

PROGRESS REPORT
FOR THE FORTY-SECOND QUARTER

on

STUDY OF WOODBORER POPULATIONS
IN RELATION TO THE OYSTER CREEK
NUCLEAR GENERATING STATION

to

GPU NUCLEAR CORPORATION
November 30, 1985

by

R.E. Hillman and C.I. Belmore

REPORT NO. 15315

For the Period
August 1, 1985 to October 31, 1985

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TABLE OF CONTENTS

	<u>Page</u>
EXECUTIVE SUMMARY.....	i
INTRODUCTION	1
PROCEDURES AND INTERIM DATA	2
Exposure Panels	2
Water Quality	2
Teredinid Gonadal Development Studies	2

LIST OF TABLES

Table 1.	Geographic Locations of Exposure Panel Arrays in Barnegat Bay, New Jersey	4
Table 2.	Incidence of Teredinidae in Panels Removed August 12-13, 1985	8
Table 3.	Incidence of Teredinidae in Panels Removed September 9-10, 1985.....	9
Table 4.	Incidence of Teredinidae in Panels Removed October 14-15, 1985	10
Table 5.	Incidence of Limnoria in Panels Removed August, September and October, 1985.....	11
Table 6.	Water Quality at Exposure Panel Stations, August 12-13, 1985	12
Table 7.	Water Quality at Exposure Panel Stations, September 9-10, 1985.....	13
Table 8.	Water Quality at Exposure Panel Stations, October 14-15, 1985.....	14
Table 9.	Condition of Gonads of Teredinid Borers Removed from Exposure Panels in Barnegat Bay from July through September, 1985.....	15

LIST OF FIGURES

Figure 1.	Outline of Barnegat Bay Showing Geographic Locations of Exposure Panels	3
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EXECUTIVE SUMMARY

This progress report presents data from field and laboratory work during the period August 1 to October 31, 1985. Also included are the results of observations on gonad development in samples collected in July, August, and September, 1985.

All field work during this quarter was carried out by GPU Nuclear personnel. Water temperature, salinity, dissolved oxygen and pH were measured and recorded at each of the 20 stations during the three periods of exposure panel exchange.

At the time of the August panel exchange, the racks at Stations 13 and 14 had been found removed from the piers and were lying on the bottom. In September, the rack at Station 8 was found to have been vandalized with the rack positioned so that seven panels were exposed to the air. The panels were not completely dry, so they may not have been in an exposed position for very long.

Due to dock repair at Station 16B, the exposure panel rack at Station 16B was relocated 20 feet closer to shore at the time of the October panel exchange.

The regular panels removed in September from Stations 1, 4A, 5, 6, 9 and 12, as well as the 12-month panels from Stations 2, 7, 11, 12 and 17 were in the refrigerator awaiting processing when power was lost for 80 hours due to a hurricane. Eight percent of the shipworms removed from the September panels were alive at the time of examination. In October, when refrigeration was not interrupted, only two percent of the shipworms were alive at the time of examination, so it is not possible to determine whether the loss of refrigeration in September had anything to do with the number of surviving shipworms in the panels.

Only four specimens of Bankia gouldi were identified in the 1- and 6-month panels examined during the quarterly report period.

Gonadal conditions in shipworms from July through September collections were typical of those usually found in September. Most of the shipworms in July and August were in the ripe through spent condition, with a few newly settled specimens showing early active stages. By September, most of the few shipworms collected were either spent or had no evident gonad tissue. Two of the September specimens were in the early active stage.

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INTRODUCTION

Battelle's New England Marine Research Laboratory is conducting an investigation to determine whether the Oyster Creek Nuclear Generating Station is affecting the resident marine borer population in Oyster Creek to the extent that the population is contributing significantly to marine borer-caused damage in Barnegat Bay.

A description of the program and procedures used may be found in the ninth annual report titled, "Study of Woodborer Populations in Relation to the Oyster Creek Generating Station," dated May 15, 1985.

This report presents data for the forty-second quarterly period from August 1 to October 31, 1985.

PROCEDURES AND INTERIM DATA

Exposure Panels

Personnel from GPU's Oyster Creek Nuclear Generating Station retrieved and replaced the long-term and short-term exposure panels with new untreated pre-soaked (for two weeks) panels at the 20 exposure sites in Barnegat Bay and adjacent waters (Figure 1) during the periods of August 12-13, September 9-10, and October 14-15, 1985.

