

CEER-O-078

5

/

4

Sevasau

?an ot?

ceER ~ 0-78

DATA REPORT

OTHER ? OTEC CRUISE

ance 22.27, 1980

CENTER FOR ENERGY AND ENVIRONMENT RESEARCH,

[UNIVERSITY OF PUERTO RICO ? US, DEPARTMENT OF ENERGY

---Page Break---

DATA REPORT

WER ~ orec course

waRcH 22-27, 1980

---Page Break---

{TABLE OF comments

List of Figures 1

Introduction... 2

Methods. . 2

Bibliography... 4

Hydrographic Data. 5

Zooplankton Data... so

Appendix

cruise Plan... se

List of Participants. a

Weather Code. oe

---Page Break---

Figure

Figure

Figure

Figure

Figure

Figure

igure

Figure 1

Figure

Figure

Figure

Figure

Figure

Figure

Figure

Figure

1?

15.

16.

?

19.

2.

a.

22.

List of Figures

Station Plan.

Seal Scale study.

Progression of XBT temperature profiles at Benchmark (17°57.3H, 65°51.5W) during March 23 and 24, 1980.

XBT Graph March 23, 1980: Time 1602, Lat. 17°30.2N, Long. 65°42.99.

XBT Graph March 25, 1980: Time 0356, Lat. 18°01.6N, Long. 65°40.4W.

XBT Graph March 26, 1980: Time 1945, Lat. 17°25.5N, Long. 66°30.0W.

Salinity (‰) vs Temperature (°C) composite March 23 to 27, 1980.

Temperature (°C) vs Depth (m) composite March 23 to 27, 1980.

Salinity (‰) vs Depth (m) composite March 23 to 27, 1980.

Dissolved oxygen (ml/l) vs Depth (m) composite March 23 to 27, 1980.

Phosphate concentration vs Depth at Benchmark 17°57.3N, 65°51.5W during March 23 & 24, 1980.

Nitrate/nitrite concentration vs Depth at Benchmark 17°57.3N, 65°51.5W during March 23 & 24, 1980.

Silicate concentration vs depth at Benchmark 17°57.3N, 65°51.5W during March 23 & 24, 1980,

Mean Phosphate concentration vs Depth at Benchmark 17°57.3N, 65°51.5W during March 23 & 24, 1980.

Mean Nitrate/nitrite concentration vs Depth at Benchmark

17°57.38, 65°51.5W during March 23 6 24, 1980.

Mean Silicate concentration vs Depth at Benchmark 17°57.38,
65°51.5W during March 23 § 24, 1980,

Phosphate concentration vs Temperature at Benchmark 17°57.3N,
65°51.5w during March 23 6 24, 1980.

Nitrate/iteite concentration vs Temperature at Benchmark
17°57.3H, 65°51.5W during March 23 6 24, 1980,

Silicate concentration vs Temperature at Benchmark 17°57.3%,
65°51.5q during March 23 © 24, 1980.

Phosphate vs Depth in a transect south of Punta Tuna on March 25, 1980.

Mitrate/itrite vs Depth (m) in a transect south of Punta Tons
fon March 25, 1980.

7.38,

Silicate vs Depth in a transect south of Punta Tuna on March 25, 1960.

---Page Break---

{ENPRODUCTION

The ability to detect the effects of an OTEC plant on the marine environment is dependent upon the magnitude of its effects relative to the scale and intensity of variability (pattern) within this ecosystem.

The scale of

area examined in this study is approximately 10 km²

which has been estimated to be the area whose alteration by the operation of an OTEC plant can be physically measured. The purpose of this cruise was to determine the magnitude of variability to various ecosystem components within and between such areas. Small scale and large scale transects were run to determine the presence of environmental gradients, if any, and the magnitude of between station variability. The cruise was conducted on the R/V CRAKFORD during March 22 through 27, 1980.

Two current meters (InterOcean Model 135) were also moored at depths of 50 and 150 meters at the benchmark buoy during the period of the

cruise.

Hydrographic Data

Hydrocasts were made with 5 liter or 12 Liter Niskin bottles

usually lowered to depths of 1000 m. bottles were placed at nominal

depths of 0, 10, 25, 50, 75, 100, 150, 200, 250, 300, 400, 500, 650,

800, 1000 m for determinations of temperature, salinity, oxygen,

chlorophyll, phytoplankton pigments and nutrients (nitrate-nitrite, phosphate,

ammonia, silicate).

---Page Break---

Temperature was measured with paired deep sea reversing thermometers, The thermometers were recently calibrated at the Physical Chemistry Oceanographic Data Facility (PCODF) at Scripps

Institution of Oceanography and measurements were considered a

curate to 0.01:

Unprotected thermometers were placed on bottles
sampling at depths of 100 meters or greater.

Salinity was determined with a Hytech induction salinometer.

Readings are considered accurate to 0.003‰.

Dissolved oxygen was determined by the Winkler method as

Revised by Carpenter (1965) and modified by Anderson (1971).

Measurements are accurate to 0.02 ml/l. Nutrients were measured

with a Technicon Autoanalyzer using methods described by Strickland

and Parsons (1968). Chlorophyll was measured with a Turner Model

11 fluorometer using methods described by Strickland and Parsons (1960).

Station depths were obtained through an 8.0.0. Depth Recorder

Permanently {nstalled on the ship or estimated from a chart, NOS 26659.

