

MARINE ECOLOGY STUDIES

PILGRIM NUCLEAR POWER STATION

REPORT No. 77

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INTRODUCTION

A. Scope and Objective

This is the seventy-seventh (77th) report, provided semi-annually, on the status and results of environmental surveillance and monitoring programs related to the operation of Pilgrim Nuclear Power Station (PNPS). The monitoring efforts discussed in this report relate specifically to the Western Cape Cod Bay marine ecosystem, with particular emphasis on the Rocky Point area. This report is submitted in accordance with the environmental monitoring and reporting requirements of the PNPS NPDES Permit from the U.S. Environmental Protection Agency (#MA0003557) and Massachusetts Department of Environmental Protection (#359).

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 potential significance is detected, corrective steps are taken to address the issue.

The efforts described in this report represent a continuation of monitoring conducted at PNPS in the past by Entergy (and before that, by Boston Edison Company). This program was submitted to U.S. EPA and MA DEP for annual review in December 2009 and received no objections. Note that in March 2002, Entergy Nuclear Operations, Inc. became the operator of Pilgrim Station, although Entergy Nuclear Generation Co. is still the owner. This change had no substantive effect on the Marine Environmental Monitoring Programs at PNPS or the personnel associated with them.

In January 2006, Marine Research, Inc., the company contracted to perform the studies described below, was acquired by Normandeau Associates, Inc. This change in ownership had no substantive effect on the Marine Environmental Monitoring Programs at PNPS or the personnel associated with them.

B. Marine Biota Studies

1. Marine Fisheries Monitoring

Marine Fisheries studies in 2010 focused on winter flounder population parameters to develop an understanding of any PNPS impact on this indicator species. Population estimates and adult equivalency analyses are conducted on this key species to help assess the impact of PNPS entrainment.

Results of the marine fisheries monitoring during the reporting period are presented in Section 3.1. Winter flounder are studied by trawling techniques.

Entergy has conducted efforts to support fisheries enhancement starting in 2000 and continuing through 2010. Winter flounder were spawned and reared in a hatchery from January to May, and then released near the Plymouth Harbor Yacht Club in early-May 2010.

In 2010, 124 tagged fish were recaptured by beach seining.

2. Entrainment Monitoring

PNPS has been monitoring entrainment of fish eggs and larvae, and lobster larvae in the plant's cooling water for more than thirty years (in 1973-1975 phytoplankton and zooplankton were also studied). 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 Normandeau Associates, Inc. and in the past, Marine Research, Inc. (MRI) in conjunction with Pilgrim environmental personnel and have incorporated comments from the U.S. EPA and MA DEP.

Plankton monitoring in 2010 emphasized consideration of ichthyoplankton entrainment and selected species adult equivalency analyses. The software program RAMAS Metapop was also used to further explore the potential effects of entrainment on the winter flounder population. Model runs were completed with fishing mortality as well as with and without entrainment.

Results of the ichthyoplankton entrainment monitoring for 2010 are discussed in Section 3.2.

3. Impingement Monitoring

The PNPS impingement monitoring and survival program has been developed to identify, quantify and determine the viability of the organisms carried onto the four intake traveling screens. Results of the impingement monitoring conducted in 2010 by Normandeau are discussed in Section 3.3.

4. Benthic Monitoring

No benthic monitoring was performed during this period.

C. Station Operation History

Monthly average capacity factors (mean electric generation) for 2010 are shown in Figure 1. The annual capacity factor for 2010 was 98.5%. There were various minor power reductions in 2010, including four pairs of thermal backwashes (May 20, July 15, August 17 and October 13), during which heat-treatment of each side of the intake structure was performed for biofouling control.

The monthly average amount of sea water used for plant cooling water as well as the average discharge water temperatures are given in Figure 2. Discharge flow is shown as percent of total possible flow volume – based on pump run times – from both the circulating water (CW) and salt service water (SSW) systems. The nominal rated capacity for each circulating water pump is 155,500 gallons per minute. To estimate annual entrainment, the combined volumetric flow rate of the CW and SSW systems is assumed to average 320,335 gal/min. (99% of maximum possible once-through cooling water flow).