At the time of the August panel exchange, the racks at Stations 13 and 14 had been found removed from the piers and were lying on the bottom. In September, the rack at Station 8 was found to have been vandalized with the rack positioned so that seven panels were exposed to the air. The panels were not completely dry, so they may not have been in an exposed position for very long.

Due to dock repair at Station 16B, the exposure panel rack at Station 16B was relocated 20 feet closer to shore at the time of the October panel exchange.

The regular panels removed in September from Stations 1, 4A, 5, 6, 9 and 12, as well as the 12-month panels from Stations 2, 7, 11, 12 and 17 were in the refrigerator awaiting processing when power was lost for 80 hours due to a hurricane. Eight percent of the shipworms removed from the September panels were alive at the time of examination. In October, when refrigeration was not interrupted, only two percent of the shipworms were alive at the time of examination, so it is not possible to determine whether the loss of refrigeration in September had anything to do with the number of surviving shipworms in the panels.

Table 1 describes the geographical locations of the exposure sites. Data from the laboratory examination of the panels are presented in Tables 2 through 5.

Water Quality

Salinity, water temperature, dissolved oxygen and pH were taken at each exposure panel site by the GPU Nuclear field team. Results for August, September and October, 1985 are presented in Tables 6 through 8.

Teredinid Gonadal Development Studies

Table 9 shows the gonad condition of teredinid borers collected in July, August, and September, 1985. Included are results from panels exposed for periods ranging from 1 to 12 months.