Sonic depths obtained in

sthons were converted to meters but vere

BRE corrected for speed of sound variations. Chart depths are indicated

By (©) and sonic depths by an (S) besides the number. All depths are

in meters.

Densities (0,) were calculated from a handbook of Oceanographic

Tables (Bialek, 1966).

Station times are given in Greenwich Mean Time (GMT), Plankton

Tow Times are in local time. Puerto Rico is 4 hours behind G.M.T.

---Page Break---

Net tows

Zooplankton tows were made with a 75 em opening-closing net

equipped with 202 um mesh, Volune of water filtered was calculated

from a flowmeter suspended off center in the mouth of the net.

BIBLIOGRAPHY

Anderson, G.C. 1971. oxygen analysis, Marine Technicians Handbook,
S10 Ref. No. 71-10, Sea Grant Pub. No. 11

Bialek, E.t. (compiler), 1966. Handbook of Oceanographic Tables.

'S. Naval Oceanographic Office, Washington, D.C. Special
Publication.

Carpenter, D-H. 1965. ?The Chesapeake Bay institute technique for
Winkler dissolved oxygen method. Limnol. Oceanogr. 10; 141-143.

Strickland, J.D.HI. and T.R. Parsons. 1968, A practical handbook of
seavater analysis. Fish. Res. Board of Canada. Bull. No. 167:

31 pp.

---Page Break---

HYDROGRAPHIC DATA

---Page Break---

ee"

ort

ast

66°0

e9'0

eo

coro 80">

00°0 oro

soro 80°

e0°0 80"

eer 80>

Y 80">

90'0 0°

so so">

Soro a0"

Soro 80"

ew ae-od

{po1sea)(aH) (210)

soe sh

budas Saney queujuog ? 4ayaeaK

WRIT TTS

Gx) (19)

0 °

poads? pusy

?Tone TNT FI

ra

692

ss2

ea

eer

v9

re

ve

ot

on

eo

eo

eo

ro

0

eo

4

(3)

wor709

wi

(vo) tart

uy s96uassag

o/eese

an/ayoron

2169 ees ge0r

weere zoe ote

goo'se eve 99

as9'se eat sts

?8e09ø ay

aser9e 60

Ter'96 862

19°96 woz

sse'se sst

se6-9e ze

sto-ee ror

68°96 %

att9e 1s

oar'9t 8

ate or

evs °

s 1 z

NS'TS.99 ? Ne?USoct

pma6u07apnasae7

?TORT TTS

i ;.

---Page Break---

coro oro

00 wo

0°0 s0'0

60"0 80'0

o'o wo

Soro

soo

100 soro

oro 90°0

100 w'0

oes eww

410)

55 Ub 1 .06t

?Sanen queuyuog

ot

cr

wh

wo

oso

eo

sro

wo

0"

80">

a0">

0">

ers

wo

wo"

?0

aeYoa

1

4augeon

roe

oe

est

ee

ez

oT

ot

0

vo

rt

eo

so

80

ro

v0

is

on

2

pants puin

ee

ze

vee

ore

ost

60

eo

st

sz

et

on

z0

zo

vo

ro

20

90

"

(s)

wet

wori08

wt

(ano) sze

2011 sa6uassey

vo

a

20

a

a

a

z0

z0

z0

90

a

20

z0

z0

a

zo

oo/eele

eA/ava/o

rere 69 ate

ast e699

e2e'se ots

seo°9e uw

t9"9ç 60e

s0s"9e use

99°96 902

89°96 vst

ss6°96 ter

e10'e = o'sz cot

ave ggz se

st'9e es2 tg

Sl's 96se ge

wg

9ç wz

s 1 z

WS'1S.99 NevUSect

?pra i6vet apna iae7

?Waa ATR

. ;.

---Page Break---

sup205

coro

wo

woo

oro

ooeus

(potsea

ss

?s9nen aweu 0g

weap

SNOT

sa

srer

sre

er

cer

80">

e0">

0

eto ls

on)

2

4auyea poods ?puyy wo 309

?Gooe ISTHwT F510

wo00t<

otere 965 stot

£06"ve or.

690°se 859

o19"se ors

00°96 cov

wee ?soe

us'9e ssz

689°9¢ 02

os6-96 ez'zz est

eeo'ue 282 Ft

e698 ze'we = zor

sor'se ?gesz

zorrse aasz ts

worse sasz

"9 90°92 OF

eet-se 8092 1

s 1 z

NS'1S.99 NeuSy2t

?2pm 16u079pn31307

BORAT

i

---Page Break---

este ee ek 2 coe t6¥e s00t

sez est ote ze t6e'¥e ?08

we ra ve ze aHTSE 5 ass

ws'92 89 vet a> WE sas seek 0s

ee vu ze ase gest oe

at ee zone soe

oro v0 se zg ever sez

toro : er a a Sd

200 ot z> wey eB calz est

oo 0 z> ry e669 ze ?FT

120 vo > ote tus9e see OL

two vo ze twee aaa

600 o zy tere wees

100 zo ze ste ws? we

0° zo vue wate ore oF

90°0 zo ze ane to

ew ave-toa ss " wha % s 1 z

(01494) (aH) (440) (0)

out 1 OF sozst (ako) e00t ornare eress9Ne2S.eT

Juaoes ??soneH aueU}NOg ?soNneeR posds ? pus OTRO ow Jabuassoq ?GA/AVO/ON

?9PMI6UO?apnaize

TOTS one 3sMIO- TAT RoETITE

---Page Break---

osrez

were

tz

w6°92

vse

owr92

ee92

cree wo

wse ovo

6e'sz suo

eve wo

sree Bio

cree

avez s0°0

geez s0r0

ewez s0"0

to ew

(04304) (aM) (430)

