

Semiannual Progress Report

1 January to 30 June, 1974

HUDSON RIVER ECOSYSTEM STUDIES

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## Introduction

New York University is attempting to produce quantitative estimates on the effects of entrainment of major organism groups (phytoplankton, zooplankton, ichthyoplankton) by the Indian Point generating facility. These data are used in conjunction with data from Texas Instruments, Inc. and Quirk, Lawler and Matusky, Engineers to assess the effects of the operation of Indian Point and other electrical generating facilities on the biota of the Hudson River.

Measurements of the densities and spatial and temporal distribution of planktonic organisms are being applied to the actual water mass (volume) subject to entrainment, and the immediate and delayed effects of the passage of non-screenable biota through the plant condensers is being measured. The effects measured are photosynthetic rate and chlorophyll a content for phytoplankton; lethal, behavioral and reproductive effects for zooplankton; and lethal and behavioral effects for fish larvae.

The significance of the effects of entrainment by the Indian Point plant on the estuarine populations will be partly determined by comparisons of species composition and abundance of populations sampled near the plant with those sampled from control areas.

Sampling effort can be divided into two broad categories of emphasis; River and Entrainment. However, it should be recognized that both categories are integral parts of the total study. River sampling is done at seven stations near Indian Point with a view towards documenting changes in the

numbers and kinds of planktonic biota subject to entrainment, and determining what effects the plant operation may have on local planktonic biota. Entrainment sampling of the planktonic biota is done to obtain information on the kinds and quantities of organisms entrained through the condensers, and to estimate the immediate and delayed effects of the passage.

All sampling was completed on schedule regardless of the Indian Point plant operational status, i.e. in the presence or absence of plant design operation.

During the critical striped bass spawning periods, New York University intensified its study effort by sampling two days each week instead of one day each week.

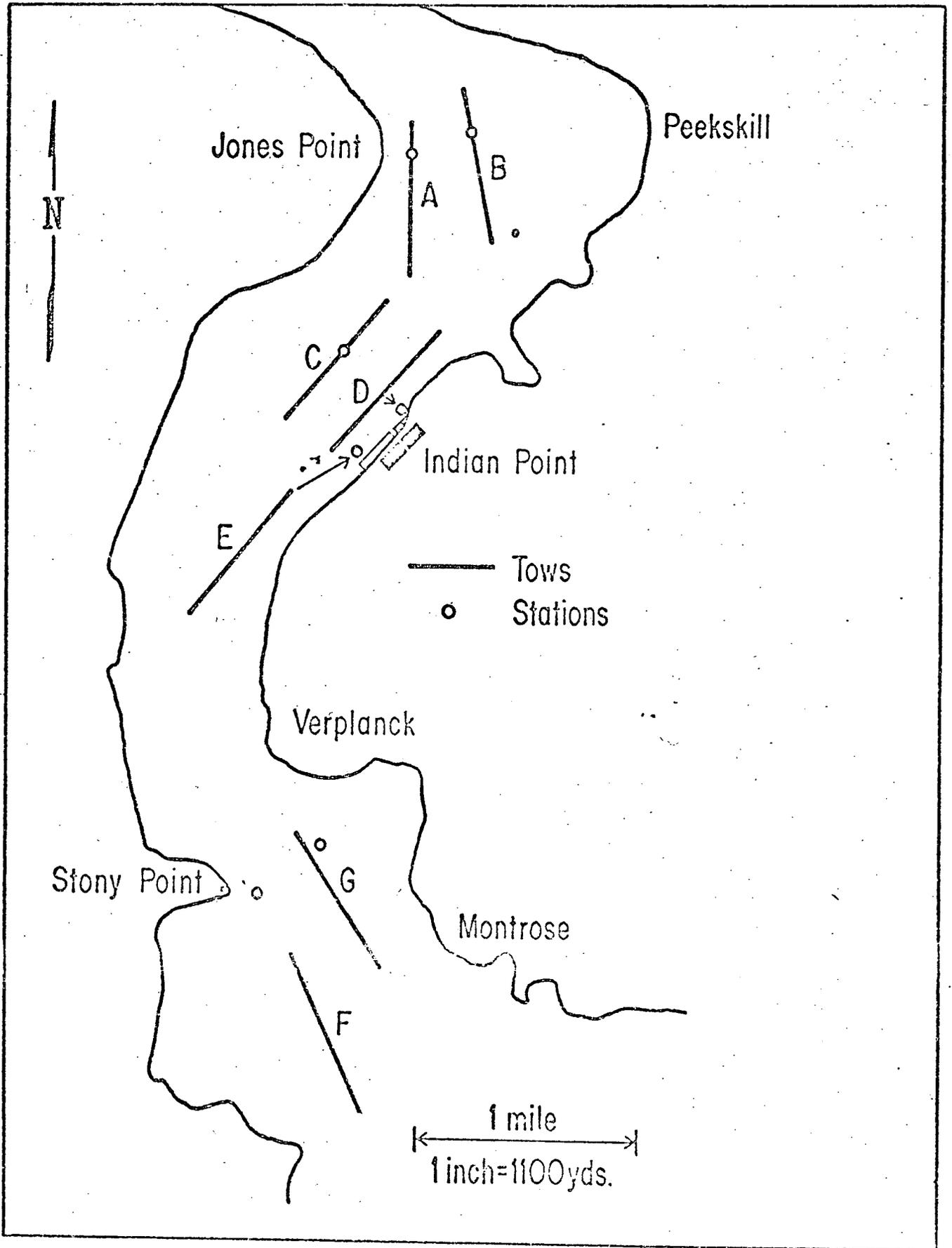
The research described in the present report represents that segment of New York University's overall study program of the Hudson River completed during January to June, 1974. Analyses of data obtained during this period will be presented in an annual report for 1974 which is scheduled for submission in comment draft form by March 31, 1975.

