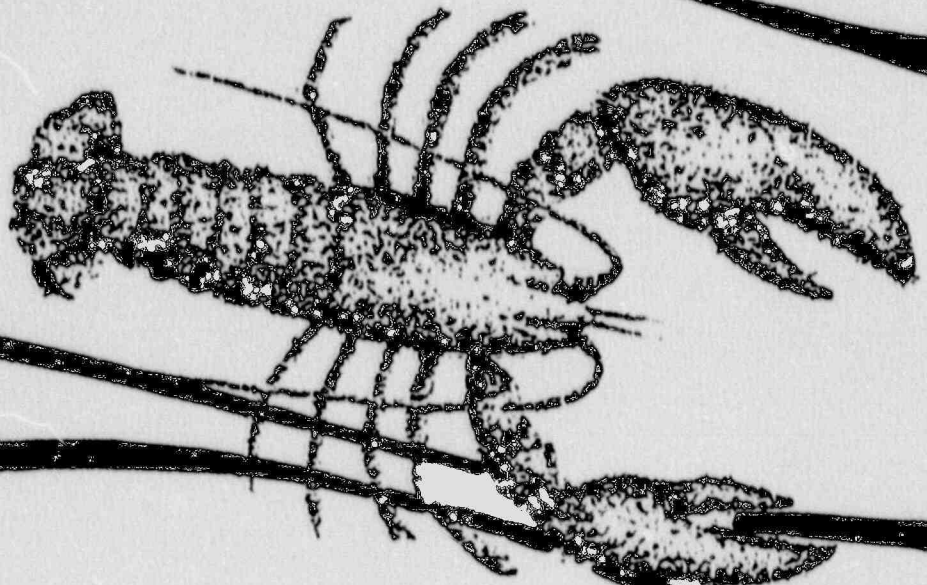
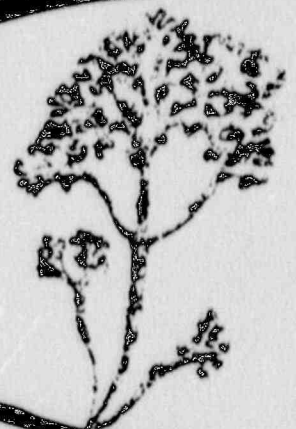
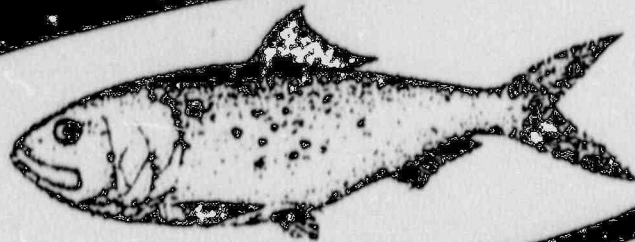


# marine ecology studies

Related to Operation of Pilgrim Station

SEMI-ANNUAL REPORT NUMBER 36  
JANUARY 1990 – JUNE 1990



BOSTON EDISON COMPANY  
REGULATORY AFFAIRS DEPARTMENT  
LICENSING DIVISION

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MARINE ECOLOGY STUDIES  
RELATED TO OPERATION OF PILGRIM STATION

SEMI-ANNUAL REPORT NO. 36

REPORT PERIOD: JANUARY 1990 THROUGH JUNE 1990

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## SUMMARY

Highlights of the environmental surveillance and monitoring program results obtained over this reporting period (January - June 1990) are presented below (Note: PNPS was operating at normal power level from January - June 1990 with the exception of an outage during most of March and April).

### Marine Fisheries Monitoring:

1. Pelagic fish mean catch from January - June 1990 at the gill net station (72 fishes/set) decreased 38% from 1989 when 117 fishes/ set were taken. Pollock (48%), striped bass (16%), Atlantic herring (9%), alewife (9%) and cunner (5%) made up 87% of the total catch. Striped bass were sampled in much higher relative numbers than during previous years in the thermal effluent.
2. Shrimp trawl catch from January - June 1990 recorded thirteen benthic fish species with winter flounder (40%), windowpane (21%), little skate (20%), and ocean pout (6%) composing 87% of the total. Mean catch-per-unit-effort (CPUE) for all species was highest at the Intake Station (7.2) and 5.5 for all stations pooled in 1990 (33% less than in 1989). CPUE from January - June 1990 for commercially important winter flounder was highest at the Intake Station. The mean smallest winter flounder recorded were sampled in the intake embayment.
3. Adult lobster mean monthly catch rate per pot haul in May - June 1990 was 0.26 lobsters (0.27 in 1989). This reflected a general constancy



in CPUE in the whole Cape Cod Bay commercial lobster fishery. The surveillance area (thermal plume) catch rate was 0.27 while the reference area (control) was 0.21.

4. In May - June 1990 fish observational dive surveys four species were observed in the discharge area. Striped bass (66%) were the most numerous species seen, with bluefish second (17%), tautog third (11%) and cunner (5%) last in observational abundance. No fish showed abnormal behavior and no gas bubble disease symptoms were observed on routine observational dives. Most fish were in greatest concentrations in the path of the PNPS discharge, being observed most often in the denuded zone (99%). Blue mussel proliferation and algal growth in the denuded zone, and outside of it, were dense following the PNPS outage for most of March and April 1990.
5. Sand lance spp. accounted for 82% of the June 1990 haul seine (shore zone) fish catch, northern pipefish 5% and Atlantic tomcod 4%, with a total of eight species collected. Diversity was greatest at the PNPS intake. CPUE was highest in the PNPS intake embayment where sand lance spp. were dominant.
6. The mid-May through June 1990 shorefront sportfish survey at Pilgrim Station recorded 470 angler-trips. PNPS operation, which resulted in maximum thermal discharge to attract sportfish species, reflected good catches of striped bass and bluefish compared with the previous, outage/low power years.
7. The research lobster study commenced in June 1990 and recorded 0.20 adult lobsters (0.31 in 1989) per pot as a catch rate in 620 pot-

hauls. The catch rate for adult lobsters was similar at Rocky Point and the PNPS discharge area but noticeably higher at Priscilla Beach, the same results as in 1989.