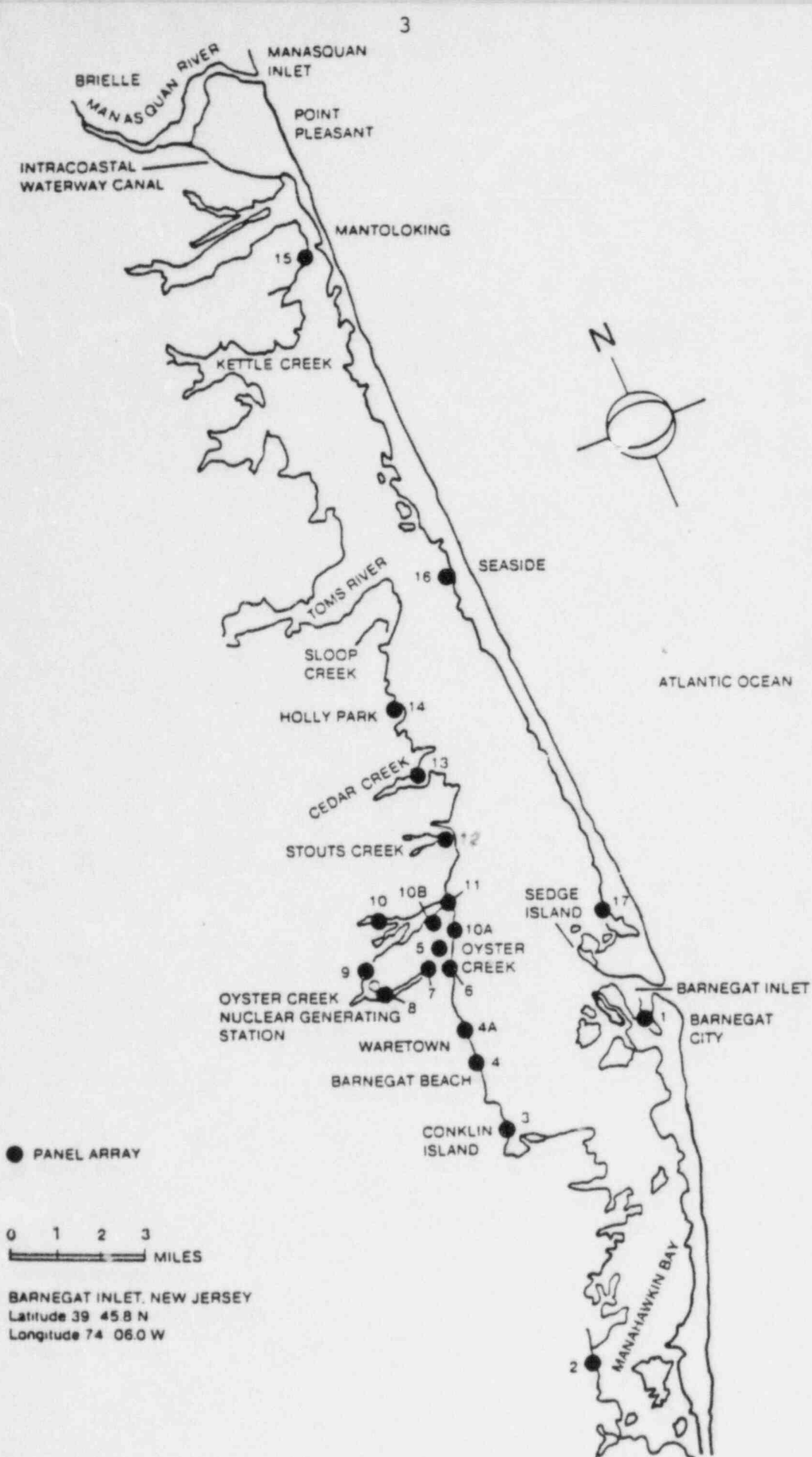


FIGURE 1. OUTLINE OF BARNEGAT BAY SHOWING GEOGRAPHIC LOCATIONS OF EXPOSURE PANELS

TABLE 1. GEOGRAPHICAL LOCATIONS OF BATTELLE NEW ENGLAND MARINE RESEARCH LABORATORY'S EXPOSURE PANEL ARRAYS IN BARNEGAT BAY, NEW JERSEY

Site No.	Site	Structure to be used for Suspension of Rack	Nearest Previous Data Stations	Approximate Latitude and Longitude
1.	Barnegat Coast Guard Station, Barnegat Inlet	Finger Pier Bulkhead	WC 1 WFCL 1948-1967	Lat. 39° 45.8'N Long. 74° 06.5'W
2.	Ashton Marina 1450 Bay Ave. Manahawkin	Bulkhead	WC 13, 14	Lat. 39° 40'N Long. 74° 13'W
3.	Iggie's Marina East Bay Ave. Barnegat (Conklin Island)	Bulkhead	WC 16, 17, 18, 19	Lat. 39° 45'N Long. 74° 12.5'W
4.	Liberty Harbor Marina Washington Ave. Waretown	Bulkhead	WC 21 R. Turner Rutgers U.	Lat. 39° 47'N Long. 74° 11'W
4-A*.	Holiday Harbor Marina Lighthouse Drive Waretown	Bulkhead	WC 21 R. Turner Rutgers U.	Lat. 39° 48'N Long. 74° 11'W
5.	Mouth of Oyster Creek Lot 4, Compass Road Offshore End	Dock	WC 29, 30 Rutgers U.	Lat. 39° 48.5'N Long. 74° 10.3'W
6.	Oyster Creek 1 Lagoon, Inshore End 37 Capstan Drive	Dock		Lat. 39° 48.5'N Long. 74° 10.35'W

TABLE 1. (Continued)

Site No.	Site	Structure to be used for Suspension of Rack	Nearest Previous Data Stations	Approximate Latitude and Longitude
7.	Private Dock Dock Ave. Oyster Creek Sands Pt. Harbor Waretown	End of dock	WC 27,28 R. Turner Rutgers U.	Lat. 39° 48.5'N Long. 74° 11.1'W
8.*	Oyster Creek Discharge Canal	Bulkhead 1500 ft. east of the R.R. bridge	WC 26	Lat. 39° 48.7'N Long. 74° 12'W
9.*	Forked River South Branch Intake Canal	Metal pier	WC 31	Lat. 39° 49.2'N Long. 74° 12.2'W
10.	Teds Marina Bay Ave. Forked River	Pier	WC 33, 34	Lat. 39° 50.1'N Long. 74° 11.6'W
10A*.	Private Dock 1217 Aquarius Ct. Forked River	Under dock		Lat. 39° 49'N Long. 74° 10'W
10B*.	Private Dock 1307 Beach Blvd. Forked River	Under dock		Lat. 39° 49.4'N Long. 74° 10.1'W
11.	Forked River (near mouth) 1413 River View Drive	Bulkhead	WC 35 Rutgers U.	Lat. 39° 49.7'N Long. 74° 10'W

TABLE 1. (Continued)