UT 09

suas, sakeq. yueuv0g

Wea HOTTVIS

eet

99"

est

wo

eo

e"0

ozo

a0">

80>

0°»

0

a0"

0°»

20>

ao"

07>

ato

t

soyavayt

oer ez

out re

6 ve

vs se

ze ot

upsst

pads wori0g

a

2

a

2

a

2

z0

2

z

a

a

2

z0

a

a

(aso) sect on/vere

2414 4e6uessak ? yA/A¥a/04

c16te e's

eee nL

merce 9°

ore'se

10°98

isr9e eet

fesse ster

W998 ¥9°6r

e268 wz

sete

ave

verse

v6'52

ws's2

ers arse

eevee ese

001

362

ey

96

962

esz

eet

Ber

at

LoL

6

s

HS°15.59Ne?rS, 21

2pm 46u01 apm)37

?aOR TE

---Page Break---

esez

seee

aes

6°92

9°92

use

2692.

ersz

use

E92

co'se

ave

wre

are

Weez

wee

sypoas

100

zo

oro

seo

ove

wo

100

wo

100

wo

aes

cod

00"

200

60°0

wo

ove

90°

w0'0

00

coro

ew)

ow)

uo

sane aueU; Dg

~HOTLVIS

at

96°1

ost

?0

SSO

sto

ovo

a0

B0'0

aro

oro

?90° >

0">

B0">

80°>

a0

ae-"og

2

«4043804

saz

esr

ca

vs

v2

60

vo

eo

1

vo

vo

co

vo

vo

vo

001

Poods pure

vse

od

ese

esr

vor

9

oe

ez

et

so

20

20

20

z0

20

eo

weroe

1w0320g

?Toe SIMA 310

ro

£0

eo

0

eo

eo

zo

z0

z0

20

z0

z0

a

a>

>

nF

(1x0) 6te0

?uy s2Suassay

Steve ees 610

ves ee ame

serse 195 ee

55l'5E cet ay

wut'9e west se

ste9e weet

ees'98paret ke

69°98 wT Let

overs = 02 ew

eeove eee et

vise ss 86

62"9e se

wise gases

wrsr toe ge

are weg

gorse gorge

s 1 z

Oe/s2/e ?Me'9he9 NSE oLT

w/AvO/OA ?aPMA6ue]?_apMay3e7

?Tao WE

---Page Break---

osrez 00 ero

erez 200 ao

*o oaeus ew

(Potded) (3H)

550

149905 saney queujwog

comerirccs

80°0 vr zo

60°0 vt 0

ae-Yos W

ay) (3)

t s 62

aauaeen paods pu wori0g

?aoe INT TaD

zo Wy astoe rset

a we ate are

nti % s 1 z

(wo) 1260 oe/sz/e?na'zeu69

ms 496u9550H ?wA/AVO/ON ?9pmajBu0T apna

TOT TE

---Page Break---

sree arr

seve wr

we wt

wo

iso

020

60

80"

so">

80">

">

o>

">

toro ">

00 a"

e0°0 80">

ews weog ls

(Po194) (34) (440) Gx) (a0)

soz 66 L a 0k

sowaeen paods pus

?neq weupwog

142095

ET WOTIS

ae

ee

ewe

oer

vs

ee

a

er

90

0

z0

z0

z0

z0

zo

z0

wet

wori0g

aoe sim Sa0

z0

so

vo

ro

ro

ot

z0

so

90

eo

vo

zn

eo

2

z0

wha

?uy s96u2ssoy

sre aaerke as SB

ae eer zk 1

coe Wee 986 st

ore 0s6"se 999

Soy wesc Se?

ivy oe9e eet wz

Wr esse eet one

vey 19°96 Gh'et Ost

te 966°96 eee MT

oer tore sorve tat

a

wey sere tw se

wy serge e6's2 Bh

ey Beo'se tose

ey scorse 692 8

zy Lose 652 o

% s 1 z

Oe/sz/t L?2E4S9Na?L0,8T

AA/AVO/OK ?9pN346u0]?_apmay3e7

?To TE

ry

---Page Break---

?

ws'e2 wer 902 ve vo tre 26

wee It ese 20 sore ue

oo

6°92 wo ey sw 2 ey

69°92 oso ve 2 26

sb92 sro zo 962

9e"92 00°0 wo 20 ee

rr-92 200 80° "0 zo 861

18's 90°0 80" ro ort

ors wo 0" z0 ot

vo'sz sto 80° vo 66

een 90°0 07> a ze

6682 90°0 80° a o>

serez 10-0 0" z0 2

eee 0-0 80°> a e

were soro a0" a 0

to Pwo ee"og is " wt s 1 z

(Posed) (3H (4g) (5)

soub2 1 5 S\$ wore (uy) att Oe/se/e ? na'2e.89 NS?BPoet

suo0as SeNEEn QueuEE ?JOyIFIN PEEKS ? PUI 60909 aL J0OUERSIH ?wA/AYO/OH ?9pm2

16407 apn3ya.87

?ER sonvis ?Woow STM F310 WROD 178

---Page Break---

uoaaS

066"¥6 thot

suse v8

£06 "ve uw

e1e'se as

e8"se uy

sea'se woe

oro to'0 eov'9e 92

100 toro 09°96 wz

sor0 196°9ø sst

ero 606 eet

oro s10"ee sor

10°0 80°0 u'9 6

100 00 : es

too v0'0 ists 9

w0'0 50°0 s0r'9e 8

too 0-0 60°96 o

o2eug ews ae-toe ls N tin s 1 z

(aH) (410) (3)

we 1 wisst (49) £102 aa/sz/eNa2e.s9 us "zeect

Seen qweujuog ?aowieen poads pus wo40g aula 96U9559N ?YA/AYO/ON ?9pm246U01_9pMa} 7

