

PROGRESS REPORT
FOR THE FORTY-THIRD QUARTER

on

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

to

GPU NUCLEAR CORPORATION
February 28, 1986

by

R.E. Hillman and C.I. Belmore

REPORT NO. 15330

For the Period
November 1, 1985 to January 31, 1986

BATTELLE
New England Marine Research Laboratory
397 Washington Street
Duxbury, Massachusetts 02332

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EXECUTIVE SUMMARY

This progress report presents data from field and laboratory work carried out during the period November 1, 1985 through January 31, 1986. Also included are the results of observations on gonad development in samples collected in October, November and December, 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.

The decline in the abundance of Bankia gouldi recovered from panels in Barnegat Bay continued through the present reporting period. Only three specimens of Bankia gouldi were identified in the 6-month exposure panels examined during the period covered by this report.

Most of the shipworms collected in October were adults in the late active to spent phase of gonad development. By November, the shipworms from the late summer and early fall set had begun to mature, and most of the specimens recovered were juveniles with gonads primarily in the early active phase. This condition persisted into December, when it was arrested by the colder water. This has been the usual pattern throughout the study.

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INTRODUCTION

Battelle 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, New Jersey.

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-third quarterly period from November 1, 1985 to January 31, 1986.

PROCEDURES AND INTERIM DATA

Exposure Panels

Personnel from GPU's Oyster Creek Nuclear Generating Station retrieved and replaced the long-term (6-month) and short-term (1-month) exposure panels with new untreated presoaked (for two weeks) panels at the 20 exposure sites in Barnegat Bay and adjacent waters (Figure 1) during the periods of November 11-12, December 9-10, 1985 and January 13-14, 1986.

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.

The short-term panel removed from Station 10A in January had been incorrectly labeled "6" instead of "C." It had been placed in the proper position for the control (short-term) panel, however, and was retrieved as the short-term panel. The regular "6" panel was properly labeled, located and retrieved, so there was no effect on the data collection or analysis.

Over 99% of the specimens collected (5515 collected for the quarter) continue to come from Station 1. The abundance of Bankia gouldi has continued to decline, with only two specimens being collected in December (one each from Stations 11 and 13), and one in January (Station 10A).

Water Quality

Salinity, water temperature, dissolved oxygen and pH were measured at each exposure panel site by the GPU Nuclear field team. Results¹ for November and December, 1985, and January, 1986 are presented in Tables 6 through 8. No unusual variations in water quality were noted during the report period.

Teredinid Gonadal Development Studies

Table 9 shows the gonad condition of teredinid borers collected in October, November, and December, 1985. Included are results from the regular long- and short-term panels, as well as the 12-month panels originally established for pathology studies. Most gonads from the October collections were in the late-active to spent phase typical of that month. By November, the juveniles that had set in late summer to early fall had begun to develop, and the early active phase predominated. This condition, arrested by the dropping water temperatures, persisted in those specimens collected in December.