Site No.	Site	Structure to be used for Suspension of Rack	Nearest Previous Data Stations	Approximate Latitude and Longitude
12.	Stouts Creek 1273 Capstan Drive	Bulkhead	WC 38, 40, 41 R. Turner Wurtz Rutgers U.	Lat. 39° 50.5'N Long. 74° 08.8'W
13.	Rocknak's Yacht Basin Seaview Ave. Lanoka Harbor Cedar Creek	End of pier	WC 46	Lat. 39° 52'N Long. 74° 09'W
14.	Dicks Landing Island Drive Bayville (Holly Park)	Pier	WC 49 R. Turner Nelson	Lat. 39° 54'W Long. 74° 08.1'W
15.	Winter Yacht Basin Inc. Rt. 528 Mantoloking Bridge	Pier	WC 57	Lat. 40° 02.5'N Long. 74° 04.9'W
16.	Berkely Yacht Basin J. Street Seaside	Pier	WC 60, 61	Lat. 39° 55.9'N Long. 74° 04.9'W
16A*.	Municipal Dock Seaside Heights	Pier	WC 60, 61	Lat. 39° 56.6'N Long. 74° 04.9'W
16B*.	Bayside Boats State Highway 35 and Bay Boulevard Seaside Heights, NJ	Pier	WC 60, 61	Lat. 39° 56.6'N Long. 74° 04.9'W

TABLE 1. (Continued)

Site No.	Site	Structure to be used for Suspension of Rack	Nearest Previous Data Stations	Approximate Latitude and Longitude
17.	Island Beach State Park (edge Island)	Pier	WC 68	Lat. 39° 47.1'N Long. 74° 05.9'W

All exposure panel racks suspended in a minimum water depth at mean low water of at least three feet. Racks hung with nylon line from existing structures so the bottom panels are close to, but not touching the bottom.

WC = Woodward-Clyde

WFCL = William F. Clapp Laboratories

- * Site 4-A installed April, 1977.
- Sites 10A, 10B installed April, 1978.
- Site 16 discontinued November, 1981.
- Site 16A installed December, 1981 - discontinued June, 1982.
- Site 16B installed June, 1982.
- Sites 8 and 9 moved from original locations November, 1983.

TABLE 2. INCIDENCE OF TEREDINIDAE IN PANELS REMOVED AUGUST 12-13, 1985

Station	Panel	No. of Specimens	Percent Filled	Size Range in mm.	Species Identification	Remarks
1	P	1000	10	<1-70	400 <u>T. navalis</u> , 600 <u>Teredinidae</u> *	Ripening gonads
	C	1100	2	<1-12	50 <u>T. navalis</u> , 1050 <u>Teredinidae</u> *	
4A	P	1	<1	6	1 <u>Teredo</u> spp.*	
	C	0				
8	P	2	2	60-115	2 <u>T. navalis</u>	
	C	0				
10A	P	1	2	155	1 <u>B. gouldi</u>	
	C	0				
11	P	34	5	<1-95	1 <u>B. gouldi</u> , 17 <u>T. navalis</u> , 16 <u>Teredinidae</u> *	Many dead
	C	40	<1	<1-7	40 <u>Teredinidae</u> *	Many dead

Stations 2-4, 5-7, 9, 10, 10B, 12-17, no Teredinidae present.

P = Long-term panel submerged February 11-12, 1985.

C = Short-term panel submerged July 8-9, 1985.

* = Not speciated due to size or condition.

TABLE 3. INCIDENCE OF TEREDINIDAE IN PANELS REMOVED SEPTEMBER 9-10, 1985*

Station	Panel	No. of Specimens	Percent Filled	Size Range in mm.	Species Identification	Remarks
1	P	600	95	1-65	100 <u>T. navalis</u> , 500 Teredinidae**	None alive
	C	46	<1	<1-3	46 Teredinidae**	
4A	P	5	<1	<1-36	3 <u>T. navalis</u> , 2 Teredinidae**	
	C	0				
8***	P	3	1	1-97	2 <u>T. navalis</u> , 1 Teredinidae	None alive
	C	0				
10A	P	1	<1	65	1 <u>T. navalis</u>	
	C	0				
11	P	43	4	1-55	26 <u>T. navalis</u> , 17 Teredinidae**	Two alive, 41 dead
	C	0				

Stations 2-4, 5-7, 9, 10, 10B, 12-17, no Teredinidae present.

P = Long-term panel submerged March 11-12, 1985.

C = Short-term panel submerged August 12-13, 1985.

* = Panels from stations 4A, 5, 6, 8, 9, and 12 in refrigerator without power for 80 hours due to hurricane Gloria.