?FA orivis ?Tow Siw 36 ROR TE

---Page Break---

we

swe

we

ww

06°92

"92

sr92

wee

zes2

9srsz

86°92

zeve

96re2

sere2

wee

rez

typoas

coro

100

600

00

coro

00

oro

ooo

oend

00°09

wo

so'0

ao

sto

60"

wo

s0'0

coro

coro

Pwo

(3H) (40)

we 06

samen weusuog

wee ese z0

eee roe z0

ore ote ae

vee a

st a

Be

a

a

zo

cad

2

a

a

e0"> a

80°» a

Goro st od

ae-Fog ts © wl

(a) (ag) 5)

t ç z90z (49). 8100 on/se/e

tauwoy paeds?purn 02209 aut a6uassoy ?UA/a¥a/oW

?too ISNT 3310

26» 960t

69 oe

seve ose ate

Test zt 68s

eze'se | euettt

99z'9e sot ze

Siy9easut aa,

fessor eet zzz

ze gst got

wove azz at

woo'ee = oxwe at

loss as'sz 98

wise 8esz as

ue W082 Oe

wore 92

woos sgz

s 1 2

rovesus No

?opmas6uoy ?9pra4907

?ROTTED 17

- }<

---Page Break---

sup995

00°09

00

wo

wo

oro

oro

100

oro

00°0

90°0

eu

Sonem_aweueog

rig

OTRAS

?0°

80>

80"

80">

a0"

0"

ao

a0"

ae-0a

on

?

soure99 paods

sar

porn

sz

viz

B21

os

ey

ez

rt

er

co

eo

0

co

eo

eo

"

(5)

ete

vori08

Boog S319 TAS

(ano) z2e0

214 s26uassay

06°2

we

ave

we

sy

st

ee

190

wy

we

wy

ee

we

oe/se/e

walnvo/ou

vr0'se 089

uy'se 5

o9e"se a

ase9e ze

rer9e wuz

109'9ç er

se8'9ç cot

ozoue §? 6L'2e get

ozs watt

cise 68°52 ng

sese 9s

wz ge

sores 992g

corse az og

s 1 z

MO'ES.\$9 Ne?PheLT

?pn26u079pm243e7

?TaD ATE

e a

---Page Break---

coro 00"0

00 wo

wo 60°0

sro sro

sto seo

e0"0 ao

100 Soro

coro Soro

100 e0'0

oro wo

oes ew

(povseay(3) (450)

seu oat 1

sup2as

Sonen aweUjwog ?4syre0%

Ad TOTS

ss

orve

er

sot

(s)

0 (we) ero

m1 sabuassan,

oa/sz/e

poods put ?wovn0g aa /avO/08

0 3ST 9310

10°86.59

-9pr336407

uo Ae

2601

208

ee

Ws

ety

92

61

oe

vor

owt

au

W0°95. 1

a

---Page Break---

eerez 000 10

geez 200 wo

to oneus eu

(904404) (3H) (440)

Sra e Cott

299s saney aueujeog

Fu cerns

80> a ©0 0 ey UV see

20" et &0 a sey 9Ut"9E Beg o

eeYod s 4 wh % s 1 z

Gn (ye)

8 oot (uno) 0580 oB/sz/E maT ES69Ne?BSoLT

ewe poods pun ?worog ? aul dabuDssay ?YA/AvO/ON 99915407 apmataeT

?Toe MT IG ?auCaTNAS ATE

rT <ç ? ç c ç c

---Page Break---

geez 00°0 20 80"> £0 a> er V9T'9e geo.

ee'ez 000 0 ®0 0 a ae g9t'9ç ge-92 1

to ooeus i) a ls " Pay %o s a t

(posed) (aH) (410) a) ts)

sue 1 ? wet (x9) coat os/se/e ?MO"9T.99 NB" pSact

sypoag SORE qweusOg ? 4auARIH POIs ?puiny ??wOI2O] ALL JaBUDSSEM ?YA/AVO/OM

?-9pNALGYO]?_apmayae7

Te HOTS ?Wood 351m 330 ?uoIVa WR

c ç (ç ç a c c @

---Page Break---

ee

me

05°92

ons

69°92

wee

or9e

9792

verse

we

s0"ve

serez

wee

sree

we

\$4095

0°0

100

oro

oro

200

200

200

200

100

toro

oaeug

(0

wo

100

zo

seo

wo

10

wo

avo

soro

wo

ew

04494)(3H) (40)

594 206

senen aueujuog

Se TOTDNS

vst

et

oe

oo

ov

av

a0"

80">

20"

80">

ao">

">

0

a0">

80">

a-boa

1

oye

oy)

\$

aed

over ve

om ow

os co

ve se

er as

eL oe

60 ze

er 60

a0 20

ar zo

vr zo

60 z0

or ze

t zo

en 20

is 4

(49) (3)

