

**COASTAL OBSERVATION PROGRAMME - ENGINEERING (COPE)**

**BURLEIGH HEADS - CITY OF GOLD COAST**

**FOR THE YEARS 1980 TO 1987**

**REPORT NO. C22.1**

**Beach Protection Authority**

**June 1988**

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All reasonable care and attention has been exercised in the collection, processing and compilation of the COPE data included in this report. However, the accuracy and reliability of this information is not guaranteed in any way by the Beach Protection Authority and the Authority accepts no responsibility for the use of this information in any way whatsoever.

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### ABSTRACT:-

This report provides a summary of primary analyses of COPE data on wind, wave and beach processes observed at Burleigh Heads, in the City of the Gold Coast, on the south east Queensland coast. The data was recorded by volunteer observer Mr. F. Patterson during the period December 1980 to June 1987. The recordings were made daily during the six and a half year period. The information published is considered representative of the long term conditions. The station was still active at June 1988.

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- Coastal Observation Programme - Engineering (COPE), Theodolite Creek - Isis Shire, (Report C21.1)

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## **1.0 INTRODUCTION**

### **1.1 The Programme**

The Beach Protection Authority requires basic data on the behaviour of Queensland's beaches in order to provide well founded advice on coastal management to Local Authorities. The COPE project aims to collect information on wind, waves and beach behaviour in areas where extensive investigations are not practical and where otherwise little or no data exist.

The project is based on the recruitment of volunteer observers who are prepared to record a series of basic parameters once or twice daily for at least a three year period.

### **1.2 Site Selection**

In selecting a site for a COPE station, consideration is given to:-

- (a) the general shoreline configuration and the possibility of extrapolation of data to other adjacent beaches;
- (b) the distribution of stations along Queensland's coastline;
- (c) the need to correlate the COPE data with planned or existing data collection programmes.

### **1.3 Instrumentation**

The COPE observers are supplied with a basic kit of recording instruments including:-

- 30 metre Tape, Wind Meter, Stop Watch, 2.0 metre Measuring sticks, Recording Forms and Fluorescent Dye.

A graduated reference pole is installed on the beach to serve as the base point for all plan measurements and the control for vertical levelling.

### **1.4 Observers**

The majority of COPE observers are volunteers, who may be local business people, local residents or school children. Some stations are operated by Government employees who carry out the observations as part of their official duties.

### **1.5 Accuracy**

Individual observers differ in their subjective assessment of the various parameters recorded as part of the COPE programme. Wave parameters such as type, height, and angle of approach together with surf zone width and the location of the vegetation line all require visual assessment, the accuracy of which will vary from observer to observer and from recording to recording.



Although the Authority is confident that all observers make their observations to the best of their ability and accepts these observations without adjustment, the existence of random and non-random errors in the recorded data is to be expected.

Problems associated with the use of data containing these errors are minimised in two ways. Firstly, regular visits are made to the COPE stations by the Authority's COPE Field Officer to provide a check on any bias introduced into the recordings by incorrect observation procedures. Secondly, it has been found that, with a large number of observations taken on a regular basis, a reasonable assessment can be made of the average climatologies of the observed parameters provided the observation errors are random. A minimum recording period of three years has been adopted for the analysis and publication of the data. Five day moving averages are applied to observations of the various beach width and foreshore slope parameters to smooth out random errors.

For these reasons, the Authority is of the opinion that published COPE data can be used with confidence provided the above inherent limitations are recognised.

## **1.6 Presentation of Data**

The purpose of this report is to present COPE data for the six and a half year period 1980 to 1987 in a useful statistical form. No attempt has been made to interpret the observed data.

If the six and a half year period is representative of the long term average meteorological conditions, the statistics presented on wind, wave and beach movements can be regarded as typical. However, this recording period may be considered too short to be representative in terms of the average occurrence of extreme events such as cyclones and floods, and this should be taken into account when consideration is being given to the influence of such events on trends of long term beach behaviour.

## **2.0 STATION PARTICULARS**

### **2.1 Location**

Burleigh Heads is located within the City of the Gold Coast and lies approximately 10 kilometres south of Surfers Paradise on the south east Queensland coast. It is a 2 kilometre stretch of coastline bounded by Burleigh Headland to the south and South Nobby Headland to the north. The location of the Burleigh Heads COPE station is shown in Figures 1.1 and 1.2

### **2.2 Observers**

This station has been operated by Mr. F. Patterson during the period December 1980 to June 1987. The Authority wishes to thank Mr. F. Patterson for his valuable service in gathering the data contained within this Report. At date of publication, Mr F. Patterson was continuing as observer.

### **2.3 Observed Parameters**

The observer at this station recorded once daily at approximately 7.30 a.m.

This station has recorded:

- Wave Period
- Wave Height
- Wave Direction
- Wave Type
- Surf Zone Width
- Presence of Offshore Bar
- Wind Speed
- Wind Direction
- State of Tide
- Distance to Berm
- Berm Elevation
- Distance to Vegetation Line
- Sand level at C.O.P.E. reference Pole
- Foreshore Slope
- Longshore Current Speed
- Longshore Current Direction.
- Distance from Shoreline to Float (recorded from February 1986)

In addition a sand sample was collected at the station each month, and since April 1981, a profile of the beach has usually been recorded monthly.

#### 2.4 Tidal Information

Tidal information is presented below. Datum is Low Water Datum.

M.H.W.S.	1.40 metres
M.H.W.N.	1.10 metres
M.S.L.	0.77 metres
M.L.W.N.	0.40 metres
M.L.W.S.	0.10 metres

A.H.D. is 0.87 metres above Low Water Datum.

Tidal information was obtained from the 1987 Department of Harbours and Marine Tide Book.

#### 2.5 Description of the Beach

The beach at the Burleigh Heads COPE Station exhibits the following characteristics:-

- Typical beach slopes: Foreshore slope is in the range 1 in 8 to 1 in 30 ( $7^{\circ}$  -  $2^{\circ}$ ).
- Beach width: Varied from 40 to 120 metres measured from the seaward toe of frontal dune to Low Water Mark over the six and a half year period.
- D50 sand size: 0.27 mm averaged over six and a half years.
- Adjoining Landform: Low narrow foredune backed by a high secondary dune with a prominent erosion scarp on its seaward face. Landward dunal areas have been levelled, cleared and used for public park and residential purposes.
- Vegetation: The foredune is vegetated with sand spinifex grass (Spinifex sericeus) and goat's foot convolvulus (Ipomoea pes-caprae).

A range of native and exotic grasses and shrubs have established a dense ground cover over the crest and seaward slope of the secondary dune.

### 2.5.1 Meteorological Events

The following cyclones were recorded by the Brisbane Bureau of Meteorology as having tracks within 500 kilometres of Burleigh Heads between December 1980 and June 1987. It is considered that these cyclone events may have had some effect on the condition of Burleigh Heads.

Cyclone Cliff	09/02/81 - 15/02/81
Cyclone Abigail	22/01/82 - 05/02/82
Low Pressure System	03/06/83 - 06/06/83 (causing erosion)
Cyclone Ingrid	20/02/84 - 25/02/84
Cyclone Lance	04/04/84 - 07/04/84
Low Pressure System	07/04/84 - 13/04/84 (causing erosion)
Low Pressure System	18/05/84 - 23/05/84 (causing erosion)
Cyclone Pierre	18/02/85 - 24/02/85
Cyclone Vernon	21/01/86 - 24/01/86

### 2.5.2 Coastal Works

Following erosion in June 1983 and April, May 1984, the Gold Coast City Council implemented a beach nourishment scheme which would provide protection for both the park and beach at Burleigh Heads.

Beach nourishment commenced in early October 1985 with 200,000 cubic metres of sand deposited onshore and a further 100,000 cubic metres placed nearshore, within 8 metres of water.

### 2.6 Supervision of Station

The observer was instructed in the recording programme by the COPE Field Officer and the initial instruction period was followed up with visits to the station during the period of recordings presented in this report.

Installation of the reference pole for this station has been carried out by the Gold Coast City Council and the Authority wishes to thank the Council for its assistance in all matters associated with the COPE project. Maintenance of the pole has been carried out by the Beach Protection Authority's COPE Field Officer.

### 3.0 DATA

#### 3.1 General

COPE data for this station for the six and a half year period December 1980 to June 1987 is presented on the attached figures. The data has been analysed statistically and/or smoothed to reveal long term averages or trends. A brief description of each of the observed parameters is given below with the relevant figure references.

#### 3.2 Wind

The observer recorded the wind speed at the beach using a hand held wind meter at 1.5 metres above beach level. Prior to February 1986 wind direction was estimated to the nearest compass sector. After this time wind direction is recorded in degrees by compass.

A summary of annual wind speed and direction percentage occurrences are shown as a wind rose in Figure 3. Where applicable, morning and afternoon readings as well as the overall average are shown.

Wind speed was recorded in miles per hour (m.p.h.) rather than knots after February 1986. The recordings are converted from (m.p.h.) to knots for Figure 3.

### 3.3 Waves

The average and maximum breaker height (trough to crest) is usually estimated to the nearest 0.1 metre. From experience the estimate of average breaker height has been found to be comparable with the equivalent deep water significant wave height.

Recordings of maximum wave height and method used to obtain wave height were introduced into the programme from February 1986. Wave type and state of tide were discontinued at this time.

The observers estimate the wave period by recording the time taken for eleven wave crests (the duration of 10 waves) to pass a point.

Wave direction was recorded in degrees of a compass from March 1986. The direction recorded was then converted to a sector (see following paragraph regarding sector system).

The wave direction is estimated as one of five direction sectors indicating the angle to the shoreline alignment from which the waves are approaching the surf zone. These sectors have been selected as:-

Sector 1	-	0° to 60°
Sector 2	-	61° to 85°
Sector 3	-	86° to 95°
Sector 4	-	96° to 120°
Sector 5	-	121° to 180°

Note: 0° is the beach alignment to the left of the observer when facing seaward, and at the COPE station this direction is approximately 345° true north.

Statistical representations of the observed wave data include:-

- (a) the percentage of wave height recordings which exceed any given wave height for all directions combined (Figure 4).
- (b) the percentage occurrence of various combinations of wave heights and periods and directions (Figure 5 and Figure 6).
- (c) surf zone width with an indication of the existence or otherwise of an offshore bar (Figure 7 to Figure 13.)
- (d) tabulation of the occurrence of various wave heights, periods, types and directions (Tables 1 to 8).

### 3.4 Longshore Currents

The observer measured the distance parallel to the shoreline that a float in the surf zone moved in one minute. Current direction is either upcoast or downcoast, upcoast being to the left when facing the sea from the beach.

The readings are converted to a velocity which is plotted on a daily basis (Figure 14 to Figure 21). Mean upcoast and downcoast components and the overall annual means are also presented.

### **3.5 Beach Profile Parameters**

Beach profile parameters were measured until 1983 using an Abney level, tape measure and reference pole. These include:

- Distance from the reference pole to the berm.
- Elevation of the berm.
- Distance from the reference pole to the vegetation line.
- The foreshore slope.

Since 1983 profiles have been recorded using a measuring stick, the reference pole, and a line of sight to the horizon.

Sand level at the reference pole was formally recorded from February 1986 and the measurement of foreshore slope was discontinued at this time.

Changes in these parameters with time indicate how the beach moves in response to varying wave attack. Plots of these parameters are shown in Figure 22 to Figure 28.

### **3.6 Monthly Beach Profiles**

Beach profiles are normally taken at the beginning of each month. However, should the beach undergo appreciable erosion or accretion during the month, then the observer is requested to take another beach profile. Monthly beach profiles are shown in Figure 29 to Figure 35.

**TABLE I**  
**MONTHLY AND ANNUAL**  
**MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND WAVE TYPE/WAVE DIRECTION**  
**OCCURRENCES**

Burleigh Heads

No. of Observations: 32

Year 1980

MONTH	MEAN WAVE PERIOD (secs)	MEAN WAVE HEIGHT (metres)	Percentage Occurrence - Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER	5.5	1.46	100.0	-	-	-	-	-	-	-	-	-	-
WHOLE YEAR	5.5	1.46	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SP - Spilling  
 PL - Plunging  
 SP/PL - Combined Spilling and Plunging

**TABLE 2**  
**MONTHLY AND ANNUAL**  
**MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND WAVE TYPE/WAVE DIRECTION**  
**OCCURRENCES**

Burleigh Heads

No. of Observations: 359

Year 1981

MONTH	MEAN WAVE PERIOD (secs)	MEAN WAVE HEIGHT (metres)	Percentage Occurrence - Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	7.8	1.22	-	-	-	-	-	-	-	-	-	-	-
FEBRUARY	7.8	1.38	-	-	-	-	-	-	-	-	-	-	-
MARCH	8.5	1.27	-	-	-	100.0	-	-	-	-	-	-	-
APRIL	8.2	1.06	16.7	10.0	-	73.3	-	-	-	100.0	-	-	-
MAY	9.0	1.41	41.9	-	-	58.1	-	-	3.7	3.7	92.6	-	-
JUNE	9.6	0.97	22.2	-	-	77.8	-	-	11.1	18.5	70.4	-	-
JULY	8.3	0.81	25.8	-	-	74.2	-	-	6.5	22.5	71.0	-	-
AUGUST	10.0	0.90	45.2	-	-	54.8	-	-	6.5	25.8	67.7	-	-
SEPTEMBER	8.9	0.91	14.3	-	-	85.7	-	-	3.6	7.1	89.3	-	-
OCTOBER	8.3	1.26	16.7	-	-	83.3	-	-	10.0	26.7	63.3	-	-
NOVEMBER	7.8	1.29	30.0	-	-	70.0	-	-	-	30.0	70.0	-	-
DECEMBER	7.8	1.03	29.1	3.2	-	67.7	-	-	6.5	41.9	51.6	-	-
WHOLE YEAR	8.5	1.13	26.1	1.5	0.0	72.4	0.0	0.0	5.9	22.3	71.8	0.0	0.0

SP - Spilling

PL - Plunging

SP/PL - Combined Spilling and Plunging

**TABLE 3**  
**MONTHLY AND ANNUAL**  
**MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND WAVE TYPE/WAVE DIRECTION**  
**OCCURRENCES**

Burleigh Heads

No. of Observations: 361

Year 1982

MONTH	MEAN WAVE PERIOD (secs)	MEAN WAVE HEIGHT (metres)	Percentage Occurrence - Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	7.9	1.19	3.6	10.7	-	85.7	-	-	-	34.5	65.5	-	-
FEBRUARY	8.4	1.39	10.7	-	-	89.3	-	-	-	21.4	78.6	-	-
MARCH	9.3	1.30	12.9	-	-	87.1	-	-	-	12.9	87.1	-	-
APRIL	8.1	0.90	76.7	-	-	23.3	-	-	-	31.1	65.5	3.4	-
MAY	8.0	0.92	12.9	-	-	87.1	-	-	-	9.7	90.3	-	-
JUNE	9.6	0.92	28.6	-	-	71.4	-	-	-	17.9	82.1	-	-
JULY	9.0	0.73	41.9	-	-	58.1	-	-	-	9.7	90.3	-	-
AUGUST	8.5	1.03	22.6	3.2	-	74.2	-	-	-	51.6	48.4	-	-
SEPTEMBER	8.9	0.75	56.7	-	-	43.3	-	-	16.7	30.0	53.3	-	-
OCTOBER	7.7	0.84	9.7	-	-	90.3	-	-	25.8	9.7	64.5	-	-
NOVEMBER	8.5	0.99	-	-	-	100.0	-	-	-	30.0	70.0	-	-
DECEMBER	8.3	0.90	45.2	-	-	54.8	-	-	16.1	61.3	22.6	-	-
WHOLE YEAR	8.5	0.99	26.9	1.2	0.0	71.9	0.0	0.0	5.0	26.7	68.0	0.3	0.0

SP - Spilling  
 PL - Plunging  
 SP/PL - Combined Spilling and Plunging



**TABLE 4**  
**MONTHLY AND ANNUAL**  
**MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND WAVE TYPE/WAVE DIRECTION**  
**OCCURRENCES**

Burleigh Heads

No. of Observations: 334

Year 1983

MONTH	MEAN WAVE PERIOD (secs)	MEAN WAVE HEIGHT (metres)	Percentage Occurrence - Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	8.4	1.13	9.7	-	-	90.3	-	-	-	77.4	22.6	-	-
FEBRUARY	7.7	0.88	17.9	-	-	82.1	-	-	10.7	46.4	42.9	-	-
MARCH	7.8	0.92	3.2	-	-	96.8	-	-	3.2	41.9	54.9	-	-
APRIL	7.9	0.85	20.0	-	-	80.0	-	-	3.3	26.7	70.0	-	-
MAY	7.6	0.96	12.9	-	-	87.1	-	-	-	51.6	48.4	-	-
JUNE	8.5	1.42	12.5	-	-	87.5	-	-	-	6.3	93.7	-	-
JULY	7.3	0.79	10.0	-	-	90.0	-	-	-	40.0	60.0	-	-
AUGUST	7.4	0.85	38.7	-	-	61.3	-	-	3.2	61.3	35.5	-	-
SEPTEMBER	6.5	0.79	56.7	-	-	43.3	-	-	16.7	36.7	46.6	-	-
OCTOBER	7.6	0.95	13.8	-	-	86.2	-	-	6.9	20.7	72.4	-	-
NOVEMBER	6.5	0.96	68.8	-	-	31.2	-	-	12.5	37.5	50.0	-	-
DECEMBER	6.8	1.06	25.8	-	-	74.2	-	-	-	38.7	61.3	-	-
WHOLE YEAR	7.5	0.95	22.8	0.0	0.0	77.2	0.0	0.0	4.5	42.2	53.3	0.0	0.0

SP - Spilling

PL - Plunging

Surge - Combined Spilling and Plunging

**TABLE 5**  
**MONTHLY AND ANNUAL**  
**MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND WAVE TYPE/WAVE DIRECTION**  
**OCCURENCES**

Burleigh Heads

No. of Observations: 333

Year 1984

MONTH	MEAN WAVE PERIOD (secs)	MEAN WAVE HEIGHT (metres)	Percentage Occurrence - Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	6.3	1.08	35.5	-	-	64.5	-	-	6.5	29.0	64.5	-	-
FEBRUARY	6.4	1.02	-	-	-	100.0	-	-	6.9	27.6	65.5	-	-
MARCH	7.9	0.91	3.2	-	-	96.8	-	-	3.2	16.1	80.7	-	-
APRIL	7.0	1.26	3.3	-	-	96.7	-	-	-	10.0	90.0	-	-
MAY	8.0	1.12	6.5	-	-	93.5	-	-	-	6.5	93.5	-	-
JUNE	8.4	1.14	-	4.0	-	96.0	-	-	-	28.0	72.0	-	-
JULY	8.7	0.75	42.9	-	-	57.1	-	-	4.8	38.1	57.1	-	-
AUGUST	9.4	0.85	41.9	-	-	58.1	-	-	3.2	22.6	74.2	-	-
SEPTEMBER	7.6	0.72	67.9	-	-	32.1	-	-	3.6	46.4	50.0	-	-
OCTOBER	7.5	0.89	64.5	-	-	35.5	-	-	6.5	32.3	61.2	-	-
NOVEMBER	7.1	0.75	70.4	-	-	29.6	-	-	11.1	55.6	33.3	-	-
DECEMBER	7.4	0.86	88.9	-	-	11.1	-	-	22.2	44.5	33.3	-	-
WHOLE YEAR	7.6	0.95	33.3	0.3	0.0	66.4	0.0	0.0	5.1	28.5	66.4	0.0	0.0

SP - Spilling  
 PL - Plunging  
 SP/PL - Combined Spilling and Plunging

**TABLE 6**  
**MONTHLY AND ANNUAL**  
**MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND TYPE/WAVE DIRECTION**  
**OCCURENCES**

Burleigh Heads

No. of Observations: 353

Year 1985

MONTH	MEAN WAVE PERIOD (secs)	MEAN WAVE HEIGHT (metres)	Percentage Occurrence - Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	6.9	0.69	87.1	-	-	12.9	-	-	16.1	38.7	45.2	-	-
FEBRUARY	7.7	1.08	40.7	-	-	59.3	-	-	-	7.4	92.6	-	-
MARCH	7.8	1.15	23.3	-	-	76.7	-	-	-	30.0	70.0	-	-
APRIL	8.3	1.15	16.7	3.3	-	80.0	-	-	-	50.0	50.0	-	-
MAY	8.0	1.32	12.9	3.2	-	83.9	-	-	-	16.1	83.9	-	-
JUNE	7.7	0.76	17.2	6.9	-	75.9	-	-	-	37.9	62.1	-	-
JULY	8.1	1.00	19.4	-	-	80.6	-	-	-	25.8	74.2	-	-
AUGUST	7.2	0.81	12.9	-	-	87.1	-	-	3.2	61.3	35.5	-	-
SEPTEMBER	8.7	0.98	-	3.8	-	96.2	-	-	11.5	42.3	46.2	-	-
OCTOBER	7.4	1.04	19.4	-	-	80.6	-	-	3.2	64.5	32.3	-	-
NOVEMBER	7.1	0.95	50.0	-	-	50.0	-	-	7.1	28.6	64.3	-	-
DECEMBER	6.6	0.86	10.7	-	-	89.3	-	-	21.4	53.6	25.0	-	-
WHOLE YEAR	7.6	0.98	26.1	1.4	0.0	72.5	0.0	0.0	5.1	38.2	56.7	0.0	0.0

SP - Spilling

PL - Plunging

SP/PL - Spilling/Plunging

**TABLE 7**  
**MONTHLY AND ANNUAL**  
**MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND TYPE/WAVE DIRECTION**  
**OCCURRENCES**

Burleigh Heads

No. of Observations: 300

Year 1986

MONTH	MEAN WAVE PERIOD (secs)	MEAN WAVE HEIGHT (metres)	Percentage Occurrence - Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	7.4	1.28	7.7	15.4	-	76.9	-	-	7.7	23.1	69.2	-	-
FEBRUARY	-	-	-	-	-	-	-	-	-	-	-	-	-
MARCH	7.8	1.19	9.1	-	-	90.9	-	-	6.3	31.3	62.4	-	-
APRIL	7.9	1.24	CR	CR	CR	CR	CR	-	3.3	30.0	66.7	-	-
MAY	9.0	0.89	-	-	-	-	-	-	9.7	48.4	41.9	-	-
JUNE	8.4	0.96	-	-	-	-	-	-	6.9	13.8	75.9	3.4	-
JULY	8.4	0.93	-	-	-	-	-	3.2	29.0	22.6	45.2	-	-
AUGUST	8.0	0.88	-	-	-	-	-	-	6.5	35.5	58.0	-	-
SEPTEMBER	6.7	0.68	-	-	-	-	-	-	46.4	39.3	14.3	-	-
OCTOBER	6.8	0.71	-	-	-	-	-	-	77.4	22.6	-	-	-
NOVEMBER	7.4	0.99	-	-	-	-	-	-	34.5	31.0	34.5	-	-
DECEMBER	7.8	1.11	-	-	-	-	-	-	64.5	25.8	9.7	-	-
WHOLE YEAR	7.8	0.96	8.3	8.3	0.0	83.3	0.0	0.3	28.7	29.7	41.0	0.3	0.0

SP - Spilling  
 PL - Plunging  
 SP/PL - Combined Spilling and Plunging  
 CR - Ceased Recording Wave Type

ADMENDMENT

**TABLE 8**  
**MONTHLY AND ANNUAL**  
**MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND WAVE DIRECTION OCCURRENCES**

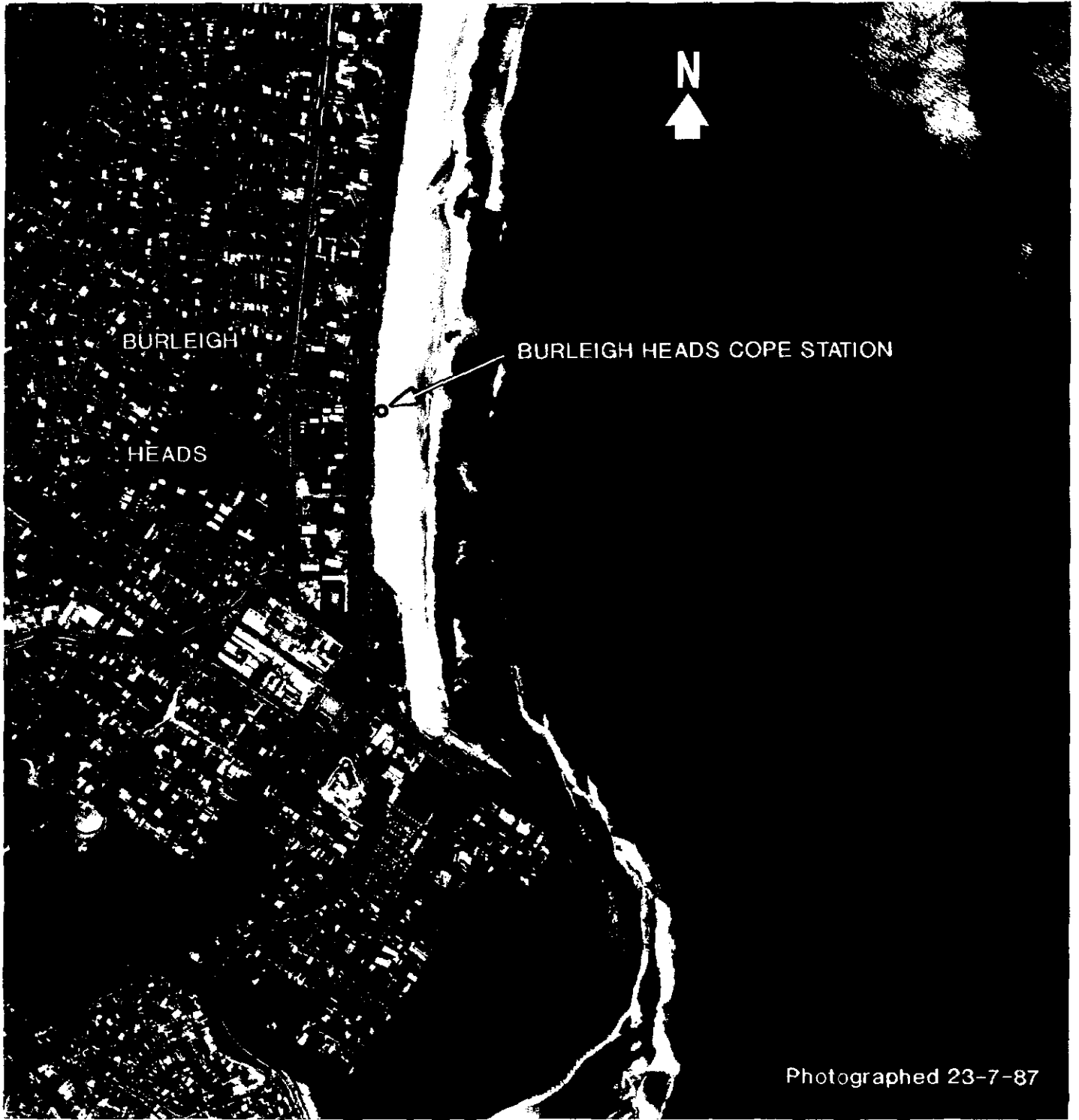
Burleigh Heads

No. of Observations: 175

Year 1987

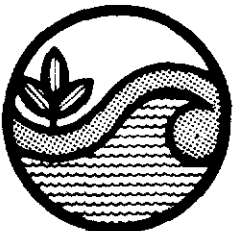
MONTH	MEAN WAVE PERIOD (secs)	MEAN WAVE HEIGHT (metres)	Percentage Occurrence - Wave Direction					
			Wave Direction					
			1	2	3	4	5	Calm
JANUARY	7.6	1.03	-	54.8	35.5	9.7	-	-
FEBRUARY	7.8	1.09	-	22.2	48.2	29.6	-	-
MARCH	7.9	0.93	-	30.0	50.0	20.0	-	-
APRIL	8.3	1.32	-	16.7	36.6	46.7	-	-
MAY	8.4	1.28	-	-	48.4	51.6	-	-
JUNE	8.3	1.09	-	7.7	34.6	57.7	-	-
JULY								
AUGUST								
SEPTEMBER								
OCTOBER								
NOVEMBER								
DECEMBER								
WHOLE YEAR	8.0	1.12	0.0	22.2	42.6	35.2	0.0	0.0

ADMENDMENT



Photographed 23-7-87

00 0 100 200 300 400 500 metres  
Scale 1:12 000 approx.