8. Preliminary, cunner tagging study research concentrated on assessing tag type, location, retention, visibility and fish survival for the planned 1991 project.

#### Impingement Monitoring:

1. The mean January - June 1990 impingement collection rate was 0.52 fish/hr. The rate ranged from 0.10 fish/hr (June) to 1.11 fish/hr (February) with Atlantic silverside comprising 55.8% of the catch, followed by winter flounder 8.2%, Atlantic herring 7.8%, and grubby 5.1%.
2. For the period January-March 1990, when the fish impingement rate was 0.62, Atlantic silverside accounted for 69.1% of the fishes collected. Fish impingement rate was approximately the same as in 1989 (0.55), but lower in 1988 (0.30) because Pilgrim Station had less circulating water pump capacity than normal that year.
3. The mean January - June 1990 invertebrate collection rate was 0.58/hr with sevenspine bay shrimp accounting for 50.0% and longfin squid 10.5% of the catch. Sixteen American lobsters were caught.
4. Initial impinged fish survival at the end of the Pilgrim Station intake sluiceway was approximately 25% for static washes and 5% for continuous washes.



### Benthic Monitoring:

1. No new species of invertebrate fauna were added to the list of sampled biota as a result of analysis of the April 1990 samples, keeping the total number of species at 483 in the PNPS area.
2. Species richness between the PNPS discharge and the Manomet Point/Rocky Point stations was not notably different in April 1990, as in March 1989.
3. Greatest faunal densities in April 1990 occurred at Manomet Point. Faunal densities were also lower at the Effluent than at Rocky Point. Approximately a 45% greater difference was found for both Manomet Point and Rocky Point when compared to the Effluent. Changes in rank were not found among stations for density without blue mussels (Mytilus edulis).
4. There was a consistency between pairs of stations for dominance patterns, with only 6 of the 15 dominant species at each station not being shared. Amphipods were the majority of the dominant taxa, and blue mussels ranked first representing a minimum of 76% of the total fauna at each station. Species diversity was intermediate at the Effluent Station between Rocky Point and Manomet Point, without Mytilus.
5. No additional algal species were encountered in the study area during April 1990. Algal community overlap was high (~92%) among all three station pairs, but community overlap values showed that the Effluent



station was lower than the reference stations when compared to each other.

6. Total algal biomass was higher at the Effluent than at the Manomet Point and Rocky Point stations. Mean Chondrus biomass was higher at the Manomet Point station than the other stations, and Phyllophora spp. biomass was highest at the Effluent and lowest at Manomet Point station.
7. April and June 1990 mappings of the near-shore acute impact zones were performed. Negligible Chondrus growth in the denuded zone was evident for both April and June indicating impact since the 1986 - 1988 PNPS outage. The warm-water alga, Gracilaria tikvahiae, was present in the discharge area because of increased operation of PNPS from January - June 1990.

#### Entrainment Monitoring:

1. A total of 34 species of fish eggs and/or larvae were found in the January - June 1990 entrainment collections.
2. Egg collections for January - April 1990 (winter-early spring spawning) were dominated by Atlantic cod, American plaice, yellowtail flounder and fourbeard rockling. May and June (late spring - summer spawning) egg samples were most representative of Atlantic mackerel and labrids.
3. Larval collections for January - April 1990 were dominated by rock gunnel, sculpin and sand lance. For May and June larvae, sand lance,

winter flounder, fourbeard rockling, American plaice and radiated shanny dominated.

4. One lobster larva (Stage I) was collected in the entrainment samples for January - June 1990, the first since 1982.
5. In no cases were unusually high densities of ichthyoplankton found, requiring contingency sampling to be initiated.



## INTRODUCTION

### A. Scope and Objective

This is the thirty-sixth semi-annual report on the status and results of the Environmental Surveillance and Monitoring Program related to the operation of Pilgrim Nuclear Power Station (PNPS). The monitoring programs discussed in this report relate specifically to the Western Cape Cod Bay ecosystem with particular emphasis on the Rocky Point area. This is the twenty-fourth semi-annual report in accordance with the environmental monitoring and reporting requirements of the PNPS Unit 1 NPDES Permit from the U.S. Environmental Protection Agency (#MA0003557) and Massachusetts Division of Water Pollution Control (#359). A multi-year (1969-1977) report incorporating marine fisheries, benthic, plankton/entrainment and impingement studies was submitted to the NRC in July 1978 as required by the PNPS Appendix B, Tech. Spec. Programs in these areas have been continued under the PNPS NPDES permit. Amendment #67 (1983) to the PNPS Tech. Specs. deleted Appendix B non-radiological water quality requirements as the NRC felt they are covered in the NPDES Permit.

The objectives of the Environmental Surveillance and Monitoring Program are to determine whether the operation of PNPS results in measurable effects on the marine ecology and to evaluate the significance of any observed effects. If an effect of significance is detected, Boston Edison Company has committed to take steps to correct or mitigate any adverse situation.



These studies are guided by the Pilgrim Administrative-Technical Committee (PATC) which was chaired by a member of the Mass. Division of Water Pollution Control in 1990 and whose membership includes representatives from the University of Massachusetts, the Mass. Division of Water Pollution Control, the Mass. Division of Marine Fisheries, the National Marine Fisheries Service (NOAA), the Mass. Office of Coastal Zone Management, the U.S. Environmental Protection Agency and Boston Edison Company. Copies of the Minutes of the Pilgrim Station Administrative-Technical Committee meetings held during this reporting period are included in Section IV.

## B. Marine Biota Studies

### 1. Marine Fisheries Monitoring

A modified version of the marine fisheries monitoring, initiated in 1981, is being conducted by the Commonwealth of Massachusetts, Division of Marine Fisheries (DMF).