06 m0

Pun wor208

wig isis vO

a

20

2

a

20

a

a

2

0

60

eo

so

ae

a

a

eta

(ano) 250

a1 sobuassag

Tse" 6's ne

ease eer ae

teuse eset see

arse ow'st a9

serve ster aa

ems'9e erat gee

wos 99°6r

e698 9922

ooze = se'ez

¥99°9 = on'sz a

see a's?

esorse c0'92 a

worse arse ge

swore greg

worse 9292

s 1 z

WO'91.99 NE?BPect

9pmyy6u0y apm iae7

BOT AT

---Page Break---

99

a

se"

30"

29"

a

a

a

Ras

0

u

eo"

a

a

a

lz

92

92

92

ve

2

se

"82

?2

ee

fa

e2

?

supdas

wo

100

ore

aro

sue

26

wo

16

wo

o0'0

eu

Fe woTivis

or

wt

wt

worl

0

wo

ove we

ovo sro

20°0 ">

ero Bo

wo ">

iro 0"

sore 80°»

wo 80"

wo ~

10'0 B0">

Wo aea

saner qweujz0g ?sayneon,

ve

aw

oer

ot

mw

68 3s

ew

ve

woe

est

on

oe

ve

ve

vl

20

ro

ve

vo

ro

vo

vo

4

2) 5)

wake

a

i Sue

08

ee

we

ore

we

ae

ove

o3'y

we

oy

soe

99"F

ay

er

we

ws

oy

%

0

(um) eset onsaere

iL s9bu0550 ?eA/AYE/OH

seerve 20g

we've apg

ero'se ase

fav'se ett

668°C pap

092"98 og-9r

Tvs o'er

20998 ayer

f06°9 gare

crore cee

266°98 tyne

forse ¥5°52

two's 0°92

eo" 92-92

E60°9E?ye-92

80°96 1952

s 1

60

ee

eo

es

ore

id

Ste

ar

ov

om

ss

or

a

o

z

¥0°91.99N"6E. ct

9pms6u01 ?apmyre7

---Page Break---

Tey vest co's ast

wee at est vst a

oveze wo soz cre a> sere gee asst.

ee 98°0 vst sz ns woz morse oye 99

0-2 oo ee est ze wee gsse eT

06-92 oso eat vet a ore geese LET ay

e992, eo 62 ?6 a we srerseuvor eee

vy9210°0 coro ere eo sy a guy obec ae

oz-s2 100 100 80°» or ve ze for gage SST ete

yss2 800 600 80°» eo ot a> Oey 66°98 eyez Tor

zersz 610 wo 80°» ve so we wey ss0'ee gare bt

ecrve 800 ozo 0°» eo v0 ae sty overs worse ot

verve ?0°0 ao 80°» wo v0 a> zy averse gy'sz a

teez 100 900 80> so ro as ey asose ate ss

os-ez 100 Soro so" x0 vo es we euo'se zee te

sez 00 oro 0°» ot ro a wy euorse eg?

sorez "0 w0'0 80°> ro ro a a a)

to oaeus eu ee-Yog 1s N tw % s 1 z

(on (s)

T 8 206 Eade (uso) GTZ ow /9R/E HO" 9TL99 NS ?HeOLT

sup99s ?Semen ueujuog ?sauyearl pends pussy woo] ul 4aBURSSIH ?-HA/AVO/OK

?epMD4EUOT?_apmaya7

oT SOLS ?Toeit Sim THB Saar AE

2

---Page Break---

we

we

earte

we

98°92

5792

spa

vero

96°82

v9'92

wese

05°82

wee

serez

osvez

ow'ez

bupoag

oro

100

0

sto

ozo

100

wo

oro

wo

100

ooeug

00°90

100

w0'0

60'0

ero

wo

Soro

woo

wo

wo

ew

(poise) 3H) (440)

36

Ws OTT

sonen queuw09

a

OTIS

wt

oorz

wel

wt

0

ovo

80

v0

wo

80°»

80"

e0">

0">

oe

aro

0"

ee"og

,

saueon

wee 292 zo ovr

see er0e 20 eee

vet 902 z0 ore

v6 ee a sore

e9 eo a 69re

ee 28 a ey

er os a ary

st ee a oe

#0 ve ze ery

a0 at a wee

vo z0 a os'y

80 10 a a'r

su ro a oy

eT ro a eee

st v0 a we

0 v0 a one

ts " %

(sa) ts)

? sort = cee (uN) S220 oa/tese

poods pur wot0g aut. aabuassay ?wA/a¥O/oH

e008 ISITE 310

serve eee UIT

oe v's ue

we om

wesc oT ats

esse ate ste

Sees 6st ae

999 6BLT tee

eso eget tee

use'se 16°02 aa

66°96 onze bo

soo-ue tenet

see'se verse ge

a

sor'se ?st'92 or

avs eee

sts sez

s 1 z

0°S4.99 NS "8200T

2pm 4640) apna4ge7

BaD ATE

- -

2%

---Page Break---

we

ov zz

zee

96°92

94°92

6992

6e92 00°0

20°92 1o'0

08's

av'se

88°92

re coro

sere. sovo

eeez 100 00

wee wo woo

Ez 000 soo

+> oaeus eww

suoo0s

=) aorns

009

ese

eH

z0

z0

zo

zo

z0

z0

so

eo

ze

ae

Be

20

z0

z0

20

20

uti

on

2

1

Boe ssi 9310

(we) 6ss0

Aoureaan pools ? pur ?worz0g aul sabuassay

90's 2901

ws ow

568069

wea as

zest ap

wat ele

erat ase

eeret ole

we at

sez fer

ave ZO

sosz oe

worse tg

era

wee 6

992g

s 1 z

oe/iz/e ?m0°S¥.99 NTH LT

/AYO/ON 990346007 aprayaeT

---Page Break---

35°92

se92

eye

acre

suse

verse

seve

aw

core

aver

ourez

6a'e2

su2005

100

too

zo

aro

ao

s0°0

20

oro

10

too

oaeug

cc

o0°0

100

0°

aro

sro

0

10

o

ore

6oro

eww

.}494) (3H) (440)

