

In one, 9 to, Year. On final report for OTEC Raiser Cable at Punta Tuna, Puerto Rico. Simplex Wire and Cable Company, Portsmouth, New Hampshire. Center for Energy and Environment Research.

Center for Energy and Environment Research of the University of Puerto Rico, College Station Mayaguez, Puerto Rico 00708. Final report for OTEC Raiser Cable at Punta Tuna, Puerto Rico. Simplex Wire and Cable Company, P.O. Box 479, Portsmouth, New Hampshire 03801.

File Date: 25 March, 1981. Prepared by: Mr. Thomas Morgan, Inspection Investigator. Approved by: Mr. Donald S. Sasser, Director, OTEC. Date: 25 March, 1981.

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Background: On December 3, 1979, the Center for Energy and Environmental Research was contracted by Simplex Wire and Cable Company to "Conduct a site-specific, corrosion and biofouling test on eight different marine riser cable coverings. The cable coverings were mounted on racks and suspended from the CEER-OTEC research platform moored at a potential OTEC site two miles off the

Properly, that evening, Tine #1 parted at a depth of 85 feet. The cut was clean and not frayed, as it would have been if it had been caused by chafing.

Conclusions: The tar on sample #12 appeared to be cracking on the first inspection. However, this condition did not worsen and there was no evidence of erosion on any of the other coverings.

Corrosion: With the exception of the copper-nickel coverings, none of the samples showed any evidence of corrosion. In October, some superficial pitting of the surface of the copper-nickel covering was evident. By January, there was considerable pitting of the surface of these samples. Pitting of the copper-nickel samples in deep water appeared to be less severe than that of the samples in shallow water.

Macro-Biofouling: As would be expected, there was little biogrowth on the copper-nickel samples.

There was some growth on the cloth which covered half of the copper-nickel samples and the hydroid *Obelia* was able to live in the crevices between the ribbons of metal. But, with the exception of amphipods, no organisms colonized the metal surface of the copper-nickel. There was no noticeable difference between biofouling on any of the tar-covered or string-covered samples. For this reason, biofouling organisms for these coverings are lumped together on the inspection form.

What we saw on the shallow samples was the successional development of a biofouling community. Initially, they were colonized by a few species – mainly the hydroids *Obelia* and *Halocordyle* and the filter-feeding amphipod *Podocerus*. With time, the communities became more complex. Algae became more and more predominant, three more amphipod species appeared, and species of sponges, anemones, polychaetes, mollusks, sipunculids, bryozoans, and ascidians were a part of the diverse community which had developed by the end of the experiment.

On the deep samples, species diversity of the fouling community was considerably less. It is doubtful that any of the organisms encountered could affect the coverings.

Adversely. Some of them adhered to the surface of the coverings while others moved freely along the coverings, but there was no evidence that any of them caused erosion or other damage to the coverings.

## SPECIES IDENTIFICATION

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Kingdom Animalia

Phylum Porifera

- *Seypha* sp.

Phylum Cnidaria

Class Hydrozoa

- *Halocordyle disticha* (Goldfuss)

- *Obelia* sp

- *Plumularia* sp.

Class Anthozoa

- *Aiptasia* sp.

Phylum Annelida

Class Polychaeta

- *Filograna* sp.

- *Hydroides* sp.

Phylum Mollusca

Class Gastropoda

- *Alaba incerta* d'Orbigny

- *Cerithium eburneum* de Bruguere

Class Bivalvia

- *Aulacomya seminuda* Lamarck
- *Musculus lateralis* Say
- *Pinctada radiata* Leach

Phylum Arthropoda

Class Crustacea

Subclass Cirripedia

- *Conchoderma* sp.

- *Lepas* sp.

Subclass Malacostraca

Order Amphipoda

- *Elasmopus pocillum*
- *Podocerus*
- *Stenothoe crenulata* Chevreux
- Unidentified Caprellidae

Phylum Sipuncula

- 1 unidentified species

Phylum Bryozoa

- 2 unidentified species

Phylum Chordata

Subphylum Urochordata

Class Ascidiacea

- *Diplosoma macdonaldi* Herdman
- *Herdmania momus* (Savigny)

RESULTS, June 1980

16 July 1980

Mr. Jeffrey P. Kurt

Development Engineer

Simplex Wire and Cable Company

P.O. Box 479

Portsmouth, New Hampshire 03801

Dear Mr. Kurt:

On 25th June, the Simplex cable samples were removed from the water and examined. Inspection forms and photographs of the samples are enclosed. The fouling organisms mentioned were sampled but have not yet been identified beyond general classification.

