	102.4	150.0	150.0	150.0	0.0
May	116.0	232.0	176.0	51.3	192.0	224.0	208.0	22.6
June	90.0	194.0	137.0	51.1	174.0	194.0	196.0	20.7
July	136.0	190.0	164.0	27.0	160.0	182.0	171.0	15.6
August	150.0	228.0	170.0	38.7	178.0	194.0	186.0	11.3
September	140.0	170.0	153.3	15.3	158.0	196.0	176.7	19.0
October	176.0	194.0	182.0	10.4	152.0	178.0	163.3	13.3
November	142.0	184.0	158.0	22.7	162.0	192.0	178.0	15.1
December	148.0	164.0	156.0	11.3	-	-	-	-
Mean			185.0	52.4			178.5	18.3

TABLE 13

CALCIUM DATA FOR BOTTOM WATER

IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	50.8	50.8	50.8	0.0	-	-	-	-
April	32.8	46.4	40.6	6.1	46.4	46.4	46.4	0.0
May	34.0	40.0	37.0	2.6	36.0	38.4	37.2	1.7
June	34.0	38.0	34.9	1.8	36.8	37.2	37.0	0.3
July	32.0	34.4	33.6	1.1	36.0	36.0	36.0	0.0
August	29.2	39.2	32.8	4.3	32.0	35.6	33.8	2.5
September	32.0	36.0	33.9	2.0	30.4	34.8	32.8	2.2
October	31.6	37.2	33.9	3.0	32.4	36.8	34.0	2.4
November	31.2	37.6	34.9	3.3	32.8	37.6	35.7	2.6
December	31.2	34.0	32.6	2.0	-	-	-	-
Mean			36.5	5.6			36.6	4.3

Month	DISCHARGE (STA. NO. 13)							
	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	50.4	50.4	50.4	0.0	-	-	-	-
April	33.6	50.4	41.7	7.0	50.0	50.0	50.0	0.0
May	34.0	41.6	37.4	3.5	36.0	36.0	36.0	0.0
June	34.0	38.4	35.9	1.9	36.8	37.6	37.2	0.6
July	32.0	36.4	34.1	1.9	33.6	38.8	36.2	3.7
August	29.6	40.4	33.6	4.7	33.2	35.6	34.4	1.7
September	32.0	36.0	33.3	2.3	31.2	33.2	32.1	1.0
October	32.0	41.2	34.2	3.9	32.8	36.0	34.1	1.7
November	31.2	34.8	33.2	1.8	32.8	38.8	36.1	3.1
December	31.2	35.2	33.2	2.8	-	-	-	-
Mean			36.7	5.5			37.0	5.5

TABLE 14

CHLORIDE DATA FOR BOTTOM WATER

IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	22.0	22.0	22.0	0.0	-	-	-	-
April	18.0	26.8	20.6	4.2	26.0	26.0	26.0	0.0
May	18.0	20.0	18.7	1.0	20.0	21.0	20.5	0.7
June	15.5	20.3	17.9	2.3	15.2	20.5	17.9	3.7
July	16.0	19.5	18.0	1.8	12.5	23.0	17.8	7.4
August	13.5	18.3	16.1	2.0	10.8	19.5	15.2	6.2
September	16.0	17.2	16.7	0.6	13.5	17.5	15.8	2.1
October	15.8	18.8	17.4	1.5	14.3	22.0	19.4	4.4
November	13.0	16.5	14.7	1.8	15.0	20.0	17.5	2.5
December	15.0	15.8	15.4	0.6	-	-	-	-
Mean			17.8	2.3			18.8	3.4
	DISCHARGE (STA. NO. 13)							
March	22.0	22.0	22.0	0.0	-	-	-	-
April	18.0	26.5	20.8	3.9	27.3	27.3	27.3	0.0
May	17.6	20.0	18.9	1.3	17.8	21.0	19.4	2.3
June	16.3	22.5	18.8	2.9	15.5	20.5	18.0	3.5
July	16.8	20.0	18.2	1.7	12.5	22.0	17.3	6.7
August	13.5	18.3	16.1	2.0	12.3	19.0	15.7	4.7
September	14.5	17.2	15.9	1.4	14.0	19.5	16.7	2.8
October	16.8	21.0	18.4	2.3	15.8	21.0	19.3	3.0
November	13.0	16.0	14.7	1.5	17.3	21.5	19.0	2.2
December	15.0	16.3	15.7	0.9	-	-	-	-
Mean			18.0	2.4			19.1	3.6

TABLE 15

SULFATE DATA FOR BOTTOM WATER

IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	10.5	10.5	10.5	0.0	-	-	-	-
April	24.0	37.0	30.8	6.0	44.0	44.0	44.0	0.0
May	25.0	30.0	28.3	2.2	22.5	26.0	24.3	2.5
June	21.0	30.5	26.4	4.3	29.0	33.5	31.3	3.2
July	20.5	26.5	24.0	2.6	23.5	28.0	25.8	3.2
August	18.5	23.0	20.6	1.9	28.0	28.0	28.0	0.0
September	20.0	22.5	21.0	1.3	20.5	28.0	23.5	4.0
October	22.0	28.0	25.7	3.2	18.0	35.5	25.2	9.2
November	19.0	24.0	21.2	2.6	21.5	29.0	25.5	3.8
December	21.0	28.5	24.8	5.3	-	-	-	-
Mean			23.3	5.6			28.5	6.7

Month	DISCHARGE (STA. NO. 13)							
	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	10.0	10.0	10.0	0.0	-	-	-	-
April	27.3	41.5	32.5	6.7	46.0	46.0	46.0	0.0
May	28.0	31.0	29.5	1.3	22.5	26.0	24.3	2.5
June	21.0	30.5	26.5	4.1	29.0	32.5	30.8	2.5
July	19.0	26.0	23.5	3.1	23.0	28.0	25.5	3.5
August	19.5	23.5	21.5	1.7	27.5	28.5	28.0	0.7
September	17.0	22.0	19.7	2.5	20.0	28.0	23.3	4.2
October	22.5	30.5	26.7	4.0	15.8	35.3	23.7	10.3
November	19.0	25.5	21.7	3.4	23.0	29.0	26.0	3.0
December	21.5	27.0	24.3	3.9	-	-	-	-
Mean			23.6	6.2			28.5	7.5

TABLE 16

SODIUM DATA FOR BOTTOM WATER

IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	10.5	10.5	10.5	0.0	-	-		
April	9.2	12.7	10.8	1.5	13.2	13.2	13.2	0.0
May	10.1	12.6	11.2	1.1	8.5	8.6	8.6	0.1
June	8.4	10.7	9.9	1.0	9.2	9.2	9.2	0.0
July	7.0	11.9	9.6	2.0	8.0	10.7	9.4	1.9
August	6.4	10.3	8.6	1.6	7.5	10.1	8.8	1.8
September	9.2	10.2	9.7	0.5	8.0	10.5	9.0	1.3
October	9.0	15.3	12.2	3.2	7.6	13.5	9.7	3.3
November	7.1	10.4	8.3	1.8	8.0	14.8	11.3	3.4
December	8.5	9.3	8.9	0.6	-	-	-	-
Mean			10.0	1.2			9.8	1.2

Month	DISCHARGE (STA. NO. 13)							
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	10.0	10.0	10.0	0.0	-	-	-	-
April	8.9	12.4	10.7	1.7	14.4	14.4	14.4	0.0
May	10.1	13.5	11.7	1.7	8.0	8.9	8.5	0.6
June	8.0	11.0	9.9	1.3	7.6	9.2	8.4	1.1
July	7.0	12.1	9.6	2.2	8.0	10.1	9.1	1.5
August	7.1	10.3	8.7	1.3	8.3	10.1	9.2	1.3
September	8.4	10.2	9.4	0.9	8.0	10.5	9.0	1.3
October	9.0	15.3	12.4	3.2	8.4	13.5	10.3	2.8
November	7.1	10.4	8.4	1.8	8.0	14.8	11.3	3.4
December	10.0	10.7	10.4	0.5	-	-	-	-
Mean			10.1	1.2			10.0	2.0

TABLE 17
MAGNESIUM DATA FOR BOTTOM WATER
IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	11.3	11.3	11.3	0.0	-	-	-	-
April	5.8	8.4	7.2	1.1	13.4	13.4	13.4	0.0
May	7.1	10.6	9.1	1.2	8.2	8.6	8.4	0.3
June	7.9	10.3	8.9	1.2	9.6	9.6	9.6	0.0
July	8.2	9.4	9.0	0.5	9.6	11.0	10.3	1.0
August	5.5	7.7	6.8	0.9	7.7	9.8	8.8	1.5
September	6.5	7.7	7.1	0.6	7.0	10.1	8.4	1.6
October	7.20	8.90	7.83	.93	7.2	10.3	8.5	1.6
November	5.0	7.7	6.7	1.5	8.2	9.8	9.1	0.8
December	5.3	8.4	6.9	2.2	-	-	-	-
Mean			8.1	1.5			9.6	1.7

Month	DISCHARGE (STA. NO. 13)							
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	11.5	11.5	11.5	0.0	-	-	-	-
April	5.8	9.1	7.1	1.5	13.4	13.4	13.4	0.0
May	7.7	10.3	9.0	1.1	8.6	8.6	8.6	0.0
June	7.7	9.6	8.5	0.8	9.8	10.1	10.0	0.2
July	8.9	9.4	9.2	0.2	11.5	12.2	11.9	0.5
August	5.3	7.2	6.7	1.0	8.4	9.6	9.0	0.8
September	6.7	7.7	7.4	0.6	7.7	9.8	8.9	1.1
October	7.9	8.2	8.0	0.2	8.2	10.1	8.9	1.0
November	7.2	8.6	7.8	0.7	8.2	10.8	9.5	1.3
December	7.4	7.9	7.7	0.4	-	-	-	-
Mean			8.3	1.4			10.0	1.7

TABLE 18

TOTAL ALKALINITY DATA FOR BOTTOM WATER IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

INTAKE (STA. NO. 8)

Month	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	110.0	110.0	110.0	0.0	-	-	-	-
April	88.0	101.0	94.5	5.3	104.0	104.0	104.0	0.0
May	92.0	101.0	95.0	4.1	89.0	89.0	89.0	0.0
June	91.0	97.0	94.3	3.2	89.0	100.0	94.5	7.8
July	86.0	92.0	88.8	2.5	95.0	100.0	97.5	3.5
August	84.0	92.0	87.5	3.7	96.0	96.0	96.0	0.0
September	89.0	104.0	95.7	7.6	86.0	95.0	90.3	4.5
October	90.0	97.0	93.7	3.5	92.0	102.0	96.7	5.0
November	87.0	94.0	90.3	3.5	90.0	100.0	95.3	5.0
December	87.0	93.0	90.0	4.2	-	-	-	-
Mean			94.0	6.3			96.0	4.8

DISCHARGE (STA. NO. 13)

Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	110.0	110.0	110.0	0.0	-	-	-	-
April	87.0	98.0	94.8	5.3	107.0	107.0	107.0	0.0
May	91.0	104.0	96.5	5.8	91.0	92.0	91.5	0.7
June	95.0	96.0	95.5	0.6	90.0	100.0	95.0	7.1
July	89.0	96.0	92.0	2.9	95.0	100.0	97.5	3.5
August	85.0	94.0	88.3	4.0	93.0	98.0	95.5	3.5
September	88.0	96.0	92.7	4.2	88.0	96.0	91.7	4.0
October	92.0	111.0	98.3	11.0	92.0	100.0	95.7	4.0
November	90.0	95.0	91.7	2.9	92.0	99.0	95.8	3.5
December	90.0	95.0	92.5	3.5	-	-	-	-
Mean			95.2	5.9			96.2	4.8

TABLE 19

NITRATE DATA FOR BOTTOM WATER
IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	17.00	17.00	17.00	0.00	-	-	-	-
April	1.99	14.90	7.46	6.19	5.40	5.40	5.40	0.00
May	0.15	13.50	6.30	5.50	1.70	14.20	8.00	8.80
June	0.00	8.00	4.20	4.00	7.30	8.70	8.00	1.00
July	0.00	7.70	3.80	3.30	5.10	7.70	6.40	1.80
August	0.00	1.20	0.40	0.60	1.40	2.70	2.10	1.00
September	0.00	2.70	1.00	1.50	0.60	2.40	1.60	1.00
October	0.50	8.00	3.40	4.10	0.30	1.20	0.80	0.50
November	1.50	2.60	1.97	0.57	5.10	7.90	6.60	1.40
December	2.40	3.60	3.00	0.85	-	-	-	-
Mean			4.90	4.79			4.86	2.93

Month	DISCHARGE (STA. NO. 13)							
	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	17.00	17.00	17.00	0.00	-	-	-	-
April	1.20	17.00	7.81	7.41	6.40	6.40	6.40	0.00
May	0.15	13.50	6.80	5.50	1.70	12.00	6.90	7.30
June	0.00	7.70	4.30	3.80	7.70	11.50	9.60	2.70
July	0.00	8.40	3.70	3.70	4.50	9.30	6.90	3.40
August	0.00	1.20	0.50	0.50	2.30	3.10	2.70	0.60
September	0.00	2.70	1.20	1.40	0.30	1.70	1.20	0.80
October	0.50	7.70	3.13	3.97	0.30	2.00	1.20	0.90
November	0.90	5.10	3.00	2.10	6.50	7.30	7.00	0.50
December	2.00	3.70	2.90	1.20	-	-	-	-
Mean			5.03	4.76			5.24	3.12

TABLE 20

PHOSPHORUS DATA FOR BOTTOM WATER

IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	0.28	0.28	0.28	0.00	-	-	-	-
April	0.06	0.12	0.09	0.03	0.02	0.02	0.02	0.00
May	0.02	0.27	0.09	0.12	0.01	0.07	0.04	0.04
June	0.01	0.04	0.03	0.02	0.02	0.04	0.03	0.01
July	0.02	0.07	0.04	0.02	0.02	0.12	0.07	0.07
August	0.01	0.06	0.04	0.02	0.02	0.02	0.02	0.00
September	0.00	0.05	0.02	0.03	0.01	0.04	0.03	0.02
October	0.00	0.05	0.02	0.02	0.01	0.11	0.06	0.05
November	0.02	0.03	0.02	0.01	0.01	0.09	0.05	0.04
December	0.01	0.07	0.04	0.04	-	-	-	-
Mean			0.07	0.08			0.04	0.02

Month	DISCHARGE (STA. NO. 13)							
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	0.26	0.26	0.26	0.00	-	-	-	
April	0.02	0.10	0.06	0.04	0.02	0.02	0.02	0.00
May	0.02	0.44	0.13	0.21	0.01	0.08	0.05	0.05
June	0.01	0.05	0.04	0.02	0.03	0.04	0.04	0.01
July	0.03	0.09	0.06	0.03	0.02	0.12	0.07	0.07
August	0.01	0.06	0.03	0.02	0.01	0.02	0.02	0.01
September	0.00	0.07	0.03	0.04	0.02	0.07	0.0	0.03
October	0.00	0.06	0.03	0.03	0.03	0.08	0.0	0.04
November	0.02	0.03	0.03	0.01	0.01	0.11	0.0	0.05
December	0.02	0.06	0.04	0.03	-	-	-	-
Mean			0.07	0.07			0.05	0.02

TABLE 21

SILICA DATA FOR BOTTOM WATER

IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	-	-	-	-	-	-	-	-
April	0.10	3.09	0.96	1.43	0.83	0.83	0.83	0.00
May	0.00	0.23	0.10	0.10	0.07	1.36	0.72	0.91
June	0.17	0.74	0.47	0.28	0.28	0.55	0.42	0.19
July	0.40	1.20	0.77	0.36	0.44	0.45	0.45	0.01
August	0.11	0.38	0.27	0.17	0.04	0.23	0.14	0.13
September	0.06	0.71	0.32	0.34	0.09	0.28	0.16	0.11
October	0.06	0.19	0.12	0.07	0.04	0.13	0.07	0.05
November	0.03	0.12	0.09	0.05	0.07	0.59	0.34	0.26
December	0.19	0.24	0.22	0.04	-	-	-	-
Mean			0.37	0.31			0.39	0.27

DISCHARGE (STA. NO. 13)

Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	-	-	-	-	-	-	-	-
April	0.06	3.50	0.98	1.68	1.29	1.29	1.29	0.00
May	0.0	0.29	0.13	0.12	0.07	1.41	0.74	0.95
June	0.16	0.78	0.46	0.26	0.22	0.62	0.42	0.28
July	0.33	0.91	0.57	0.25	0.47	0.65	0.56	0.13
August	0.10	0.44	0.27	0.18	0.02	0.19	0.11	0.12
September	0.06	0.59	0.28	0.28	0.07	0.36	0.22	0.15
October	0.09	0.19	0.13	0.06	0.07	0.10	0.09	0.02
November	0.03	0.16	0.10	0.07	0.11	0.64	0.35	0.27
December	0.16	0.26	0.21	0.07	-	-	-	-
Mean			0.35	0.28			0.47	0.40

TABLE 22

BIOCHEMICAL OXYGEN DEMAND DATA FOR BOTTOM WATER IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
INTAKE (STA. NO. 8)								
March	3.00	3.00	3.00	0.00	-	-	-	-
April	0.92	4.00	2.70	1.30	4.0	4.0	4.0	0.0
May	0.50	3.0	1.40	1.10	4.0	2.0	3.0	1.4
June	1.00	3.10	2.00	1.20	4.0	3.0	3.5	0.7
July	2.00	4.00	3.00	1.00	2.0	3.0	2.5	0.7
August	3.00	3.00	3.00	0.00	2.0	2.0	2.0	0.0
September	2.00	3.00	2.33	0.58	1.0	3.0	2.3	1.2
October	2.00	3.00	2.33	0.58	2.0	4.0	2.7	1.2
November	1.00	2.00	1.70	0.60	2.0	2.0	2.0	0.0
December	1.00	2.00	1.50	0.71	-	-	-	-
Mean			2.30	0.63			2.8	0.7
DISCHARGE (STA. NO. 13)								
March	3.00	3.00	3.00	0.00	-	-	-	-
April	2.00	4.50	3.40	1.10	4.0	4.0	4.0	0.0
May	0.60	4.00	2.40	1.50	2.0	3.0	2.5	0.7
June	1.00	3.00	2.10	0.90	3.0	5.0	4.0	1.4
July	1.00	3.00	2.30	1.20	3.0	3.0	3.0	0.0
August	2.00	4.00	3.00	0.80	2.0	3.0	2.5	0.7
September	2.00	3.00	2.67	0.58	2.0	4.0	3.0	1.0
October	2.00	4.00	3.00	1.00	3.0	4.0	3.7	0.6
November	2.00	3.00	2.30	0.60	1.0	4.0	2.3	1.5
December	1.00	2.00	1.50	0.71	-	-	-	
Mean			2.57	0.56			3.13	0.7

TABLE 23

TEMPERATURE DATA FOR BOTTOM WATER

IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (°C)				Operational Data (°C)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	-	-	-	-	-	-	-	-
April	6.0	10.0	7.7	1.7	10.0	10.0	10.0	0.0
May	14.0	20.0	15.8	2.8	10.4	17.8	14.1	5.2
June	18.0	21.5	20.0	1.5	21.0	24.2	22.6	2.3
July	22.0	24.0	22.6	1.0	24.0	24.0	24.0	0.0
August	22.0	24.2	23.1	1.2	21.5	23.0	22.3	1.1
September	18.0	20.5	19.3	1.3	18.0	21.7	19.8	1.9
October	9.0	13.0	11.2	2.0	8.0	11.2	9.5	1.6
November	5.0	10.0	8.2	2.8	4.0	10.2	6.9	3.1
December	-	-	-	-	-	-	-	
Mean			16.0	6.3			16.2	6.8

Month	DISCHARGE (STA. NO. 13)							
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	-	-	-	-	-	-	-	-
April	7.5	10.0	8.6	1.1	10.5	10.5	10.5	0.0
May	14.0	20.0	15.8	2.8	10.4	18.0	14.2	5.4
June	19.0	21.0	20.2	1.1	21.5	24.7	23.1	2.3
July	22.0	24.1	22.9	0.9	23.5	25.0	24.3	1.1
August	21.5	24.5	23.0	1.5	21.5	23.0	22.3	1.1
September	18.0	20.5	19.2	1.3	18.5	22.1	19.9	1.9
October	8.5	13.0	11.0	2.3	8.5	11.5	9.9	1.5
November	5.0	10.5	7.9	2.8	4.0	10.1	6.9	3.1
December	-	-	-	-	-	-	-	-
Mean			16.1	6.2			16.4	6.8

TABLE 24

OPERATIONAL WATER QUALITY PARAMETERS FALLING OUTSIDE OF THE RANGE OF PRE-OPERATIONAL VALUES AT STATION 13

PARAMETER	Nearest Number of Standard Deviation Units Outside the Pre-operational Range										
	MONTH										
	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Sum of Difference
Dissolved Oxygen		-5	+1	0	0	0	0	0	-3		- 7
Hydrogen-ions(pH)		0	0	0	0	0	+2	-1	0		+ 1
Transparency		0	0	0	0	0	0	0	0		0
Turbidity		0	+4	+3	0	0	+2	0	0		+ 9
Suspended Solids		0	+5	0	0	0	+2	+2	+5		+14
Conductivity		+2	0	0	0	0	0	0	0		+ 2
Dissolved Solids		0	0	0	0	0	0	-1	0		- 1
Calcium		0	0	0	0	0	0	0	+1		+ 1
Chloride		0	0	0	0	0	0	0	+2		+ 2
Sulfate		+1	-3	0	0	+3	+1	0	0		+ 2
Sodium		+1	-1	0	0	0	0	0	+1		+ 1
Magnesium		+3	0	+1	+13	+2	+2	+4	+1		+26
Total Alkalinity		+2	0	0	+1	0	0	0	0		+ 3
Nitrate		0	0	+1	0	+3	0	0	+1		+ 5
Phosphorus		0	0	0	0	0	0	0	+3		+ 3
Silica		0	+4	0	0	0	0	0	+3		+ 7
Biochemical Oxygen Demand		0	0	+1	0	0	0	0	0		+ 1
Temperature		0	0	+2	0	0	0	0	0		+ 2

TABLE 25

MEAN WATER QUALITY VALUES FOR PRE-OPERATIONAL AND OPERATIONAL PERIODS IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

PARAMETER	UNITS	PRE-OPERATIONAL		OPERATIONAL		PERCENT CHANGE	
		Sta. 8	Sta. 13	Sta. 8	Sta. 13	Sta. 8	Sta. 13
Dissolved Oxygen	ppm	9.9	10.0	9.4	9.1	-5.1	-9.0
Hydrogen-ions	pH	8.3	8.3	8.3	8.3	0.0	0.0
Transparency	m	0.55	0.48	0.56	0.49	+1.8	+2.1
Turbidity	F.T.U.	33.4	35.1	34.9	38.9	+4.5	+10.8
Suspended Solids	mg/l	33.7	40.4	39.4	46.8	+17.0	+15.8
Conductivity	µmhos/cm	293.3	296.2	303.7	309.3	+3.5	+4.4
Dissolved Solids	mg/l	181.2	185.0	172.6	178.5	-4.7	-3.5
Calcium	mg/l	36.5	36.7	36.6	37.0	+0.3	+0.8
Chloride	mg/l	17.8	18.0	18.8	19.1	+5.6	+6.1
Sulfate	mg/l	23.3	23.6	28.5	28.5	+22.3	+20.8
Sodium	mg/l	10.0	10.1	9.8	10.0	-2.0	-1.0
Magnesium	mg/l	8.1	8.3	9.6	10.0	+18.5	+20.5
Total Alkalinity	mg/l	94.0	95.2	96.0	96.2	+2.1	+1.1
Nitrate	mg/l	4.90	5.03	4.86	5.24	-0.8	+4.2
Phosphorus	mg/l	0.07	0.07	0.04	0.05	-42.9	-28.6
Silica	mg/l	0.37	0.35	0.39	0.47	+5.4	+34.3
Biochemical Oxygen Demand (BOD)	mg/l	2.30	2.57	2.80	3.13	+21.7	+21.8
Temperature	C°	16.0	16.1	16.2	16.4	+1.3	+1.9

TABLE 26

PLANKTON AND WATER QUALITY SAMPLING DATES

Month \ Year	1973[1]	1974	1975	1976	1977	1978	1979
March				18			
April		18	22	14	26		
May	25	22	29	17	24	11	1 and 23
June	27	19	16	16	22	29	21
July	25	17	14	20	13	25	28
August	23	22	11	18	30	17	29
September	26	10	8	14	12	15	27
October		9	6	19	26	17	30
November	6	7	3	2	22	1	28
December	4		16				

[1] No phytoplankton collections.

TABLE 27

PHYTOPLANKTON AND ZOOPLANKTON SAMPLING STRUCTURE, 1973-1979[1]

Station	1973[2]	1974	1975	1976	1977	1978	1979
1	X	X	X	X	X	X	X
2							
3	X	X	X	X	X	X	X
4							
5	X						
6		X	X	X	X	X	X
7	X						
8	X	X	X	X	X	X	X
9	X	X	X				
10	X	X	X				
11							
12	X	X	X	X			
13	X	X	X	X	X	X	X
14		X	X	X	X	X	X
15							
16							
17	X						
18	X	X	X	X	X	X	X
19	X	X	X				
20	X						
21							
22							
23							
24							
25							
26				X			
27				X			
28				X			
29				X			
First Month Last Month	May December	April November	April December	March November	April November	May November	May November

[1] All samples were collected by a vertical tow with a Wisconsin plankton net; 12cm mouth 0.064 mm mesh in 1973 and 1974 and 0.080 mm mesh from 1975-1979.

[2] No phytoplankton sampling; Zooplankton only.

TABLE 28

PRE-OPERATIONAL AND OPERATIONAL PHYTOPLANKTON DATA FROM LAKE ERIE IN THE VICINITY OF THE DAVIS-BESSE NUCLEAR POWER STATION

	BACILLARIOPHYCEAE							
	Pre-Operational Data[1] (no/l)				Operational Data[2] (no/l)			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	---	---	22404	---	---	---	---[3]	---
April	7531	216609	105938	85684	---	---	733663[3]	---
May	2080	167574	69785	78218	35855	408898	222377	263781
June	90	6573	2131	2991	1628	11078	6353	6682
July	285	2556	1206	1073	1830	10882	6356	6401
August	772	20481	7513	8870	3372	5712	4542	1655
September	907	17383	7577	8674	4996	18138	11688	6574
October	5958	34799	24927	16432	12505	89804	53004	38782
November	7993	13002	10584	2509	16471	105250	46563	50830
December	---	---	79879	---	---	---	---	---
Mean	3202	59872	33194	37727	10951	92823	135568	252388
	CHLOROPHYCEAE							
March	---	---	32	---	---	---	---[3]	---
April	102	2888	916	1323	---	---	261[3]	---
May	432	2110	1167	716	700	2416	1558	1213
June	904	8347	4604	3951	1574	5556	3565	2816
July	1024	3384	1955	1012	4092	26052	15072	15528
August	793	5910	2362	2194	3791	4192	3992	284
September	2921	9511	5780	3381	2843	10034	27956	37443
October	7366	21872	13686	7431	16665	27160	21208	5388
November	1691	21198	11544	9755	27141	117566	48414	61348
December	---	---	1522	---	---	---	---	---
Mean	1904	9528	4357	4706	8115	27568	15253	16785

[1]Results from samples collected from 1974 through August 1977.

[2]Results from samples collected from September 1977 through 1979.

[3]April sample actually collected May 1.

TABLE 28 (cont'd)

PRE-OPERATIONAL AND OPERATIONAL PHYTOPLANKTON DATA FROM LAKE ERIE IN THE VICINITY OF THE DAVIS-BESSE NUCLEAR POWER STATION

	MYXOPHYCEAE							
	Pre-Operational Data[1]				Operational Data[2]			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	---	---	82	---	---	---	---	---
April	81	954	358	402	---	---	842[3]	---
May	0	688	221	315	1221	1886	1554	470
June	13	12854	3471	6269	1243	45570	23407	31344
July	313	84901	37539	35129	28878	216958	122918	132993
August	35	315263	101877	146415	69043	96697	82870	19554
September	1881	17977	7902	8780	19954	75577	171276	215727
October	5109	14203	8394	5045	19629	60168	40973	20355
November	1504	2578	2179	588	28219	31652	20275	16820
December	---	---	1563	---	---	---	---	---
Mean	1117	56177	16359	32084	24027	75501	58027	62124

TOTAL PHYTOPLANKTON

Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	---	---	22517	---	---	---	---	---
April	7860	224076	108178	88757	---	---	734777	---
May	4883	168899	71305	77644	39497	411501	225499	263047
June	1604	17817	10357	12247	4595	62414	33505	40884
July	3460	87260	41833	34760	59120	266502	162811	146641
August	1603	327915	112143	147757	76687	106244	91466	20900
September	5751	31352	21378	13705	48372	83480	211073	252015
October	19232	70129	47052	25778	99846	126796	115422	13958
November	17148	33499	24324	8357	161456	165699	115537	83236
December	---	---	82963	---	---	---	---	---
Mean	7693	121368	54205	37254	69939	174662	211261	220686

[1] Results from samples collected from 1974 through August 1977.

[2] Results from samples collected from September 1977 through 1979.

[3] April sample actually collected May 1.

TABLE 29

PRE-OPERATIONAL AND OPERATIONAL PHYTOPLANKTON DATA[1] FROM THE VICINITY OF THE INTAKE AND DISCHARGE STRUCTURES AND A CONTROL STATION

	STATION 3							
	Pre-Operational Data[2]				Operational Data[3]			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	---	---	---	---	---	---	---	---
April	5929	188717	91274	76544	---	---	737866[4]	---
May	3553	201735	74227	91342	45212	267882	156547	157451
June	1607	18380	6303	8079	8252	30840	19546	15972
July	2737	113803	48155	47231	57331	327506	192419	191043
August	1329	358252	125142	162782	48336	94904	71620	32929
September	3891	27850	16441	12020	40281	64617	207482	268801
October	12016	66619	46585	30064	152681	226943	175074	45060
November	12786	33484	20171	11552	149954	244023	138399	111850
December	---	---	---	---	---	---	---	---
Mean	5481	102539	53537	41018	71721	179531	212369	221533
	STATION 8							
March	---	---	22747	---	---	---	---	---
April	8250	142686	72523	57337	---	---	872472[4]	---
May	1634	124782	58863	62864	28665	384544	206605	251644
June	1348	22427	7242	10174	1945	6778	4362	3417
July	2313	80734	39508	32224	31659	94904	63282	44721
August	1562	389417	133684	182880	116805	181824	149315	45975
September	5528	28524	19847	12473	36743	82952	200363	244475
October	14883	52375	35282	18963	71015	116363	96087	23051
November	15181	43947	26842	14813	93383	199435	103448	91371
December	---	---	79075	---	---	---	---	---
Mean	6337	111737	49561	37676	54316	152400	211992	275361
	STATION 13							
March	---	---	21247	---	---	---	---	---
April	6657	193221	113796	78639	---	---	889947[4]	---
May	4224	191170	78251	87463	36594	429182	232888	277602
June	1597	23356	9191	10200	3961	85402	44682	57587
July	2139	53265	35461	23674	47743	260850	154297	150689
August	1679	405706	132161	186211	96672	119697	108185	16281
September	6444	40540	23973	17068	46421	89766	276358	361375
October	17977	98873	52447	41752	77695	136376	115918	33129
November	13995	26408	20205	6207	75855	111081	66422	50057
December	---	---	83306	---	---	---	---	---
Mean	6839	129067	57004	42833	54992	176051	236087	275701

[1]Data presented as number of whole organisms per liter.

[2]Data collected from 1974 through August 1977.

[3]Data collected from September 1977 through 1979.

[4]April sample actually collected May 1, 1979.

TABLE 30

PRE-OPERATIONAL AND OPERATIONAL ZOOPLANKTON DATA FROM THE LOCUST POINT AREA

	ROTIFERS							
	Pre-Operational Data[1] (no/l)				Operational Data[2] (no/l)			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	---	---	27	---	---	---	---	---
April	39	362	169	138	---	---	200[3]	---
May	94	479	304	166	170	264	217	66
June	87	234	149	71	33	70	52	26
July	35	573	259	234	39	102	71	45
August	23	592	292	213	36	41	39	4
September	119	369	241	128	82	213	214	132
October	73	681	280	347	70	120	100	26
November	143	513	282	164	15	49	25	21
December	219	236	228	12	---	---	---	---
Mean	92	449	223	86	64	123	115	82
	COPEPODS							
March	---	---	5	---	---	---	---	---
April	24	46	35	9	---	---	44[3]	---
May	233	851	400	255	31	195	113	116
June	182	591	340	165	91	262	177	121
July	62	423	186	148	126	176	151	35
August	33	163	77	51	87	141	114	38
September	66	177	103	51	47	109	86	34
October	67	105	82	20	59	67	55	14
November	24	119	68	42	25	48	28	19
December	32	52	42	14	---	---	---	---
Mean	80	281	134	134	67	143	96	53

[1] Results from samples collected from 1973 through August 1977.
[2] Results from samples collected from September 1977 through 1979.
[3] April sample actually collected May 1.

TABLE 30 (cont'd)

PRE-OPERATIONAL AND OPERATIONAL ZOOPLANKTON DATA FROM THE LOCUST POINT AREA

	CLADOCERAN							
	Pre-Operational Data[2] (no/l)				Operational Data[2] (no/l)			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	---	---	0.2	---	---	---	---	---
April	0	11	3	5	---	---	2[3]	---
May	8	130	45	49	1	162	82	114
June	103	335	198	90	64	360	212	209
July	39	188	134	61	73	122	98	35
August	2	39	25	15	72	92	82	14
September	29	205	104	74	30	192	90	89
October	26	211	101	97	27	56	37	16
November	17	58	34	18	16	26	14	13
December	12	24	18	8	---	---	---	---
Mean	26	133	66	65	40	144	77	66
	TOTAL ZOOPLANKTON							
March	---	---	32	---	---	---	---	---
April	77	439	217	157	---	---	245[3]	---
May	555	1086	819	191	295	536	416	170
June	707	1365	902	266	483	518	501	25
July	306	1168	911	345	252	370	811	624
August	144	825	454	249	250	334	292	59
September	391	627	500	110	251	557	461	182
October	259	831	489	302	159	246	253	97
November	256	650	391	178	55	135	71	58
December	275	303	289	20	---	---	---	---
Mean	330	810	500	296	249	385	381	222

[1]Results from samples collected from 1973 through August 1977.

[2]Results from samples collected from September 1977 through 1979.

[3]April sample actually collected May 1.

TABLE 31

PRE-OPERATIONAL AND OPERATIONAL ZOOPLANKTON DATA IN THE VICINITY OF THE INTAKE AND DISCHARGE STRUCTURES AND A CONTROL STATION

	STATION 3							
	Pre-Operational Data[1] (no/l)				Operational Data[2] (no/l)			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	---	---	---	---	---	---	---	---
April	54	323	177	118	---	---	207[3]	---
May	415	1007	682	261	327	568	448	170
June	640	1210	862	218	489	535	512	33
July	265	1211	642	360	550	802	676	178
August	223	731	371	244	257	271	264	10
September	386	742	507	163	230	541	378	156
October	214	855	492	329	112	265	254	137
November	248	520	367	138	42	151	72	69
December	---	---	280	---	---	---	---	---
Mean	306	825	487	215	287	448	351	192
	STATION 8 (Intake)							
March	---	---	30	---	---	---	---	---
April	56	318	151	115	---	---	218	---
May	265	846	656	268	124	657	391	377
June	504	1673	897	526	337	386	362	35
July	216	918	487	328	319	1285	802	683
August	100	435	303	148	228	291	260	45
September	243	564	394	133	263	412	329	76
October	256	513	354	139	154	252	247	91
November	225	489	323	144	34	137	64	63
December	---	---	234	---	---	---	---	---
Mean	233	720	383	250	208	489	334	215
	STATION 13 (Discharge)							
March	---	---	33	---	---	---	---	---
April	63	482	223	184	---	---	287	---
May	454	1421	894	350	243	354	299	78
June	621	1230	872	222	498	563	531	46
July	387	1243	808	413	337	1433	885	775
August	136	793	446	262	197	403	300	146
September	363	533	459	83	249	513	505	253
October	282	984	565	370	176	179	265	152
November	237	569	375	140	80	127	72	59
December	170	346	258	124	---	---	---	---
Mean	301	845	493	292	254	510	393	245

[1]Data collected from 1973 through August 1977.

[2]Data collected from September 1977 through 1979.

[3]April sample actually collected May 1.

TABLE 32

BENTHIC MACROINVERTEBRATE SAMPLING DATES

Month \ Year	1973	1974	1975	1976	1977	1978	1979
March				18			
April		17-18	23	9	27		
May	25	22-23	21	4		11	30
June		19-20	19	7	22		
July	2, 26-1	17	17	5		26	29
August	23	14	19	5	16		
September	19-26	6	11	3		26	30
October		10	9	5	3		
November	2-7	7	6	1		1	4
December	4		16				

TABLE 33

BENTHIC MACROINVERTEBRATE
SAMPLING STRUCTURE, 1973-1979[1]

Station	1973	1974	1975	1976	1977	1978	1979
1	X	X	X	X	X	X	X
2	X	X	X				
3	X	X	X	X	X	X	X
4	X	X	X				
5	X	X	X				
6	X	X	X	X			
7	X	X	X	X			
8	X	X	X	X	X	X	X
9	X	X	X	X	X	X	X
10	X	X	X				
11	X	X	X	X			
12	X	X	X	X			
13	X	X	X	X	X	X	X
14	X	X	X	X	X	X	X
15	X	X	X	X	X	X	X
16	X	X	X	X			
17	X	X	X	X	X	X	X
18	X	X	X	X	X	X	X
19	X	X	X				
20	X	X[2]					
21							
22							
23							
24							
25							
26				X	X	X	X
27				X			
28				X			
29				X			
First Month	May	April	April	March	April	May	May
Last Month	December	November	December	November	October	November	November
Frequency	Monthly	Monthly	Monthly	Monthly	Every-other-month	Every-other-month	Every-other-month

[1] Three replicate grab samples with a ponar dredge (A=0.052 m^2) were collected at the stations indicated each year except 1973 when only one grab was collected at each station.

[2] Samples were collected only in April as water at this station was removed after this date to allow construction on the intake pumps.

TABLE 34

PRE-OPERATIONAL AND OPERATIONAL BENTHIC MACROINVERTEBRATE DENSITIES[1] FROM LAKE ERIE IN THE VICINITY OF THE DAVIS-BESSE NUCLEAR POWER STATION

	COELENTERATA							
	Pre-Operational Data[2]				Operational Data[3]			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	---	---	0	---	---	---	---	---
April	0	3	1	2	---	---	---	---
May	9	51	21	20	1	21	11	14
June	0	210	89	89	---	---	---	---
July	0	5	2	2	0	4	2	3
August	0	7	2	3	---	---	---	---
September	1	36	10	17	1	40	21	20
October	2	72	30	37	---	---	57	---
November	7	98	32	44	17	74	46	40
December	0	27	14	19	---	---	---	---
Mean	2	57	20	27	5	35	27	23
	ANNELIDA							
March	---	---	113	---	---	---	---	---
April	506	1448	923	473	---	---	---	---
May	368	1153	637	358	302	306	304	3
June	547	822	705	101	---	---	---	---
July	481	1417	918	397	564	1947	1256	978
August	212	2212	1254	736	---	---	---	---
September	1012	2715	1561	783	443	813	628	262
October	767	2226	1305	801	---	---	1371	---
November	654	1705	1157	509	496	1788	1142	914
December	140	1543	842	992	---	---	---	---
Mean	521	1693	942	409	451.2	1214	940	455
	ARTHROPODA							
March	---	---	11	---	---	---	---	---
April	29	149	89	68	---	---	---	---
May	71	107	120	60	257	330	294	52
June	105	700	449	218	---	---	---	---
July	243	1146	491	437	169	2346	1258	1539
August	109	1583	642	562	---	---	---	---
September	96	1035	602	407	275	601	438	231
October	270	729	440	252	---	---	180	---
November	124	3016	896	1415	239	737	488	352
December	30	217	124	132	---	---	---	---
Mean	120	976	386	290	235	1004	532	424

[1]Data presented as number of organisms per square meter.

[2]Data collected from 1973 through August 1977.

[3]Data collected from September 1977 through 1979.

TABLE 34 (cont'd)

PRE-OPERATIONAL AND OPERATIONAL BENTHIC MACROINVERTEBRATE DENSITIES[1] FROM LAKE ERIE IN THE VICINITY OF THE DAVIS-BESSE NUCLEAR POWER STATION

	MOLLUSCA							
	Pre-Operational Data[2]				Operational Data[3]			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	---	---	4	---	---	---	---	---
April	0	2	1	1	---	---	---	---
May	0	4	2	2	0	1	1	1
June	0	5	2	2	---	---	---	---
July	1	3	2	1	0	0	0	0
August	0	4	1	2	---	---	---	---
September	0	4	2	2	0	1	1	1
October	0	2	1	1	---	---	1	---
November	0	3	1	1	0	0	0	0
December	0	1	1	1	---	---	---	---
Mean	0	3	2	1	0	1	1	1

	TOTAL BENTHIC MACROINVERTEBRATE POPULATION							
March	---	---	127	---	---	---	---	---
April	540	1592	1018	535	---	---	---	---
May	537	1216	777	315	560	653	607	66
June	653	1557	1241	363	---	---	---	---
July	772	2559	1399	805	737	2346	1542	1138
August	321	2782	1893	1008	---	---	---	---
September	1254	3753	2179	1116	601	1090	846	346
October	1065	3027	1767	1094	---	---	1609	---
November	894	4492	2090	1675	737	2044	1391	924
December	170	1788	979	1144	---	---	---	---
Mean	690	2530	1347	649	659	1533	1199	447

[1]Data presented as number of organisms per square meter.

[2]Data collected from 1973 through August 1977.

[3]Data collected from September 1977 through 1979.

TABLE 35

PRE-OPERATIONAL AND OPERATIONAL BENTHIC MACROINVERTEBRATE DATA[1] FROM THE VICINITY OF THE INTAKE AND DISCHARGE STRUCTURES AND A CONTROL STATION

Month	Pre-Operational Data[2] Min	Pre-Operational Data[2] Max	Pre-Operational Data[2] Mean	Pre-Operational Data[2] Std Dev	Operational Data[3] Min	Operational Data[3] Max	Operational Data[3] Mean	Operational Data[3] Std Dev
STATION 3 (CONTROL)								
March	---	---	---	---	---	---	---	---
April	172	1910	1044	816	---	---	---	
May	376	1662	824	604	923	955	939	23
June	1356	4181	2591	1451	---	---	---	---
July	1448	3565	2529	1008	19	204	112	131
August	0	2776	1248	1151	---	---	---	---
September	1191	2540	1828	648	280	382	331	72
October	1719	2903	2209	618	---	---	83	---
November	1573	3247	2320	739	96	4081	2089	2818
December	---	---	2660	---	---	---	---	---
Mean	979	2848	1917	711	330	1406	711	844
STATION 8 (INTAKE)								
March	---	---	57	---	---	---	---	---
April	64	3361	1598	1642	---	---	---	---
May	255	1483	906	506	89	592	341	356
June	573	1598	1387	455	---	---	---	---
July	458	1834	1127	700	554	3031	1793	1752
August	18	4164	1328	1639	---	---	---	---
September	1229	3095	2178	1003	618	1496	1057	621
October	414	2604	1488	1096	---	---	611	---
November	172	1995	1125	819	649	1706	1178	747
December	51	325	188	194	---	---	---	---
Mean	359	2273	1138	636	478	1706	996	559
STATION 13 (DISCHARGE)								
March	---	---	191	---	---	---	---	---
April	83	1293	417	585	---	---	---	---
May	280	901	498	280	669	1178	924	360
June	337	1776	884	543	---	---	---	---
July	181	5068	2594	2374	649	1490	1070	595
August	89	3120	1319	1257	---	---	---	---
September	1827	3795	2701	851	140	1012	576	617
October	337	5100	2171	2563	---	---	592	---
November	337	1490	874	700	121	1834	978	1211
December	255	2497	1376	1585	---	---	---	---
Mean	414	2782	1303	907	395	1379	828	229

[1]Data presented as number of organisms per square meter.

[2]Data collected from 1973 through August 1977.

[3]Data collected from September 1977 through 1979.

TABLE 36

GILL NET SAMPLING DATES

Month \ Year	1973	1974	1975	1976	1977	1978	1979
April		25-26	17-18	12-13	18-19		30-1 (May)
May		21-22	22-23	10-11	16-17	18-19	30-31
June		13-14	16-17	14-15	13-14	29-30	20-21
July	2-3	10-11	14-15	14-15	12-13	24-25	28-29
August	2-3, 30-31	19-20	11-12	11-12	9-10	17-18	28-29
September	28-29	12-13	8-9	30-1	13-14	24-25	29-30
October		16-17	6-7		20-21	17-18	27-28
November	12-13	25-26	3-4, 17-18	4-5		1-2	3-4
December			16-17				

TABLE 37

PRE-OPERATIONAL AND OPERATIONAL GILL NET CATCHES[1] OF SELECTED SPECIES FROM LAKE ERIE IN THE VICINITY OF THE DAVIS-BESSE NUCLEAR POWER STATION DISCHARGE (STATION 13)

	ALEWIFE							
	Pre-Operational Data[2]				Operational Data[3]			
Month	Min.	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
April	0	10	3	5	---	---	0	---
May	0	44	30	20	0	0	0	0
June	0	43	19	19	0	1	1	1
July	0	159	49	68	0	0	0	0
August	0	72	14	32	0	6	3	4
September	0	200	87	102	1	136	48	76
October	4	322	117	178	36	88	41	44
November	0	47	16	22	41	52	47	8
December	---	---	0	---	---	---	---	---
Mean	1	112	37	40	11	40	18	23
	CHANNEL CATFISH							
April	0	1	0	1	---	---	1	---
May	0	1	1	1	0	0	0	0
June	0	7	2	3	3	6	5	2
July	1	18	6	7	3	4	4	1
August	0	5	2	2	0	0	0	0
September	0	2	1	1	0	0	0	0
October	0	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0	0
December	---	---	0	---	---	---	---	---
Mean	0	4	1	2	1	1	1	2
	FRESHWATER DRUM							
April	0	17	4	9	---	---	4	---
May	0	4	1	2	1	1	1	0
June	3	9	5	3	20	75	48	39
July	1	50	18	20	0	14	7	10
August	0	12	5	5	0	6	3	4
September	0	11	4	5	0	3	1	2
October	0	7	4	4	0	0	0	0
November	0	0	0	0	0	0	0	0
December	---	---	0	---	---	---	---	---
Mean	1	14	5	5	3	14	8	16

[1]Results presented as the number of fish per unit effort, where one unit of effort equals a 24-hour bottom set with an experimental gill net 125 ft long consisting of five 25-ft contiguous panels of ½, 3/4, 1, 1½, and 2-inch bow mesh.

[2]Results from samples collected from 1973 through August 1977.

[3]Results from samples collected from September 1977 through 1979.

TABLE 37 (cont'd)

PRE-OPERATIONAL AND OPERATIONAL GILL NET CATCHES[1] OF SELECTED SPECIES FROM LAKE ERIE IN THE VICINITY OF THE DAVIS-BESSE NUCLEAR POWER STATION DISCHARGE (STATION 13)

	GIZZARD SHAD							
	Pre-Operational Data[2]				Operational Data[3]			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
April	0	3	1	1	---	---	1	---
May	0	9	4	4	1	5	3	3
June	4	9	8	3	9	22	16	9
July	7	50	30	15	3	13	8	7
August	40	184	103	63	7	109	58	72
September	3	168	76	68	1	114	55	57
October	24	155	106	71	0	291	103	162
November	1	51	26	26	9	11	10	1
December	---	---	7	---	---	---	---	---
Mean	10	79	40	43	4	81	32	37
	SPOTTAIL SHINER							
April	58	142	97	43	---	---	58	---
May	66	1331	482	574	12	224	118	150
June	0	85	29	39	0	4	2	3
July	0	29	8	12	0	14	7	10
August	2	58	15	24	4	21	13	12
September	0	25	10	11	18	75	44	29
October	31	35	33	2	4	27	15	12
November	0	64	21	29	24	26	25	1
December	---	---	5	---	---	---	---	---
Mean	20	221	78	154	9	56	35	38
	WALLEYE							
April	0	3	1	1	---	---	0	---
May	0	2	1	1	0	1	1	1
June	0	4	2	2	0	1	1	1
July	0	15	3	7	0	4	2	3
August	0	2	1	1	0	8	4	6
September	0	1	1	1	0	1	1	1
October	0	1	0	1	0	0	0	0
November	0	0	0	0	0	0	0	0
December	---	---	0	---	---	---	---	---
Mean	0	4	1	1	0	2	1	1

[1]Results presented as the number of fish per unit effort, where one unit of effort equals a 24-hour bottom set with an experimental gill net 125 ft long consisting of five 25-ft contiguous panels of ½, 3/4, 1, 1½, and 2-inch bow mesh.

[2]Results from samples collected from 1973 through August 1977.

[3]Results from samples collected from September 1977 through 1979.

TABLE 37 (cont'd)

PRE-OPERATIONAL AND OPERATIONAL GILL NET CATCHES[1] OF SELECTED SPECIES FROM LAKE ERIE IN THE VICINITY OF THE DAVIS-BESSE NUCLEAR POWER STATION DISCHARGE (STATION 13)

	WHITE BASS							
	Pre-Operational Data[2]				Operational Data[3]			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
April	0	3	1	1	---	---	0	---
May	0	3	1	1	0	2	1	1
June	0	6	3	3	8	43	26	25
July	0	6	3	3	4	25	15	15
August	1	29	9	12	0	7	4	5
September	1	11	5	5	0	2	1	1
October	1	4	2	2	0	6	2	3
November	0	1	0	1	0	1	1	1
December	---	---	0	---	---	---	---	---
Mean	0	8	3	3	2	12	6	9
	YELLOW PERCH							
April	10	119	55	47	---	---	24	---
May	9	109	48	44	9	40	25	22
June	3	95	47	39	2	28	15	18
July	5	125	37	50	35	76	56	29
August	33	100	65	28	43	313	178	191
September	32	160	73	60	43	71	53	15
October	18	158	67	79	7	18	12	6
November	0	28	8	14	6	7	7	1
December	---	---	0	---	---	---	---	---
Mean	14	112	44	26	21	79	46	56

[1]Results presented as the number of fish per unit effort, where one unit of effort equals a 24-hour bottom set with an experimental gill net 125 ft long consisting of five 25-ft contiguous panels of ½, 3/4, 1, 1½, and 2-inch bow mesh.

[2]Results from samples collected from 1973 through August 1977.

[3]Results from samples collected from September 1977 through 1979.

TABLE 38

PRE-OPERATIONAL AND OPERATIONAL GILL NET DATA[1] FROM THE VICINITY OF THE DAVIS-BESSE NUCLEAR POWER STATION INTAKE, DISCHARGE, AND TWO CONTROL STATIONS

	STATION 3							
	Pre-Operational Data[2]				Operational Data[3]			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
April	---	---	197	---	---	---	72	---
May	---	---	49	---	98	319	209	165
June	---	---	263	---	102	239	171	97
July	---	---	110	---	71	222	147	107
August	---	---	396	---	241	267	254	18
September	---	---	---	---	178	481	331	151
October	---	---	---	---	31	178	108	74
November	---	---	---	---	162	1371	577	688
December	---	---	---	---	---	---	---	---
Mean	---	---	203	135	126	440	234	161
	STATION 8							
April	8	52	26	19	---	---	33	---
May	32	2077	676	959	20	134	77	81
June	62	260	154	98	69	196	133	90
July	85	179	122	45	86	262	174	124
August	89	166	135	38	122	208	165	61
September	61	343	203	124	174	221	191	26
October	55	652	257	342	25	93	57	34
November	4	112	49	52	12	816	288	458
December	---	---	19	---	---	---	---	---
Mean	50	480	182	202	73	276	140	83

[1]Results presented as number of fish per unit effort, where one unit of effort equals a 24-hour bottom set with an experimental gill net 125 ft long consisting of five 25-ft contiguous panels of ½, 3/4, 1, 1½, and 2-inch bar mesh.

