PROGRESS REPORT FOR THE THIRTY-SEVENTH QUARTER

On

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

To

GPU NUCLEAR CORPORATION August 31, 1984

by

R.E. Hillman and C.I. Belmore

REPORT NO. 15245

May 1, 1984 to July 31, 1984

BATTELLE New England Marine Research Laboratory Duxbury, Massachusetts 02332

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EXECUTIVE SUMMARY

This progress report presents data from field and laboratory work during the period May 1 to July 31, 1984. Also included are the results of observations on gonad development in samples collected in April, May, and June, 1984.

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

Teredinidae were found in the six-month exposure panel removed in May, 1984 from the Coast Guard Station. Prior to 1983, no shipworms had ever been found in exposure panels removed in May or June from sites in Barnegat Bay.

For the most part, gonad development was in the early active stage through April and May, and into the late active phase in June. A notable exception was at Station 17, where many of the <u>Teredo navalis</u> specimens recovered in April were ripe to partially spawned. This was also true of June's sample. Otherwise, development patterns were normal for this time of year.

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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 that 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 eighth annual report titled, "Study of Woodborer Populations in Relation to the Oyster Creek Generating Station", dated May 15, 1984.

This report presents data for the thirty-seventh quarterly period from May 1 to July 31, 1984.

PROCEDURES AND INTERIM DATA

Exposure panels

The long-term and short-term exposure panels were retrieved and replaced 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 May 14-15, June 11-12, and July 9-10, 1984. Long-term and short-term panels at all stations were retrieved and replaced by personnel from GPU's Oyster Creek Nuclear Generating Station.

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 site by the GPU Nuclear field team. Results for May, June, and July, 1984 are presented in Tables 6 through 8.

Teredinid Gonadal Development Studies

Table 9 shows the gonad condition of teredinid borers collected in April, May, and June, 1984. Included are results from panels exposed for periods ranging from 6 to 12 months.

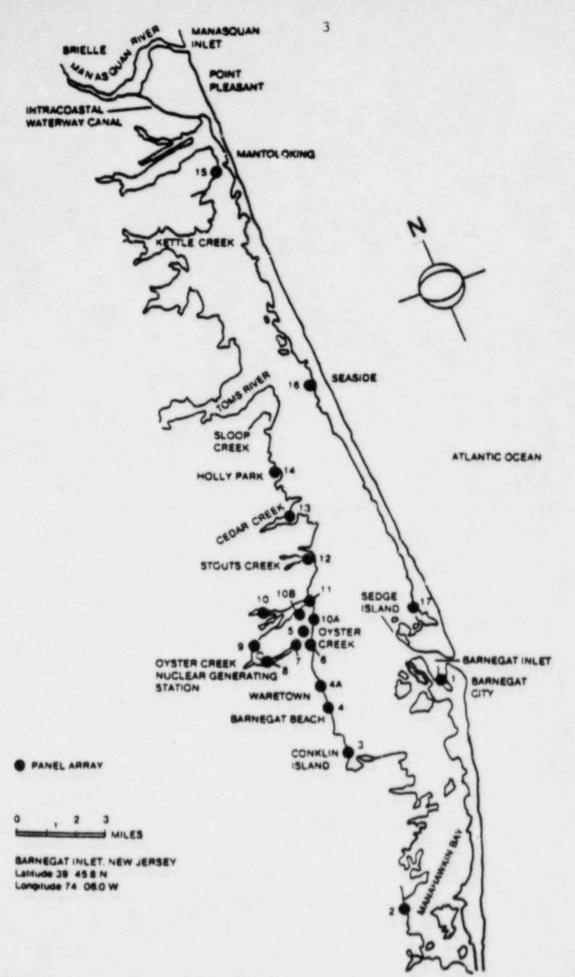


FIGURE 1. OUTLINE OF BARNEGAT BAY SHOWING GEOGRAPHIC LOCATIONS OF EXPOSURE PANELS

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. 39º 45.8'N Long. 74º 06.5'W
2.	Ashton Marina 1450 Bay Ave. Manahawkin	Bulkhead	WC 13, 14	Lat. 39º 40'N Long. 74º 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 R. Turner Rutgers U.	WC 21	Lat. 39º 48'N Long. 74º 11'N
5.	Mouth of Oyster Creek, Lot 4, Compass Road Offshore End	Dock	WC 29, 30 Rutgers U.	Lat. 39º 48.5'N Long. 74º 10.3'W
6.	Oyster Creek I Lagoon, Inshore End 37 Capstan Road	Dock		Lat. 39° 48.5'N Long. 74° 10.35'W