5942 et

5aney queusuog

9 sngnis

180

zo

wo

80'0

ae-Yoa

t

souaeor

v9 oer ocre zaa'se as

ve eer 090°96 ow.

el 20°98 oe

wo wr el" 9s.

vo ee a sus" 902

zo vt re ere ver

vo vo wy Te0"e tet

wo £0 we overse er'sz cot

60 £0 see wees uersz ge

v0 zo 99" verse = ots2 as

x0 vo out se0'9E ?owez Bz

eo vo o'r 800" = ge"92

vt to ony 00°9E?op'92 1

s N % s 4 z

(x) (asa)

? 30E (uno) 9460. elise = MO"SH99 Nb" ESOLT

pads pune ?aL aaGuassoy ?UA/AYO/OM ?-9pMILBUOY?_opmaxyeT

?Woe asiiD 9310 DeOaMET NA

---Page Break---

sorsz

wwe

wee

oorez

149995

wo

0

0"0

100

ora

{P0442} (24) (440)

2 30st

me

sro

wo

0

0

ew

saney, quejug

STOTAWIS

aun

0

30

oo

wo

ss

(

Boge sina Tai

(s)

695

wor109

zo

ze

vo

a

tay

(aio)

uy

ses'se 62H gor

2so'eW'SZ ag

ory es" eee ee

ony 966"5? EG

% s 1 z

SelL ??og/ea/e?H0"S¥.99 No

essay MA/AYO/OM apm y6veq apm 3.7

?aan AT

ec e a

---Page Break---

?sandara

van vara

soaseat

etd vores ?| ounbiy

---Page Break---

---Page Break---

---Page Break---

DEPTH IN METERS

50

1004

1504

200

2504

300

350

400

450.

500:

550

600

6504

700:

750

Figure 4.

XBT Graph Marck 23, 1980

Time 1802

tat 17°30.2N

tons 65°42,9w

TEMPERATURE

---Page Break---

DEPTH IN METERS

Figure 5.

50-4 XBT Grara March 25, 1980

Time 0356

1004 aT 18°01.6N

LONG 65°40,tn

150

2004

2504

300

350

400 4

4504

8

600 4

6504

15 § >

TEMPERATURE °C

7004

750 4

---Page Break---

DEPTH IN METERS

Figure 6.

XBT GRaPH March 26, 1980

Time 1945

lat 17°25.5n

Long 66°30.0w

50

100,

150.

200

250.

300

350,

400,

450.

500,

550

600

650

709. po os

TEMPERATURE °C

750,

a»

---Page Break---

TeMPERATURE °C

20.00

18.00

16.00

14.00

12.00

10.00

8.00

6.00

4.00

SALINITY 2.

35.50 36.00

Figure 7. Salinity (2) versus Temperature (°C) composite

March 23 to 27, 1980,

a

---Page Break---

DEPTH IN METERS

?TEMPERATURE °C

\$8338

8 10 1 2426 28 30

a

Figure 8. Temperature (°C) vs Depth (m) composite

March 23 to 27, 1980

---Page Break---

100

200

300

400

8.8

DEPTH IN METERS

800

300

1000

110)

1200?

SALINITY (0/00)

34,50 35,00 37,00

?

Figure 9. Salinity (x) vs Depth (m) composite

March 23 to 27, 1980.

---Page Break---

100.

200

300.

4004

50

60

DEPTH IN METERS

700-

800.

900

1000-

1100

1200.

DISSLOVED OXYGEN (mL/L)

2.5 0 35 4.0 4, 5,0

x

Figure 10. Dissolved oxygen (mi/) vs Depth (m)

. composite March'23"to 27, 1960.

---Page Break---

100

200

300

400

500

600

DEPTH IN METERS

700

800

1000

1100

1200

PwosPHATE GAT PO,-P/L

24.6 § 9 Zw i 18 9

Figure 11. Phosphate concentration versus depth at Benchmark

17°57.3N, 65°51.5W during March 23 8 26, 1980.

a

---Page Break---

NitRATE/NITRITE eat N/L

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

100

200] ° #6

300 eee

400 ay

3

600:

DEPTH IN METERS

700.

80 .

Figure 12. Nitrate/Nitrite concentration versus depth at

1000; Benchmark 17°57.3N, 65°S1.5N during March

258 26, 1980,

100 .

120

---Page Break---

DEPTH IN METERS

100

200

300

400

500

6004

700

800 .

|

900

1000

100.

SILICATE UGAT S1/L

8 10 12 14 16 18 20 22 24 26 28 30

wo

Figure 13. Silicate concentration versus depth at Benchmark

17°57.2N, 65°51.5N during March 23 8 28, 1980.