[2]Results from samples collected from 1973 through August 1977.

[3]Results from samples collected from September 1977 through 1979.

TABLE 38 (cont'd.)

PRE-OPERATIONAL AND OPERATIONAL GILL NET DATA[1] FROM THE VICINITY OF THE DAVIS-BESSE NUCLEAR POWER STATION INTAKE, DISCHARGE, AND TWO CONTROL STATIONS

	STATION 13							
	Pre-Operational Data[2]				Operational Data[3]			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
April	88	269	166	75	---	---	88	---
May	120	1381	573	558	29	270	150	170
June	49	232	125	77	112	122	117	7
July	94	254	163	82	85	138	112	37
August	136	327	237	84	186	387	287	142
September	73	382	270	141	122	366	206	138
October	104	691	337	312	7	433	178	225
November	6	208	76	94	85	1455	544	789
December	---	---	14	---	---	---	---	---
Mean	84	468	218	166	89	453	210	150

STATION 26

April	---	---	191	---	---	---	47	---
May	---	---	44	---	34	127	81	66
June	---	---	238	---	101	175	138	52
July	---	---	41	---	118	258	188	99
August	---	---	293	---	345	348	347	2
September	---	---	---	---	41	637	336	298
October	---	---	---	---	54	71	61	9
November	---	---	---	---	28	907	328	502
December	---	---	---	---	---	---	---	---
Mean	---	---	161	114	103	360	191	129

[1]Results presented as number of fish per unit effort, where one unit of effort equals a 24-hour bottom set with an experimental gill net 125 ft long consisting of five 25-ft contiguous panels of ½, 3/4, 1, 1½, and 2-inch bar mesh.

[2]Results from samples collected from 1973 through August 1977.

[3]Results from samples collected from September 1977 through 1979.

TABLE 39

ICHTHYOPLANKTON SAMPLING DATES

Month \ Year	1973	1974	1975	1976	1977	1978	1979
March							
April			22	6, 14, 30	20, 29	30	
May		21	12, 25	10, 17, 27	21	22	1, 9, 31
June		14	2, 15, 22	11, 17, 28	2, 13, 25	8, 20	5, 21
July		10	2, 13	8, 23, 29	5, 13, 20, 27	5, 19	5, 12, 20
August		19	4, 30	9, 20, 31	12, 22	1, 11, 23	3, 15
September		12			2		
October		16					
November		25					

TABLE 40

ICHTHYOPLANKTON DENSITIES IN THE VICINITY OF THE INTAKE
OF THE DAVIS - BESSE NUCLEAR POWER STATION - 1978*

SPECIES	STAGE \ DATE	April 30	May 11	May 21	June 7	July 4	July 19	Aug. 1	Aug. 11	MEAN
Carp	Pro-larvae					0.3				0.04
	Post-larvae									
	Subtotal					0.3				0.04
Emerald Shiner	Pro-larvae					14.7				1.84
	Post-larvae					1.6		1.6	0.8	0.50
	Subtotal					16.3		1.6	0.8	2.34
Freshwater Drum	Pro-larvae			0.7		4.9				0.70
	Post-larvae					0.4				0.05
	Sub-total			0.7		5.3				0.75
Gizzard Shad	Pro-larvae				16.4				0.4	2.10
	Post-larvae				5.2	181.9	30.0	3.6	24.3	30.63
	Subtotal				21.6	181.9	30.0	3.6	24.7	32.73
Rainbow Smelt	Pro-larvae			0.7						0.09
	Post-larvae						4.2		0.6	0.60
	Subtotal			0.7			4.2		0.6	0.69
Spottail Shiner	Pro-larvae				0.3					0.04
	Post-larvae						0.4		0.2	0.08
	Subtotal				0.3		0.4		0.2	0.11
Walleye	Pro-larvae		79.2	4.0						10.40
	Post-larvae									
	Subtotal		79.2	4.0						10.40
Yellow Perch	Pro-larvae		1.4	1.8						0.40
	Post-larvae									
	Subtotal		1.4	1.8						0.40
TOTAL LARVAE	Pro-larvae		80.6	7.2	16.7	19.9			0.4	15.60
	Post-larvae				5.2	183.9	34.6	5.2	25.9	31.85
	Subtotal		80.6	7.2	21.9	203.8	34.6	5.2	26.3	47.45
EGGS					2.4					0.30

* Data presented as number of individuals per $100m^3$ and computed from 4 oblique tows (bottom to surface) collected at night.

TABLE 41
ICHTHYOPLANKTON DENSITIES IN THE VICINITY OF THE INTAKE OF THE DAVIS-BESSE NUCLEAR POWER STATION - 1979*

SPECIES	DATE / LARVAL STAGES**	May 1	May 31	June 5	June 21	July 5	July 11	July 19	August 2	August 15	MEAN
Carp	Stage 1				0.2	2.9	0.2				0.37
	Stage 2				0.1						0.01
	Stage 3										
	Subtotal				0.3	2.9	0.2				0.38
Emerald Shiner	Stage 1				10.5	144.2	1.6	0.5	0.2		17.44
	Stage 2				23.8	86.4	38.3	10.5			17.67
	Stage 3					43.3	7.9	38.3			9.94
	Subtotal				34.3	273.9	47.8	49.3	0.2		45.06
Freshwater Drum	Stage 1				3.1	7.7	38.3		0.2		5.48
	Stage 2					4.8			0.5		0.59
	Stage 3						1.0		4.8		0.64
	Subtotal				3.1	12.4	39.3		5.5		6.70
Gizzard Shad	Stage 1		33.3	82.5	61.8	91.8	25.2	8.7	0.3		33.73
	Stage 2		8.7	15.5	82.6	69.5	64.4	15.1	2.8		28.73
	Stage 3				7.8	39.4	22.1	9.5	5.5		9.37
	Subtotal		42.0	98.0	152.1	200.7	111.7	33.3	8.6		71.82
Logperch	Stage 1			3.6							0.40
	Stage 2					0.1					0.01
	Stage 3				0.1	0.1					0.02
	Subtotal			3.6	0.1	0.2					0.43
Rainbow Smelt	Stage 1		0.2	33.5				0.6			3.81
	Stage 2		9.0		0.1			2.8	1.3		1.47
	Stage 3				0.5	0.4					0.10
	Subtotal		9.2	33.5	0.6	0.4		3.4	1.3		5.38
Spottail Shiner	Stage 1					1.9					0.21
	Stage 2				0.5						0.06
	Stage 3										
	Subtotal				0.5	1.9					0.27
Unidentified	Stage 1				0.1						0.01
	Stage 2										
	Stage 3										
	Subtotal				0.1						0.01
Unidentified Percid	Stage 1										
	Stage 2		0.2								0.02
	Stage 3										
	Subtotal		0.2								0.02
Unidentified Shiner	Stage 1				0.1						0.01
	Stage 2					0.1					0.01
	Stage 3										
	Subtotal				0.1	0.1					0.02
Unidentified Sucker	Stage 1										
	Stage 2					0.1					0.01
	Stage 3										
	Subtotal					0.1					0.01
Walleye	Stage 1	0.7	0.2								0.10
	Stage 2		1.2								0.13
	Stage		0.3								0.03
	Subtotal	0.7	1.7								0.27
White Bass	Stage 1				0.1		0.3	0.3			0.08
	Stage 2		0.2		0.3	0.3	0.1	0.6			0.17
	Stage 3					0.8		0.1	0.2		0.12
	Subtotal		0.2		0.4	1.1	0.4	1.0	0.2		0.37
White Sucker	Stage 1						0.2				0.02
	Stage 2										
	Stage 3										
	Subtotal						0.2				0.02
Yellow Perch	Stage 1		7.0	16.4							2.60
	Stage 2		55.5	3.6							6.57
	Stage 3		14.7	5.0	0.2						2.21
	Subtotal		77.2	25.0	0.2						11.38
Freshwater Drum Egg					0.3	1.0	6.0				0.81
Total Ichthyoplankton	Stage 1	0.7	40.8	135.9	75.8	246.6	65.7	10.1	0.7		64.03
	Stage 2		75.0	19.1	107.4	163.2	102.8	29.1	4.5		55.68
	Stage 3		14.9	5.0	8.6	84.1	31.0	48.0	10.5		22.47
	Egg				0.3	1.0	6.0				0.81
	Subtotal	0.7	130.7	160.0	192.0	494.9	205.5	87.1	15.8		142.97

*Data presented as number of individuals per $100 m^3$ and computed from 4 oblique tows (bottom and surface) collected at night.

**This is the subtotal of the larval stages. It is the mean of the surface and bottom densities. Stage 1 = proto-larvae, no rays in fin/finfold. Stage 2 = meso-larvae, first ray seen in median fins. Stage 3 = meta-larvae, pelvic fin bud is visible.

TABLE 42

ICHTHYOPLANKTON ENTRAINMENT AT THE
DAVIS-BESSE NUCLEAR POWER STATION - 1978

Species	Period During Which Entrainment Occurred[a]	Volume of Water ($100m^3$) withdrawn during period[b]	Larvae/$100m^3$ [c]			Number of Larvae Entrained		
			Mean	95% Confidence Interval		Mean	95% Confidence Interval[d]	
				Lower Limit	Upper Limit		Lower Limit	Upper Limit
Carp	21 June - 12 July	20,443	0.32	-0.69	1.32	6,542	0	26,985
Emerald Shiner	21 June - 17 August	73,704	4.68	-7.70	17.05	344,935	0	1,256,653
Freshwater Drum	16 May - 12 July	49,951	2.00	-5.15	9.15	99,902	0	457,052
Gizzard Shad	30 May - 17 August	91,598	52.36	-38.38	143.00	4,796,071	0	13,098,514
Rainbow Smelt	16 May - 17 August	103,211	0.92	-0.80	2.64	94,954	0	272,477
Spottail Shiner	30 May - 17 August	91,598	0.18	-0.04	0.40	16,488	0	36,639
Walleye	6 May - 30 May	22,037	41.60	-436.15	519.35	916,739	0	11,444,915
Yellow Perch	6 May - 30 May	22,037	1.60	-0.94	4.14	35,259	0	91,233
TOTAL LARVAE						6,310,890		
EGGS	30 May - 21 June	18,449	2.40	-5.24	10.04	44,278	0	185,228

[a] Estimated from Table 1. See discussion on page 1.
[b] Estimated by multiplying daily discharge rate by 1.3 and adding all daily estimates for the specified period.
[c] Average concentration during their period of occurrence.
[d] Values which would have been less than zero were rounded back to zero.

TABLE 43

ICHTHYOPLANKTON ENTRAINMENT AT THE DAVIS-BESSE NUCLEAR POWER STATION - 1979

Species	Period During Which Entrainment Occurred[a]	Volume of Water ($100m^3$) Withdrawn During Period[b]	Larvae/$100m^3$ [c] Mean	Larvae/$100m^3$ [c] 95% Confidence Interval Lower Limit	Larvae/$100m^3$ [c] 95% Confidence Interval Upper Limit	Number of Larvae Entrained Mean	Number of Larvae Entrained 95% Confidence Interval Lower Limit	Number of Larvae Entrained 95% Confidence Interval Upper Limit
Carp	13 June-15 July	41,903	1.13	0.20	2.06	47,350	8,381	86,320
Emerald Shiner	13 June-9 August	84,023	81.11	33.83	128.39	6,815,106	2,842,498	10,787,713
Freshwater Drum	13 June-9 August	84,023	12.07	6.84	17.30	1,014,158	574,717	1,453,598
Gizzard Shad	16 May-9 August	110,283	92.37	62.66	122.08	10,186,841	6,910,333	13,463,349
Logperch	2 June-8 July	43,542	1.30	0.36	2.24	56,605	15,675	97,534
Rainbow Smelt	16 May-9 August	110,283	6.92	4.27	9.57	763,158	470,908	1,055,408
Spottail Shiner	13 June-8 July	32,771	1.17	-1.01	3.35	38,342	0	109,783
Unidentified	13 June-28 June	20,474	0.05	-0.10	0.20	1,024	0	4,095
Unidentified Percid	16 May-2 June	16,302	0.24	-0.52	1.00	3,912	0	16,302
Unidentified Shiner	13 June-8 July	32,771	0.08	- .05	0.21	2,622	0	6,882
Unidentified Sucker	28 June-8 July	13,477	0.12	-0.26	0.50	1,617	0	6,739
Walleye	26 April-2 June	34,138	1.22	0.64	1.80	41,648	21,848	61,448
White Bass	16 May-9 August	110,283	0.47	0.22	0.72	51,833	24,262	79,404
White Sucker	8 July-15 July	10,112	0.15	-0.33	0.64	1,517	0	6,472
Yellow Perch	16 May-28 June	46,735	34.13	27.67	40.59	1,595,066	1,293,157	1,896,974
TOTAL LARVAE						20,620,799		
F. Drum Eggs	13 June-15 July	41,903	2.42	0.85	3.99	101,405	35,618	167,193
TOTAL ICHTHYOPLANKTON						20,722,204		

[a]Estimated from Table 1. See discussion on page 1.

[b]Estimated by multiplying daily discharge rate by 1.3 and adding all daily estimates for the specified period.

[c]Average concentration during their period of occurrence.

[d]Values which would have been less than zero were rounded back to zero.

TABLE 44

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION
FROM 1 JANUARY TO 31 DECEMBER 1978

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
2 January 1978	22.09	22.41	Y	46.41
4 "	21.30	22.00	Y	47.59
5 "	16.15	17.05	N	19.05
6 "	16.39	17.17	Y	24.12
8 "	16:01	16.37	Y	47.20
12 "	16.45	17.15	N	96.73
14 "	17.50	18.30	N	49.15
20 "	20.15	20.45	Y	146.15
22 "	17.30	18.00	Y	45.55
24 "	17.00	18.24	Y	48.24
28 "	18.00	19.30	Y	97.06
30 "	20.30	21.00	Y	49.70
1 February 1978	20.45	21.15	N	48.15
3 "	20.55	21.25	Y	48.10
5 "	16.45	17.16	Y	43.91
7 "	17.30	18.00	Y	48.84
9 "	21.00	21.30	Y	51.30
11 "	17.40	18.15	Y	44.85
13 "	20.00	20.40	Y	50.25
17 "	17.00	17.30	Y	92.90
19 "	17.12	17.45	Y	48.15
21 "	20.30	21.20	N	51.75
22 "	18.40	17.20	N	20.00
23 "	19.55	20.50	N	27.30
25 "	20.57	21.40	N	48.90
27 "	18.10	19.40	Y	46.00
1 March 1978	23.00	23.40	N	52.00
2 "	16.30	17.10	N	17.70
3 "	18.00	18.35	Y	25.25
5 "	20.30	21.00	Y	50.65
6 "	21.30	22.00	N	25.00
7 "	20.15	20.50	Y	22.50
10 "	19.40	20.10	Y	71.60
11 "	19.10	19.45	Y	23.35
12 "	17.20	17.50	N	22.05
13 "	17.30	18.00	N	24.50
15 "	17.50	18.22	Y	48.22
17 "	18.50	19.20	Y	48.98
19 "	20.40	21.12	Y	49.92
21 "	19.58	20.28	N	47.16
23 "	20.50	21.26	Y	48.98
25 "	22.40	23.10	Y	49.84
26 "	18.00	18.30	N	19.20
27	20.00	21.05	N	26.75
29 "	21.19	21.56	Y	48.51

TABLE 44 (Con't.)

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION FROM 1 JANUARY TO 31 DECEMBER 1978

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
2 April 1978	19.06	19.40	Y	93.84
3 "	20.15	20.50	N	25.10
4 "	20.00	20.30	N	23.80
7 "	19.40	20.40	N	72.10
8 "	20.30	21.00	Y	24.60
9 "	20.10	20.40	N	23.40
10 "	21.00	22.00	Y	25.60
12 "	20.50	21.20	Y	47.20
13 "	20.30	21.00	N	23.80
14 "	20.30	21.00	Y	24.00
15 "	17.00	17.45	N	20.45
16 "	16.58	17.36	Y	23.91
17 "	16.30	17.45	N	24.09
18 "	17.25	17.55	Y	24.10
19 "	16.20	17.00	N	23.45
20 "	16.37	17.13	Y	24.13
22 "	18.00	18.35	Y	49.22
24 "	17.32	18.05	Y	47.70
26 "	17.15	17.45	Y	47.40
28 "	18.00	18.30	Y	48.85
30 "	23.20	23.50	Y	53.20
1 May 1978	18.30	19.00	N	19.50
2 "	18.45	19.15	Y	24.15
5 "	10.30	11.00	N	63.85
6 "	21.15	21.45	Y	34.45
8 "	20.25	20.55	Y	47.10
10 "	16.55	17.25	Y	44.70
12 "	22.00	22.30	Y	53.05
14 "	16.30	17.00	Y	42.70
16 "	16.35	17.05	Y	48.05
18 "	16.10	16.40	Y	47.35
20 "	17.00	17.30	N	48.90
22 "	19.00	20.30	Y	51.00
24 "	16.32	17.04	Y	44.74
26 "	14.40	15.10	Y	46.06
28 "	18.03	18.33	Y	51.23
30 "	15.45	16.15	Y	45.82
1 June 1978	16.25	17.00	Y	48.85
3 "	14.50	15.20	Y	46.20
5 "	18.55	19.35	Y	52.15
6 "	18.30	19.15	N	23.80
7 "	21.05	21.35	Y	26.20
9 "	21.36	22.06	Y	48.71
10 "	16.15	16.36	N	18.30
11 "	17.55	18.30	Y	25.94

TABLE 44(Con't.)

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION
FROM 1 JANUARY TO 31 DECEMBER 1978

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
12 June 1978	17.00	17.30	N	23.00
13 "	16.35	17.05	Y	23.75
15 "	12.52	13.24	Y	44.19
16 "	18.40	19.10	N	29.86
17 "	13.39	14.10	Y	19.00
19 "	18.45	19.25	N	53.15
20 "	16.25	16.55	N	21.30
21 "	16.07	16.37	Y	23.82
23 "	14.25	14.55	Y	46.18
25 "	16.10	16.50	Y	49.95
27 "	20.30	21.15	N	52.65
28 "	17.25	17.50	N	20.35
29 "	15.50	16.20	Y	22.70
30 "	16.00	16.30	N	24.10
2 July 1978	18.00	18.30	Y	50.00
4 "	17.15	17.45	Y	47.15
6 "	16.20	16.55	Y	47.10
8 "	14.20	14.50	Y	45.95
9 "	18.20	18.50	N	28.00
10 "	18.40	19.20	Y	24.70
11 "	20.45	21.16	Y	25.96
13 "	21.15	21.45	N	48.29
14 "	18.45	19.15	Y	21.70
15 "	16.25	16.55	N	21.40
16 "	16.30	17.00	Y	24.45
17 "	19.20	19.50	Y	26.50
20 "	20.15	20.50	Y	73.00
22 "	19.25	19.55	Y	47.05
24 "	17.00	17.30	Y	45.75
25 "	20.45	21.20	Y	27.90
26 "	20.15	20.45	Y	23.25
27 "	16.55	17.25	N	20.80
28 "	18.25	19.00	Y	25.75
30 "	17.16	17.46	Y	46.46
1 August 1978	17.00	17.30	Y	47.84
2 "	16.20	16.50	N	23.20
3 "	16.35	17.05	Y	24.55
4 "	19.00	19.30	N	26.25
5 "	19.02	19.37	Y	24.07
7 "	16.45	17.15	Y	45.78
9 "	19.30	20.00	Y	50.85
11 "	16.20	16.50	Y	44.50
13 "	16.43	17.18	N	48.68
14 "	22.00	22.30	N	29.12
17 "	20.20	21.30	N	71.00

TABLE 44 (Con't.)

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION FROM 1 JANUARY TO 31 DECEMBER 1978

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
19 August 1978	18.55	19.29	Y	45.99
21 "	19.20	20.15	Y	48.86
23 "	20.15	20.45	Y	48.30
25 "	18.35	19.10	Y	46.65
26 "	18.05	18.50	N	23.40
27 "	17.37	18.14	Y	23.64
29 "	16.45	17.15	Y	47.01
31 "	17.30	18.00	Y	48.85
1 September 1978	16.38	17.08	N	23.08
3 "	16.13	16.43	Y	47.35
4 "	16.35	17.25	Y	24.82
6 "	16.52	17.23	Y	47.98
8 "	18.07	18.37	Y	49.14
10 "	17.20	18.00	Y	47.63
12 "	20.13	20.45	Y	50.45
14 "	19.15	19.50	Y	47.05
16 "	17.30	18.20	N	46.70
18 "	21.30	22.05	Y	51.85
19 "	22.15	22.50	N	24.45
20 "	20.00	20.30	Y	21.80
22 "	23.00	23.30	Y	51.00
24 "	17.20	18.05	N	42.75
25 "	20.35	21.05	N	27.00
28 "	19.00	19.35	Y	70.30
30 "	16.55	17.25	Y	45.90
2 October 1978	19.25	19.55	Y	50.30
3 "	18.20	18.40	N	22.85
4 "	17.45	18.15	Y	23.75
5 "	16.30	17.01	N	22.86
6 "	20.25	21.00	N	27.99
9 "	16.25	16.55	N	67.55
10 "	17.05	17.36	Y	24.81
11 "	15.05	15.35	N	21.99
12 "	18.43	19.17	Y	27.82
13 "	16.40	17.10	N	21.93
14 "	21.34	22.04	Y	28.94
16 "	17.00	17.30	Y	43.26
20 "	17.20	17.50	Y	96.20
22 "	21.45	22.20	Y	52.70
25 "	18.20	18.50	N	68.30
26 "	16.30	17.00	Y	22.50
28 "	20.05	20.40	Y	51.40
30 "	21.10	21.45	Y	49.05

TABLE 44(Con't.)

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION
FROM 1 JANUARY TO 31 DECEMBER 1978

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
1 November 1978	18.45	19.17	Y	45.72
3 "	20.45	21.18	Y	50.01
5 "	20.08	20.40	Y	47.22
6 "	16.25	16.55	N	20.15
7 "	16.48	17.12	Y	24.57
8 "	16.40	17.10	N	23.98
9 "	16.50	17.20	Y	24.10
11 "	18.25	18.55	Y	49.35
12 "	17.05	17.35	N	22.80
13 "	18.15	18.35	Y	25.00
14 "	16.26	17.00	N	22.65
15 "	18.30	19.00	Y	26.00
17 "	20.05	20.57	N	49.57
20 "	19.45	20.30	N	71.73
21 "	20.50	21.20	N	24.90
23 "	16.15	16.45	Y	43.25
24 "	19.00	20.08	N	27.63
25 "	20.00	20.30	Y	24.22
27 "	20.30	21.00	Y	48.70
29 "	20.15	20.45	Y	47.45
1 December 1978	19.15	19.45	Y	47.00
3 "	16.28	17.08	Y	45.63
5 "	16.00	17.34	N	48.26
6 "	17.55	18.25	Y	24.91
9 "	17.55	18.25	N	72.00
10 "	19.46	20.23	N	25.98
11 "	16.30	17.00	N	20.77
12 "	17.45	18.15	N	25.15
13 "	18.04	18.34	Y	24.19
15 "	17.20	17.50	Y	47.16
17 "	18.45	19.15	Y	49.65
18 "	17.34	18.10	N	22.95
19 "	22.20	22.50	Y	28.40
20 "	18.20	18.50	N	20.00
21 "	16.25	16.59	Y	22.09
23 "	19.45	20.15	Y	51.56
24 "	19.35	20.05	N	23.90
25 "	21.50	22.20	Y	26.15
27 "	17.30	18.00	N	43.80
28 "	19.37	20.07	N	26.07
29 "	20.20	20.50	Y	24.43
30 "	17.30	19.30	N	22.80
31 "	18.35	19.08	Y	23.78

TABLE 45

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION
FROM 1 JANUARY TO 31 DECEMBER 1979

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
1 January	0.01	0.31	N	0.31
2 January	19.20	21.45	N	45.14
4 January	17.55	18.26	Y	44.81
6 January	20.25	20.55	Y	50.29
8 January	16.00	17.54	N	44.99
10 January	17.20	17.52	Y	47.98
12 January	17.40	18.15	Y	48.63
13 January	16.05	16.35	N	22.20
14 January	19.20	19.50	Y	27.15
16 January	18.26	18.56	Y	47.06
17 January	16.12	16.42	N	21.86
20 January	17.20	18.45	N	74.03
24 January	11.50	17.30	N	94.85
26 January	18.55	19.25	N	49.95
27 January	16.27	16.57	N	21.32
28 January	16.30	17.00	N	24.43
1 February	19.39	20.09	N	99.09
2 February	20.15	21.00	N	24.91
3 February	21.07	21.40	Y	24.40
5 February	17.30	18.00	Y	44.60
7 February	18.19	18.57	N	48.57
9 February	17.00	17.35	Y	46.78
11 February	19.32	20.05	Y	50.70
13 February	18.20	18.50	N	46.45
15 February	19.10	19.41	N	48.91
16 February	18.55	19.25	N	23.84
17 February	17.02	17.35	Y	22.10
19 February	17.50	18.25	Y	48.90
20 February	17.00	17.35	N	23.10
21 February	18.45	19.15	Y	25.80
23 February	19.10	19.40	Y	48.25
24 February	21.45	22.25	N	26.85
25 February	21.05	21.31	Y	23.06
26 February	21.00	21.30	N	23.99
27 February	17.50	18.25	Y	20.95
28 February	22.00	22.30	N	28.05
1 March	21.22	21.52	Y	23.22
3 March	19.33	20.03	Y	46.51
5 March	16.10	16.40	Y	44.37

TABLE 45(con't)

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION
FROM 1 JANUARY TO 31 DECEMBER 1979

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
7 March	16.52	17.22	Y	48.82
9 March	16.10	16.40	Y	47.18
10 March	21.15	21.45	N	29.05
11 March	19.30	20.00	Y	22.55
13 March	17.17	17.50	Y	45.50
17 March	19.50	20.25	N	98.75
18 March	16.45	17.15	N	20.90
19 March	20.15	20.45	Y	27.30
21 March	16.13	16.43	Y	43.98
22 March	17.03	17.33	N	24.90
23 March	19.50	20.20	Y	26.87
24 March	16.58	17.30	N	21.10
25 March	16.40	17.10	Y	23.80
26 March	16.03	16.36	N	23.26
27 March	18.40	17.12	Y	24.76
28 March	17.30	18.00	N	24.88
31 March	16.20	16.50	Y	70.50
2 April	18.10	18.42	Y	49.92
3 April	21.00	21.30	Y	26.88
4 April	20.50	21.26	N	23.96
6 April	21.40	22.10	Y	48.84
8 April	17.27	18.00	Y	43.90
9 April	19.45	20.20	N	26.20
10 April	18.10	18.40	Y	22.20
12 April	18.15	18.45	Y	48.05
13 April	19.44	20.20	N	25.75
14 April	16.30	17.00	N	20.80
16 April	18.55	19.27	N	50.27
18 April	20.45	21.15	N	49.88
19 April	22.30	23.00	N	25.85
20 April	22.00	22.38	Y	23.38
21 April	16.50	17.25	Y	18.87
22 April	18.40	19.10	N	25.85
23 April	17.20	18.00	Y	22.90
24 April	18.00	18.30	N	24.30
25 April	18.43	19.09	Y	24.79
26 April	16.35	17.06	N	21.97
27 April	16.50	17.25	N	24.19
28 April	16.55	17.30	N	24.05
29 April	19.30	20.00	Y	26.70
30 April	19.50	20.20	Y	24.20

TABLE 45 (con't)

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION
FROM 1 JANUARY TO 31 DECEMBER 1979

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
1 May	19.45	20.21	N	24.01
3 May	19.30	20.02	Y	47.81
4 May	16.50	17.20	N	21.18
5 May	16.05	16.35	N	23.15
7 May	18.25	18.55	Y	50.20
8 May	16.45	17.15	N	22.60
9 May	18.20	18.50	Y	25.35
11 May	17.35	18.05	Y	47.55
12 May	20.10	20.40	N	26.35
13 May	18.36	19.06	Y	22.66
13 May	17.17	17.49	Y	46.43
16 May	19.55	20.30	N	26.81
17 May	19.16	19.46	Y	23.16
19 May	20.05	20.35	Y	48.89
20 May	17.18	17.48	N	21.13
21 May	17.17	17.48	Y	24.00
22 May	17.17	17.48	N	24.00
23 May	16.37	17.08	Y	23.60
24 May	15.30	16.00	Y	22.92
8 June	16.25	17.00	N	361.00
9 June	19.15	19.45	N	26.45
10 June	22.30	23.00	N	27.55
11 June	19.30	20.25	N	21.25
12 June	17.43	18.15	N	21.90
13 June	23.15	23.45	N	29.30
14 June	22.30	23.00	N	23.55
15 June	23.20	23.50	N	24.50
17 June	21.38	22.08	Y	46.58
19 June	18.45	19.15	Y	45.07
21 June	18.18	19.19	N	48.04
23 June	18.40	19.15	N	47.96
25 June	20.25	21.25	Y	50.10
26 June	16.15	17.15	N	19.90
27 June	17.45	18.35	Y	25.20
28 June	22.05	22.35	N	28.00
29 June	1.00	1.30	Y	2.95

TABLE 45 (con't)

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION
FROM 1 JANUARY TO 31 DECEMBER 1979

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
1 July	20.55	21.25	Y	67.95
3 July	21.20	22.00	N	48.75
4 July	23.00	24.00	N	26.00
5 July	16.45	17.25	N	17.25
7 July	20.00	21.00	Y	51.75
8 July	22.00	23.00	N	26.00
9 July	18.35	19.35	Y	20.35
10 July	20.30	21.30	N	25.95
11 July	19.40	20.40	N	23.10
12 July	21.00	22.00	N	25.60
13 July	20.05	21.05	Y	23.05
14 July	18.15	18.45	N	21.40
15 July	18.30	19.00	Y	24.55
16 July	17.30	18.00	N	23.00
17 July	20.10	20.40	Y	26.40
18 July	17.20	17.50	N	21.10
19 July	19.10	21.00	Y	27.50
20 July	17.20	18.10	N	21.10
21 July	19.55	20.45	Y	26.35
22 July	20.00	20.30	N	23.85
25 July	20.12	20.42	Y	72.12
27 July	19.30	20.30	Y	47.88
28 July	16.45	17.15	N	20.85
29 July	16.15	19.16	Y	26.01
30 July	17.06	18.06	N	22.90
31 July	18.35	19.35	Y	25.29
1 August	16.30	17.30	N	21.95
2 August	16.45	17.45	Y	24.15
3 August	16.15	17.15	N	23.70
4 August	17.25	18.25	N	25.10
6 August	17.10	17.40	Y	47.15
7 August	16.00	17.00	N	23.60
8 August	17.35	18.05	Y	25.05
9 August	17.15	18.15	N	24.10
10 August	16.35	17.31	Y	23.16
11 August	18.45	19.15	N	25.84
13 August	21.45	22.15	Y	51.00
15 August	17.00	17.30	N	43.15
17 August	18.00	18.40	Y	49.10
18 August	20.05	20.40	N	26.00
19 August	16.45	17.45	Y	21.05

TABLE 45 (con't)

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION
FROM 1 JANUARY TO 31 DECEMBER 1979

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
20 August	20.30	21.30	N	27.85
21 August	17.00	18.00	Y	20.70
22 August	17.50	18.50	N	24.50
23 August	17.45	18.45	Y	23.95
24 August	20.55	22.00	N	27.55
25 August	17.00	18.00	Y	20.00
27 August	16.20	17.20	Y	47.20
28 August	18.50	19.50	N	26.30
29 August	16.45	17.45	Y	21.95
30 August	22.05	23.05	N	29.60
1 September	16.45	17.15	N	42.10
2 September	16.50	17.20	Y	24.05
3 September	16.45	17.15	N	23.95
4 September	16.50	17.20	Y	24.05
5 September	16.50	17.20	N	24.00
6 September	16.45	17.15	Y	23.95
7 September	17.00	17.40	N	24.25
8 September	18.12	19.18	Y	25.78
9 September	18.30	19.45	N	24.27
10 September	17.30	18.45	N	23.00
11 September	17.40	18.40	N	23.95
12 September	19.25	20.33	Y	25.93
13 September	16.40	18.15	N	21.82
14 September	16.38	17.40	Y	23.25
15 September	20.00	21.00	N	27.60
16 September	16.31	17.02	N	20.02
17 September	16.35	17.05	N	24.03
18 September	19.02	19.35	Y	26.30
20 September	18.40	19.10	Y	47.75
21 September	16.25	16.55	N	21.45
22 September	16.35	17.05	Y	24.50
23 September	16.15	16.50	N	23.45
24 September	16.54	17.27	Y	24.77
25 September	16.20	16.57	N	23.30
26 September	17.00	17.35	Y	24.78
28 September	16.40	17.10	N	23.75
29 September	16.11	16.44	Y	23.34
31 September	17.06	18.09	N	49.65
1 October	20.06	21.07	N	26.98
2 October	20.00	21.02	Y	23.95
4 October	17.14	18.25	Y	45.23
6 October	20.50	21.20	Y	50.95

TABLE 45(con't)

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION
FROM 1 JANUARY TO 31 DECEMBER 1979

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
7 October	18.35	19.05	N	21.85
8 October	20.11	20.41	Y	25.36
9 October	20.30	21.00	N	24.59
10 October	21.00	21.30	Y	24.30
11 October	23.00	23.30	N	26.00
13 October	16.50	18.05	N	42.75
14 October	17.08	18.10	Y	24.05
15 October	21.10	22.20	N	28.10
16 October	21.20	22.25	Y	24.05
17 October	21.05	22.10	N	23.85
18 October	22.05	23.10	Y	25.00
19 October	21.05	22.10	N	23.00
20 October	16.50	18.10	Y	20.00
21 October	16.35	17.35	N	23.25
22 October	16.38	17.38	Y	24.03
23 October	16.40	17.00	N	23.62
24 October	16.45	18.00	N	25.00
25 October	16.45	17.45	N	23.45
26 October	16.05	17.15	Y	23.70
30 October	16.06	17.15	Y	96.00
31 October	18.30	19.30	N	26.15
1 November	23.15	23.45	Y	28.15
2 November	20.40	21.10	N	21.65
3 November	17.10	17.43	Y	20.33
4 November	23.00	23.30	N	29.87
5 November	23.20	23.40	Y	24.10
7 November	21.10	22.40	Y	47.00
8 November	17.45	18.45	N	20.05
9 November	21.18	22.20	Y	27.75
10 November	22.00	23.00	N	24.80
11 November	18.00	19.00	N	20.00
12 November	17.07	18.07	N	23.07
13 November	17.22	18.25	Y	24.18
14 November	16.37	17.37	N	23.12
15 November	16.57	18.00	Y	24.63
16 November	19.13	20.25	N	26.25
17 November	21.15	22.20	Y	25.95
18 November	20.40	21.45	N	23.25
19 November	22.00	23.10	Y	25.65
20 November	19.20	19.50	N	20.40

TABLE 45(con't)

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION
FROM 1 JANUARY TO 31 DECEMBER 1979

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
21 November	19.12	20.15	Y	24.65
22 November	19.07	20.25	N	24.10
23 November	17.15	18.30	Y	22.05
24 November	21.10	22.10	N	27.80
25 November	19.30	20.30	Y	22.20
26 November	20.55	22.05	N	25.75
27 November	18.40	19.40	Y	21.35
28 November	20.35	22.00	N	26.60
29 November	19.10	20.10	Y	22.10
30 November	21.00	22.30	N	26.20
3 December	19.45	20.00	Y	69.70
5 December	16.30	17.05	Y	45.05
7 December	21.12	21.45	Y	52.40
8 December	20.30	21.30	N	23.85
9 December	17.20	18.10	Y	20.80
10 December	20.40	21.30	N	27.20
11 December	21.00	21.30	Y	24.00
12 December	19.00	19.30	N	22.00
13 December	17.05	17.35	Y	22.05
15 December	21.12	21.42	Y	52.07
16 December	16.30	17.05	N	19.63
17 December	17.00	17.30	Y	24.25
19 December	19.07	19.37	Y	50.07
20 December	16.40	17.10	N	21.73
21 December	19.00	19.30	Y	26.20
22 December	20.43	23.10	N	27.80
23 December	21.20	23.00	Y	23.90
24 December	21.20	22.00	N	23.00
25 December	19.10	20.15	Y	22.15
26 December	19.30	20.10	N	23.95
27 December	27.20	22.30	Y	26.20
29 December	17.20	21.10	Y	46.80
31 December	22.00	23.30	Y	50.20

TABLE 46

FISH SPECIES IMPINGED AT THE DAVIS-BESSE NUCLEAR POWER STATION: 1 January through 31 December 1978

SPECIES	NUMBER IMPINGED			WEIGHT (grams)			LENGTH (mm)		
	Estimate	95% Confidence Interval		Mean	95% Confidence Interval		Mean	95% Confidence Interval	
		Lower Bound	Upper Bound		Lower Bound	Upper Bound		Lower Bound	Upper Bound
Alewife	4	1	9	4	0	8	75	39	110
Black Crappie	82	53	128	17	16	17	117	116	119
Blackside Darter	1	0.5	4	1	*	*	27	*	*
Bluegill Sunfish	5	3	9	10	9	10	68	67	68
Bluntnose Minnow	1	1	3	1	*	*	25	*	*
Carp	6	3	15	2	1	3	56	51	60
Channel Catfish	3	1	7	0.4	*	*	59	*	*
Emerald Shiner	991	636	1,545	1	1	1	60	60	61
Freshwater Drum	80	55	114	4	3	4	81	78	83
Gizzard Shad	391	201	758	7	6	8	88	87	90
Goldfish	3,299	2,435	4,468	5	5	6	72	71	73
Green Sunfish	5	3	11	12	9	16	58	48	68
Logperch Darter	12	8	21	2	1	2	63	60	67
Pumpkinseed Sunfish	9	3	24	11	9	13	82	77	87
Rainbow Smelt	69	45	107	1	1	1	60	59	61
Spottail Shiner	15	9	25	2	2	2	65	63	66
Stonecat Madtom	1	1	3	1	*	*	30	*	*
Trout-perch	29	20	41	4	4	5	80	77	82
White Crappie	22	15	31	8	8	8	88	85	91
Yellow Perch	1,582	1,082	2,312	5	5	5	83	83	84
TOTAL	6,607	5,447	8,015	5	5	5	74	74	75

* Confidence intervals could not be computed when no more than one representative of a given species occurred.

TABLE 47

FISH SPECIES IMPINGED AT THE DAVIS-BESSE NUCLEAR POWER STATION: 1 January through 31 December 1979

SPECIES	NUMBER IMPINGED			WEIGHT (grams)				LENGTH (mm)	
		95% Confidence Interval			95% Confidence Interval			95% Confidence Interval	
	Estimate	Lower Bound	Upper Bound	Mean	Lower Bound	Upper Bound	Mean	Lower Bound	Upper Bound
Alewife	1	0	5	0	*	*	100	*	*
Black Bullhead	17	17	17	2	-1	5	59	57	60
Black Crappie	28	14	54	8	-27	44	81	70	91
Brown Bullhead	11	7	17	12	12	12	83	83	83
Carp	3	1	9	12	*	*	99	*	*
Emerald Shiner	214	90	511	1	1	1	55	54	55
Freshwater Drum	115	61	218	4	-1	8	82	79	84
Gizzard Shad	162	95	275	8	0	15	91	88	93
Goldfish	3449	2266	5248	5	1	9	70	70	71
Logperch Darter	21	13	34	2	-2	7	66	63	70
Pumpkinseed Sunfish	3	1	9	1	*	*	36	*	*
Rainbow Smelt	32	18	55	2	-8	12	64	58	70
Spottail Shiner	9	5	16	3	-17	24	69	58	81
Troutperch	5	2	15	4	-1	8	83	78	88
Unidentified Sunfish	1	0	5	1	*	*	32	*	*
White Bass	3	1	12	4	*	*	81	*	*
White Crappie	23	13	40	6	-16	28	69	62	75
White Perch	3	1	9	2	2	2	62	60	64
Yellow Perch	285	129	631	5	-3	13	76	73	78
TOTAL	4385	3128	6149	5	2	8	71	70	71

* Confidence intervals could not be computed when no more than one representative of a given species occurred.

TABLE 48

A SUMMARY OF MONTHLY FISH IMPINGEMENT
AT THE DAVIS-BESSE NUCLEAR POWER STATIONS: 1 January through 31 December 1978

MONTHS	NUMBER IMPINGED			WEIGHT (grams)			LENGTH (mm)		
	Estimate	95% Confidence Interval		Mean	95% Confidence Interval		Mean	95% Confidence Interval	
		Lower Bound	Upper Bound		Lower Bound	Upper Bound		Lower Bound	Upper Bound
January	45	31	66	13	12	14	104	102	106
February	17	9	31	5	5	6	76	72	79
March	13	7	25	4	4	4	72	70	73
April	2,875	2,157	3,833	5	5	6	79	78	79
May	648	479	874	5	4	5	79	78	79
June	45	29	69	12	7	17	92	86	98
July	7	5	11	9	9	9	79	77	81
August	4	2	8	12	9	14	100	90	110
September	19	12	32	11	9	12	83	80	87
October	28	18	43	10	9	11	59	55	64
November	576	314	1,058	3	3	3	62	61	63
December	2,330	1,594	3,406	3	3	3	68	67	69
TOTAL	6,607	5,447	8,015	5	5	5	74	74	75

TABLE 49

A SUMMARY OF MONTHLY FISH IMPINGEMENT
AT THE DAVIS-BESSE NUCLEAR POWER STATIONS: 1 January through 31 December 1979

MONTHS	NUMBER IMPINGED			WEIGHT (grams)			LENGTH (mm)		
		95% Confidence Interval			95% Confidence Interval			95% Confidence Interval	
	Estimate	Lower Bound	Upper Bound	Mean	Lower Bound	Upper Bound	Mean	Lower Bound	Upper Bound
January	2429	1363	4335	4	1	6	71	70	71
February	30	17	52	3	-4	10	62	58	66
March	501	345	726	3	-0	7	64	63	65
April	753	498	1137	3	-1	7	66	65	67
May	16	9	29	3	0	5	63	61	64
June	20	6	66	7	-42	56	77	65	89
July	29	18	45	18	-18	53	108	100	116
August	54	39	76	17	-177	210	63	51	76
September	35	20	60	5	13	22	62	52	71
October	2	0	8	18			97		
November	147	83	269	11	1	21	83	81	86
December	367	172	786	9	5	13	84	83	85
TOTAL	4385	3128	6149	5	2	8	71	70	71

TABLE 50

ESTIMATED 1978 SPORT AND COMMERCIAL FISH HARVEST FROM THE OHIO WATERS OF LAKE ERIE[a]

SPECIES	SPORT HARVEST		COMMERCIAL HARVEST		TOTAL HARVEST	
	No. of Individuals	Weight (Kilograms)	No. of Individuals	Weight (Kilograms)	No. of Individuals	Weight (Kilograms)
Yellow Perch	11,483,000	1,116,386	9,178,000[b]	890,294	20,661,000	2,006,680
Walleye	1,652,000	1,515,906	0[f]	0	1,652,000	1,515,906
White Bass	1,533,000	334,825	3,380,000[b]	736,842	4,913,000	1,071,667
Freshwater Drum	668,000	363,200	981,000[b]	533,904	1,649,000	897,104
Channel Catfish	218,000	86,033	235,000[b]	92,843	453,000	178,876
Smallmouth Bass	32,000	20,203	0[f]	0	32,000	20,203
Others	c	c	—	1,867,983[d]	—	1,867,983[e]
TOTAL	15,586,000[e]	3,436,553[e]	—	4,121,866	—	7,648,419

a Scholl (1979).

b Estimated based on mean weight of sport fish.

c Data not available.

d Thirty-eight percent carp.

e Excludes weight of "Others" caught by sport fishermen.

f Closed to commercial fishing.

TABLE 51

COMMERCIAL FISH LANDINGS FROM THE OHIO WATERS OF LAKE ERIE: 1974-1979*

SPECIES	1974	1975	1976	1977	1978	1979
Buffalo	14,528	14,982	13,620	15,890	16,344	14,982
Bullhead	12,258	14,074	19,522	29,056	32,688	24,062
Carp	1,284,366	1,265,298	1,196,290	1,249,408	701,430	883,938
Channel Catfish	136,200	117,586	101,242	115,316	92,843	107,144
Freshwater Drum	307,812	340,500	432,208	361,838	533,904	574,764
Gizzard Shad	**	**	274,216	228,816	706,878	863,962
Goldfish	29,510	23,608	60,836	250,154	343,678	98,064
Quillback	**	**	57,658	46,762	46,762	36,320
Rainbow Smelt	2,270	4,086	15,890	454	4,994	**
Sucker	39,952	24,516	28,602	14,982	14,982	17,706
White Bass	1,314,330	760,450	680,546	501,216	736,842	866,232
Yellow Perch	797,678	675,552	652,852	1,051,918	890,294	1,189,934
TOTAL	3,934,364	3,241,106	3,533,482	3,865,810	4,122,774	4,677,108

* Ohio Dept. of Natural Resources (1980). Data presented in kilograms.

** Data not available.

TABLE 52

COMMERCIAL FISH LANDINGS FROM LAKE ERIE: 1975 - 1979[a]

SPECIES	WEIGHT (Kilograms)				
	1975	1976	1977	1978	1979
Bowfin	c	c	15,000	12,000	10,000
Buffalo	30,000	43,000	34,000	25,000	24,000
Bullhead	69,000	64,000	77,000	54,000	47,000
Carp	1,491,000	1,444,000	1,439,000	871,000	1,091,000
Channel Catfish	197,000	155,000	160,000	148,000	151,000
Freshwater Drum	538,000	619,000	538,000	692,000	720,000
Gizzard Shad	1,000	301,000	229,000	707,000	888,000
Goldfish	26,000	61,000	250,000	344,000	89,000
Lake Whitefish	c	c	3,000	2,000	1,000
Quillback	60,000	58,000	47,000	47,000	38,000
Rainbow Smelt	7,688,000	7,845,000	9,700,000	11,002,000	10,148,000
Rock Bass	c	c	19,000	10,000	20,000
Sucker	52,000	48,000	31,000	33,000	43,000
Sunfish	c	c	33,000	23,000	21,000
Walleye[b]	114,000	138,000	261,000	295,000	489,000

TABLE 52 (Cont'd)

COMMERCIAL FISH LANDINGS FROM LAKE ERIE: 1975 - 1979[a]

SPECIES	WEIGHT (Kilograms)				
	1975	1976	1977	1978	1979
White Bass	1,932,000	1,162,000	948,000	1,590,000	1,626,000
Yellow Perch	4,597,000	2,903,000	4,801,000	4,918,000	5,931,000
Others	927,000	833,000	928,000	796,000	639,000
TOTAL	17,722,000	15,674,000	19,513,000	21,569,000	21,976,000

[a] Muth (1980).

[b] Not taken commercially in Ohio and Michigan waters.

[c] Included with "Others" during this year.

FIGURES

Figure 1. Reactor Power Record for the Davis-Besse Nuclear Power Station, Unit 1 (1978).

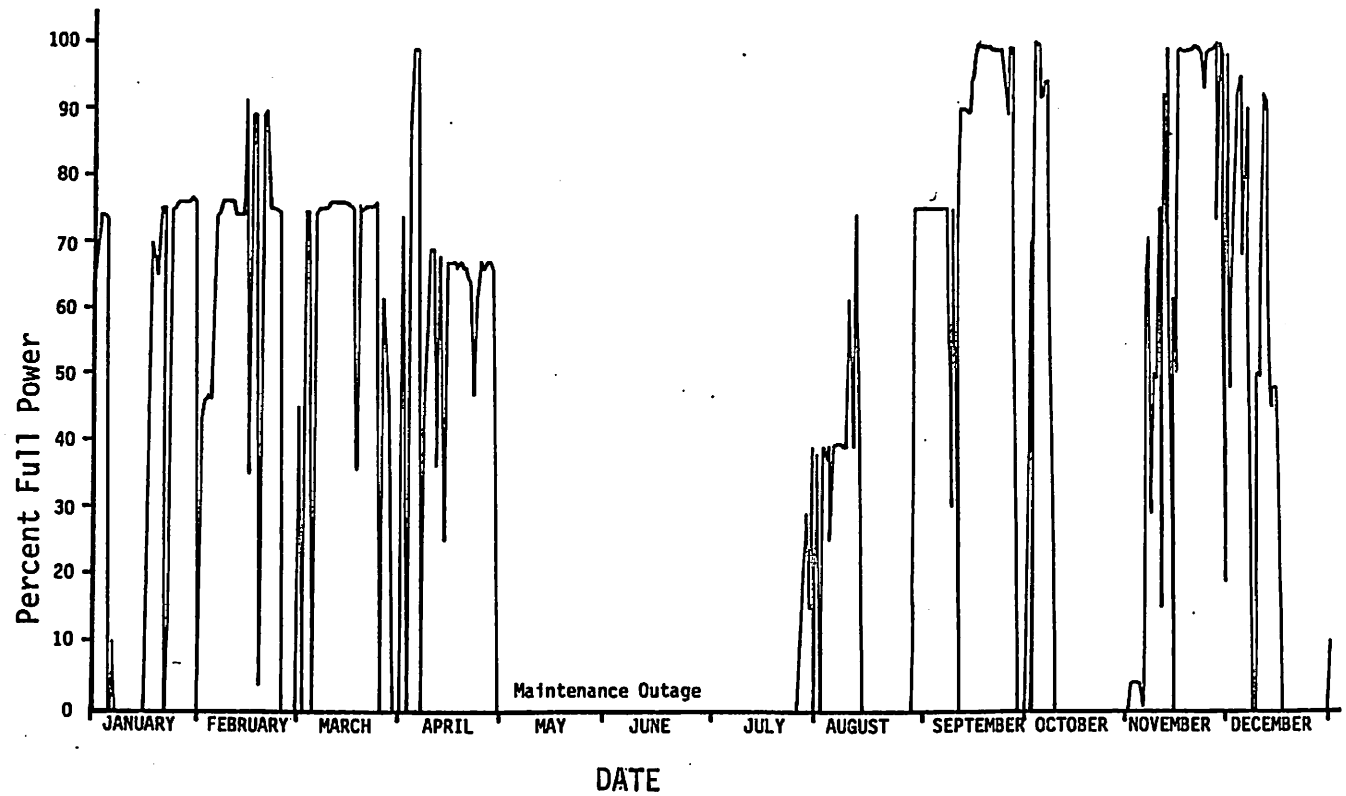


Figure 2. Reactor Power Record for the Davis-Besse Nuclear Power Station, Unit 1 (1979).