The occurrence and distribution of fish around Pilgrim Station and at sites outside the area of temperature increase are being monitored. Pelagic species were sampled using gill net (1 station) collections (Figure 1) made at monthly intervals. In 1981, shrimp trawling and haul seining were initiated which provide more PNPS impact-related sampling of benthic fish and shore zone fish, respectively. Shrimp trawling was done once/month (January - March) and twice/month (April - December) at 4 stations (Figure 2) and haul seining biweekly during June - November at 4 stations (Figure 1).

Monitoring is conducted of local lobster stock catch statistics for areas in the proximity of Pilgrim Station (Figure 4). Catch statistics are collected approximately biweekly throughout the fishing season (May-November).

A finfish observational dive program was initiated in June 1978. SCUBA gear is utilized on biweekly dives from May-October (weekly mid-August to mid-September) at 6 stations (Figure 2) in the PNPS thermal plume area.

In 1986, an experimental, lobster pot trawl monitoring effort was initiated to eliminate any biases associated with the collection of lobster stock catch statistics for determining PNPS effects. Ten 5-pot lobster trawls were fished in the thermal plume and control areas around PNPS (Figure 3).

Results of the marine fisheries monitoring during the reporting period are presented in Section IIIA.

## 2. Benthic Monitoring

The benthic monitoring described in this report was conducted by Science Applications International Corp., Woods Hole, MA.



The benthic flora and fauna were sampled at three locations at depths of 10 feet (MLW) (Figure 1). Quantitative (rock substratum) samples were collected, and the dominant flora and fauna in each plot were recorded. Sampling was conducted two times per year (March and September) to determine biotic changes, if any. Transect sampling off the discharge canal to determine the extent of the denuded and stunted zones is conducted four times a year (March, June, September and December). Results of the benthic surveys reported during this period are discussed in Section IIIB.

### 3. Plankton Monitoring

Marine Research, Inc. (MRI) of Falmouth, Massachusetts, has been monitoring entrainment in Pilgrim Station cooling water of fish eggs and larvae, and lobster larvae (from 1973-1975 phytoplankton and zooplankton were also studied). Figure 5 shows the entrainment contingency sampling station locations. Information generated through these studies has been utilized to make periodic modifications in the sampling program to more efficiently address the question of the effect of entrainment. These modifications have been developed by the contractor, and reviewed and approved by the Pilgrim A-T Committee on the basis of the program results. Plankton monitoring in 1990 emphasized consideration of ichthyoplankton entrainment. Results of the ichthyoplankton entrainment monitoring for this reporting period are discussed in Section IIIC.



#### 4. Impingement Monitoring

The Pilgrim 1 impingement monitoring and survival program speciates, quantifies and determines viability of the organisms carried onto the four intake traveling screens. Since January 1979, Marine Research, Inc. has been conducting impingement sampling with results being reported on by Boston Edison Company.

A new screen wash sluiceway system was installed at Pilgrim in 1979 at a total cost of approximately \$150,000. This new sluiceway system was required by the U.S. Environmental Protection Agency and the Mass. Division of Water Pollution Control as a part of NPDES Permit #MA0003557. Special fish survival studies conducted from 1980-1983 to determine its effectiveness in protecting marine life were terminated in 1984, and information on them appears in Marine Ecology Semi-Annual Report #23.

Results of impingement monitoring and survival program for this reporting period are discussed in Section IIID.

#### C. Fish Surveillance Studies

March - November, weekly fish spotting overflights were conducted as part of a continuing effort to monitor the times when large concentrations of fish might be expected in the Pilgrim vicinity.

An annual summary report for this effort for 1990 will be presented in Semi-Annual Report No. 37.

D. Station Operation History

The daily average, reactor thermal power levels from January through June 1990 are shown in Figure 6. As can be seen, PNPS was in a normal operating stage during most of this reporting period.

E. 1990 Environmental Programs

A planning schedule bar chart for 1990 environmental monitoring programs related to the operation of Pilgrim Station, showing task activities and milestones from December 1989 - June 1991, is included as Figure 7.