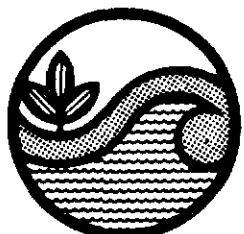
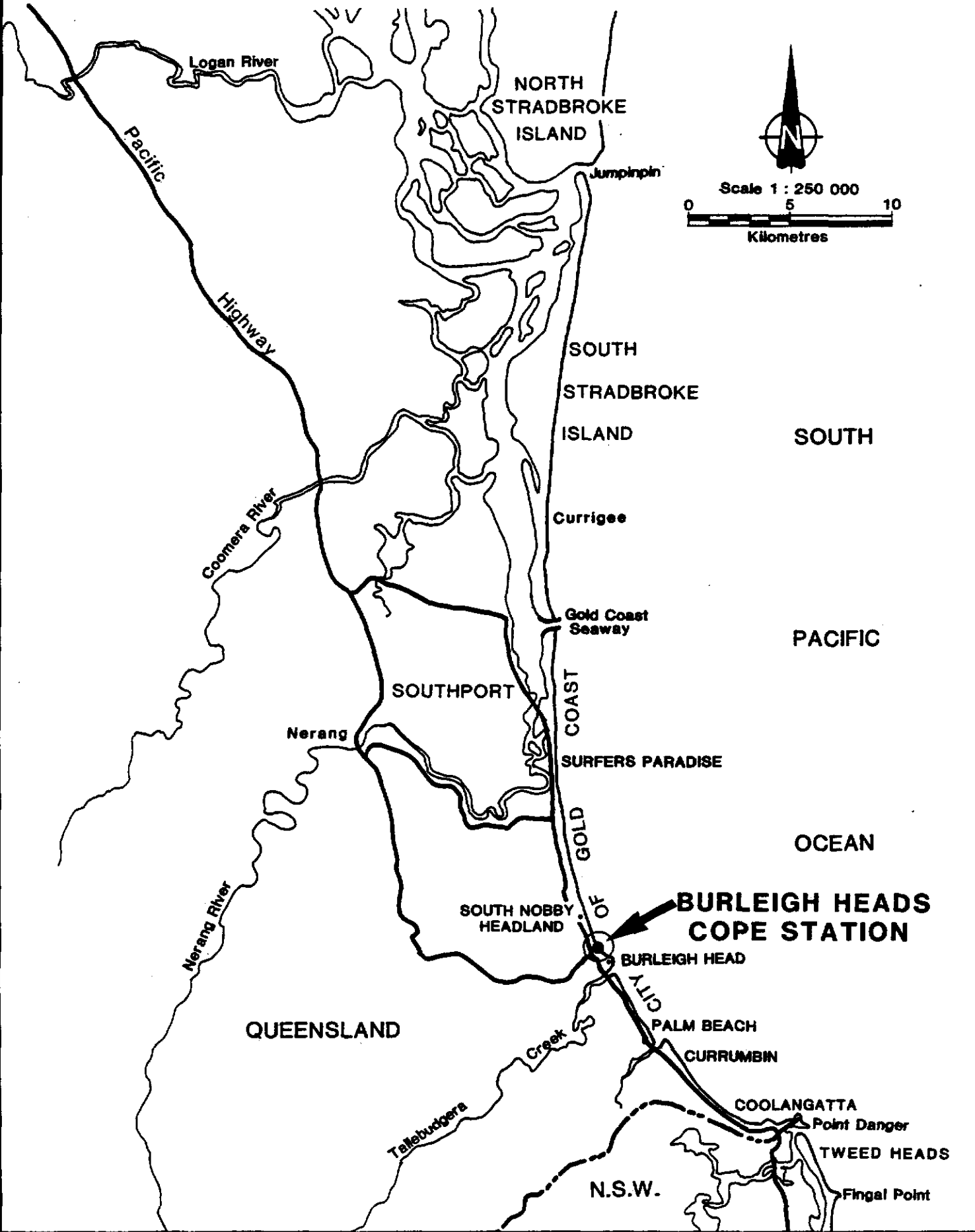


Beach Protection Authority

SITE PLAN  
**BURLEIGH HEADS COPE STATION**

COPE  
Burleigh Heads

**Figure 1.1**  
C 22.1



Beach Protection Authority

**LOCALITY PLAN**

COPE  
Burleigh Heads

**Figure 1.2**  
C22.1

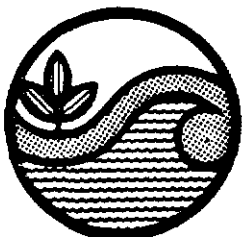


COASTAL OBSERVATION PROGRAMME - ENGINEERING

COPE

RECORD ALL DATA CAREFULLY AND LEGIBLY

<p><b>SITE NUMBER</b></p> <table style="width:100%; text-align:center;"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td> </tr> <tr> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>	1	2	3	4	5	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<p><b>DAY</b></p> <table style="width:100%; text-align:center;"> <tr> <td>6</td><td>7</td> </tr> <tr> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>	6	7	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<p><b>MONTH</b></p> <table style="width:100%; text-align:center;"> <tr> <td>8</td><td>9</td> </tr> <tr> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>	8	9	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<p><b>YEAR</b></p> <table style="width:100%; text-align:center;"> <tr> <td>10</td><td>11</td> </tr> <tr> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>	10	11	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<p><b>TIME</b></p> <p>Record time using 24 hour system</p> <table style="width:100%; text-align:center;"> <tr> <td>12</td><td>13</td><td>14</td><td>15</td> </tr> <tr> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>	12	13	14	15	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>																										
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<p>(i) <b>WAVE HEIGHT (AVERAGE)</b></p> <p>Record the best estimate of the average breaking wave height to the nearest tenth of a metre. If less than 0.1 record as 0.0 and go directly to Section (ii).</p>	<p>16      17</p> <table style="width:100%; text-align:center;"> <tr> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<p><b>WAVE HEIGHT (MAXIMUM)</b></p> <p>Record the best estimate of the maximum breaking wave height during the entire observation period to the nearest tenth of a metre.</p>	<p>18      19</p> <table style="width:100%; text-align:center;"> <tr> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>																																																					
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<p><b>WAVE HEIGHT METHOD</b></p> <p>Record the method that you used to obtain wave height.          Record 1 if visual estimate          Record 2 if measured with COPE sticks          Record 3 if measured by COPE pole</p>	<p>20</p> <table style="width:100%; text-align:center;"> <tr> <td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>	<input style="width:20px; height:20px;" type="text"/>	<p><b>WAVE PERIOD</b></p> <p>Record the time in seconds for eleven (11) wave crests to pass a stationary point just seaward of the surf zone.</p>	<p>21   22   23</p> <table style="width:100%; text-align:center;"> <tr> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>																																																					
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<p><b>WAVE DIRECTION</b></p> <p>Determine the direction that the waves are entering the surf zone using the compass provided and record the direction in degrees.</p>	<p>24   25   26</p> <table style="width:100%; text-align:center;"> <tr> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<p><b>SURF ZONE WIDTH</b></p> <p>Record the time in seconds for a wave of average height to traverse the surf zone from break point to final run-up on the beach.</p>	<p>27   28   29</p> <table style="width:100%; text-align:center;"> <tr> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>																																																			
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<p>(ii) <b>CURRENT SPEED</b></p> <p>Measure in metres the distance that the centre of the dye patch is observed to move during a one (1) minute period; if no long shore movement record 000.</p>	<p>30   31   32</p> <table style="width:100%; text-align:center;"> <tr> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<p><b>CURRENT DIRECTION</b></p> <p>When the observer faces the sea          0 — no long shore movement          L — dye moves to the left          R — dye moves to the right</p>	<p>33</p> <table style="width:100%; text-align:center;"> <tr> <td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>	<input style="width:20px; height:20px;" type="text"/>																																																					
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<p><b>DISTANCE FROM SHORE</b></p> <p>Record the distance in metres from the shore to where the current measurements were commenced.</p>	<p>34   35</p> <table style="width:100%; text-align:center;"> <tr> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<p><b>OFFSHORE BAR</b></p> <p>Is an off-shore bar causing the waves to break?          1—yes      0—no</p>	<p>36</p> <table style="width:100%; text-align:center;"> <tr> <td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>	<input style="width:20px; height:20px;" type="text"/>																																																						
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<p>(iii) <b>WIND SPEED</b></p> <p>Record wind speed to the nearest m.p.h. If calm record 00 and go directly to Section (iv).</p>	<p>37   38</p> <table style="width:100%; text-align:center;"> <tr> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<p><b>WIND DIRECTION</b></p> <p>Determine the direction that the wind is coming from using the compass provided and record the direction in degrees.</p>	<p>39   40   41</p> <table style="width:100%; text-align:center;"> <tr> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>																																																				
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<p>(iv) <b>BERM ELEVATION</b></p> <p>Record the elevation of berm to the nearest tenth of a metre. Measurements should be taken of the most seaward berm if more than one exists.</p>	<p>42      43</p> <table style="width:100%; text-align:center;"> <tr> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<p><b>DISTANCE TO THE BERM</b></p> <p>Record the distance, to the nearest metre, from the reference post to the berm. Distances landward of the reference post are negative.          e.g. 009 measures 9 metres seaward (No sign);          -07 measures 7 metres landward. (Minus sign).</p>	<p>44   45   46</p> <table style="width:100%; text-align:center;"> <tr> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>																																																				
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<p>(v) <b>DISTANCE TO THE VEGETATION</b></p> <p>Record the distance from the reference post to the average vegetation line. Distances landward of the reference post are negative.</p>	<p>47   48   49</p> <table style="width:100%; text-align:center;"> <tr> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<p><b>SAND LEVEL AT POLE</b></p> <p>Record to nearest tenth of a metre.</p>	<p>50      51</p> <table style="width:100%; text-align:center;"> <tr> <td><input style="width:20px; height:20px;" type="text"/></td> <td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>																																																				
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<p>(vi) <b>SAND SAMPLE</b></p> <p>If sample taken then record 1. Otherwise leave blank.</p> <p>52</p> <table style="width:100%; text-align:center;"> <tr> <td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>	<input style="width:20px; height:20px;" type="text"/>	<p><b>PLEASE PRINT</b> <span style="float:right;">Please check the form for completeness</span></p> <p style="text-align:center;">_____</p> <p style="text-align:center;"><b>SITE NAME</b> <span style="float:right;"><b>OBSERVER</b></span></p> <p style="text-align:center;">_____</p> <p><b>REMARKS:</b> _____</p> <p>_____</p> <p style="text-align:center;">Make any additional remarks, computations or sketches on the reverse side of this form.</p> <p>(for office use only)</p> <table style="width:100%; text-align:center;"> <tr> <td>53</td><td>54</td><td>55</td><td>56</td><td>57</td><td>58</td><td>59</td><td>60</td><td>61</td><td>62</td><td>63</td><td>64</td><td>65</td><td>66</td><td>67</td><td>68</td><td>69</td><td>70</td><td>71</td><td>72</td><td>73</td><td>74</td><td>75</td><td>76</td><td>77</td><td>78</td><td>79</td><td>80</td> </tr> <tr> <td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td><td><input style="width:20px; height:20px;" type="text"/></td> </tr> </table>			53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>	<input style="width:20px; height:20px;" type="text"/>
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OBSERVATION FORM

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Figure 2.1  
C22.1



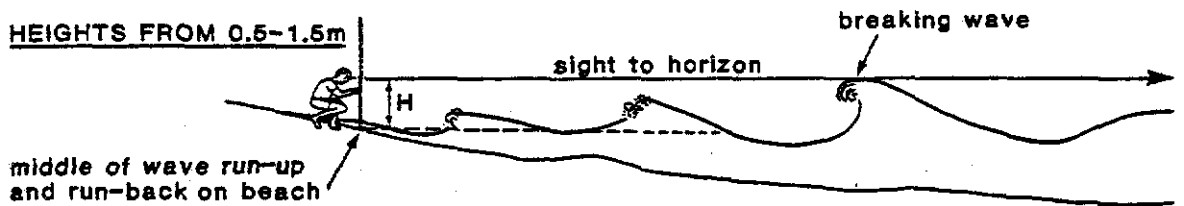
## WAVE HEIGHT AND DIRECTION INSTRUCTIONS

### METHOD 1 VISUAL ESTIMATION

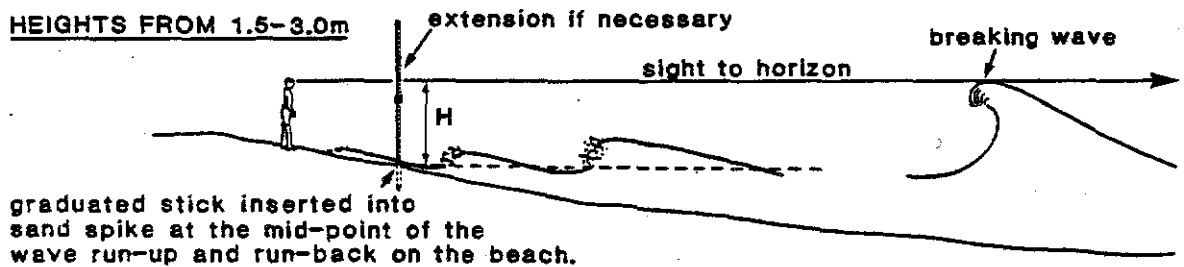
This method should only be used where the waveheights are below 0.5 and it is not practicable to use the preferred Method 2.

### METHOD 2

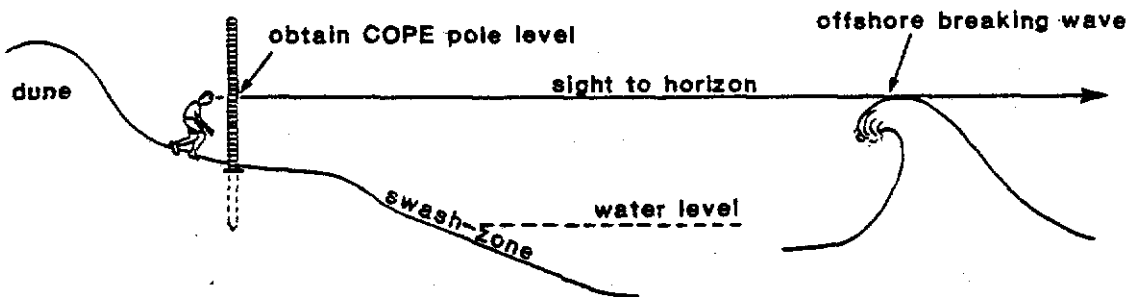
HEIGHTS FROM 0.5-1.5m



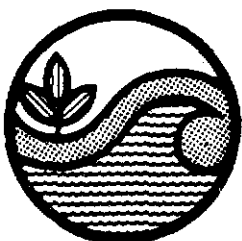
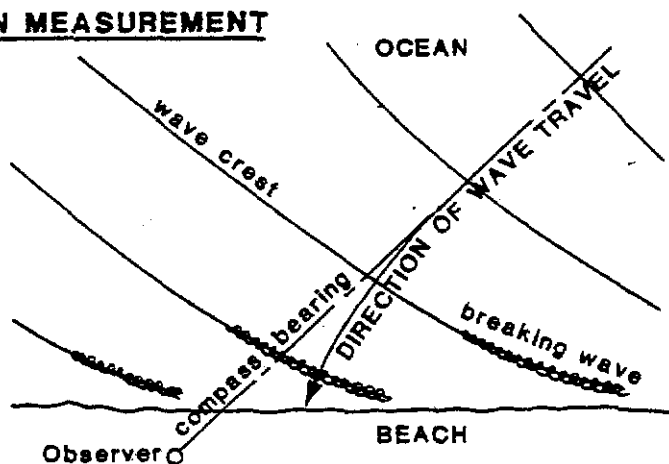
HEIGHTS FROM 1.5-3.0m



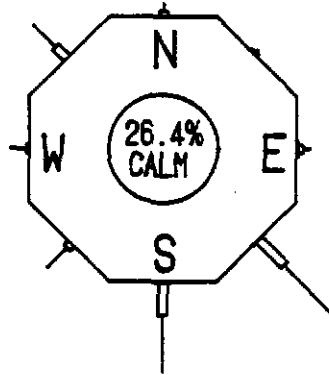
### METHOD 3 FOR WAVES OVER 3m



### WAVE DIRECTION MEASUREMENT



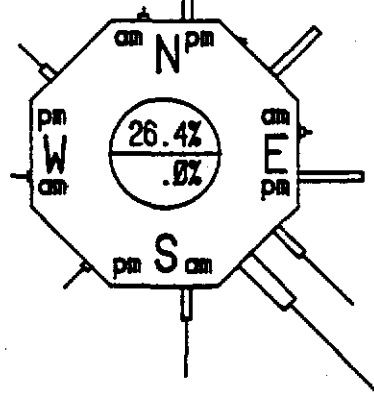
ALL OBSERVATIONS



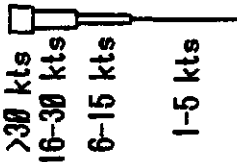
Total No. of Observations : 2238

MORNING - AFTERNOON OBSERVATIONS

NOTES :  
 Figures in Central Circle  
 Represent Percentage  
 of CALM Observations.  
 Upper Figure for AM  
 Lower Figure for PM



LEGEND

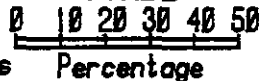


No. of Morning Observations : 2231

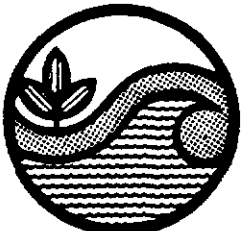
No. of Afternoon Observations : 7

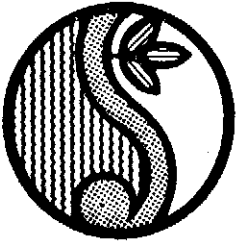
Mean Time :- Morning Obs : Ø71Ø hrs  
 Mean Time :- Afternoon Obs : 1551 hrs

SCALE



WIND DATA - DEC 198Ø to JUNE 1987





WAVE HEIGHT % EXCEEDANCE

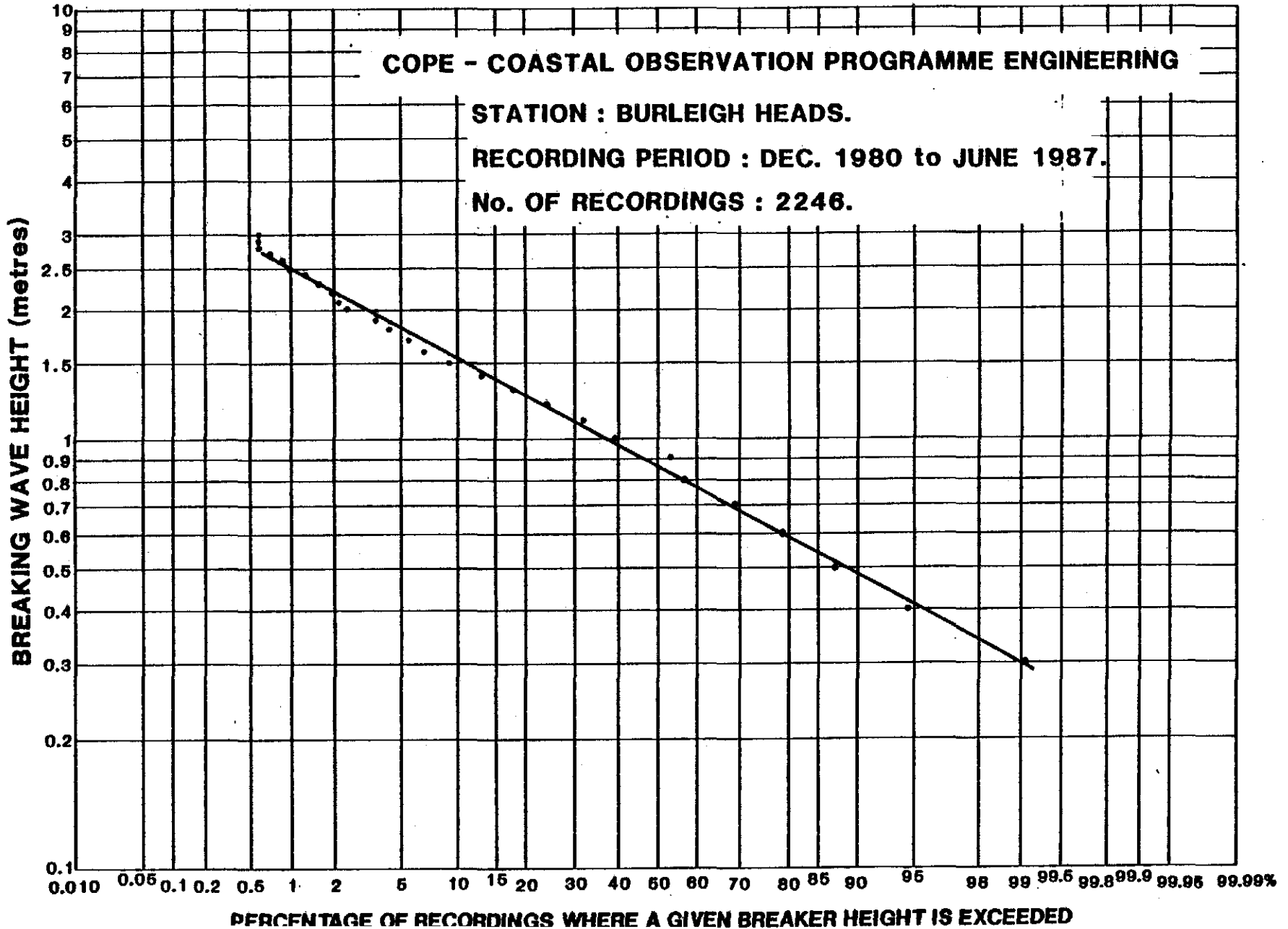
ALL DATA

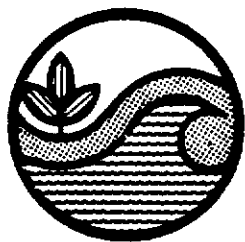
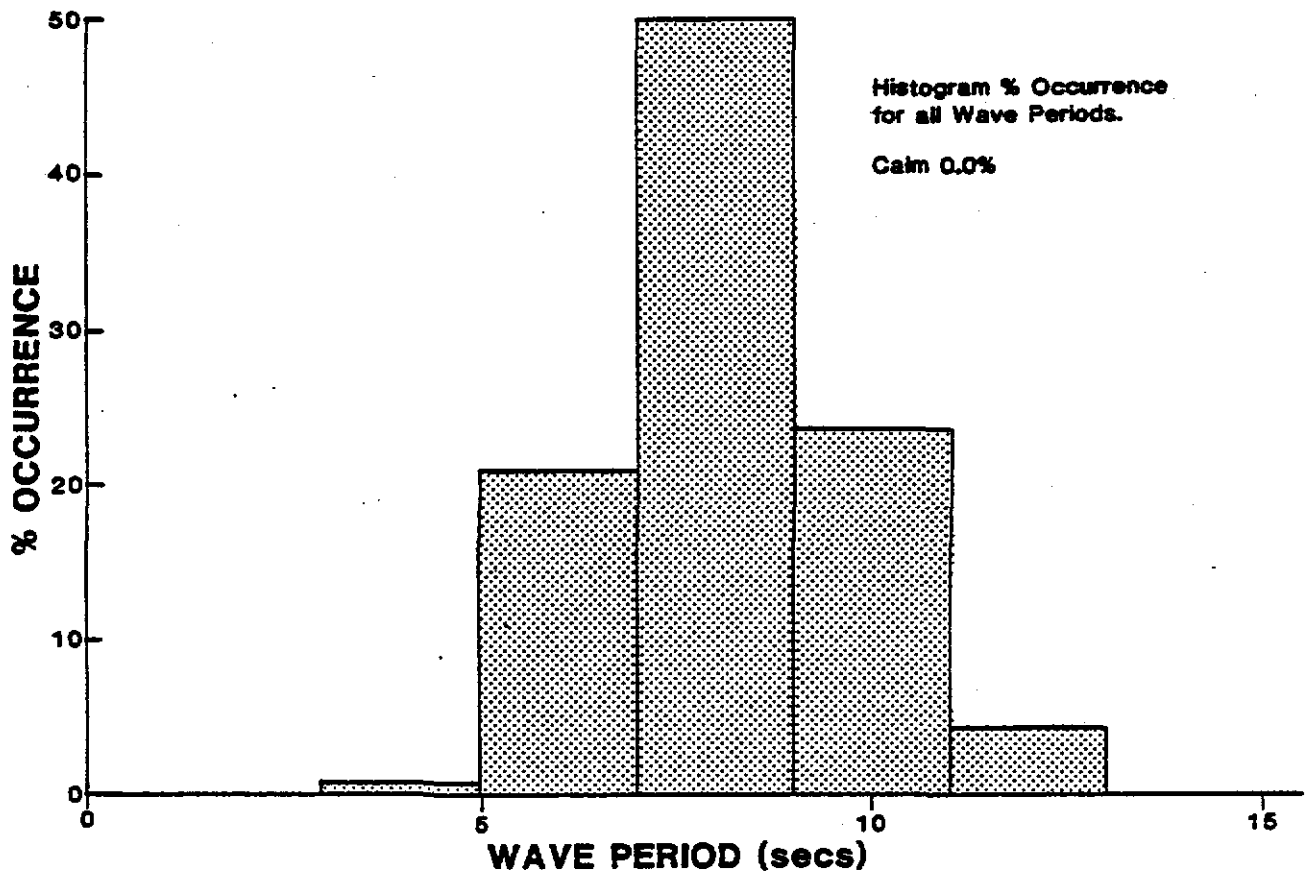
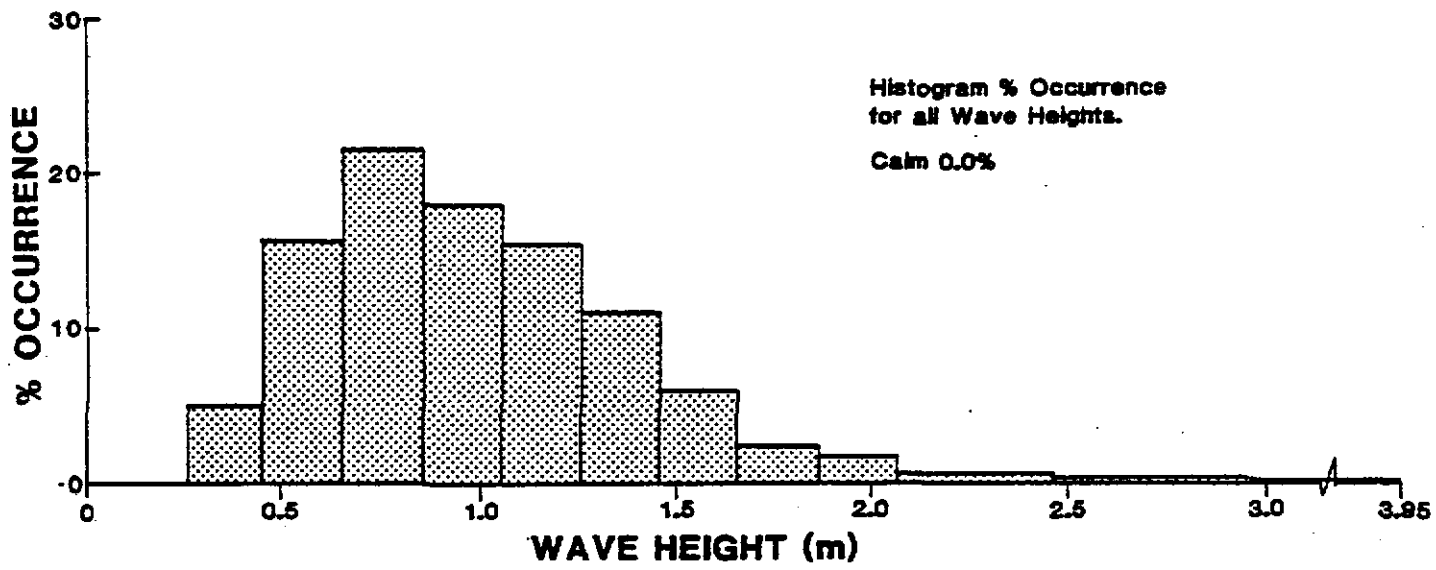
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Figure