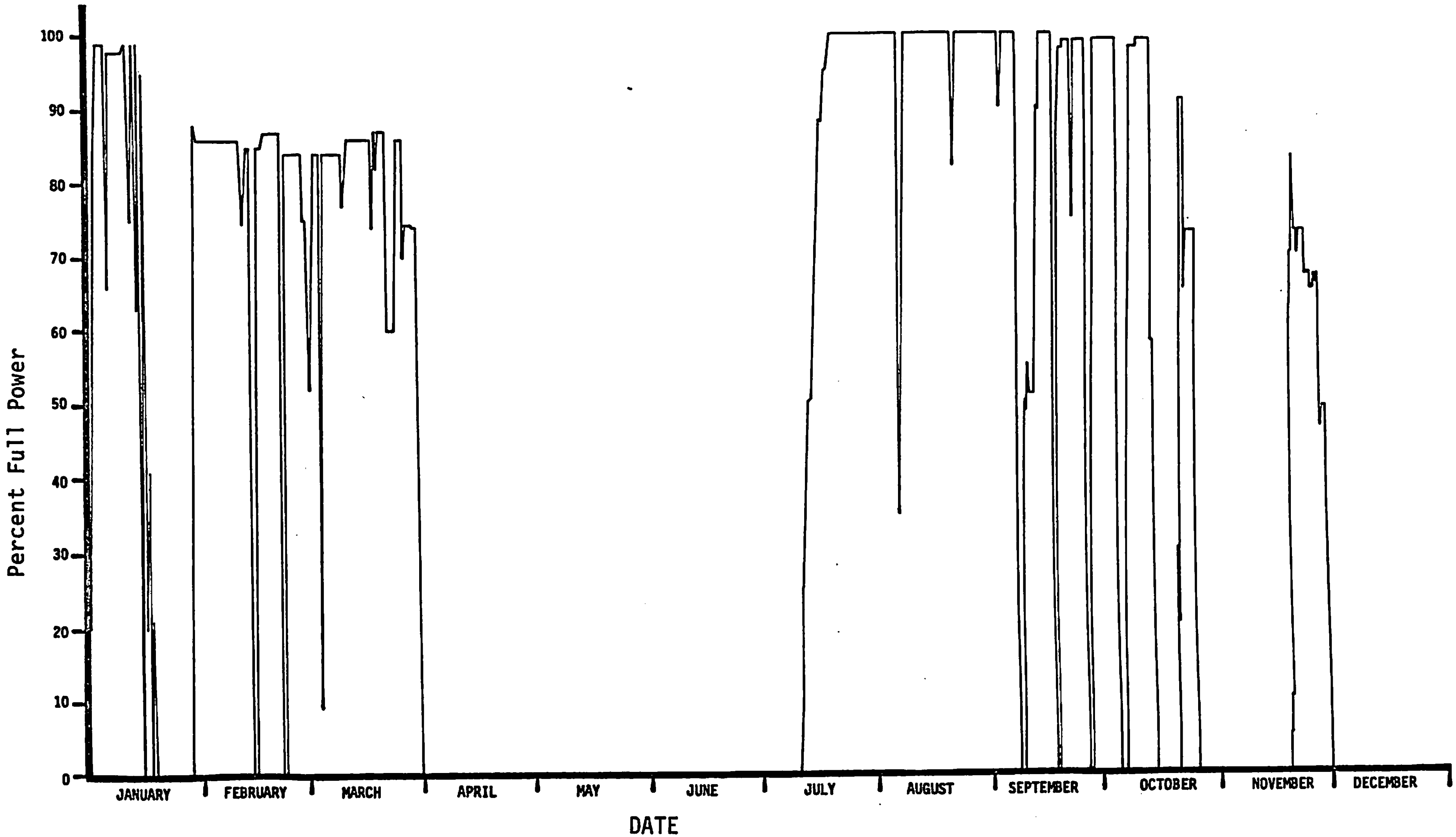


Figure 3. Gross Electric Power Generation Record for the Davis-Besse Nuclear Power Station, Unit 1 (1978).

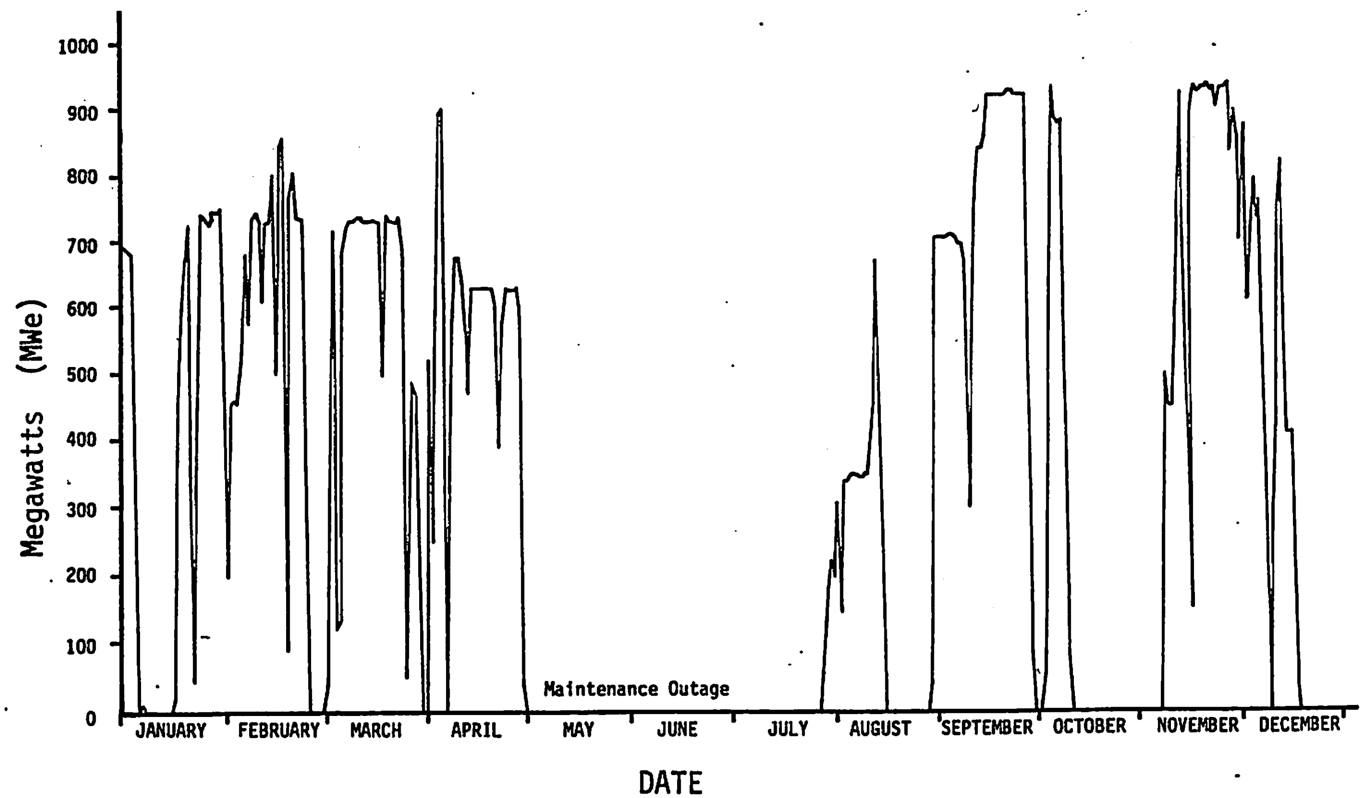


Figure 4. Gross Electric Power Generation Record for the Davis-Besse Nuclear Power Station, Unit 1, (1979).

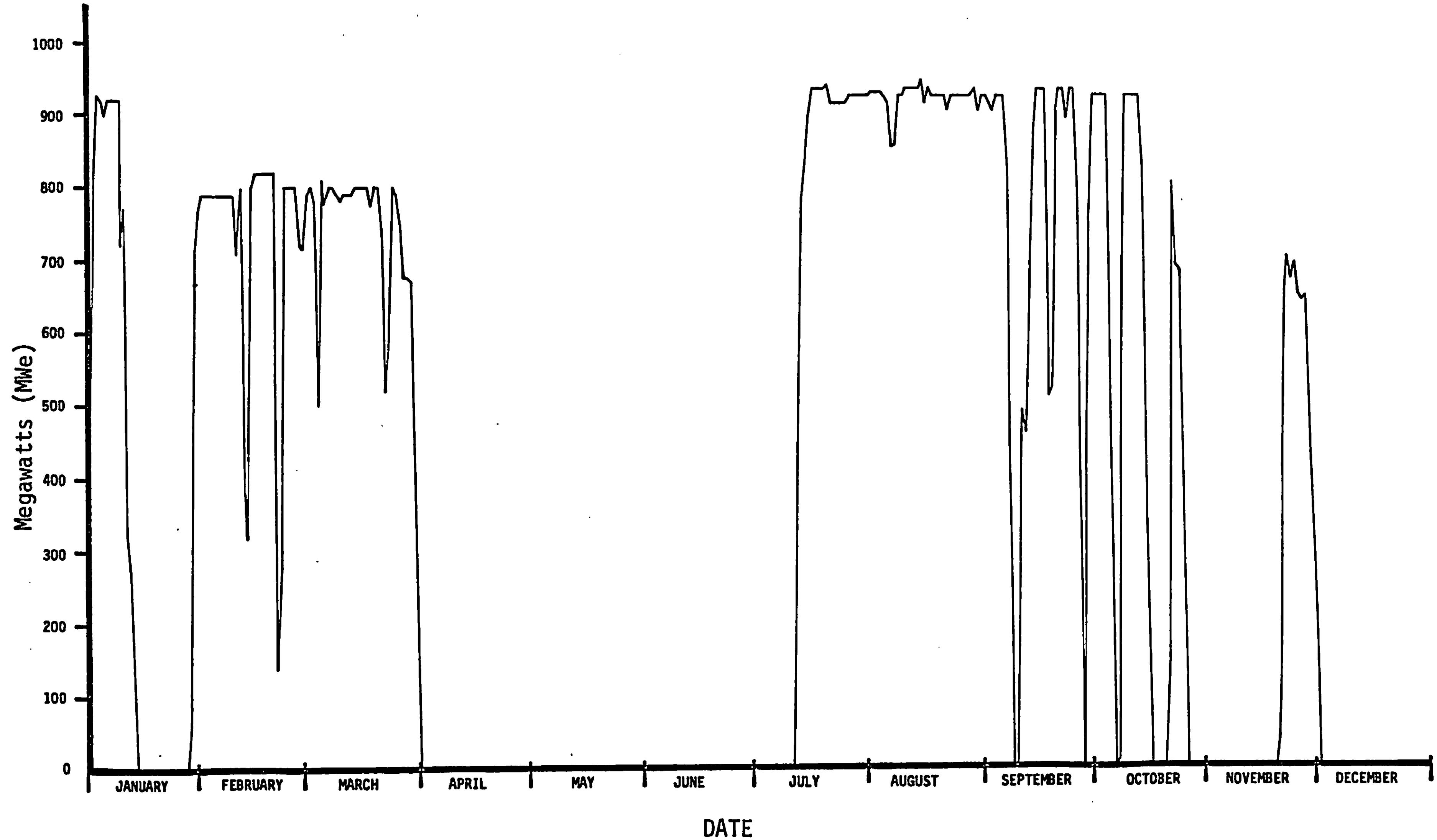


Figure 5. Water Temperature Record for Intake and Discharge for the Davis-Besse Nuclear Power Station, Unit 1 (1978).

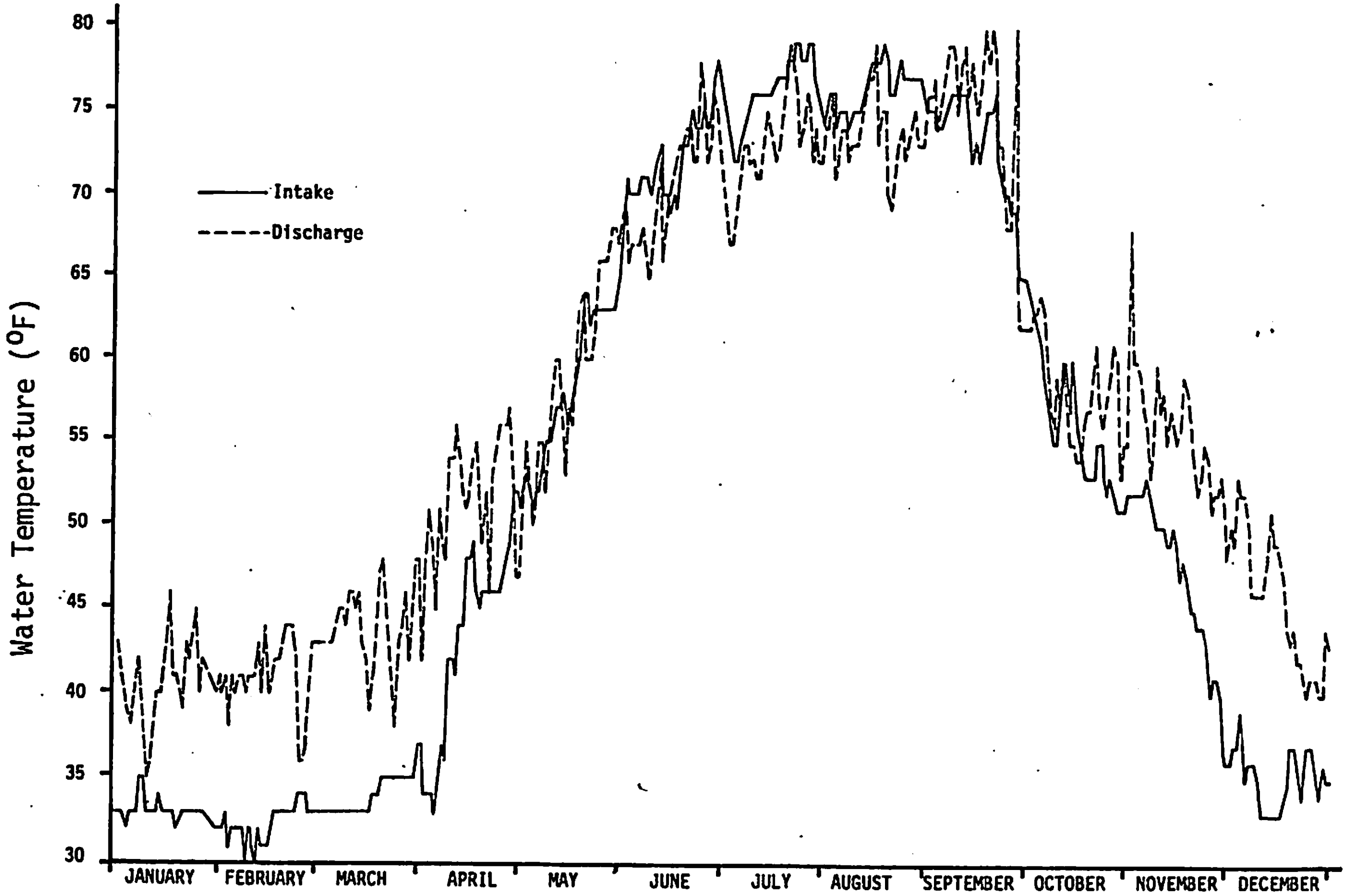


Figure 6. Water Temperature Record for Intake and Discharge for the Davis-Besse Nuclear Power Station, Unit 1 (1979).

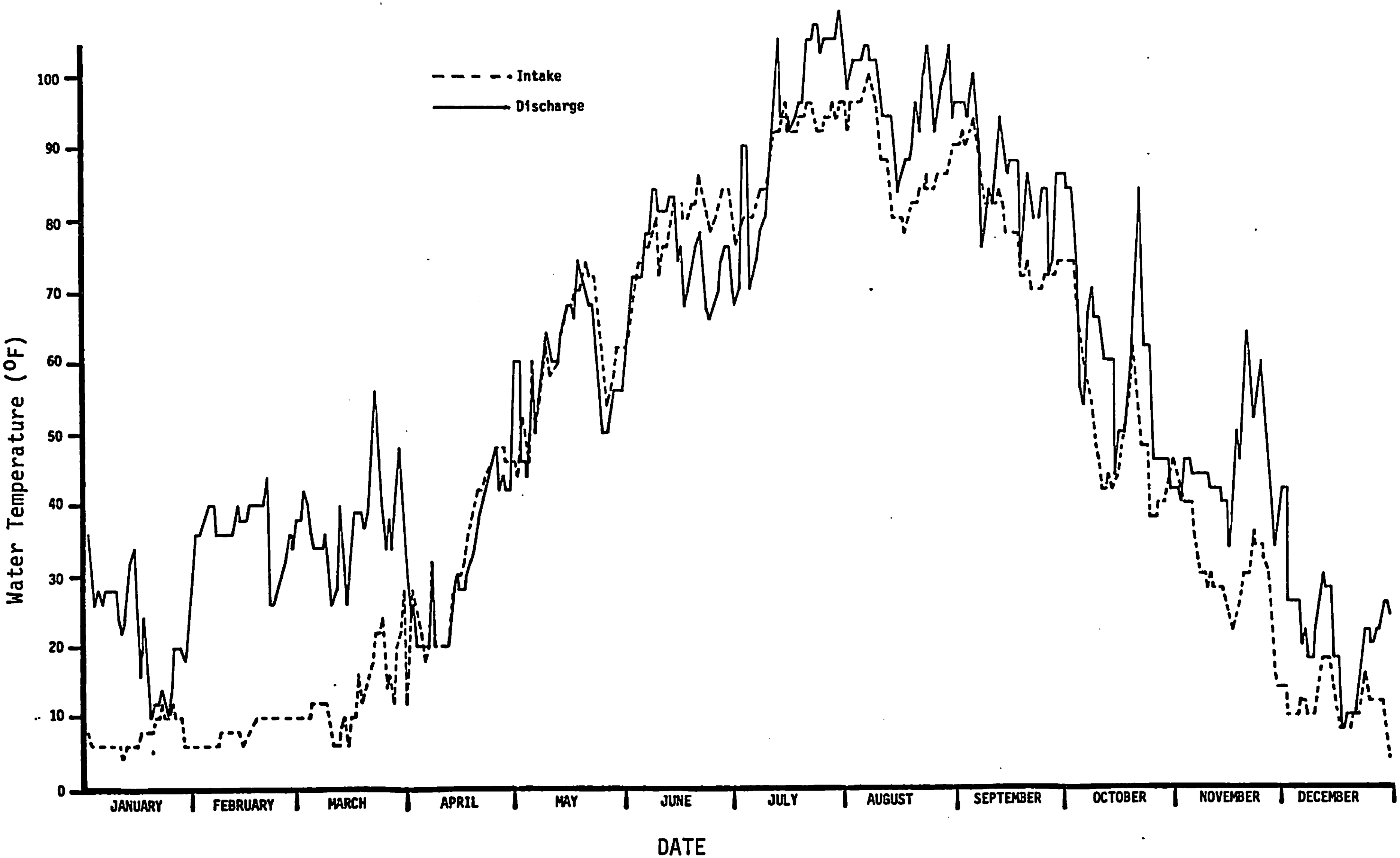


Figure 7. Water Intake Conduit Flow Record for the Davis-Besse Nuclear Power Station, Unit 1 (1978).

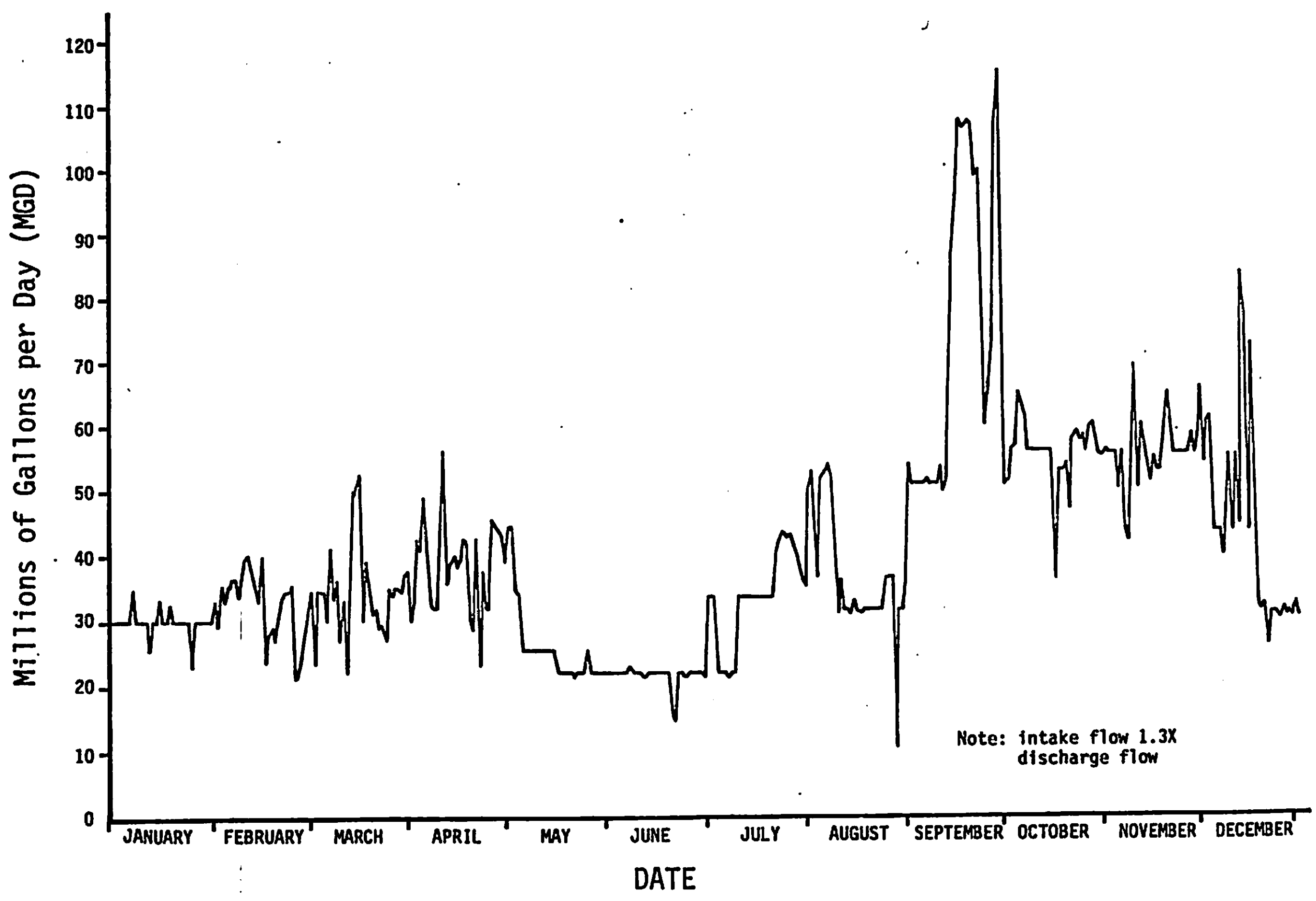


Figure 8. Water Intake Conduit Flow Record for the Davis-Besse Nuclear Power Station, Unit 1, (1979).

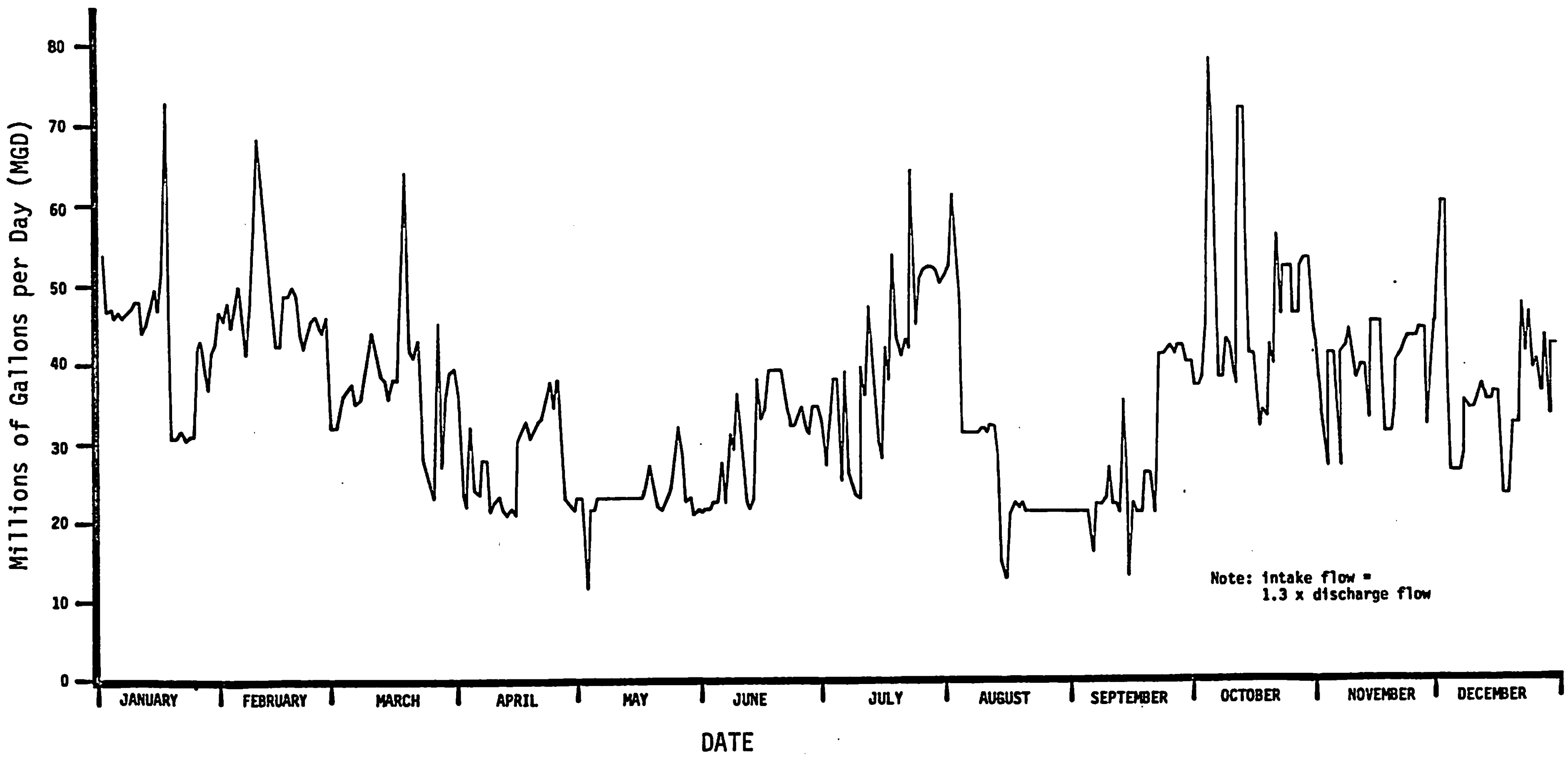


Figure 9. Discharge Conduit Flow Record for the Davis-Besse Nuclear Power Station, Unit 1 (1978).

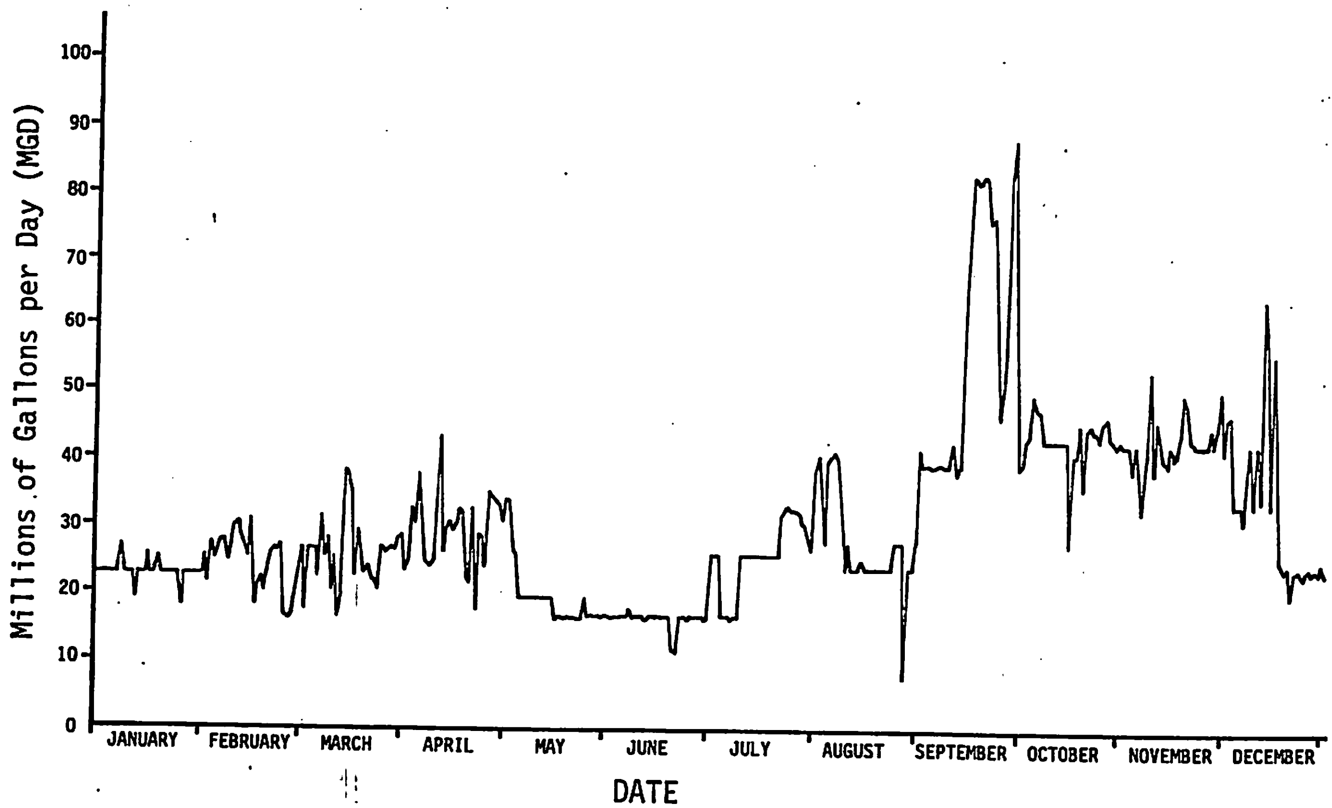
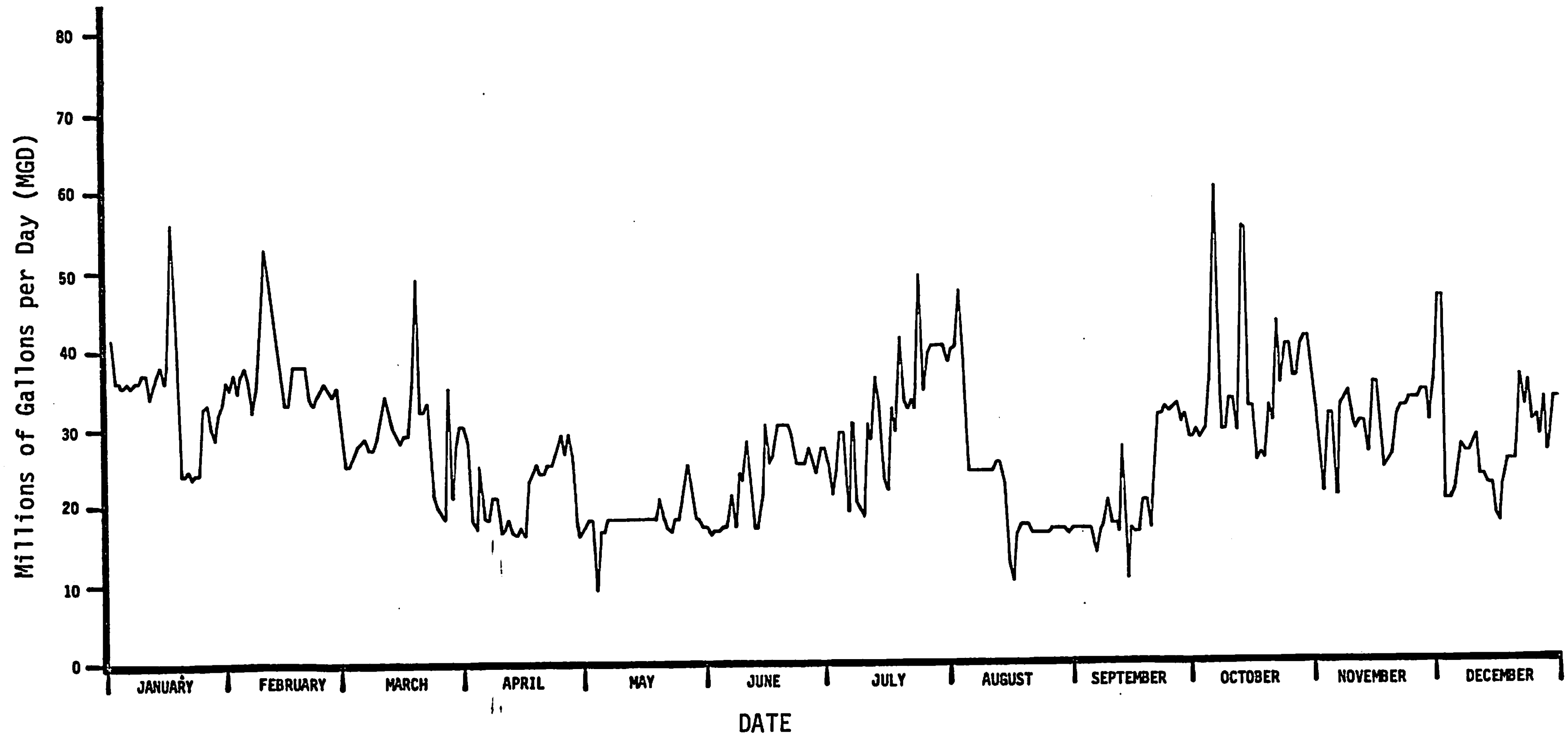
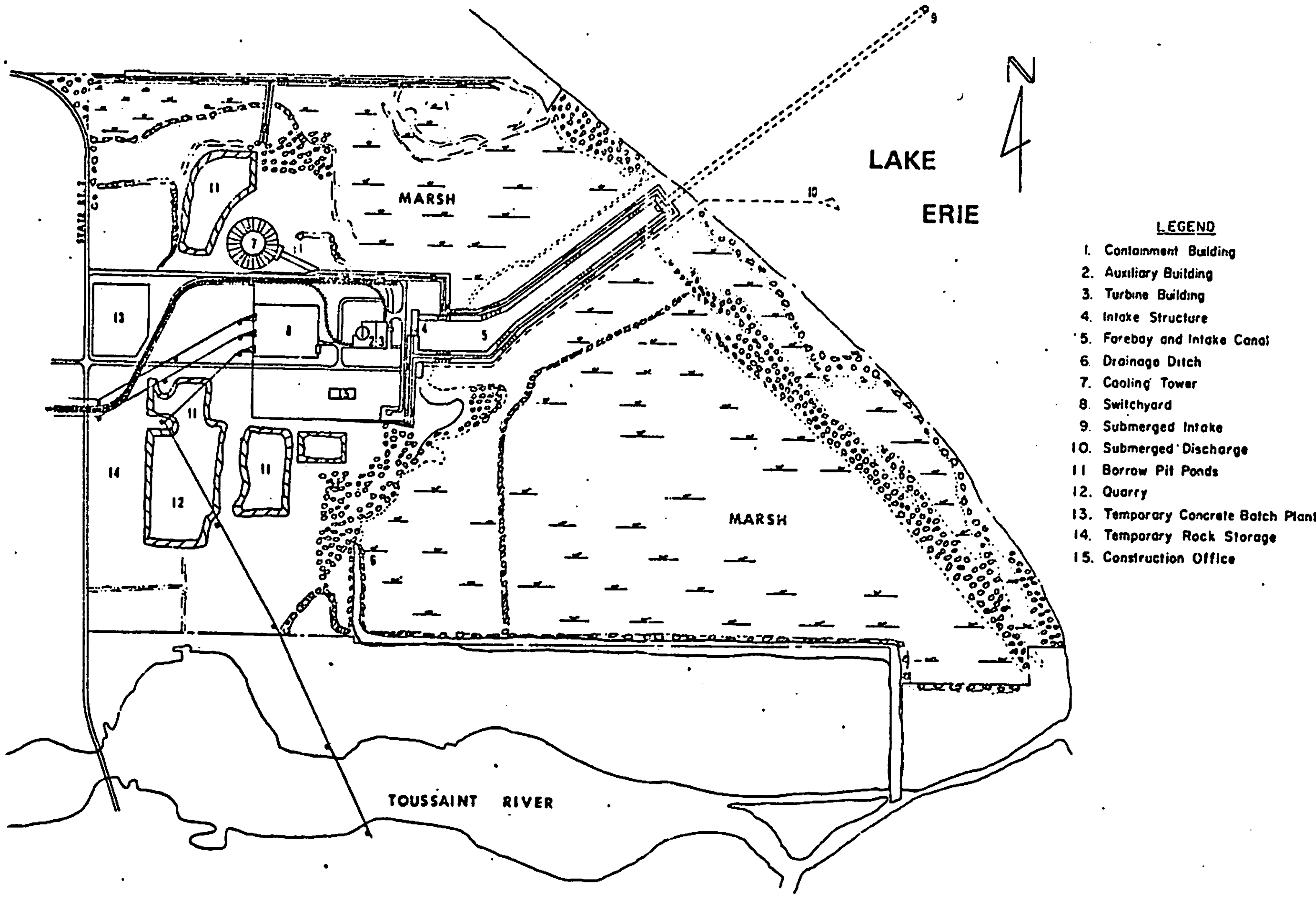


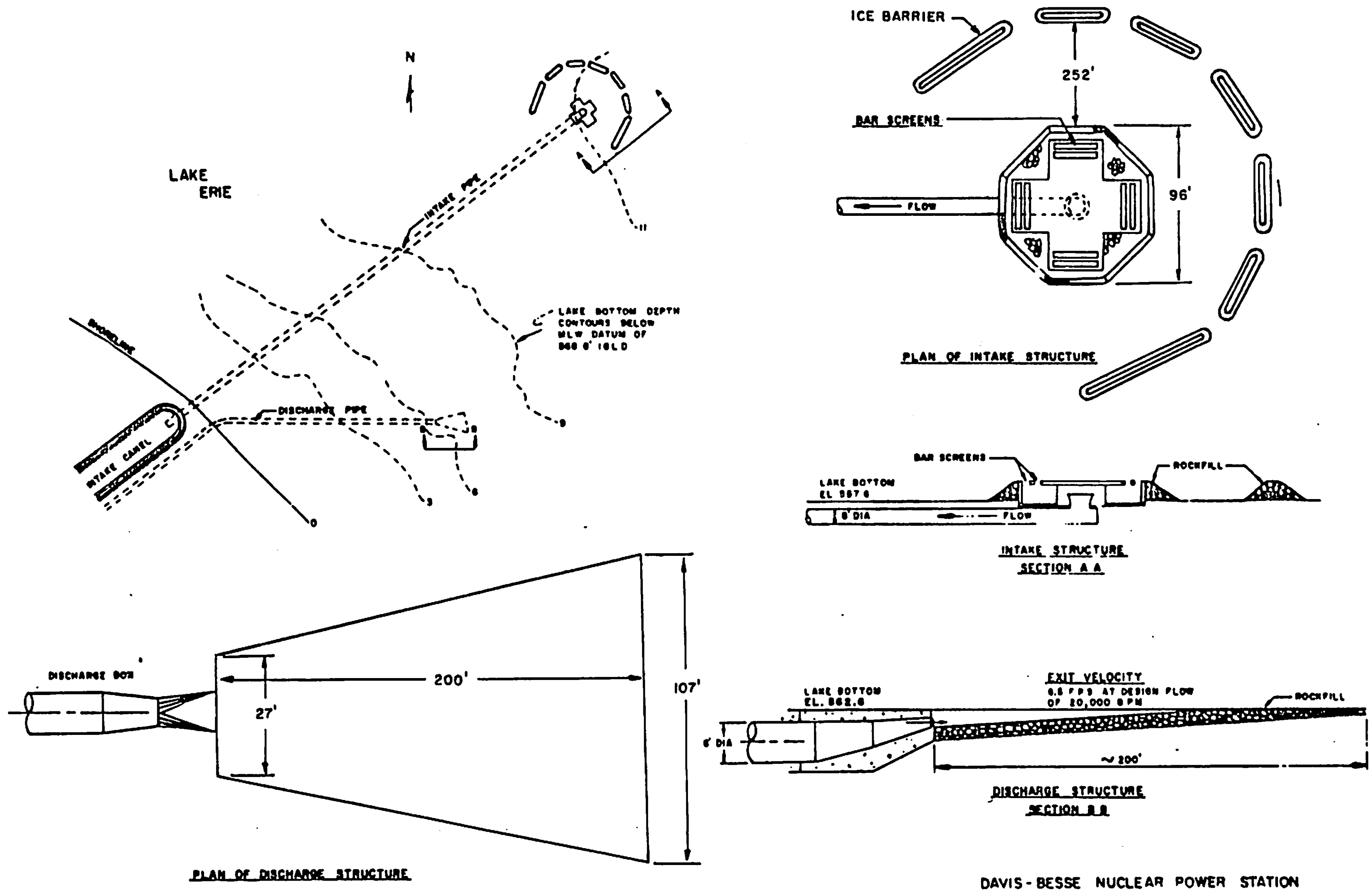
Figure 10. Discharge Conduit Flow Record for the Davis-Besse Nuclear Power Station, Unit 1, (1979).





DAVIS-BESSE NUCLEAR POWER STATION UNIT NO. I
SITE PLAN

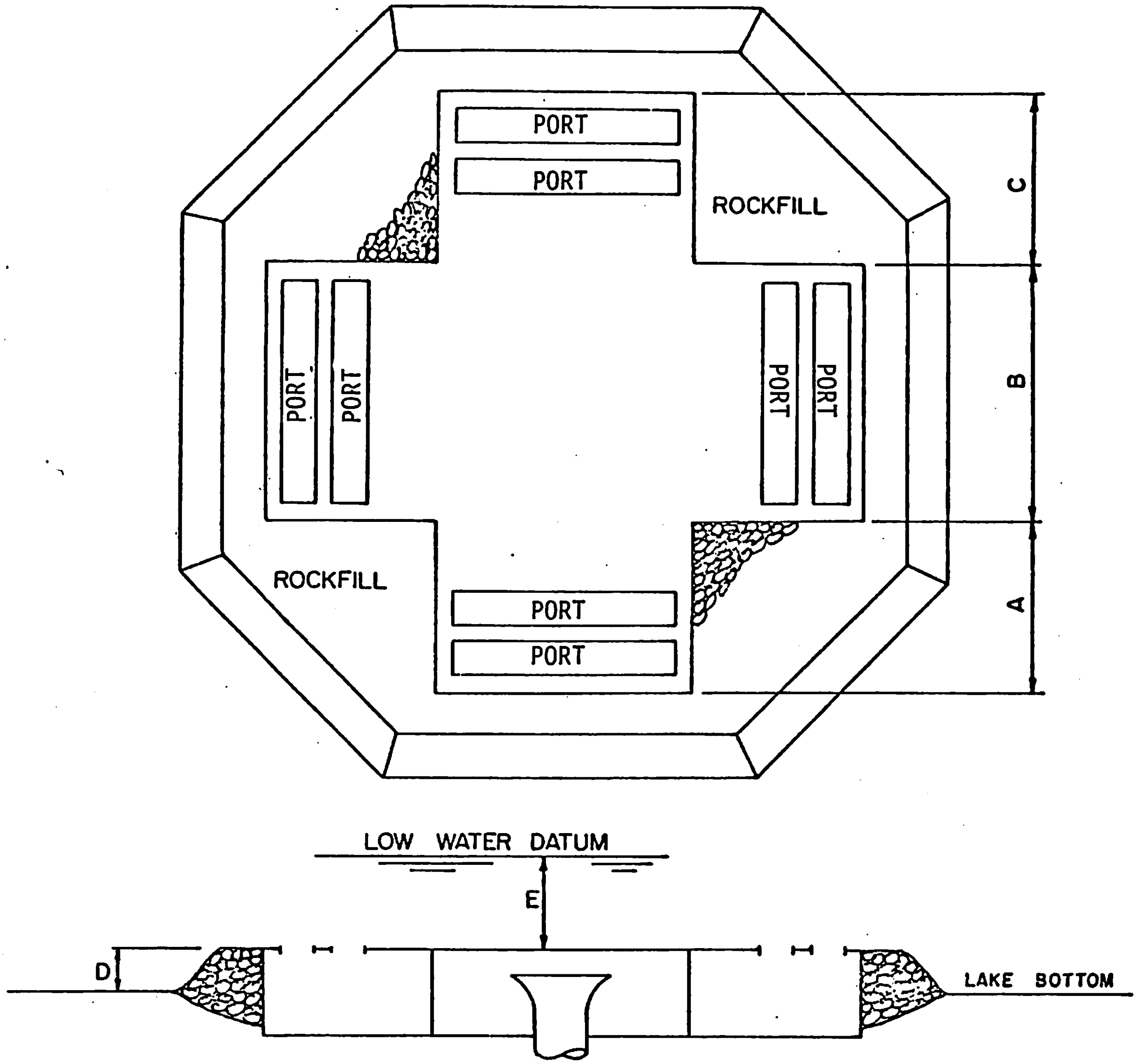
FIGURE 11. STATION LOCATION MAP



NOTE NOT TO SCALE

DAVIS-BESSE NUCLEAR POWER STATION
SUBMERGED INTAKE & DISCHARGE ARRANGEMENTS

FIGURE 12. WATER INTAKE AND DISCHARGE STRUCTURES



INTAKE CRIB	A	B	C	D	E	DESIGN INTAKE VELOCITY
DAVIS-BESSE	18'-0"*	23'-0"	18'-0"*	3'-10"	6'-9"	0.25 FT/SEC
OREGON	13'-0"	16'-0"	13'-0"	5'-10"	8'-2"	0.25 FT/SEC
PORT CLINTON	11'-2"	9'-8"	11'-2"	3'-11"	6'-2"	0.25 FT/SEC

* 18'-2" on the other side of the crib

FIGURE 13. DETAILS OF WATER INTAKE CRIB

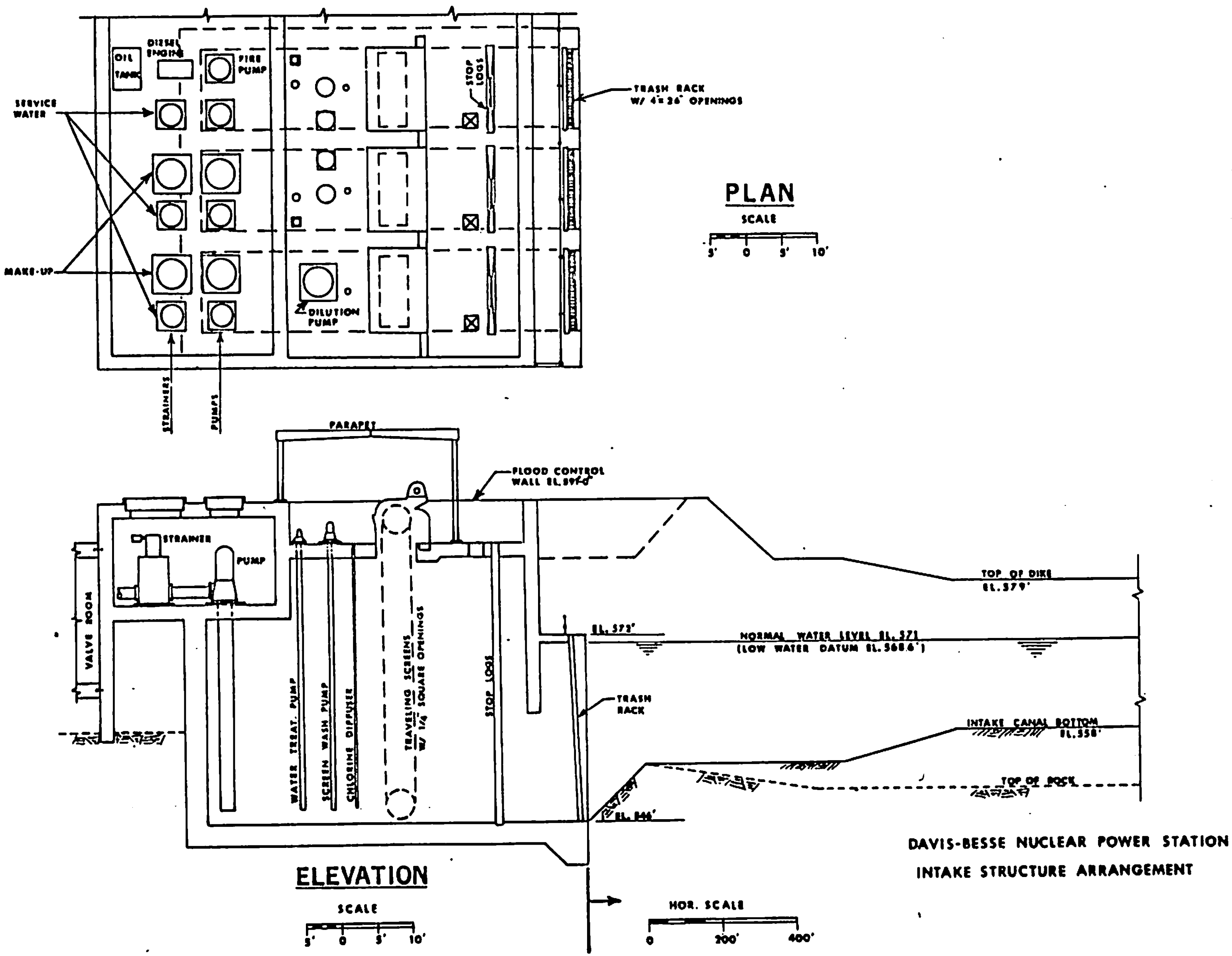


FIGURE 14. WATER INTAKE PUMPS AND SCREENS ARRANGEMENT

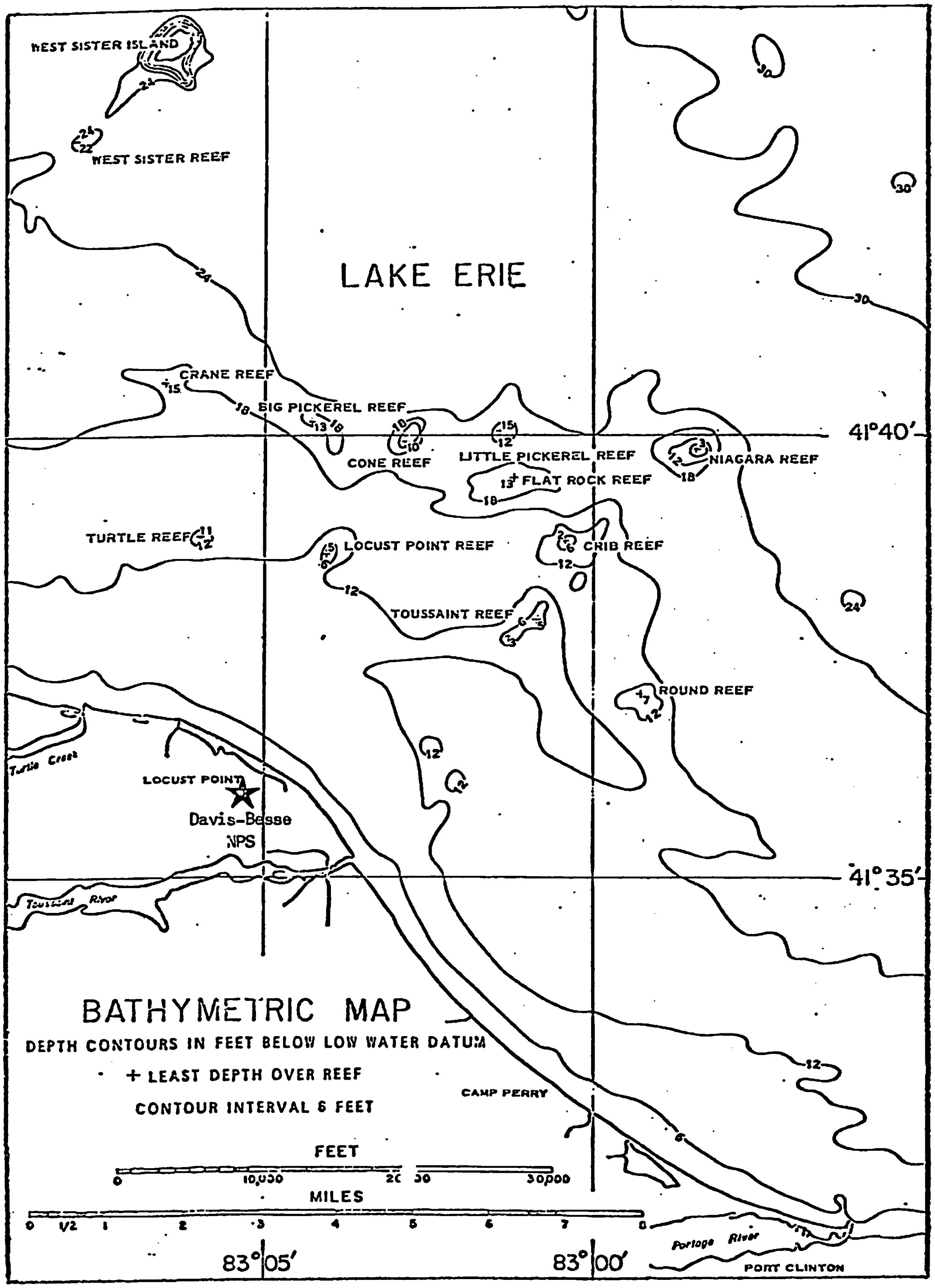


FIGURE 15. REEFS NEAR LOCUST POINT.