Sincerely yours,  
Thomas Morgan  
Senior Associate

cc: Dr. Donald S. Sasscer w/encl.

MAILING ADDRESS  
CENTER FOR ENERGY AND ENVIRONMENT RESEARCH  
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SIMPLEX CABLE EXPERIMENT

Page 2 of 2

MONTHLY INSPECTION FORM

Buoy (1) 2

DATE 25-08-09

DEPTH 25" (200°)

Time out 1320

Inspector Morgan

Time in 3345

SAMPLE EROSION corrosion

- Amount 3

- None found

Hydroids (<5% cover)

- None found

Hydroids (30% cover)

- None found

Hydroid (50-100% cover), 15 New one, Hydrose (50% cover); a New one, Superficial None, Some oxidation 22 New, Slight corrosion, None at seams 25 New, New, Hydrosa (50% cover), 27 NONE, NONE, Hydroia (50% cover)

15. SIMPLEX CABLE EXPERIMENT: MONTHLY INSPECTION FORM, Page 1 (2), DATE: 6-25-80, DEPTH (25-200"), Time Over: 1410, INSPECTOR: Morgan, Time In: 1450, SAMPLE & EROSION CORROSION BIOFOULING

1. None, NONE, Hydroids (50% cover), Amphipods (numerous)  
5. New, New, Hydroids (50% cover), Amphipods (numerous)

- 9. None, none, Hydroids (70% cover), Amphipods (numerous), Polychaete (13)
- 13. None, NONE, Hydroids (70% cover), Amphipods (numerous), Polychaete (13)
- 15. None, Some superficial, None, oxidation
- 20. None, Slight corrosion, Hydroids (50-100% cover), at Seams
- 26. None, None, Hydroids (100% cover), Macro-algae (<1% cover), Amphipods (numerous)
- 31. None, None, Hydroids (70% cover), Macro-algae (<1% cover), Amphipods (numerous)

20. Page 4 of Monthly Inspection Form, Page 2 (2), Date: 5-80, Depth: 25" (200"), Time Over: 1440, Inspector: Morgan, Time In: 1510, Sample #, Erosion, Corrosion, Biofouling

- 2. None, None, Hydroids (40% cover)
- 6. None, none, Hydroids (40% cover)
- 20. None, None, Hydroids (50% cover)
- 24. None, Some superficial, None, oxidation
- 24. None, Slight corrosion, Hydroids (50-200% cover)
- 28. None, None, Hydroids (50% cover)
- 120. None, None, Hydroids (50% cover)

October 1980

25. SIMPLEX CABLE EXPERIMENT, Page Monthly Inspection Form, Page 12, Date: 31 October 1980, Depth: 25" 200", Time Out: 1230, Inspector: Thomas Morgan, Time In: 1300, Sample & Corrosion, Biofouling

- 4. None, None, See Detailed Analysis
- 8. None

The text appears to be a compilation of a number of scientific reports or logs, possibly related to marine biology or underwater research. Here's a possible revision of the text:

## 1. DETAILED ANALYSIS

Buoy: Depth: 2st

Date: 31 October 1980

Biofouling on samples 4, 8, 12, 16, 27, 119

Algae 80% cover

Dominant Algae: Cladophora, Heterosiphonia, Microcoleus, Polysiphonia

Bryozoan: Present

Sea Anemone: Occasional (e.g. Aiptasiogeton)

Worms: Several per sample (e.g. Serpulidae)

Amphipod: Numerous (e.g. Podocerus, Stenothoe)

Bivalve: Occasional

## 2. MONTHLY INSPECTION FORM

Buoy: 1 2

Date: 31 October 1980

Depth: 25! 200"

Time Over: 0950

Inspector: Thomas Morgan

Time In: 1030

### SAMPLE EROSION CORROSION BIOFOULING

1 None None See Detailed Analysis

3 None None None

7 None Shallow Pitting None

20 None Cover Gone Shallow Pitting

26 None None See Detailed Analysis

8 None None

## 3. DETAILED ANALYSIS

Biofouling on samples 1, 5, 9, 13, 26, 118

Algae 80% cover

Dominant Algae: Cladophora, Microcoleus, Polysiphonia

Bryozoan: Present

Sea Anemone: Occasional (e.g. Aiptasiogeton)

Worms: Several per sample (e.g. Filograna, Hydroides)

Bivalve: Occasional (e.g. Pinctada)

Amphipod: Numerous (e.g. Podocerus)