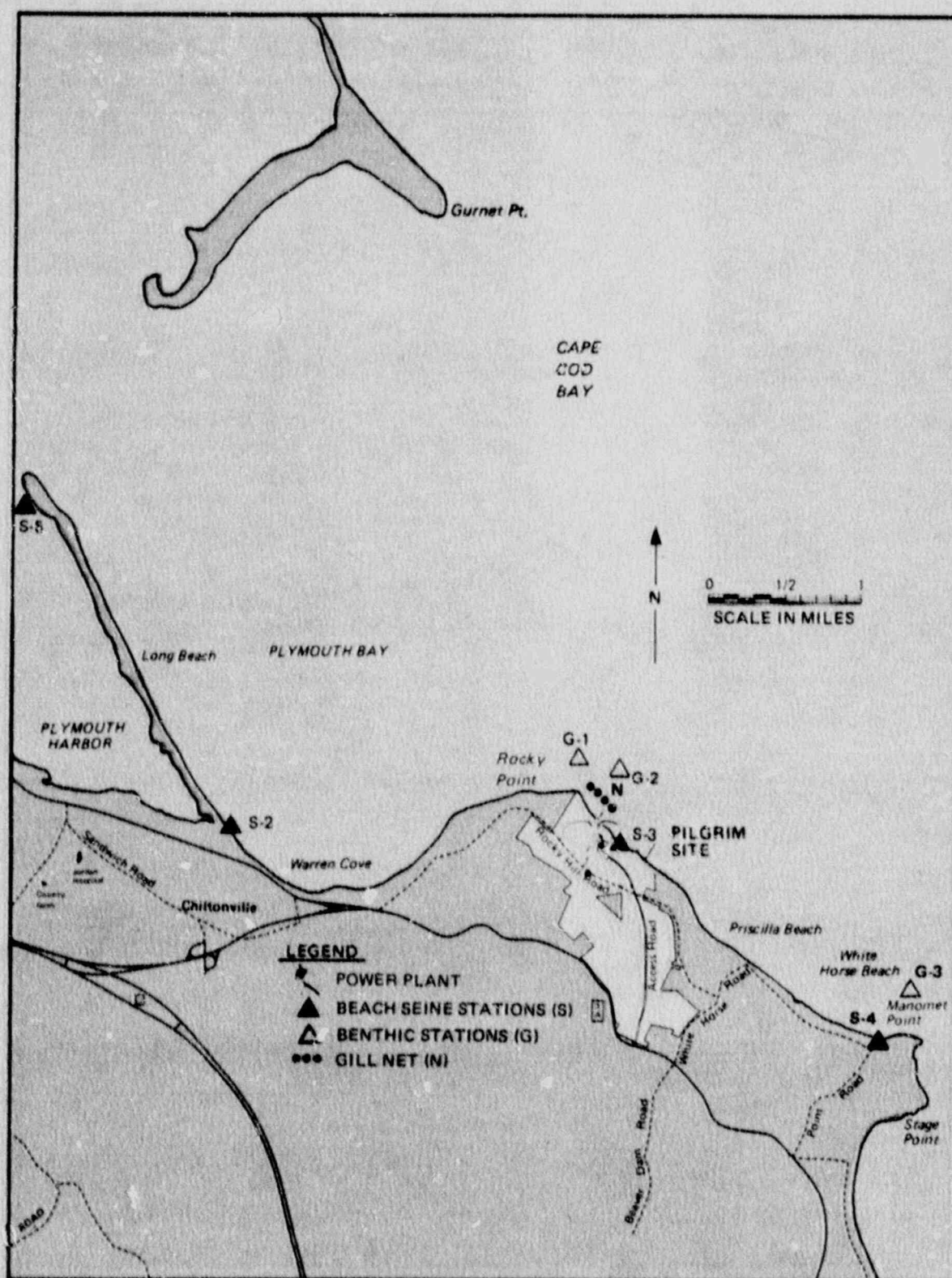


Figure 1. Location of Beach Seine and Gill Net Sampling Stations for Marine Fisheries Studies, and Benthic Studies Sampling Stations



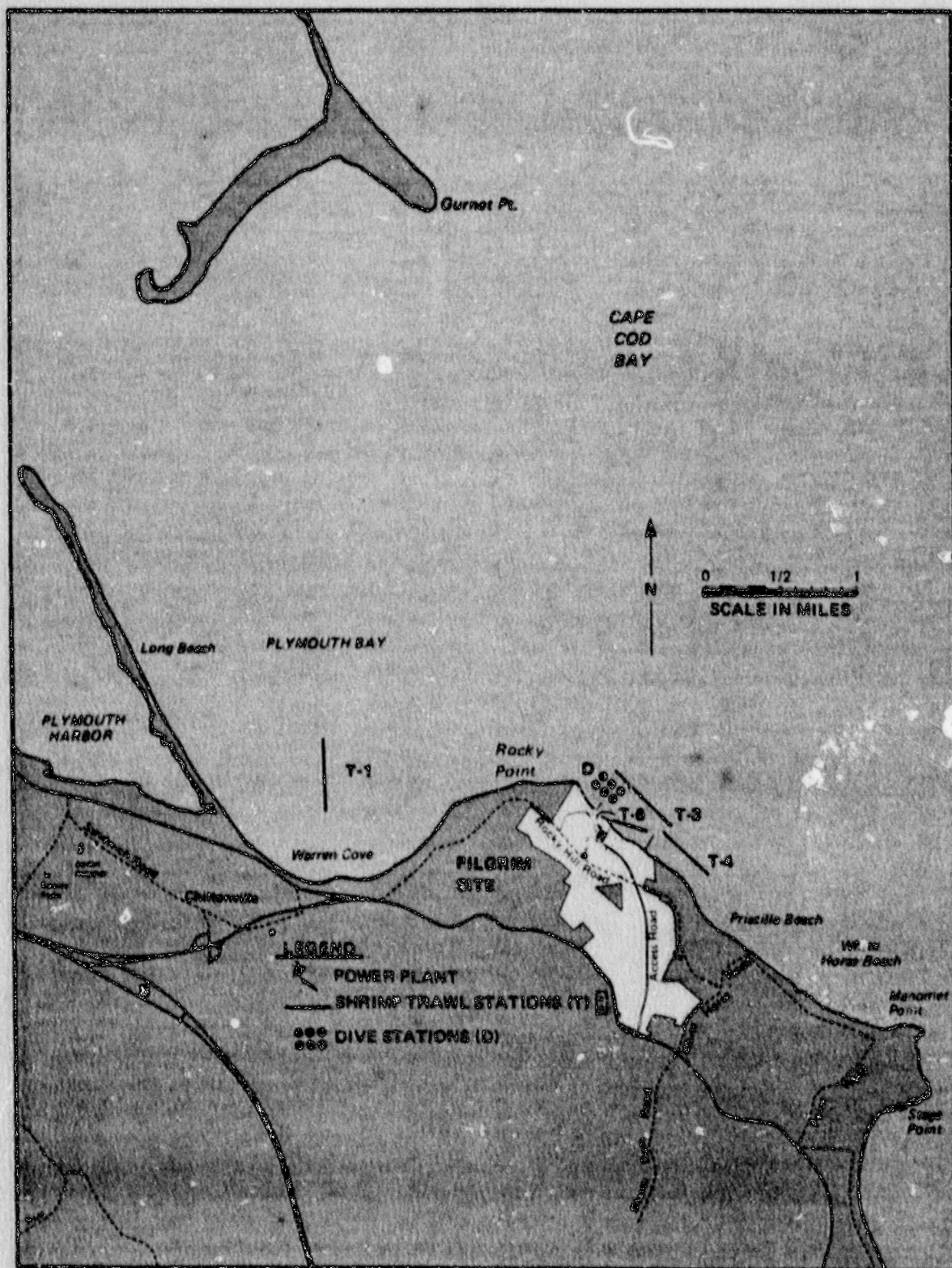


Figure 2. Location of Shrimp Trawl and Dive Sampling Stations for Marine Fisheries Studies