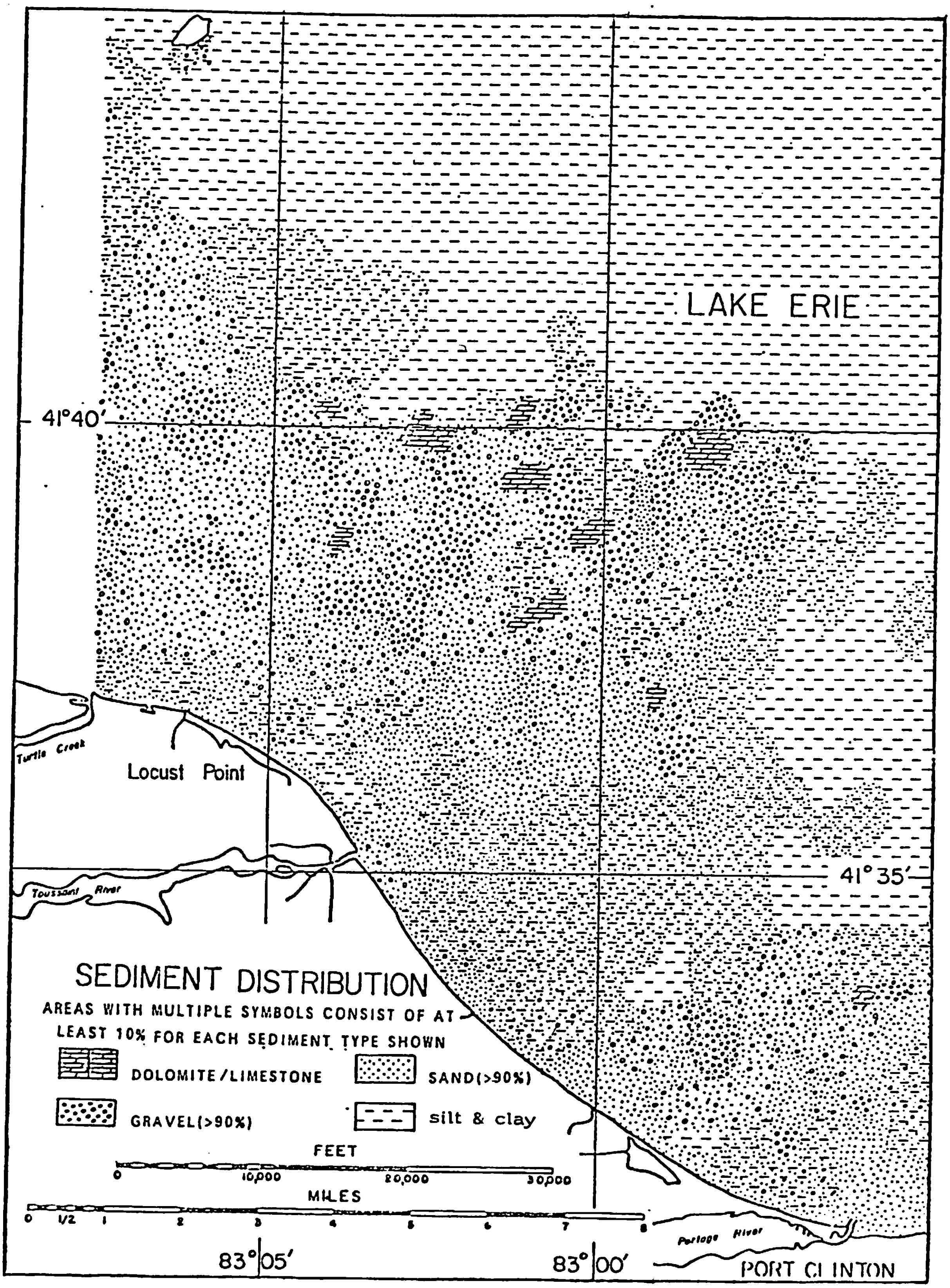


FIGURE 16. SEDIMENT DISTRIBUTION MAP OF WESTERN LAKE ERIE IN THE VICINITY OF LOCUST POINT

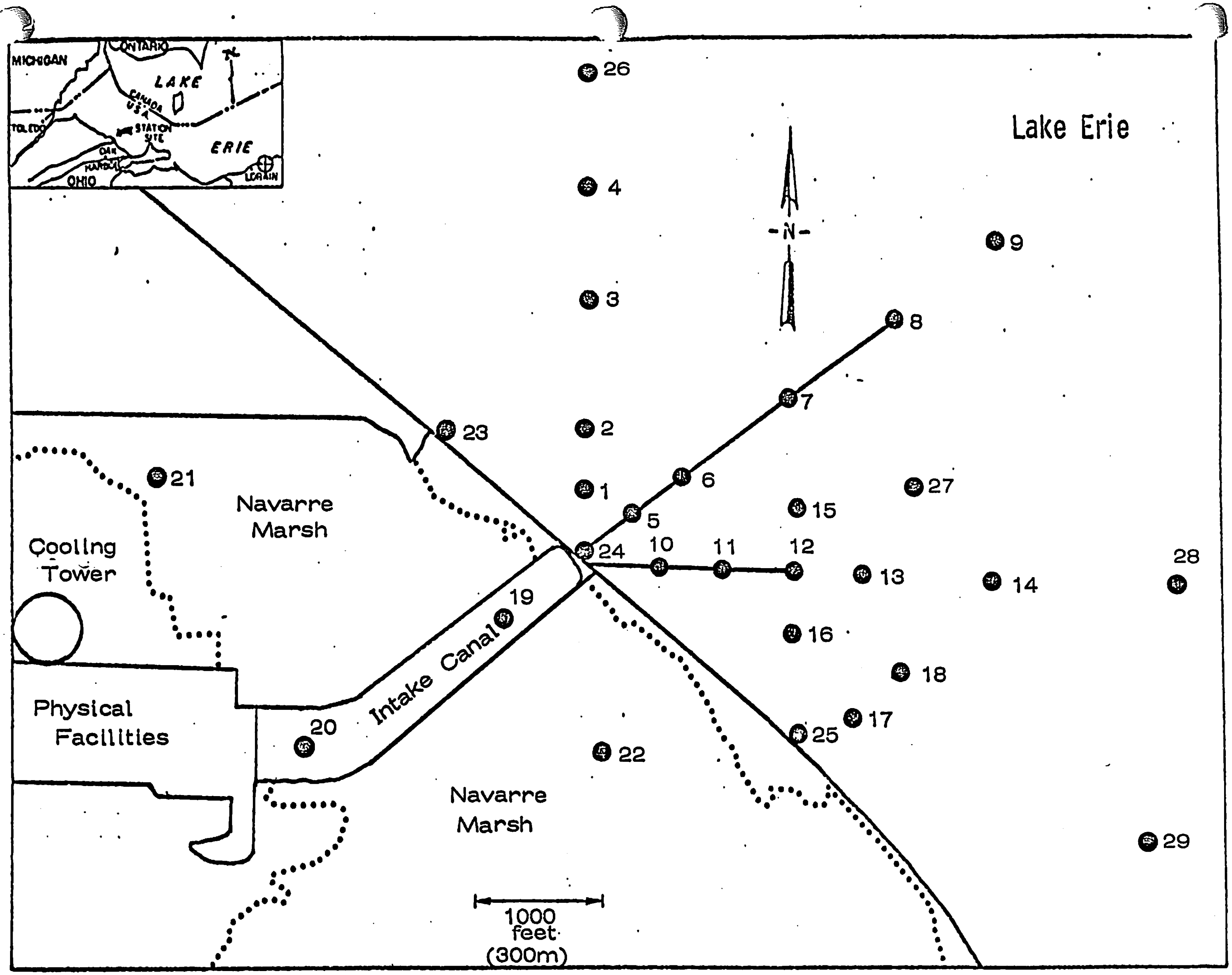


FIGURE 17. BIOLOGICAL SAMPLING STATIONS AT THE DAVIS-BESSE NUCLEAR POWER STATION.

FIGURE 18. TRENDS IN MEAN MONTHLY TEMPERATURE, DISSOLVED OXYGEN, AND HYDROGEN ION MEASUREMENTS FOR LAKE ERIE AT LOCUST POINT FOR THE PERIOD 1972-1979.

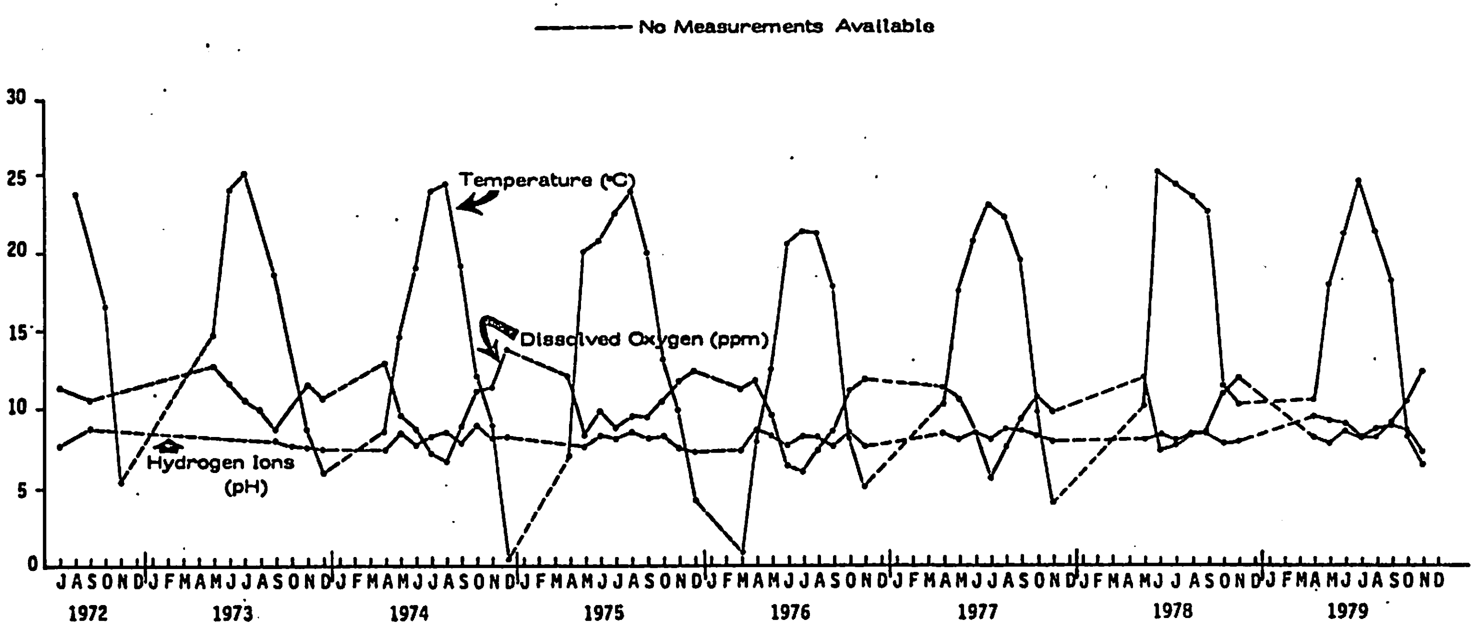


FIGURE 19. TRENDS IN MEAN MONTHLY CONDUCTIVITY, ALKALINITY AND TURBIDITY MEASUREMENTS FOR LAKE ERIE AT LOCUST POINT FOR THE PERIOD 1972-1979.

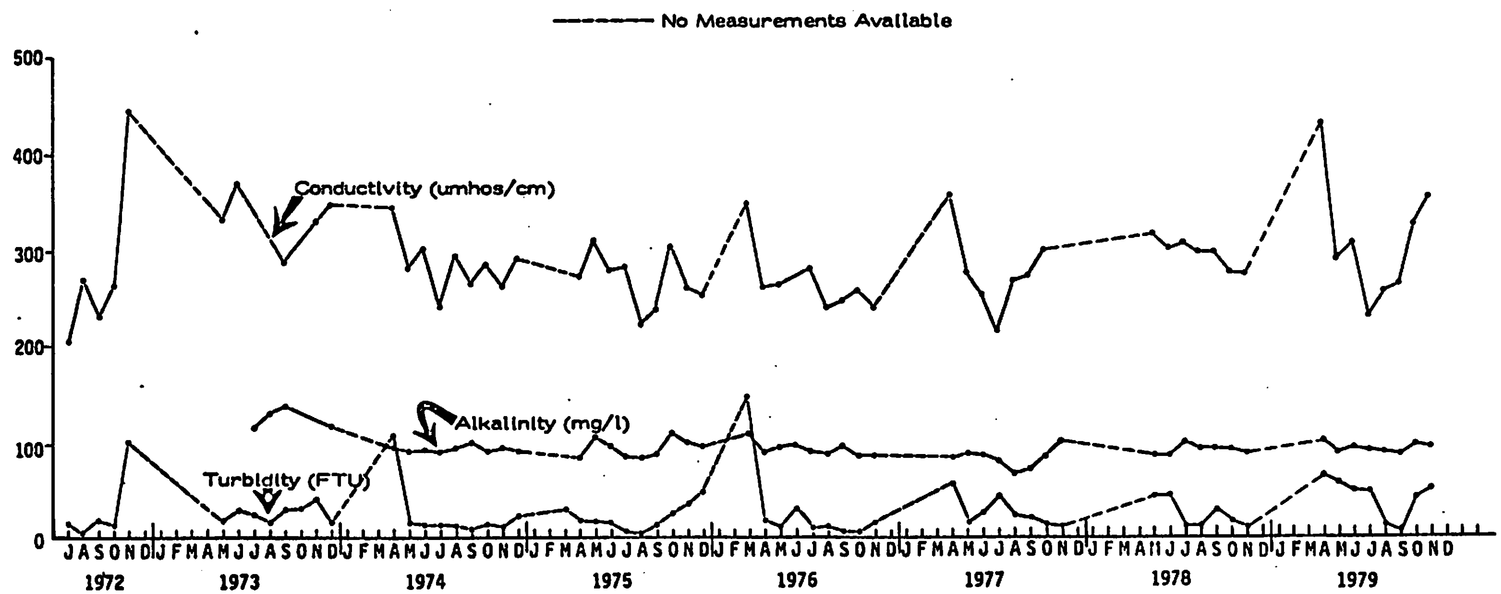


FIGURE 20. TRENDS IN MEAN MONTHLY TRANSPARENCY AND PHOSPHORUS MEASUREMENTS FOR LAKE ERIE AT LOCUST POINT FOR THE PERIOD 1972-1979.

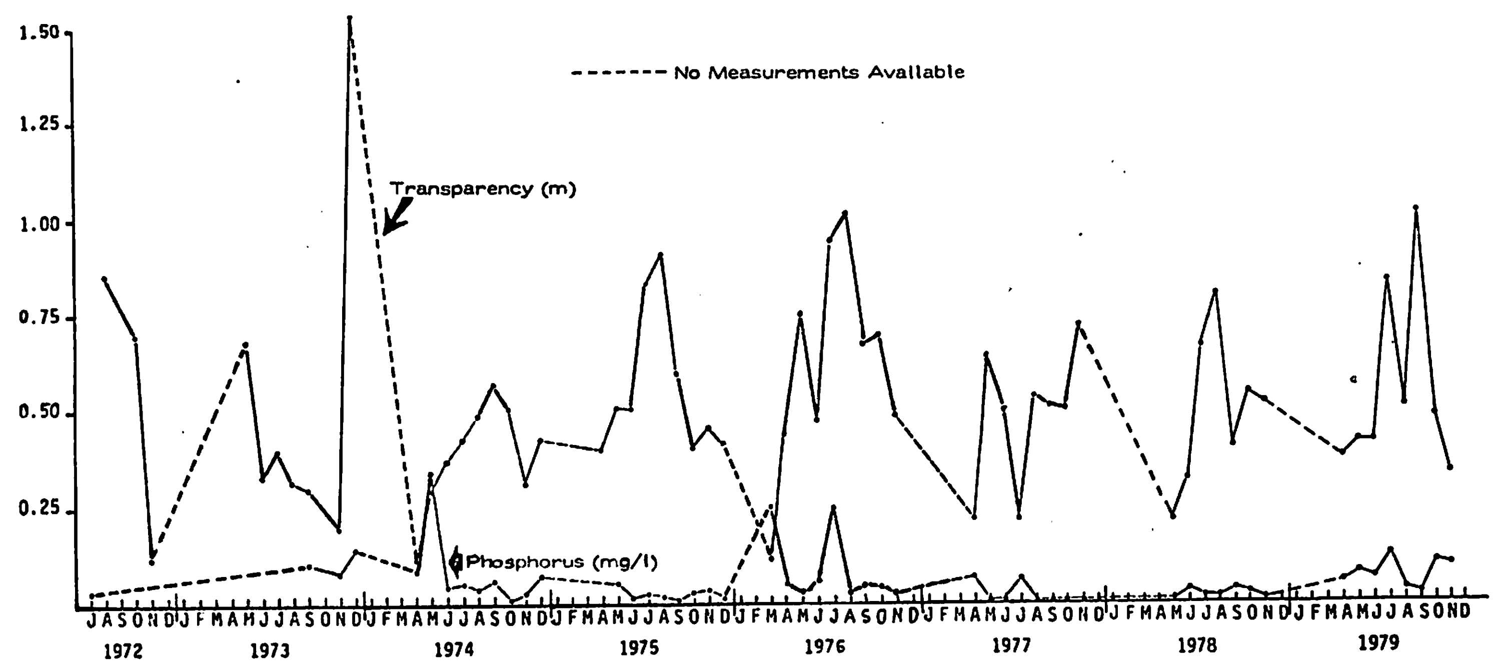


FIGURE 21. Comparison of Pre-operational and Operational Data for Dissolved Oxygen in Bottom Water at Station Discharge (Station No. 13).

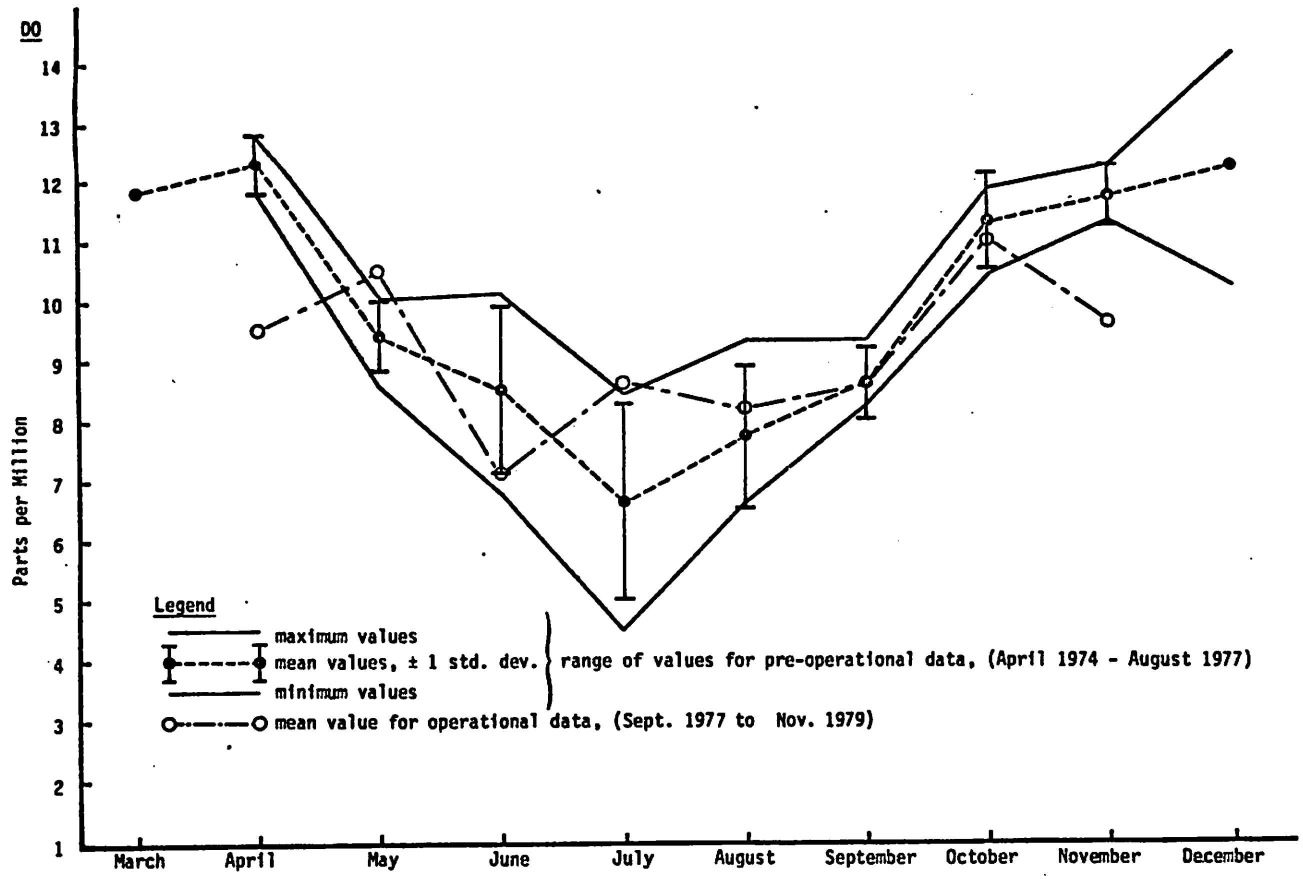


FIGURE 22. Comparison of Pre-operational and Operational Data of Hydrogen Ion Concentration (pH) in Bottom Water at Station Discharge (Station No. 13).

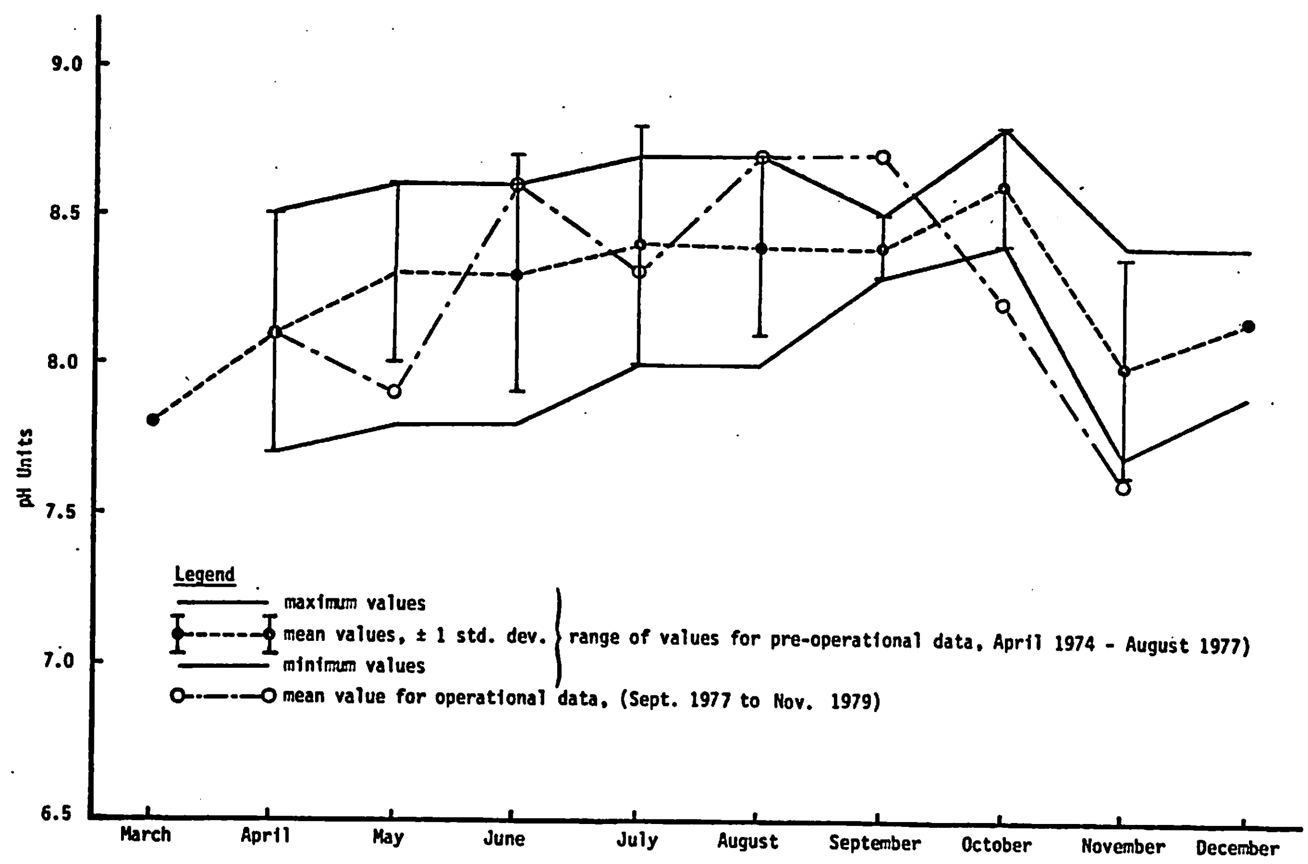


FIGURE 23. Comparison of Pre-operational and Operational Data for Transparency (Secchi Disk) of Water at Station Discharge (Station 13).

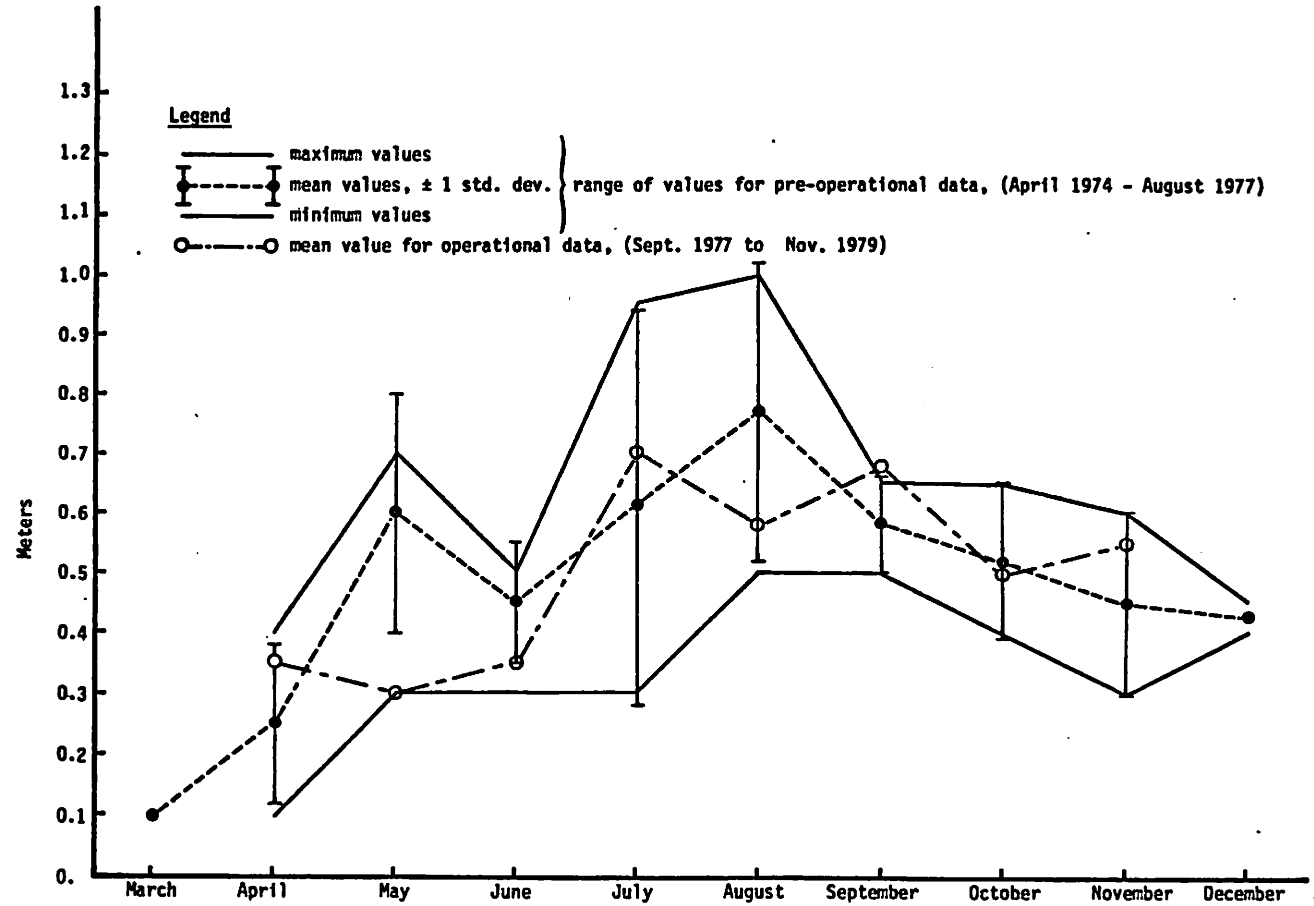


FIGURE 24. Comparison of Pre-operational and Operational Data for Turbidity of Bottom Water at Station Discharge (Station No. 13).

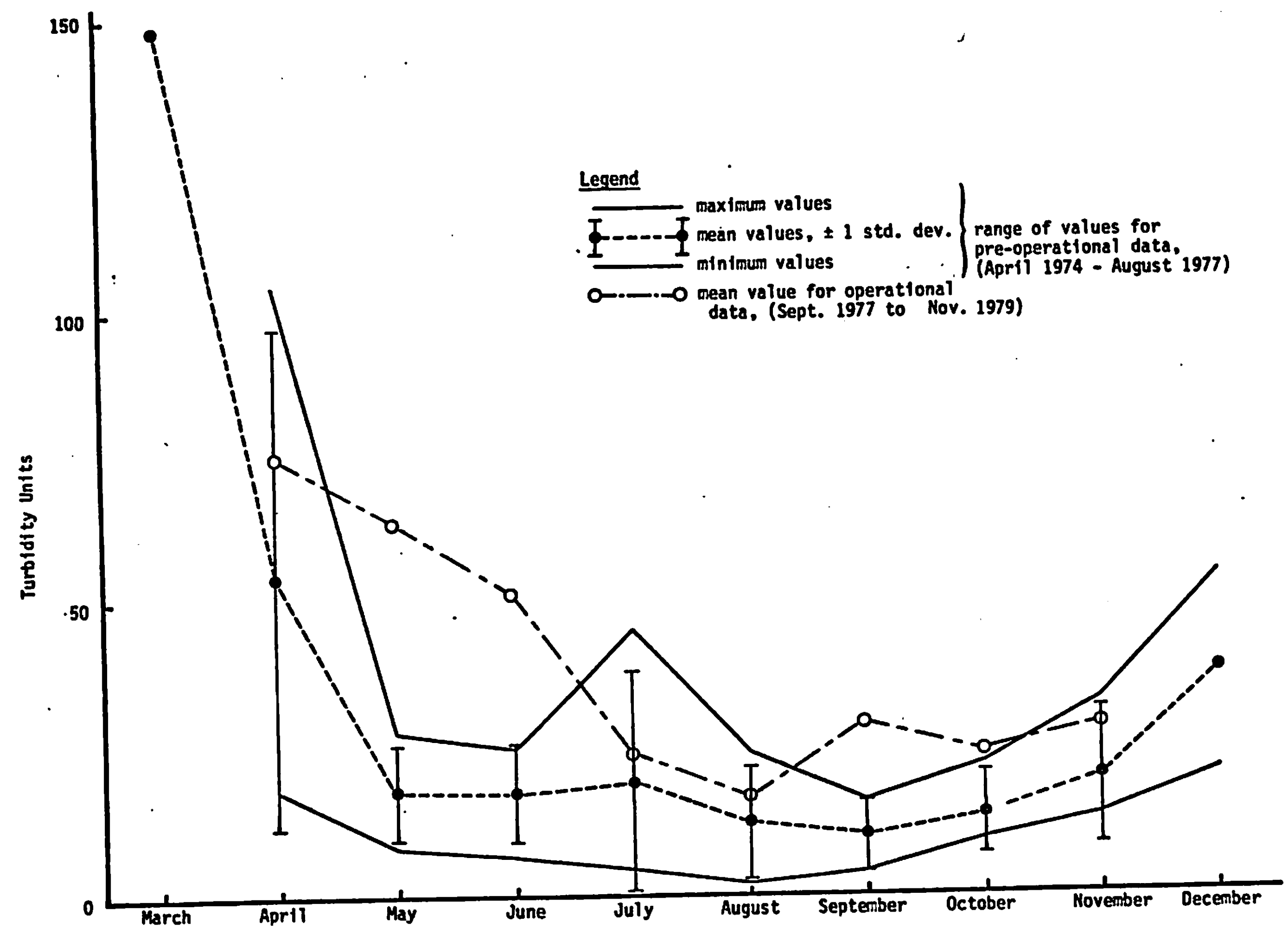


FIGURE 25 . Comparison of Pre-operational and Operational Data for Suspended Solids in Bottom Water at Station Discharge (Station No. 13).

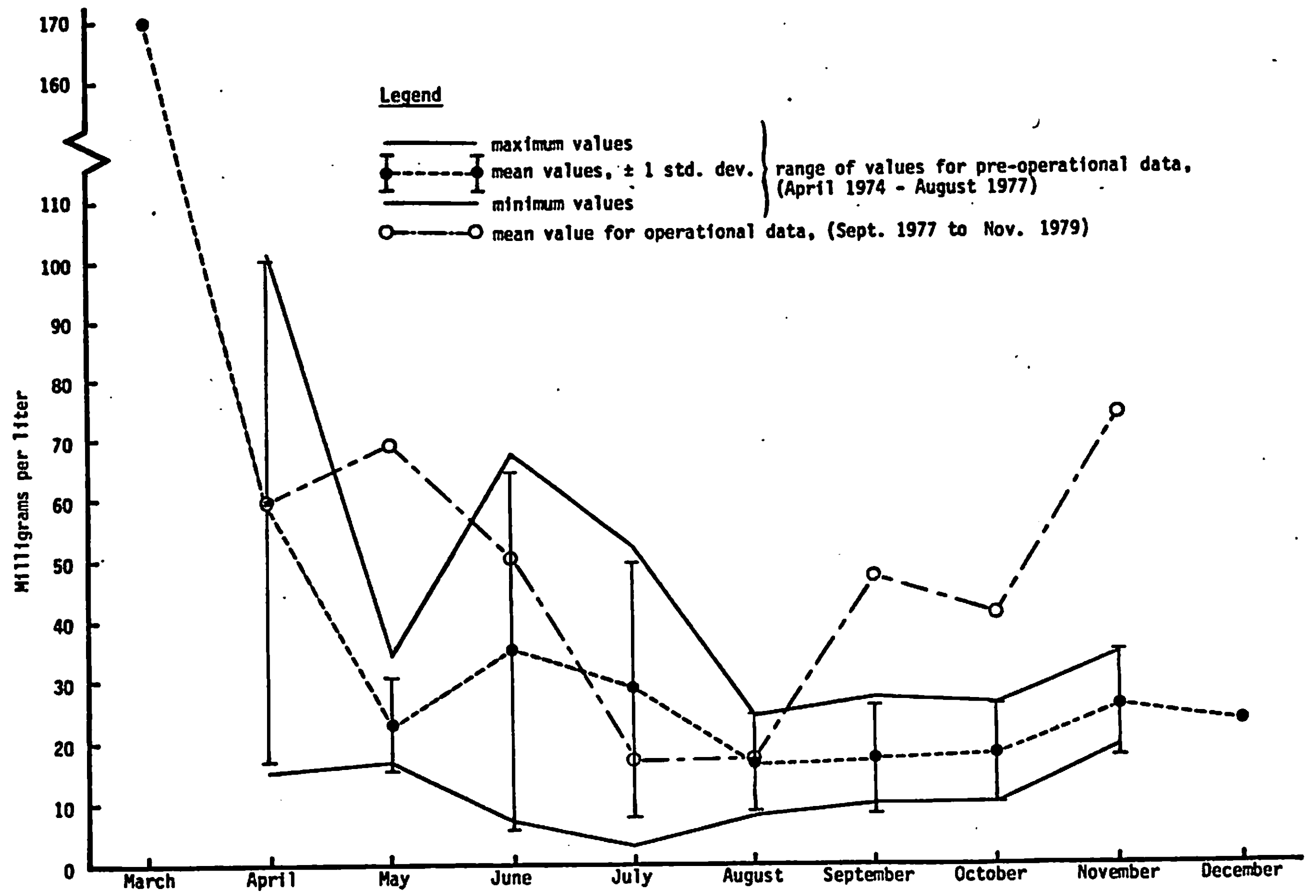


FIGURE 26. Comparison of Pre-operational and Operational Data for Conductivity of Bottom Water at Station Discharge (Station No. 13).

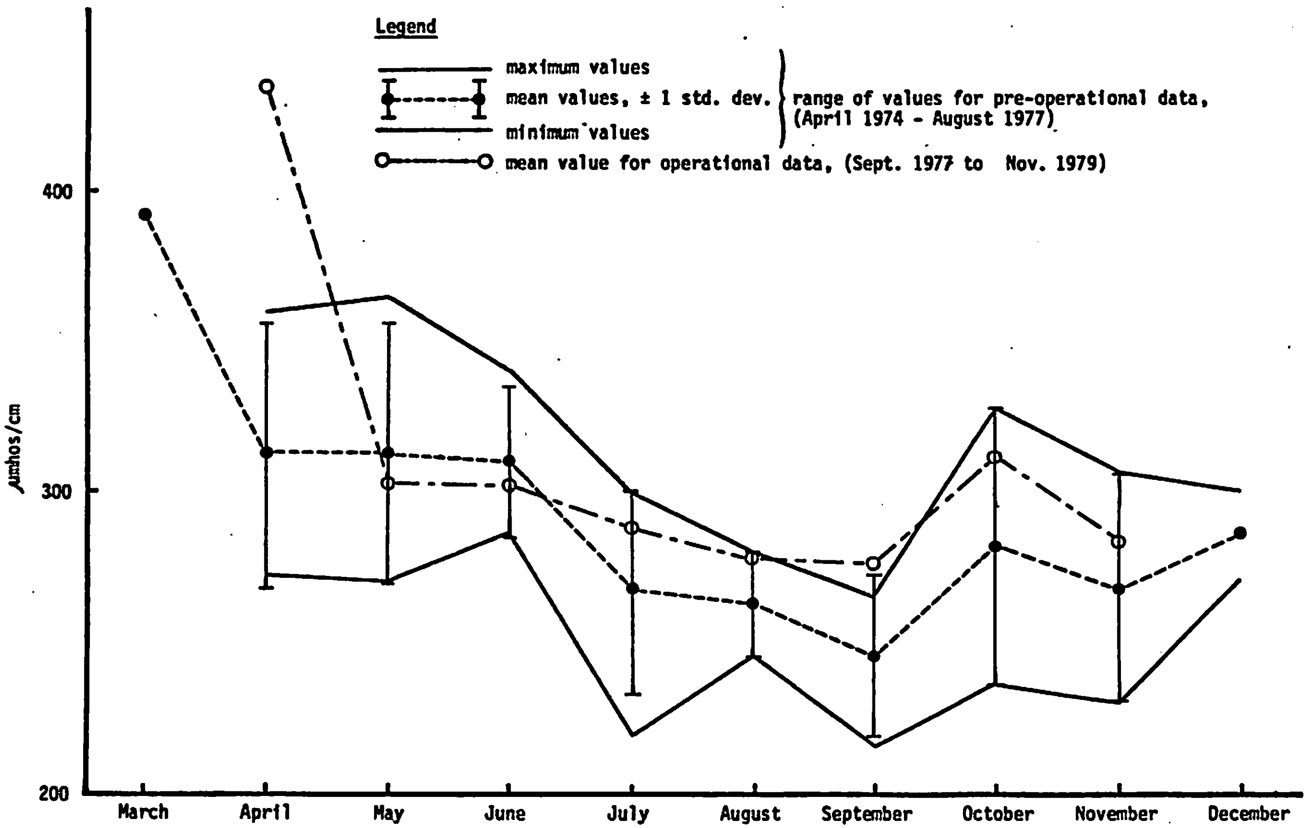


FIGURE 27. Comparison of Pre-operational and Operational Data for Dissolved Solids in Bottom Water at Station Discharge (Station No. 13).

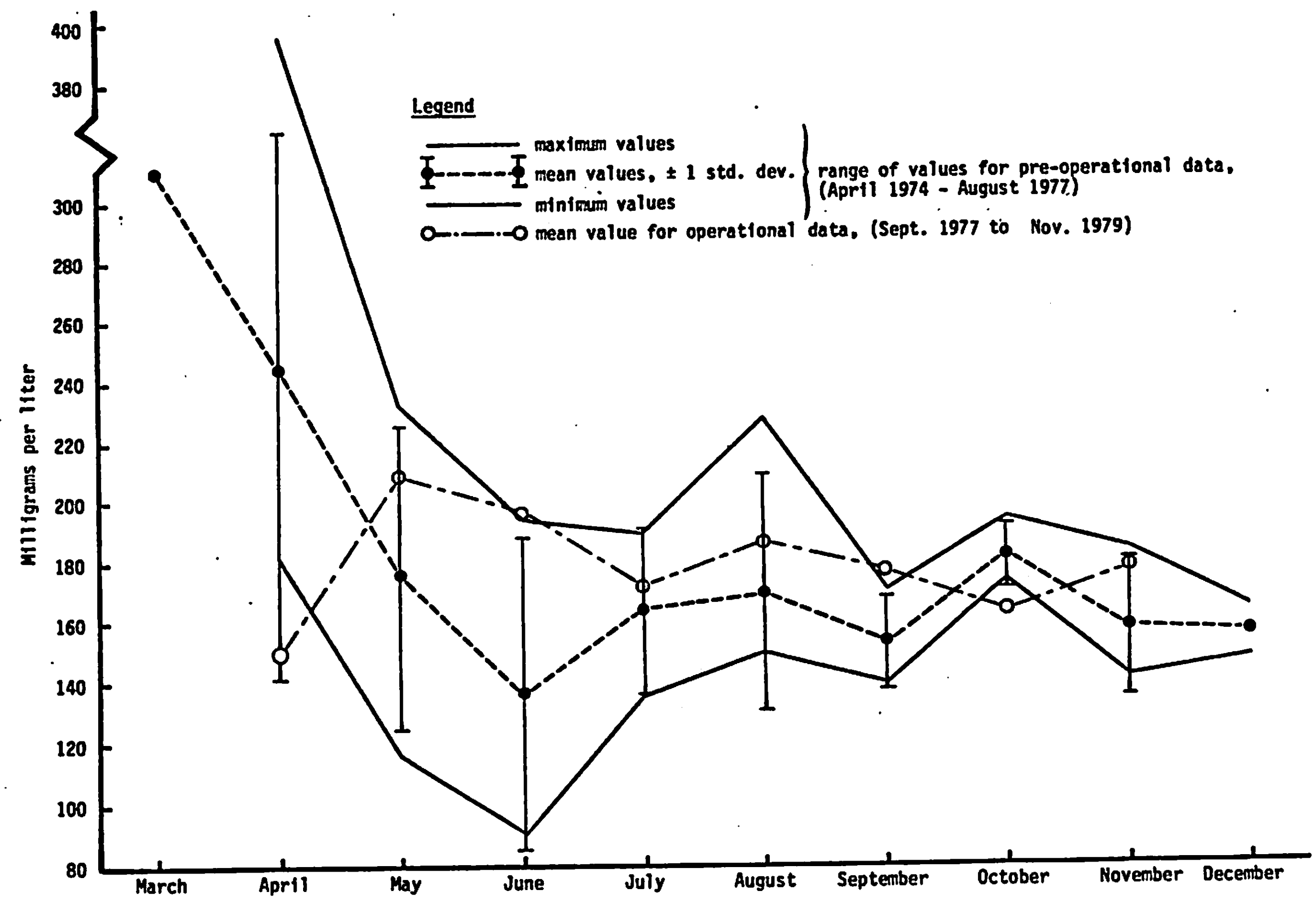


FIGURE 28. Comparison of Pre-operational and Operational Data for Calcium in Bottom Water at Station Discharge (Station No. 13).

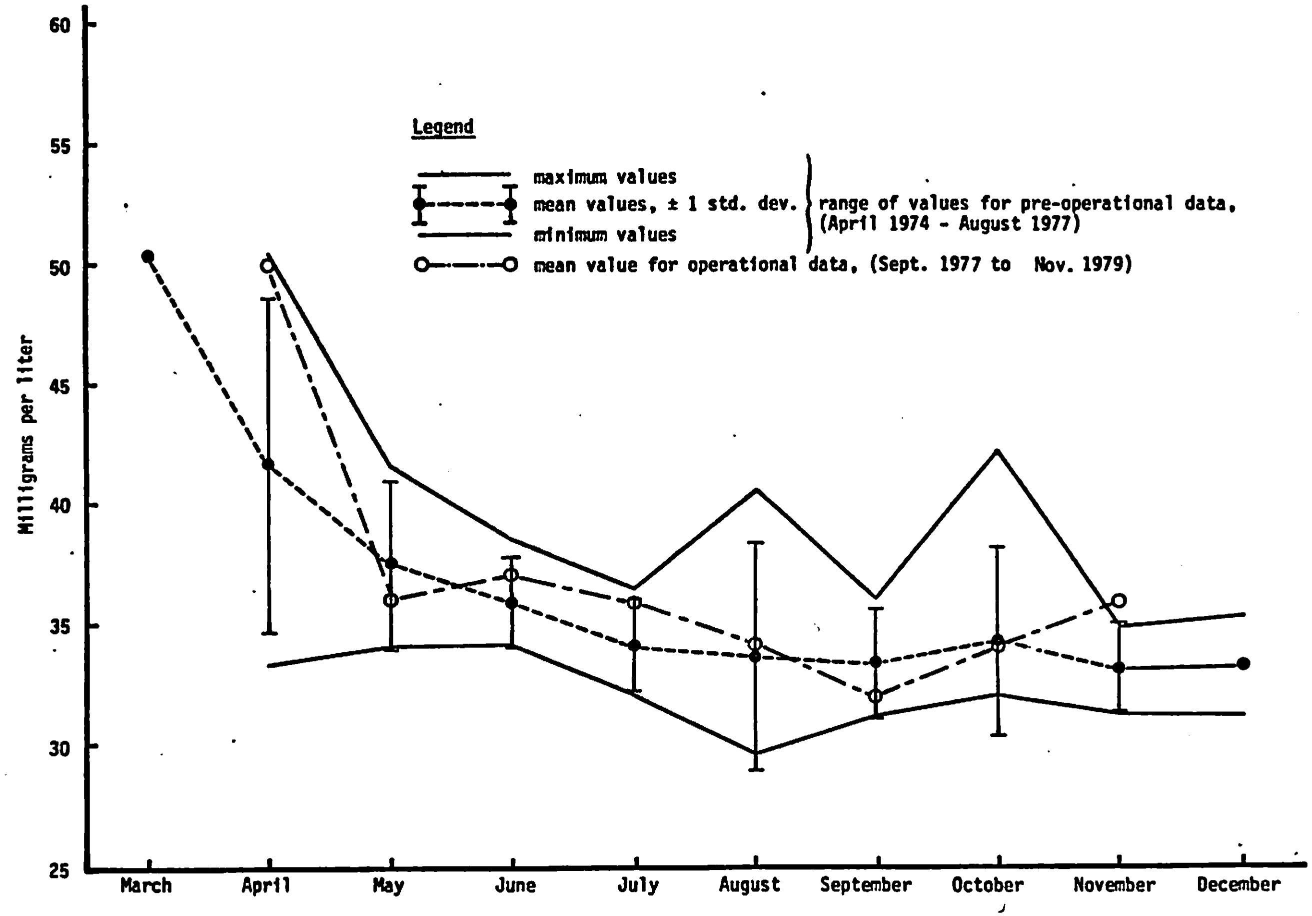


FIGURE 29. Comparison of Pre-operational and Operational Data for Chloride in Bottom Water at Station Discharge (Station No. 13).

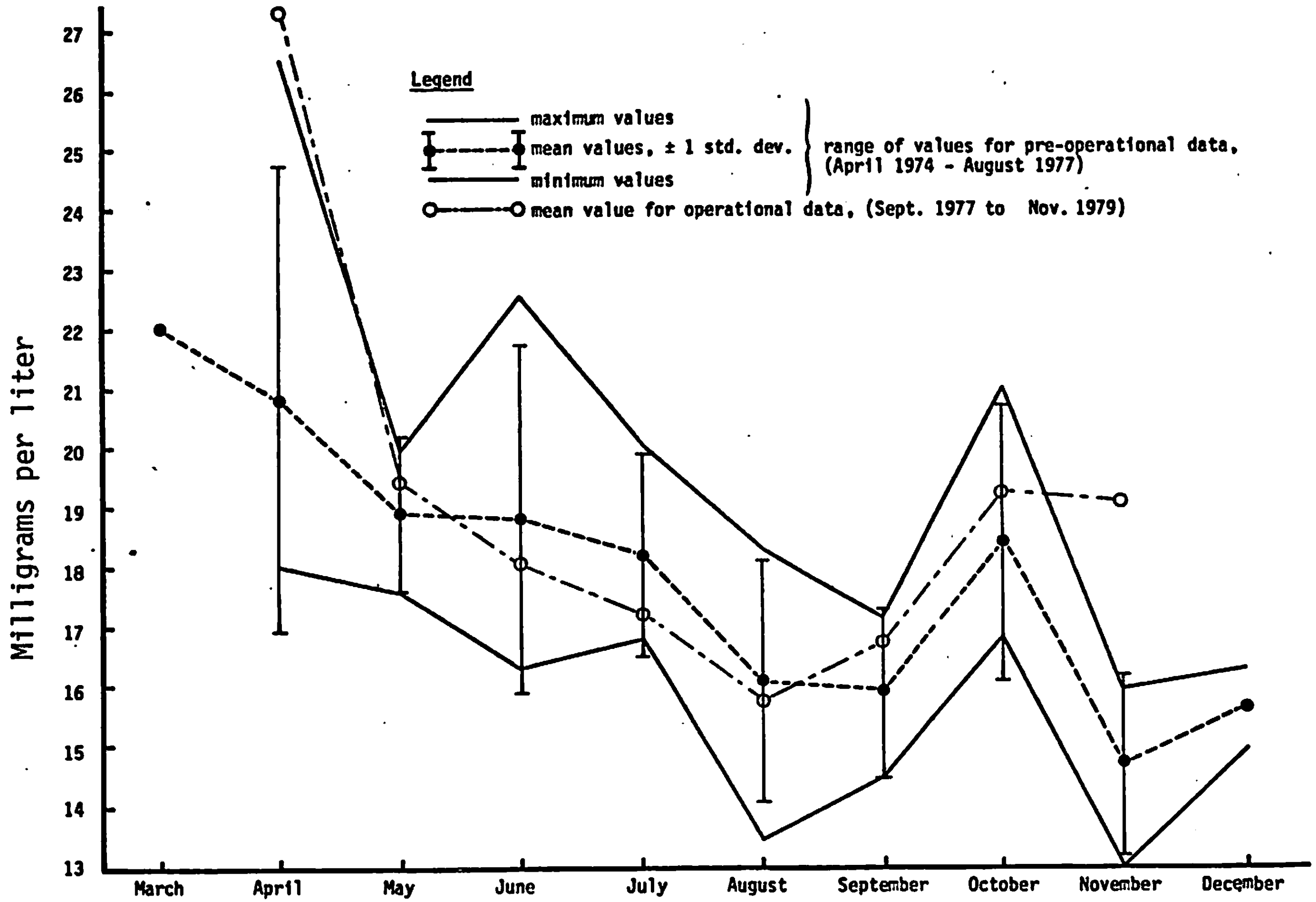


FIGURE 30. Comparison of Pre-operational and Operational Data of Sulfate in Bottom Water at Station Discharge (Station No. 13).