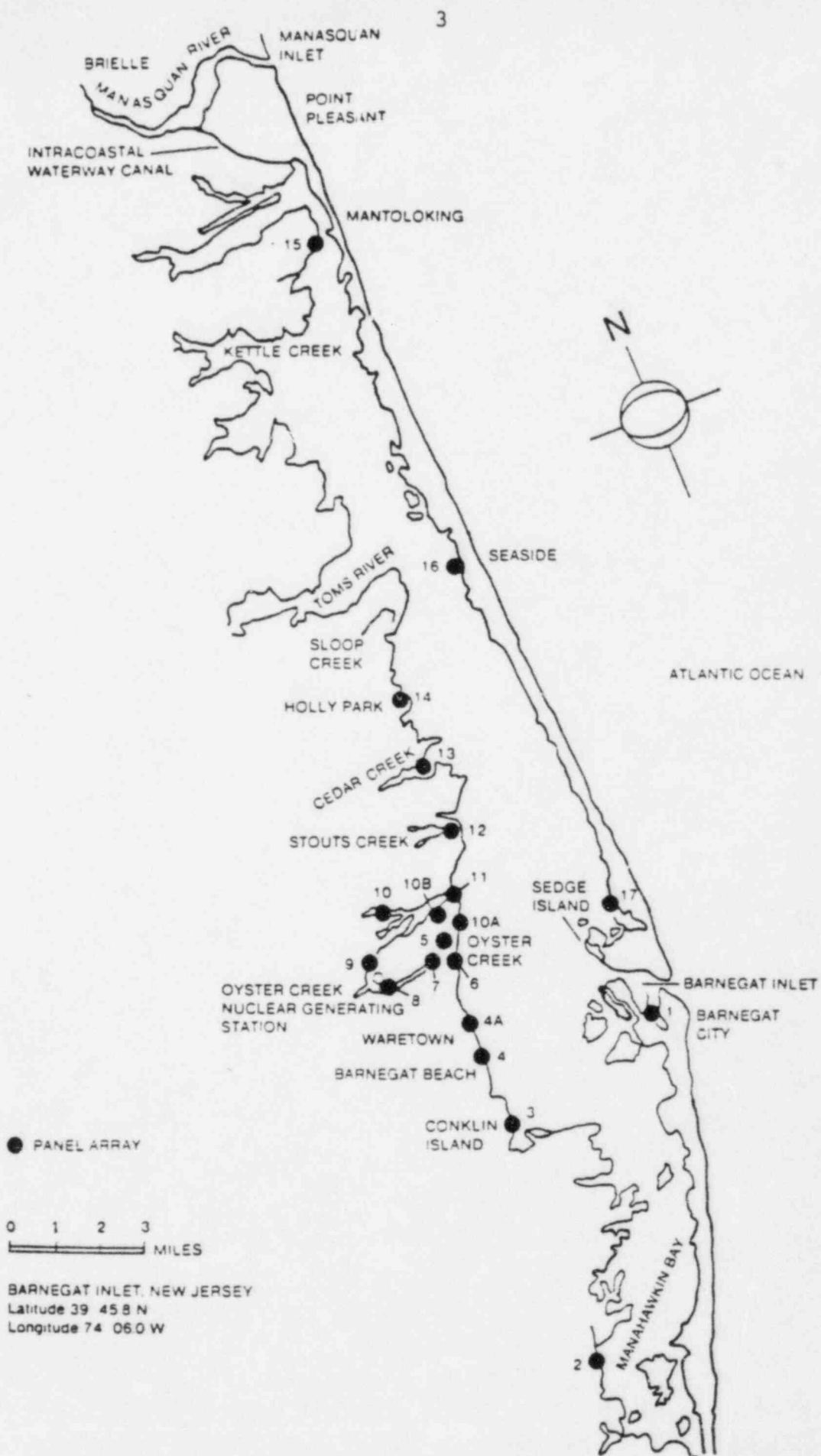


FIGURE 1. OUTLINE OF BARNEGAT BAY SHOWING GEOGRAPHIC LOCATIONS OF EXPOSURE PANELS

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 I 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 (Sedge 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 NOVEMBER 11-12, 1985.

Station	Panel	No. of Specimens	Percent Filled	Size Range in mm	Species Identification	Remarks
1	P	500	97	<1-65	80 <u>T. navalis</u>	Less than 2% were alive
	C	380	<1	<1	420 Teredinidae* 380 Teredinidae*	
10A	P	2	1	48-105	2 <u>T. navalis</u>	Both dead
	C	0				
11	P	56	10	8-68	49 <u>T. navalis</u>	9 live, rest dead
	C	0			7 Teredinidae*	
15	P	2	2	38-180	2 <u>T. navalis</u>	1 live, 1 dead
	C	0				

Stations 2-10, 10B, 12-14, 16B and 17, no Teredinidae present.

P = Long-term panel submerged May 13-14, 1985.

C = Short-term panel submerged October 14-15, 1985.

* = Not speciated due to size or condition.