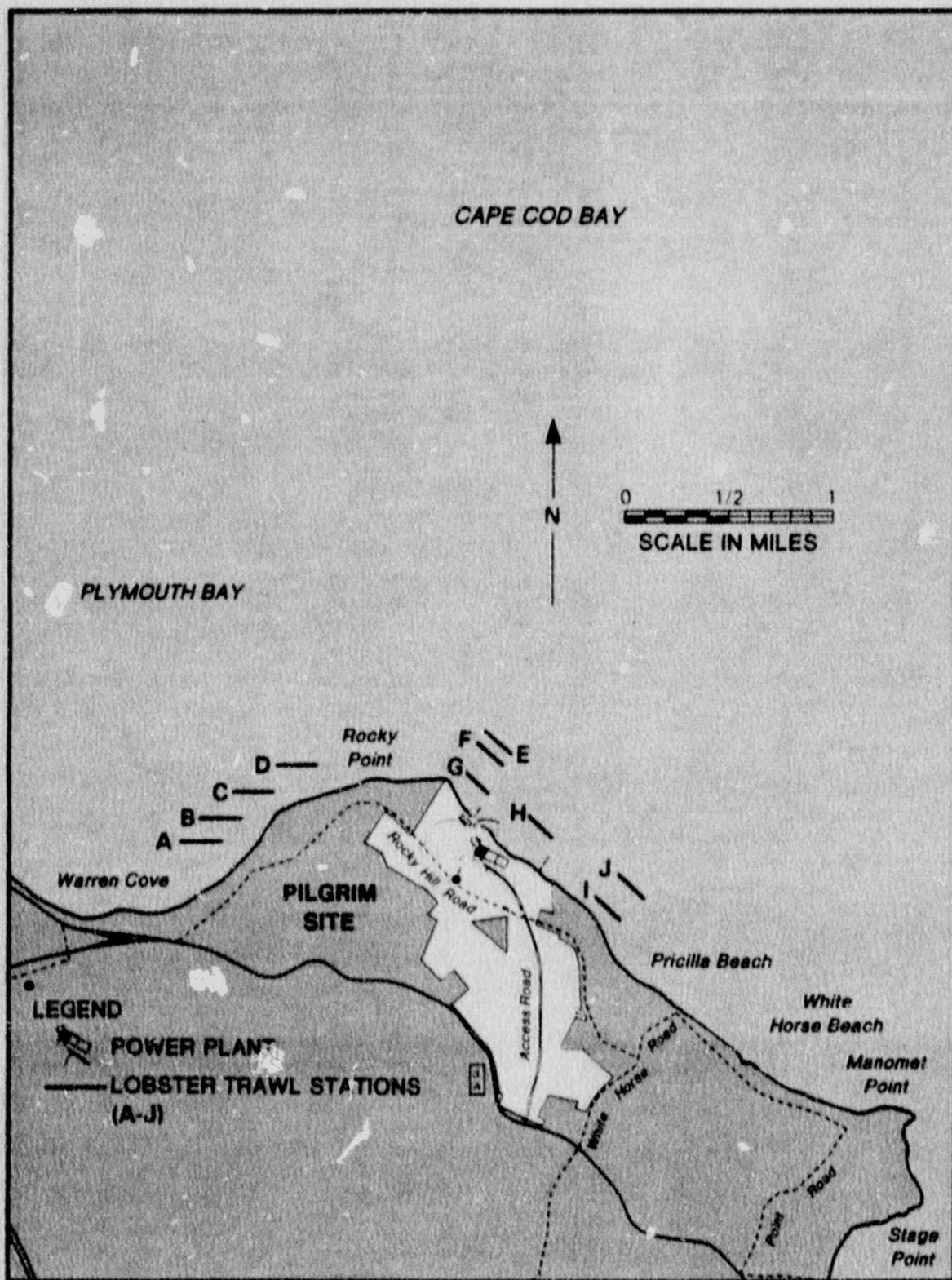


Figure 3. Location of experimental lobster gear (5-pot trawls) for Marine Fisheries Studies.