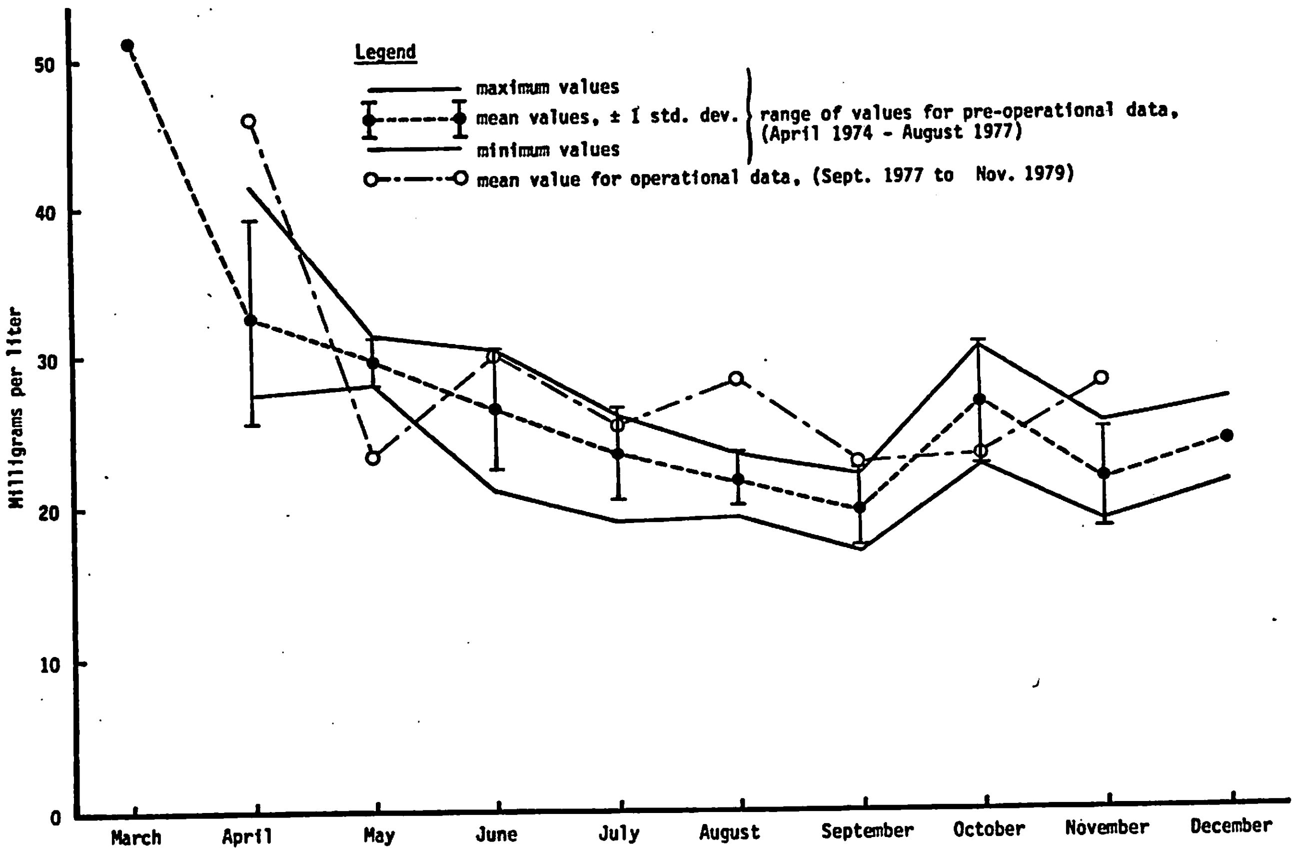


FIGURE 31. Comparison of Pre-operational and Operational Data for Sodium in Bottom Water at Station Discharge (Station No. 13).

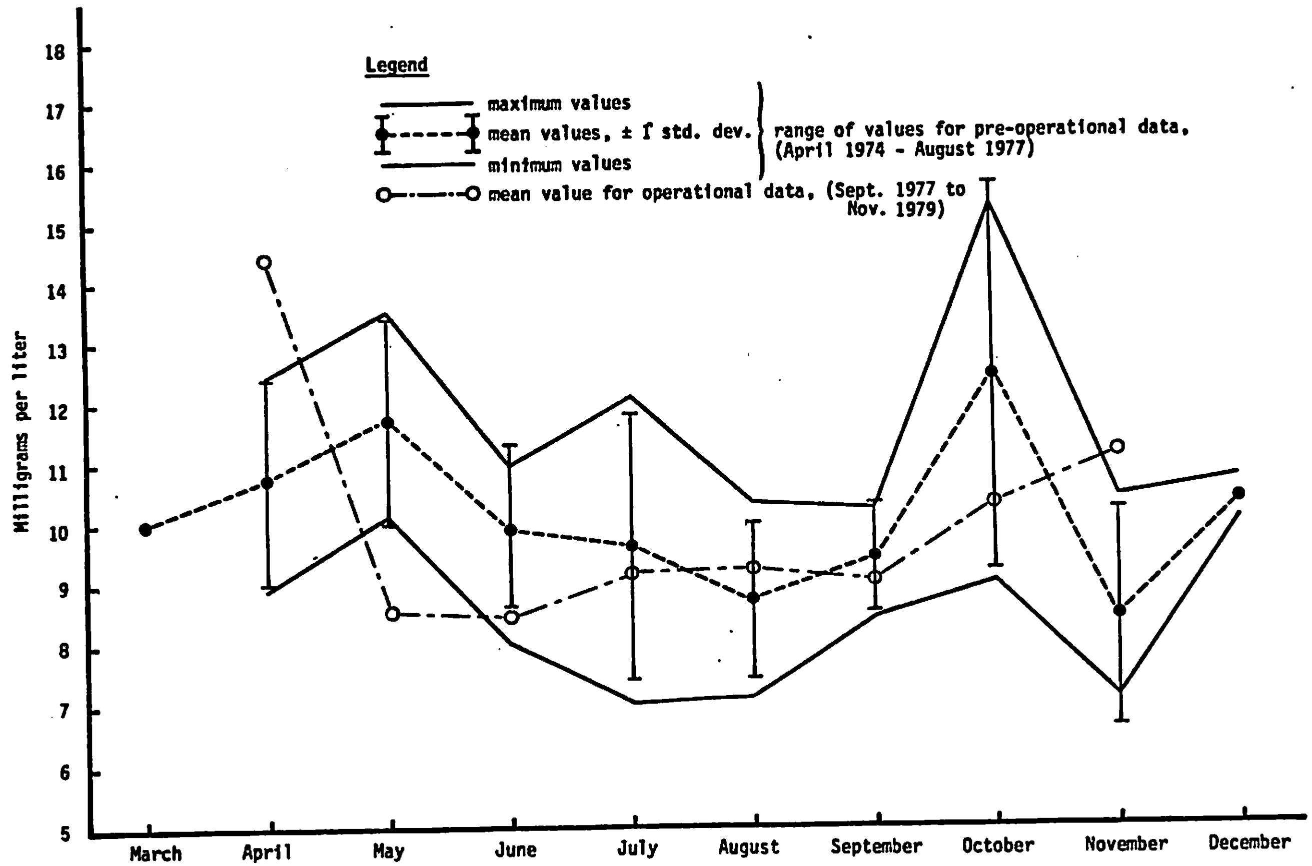


FIGURE 32 Comparison of Pre-operational and Operational Data for Magnesium in Bottom Water at Station Discharge (Station No. 13).

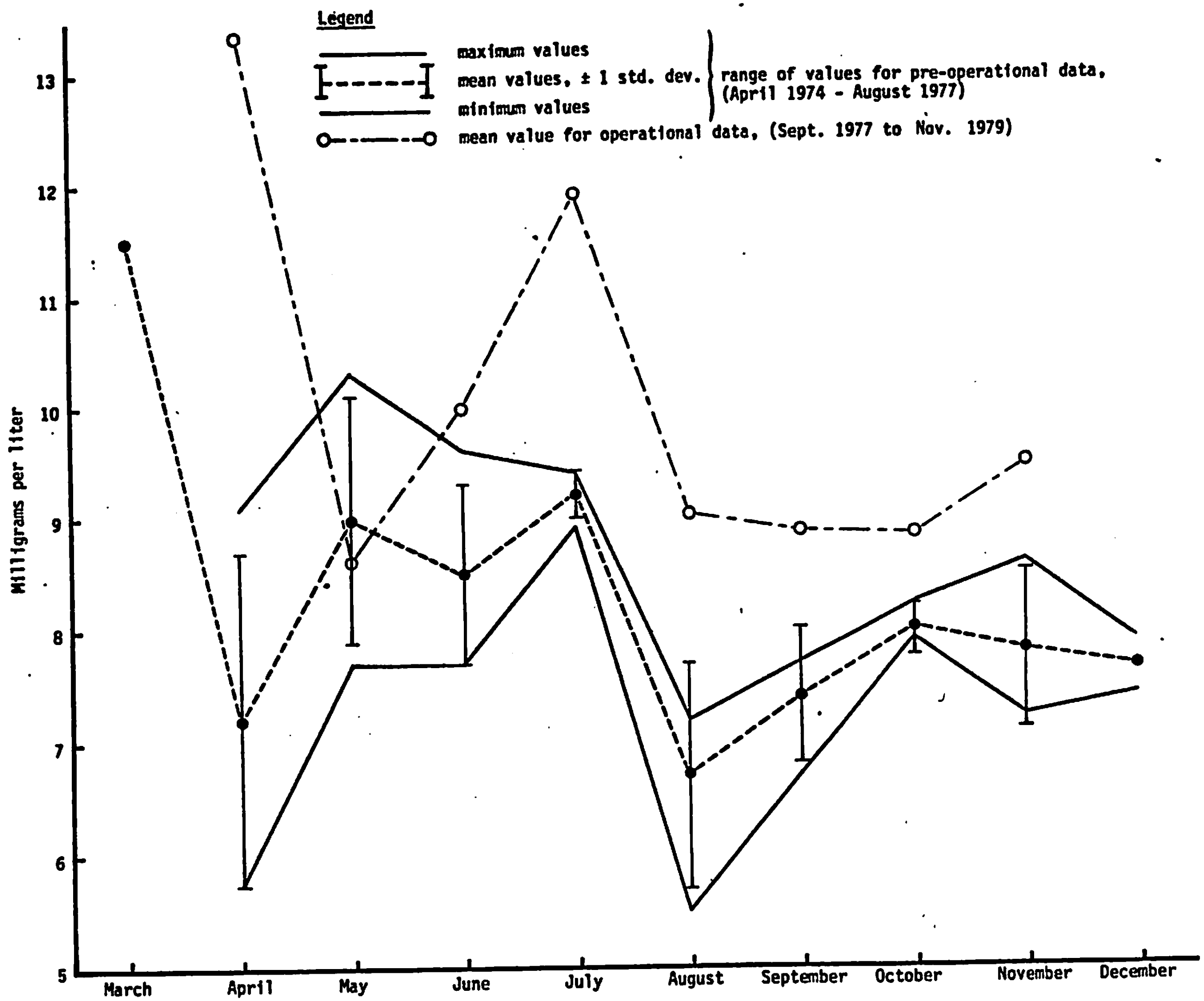


FIGURE 33. Comparison of Pre-operational and Operational Data for Total Alkalinity of Bottom Water at Station Discharge (Station No. 13).

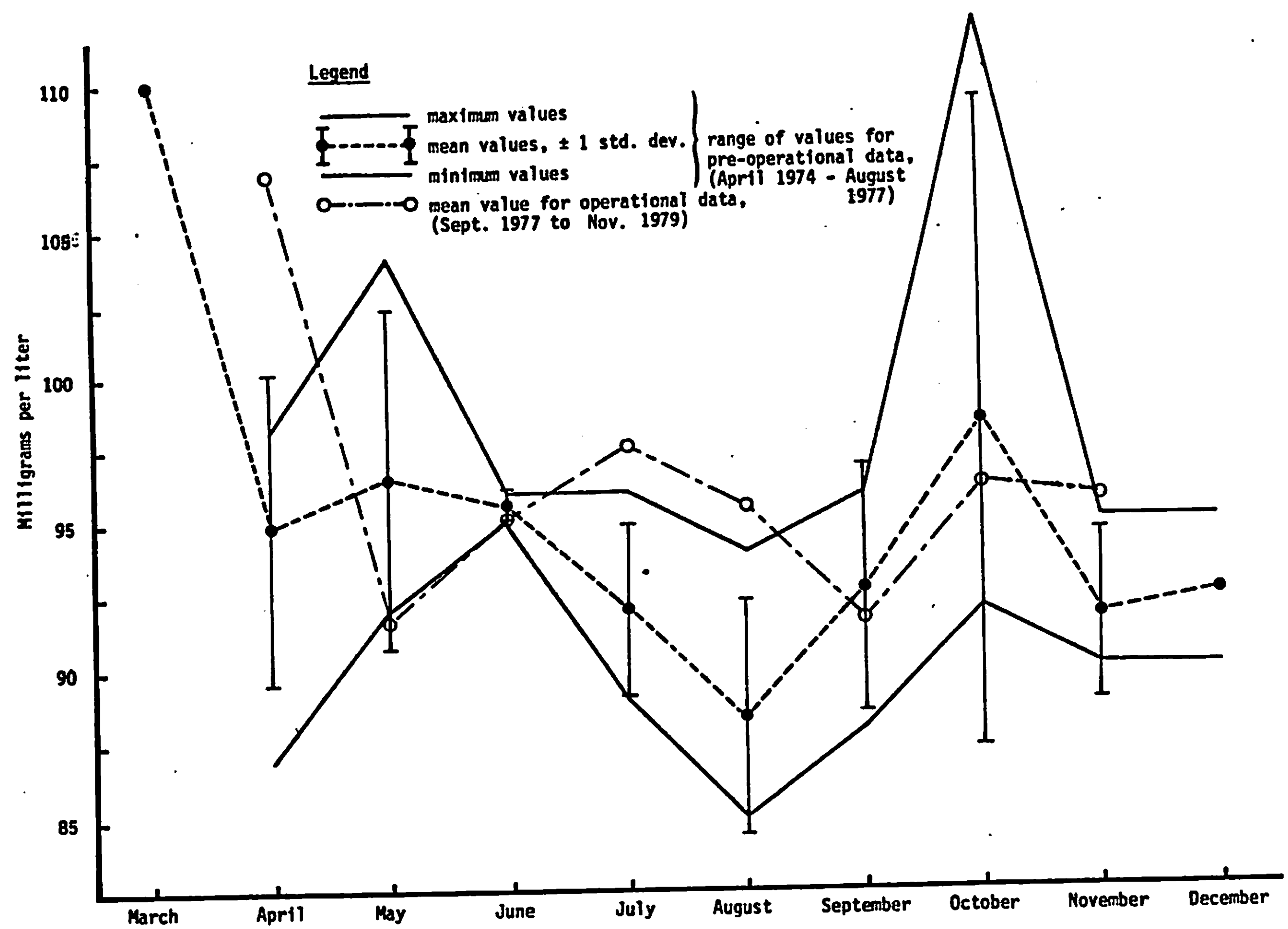


FIGURE 34. Comparison of Pre-operational and Operational Data for Nitrate in Bottom Water at Station Discharge (Station No. 13).

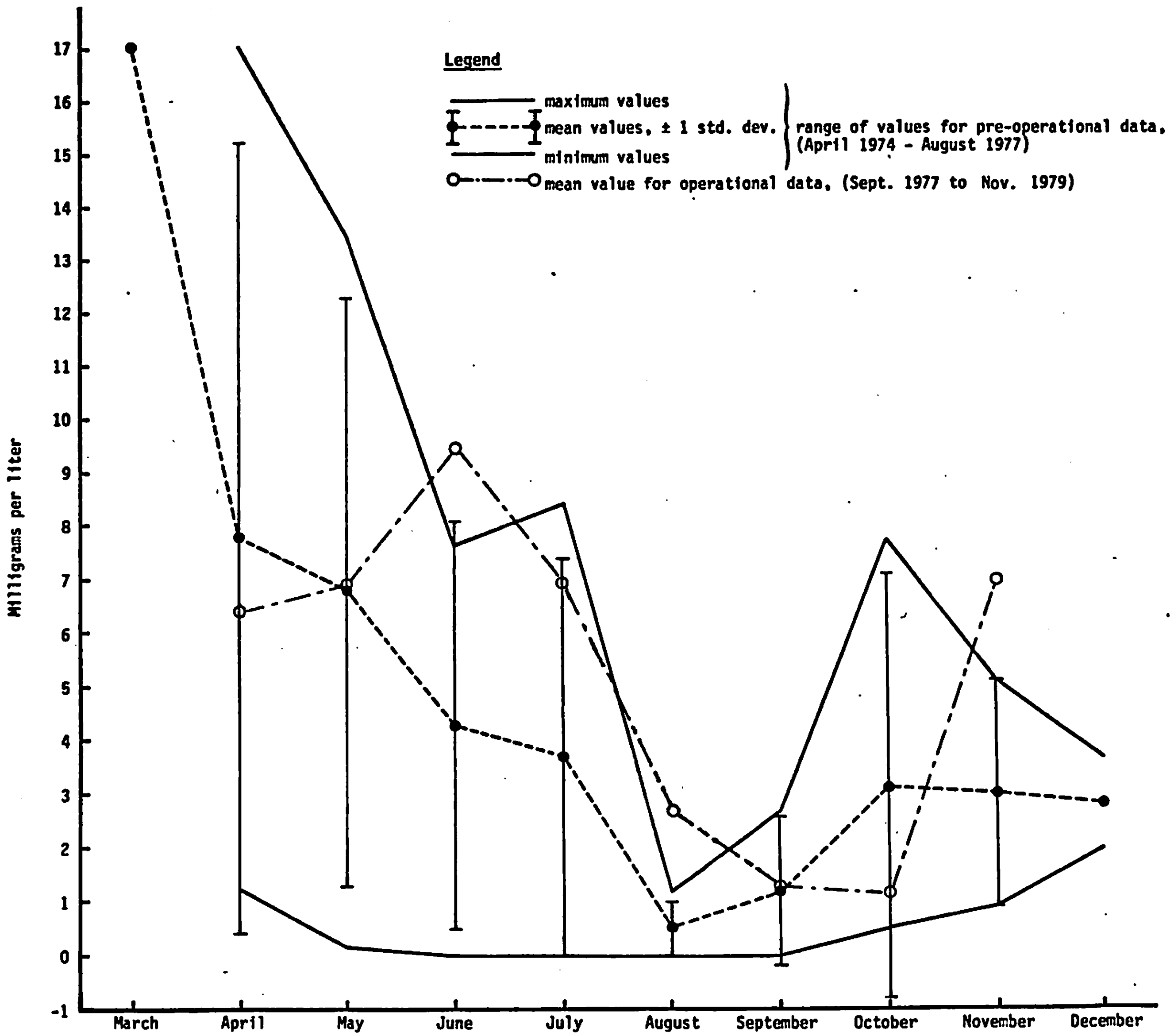


FIGURE 35. Comparison of Pre-operational and Operational Data for Phosphorus in Bottom Water at Station Discharge (Station No. 13).

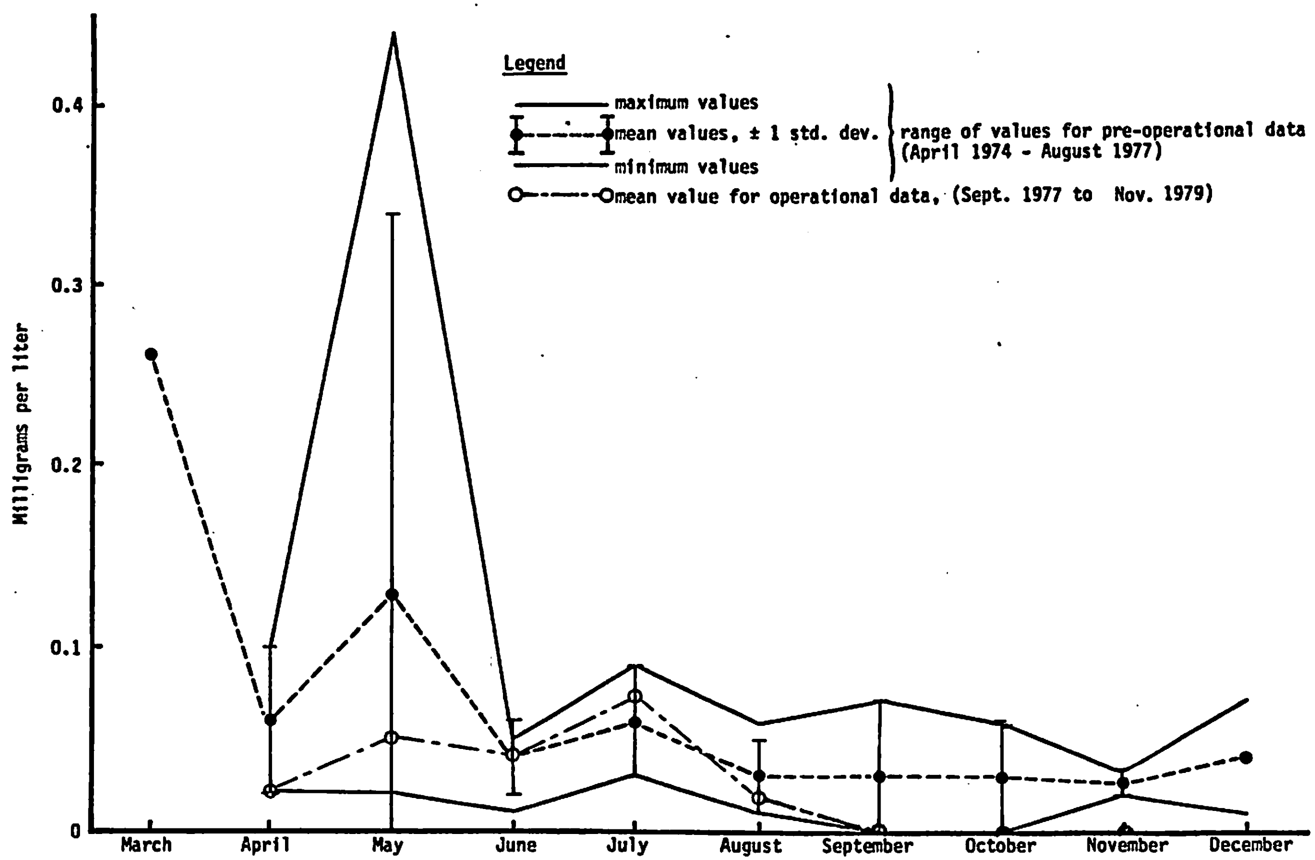


FIGURE 36. Comparison of Pre-operational and Operational Data for Silica in Bottom Water at Station Discharge (Station No. 13).

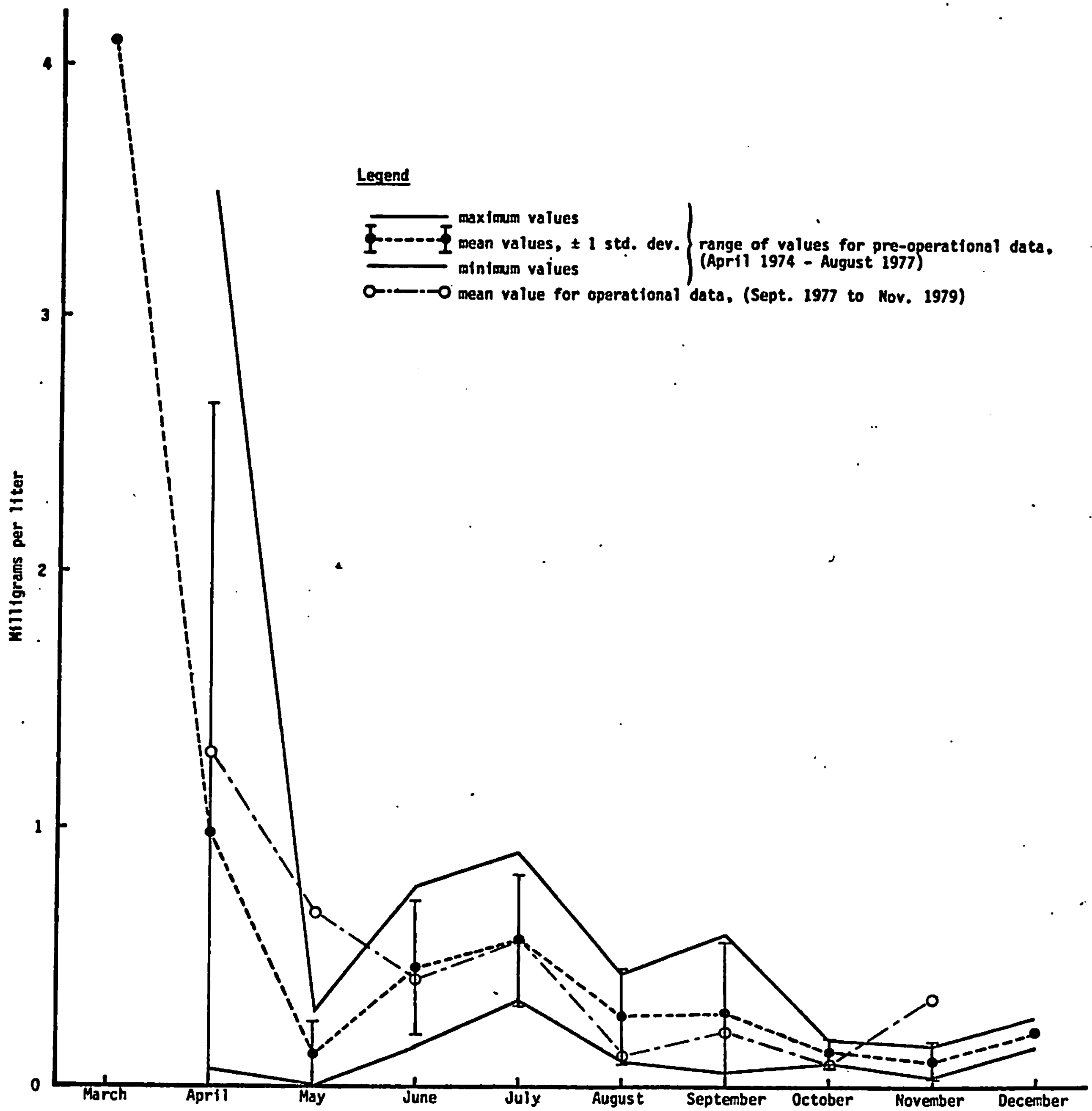


FIGURE 37. Comparison of Pre-operational and Operational Data of Biochemical Oxygen Demand of Bottom Water at Station Discharge (Station No. 13).

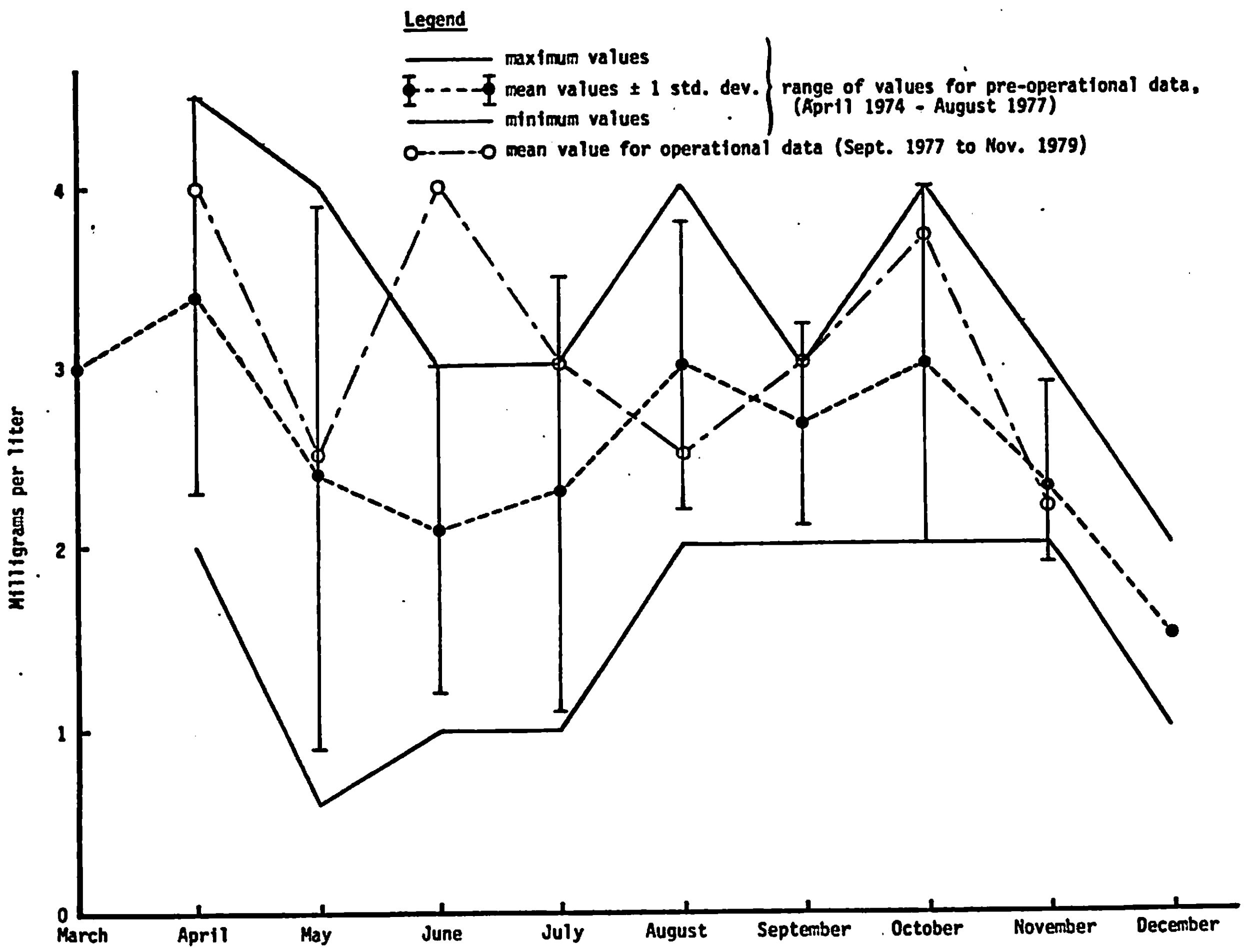


FIGURE 38. Comparison of Pre-operational and Operational Data for Temperature of Bottom Water at Station Discharge (Station No. 13).

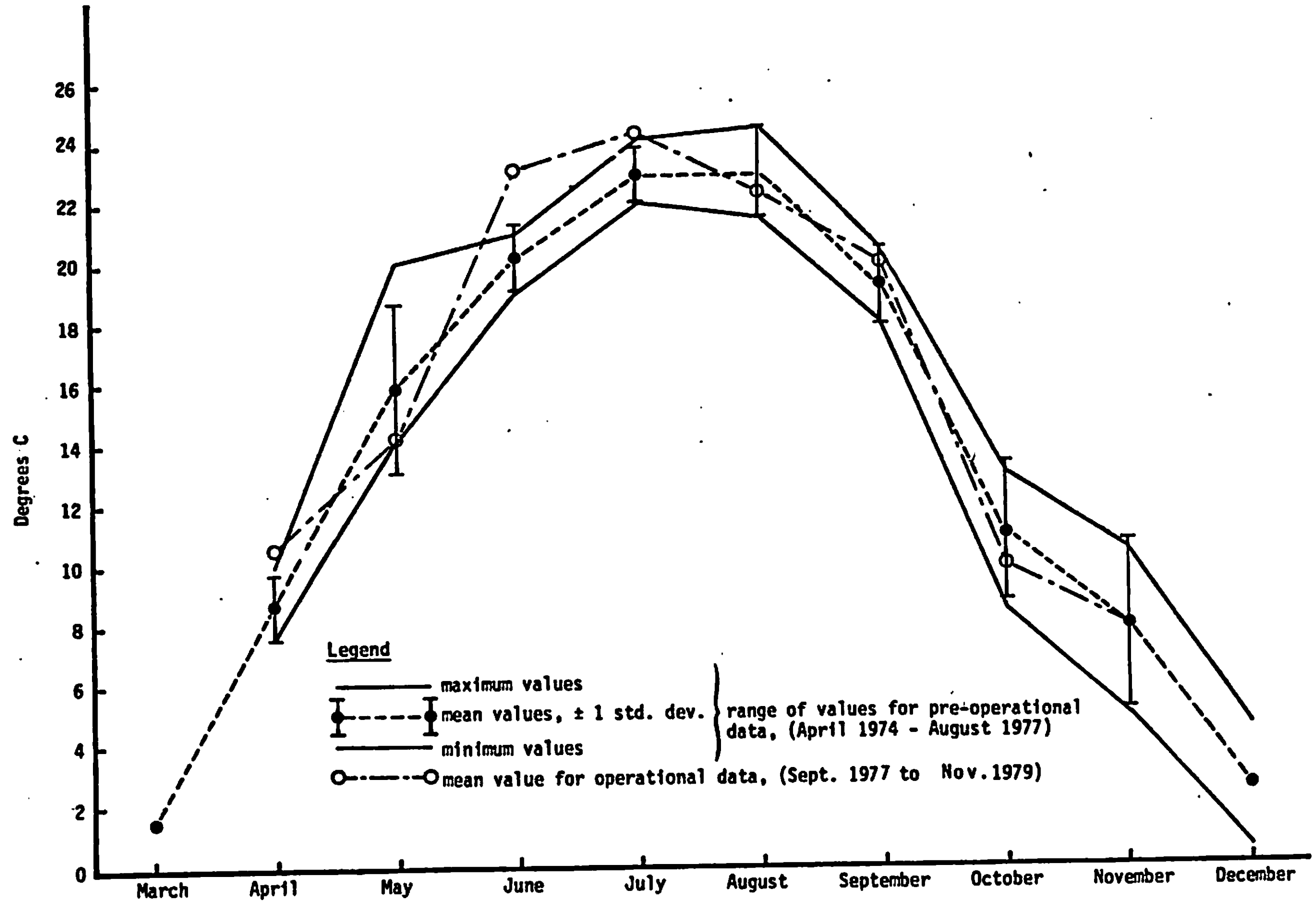
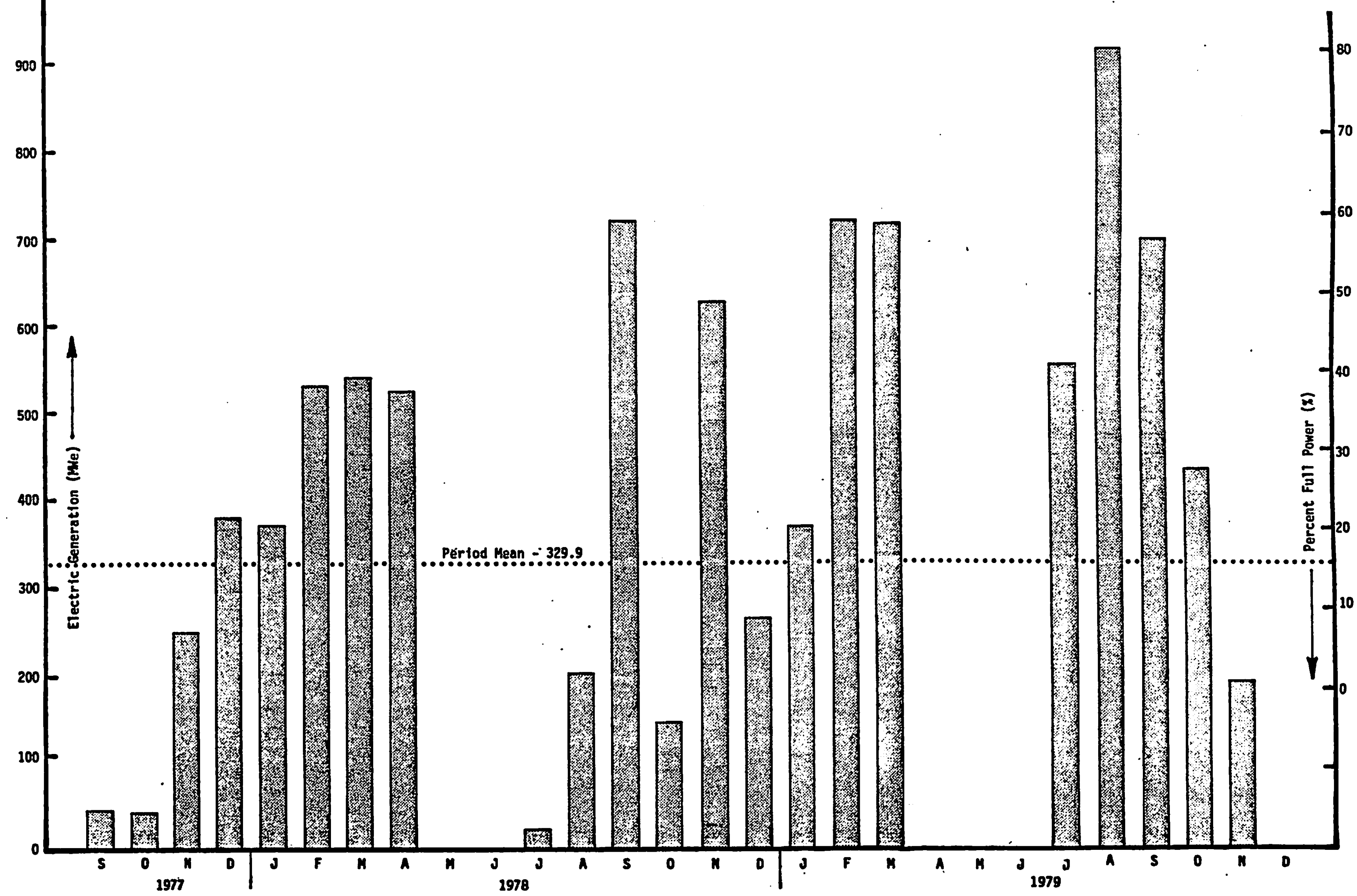


Figure 39. Mean Monthly Power Generation for the Davis-Besse Nuclear Power Station, Unit 1 (1977 - 1979).



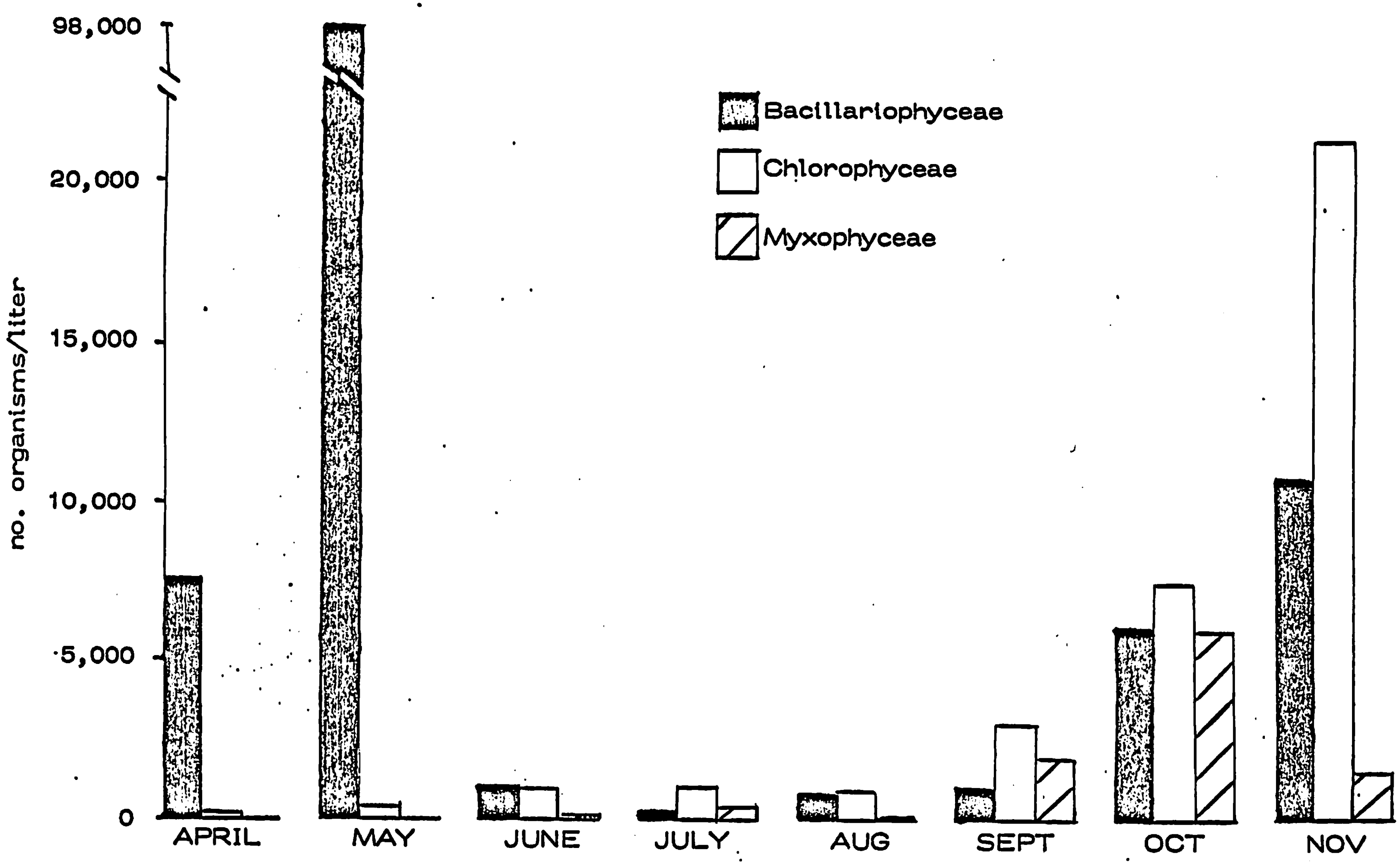


FIGURE 40. MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT - 1974.

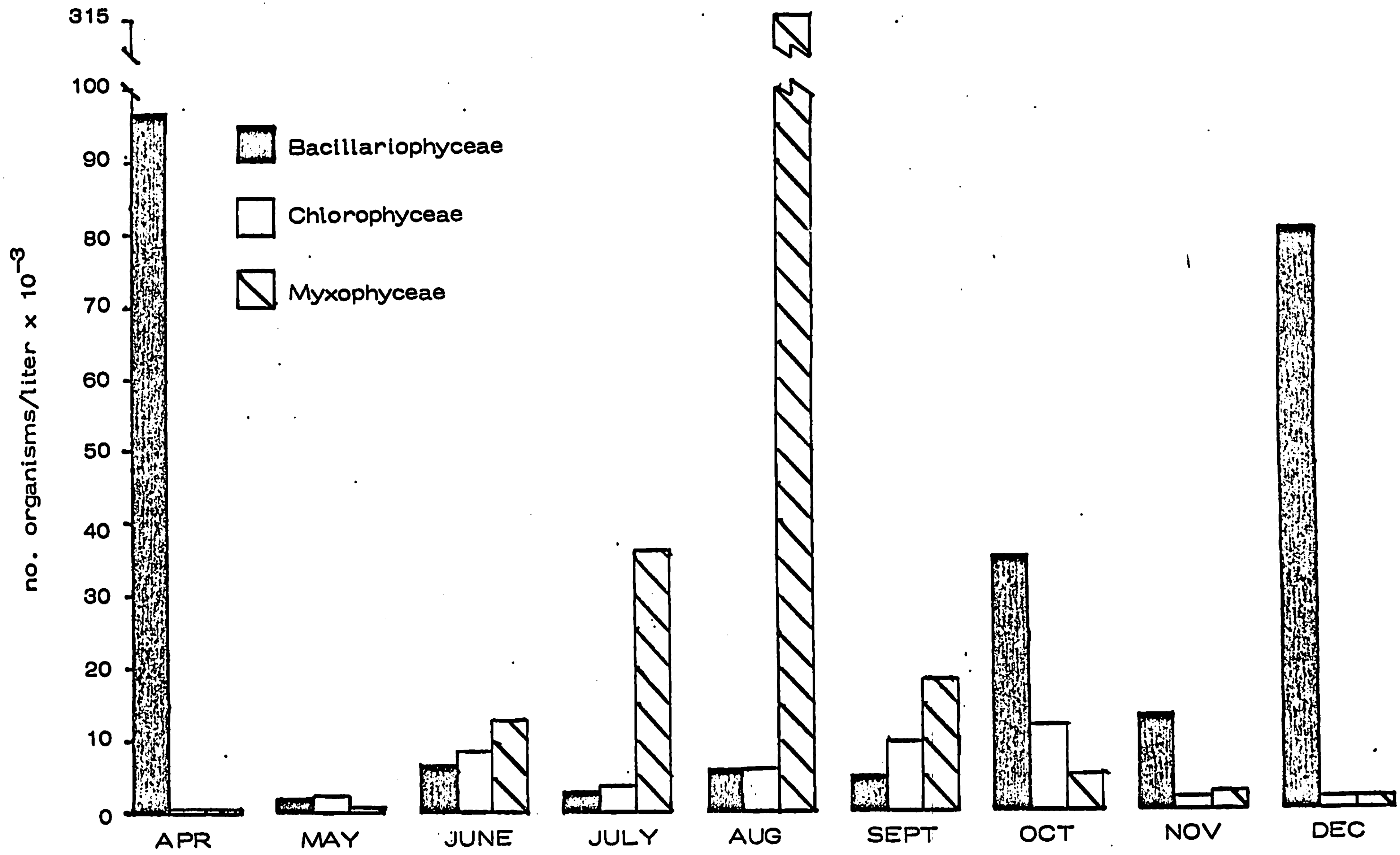


FIGURE 41. MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT - 1975.

FIGURE 42. MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1976.

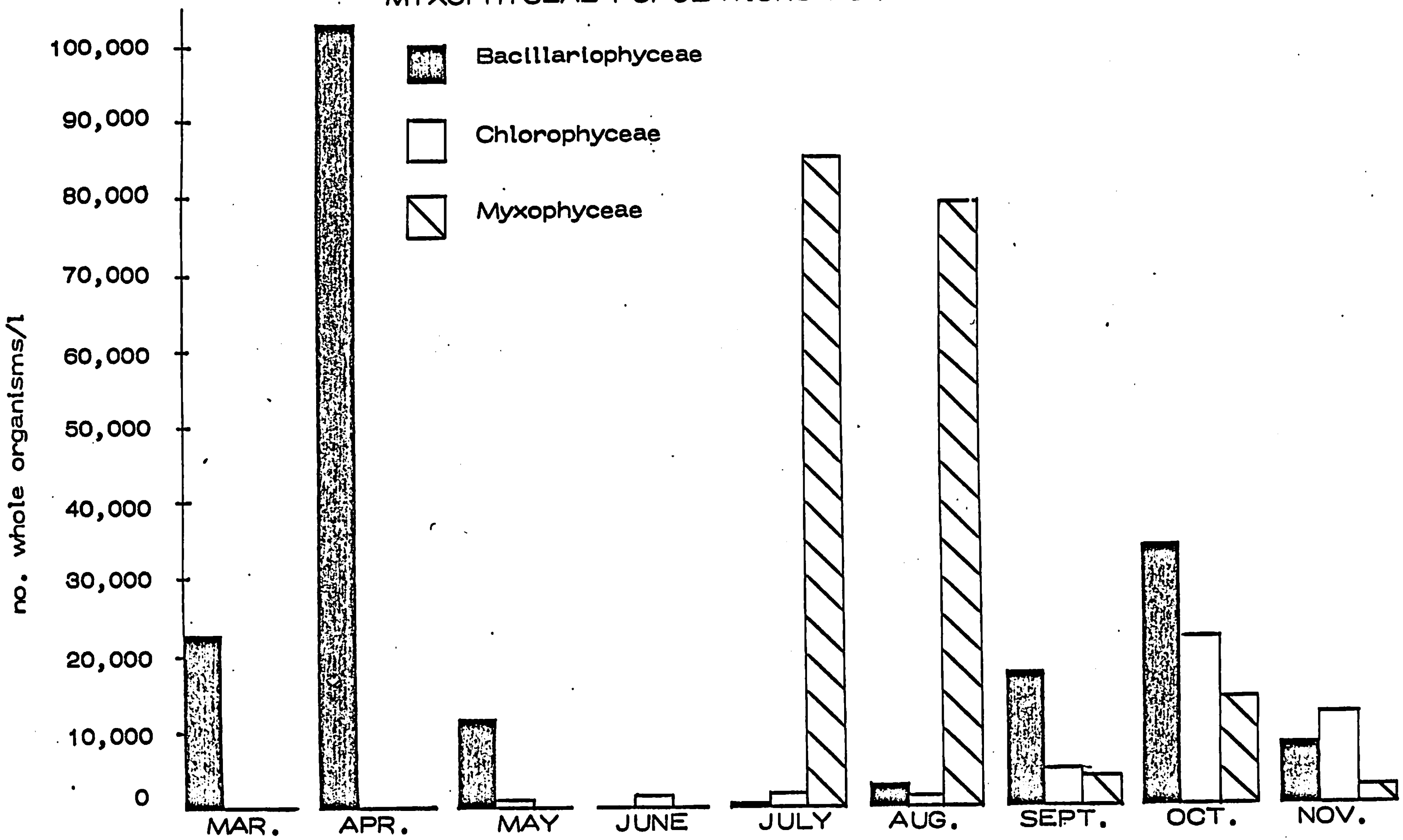


FIGURE 43

MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1977.

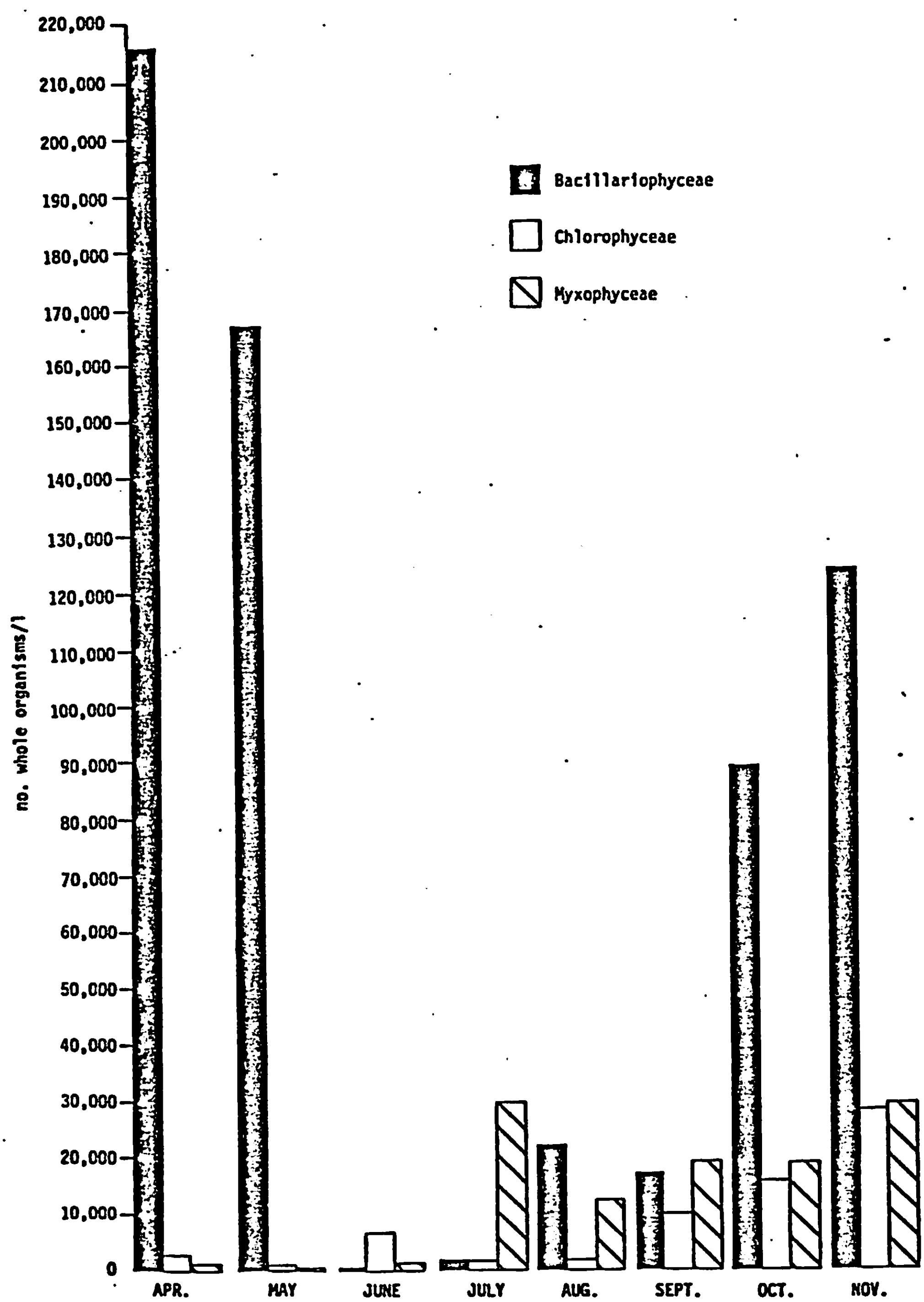


FIGURE 44

MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1978.