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

Station	Panel	No. of Specimens	Percent Filled	Size Range in mm	Species Identification	Remarks
1	P	550	90	<1-70	150 <u>T. navalis</u>	None live
	C	85	<1	<1	400 Teredinidae* 85 Teredinidae**	
4A	P	1	<1	80	1 <u>T. navalis</u>	
	C	0				
7	P	3	2	60-105	2 <u>T. navalis</u>	1 live, 2 dead
	C	0			1 Teredinidae*	
8	P	1	1	75	1 <u>T. navalis</u>	Dead
	C	0				
9	P	2	1	38-80	2 <u>T. navalis</u>	Both dead
	C	0				
11	P	53	20	10-150	1 <u>B. gouldi</u> 18 <u>T. navalis</u> 34 Teredinidae*	5 live, rest dead
	C	0				
13	P	1	2	175	1 <u>B. gouldi</u>	
	C	0				
17	P	1	<1	58	1 <u>T. navalis</u>	
	C	0				

Stations 2-4, 5, 6, 10-10B, 12, 14-16B, no Teredinidae present.

- P = Long-term panel submerged June 10-11, 1985.
 C = Short-term panel submerged November 11-12, 1985.
 * = Not speciated due to size or condition.

TABLE 4. INCIDENCE OF TEREDINIDAE IN PANELS REMOVED JANUARY 13-14, 1986.

Station	Panel	No. of Specimens	Percent Filled	Size Range in mm	Species Identification	Remarks
1	P	4000	95	<1-130	1000 <u>T. navalis</u>	14 live, rest dead
	C	0			3000 <u>Teredinidae</u> *	
5	P	1	1	115	1 <u>T. navalis</u>	
	C	0				
9	P	3	2	60-125	3 <u>T. navalis</u>	
	C	0				
10A	P	1	1	130	1 <u>B. gouldi</u>	
	C	0				
11	P	41	4	1-88	23 <u>T. navalis</u>	7 live, rest dead
	C	0			18 <u>Teredinidae</u> *	
15	P	3	3	100-170	3 <u>T. navalis</u>	
	C	0				

Stations 2-4A, 6-8, 10, 10B, 12-14, 16B-17, no Teredinidae present.

P = Long-term panel submerged July 8-9, 1985.

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

* = Not speciated due to size or condition.

TABLE 5. INCIDENCE OF LIMNORIA IN PANELS REMOVED NOVEMBER AND DECEMBER 1985 AND JANUARY 1986.

Station	Panel	November		December		January	
		No. of Tunnels	No. of Specimens	No. of Tunnels	No. of Specimens	No. of Tunnels	No. of Specimens
1	P	0		0		0	
	C	3	3	0		0	
2	P	1400	1900	340	200**	145	50
	C	0		0		0	
3	P	34	40	18	12	4	2
	C	0		0		0	
4	P	34	36*	0		1	0
	C	0		0		0	
4A	P	8	10	2	2	36	14
	C	0		0		0	

Stations 5-17, no Limnoria present.

- P = Long-term panel, submerged 6 months.
 C = Short-term panel, submerged 1 month.
 * = Juveniles present.
 ** = Gravid females and juveniles present.

TABLE 6. WATER QUALITY AT EXPOSURE PANEL STATIONS
NOVEMBER 1985

Station	Date	Time	Depth in Feet	Salinity o/oo	Temperature (°C)	O ₂ (mg/l)	pH
1	11/11/85	0852	7.0	29.4	13.8	8.4	7.7
2	11/11/85	0935	5.0	29.0	13.6	7.3	7.6
3	11/11/85	1001	2.5	27.5	13.7	8.4	7.7
4	11/11/85	1017	4.5	28.0	13.9	6.2	7.5
4A	11/11/85	1037	2.5	27.4	13.6	8.1	7.6
5	11/11/85	1052	2.5	24.5	13.8	8.5	7.5
6	11/11/85	1110	3.0	24.6	13.3	9.0	7.6
7	11/11/85	1125	5.0	24.2	13.7	8.6	7.5
8	11/11/85	1141	3.5	24.9	13.5	8.5	7.6
9	11/11/85	1159	7.0	25.5	13.1	8.5	7.6
10	11/11/85	1350	5.5	25.6	13.6	7.8	7.5
10A	11/11/85	1259	2.5	26.5	14.1	9.6	7.6
10B	11/11/85	1313	4.5	26.8	13.6	9.6	7.6
11	11/11/85	1328	2.5	26.8	14.4	9.3	7.6
12	11/11/85	1410	4.5	26.2	13.8	9.5	7.5
13	11/11/85	1436	4.0	25.7	14.2	8.7	7.6
14	11/11/85	1456	4.5	23.9	13.8	8.2	7.6
15	11/12/85	0845	4.5	25.8	12.7	9.4	7.2
16B	11/12/85	0906	6.5	22.0	12.8	8.0	7.5
17	11/12/85	0957	2.5	30.0	13.3	6.3	7.5