#### I. Program Progress - January through June, 1974

##### a) River Phytoplankton Sampling in 1974

Whole water phytoplankton samples were collected monthly in April and every two weeks during May and June 1974 by compositing equal aliquots from each five foot depth interval at stations A-G (Figure 1). The identification and abundances of the major taxa have been determined for samples through mid-May.

Chlorophyll a and  $^{14}\text{C}$  uptake measurements were taken at stations A-G and E (Figure 1) respectively during May and June.



These data are in preparation for statistical analyses.

b) River Microzooplankton Sampling in 1974

Microzooplankton river samples were collected monthly in April and every two weeks during May and June at three depths (just below water surface, mid-depth, and near the bottom) at stations A-G (Figure 1). Identification of the 1972 microzooplankton samples has been completed and the data are presently being put on cards.

c) River Macrozooplankton and Ichthyoplankton Sampling in 1974

Macrozooplankton and ichthyoplankton samples were collected monthly in April and on one day and one night each week during May and June 1974 at three depths (just below water surface, mid-depth, and near the bottom) at stations A-G (Figure 1).

All of the 1973 macrozooplankton samples collected were sorted and identified by the end of June, 1974. These data are in preparation for statistical analyses.

d) Phytoplankton Pumped Entrainment Effects in 1974

Phytoplankton entrainment samples were collected monthly from April through June for species identification and abundance,  $^{14}\text{C}$  uptake rate and chlorophyll a content.

The taxonomic samples are being identified and enumerated. The  $^{14}\text{C}$  uptake rate and chlorophyll a content data are being prepared for statistical analyses.

e) Microzooplankton Pumped Entrainment Effects in 1974

Microzooplankton entrainment samples were collected monthly from April through June to determine species composition, abundance,

and survival. Species composition and survival data are complete through June and abundance counts are complete for the month of April. The completed data are currently being prepared for statistical analyses.

f) Macrozooplankton and Ichthyoplankton Pumped Entrainment Effects in 1974

Macrozooplankton and ichthyoplankton pumped entrainment samples were collected monthly during April and twice weekly during the striped bass spawning and larvae season (May-June). A series of duplicate samples were collected from three depths (just below the surface, mid-depth, and near the bottom) at one intake of each unit (Unit 1 and Unit 2) and in the discharge canal. Live and stunned specimens of key species of macrozooplankton and ichthyoplankton were counted as soon as possible following collection, and observed daily for at least 72 hours and 120 hours respectively for latent effects. These data are being prepared for analyses.

g) Determine Transit Times of Pump Entrainment Organisms

Populations of Morone saxatilis eggs and larvae were tagged with neutral red dye and introduced into a Unit 2 intake bay during combined unit operation. Samples were then taken from discharge canal stations to determine transit times. The results of these experiments indicate transit times similar to those predicted solely on the basis of water flow rates.