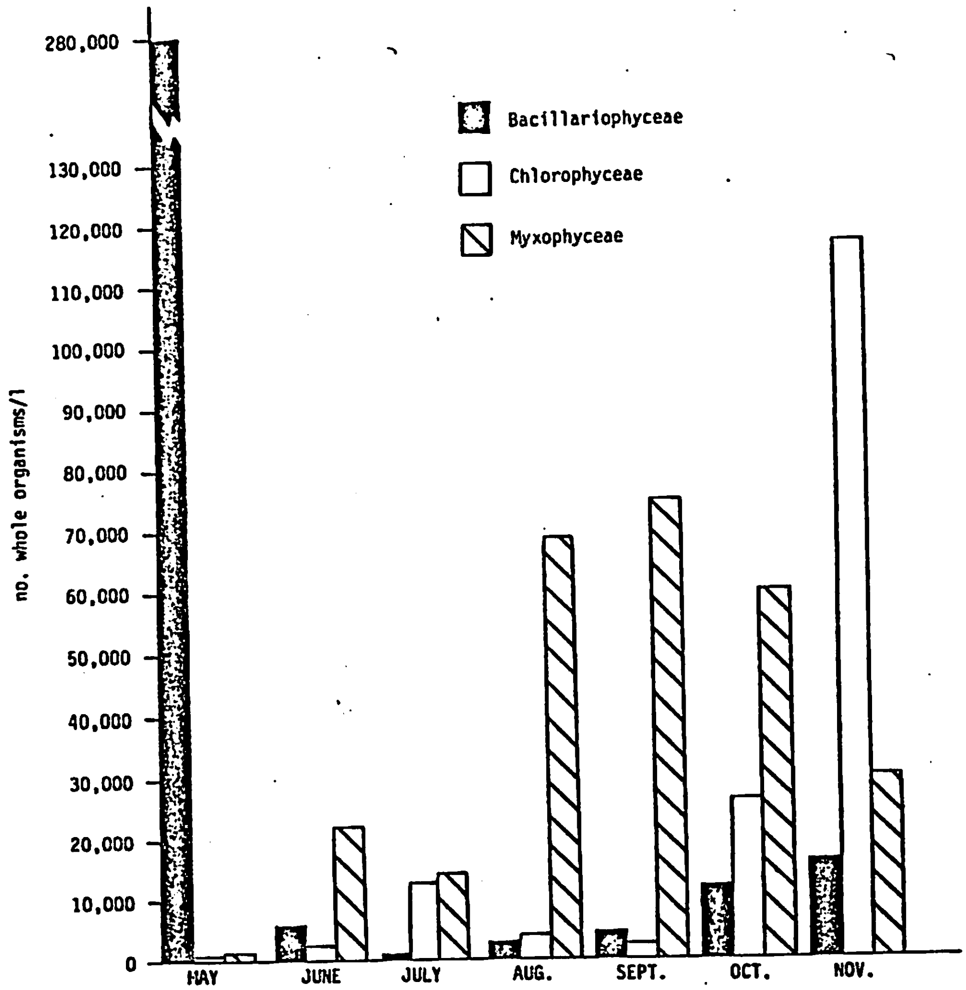


FIGURE 45 MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1979.

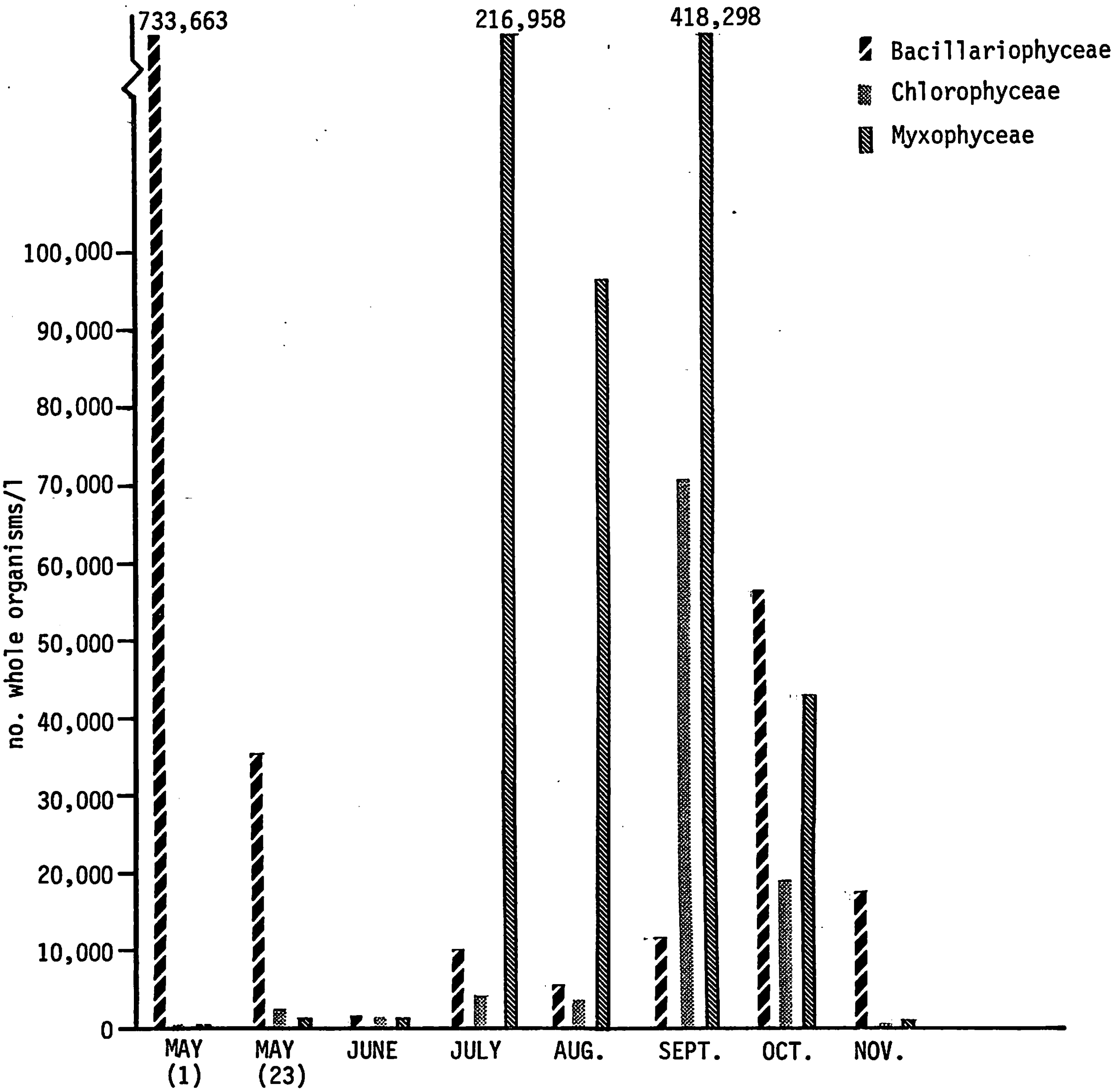
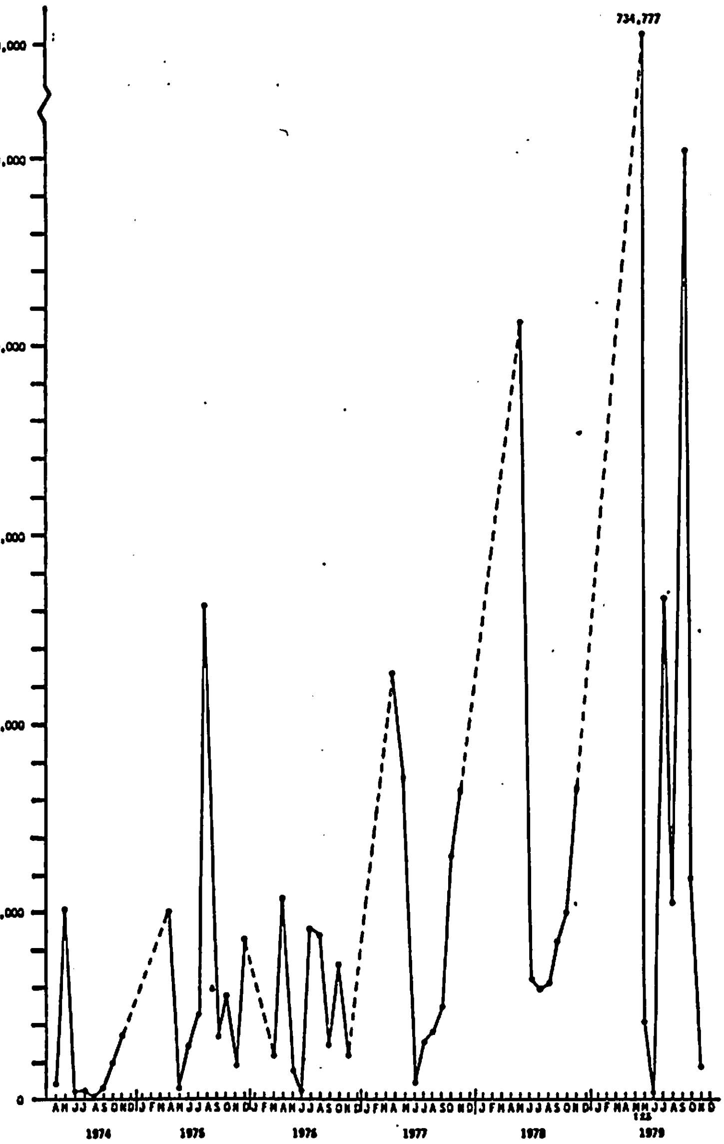


FIGURE 46.MONTHLY MEAN PHYTOPLANKTON POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1974 - 1979.*



*Dotted lines connect points (sampling dates) separated by more than a full calendar month. Solid lines connect points (dates) in consecutive months.

Figure 47. Comparison of Pre-operational and Operational Data for Diatom Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

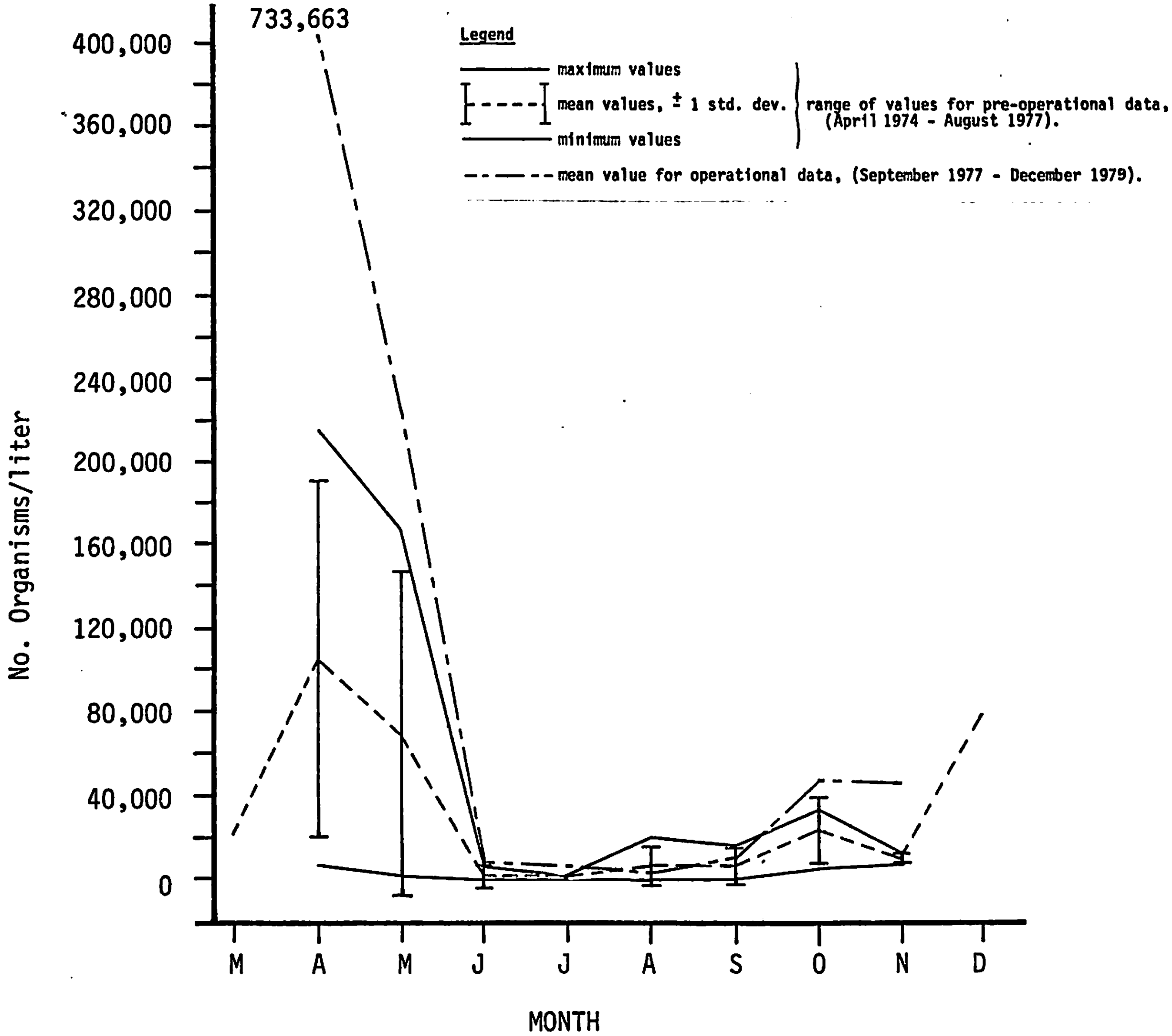


Figure 48. Comparison of Pre-operational and Operational Data for Green Algae Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

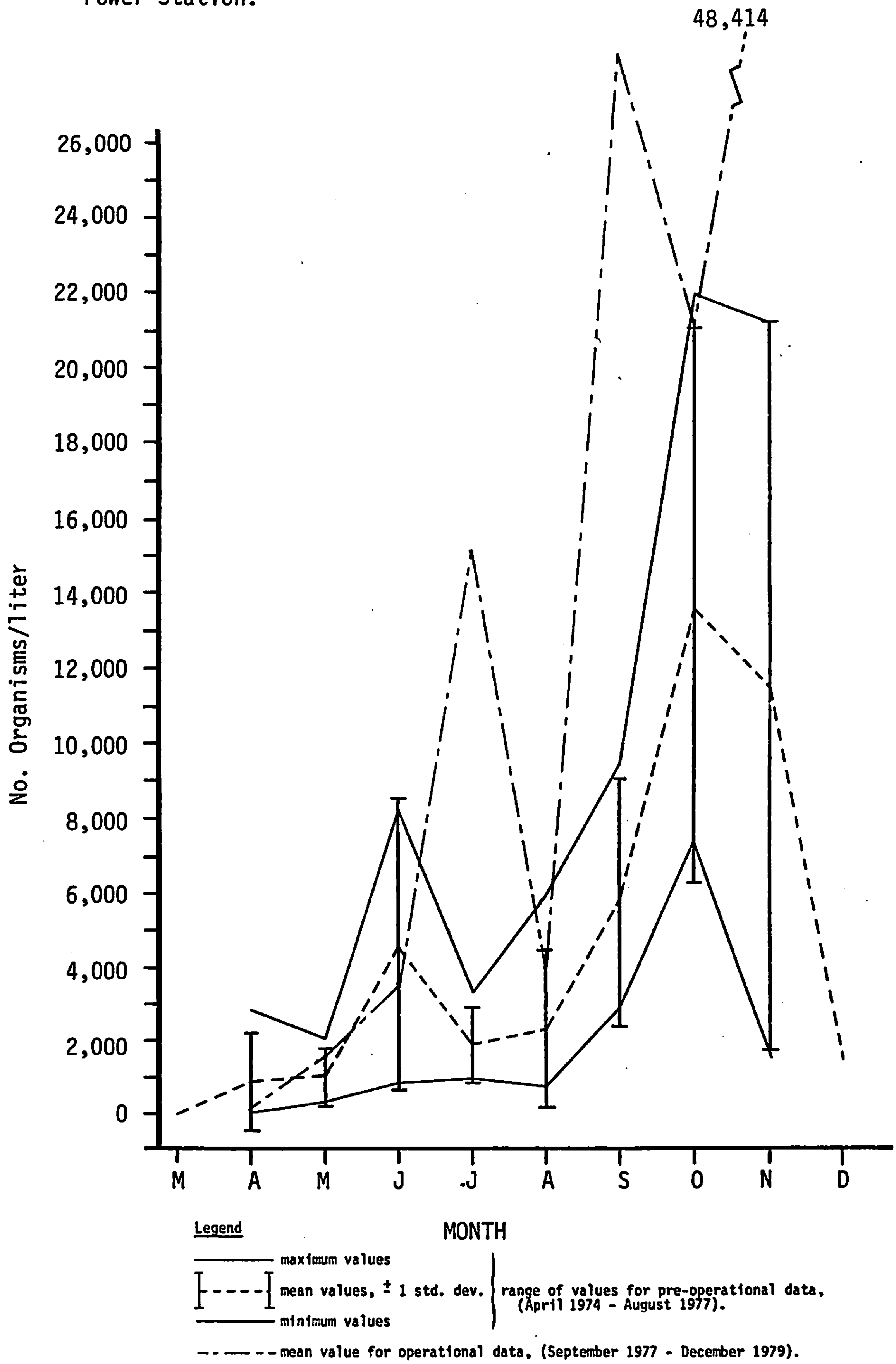


Figure 49. Comparison of Pre-operational and Operational Data for Blue-green Algae Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

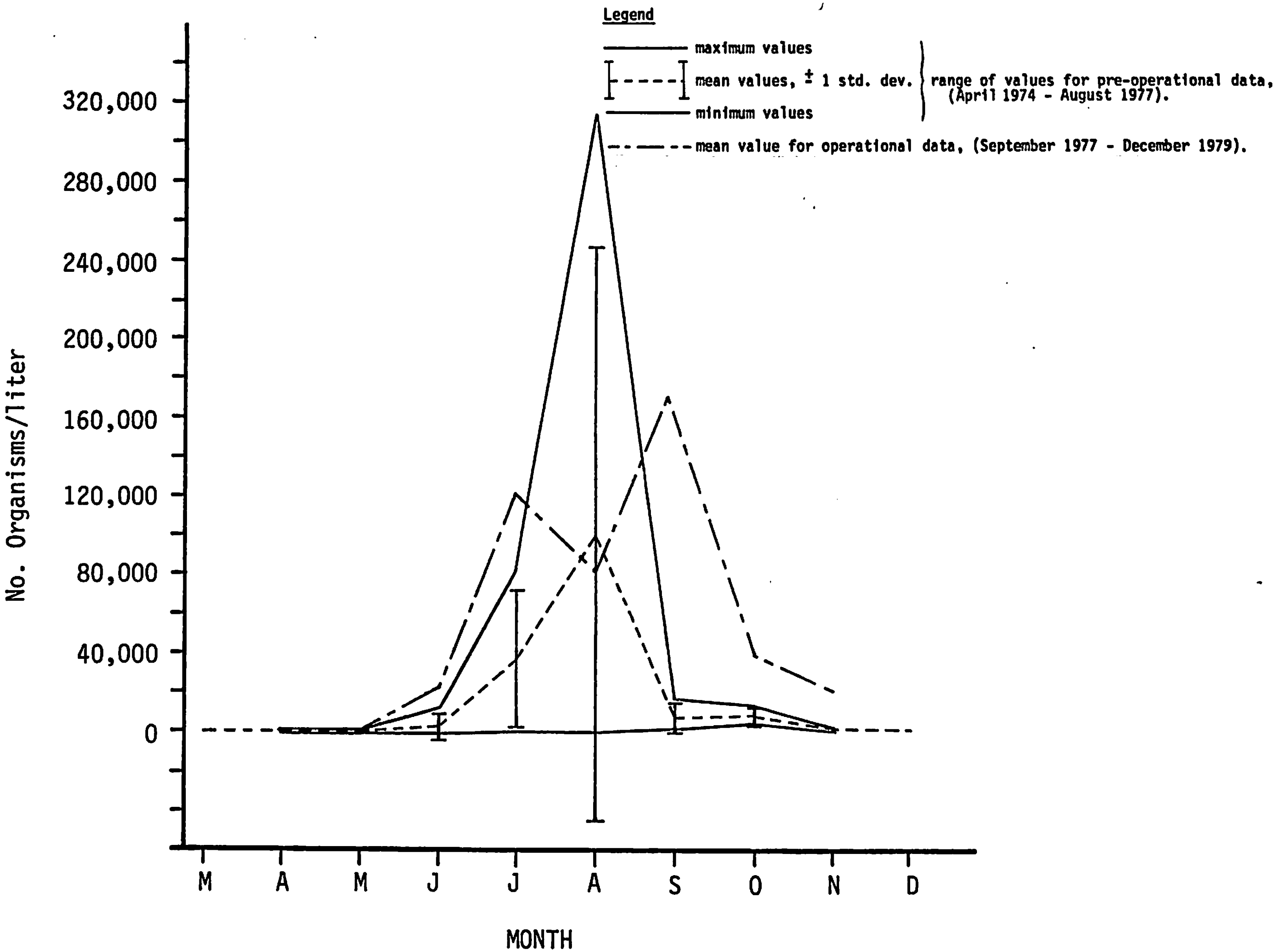


Figure 50. Comparison of Pre-operational and Operational Data for Phytoplankton Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

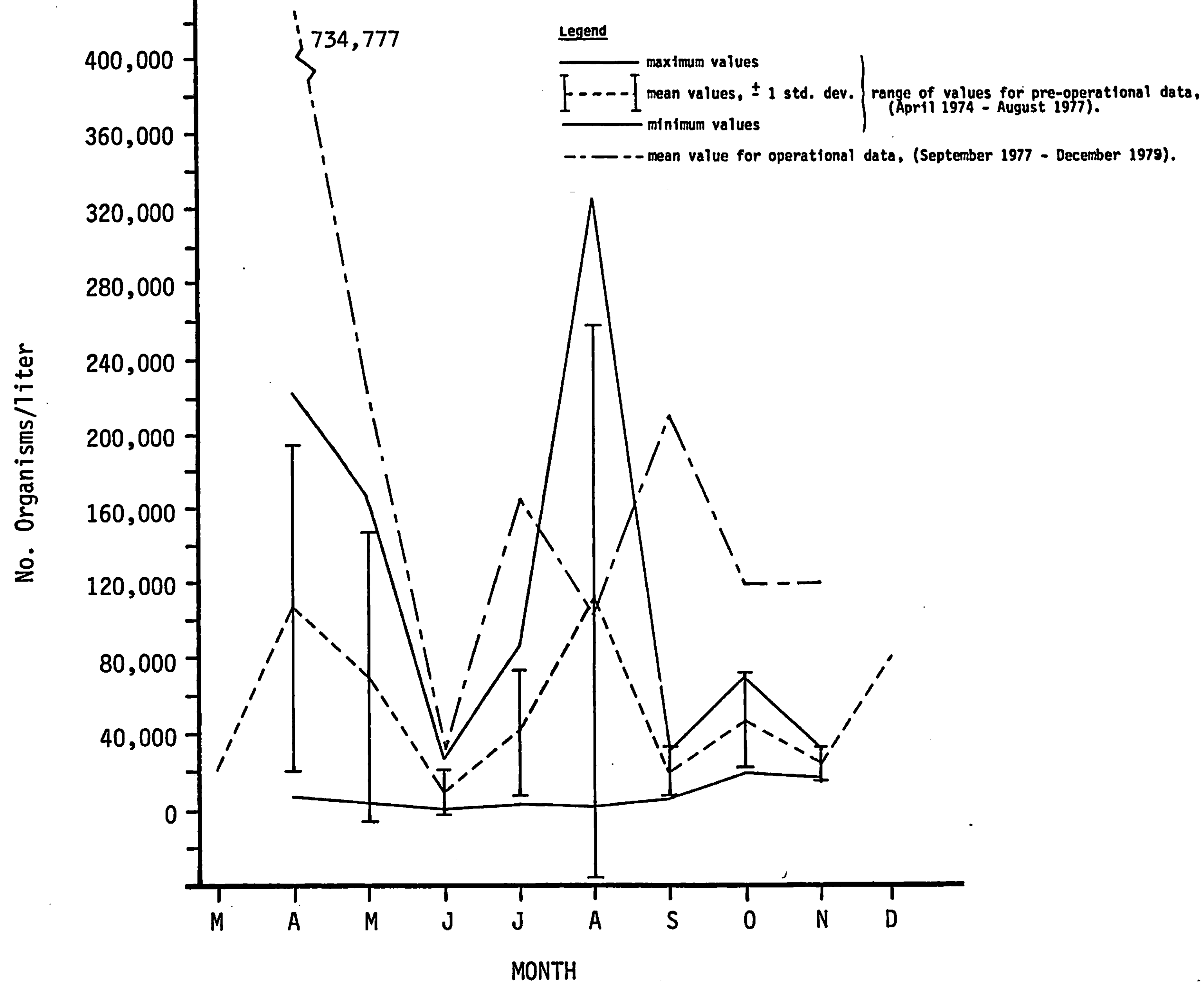


Figure 51 Comparison of Pre-operational and Operational Data for Phytoplankton Densities at the Station Intake (Sta. No. 8).

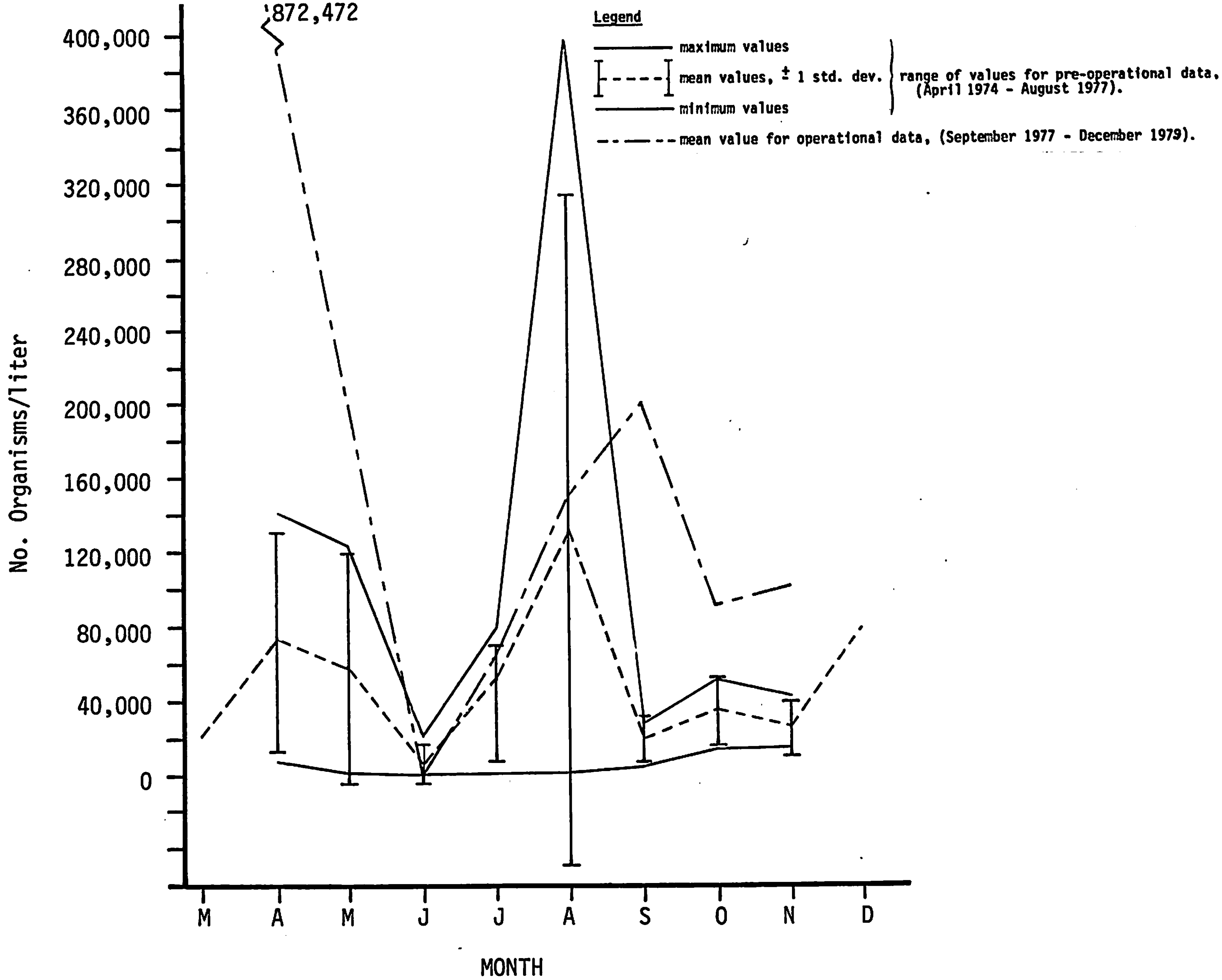


Figure 52. Comparison of Pre-operational and Operational Data for Phytoplankton Densities at the Station Discharge (Sta. No. 13).

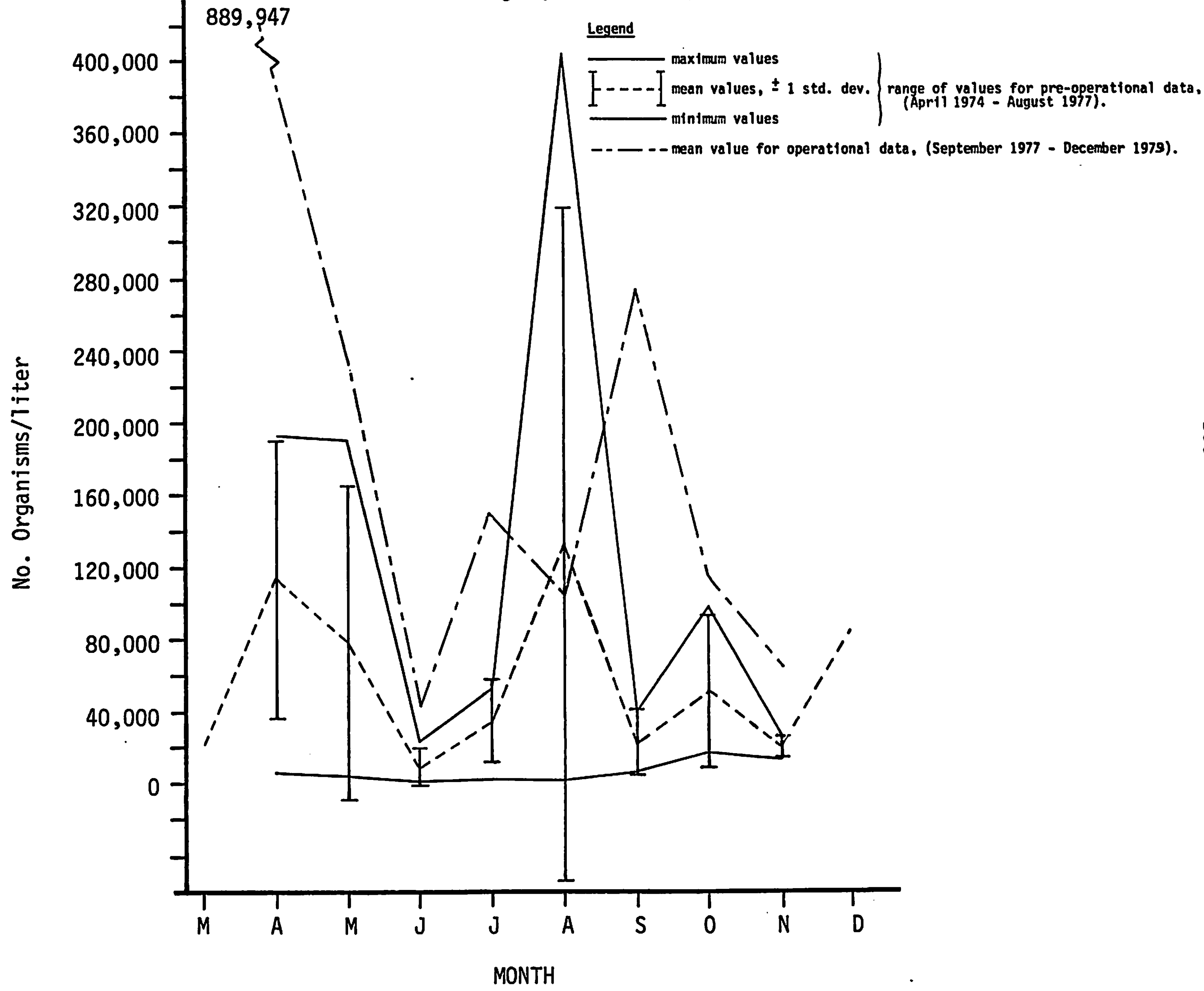


Figure 53. Comparison of Pre-operational and Operational Data for Phytoplankton Densities at a Control Station (Sta. No. 3).

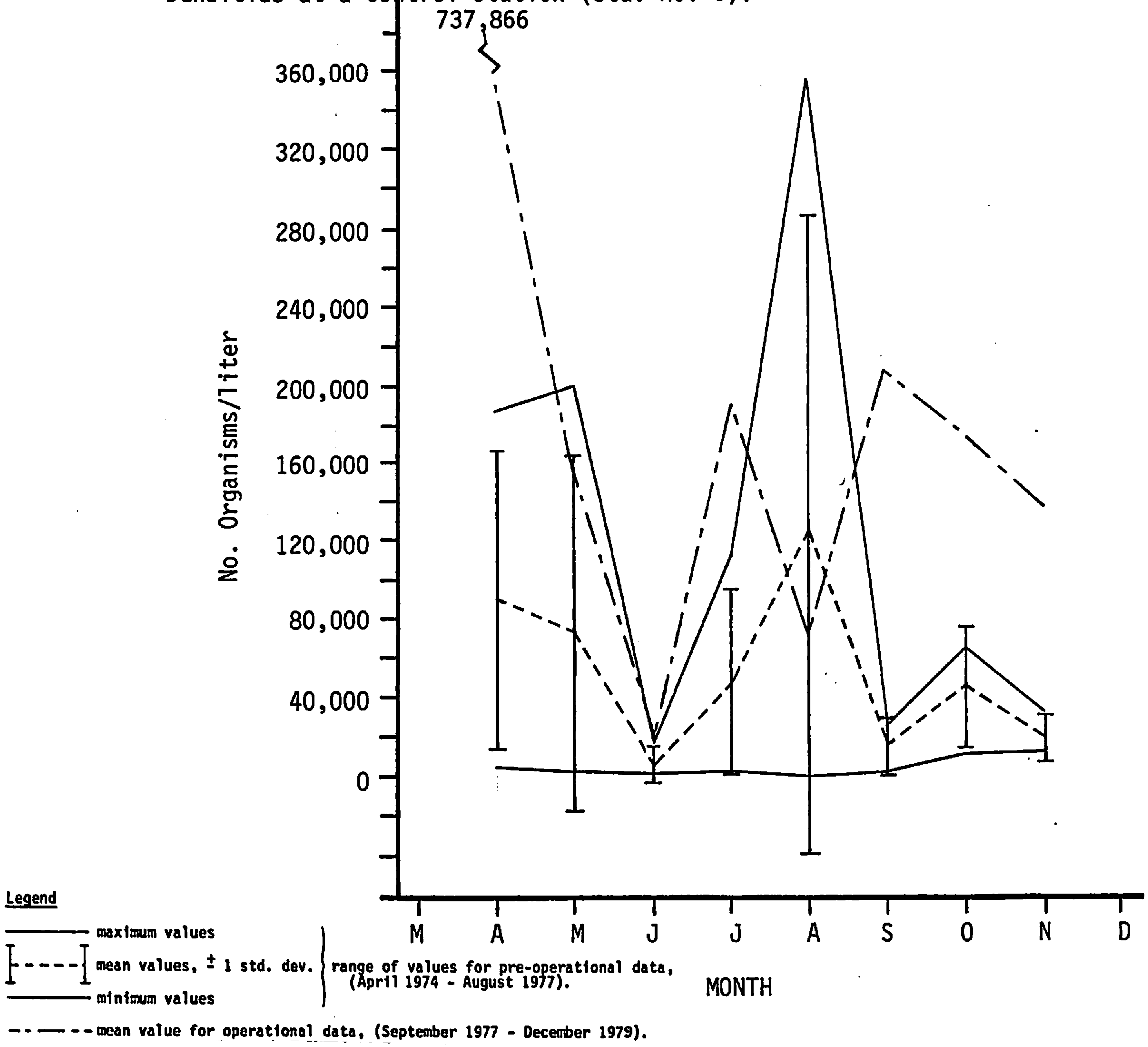
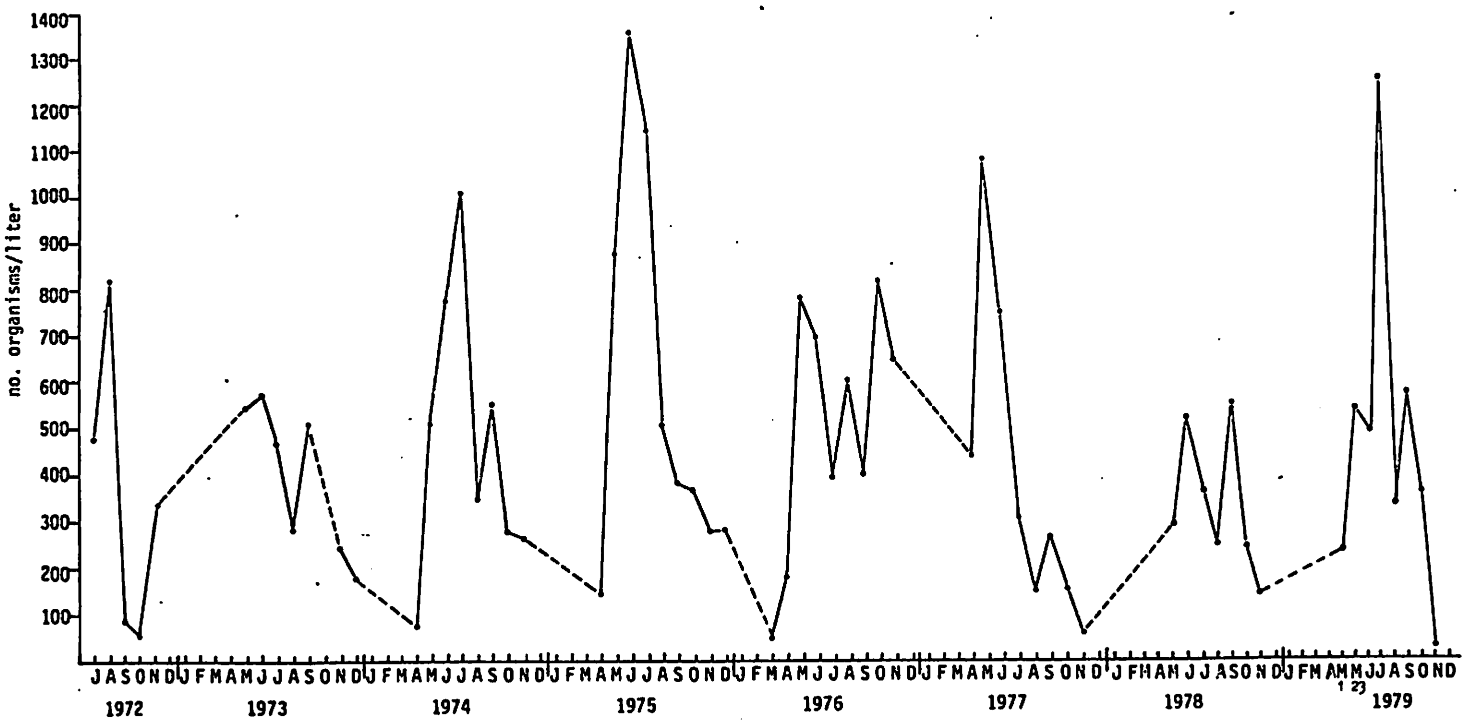
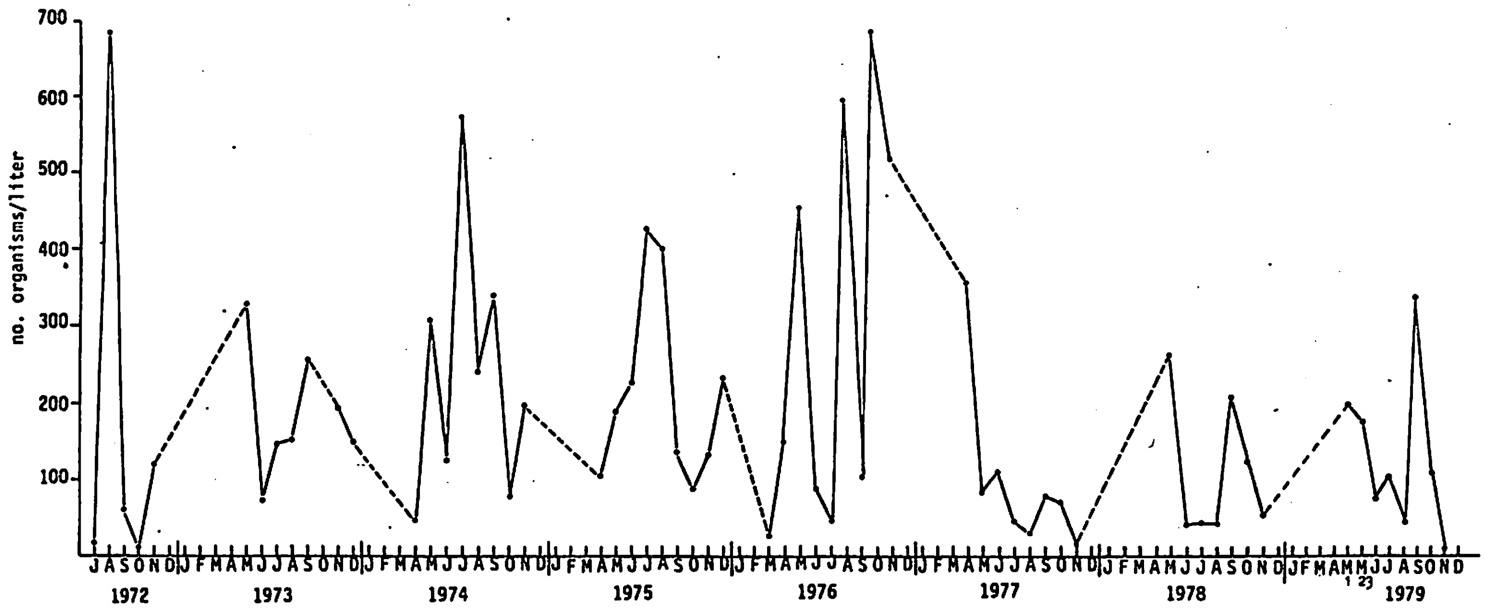


FIGURE 54 MONTHLY MEAN ZOOPLANKTON POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1972 - 1979.*



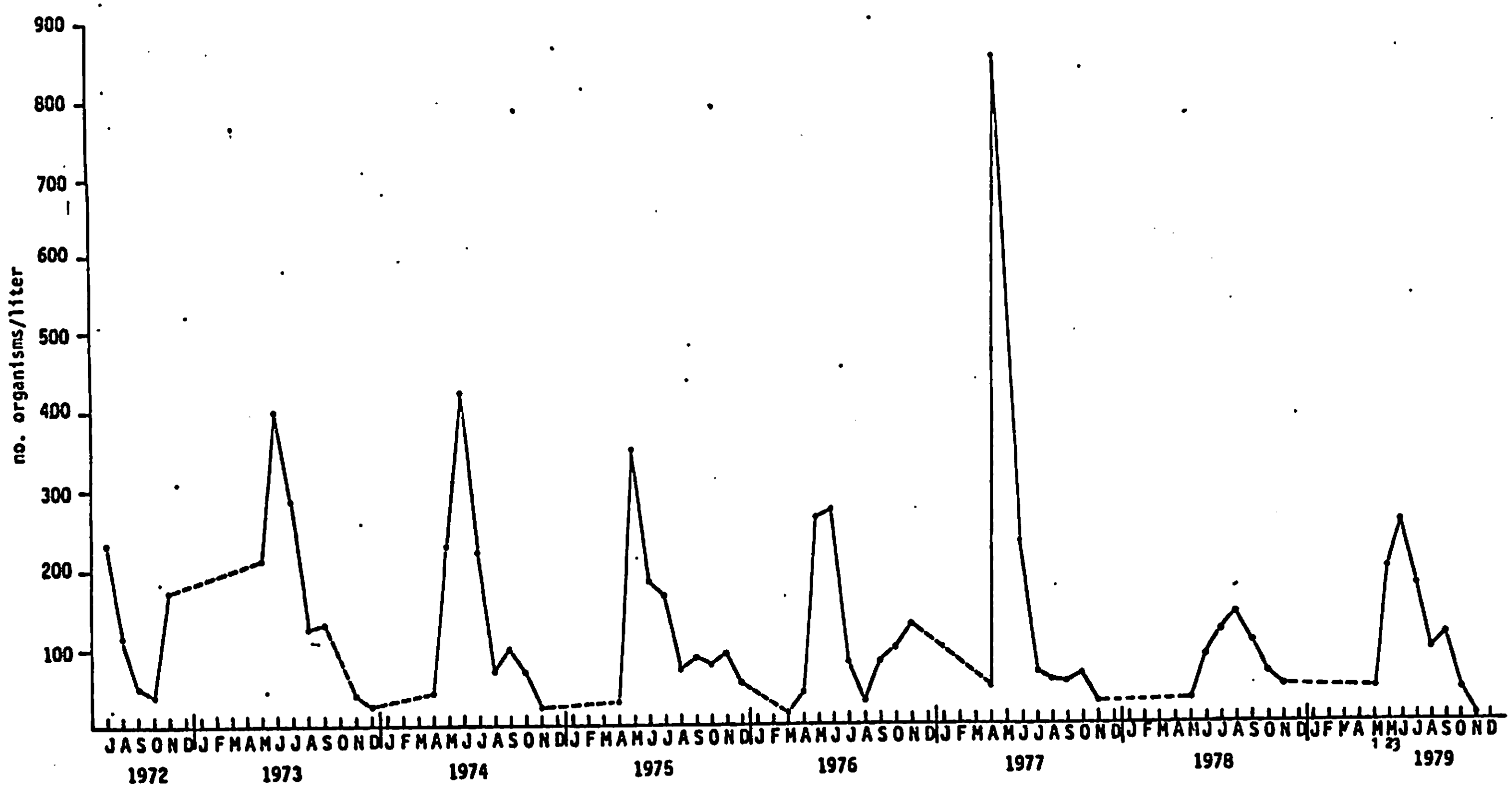
*Dotted lines connect points (sampling dates) separated by more than a full calendar month. Solid lines connect points (dates) in consecutive months.

FIGURE 55. MONTHLY MEAN ROTIFER POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1972 - 1979.*



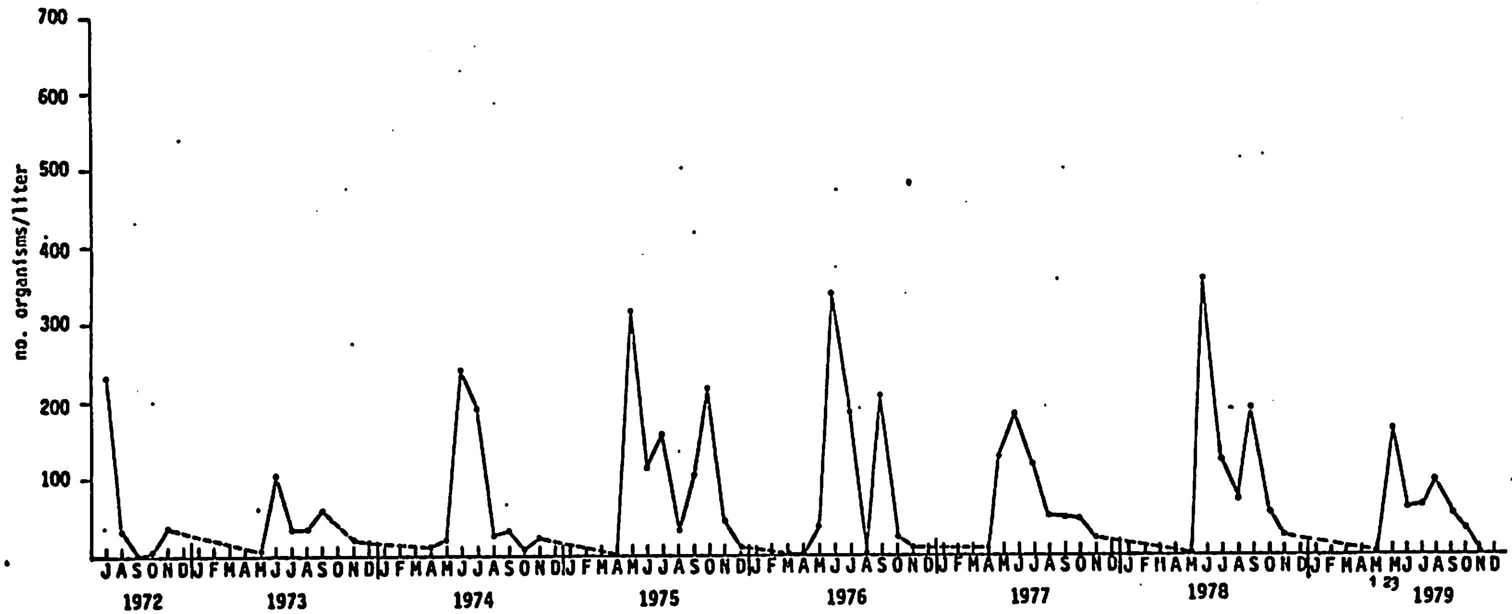
*Dotted lines connect points (sampling dates) separated by more than a full calendar month. Solid lines connect points (dates) in consecutive months.

FIGURE 56. MONTHLY MEAN COPEPOD POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1972 - 1979.*



*Dotted lines connect points (sampling dates) separated by more than a full calendar month. Solid lines connect points (dates) in consecutive months.