Electricity Generated -- 2010 Monthly Averages

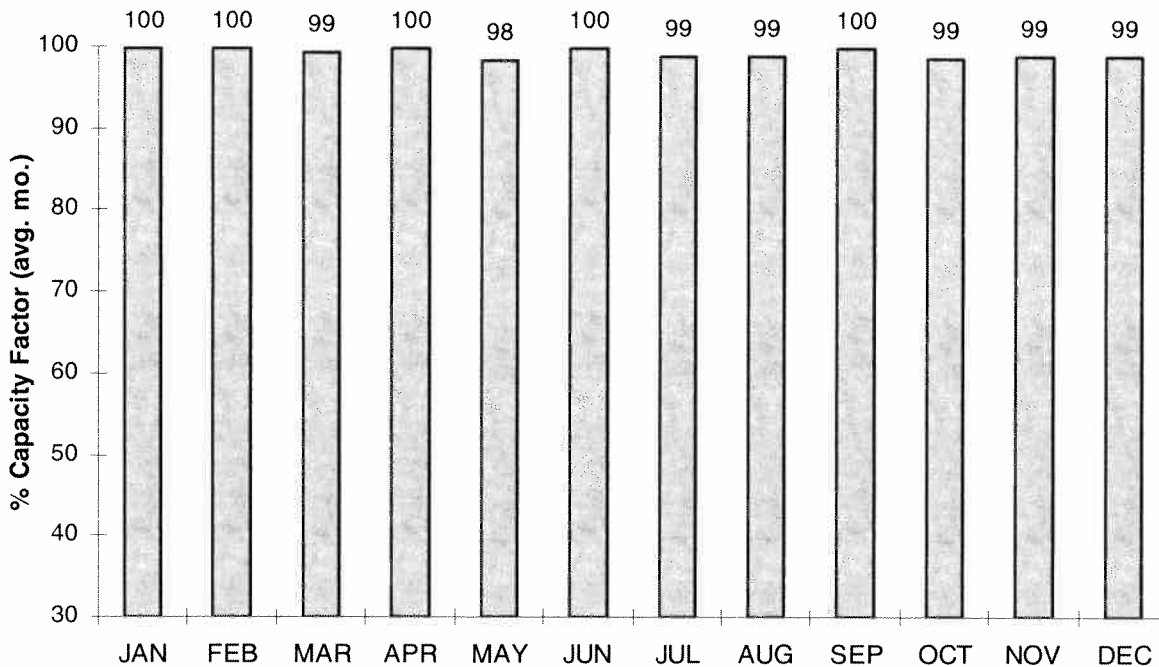


Figure 1. Monthly Electrical Output from Pilgrim Station for 2010
(AVERAGE PERCENT CAPACITY FACTOR)