Attempts to conduct similar experiments with Gammarus sp. and Neomysis sp. using neutral red, bismarck brown, methylene blue, rose bengal and malachite green were unsuccessful due to

the inadequate dye retention of, and/or dye toxicity to both organisms.

h) Determine Temperature Tolerance of Entrainable Stages of Striped Bass from Hudson River Stock

Hatchery cultured eggs and larvae (Hudson River Stock) of Morone saxatilis were subjected to several different combinations of ambient temperature,  $\Delta T$  and exposure time during June, 1974. Data from these experiments are being prepared for analyses.

i) Determine Effects of Plume Entrainment on the Hudson River Biota

A series of cages designed to expose representative Hudson River organisms to the Indian Point discharge plume were tested on site. The cages were attached to a floating rack, suspended just below the water surface and the rack was allowed to drift at the whim of the plume currents. Preliminary experiments were carried out to obtain rough estimates of transit times, movement patterns, and temperature regimes through the plume.

The cages designed to hold macrozooplankton and juvenile fish were found to be adequate. The cages designed to hold microzooplankton required mesh netting which proved to be too fine to allow adequate water exchange to the cage interior. As a result, a laboratory simulation of microzooplankton plume entrainment was devised for use in lieu of the cages.

j) Analysis of 1973 River and Entrainment Macrozooplankton Samples

Representative samples (river and entrainment samples matched by date) of the 1973 macrozooplankton collections have

been sorted and identified. These data are currently in preparation for statistical evaluation including correlation analyses.

k) Catalogue and Organize 1973 Intake and River Clupeid Samples (blue-back herring, alewife and American shad)

All river and intake samples containing clupeid specimens (May-July, 1973) have been organized and catalogued relative to known spawning times, developmental times, and distributional patterns. These data are being prepared for analyses.

II. Future Program-July through December, 1974.

The same sampling and processing schedules and procedures outlined in the present report (above I. Program Progress-January through June, 1974; items a-f) will be continued during the remainder of the calendar year, i.e. July through December, 1974. Laboratory and field studies of the effects of plume entrainment upon the Hudson River biota will be completed during the same period. Statistical analyses of all processed data will also be completed by December, 1974.

III. Meetings Attended and Papers Presented

1974 Northeast Fish and Wildlife Conference, American Fisheries Society (N.E. Division), McAfee, New Jersey, February 25-28, 1974. "Fish Eggs and Larvae Entrainment by the Indian Point Power Plant on the Hudson River Estuary" presented by Dr. Gerald J. Lauer.

First Annual UMR-MEC Conference on Energy Resources, University of Missouri, Rolla, Missouri, April 24-26, 1974. "Interfaces of Steam Electric Power Plants with Aquatic Ecosystems" presented by Dr. Gerald J. Lauer.

IV. Publications

Lauer, Gerald J., Waller, William T., and Dale W. Bath, 1974. Fish Eggs and Larvae Entrainment by the Indian Point Plant

on the Hudson River Estuary. Abstracts of Fisheries Papers, 1974 Northeast Fish and Wildlife Conference, American Fisheries Society.

Lauer, Gerald J., Waller, William T., and Guy R. Lanza, 1974. Interfaces of Steam Electric Power Plants with Aquatic Ecosystems. Proceedings of the First Annual UMR-MEC Conference on Energy Resources, 1974.

Ginn, Thomas C., Waller, William T., and Gerald J. Lauer (In Press). The Effects of Power Plant Condenser Cooling Water Entrainment on the Amphipod, Gammarus sp. Water Research.

Ginn, Thomas, C. Waller, William T., and Gerald J. Lauer (In Press). Survival and Reproduction of Gammarus spp. (Amphipoda) Following Short-Term Exposures to Elevated Temperature. Chesapeake Science.

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