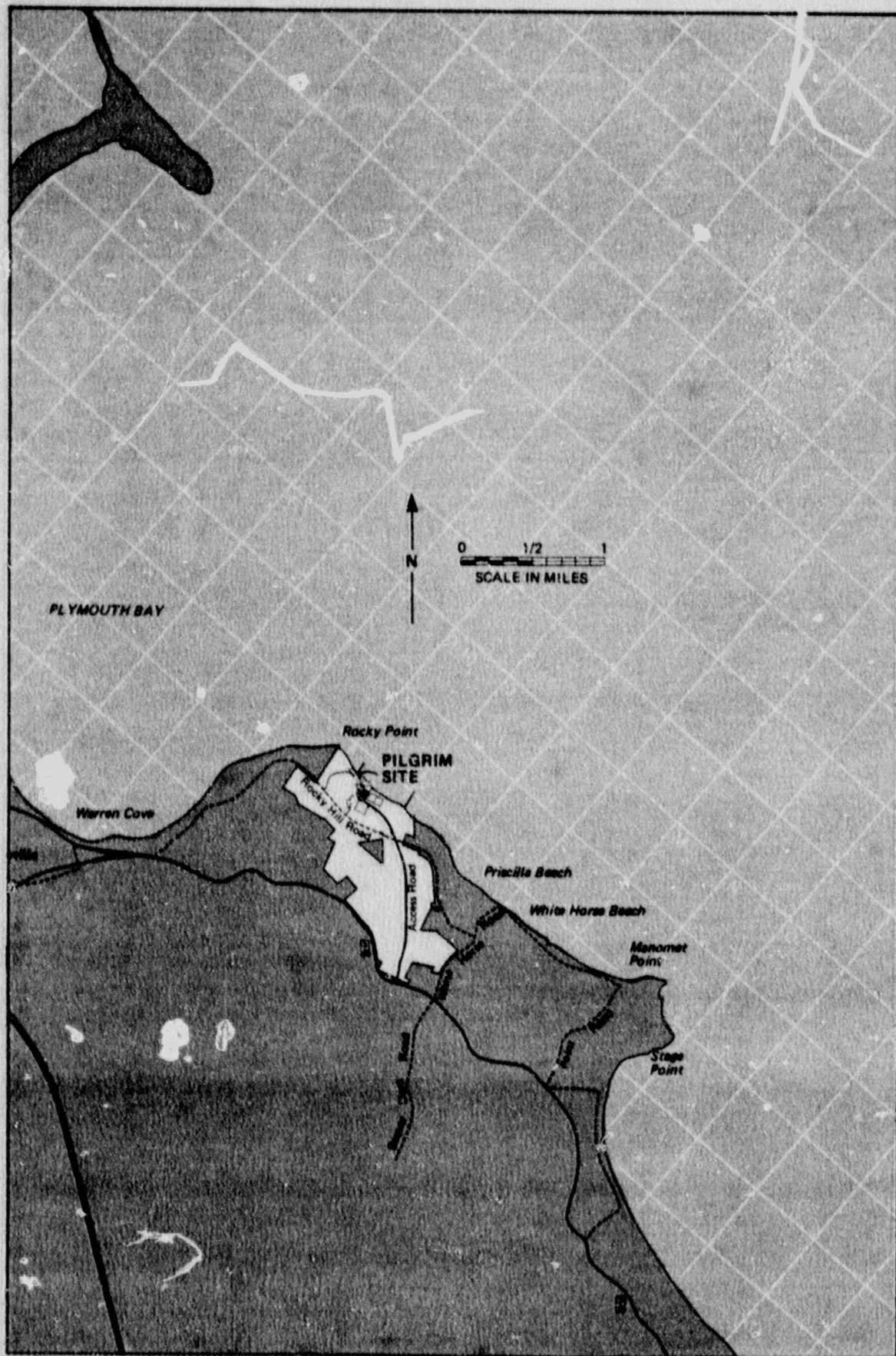


Figure 4 Lobster Pot Sampling Grid for Marine Fisheries Studies.

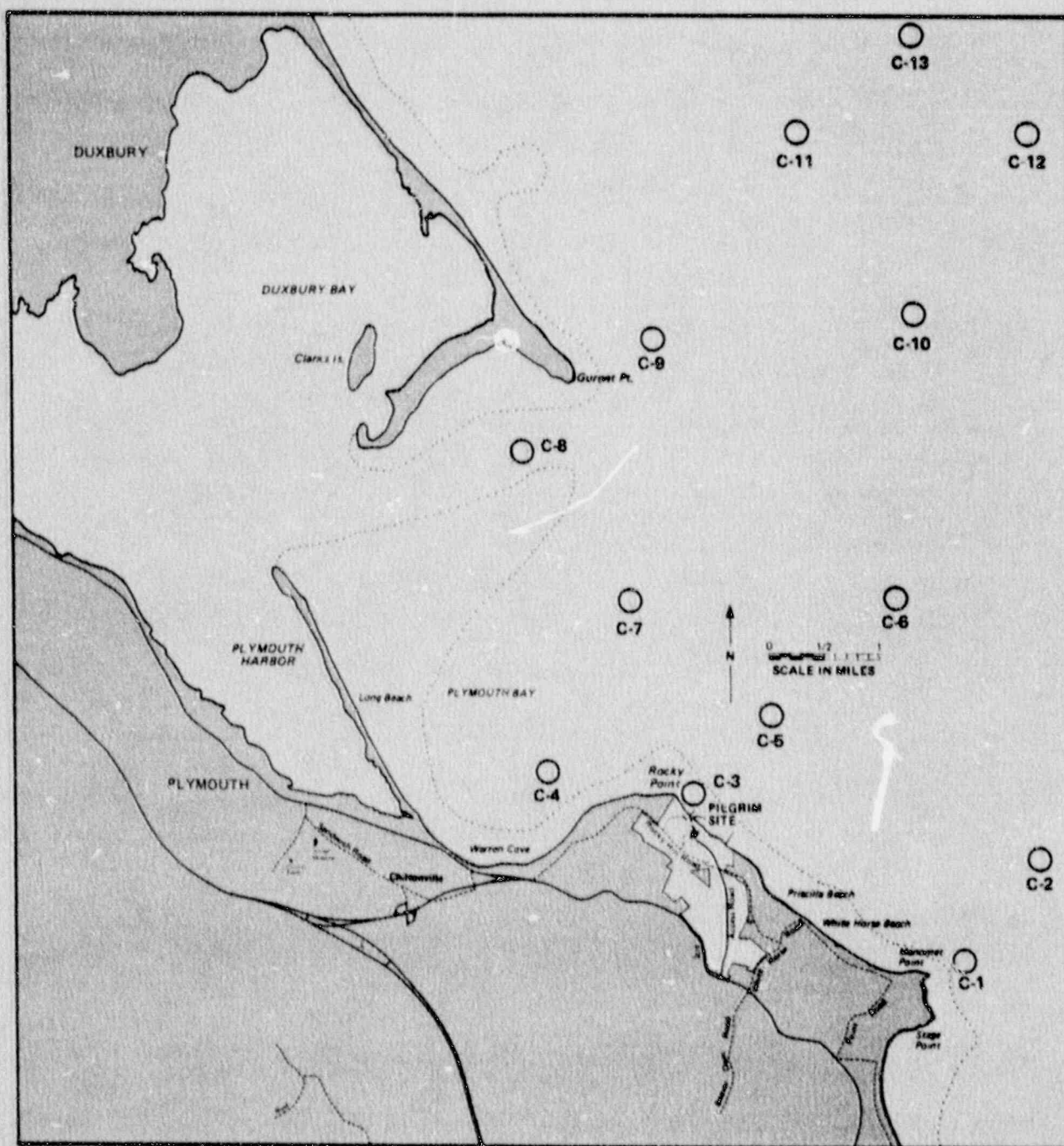
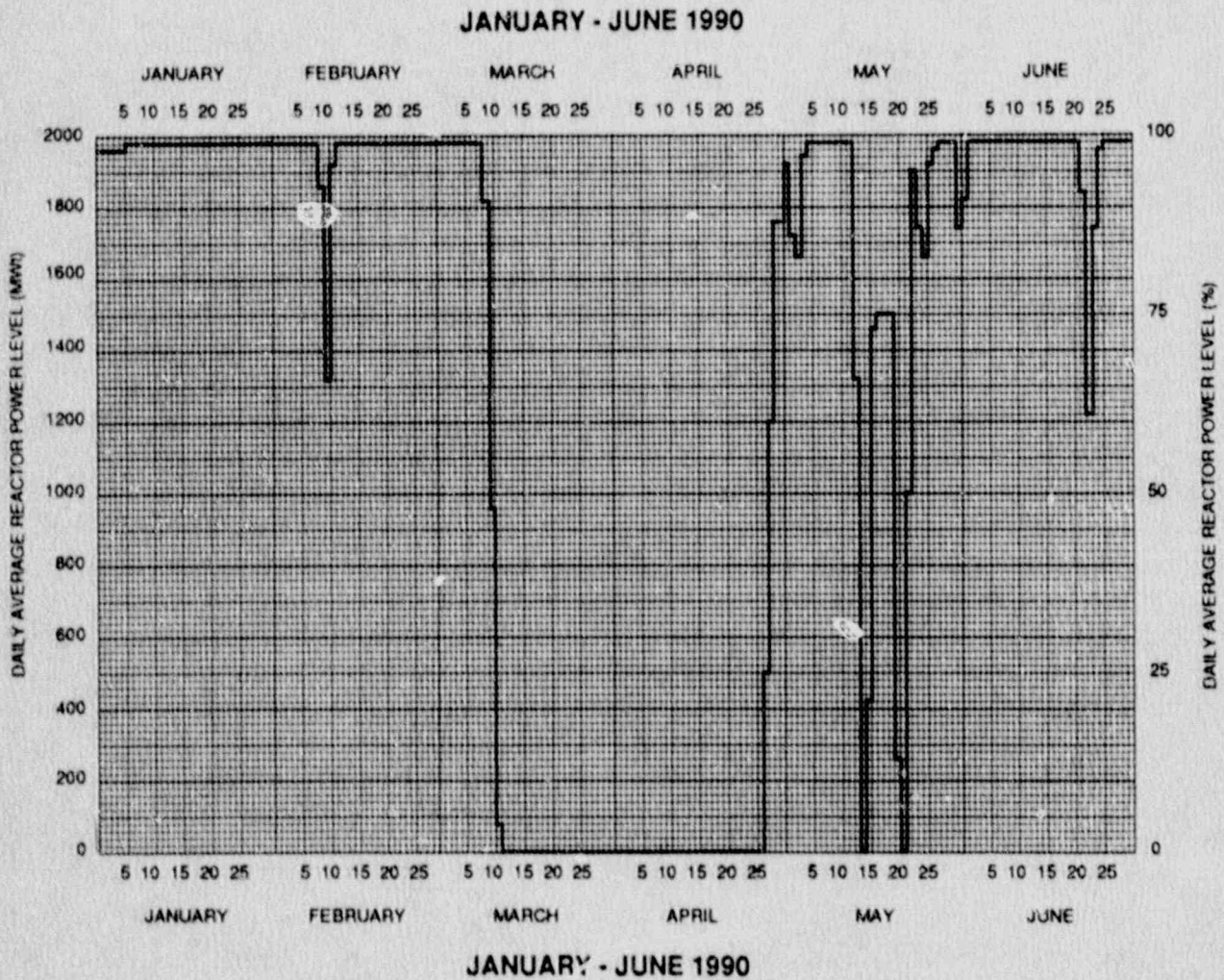