C22.1





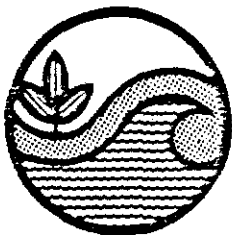
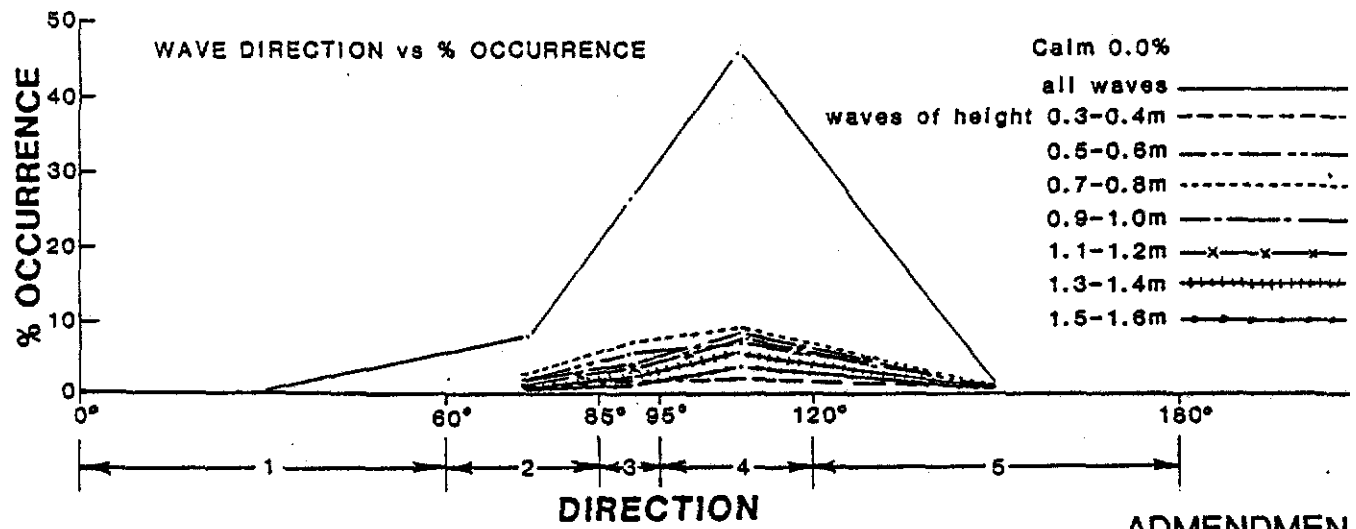
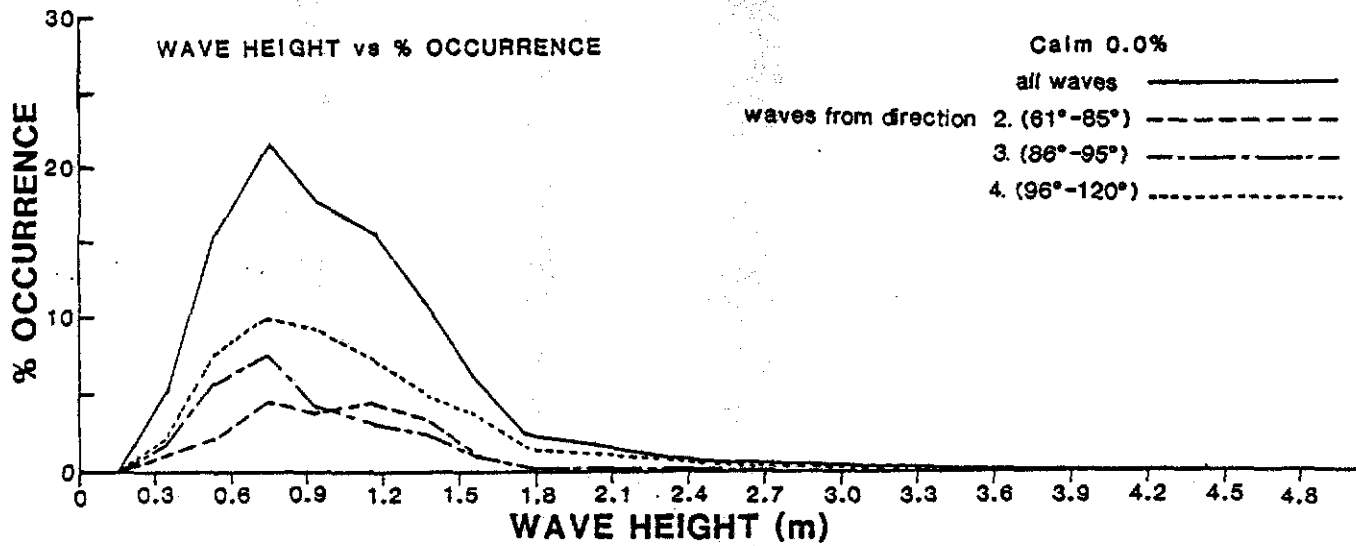
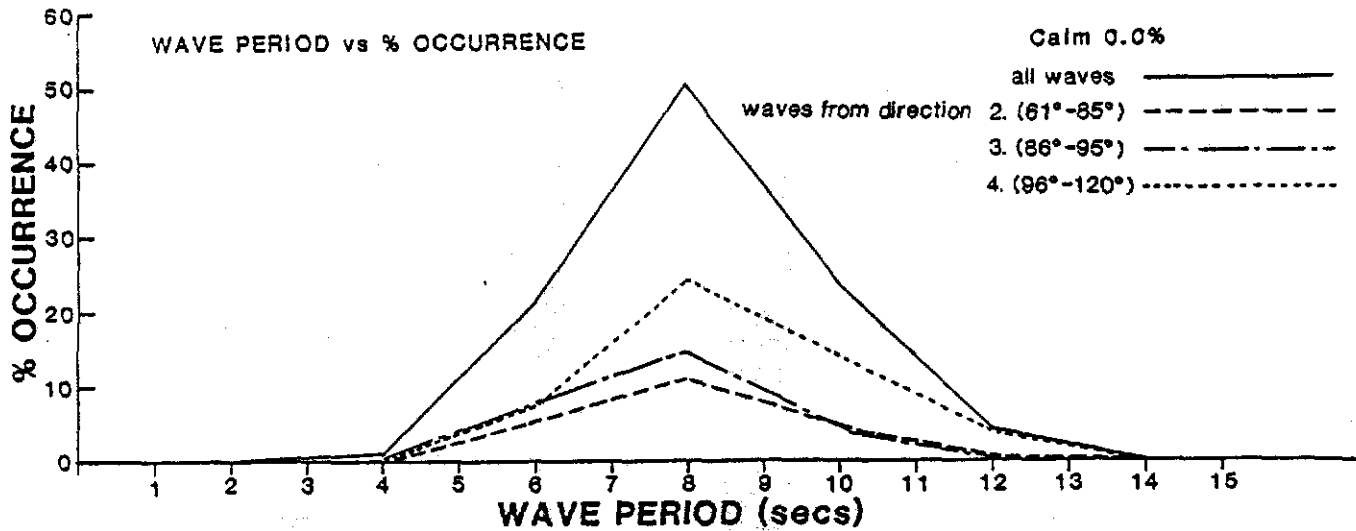
Beach Protection Authority

**WAVE HEIGHT AND WAVE PERIOD  
PERCENTAGE OCCURRENCE**

**ALL DATA**

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**Figure 5  
C22.1**



Beach Protection Authority

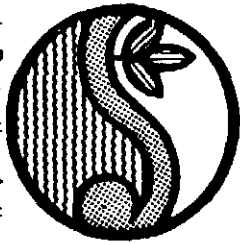
**WAVE DIRECTION ANALYSIS**

**ALL DATA**

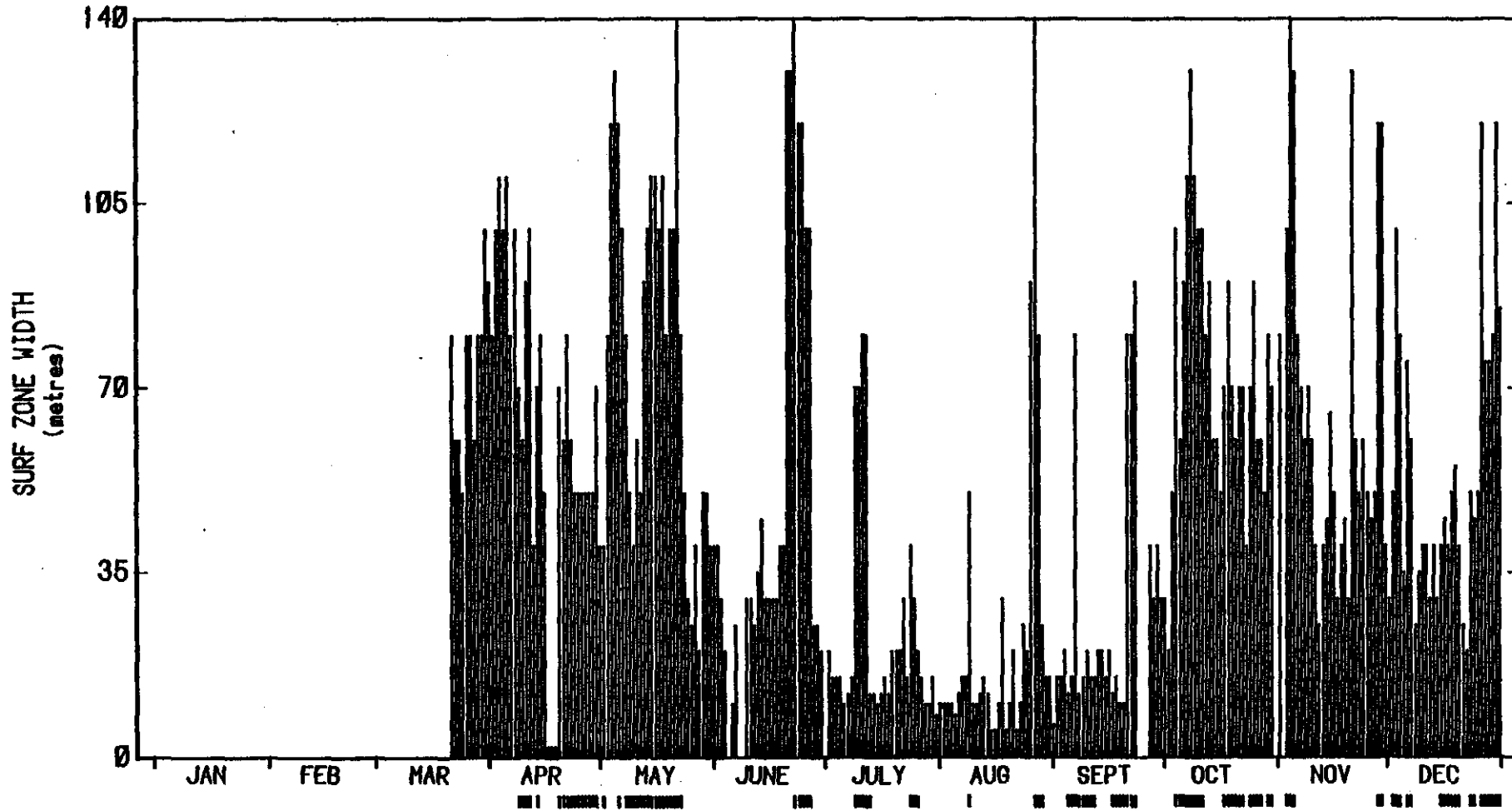
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**Figure 6**

C22.1



SURF ZONE WIDTH - MORNING 1981



SURF ZONE WIDTH SUMMARY - 1981

No. of Observations : 277

MORNING OBSERVATIONS

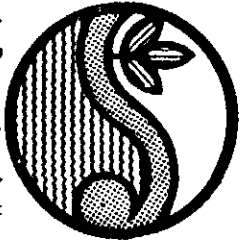
Mean Surf Zone Width = 52.3 m

■ Indicates Offshore Bar Present

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Figure 7

C22.1



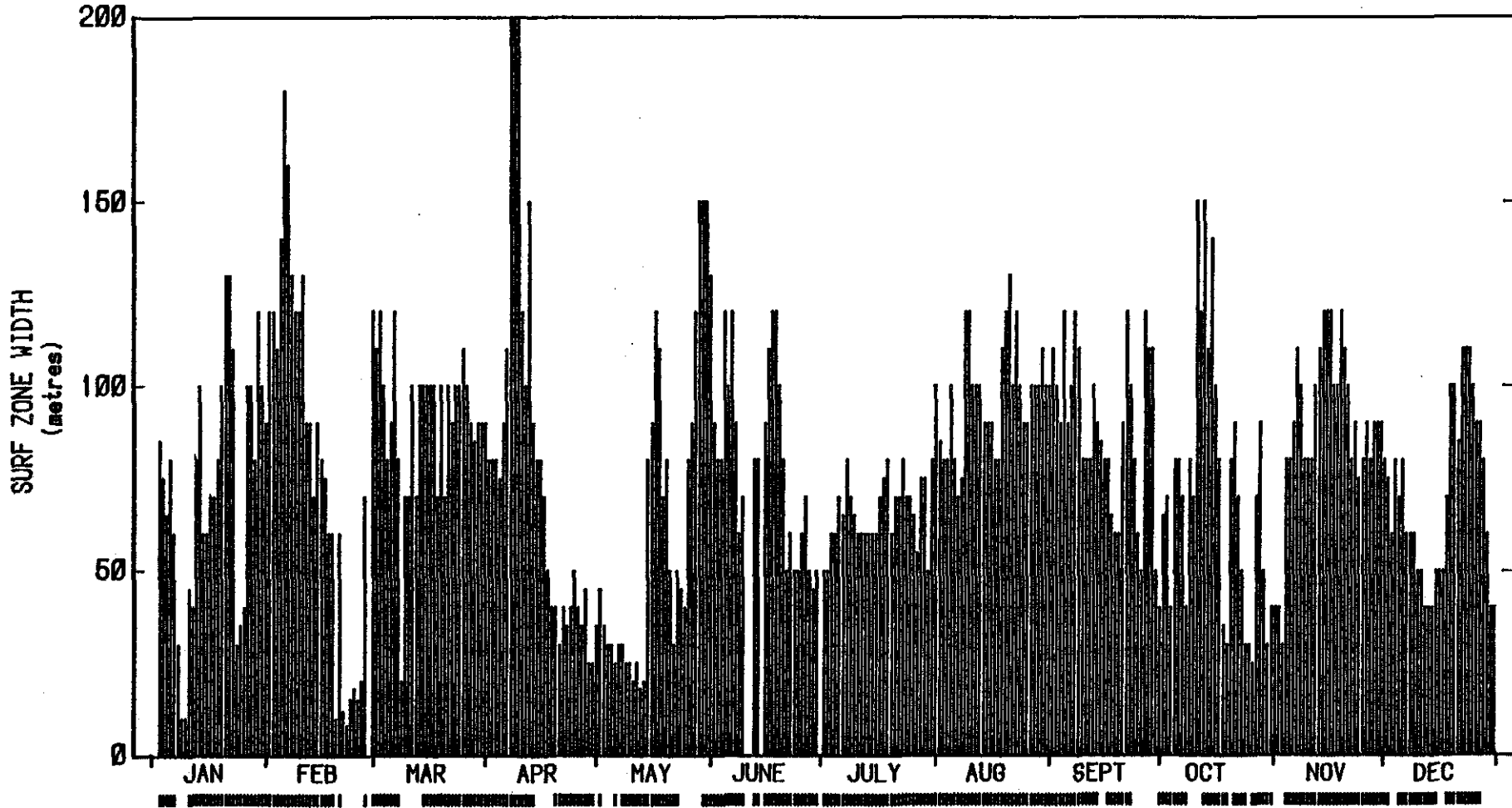
SURF ZONE WIDTH - MORNING 1982

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0106



SURF ZONE WIDTH SUMMARY - 1982

No. of Observations : 360

MORNING OBSERVATIONS

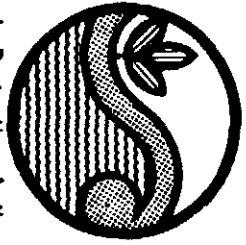
Mean Surf Zone Width = 79.3 m

■ Indicates Offshore Bar Present

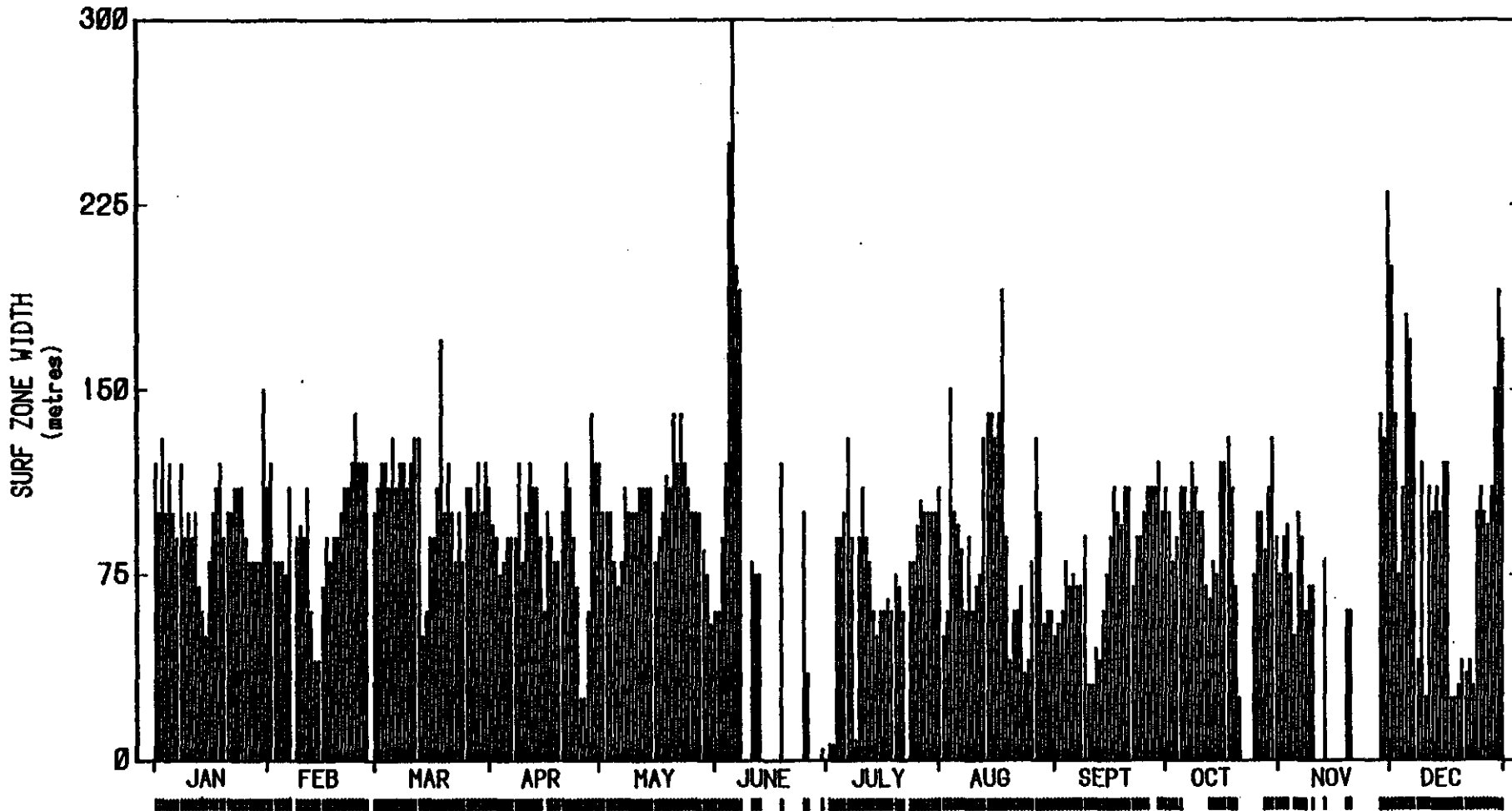
C22.1

Figure 8

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SURF ZONE WIDTH - MORNING 1983



SURF ZONE WIDTH SUMMARY - 1983

No. of Observations : 331

MORNING OBSERVATIONS

Mean Surf Zone Width = 94.5 m

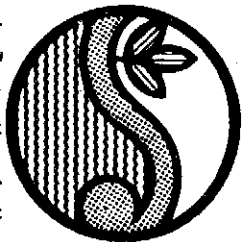
■ Indicates Offshore Bar Present

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Figure 9

C22.1





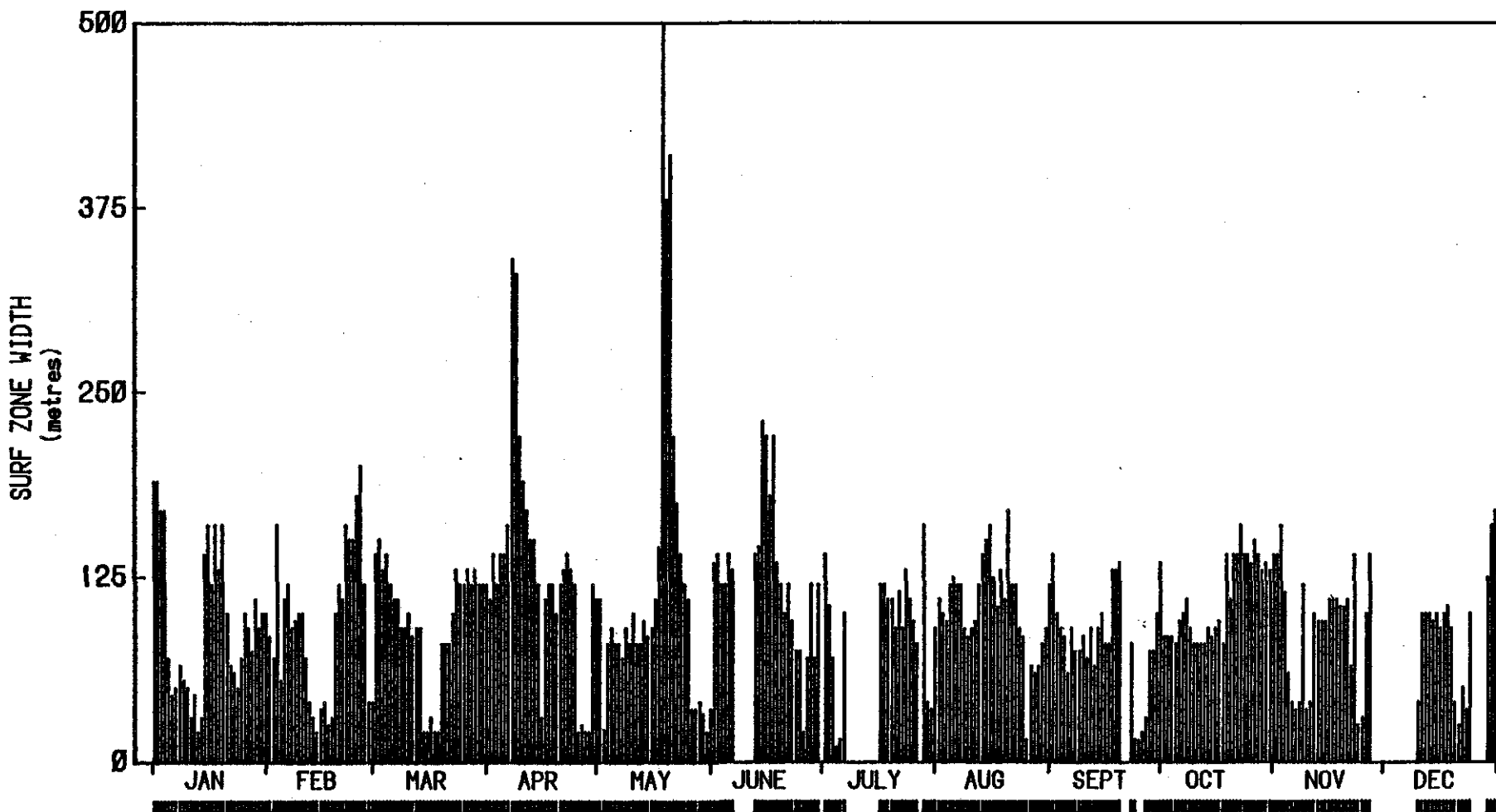
SURF ZONE WIDTH - MORNING 1984

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SURF ZONE WIDTH SUMMARY - 1984