## 4. SIMPLE CABLE EXPERIMENT - MONTHLY INSPECTION FORM

Buoy: 1 2

Date: 31 October 1980

Depth: 25! 200"

Time Over: 1300

Inspector: Thomas Morgan

Time In: 1530

### SAMPLE EROSION CORROSION BIOFOULING

3 None None 80% Cover

7 None None 80% Cover

8 None None 60% Cover

Cover B < 5t. Cover C has a few numerous 18. No shallow pitting A in crevice 2. Cover torn. There

is shallow pitting 25. A has 80% cover, few D and numerous n7. A has 60% cover. There are few D and numerous A. hydroid Obelia B. hydroid Halocordyle C. Serpulid worm Hydroides, rat D. Amphipod Podocerus, Stenothoe, chprel E. Gooseneck bapnacle Lepas.

#### SIMPLEX CABLE MONTHLY INSPECTION - Page 45

Date: 31 October 1980

Depth: 25° 200"

Time Out: 1030

Inspector: Thomas Morgan

Time In: 115

Sample: EROSION corrosion

Biofouling: None

Cover A: 80%, Cover C: few, Cover D: numerous

Cover A: 20%, Cover C: few, Cover D: few

Cover A: 20%, Cover C: few, Cover D: few

Cover A: 80%, Cover D: numerous

A. hydroid Obelia B. hydroid Halocordyle C. Serpulid worm Hydroides, Filograna D. Amphipod Podocerus, Stenothoe, cajrellid E. Gooseneck Barri

#### RESULTS January Inspection

Date: January 1981

#### CABLE EXPERIMENT MONTHLY INSPECTION FORM - Page 50

Buoy: ot 2

Date: 20 January

Depth: 25" 200°

Inspector: Thomas Morgan

Erosion Corrosion: None

Biofouling: See Detailed Analysis

#### DETAILED ANALYSIS - Page 51

Buoy: 162

Depth:

Date: 20 - 21 January 1981

Biofouling on samples 4, 8, 12, 16, 27, 119: Algae 100% cover. Antithamnion algae dominant. Chondria, Dass, Heicrosiphonta, Neomeris, Polysiphonia, Speraotherion, nya, Plumularia, bryozoan, ascidian Diplosoma, sponge.

Several samples contain the following:

- 'Seypha': 'Aiptasiogeton', a serpulid worm, several per sample
- Filograna Hydrides: a gastropod, several per sample
- 'Alaba Cerithium': a bivalve, occasionally found
- 'Musculus': 1 amphipod, numerous per sample

- Etbemopus: a sipunculid, few per sample

Information regarding Buoy 1 and 2 on 21 January 1981:

- Depth: 25¢, 200°
- Inspector: Thomas Morgan
- Corrosion: None for all except one sample with considerable pitting
- Biofouling: See detailed analysis
- Example of detailed analysis: Podoceros (numerous amphipods); Stenothoes (considerable pitting)

Detailed analysis for Buoy 162 on 21 January 1981:

- Depth: 25
- Biofouling on samples 4, 8, 12, 16, 27, 119, 11, 5, 9, 13, 26, 118
- Algae: 100% cover
- Antithamnion: algae, dominant
- 'Merowieas Jamerls Sperrothamion Nara Plumularia': a bryozoan
- 'Diplosoma': a sponge, several per sample
- 'Seypha': 'Aiptasiogeton', a serpulid worm, several per sample
- Filograna Hyavoides: a gastropod, several per sample
- 'Alaba': a bivalve, 'Atrina Musculus'
- Amphipod: numerous 'Elasmopus', 'Podocerus', 'Stenothoe'
- 'Saprelid' sipunculid: few per sample

Monthly Inspection Form for 21 January 1981:

- Depth: 25", 200"
- Inspector: Thomas Morgan
- Erosion, Corrosion, Biofouling: See detailed analysis
- Specific mention: Podocerus (a considerable number of amphipods)

Detailed analysis for Buoy at 200 depth on 20 January 1981:

- Biofouling on samples 2, 6, 10, 18, 28, 120
- Hydroid: 100% cover
- 'Halocordyle bel': few per sample, few

The text appears to be a list of species found in a sample, with multiple page breaks. Here's a more organized version:

Per sample, the following were found: occasional bivalve 'Atrina', occasional gooseneck barnacle, occasional Lepas amphipod. Several Podocerus and Stenothoe were also found per sample. A single specimen of faprellid ascidian was identified as Herdmar.



Page Break

Page 18 NV or

Page Break

Please note that the context of "18 NV or" is unclear, so I left it as is.