---Page Break---

PHOSPHATE UGAT PO,-P/L

24 46 8 40 12 14 16 18 2,0

100;

DEPTH IN METERS

B00} Figure 14, Mean Phosphate concentration »

versus depth at Benchmark

17°57.3N, 6551.54 during

March?23's 24, i380

1006

1106

---Page Break---

DEPTH IN METERS

104

200:

300

490:

500:

600

700

800

900

1000

1100

NITRATE/NITRITE UGAT N/L

204 6 8 10 2 WW 16

Figure 15. Mean Nitrate/Nitrite concentration versus depth
at Benchmark 17°57.2N, 65°51.5H during Karch
23 & 24, 1980,

2

---Page Break---

10

200}

300}

50

604

DEPTH IN METERS

70

90

909}

1000

1100

SILICATE uGAT S1/L

2 4 6 8 10 12 4 16 18 20 22

pes ee

Figure 16. Mean Silicate concentration versus depth at

Benchmark 17°57.3N, 65°51.54 curing March

238 28, 1980,

---Page Break---

"ç

TEMPERATURE

22

20)

PHOSPHATE GAT POy-P/L

Ou 06 98 10 12 WW 16 1g 2 2

Figure 17. posorate concentration versus temperature at Becimark

17°57.3N, 65°51.5" during March 23 & 24,

---Page Break---

TEMPERATURE °C

NETRATE/NITRITE UGAT N/L

a_i § 8 9 YD 12 W 6 18 2 2 2H 2 2 30

23

aq 8

4

19) .

By

---Page Break---

TEMPERATURE °C

19

2

4

SILICATE UGAT SI/L

6 8 10 12 14 16 18 20 22 4 2% 2 30

Figure 19. Silicate concentration versus temperature at Benchmark 17°57-3', 65°51.5N during March 23 & 24, 1980.

46

---Page Break---

PHOSPHATE UGAT Poy p/.

02 04 06 08 10 12 14 16 18 20

DEPTH (Mm)

* PRI ye 0.5 miles from coast

* Pt3 © 3.5 miles from coast

100 1 PES 415.5 miles from coast

is Pte 31.5 miles from coast

ae

200

*

30) °?®

oe *

400

. *

500

~

600

*

700 ~

800

Fare 20. papnte versus Oeth neg

resect south of Punta Tun

900 on taren 23y ra90,.v"* "0"

1,000 4

1,100 £

---Page Break---

Dept (M)

100

200

300

400

500

600

700

800

900

1,000

1,100

NITRATE/NITRITE UGAT N/L

204 6 8 10 2 Wy Je 18 20 22 my 26 30

PUI 0.5 miles from coast

% Pt3@ 3.5 miles from coast

'o PRS @ 15.5 miles from coast

Pt6 © 31.5 miles from coast

#0

Figure 21. Nitrate/Nitrite versus Depth (m) in a transect south of
Punta Tuna on March 25, 1960,

---Page Break---

DepTH (m)

SILICATE UGAT SI/L

o

? Ptlfe 0.5 miles from coast

100100 Pst 3.5 miles from coast

io PtS@ 15.5 miles from coast

ooo Pt6Q 31.5 miles from coast

-s

300 |

o ¢?

400

?6

500

* ©

6004

.

700

o

800

Figure 22. sticate versus death in a transect @ ®

900 4 F906 2 sath oF Punts Tuna on hareh 36,1580.

1,000

1100 o-

---Page Break---

ZOOPLANKTON DATA

---Page Break---

asses

feo terse |

Boo Genet

ooeere

Bre

are

area.

tanec

re

ournare

omer

certere

Pista

b\$283aad Saddaaes

caret Mesa

ae yey

Hy

aus Us

aaa Sos

aa toes

aay Ue

aa oe

aes us

ae Ee

aes

a

Ba

2

o

:

e

ne18659 acest

Sar wr

Tae aalilll

ora

sim owe,

st

---Page Break---

m3

5

na

oo

m9

mre

wr : sso

mortiss Weztset S80

ww

ideo (oT

2s1m9 cata

a - 7

careere

are

ais

ae

eh

ae

oe

oat

cusere

our

52

---Page Break---

3

---Page Break---

THR CRUISE (een)

54

---Page Break---

APPENDIX

---Page Break---

AY 0

1600

DAY a

0600

1000

1100

1200

1300

1400

1500

1600

1700

1930

2030

2130

2230

2330

pay 2

0030

0130

0330

0530

0630

0830

MARCH 1980 CRUISE PLAN (CRUISE 8003)

Depart Helecén

Arrive Benchmark station ?17°57.3N 65°51.54

XBT

hydrocast (primary productivity), 15 depths

XT

?oblique net tows (0-100, 100-200n)

vertical net tow (1000-200n), xT

light profile, secehi

oblique net tows (0-100, 100-200n)

vertical net tow (1000-200n), x87

oblique net tow (0-100, 100-200m)

vertical net tow (1000-200n)

hydrocast

x8T

vertical net tow (1000-200), x3T

oblique net tows (0-100, 100-200n)

vertical net tow (1000-200n)

oblique net tows (0-100, 100-2000)

vertical net tow (1000-220n)

x8T

oblique net tows (0-11, 100-200n)

hydrocast

xT

Begin small scale pattern study

steam for station S-1

Arrive S-1 179527" 6553.90

hydrocast at station S-1 (primary productivity)

station S-1

56

---Page Break---

DAY 2 (cont)