No. of Observations : 334

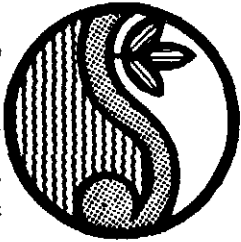
MORNING OBSERVATIONS

Mean Surf Zone Width = 102.8 m

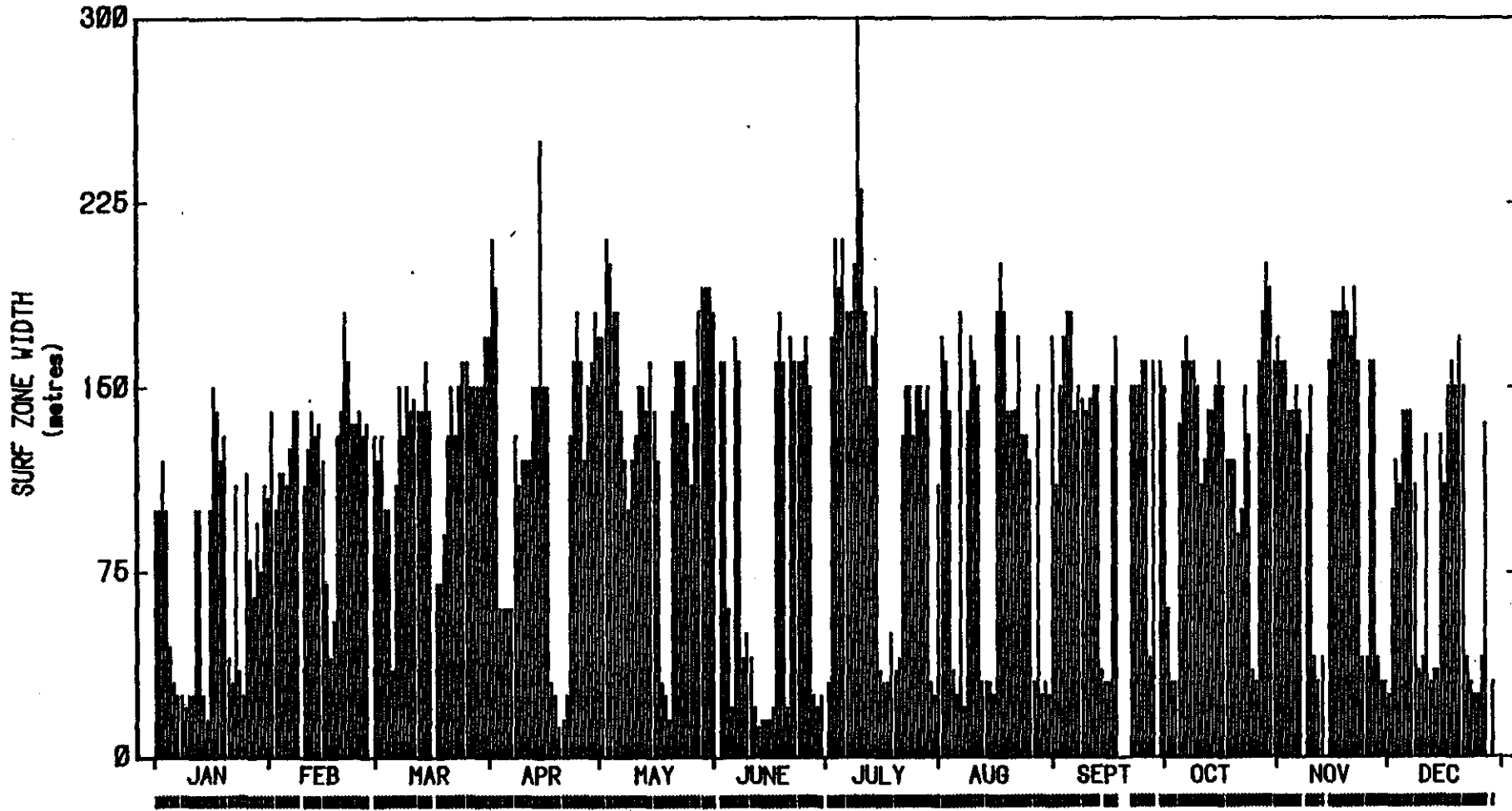
■ Indicates Offshore Bar Present

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Figure 11  
C22.1



SURF ZONE WIDTH - MORNING 1985



SURF ZONE WIDTH SUMMARY - 1985

No. of Observations : 353

MORNING OBSERVATIONS

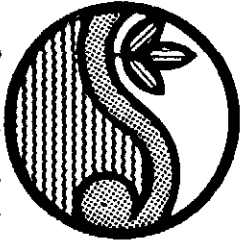
Mean Surf Zone Width = 116.6 m

■ Indicates Offshore Bar Present

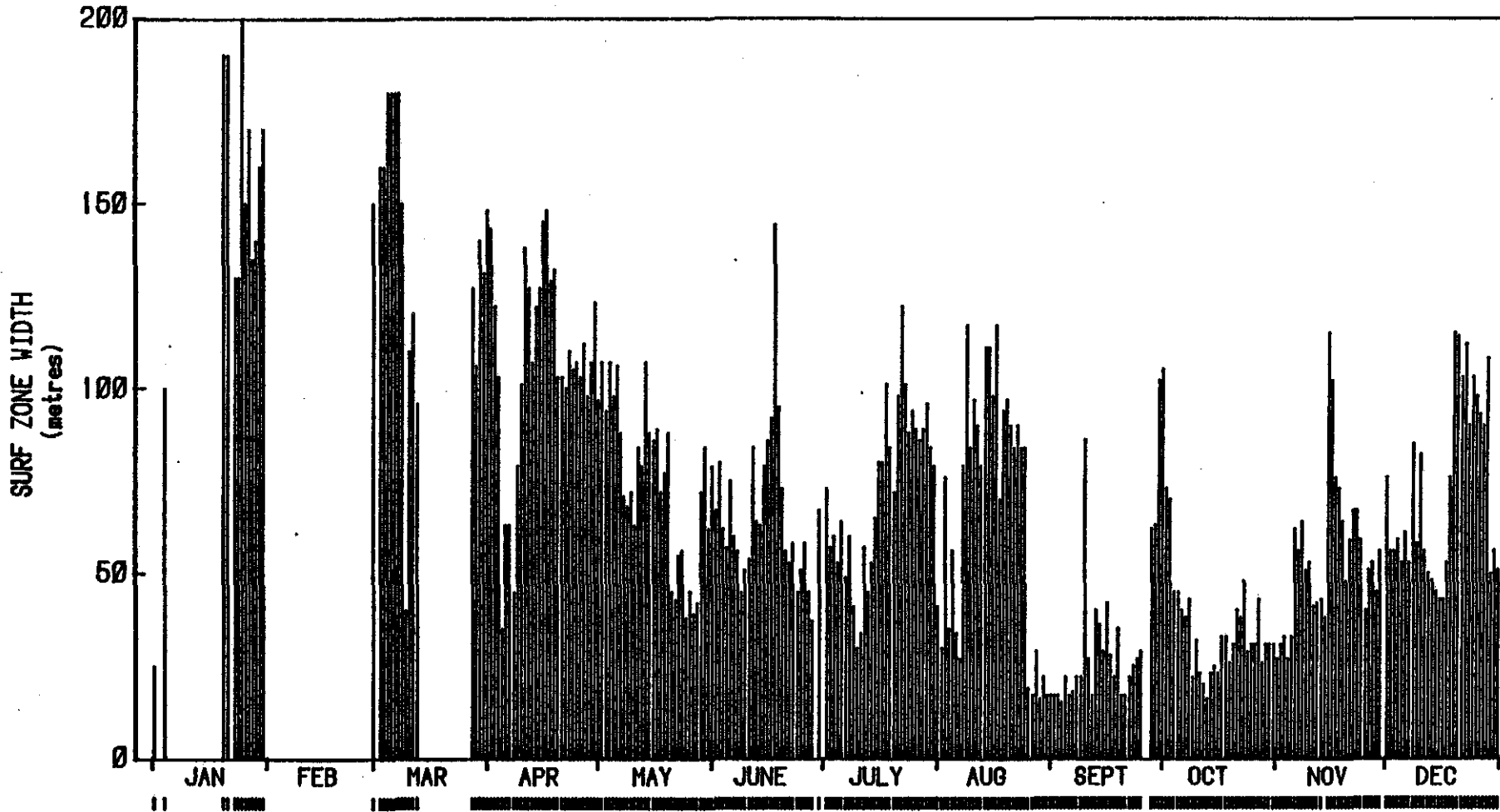
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Figure 11

C22.1



SURF ZONE WIDTH - MORNING 1986



SURF ZONE WIDTH SUMMARY - 1986

No. of Observations : 300

MORNING OBSERVATIONS

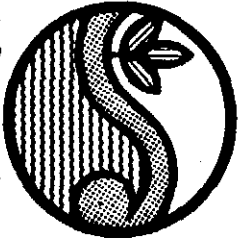
Mean Surf Zone Width = 72.5 m

■ Indicates Offshore Bar Present

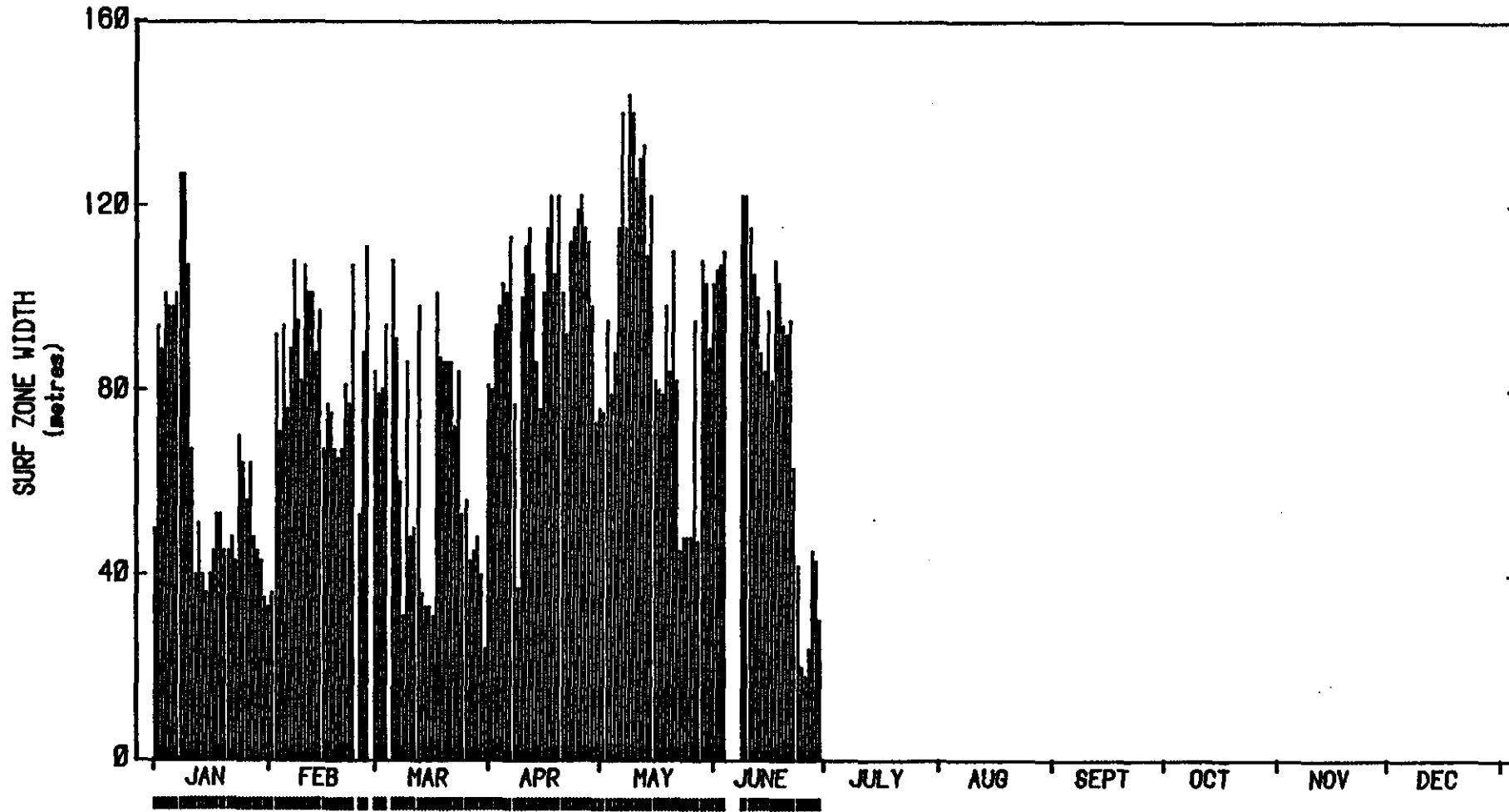
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Figure 12

C22.1



SURF ZONE WIDTH - MORNING 1987



SURF ZONE WIDTH SUMMARY - 1987

No. of Observations : 175

MORNING OBSERVATIONS

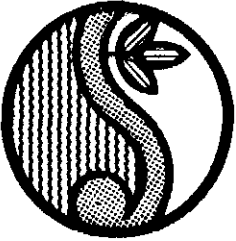
Mean Surf Zone Width = 81.3 m

■ Indicates Offshore Bar Present

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Figure 13

C22.1



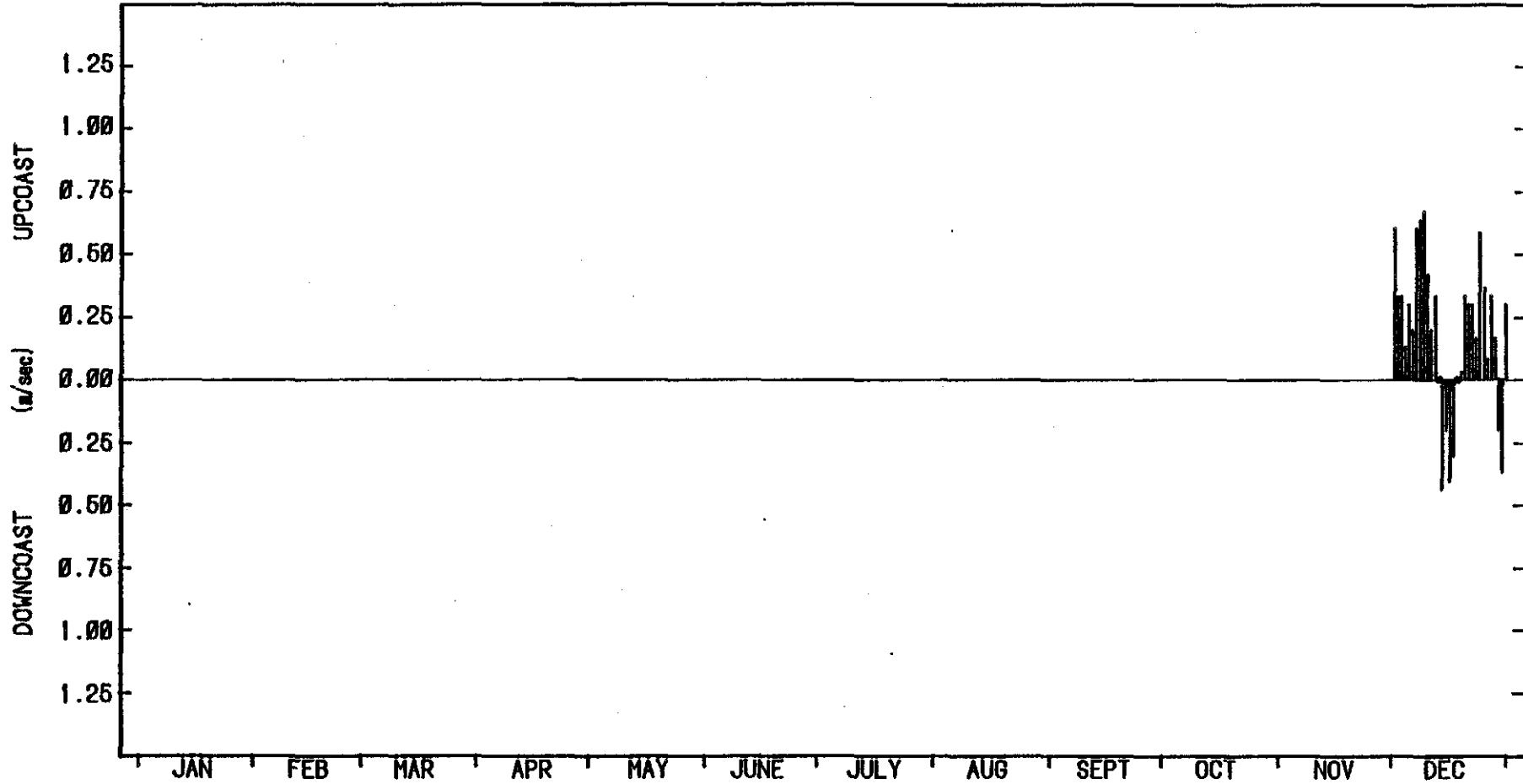
LITTORAL CURRENTS - MORNING 1980

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LITTORAL CURRENT SUMMARY - 1980

Mean Vel = .188 m/sec (up)

Mean Upcoast Vel = .336 m/sec

Mean Downcoast Vel = .317 m/sec

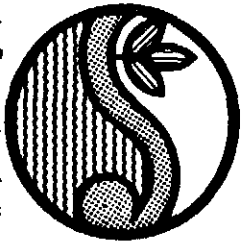
MORNING OBSERVATIONS - ( 31 recordings)

COPE

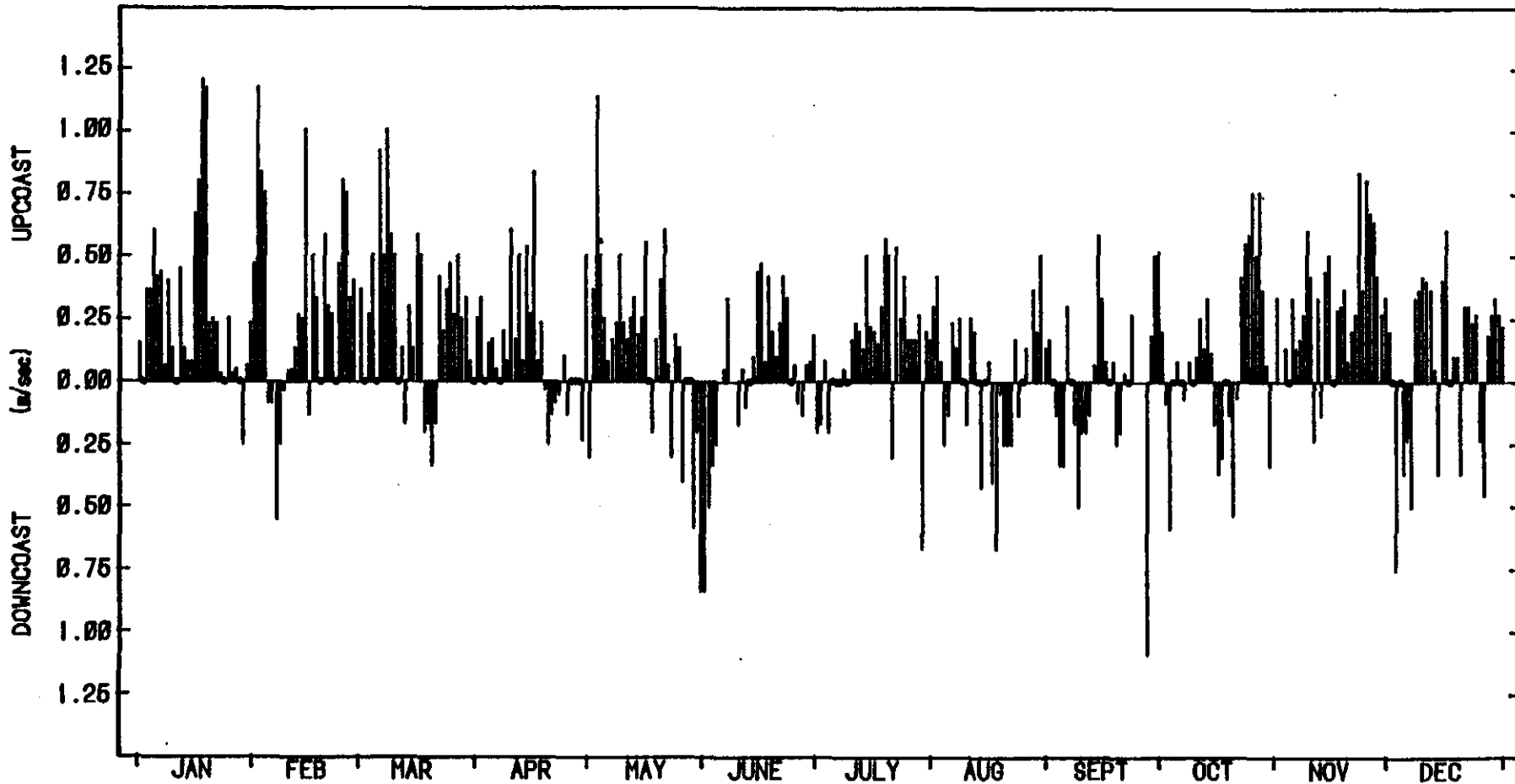
Burleigh Heads

Figure 1

C22.1



LITTORAL CURRENTS - MORNING 1981



LITTORAL CURRENT SUMMARY - 1981

Mean Vel = .149 m/sec (up)

Mean Upcoast Vel = .324 m/sec

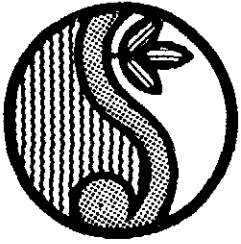
Mean Downcoast Vel = .282 m/sec

MORNING OBSERVATIONS - (356 recordings)

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Figure 15

C22.1



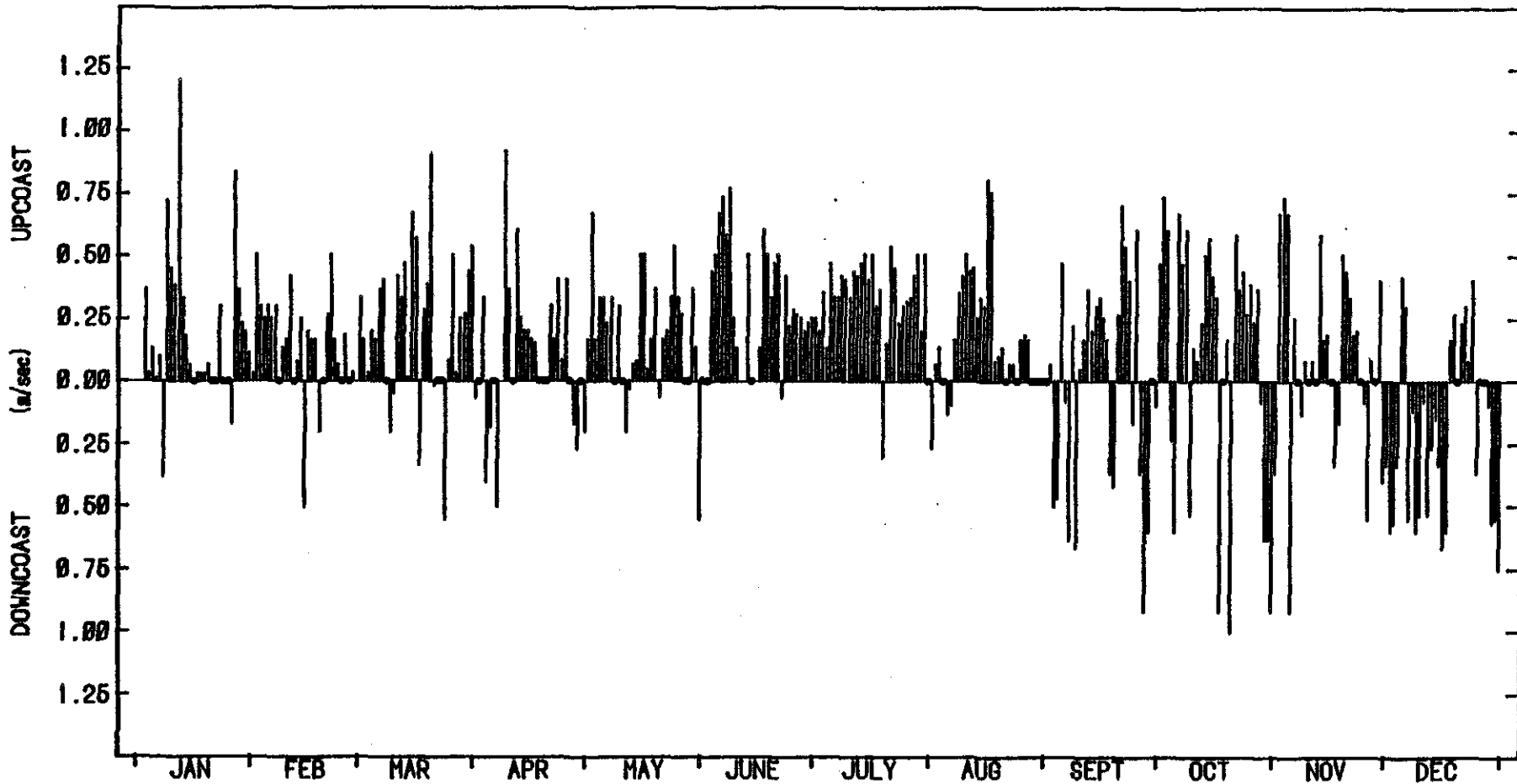
LITTORAL CURRENTS - MORNING 1982

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LITTORAL CURRENT SUMMARY - 1982