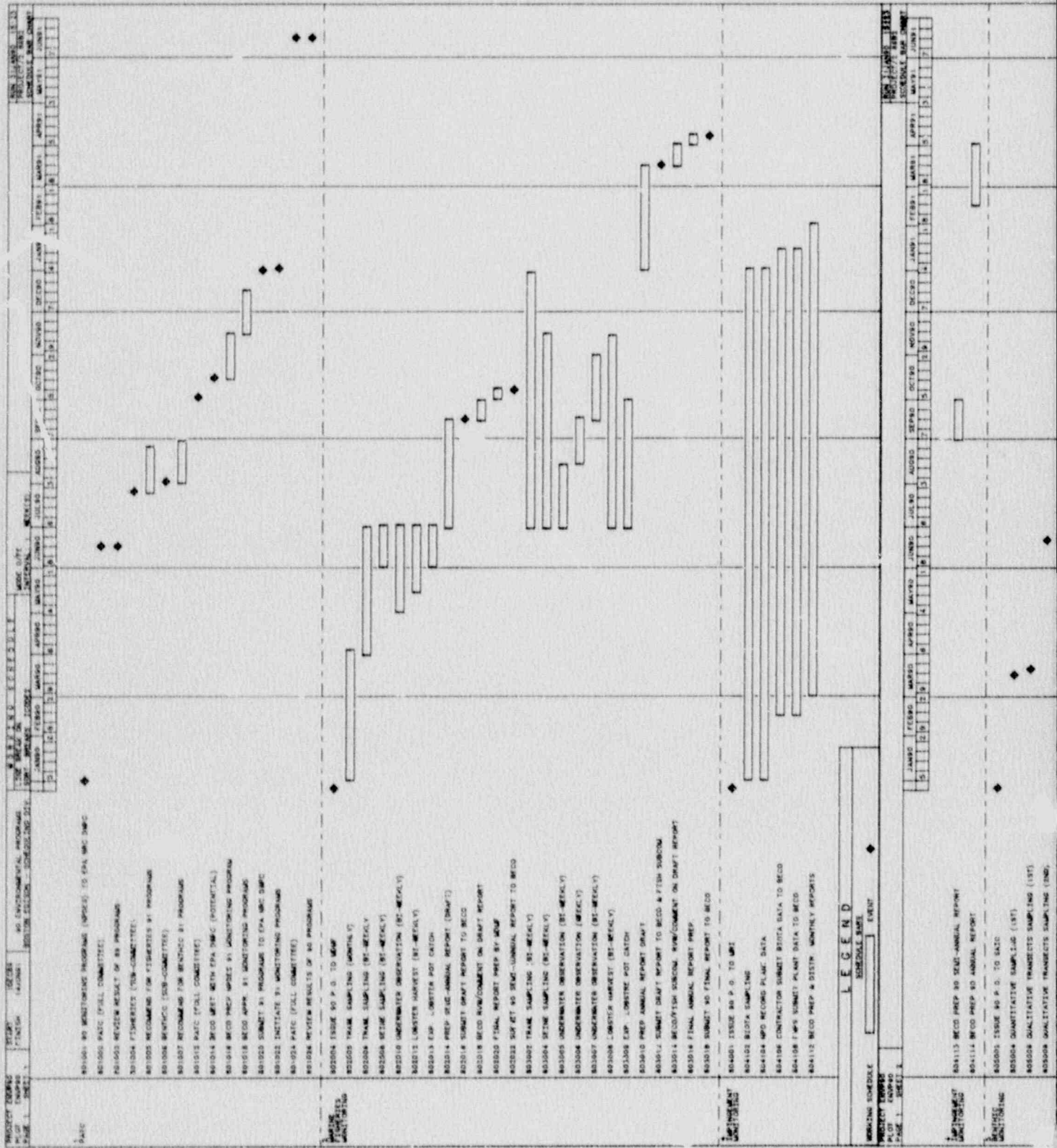
Figure 5 Location of Entrainment Contingency Plan Sampling Stations, C.



