

POWER PLANT CONDENSER TUBE SIMULATOR RESEARCH PROJECT

PROGRESS REPORT

to

NEW YORK STATE
ENERGY RESEARCH AND DEVELOPMENT AUTHORITY

and

UNITED STATES NUCLEAR REGULATORY COMMISSION

Submitted by

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Reporting Period: 1 December, 1979 to 15 March, 1980

March, 1980

I. Personnel

The following personnel have participated in project activities during the reporting period:

Joseph M. O'Connor, Ph.D.	Principal Investigator
Gerald V. Poje, M.S.	Project Coordinator
Stacey R. Riordan	Laboratory Aide

II. Research Activities

A. Organism culture, maintenance and collection

During this period the following species representative of four crustacean orders have been held in individual, large-

batch cultures:

<u>Gammarus tigrinus</u> , <u>G. daiberi</u>	- Amphipoda
<u>Daphnia magna</u>	- Cladocera
<u>Cyclops</u> sp.	- Copepoda
<u>Cypris</u> sp.	- Ostracoda

Culture methods are considered optimal for the production of amphipoda and cladocerans. Additional studies have been initiated to maximize the laboratory production of the other crustacean species.

All organisms with the exception of gammarids have been maintained at room temperature ($\sim 20^{\circ}\text{C}$) and in fresh water conditions. Individual batch cultures of Gammarus tigrinus have been held at five levels of salinity (2, 5, 10, 20 and 30 parts per thousand (ppt) with Marine Mix sea salt) and G. daiberi at 5 ppt salinity.

During December, 1979 environment sampling for test organisms was initiated along the estuarine portion of the Hudson River from the Bear Mountain Bridge to the Tappan Zee Bridge. Several epibenthic tows with a 1 meter diameter (571 μ mesh) plankton net resulted in the collection of the amphipods

G. daiberi, Monoculodes edwardsii and Leptochirus plumulosus; the isopods Cyathura polita and Edotea sp., and the mysid shrimp Neomysis americana. Only G. daiberi populations thrived under laboratory conditions, and therefore presently remain in culture.

B. Simulator Testing

During this period the Verplanck testing site was shut down to minimize winter freezing damage to the simulator and the associated laboratory facilities. Therefore, no testing was attempted with the simulator.

Coinciding with more favorable weather conditions, during March the physical plant of the Verplanck site was surveyed in preparation for start-up operations during early April. The following operations are scheduled for the last week of March:

1. Several sections of plastic feed piping were fractured over the winter and these must be replaced.
2. The 1979 Hudson River intake housing and associated plumbing must be replaced.
3. The pump systems for both the Verplanck quarry water supply and the Hudson River must be reinstalled.
4. The wet lab facility must be provided with its head feed tank and the proper piping for the flow-through water tables.
5. The condenser tube simulator biota injection system and larval collection tables must be reinstalled.

6. The temperature, flow, and biocide regulation capacity of the simulator must be demonstrated prior to the 1980 testing season.

C. Laboratory Testing

Vital and mortal staining techniques have been suggested as quick and reliable methods for distinguishing live and dead planktonic organisms for on-site entrainment mortality estimates. Previous studies by NYU personnel had indicated variable success with neutral red staining (vital) with copepods. Laboratory tests were designed to establish a dye discrimination technique for zooplankton passed through the simulator. Variables examined included concentration of neutral red and/or trypan blue (mortal stain), duration of staining, persistence of stain and test organisms. There was no combination of conditions which proved reliable for distinguishing between live and dead ostracods, cladocerans or gammarids.

Elevated thermal tolerance profiles as a function of exposure duration were established for laboratory populations of Daphnia magna newly-released (< 24 h) young. Exposure periods ranged from 3 to 100 minutes.

Gilson respirometric measurements (oxygen consumption rates) were established with adult male and female Gammarus tigrinus which had been exposed to elevated temperatures. Measurements were taken at 1 h, 2 h, and 24 h post exposure to identify recovery rates after stress.

Groups of G. tigrinus acclimated to 5, 10, 20 and 30 ppt salinity were isolated in the following size classes: newly-

releas (< 2 mm); 3 mm; 4 mm; 6 mm; and adults (> 8 mm). Weight-specific respiratory rate profiles as a function of salinity were calculated.

A laboratory, flow-through chlorine dosing system was devised and tested. The system was rejected for experimental purposes because of high variability in maintaining chlorine concentrations in the range expected at power generation facilities.

The Orion 401 A selective ion system was tested and found inadequate for the analysis of ammonia and water hardness measurements. The meter was calibrated as functional, and therefore the ammonia and divalent cation probes were disassembled, cleaned and repaired.

III. Research Projections and Preparations

During 1978 and 1979 the NYU Medical Center experimental program on striped bass ichthyoplankton stages focused upon the exposure of later larval and early juvenile fish to condenser tube passage. The stresses consisted of variable flow rates, thermal elevations and biocide concentrations. Testing of entrainable egg and yolk-sac larval stages has been limited by the brevity of these developmental stages.

During February and March 1980, NYU contacted three hatcheries to insure adequate supplies of striped bass eggs and yolk-sac larvae. These facilities are geographically isolated, and therefore they would permit a more extensive testing program by prolonging the spawning season. For each

stage, three major experimental protocols have been devised to assess the tolerance of bass to flow variations, thermal elevations and variable chlorine concentrations. Given the short duration of these stages, only a limited number of experiments can be planned with each separate hatchery group.

The projected number of animals needed to complete these experiments are as follows:

<u>Stress Variable</u>	<u>Stage</u>	
	<u>Eggs</u>	<u>Yolk-sac Larvae</u>
1. Temperature-varied	7,000	7,000
2. Flow-varied	8,000	8,000
3. Chlorine-dose varied	<u>14,000</u>	<u>14,000</u>
Total	29,000	29,000

These numbers have been requested from the following hatcheries:

1. Monck's Corners Hatchery along the Santee-Cooper Reservoir in South Carolina. Reginal Harrell of the Dennis Wildlife Center in South Carolina will operate the hatchery. He has confirmed the availability of striped bass for this research and has projected an initial spawning date of April 1. Shipping will be by air freight from Charleston, S.C. to J.F. Kennedy Airport, New York.
2. Brookneal Hatchery on the Carl Reservoir in Virginia. David Whitehurst of the Virginia Commission of Game and Inland Fisheries has been extremely cooperative in making their bass available for this research. A projected

spawning date has been set at April 15. Personnel at the Benedict Estuarine Research Laboratory in Maryland have agreed to transport these stages from the Brookneal to Maryland. From here, NYU will transport by automobile to the Verplanck site.

3. Verplanck Hatchery along the Hudson River in New York. Roger Koeppel of Consolidated Edison Co. of N.Y. has received the request for striped bass. While no written confirmation of availability has been given, he projects no difficulty in complying with the request. Spawning usually occurs during the last two weeks in May, and since the simulator is located on the same site, no special arrangements are necessary for shipping.

IV. Professional Activities

A. Meetings and Conferences

NYU presented a synopsis of the simulator project at the Energy Expo 79 sponsored by the N.Y. State Energy Office and N.Y. State ERDA on November 16, 17 and 18, 1979.

B. Reports and Publications

There are two manuscripts in preparation. One is a technical description of the simulator and experimental design. The other consists of results of the 1979 testing program. These will be forwarded to the Authority and NRC when finalized.