TABLE 7. WATER QUALITY AT EXPOSURE PANEL STATIONS
DECEMBER 1985

Station	Date	Time	Depth in Feet	Salinity o/oo	Temperature (°C)	O ₂ (mg/l)	pH
1	12/9/85	0850	6.5	27.6	4.8	10.4	7.8
2	12/9/85	0924	5.0	25.5	3.0	9.6	7.4
3	12/9/85	0956	3.0	26.2	4.5	9.5	7.5
4	12/9/85	1018	4.5	26.8	6.0	8.4	7.3
4A	12/9/85	1035	3.0	25.9	4.9	8.5	7.3
5	12/9/85	1050	3.0	23.3	8.5	9.4	7.3
6	12/9/85	1108	3.0	23.2	8.2	9.4	7.3
7	12/9/85	1120	5.5	22.8	8.8	9.5	7.4
8	12/9/85	1134	3.5	22.8	9.0	9.5	7.3
9	12/9/85	1154	7.0	23.3	4.1	9.7	7.4
10	12/9/85	1400	5.5	23.6	5.7	8.7	7.3
10A	12/9/85	1304	2.5	23.6	7.6	10.2	7.4
10B	12/9/85	1320	4.5	24.7	5.8	9.2	7.3
11	12/9/85	1335	2.5	24.1	4.9	9.7	7.3
12	12/9/85	1422	4.0	24.1	6.5	9.0	7.3
13	12/9/85	1447	4.0	24.5	5.8	8.5	7.3
14	12/9/85	1508	4.5	23.5	4.6	9.7	7.5
15	12/10/85	0828	5.0	22.8	5.6	10.1	7.3
16B	12/10/85	0858	7.0	19.4	4.9	8.5	7.1
17	12/10/85	0935	2.5	26.6	5.7	7.6	7.3

TABLE 8. WATER QUALITY AT EXPOSURE PANEL STATIONS
JANUARY 1986

Station	Date	Time	Depth in Feet	Salinity o/oo	Temperature (°C)	O ₂ (mg/l)	pH
1	1/13/86	0836	8.0	28.8	2.1	11.2	7.7
2	1/13/86	0912	4.5	25.7	0.1	11.6	7.7
3	1/13/86	0940	2.5	25.5	1.1	11.7	7.7
4	1/13/86	0958	4.0	27.5	1.8	11.1	7.6
4A	1/13/86	1014	2.0	27.5	2.0	12.2	7.6
5	1/13/86	1032	2.0	25.0	7.2	11.1	7.5
6	1/13/86	1050	2.0	24.8	4.9	10.8	7.4
7	1/13/86	1110	5.0	25.5	7.7	11.1	7.5
8	1/13/86	1124	3.5	25.6	7.8	10.9	7.5
9	1/13/86	1144	6.5	25.9	2.3	11.1	7.5
10	1/13/86	1350	5.5	26.6	4.0	11.6	7.5
10A	1/13/86	1254	3.0	25.3	4.8	12.8	7.5
10B	1/13/86	1312	5.0	26.2	3.1	12.0	7.5
11	1/13/86	1324	3.0	26.9	3.0	11.5	7.5
12	1/13/86	1420	4.5	24.5	2.3	13.1	7.6
13	1/13/86	1445	4.0	23.4	2.2	13.9	7.7
14	1/13/86	1510	5.0	24.7	1.0	12.2	7.6
15	1/14/86	0825	4.5	23.8	0.1	13.3	7.6
16B	1/14/86	0850	6.0	19.9	2.3	2.1	6.8
17	1/14/86	0920	2.0	30.5	-1.6	10.8	7.1