Mean Vel = .136 m/sec (up)

Mean Upcoast Vel = .325 m/sec

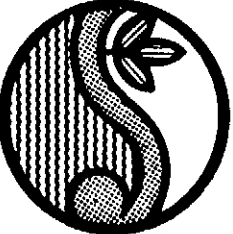
Mean Downcoast Vel = .382 m/sec

MORNING OBSERVATIONS - (359 recordings)

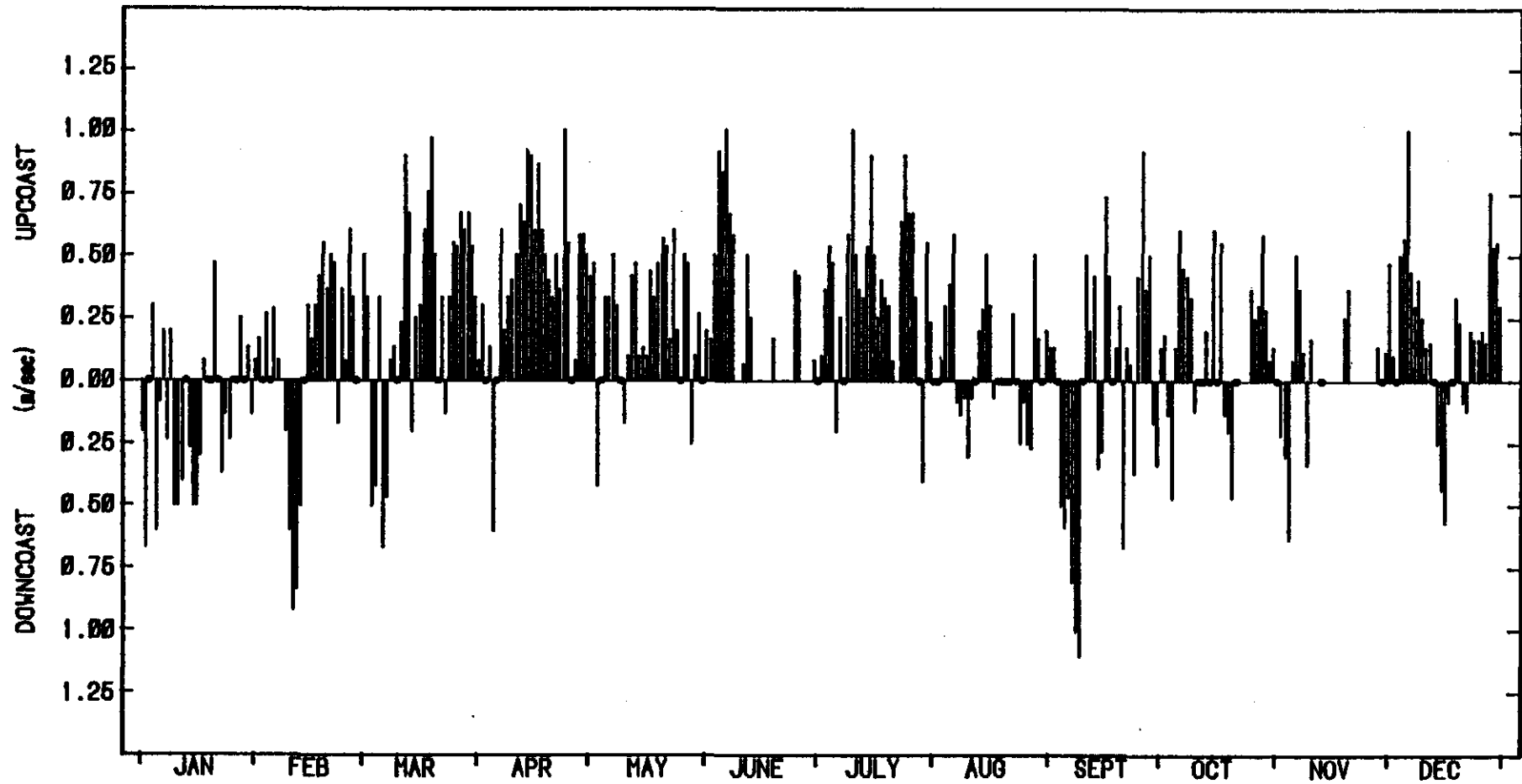
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Burleigh Heads

Figure 11

C22.1



LITTORAL CURRENTS - MORNING 1983



LITTORAL CURRENT SUMMARY - 1983

Mean Vel = .172 m/sec (up)

Mean Upcoast Vel = .391 m/sec

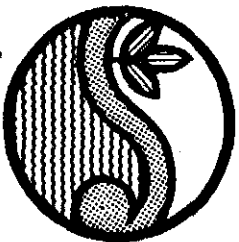
Mean Downcoast Vel = .361 m/sec

MORNING OBSERVATIONS - (331 recordings)

Figure 17  
C22.1

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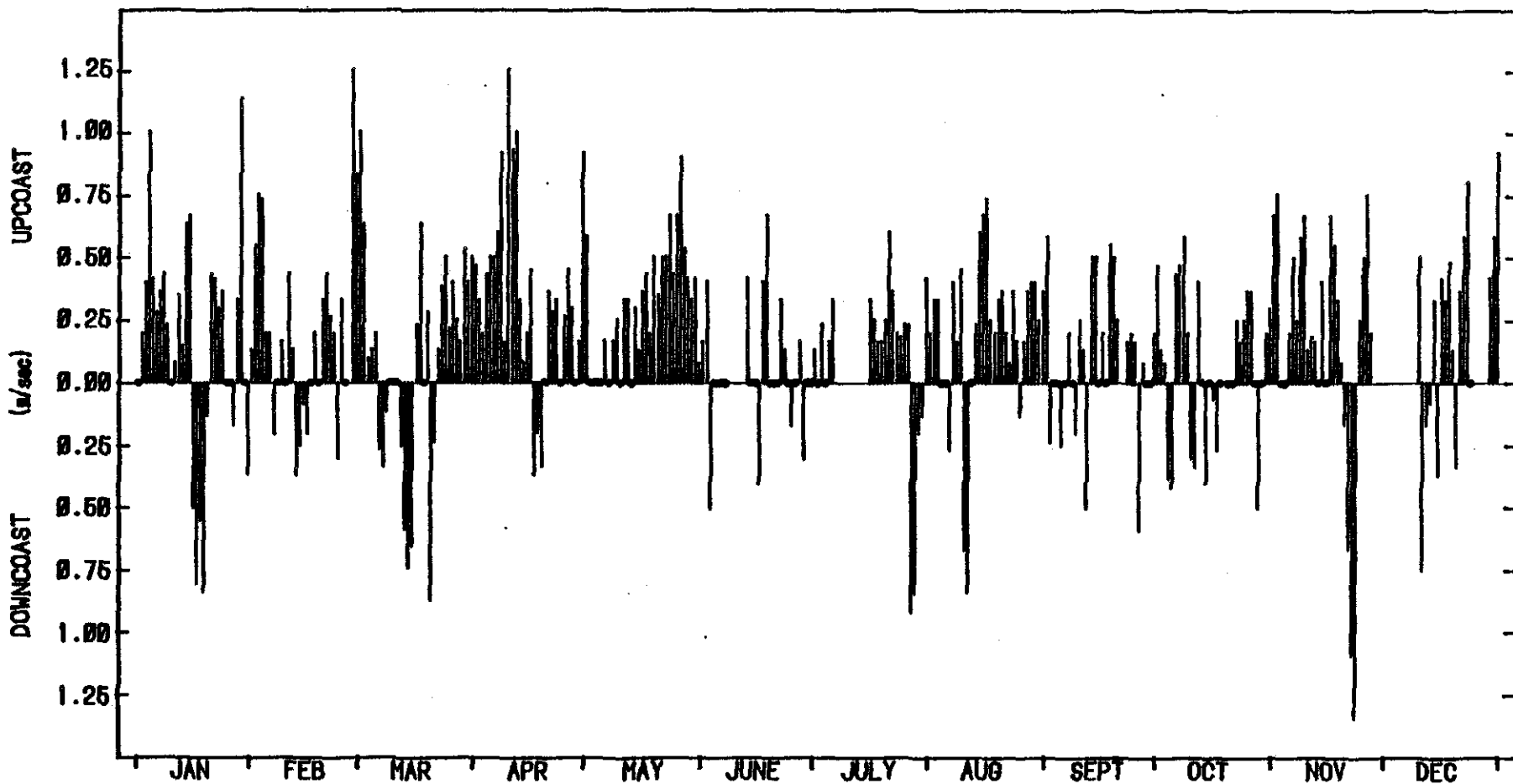
LITTORAL CURRENTS - MORNING 1984

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LITTORAL CURRENT SUMMARY - 1984

Mean Vel = .170 m/sec (up)

Mean Upcoast Vel = .383 m/sec

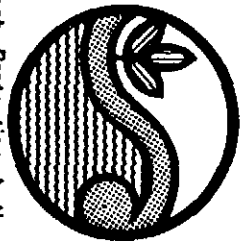
Mean Downcoast Vel = .414 m/sec

MORNING OBSERVATIONS - (332 recordings)

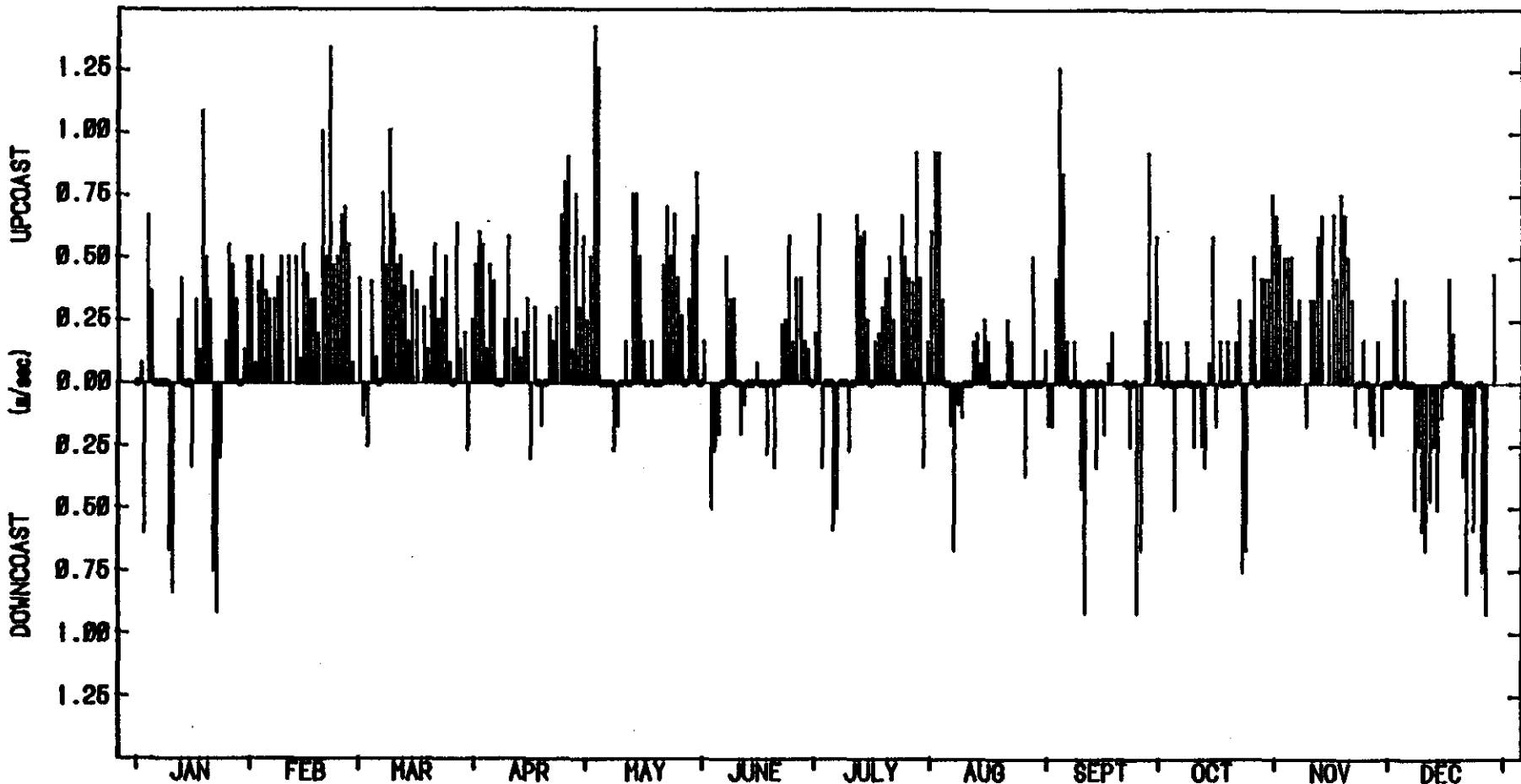
COPE  
Burleigh Hea

Figure 1

C22.1



LITTORAL CURRENTS - MORNING 1985



LITTORAL CURRENT SUMMARY - 1985

Mean Vel = .171 m/sec (up)

Mean Upcoast Vel = .420 m/sec

Mean Downcoast Vel = .396 m/sec

MORNING OBSERVATIONS - (352 recordings)

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Figure 19

C22.1



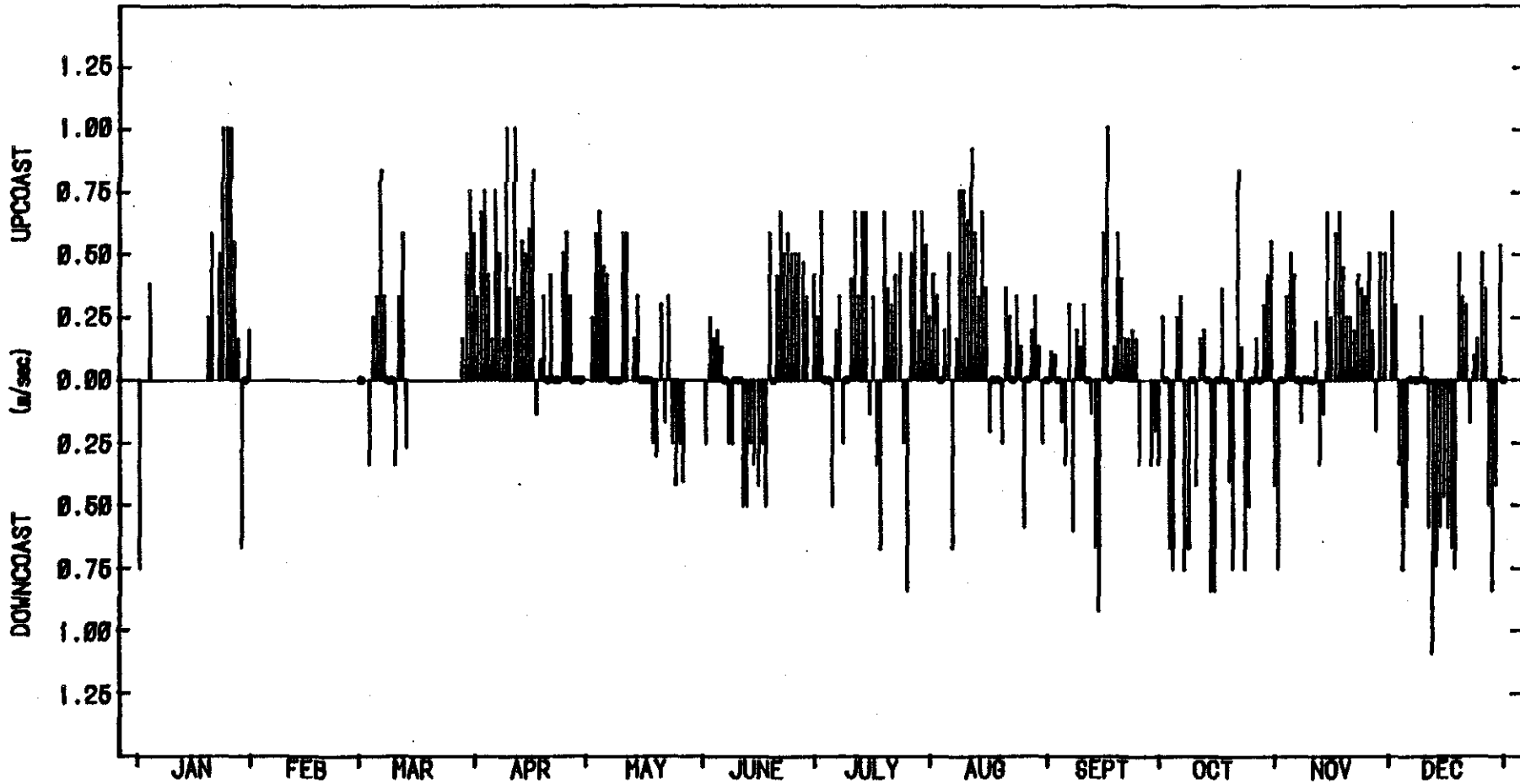
LITTORAL CURRENTS - MORNING 1986

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LITTORAL CURRENT SUMMARY - 1986

Mean Vel = .121 m/sec (up)

Mean Upcoast Vel = .424 m/sec

Mean Downcoast Vel = .457 m/sec

MORNING OBSERVATIONS - (292 recordings)

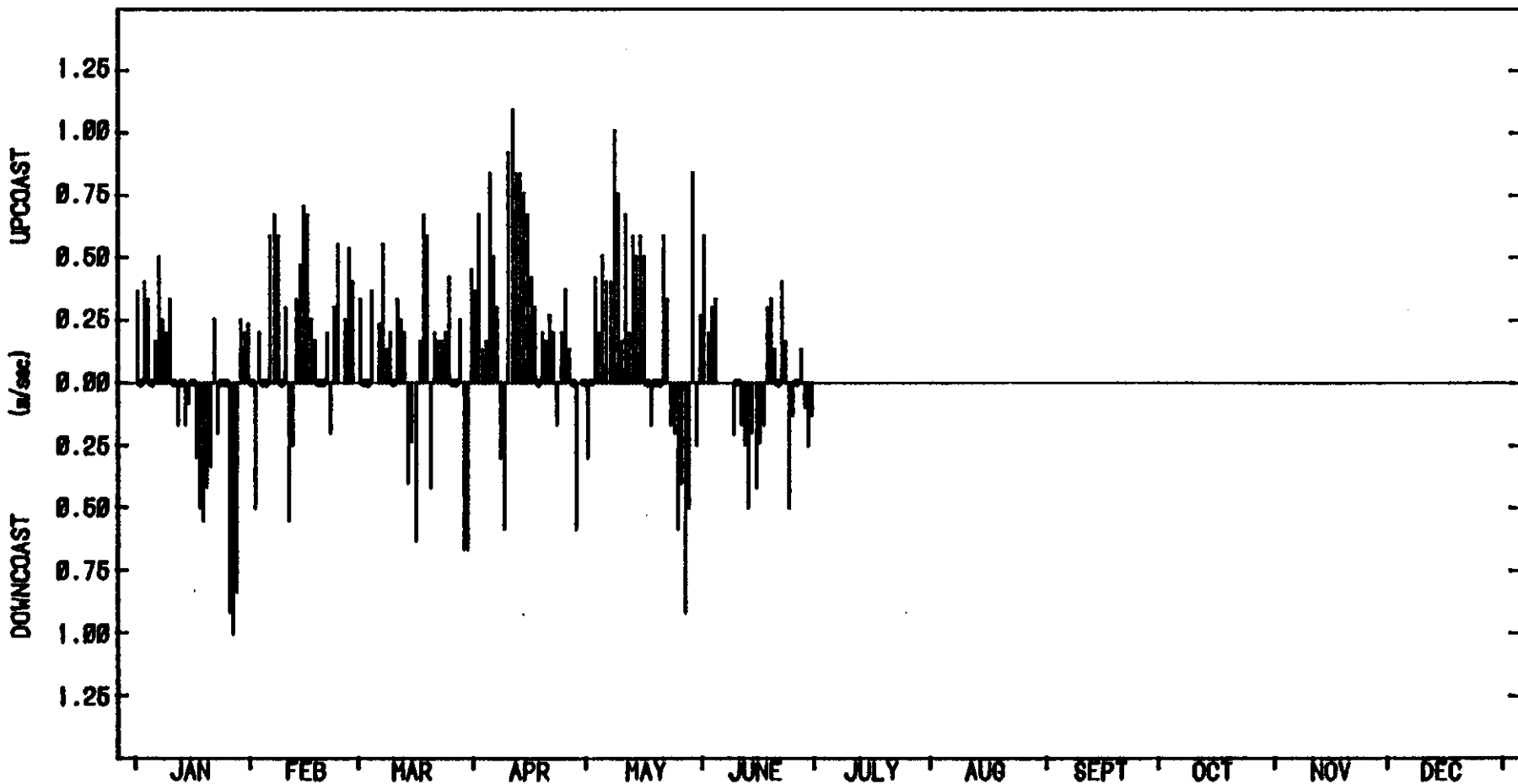
COPE  
Burleigh Head

Figure 21

C22.1



LITTORAL CURRENTS - MORNING 1987



LITTORAL CURRENT SUMMARY - 1987

Mean Vel = .116 m/sec (up)

Mean Upcoast Vel = .394 m/sec

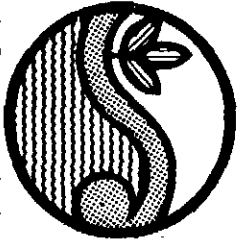
Mean Downcoast Vel = .382 m/sec

MORNING OBSERVATIONS - (174 recordings)

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Figure 21

C22.1



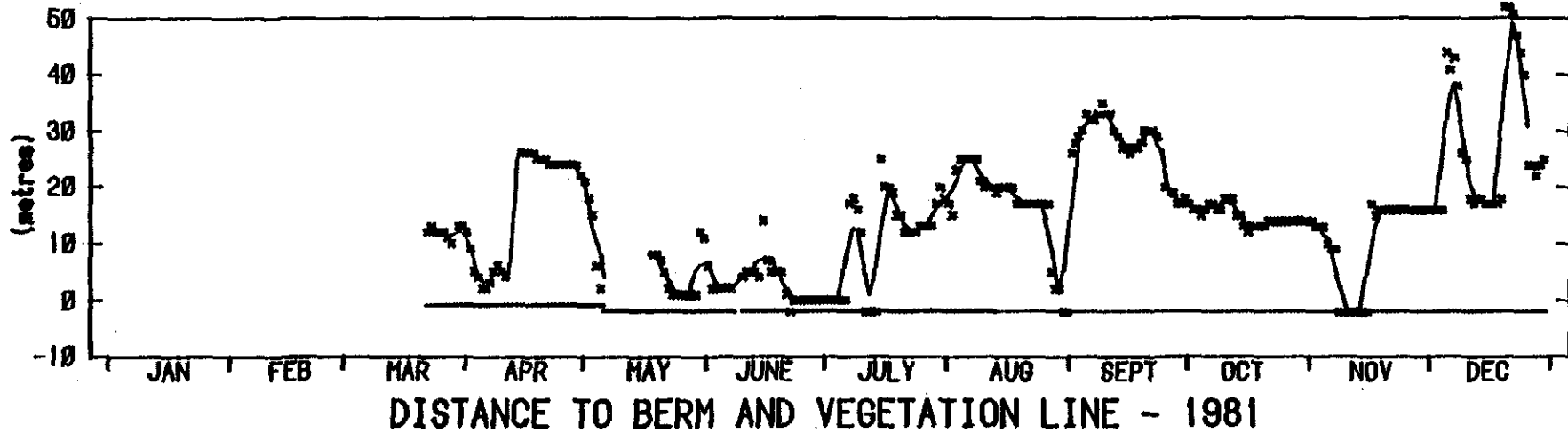
BEACH PROFILE PARAMETERS - 1981

COPE - Coastal Observation Programme Engineering

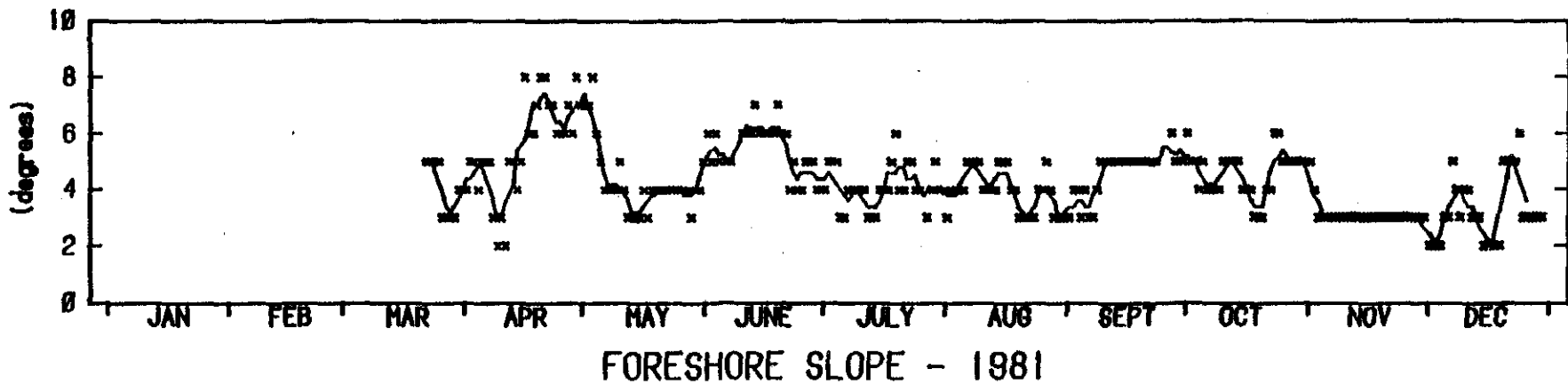
GOLD COAST CITY

BURLEIGH HEADS

0106

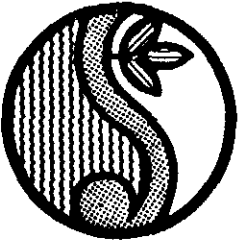


x x x x Indicates Distance to Berm : 263 Observations  
 — Indicates Distance to Vegetation Line : 278 Observations