TABLE 1. (Continued)

Site No.	Site	ructure 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° 48.9N Long. 74° 11.1'W
8*.	Oyster Creek Discharge Canal	Bulkhead 1500 ft. east of the R.R. bridge	WC 26	Lat. 39º 48.7'N Long. 74º 12'W
9*.	Forked River South Branch Intake Canal	Metal pier	WC 31	Lat. 39º 49.2'N Long. 74º 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. 39º 49.4'N Long. 74º 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 I. (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. 39º 50.5'N Long. 74º 08.8'W
13.	Rocknak's Yacht Basin Barramore Ave. Lanoka Harbor Cedar Creek	End of Pier	WC 46	Lat. 39º 52'N Long. 74º 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. 39º 56.6'N Long. 74º 04.9'W
16B*.	Bayside Boats State Highway 35 and Bay Boulevard Seaside Heights, NJ	Pier	WC 60, 61	Lat. 390 56.6'N Long. 740 04.9'W

TABLE 1. (Continued)

Site No. Site		Structure to be used for	Nearest Previous	Approximate Latitude
		Suspension of Rack	Data Stations	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. Racks at Forked River railroad bridge and Oyster Creek railroad bridge suspended with wire rope.

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.

TABLE 2. INCIDENCE OF TEREDINIDAE IN PANELS REMOVED MAY 14-15, 1984

Station	Panel	No. of Specimens	Percent Filled	Size Range in mm.	Species Identification
1	Р	170	<1	<1	170 Teredinidae*
	С	0			

Stations 2-17 - No Teredinidae present.

P = Long-term panel submerged November 7-8, 1983.
C = Short-term panel submerged April 16-17, 1984.
* = Not speciated due to size.

TABLE 3. INCIDENCE OF TEREDINIDAE IN PANELS REMOVED JUNE 11-12, 1984

Station Panel Specimens Filled in mm. Species Identificati	on
--	----

Stations 1-17 - No Teredinidae present.

TABLE 4. INCIDENCE OF TEREDINIDAE IN PANELS REMOVED JULY 9-10, 1984

Station	Panel	No. of Specimens	Percent Filled	Size Range in mm.	Species Identification
1	Р	0			
	С	2	<1	1-2	2 Teredinidae*
7	P	1	<1	5	1 Bankia spp.
	С	0			
8	P C	0	<1	<1	l Teredinidae*
11	Р	9	<1	1-3	2 Bankia spp., 7
	С	7	<1	1-3	Teredinidae* 1 Bankia spp., 6 Teredinidae*
12	P	1	<1	<1	1 Teredinidae*

Stations 2-6, 9-10B, 13-17 - No Teredinidae present.

P = Long-term panel submerged January 9-10, 1984.
C = Short-term panel submerged June 11-12, 1984.
* = Not speciated due to size.

TABLE 5. INCIDENCE OF LIMNORIA IN PANELS REMOVED MAY, JUNE, AND JULY, 1984.

			May	30	une*	Ju	dy**
Station	Panel	No. of Tunnels	No. of Specimens	No. of Tunnels	No. of Specimens	No. of Tunnels	No. of Specimens
1	P C	0		0		14	21
2	P C	2 7	0 2	93 34	153 57	310 36	480 49
3	P C	0		4 2	6 3	16	11
4	P C	0		0	0	3 0	2
4A	P C	2 0	2 .	230 14	315 4	690 56	1000

Stations 5-17 - No Limnoria present.