TABLE 9. CONDITION OF GONADS OF TEREDINID BORERS REMOVED FROM EXPOSURE PANELS IN BARNEGAT BAY FROM OCTOBER THROUGH DECEMBER 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
1564 a	15	Oct '85	6	<u>Teredo</u> <u>navalis</u>	F	LA	
b				<u>Teredo</u> <u>navalis</u>	F	S	
c				<u>Teredo</u> <u>navalis</u>	F	S	
1565	12	Oct '85	6	<u>Bankia</u> <u>gouldi</u>	F	LA	
1566 a	10A	Oct '85	6	<u>Teredo</u> <u>navalis</u>	M	S	
b				<u>Teredo</u> <u>navalis</u>	M	S	
1567 a	4A	Oct '85	6	<u>Teredo</u> <u>navalis</u>			NDG
b				<u>Teredo</u> <u>navalis</u>	F	S	
1568	11	Oct '85	6	<u>Bankia</u> <u>gouldi</u>	M	S	
1569 a	11	Oct '85	6	<u>Teredo</u> <u>navalis</u>	F	S	NDG
b				<u>Teredo</u> <u>navalis</u>			NDG
c				<u>Teredo</u> <u>navalis</u>			NDG
d				<u>Teredo</u> <u>navalis</u>			NDG
1570	2	Oct '85	6	<u>Teredo</u> <u>navalis</u>			NDG
1571	11	Oct '85	12	<u>Teredo</u> <u>navalis</u>			Special panel; NDG
1572 a	1	Nov '85	6	<u>Teredo</u> <u>navalis</u>	M	EA	
b				<u>Teredo</u> <u>navalis</u>	F	S	
c				<u>Teredo</u> <u>navalis</u>	M	EA	
d				<u>Teredo</u> <u>navalis</u>	M	EA	
e				<u>Teredo</u> <u>navalis</u>	F	EA	
f				<u>Teredo</u> <u>navalis</u>	F	EA	
g				<u>Teredo</u> <u>navalis</u>	F	EA	
1573	15	Nov '85	6	<u>Teredo</u> <u>navalis</u>	H	S	

TABLE 9. (Continued)

Specimen No.	Station	Month Re.noved	No. Months Exposed	Species	Sex	Gonad Condition	Comments
1574 a	11	Nov '85	6	<u>Teredo</u> <u>navalis</u>	F	EA	NDG
b				<u>Teredo</u> <u>navalis</u>	M	EA	
c				<u>Teredo</u> <u>navalis</u>	F	EA	
d				<u>Teredo</u> <u>navalis</u>	F	EA	
e				<u>Teredo</u> <u>navalis</u>	F	EA	
f				<u>Teredo</u> <u>navalis</u>	F	EA	
g				<u>Teredo</u> <u>navalis</u>	F	EA	
h				<u>Teredo</u> <u>navalis</u>	F	EA	
i				<u>Teredo</u> <u>navalis</u>	M	EA	
1575 a	7	Dec '85	6	<u>Teredo</u> <u>navalis</u>	M	EA	
1576 a	11	Dec '85	6	<u>Teredo</u> <u>navalis</u>	F	EA	
b				<u>Teredo</u> <u>navalis</u>	F	EA	
c				<u>Teredo</u> <u>navalis</u>	F	EA	
d				<u>Teredo</u> <u>navalis</u>	H	EA	
1577	11	Dec '85	6	<u>Bankia</u> <u>gouldi</u>	M	EA	
1578	4A	Dec '85	6	<u>Teredo</u> <u>navalis</u>	H	EA	
1579	17	Dec '85	6	<u>Teredo</u> <u>navalis</u>			NDG
1580	13	Dec '85	6	<u>Bankia</u> <u>gouldi</u>	M	EA	
1581	11	Dec '85	12	<u>Teredo</u> <u>navalis</u>			Special panel; NDG