FIGURE 57. MONTHLY MEAN CLADOCERAN POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1972 - 1979.*



*Dotted lines connect points (sampling dates) separated by more than a full calendar month. Solid lines connect points (dates) in consecutive months.

Figure 58. Comparison of Pre-operational and Operational Data for Zooplankton Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

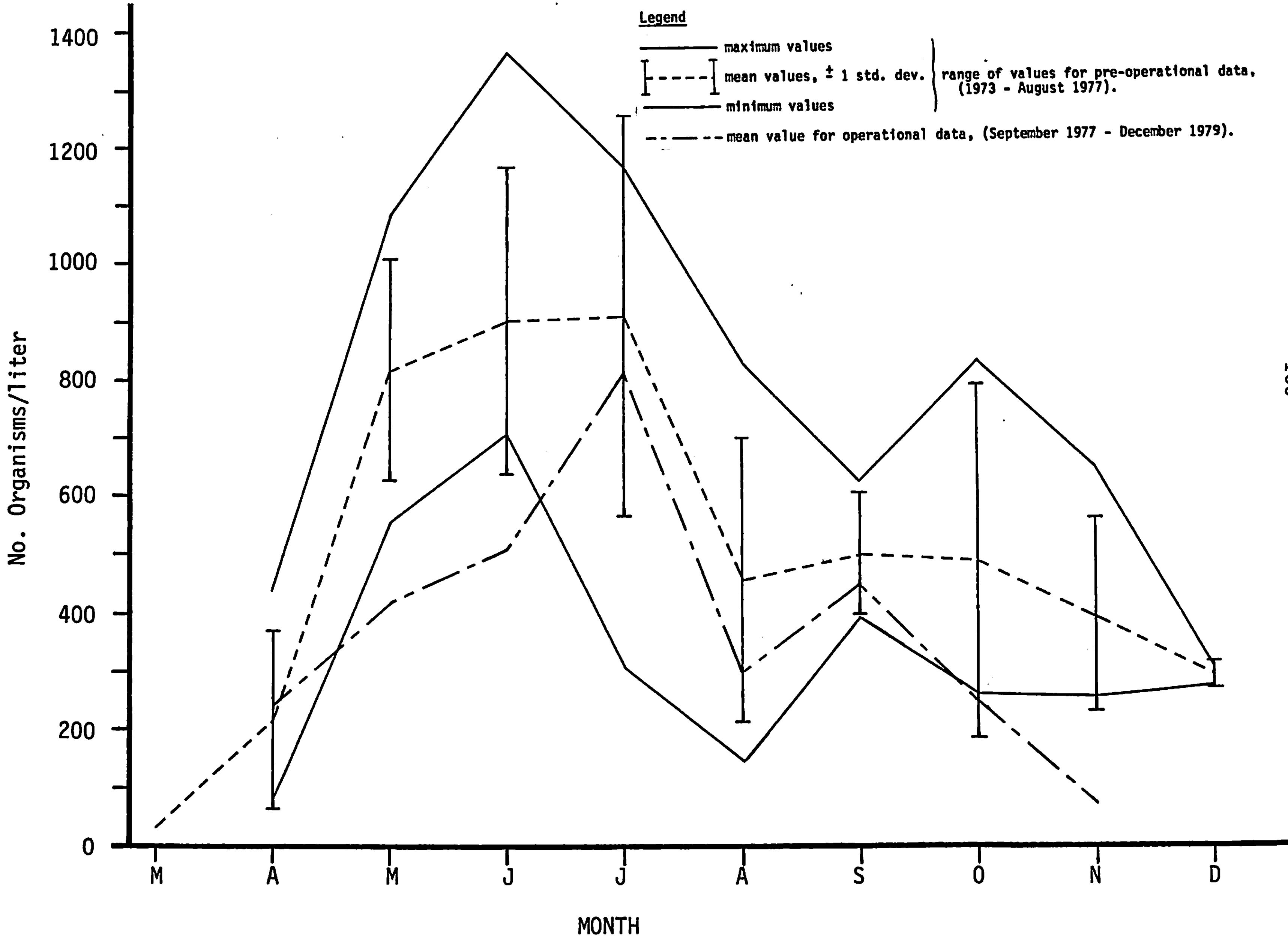


Figure 59. Comparison of Pre-operational and Operational Data for Zooplankton Rotifer Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

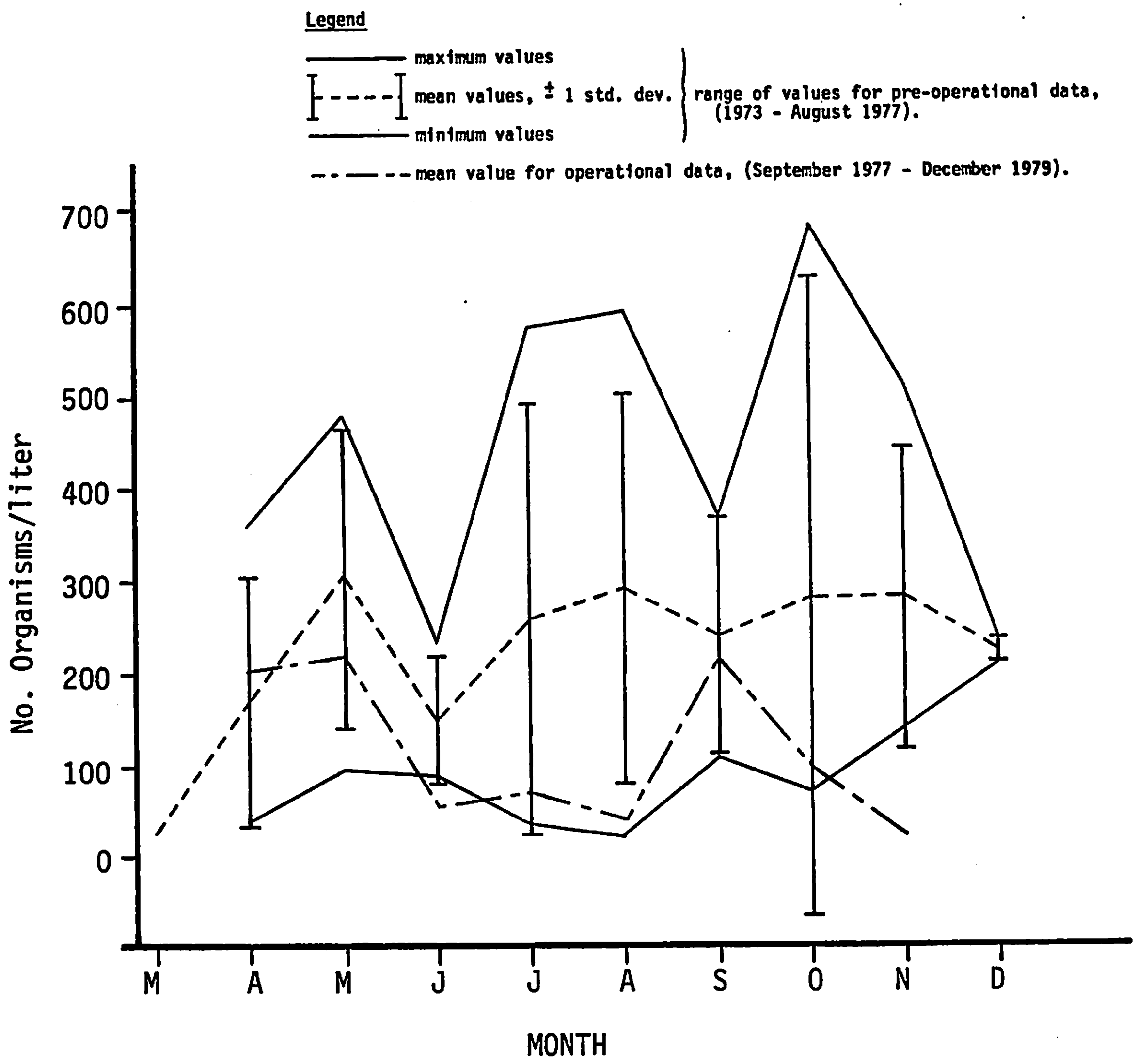


Figure 60. Comparison of Pre-operational and Operational Data for Zooplankton Copepod Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

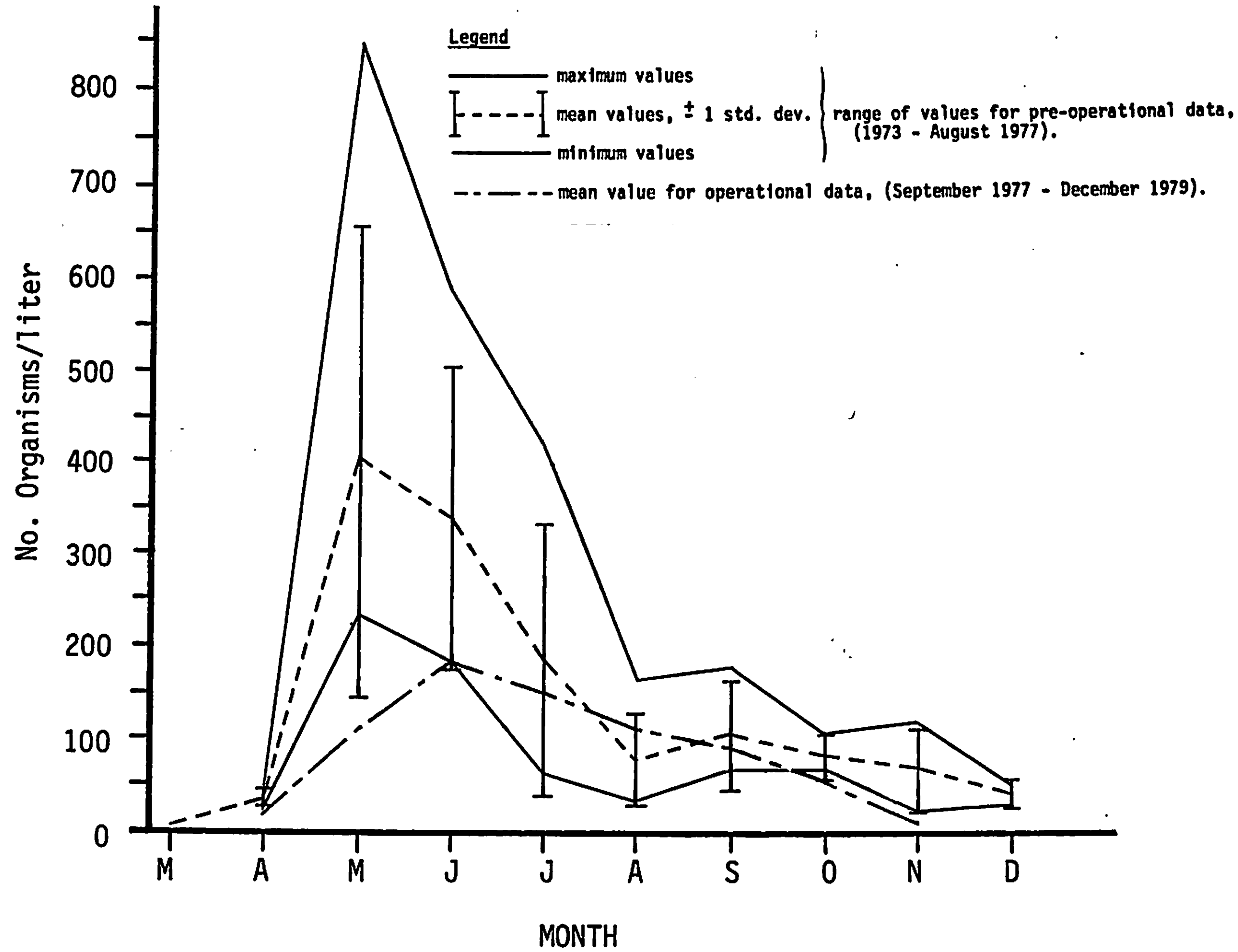


Figure 61. Comparison of Pre-operational and Operational Data for Zooplankton Cladoceran Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

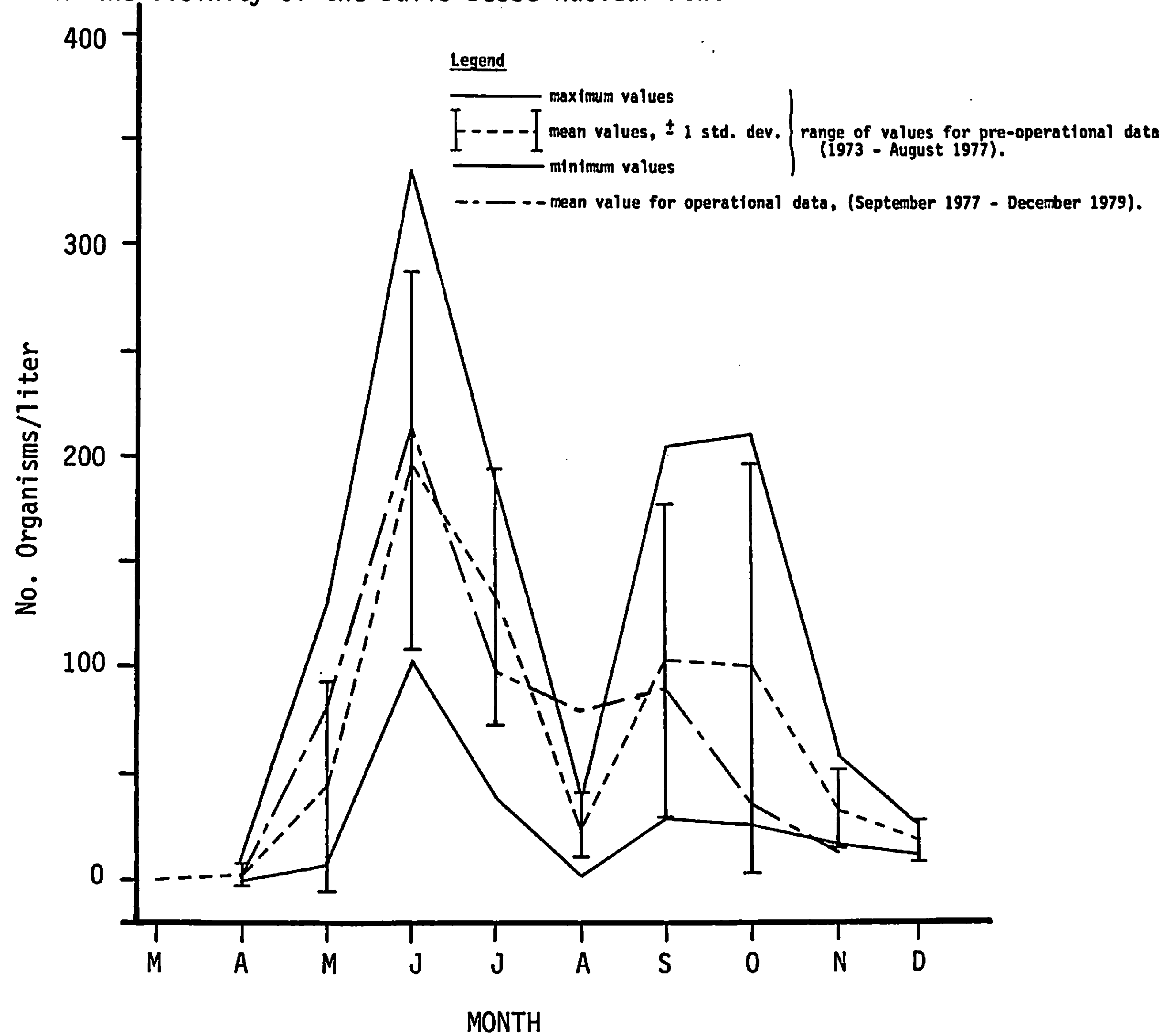


Figure 62. Comparison of Pre-operational and Operational Data for Zooplankton Densities at the Station Intake (Sta. No. 8).

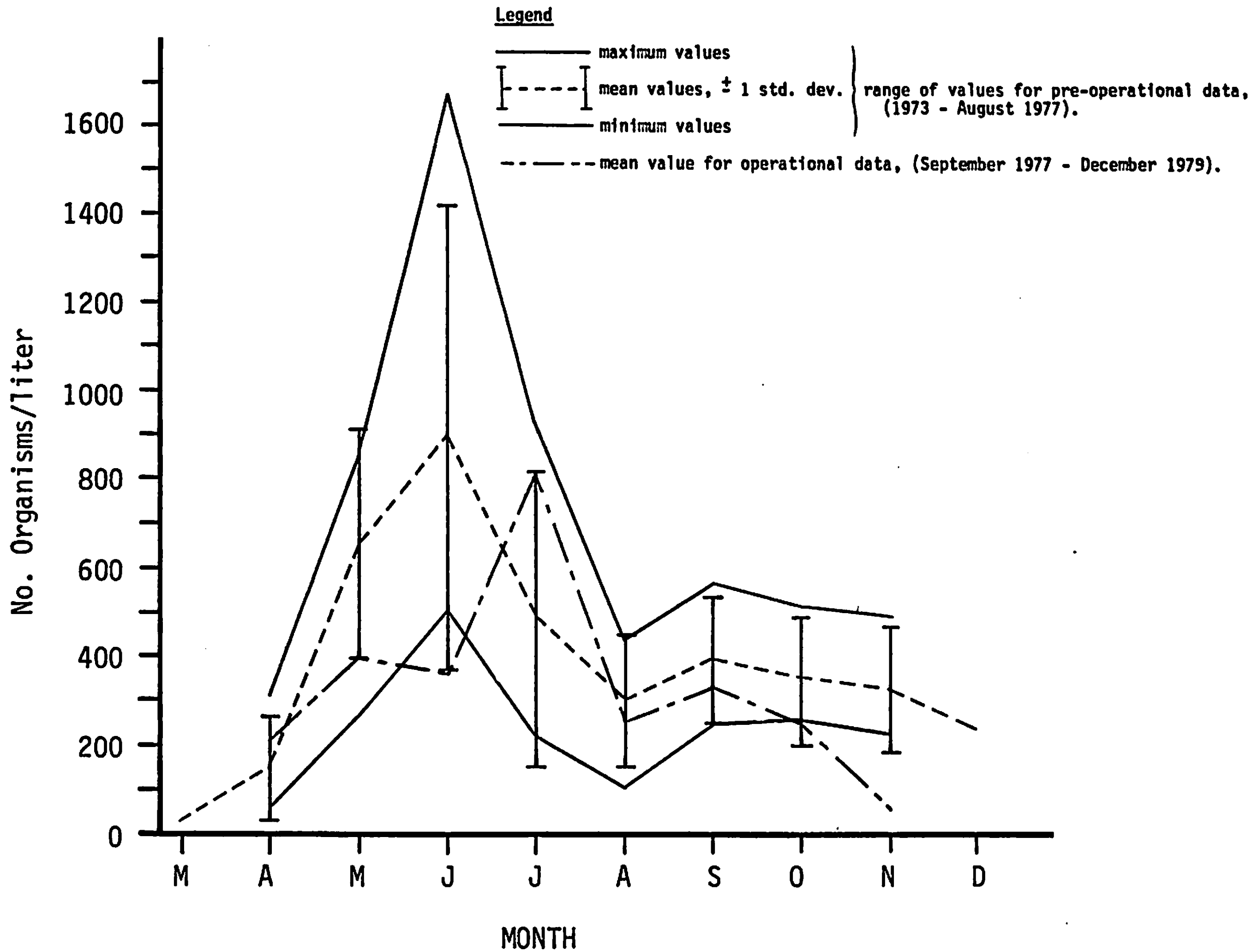


Figure 63. Comparison of Pre-operational and Operational Data for Zooplankton Densities at the Station Discharge (Sta. No. 13).

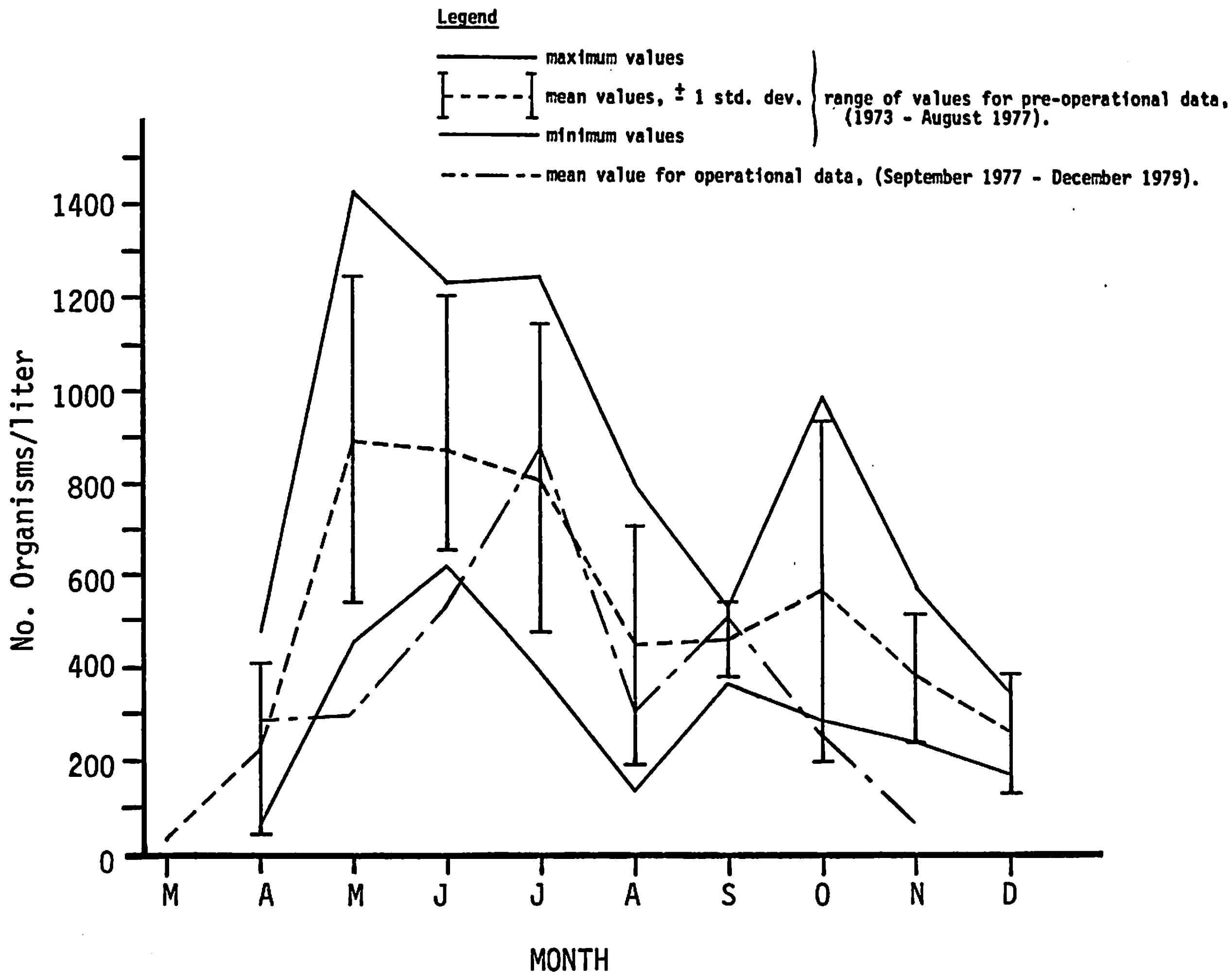


Figure 64. Comparison of Pre-operational and Operational Data for Zooplankton Densities at a Control Station (Sta. No. 3).

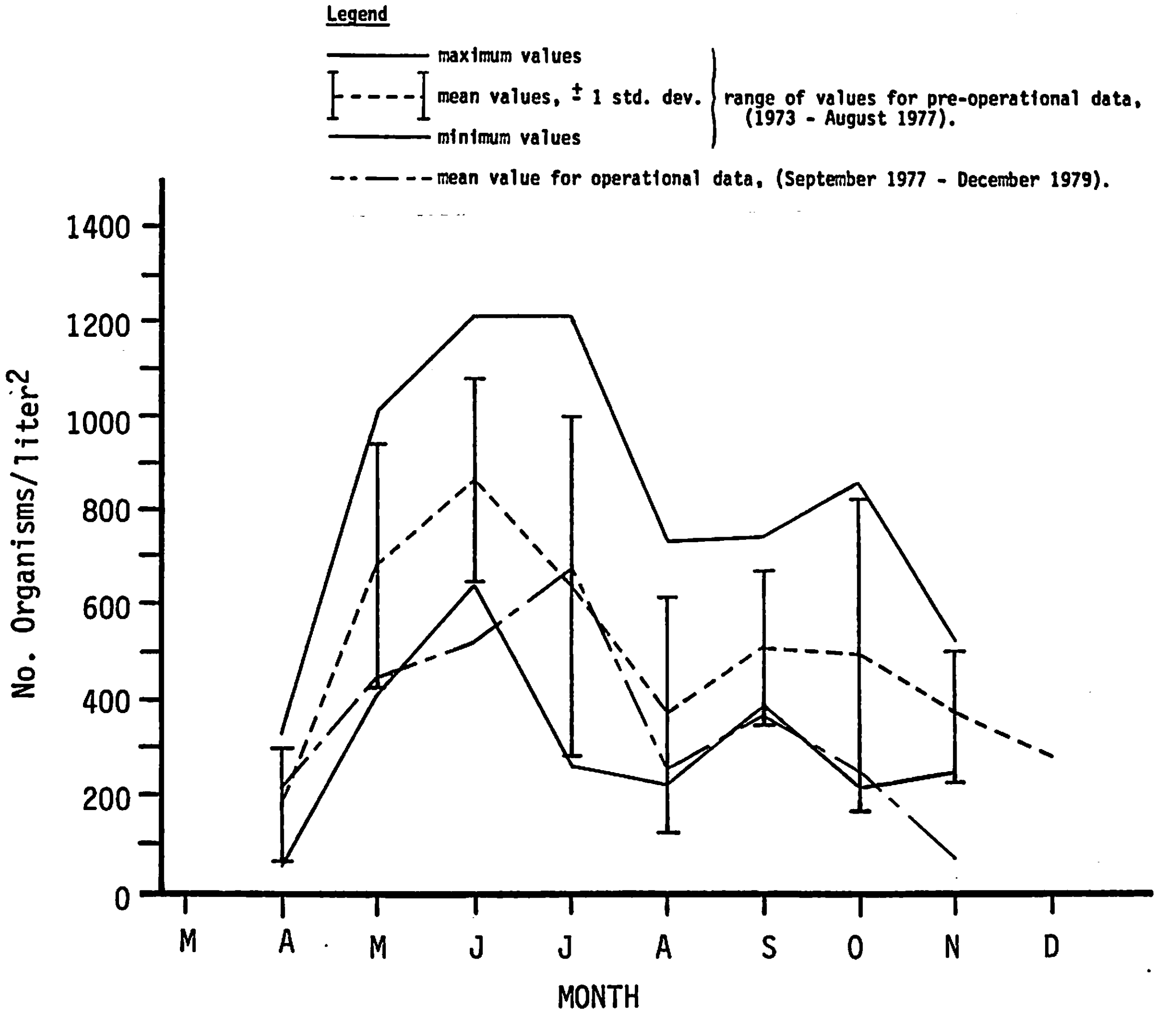
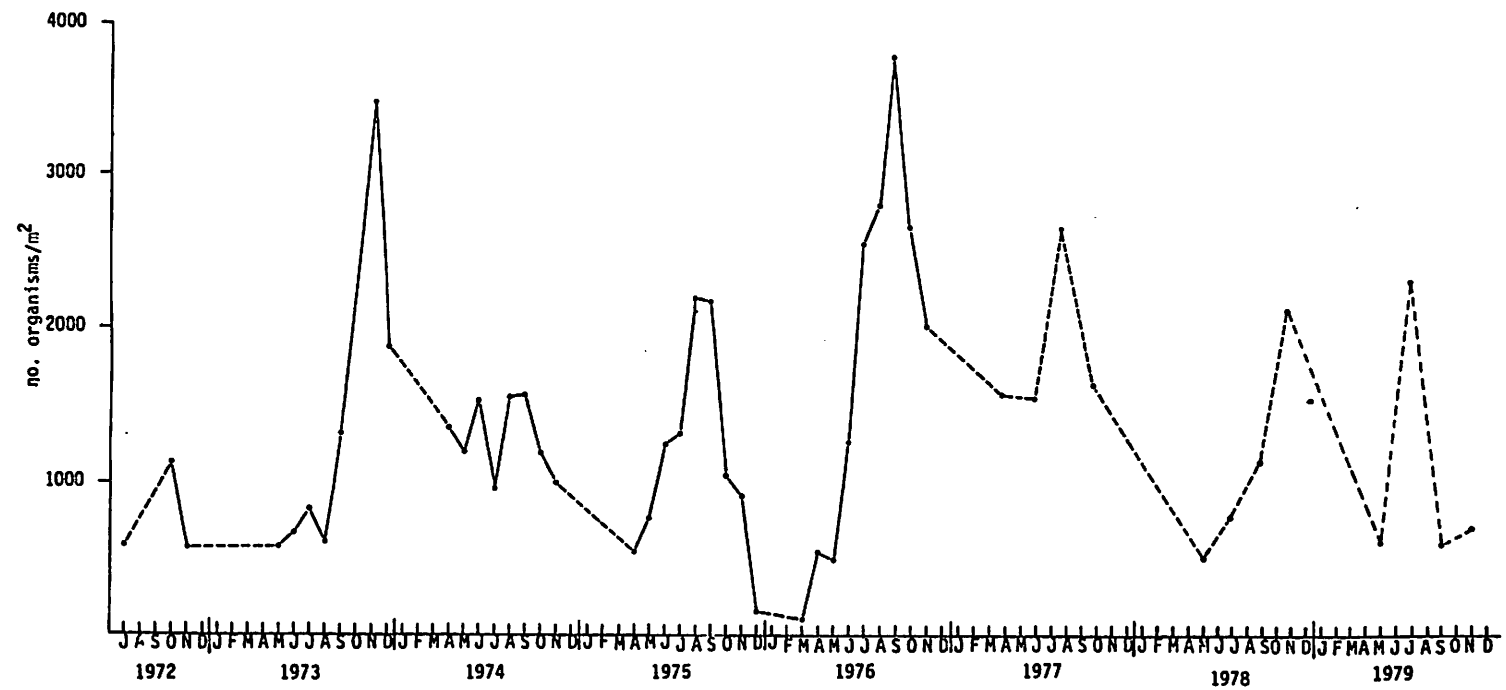


FIGURE 65 MONTHLY MEAN BENTHIC MACROINVERTEBRATE POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1972 - 1979.*



*Dotted lines connect points (sampling dates) separated by more than a full calendar month. Solid lines connect points (dates) in consecutive months.

Figure 66. Comparison of Pre-operational and Operational Data for Benthic Macroinvertebrate Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

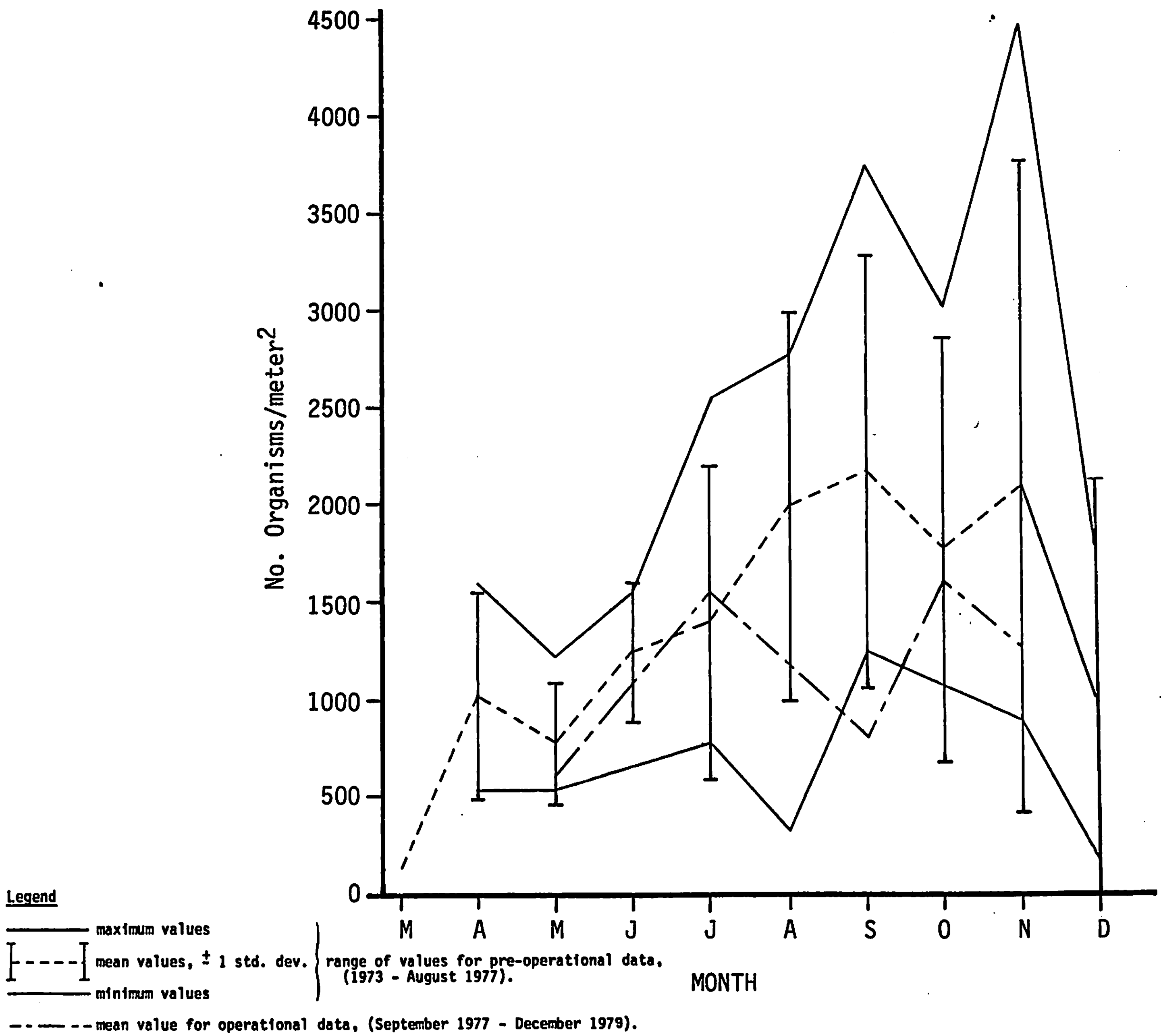


Figure 67. Comparison of Pre-operational and Operational Data for Benthic Ceolenterate Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

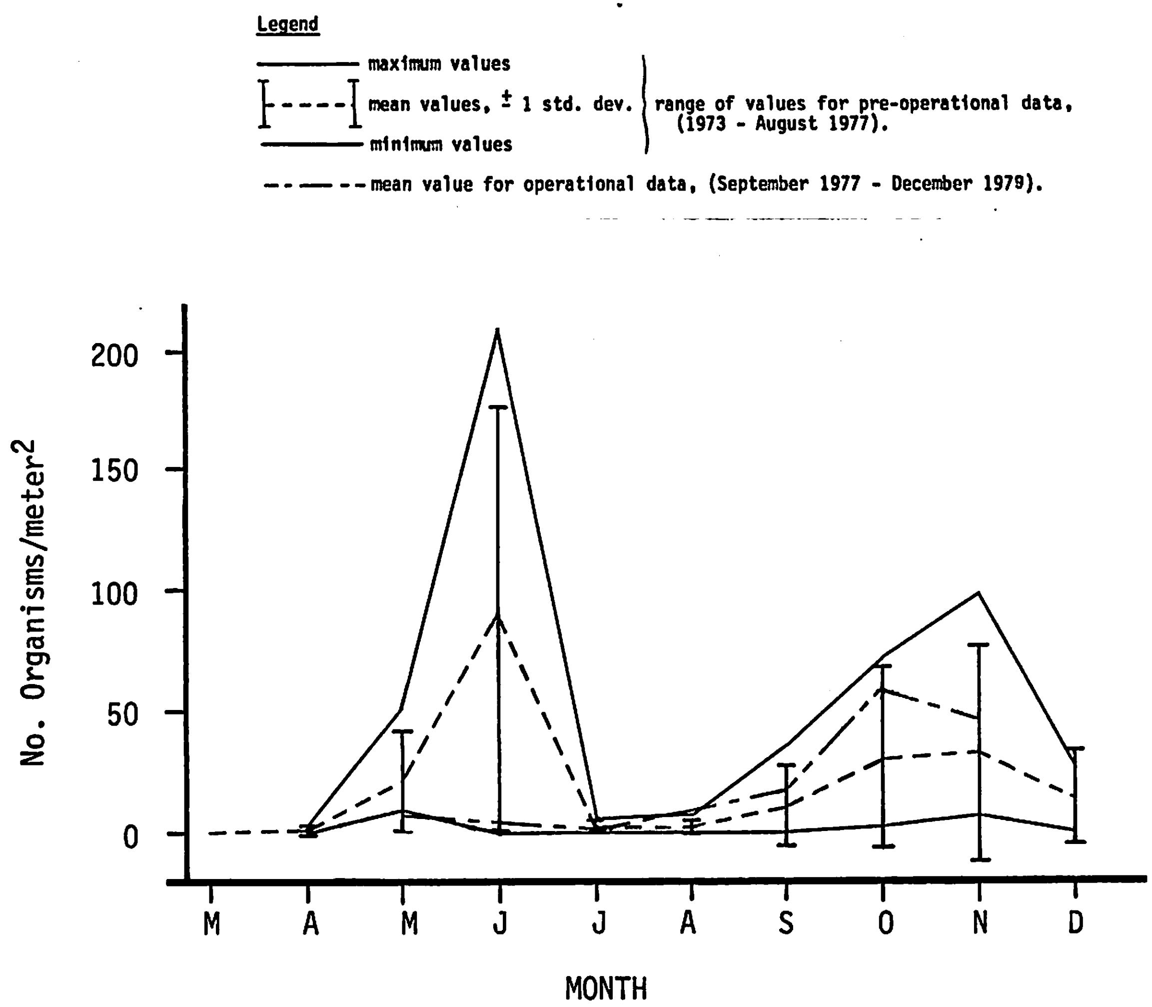


Figure 68. Comparison of Pre-operational and Operational Data for Benthic Annelid Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

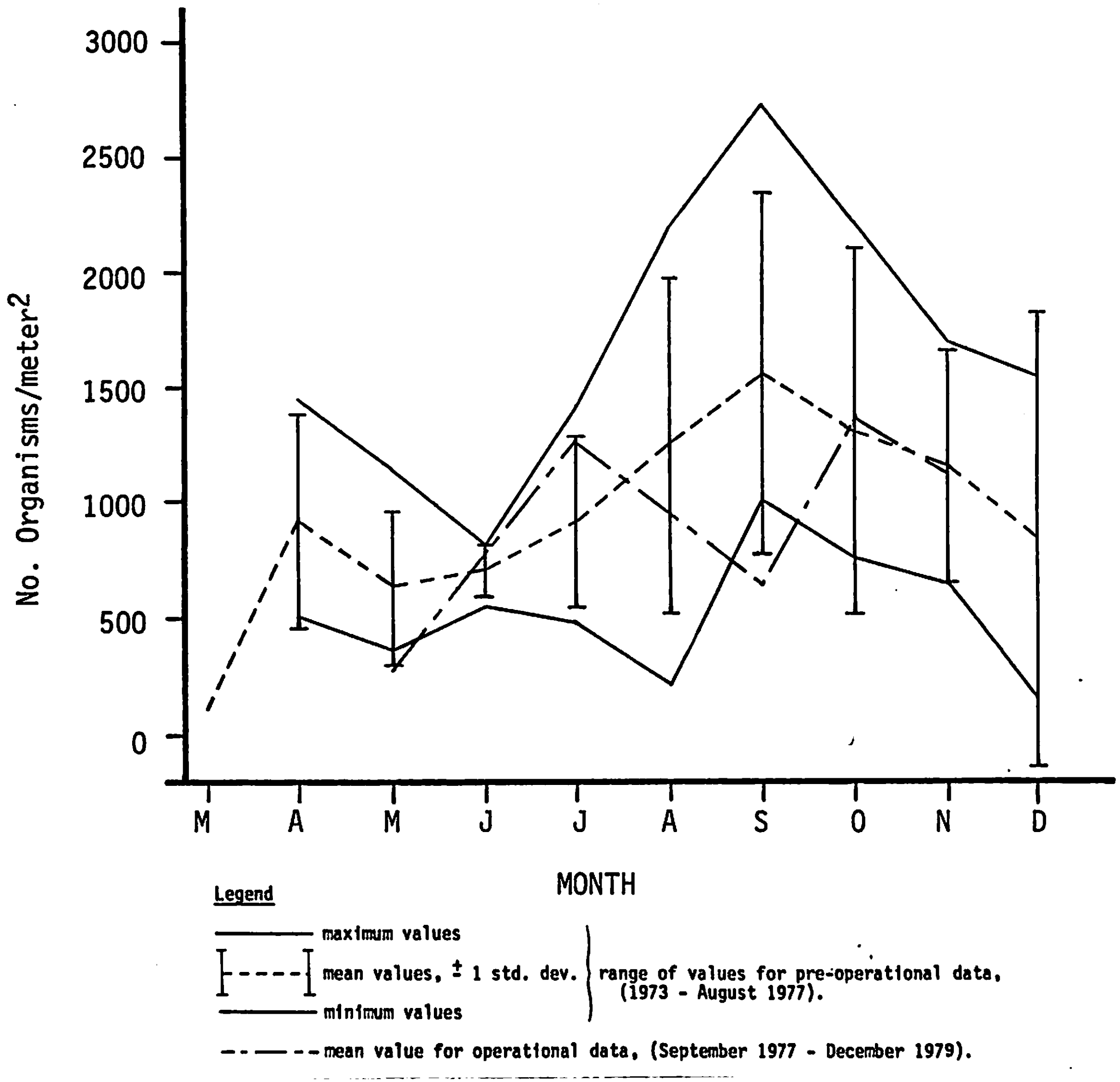


Figure 69. Comparison of Pre-operational and Operational Data for Benthic Arthropod Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

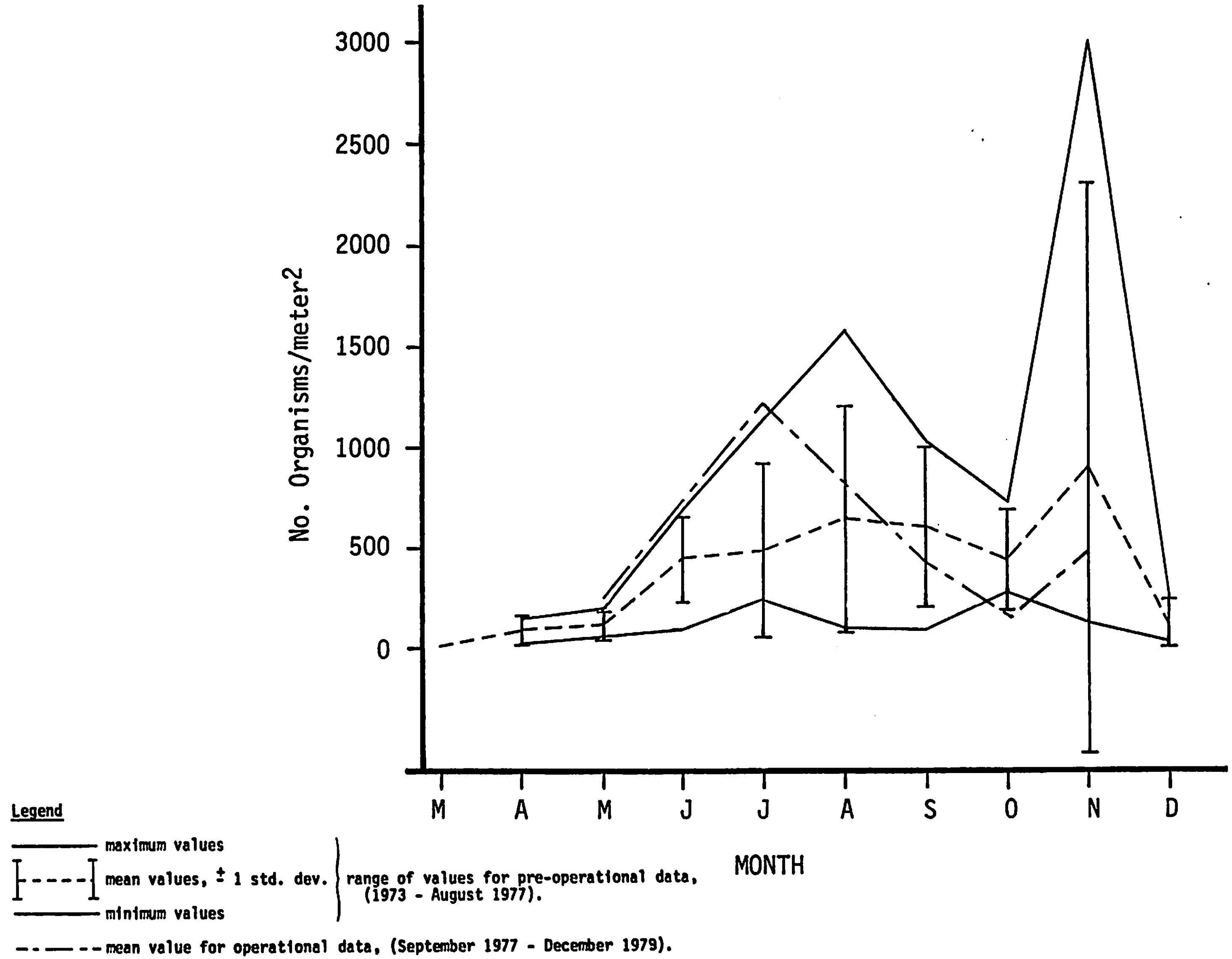


Figure 70. Comparison of Pre-operational and Operational Data for Benthic Mollusc Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

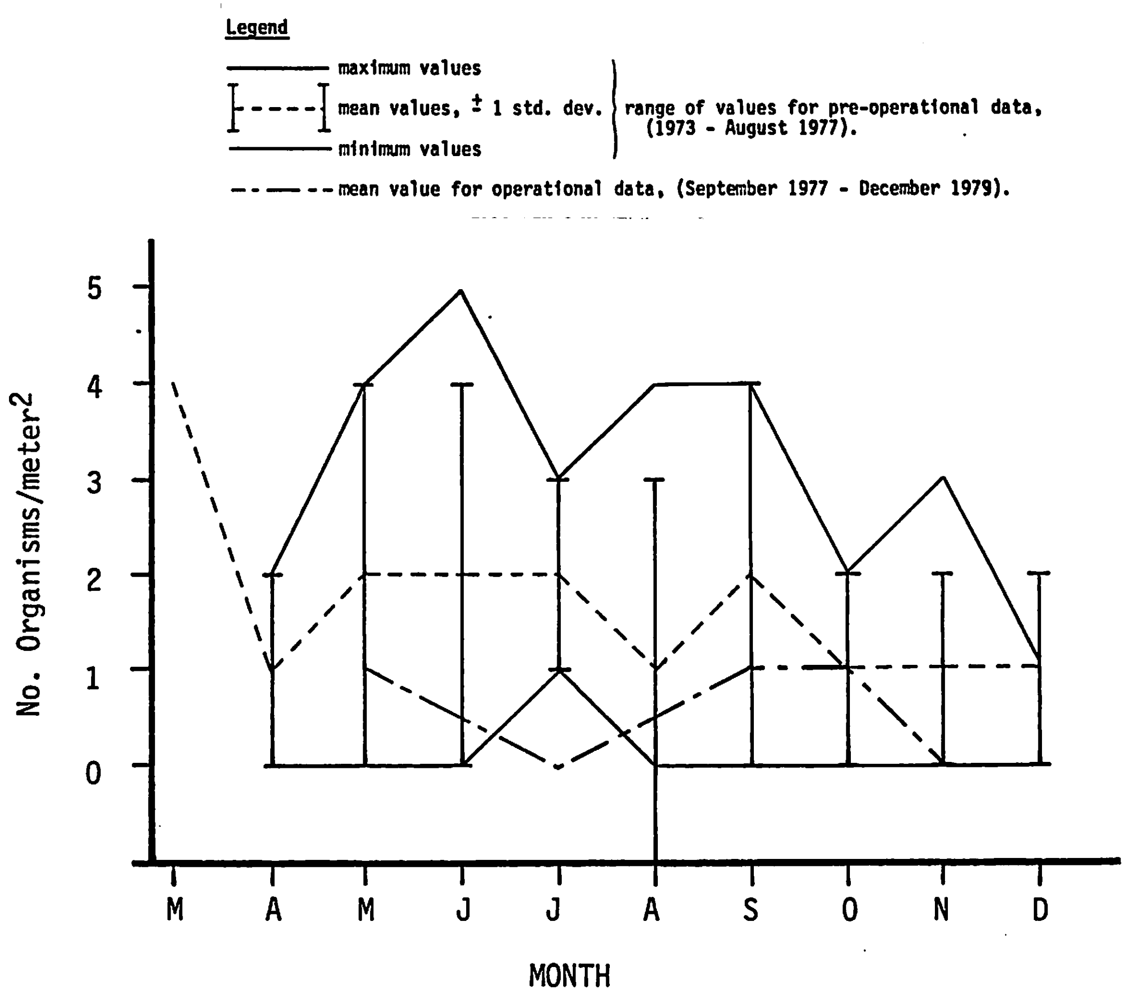


Figure 71. Comparison of Pre-operational and Operational Data for Benthic Macroinvertebrate Densities at the Station Intake (Sta. No. 8).

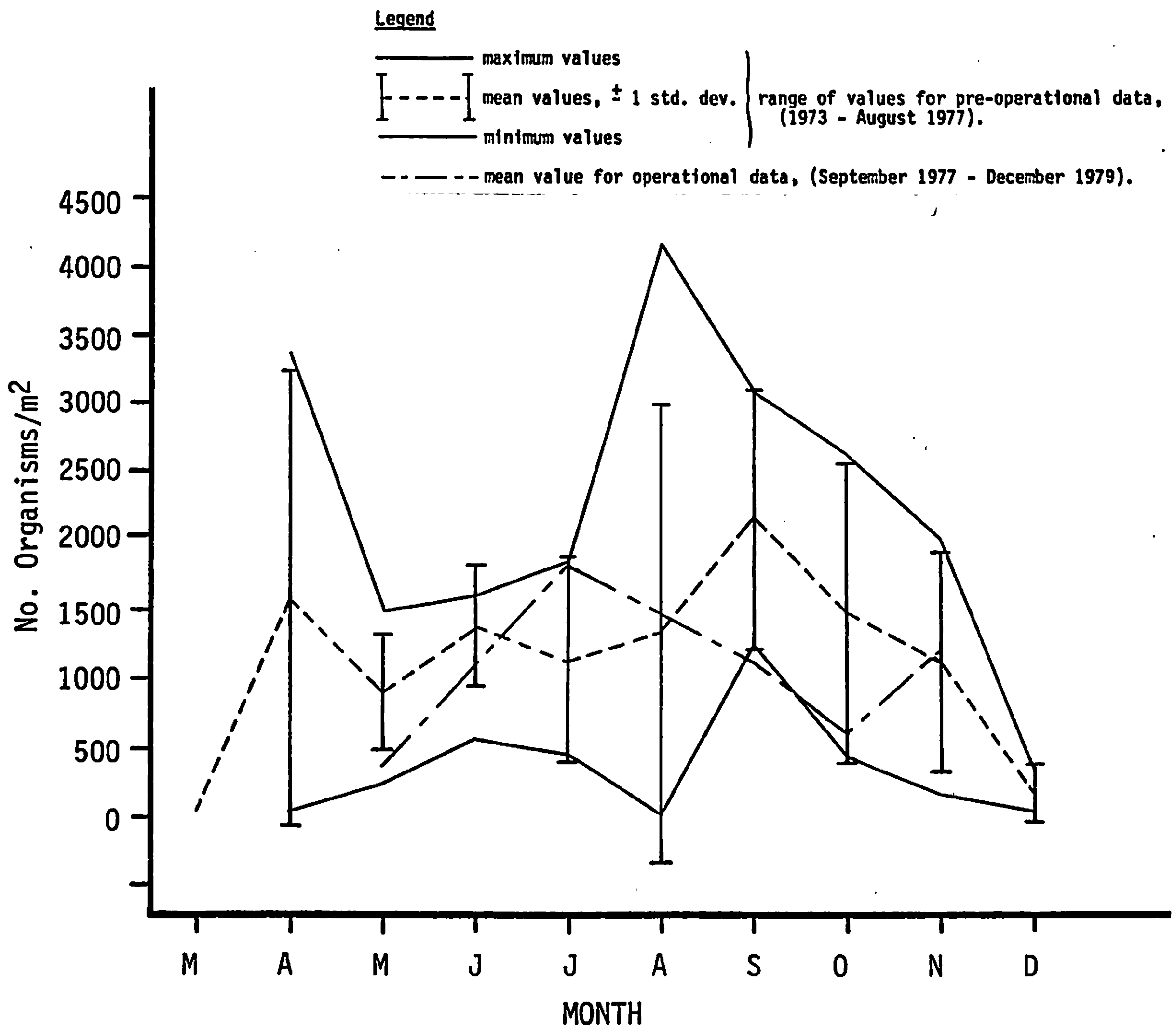


Figure 72. Comparison of Pre-operational and Operational Data for Benthic Macroinvertebrate Densities at the Station Discharge (Sta. No. 13).