Five Day Moving Average

No. of Observations : 277



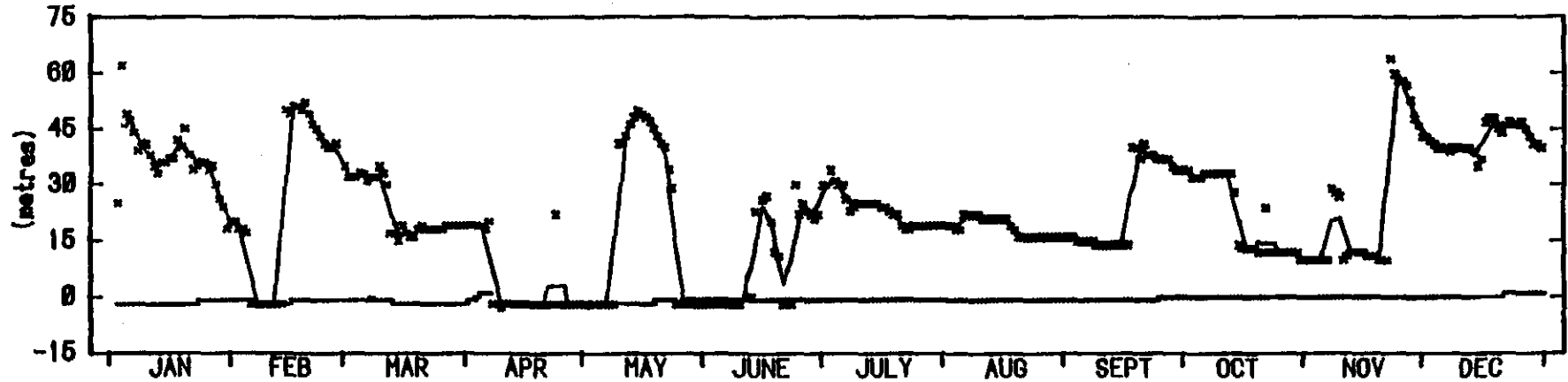
COPE - Coastal Observation  
Programme Engineering

GOLD COAST CITY

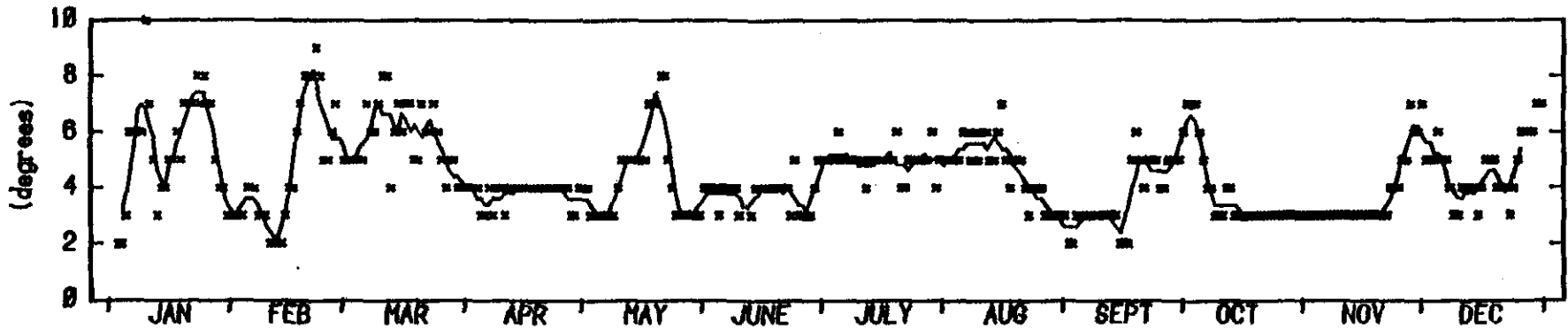
BURLEIGH HEADS

0106

BEACH PROFILE PARAMETERS - 1982



■ Indicates Distance to Berm : 361 Observations  
 — Indicates Distance to Vegetation Line : 361 Observations



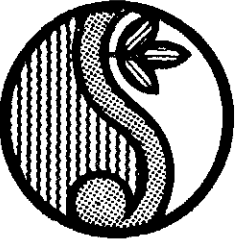
— Five Day Moving Average

No. of Observations : 359

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Burleigh Heads

Figure 23

C22.1



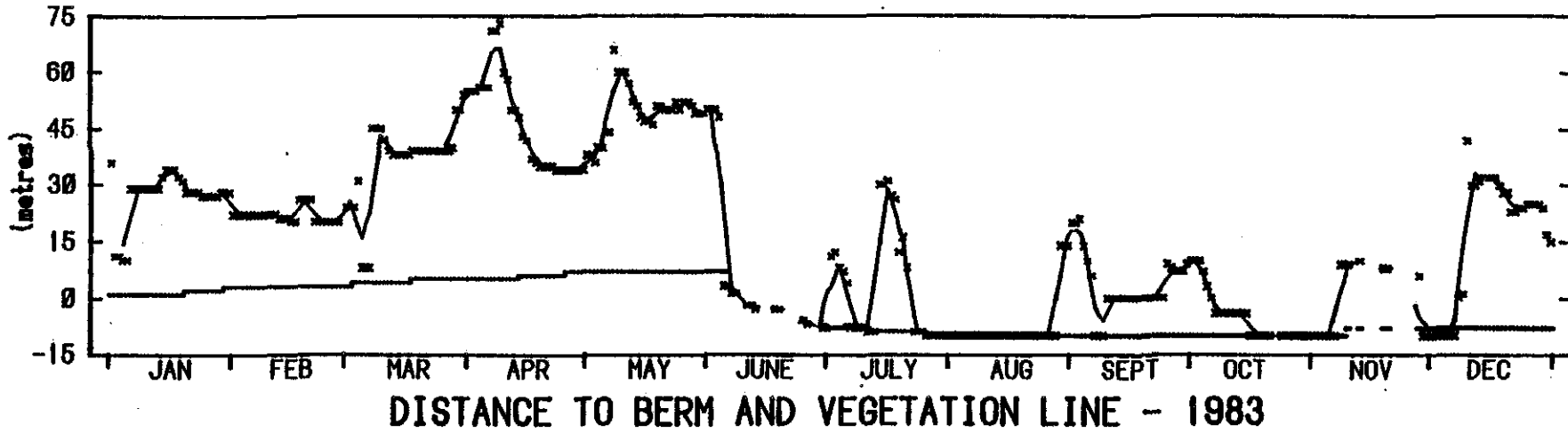
COPE - Coastal Observation  
Programme Engineering

GOLD COAST CITY

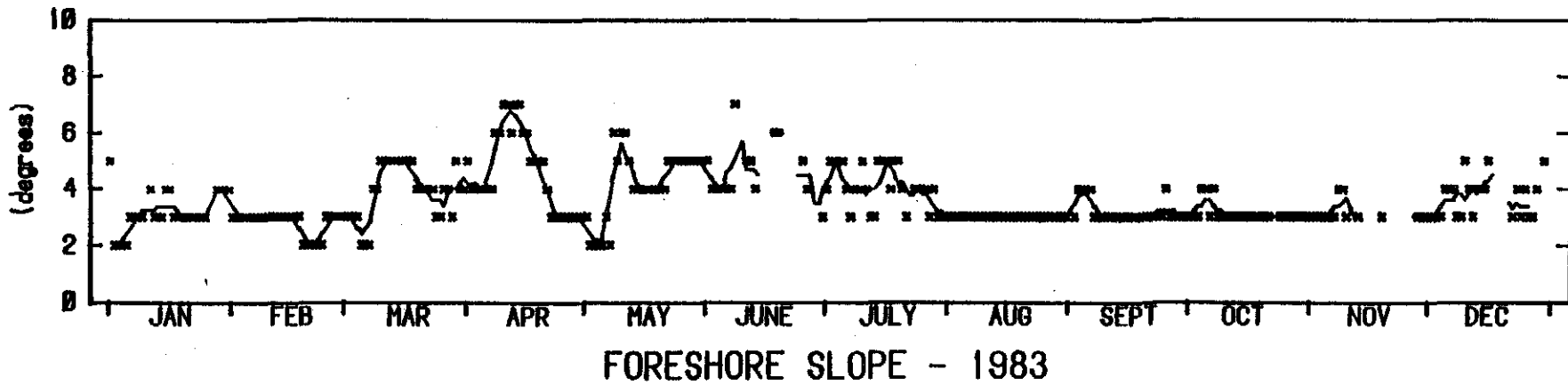
BURLEIGH HEADS

0106

BEACH PROFILE PARAMETERS - 1983



--- Indicates Distance to Berm : 334 Observations  
 — Indicates Distance to Vegetation Line : 334 Observations

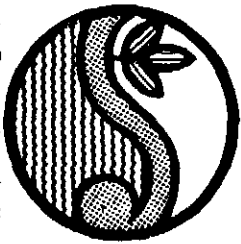


∩ Five Day Moving Average

No. of Observations : 321

Figure 24  
C22.1

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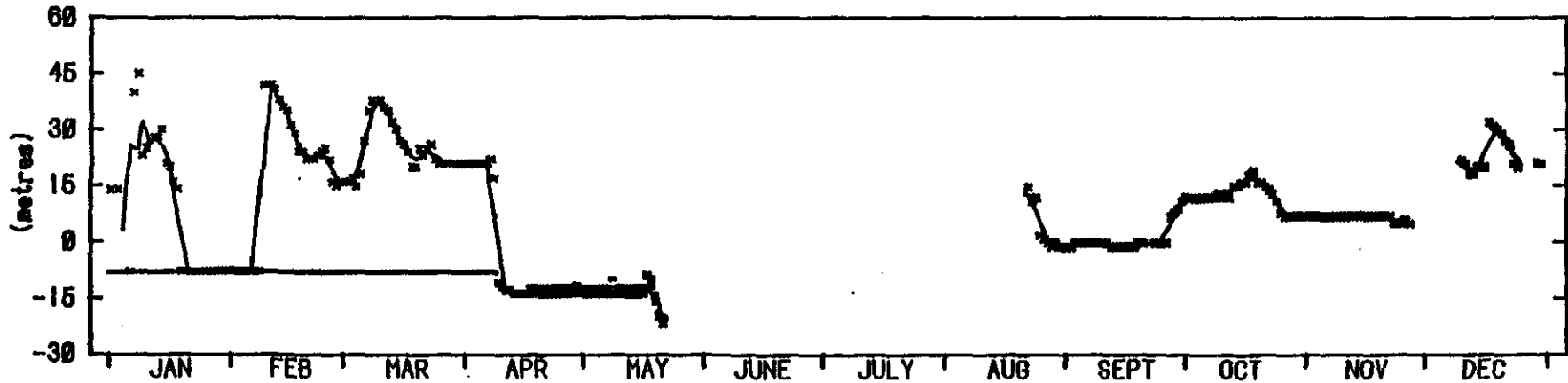


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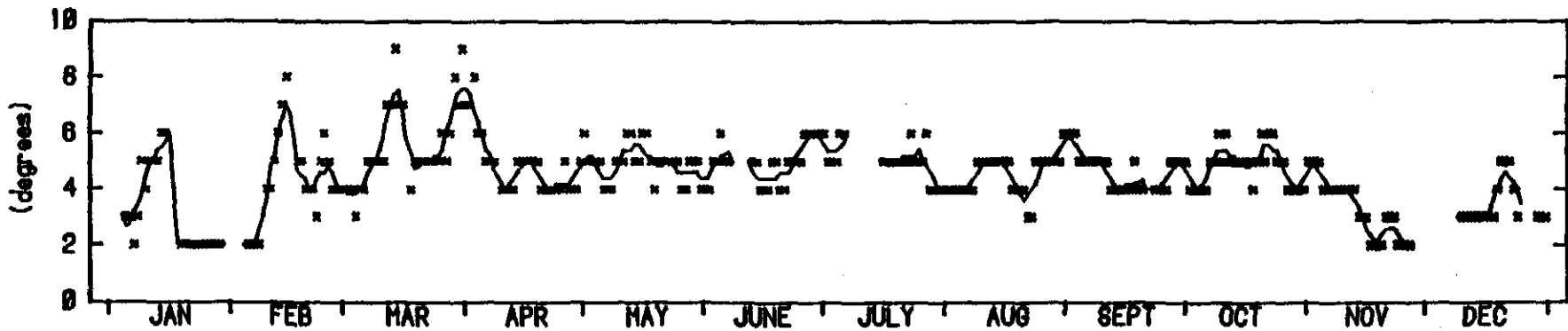
BURLEIGH HEADS

0106



DISTANCE TO BERM AND VEGETATION LINE - 1984

----- Indicates Distance to Berm : 252 Observations  
 ———— Indicates Distance to Vegetation Line : 143 Observations



FORESHORE SLOPE - 1984

— Five Day Moving Average

No. of Observations : 316

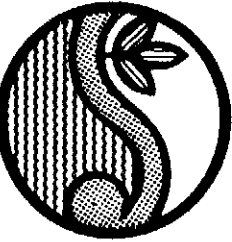
BEACH PROFILE PARAMETERS - 1984

COPE  
Burleigh Heads

Figure 25

C22.1





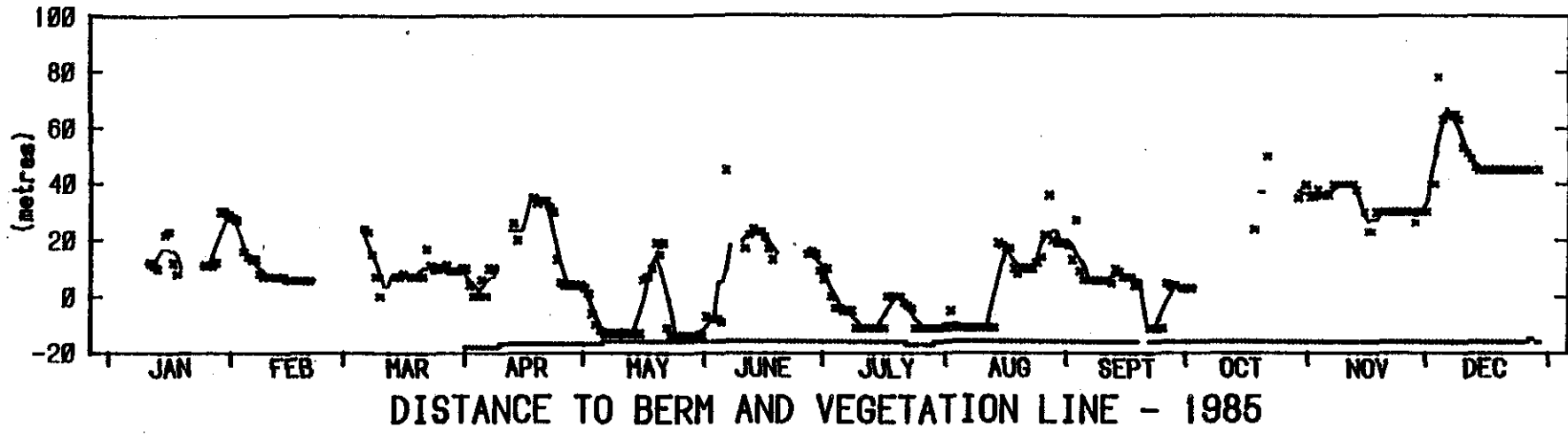
COPE - Coastal Observation Programme Engineering

GOLD COAST CITY

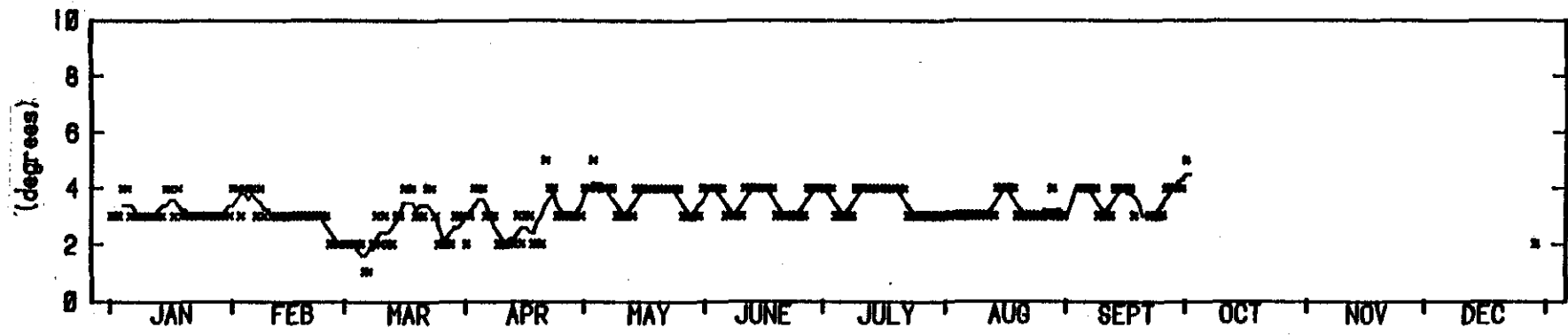
BURLEIGH HEADS

0106

BEACH PROFILE PARAMETERS - 1985



x x x x x Indicates Distance to Berm : 276 Observations  
 — Indicates Distance to Vegetation Line : 265 Observations



Five Day Moving Average

No. of Observations : 265

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 Burleigh Heads  
 Figure 26  
 C22.1



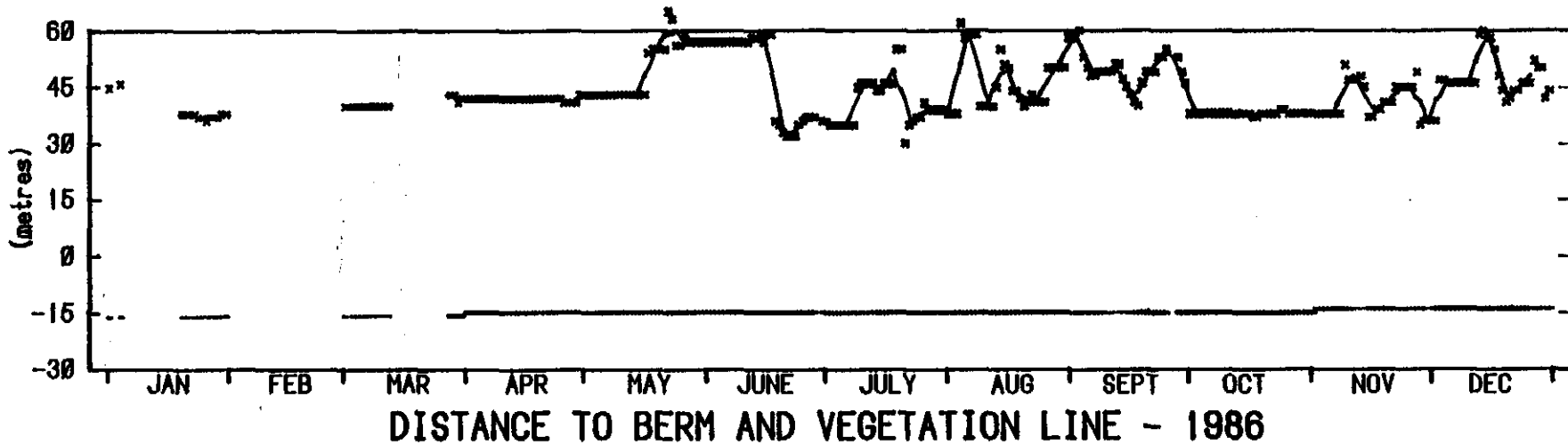
BEACH PROFILE PARAMETERS - 1986

COPE - Coastal Observation Programme Engineering

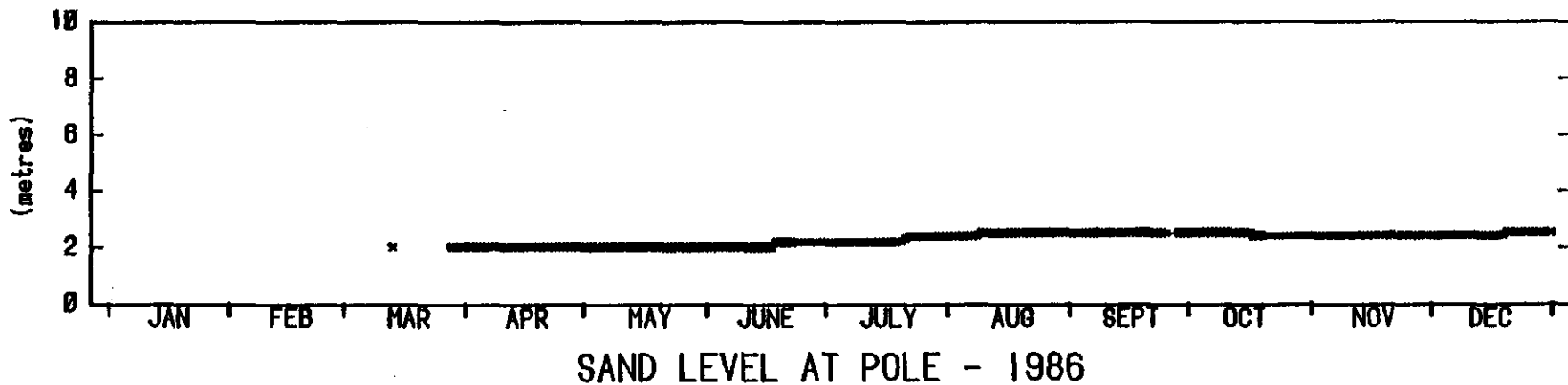
GOLD COAST CITY

BURLEIGH HEADS

0106



xxxx Indicates Distance to Berm : 276 Observations  
 — Indicates Distance to Vegetation Line : 276 Observations



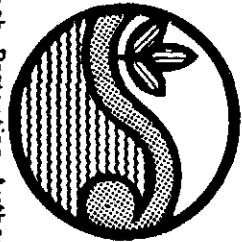
Five Day Moving Average

No. of Observations : 276

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Figure 27

C22.1



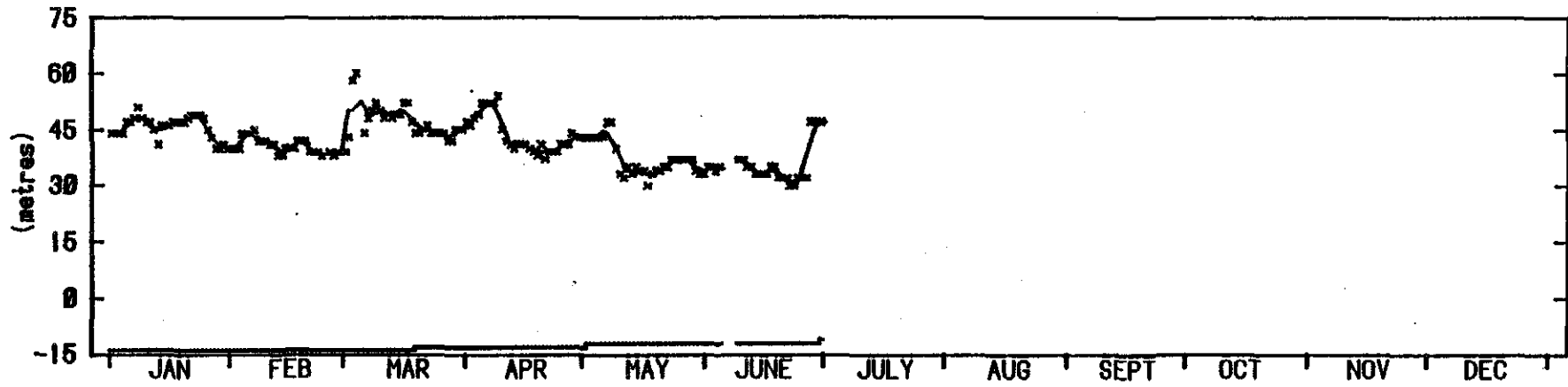
BEACH PROFILE PARAMETERS - 1987

COPE - Coastal Observation Programme Engineering

GOLD COAST CITY

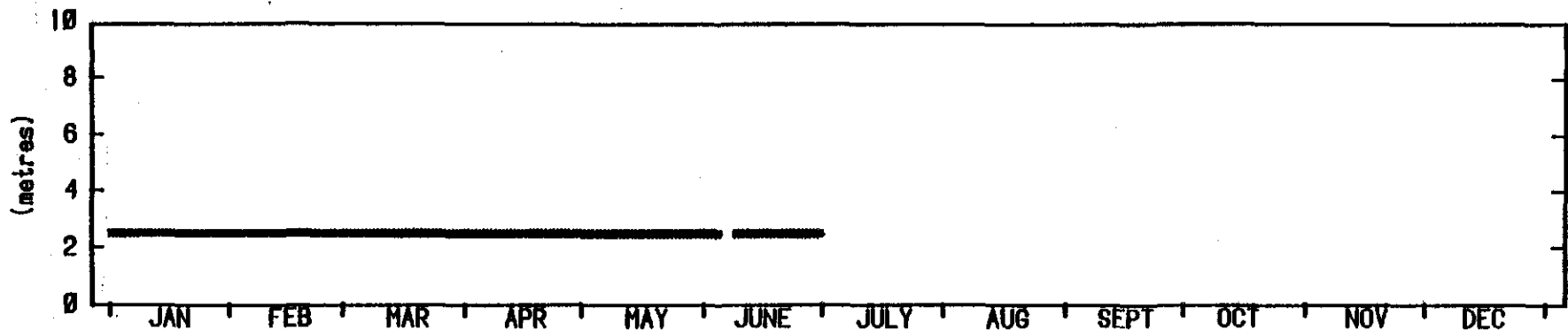
BURLEIGH HEADS

0106



DISTANCE TO BERM AND VEGETATION LINE - 1987

 Indicates Distance to Bera : 175 Observations  
 Indicates Distance to Vegetation Line : 176 Observations