** = Not speciated due to size or condition.

*** = Rack found out of the water.

TABLE 4. INCIDENCE OF TEREDINIDAE IN PANELS REMOVED OCTOBER 14-15, 1985

Station	Panel	No. of Specimens	Percent Filled	Size Range in mm.	Species Identification	Remarks
1	P	650	99	1-65	100 <u>T. navalis</u> , 550 <u>Teredinidae</u> *	None alive
	C	0				
2	P	1	<1	60	1. <u>T. navalis</u>	
	C	0				
4A	P	2	<1	40-57	2 <u>T. navalis</u>	
	C	0				
7	P	1	<1	45	1 <u>T. navalis</u>	Dead. Tube empty except for shells & pallets
	C	0				
8	P	1	1	95	1 <u>T. navalis</u>	Dead. Tube empty except for shells & pallets
	C	0				
10A	P	3	2	60-85	3 <u>T. navalis</u>	1 dead, 2 alive
	C	0				
11	P	47	25	8-200	1 <u>B. gouldi</u> , 31 <u>T. navalis</u> , 15 <u>Teredinidae</u> *	Only 5 alive, rest dead
	C	0				
12	P	1	4	255	1 <u>B. gouldi</u>	
	C	0				
15	P	3	2	42-90	3 <u>T. navalis</u>	
	C	0				

Stations 3, 4, 5, 6, 9, 10, 10B, 13, 14, 16B and 17, no Teredinidae present.

P = Long-term panel submerged April 3-9, 1985.

C = Short-term panel submerged September 9-10, 1985.

* = Not speciated due to size or condition.

TABLE 5. INCIDENCE OF LIMNORIA IN PANELS REMOVED AUGUST, SEPTEMBER AND OCTOBER, 1985.

Station	Panel	August*		September		October	
		No. of Tunnels	No. of Specimens	No. of Tunnels	No. of Specimens	No. of Tunnels	No. of Specimens
1	P	14	11	10***	0	39***	9
	C	2	2	0		7	7
2	P	1000	1500	950*	1200	2100*	2300
	C	1	1	3	3	0	
3	P	32	58	46**	60	370*	470
	C	1	1	0		0	
4	P	28	16	30**	25	54***	53
	C	3	2	0		0	
4A	P	63	0	46***	10	28***	19
	C	1	2	4	1	0	
11	P	0		0		0	
	C	0		0		1	1

Stations 5-10B, 12-17, no Limnoria present.

P = Long-term panel, submerged 6 months.

C = Short-term panel, submerged 1 month.

* = Gravid females and juveniles present.

** = Gravid females present.

*** = Juveniles present.

TABLE 6. WATER QUALITY AT EXPOSURE PANEL STATIONS
AUGUST, 1985

Station	Date	Time	Depth in Feet	Salinity o/oo	Temperature (°C)	O ₂ (mg/l)	pH
1	8/12/85	0856	4.5	28.8	24.9	5.2	7.7
2	8/12/85	0940	4.0	27.2	26.7	3.5	7.6
3	8/12/85	1015	2.5	25.8	27.3	3.7	7.7
4	8/12/85	1040	4.0	26.0	27.5	1.8	7.5
4A	8/12/85	1105	2.5	26.2	28.1	5.8	7.8
5	8/12/85	1130	2.0	24.4	30.3	5.5	7.8
6	8/12/85	1200	3.0	24.2	30.7	6.5	7.8
7	8/12/85	1220	4.5	24.0	31.6	6.4	7.8
8	8/12/85	1245	3.0	24.3	31.8	6.1	7.8
9	8/12/85	1300	5.5	24.8	27.6	6.2	7.9
10	8/12/85	1513	5.0	23.0	28.0	4.0	7.6
10A	8/12/85	1405	2.5	25.2	28.9	6.7	7.8
10B	8/12/85	1430	4.0	25.2	29.1	7.3	7.9
11	8/12/85	1450	2.5	25.6	28.3	6.9	7.9
12	8/12/85	1535	4.0	23.7	28.3	7.7	8.0
13	8/12/85	1600	3.5	20.3	29.4	7.4	7.9
14	8/12/85	1700	4.0	22.9	28.5	7.6	8.0
15	8/13/85	0850	4.0	20.8	25.7	6.4	7.1
16B	8/13/85	0915	5.0	20.8	25.9	4.2	7.2
17	8/13/85	0945	2.0	28.2	25.9	2.6	7.3