Seawater Discharged -- 2010 Monthly Averages

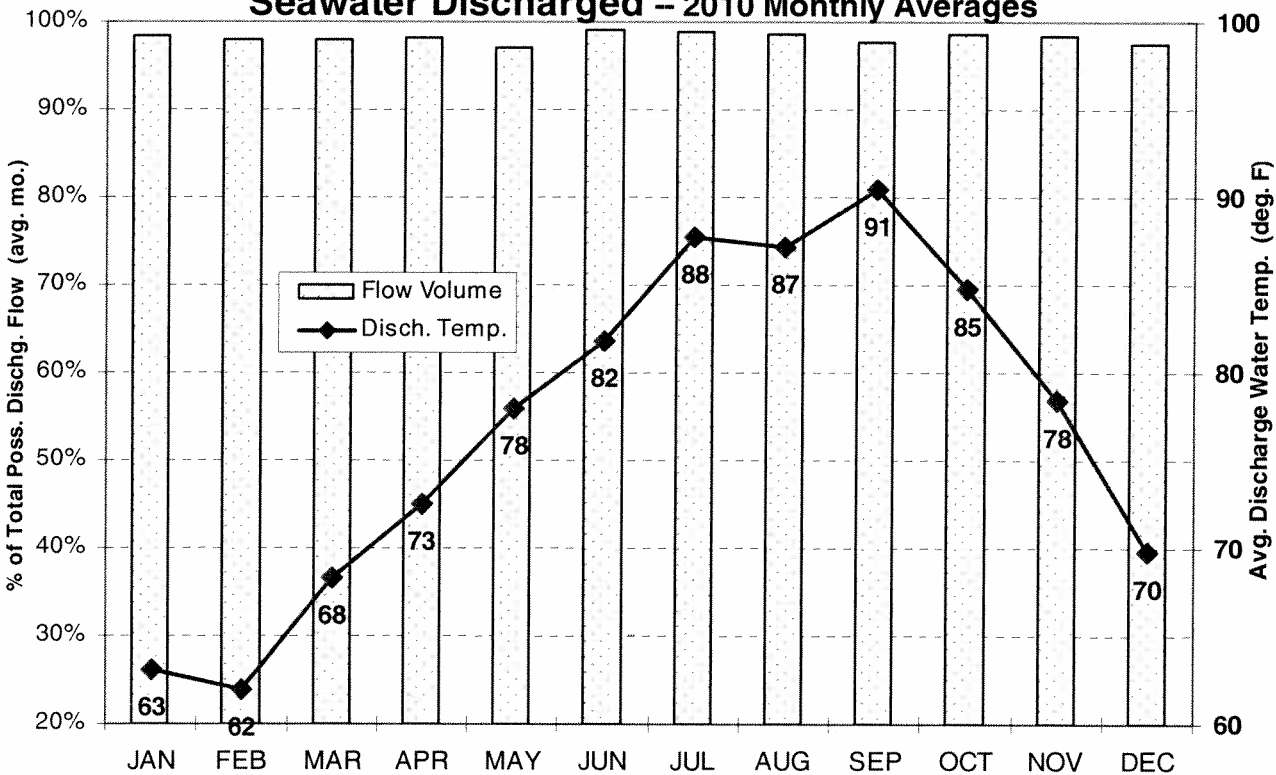


Figure 2. Seawater Discharged from Pilgrim Station for 2010
(TOTAL POSSIBLE FLOW & AVERAGE DISCHARGE TEMPERATURE)

SUMMARY

Results of the January – December 2010 Environmental Surveillance and Monitoring Program at Pilgrim are highlighted below.

Section 3.1 – Marine Fisheries Monitoring:

1. Trawls for winter flounder stock assessment were performed for the sixteenth consecutive year. The “area-swept” study consisted of 80 tows in northwestern Cape Cod Bay to estimate this species’ population (instantaneous abundance).
2. Winter flounder population size (instantaneous abundance) was estimated using an area/density approach, based on the area-swept densities over the entire study area.
3. Unadjusted estimates of winter flounder abundance in the study area for 2010 were 127,504 adults and 495,606 total winter flounder. These estimates were doubled to account for trawl efficiency which was assumed to be 50%; the adjusted numbers were therefore 255,008 and 991,211, respectively.
4. The total fish Catch Per Unit Effort (CPUE) for 2010 was 251 fish per tow, the highest since the study began in 1995. The adult CPUE estimate for 2010 (64.4 per tow) was slightly greater than 2003 (63.1 adults per tow) making it the greatest since 2002 (103.4 adults per tow).

Section 3.2 – Entrainment Monitoring:

1. A total of 40 species of fish were represented in the January-December samples, slightly higher than the 35-year mean (39 species).
2. Winter-early spring (January – April) samples were dominated by Gadidae-*Glyptocephalus*, Labridae-*Limanda*, windowpane, fourbeard rockling, and American plaice eggs along with sand lance, grubby, rock gunnel, and Atlantic seasnail
3. Late spring-early summer collections, taken from May through July, were dominated by tautog-cunner-yellowtail flounder, fourspot flounder-windowpane, fourbeard rockling-hake-butterfish, and Atlantic mackerel eggs along with cunner, winter flounder, radiated shanny, tautog, fourbeard rockling, yellowtail flounder, and Atlantic menhaden larvae.

4. Late summer-autumn collections (August – December) were dominated by the tautog-cunner-yellowtail, silver hake-scup-weakfish, fourspot flounder-windowpane, and fourbeard rockling-hake-butterfish egg groups, along with cunner, tautog, Atlantic menhaden, hake, fourbeard rockling, fourspot flounder, windowpane, and silver hake larvae.
5. Twenty-seven lobster larvae were collected at PNPS during the January-December 2010 entrainment sampling period, resulting in an estimated total of 766,221 entrained larvae. The equivalent adult (82 mm CL) estimates for lobster larvae entrained in 2010 were 15 lobsters.
6. Comparisons of ichthyoplankton densities over the 1975-2009 time series suggested that, in most cases, numbers in 2010 were consistent with those recorded since sampling began at PNPS in 1975.

Section 3.3 – Impingement Monitoring:

1. The average hourly impingement rate for 2010 at Pilgrim Station from January to December was 4.4 fish per hour for all fish combined. The estimated annual impingement total of 32,962 fish ranked 11th over the 31-year time series, 66% of all previous annual totals were lower.
2. Thirty-three species of fish were sampled in 437.28 collection hours in 2010.
3. Atlantic silversides, alewife, Atlantic menhaden,, winter flounder, rainbow smelt, and cunner, were the numerical dominants accounting for 41.2, 38.5, 4.3, 3.1, 2.8 and 1.6 %, respectively, of the annual total.
4. Invertebrates were impinged at a rate of 1.4 animals per hour. Sevenspine bay shrimp, cancer crabs and green crabs accounted for 51, 18, and 8% of the 2010 estimated annual total of 12,454 invertebrates.

Section 3.4 – Hatchery Release and Collection Study:

1. An adjusted total of 124 hatchery winter flounder were collected during in 2010, 87 were identified with VIE tags and 37 were assumed to be recaptured based on size.
2. Post release collections from 2000 through 2010 indicated that released hatchery fish do survive and grow, particularly when released early in the season.
3. Due to practical and economic considerations, Entergy will not continue to sponsor the winter flounder hatchery beyond 2010.