0915

1000

1085

1130

ais

1300

1345

1430

1515

1600

1605

1730

1930

2000

2100

2200

2400

pay 3

0000

100

0200

oblique net tow (0-100n) station S-1

steam for \$2

station S-2. 17°54.3N 65°57.4W

oblique net tow (0-100)

steam for \$-3

Station \$-3 17°56.0N 65°46,7W

?oblique net tow (0-100)

steam for S-4

station S-0 17°56.2N65°55.44

oblique net tow (9-100n)

steam for \$-5

station S-5 (Benchmark) 17°57,3" 65°52.0W

oblique net tow

steam for S-6

station S-6 17°58.8N 65°48.24

oblique net tow

return to benchmark

hydrocast,

begin night series 17°52,5N 65°53.64

steam for S-

oblique net tow (0-100n)

steam for S-2

Obl que net tow (0-100n) 17°54" 65°50W

steam for \$-3

oblique net tow (0-100m) 17°55.9N 65°46.4M

hydrocast

steam for S\$ 17°56.1N 65°55.36

oblique net tow (0-100m)

steam for S-5 (benchmark)

?oblique net tow (0-100n) 17957.3N 65°52.0%

steam for \$-6

oblique net tow (0-100n)

steam to Vieques

Begin large scale study

7

---Page Break---

DAY 3 (cont.)

0220

034s

0515

0830

1200

1500

1750

2000

2300

Day 4

100

0200

¥BT (underway)

arrive station Vel 18°08.4N 65°32.6)

hydrocast (2 depths)

shallow net tow

steam for V-2 18°03.6N 65°32.6W

shallow net tow

steam for V-3 18°01.8N 65°32.7W

hydrocast,

?oblique net tow (0-100)

steam for V=4 17°57.7N 65°32.64

?oblique net tow (0-100n)

steam for V-5 17°48.5N 65°32..64

oblique net tow (0-100n)

hydrocast

steam for V6

hydrocast 17°32.5N 65°32.8H

oblique net tow (0-100n)

steam for PT-6

X8T (underway)

arrive PT-6 17°28'N 65°53'W

hydrocast net tow

?oblique net tow (0-100n)

steam for PT-5

arrive PT-5

oblique net tow (0-100) 17°48.25" 65°53 "6

hydrocast

steam for PT-4

arrive PT-4 ?17°52.0N 65°53"W

oblique net tow (0-100n)

steam for PT-3 (benchmark)

arrive PT-3 17°56.0N 65°54

hydrocast,

oblique net tow (0-100m)

steam for PT-2

se

---Page Break---

DAY 4 (cont.)

0830

0830

0930

1000

1035,

1790

1430

1700

1800

1930

2100

2230

0200

arrive PT-2 17°58.1'N 65°53'

oblique net tow

steam for PT-1

arrive PT-1 17°58.2'N 65°53'W

Shallow hydrocast (2 depths)

shallow net tow

steam for J=1

arrive J-1 17°54.8'N 66°16'N

shallow hydrocast (2 depths)

shallow net tow

steam for J-2

arrive J-2 17°53.7'N 66°16.1'W

oblique net tow

steam for J-3

arrive J-3 17°48.7'N 66°16.1'N

oblique net tow (0-100n)

steam for J-4

arrive J-4 17°47.7N 66°16.0W

oblique net tow (0-100n)

steam for J-5

arrive J-5 17°39.7N 66°26.08

oblique net tow (0-100)

steam for J-6

arrive J-6 17°24.5N 66°16.0W

hydrocast

oblique net tow (0-100)

Depart for G-6

XBT (underway)

arrive G-6 17°26.5'N 66°45'W

oblique net tow (0-100n)

hydrocast

depart for 6-5

arrive G-5 17°41.6'N 66°45'W

hydrocast.

oblique net tow (0-100n)

depart for Gt

59

---Page Break---

DAY 4 (cont.)

0830

0600

0730

0815

ses

0015

arrive Gt 17°49.3'N 66°45'W

oblique net tow (0-100n)

depart for 6-3

arrive G-317°53.4'N 66°45'W

oblique net tow (0-100n)

hydrocast

depart for G-2

arrive G2 17°56.9'N 66°45'W

oblique net tow

depart for G-1

arrive G-1 17°56'N 66°45'W

oblique net tow

shallow hydrocast

depart 6-0

arrive G0 17°58'N 66°45.7'W

oblique net tow

depart for Malecén

60

---Page Break---

9.

10.

a

32,

os

15,

List of Participants

Crawford Cruise 22-27 March 1960

José M. Lopez

Juan G. González

Paul M. Yoshioka

Daniel Pesante

George Anderson

José A. Ramirez

Jorge Capella

Jorge Garcfa

Angel Nazario

Dennis Corales

Edwin González

Carlos Bonafé

Carlos Aranda

Nana Pérez

Nigdalia Alvarez

a

Chief scientist

Scientist

Scientist

Scientist

Head Technician

Technician

Technic:

Technic:

Technician

Technician

Technician

Technician

Technician

Technician

Technician

---Page Break---

WeRATHER cove

Clear (no cloud at any level)

Partly cloudy (scattered or broken clouds)

continuous layer (s) of cloud (s)

Sandstorm, duststorm, or blowing snow

Fog, thick dust, or haze

Drizzle

Rain

Snow, or rain and snow mixed

shower (s)

Thunderstorm (s)

---Page Break---