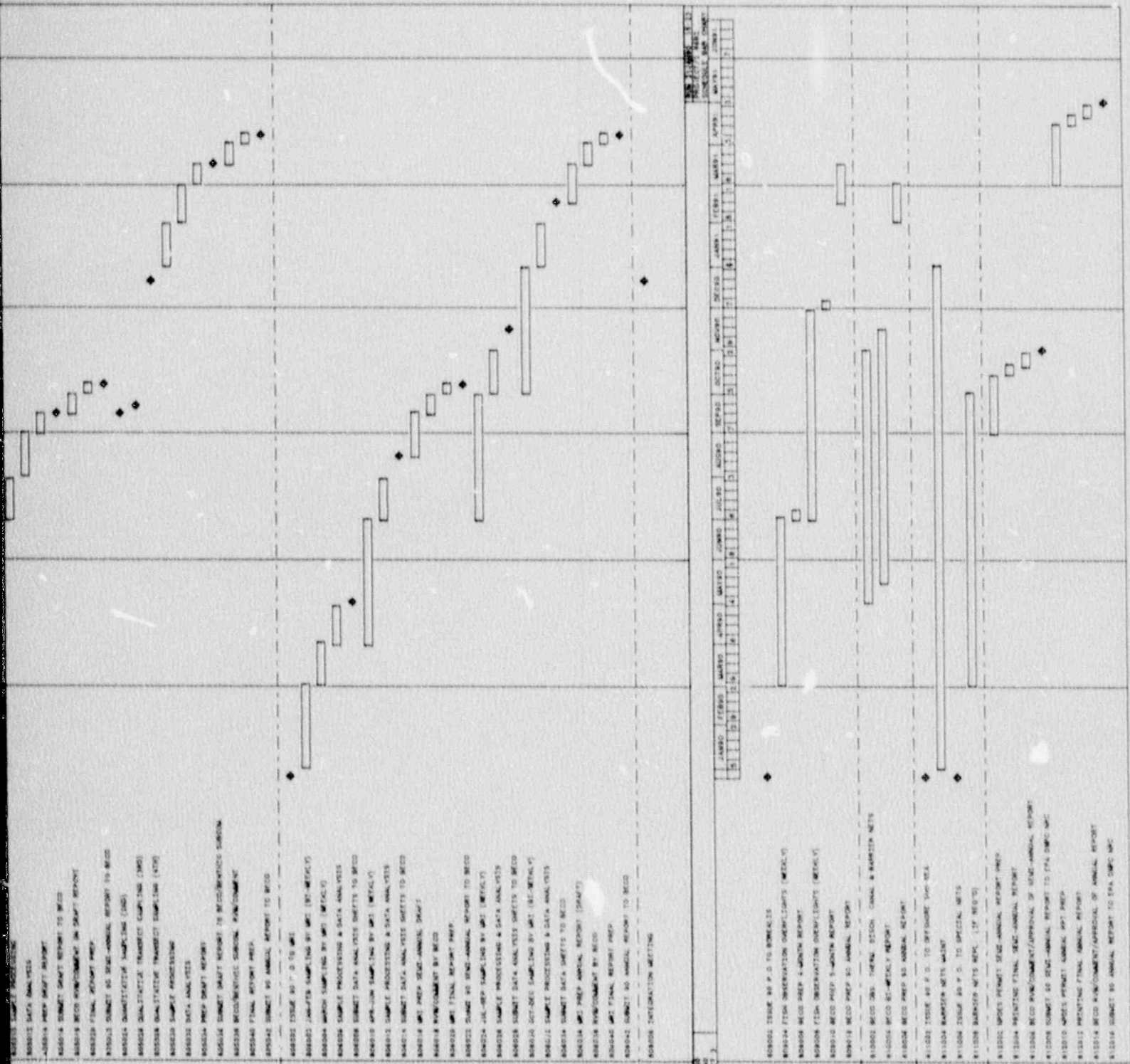


**Figure 6. Daily Average Reactor Thermal Power Level (MWt And %) from January - June 1990 for Pilgrim Nuclear Power Station.**

Figure 7. Schedule for Pilgrim Station 1990 Environmental Monitoring Programs (NPDES Permit).







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