SAND LEVEL AT POLE - 1987

 Five Day Moving Average

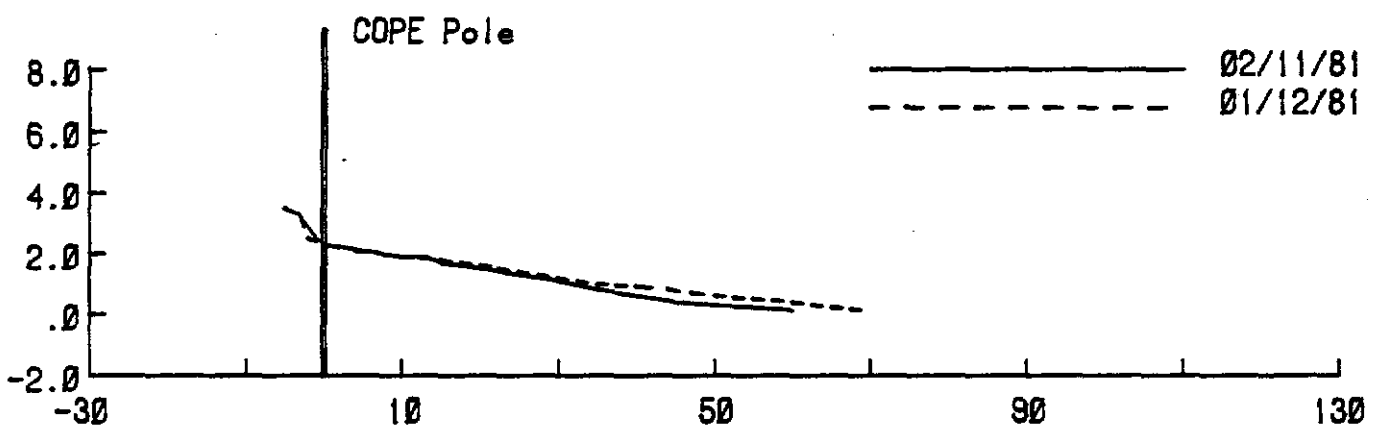
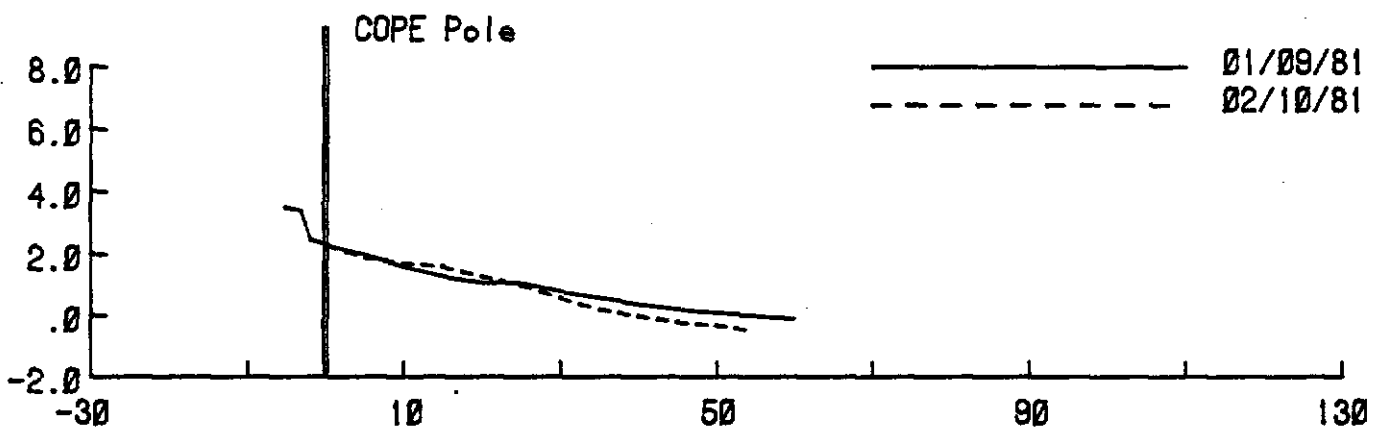
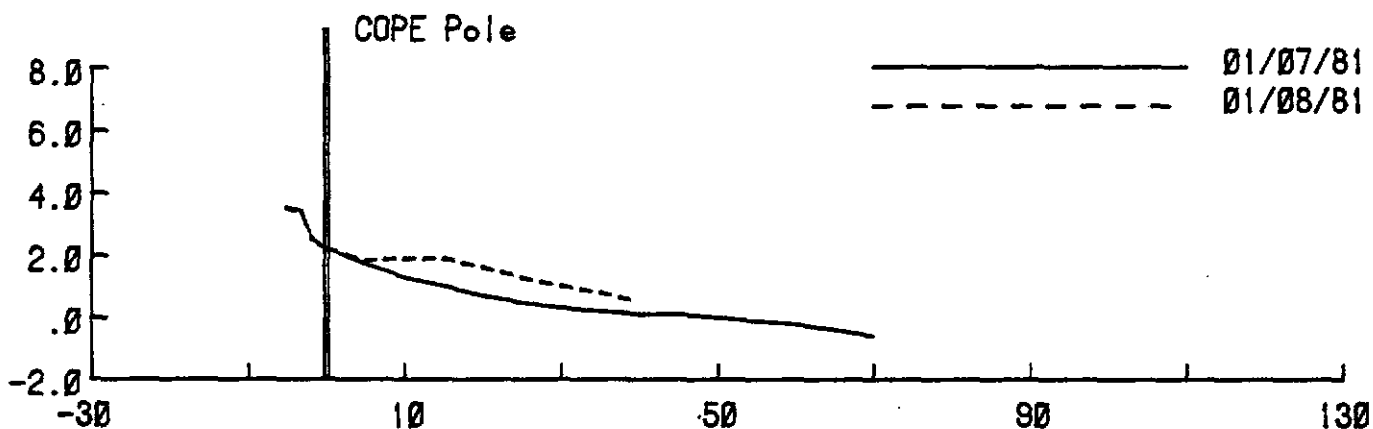
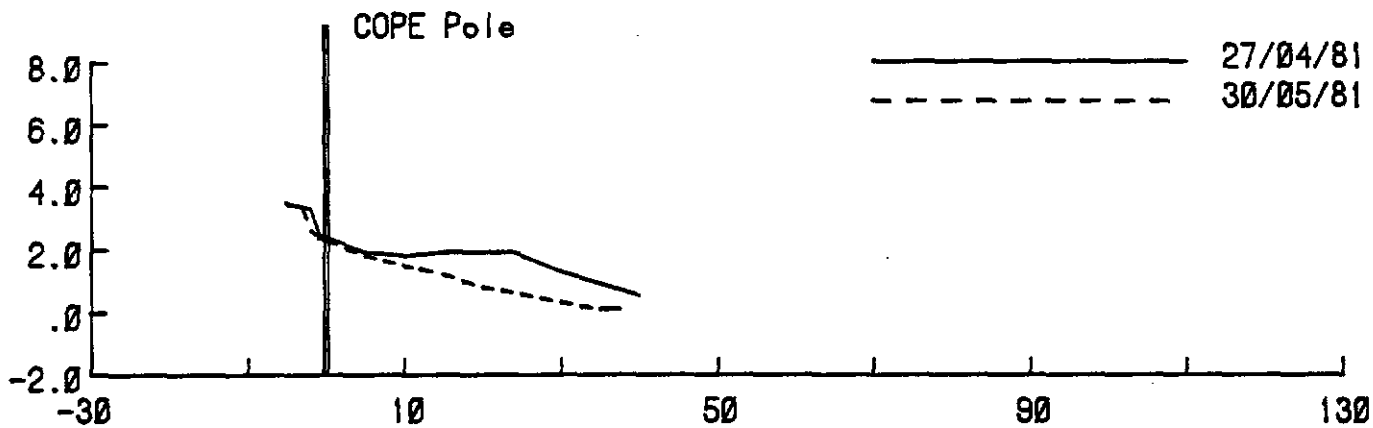
No. of Observations : 176

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Burleigh Heads

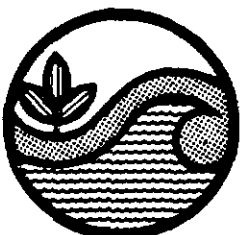
Figure 28

C22.1



Level Datum is A.H.D.

Distances and Levels are measured in Metres



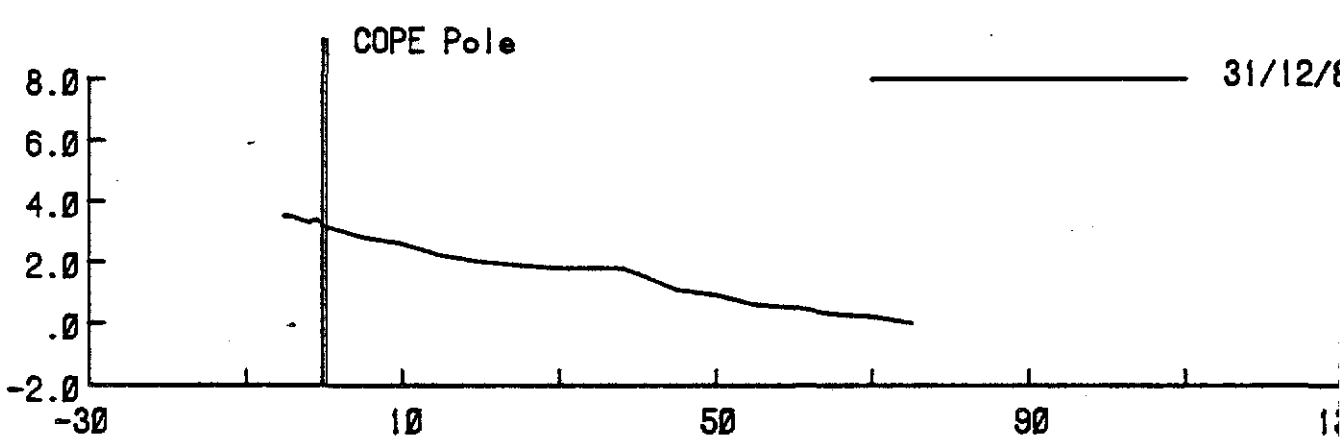
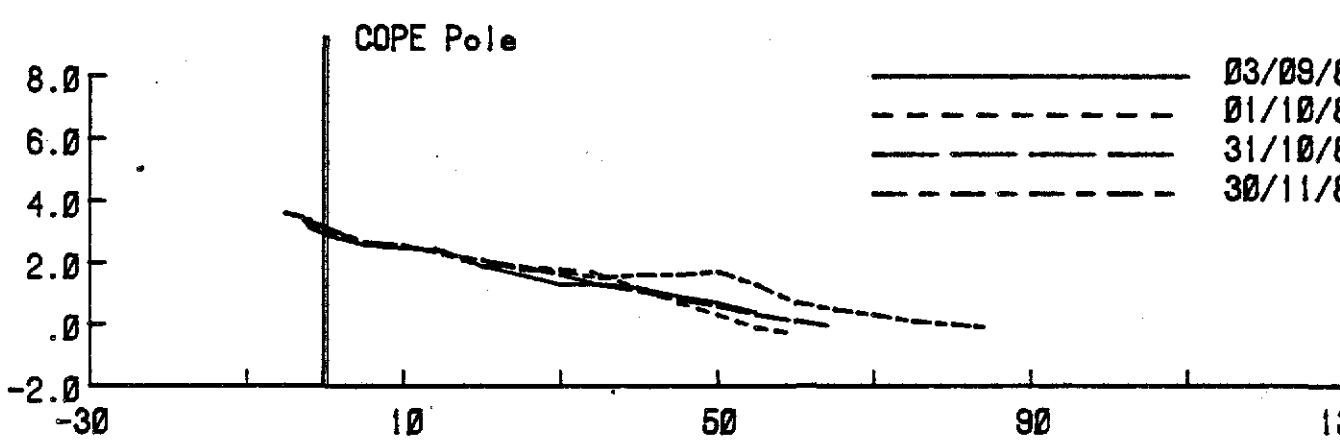
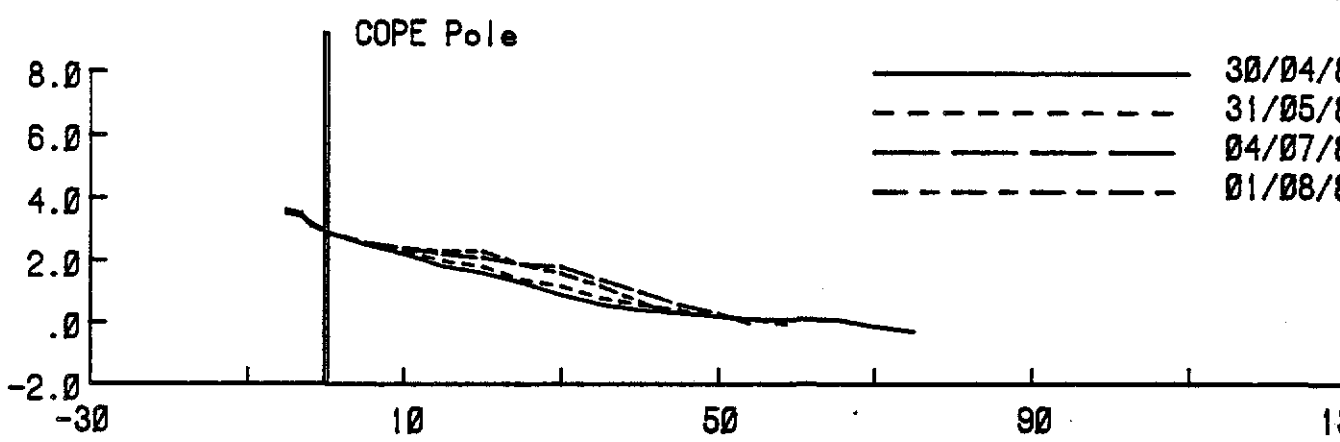
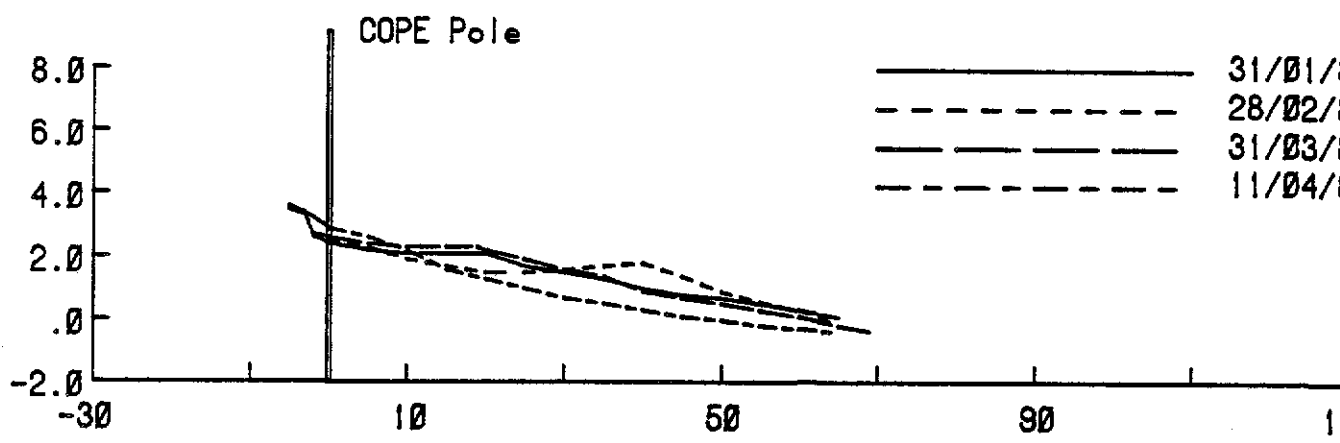
Beach Protection Authority

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Burleigh Heads

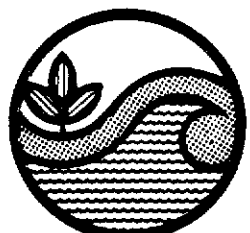
Figure 29

C22.1



Level Datum is A.H.D.

Distances and Levels are measured in Metres



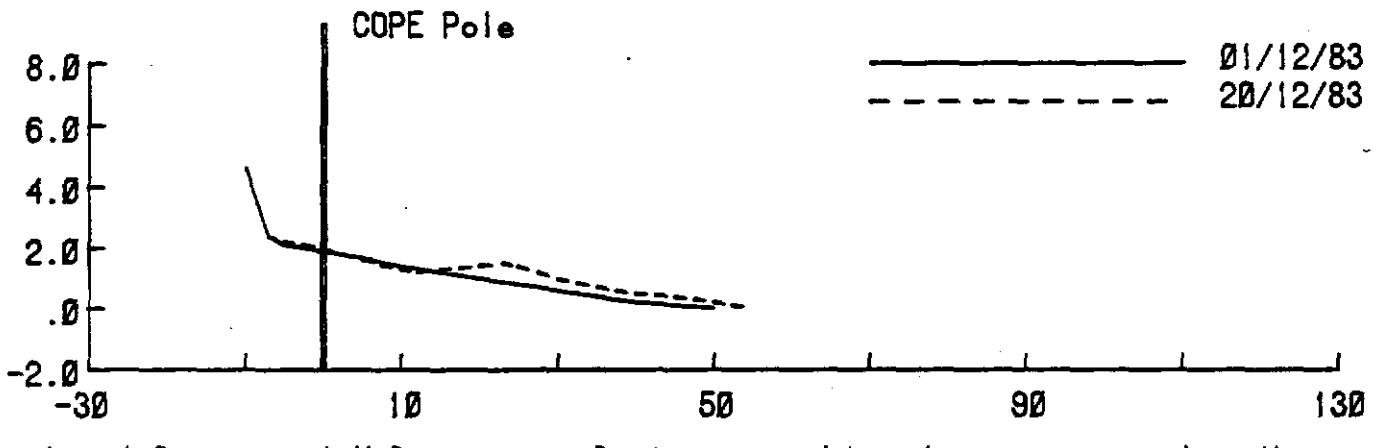
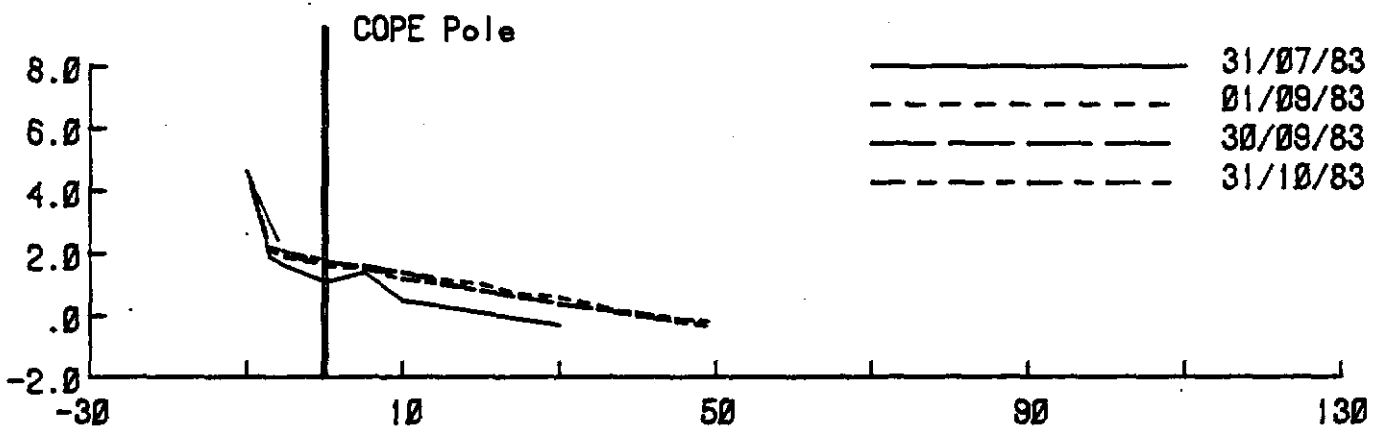
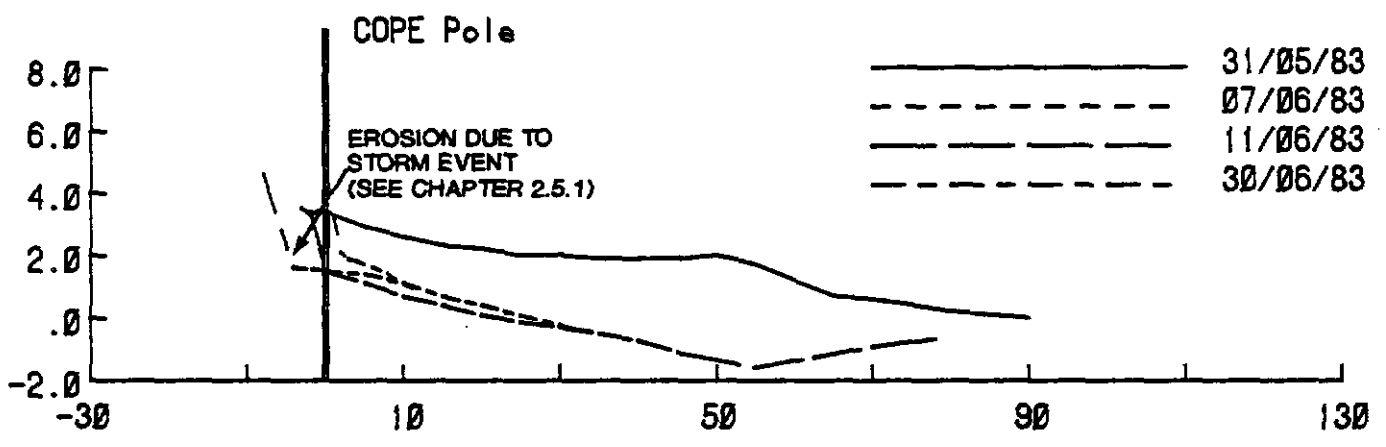
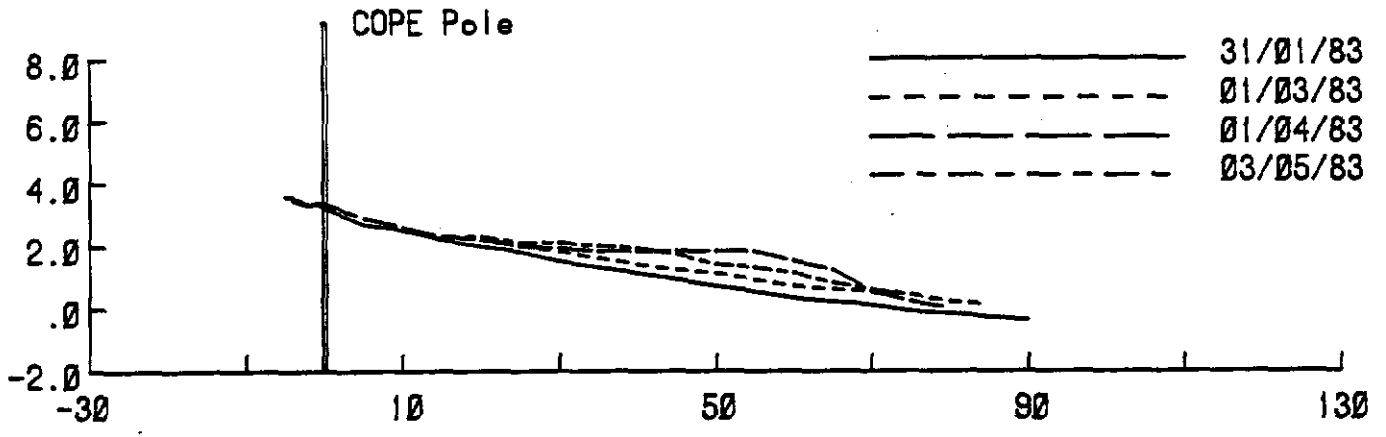
Beach Protection Authority

MONTHLY BEACH PROFILES

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Burleigh Head

Figure 30

C22.1



Level Datum is A.H.D.