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

TABLE 6. WATER QUALITY AT EXPOSURE PANEL STATIONS MAY, 1984

Station	Date	Time	Depth in Feet	Salinity o/oo	Temperature (°C)	O ₂ (mg/l)	pH
1	5/14/84	0939	5.5	28.8	11.8	8.0	7.6
2	5/14/84	1025	5.5	20.0	17.0	7.6	8.1
3	5/14/84	1110	2.0	18.0	17.1	7.8	8.1
4	5/14/84	1138	3.0	20.0	17.0	7.4	8.0
4A	5/14/84	1200	2.0	19.9	17.2	6.6	
5	5/14/84	1230	1.5	7.2	16.2	9.4	7.5
6	5/14/84	1252	2.0	9.3	16.9	9.4	7.4
7	5/14/84	1313	3.5	15.1	17.1	8.9	7.8
8	5/14/84	1337	2.0	15.1	16.7	9.0	7.9
9	5/14/84	1444	5.5	16.7	16.2	7.6	7.9
10	5/15/84	1343	4.0	16.1	15.3	7.2	7.4
10A	5/14/84	1518	1.5	16.9	17.0	9.8	8.0
103	5/14/84	1530	3.0	17.1	17.1	9.6	
11	5/14/84	1548	1.5	12.8	16.2	9.4	7.8
12	5/15/84	1308	2.5	14.9	16.0	9.3	8.2
13	5/15/84	1240	3.0	13.9	16.0	8.5	7.7
14	5/15/84	1208	2.0	12.2	15.8	8.8	7.7
15	5/15/84	0900	3.0	13.9	14.0	8.7	7.5
16B	5/15/84	0930	4.0	9.5	15.0	8.1	
17	5/15/84	1012	1.0	24.0	13.8	7.9	7.3 7.9

TABLE 7. WATER QUALITY AT EXPOSURE PANEL STATIONS JUNE, 1984

Station	Date	Time	Depth in Feet	Salinity o/oo	Temperature (OC)	O ₂ (mg/l)	pH1
1	6/11/84	0910	5.0	28.8	19.6	6.2	6.2*
2	6/11/84	0950	5.5	21.6	27.9	5.3	6.0*
3	6/11/84	1020	1.5	20.9	27.5	5.8	6.1*
4	6/11/84	1045	3.5	20.7	28.0	4.0	6.1*
4A	6/11/84	1100	2.0	20.7	28.0	5.4	6.4*
5	6/11/84	1120	1.2	13.0	27.3	6.8	6.3*
6	6/11/84	1133	2.0	13.8	28.0	6.6	6.3*
7	6/11/84	1148	3.0	16.7	26.5	5.6	6.0*
8	6/11/84	1210	2.0	16.8	27.0	5.6	6.1*
9	6/11/84	1340	5.0	16.3	25.2	4.1	6.6
10	6/11/84	1511	4.0	13.7	27.2	4.7	6.7
10A	6/11/84	1408	1.2	17.0	29.8	6.8	7.6
10B	6/11/84	1424	3.0	16.6	29.9	7.0	7.6
11	6/11/84	1440	2.0	11.9	30.3	7.0	7.3
12	6/11/84	1533	3.0	16.6	29.5	6.6	7.5
13	6/11/84	1600	2.5	12.7	28.9	5.4	6.9
14	6/12/84	1240	3.5	11.8	27.3	6.4	7.2
15	6/12/84	0925	3.0	14.8	26.9	6.4	7.3
16B	6/12/84	1000	4.0	11.0	27.0	6.3	7.2
17	6/12/84	1122	1.0	22.8	26.5	5.4	7.0

¹ Problems were experienced with the operation of pH meters on both days. Values identified with an asterisk are unusually low and probably represent erroneous readings.

TABLE 8. WATER QUALITY AT EXPOSURE PANEL STATIONS JULY, 1984

Station	Date	Time	Depth in Feet	Salinity o/oo	Temperature (°C)	O ₂ (mg/I)	pН
1	7/9/84	0906	5.0	27.0	19.0	6.9	7.8
2	7/9/84	0942	5.0	26.8	22.5	6.2	7.6
3	7/9/84	1015	1.5	19.0	22.9	6.1	7.5
4	7/9/84	1037	3.5	20.0	23.5	6.0	7.2
4A	7/9/84	1059	2.0	20.3	24.5	5.6	7.3
5	7/9/84	1117	1.0	8.4	22.0	7.2	6.9
6	7/9/84	1133	2.0	7.6	21.5	7.4	6.7
7	7/9/84	1149	3.5	14.0	24.2	6.0	7.0
8	7/9/84	1210	2.0	13.8	24.8	5.6	7.0
9	7/9/84	1232	5.5	16.0	24.2	5.4	7.1
10	7/9/84	1434	4.0	14.0	24.5	5.2	7.1
10A	7/9/84	1339	1.0	16.5	25.5	8.2	8.0
10B	7/9/84	1358	3.0	16.8	25.2	7.6	7.8
11	7/9/84	1410	1.0	13.8	24.2	8.3	7.8
12	7/9/84	1548	3.0	15.0	25.3	9.6	8.3
13	7/9/84	1458	2.5	11.8	24.2	7.2	7.1
14	7/9/84	1521	3.0	13.6	24.5	8.4	7.9
15	7/10/84	0858	4.0	10.7	23.3	7.3	7.0
16B	7/10/84	0930	4.0	11.2	23.5	7.0	7.2
17	7/10/84	1013	1.0	23.0	23.1	3.4	7.3