TABLE 7. WATER QUALITY AT EXPOSURE PANEL STATIONS
SEPTEMBER, 1985

Station	Date	Time	Depth in Feet	Salinity o/oo	Temperature (°C)	O ₂ (mg/l)	pH
1	9/9/85	0845	6.0	31.1	25.0	4.6	7.7
2	9/9/85	0915	4.0	29.4	26.0	3.3	7.6
3	9/9/85	0935	2.5	28.7	26.0	4.1	7.6
4	9/9/85	0955	4.0	29.4	26.1	2.1	7.4
4A	9/9/85	1015	2.5	29.6	26.7	4.5	7.5
5	9/9/85	1030	2.0	28.1	30.0	4.4	7.6
6	9/9/85	1040	3.0	28.0	30.0	4.7	7.7
7	9/9/85	1100	5.0	28.1	30.6	5.2	7.7
8	9/9/85	1110	3.0	28.1	30.9	5.4	7.7
9	9/9/85	1115	6.0	28.3	26.6	5.4	7.6
10	9/9/85	1325	6.0	26.4	26.8	3.6	7.5
10A	9/9/85	1235	2.0	28.5	29.3	6.3	7.8
10B	9/9/85	1240	4.0	28.8	28.2	6.3	7.8
11	9/9/85	1300	2.5	28.8	27.5	6.1	7.8
12	9/9/85	1400	4.5	27.3	26.9	7.3	7.8
13	9/9/85	1420	4.0	26.2	27.3	5.7	7.7
14	9/9/85	1440	4.5	24.7	27.3	6.9	7.8
15	9/10/85	0840	5.0	23.9	25.3	3.4	7.1
16B	9/10/85	0910	5.5	21.9	26.0	2.7	7.2
17	9/10/85	0930	2.5	30.2	25.2	2.2	7.3

TABLE 8. WATER QUALITY AT EXPOSURE PANEL STATIONS
OCTOBER, 1985

Station	Date	Time	Depth in Feet	Salinity o/oo	Temperature (°C)	O ₂ (mg/l)	pH
1	10/14/85	0845	9.0	31.7	17.9	6.1	7.6
2	10/14/85	0928	5.5	28.0	17.0	6.5	7.6
3	10/14/85	1000	3.5	27.8	17.1	6.0	7.6
4	10/14/85	1027	5.0	28.9	17.7	4.4	7.5
4A	10/14/85	1045	3.5	28.3	18.4	4.4	7.4
5	10/14/85	1100	3.5	25.9	24.0	6.0	7.6
6	10/14/85	1115	4.0	25.8	23.7	6.2	7.6
7	10/14/85	1140	6.0	26.6	24.4	6.8	7.6
8	10/14/85	1158	4.5	26.5	24.5	6.8	7.6
9	10/14/85	1210	8.0	26.6	18.1	7.0	7.7
10	10/14/85	1430	6.5	26.5	19.0	5.9	7.6
10A	10/14/85	1330	3.5	26.7	20.0	7.6	7.7
10B	10/14/85	1345	5.0	26.8	20.1	7.8	7.7
11	10/14/85	1400	3.5	27.5	19.0	6.7	7.7
12	10/14/85	1450	5.0	25.3	18.7	7.9	7.7
13	10/14/85	1530	4.5	25.3	18.0	7.6	7.8
14	10/14/85	1600	5.0	24.7	17.2	6.5	7.7
15	10/15/85	0830	5.5	23.4	18.1	7.5	7.5
16B	10/15/85	0915	7.0	19.7	18.1	5.0	7.3
17	10/15/85	1015	2.0	29.7	19.3	5.0	7.3

TABLE 9. CONDITION OF GONADS OF TEREDINID BORERS REMOVED FROM EXPOSURE PANELS IN BARNEGAT BAY FROM JULY THROUGH SEPTEMBER, 1985

EA=Early active; LA=Late active; R=Ripe; PS=Partially spawned; NDG=No discernable gonad; S=Spent; M=Male; F=Female; H=Hermaphrodite