Distances and Levels are measured in Metres



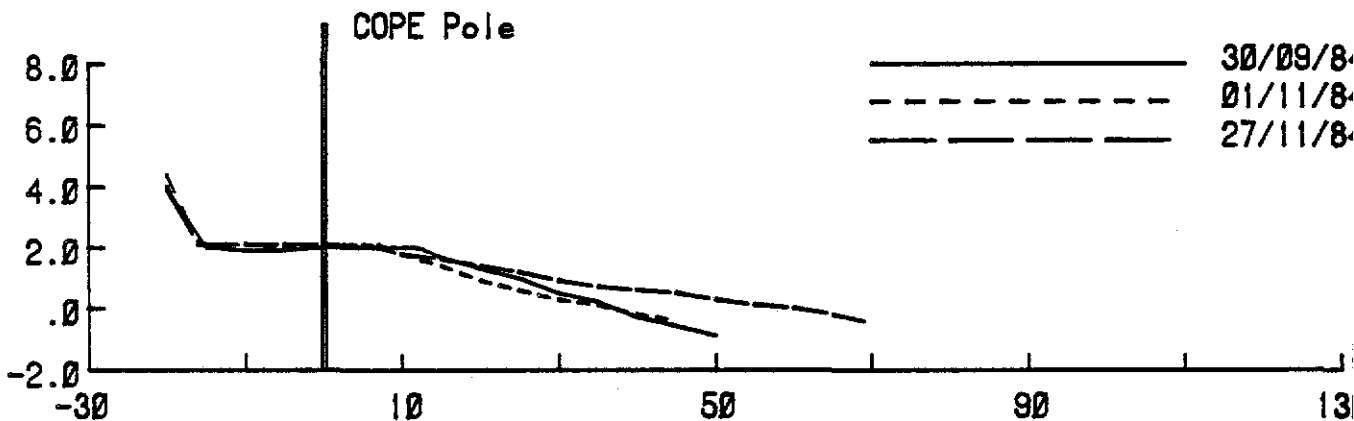
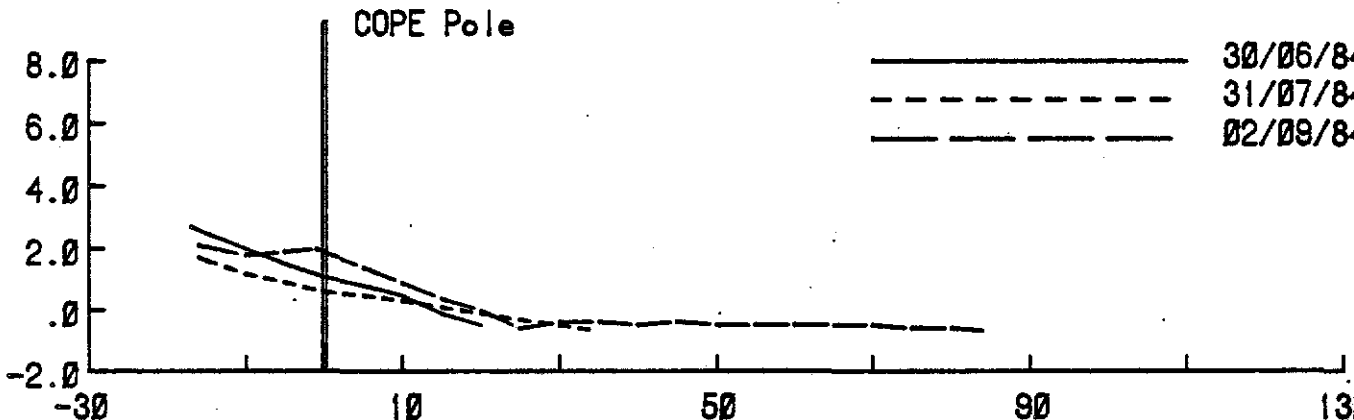
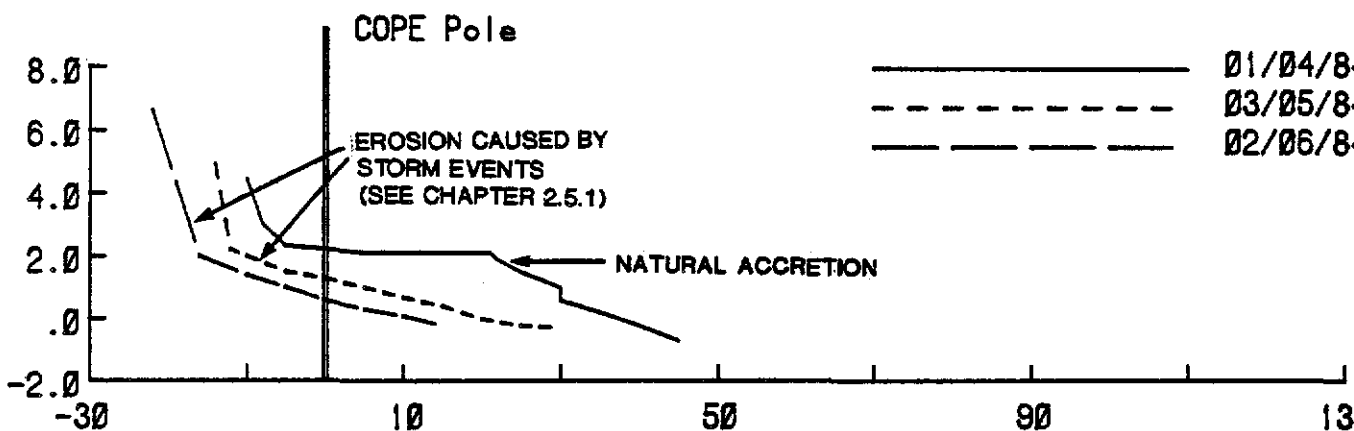
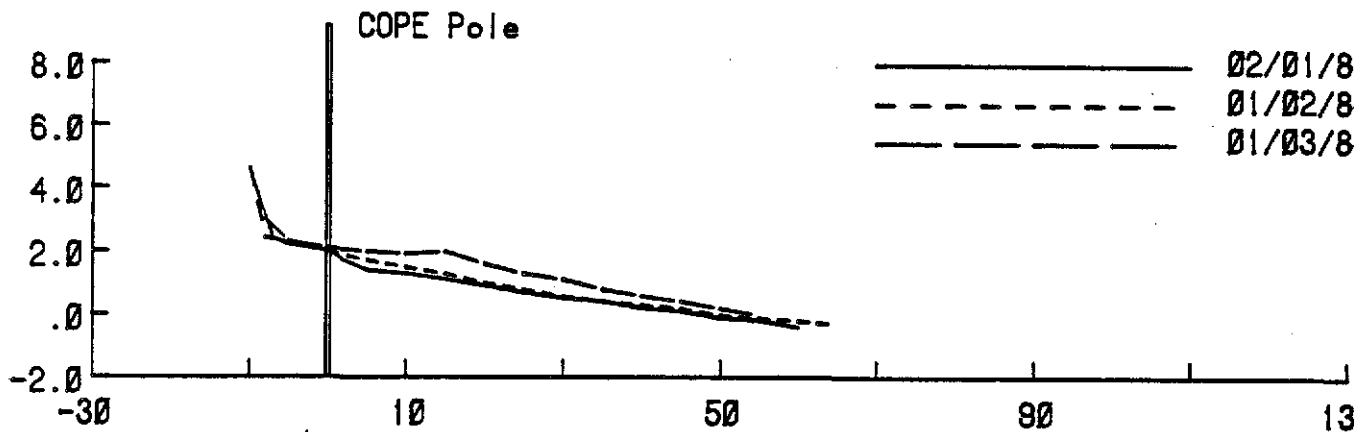
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Burleigh Heads

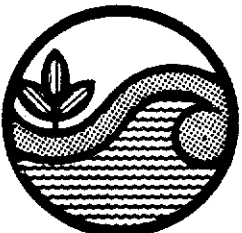
Figure 31

C22.1



Level Datum is A.H.D.

Distances and Levels are measured in Metres

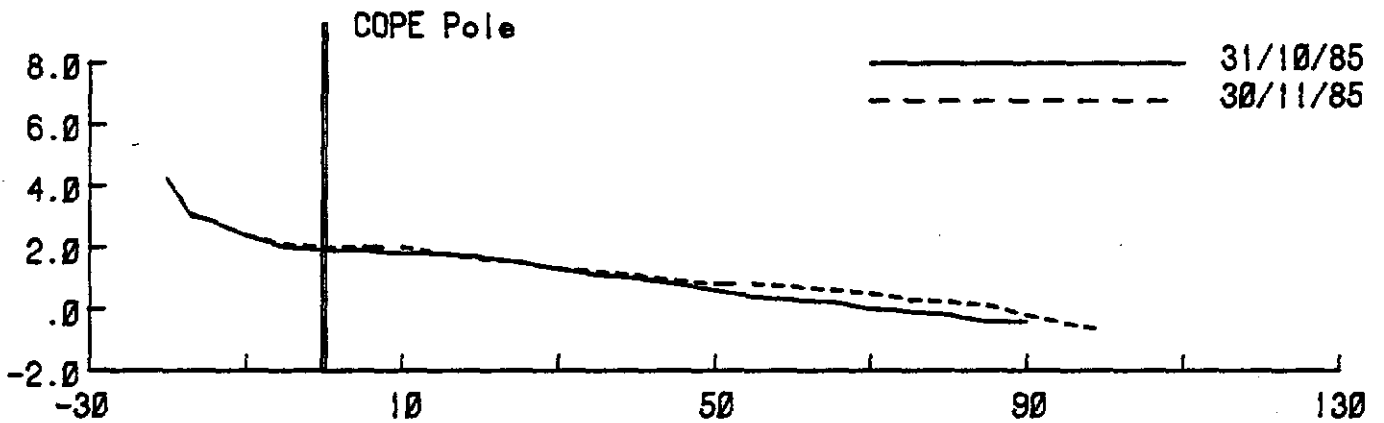
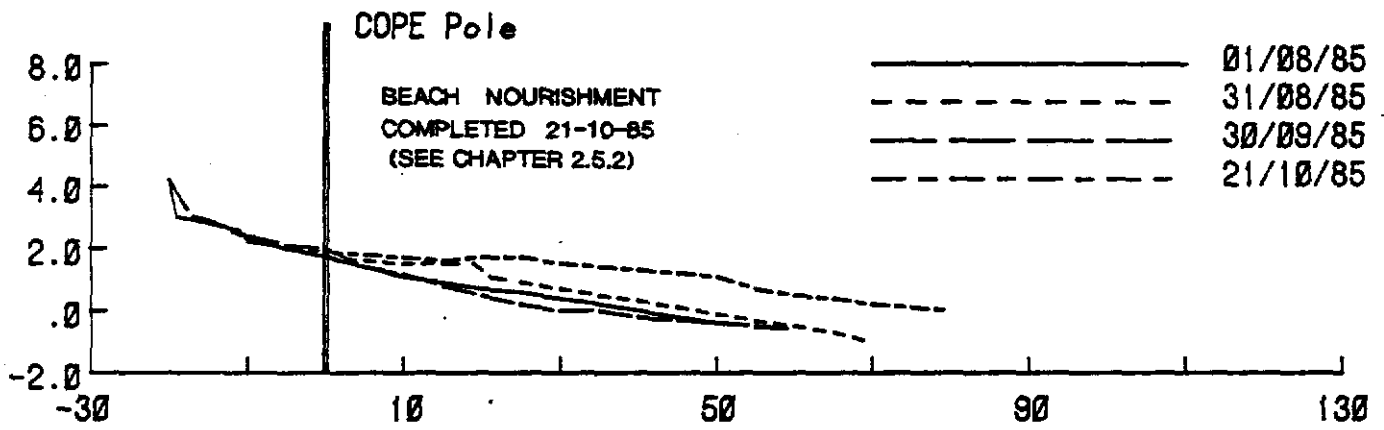
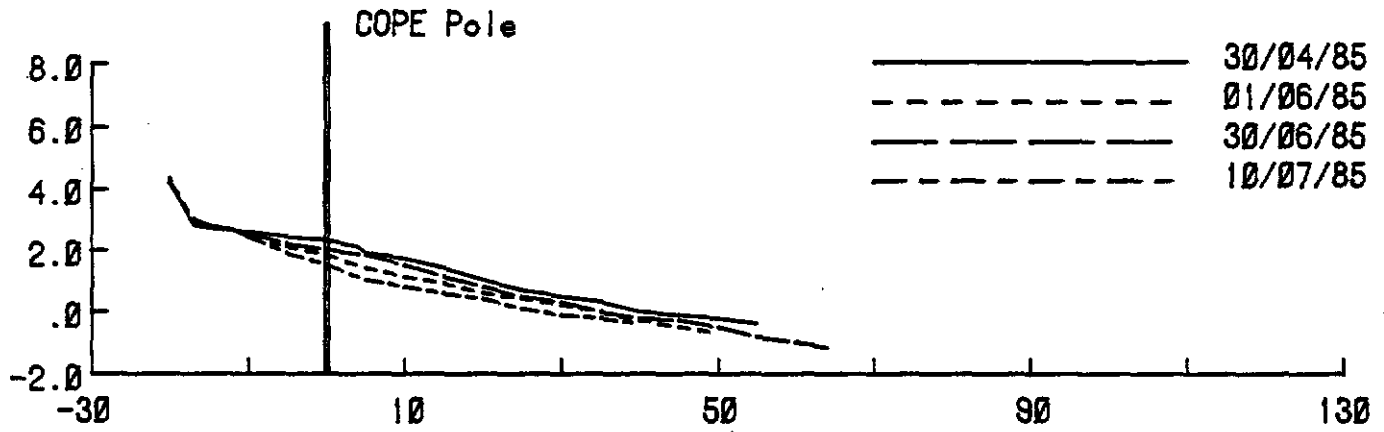
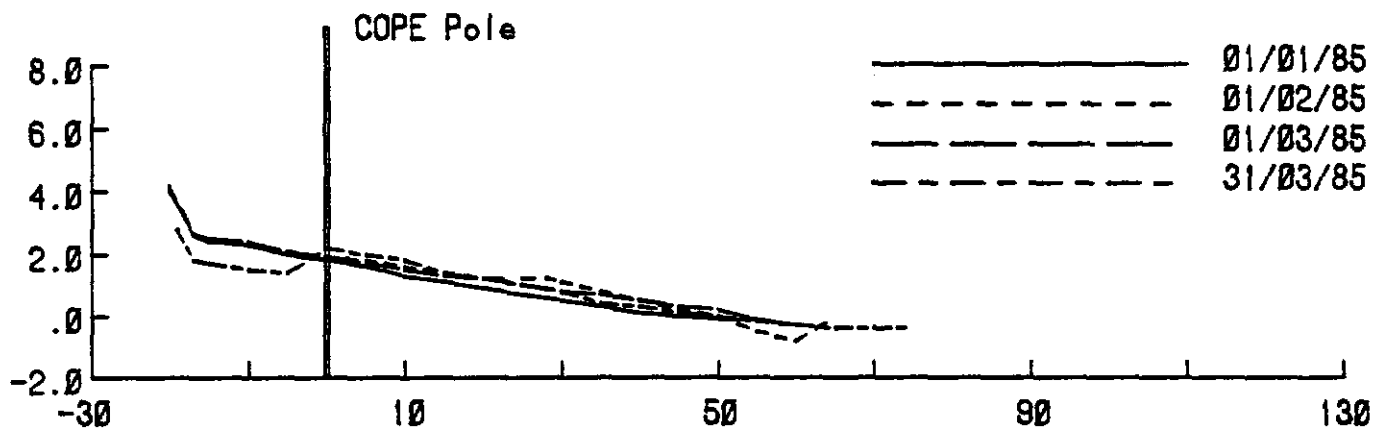


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Figure 32  
C22.1



Level Datum is A.H.D.

Distances and Levels are measured in Metres



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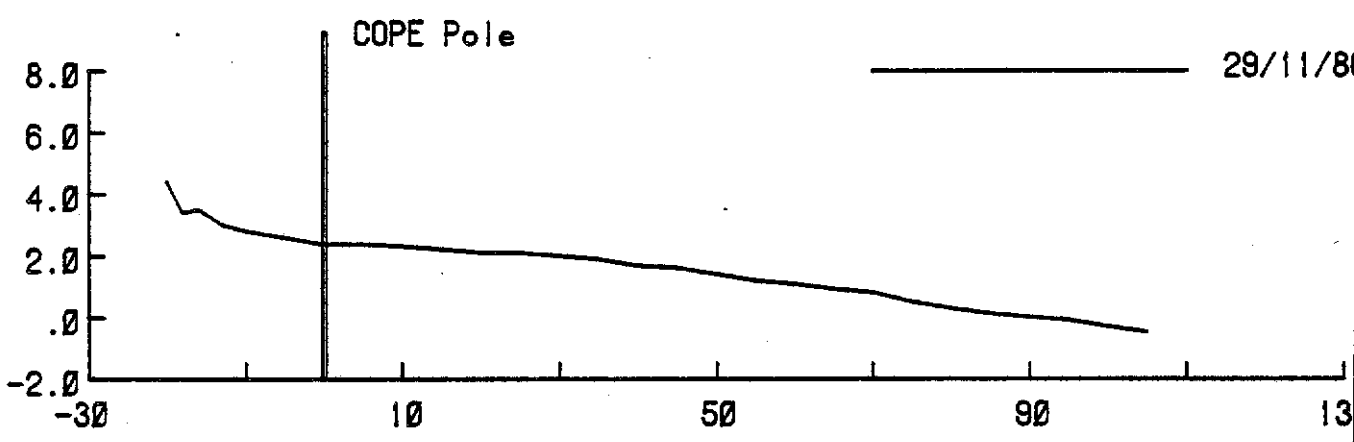
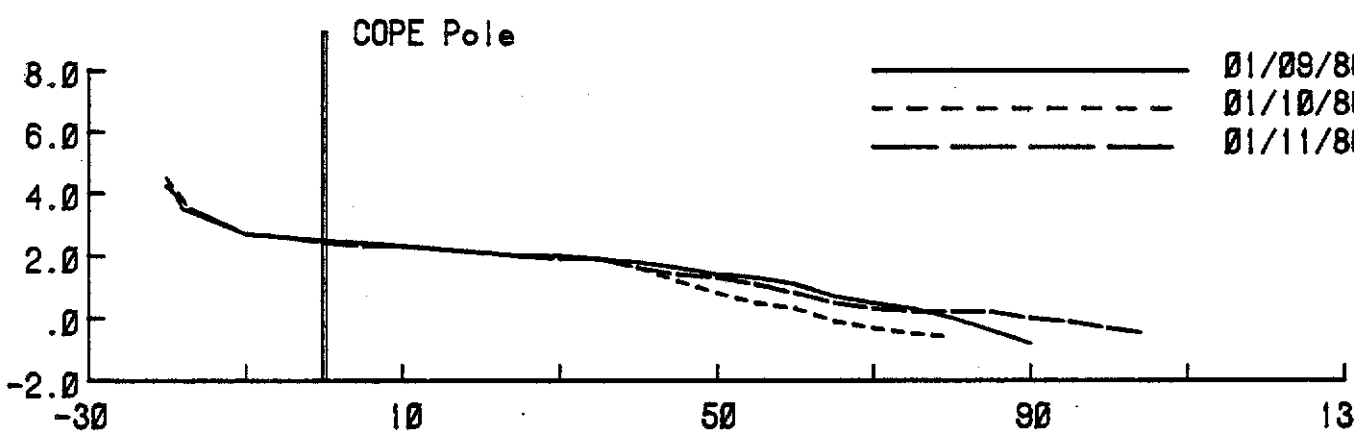
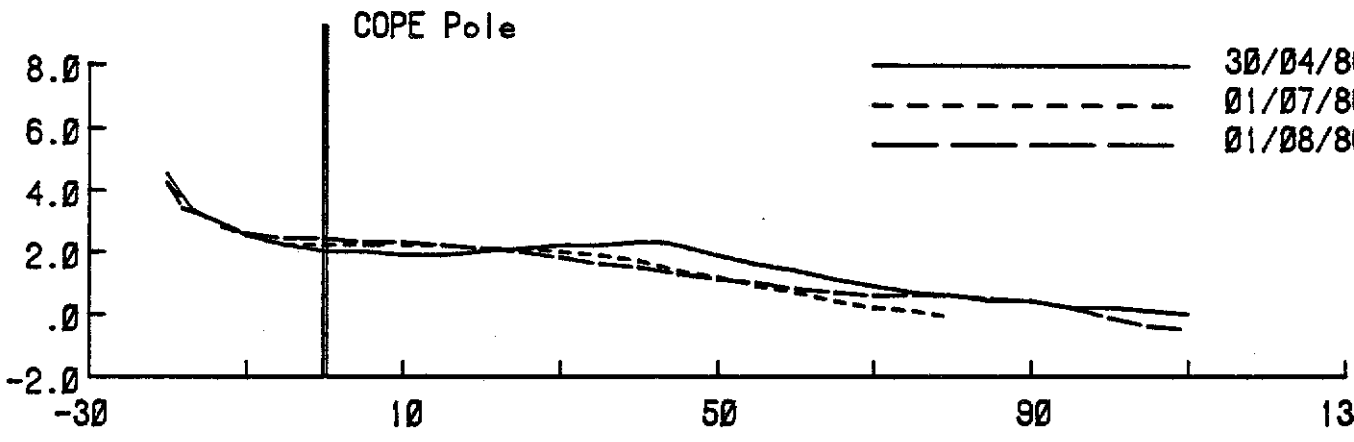
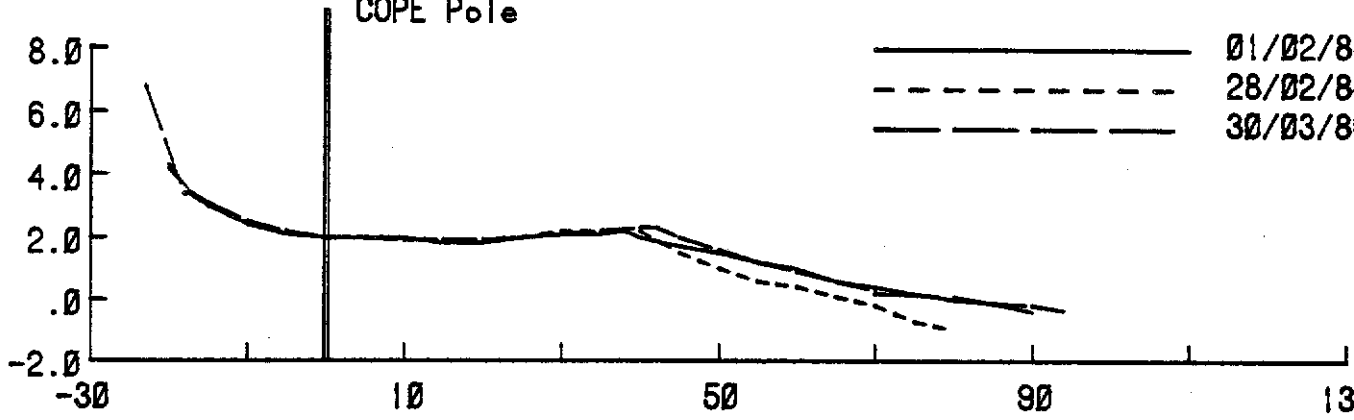
MONTHLY BEACH PROFILES

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Burleigh Heads

Figure 33

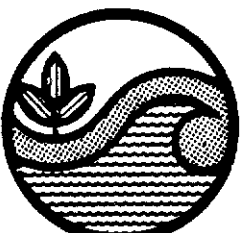
C22.1





Level Datum is A.H.D.

Distances and Levels are measured in Metres

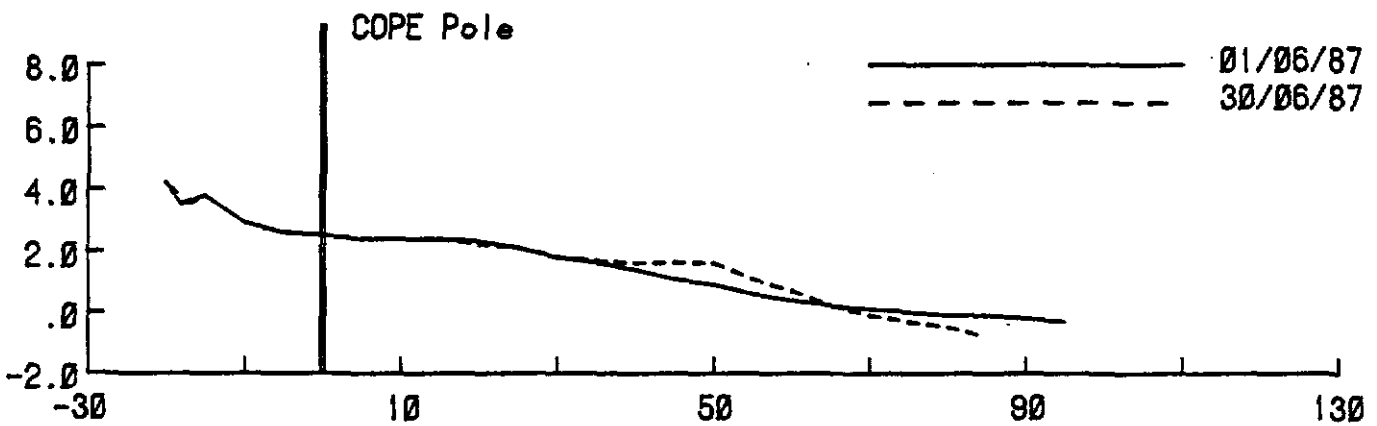
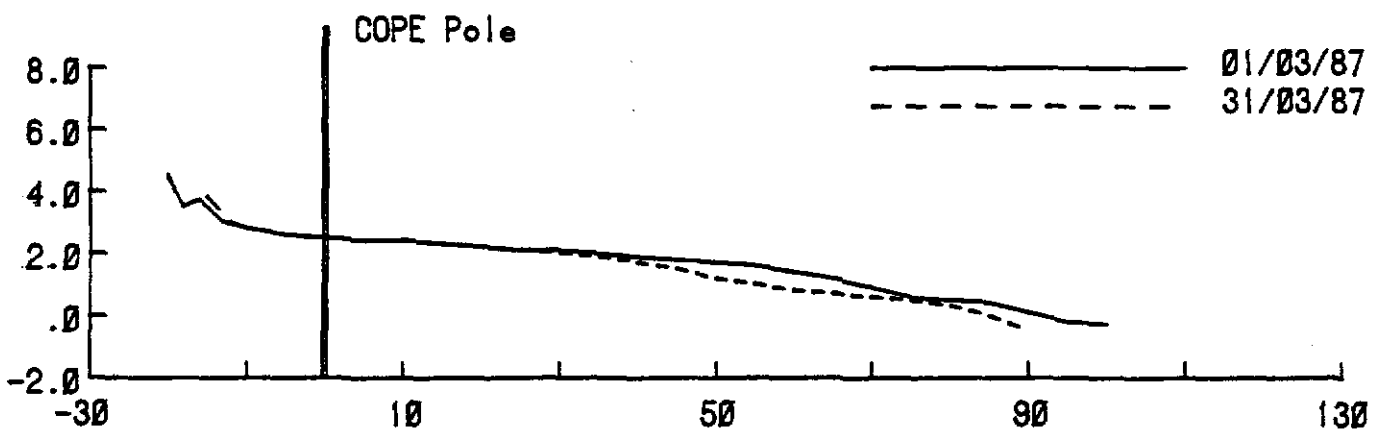
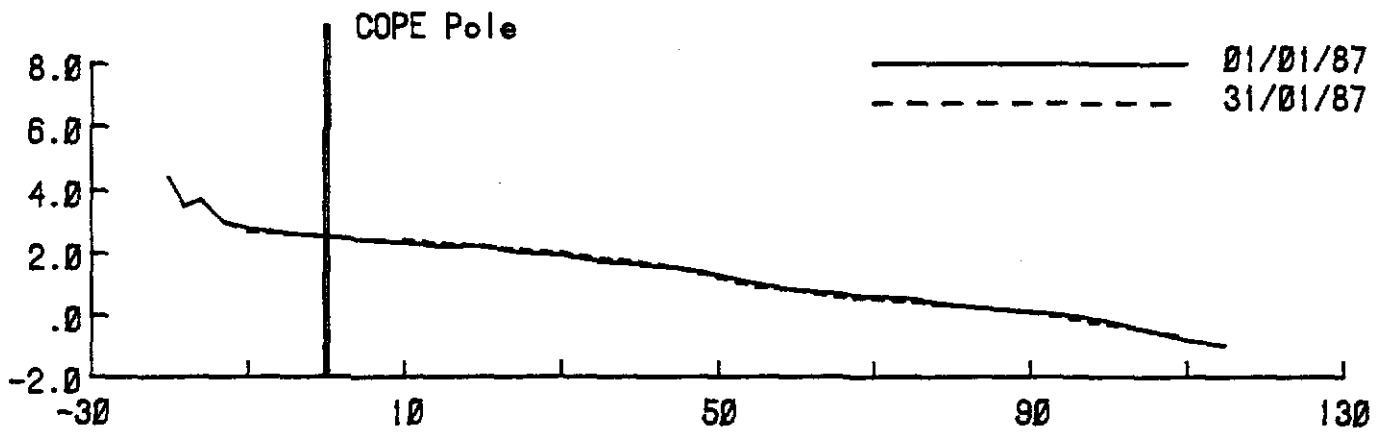


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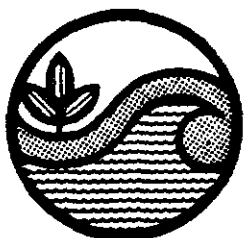
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Figure 34  
C22.1



Level Datum is A.H.D.

Distances and Levels are measured in Metres



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Burleigh Heads

Figure 35

C22.1