TABLE 9. CONDITION OF GONADS OF TEREDINID BORERS REMOVED FROM EXPOSURE PANELS IN BARNEGAT BAY FROM APRIL THROUGH JUNE, 1984

EA=Early active; LA=Late active; R=Ripe; PS=Partially spawned; S=Spent; M=Male; F=Female; H=Hermaphrodite

Specimen No.	Station	Month Removed	No. Months Exposed	Species	Sex	Gonad Condition	Comments
1373 a	7	Apr 84	12	Bankia gouldi	М	S	Special panel
Ь				Bankia gouldi	M	S	
С				Bankia gouldi			No discernable gonad
1374 a	12	Apr 84	12	Bankia gouldi			Special panel; no discernable gonad
b				Bankia gouldi	M	S	
С				Bankia gouldi			No discernable gonad
1375 a	17	Apr 84	12	Teredo navalis	F	PS	Special panel; cytolysis of gonad
b c				Teredo navalis Teredo navalis	М	EA	Necrotic No discernable gonad; necrotic
d				Teredo navalis	M	PS	
e				Teredo navalis	M	LA	
f				Teredo navalis	M	PS	Necrotic
g				Teredo navalis	Н	S	Necrotic
g h				Teredo navalis	F	PS	
i				Teredo navalis	F	R	Cytolysis
j				Teredo navalis	F	PS	Cytolysis
k				Teredo navalis	Н	S	

TABLE 9. (Continued)

Specimen No.	Station	Month Removed	No. Months Exposed	Species	Sex	Gonad Condition	Comments
1376 a	11	Apr 84	12	Bankia gouldi	М	EA	Special panel
b				Bankia gouldi	M	EA	
С				Bankia gouldi	M	EA	
d				Bankia gouldi			No discernable gonad
e				Bankia gouldi	M	EA	
e f				Bankia gouldi	M	EA	
				Bankia gouldi	M	EA	
g h				Bankia gouldi	M	EA	
i				Bankia gouldi	F	EA	
j				Bankia gouldi	M	EA	
k				Bankia gouldi			No discernable gonad
1				Bankia gouldi	M	EA	Cytolysis
m				Bankia gouldi	М	EA	Cytolysis
1377 a	15	May 84	12	Bankia gouldi			Special panel; no discernable gonad
b				Bankia gouldi			No discernable gonad
С				Bankia gouldi	М	LA	
1378 a	15	May 84	12	Teredo navalis	М	LA	Special panel
b				Teredo navalis	F	R	
1379	16B	May 84	12	Bankia gouldi	М	EA	Special panel
1380	14	May 84	12	Teredo navalis	F	R	Special panel

TABLE 9. (Continued)

Specimen No.	Station	Month Removed	No. Months Exposed	Species	Sex	Gonad Condition	Comments
1381 a	8	May 84	12	Bankia gouldi	М	LA	Special panel
b				Bankia gouldi	M	LA	
С				Bankia gouldi			No discernable gonad
d				Bankia gouldi	F	S	
382 a	14	May 84	12	Bankia gouldi	М	LA	Special panel
Ь				Bankia gouldi	M	EA	
С				Bankia gouldi	F	EA	
d				Bankia gouldi			No discernable gonad
e				Bankia gouldi	M	S	
f				Bankia gouldi	M	EA	
g h				Bankia gouldi	M	EA	
h				Bankia gouldi	M	LA	
i				Bankia gouldi	F	EA	
j				Bankia gouldi	M	EA	
k				Bankia gouldi	M	EA	
1				Bankia gouldi	M	LA	
m				Bankia gouldi	M	LA	
n				Bankia gouldi	M	LA	
0				Bankia gouldi	М	LA	
383 a	7	May 84	12	Bankia gouldi			Special panel; no discernable gonad
Ь				Bankia gouldi			No discernable gonad
С				Bankia gouldi			No discernable gonad
d				Bankia gouldi	M	LA	8

TABLE 9. (Continued)