Specimen No.	Station	Month Removed	No. Months Exposed	Species	Sex	Gonad Condition	Comments
1544	7	Jul '85	12	<u>Bankia gouldi</u>	F	S	special panel; necrotic
1545	17	Jul '85	12	<u>Teredo navalis</u>	H	S	special panel
1546 a	7	Jul '85	12	<u>Teredo navalis</u>	F	R	special panel; necrotic
b				<u>Teredo navalis</u>	H	PS	necrotic
c				<u>Teredo navalis</u>	F	S	necrotic
d				<u>Teredo navalis</u>	F	R	
1547 a	11	Jul '85	12	<u>Bankia gouldi</u>	M	R	special panel
b				<u>Bankia gouldi</u>	F	S	
c				<u>Bankia gouldi</u>	M	PS	
d				<u>Bankia gouldi</u>			NDG
e				<u>Bankia gouldi</u>	F	S	
f				<u>Bankia gouldi</u>	M	R	
1548	11	Jul '85	6	Teredinidae			NDG
1549 a	8	Aug '85	6	<u>Teredo navalis</u>	H	PS	
b				<u>Teredo navalis</u>	F	S	
1550 a	11	Aug '85	6	<u>Teredo navalis</u>	M	EA	
b				<u>Teredo navalis</u>	H	S	
c				<u>Teredo navalis</u>	M	S	
d				<u>Teredo navalis</u>	F	R	
e				<u>Teredo navalis</u>	H	PS	
f				<u>Teredo navalis</u>	M	S	
1551	11	Aug '85	6	<u>Bankia gouldi</u>			NDG
1552	10A	Aug '85	6	<u>Bankia gouldi</u>	M	R	

TABLE 9. (Continued)

Specimen No.	Station	Month Removed	No. Months Exposed	Species	Sex	Gonad Condition	Comments
1553 a	1	Aug '85	1	<u>Teredo</u> <u>navalis</u>	M	LA	
b				<u>Teredo</u> <u>navalis</u>	M	LA	
c				<u>Teredo</u> <u>navalis</u>	M	LA	
d				<u>Teredo</u> <u>navalis</u>			NDG (very young)
e				<u>Teredo</u> <u>navalis</u>	M	EA	
f				<u>Teredo</u> <u>navalis</u>	H	LA	necrotic
g				<u>Teredo</u> <u>navalis</u>	M	LA	necrotic
1554 a	1	Aug '85	6	<u>Teredo</u> <u>navalis</u>			NDG; necrotic
b				<u>Teredo</u> <u>navalis</u>			NDG
c				<u>Teredo</u> <u>navalis</u>			NDG; necrotic
d				<u>Teredo</u> <u>navalis</u>	F	R	necrotic
e				<u>Teredo</u> <u>navalis</u>	F	R	necrotic
f				<u>Teredo</u> <u>navalis</u>	H	PS	necrotic
g				<u>Teredo</u> <u>navalis</u>	F	S	necrotic
h				<u>Teredo</u> <u>navalis</u>	M	LA	necrotic
i				<u>Teredo</u> <u>navalis</u>	M	R	necrotic
j				<u>Teredo</u> <u>navalis</u>	M	R	necrotic
k				<u>Teredo</u> <u>navalis</u>	F	R	necrotic
l				<u>Teredo</u> <u>navalis</u>	H	R	necrotic
m				<u>Teredo</u> <u>navalis</u>	F	PS	necrotic
n				<u>Teredo</u> <u>navalis</u>	F	PS	
o				<u>Teredo</u> <u>navalis</u>	H	LA	necrotic
p				<u>Teredo</u> <u>navalis</u>	H	PS	necrotic
q				<u>Teredo</u> <u>navalis</u>	M	EA	
1555	4A	Aug '85	6	<u>Teredo</u> spp.			NDG
1556	11	Aug '85	12	<u>Bankia</u> <u>gouldi</u>	M	R	special panel; necrotic
1557	17	Aug '85	12	<u>Teredo</u> <u>navalis</u>	H	S	special panel; necrotic
1558	17	Aug '85	12	<u>Teredo</u> <u>navalis</u>			special panel; NDG; necrotic

TABLE 9. (Continued)

Specimen No.	Station	Month Removed	No. Months Exposed	Species	Sex	Gonad Condition	Comments
1559	10A	Sep '85	6	<u>Teredo navalis</u>	M	S	
1560 a b	11	Sep '85	6	<u>Teredo navalis</u> <u>Teredo navalis</u>	M	S	NDG
1561	7	Sep '85	12	<u>Teredo navalis</u>			special panel; NDG, necrotic
1562 a b	4A	Sep '85	6	<u>Teredo navalis</u> <u>Teredo navalis</u>	M M	S EA	
1563	11	Sep '85	12	<u>Bankia gouldi</u>	F	EA	special panel



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