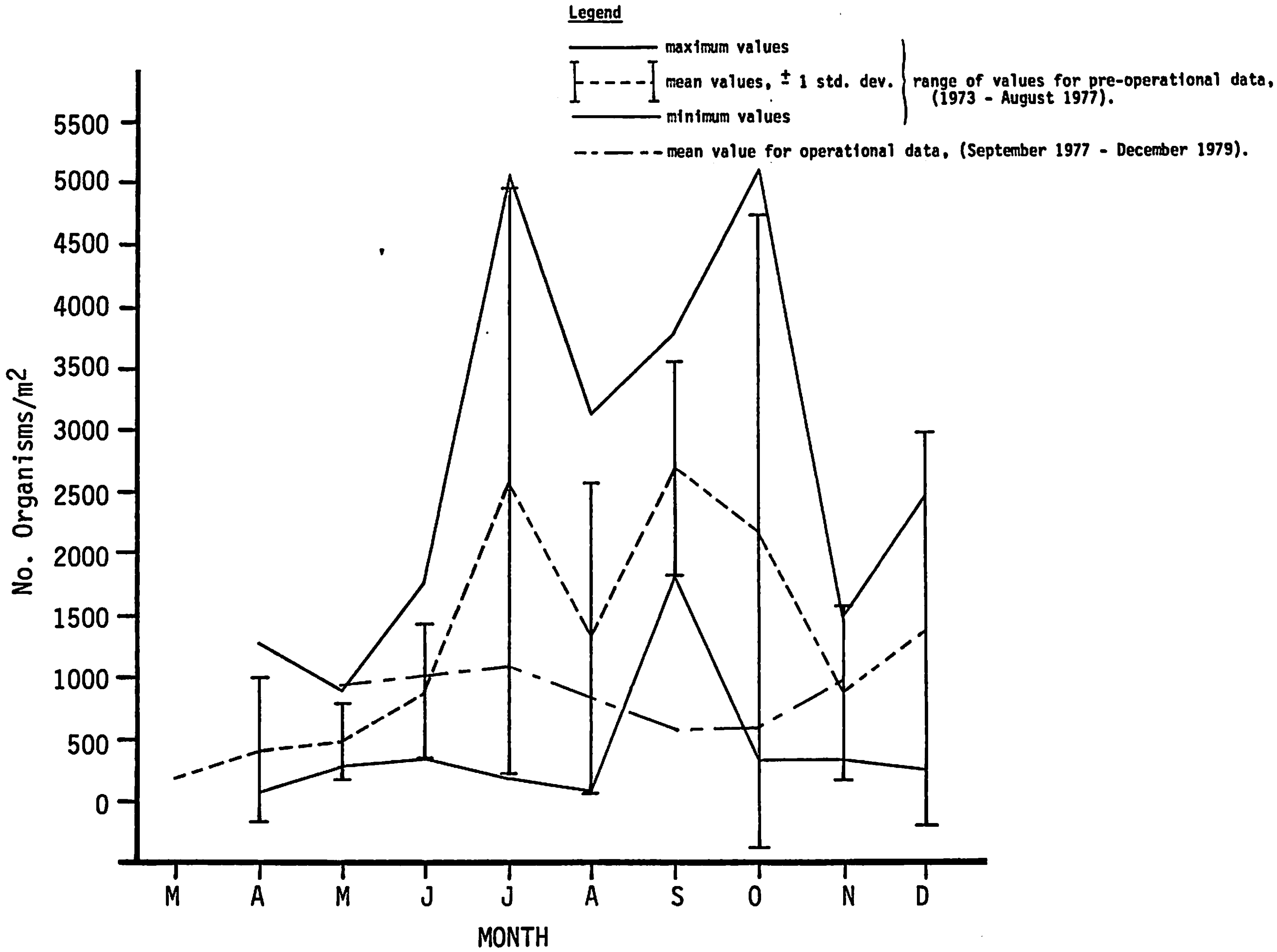


Figure 73. Comparison of Pre-operational and Operational Data for Benthic Macroinvertebrate Densities at a Control Station (Sta. No. 3).

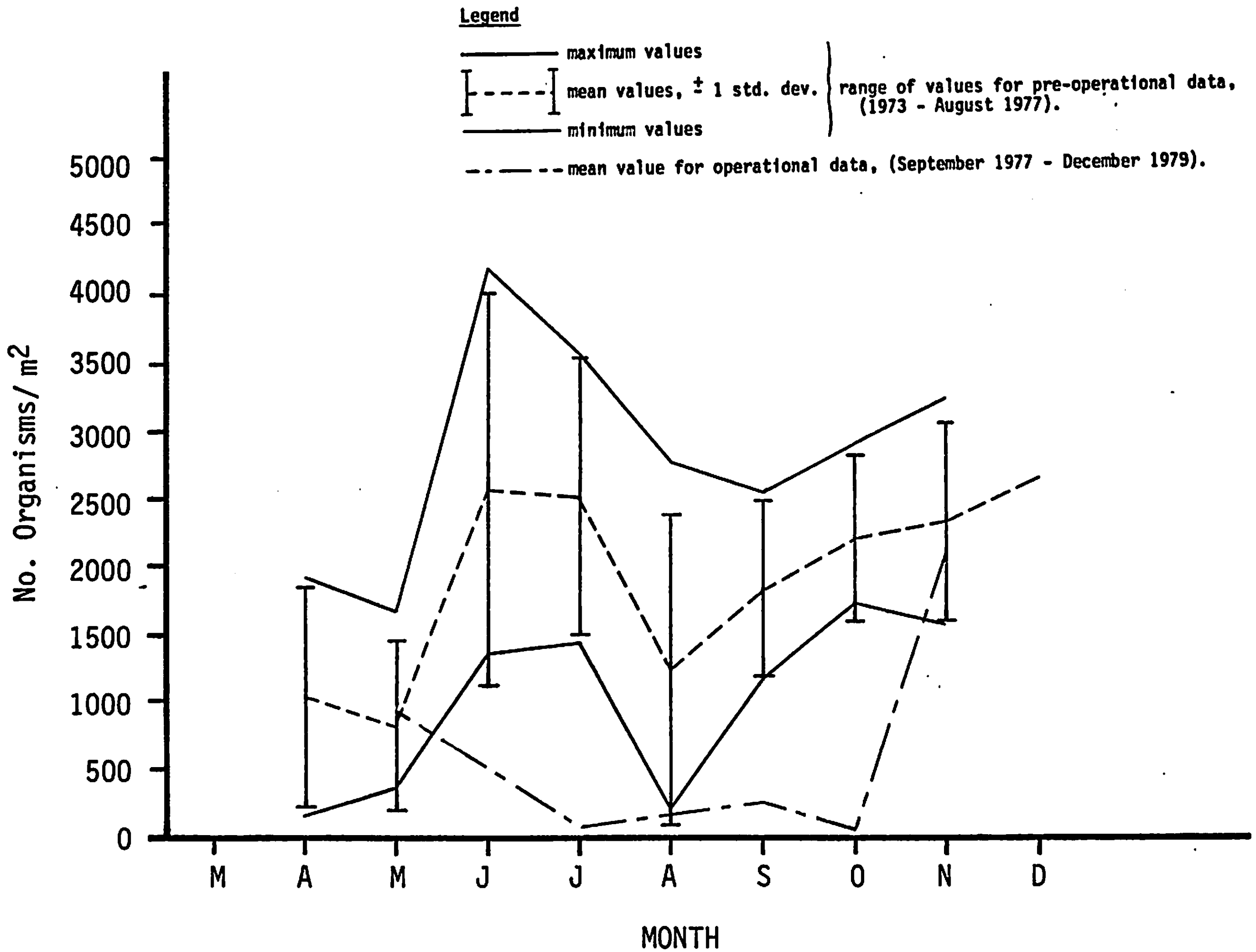


Figure 74. Comparison of Pre-operational and Operational Alewife Catches in Gill Nets Set in the Vicinity of the Davis-Besse Nuclear Power Station Discharge (Station 13).

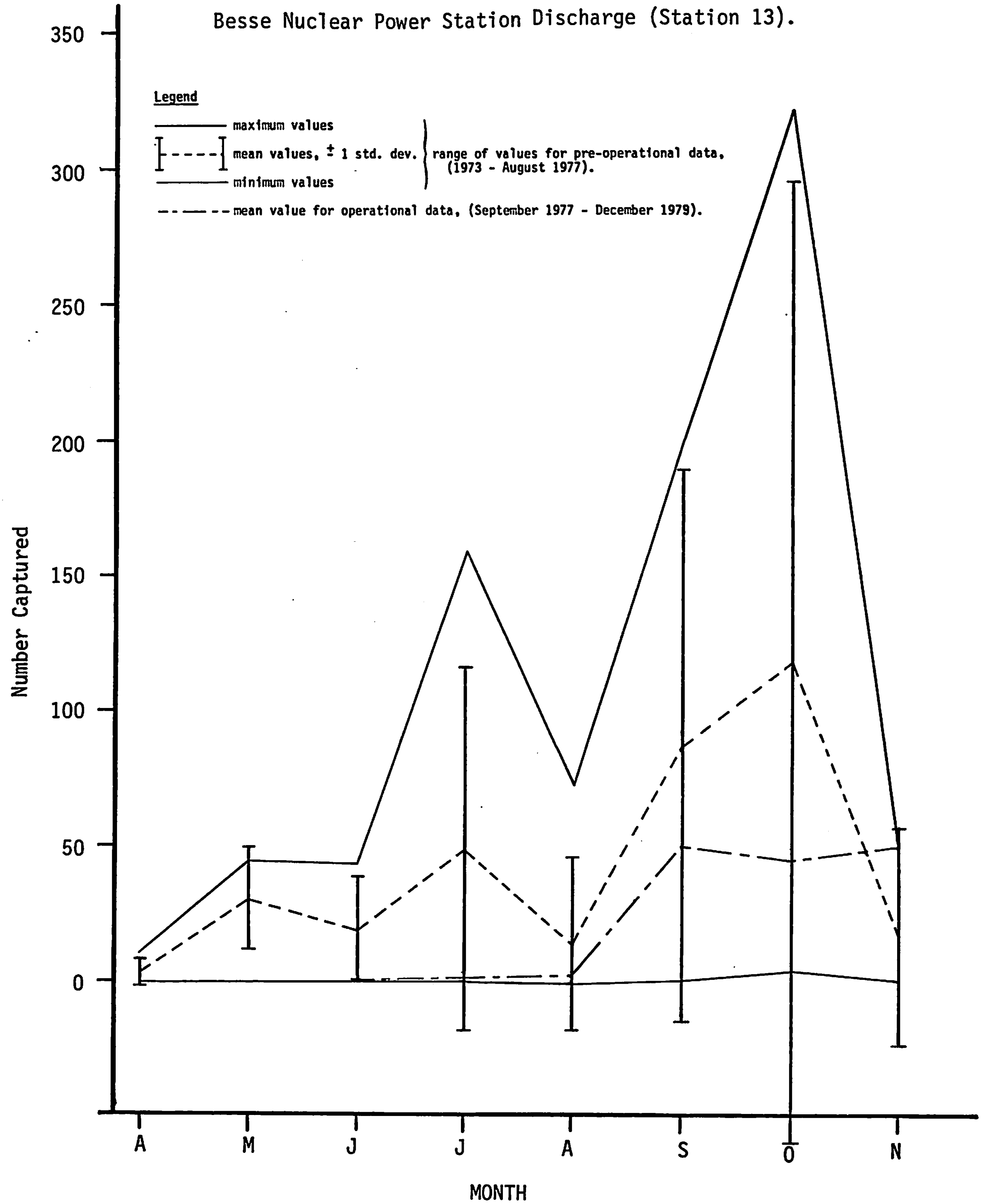


Figure 75. Comparison of Pre-operational and Operational Channel Catfish Catches in Gill Nets Set in the Vicinity of the Davis-Besse Nuclear Power Station Discharge (Station 13).

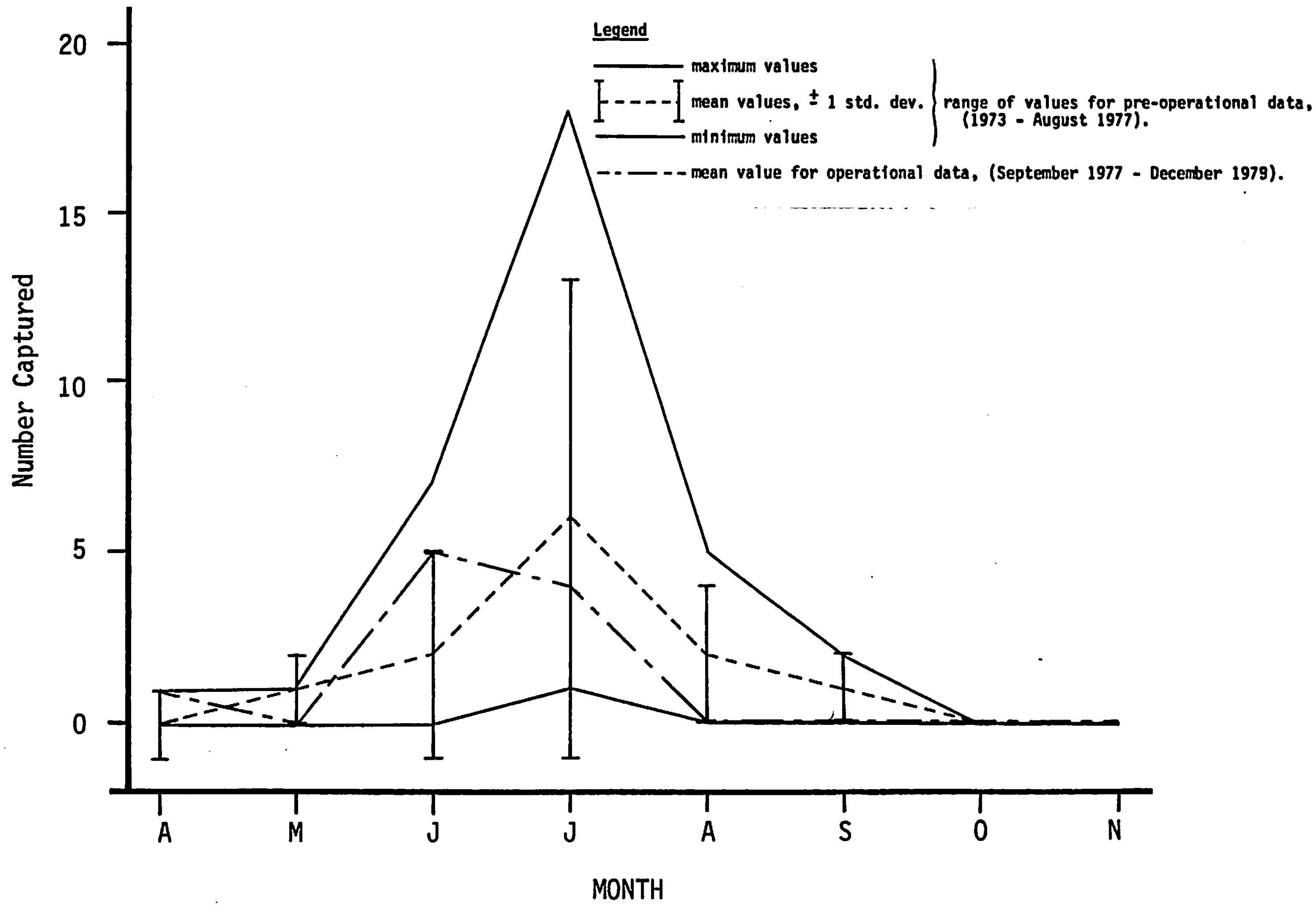


Figure 76. Comparison of Pre-operational and Operational Freshwater Drum Catches in Gill Nets Set in the Vicinity of the Davis-Besse Nuclear Power Station Discharge (Station 13).

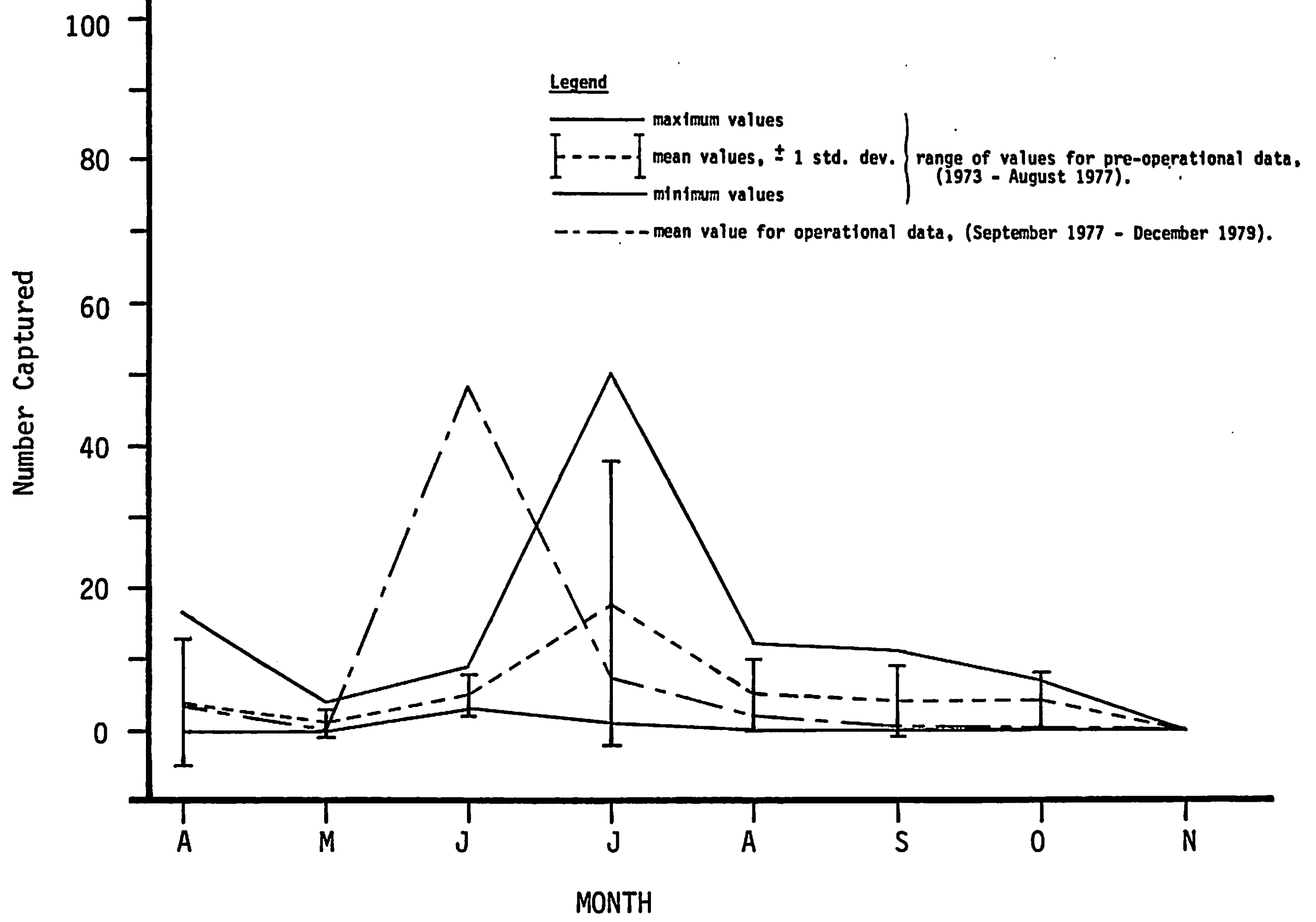


Figure 77. Comparison of Pre-operational and Operational Gizzard Shad Catches in Gill Nets Set in the Vicinity of the Davis-Besse Nuclear Power Station Discharge (Station 13).

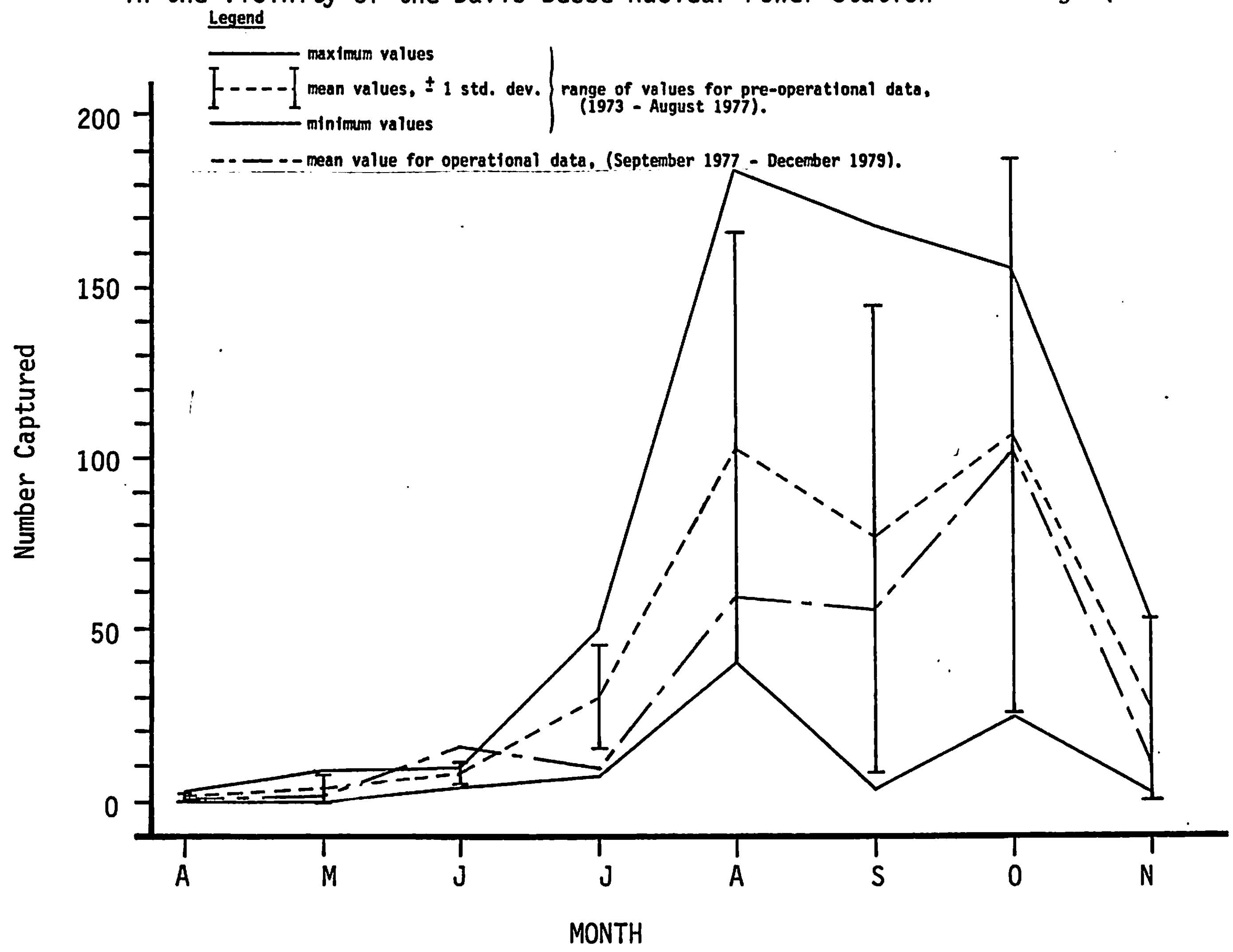


Figure 78. Comparison of Pre-operational and Operational Spottail Shiner Catches in Gill Nets Set in the Vicinity of the Davis-Besse Nuclear Power Station Discharge (Station 13).

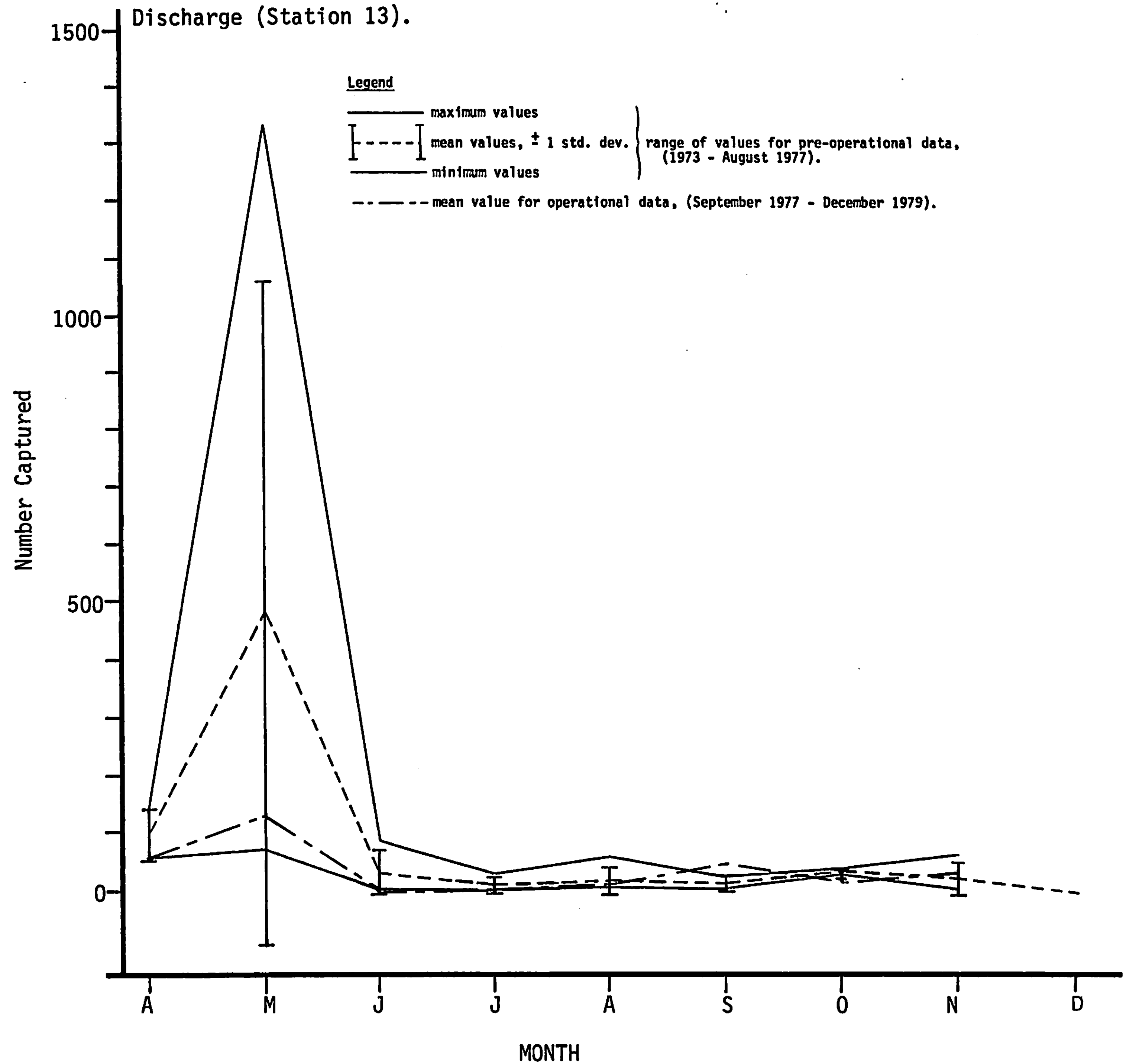


Figure 79. Comparison of Pre-operational and Operational Walleye Catches in Gill Nets Set in the Vicinity of the Davis-Besse Nuclear Power Station Discharge (Station 13).

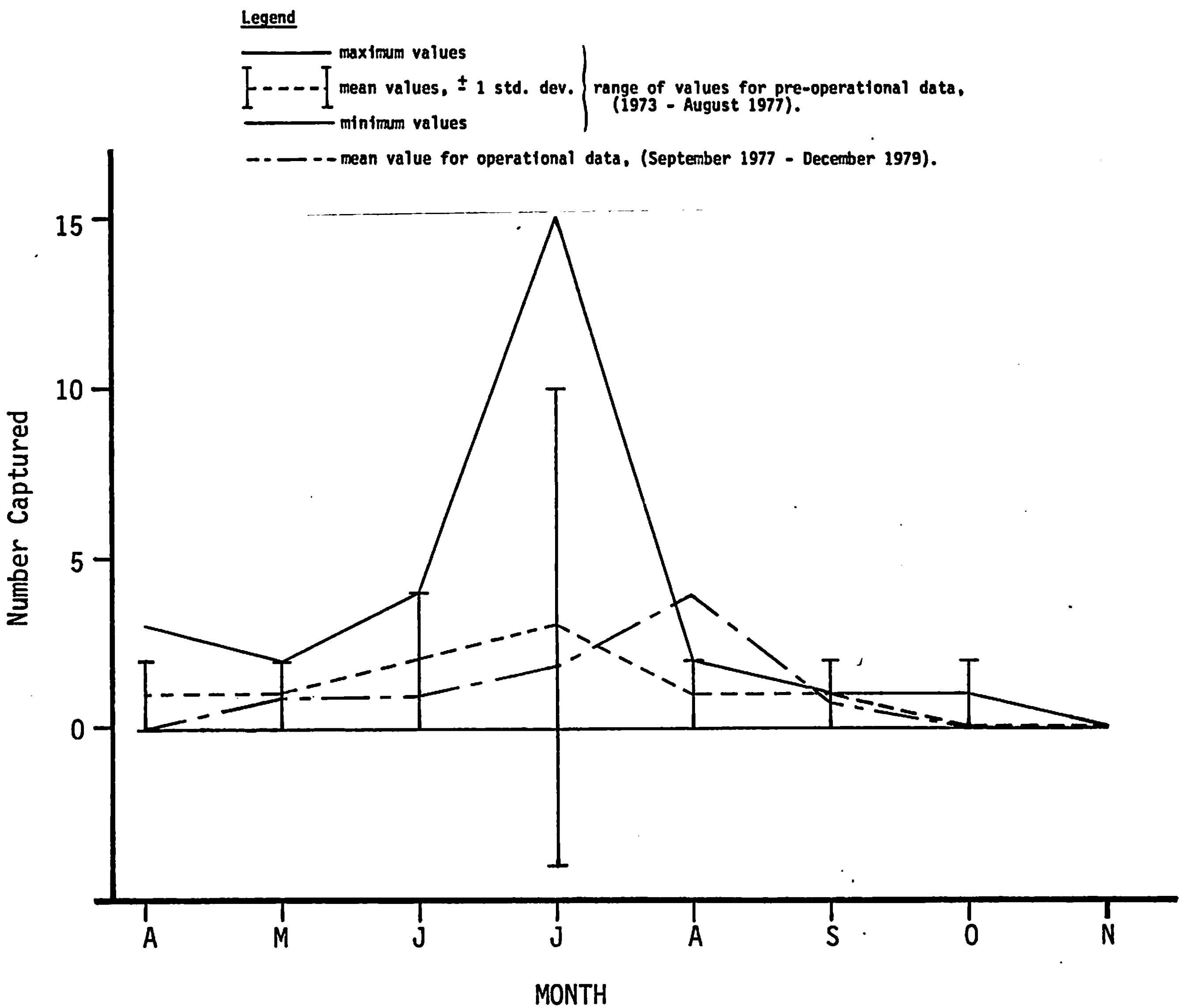


Figure 80. Comparison of Pre-operational and Operational White Bass Catches in Gill Nets Set in the Vicinity of the Davis-Besse Nuclear Power Station Discharge (Station 13).

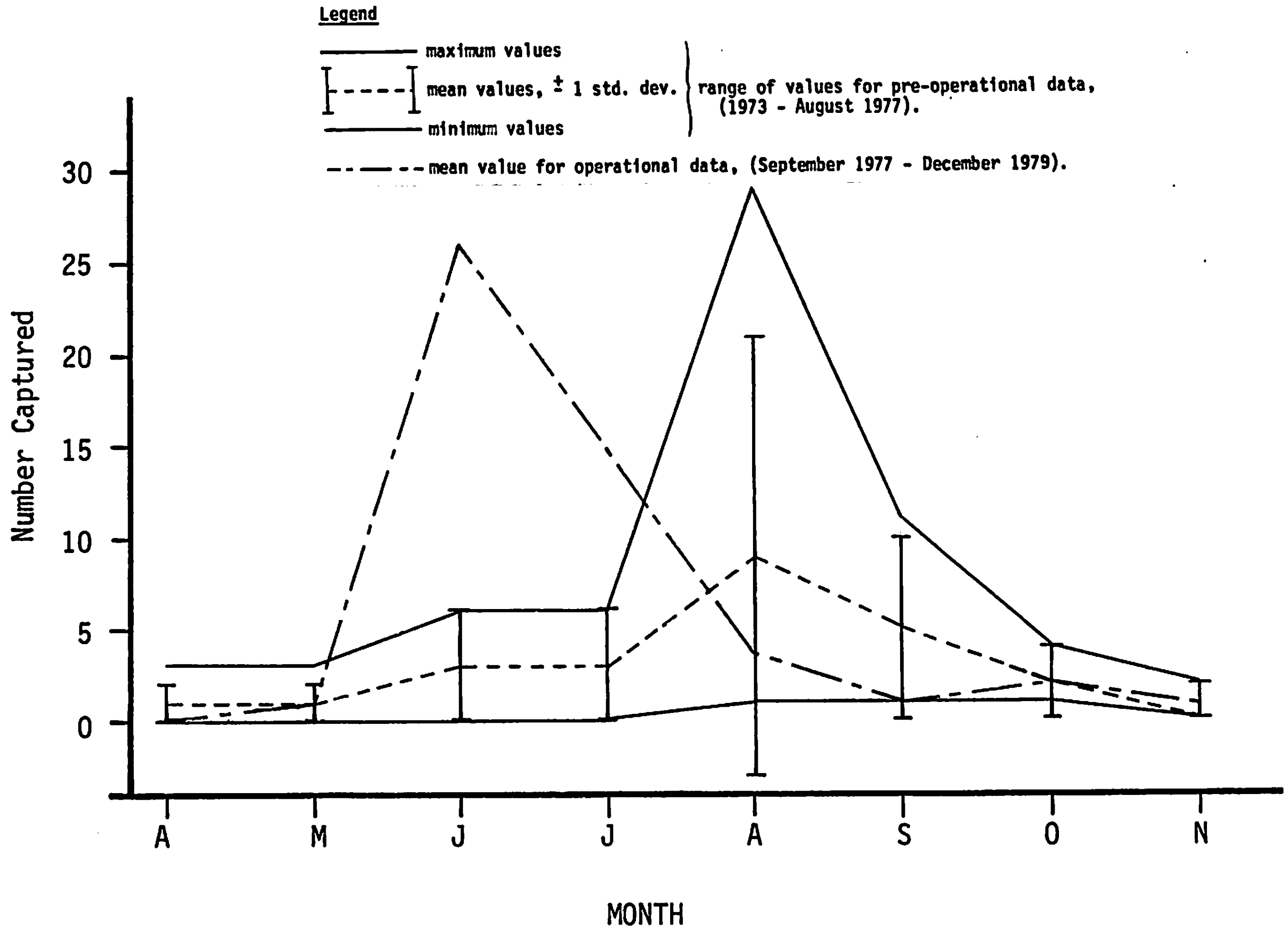


Figure 81. Comparison of Pre-operational and Operational Yellow Perch Catches in Gill Nets Set in the Vicinity of the Davis-Besse Nuclear Power Station Discharge (Station 13).

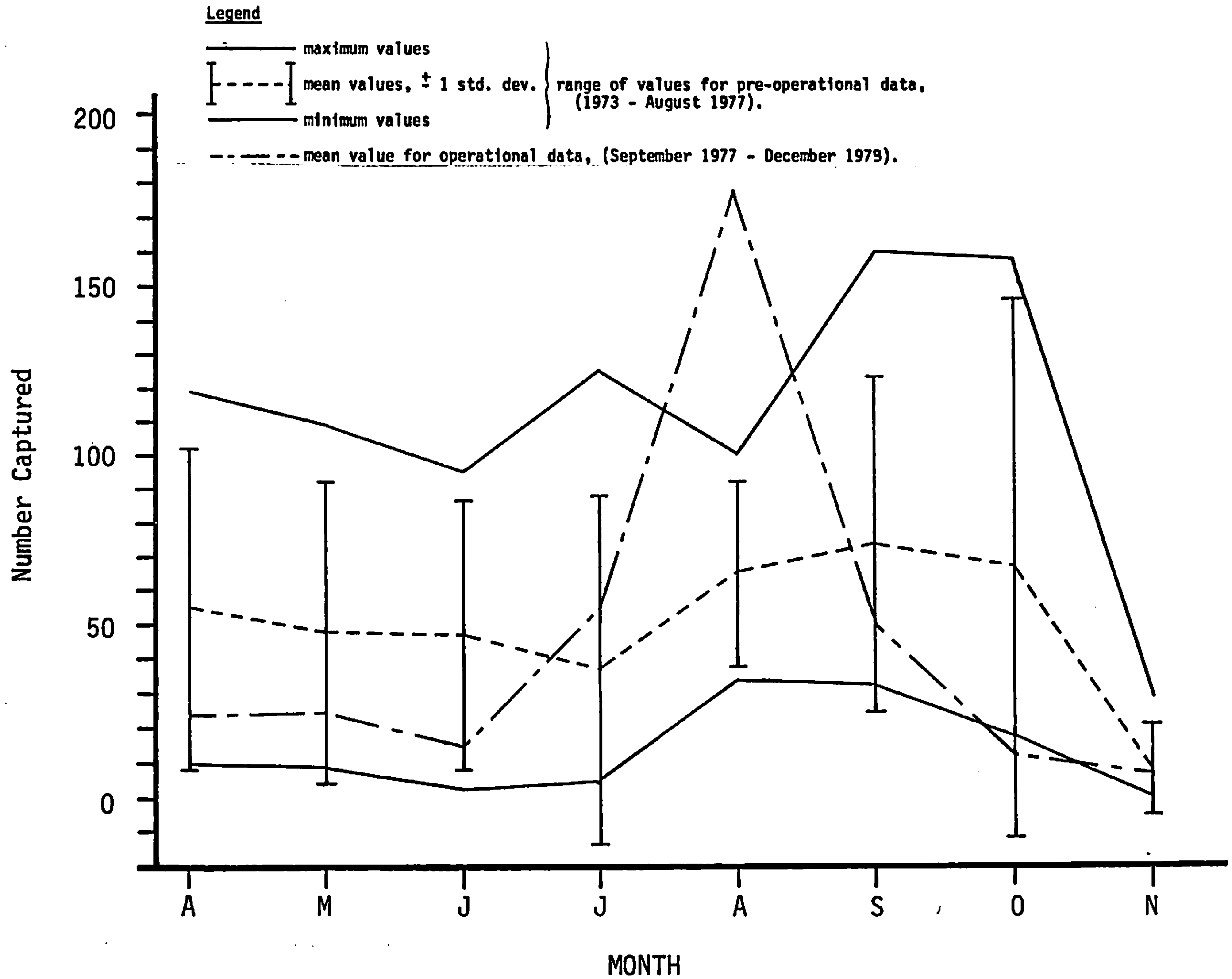


Figure 82. Comparison of Pre-operational and Operational Gill Net Results at the Station Intake (Sta. No. 8).

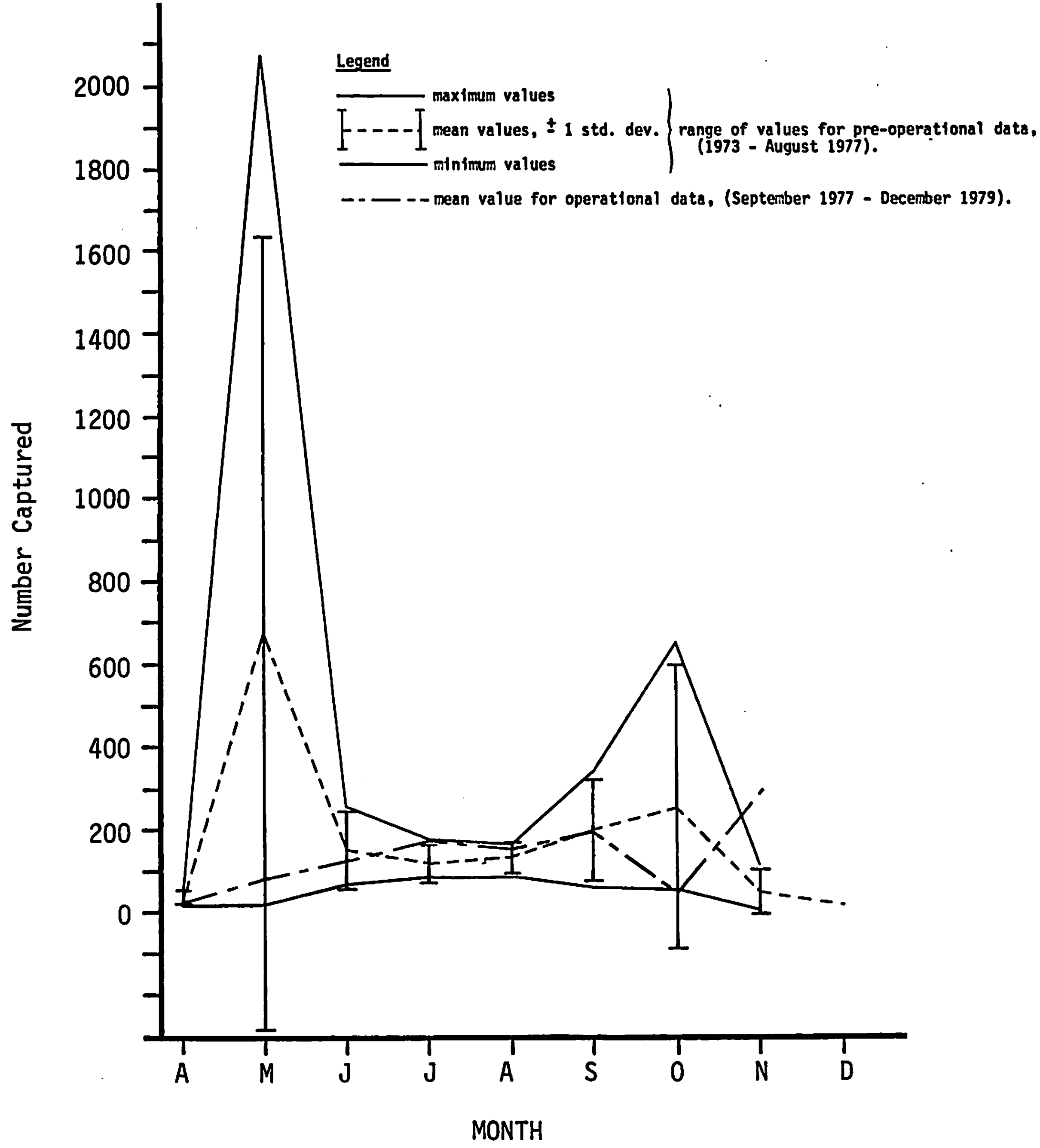


Figure 83. Comparison of Pre-operational and Operational Gill Net Results at the Station Discharge (Sta. No. 13).

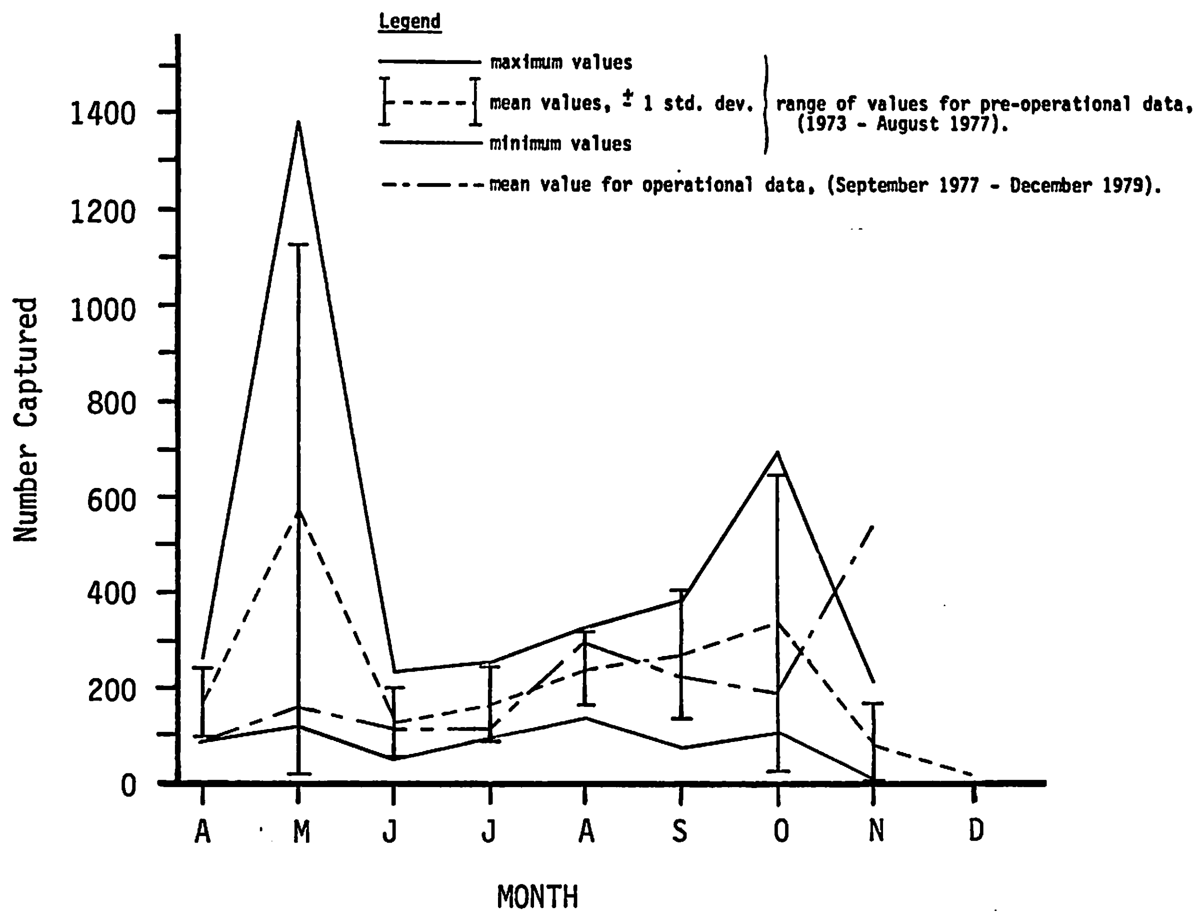


Figure 84. Comparison of Pre-operational and Operational Gill Net Results at an In-shore Control Station (Sta. No. 3).

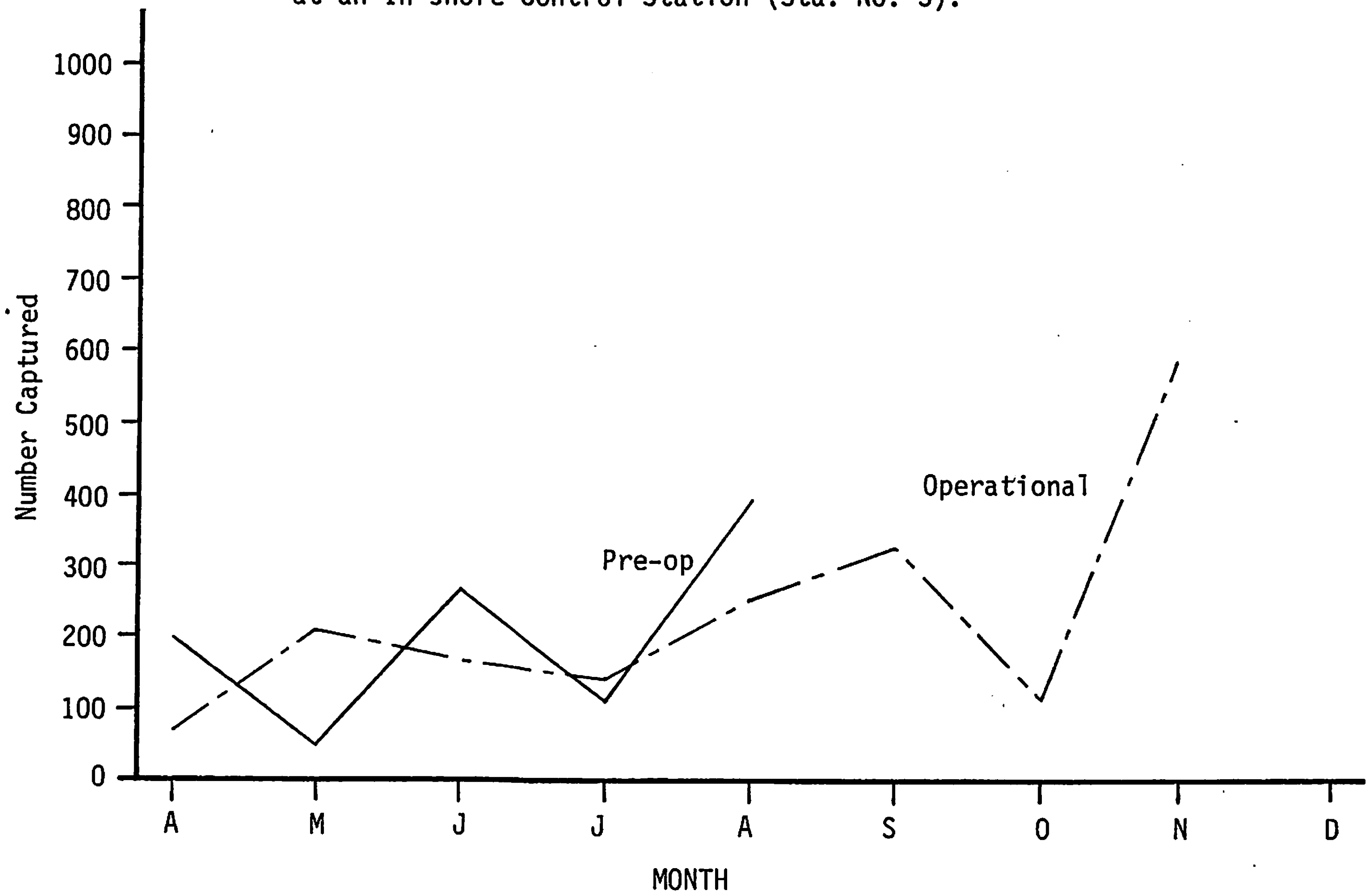


Figure 85. Comparison of Pre-operational and Operational Gill Net Results at an Off-shore Control Station (Sta. No. 26).