Specimen M	No. Station	Month Removed	No. Months Exposed	Species	Sex	Gonad Condition	Comments
1384 a	10B	May 84	12	Bankia gouldi			Special panel; no discernable gonad
ь				Bankia gouldi	М	LA	
385 a	11	May 84	12	Bankia gouldi	н	LA	Special panel
b				Bankia gouldi	M	EA	
1386 a	12	May 84	12	Bankia gouldi Bankia gouldi	М	LA	Special panel No discernable gonad
С				Bankia gouldi	M	EA	
d				Bankia gouldi	M	LA	
387 a	11	May 84	12	Bankia gouldi	н	EA	Special panel
b				Bankia gouldi	M	LA	
С				Bankia gouldi	M	LA	
d				Bankia gouldi	M	PS	
e f				Bankia gouldi	M	LA	
f				Bankia gouldi	M	LA	
g h				Bankia gouldi	M	EA	
h				Bankia gouldi	M	LA	
i				Bankia gouldi	M	EA	
j				Bankia gouldi	M	EA	
k				Bankia gouldi	M	LA	
1				Bankia gouldi	М	LA	
388 a	7	May 84	12	Bankia gouldi	М	LA	Special panel
ь				Bankia gouldi	M	EA	
С				Bankia gouldi	M	LA	
d				Bankia gouldi			No discernable gonad

TABLE 9. (Continued)

Specimen No.	Station	Month Removed	No. Months Exposed	Species	Sex	Gonad Condition	Comments
1394 a	17	May 84	12	Teredo navalis	М	PS	Special panel
b				Teredo navalis	F	R	
С				Teredo navalis	F	R	
d				Teredo navalis	M	LA	
e f				Teredo navalis	M	PS	
f				Teredo navalis	Н	PS	
g h				Teredo navalis	M	PS	
h				Teredo navalis	F	R	
i				Teredo navalis	M	PS	
j				Teredo navalis	Н	PS	
1395	17	May 84	12	Bankia gouldi	М	EA	Special panel
1396 a	8	Jun 84	12	Bankia gouldi	М	R	Special panel
Ь				Bankia gouldi	Н	R	
С				Bankia gouldi	М	R	
1397 a	11	Jun 84	12	Bankia gouldi	M	LA	Special panel
Ь				Bankia gouldi	F	PS	
1398 a	7	Jun 84	12	Bankia gouldi Bankia gouldi	М	LA	Special panel No discernable gonad
С				Bankla gouldi	M	LA	140 discernable gonac
d				Bankia gouldi	M F	PS	

TABLE 9. (Continued)

Specimen No.	Station	Month Removed	No. Months Exposed	Species	Sex	Gonad Condition	Comments
1399	11	Jun 84	12	Teredo navalis	F	LA	Special panel
1400 a	15	Jun 84	12	Bankia gouldi	М	PS	Special panel
b				Bankia gouldi	F	PS	
1401	13	Jun 84	12	Bankia gouldi	М	PS	Special panel
1402	12	Jun 84	12	Bankia gouldi	F	PS	Special panel
1403 a	12	Jun 84	12	Bankia gouldi			Special panel; no discernable gonad
ь				Bankia gouldi			No discernable gonad
С				Bankia gouldi			No discernable gonad
404	2	Jun 84	12	Teredo navalis	F	PS	Special panel
405	17	Jun 84	12	Teredo navalis	F	R	Special panel; necrotic
406 a	17	Jun 84	12	Teredo navalis	М	PS	Special panel
b				Teredo navalis	F	PS	
c				Teredo navalis	Н	PS	
d				Teredo navalis	М	PS	Necrotic
e				Teredo navalis	M	PS	
f				Teredo navalis	Н	PS	
g h				Teredo navalis	M F	PS PS	

TABLE 9. (Continued)

Specimen No.	Station	Month Removed	No. Months Exposed	Species	Sex	Gonad Condition	Comments
1406 (Continued	1)						
i				Teredo navalis	М	PS	
j				Teredo navalis		R	
k				Teredo navalis	F F F	PS	
1				Teredo navalis	F	LA	
m				Teredo navalis	F	R	
n				Teredo navalis	M	PS	
0				Teredo navalis	M	PS	
P				Teredo navalis	M	PS	
q				Teredo navalis	F	PS	
r				Teredo navalis	M	PS	
S				Teredo navalis	Н	PS	
t				Teredo navalis	F	R	
u				Teredo navalis	M	PS	
٧				Teredo navalis	M	PS	
1407	16B	June 84	12	Bankia gouldi	М	LA	Special panel
1408 a	7	Jun 84	12	Bankia gouldi	М	R	Special panel
b				Bankia gouldi	M	PS	
С				Bankia gouldi			No discernable gonad
d				Bankia gouldi	M	PS	80.100



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